# New Planting Procedure - Summary of Assessments

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| **NPP Reference Number:** | CU-890216-NPP |
| **Country of the NPP submission:** | Papua New Guinea |
| **RSPO Membership Number:** | 1-0008-04-000-00 |

## Section 1: General Information

Guidance Note: In this section, the growers need to provide all the necessary information in relation to the new development projects. This includes the type of assessment conducted, location of the project, the type of permit currently obtained, the rights to use the land information, and all relevant information. The land clearing plans will be included in this section as well.

The purpose of this NPP is to enable NBPOL to comply with RSPO NPP requirements, which necessitates all new oil palm developments to undertake a suite of assessments prior to development. These assessments are done to ensure that:

- Development is done in harmony with the environment and in harmony with the communities that live within and around the assessment area.
- Any HCV area or HCS forest in the assessment area are identified and mapped prior to development, and management and monitoring recommendations are provided to ensure the HCV/HCS present are maintained or enhanced if the project proceeds.
- Development is planned to minimise carbon emissions and maximise carbon sequestration.

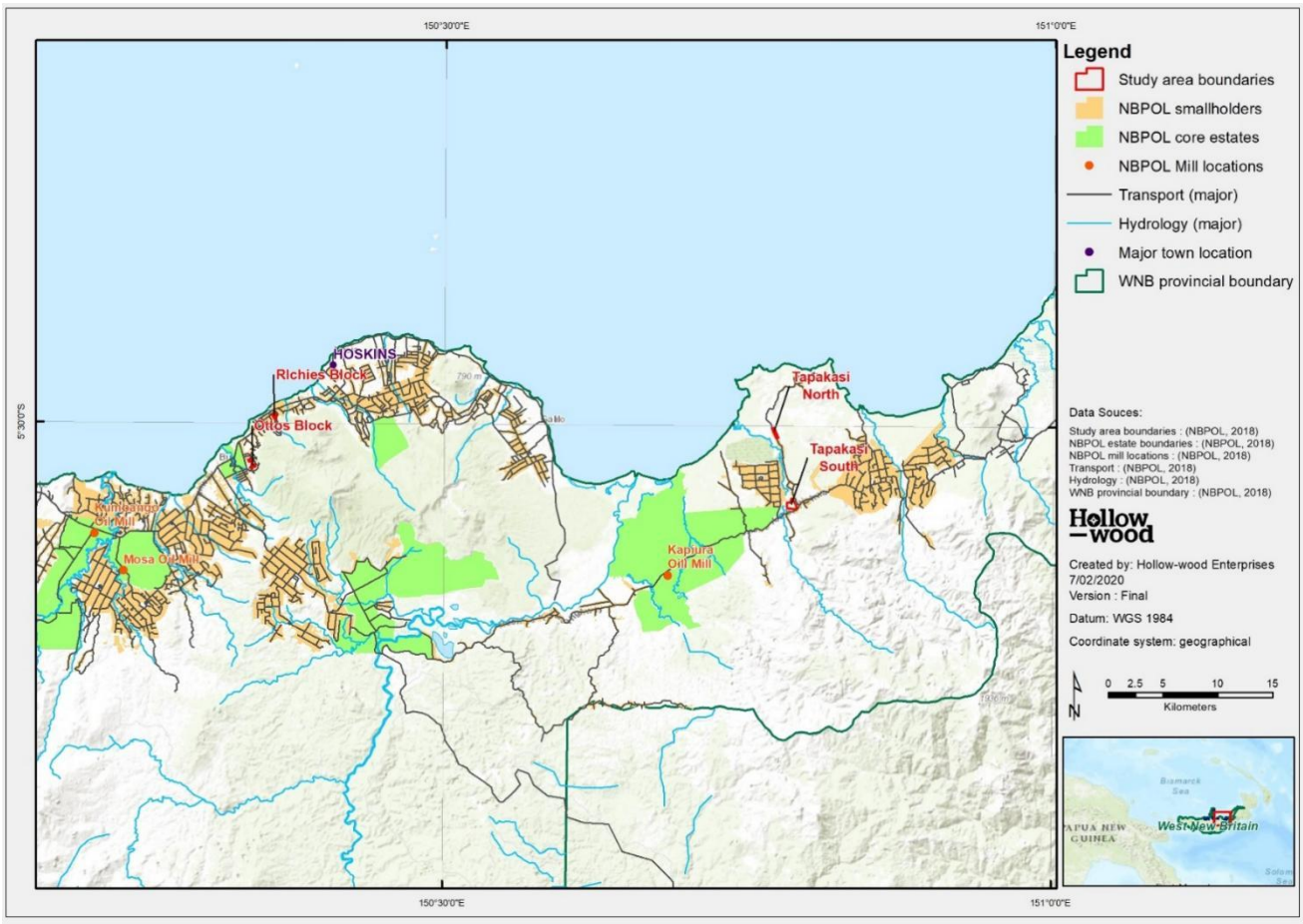
The assessment areas are located in West New Britain, PNG. Each of the assessment areas are spread out across the landscape. The name and coordinates of each assessment area are provided in Table 1, the assessment areas can be seen in Map 1 and Map 2. The total area is 2,395.1 Ha.

**Table 1. Study areas that are relevant to this assessment.**

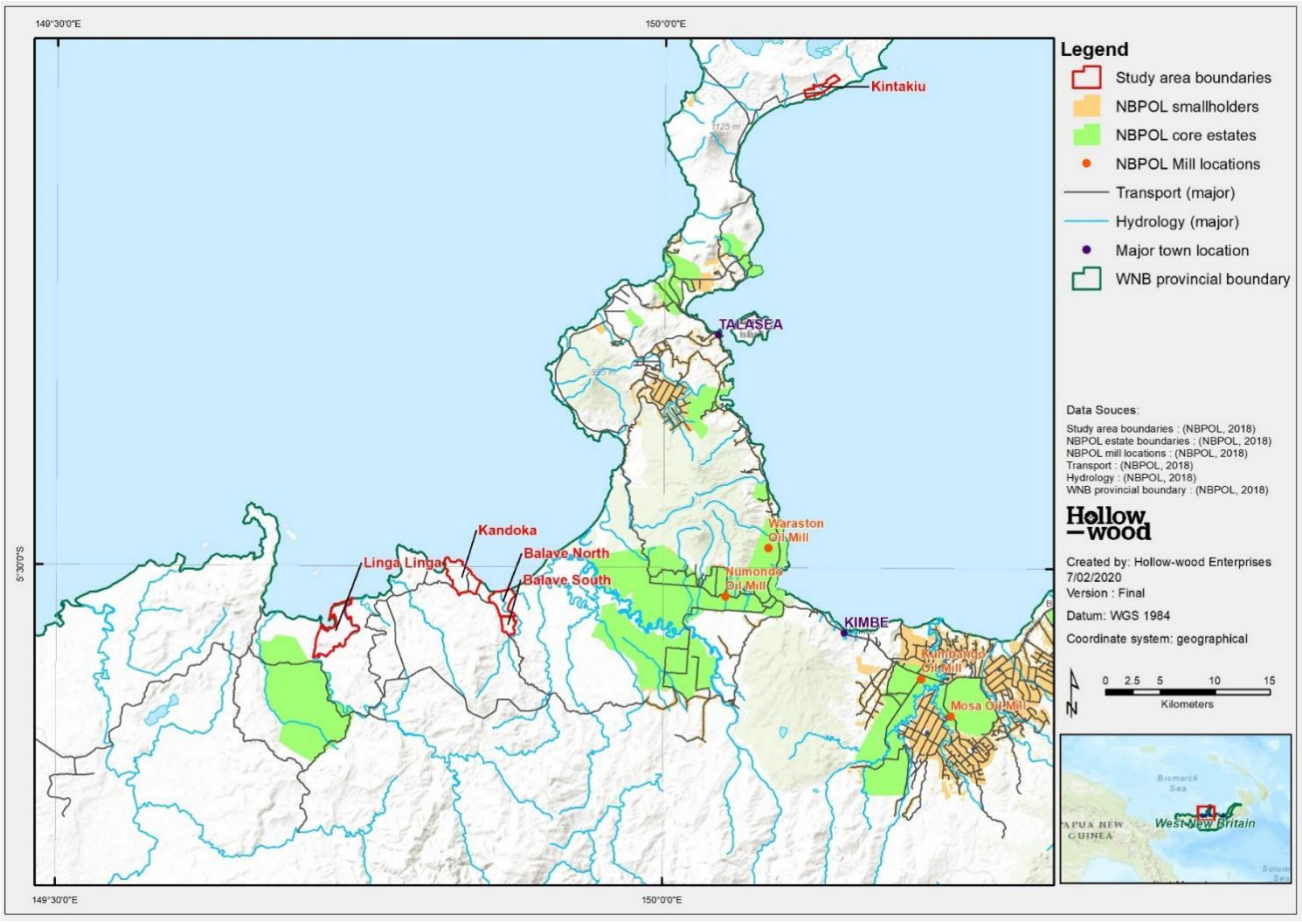
| Site name | Land tenure | Area (ha) | Coordinates of the centre of the site (decimal degrees) |
|---|---|---|---|
| **Tapakasi North** | Customary | 19.8 | 150.7714, -5.505925 |
| **Tapakasi South** | Customary | 54.90 | 150.7854, -5.564489 |
| **Lingalinga** | Freehold | 957.96 | 149.7302, -5.552698 |
| **Kintakiu** | Customary | 211.55 | 150.128, -5.103213 |
| **Balave North** | Customary | 363.28 | 149.8677, -5.529088 |
| **Balave South** | Customary | 176.02 | 149.8725, -5.549349 |
| **Kandoka** | Customary | 618.49 | 149.8339, -5.508725 |
| **Richard's Block** | State Lease (Land Settle Scheme Block) | 12.89 | 150.3599, -5.494289 |

| | | | |
|---|---|---|---|
| **Otto's Block** | Customary (socialised through a CLUA) | 15.32 | 150.3418, -5.53337 |

NB: These will all be scheme smallholders if the development goes ahead.




