

Ok Birim Tailings Storage Facility Project

Environmental and Social Impact Assessment

Chapter 9

Description of existing social environment



9. DESCRIPTION OF EXISTING SOCIAL ENVIRONMENT

9.1 INTRODUCTION

This chapter provides a summary of the existing social environment of the proposed Ok Birim Tailings Storage Facility (TSF) Project (the project), including the social characterisation, ecosystems services, and archaeological and cultural values.

9.2 SOCIAL CHARACTERISATION

This section provides an overview of the existing socio-economic values of local and regional communities, including people, landscape and amenity, economy and livelihoods, and infrastructure and services. The information presented summarises the Ok Birim Tailings Storage Facility Project Social Characterisation Report provided as Appendix M.

9.2.1 Social characterisation method

The following summarises the method used to develop this social characterisation, including approach to defining, reviewing and analysing existing social conditions.

9.2.1.1 Scoping of potential impacts

A preliminary review of the project and existing information was carried out to identify likely social, ecosystem services and human rights issues of the project and potentially affected communities and groups, to inform the definition of the study area for the social characterisation (and subsequent impact assessments), and the data and information to be collected. This involved:

- Review of project information, including environmental and social issues in the project Environmental Inception Report (EIR).
- Review of existing socio-economic data and information on potentially affected communities.
- Consideration of requirements of relevant international standards (e.g., IFC PS, UNGPs).
- Identification of key themes for the social characterisation and gaps in information needed to support the assessment of social, ecosystem services and human rights impacts.

9.2.1.2 Analysis of existing social conditions

Information on the social characteristics, values and features was collected through desktop review and analysis on existing socio-economic data and information on potentially affected communities, and collection and analysis of primary data collected through engagement undertaken for the social studies and ESIA.

A desktop review was conducted of existing socio-economic and environmental data and reports relevant to potentially affected communities, including:

- Existing social data, reports and studies held by OTML.
- Population and health data and information from the PNG National Statistics Office (NSO).
- Publicly available literature on the social context of potentially affected communities, including from reports, studies and other information from government agencies, non-government organisations, industry associations, and academic institutions.
- Review of outcomes of other technical investigations for the ESIA (e.g., cultural heritage impact assessment, terrestrial biodiversity, aquatic ecology assessment).

This social characterisation has also been informed by primary data collected during fieldwork and engagement with potentially affected communities and other stakeholders, including:

- Household surveys conducted by OTML's Community Relations and Sustainability (CRS) Department within the seven TSF villages.
- Village surveys for each of the TSF villages, which were conducted with village leaders and other relevant stakeholders.
- Focus group discussions (FGDs) with project affected communities, including separate FGDs with men and women, and mapping of community livelihood resources (e.g., gardens, hunting grounds, fishing areas, water sources, and access tracks) as part of the FGDs.
- Key informant interviews (KIIs) with community leaders, service providers and other stakeholders in Kiunga, Ningerum and Tabubil.
- Visual surveys and observations of roadside trade stalls along the Kiunga–Tabubil Highway, between Ningerum and Ok Tedi Mine.

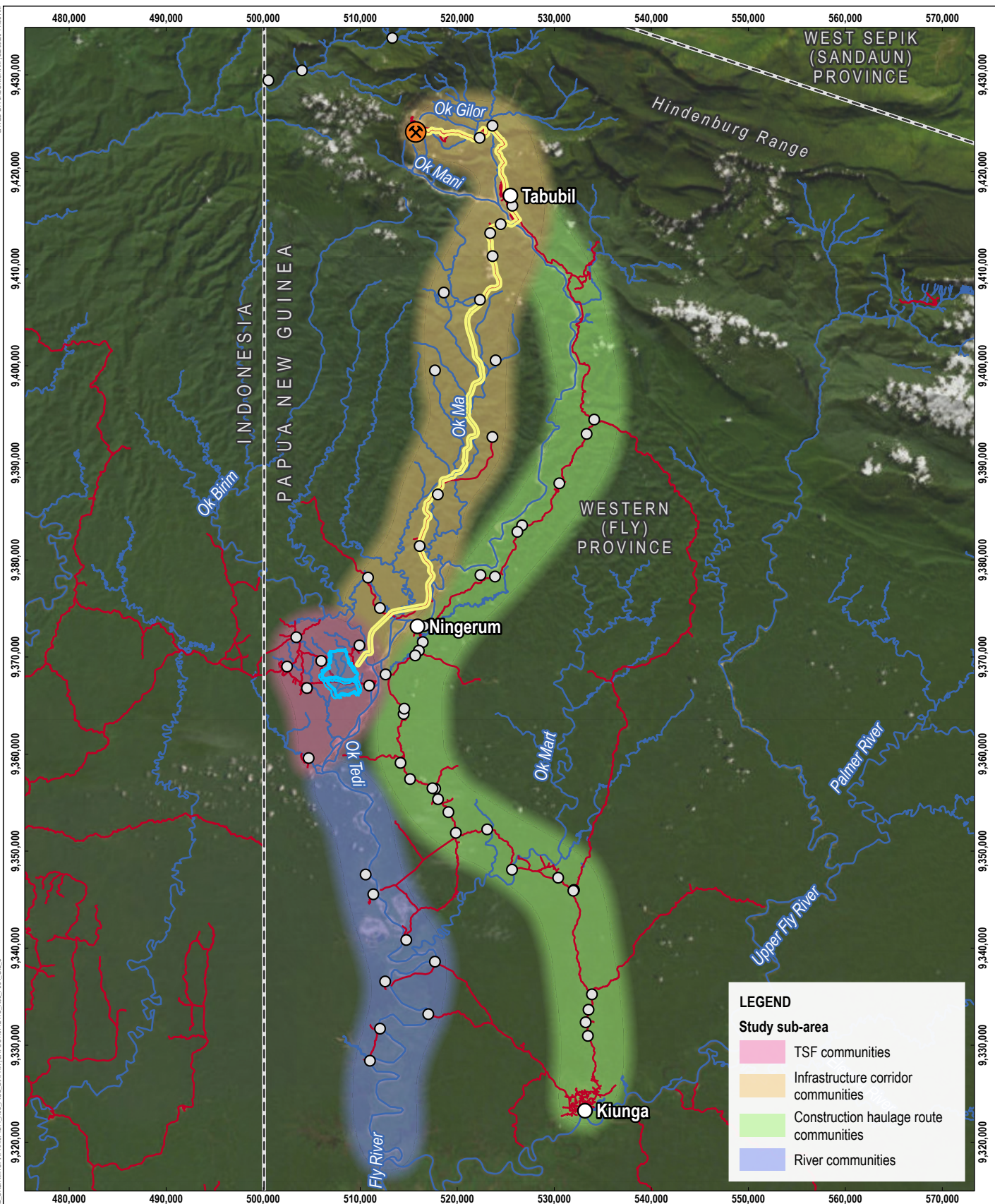
Social values are the qualities of the social environment that are conducive to people's economic, social, and spiritual wellbeing that people in the study area regard highly. The social characterisation is presented with an organising framework based around four identified social values:

- People, place and community identity, which can be understood through demographics, cultural identity, social capital and community safety.
- Economy and livelihoods, which can be characterised by people's natural resource use, employment, income and expenditure and housing.
- Infrastructure and services, comprising health, education and support infrastructure and sanitation.
- People's productive capacities. That is, people's health, level of educational attainment, food security and water security.

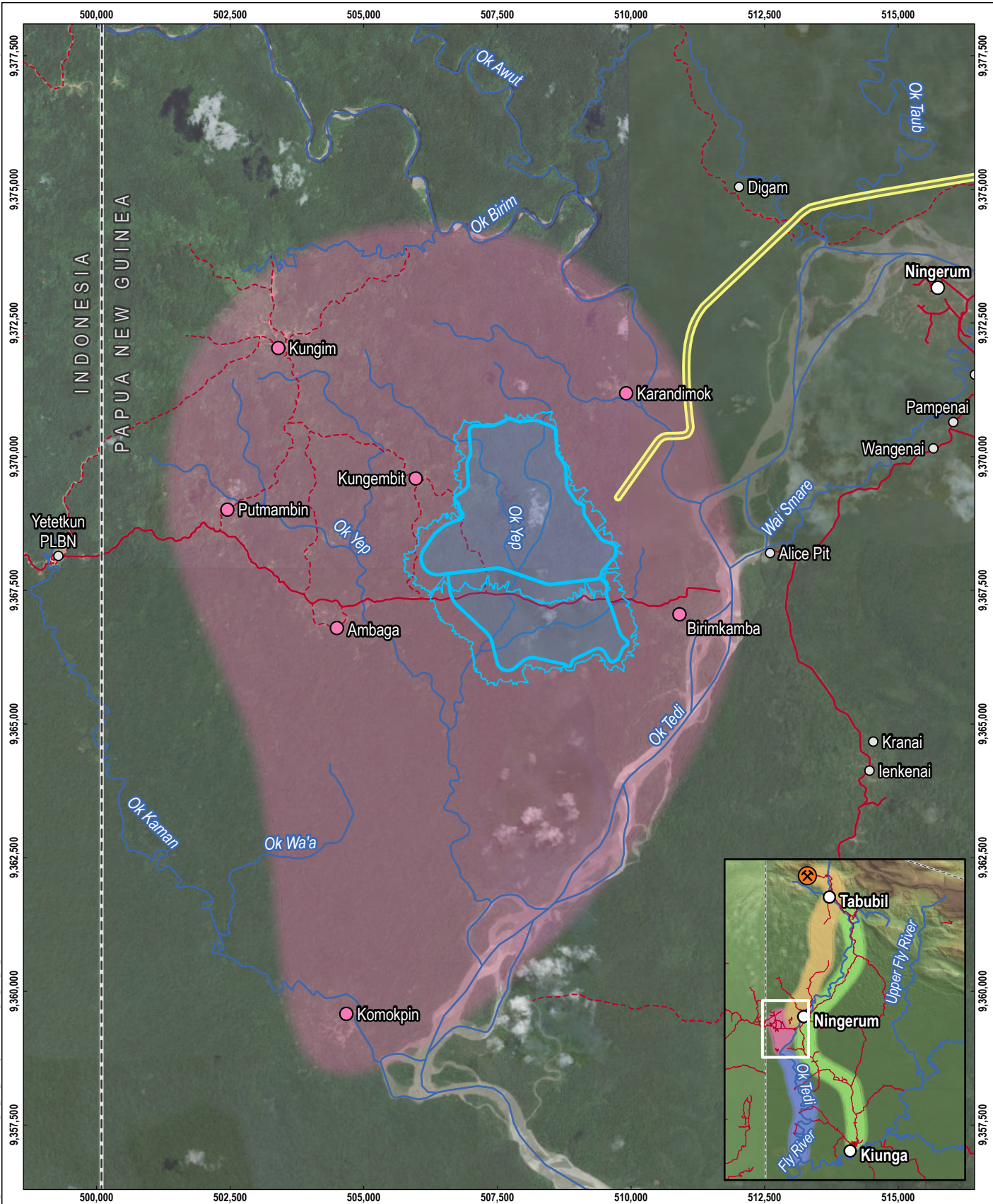
9.2.2 Social study area

The project is located within the Western Province of Papua New Guinea. The area of influence for this social characterisation includes local and regional communities that may experience changes to living conditions, livelihoods or wellbeing from the project, including the location of project infrastructure and facilities, and proposed construction, operation and decommissioning activities. The area of influence, referred to as the study area in this social characterisation, is divided into five sub-areas that recognise the proximity, type, scale and duration of project activities. These sub-areas are shown in Figure 9.1 and include:

- **TSF communities**, comprising seven villages (Kungim, Ambaga, Birimkamba, Karandimok, Kungembit, Putmambin and Komokpin), which may experience impacts due to their proximity to the proposed TSF site and construction, operation and decommissioning activities (Figure 9.2).
- **Infrastructure corridor communities**, comprising villages and settlements along the proposed tailings pipeline and pipeline access road between Ok Tedi Mine and the TSF, which would mainly experience impacts during construction phase, apart from ongoing operation of the pipeline access road (Figure 9.3).
- **Construction haulage route communities**, includes villages and settlements along the Kiunga-Tabubil Highway between Ok Tedi Mine and Kiunga, including Alice Pit, which would mainly experience impacts during the construction phase (Figure 9.4 and Figure 9.5).
- **River communities**, comprising villages along the Ok Tedi downstream of Ok Tedi Mine to the Fly River, that may experience impacts during the operations phase.
- **Regional centres**, comprising the urban centres of Kiunga, Ningerum and Tabubil.



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LEGEND

- TSF community
- Regional centre
- Study area community
- Road
- - - Track
- Watercourse
- Proposed TSF footprint
- Proposed infrastructure corridor
- Study sub-area**
- TSF communities



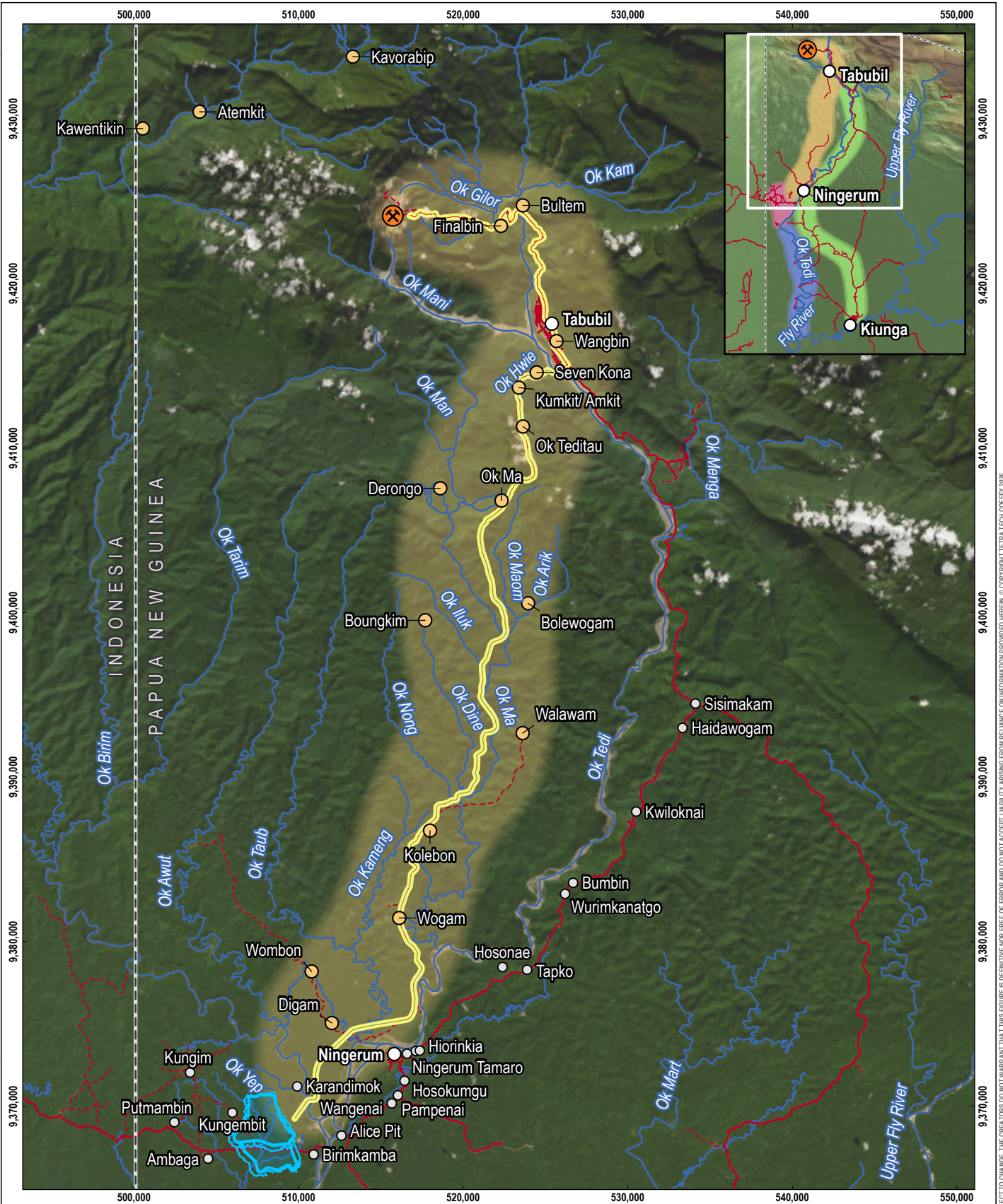
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SOURCE
Study areas and villages from Tetra Tech Coffey.
Proposed infrastructure from KCB and OTML.
Topographic features from OSM. Provinces from NSO.
DEM from SRTM. Imagery from ESRI and Google Earth.

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FIGURE 9.2
TSF communities





LEGEND

- Ok Tedi Mine
- Infrastructure corridor community
- Regional centre
- Study area community
- Road
- Track
- Watercourse
- Proposed TSF footprint
- Proposed infrastructure corridor
- Study sub-area**
 - Infrastructure corridor communities



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PROJECTION: PNG94 PNGMG94 Zone 54

SOURCE
Study areas and villages from Tetra Tech Coffey.
Proposed infrastructure from KCB and OTML.
Topographic features from OSM. Provinces from NSO.
DEM from SRTM. Imagery from ESRI.

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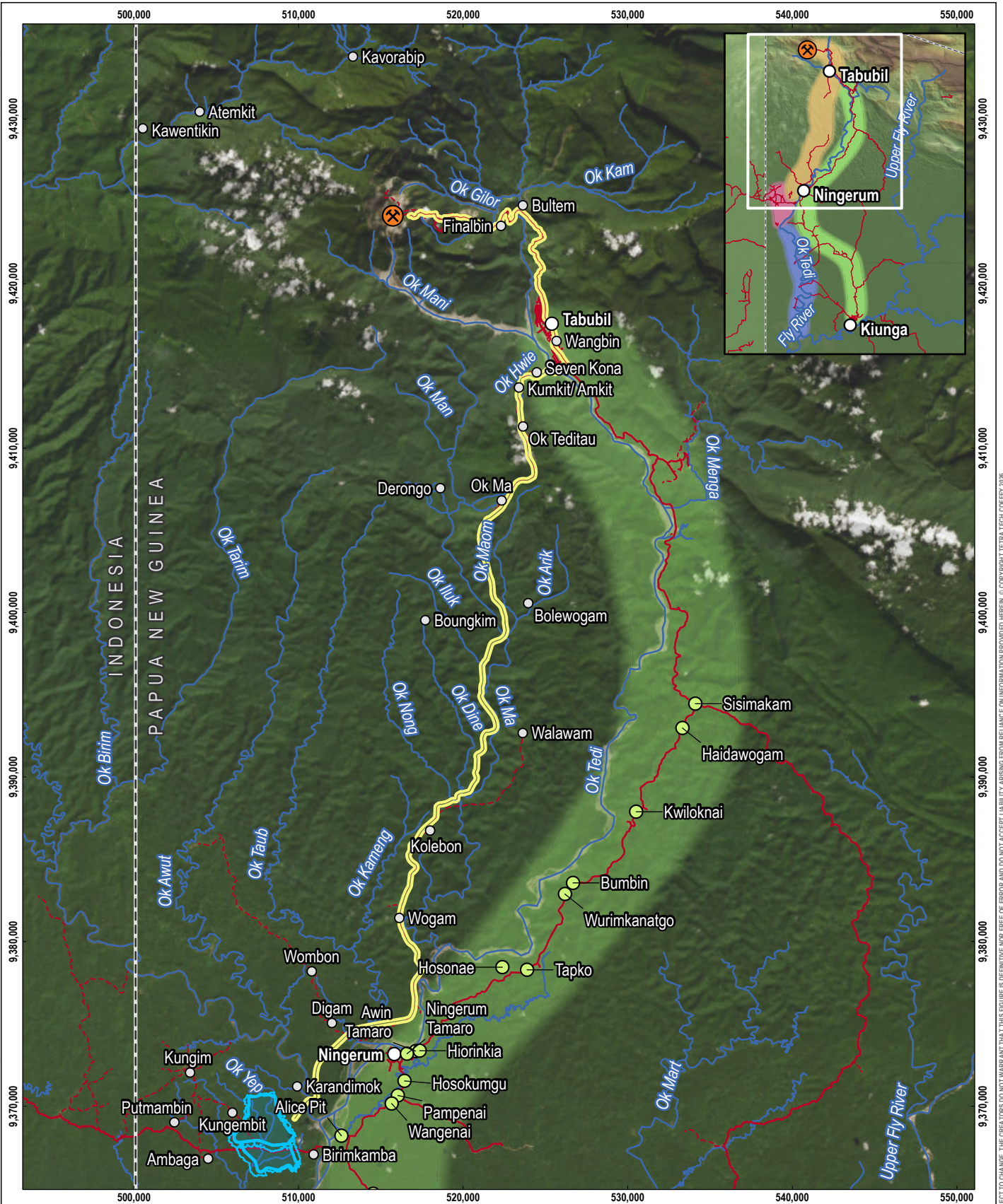
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FIGURE 9.3

Infrastructure corridor communities -
Ok Tedi Mine to TSF



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LEGEND

- Ok Tedi Mine
- Construction haulage route community
- Regional centre
- Study area community
- Road
- Track
- Watercourse
- Proposed TSF footprint
- Proposed infrastructure corridor
- Study sub-area**
- Construction haulage route communities



0 5 10 km
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PROJECTION: PNG94 PNGMG94 Zone 54

SOURCE
Study areas and villages from Tetra Tech Coffey.
Proposed infrastructure from KCB and OTML.
Topographic features from OSM. Provinces from NSO.
DEM from SRTM. Imagery from ESRI.

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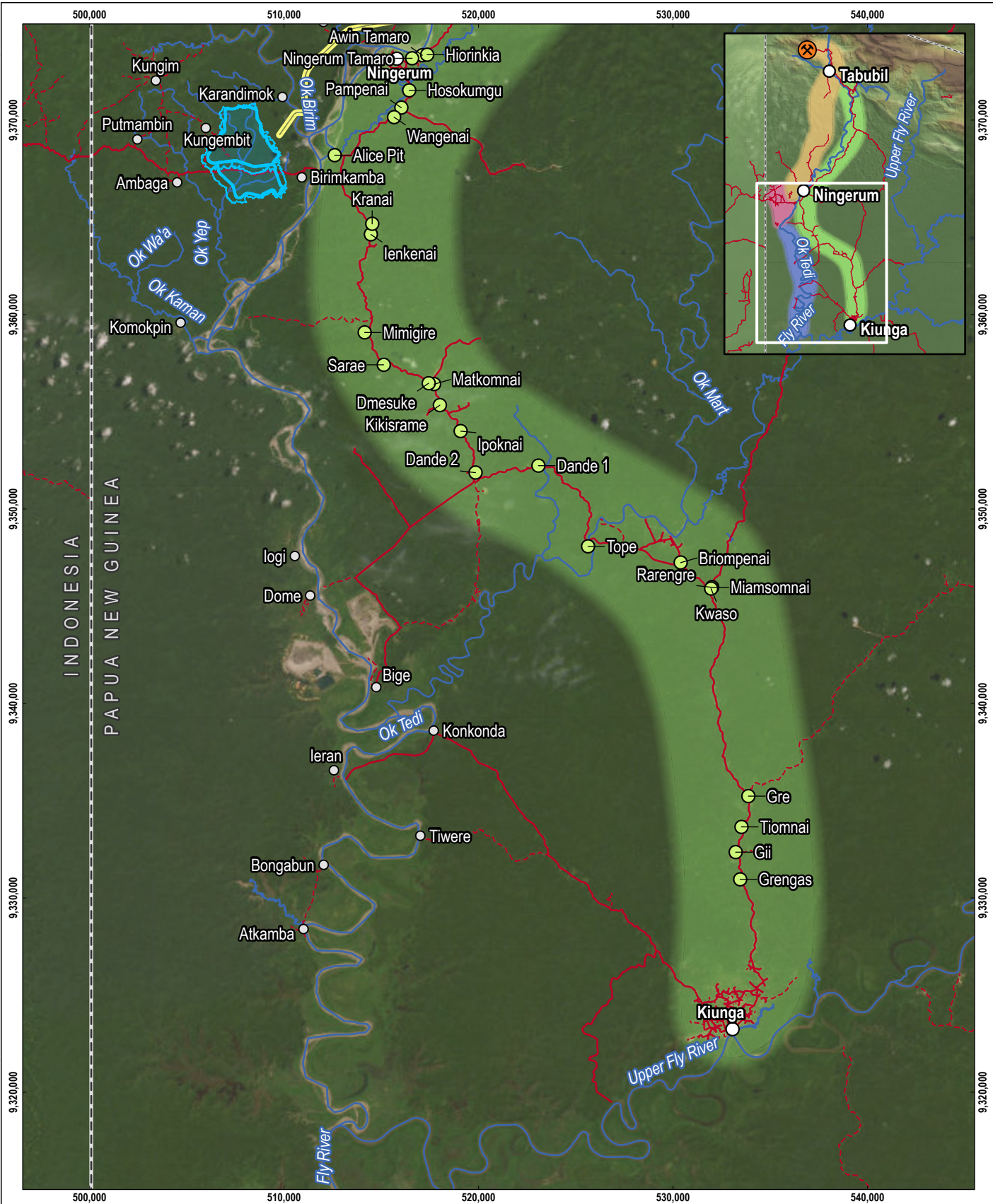
FIGURE 9.4

Construction haulage route communities - Tabubil to Alice Pit



TETRA TECH
COFFEY

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LEGEND

- Construction haulage route community
- Regional centre
- Study area community
- Road
- - - Track
- Watercourse
- Proposed TSF footprint
- Proposed infrastructure corridor
- Study sub-area**
- Construction haulage route communities



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PAGE SIZE: A4
PROJECTION: PNG94 PNGMG94 Zone 54

SOURCE
Study areas and villages from Tetra Tech Coffey.
Proposed infrastructure from KCB and OTML.
Topographic features from OSM. Provinces from NSO.
DEM from SRTM. Imagery from ESRI.

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FIGURE 9.5

Construction haulage route communities - Alice Pit to Kiunga



TETRA TECH
COFFEY

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9.2.3 Regional context

The Western Province is the largest province area in PNG. The province shares international borders with Indonesia to the west and Australia to the south. An official border crossing post between PNG and Indonesia, the Pos Lintas Bastas Negara Yetetkun (Yetetkun PLBD), is established on the Indonesian side. The province has three districts: North Fly, Middle Fly and South Fly. The North Fly, where the project is located, consists of five LLG areas. The TSF development area is located within the Ningerum Rural LLG, while the infrastructure corridor is within the Star Mountain Rural and Ningerum Rural LLGs. Facilities supporting transport activities for the project are located within the Kiunga Urban and Kiunga Rural LLGs.

The population of Western Province was approximately 300,019 people in 2024 and is the most sparsely populated province in PNG (NSO 2024). Most the population in the Western Province live along or near the Fly River and its tributaries. Though it is sparsely populated, the province has relatively high levels of urbanisation, with population, services and markets concentrated in the provincial capital of Daru and centres such as Kiunga and Tabubil (OTDF n.d.).

The province was one of the fastest growing provinces in PNG, growing at an average of 3.1% annually between 2011 and 2024, compared to 2.6% for PNG as a whole (NSO 2024). Information on population movement from the 2011 Census noted that approximately 80% of in-migration by people born in PNG were from other PNG provinces, with the largest number from West Sepik Province to the north. At the same time, the Western Province was home to approximately 13% of people born overseas, with these mostly from Indonesia (NSO 2011b). In 2024, the province had more males than females, with a sex ratio of 109 males for every 100 females, similar to PNG as a whole (NSO 2024).

The North Fly district is the largest district by population. The population of the district was 102,633 people in 2024, accounting for about one third of the total provincial population (NSO 2024). The district includes four larger regional towns – Kiunga, Tabubil, Ningerum, and Olsobip, with other communities mostly comprising small rural villages and settlements situated near rivers, forest margins or bushland to support subsistence livelihoods such as gardening, hunting, fishing, and sago production (NFDPA n.d.). These smaller settlements vary in size and are generally isolated and dependent on bush tracks or waterways for access.

The Ok Tedi Mine contributed 3.5% to PNG's gross domestic product in 2024 (OTML 2024a). The mine is a significant employer in the Western Province and for PNG more broadly. In 2024, the mine employed 2,886 people, of which approximately 35% were from the Western Province (OTML 2024a). Other livelihoods in the Western Province are largely subsistence-based, supplemented by cash cropping, hunting, and gathering (Fly River Provincial Government and PNGAus Partnership 2022). Local populations live primarily on small-scale gardening, fishing, sago production and informal trade.

9.2.4 Local context

This section provides an overview of existing social characteristics of the study area, presented for each of the five sub-areas.

9.2.4.1 TSF communities

This following presents information on the existing social characteristics and values of communities near to the proposed TSF site, including people, the landscape and amenity, livelihoods and services.

People, community identity and place

This section describes the TSF communities' population, where they live and why they live there.

Overview of TSF communities

The proposed TSF site is in a sparsely populated area of the North Fly District. Seven villages are located around the proposed TSF site, the closest of which are Kungembit, Birimkamba, Karandimok and Ambaga. These are generally isolated, with most comprising relatively small permanent populations that rely mainly on subsistence livelihood activities. TSF communities mainly comprise people from the Yongom tribe and are connected through family ties. People within the TSF communities also have strong family connections to Indonesian communities, with consultation noting that frequent cross-border movement occurs for marketing, informal trade and visiting family. The following provides an overview of each of the TSF communities. All TSF villages apart from Karandimok, are part of the Community Mine Continuation Agreement (CMCA).

Kungembit

Kungembit is located approximately 600 m west of cell 1 of the proposed TSF and is situated in an elevated location along a narrow ridge, surrounded by areas of dense forest vegetation in lower lying areas (Plate 9.1). The village was established at its current location in 1957. Traditional land ownership is distributed amongst nine clans, with small creeks, hill slope features and ancestral sago gardens forming traditional clan boundary markers (Appendix L). The total estimated population of Kungembit was 1,610 people in 2023 (OTML 2023d), although community feedback reported that ‘only some people live permanently in the village’. This was estimated by community members to be about 15 households, with other households living in Alice Pit, regional centres, other PNG provinces, or Indonesia returning to Kungembit occasionally for family and social reasons, and livelihood activities.

Housing in Kungembit comprises mainly permanent or semi-permanent dwellings, although about one in three dwellings are made from traditional materials (e.g., hardwood trees, black palm, sago leaves) sourced from surrounding bush areas (Plate 9.2). Many households in Kungembit rely on subsistence farming, hunting and fishing for their main food sources, although store food such as rice was also identified as a staple food for some households. Nearby creeks, rivers and springs are the main water sources for drinking, cooking and washing, with wells also used during periods of prolonged drought. Key sources of income for community members are alluvial mining within the Ok Tedi, and the sale of betel nut and garden produce.

There are no schools or health care within Kungembit, with these facilities accessed by walking via bush track to Kungim, or by a combination of walking (via bush track), boat and bus (PMV) to Ningerum and elsewhere.

Birimkamba

Birimkamba is located approximately 850 m east of the TSF site and around 100 m south of the Infrastructure Tax Credit Scheme (ITCS) Road currently under construction. The village lies on undulating terrain that rises from the Ok Tedi to a small rise that is the site of the village, before falling away to lower lying areas towards the west. Plate 9.3 and Plate 9.4 show views of Birimkamba.

Birimkamba was originally settled in the mid-1960s closer to the Ok Tedi, relocating to the current village location in 1991. Traditional land ownership in Birimkamba is shared between several main clans and sub-clans, the main clans being Namago and Kimki clans (Appendix L). The total population of Birimkamba is estimated to be 743 people (OTML 2023d), although it was reported during consultation that most of the population live elsewhere for school or work reasons. Households living in Alice Pit and Ningerum return to the village on weekends to gather food from their gardens, with others that live further away returning ‘one in a while’ (e.g., school holidays, Christmas, ‘*haus krai*’).

Birimkamba has about 20 dwellings, of which about two in five are ‘village houses’ that are made from traditional materials. Households mainly rely on food grown in household gardens along on the banks of the Ok Tedi, along the ITCS Road, or around the village, as well as food from the bush or swamp areas. Water for domestic uses is mainly sourced from small creeks and streams close to the village or wells and communal water tanks. Earnings from the sale of betelnut, sale of garden produce at Ningerum markets, alluvial mining, and mine-related compensation are the main income sources for households.

Education and health facilities in Birimkamba are currently not operational and these services are accessed in Ningerum, Kungim, Rumginae, Matkomnai and Tabubil. Access to these services is either by walking (via road/ bush track) to Kungim, or by boat and PMV to other locations.

Karandimok

Karandimok is located on the eastern bank of the Ok Birim, approximately 1.5 km northeast of the TSF site. The village sits on a ridgeline surrounded by forested slopes and gardens. Karandimok was established on the northern side of the Ok Birim, relocating to the current village location in 1987. Plate 9.5 shows Karandimok village. The community comprises three major common clans and six sub-clans (Appendix L). The population of Karandimok is estimated at 216 people, although community feedback indicated that a small number of people live permanently in the village. Younger people particularly have moved away from the village to places such as Ningerum, Tabubil, Kiunga, and Port Moresby, returning occasionally to garden for their own consumption or marketing, hunt, gather timber for housing, or to look after children.

Approximately two-thirds of houses in Karandimok are built from traditional bush materials, with remaining houses comprising semi-permanent houses built from a mix of traditional and modern materials. Community members generally live a subsistence lifestyle, growing food in household gardens, making sago, hunting from the wild, and fishing from the Ok Birim and nearby creeks. Gardening and cultivation areas are mainly situated within or near to the village and along the banks of the Ok Birim and smaller creeks. Drinking water is mainly sourced from four communal water tanks, and dug wells, springs, and surface water sources. Key income sources for households include earnings from the sale of betelnut, sale of gold from alluvial mining, wages from working with OTML, mine-related compensation payments, and income from a business operation such as boat hire, trade store, or non-farm business. There are no schools or health facilities in Karandimok (although an aid post is under construction), with most people accessing these services in Ningerum. Travel to Ningerum is mainly by canoe or dinghy to Alice Pit and by PMV from Alice Pit, although access is also provided by canoe and walking (via bush tracks).

Ambaga

Ambaga is located immediately south of the ITCS Road approximately 1.6 km southwest of cell 1 and 2 km west of cell 2 of the TSF. The village was established at its current location in 1995 and occupies a small series of clearings or hamlets, surrounded by dense forest. Land in Ambaga is held by five clans, including the Buseki people who migrated to Lake Murray (Appendix L). The total estimated population of Ambaga was 1,233 people in 2023 (OTML 2023d), although community feedback notes that about 200 people reside permanently in the village. Those living elsewhere mainly reside in Alice Pit, Ningerum, Kiunga, Tabubil, and Port Moresby, returning for special occasions, school holiday periods, or other times of need. Community members describe Ambaga as a safe community, with law-and-order issues reported to occur occasionally, such as during holiday periods.

Nearly half of houses in Ambaga comprise semi-permanent dwellings and about a third permanent dwellings. Remaining dwellings are made from traditional materials sourced from surrounding bush areas. Sago and banana are the key staple foods for households, with these generally grown in household gardens and surrounding bush and swamp areas. Households also rely on garden foods or food exchanged with family members across the border or purchased from markets and stores at Yetetkun PLBN. Areas used for gardening or cultivation are mainly in areas surrounding the village, along the border track, along the Ok Yep, and bush areas west of the village. Key water sources are wells, rivers and streams, with springs, household tanks/ drums, or communal water tanks also used by some households. Community feedback noted that the Ok Yep is used for water during periods of drought.



Photo credit: Tetra Tech Coffey, 2025

Plate 9.1
Aerial view of Kungembit



Photo credit: Tetra Tech Coffey, 2025

Plate 9.2
Community meeting area, Kungembit



Photo credit: Tetra Tech Coffey, 2025

Plate 9.3
View of Birimkamba village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.4
Birimkamba village community area



Photo credit: Tetra Tech Coffey, 2025

Plate 9.5
Karandimok village

The main income sources for households in Ambaga are the sale of cash crops such as betelnut and rubber, and mine-related compensation. Other income generating activities include wages from work with OTML, sale of timber, and income from a business operation such as a trade store (Plate 9.6). Ambaga has an elementary school and sub-health centre, although these are not currently operating. Access to these services is mainly at Kungim, although some students attend school in Komokpin or Ningerum, or go to primary schools across the border. The border track is used by residents for access to surrounding communities, the Ok Tedi at Birimkamba, and the border crossing at Yetetkun PLBN.

Kungim, Putmambin and Komokpin

Kungim and Putmambin are located north of the border track, about 3 km northwest and west, respectively, of the TSF site and 2 to 3 km from the PNG border with Indonesia.

Kungim was established in 1935 by the Montfort Catholic Missionaries and is the main centre for education and health services for villages west of the TSF site. Plate 9.7 shows an aerial view of Kungim looking towards the southeast. The total population of Kungim was estimated at 1,808 people in 2023 (OTML 2023d), although community feedback estimates the population at 1,658 people, with about 600 people living in nearby communities (e.g., Alice Pit, Ningerum, Kiunga or Tabubil), other PNG provinces or Indonesia. Gardening and cultivation areas for community members include areas surrounding the village, and bush areas west of the village, along the north branch of the Ok Yep and bush tracks northwest towards the Ok Birim, and along bush tracks and creeks south and southeast of the village. Access from Kungim to communities such as Alice Pit and Ningerum is by walking (via bush tracks) or by boat via the Ok Birim (Plate 9.8).

Putmambin was established in 2000 following relocation from Ambaga. Plate 9.9 shows an aerial view of Putmambin village. The population was estimated to be 1,690 people in 2023 (OTML 2023d), although estimates of permanent populations reported by community members during consultation varied from about 105 to 1,000 people. Kungim is the main location for education and health services for Putmambin community with walking via bush track taking about one hour. Land used for gardening and cultivation is mainly located in bush areas north and west of the village towards the border, and east of Putmambin on either side of the west branch of the Ok Yep. Access to communities such as Ningerum and Alice Pit is either via boat from Kungim, or via the border track to Birimkamba.

Komokpin is located approximately 6 km south of the TSF site, on the southwest bank of the Ok Kamam about 1 km upstream from its confluence with the Ok Tedi. The village was established in the late 1950s, with community members relocating to the current village site from Kurumbiran due to social issues. Plate 9.10 shows a view of Komokpin village. The estimated population of the village was 422 people in 2023 (OTML 2023d), although community feedback noted that some people live in other centres (Alice Pit, Ningerum, Kiunga or Tabubil), other PNG provinces or Indonesia, and return to the village periodically for family, social reasons and livelihood activities. Komokpin has an elementary school and a primary school, which is attended by students from other TSF villages. Access to communities such as Alice Pit and Ningerum is by boat via the Ok Tedi. A bush track also connects to Ambaga.

Plate 9.6
Trade store, Ambaga village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.7
Kungim village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.8
Boat ramp, Kungim village

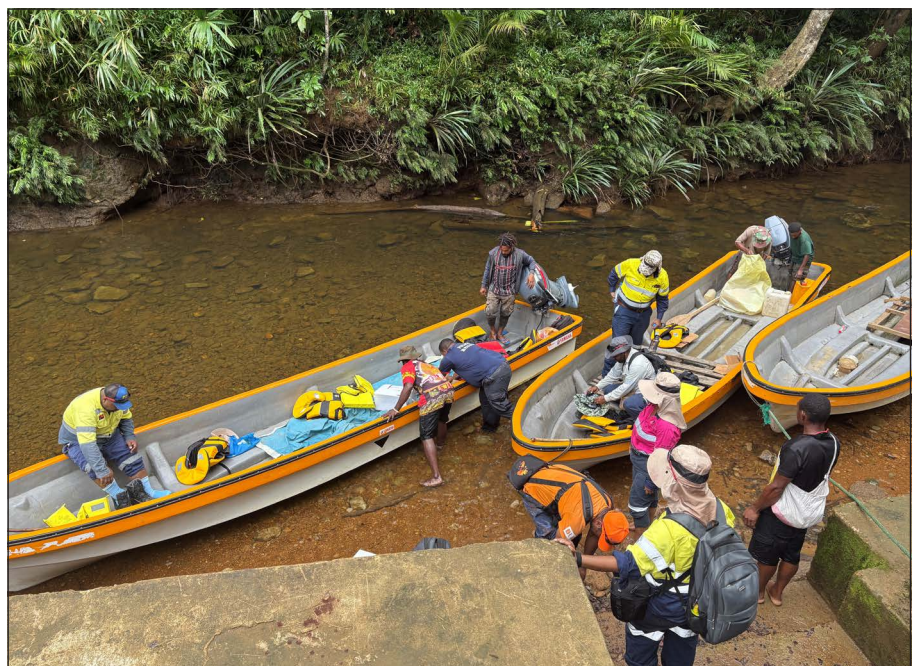


Photo credit: Tetra Tech Coffey, 2025



Photo credit: Tetra Tech Coffey, 2025

Plate 9.9
Putmambin village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.10
Komokpin village

Population

Table 9.1 presents the demographic profile for the TSF communities based on information collected through the household survey. TSF communities generally comprise older populations, likely due to the movement of young families and working aged people out of the TSF villages to larger communities for access to services and employment opportunities. This is reflected in the outcomes of the household survey that found median ages for each of the TSF villages was above that for the Western Province. The household survey also found that:

- The populations of most TSF villages include more males than females, with Kungim and Karandimok the only villages with a sex ratio (i.e., the number of males per 100 females) less than 100. Komokpin and Kungembit had sex ratios well above the Western Province, while the sex ratio of Ambaga and Putmambin were similar to the province.
- All TSF villages, apart from Karandimok, have a dependency ratio¹ lower than that for the Western Province, reflecting more people aged 15 to 64 years supporting fewer dependents aged under 15 years or over 65 years.
- Karandimok has a higher proportion of households that have a dependency ratio above the Western Province, which is likely reflective of the villages higher number of older people.

Table 9.1 Demographic profile, TSF communities

Location	Median age (years)	Sex ratio: males per 100 females	Dependency ratio: dependents per 100 working-age people	Percentage of households with dependency ratio higher than province
Ambaga	26	106	53%	26%
Birimkamba	23	100	49%	42%
Karandimok	28	81	72%	57%
Komokpin	25	127	44%	33%
Kungembit	25	124	44%	29%
Kungim	29	76	31%	25%
Putmambin	26	108	48%	39%
Western Fly Province ^(a)	21	109	62%	NA

Source: (a) NSO (2019). Note: NA = not available.

There are groups within the TSF communities that may be more vulnerable to impacts of the project due to factors such as access to economic resources, age, need for assistance, or cultural traditions. Those identified through engagement were women, particularly 'single mothers', children, people with disabilities, elderly people, migrants and refugees.

PNG ranked among the most unequal for women and girls in 2023, ranking 156 out of 170 countries in the UNDP (2025b) Gender Inequality Index. Women are active in the economy; however, their role is primarily within the informal economy (e.g., subsistence and marketing activities) due to factors such as cultural obligations, challenges in accessing finance, and women's secondary right to land (MDF 2018, Overfield 1995). Malnutrition, lack of access to health care, reproductive responsibilities, excessive workloads, and gender-based violence also contribute to the vulnerability of women and girls in PNG (MDF 2018). Compared to men, women within the TSF communities generally have lower levels of education, with higher proportions of women and girls who had never attended school, and lower proportions of women and girls who had completed high school education (e.g., Grade 9 to 12) or tertiary level education. Women and girls in the TSF

¹ Dependency ratio measures the number of dependents (those aged under 15 years old and over 65 years old) against the population aged 15 to 64 years old.

communities also had lower levels of literacy, and lower levels of participation in the formal work. Women also reported having less participation in decision making about community issues.

Compared to rural PNG, the TSF communities have a lower proportion of female-headed households (i.e., households with no adult male present that contributes to household income) (NSO 2019). However, community feedback suggests that the number of 'single mothers' may be higher in some communities and include widows and older women (*'most are grandmothers who look after the village'*).

Consultation for this social characterisation found that permanent residents within the TSF villages are typically older people (e.g., *'only old people are in the village'*). Consultation feedback also reported that there are individuals within the TSF communities that have a disability, including those with vision and hearing impairment, physical disabilities and intellectual disabilities. Support services for people living with disabilities is limited in TSF communities and generally people rely on family or extended community support. Disability was also given as a reason for some children not attending school.

Migration

The TSF villages mainly comprise local people, with community feedback indicating low levels of in-migration. This was supported by the results of the household survey with most respondents indicating they were originally from their village. Birimkamba had the highest proportion of people from elsewhere, although these were generally from another TSF villages or another village within the North Fly District. Marriage was the main reason for in-migration, particularly in Karandimok, Komokpin, and Putmambin. This was consistent with feedback from FGDs, which noted that:

- People had married in from communities within the Western Province, as well as from other places in PNG (e.g., Simbu, Mt Hagen, Sepik) (Women's FGD).
- There are about two or three people from elsewhere that live in Karandimok (e.g., Highlands, East Sepik, Madang provinces and West Papua), some of which settled permanently through marriage, or customs (Community FGD).

Feedback from FGDs with people from Ambaga noted that only a few people have married outside of the village. Other drivers of in-migration included people moving for family reasons, such as the marriage of parents or grandparents, or to stay with family members, particularly in Birimkamba and Kungim. Employment and education were reasons for in-migration in Ambaga and Kungembit. A small number of in-migrants across the TSF communities also comprise refugees from West Papua (Indonesia).

Cultural identity

The TSF communities share the same language, and similar cultural norms and traditional practices. The social organisation of the tribe is patrilineal, where land ownership and decision-making powers are male dominated and land is passed from father to son (Appendix L). The most commonly spoken language of people in the TSF communities is Tok Pisin, alongside a local dialect, Yongom. Other traditional languages are also spoken by small numbers of people across the TSF communities, with those identified through the household surveys including Ningerum, Yonngomdee, Wongom and Bahasa. English was reported as the main language spoken by a small number of survey respondents from Birimkamba.

Cultural traditions and practices continue to be upheld and exercised within the TSF communities, particularly by older people. Community feedback noted examples of language, use of traditional medicines, traditional dancing and costumes, and traditional methods for cooking, hunting and fishing as some of the customs that continue to be maintained. Consultation for the Cultural Heritage Assessment also noted that cultural traditions around arranged marriages, monogamous and polygamous marriage practices, bride price payments, and ceremonial feasts continue to be practiced by community members (Appendix L).

During consultation, community members reported that cultural traditions and practices were changing and diminishing across the villages. This was mainly attributed to factors such as missionaries coming into the villages and the influence of the church, education providing new perspectives and ways of doing things, the

introduction of the cash economy and modern lifestyles, and younger generations not upholding practices. Examples of the cultural traditions and practices reported to be declining included declining use of traditional medicines, traditional dances and clothing no longer being practiced by young people, and initiation practices no longer being maintained.

Access to, and use of, customary land is highly valued in Papua New Guinean culture (Ballard 1997; Anderson 2006) for its subsistence activities and food provision, and cultural activities and identity (Anderson 2006). Similarly to other areas of PNG, people from the TSF communities have a strong connection and attachment to their land, with feedback including that land is viewed as being ‘vital to survival and identity’.

Social capital and community safety

Social capital refers to the value of social networks, which bonds and bridges diverse people with the norms of reciprocity (Claridge 2004). In PNG, the social system (*wantok* system), in addition to clan lineage support, religious groups and aid organisations can provide a financial and social safety net for households (MDF 2018). The most common source of support varied across the TSF communities. The commonly reported sources include community associations, religious groups and clans.

TSF communities have access to a range of groups that support participation of community members in village activities such as women’s groups, youth groups, religious groups, village planning committees, and sports groups. Clan groups are also important sources of support for people in the TSF communities. Households in all TSF communities, apart from Karandimok, reported seeking emotional, economic or in-kind support from a community group or clan over the previous 12 months. In addition to Karandimok, households in Birimkamba and Kungim reported higher levels of people that did not seek support.

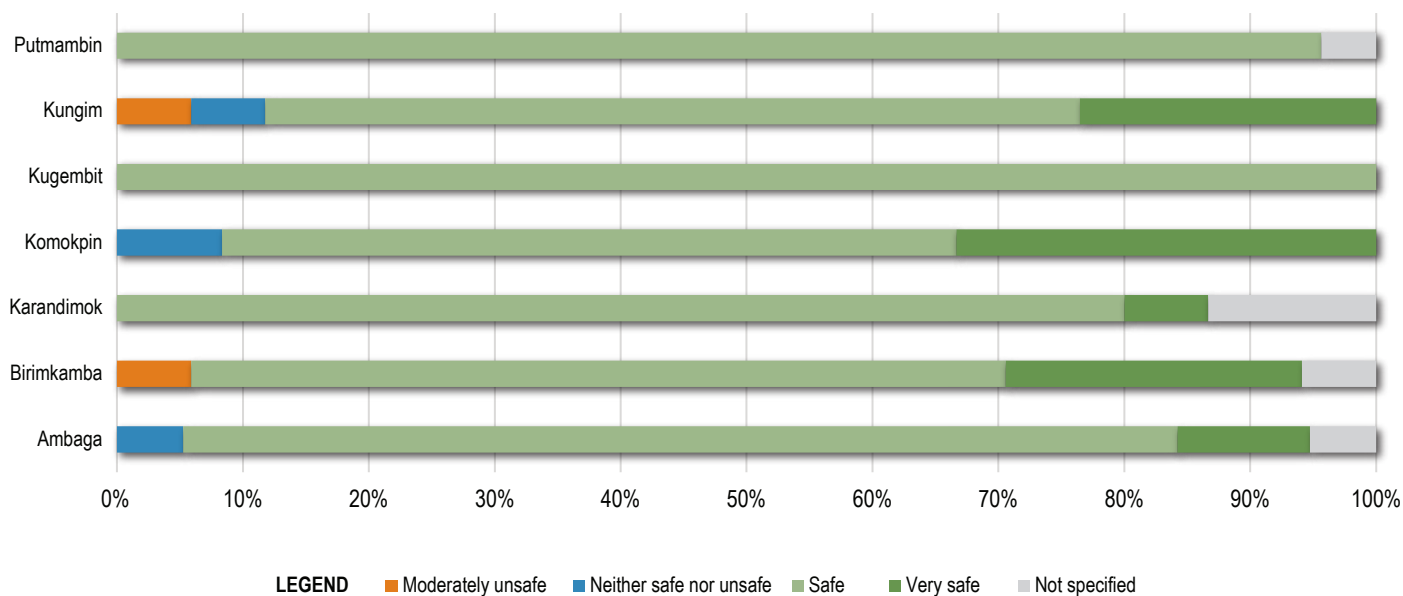
Social capital can be also understood through the community’s perception of safety. People in the TSF communities generally perceive their villages to be safe and peaceful, with most households reporting that their community was a ‘safe’ or ‘very safe’ place (Figure 9.6). Community feedback from FGDs included comments that their village was ‘a *safe village*’, that women feel safe to move around freely, and that while drug and alcohol related problems do occur, these are not common (e.g., ‘*drug and alcohol abuse is present but containable*’). Community members generally attributed this to village leaders who maintain peace within the community, although it is likely that the remoteness of the TSF villages contribute to perceptions of community safety. Community members across the TSF communities reported that levels of violence over the previous five years had ‘stayed about the same’ or had decreased, although households in Birimkamba, Karandimok and Kungim felt that violence had ‘increased a little’ compared to previous years. This was also reflected in community feedback from FGDs, which noted that previously ‘*law and order was tough so people abide by the rules. If you disobey or break the law, you will be dealt with accordingly*’, whereas now ‘*there is so much freedom and people get away, even if they break the laws within the community*’.

Stakeholder consultation noted that the traditional belief of sorcery (*Sanguma*) remains strong within the area, with fear of sorcery accusation related violence (SARV) noted as a concern for community members from most TSF villages (e.g., ‘*safety is not an issue, the only issue is sorcery-related issues*’). Other issues reported by community members during the FGDs included:

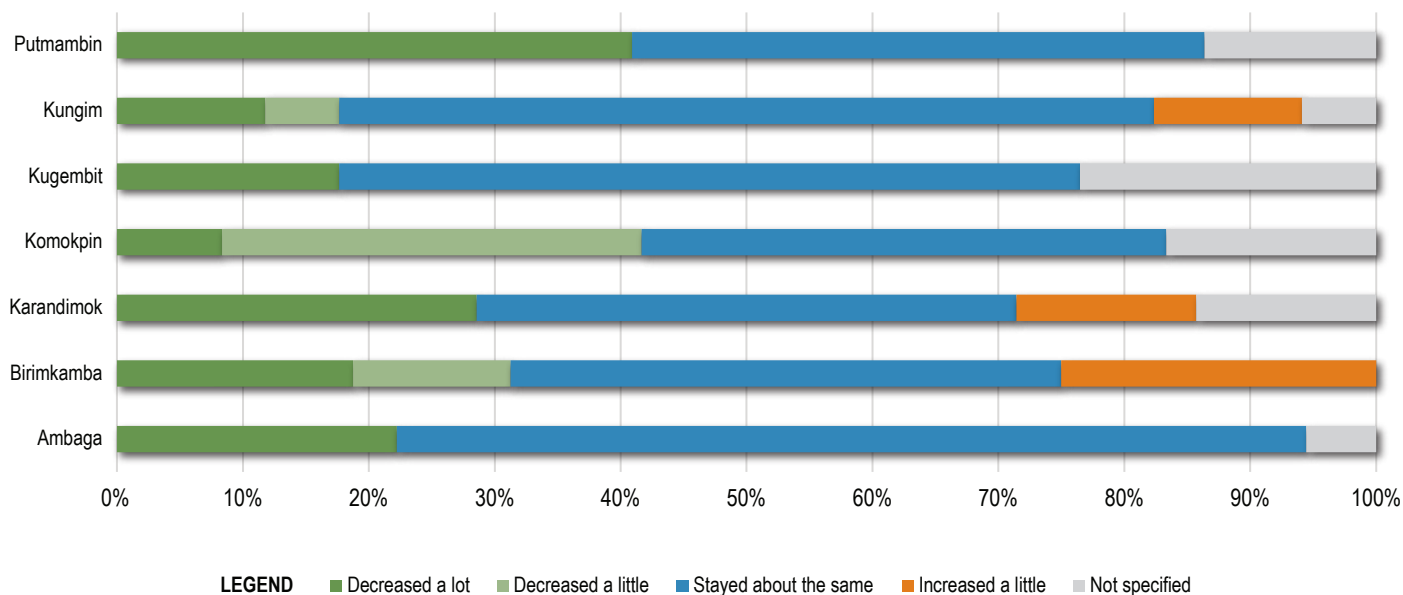
- Occasional disturbances related to the consumption of alcohol and drugs, particularly during community events or celebrations such as Independence and Christmas, with this largely attributed to youth and outsiders.
- Land disputes when people cross boundaries to other communities and hunt or fish without permission.

Across the TSF villages, women generally reported feeling safe, although when asked whether they felt safe or not safe from a law-and-order perspective, some women noted feeling ‘*not safe*’ or ‘*in between safe and not safe*’. Fear of sorcery was the main concern raised during FGDs.

Perceived community safety



Perceived violence in community compared to the past five years



SOURCE
Tetra Tech Coffey, 2026



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FIGURE 9.6
Household survey responses –
community safety



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Landscape character and amenity

This section provides an overview of the existing landscape and community amenity in areas surrounding the proposed TSF site.