**Map 1. Spatial location of study areas (blue) in the east of the AOI.**




**Map 2. Spatial location of study areas (blue) in the west of the AOI**

**Table 2. Permits by which use of the land will be allowed.**

| Site name | Type of Permit |
|---|---|
| **Tapakasi North** | Sub- leased through an ILG ( Incorporated Land Group) |
| **Tapakasi South** | Sub- leased through an ILG ( Incorporated Land Group) |
| **Lingalinga** | Private lease with an owner with a Freehold title |
| **Kintakiu** | Sub- leased through an ILG ( Incorporated Land Group) |
| **Balave North** | Sub- leased through an ILG ( Incorporated Land Group) |
| **Balave South** | Sub- leased through an ILG ( Incorporated Land Group) |
| **Kandoka** | Sub- leased through an ILG ( Incorporated Land Group) |
| **Richard's Block** | State Lease (Land Settlement Scheme Block) |
| **Otto's Block** | Leased through a CLUA |

The assessments conducted over these areas were:

- HCV / HCS assessment
- SEIA
- GHG
- LUCA
- Soil and Topography

### *Landforms*

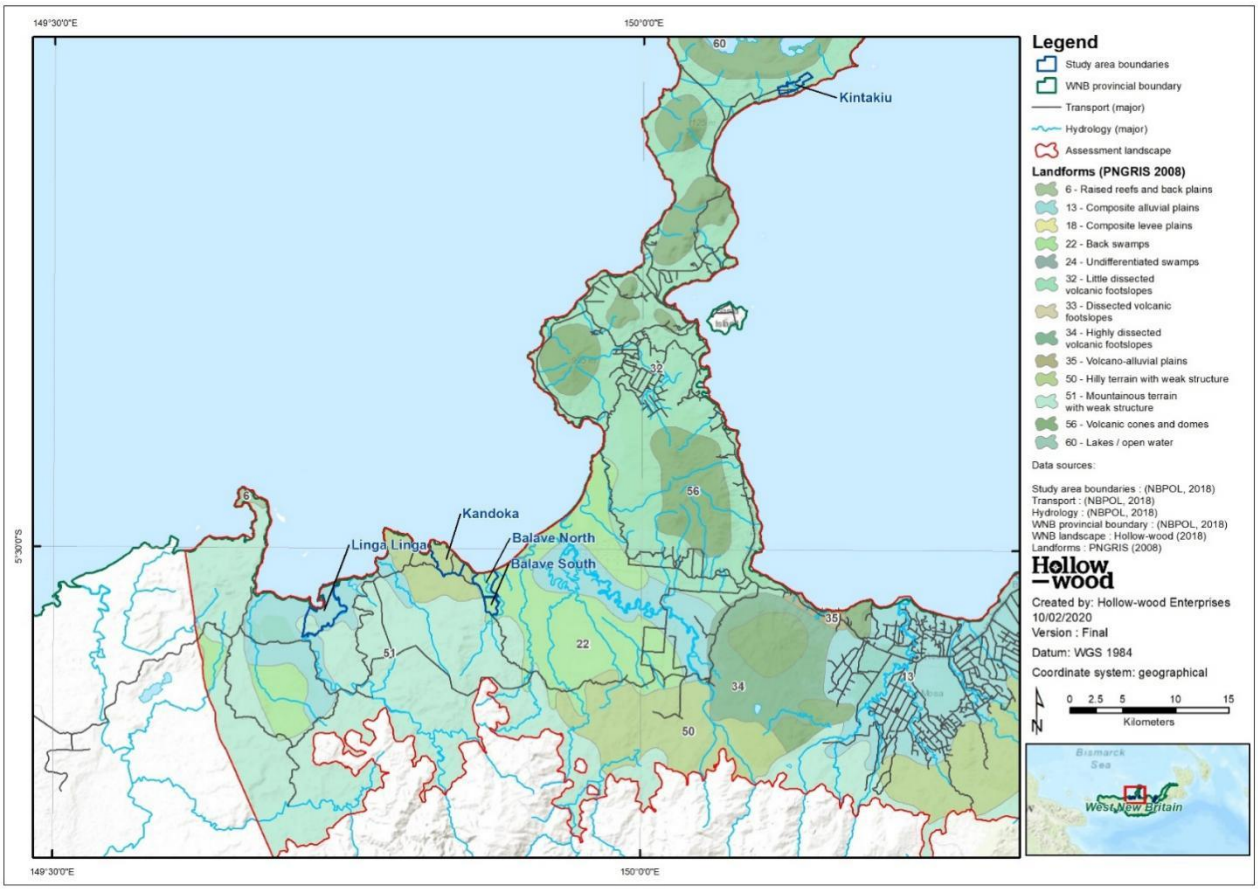
A landform refers to a 'recurring pattern of topography within the landscape' (Bryan and Shearman, 2008), with specific landforms often associated with specific vegetation associations and/or communities.

As New Britain Island is geologically young and tectonically active, the landforms reflect this fact, particularly the alluvial or volcano-alluvial plains across the AOI. Landform extent across the AOI can be seen in Map 3 and Map 4, and the descriptions have been taken from the PNGRIS handbook (Bryan and Shearman, 2008).

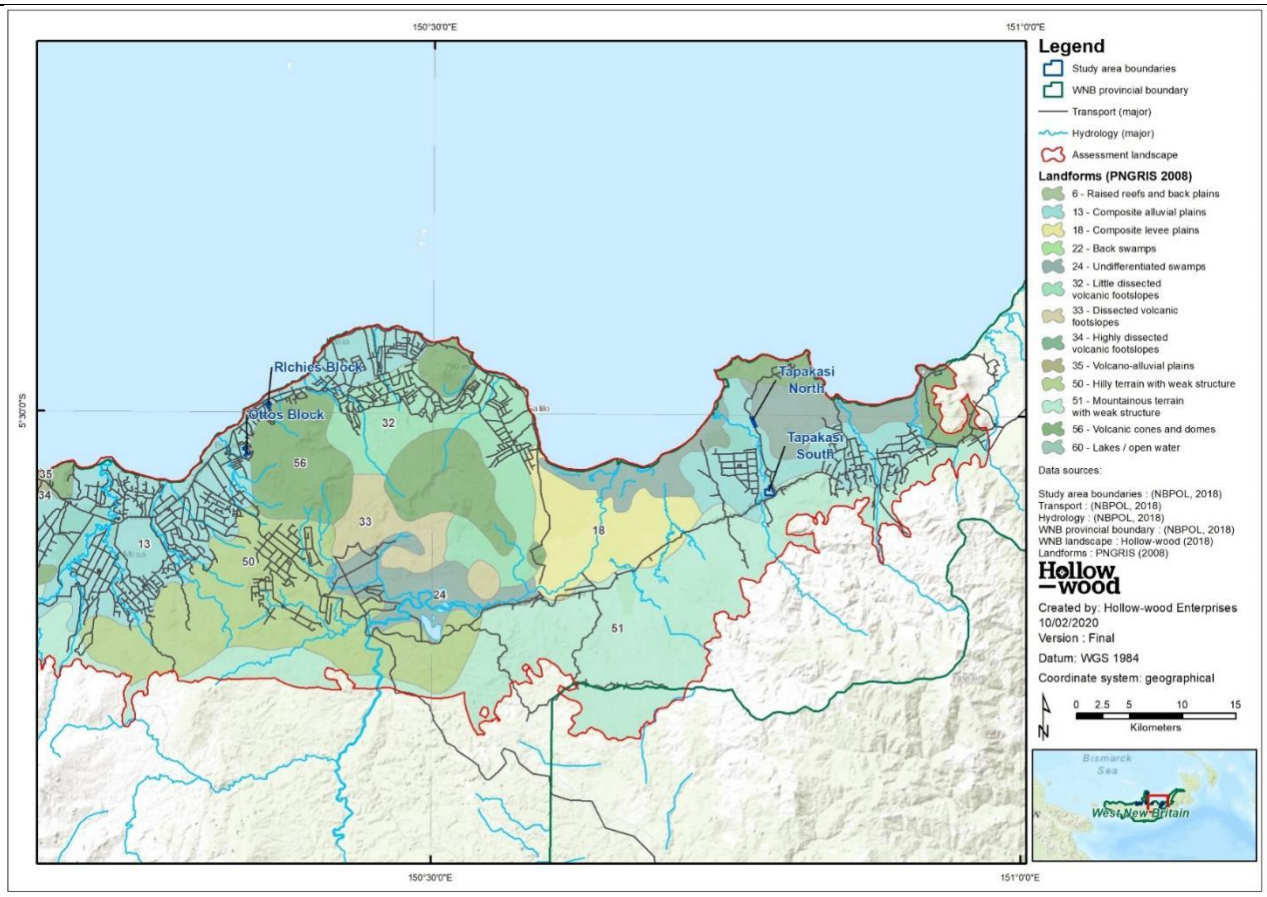
**Table 3. Landforms present in the assessment AOI, as per PNGRIS (2008).**

| Landform Number | Landform group | Landform name | Description |
|---|---|---|---|
| **6** | Relict littoral landforms | Raised coral reefs and associated back plains | Uplifted reef surface continuing inland as a marine depositional plain formed on soft calcareous sediments, such as the western part of New Britain Island |
| **13** | Depositional landforms (recent plains) | Composite alluvial plains | Complex alluvial plains or basins consisting of a central flat to gently undulating meander floodplain with meandering channels, low discontinuous levees, meander scrolls and oxbows, which merge into poorly drained flanking back plains an back swamps and/or higher well drained terraces. |
| **18** | Depositional landforms (Fluvial - recent plains) | Composite levee plains | Stable depositional alluvial floodplains of very low relief consisting of a better drained central levee plain, flanked by more extensive and typically very poorly drained back plains. The central levee plain consists of a channel with low sinuosity, bounded by continuous levee banks. |
| **22** | Depositional landforms (Fluvial - recent plains) | Back swamps | Extensive marshy semi-permanently to permanently inundated depressed areas of floodplains with drainage impounded or impeded by a central levee or meander plain. These freshwater swamps are maintained wherever land gradients and drainage outlets are inadequate to disperse the rain and run-on water. The depth of standing water and duration and depth of flooding is highly variable throughout PNG and depends entirely on local conditions. |
| **24** | Depositional landforms (Fluvial - recent plains) | Undifferentiated swamps | All seasonal or permanent swamps that cannot be classified as either back swamps or blocked valley swamps. Many of these swamps occur in karst areas where they occupy basins without drainage or with poor internal drainage, and where the water table is either seasonally or permanently at or above the ground surface level. |
| **32** | Volcanic landforms (Fans and footslopes) | Little dissected volcanic footslopes and volcano-alluvial fans | A variety of undissected to little dissected landforms generally surrounding young or recently active volcanoes and including partially dissected extensive coalescing volcano-alluvial fans of slightly concave profile. Fans are dissected by shallow, frequently steep sided radiating valleys separated by either long low ridges with accordant crests or by undulation plains at lower altitudes and slopes. |
| **33** | Volcanic landforms (Fans and footslopes) | Dissected volcanic footslopes and volcano-alluvial fans | Dissected volcanic footslopes and former volcano-alluvial fans of slightly concave profile, formed of intercalated fluvial, lahric (mudflow) and nuee (avalanche) deposits with superficial ash. On the flanks of major volcanoes, they are dissected by numerous radiating streams to form a pattern of long, radianting or sub-parallel ridges and narrow, steep sided valleys. |
| **34** | Volcanic landforms (Fans and footslopes) | Deeply dissected older volcanic footslopes and fans | Broadly dissected lower flanks of deeply dissected older, extinct volcanic centres consisting of long radial raidges with accordant crests separated by deep radial gorges. On the lower slopes valleys are U shaped and separated by triangular shaped footslope remnants, and along the coast they frequently form drowned valleys or fjord-like inlets. |
| **35** | Volcanic landforms (Fans and footslopes) | Volcano-alluvial plains | Actively forming very low angle volcanic plains which may take various forms. |