Landscape character and visual amenity

The proposed TSF site and its surrounding villages are located within a predominantly natural landscape characterised by dense tropical forest, river valleys, and gently undulating ridges. The visual character and natural serenity of the landscape contribute to quality of life and reinforce peoples' connection to the land. Across the TSF villages, the visual landscape is dominated by continuous forest canopies, shaded clearings, garden plots, and small, dispersed settlements. The landscape retains a natural and cohesive character, defined by forested slopes, and enclosed clearings. Elevations across the area typically range from 40 to 110 m above mean sea level (AMSL) and long-distance views are generally limited by vegetation and terrain, with broader outlooks mainly available from local high points. The following provides an overview of the landscape character and visual amenity for villages near to the TSF site:

- Kungembit is situated on a narrow, elevated ridgeline between approximately 70 and 85 m AMSL. Dense forest extends down the eastern slopes into the valley below, creating a visually enclosed setting for most areas of the village. Dwellings are oriented toward nearby gardens, adjacent ridgelines, and surrounding vegetation. Houses in the eastern parts of the village experience restricted outward views due to the combination of forest cover and terrain. The helipad, located on one of the higher ridges, provides the most open vantage point, although views towards the TSF site remain dominated by uninterrupted forest canopy.
- Birimkamba lies on gently undulating terrain, within a low-lying riverine landscape characterised by dense lowland forest, flat to mildly sloping ground, and broad gravel bars. The surrounding vegetation encloses the village, limiting long-distance views. A more open vantage point occurs near the village entry with views extending along the ITCS Road towards the west.
- Karandimok is positioned on a ridgeline, with the highest points around 80 m AMSL. Forested slopes and shallow depressions separate the village from the lower-lying valley to the southwest. The village helipad, located on an elevated ridge, offers a clear illustration of baseline visibility: only the upper forest canopy and distant treetops are visible. Aerial imagery confirms that broader views of the surrounding landscape, including the Ok Birim, only emerge once above tree-top height.
- Ambaga, located between approximately 50 and 70 m AMSL, occupies a series of small clearings and hamlets within dense forest. The visual environment is highly enclosed, with short-range views oriented toward vegetation and nearby houses. Elevated points offer slightly wider visibility across the surrounding landscape, while lower parts of the settlement remain visually contained.
- Kungim is located on an upland plateau between roughly 80 and 110 m AMSL. The village is dispersed across low ridges and rises surrounded by dense forest. Views within the settlement are mostly short-range and directed toward vegetation, palms, and small garden clearings. Elevated points on the western side provide broader views across the forest canopy toward distant ridgelines and nearby villages such as Kungembit and Putmambin, though these wider views remain framed by thick vegetation.
- Putmambin is situated on an upland ridge between approximately 80 and 100 m AMSL, with dwellings located along the ridge crest and upper slopes. Dense forest and tall canopy trees enclose the village, producing mostly short- to mid- range views.

Community amenity

The TSF villages are located away from any major industrial activities, major roads or large-scale development and the overall amenity environment remains consistent with remote forest and riverine settlements in the North Fly District.

Local air quality is mainly influenced by village activities such as fire smoke, and farming, burning of vegetation, and dust from cleared or cultivated areas. Air quality in Birimkamba, Ambaga and Putmambin is influenced to a small degree by dust generated from the use of existing established walking tracks by occasional motorbike traffic, while areas of Birimkamba close to the ITCS Road are affected by dust generated by the present road construction activities. Ambaga and Putmambin, located along the ITCS Road, are also expected to be affected by dust generated by road construction as this extends west (Plate 9.11).

The main noise sources within the TSF communities are natural sources, such as wind, rustling vegetation, rainfall, flowing water, and wildlife (e.g., insects, bird calls). Local village activities including livestock, wood chopping, talking and domestic work also contribute to noise levels. Other noise sources observed during fieldwork included:

- Noise from construction activities for the ITCS Road in Birimkamba, with this likely to affect Ambaga and Birimkamba as construction progresses westward (Plate 9.12).
- Noise from gravel mining operations in the Ok Tedi, for areas of Birimkamba village close to the river.
- Transport noise from:
 - Motorised dinghies on the Ok Tedi and Ok Birim (Birimbamba and Karandimok).
 - Motorbikes using existing local tracks and border track (Birimbamba, Ambaga and Putmambin).
 - OTML helicopter when travelling to nearby villages or passing overhead.

These noise sources are generally occasional and intermittent and do not significantly alter the otherwise quiet acoustic environment, which is dominated by natural sounds.

Economy and livelihoods

This section provides details on how people make a living and the economic composition of the TSF communities, including use of natural resources, employment and income, and infrastructure.

Natural resource use

Livelihoods in TSF communities are primarily derived by natural resource use. The primary livelihood activity for households in the TSF communities is subsistence gardening, with formal employment, marketing and the sale of produce, casual labour, and ASM also important livelihood activities.

Gardening

Subsistence gardening is the primary food source for households within TSF communities with household gardens the main source of staple foods in all TSF communities, apart from Birimkamba and Putmambin, which mainly relied on bush and swamp resources. This is consistent with other regions in the North Fly District where the main sources of food for households were gardens, local markets, bush and riverine resources (PSO Department 2023). Land used for gardening by TSF communities is mostly located within or around villages and along rivers and smaller creeks, including the Ok Tedi, Ok Birim, Ok Yep and Ok Indok. Within each community, gardening land is restricted to clan boundaries, although community feedback from FGDs in Ambaga reported that land is shared between villages and is not limited to village boundaries due to clan lineage, ancestral connections, and intermarriages, which 'expand clan boundaries'. Further, people in Birimkamba who are from other villages are required to request land to make gardens. Figure 9.7 shows land used for gardening, identified through the review of satellite imagery. Examples of garden areas are shown in Plate 9.13 and Plate 9.14 .



Plate 9.11
ITCS Road construction dust



Plate 9.12
ITCS Road construction vehicle

Sago is the main staple crop for households in the TSF communities. Sago palms are generally found in low lying swamp areas and along small streams and creeks. Community feedback indicated that sago was generally widespread rather than confined to particular sago swamp areas, and that while their ancestors had grown larger sago plantations, people now plant sago where new gardens are established (e.g., 'most sago are planted where there is a garden. If people have gardens, they plant one or two'). A review of satellite imagery shows that larger areas of sago generally exist in low lying areas and along small creeks near to villages, with more scattered, individual palms in forested areas (Figure 9.8). Anecdotal evidence suggests much of this has been planted by villagers. Other staple crops grown by TSF communities include banana (Plate 9.15), cassava, taro, yam, kumu (leafy greens), kau kau (sweet potato), aibika, pitpit, sugar cane and corn. Feedback from consultation noted that some staple foods are no longer available, including kau kau and taro in Kungembit, Birimkamba and Ambaga, and yam in Karandimok, Komokpin and Kungim.

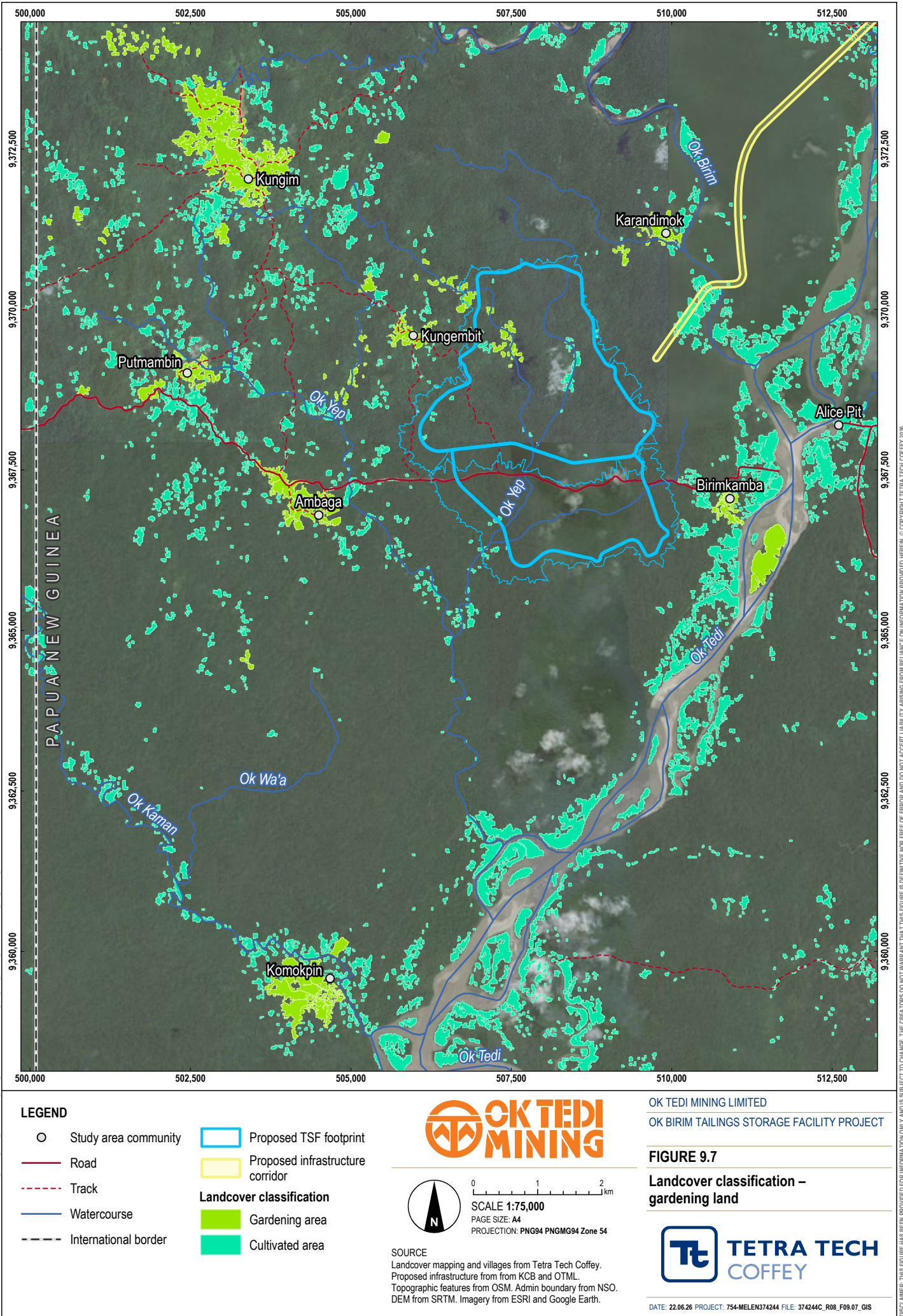
The household survey included several questions to identify existing gardening issues for TSF communities, such as whether it was easier or harder to source food compared to previous years. A majority of households in Kungembit, Ambaga, Karandimok, and Kungim reported that compared to previous years, resource collection was 'about the same' or 'easier', with modern gardening tools and location of gardens closer to home reasons for resource collection being easier. In Birimkamba, Komokpin, and Putmambin, higher proportions of households indicated that resource collection was 'harder'. Across all villages, the main reasons given for an increase in the difficulty in collecting resources were scarcity of resources and poor condition of resources. Other reasons included population pressures (Kungim and Birimkamba), loss of resource due to rising water (Birimkamba, Karandimok, and Komokpin), and longer travel time to resources (Kungim, Komokpin, Putmambin, and Ambaga).

Trespassing animals and pests such as insects, rats, beetles destroying food crops were commonly reported barriers to gardening. Other barriers reported by households included poor soil fertility, which was raised as an issue by households in all villages apart from Kungembit, and insufficient land in Karandimok and Putmambin. Less time spent in the village due to work or living away from the village and flooding were identified as barriers to gardening by a small number of households.

Cash crops

Cash cropping is an important source of income for households in the TSF communities with approximately 50% or more households in each TSF village selling cash crops in the last year. The main cash crop grown by households is betel nut, which is also one of the most commonly grown cash crops in rural PNG (Schmidt et al. 2024). The sale of betel nut is the preferred cash crop for community members as it is '*light weight and easy to carry to the markets for sale*': Secondary cash crops include rubber, balsa wood, eagle wood and coconuts, although community members reported that the sale of these is limited by the remoteness of the TSF communities and challenges with access to markets.

Plantation areas used for cash crops are shown in Figure 9.9. Garden and forested areas are also used for growing cash crops. Most households in each TSF village have access to land for growing cash crops, with more than 80% of households in Kungembit, Ambaga, Putmambin, Komokpin, and Kungim reported having access to land for cash cropping. In Birimkamba and Karandimok, this was around 70% of households. Most households reported that they believed they had the same amount of land for growing cash crops as previous generations. The exception to this were households in Birimkamba, with about half reporting they had less land for this purpose due to population growth.





○ Study area community
— Road
- - - Track
— Watercourse
- - - International border

Landcover classification

 Sago stand



0 1 2 km
SCALE 1:75,000
PAGE SIZE: A4
PROJECTION: PNG94 PNGMG94 Zone 54

SOURCE
Landcover mapping and villages from Tetra Tech Coffey.
Proposed infrastructure from from KCB and OTML.
Topographic features from OSM. Admin boundary from NSO.
DEM from SRTM. Imagery from ESRI and Google Earth.

FIGURE 9.8
Landcover classification –
sago



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Plate 9.13
Garden area (with sago palm in background),
Ambaga village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.14
Small garden plot, Putmambin village

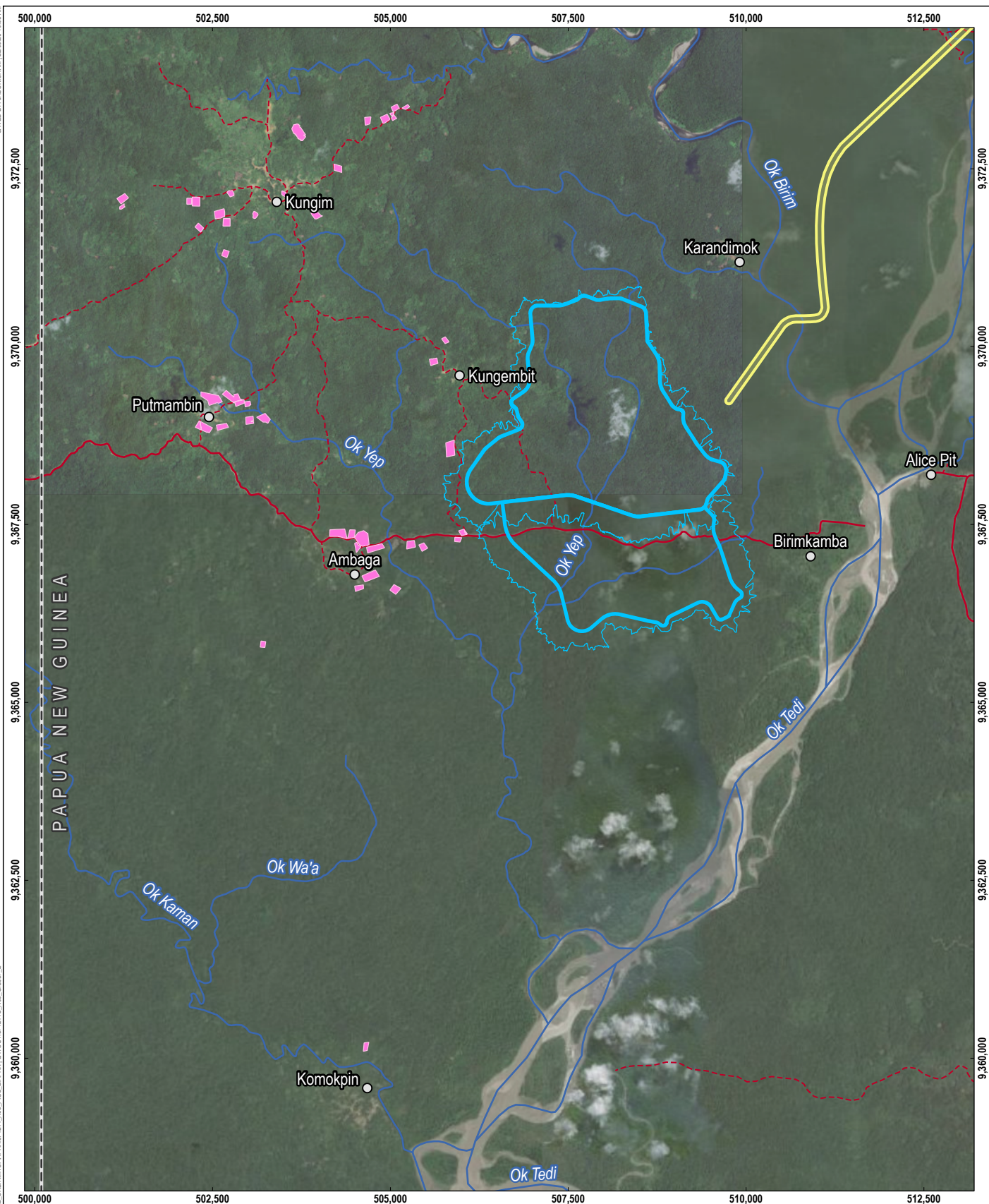


Photo credit: Tetra Tech Coffey, 2025

Plate 9.15
Banana plants, Putmambin village



Photo credit: Tetra Tech Coffey, 2025



LEGEND

- Study area community
 — Road
 - - - Track
 — Watercourse
 - - - International border
- Proposed TSF footprint
 Proposed infrastructure corridor
Landcover classification
 Cash crop



0 1 2 km
SCALE 1:75,000
PAGE SIZE: A4
PROJECTION: PNG94 PNGMG94 Zone 54

SOURCE
Landcover mapping and villages from Tetra Tech Coffey.
Proposed infrastructure from from KCB and OTML.
Topographic features from OSM. Admin boundary from NSO.
DEM from SRTM. Imagery from ESRI and Google Earth.

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FIGURE 9.9
Landcover classification – cash crops



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Hunting and bush resources

Apart from Karandimok, most households in each of the TSF communities engaged in hunting, with wild pigs, birds, bandicoots, *cus cus* and flying foxes generally reported as the main animals hunted. Most households go hunting weekly or less often. Hunting activities are mainly carried out by men, although some households in Ambaga reported that women also go hunting. Hunting methods include use of traps and traditional bow and arrows, although consultation with community members for the biodiversity assessment noted air guns were also used for hunting (Appendix F).

Hunting is generally undertaken in areas further from villages, with households reporting travelling up to a day (return) to access hunting areas within their respective clan boundaries. More than half of households in Birimkamba, Karandimok and Komokpin reported a decrease in the availability and abundance of resources. This was also reflected in feedback from engagement with community members in Putmambin, who noted that growing population was putting pressure on available resources, and that due to a scarcity in resources people 'had to travel far to look for the wild animals for meat'.

Bush resources are collected from forested areas to provide food, traditional medicines, building materials and other materials such as firewood. In addition to permanent residents of TSF villages, bush resources are collected by community members currently living in communities such as Ningerum and Alice Pit, who often return to their home communities to collect bush foods and materials (e.g., firewood, timber for house construction). Community members reported that these resources were harvested from within their respective clan boundaries.

Most households collected bush resources on a weekly basis from areas with about a half day travel from communities. Firewood and building materials were reported by TSF households as the most collected bush resources, including by communities closest to the TSF site. Collection of bush resources for medicinal purposes was commonly reported by households in the TSF communities, particularly for Kungembit and Putmambin where about 90% of households collected bush medicine (e.g., salat plant). Community feedback from FGDs suggested that use of bush medicine by communities was partly due to challenges in accessing health care (e.g., *'resort to traditional medicine first thinking hospital is quite far to reach. When close to town or when accessible, they [use] medicine from the hospital'*).

Fishing and riverine resources

Fishing and collection of river resources is undertaken by most households in the TSF. Food resources such as fish, crustaceans, turtles, and edible plants are the main riverine resources collected by households, although households also reported collecting logs for canoe making, firewood, and building materials (e.g., stones and pebbles).

Households generally fish or collect riverine resources from rivers, and smaller channels and creeks closest to their village, including the Ok Tedi, Ok Birim and Ok Yep. Specifically, it was reported during the household survey and FGDs that:

- Kungembit community fish in the Ok Yep and its tributaries, and Ok Birim.
- Birimkamba community fish in the Ok Tedi, Ok Birim and its tributaries, and smaller channels and creeks in the forest surrounding the village, or up to about a half day walk.
- Ambaga and Putmambin communities mostly fish in rivers and creeks around the village or up to about a half day walk, including the Ok Yep.
- Karandimok community mostly fish in the Ok Birim and creeks (Plate 9.16 and Plate 9.17).

Households generally go fishing on a weekly or monthly basis and mainly catch enough for their own consumption. This is consistent with trends in other regions of the North Fly District where fishing and riverine resources supplement garden food. The main food resources collected from waterways are fish such as snakefish, catfish, tilapia, and prawns, shrimp, eels, and turtles. Creeks are mainly used for collecting prawns, crayfish, small and large fish, and eels, while larger fish are mainly collected from larger creeks and the Ok Birim (Appendix E).

Plate 9.16
Ok Birim, near Karandimok village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.17
Creek, Karandimok village



Photo credit: Tetra Tech Coffey, 2025

Fishing is conducted by a range of methods, including hook and line, gill netting, diving, spearing, hoop nets, and bush rope (Appendix E). Feedback from consultation also noted that people block water in smaller channels and scoop out the water to harvest fish and prawns. Derris root, which is a locally growth natural fish toxicant, is also used in smaller creeks (Appendix E).

Availability and abundance of fishing grounds and river resources were reported differently across TSF communities. More than half of households in Ambaga, Kungembit, Kungim and Putmambin thought that the availability and abundance of fishing grounds and river resources were about the same or better compared to previous years, although people living in Birimkamba, Kungim and Karandimok reported decreased fish stocks, with some community members attributing this to changes in water quality in rivers such as the Ok Birim and other waterways.

Artisanal and small-scale mining

Artisanal and small-scale mining (ASM) for gold is an important economic activity for individuals and communities across PNG (Bainton et al. 2020). In the Ok Tedi context, ASM largely involves reworking mine-derived tailings and tailings-laden river sediments that have been discharged into the Ok Tedi under the mine's riverine disposal regime; these materials are reworked/panned by residents of tailings affected communities along the river (Jenkins 2016). Advice from OTML suggests that most gold in the Ok Tedi that is targeted by ASM is from both historic and current waste rock disposal, and historical accumulation of tailings; there is a very low concentration of gold in the final tailings discharged to the river system now due to low head grades and gravity separation and pyrite flotation in the process plant. Alluvial mining was identified as a key driver of in-migration into project communities, with feedback from consultation reporting that alluvial mining had attracted people from all over PNG to settle in the area.

ASM occurs within the Ok Tedi mainly occurs between Tabubil in the north and Bige in the south and is important source of income for households in TSF communities and the wider project area. Within TSF communities, households in Birimkamba, Karandimok, Kungembit, and Komokpin reported that alluvial mining/ sale of gold had contributed to household incomes over the previous year. Community feedback from FGDs also noted the importance and prevalence of ASM for TSF communities. Specifically, it was noted that ASM is a main source of income, particularly for communities closest to the Ok Tedi. ASM activities by people from TSF communities is mainly conducted along the Ok Tedi between Komokpin and Ningerum, with men and women participating in ASM. Feedback from FGDs in Birimkamba noted that ASM activities were mainly limited to people who have rights to clan land located along the banks of the Ok Tedi.

Gold from alluvial mining was generally taken to Ningerum to sell with community feedback noting that there were several local buyers. It was reported that some people can earn up to about PGK 7,000 in less than two weeks from the sale of gold.

Further discussion on ASM activities conducted by communities in the study area is in Section 9.2.4.2 to Section 9.2.4.5.

Employment, income and expenditure

This section describes economic activity in the study area, including employment (both formal and informal), household income and expenditure across the TSF communities.

Employment and income

Informal employment in PNG involves cash crop production, managing small stalls, selling cooked food in markets, sewing and house cleaning (NRI 2023). Conversely, formal employment involves jobs legally formalised with companies or businesses where people earn a wage. Consistent with rural PNG, most people employed in TSF communities are employed in informal employment. Approximately half of those engaged in informal employment mainly participate in subsistence gardening activities followed by alluvial mining, hunting

and marketing to a lesser extent. Women, particularly, are more likely to be involved in informal employment activities than men.

The TSF communities generally have low proportions of people employed in formal employment. The exception to this is Kungim, where approximately 18% of people surveyed were in formal employment. Males have greater formal employment than females in the TSF communities, with Kungim the only village where households reported that women were engaged in formal employment (e.g., with OTML, teacher). However, it was noted during FGDs that some women from Putmambin were teachers in Kiunga. Low levels of women participating in formal employment is consistent with trends across rural PNG, with this due to a range of cultural, social and economic factors including a lack of educational infrastructure, gender dynamics and land rights (MDF 2018).

The main sources of income reported by households in TSF communities included:

- **Cash cropping**, with households earning income primarily from the sale of cash crops, and particularly betel nut.
- **Income from compensation**, including CMCA village benefits received directly by households annually, and general compensation payments for environmental impacts paid to clans.

Income inequality is evident between TSF villages, with median fortnightly household income across the TSF communities ranging from PGK50 in Kungembit to PGK525 in Komokpin. Income inequality is also evident within some TSF villages, which reported income ranges from zero to PGK2,600.

Household expenditure

Food and transportation costs are the primary expenditure costs for households in the TSF communities. Other annual expenses included education fees and expenses, health care such as purchasing medicine, and purchasing of capital items (e.g., generator and mobile phone). Reliance on purchased food varies across the TSF communities and is generally higher when compared to rural PNG. In Birimkamba, Karandimok, Kungembit and Kungim up to half of households purchased food in the previous fortnight, while all households in Komokpin reported purchasing food. Several factors can be attributed to a higher reliance on purchased food:

- **Disposable income.** Households with a higher median income may be more able to spend income on purchased food. Households in Putmambin, Ambaga, and Kungembit reported the lowest household incomes and had some of the lowest proportions of households that spent money on food. It is likely that households in these villages will have a higher reliance on food they grow or collect themselves. Women in Ambaga noted that they trade or purchase food from markets and stores across the border, which are more affordable.
- **Barriers to gardening.** Households may be unable to rely on consuming own-produced food if they face barriers to gardening. Common barriers identified by households included animal trespass, insects and birds in Kungembit, and poor soil fertility in Birimkamba, and animal trespass, poor soil fertility, and insects in Ambaga and Komokpin. Animal trespass, poor soil fertility, insufficient land and time available for gardening were also identified as barriers by households in Kungim and Putmambin.
- **Food shortages.** Food insecurity is a concern for households in all TSF communities. Birimkamba, Komokpin and Putmambin had the highest proportion of households that experienced food shortages, while Kungim, Kungembit, and Karandimok reported lower levels of food security.

Housing and asset ownership

Houses in TSF communities comprise permanent housing, that is dwellings constructed from finished materials such as metal and wood; semi-permanent housing constructed by a mix of finished and bush materials such as thatched walls with metal roof; and traditional housing constructed from bush materials such as thatch and palm leaf. Plate 9.18 to Plate 9.20 show examples housing types within the TSF villages. Ambaga, Kungembit and Birimkamba had the highest proportions of semi-permanent or permanent dwellings,

with 50% of houses in Birimkamba reported to be permanent dwellings, while about half of dwellings in Kungembit and Ambaga were semi-permanent. The proportion of traditional dwellings in these villages as approximately 20% in Ambaga, 30% in Kungembit and nearly 40% in Birimkamba. Housing in Karandimok, Komokpin and Kungim mainly comprises traditional housing made from bush materials.

The TSF area is not connected to the PNG Power network. Household energy/ lighting sources are mainly battery powered lanterns, solar power kits and open fire. Wood is the main source of fuel for cooking, which is consistent with rural PNG. In Ambaga, Birimkamba and Kungembit cooking is done in a separate building (*haus kuk*).

Asset ownership is crucial for individual and household wellbeing and plays a key role in reducing poverty by generating income, credit collateral and assisting households overcome financial challenges. Asset ownership amongst households in TSF communities is limited. The most owned assets are mobile phones, livestock, and solar panels, which can support income generation and household improvements. Motorcycle ownership is limited in TSF communities and reflects the lack of roads. Ambaga and Kungim were the only villages that had households that owned motorbikes. This is likely to reflect the proximity of these villages to Indonesia, which is the main source of motorbikes in the region.

Motorboat ownership reflects proximity to the Ok Tedi and Ok Birim for Birimkamba, Karandimok and Komokpin. Komokpin particularly had relatively high levels of motorboat ownership, which is also likely to reflect the remoteness of the village and lack of alternate access to centres (e.g., bush tracks).

Infrastructure and services and people's productive capacity

This section provides an overview infrastructure and services in the TSF communities, including health, education and support infrastructure, along with a description of food and water security.

Community health

Access to services

Access to functioning health services is limited in the TSF communities, with the only functioning health facility at Kungim. Figure 9.10 shows health care facilities used by TSF communities. Kungim sub-health centre is run by the Monfort Catholic Mission and provides services to the communities of Kungim and surrounding villages. Other health care facilities within the TSF villages include:

- Non-operational aid post at Ambaga (no community health worker).
- An aid post staffed by a community health worker in Komokpin. It was reported during engagement that the aid post building is condemned, and a new aid post is under construction.

A new aid post was under construction in Karandimok at the time of engagement for this social characterisation in July and August 2025.

Barriers to health care access for TSF communities include lack of facilities, distance to health facilities, and lack of transport. In addition to the Kungim sub-health centre and Komokpin aid post, people in the TSF communities access health services at other centres within the North Fly District, including Ningerum, Rumginae, Motkomnai, and Yenkenai. In cases of serious illness people travel to hospital in Kiunga or the OTML-run hospital in Tabubil.