| | | | |
|---|---|---|---|
| **50** | Erosional landforms (mountains and hills) | Hilly terrain with weak or no structural control | Dissected hills of low relief (less than 100m) with weak or no structural control and with steep slopes, and sharp crests separated by narrow incised V-shaped valleys. Broadly, mountains and hills or hilly terrain on igneous rocks are of massive appearance, with a coarse dissection pattern and steep rather straight slopes. On metamorphic rocks slopes are more irregular, but ridges are still massive and straight in the overall slope profile. On sedimentary rocks these landforms have great variability due to differences in composition, degree of induration, bedding, homogeneity within the layers, and degree of tectonic deformation. |
| **51** | Erosional landforms (mountains and hills) | Mountains or hills with weak or no structural control | Mountains and hills of high to very high relief (greater than 100m) with weak or no structural control, steep escarpments and narrow sharp crested ridges separated by V-shaped valleys with steep river gradients.<br><br>Mountains and hills with weak or no structural control on soft fine -grained sedimentary rocks such as marl, mudstone and siltstone. They are characterized by a very dense dissection pattern and highly irregular slopes with great variability in slope steepness because of frequent slumping and intense gullying. Slopes can vary from 50º at slump headwalls to a few degrees at slump toes. Weathering is mostly shallow and immature. |
| **56** | Volcanic landforms (mountains and hills) | Volcanic cones and domes | Volcanic cones and domes encompass a wide variety of volcanic landforms which form high to very high mountains and include strato-volcanoes, lava shields, ash cones, scoria cones and caldera. |
| **60** | Water bodies | Lake | Open water bodies |



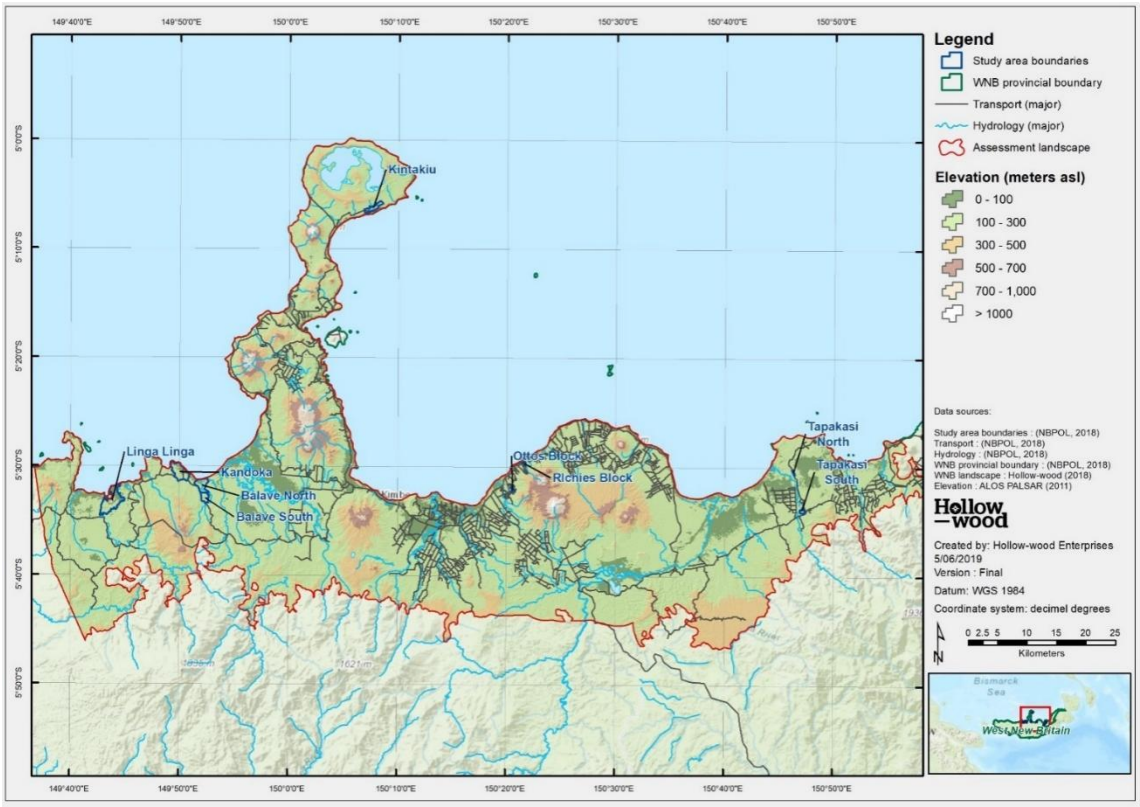

**Map 3. Landforms in the western AOI, derived from PNGRIS (2008).**



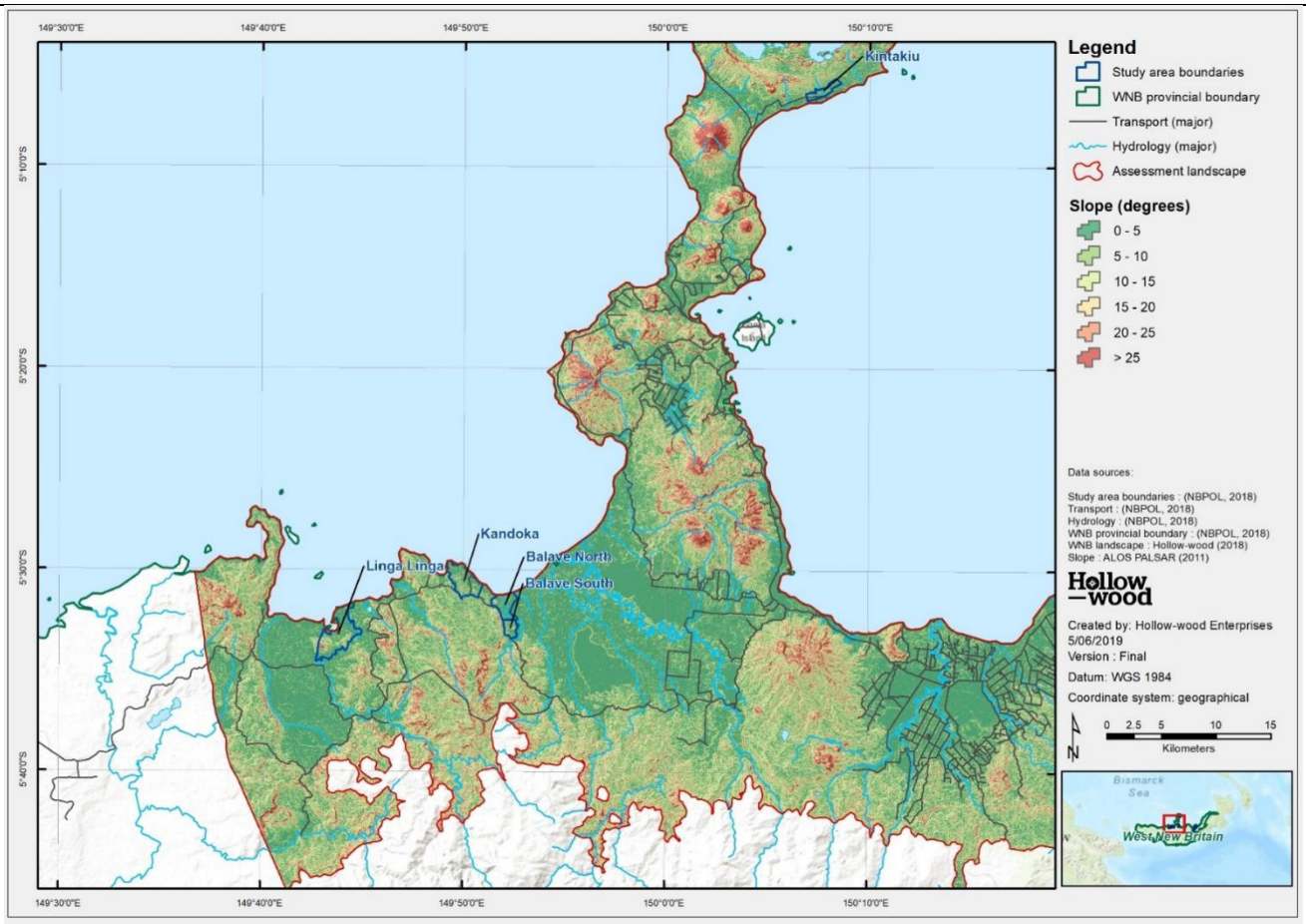

**Map 4. Landforms in the eastern AOI, derived from PNGRIS (2008).**

**Elevations and Slopes**

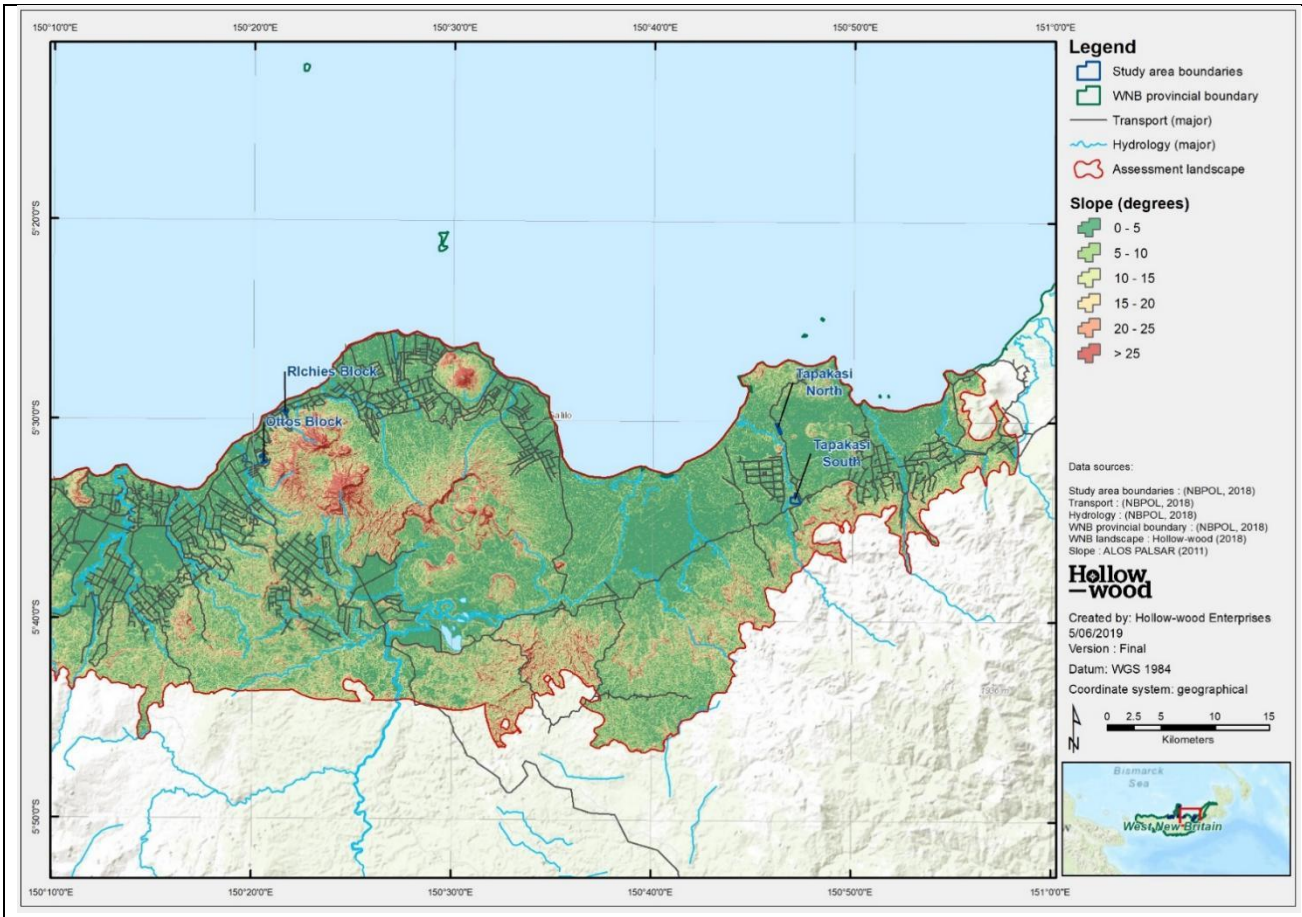
All the blocks are of low elevations (<300 m) and flat (except for Kandoka which is rolling).




Map 5. Elevations across the assessment landscape. Higher elevations are volcanic cones or domes.




**Map 6. Slope modelling, derived from ALOS PALSAR, relevant to the western study area landscape.**




**Map 7. Slope modelling, derived from ALOS PALSAR, relevant to the eastern study area landscape.**

***Hydrology***

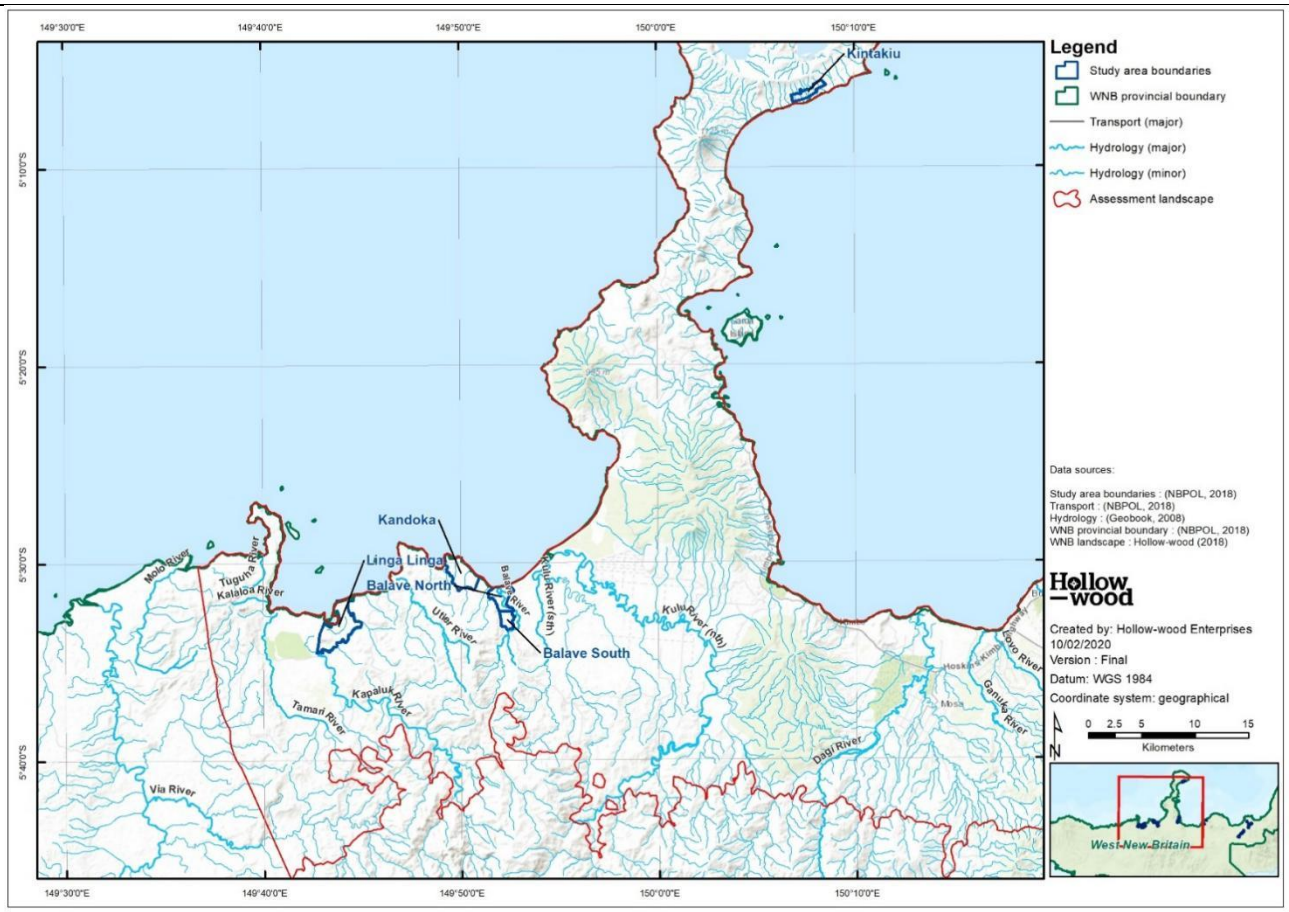
As the Walter-type climate diagrams indicate in figure 2, New Britain Island has very wet tropical climate, with the Rabaul station receiving a mean annual average rainfall of 2281 mm.

All rivers within the assessment AOI are generally northern flowing, with their headwaters outside the AOI in the Whiteman Ranges, and their terminus on the north coast of the Island into the Bismarck Sea. Many of the larger rivers within the AOI form estuarine environments along the coast, allowing extensive mangrove communities to form in more sheltered situations.

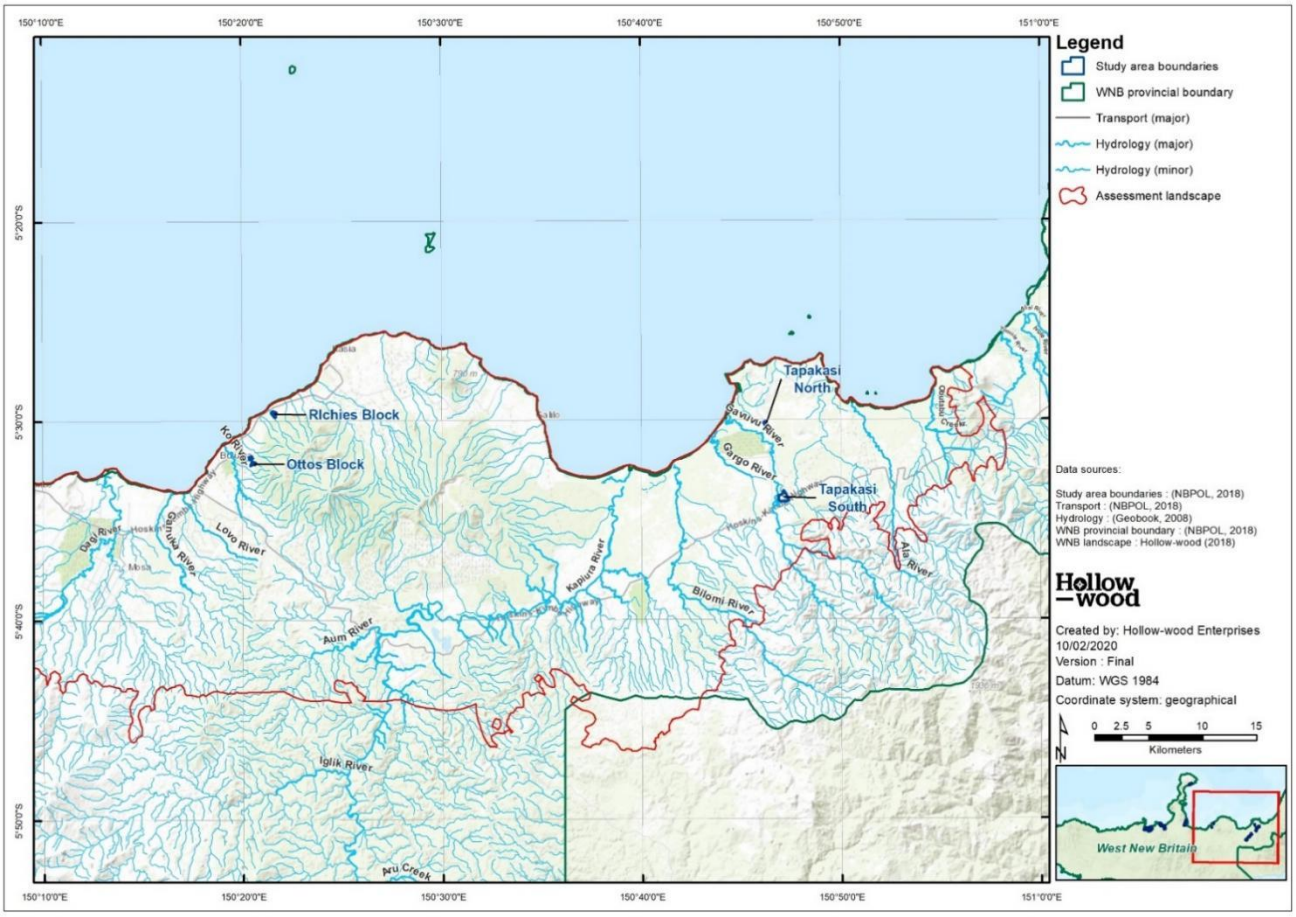
Such communities are common in the west of the AOI, where the study areas extend to the coast; Linga Linga, Kandoka and Balave North, with the Kapaluk and Balave Rivers (see Map 8) both being good examples of large, permanent rivers with mountainous headwater that terminate in estuarine situations and mangrove communities.