Plate 9.18
Example of a permanent house,
Birimkamba village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.19
Example of a semi-permanent house

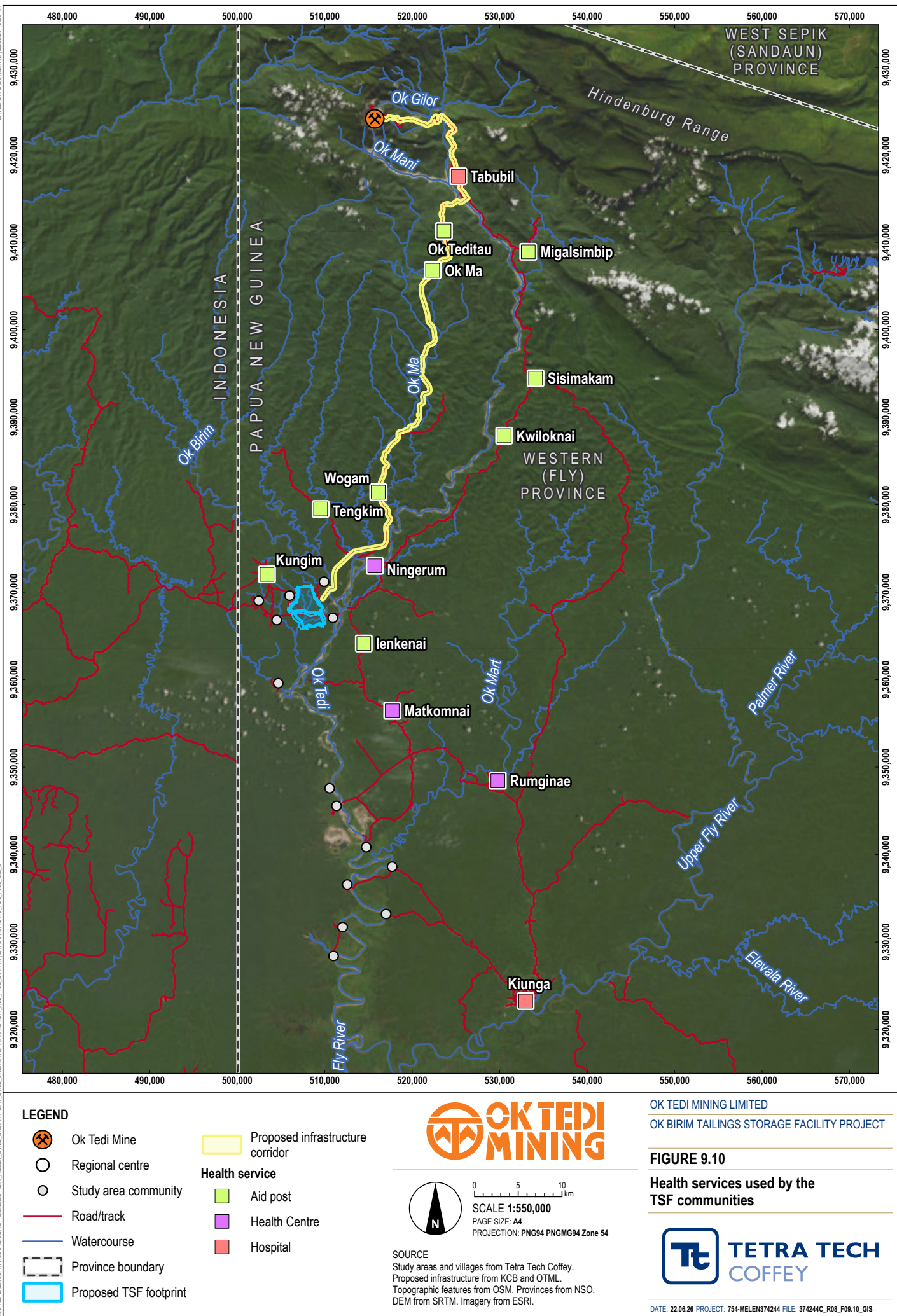


Photo credit: Tetra Tech Coffey, 2025

Plate 9.20
Example of a traditional house,
Karandimok village



Photo credit: Tetra Tech Coffey, 2025



Access to maternal health care is a particular issue for TSF communities. Maternal and infant mortality is a concern across PNG and is exacerbated by delays in seeking health care, delays in reaching health facilities, and poor-quality health services (NSO 2019). Community feedback identified childbirth as a health care issue faced by women in the TSF communities, with women facing challenges associated with childbirth related to access and distance to hospital and health care facilities. Feedback from women's FGDs noted that many women give birth in the village with assistance from village nurses. Further, women in Ambaga and Kungembit reported instances of women giving birth alongside the road while travelling to access health care at Kungim, sometimes during which babies die and are buried along the roadside.

Cost of health care, medicines and travel to health facilities were also identified as a barrier for some households. Feedback from FGDs with women in TSF villages reported that women seeking birthing support or post-partum treatment at Kungim sub-health centre were required to pay PGK1 for one day or PGK10 for a year. It was also reported that some government health services did not always have medicine supplies. This is consistent with conditions across Western Province and PNG broadly which is challenged by remoteness and '*significant operational deficits*' (Fly River Provincial Government 2022).

Health conditions

Illnesses within TSF communities most often reported during the household survey included malaria, diarrhoea, stomach pains and respiratory diseases such as tuberculosis (TB). This is broadly consistent with health data across PNG, where communicable diseases such as diarrhoea and respiratory diseases such as pneumonia and tuberculosis is most prevalent (WHO 2016). Tuberculosis is a key public health issue for communities in the study area and wider North Fly District and Western Province. The Western Province has one of the highest rates of TB, including multi-drug-resistant TB, in PNG (OTML 2026), with feedback from OTML's Health Services noting migration as a key pathway for the disease.

Malaria is endemic in PNG. The malaria incidence rate for PNG was 163 infections per 1,000 persons in 2022 (WHO 2024). In the North Fly District, the malaria incidence rate was 194 infections per 1,000 persons, 15% above that for PNG and other districts in Western Province (GPNG 2021). Ownership and use of mosquito nets is a key strategy for malaria prevention. All TSF communities, except Ambaga, reported a higher proportion of households in which all members sleep under treated nets compared to Western Province, with most households reporting that they treated their nets between one to three years ago.

Incidences of sanitation related communicable diseases, such as dysentery and diarrhoea, were commonly reported by health facilities in the North Fly District (PSSD Department 2023). These diseases are spread from living in close contact with others, and having poor housing, water and sanitation conditions. Inadequate sanitation and hygiene facilities are a common health concern across PNG, with the majority of households lacking access to improved sanitation facilities (PNG IMR 2021). Consistent with this, most houses in the TSF communities indicated that they either shared or owned an unimproved sanitation facility². Ambaga has the highest proportion of households with improved sanitation facilities (36.8%), while Kungim has the highest proportion of households with no sanitation facility (17.6%).

Education

Access to services

Access to educational facilities in the TSF communities is generally limited (Figure 9.11). There are five schools across the TSF communities, although only schools at Komokpin and Kungim are operational Plate 9.21 and Plate 9.22 . Feedback from FGDs indicated that a lack of access to education has resulted in families moving to larger communities such as Alice Pit or Ningerum.

The closest secondary school to the TSF communities is in Ningerum. Feedback from engagement with Ningerum High School noted that most students who board at the school were students who lived in the TSF

² Unimproved sanitation involves the use of pit toilets without a slab or open defecation (e.g., bush or river).

communities. There is one tertiary training facility (TVET) within the TSF communities, located at Kungim. Other villages must travel to the regional centres to attend training institutions following school.

Education attainment

Literacy levels of people within the TSF communities are similar to those for the Western Province. Males typically reported higher levels of literacy than females. Apart from Karandimok, TSF villages generally reported literacy rates amongst males of between 70% and 90%. For females, literacy rates generally ranged from about 50% to 60%, although literacy rates for females in Ambaga were lower at about 40%.

Information from the household survey on school attendance of individuals aged between 6 and 24 years old found that:

- Attendance of children at primary school was generally consistent with attendance data for the Western Province (54.1%). Exceptions to this were Putmambin, which had higher attendance rate (79.3%), and Komokpin, which had a lower attendance rate (22.7%).
- Attendance of children at secondary school was generally lower than attendance data for the Western Province (17%), although Kungim reported a higher school attendance rate.
- School attendance by females was generally higher than attendance by males.

Table 9.2 details reported levels of educational attainment for people aged 15 years and older in the study area. Educational outcomes differ between villages, though the most common level of education achievement reported through the household survey was preparatory, elementary or primary school.

Higher proportions of males indicated finishing secondary school and tertiary study compared to females, which is consistent with the broader Western Province population. This was also reflected in feedback from FGDs, where women noted that education levels for girls and women are not high and that few girls make it to secondary school to continue grade 10 to grade 12. Cost of school fees and distance to school were identified as barriers to schooling for girls and women.

Table 9.2 Highest level of educational attainment

Education level	Gender	Ambaga	Birimkamba	Karandimok	Komokpin	Kungembit	Kungim	Putmambin	Western Province*
None	Female	6.7%	0.0%	0.0%	5.3%	5.6%	9.1%	0.0%	6.7%
	Male	5.3%	5.9%	0.0%	0.0%	0.0%	0.0%	0.0%	5.3%
Preparatory/elementary/primary school	Female	53.3%	63.2%	57.1%	42.1%	50.0%	45.5%	63.2%	40.0%
	Male	47.4%	47.1%	30.0%	16.7%	61.1%	64.7%	54.5%	36.8%
Secondary school	Female	13.3%	21.1%	35.7%	15.8%	22.2%	40.9%	21.1%	13.3%
	Male	31.6%	35.3%	40.0%	38.9%	38.9%	47.1%	27.3%	31.6%
University/Vocational/ technical college	Female	0.0%	0.0%	7.1%	5.3%	0.0%	4.5%	0.0%	6.7%
	Male	5.3%	11.8%	40.0%	11.1%	16.7%	11.8%	13.6%	15.8%

Source: *NSO (2019). Note: NA – not available

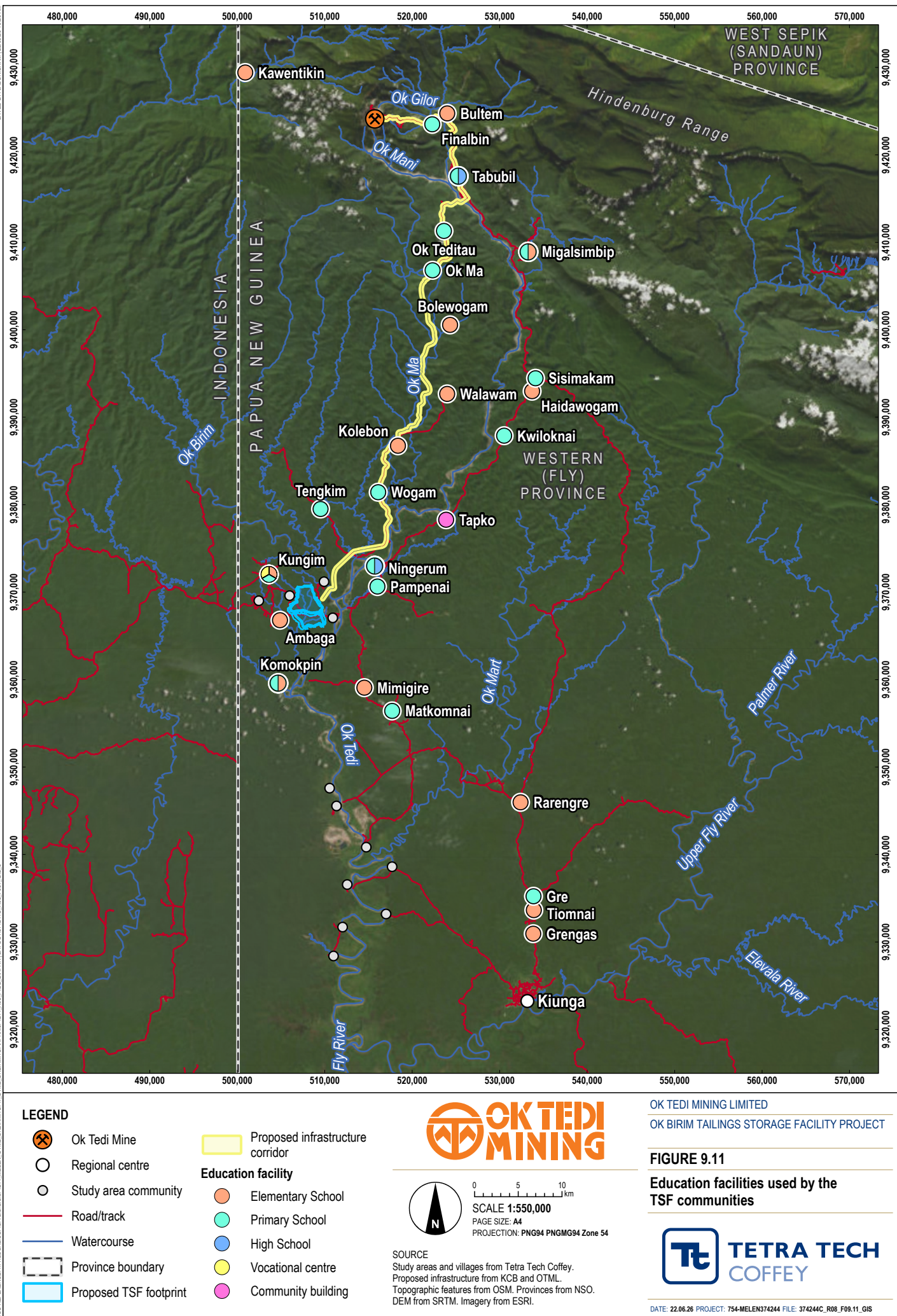




Photo credit: Tetra Tech Coffey, 2025

Plate 9.21
Komokpin Primary School



Photo credit: Tetra Tech Coffey, 2025

Plate 9.22
Kungim school

Support infrastructure

This section provides an overview of infrastructure that supports the societal and economic function of the TSF communities, including transport, governance and law and order services, and drinking water. The tracks (Plate 9.23) or dinghy or canoe along creeks and rivers (Plate 9.24). Feedback from FGDs on travel time between TSF communities indicated that travel:

- To Kungim from either Kungembit or Putmambin takes about one to two hours each way by walking, while travel from Birimkamba or Ambaga takes about three to four hours.
- Between Kungembit and Karandimok takes about one and a half hours, while travel from Birimkamba to Kungembit can take three to four hours each way.
- Between Ambaga and Birimkamba takes about two hours by walking, and between Ambaga and Komokpin between two to three hours.

People also commonly reported travelling by a combination of walking, canoe/boat and public motor vehicle (PMV) when visiting service centres such as Kiunga information presented is primarily informed by community feedback from the FGDs and village surveys.

Transport

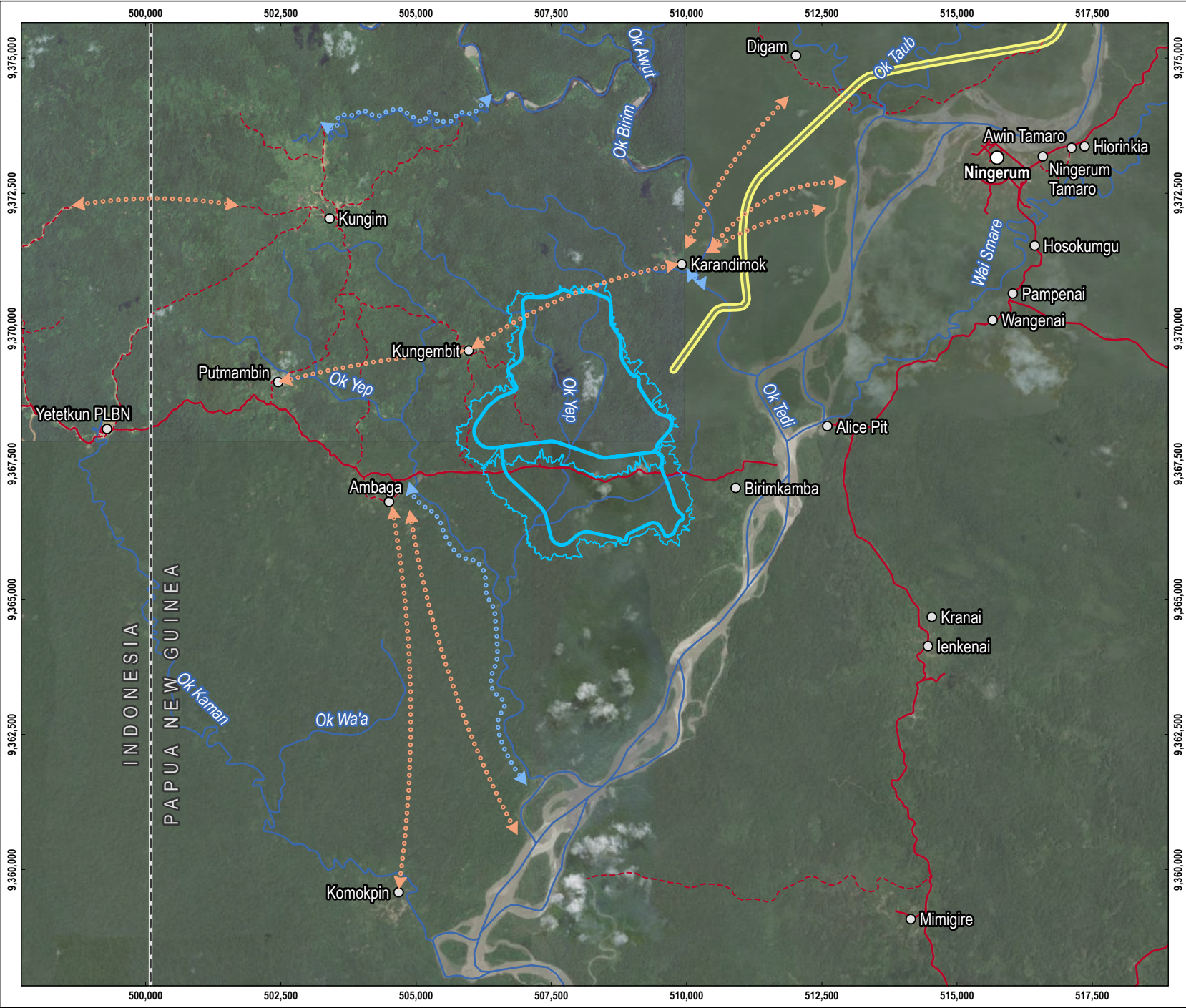
The Kiunga–Tabubil Highway is the main road in the region and connects the service centres from Tabubil in the north, to Kiunga in the south (see Figure 9.1). The ITCS Road, which is currently under construction, and will connect the Yetetkun PLBN to the Kiunga-Tabubil Highway at Alice Pit with a bridge crossing the Ok Tedi at Birimkamba (Plate 9.25). Construction of the road was announced by OTML in 2024 with the aim of providing local communities with ‘better access to cheaper goods and services that foster social and economic growth’ (OTML 2024e). The road currently provides access for pedestrians to villages of Putmambin, Ambaga and Birimkamba and is described by communities as being in fair to good condition.

Travel between TSF communities, to areas used for livelihood activities, and to other locations such as the Indonesian border and Alice Pit mainly occurs on foot via bush tracks or by dinghy or canoe along creeks and rivers. Access routes mapped during the field investigations in 2025 are shown in Figure 9.12. People reported travelling by a combination of walking, canoe/boat and public motor vehicle (PMV) when visiting centres such as Kiunga and Ningerum. Community members reported that travel to Ningerum costs between PGK15 from Karandimok, including PGK10 for the boat to Alice Pit and PGK5 for the PMV to Ningerum. From Kungim, the cost of travel is between PGK30 and PGK40, which includes costs for boat travel to Alice Pit of about PGK25 to PGK30. When travelling by river, people from Birimkamba, Karandimok, Komokpin, Kungembit, Kungim and Putmambin use a dinghy or canoe. Canoes are used to travel via river in Ambaga, though walking is the preference. Similarly, use of canoes was noted by the men from Komokpin during FGDs.

Markets in PNG are important places for the generation of income, purchasing food and for informal meetings and socialisation (Kopel 2021). Livelihoods of people are dependent on accessibility to markets to sell cash crops (OTDF 2018). TSF communities face barriers in accessing markets due to limited transport access, long distances, and high travel costs. Figure 9.13 shows the location of markets accessed by TSF communities. The main markets accessed include those at Ningerum, Kungim and Alice Pit, although feedback from FGDs noted that people from Kungim, Putmambin and Ambaga also access markets at the Yetetkun PLBN border crossing.

Law and order

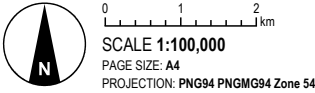
Law and order services are limited in the TSF communities. There are no police stations in the villages, with the nearest station at Ningerum. During FGDs, village leaders were commonly reported to be the first option for resolving community safety issues, followed by ward councillors in some instances. More serious issues were taken to the police in Ningerum. No village courts were reported to be in the TSF villages.



LEGEND

- Regional centre
- Study area community
- Road
- - - Track
- Watercourse
- - - International border
- Proposed TSF footprint
- Proposed infrastructure corridor
- Access and transport route
 - Bush track
 - Canoe/boat path

SOURCE
Resource use mapping and villages from Tetra Tech Coffey.
Proposed infrastructure from KCB and OTML.
Topographic features from OSM. Admin boundary from NSO.
DEM from SRTM. Imagery from ESRI.



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FIGURE 9.12
Access and transport routes



Plate 9.23
Bush track, Birimkamba village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.24
Dinghies located on the bank of the Ok Kaman,
Komokpin village

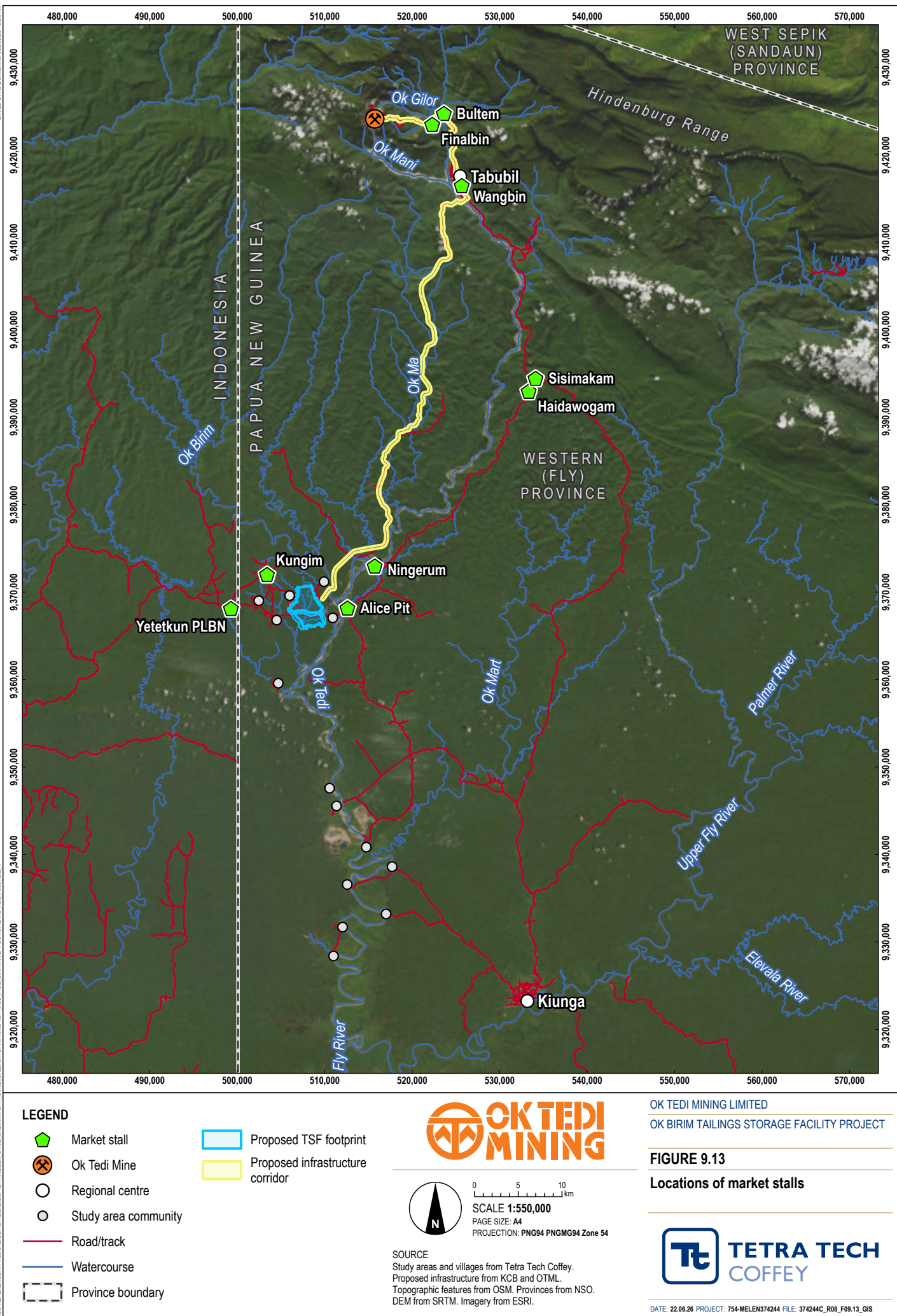


Photo credit: Tetra Tech Coffey, 2025

Plate 9.25
ITCS Road looking west, Birimkamba



Photo credit: Tetra Tech Coffey, 2025



Drinking water

Basic drinking water services are defined as water from an improved source such as a household connection, public standpipe, borehole, protected dug well, protected spring and rainwater collection (e.g., tanks), within a collection time of not more than 30 minutes return trip (World Bank 2026; WHO 2023). Drinking water sources used by households differed across the TSF communities depending on their location and whether it was wet or dry season. The most common drinking water source reported by households are dug wells, followed by surface water, such as rivers, creeks and springs. This is consistent with drinking water sources reported in communities across North Fly District (PSSD Department 2023). Specific water sources reported by TSF villages closest to the TSF site include:

- Kungembit – dug wells and nearby creeks, rivers and springs are the main water sources for drinking, cooking and washing.
- Birimkamba – water for drinking, cooking and washing is mainly sourced from small creeks and streams close to the village, as well as wells and communal water tanks.
- Karandimok – drinking water is mainly sourced from four communal water tanks connected to the roof of the community meeting area, with other household water sources including dug wells, springs, and surface water sources (e.g., river, creek, streams).
- Ambaga – the main water sources include wells and rivers and streams, including the Ok Yep ('big river') during periods of drought, with springs, household tanks/ drum, or communal water tanks also used by some households.