The Linga Linga and Balave North study areas are the only two with large, major rivers as boundaries, although the western boundary of the Tapakasi South study area is within 150m of the Gavuvu River. All other study areas possess a range of permanent, small creeks or ephemeral drainage lines.

Most rivers generally have relatively short courses, with the top of the Whiteman Ranges being approximately 30km from the northern coast, with most larger rivers possessing courses considerable shorter than this distance. The management actions associated with the protection of water courses and their riparian zones are detailed in section 10 and the major water courses are for the west and east of the AOI are supplied on Maps 10 and 11 respectively.




**Map 8. Major northern draining rivers in the west of the AOI**




**Map 9. Major northern draining rivers in the east of the AOI**.

***Formally protected and informal conservation areas***

There are relatively few areas formally set-aside for biodiversity conservation in WNB, or across PNG as a whole. As of 2009, 57 protected areas (PA) existed across the PNG mainland and satellite islands, covering 1.7 million ha (Leverington *et al.*, 2017). The appropriate management of formal PA's has proven problematic, with several being cleared or degraded since 2006. Many of the formally gazetted PA's are essentially reserves on paper only, i.e. very few possess management plans that have been implemented (Leverington *et al.*, 2017).

The HCV PNG National Interpretation guide is the authority on PAs in PNG, however does not contain spatial data to enable accurate location of PAs. As such, within the current assessment, three major sources were interrogated and cross-referenced against the PNG National Interpretation to determine the location of PAs adjacent to study areas and across NIP as a whole:

1. The HCVF National Interpretation Toolkit for PNG (PNG FSC, 2005)
2. The 'Protected Planet' database (https://www.protectedplanet.net)
3. Any areas that are considered to be 'intact forest landscapes' (IFL) or 'degraded intact forest landscapes' (Brown *et al.*, 2013)

The only formally protected areas in WNB are Garu, Pokili[1] and Tavalo WMA and the Loroko National Park (Map 10). These are a significant distance from all the study areas.

[1] Pokili and Garu WMA are important areas of lowland forest with two major *Megapodius eremita* nesting grounds as well as virtually all the island's lowland and foothill species (Keast, 2000).

**Intact Forest Landscapes**

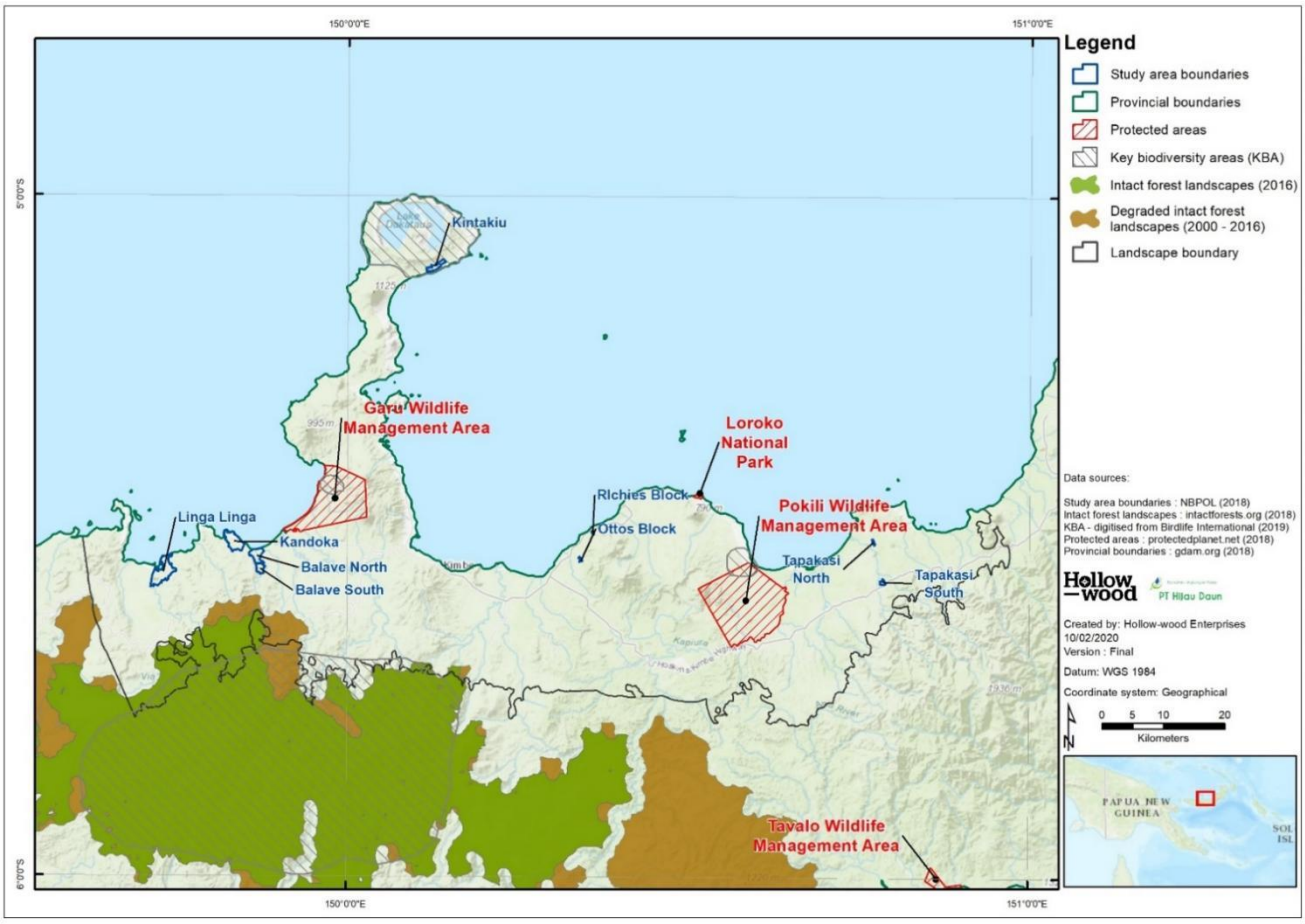
There are Intact Forest Landscapes to the south of the study areas (6 km from Balave South – which is the closest area to an IFL). These areas can be seen below on Map 10.

**Endemic Bird Areas (EBA) and Important Bird Areas (IBA)**

The are no IBAs on WNB. However, the whole of WNB island is classified as an EBA. This is based on the fact that it supports 14 endemic bird species and together with New Ireland, forms an Endemic Bird Area that supports 38 restricted range species (Davis, Dutson and Szabo, 2018). All these birds are moderately to highly dependent on forest (Buchanan and Pilgrim, 2008).

**Key Biodiversity Areas (KBA)**

There are four KBAs in this landscape. Sites qualify as global KBAs if they meet one or more of 11 criteria, clustered into five categories: threatened biodiversity; geographically restricted biodiversity; ecological integrity; biological processes; and, irreplaceability (*World Database of Key Biodiversity Areas*, no date).




**Map 10. Shows the formally Protected Areas (red hatching), KBAs (grey hatching) and IFLs in the AOI. The closest IFL is 3.2 km from Balave South. Endemic Bird Areas are mapped over the whole of WNB**

## Social, cultural and economic characteristics

### *Ownership*

### *Customary Land*

Customary land within PNG is owned by Clans, not individuals. In general the clans live in a village. Although there may be several clans in a village. The "Study Areas" are an arbitrary boundary drawn up between NBPOL and the clan which describes the area the clan(s) wants to be considered for oil palm development.

***Freehold Land***

This is something of an anomaly in PNG. Lingalinga has a freehold title, and is owned by an individual, which is very uncommon.

***State Lease***

This is land owned by the state and leased to individuals or groups. The term is generally a 99 year lease. Most of NBPOL's existing blocks are state lease land. However, as part of a transmigration scheme the PNG government created Land Settlement Scheme (LSS) blocks. Each of these 6-6.5 ha. The LSS blocks are state lease land.

**Table 4. Study areas covered by this integrated HCV-HCSA assessment**

| Study area name | Land Tenure | Development Plan[2] | Area (ha) | Affected Communities (Village) | Clan |
|---|---|---|---|---|---|
| **Kintakiu** | Customary | ME | 211.55 | Kintakiu | Lobe and Poligokoru |
| **Balave** | Customary | ME | 505.3 | Kandoka | Loko |
| **Kandoka** | Customary | CP | 618.1 | Kandoka | Kandoka3 (Usufruct rights) Loko (ownership rights) |
| **Lingalinga** | Freehold | ME | 957.96 | Freehold (No affected communities) | N/A |
| **Richard's Block** | State Lease | SH | 12.1 | Richard and the neighbours | N/A |
| **Otto's Block** | Customary | SH | 15.32 | Otto and the neighbours | Hie |
| **Tapakasi North** | Customary | CP | 19.8 | Tarobi | Kambulbulu |
| | | | | Sisimi | Ilalau |
| **Tapakasi South** | Customary | CP | 55.1 | Kae | Baumumu |
| **Total** | | | **528.76** | | |

Note that Richard's and Otto's Blocks were added during the full assessment. This was due to a lack of clarity about how to treat smallholders' blocks and get these small areas added to the supply chain in an economic way.

***Demographic and socio-economic context***

The assessment area lies within the Kove / Kaliai Rural, Talasea Rural and Mosa Rural LLGs

**Table 5. Populations and growth rates in the wider landscape based on previous censuses.**

| LLG Name | Population 2000 | Population 2011 | Growth rate (%/year) | Area (km2) |
|---|---|---|---|---|
| **Kove / Kaliai** | 14,791 | 18,912 | 2.26% | 3,599 |
| **Talasea** | 20,522 | 29,610 | 3.39% | 2,184 |
| **Mosa** | 24,837 | 33,101 | 2.65% | 1,748 |

(Papua New Guinea National Statistical Office, 2011)

Annual population growth reaching 3% is considered high by world standards. The population of Kimbe Bay could double by 2035. This would put huge strains on both the environment and government services.

With the development of the oil palm industry in the area it is seen as an area of economic opportunity. Many of the people that were interviewed had come from Morobe or the Highlands seeking employment. The high population increase is due to both in-migration and a high rate of natural increase. At the 2000 census, 31% of the WNB population were migrants. (Koczberski *et al.*, 2006)

***Migrants***

Economic opportunity has brought a constant stream of migrants to the area. Typically, they take up residence on the fringes of urban centres, on plantation compounds, in rural 'squatter' camps, or on the land settlement

schemes. Talasea District Census, which covers Kimbe Bay, has a migrant population of 38% of the total population. The growing numbers of migrants located around Kimbe and Bialla have created a feeling among some customary landowners that they are being "swamped" by "outsiders". They blame the deteriorating law and order situation on the settlers and the transient youth population attracted by work opportunities. Intolerance of migrants is occasionally expressed as disputes over land and marine resources, as well as more violent conflicts (Koczberski *et al.*, 2006)

***Education***

The education levels in PNG make somewhat depressing reading. Ryan et al (2017) makes the following finding based on data sourced in the Kimbe area:

"The current state of education in PNG is characterised by low levels of educational attainment and literacy, poor school attendance and retention rates, and high levels of gender inequality. The average years of schooling received by people aged 25 years and older is just 3.9 years…..PNG also has national literacy rates that are far below the regional averages with just 62.4% of adults being literate compared with 94.4% for the region, and 70.8% of youths compared with the regional average of 98.8%."

A study undertaken on Land Settlement Scheme (LSS) blocks in Kimbe area found that "adult education levels on the LSS blocks are higher than the national average but still low considering that most smallholders do not finish primary school and the retention rate from primary to secondary school is low." These LSS where people are comparatively wealthier in PNG. However, this doesn't appear to have flowed through into an investment in education.

***Food and Land Tenure***

Land in the area is owned by clans not individuals. Typically, boundaries are based on physical features such a rivers or ridges, in other places marked out by particular species of plants (a variety of cordyline is a common marker).

The dominant tenure system governing both terrestrial and marine resources is matrilineal, with men inheriting rights from their maternal uncles. Land tenure is more spatially differentiated than marine tenure, partly because the planting of economic crops gives tenure rights to the cultivator. Marine tenure rights are also overlapping, so that people from major clans residing outside the village sometimes have access to the village's marine resources.

Efforts to translate this traditional understanding of land tenure in a western style titling system, with surveyed boundaries, has resulted in many disputes. Resolution of these disputes is required before the land can be leased to a third party (e.g. NBPOL). These disputes typically take years to resolve.

Within PNG 83% of the population lives in rural areas and their main economic and social activity is subsistence agriculture. 83% of food energy and 76% of protein consumed in PNG continues to come from locally grown foods, derived largely from village gardens. This description, although based on PNG-wide data, probably reflects that of the assessment landscape.

Many people have moved from areas within PNG from areas of disadvantage to places like the WNB with employment and better services. In the process of moving they lose their customary rights to land for food

[2] CP – Community Planting, where NBPOL agrees to buy the FFB off the community. The price is based on an agreed formula. ME – Mini Estate,where NBPOL pays a lease and a royalty on the FFB. The management of the estate is NBPOL's responsibility. SH - Smallholders where NBPOL agrees to buy the FFB off the community. The price is based on an agreed formula.

[3] The intention is that Kandoka land would be developed by the Kandoka clan, even though Loka have ownership rights over this area.

gardening and who therefore depend on purchased food. Many people were involved in land settlement schemes where they have been given 6 ha blocks. Surveys have showed that between 1975 – 2010 the :

- Average number of people being supported by these blocks had doubled.
- Area of oil palm per block had increased from 3.24 ha to 6.00 ha.

These statistics mean there is an increased reliance on both bought food and to downturns in the oil palm price. This has flowed through to an increased overall pressure on land in the area, with areas such as buffer zones always at risk of encroachment and unsuitable areas likely to be cleared for gardening. Similarly, "informal" sales of customary land, which leaves the land at risk of being reclaimed by the customary owners. (Koczberski, Curry and Bue, 2012)

***Economic***

The financial situation in most rural PNG communities is mainly the result of poor financial literacy and management where development (eg OP) is concerned. Those communities that were visited have money and could be able to generate an income. Due to poor provision of services there is an unwillingness to save and as a result generate an income and better their standard of living.

Life is very egalitarian in PNG villages. There is a huge importance placed on the concept of "sharing", which acts as a financial "leveller." Meaning that there is not a large variation in wealth. Furthermore, the concept of wealth in rural communities is not valued only on monetary value but is also determined based on cultural and customary beliefs and values. Eg- A man who owns more land is considered wealthy. Or in some areas if a man has many wives he is seen as being wealthy.

The main avenues for generating cash income in coastal villages in Kimbe Bay include:

- Cultivation of oil palm, coconuts and cocoa on smallholdings.
- Local marketing of garden, tree and marine produce (mostly by women).
- Small business enterprises (e.g., village trade stores and poultry projects).
- Fishing and the sale of marine products.
- Wage employment.

Most villagers cultivate a range of cash crops and each individual have two or more. The concept that people were solely farmers or fishermen is not correct, everyone embarks in a range of activities, both men and women. For example, men would tend to go fishing outside the reefs, whilst women collected shellfish. The same people would have gardens to tend. Food is sold in markets in town or in oil palm workers camps. It appeared that the people that caught the fish or tended the crops also sold it. There didn't appear to be middlemen that came round the villages and collected the food for sale and then passed it on to shops in town to sell to consumers.

Communities in the area rely on both land and marine resources to feed themselves and provide an income. It is the balance of terrestrial and marine-based livelihood strategies that varies between villages. It has been noted in the area that, while land-based subsistence activities do not vary greatly amongst villages. It is rather the utilisation of marine resources and the types of cash income activities pursued reflect, to an extent, the degree of accessibility of each village as well as the particular assemblage of marine resources available to each village. Villages that are relatively remote from towns and markets tend to be more dependent on marine resources for food and cash than those that are easily able to reach the markets. Fish can be smoked and kept and then transported to markets.

A significant socio-economic trend, is the growing reliance on the cash economy to meet customary obligations, everyday household needs, school fees and growing consumer aspirations. Young people in particular aspire to a better life materially than their parents, and there is a desire for more consumer goods and modern lifestyles. Access to cash is now essential for fulfilling customary obligations such as brideprices, mortuary payments and other community obligations.

Oil palm is by far the most important cash crop in the area with 8300 smallholders with a total of 27,000 planted ha of oil palm (data supplied by NBPOL).

There is an increased change in attitudes towards natural resources insofar as they are now more seen as things that can be exchanged for cash income e.g. timber royalties and customary land sold to migrants.

Koczberski et al. (2012) has noted an inverse relationship between dependence on export cash crops and the exploitation of marine resources. There is also evidence that when cash crop prices fall below a certain level, such as in 2000 when oil palm prices dropped to K50/tonne, fishing assumes more importance in income strategies than when prices are higher. This is an important point as it reinforces the importance of external income streams as a means of preserving the marine environment.

***Social environment impact assessment***

Loxley & Puzyreva, 2014 have undertaken a Social Impact Assessment (SIA) on a number of the estates in the area. Although none of the estates in the SIA are included in the scope of this study there are many universal themes and recommendations that are relevant to this study, which have been taken into account. Particularly recommendations surrounding improving the well-being and stability of the communities.

An important part of this is the NBPOL Social Management Plan and Social Impacts Register. These documents rely on interviews to identify particular projects to improve the well-being of the workers. From there, projects are implemented. Another valuable source of economic data are Bilum Index surveys, which use interviews to ask the field workers about the cost of living and what they spend their money on. In this respect NBPOL is able to ensure workers are paid a sufficient amount to cover the cost of living.

Associated with this study, a SEIA was undertaken. A major part of this is establishing a "baseline" just prior to development.

***Free Prior and Informed Consent.***

Most of the FPIC procedures are contained in an NBPOL document, "MG 21 Land Acquisition Practices." This describes the process that NBPOL goes through to develop mini-estates. These mini-estates rely on "leasing" land not actually acquiring it. Primarily it involves assisting clans to form an ILG ( Incorporated Land Group), which gives the clan a legal entity to be able to lease land to NBPOL. The process of formation of an ILG mirrors the FPIC process, ensuring that all the members of the ILG ( Incorporated Land Group) are informed and agree to the scheme. An ILG ( Incorporated Land Group) can only lease land, it cannot sell the land. Therefore, the community maintains their land rights and cannot result in landlessness.

## Land use and development trends

***Land use planning***

PNG does not have a formal land use planning system which gazettes particular areas for example, for forestry, urban development or agriculture. Any applications for land use change are handled through CEPA (Conservation and Environment Protection Authority).(Pers Comm staff of WNBPA Division of Lands). As such there are no future land use plans for the area.

***Land use history***

**Agricultural Land**

Bourke, R.L. et al, 2002 has identified 12 land use intensity classes in the study area and divided them into seven cultivated and five uncultivated land categories. Mapping undertaken at the time showed 27% of WNB was cultivated and 30% was used[4]. Although this research is very dated now, the classification system is still relevant

[4] Used = Cultivated + uncultivated

and describes land use in the area very well. There are several current observations that come out of this classification system:

1. With existing population pressure and the arrival of the oil palm industry clearly there has been a shift towards intensification of agriculture (oil palm would be LU1 – the most intensive category).
2. In 1993 the "used" land was 30% of WNB. Of the other 70% most of it is far too steep or too isolated for any development.
3. More intensive land use becomes dominant closer to Kimbe.
4. In the area surrounding the project areas, which are reasonably remote areas, land uses with long fallow periods are dominant.