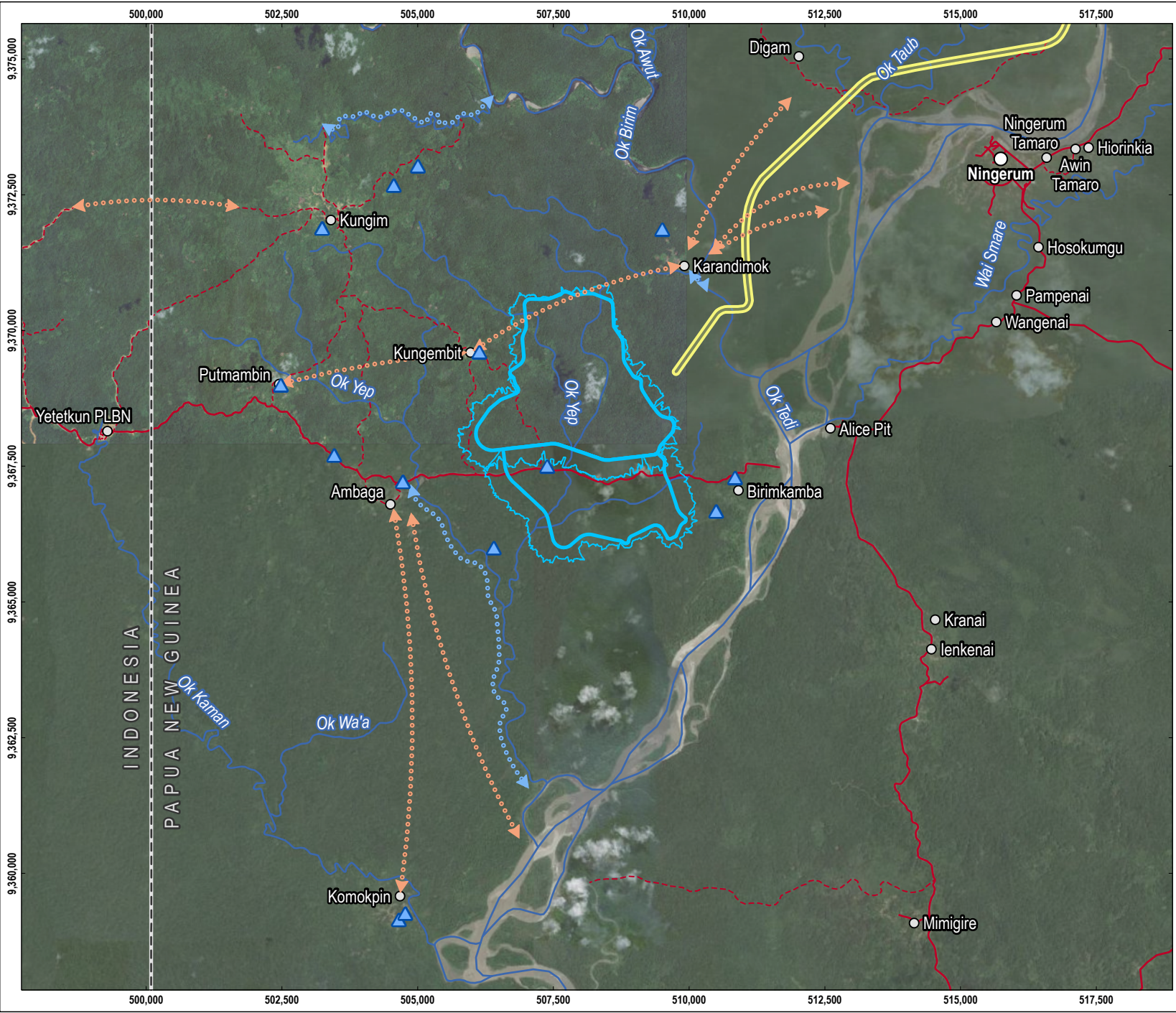
Respondents of the village survey in Karandimok and Ambaga noted that the community had rainwater tanks required cleaning and maintenance, and as a result were not relied on by community members. Figure 9.14 shows some of the water source locations identified through engagement with community members, while Plate 9.26 to Plate 9.28 provide examples of drinking water sources within the TSF communities.

In relation to water security, all communities have access to at least two different water sources that were used throughout the year. Communities reported that alternative water sources are used during different seasons or periods of drought due to changes in water levels (e.g., 'during long drought when the tank water runs dry, community normally use the underground spring water for drinking and cooking'). The self-reported availability of drinking water in all TSF communities was sufficient, except for Komokpin, where some shortages were reported. Households also reported that their water sources were within 30 minutes total collection time during both wet and dry seasons, which is consistent with data for rural PNG with 84% of households having access to drinking water within 30 minutes or less (NSO 2019).

Households did not report a change in total collection time between wet and dry seasons. Most respondents across the TSF communities did not report any issues with their drinking water sources (Table 9.3). Where there were concerns about drinking water, common quality issue are sedimentation, particularly after rainfall. Some households reported that the water tasted bad or 'tasteless'; however, these concerns were not expressed by all communities, with community members from Putmambin reporting that the spring water tasted '*better than tank* [water]'. Further information on water quality is in Appendix C, and Appendix D.

Table 9.3 Reported water quality issues

Issue	Ambaga	Birimkamba	Karandimok	Komokpin	Kungembit	Kungim	Putmambin
No issues	47.1%	46.7%	55.6%	58.3%	68.8%	92.9%	61.9%
Sediment	41.2%	33.3%	33.3%	0.0%	31.3%	0.0%	38.1%
Bad taste	5.9%	20.0%	11.1%	33.3%	0.0%	0.0%	0.0%
Other, including discoloured/ odour	5.9%	0.0%	0.0%	8.3%	0.0%	7.1%	0.0%



LEGEND

- ▲ Water source (drinking/cooking)
- Regional centre
- Study area community
- Road
- Track
- Watercourse
- International border
- Proposed TSF footprint
- Proposed infrastructure corridor
- Access and transport route**
- Bush track
- Canoe/boat path

SOURCE

Resource use mapping and villages from Tetra Tech Coffey.
Proposed infrastructure from KCB and OTML.
Topographic features from OSM. Admin boundary from NSO.
DEM from SRTM. Imagery from ESRI.



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FIGURE 9.14

Water source mapping



DATE: 22.06.26 PROJECT: 754-MELN374244 FILE: 374244C_R08_F09.14_GIS

Plate 9.26
Water source, Karandimok village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.27
Water sourced from spring, Birimkamba village



Photo credit: Tetra Tech Coffey, 2025

Plate 9.28
Rainwater tanks, Birimkamba village



Photo credit: Tetra Tech Coffey, 2025

Food security

Food insecurity is a common problem across PNG, with more than half of the population (57%) experiencing moderate to severe food insecurity (NSO 2019). Participants from all TSF communities self-reported that there was a mild level of malnutrition within their village. Without a balanced nutritional daily diet, communities in the North Fly District are more vulnerable to malnutrition and other health issues (PSO Department 2023).

Data from the household survey indicates that food insecurity is widespread across the TSF communities (Table 9.4), although TSF communities apart from Birimkamba and Komokpin experienced lower levels of food insecurity compared the North Fly District. Food security data for the North Fly district (Schneider 2021), indicates that 60% of households experienced severe food insecurity in the previous 12 months.

Findings on food security for households in the TSF communities are summarised below:

- Birimkamba indicated instances of severe food insecurity, particularly during flood periods, with participants of FGDs reporting that gardens do not provide enough '*when it rains heavily*'.
- Feedback from Ambaga and Putmambin suggests moderate food insecurity with approximately half of households reporting concerns about having enough food, skipping meals, or food shortages.
- Putmambin households reported there have been some food shortages.
- Komokpin responses show more than about two-thirds of households reported instances of moderate and severe food insecurity. Concerns regarding the impact of the Ok Tedi Mine on natural resources and food security were raised during FGDs in Komokpin.
- Remaining TSF communities (Karandimok, Kungembit and Kungim) indicate food insecurity is present but less widespread, with less households reporting concerns about having enough food, skipping meals, or food shortages. Karandimok and Kungim households reported that there have been some food shortages, while Kungembit households reported there has been sufficient food.

The most common coping strategies for households when they do not have enough food was to travel further to collect food, with households stating that they harvest sago and collect other traditional bush food sources. This is consistent with food consumption data for other North Fly District communities, which identified that there was a high consumption of sago and other root crops (PSO Department 2023). All TSF communities, except Putmambin, indicated that trade stores were one of their primary food sources, suggesting that there is some consumption of trade store foods. In PNG, food sold in trade stores is often highly processed, low in nutritional value, and offers little variety (Schmidt et al. 2021).

Table 9.4 Food insecurity in TSF communities

Indicator	Household was concerned about having enough to eat in the last 12 months (i.e., mild food security)	Households that had to skip a meal in the last 12 months sometimes or frequently (i.e., moderate food security)	Households that ran out of food in the last 12 months (i.e., severe food security)
Ambaga	52.9%	47.1%	50.0%
Birimkamba	37.5%	43.8%	68.8%
Karandimok	33.3%	36.4%	36.4%
Komokpin	66.7%	75.0%	66.7%
Kungembit	35.3%	35.3%	35.3%
Kungim	29.4%	17.6%	29.4%
Putmambin	54.5%	50.0%	54.5%

Note: Multiple choice question, so responses may not equal 100%.

9.2.4.2 Infrastructure corridor

This section provides an overview of existing characteristics, values and features of villages and settlements along the proposed tailings pipeline route and pipeline access road. Information presented in this section includes information collected through social fieldwork in October 2025, and secondary data sources, including CMCA population data held by OTML.

People, community identity and place

This section describes the setting of the infrastructure corridor communities, including a demographic profile of the people who live in the area, where they live and why.

Overview of tailings pipeline communities

The tailings pipeline and pipeline access road passes through land belonging to 21 communities, including:

- Mine communities of Antikink, Finalbin, Atemkit, Bullem, Kavorabip, and Wangbin.
- Kumkit and Ankit towards the northern section of the route.
- Ok Teditau, Nioksiwiki, Derongo, Bolewogam, and Bounghim, within and around Ok Ma.
- Walawan, Kolebon, Bumbin, Wurimkannatgo, Wogam, Wombom, Digam and Ningerum Tamaro towards the southern section of the route.

In addition, Seven Kona community is located on the western bank of the Ok Tedi (Plate 9.29 and Plate 9.30). The community was established in about 2008 and comprises a mix of settler communities (kona 1 to 4) and hamlets of Kumkit and Ankit (kona 5 to 7). Community members estimate that kona 1 to 3 have a total population of about 700 people, although it was suggested that this was over 1,000 people prior to the collapse of the Ok Tedi bridge. Feedback from consultation for the social characterisation noted that settlers came from across PNG including the Highland areas of Tari, Hela, Oksapmin from Sandaun Province, Awin peoples from Western Province, and people from Sepik and Wabag.

The six mine communities have a total population of 4,672 people, of which about one third are in Bullem. The Kumkit-Ankit community was established at its current location in 1992, by community members who migrated from their village west of the community. The agreement with landowners allows the community to live and conduct activities within certain locations and boundary extents. The main livelihood activities for people in Kumkit-Ankit include sale of betelnut, sago and garden produce and sale of gold from ASM. Land used for gardening and farming is generally within the boundary of the community agreed with landowners. The community reported restrictions on fishing and hunting within this area, with these activities conducted in their home villages, located approximately a day travel. Services such as health, markets and banking are mainly accessed in Tabubil, which is approximately 3.5 km by road/ footbridge. Schooling is accessed in Tabubil and at Ok Ma, approximately 8 km south of Kumkit-Ankit by road.

Ok Ma is located approximately 10 km (direct line) southwest of Tabubil and approximately 12 km by road. The settlement was established in about 1985 on land of Ok Teditau, and comprises residents of Ok Teditau, Nioksiwi, Bounghim and Derongo. Plate 9.31 and Plate 9.32 show views of the community. Development of the settlement was mainly driven by better access to services (e.g., school, healthcare and markets). The CMCA population of the four communities was about 1,448 people in 2023 (OTML 2023d), although community feedback reported that the population was approximately 1,000 people with other people living in their respective villages or elsewhere (e.g., Tabubil, Ningerum). It was reported that some people spend the weekends in their respective villages. The main livelihood activities of community members include sale of garden produce. Rivers and smaller waterways near the settlement are used for fishing, and water for drinking and washing. Overall, the community members describe the settlement as peaceful, with safety issues generally minor and manageable.



Photo credit: Tetra Tech Coffey, 2025

Plate 9.29
Aerial view of Seven Kona community



Photo credit: Tetra Tech Coffey, 2025

Plate 9.30
Seven Kona community



Plate 9.31
Housing, Ok Ma community



Plate 9.32
Recreation area, Ok Ma community

An increase in drug and alcohol use has occurred over recent years, with this attributed to shifting perspectives and social changes introduced by younger generations. Access to Tabubil is by walking, which takes about three to four hours. Prior to the collapse of the Ok Tedi bridge in 2013, access to Tabubil would take about 45 minutes by road.

There are eight villages located south of Ok Ma, including Kolebon, Walawam, Boliwogam, Bumbin, Digam, Ningerum Tamarao, Wogam and Wombon. People from each of the villages apart from Kolebon, Wogam, and Wombon have migrated to Ningerum or to settlements along the Kiunga-Tabubil Highway.

Kolebon was established at its current site in 1983 and includes clans from Kolebon and a previous village, Tingwi. Plate 9.33 shows an aerial view of Kolebon village looking northwest, while Plate 9.34 shows a view of Kolebon village. The CMCA population of Kolebon was 376 people in 2023 (OTML 2023^d), although community feedback indicates that the population is about 319 people of which about 200 people live in the community. Other community members have migrated out (e.g., to Ningerum, Alice Pit) for school and work opportunities. Access to Ningerum takes about 4 or 5 hours walking via bush tracks. The village has a primary school and previously had an aid post, although this has not been operational since the early 2000s. Community feedback noted that some people conduct ASM activities in the Ok Tedi (Alice River), particularly young people, with income from ASM supporting daily expenses.

Bolewogam village is located south of Ok Tedi Mine. Most of the community have settled at four main locations: Ok Ma, Bolewogam settlement on the Kiunga-Tabubil Highway (KM 117), settlement at KM112 on the highway, and Guimdum, which is located on the west bank of the Ok Tedi opposite KM 115. It is reported that people moved to the three settlements east of the Ok Tedi following the collapse of the Ok Tedi bridge in 2013. About 50 or 60 people continue to live at Ok Ma, and about 10 people live in Bolewogam village. Community members return to the village weekly to carry out activities such as gardening due to restrictions on land available for gardening at the Bolewogam settlement. Access to the village involves crossing the Ok Tedi (by tube) and walking via bush track, with the trip taking between three and six hours. Sale of gold from ASM along the Ok Tedi is the main source of income for households, with community members reporting that people spend time daily at the river for ‘panning purposes’. Other income generating activities including sale of garden produce at markets, and sale of groceries at stalls and roadside markets at Bolewogam settlement.

Many community members relocated from Wogam in about 1964, with about half of the 600 people living at Wogam settlement, and the remaining population spread across other locations including garden houses in the wider Wogam area, Tabubil and Ningerum, and other provincial towns. The village has a school and aid post with a voluntary community health worker. The main income generating activities for households in Wogam include sale of garden produce, and ASM. Alluvial mining is conducted by men and women (‘basically those that have the strength and energy to do so’) with money from ASM used for school fees and purchase of essentials. Local creeks are used for catching fish and prawns to eat.

Community members in Digam, Ningerum Tamarao, and Wombon mainly reside in Ningerum. The total CMCA population of these villages is 1,224 people, although feedback during consultation noted that the total population is about 850 people, which includes people living in the original Digam and Wombon villages.

Plate 9.33
Kolebon village, looking northwest



Photo credit: Tetra Tech Coffey, 2025

Plate 9.34
Hall, Kolebon village



Photo credit: Tetra Tech Coffey, 2025

Feedback from community members about each of the villages included:

- Digam – most people from the village migrated to Ningerum in 1964 due to better access to schools and employment opportunities. Approximately five to seven families remain in the village, and many community members return daily or weekly for activities such as gardening, hunting, tending to graves, etc. Access to the village is by bush track or walking. Key livelihood activities include selling of gold from ASM, marketing, and sale of garden produce.
- Ningerum Tamaro – the community relocated to Ningerum in the 1950s to have access to goods and services. No people live in the original Tamarao village, although there are a small number of garden houses at Brekonem village that people use when they return for hunting and gardening. Brekonem is the location of the village prior to the community's relocation to Ningerum.
- Wombon – many community members of Wombon relocated to Ningerum in 1999. About a third of the village's estimated population (400 people) live in the village. The main income generating activities for the community include sale of garden produce at the Ningerum market and in the community, and sale of gold from ASM. Community feedback noted that most of youths and some older men pan for gold daily along the Ok Tedi (Alice River) as part of their sustenance activities. The village is located about two to three hours walk from Ningerum. Community members return to the village daily to carry out livelihood activities (e.g., gardening) as they do not have land available at Ningerum.

Population

Table 9.5 presents information on the CMCA population for villages along that section of the infrastructure corridor west of the Ok Tedi. The total population of villages in this section was 4,853 people in 2023, although this includes people that have relocated away from the village, for example to settlements along the highway, Ningerum, Tabubil or other PNG provinces. Most of the infrastructure corridor communities had more females than males and, apart from Kumkit, Bounkim, and Wogam, sex ratios in the infrastructure corridor communities were below the Western Province ratio.

Table 9.5 Infrastructure corridor population and housing, 2023

Village	CMCA population	Sex ratio: males per 100 females	Households
Ankit	209	97	64
Kumkit	251	111	76
Ok Teditau	265	91	73
Nioksikwi	315	101	75
Bounkim	248	114	43
Derongo	620	91	118
Bumbin	161	94	31
Kolebon	376	97	76
Bolewogam	281	95	54
Wogam	613	104	124
Ningerum Tamarao	232	88	61
Digam	417	100	88
Walawam	290	72	52
Wombon	575	103	122

Source: OTML 2023d CMCA data

Migration

Many communities within the infrastructure corridor have relocated to settlements along the corridor (e.g., Ok Ma, Seven Kona), along the Kiunga-Tabubil Highway, or regional centres such as Ningerum or Tabubil for better access to services such as schools, health and markets. Within the infrastructure corridor, land belonging to the customary landowners of Ok Teditau accommodates a number of settlements, including Seven Kona, Kumkit-Ankit community, and Ok Ma. Settlement on the land has occurred with the agreement of landowners. Community feedback from Kumkit-Ankit noted that the agreement with the customary landowners allowed community members to live and conduct activities within certain locations and boundary extents, with restrictions on some activities such as hunting and fishing. As a government station, land within Ningerum is state land.

Community feedback from FGDs identified existing law and order and social disorder issues related to in-migration of outsiders, particularly from the Highlands regions, and raised concerns about potential for the project to increase in-migration of outsiders.

Landscape character and amenity

The proposed pipeline route extends from the Ok Tedi Mine to the TSF site south of the Ok Birim, following a predominantly north-south alignment through the Star Mountains and Ningerum Rural LLGs. The landscape varies along the corridor from the rugged, steep-sided valleys and dissected ridgelines near the Ok Tedi Mine and Tabubil area, through mid-slope forested terrain along the Kumkit-Ankit and Ok Ma sections, to more gently undulating landforms and alluvial floodplains surrounding the lower Ok Tedi and Ok Birim catchments near Ningerum and the proposed TSF site.

Seven Kona, Kumkit-Ankit and Ok Ma communities located closer to Tabubil, are situated on low ridges and terraces between the Ok Ma in the west and the Ok Maun in the east. Settlements are dispersed, with traditional dwellings interspersed among gardens and secondary forest regrowth. These communities maintain active subsistence systems supported by access to forest products, sago stands, and riverine resources.

Further south, Digam, Wombon, Wogam and Kolebon villages are located along tributaries of the lower Ok Tedi. These areas are defined by gently undulating landforms, extensive river corridors, and high forest cover. Residents rely heavily on gardening, alluvial mining, and fishing. Despite proximity to Ningerum and the Kiunga-Tabubil Highway, the landscape retains a predominantly natural and undeveloped character, with forested hills providing a natural serenity setting.

Amenity values across the corridor communities are like the TSF communities which are closely connected to the quality, accessibility, and integrity of the natural environment. During FGDs, community members expressed that the forest and rivers define their sense of place: they provide serenity, livelihood, and cultural grounding. Open areas within villages are used for gardening, recreation, and social gatherings such as funerals and '*haus krai*', which rely on the natural setting to uphold customary practices and social bonds. Seasonal and daily movements through the landscape to access gardens, fishing grounds, and hunting areas, reflect a relationship between residents and their surrounding environment.

Livelihoods

This section describes how people make a living and the economic composition of infrastructure corridor communities, including natural resource use.

Natural resource use

Livelihoods among the communities situated along the proposed tailings pipeline corridor are primarily dependent on the use of natural resources. As in much of the North Fly District, the forest, rivers, and land provide the basis for food, shelter, and income generation. FGDs undertaken in Kumkit-Ankit, Ok Ma

(Ok Teditau, Niosikwi, Derongo and Boungkim), Kolebon, Ningerum waterfront (Digam, Wombon and Ningerum Tamaro), Bolewogam, and Wogam indicate that subsistence gardening, hunting, fishing, sago harvesting, and ASM are the principal livelihood activities. Small-scale marketing of produce and cash crops such as betel nut also provides a supplementary source of household income, with earnings from the sale of garden produce often used to purchase store-bought goods, such as rice, tinned fish, cooking oil, salt, and sugar, for resale within the communities. Other sources of income exist, with a small pool of people in the communities formally employed or engaged in casual labour.

Gardening

Subsistence gardening is the dominant livelihood and primary source of staple foods for all corridor communities. Gardens are typically located adjacent to village clearings or along river terraces and low ridges where soil fertility and accessibility are favourable. The main crops cultivated include banana, cassava, taro, sago, sweet potato (*kau kau*), aibika, corn, and leafy greens. These gardens provide food for daily consumption and limited surplus for sale at nearby markets in Tabubil, Wangbin, and Ningerum.

FGDs across the corridor communities indicated that households rely heavily on gardening for food security, often maintaining gardens in several locations such as near their homes and along rivers or ridges. Women were identified as primarily responsible for planting, weeding, and harvesting, although gardening is generally a shared household activity involving men and older children. Soil fertility decline and pest damage, particularly from wild pigs, rats, and insects were commonly reported challenges, especially in Kumkit-Ankit and Bolewogam. Participants also noted that because families prefer to establish gardens close to their villages for convenience and security, the same plots are used repeatedly, reducing soil fertility and crop yields over time. Seasonal weather events, including droughts and flooding, were identified as major factors influencing gardening success. Community members observed that changing rainfall patterns and periodic flooding along the Ok Tedi and Ok Ma frequently damage gardens established on alluvial flats.

Cash crops

Cash cropping and the sale of surplus produce represent an important, though secondary, component of livelihoods in the pipeline corridor. Betel nut was identified across all FGD sites as the most common cash crop, favoured because it is light, easily transportable, and can be sold in small quantities for regular income. Other cash crops cultivated in smaller quantities include peanuts, pineapples, and corn. Rubber, balsa, and eaglewood were mentioned in Wombon as potential cash crops; however, these are largely inactive due to the lack of road access and market connectivity. Garden produce and betel nut are sold at local roadside stalls or transported to Ningerum and Tabubil markets, often by boat or on foot. The income generated is typically used to purchase basic goods, school fees, and building materials. Participants in Bolewogam and Kumkit-Ankit emphasised that the remoteness of their original villages and poor road access limit marketing opportunities and increase transport costs, reducing the profitability of agricultural sales.

Hunting and bush resource collection

Hunting and the collection of forest resources are important livelihood activities for the corridor communities and form part of their traditional way of life. Hunting is mainly carried out by men, while women collect firewood, fruits, and materials for household use. The main animals hunted are wild pigs, cassowaries, other birds, and lizards. Sago palms are also harvested as an important food source and for building materials.

Hunting areas are located within clan boundaries, and community members stated that they do not hunt or collect resources outside their customary land. Within their own territories, firewood, timber, sago leaves, and plants for traditional medicine are commonly collected for daily use. In Digam and Wombon, participants described the continued use of medicinal plants for treating sickness and pain, and noted that older women hold most of this knowledge. Community members also reported that wildlife is less abundant than in the past, and that hunters now travel further into the bush to find animals.

Fishing and riverine resource collection

Rivers and creeks, including the Ok Ma and other nearby waterways, are used by communities for daily activities including fishing. Rivers identified by community members during FGDs that are used for fishing included the Ok Maung, Ok Arok, Oktap, and Okam. Fishing was undertaken by both men and women, with local communities collecting prawns, crayfish, small and large fish including catfish, and eels from creeks and larger fish in the Ok Ma. Larger fish are generally caught using hook and line, and gill netting, and diving and spearing when water levels are low. In smaller creeks, small fish would be collected with hoop nets made from cane/sapling and bush rope/twine. Locally grown derris root is also used to capture fish (Appendix E). Feedback from some FGDs noted that pollution from the mine had resulted in a decline in fish and fish catches, with people moving away from areas affected by the mine to new fishing grounds in local creeks or further upstream. Fish catches were reported to vary.

Artisanal and small-scale mining

Information on ASM activities within the Ok Tedi is provided in Section 9.2.4.1. ASM is an important livelihood activity and key income source for communities along the infrastructure corridor, particularly for people living near the Ok Tedi. ASM is undertaken by men and women daily, with income earned used to pay school fees, buy food, and meet other household needs. Feedback noted that ASM was conducted 'anywhere allowed by landowners' downstream from Tabubil. It was also noted that settlements have been established along the Ok Tedi by people participating in ASM.

Infrastructure and services and peoples' productive capacities

This section provides an overview of the location and accessibility of infrastructure and services in the tailings pipeline communities, and information on food and water security.

Access to services

Access to functioning health and education facilities and services across the infrastructure corridor is limited but includes:

- Schools:
 - Ok Ma – elementary and primary school, which has operated since 1985 and provides schooling for students up to Grade 9.
 - Kolebon – primary school at Kolebon, which was established in 1981 and provides for students up to Grade 6.
 - Wogam – primary school providing schooling for Grades 1 to 6, and junior high school for students in Grades 7 to 10.
- Health care:
 - Ok Ma – non-functioning aid post.
 - Wogam – aid post with volunteer community health worker.

Communities in the infrastructure corridor also access education and health services in Tabubil, Ningerum, Migalsimbip, and Sisimakam.

Transport access in the infrastructure corridor to villages and centres is by walking or boat. Footbridges are provided at Tabubil and north of Ningerum (Plate 9.35 to Plate 9.36) that provide access for communities west of the Ok Tedi to Tabubil and Ningerum. A road previously connected Ok Ma and Tabubil via a bridge over the Ok Tedi. The bridge collapsed in 2013 and has not been prepared to allow vehicle access, although it does provide pedestrian access. Plate 9.37 and Plate 9.38 show sections of the old Ok Ma Road at Ok Ma. The lower sections of the Ok Ma are used by local communities for transport to and from Ningerum, although the rapids and flows in the upper reaches of the Ok Ma make these sections unsuitable for transport (Appendix E).



Photo credit: Tetra Tech Coffey, 2025

Plate 9.35
Aerial view of Ok Tedi Bridge

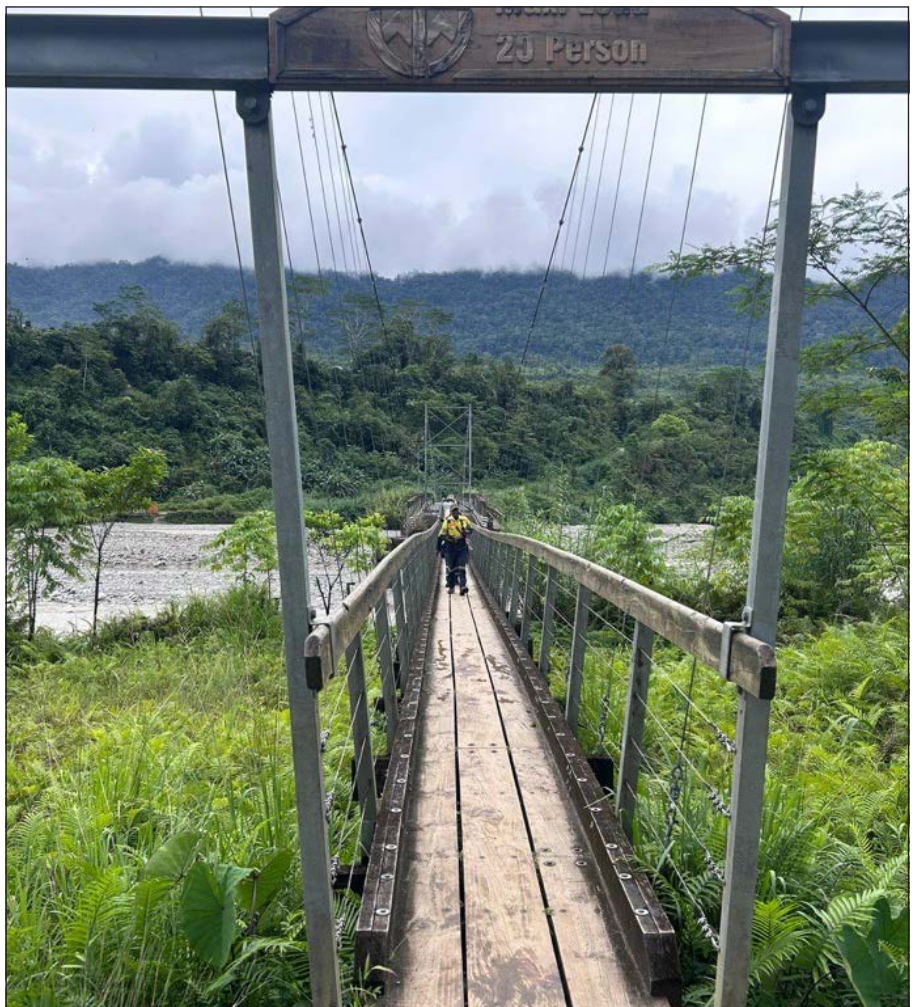


Photo credit: Tetra Tech Coffey, 2025

Plate 9.36
Ok Tedi Bridge



Plate 9.37
Old Ok Ma Road looking south,
Ok Ma community



Plate 9.38
Old Ok Ma Road looking north,
Ok Ma community

Food security

Staple foods across the villages primarily includes garden produce, particularly sago, banana, taro, kau kau and aibika. However, infrastructure corridor communities diet have shifted from being primarily subsistence gardening to including store bought staples (e.g., rice and noodles). Communities also reported consuming fish and prawns caught in rivers and creeks.