**Background to the Land Settlement Scheme**

An important part of the land use history of the area is the Land Settlement Scheme. In the 1960s PNG adopted land settlement programmes to promote agricultural and economic development. The administration envisaged that by taking people out of the context of village life and settling them on individualised land holdings on various settlement schemes, the perceived problems of traditional communal land tenure in constraining agricultural development would be overcome. It was thought that Papua New Guineans would quickly recognise the benefits of an individualised land tenure system, a recognition that would hasten the replacement of customary land tenure based on group ownership with individual land titles. Furthermore, it was envisaged that as settlers became increasingly integrated into cash crop production, they would gradually reduce their dependence on subsistence production to become more market-oriented and market-driven producers and consumers. However, after forty years this sort of progress has not eventuated. Many people spend more time in food production than tending their oil palm. (Koczberski, Curry and Bue, 2012)

**Forestry**

Buchanan and Pilgrim, (2008) state that the forests of New Britain are under serious threat from deforestation, with its lowland forest most susceptible to clearance for timber and conversion to small-scale agriculture and larger-scale commercial coconut and oil palm plantations. Government forest allocation plans and logging concession boundaries show that all lowland forest in West New Britain, is allocated to industrial logging. West New Britain province alone continues to account for at least 50% of Papua New Guinea's timber exports. As a graphic example of this the reader should refer to map 55 where vast areas of former IFL have been cleared south of Balave in recent years.

**Section 2: Maps**

*Guidance Note: Please include the following maps here with minimum 300 dpi resolution*

- *Boundary Maps owned by the company*
- *Proposed NPP area Maps*
- *Proposed NPP area Maps overlay with HCV and HCS areas*

**Boundary Maps owned by the company and Proposed NPP area Maps**

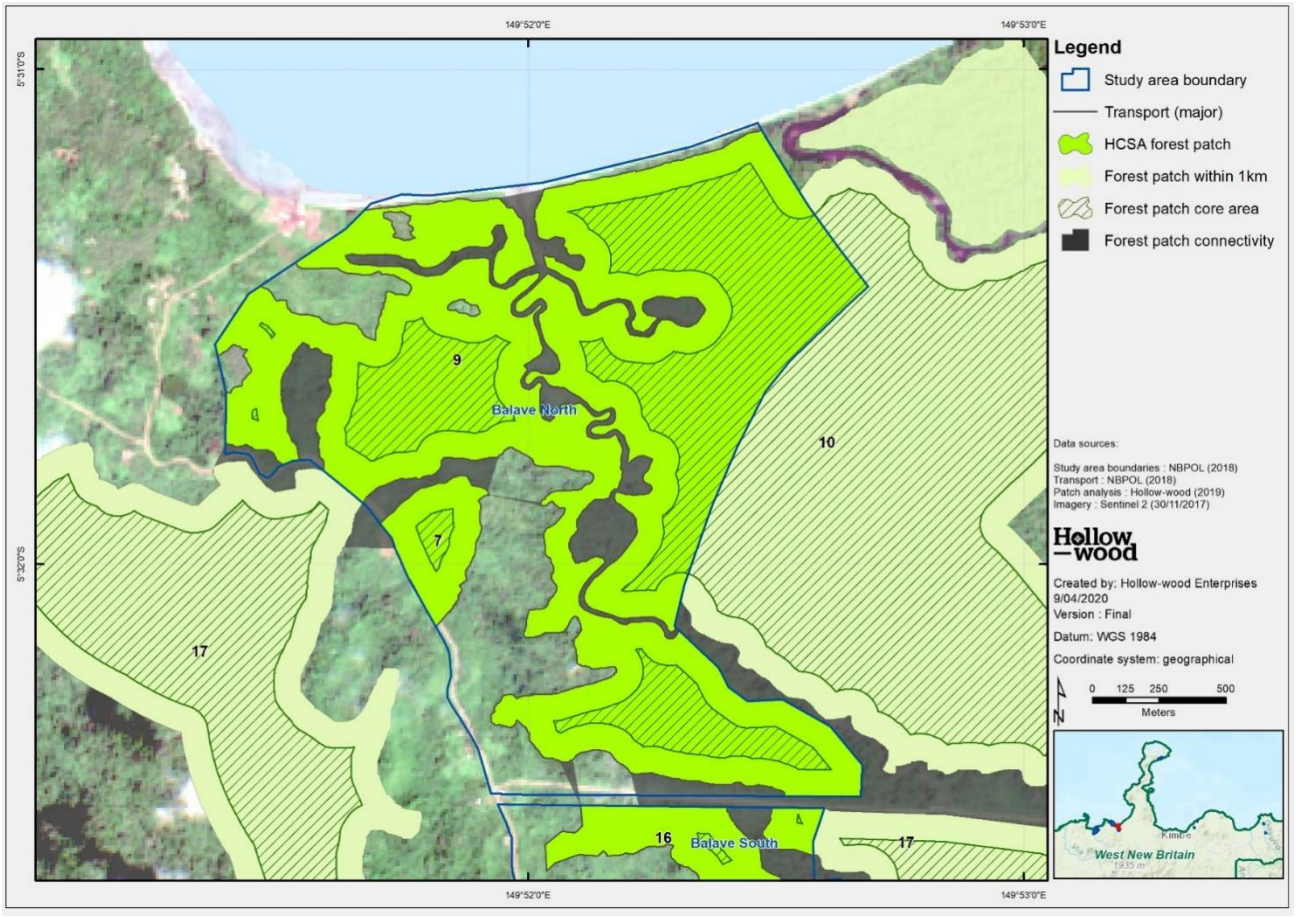
The NPP consists of 9 blocks located in West New Britain. NBPOL has a significant business in the region, but these are 9 separate blocks not connected with NBPOL's current estates. The boundaries of the blocks are marked on Map 11 - Map 19 (blue boundary lines). These constitute the:

- Customary land blocks – the complete extent of the Incorporated Land Group ( ILG) (note this is not necessarily the complete extent of the landowners' land).
- Lingalinga (the complete extent of the freehold title).
- Otto's Block (the complete extent of the CLUA).
- Richard's Block (the complete extent of the state lease).

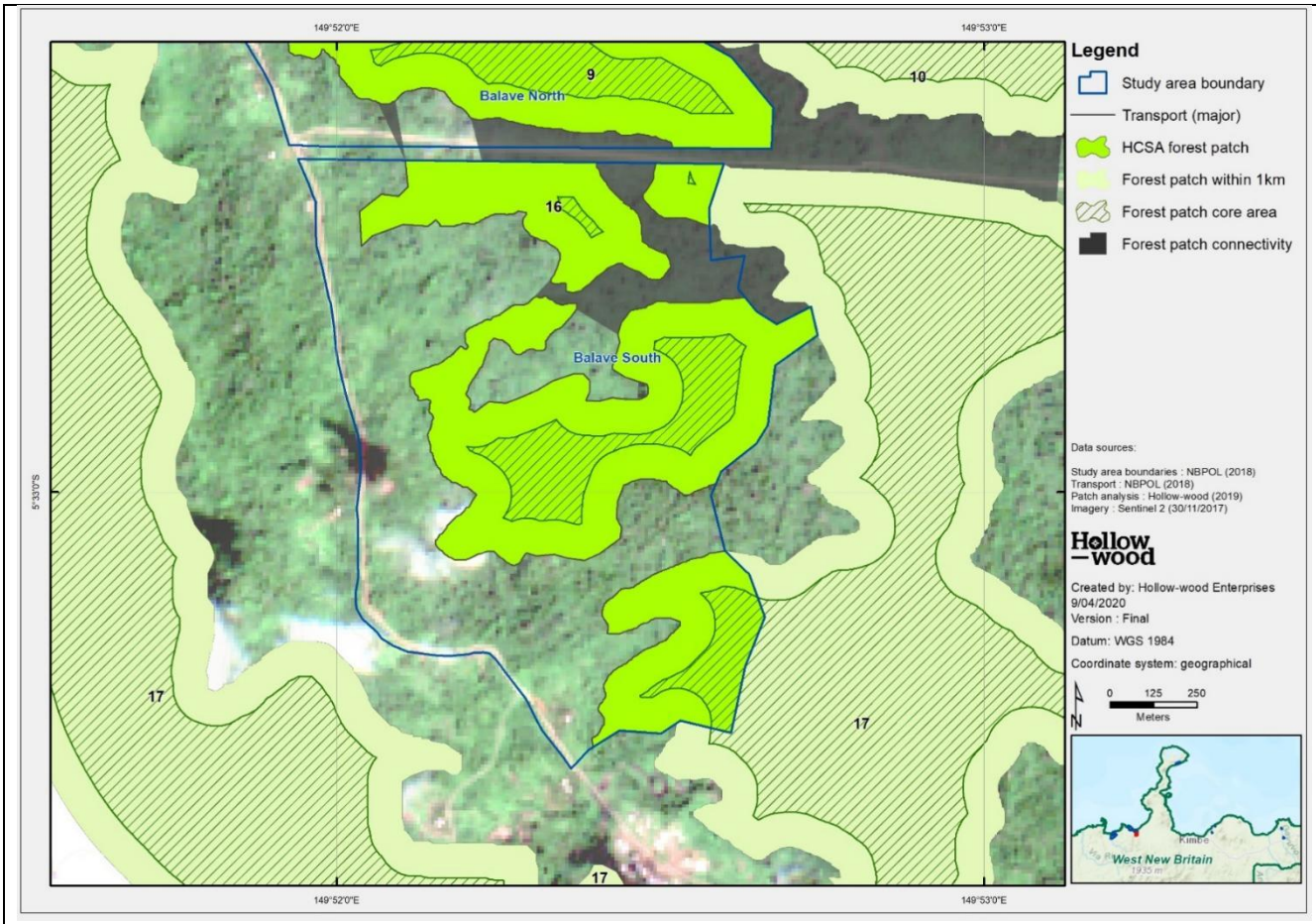
As such, the blue boundary constitutes the boundary that NBPOL will lease as well as the legal extent of the land. This blue boundary is also the proposed NPP area.