No food shortages were not reported during consultation; however, communities reported several concerns related to food security:

- Destruction of gardens by wild boars in Bolewogam.
- Digam settlement participants were concerned that perceived mine-related contamination has led to a decline in soil fertility and a reduction in crop productivity, and a reduction in fish catches which has not improved over the last 5 years.
- Participants in Kumkit-Ankit noted that the price of garden produce is low, however the price is influenced by quality of the yield and availability of the produce.
- Participants in Kumkit-Ankit and Wogam, reported buying food staples from stores is high and continues to increase.

Drinking water

Infrastructure corridor communities mainly source water for drinking, cooking and washing from creeks, rivers and shallow springs. Creeks and springs identified by community members during FGDs included Ok Vavo, Ok Gungu, Ok Omaka, Ok Arok, Ok Nanok and Ok Digam. Creeks and springs are generally close to villages. Tank usage is not common across the infrastructure corridor, although some villages have rainwater tanks that collect water from houses with iron roofs (Appendix E). In Digam, a few houses have been provided tanks by OTML, with community members in Kumkit-Ankit reported sourcing water from tanks, although these are no longer in good condition. There is no piped water infrastructure within the infrastructure corridor, though participants in Ok Ma stated that they previously had a piped water source in the village.

No water quality or availability issues were reported for these sources during consultation. Participants in Digam settlement reported that the water “*tastes good and healthy for us*” and “*runs all year even during the season of drought*”. However, in some communities, the water sources are used seasonally due to availability. For example, Kumkit-Ankit participants stated they use the spring during wet season, and Ok Hwe during dry season as the spring dries up.

9.2.4.3 Construction haulage route

This section provides an overview of existing characteristics, values and features of villages and settlements along the construction haulage route between Kiunga and Tabubil. Information presented in this section is mainly from secondary data sources, including OTML CMCA population data, and the Livelihood Development and Basic Socio-economic Baseline Survey (OTDF 2018), supported by information collected through FGDs in Alice Pit and with villages between Ningerum and Tabubil.

People, community identity and place

There are 30 villages plus a number of smaller informal settlements along the Kiunga-Tabubil Highway, which is the main construction haulage route for materials, plant, equipment and supplies.

Population demographics and migration

There were approximately 20,000 people living in CMCA villages located along the proposed haulage route. The populations of villages along the haulage route vary from less than 250 people across two villages to more than 1,000 people in six villages between Kiunga and Alice Pit (Table 9.6). The largest village between

Kiunga and Alice Pit is Grengas, which had a population of 1,467 people, while the largest village along the route north of Alice Pit is Sisimakam, which had a population of 990 people.

Table 9.6 Population estimates – construction haulage route

Population (2023)	Total villages	Kiunga to Alice Pit	North of Alice Pit to Tabubil
Less than 250 people	2	Tope, Rudmesuke	
250 to 500 people	10	Dande 1, Ipoknai, Dande 2, Mimigire, Menumsore, Grehosore, Hoponai	Hosonae, Wangenai, Horinkian
500 to 750 people	6	Briompenai, Rarengre, Alice Pit*	Awin Tamaro, Hosokumgu, Pampanai,
750 to 1,000 people	6	Kasrenai, Matkomnai, Miamsomnai	Kwiloknai, Tapko, Sisimakam,
More than 1,000 people	6	Timindemesuke, Gii, Tiomnai, Ienkenai, Gre, Grengas	

Sources: 2023 CMCA population data provided by OTML, *OTML 2025f

During consultation for this social characterisation, community members reported migration of people into Alice Pit and highway villages. Several settlements have been established along the highway by communities west of the Ok Tedi, or by in-migrants from villages within the Western Province, other PNG provinces, and Indonesian communities close to the border. Feedback from engagement suggests that this is driven by factors such as improved access to services (e.g., health care and education facilities), access to markets, and ASM opportunities within the Ok Tedi.

Alice Pit, located on the Kiunga-Tabubil Highway south of Ningerum, is a rapidly expanding settlement (OTML 2025f). Alice Pit is on the customary land of the Awin people, with consultation for this assessment reporting that the community was established by the Beke-Ikramnai clan, who were previously living at Yankere (Kilometre 61). Feedback from consultation noted that landowners have given their agreement for people to settle in Alice Pit. In 2025, Alice Pit (Mendua) had a population of about 426 people (OTML 2025f), which includes people from TSF villages who have relocated to Alice Pit for better living conditions and access to services in Ningerum, Tabubil and Kiunga. Family and traditional ties were also identified as reasons for people settling in Alice Pit. Alice Pit has more females than males, with a sex ratio in 2025 of 96 males for every 100 females (OTML 2025f). Alice Pit is a transit point for Yongom communities west of Ok Tedi to access services at Ningerum, Tabubil and Kiunga, with community feedback from FGDs noting that in-migrants also come to Alice Pit for marketing purposes.

Social cohesion and community safety

Community safety was discussed during engagement with villages along the haulage route. During FGDs with villages along the Kiunga-Tabubil Highway, including Alice Pit, safety issues raised included incidences of antisocial behaviour associated with alcohol and drugs, sorcery and road accidents due to the movement of heavy traffic.

In-migration of people into villages and settlements along the highway has impacted on perceptions of community safety, with some community members of highway villages reporting that they 'live in fear' and 'get threatened' when they raise issues with those that have settled into the area. Feedback from the Alice Pit FGD also noted that 'many illegal activities are happening' (e.g., selling marijuana) because of in-migration. Drug and alcohol abuse was reported to be common in Alice Pit 'due to its location as a transit point', with women reporting that they feel unsafe, and incidents of harassment. Sorcery was also reported to impact on perceptions of safety for community members in Alice Pit with this identified as the 'main safety concern amongst the community'.

Limited local police presence means that law and order issues in Alice Pit and highway villages are generally mediated by community leaders. Where issues are unable to be resolved by community leaders, these are reported to police.

Landscape character and amenity

The Kiunga-Tabubil Highway passes through numerous villages and settlements (Plate 9.39 to Plate 9.42). Land uses fronting the highway mainly comprise a mix of:

- Traditional housing, semi-permanent housing, and permanent housing that comprise modern materials.
- Retail uses, including trade stores, formal and informal markets, and trade stalls.
- Community uses, such as schools.
- Areas used for gardening and livelihood activities.

Existing amenity issues reported by communities during consultation include:

- The amenity of communities along the highway is currently impacted by vehicles using the highway, including light vehicles, PMVs, and daily OTML heavy vehicle convoys that operate between Kiunga and Ok Tedi Mine. Plate 9.43 show dust created by heavy vehicle convoys and convoy traffic through Alice Pit.
- Dust generated by vehicles using the Kiunga-Tabubil Highway was identified as a concern during FGDs with highway villages:
 - Dust is a major issue for rainwater collected in tanks in Alice Pit.
 - Concerns were expressed about contamination of food crops grown in gardens near the road (Haidawogam and Sisimakam).
 - Concerns were expressed about dust and the potential for gravel from the Ok Tedi used for the highway to contain chemicals (Wirimkanato and Wolawam).

Sealing of the Kiunga-Tabubil Highway from Kiunga commenced in 2024. As at May 2026, sealing was approaching Alice Pit and Ningerum. The timing of sealing of the highway north of Ningerum is still to be determined.

Economy and livelihoods

The livelihoods of people in villages along the construction haulage route rely on the gardening, sale of produce or goods, and availability of natural resources. Primary income sources included rubber production and trade stores for villages between Kiunga and Alice Pit, while communities north of Alice Pit relied on gardening, alluvial mining and rubber production (OTDF 2018). These results are consistent with feedback during FGDs at Alice Pit and with villages north of Ningerum, which noted:

- ASM is the main source of income for communities north of Bige (see Section 9.2.4.1).
- Communities depend on growing garden foods (e.g., banana, greens and sago) as a source of income, particularly for Wirimkanatko and Wolawam villages as they do not have access to cash crops.
- Informal marketing and trade stalls along Kiunga-Tabubil Highway sell food to the local communities (e.g., rice, tinned fish, noodles, flour, biscuits, cooking oil, and assorted drinks), as well as fuel.

CMCA benefits, compensation from OTML, and employment opportunities provided by OTML to landowners were also identified as key income sources for participants of FGDs at Alice Pit and highway villages north of Ningerum. Small and medium enterprises, such as trade stores, are important contributors to the formal economy in PNG (NRI 2024). Feedback from engagement with store owners along the Kiunga-Tabubil Highway noted that competition between local traders was a challenge with some trade store owners diversifying their businesses by selling fuel or providing rental accommodation to supplement their income.

Plate 9.39
Kiunga-Tabubil Highway, Tapko



Photo credit: Tetra Tech Coffey, 2025

Plate 9.40
Kiunga-Tabubil Highway, Haidawogam



Photo credit: Tetra Tech Coffey, 2025

Plate 9.41
Trade stores, Kiunga-Tabubil Highway



Photo credit: Tetra Tech Coffey, 2025



Plate 9.42
Kiunga-Tabubil Highway, Alice Pit



Plate 9.43
Dust from heavy vehicle convoy, Alice Pit

Infrastructure and services and people's productive capacity

This section provides information on existing infrastructure and services within the construction haulage route communities.

Access and connectivity

The Kiunga-Tabubil Highway is a 157 km access route that supports the transport of mining equipment and supplies (e.g., fuel, food) between the river port of Kiunga, the township of Tabubil and Ok Tedi Mine (TEG Consulting Engineers 2019), and access for pedestrians, private vehicles and PMVs to villages, regional centres (Kiunga, Ningerum and Tabubil) and community services. A range of land uses front the highway, including houses, formal and informal trade stalls, markets and schools. The highway has a maximum speed limit of 65 km/h, with this reducing to 40 km/h through villages. The highway is mostly unsealed, although works to upgrade and seal the Kiunga-Tabubil Highway have been occurring over recent years. These works are progressing from Kiunga to Ningerum.

Data provided by OTML on the use of the Kiunga-Tabubil Highway at the highway checkpoint south of Tabubil shows that, on average approximately 200 OTML and private vehicles use the highway daily. This includes approximately:

- 15 OTML vehicles, including 10 light vehicles and 5 medium-rigid trucks.
- 46 vehicles, including light vehicles and trucks, associated with OTML and contractor convoys.
- 137 private vehicles, including 87 light vehicles, 25 medium rigid trucks, and 25 PMVs.

Currently, there are approximately 7 convoys per day (each way), which comprise between four and 10 vehicles including light vehicles and trucks.

Observations of travel along the highway during social fieldwork noted several safety concerns including blind corners and crests of hills, narrow sections of the road that made passing difficult, and a lack of pedestrian access meaning that pedestrians, including school children, were required to walk along the highway. During engagement, it was noted that some road accidents along the Kiunga-Tabubil Highway had resulted in fatalities. Over the past two years, there have been 23 accidents involving OTML and contractor vehicles, including three involving OTML light vehicles and 20 involving convoy trucks.

Health and education

Local health services within communities along the Kiunga-Tabubil Highway are limited and include a health centre at Matkomnai, and aid posts at Ikenai village between Kiunga and Alice Pit, and Kwiloknai and Sisimakam villages north of Alice Pit. Patients from villages along the Kiunga-Tabubil Highway mainly walk or travel by PMV to the nearest health facility (OTDF 2018). Feedback from consultation with highway villages reported that communities in Alice Pit travel to Ningerum or Kiunga to access government health services, while communities north of Ningerum reported that they access health services from Ningerum and the OTML-operated hospital in Tabubil. The aid post at Sisimakam is accessed by people from nearby villages (e.g., Bolewogam and Haidawogam). The aid post is supported by OTML through provision of medicine and other support services.

There are five elementary schools, five primary schools and two community schools within the construction haulage route communities. This includes seven schools (four elementary, two primary and one community school) in villages between Kiunga and Alice Pit, and five schools (one elementary, three primary, and one community school) in those villages north of Alice Pit. Access to secondary schooling and tertiary education facilities is provided in regional centres such as Kiunga, Ningerum and Tabubil. Consultation for this social characterisation noted that students attending schools in nearby villages generally travel by PMV or walk along the Kiunga-Tabubil Highway. Students walking along sections of the highway between the Tabubil and the mine were observed during the fieldwork for this social characterisation.

Utilities infrastructure

Villages along the construction haulage route have limited access to water, electricity and public services and facilities (OTML 2025f). These challenges identified by OTML (2025f) include:

- **Water supply.** Communities rely on natural water sources (e.g., rivers, creeks, boreholes or tanks). The lack of formal and reliable water supply poses serious health, sanitation and livelihoods concerns.
- **Electricity.** Access to electricity is uneven across the settlements. A significant number of houses have unreliable or illegal electricity sources. Outages are frequent and power supply is limited.
- **Public services and facilities.** Challenges include limited job opportunities and lack of police presence.

9.2.4.4 River communities

Seven villages are directly located along the Ok Tedi downstream of the Ok Tedi Mine, extending to the junction of the Ok Tedi and Fly River at D'Albertis Junction. The population of the villages ranges from 1,912 people at Atkamba to 181 people who reside in Dome. The river communities form part of the Lower Ok Tedi CMCA region (previously known as the Wai Tri Trust).

The riverine communities are closely tied to the river system for transport, fishing, water access, and subsistence gardening. The Ok Tedi is currently impacted by existing mine operations and riverine disposal of tailings and waste rock continues to affect the Ok Tedi system, including downstream communities, their livelihoods, and the environment.

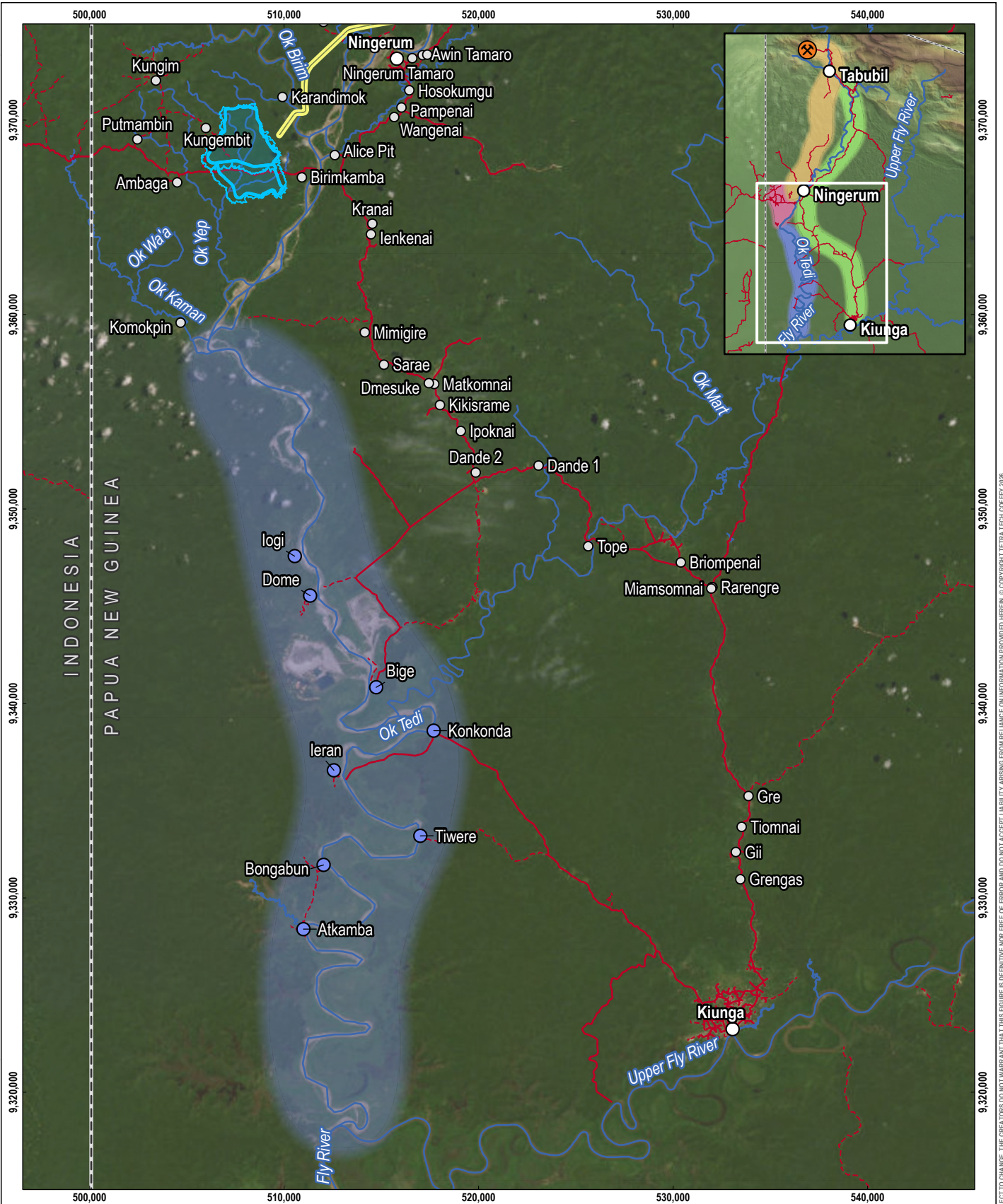
Livelihoods across the river communities reflect a mix of informal and subsistence economic activities. Primary income sources of river communities include rubber farming, alluvial mining and fishing, with secondary income sources including subsistence gardening and trade stores (OTDF 2018). In 2018, the average annual income for rubber growers in the Lower Ok Tedi region was between PGK200 to 500 per month. This was also the range of average incomes received from ASM or the selling betelnut, although income from these sources were considered less sustainable. Villages involved in selling crops, fishing, and sago production earned approximately PGK100 to 200 per month (OTDF 2018). The livelihoods of people in the region are highly dependent on accessibility to markets, as well as the quality of the land and availability of natural resources (OTDF 2018).

Education and health facilities in the river communities are limited. Primary schools are located at Atkamba, Dome and logi, while health facilities include an aid post in Atkamba and a sub-health centre in Dome, both of which were reported to be in good condition in 2018 (OTDF 2018). Access to health and education services, and to markets and trade stores, in the region is generally challenged by a lack of infrastructure and the geographical setting. Communities travelling to neighbouring villages or towns mainly travel by river using dugout canoe, motorised canoe or dinghy, with road the primary means of travel for people in Bige and Kokonda (OTDF 2018; OTDF 2023).

The main sources of food for river communities include rivers, local markets, the bush and household gardens. The main type of foods grown include tree crops, particularly banana, sago and breadfruit; root or tuber crops such as taro and cassava; vegetables such as greens; and fruits, including pineapple and cucumber (OTDF 2023).

9.2.4.5 Regional centres

This section provides an overview of the existing social environment of the regional centres of Tabubil, Ningerum and Kiunga (Figure 9.15).



LEGEND

- River community
- Regional centre
- Study area community
- Road
- - - Track
- Watercourse

- Proposed TSF footprint
- Proposed infrastructure corridor

Study sub-area

- River communities



0 2.5 5 km
SCALE 1:275,000
PAGE SIZE: A4
PROJECTION: PNG94 PNGMG94 Zone 54

SOURCE
Study areas and villages from Tetra Tech Coffey.
Proposed infrastructure from KCB and OTML.
Topographic features from OSM. Provinces from NSO.
DEM from SRTM. Imagery from ESRI.

OK TEDI MINING LIMITED

OK BIRIM TAILINGS STORAGE FACILITY PROJECT

FIGURE 9.15

River communities and regional centres



People, community identity and place

Tabubil is within the Star Mountains LLG and was purpose built as the operational hub for the Ok Tedi Mine and is the headquarters of OTML, and the administration centre of the Star Mountains LLG. Tabubil had a population of approximately 10,270 people in 2011 (NSO 2011), although the population is estimated to be higher at about 15,000 people, including fly-in/ fly-out mine workers, residents, and in-migrants (Gilberthorpe 2013). Tabubil has more males than females with a sex ratio of 109 males per 100 females (NSW 2011), which is likely to reflect the presence of the mine and its predominantly male workforce. Tabubil offers a range of district level services and facilities such as health care, schools, recreational uses, airport, business and commercial uses, which serve mine workers, Tabubil residents, and communities in the surrounding district. Many of these services and facilities are either provided directly or supported by OTML.

Ningerum is located at the mid-point of the Kiunga-Tabubil Highway, approximately 65 km south of Tabubil and north of Kiunga. Ningerum is the nearest township to the proposed TSF and is the administrative centre for the Ningerum Rural LLG. Plate 9.44 and Plate 9.45 show views of Ningerum centre. The town provides a range of health, education, and commercial services accessed by residents of Ningerum and surrounding communities. Population surveys carried out by OTML found that Ningerum had a population of about 4,031 people in 2025 (OTML 2025f). Ningerum had a relatively balanced number of males and females, with about 102 males for every 100 females (OTML 2025f). Kiunga is located on the Upper Fly River and has a population of approximately 10,981 people in 2011. In 2011, Kiunga had more males than females with a sex ratio of 106 males per 100 females (NSO 2011). It is an administration centre for the North Fly District, Kiunga Urban LLG, and Kiunga Rural LLG. Kiunga has a port owned by OTML, and services the Ok Tedi Mine with fuel, equipment and goods, as well as the export of concentrate for sale on overseas markets.

The towns of Kiunga, Ningerum and Tabubil are densely populated, attracting high levels of in-migrants from rural villages within the North Fly District and wider Western Province, as well as other PNG provinces, and Indonesia for access to services, employment and business opportunities, and activities such as ASM within the Ok Tedi.

Economy and livelihoods

Tabubil, Ningerum and Kiunga play an important role for the livelihoods of residents and people from surrounding villages. Livelihoods across the regional centres reflect a mix of formal, informal and subsistence economic activities. Formal sector wage employment in the regional centres includes:

- Services such as health and education, and business services (e.g., accommodation).
- Industry, including the processing of goods and construction.
- Retail uses such as supermarkets, hardware stores, and electronics.
- Public administration.
- Employment through OTML, or with mine contractors and suppliers.

Many people in Tabubil are employees of OTML and mine related contracting and supplier businesses, reflecting the role of the town as the headquarters of the mine. Similarly, OTML employment is a significant livelihood source for residents in Ningerum, with between 10 to 15% of households in Ningerum communities deriving income from the company (OTML 2025f). Local industry in Kiunga is centred on haulage and freight of goods and supplies, and concentrate export, through the port, which is owned by OTML.

Income in the regional centres is also generated through informal wage employment, including trading or selling goods and crops at markets and alluvial mining. Within the North Fly District, most markets are concentrated in Tabubil (Fly River Provincial Government 2022). Key income sources for households in the wider Ningerum area include ASM (Plate 9.46), which contributes between about 30 and 40% of income for households in some Ningerum communities, and informal marketing (between 20 and 40%).



Photo credit: Tetra Tech Coffey, 2025

Plate 9.44
Ningerum township



Photo credit: Tetra Tech Coffey, 2025

Plate 9.45
Kiunga-Tabubil Highway, Ningerum township



Photo credit: Tetra Tech Coffey, 2025

Plate 9.46
ASM activity near Ningerum

Communities reported accessing markets at Ningerum during engagement for this social characterisation. Government and administration employment is also a common income source for households in Ningerum Station (OTML 2025f). In contrast, limited amounts of food and animal products are taken to Kiunga to be sold or traded at markets. This is likely due to the high cost of outboard motor fuel resulting people having to walk long distances (Kanua and Bourke 2022).

Rubber historically was a successful cash crop in some areas of Western Province. North Fly Rubber Limited operates a factory out of Kiunga and employs local residents (Kanua and Bourke 2022). Rubber farmers in the region have received ongoing funding from the North Fly District Development Authority through North Fly Rubber Limited to enhance the industry and their livelihoods (Post-Courier 2023a). Feedback from consultation for this social characterisation noted that a decline in the price of rubber has resulted in people leaving rubber tapping.

Infrastructure and services

The regional centres contain a range of infrastructure and services that are accessed by residents and by people from smaller rural villages. These services consist of administration, health care, education, cultural facilities and emergency services. Table 9.7 provides a summary of these services.

Major health care services include Tabubil Hospital, which is operated by OTML, and the government-run Kiunga District Hospital. A health centre is also located at Ningerum. Medicine shortages are an ongoing issue which is affecting the delivery of clinical services in Kiunga (Post-Courier 2023b).

Although all regional centres have a police presence, law and order issues are reportedly increasing (Post-Courier 2023c). Key issues include high alcohol consumption, selling of illicit substances (e.g., marijuana) in Kiunga and in the Ningerum LLG along the Kiunga-Tabubil Highway, family violence, hijacking of PMVs near Tabubil and petty theft. North Fly Command reports an insufficient number of police officers in the North Fly District to conduct effective policing, with 78 officers stationed in the district in 2023 (Post-Courier 2023c). Similarly, communities report minimal police presence in the Ningerum area (OTML 2025f).

Table 9.7 Summary of services in regional centres

Service	Tabubil	Ningerum	Kiunga
Health care and emergency services	<ul style="list-style-type: none"> • Tabubil Hospital • Tabubil Urban Clinic • Tabubil Pharmacy • Tabubil Police Station 	<ul style="list-style-type: none"> • Ningerum Health Centre • Ningerum Police Station 	<ul style="list-style-type: none"> • Kiunga District Hospital • Kiunga Health Centre • Kiunga Police Station
Education facilities	<ul style="list-style-type: none"> • Tabubil International School • Tabubil Secondary School • Tabubil Primary School (Plate 9.47) 	<ul style="list-style-type: none"> • Ningerum Elementary and Primary School • Ningerum High School 	<ul style="list-style-type: none"> • Kiunga Secondary School • Kiunga International School • Kiunga Technical Vocational Training Centre
Other facilities	<ul style="list-style-type: none"> • Banks (Bank South Pacific, Papua New Guineas First Bank) • Retail stores (supermarket, hardware, electronics) • Churches, recreational uses (e.g., oval) • Star Mountain LLG office 	<ul style="list-style-type: none"> • Markets • Retail stores (supermarkets, hardware) • Ningerum Rural LLG office 	<ul style="list-style-type: none"> • Bank (Bank of South Pacific) • Western Provincial Administration • District Court House



Plate 9.47
Tabubil primary and elementary school

The regional centres are connected via the Kiunga-Tabubil Highway and the Fly River and Ok Tedi. People travel via road, mainly by PMV or walking. Kiunga includes the OTML-owned Kiunga Port and Kiunga airport which is used by commercial flights and OTML charter flights. In addition to supporting mine operations, the port is used for the export of rubber and lumber, and the import of goods and supplies. Transport infrastructure in Tabubil includes a local road network, and domestic and international airport, that has an all-weather airstrip and is used by commercial flights and OTML charter flights. The airstrip is currently being extended to service larger planes.

Formal water infrastructure is more common in the regional centres than the surrounding smaller villages. Rainwater tanks are common in Ningerum Station, while unimproved natural water sources (rivers and creeks) and bore water is more common in smaller surrounding villages. This lack of formal water infrastructure is reported to pose serious health and sanitation risks across the Ningerum area (OTML 2025f). In comparison, Tabubil has well developed infrastructure including reticulated water, sewage and waste management that are provided by OTML (OTML n.d.). Electricity supply in Ningerum, Tabubil and Kiunga is provided through Ok Tedi Power Limited. Power in Kiunga and Ningerum is supplied by diesel generator stations. Power in Tabubil is provided by diesel fuelled thermal power station and hydropower from the Ok Menga hydroelectric station (OTML 2025).

9.2.5 Summary of sensitivity of social values

Table 9.8 provides initial assessment of the sensitivity of each of the social values identified within this characterisation.

Table 9.8 Sensitivity of social values

Social value	Value	Level of sensitivity	Justification
People, community identity and place	Cultural connection to place	High	People across the study area share a strong cultural connection and attachment to their land, with feedback including that land is viewed as being 'vital to survival and identity'.
People, community identity and place	Ability to sustain cultural identity and traditions.	Moderate	Cultural traditions and practices continue to be maintained and valued by TSF and infrastructure corridor communities but there has been a recent decline in the practice by younger generations.
People, community identity and place	An environment that supports social cohesion	Moderate	Community feedback reported that communities generally perceive their villages to be safe and peaceful. Communities have access to a range of groups that support participation in village activities. Clan groups are also important sources of support for people.
People, community identity and place	An environment that supports community safety	High	People in the project communities generally perceive their communities to be safe and serious law and order issues are uncommon outside of larger communities. Communities are removed from existing roads that may present safety risks for community members.
People, community identity and place	An environment that supports community safety for women and girls	Very high	Levels of family and sexual violence are exceptionally high across PNG, with women being the primary victim. Within villages, women generally reported feeling safe to move around, garden and complete chores alone.
People, community identity and place	Natural landscape and its scenic amenity	Moderate	The visual character and natural serenity of the landscape contribute to the quality of life for people and reinforces their connection to the land.
People, community identity and place	Amenity of TSF and infrastructure corridor communities	Moderate	TSF and infrastructure corridor communities are located within a remote and undisturbed part of the Western Province, away from any major industrial activities or major roads. Amenity is influenced by the natural environment and village activities, and the overall amenity environment remains consistent with remote forest and riverine settlements in the North Fly District.

Social value	Value	Level of sensitivity	Justification
People, community identity and place	Amenity of construction haulage communities	Low	The amenity of these communities is currently affected by noise and dust from existing vehicle use of the highway, including OTML convoys.
Economy and livelihoods	Subsistence livelihood values of the TSF and infrastructure corridor communities	High	Livelihoods in the TSF communities are primarily derived from natural resources and land to support participation in the cash economy and to harvest bush resources.
Economy and livelihoods	Subsistence livelihood values of the Ok Tedi	Low	The riverine environment of the Ok Tedi is currently degraded.
Economy and livelihoods	Opportunities to participate in the cash economy	Moderate	Across the TSF and infrastructure corridor communities, people are mainly employed in informal employment. Opportunities to participate in employment opportunities with the project were identified as important during engagement.
Economy and livelihoods	Livelihoods of the Ok Tedi for ASM	Very high	ASM is an important livelihood activity and key income source for communities living near the Ok Tedi, with income earned used to pay school fees, buy food, and meet other household needs.
Infrastructure and services	Access to services that support community health and wellbeing	High	Access to health services within the TSF communities is limited, and people must travel long distances, often by foot to access care.
Infrastructure and services	Access to services that support education.	Moderate	Access to education varies across the TSF and infrastructure corridor villages. People value education as it contributes to livelihoods and leading to many moving to larger settlements to secure education for their children.
Infrastructure and services	Safe and efficient transport access and connectivity	Moderate	Formal transport infrastructure is limited within the study area but contributes to livelihoods and the health and safety of people by providing access to essential services.
Infrastructure and services	Safe transport access to Ok Tedi and Ok Birim	Moderate	The Ok Tedi and Ok Birim provide important transport access for some TSF communities and communities in the southern part of the infrastructure corridor.
Peoples' productive capacities	An environment that supports community health and wellbeing, including for women and girls	High	Health of project communities is integral to the overall wellbeing of people in the study area.
Peoples' productive capacities	Subsistence livelihood value of land and water resources	High	Communities value access to land and waterways within the study area for food security and are reliant on surface water and groundwater resources for domestic uses.

9.3 ECOSYSTEM SERVICES

Ecosystem services are defined as ‘benefits that people, including businesses, derive from ecosystems’ (IFC 2019). Ecosystem services arise from biophysical processes in the environment; however, they are only considered an ecosystem service when they provide benefits to people (IFC 2019).

The International Finance Corporation Performance Standard 6 (IFC PS6) (2012) categorises ecosystem services as:

- **Provisioning services**, which are the products people obtain from ecosystems, such as food for subsistence, timber for building materials and fuel, and water for drinking and domestic purposes.
- **Regulating services**, which are the benefits people obtain from the regulation of ecosystem processes, such as climate regulation and carbon storage and sequestration.
- **Cultural services**, which are the nonmaterial benefits people obtain from ecosystems, such as spiritual and sacred sites and areas used for recreational purposes.
- **Supporting services**, which are the natural processes that maintain the other services, such as nutrient capture and recycling.

For the purposes of implementing IFC PS 6 (IFC 2019), ecosystem services are categorised as:

- **Type 1:** ecosystem services that the client has direct management control or significant influence over, and where impacts on such services may adversely affect communities.
- **Type 2:** ecosystem services that the client has direct management control or significant influence over, and on which the project directly depends for its operations.

This assessment addresses Type 1 ecosystem services. Type 2 ecosystem services represent operational risks rather than risks to ecosystem service beneficiaries.

9.3.1 Ecosystem services characterisation method

This section describes the method used to develop this ecosystem services characterisation, including the approach for identifying, scoping and characterising the nature and extent of ecosystem services relevant to the project.

The area of influence for this ecosystem services characterisation includes communities that may experience changes in availability of, and access to ecosystems services due to the construction, operation and decommissioning of the project. The area of influence, referred to as the study area for the ecosystem services characterisation, is the same as that described in Section 9.2.2, for the social characterisation (see Figure 9.1).

9.3.1.1 Scoping and identification of priority ecosystem services

A review of the project description and existing information was undertaken to identify ecosystem services that have potential to be affected by the project. This review was conducted as part of the scoping process for the social characterisation given the links between ecosystems services and socio-economic conditions (see Section 9.2.1).

Priority ecosystem services were identified through the scoping process where potentially significant project-related risks to services were identified. Priority ecosystem services are those that the project is most likely to affect and that could result in adverse impacts on affected communities’ livelihoods, health, safety and/or cultural heritage (IFC 2019). Section 9.3.2 provides a summary of the priority ecosystem services screening process.

9.3.1.2 Data collection and interpretation

Potentially affected communities and other stakeholders were engaged during fieldwork for the social characterisation (see Section 9.2.1). Fieldwork activities included focus group discussions (FGDs), household and village surveys, and key informant interviews, with questions asked to understand the nature of ecosystem services benefited from by communities within the study area. Participatory mapping exercises were conducted during FGDs with men and women to identify the location and spatial extent of ecosystem services used by communities, including land and water resources used for livelihood and cultural activities (e.g., gardens, hunting grounds, water sources).

Data collected by other technical specialist studies was also used to inform this study, including terrestrial biodiversity (Appendix F), freshwater ecology (Appendix E:) and cultural heritage (Appendix L).

Aspects of ecosystem services determined based on the data from the social characterisation fieldwork, existing OTML data and reports, and other technical studies included the:

- Nature and extent of services within the study area.
- Condition, trends and external (non-project) threats to services.
- Communities who benefited from services (e.g., beneficiaries).

9.3.2 Priority ecosystem services screening

Livelihoods, food security and wellbeing for communities within the study area are closely linked to the natural environment. As such, a wide range ecosystem services are present and are relied on by local communities to support subsistence activities, livelihoods and cultural practices.

Ecosystem services, including provisioning, regulating and cultural services, were identified in the construction haulage route, river communities or regional centres study areas. However, these are not expected to be significantly affected by the project and are not considered further in the ecosystem services assessment.

Table 9.9 summarises the priority screening outcomes for the TSF communities and infrastructure corridor study areas.

Table 9.9 Priority ecosystem services screening

Study area	Ecosystem service	Potentially significantly affected by the project*	Rationale for further assessment
TSF communities	Provisioning – food, timber and other wood products, natural medicines, biomass fuel, freshwater	✓	Households within the TSF communities collect and use resources within areas that would be permanently affected by the project. This includes waterways such as the Ok Yep used for water supply and fishing, areas used for gardening and cultivation, sago growing, and forested areas used for bush resources.
	Regulating – air quality, climate, erosion control	✗	The project would not significantly impact on these services (see Section 9.2.4.1). In particular, given the naturally high annual rainfall levels within the study area, potential dust impacts for communities are expected to be manageable with the implementation of dust mitigation measures. However, temporary, localised impacts may occur from periods of high construction intensity such as peak earthworks, during dry and windy conditions. Emissions from diesel powered construction equipment have potential to result in small, localised increases in ambient concentrations. This is not expected to cause short- or longer-term changes in air quality. Therefore, this is not assessed further.

Study area	Ecosystem service	Potentially significantly affected by the project*	Rationale for further assessment
	Cultural – ethical and spiritual values	✓	A large number of cultural heritage sites were identified across the TSF communities study area during community interviews sessions with clan elders of each village. These include sites within and immediately surrounding the TSF footprint that have importance at a tribal level and remain integral to contemporary cultural identity. Some of these sites have potential to be significantly impacted by construction of the TSF and associated infrastructure.
	Supporting – habitat	✓	Sago patches occur throughout the TSF footprint and these appear to provide socio-economic value to the landowners living in the vicinity (Appendix F). Addressed under the biodiversity assessment (Appendix F).
Infrastructure corridor	Provisioning – food, timber and other wood products, natural medicines, biomass fuel, freshwater	✓	Households from villages along the infrastructure corridor collect and use resources from areas that may be significantly affected by the project. This includes major waterways such as the Ok Birim and Ok Ma and other smaller creeks, and areas used for gardening, harvesting sago, hunting and bush materials.
	Regulating – air quality, climate, erosion control	✗	The project would not significantly impact on these services (see Section 9.2.4.2). Therefore, this is not assessed further.
	Cultural – ethical and spiritual values	✓	Over 200 settlement, oral tradition and archaeological sites were identified through consultative mapping sessions held with landowning community members, clan elders, and knowledge holders for infrastructure corridor villages. These have potential to be significantly impacted by the construction of the tailings pipeline and pipeline access road.
	Supporting – habitat	✗	The project is not expected to result in a significant impact on these services (see Appendix F). Therefore, this is not assessed further.

* Potentially significantly affected refers to the likelihood of a material project-related interaction in accordance with IFC PS6 (IFC 2019)

9.3.3 TSF communities

The following ecosystem services are relevant to the project within and surrounding the TSF site:

- Provisioning services – food, timber and other wood products, freshwater, biomass fuel and natural medicines.
- Cultural services – ethical and spiritual values.

Section 9.2.4.1 provides a detailed description of natural resource use within the TSF communities; the following provides a summary of the natural resource use across the study area relevant to the identified priority ecosystem services. Table 9.10 summarises community feedback from engagement for the social characterisation on the importance of ecosystem services and concerns regarding project-related impacts.

Agricultural land within the study area is the primary source of food for households in the TSF communities, with garden crops the main source of food for households. Gardening land is mostly located within or around the communities and along rivers and smaller creeks, including the Ok Tedi, Ok Birim, Ok Yep and Ok Indok. The main staple crop used by households in the TSF communities is sago, with other important crops including banana, cassava, taro and yam.

Small patches of sago palms are present in low-lying plains and drainage corridors of the TSF footprint. These represent ecologically sensitive habitats with dual ecological and cultural functions. Ecologically, these areas serve as swamp forest macrohabitats supporting hydrophilic flora that contribute to habitat heterogeneity and microtopographic complexity, and their saturated soils function as carbon sinks, enhancing ecosystem services related to climate regulation. Culturally, these areas embody agroforestry traditions, reflecting intergenerational stewardship and food sovereignty. Many of the sago palms were planted by the ancestors of local communities and continue to be harvested by households as an important food source. The fronds of the sago palms are also used in house construction as roofing and walling ([Appendix F](#)).

The cultivation and collection of cash crops, such as betel nut, rubber, balsa wood, eagle wood and coconut, for sale at local markets supports household income, and contributes to food security.

Forested areas within the study area support the provision of bush resources, including collection of wild foods, medicinal plants, construction materials and firewood. Households in TSF communities mostly go hunting weekly, or less frequently, and commonly hunt wild pigs, birds, bandicoots, cuscus and flying foxes. Bush resources are collected by most households, including firewood, building materials (e.g., the fronds of the sago palm are used for roofing and walls of houses), and materials for household use and medicinal purposes. Community members reported that different plant species were used to treat illnesses (e.g., salat plant, bush ropes to cure sore throats (yengnong in local language), barks from special trees). These resources grow throughout the TSF communities study area and are collected within individual clan boundaries.

Freshwater and riverine ecosystems, including the Ok Tedi, Ok Birim, Ok Yep and other smaller tributaries, provide freshwater for drinking and domestic use. Households in TSF communities most commonly collect drinking water from dug wells and surface water sources, with the quality and availability of these sources noted to be good by the TSF communities. Freshwater and riverine ecosystems also support fishing and collection of other riverine resources. People mostly fish and collect resource from watercourses closest to their communities, including larger rivers such as the Ok Birim and Ok Yep, and smaller creeks (e.g., Ok Kaman, Ok Hap). For example:

- Kungembit community fish in the Ok Birim and its tributaries, including Ok Yep.
- Birimkamba community fish in tributaries of the Ok Tedi, including smaller channels and creeks in the forest surrounding the village, or up to about a half day walk.
- Ambaga and Putmambin communities mostly fish in rivers and creeks around the village or up to about a half day walk, including the Ok Yep.
- Karandimok community mostly fish in the Ok Birim and creeks.

Creeks are mainly used for collecting prawns, crayfish, small and large fish, and eels, while larger fish are mainly collected from larger creeks and the Ok Birim ([Appendix E](#)). Fishing is conducted by a range of methods, including hook and line, gill netting, diving, spearing, hoop nets, and bush rope ([Appendix E](#)). Feedback from consultation also noted that people block water in smaller channels and scoop out the water to harvest fish and prawns. Derris root, which is a locally growth natural fish toxicant, is also used in smaller creeks ([Appendix E](#)).

Cultural heritage sites recorded within the study area represent a diverse range of tangible and intangible values and include archaeological locations, settlement sites, and oral traditional sites associated with ancestral settlement history, clan territories, and culturally significant landscape features.

Tangible values include sacred and mythical areas associated with ancestral beings, traditional settlement sites, ancient clan boundaries, burial grounds, waterway route or tracks, and resource-use zones (e.g., gardens, sago areas, fishing sites) ([Appendix L](#)). Section 9.4 provides a detailed description of the archaeological and cultural heritage values within and surrounding the TSF site.

Table 9.10 Summary of community feedback from FGDs

Community	Provisioning services
Ambaga	<p>Provisioning services</p> <ul style="list-style-type: none"> Sago is the primary staple food for households, with garden crops such as taro, banana and yam complementing sago production. Garden produce, sago and cash crops, such as betel nut, are sold to support household income. Community members expressed concern that project activities may reduce the availability of land for gardening. Forested areas are used for hunting and the collection of bush resources, including wild foods and plants used for traditional medicine. Rivers and creeks are used for fishing and to collect riverine resources, e.g., <i>'We go diving in small river channels – we dive for fish. When the water levels are low enough, we block the water (in a small channel) and scoop out all the water to harvest fish/prawns.'</i> Creeks, rivers and dug wells are the main sources of water for domestic use. Community members raised concerns that project activities could affect the Ok Yep, with potential implications for livelihoods. <p>Cultural services</p> <ul style="list-style-type: none"> The use of traditional medicine remains an important practice within the community, particularly by older women. Community members expressed concern that this knowledge is not being passed on to younger generations, as younger women were reportedly less interested in learning about traditional medicinal practices. Traditional bow and arrow hunting techniques are used for hunting wild pigs.
Birimkamba	<p>Provisioning services</p> <ul style="list-style-type: none"> Gardening land surrounding the village and along the Ok Tedi is the primary source of food for households. Surplus produce is sold at local markets to support households' livelihoods. Sago palms are commonly planted within garden areas and relied upon as a staple crop (e.g., <i>'Most sago are planted where there is a garden. If people have gardens, they plant one or two'</i>). Community members raised concerns that dust generated by project-related activities along the ITCS Road could affect garden productivity. Forested areas further inland from the village are used for hunting and to collect bush resources, such as traditional medicine. Concerns were raised that construction of the TSF may affect these resources. Creeks near the village are used for drinking and domestic use, including cooking, laundry and washing. Freshwater and riverine resources, including the Ok Birim and smaller river channels in forested areas, are also used for fishing and the collection of riverine resources. Community members reported concerns that contamination in the Ok Tedi has reduced fish availability (e.g., <i>'The number of fish has gone down. Before there was plenty, now there is less'</i>). <p>Cultural services</p> <ul style="list-style-type: none"> Traditional practices, including dancing, food preparation and the use of traditional medicine, continue to be observed within the community, e.g., <i>'Our traditional dancing and customs we still practice. Our sago, we still cook it with the sago leaves and the bark. Some of these traditions from the past, we still practice'</i>. Concerns were raised that the project may change these practices due to younger generations not upholding the practices.
Karandimok	<p>Provisioning services</p> <ul style="list-style-type: none"> Crops from gardening land surrounding the village is the main source of food. Sago is also used as a staple crop during drought or periods of food shortage, <i>'sago is planted where new [a] garden is made and along creeks and streams'</i>. Forested areas surrounding the village are highly valued for hunting, harvesting sago and firewood and collecting plants used for traditional medicine. Timber is also collected to build houses and canoes. Creeks and springs surrounding the village are used as the main source of water by households. Rivers and creeks, including the Ok Tedi and Ok Birim, are also used for fishing and to breed crocodiles and turtles. Concerns were raised that the project may result in impacts to the Ok Birim which could affect their livelihoods. <p>Cultural services</p> <ul style="list-style-type: none"> Cultural traditions and practices are still practiced in the community, including use of traditional medicine.

Community	Provisioning services
Komokpin	<p>Provisioning services</p> <ul style="list-style-type: none"> Land used for gardening occurs along the Ok Tedi and in bush areas north of the village. Gardening land is used to grow crops and sago for consumption and to sale at local markets. Concerns were raised that poor soil quality and flooding in the Ok Tedi affected gardening yields. The community previously highly valued the Ok Tedi, e.g., 'we depend on the River Alice [Ok Tedi], for our vegetables, crops and fruits. Previously, we always have surplus and we had enough food and we do not rely on the market. After agreements, the river system is fully damaged. We are not collecting much from the Alice [Ok Tedi]'.
Kungembit	<p>Provisioning services</p> <ul style="list-style-type: none"> Gardening land and sago palms are important to community members as their main sources of food. These areas are also used for bush resource collection and fishing, '<i>same place where gardens are made, bush materials are sourced for housing, and where fishing also happens</i>'. Concerns were raised that the project may reduce the land available for gardening and sago. Forested resources, such as hardwood trees, black palm and sago leaves, are important to community members. These resources are used for building houses and preserving sago and cooking <i>mumu</i>. Concerns were raised the project would result in a decline in bush resources. Creeks and rivers within their clan boundaries are used for fishing and as their primary water sources. Concerns were raised by women that these creeks and rivers would be affected by the project. <p>Cultural services</p> <ul style="list-style-type: none"> Cultural traditions and practices within the community include wearing traditional clothing, e.g., '<i>women wear grass skirts... men wear hornbill beak</i>'. Concerns were raised that the younger generations are not upholding or practicing these cultural traditions. Traditional medicine continues to be used within the community, with medicinal resources collected from within customary land boundaries.
Kungim	<p>Provisioning services</p> <ul style="list-style-type: none"> Gardening land is valued by community members as it is their primary source of food and a source of income. Sago is a staple crop collected from along creeks and swamps within their village boundaries. Garden produce, sago and cash crops, such as betel nut, are also sold to support household income. Bush resources, including firewood, traditional medicine and timber for houses, are collected from forested areas surrounding the village. These areas are often accessed in the same locations as gardening areas and water sources. The Ok Birim is used by community members for diving, fishing, transportation and washing. Smaller creeks are also used as the main source of drinking water. Community members raised concerns that project activities could affect the quality and flow of the Ok Birim. <p>Cultural services</p> <ul style="list-style-type: none"> Most cultural practices are still being exercised, although it was noted that practices were declining, e.g., '<i>traditional herbs changed to medicine at hospital</i>'.
Putmambin	<p>Provisioning services</p> <ul style="list-style-type: none"> Gardening land is used to grow crops for household consumption and for sale at local markets. Women raised concerns that project activities may affect soil quality, potentially reducing garden productivity. Forested areas surrounding the village are used for hunting and the collection of bush resources, including timber for house construction. Community members noted that population growth is affecting the availability of these resources. Plants used in traditional medicine, including salat and yengnong, are also collected from forested areas. Creeks, dug wells and rainwater tanks are the main sources of water for drinking and domestic use. Creeks and dug wells are preferred due to perceived better water quality. Rivers and creeks, including the Ok Yep, are used for fishing and the collection of riverine resources. Community members raised concerns that project activities could affect freshwater and riverine systems, with implications for water supply. <p>Cultural services</p> <ul style="list-style-type: none"> Traditional medicine continues to be used within the community, with medicinal resources collected from within customary land boundaries.

9.3.4 Infrastructure corridor

The following ecosystem services are relevant to the project in the infrastructure corridor:

- Provisioning services – food, timber and other wood products, freshwater, biomass fuel and natural medicines.
- Cultural services – ethical and spiritual values.

Section 9.2.4.2 provides a detailed description of natural resource use within communities along the infrastructure corridor. The following provides an overview of the natural resource use across the tailings pipeline corridor, relevant to the identified priority ecosystem services. Table 9.11 summarises the community feedback from the social fieldwork on the importance of ecosystem services and concerns raised regarding project-related impacts.

Agricultural land and subsistence gardening is the primary source of food for pipeline corridor communities. Gardening land is typically found in the area surrounding the villages, or along river terraces and low ridges where soil fertility and accessibility are favourable. Gardens provide staple crops, such as banana, cassava, taro and sago, for daily consumption and limited surplus for sale at markets. The cultivation and collection of cash crops, such as betel nut, peanuts, rubber and balsa wood, for sale at local markets supports household income, and contributes to food security.

Forested areas near corridor communities provide bush resources to support livelihood activities and form part of the communities' traditional way of life. Within their own territories, community members frequently collect firewood, timber, fruits, material for household use, bush meat, and plants for traditional medicine. Sago palms are also harvested as an important food source and for building materials.

Freshwater and riverine ecosystems, including the Ok Ma, Ok Hwie, Ok Kameng, Ok Birim and other smaller waterways, are used for fishing and the collection of riverine resources. Smaller creeks and streams found in forested areas are used by communities for drinking and other domestic purposes, including washing and cooking.

The tailings pipeline corridor contains a range of tangible cultural values including traditional settlement sites, burial grounds and archaeological sites, as well as intangible cultural values including sacred and spiritual sites. Section 9.4.2.10 provides a detailed description of the archaeological and cultural heritage values along the infrastructure development corridor.

Table 9.11 Summary of community feedback from infrastructure corridor villages

Community	Provisioning services
Northern pipeline communities <ul style="list-style-type: none"> • Kumkit-Ankit • Ok Teditau • Derongo • Nioksikwi • Bolewogam • Bounskim 	<p>Provisioning services</p> <ul style="list-style-type: none"> • Crops from gardening land surrounding the communities are the primary source of food, and source of income for households. Produce sold at local markets include surplus garden produce, betel nut, sago and breadfruit. Concerns were raised that construction of the tailings pipeline may impact gardening land and sago plantations. • Forested areas in the land surrounding the villages and further inland are used for hunting and the collection of bush resources, including wild foods, building materials, eagle wood, palsah tree. • Freshwater and riverine systems, such as Ok Hwie, Ok Ma, Ok Man, are used for drinking, fishing and domestic use, such as cooking and washing. Smaller springs are also used during the wet season, while larger waterways are used during the dry season. <p>Cultural services</p> <ul style="list-style-type: none"> • No feedback was provided during engagement with villages within the northern pipeline corridor.

Community	Provisioning services
<p>Southern pipeline communities</p> <ul style="list-style-type: none"> • Walawan • Kolebon • Wogam • Wombon • Digam • Ningerum Tamaro 	<p>Provisioning services</p> <ul style="list-style-type: none"> • Gardening land is valued by community members as it is their primary source of food and source of income. Surplus garden produce, such as banana, cucumber, kau kau and aibika, and cash crops, such as betel nut, are sold at local markets as a source of income. Sago is a staple crop relied on by households throughout the communities. Concerns were raised by community members that the project may impact gardening land and sago plantations. • Hunting and the collection of bush resources, including sago leaves for roofing and timber for houses and canoes, occurs in forested areas surrounding the communities. These areas are often accessed in the same locations as gardening areas and fishing locations. • Creeks and springs near the communities are used for drinking and domestic purposes. Larger creeks and rivers, including the Ok Kameng, Ok Taub and Ok Ma, are used for fishing and collection of riverine resources. Households from Wombon use the Ok Birim for daily activities, and people from Digam use the Ok Tedi for washing, although they raised concerns about contamination, e.g., <i>'The river is polluted by mine operations including panning of gold from alluvial mining'</i>. Concerns were raised by community members that a pipeline failure may impact water sources used by people. <p>Cultural services</p> <ul style="list-style-type: none"> • Cultural traditions and practices are still practiced in Digam, including traditional canoe making, ceremonial activities and initiations, construction of traditional housing.

9.4 ARCHAEOLOGY AND CULTURAL HERITAGE

This section provides an overview of the existing archaeology and cultural heritage environment within the project footprint. The information presented summarises the findings of the Ok Birim Tailings Storage Facility Project Archaeology and Cultural Heritage Characterisation Report prepared by IHM Consulting Limited and included in Appendix L.

9.4.1 Heritage characterisation method

The method used to characterise the archaeology and cultural heritage environment for the project involved:

- Desktop review of existing information, including previous archaeological studies, National Museum and Art Gallery (NMAG) records, and historical and ethnographic literature.
- Community consultation and cultural mapping, including engagement with community knowledge holders to identify culturally significant locations (e.g., sacred landscape features, ancestral settlement sites, burial locations, traditional clan boundaries).
- Archaeological field surveys using pedestrian transects of accessible areas within the project footprint.

9.4.1.1 Study area

The study area for the archaeology and cultural heritage assessment comprises:

- Areas within and around the TSF development area, including ancillary facilities inside the TSF development areas. The TSF communities surveyed included:
 - Birimkamba village.
 - Karandimok village.
 - Kungim village.
 - Putmambin village.
 - Ambaga village/Buseki People.
 - Kungembit village.
 - Mendua People/Alice Pit.
 - Komokpin village.
- The infrastructure corridor, which includes the tailings pipeline and pipeline access road, located on the western side of the Ok Tedi. communities and villages involved in the cultural heritage mapping consultations included:
 - Digam/Wombon/Ningerum Tamoro villages.
 - Ok Ma villages.
 - Ankit/Kumkit village.
 - Kolebon village.
 - Walawam village.
 - Bolewogam village.
 - Wogam village.

9.4.1.2 Study method

This characterisation study involved desktop research, community consultation, cultural mapping, and field survey. This approach was adopted to recognise that cultural heritage within the project area includes both:

- Tangible heritage, such as archaeological sites, former settlements, burials and artefacts; and
- Intangible heritage, such as sacred places, oral traditions, clan boundaries, named landscapes and culturally important access routes.

Desktop research

A review of existing cultural heritage information was undertaken to identify previously recorded archaeological and cultural heritage sites within the broader Ningerum region. This included review of:

- Previous archaeological and heritage studies in the wider Ok Tedi / Ningerum region.
- National Museum and Art Gallery (NMAG) records where available.
- Historical and ethnographic references.
- Topographic mapping and aerial imagery.
- Project design information and infrastructure layouts.
- Community-supplied historical information where available.

Community consultation and cultural mapping

Consultation was undertaken with community representatives, elders, landowners and local knowledge holders associated with communities in or near the TSF development area and infrastructure corridor. Women's perspectives and participation were incorporated into the consultation process where culturally appropriate and practicable. Consultation sought to identify:

- Sacred places.
- Ancestral settlement areas.
- Burial places.
- Clan boundaries.
- Historical tracks and movement routes.
- Culturally sensitive natural features.
- Oral history associations linked to place.

Where appropriate, consultation outcomes were recorded through field notes, mapping and guided site inspections.

Field survey

Two fieldwork campaigns were conducted in August and October-November 2025 by qualified archaeologists, with support from OTML's Community Relations and Sustainability Department, customary landowners, local guides and relevant community knowledge holders from Birimkamba, Karandimok, Ambaga, Kungim, Putmambin, Kungembit and the Buseki people of Lake Murray who own land within the TSF site.

Field investigations were undertaken within accessible portions of the project area using pedestrian walkover survey and guided inspections with community participants. Survey tasks included:

- Visual inspection of proposed disturbance areas.
- Identification of surface artefacts and archaeological indicators.
- Recording of settlement-related places.
- Verification of culturally significant locations identified during consultation.
- GPS location recording where appropriate.
- Photographic documentation where suitable.
- Preliminary condition and significance observations.

Identified places were classified into the following broad categories:

- Archaeological sites – places containing physical evidence of past human activity, including artefacts or occupation traces.
- Settlement sites – former or current occupation areas, village extensions, gardens, tracks or burial places
- Oral traditional sites – places recognised primarily through story, belief, customary significance or inherited knowledge.

This classification system reflects the mixed archaeological and living heritage character of the project area.

Due to adverse weather conditions preventing safe helicopter travel, field surveys were not able to be completed for Kungembit, Kungim, and Putmambin. Consequently, consultation-identified cultural heritage locations were not able to be physically verified during the ESIA fieldwork program.

9.4.1.3 Assumptions and limitations

The Archaeological and Cultural Heritage Assessment was undertaken to identify and document cultural heritage resources within the proposed TSF development area and associated infrastructure corridor. The study was conducted in accordance with recognised archaeological survey practices and international ESIA standards, although is subject to the following limitations:

- Archaeological field surveys using pedestrian transects were undertaken across accessible areas of the project using pedestrian transects. Survey coverage was restricted in some locations due to dense vegetation, steep terrain and limited access. Additional cultural heritage sites may remain unidentified in areas that could not be systematically surveyed.
- The study was based on non-intrusive survey methods, consultation outcomes and surface observations. No archaeological excavation, test pitting or artefact collection formed part of this assessment.
- Oral tradition site identification relied heavily on information provided by community knowledge holders during consultation. The exact location and extent of some culturally significant areas may vary according to community interpretation and traditional knowledge.
- Culturally significant locations for the infrastructure corridor were identified through oral accounts during cultural heritage consultations. Archaeological surveys have not conducted to verify these locations.

Despite these limitations, the assessment provides a comprehensive baseline understanding of the cultural heritage environment within the project area and forms a suitable basis for impact assessment and the development of cultural heritage management measures.

9.4.2 Existing environment

The study area is inhabited by communities belonging to three major cultural groups: Awin, Ningerum, and Yongom. These groups maintain distinct identities while also sharing historical connections through trade, marriage, migration, conflict resolution and customary land use across the wider Ok Tedi region, and traditional relationships with rivers and surrounding land remain central to community identity and livelihood systems.

9.4.2.1 Customary land tenure

Land within the project area is strongly connected to customary ownership and inherited rights. Rights to occupy, use and speak for land may be associated with clan membership, descent lines, historical occupation, marriage links, negotiated access arrangements, and recognised customary boundaries. As such, places that may appear physically modest such as former settlement sites, clan boundary markers, named ridges or watercourses, garden areas, or burial grounds, can hold substantial cultural significance because of their relationship to identity, ownership and social memory.

9.4.2.2 River systems and landscape use

The project area is associated with catchments of the Ok Tedi and Ok Birim, together with tributaries, swamps, ridges and lowland forest environments. Historically and presently, these landscapes support:

- Movement between communities.
- Fishing and hunting.
- Collection of forest products.
- Gardening and small-scale cultivation.
- Settlement establishment on suitable elevated ground.
- Spiritual and ceremonial associations.

Waterways often function as cultural boundaries, travel routes and named places in oral history.

9.4.2.3 Settlement patterns

Settlement in the wider project area has historically included permanent villages, smaller satellite hamlets, temporary garden houses, seasonal use areas, and former villages that have been relocated over time. Settlement movement may occur for various reasons such as flooding, health, access to services, inter-group relations, agricultural needs. Consequently, former settlement areas may remain culturally important even where no standing structures survive.

9.4.2.4 Cultural heritage values

The principal cultural heritage values in the study area include:

- Archaeological values, including isolated stone artefacts, grinding stones, and surface indicators of former occupation.
- Historical and settlement values, including former village sites, cemetery and burial places, historical tracks, and community gathering areas.
- Living cultural values, including sacred trees, sacred hills or ridges, spiritually sensitive water places, clan boundaries, named places linked to origin stories, and culturally important access routes.

Burial places are among the most sensitive cultural heritage receptors in the study area and include current community burial grounds, older family burial areas, and ancestral graves associated with former settlements.

Certain natural features such as trees, hills, swamps, rock outcrops, river bends and crossings may be culturally significant because of ancestral stories, spirit associations, customary law restrictions, ceremonial use, and historic conflict or peace-making events.

9.4.2.5 Archaeological potential

A limited number of recorded artefacts have currently been identified, although this does not necessarily indicate low archaeological potential. The broader region has a long history of occupation and movement and subsurface archaeological materials may occur in former settlement areas, elevated terraces, river margins, and undisturbed soils near known occupation zones.

Parts of the wider study area such as existing roads and tracks, transport routes, small-scale clearing, village expansion, have previously been disturbed. These areas may have reduced archaeological integrity, although prior disturbance does not remove living cultural significance or community attachment to a place.

9.4.2.6 Significance context

The majority of known cultural heritage values in the project area are of:

- Local significance.
- Community significance.
- Clan significance.

9.4.2.7 Critical cultural heritage screening

The IFC PS8 (IFC 2012) identifies additional protections where Critical Cultural Heritage is present. This generally applies to places of exceptional cultural significance at national or international scale, or places essential to the identity of communities. Further, IFC PS7 recognises that certain cultural heritage values, natural features and cultural landscapes may hold fundamental importance to the identity, spirituality, customary practices and cultural continuity of Indigenous Peoples and affected traditional communities.

Based on available information and verification undertaken during the assessment, no identified heritage values within the project area were determined to meet the criteria for Critical Cultural Heritage in IFC PS8 or IFC PS7. Notwithstanding, the assessment identified numerous burial grounds, cemeteries, sacred sites, ceremonial locations, ancestral settlement areas, customary boundaries and culturally significant landscape features that retain high cultural, spiritual and customary significance for affected communities. These heritage values are not currently considered Critical Cultural Heritage under IFC PS7 or IFC PS8, although they remain highly sensitive receptors that require avoidance where practicable and appropriate management throughout the project lifecycle.

9.4.2.8 Survey results

Archaeological and cultural heritage investigations undertaken for the project identified a large and culturally complex suite of heritage locations within the TSF development area, infrastructure corridor development area and adjacent customary lands through a combination of field survey, community consultation, oral testimony and participatory cultural mapping.

The identified places comprise:

- Archaeological sites.
- Ancestral settlement and occupation areas.
- Burial and cemetery locations.
- Oral traditional and sacred places.
- Ceremonial and ritual locations.

- Clan boundaries and culturally significant landscape features.
- Traditional pathways and access routes.
- Hunting and subsistence-use areas.
- Sacred hills, swamps, rivers and forest locations/
- Places associated with oral history, spiritual belief systems and customary land use.

9.4.2.9 TSF development area

This section summarises the survey results for the TSF development area.

Consultation-identified cultural heritage sites

In addition to physically verified cultural heritage sites (see Section 9.4.2.8), 268 culturally significant locations were identified through community consultation, oral testimony and participatory cultural mapping that were not able to be verified through field surveys.

Table 9.12 provides a summary of cultural heritage sites identified in the TSF development area, including those that were verified through field surveys.

Table 9.12 Summary of cultural heritage sites – TSF development area

Village	Total sites	Verified sites	Non-verified sites
Birimkamba	27	27	0
Ambaga	36	33	3
Karandimok	13	10	3
Komokpin	8	7	1
Kungim	18	0	18
Kungembit	7	0	7
Putmambin	12	0	12

Field verified sites

Archaeological surveys recorded a total of 77 cultural heritage sites that were able to be physically verified during field investigations. These places include archaeological sites, settlement-related places and oral traditional places of continuing community significance. The results demonstrate that the project area forms part of an active customary cultural landscape rather than a culturally vacant area.

The high proportion of oral traditional sites is consistent with the cultural setting of the region, where many significant places are recognised through inherited knowledge, story and customary practice rather than visible built features.

Summary of cultural heritage values

The TSF development area include archaeological locations, settlement sites, and oral traditional sites associated with ancestral settlement history, clan territories, and culturally significant landscape features. Table 9.13 provides a summary of cultural heritage sites identified through field surveys, including community-identified sites, and field-verified sites.

Table 9.13 Cultural heritage sites – TSF development area

Village	Summary of results
Birimkamba	<ul style="list-style-type: none"> Birimkamba Village represents one of the most culturally layered localities within the study area, combining historical settlement remains, ongoing burial traditions, oral-traditional landscape features and continuing customary associations linked to ancestral beings such as the Gungotim spirit-dog. While portions of the area have experienced historical disturbance associated with the ITCS Road and earlier infrastructure activities, many identified sites continue to retain cultural meaning and remain active within community memory and customary land use practices. Archaeological significance within Birimkamba is considered moderate. Several locations may retain subsurface cultural deposits associated with earlier occupation and settlement history. Customary significance within Birimkamba is very high. Many locations remain active components of the living customary landscape.
Ambaga	<ul style="list-style-type: none"> The Ambaga customary area contains one of the densest concentrations of cultural heritage locations recorded during the assessment. Several sacred oral-traditional locations remain culturally active and continue to hold strong importance within local clan identity systems and community memory. Ambaga contains moderate archaeological significance. The area demonstrates evidence of prolonged cultural interaction with the environment. Customary significance within Ambaga is very high. Many locations continue to function as active components of the customary landscape and remain strongly connected to clan identity and spiritual belief systems.
Karandimok	<ul style="list-style-type: none"> The cultural landscape of Karandimok is strongly expressed through traditional resource-use features, customary pathways, sacred natural features, burial locations and ancestral settlement associations linked to the Yongom-Kimki communities. While most identified sites possess low to moderate archaeological potential, they retain high ethnographic, customary and social significance, reflecting the continuing coexistence of livelihood, spirituality and oral tradition across the broader landscape. Archaeological significance within Karandimok is generally low to moderate. Limited physical archaeological material was identified during field survey; however, burial locations, historical settlement areas and traditional movement corridors retain archaeological potential associated with long-term occupation and cultural landscape use. Customary significance within Karandimok is high. Several sites continue to function as active cultural locations within the living customary landscape.
Komokpin	<ul style="list-style-type: none"> The Komokpin cultural landscape is characterised by the close interaction between resource use, ritual practice, subsistence activity and clan identity. Rivers and creeks function not only as ecological resources, but also as spiritual and territorial boundaries within the customary landscape. Similarly, sago swamps, gardens, ceremonial areas and hunting grounds remain active expressions of social organisation, ancestral association and customary environmental management. Archaeological significance within Komokpin is generally low to moderate. Limited visible archaeological material was identified during field investigations; however, ancestral burial areas, settlement activity zones and ceremonial locations retain archaeological potential associated with long-term customary occupation and land use. Customary significance within Komokpin is high. Many identified locations remain active components of the living cultural landscape and continue to support customary social and subsistence practices.
Kungembit	<ul style="list-style-type: none"> Seven consultation-identified sites were identified through engagement with Kungembit community. These included: <ul style="list-style-type: none"> Three settlement sites, including a cemetery and a settlement location of high local significance, and a garden area of medium local significance. Four oral tradition sites, including sacred sites, hunting zone, and Raggiana lekking sites. The local significance of these sites is low to high.

Village	Summary of results
Kungim	<ul style="list-style-type: none"> Eighteen consultation-identified sites were identified through engagement with Kungim community, including: <ul style="list-style-type: none"> Eight settlement sites, which include garden areas for sago, and cash crops cultivated by the community. The local significance of these sites is medium to high. Nine oral tradition sites, comprising burial sites, hunting grounds, ancestry tracks, boundary markers, sago gardens, sacred sites, and hunting and fishing sites. The local significance of these sites is low to medium. One archaeological site, being a World War 2 historical site of high local significance.
Putmambin	<ul style="list-style-type: none"> Twelve consultation-identified sites were identified through engagement with Putmambin community. <ul style="list-style-type: none"> Five settlement sites, including a sacred site, garden area, and rubber plot. The local significance of these sites is medium. Seven oral tradition sites, including burial site, temporary hut/ camp site, hunting grounds, ancestry tracks, boundary markers, sacred areas, and fishing grounds. The local significance of these sites is low to high.

Table 9.12 summarises cultural heritage sites verified during field surveys with TSF villages. Figure 9.12 shows the location of these sites. They include:

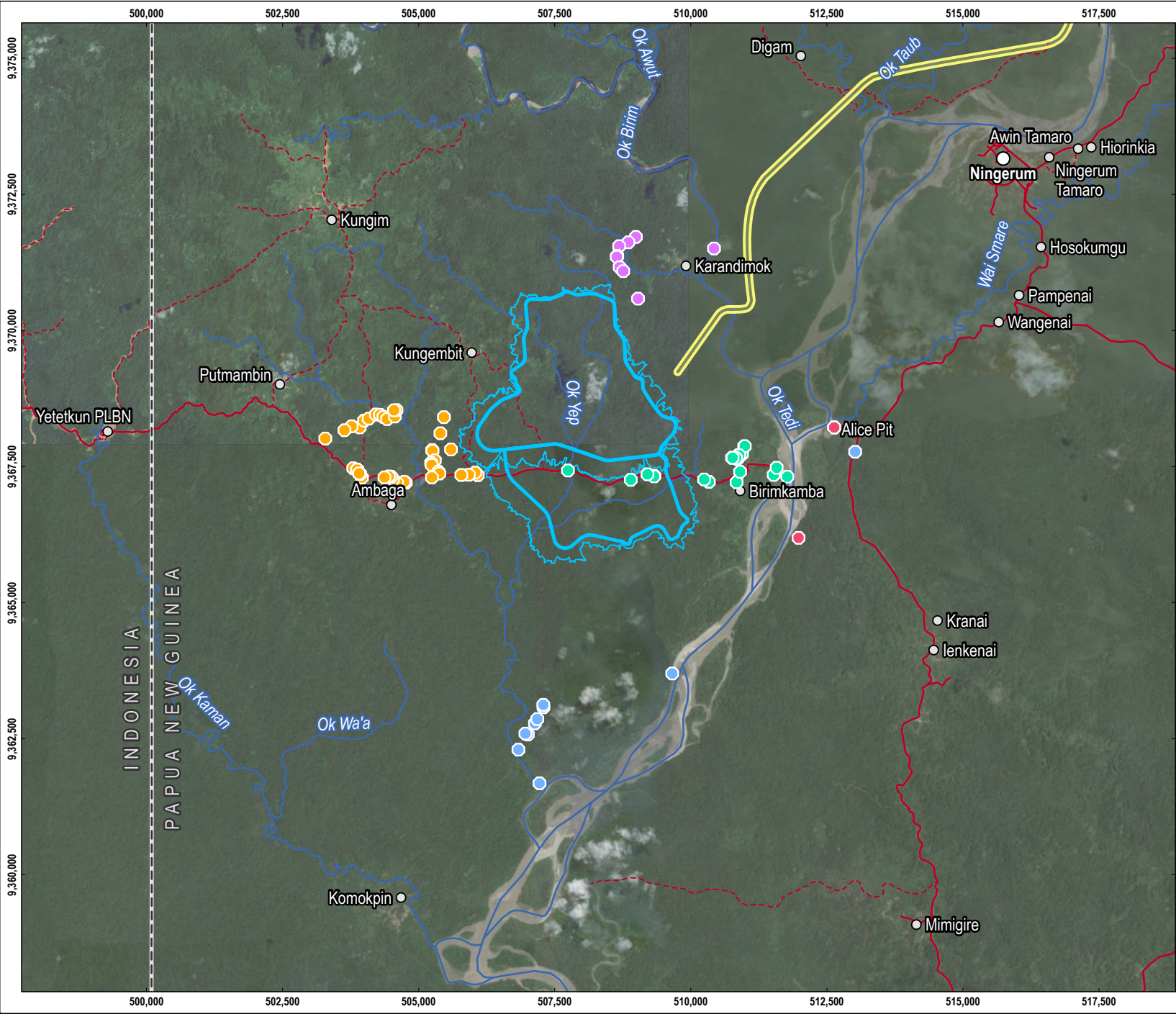
- Twenty-seven cultural heritage sites within Birimkamba village and its adjacent landscapes. These comprise a community cemetery, sacred oral-historical sites, post-colonial settlement remains, clan boundaries, and a former construction camp. The findings illustrate the overlapping character of living, ancestral, and industrial heritage features within the TSF development area.
- The Ambaga survey verified 33 sites, with a notably dense cluster of sites within the buffer zone of TSF development area. The documented features comprise ancestral burial grounds, sacred oral-historical sites, economic and agricultural zones, clan boundaries, and one potential archaeological site.
- Ten cultural heritage sites were verified for Karandimok. These include a village centre, clan boundaries, resource use areas, and sacred natural features associated with local oral histories. The area forms part of the lower Ok Birim catchment and features rich biocultural connections between people, land, and water systems.
- The Komokpin survey verified seven cultural heritage sites within the village and its surrounding customary lands. Recorded sites demonstrate the strong ritual ecology of the Buburam clans, where ancestral, subsistence, and environmental domains coexist and continue to structure community life.

Table 9.14 Field verified cultural heritage sites – TSF development area

Village	Site code	Details	Archaeological potential	Cultural significance
Birimkamba	OKB-BIR:000	River frontage adjacent to Birimkamba settlement used for subsistence and transport.	Low	Medium
	OKB-BIR:000.1	Current Birimkamba settlement area.	Low	Medium
	OKB-BIR:001	Cultural landscape encompassing sacred hill, swamp and fig tree.	Low	High
	OKB-BIR:001.1	Hill associated with mythical dog-spirit narrative.	Low	High
	OKB-BIR:001.2	Swamp associated with disappearance story in local tradition.	Low	High
	OKB-BIR:001.3	Sacred Masalai tree associated with spiritual beliefs.	Low	High
	OKB-BIR:002	Cemetery currently used by the community.	Medium	High
	OKB-BIR:003	Burial of Chief Mukon Wangbon recognised in local history.	Medium	High
	OKB-BIR_003.1	Former settlement predating the current village location.	Medium	High
	OKB-BIR_003.2	Secondary burial site within ancestral village zone.	Medium	High
	OKB-BIR_003.3	Burial ground linked to former village occupation.	Medium	High
	OKB-BIR_003.4	Traditional ceremonial gathering area approximately 50 × 100 m.	Low	Medium
	OKB-BIR_003.5	Isolated lithic artefact indicating prehistoric tool production.	High	Medium
	OKB-BIR_003.6	Extension of former village settlement area.	Medium	Medium
	OKB-BIR_003.7	Terminal boundary of ancestral settlement zone.	Medium	Medium
	OKB-BIR_004	Historic colonial-era pathway.	Low	Medium
	OKB-BIR_004.1	Rear section of historic track.	Low	Medium
	OKB-BIR_004.2	Entry point to colonial track.	Low	Medium
	OKB-BIR_004.3	Road connection point to colonial track.	Low	Medium
	OKB-BIR_005	Boundary between Namago-Komlegi and Kimki-Obit clans.	Medium	Medium
	OKB-BIR_005.1	Boundary marker along access road corridor.	Medium	Medium
	OKB-BIR_005.2	Boundary marker at Niktem Creek separating clans.	Medium	Medium
	OKB-BIR_006	Former construction camp established during 1979 road works.	Low	Low
	OKB-BIR_007	Mt Mogabit Gungoktim associated with mythical spirit dog narrative.	Low	High

Village	Site code	Details	Archaeological potential	Cultural significance
Ambaga	OKB-BIR_008	Recent settlement extension near TSF area.	Low	Medium
	OKB-BIR_008.1	Burials associated with named individuals from community.	Medium	High
	OKB-BIR:008.2	End of satellite settlement near stockpile area.	Low	Medium
	OKB-AMB_001	Boundary marker separating Buburam and Kimki-Namago clans.	Low	Medium
	OKB-AMB_002	Plantation area established by Ambaga villagers.	Low	Low
	OKB-AMB_003	Boundary marker separating Onakama and Buburam clans.	Low	Medium
	OKB-AMB_004	Traditional territorial boundary marker between clan groups.	Low	Medium
	OKB-AMB_005	Sacred cultural landscape feature associated with oral traditions.	Low	High
	OKB-AMB_006	Traditional subsistence gardening area used by community members.	Low	Low
	OKB-AMB_007	Traditional access track linking gardens and settlement areas.	Low	Medium
	OKB-AMB_008	Isolated grinding stone artefact located west of site 007.	High	Medium
	OKB-AMB_009	Traditional food garden area within clan territory.	Low	Low
	OKB-AMB_010	Traditional pathway connecting Ambaga gardens and settlement.	Low	Medium
	OKB-AMB_011	Secondary traditional pathway used by villagers.	Low	Medium
	OKB-AMB_012	Traditional pathway through customary land areas.	Low	Medium
	OKB-AMB_013	Subsistence garden area used for food cultivation.	Low	Low
	OKB-AMB_014	Garden area associated with local clan subsistence activities.	Low	Low
	OKB-AMB_015	Oral tradition location associated with Masalai marriage narrative.	Low	High
	OKB-AMB_016	Track connecting Ambaga settlement and nearby gardens.	Low	Medium
	OKB-AMB_017	Traditional pathway used by villagers for travel.	Low	Medium
	OKB-AMB_018	Traditional agricultural area used for subsistence crops.	Low	Low
	OKB-AMB_019	Garden area within Ambaga customary land.	Low	Low
	OKB-AMB_020	Cultivation area used by Ambaga households.	Low	Low
Karandimok	OKB-KAR_001	Boundary marker along Ok Birim tributary separating Yongom clan territories.	Low	Medium
	OKB-KAR_001.1	Current Karandimok village including cemetery, airstrip, creek access and mission area.	Low	Medium

Village	Site code	Details	Archaeological potential	Cultural significance
	OKB-KAR_001.2	Community meeting structure located within village centre.	Low	Low
	OKB-KAR_001.3	Secondary marker indicating spatial extent of the village area.	Low	Low
	OKB-KAR_002	Traditional bush track junction connecting Karandimok with Kungim and Kungembit areas.	Low	Medium
	OKB-KAR_003	Burial location associated with local clan groups.	Medium	High
	OKB-KAR_004	Traditional fishing location along Ok Amung River used by villagers.	Low	Medium
	OKB-KAR_005	Sacred medicinal tree used for herbal remedies in traditional knowledge systems.	Low	Medium
	OKB-KAR_005.1	Tree species used traditionally to stun fish during harvesting activities.	Low	Medium
	OKB-KAR_006	Traditional pathway linking Karandimok and Kungim villages.	Low	Medium
	OKB-KAR_007	Traditional pathway connecting Karandimok and Kungembit.	Low	Medium
	OKB-KAR_008	Burial ground associated with Kaiyuk and Kadep clans.	Medium	High
	OKB-KAR_009	Sacred cultural landscape feature referenced in oral traditions.	Low	High
Komokpin	OKB-KOM_001	Current Komokpin village settlement area including houses and gardens.	Low	Medium
	OKB-KOM_002	Burial area used by Komokpin residents.	Medium	High
	OKB-KOM_003	Former settlement site associated with earlier village occupation.	Medium	High
	OKB-KOM_004	Cultural site referenced in local oral traditions.	Low	High
	OKB-KOM_005	Traditional subsistence gardening area used by villagers.	Low	Low
	OKB-KOM_006	Traditional pathway linking Komokpin with neighbouring areas.	Low	Medium
	OKB-KOM_007	Traditional fishing location used by villagers.	Low	Medium
	OKB-KOM_008	Tree associated with traditional beliefs.	Low	Medium
	OKB-KOM_009	Subsistence agricultural area used by villagers.	Low	Low
	OKB-KOM_010	Stone artefact identified during field survey.	High	Medium



LEGEND

- Regional centre
- Study area community
- Road
- - - Track
- Watercourse
- - - International border
- Proposed TSF footprint
- Proposed infrastructure corridor

Cultural heritage site

- Access Road
- Ambaga
- Birimkamba
- Karadimok
- Komokpin

SOURCE

Cultural heritage survey sites from IHM.
Villages from Tetra Tech Coffey.
Proposed infrastructure from KCB and OTML.
Topographic features from OSM. DEM from SRTM.
Imagery from ESRI and Google Earth.



0 1 2 km
SCALE 1:100,000
PAGE SIZE: A4
PROJECTION: PNG94 PNGMG94 Zone 54

OK TEDI MINING LIMITED

OK BIRIM TAILINGS STORAGE FACILITY PROJECT

FIGURE 9.16

TSF cultural heritage survey sites



TETRA TECH
COFFEY

DATE: 22.02.26 PROJECT: 754-MELN374244 FILE: 374244C_R08_F09.16_GIS

Only a small number of archaeological finds were recorded, including isolated stone artefacts and a grinding stone (see Table 9.15). These finds indicate past human occupation and land use but do not presently demonstrate evidence of extensive archaeological complexes of national significance. The dispersed and low-density character of the recorded assemblage is consistent with mobile forest occupation, repeated short-term land use, and relocation of settlement through time rather than large permanent archaeological centres.

Table 9.15 Archaeological finds

Area	Site Type	Interpretation
Birimkamba	Stone flake	Tool use / occupation evidence
Ambaga	Grinding stone	Domestic processing activity
Komokpin	Lithic artefact	Occupation indicator

9.4.2.10 Infrastructure corridor

The infrastructure corridor development area extends through a culturally active landscape connecting the TSF with existing OTML operational areas. A large number of cultural heritage sites were identified during the community interviews and consultative mapping sessions held with landowning community members, clan elders, and knowledge holders. These are summarised in Table 9.16.

Table 9.16 Cultural heritage sites – infrastructure corridor

Village	Summary of results
Kumkit and Ankit	<ul style="list-style-type: none"> Settlement site: One community cemetery identified with over nine deceased buried. Oral tradition site: seven sites were recounted; all were sacred sites.
Ok Ma	<ul style="list-style-type: none"> Settlement site: Seven settlement sites were identified, three were said to be community cemeteries with over 100 deceased buried, four were small burial sites with less than 10 deceased. Oral tradition site: 11 sacred sites were recounted. Archaeological site: four cave sites were identified, used for hunting bats and shelter.
Kolebon	<ul style="list-style-type: none"> Settlement sites: A total of 15 settlement sites identified, 13 were ancestral burial sites and two were community cemetery with over 100 deceased for eight clans. Oral tradition site: 22 oral tradition sites were recorded; all were categorised as spirit or ritual sites.
Digam	<ul style="list-style-type: none"> Settlement site: Nine sites were identified in the interview by three chiefs of Digam Village representatives: two of the sites were burial site while seven were cemeteries. For one burial site, it was reported the deceased was taken away by flood, so it is highly unlikely a site of inhumation. Oral tradition site: 35 sites were recounted; all were sacred and spirit sites.
Ningerum-Tamaro	<ul style="list-style-type: none"> Settlement site: Three sites identified, two were cemeteries and one was ancestral burial site for a male. Oral tradition site: 22 sites were identified in the interview; all were sacred sites.
Wombon	<ul style="list-style-type: none"> Settlement sites: Three sites identified, two were ancestral cemeteries, one was ancestral burial site.
Bolewogam	<ul style="list-style-type: none"> Settlement site: 11 sites were identified, three were ancestral cemetery sites, one other was ancestral burial, seven were current cemetery for respective clans. Oral tradition site: 23 sites were recounted, most were assessed as sacred sites, some were economic sites for hunting.

Village	Summary of results
Wogam	<ul style="list-style-type: none"> Settlement site: 12 sites were identified in the interviews, two sites were ancestral burial sites, four were small cemetery sites with deceased less than five per site, five were ancestral cemetery sites, and one was current community cemetery. Oral tradition site: About six clans have recounted for a total of 97 sites, all were regarded as sacred sites. Archaeological site: Five sites were identified as sacred cave sites.
Walawam	<ul style="list-style-type: none"> Settlement site: Five cemeteries were identified for respective clans with more than 40 deceased estimated buried. Oral tradition site: 44 sites were identified, all were described as sacred sites or economic sites, one was identified as PPL 269-L19 which is understood to be a petroleum prospect site.
Wirimkanatko	<ul style="list-style-type: none"> Settlement site: Four settlement sites, all were cemeteries for respective clans adding to over 50 deceased buried.

9.4.2.11 Intangible heritage values

Intangible heritage comprises local knowledge and practices such as the skill of gardening, building houses, canoes, ceremonial practices (magic needed for rain, harvesting food crops, hunting expedition, or procreation and childbearing rituals) and visual performances such as dancing, singing and local languages that unify local identity. Intangible cultural systems remain active and socially embedded in villages across the study area and constitute regulatory systems governing land use, behaviour and clan identity, and are embedded within ongoing systems of belief, lineage and customary tenure.