**Proposed NPP area Maps overlay with HCV and HCS areas**

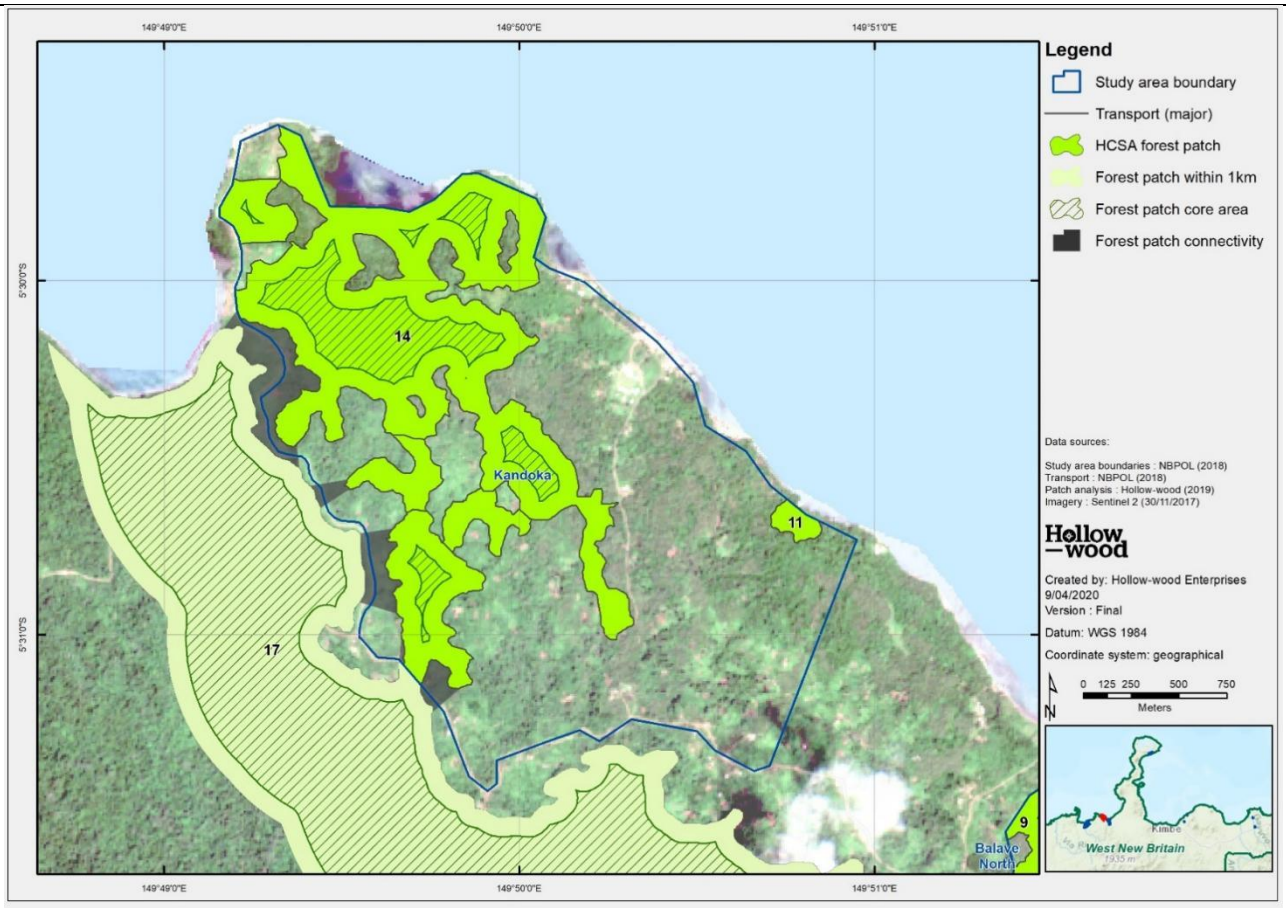
Map 11 - Map 19 show the extent of the HCS areas and Map 20 - Map 28 are the HCV areas.



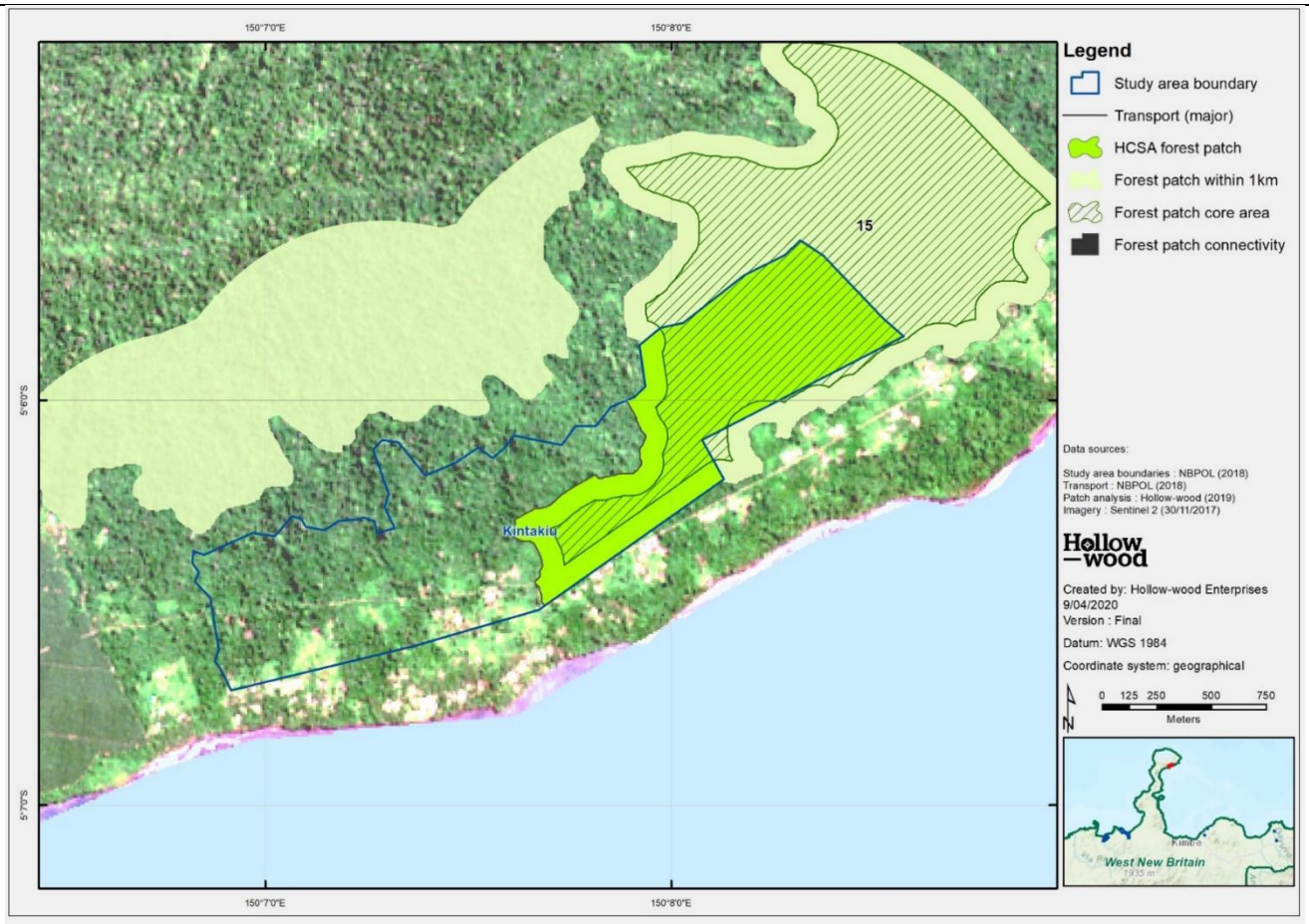

**Map 11. Patch analysis decision tree results for the Balave North study area.**



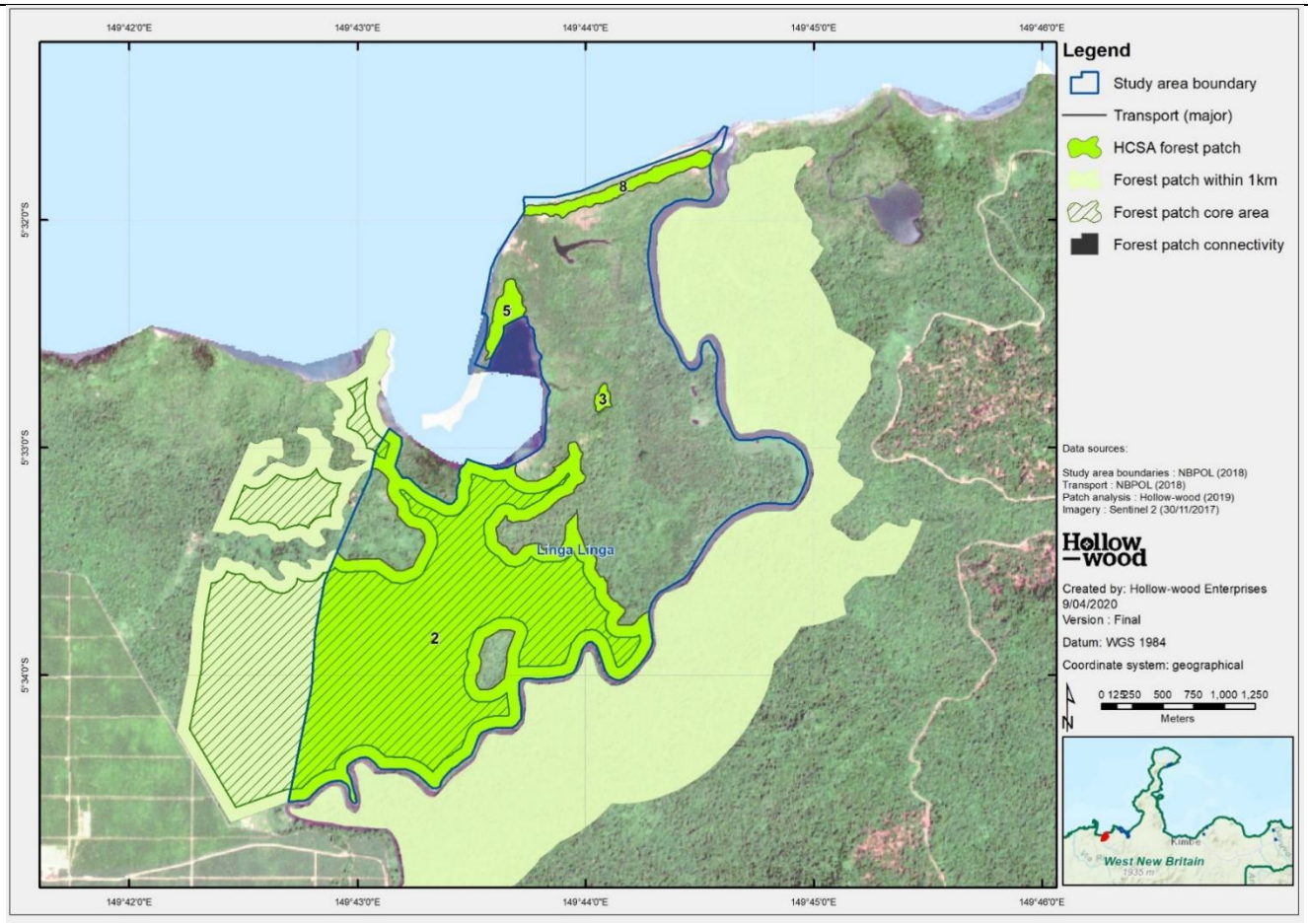

**Map 12. Patch analysis decision tree results for the Balave South study area.**



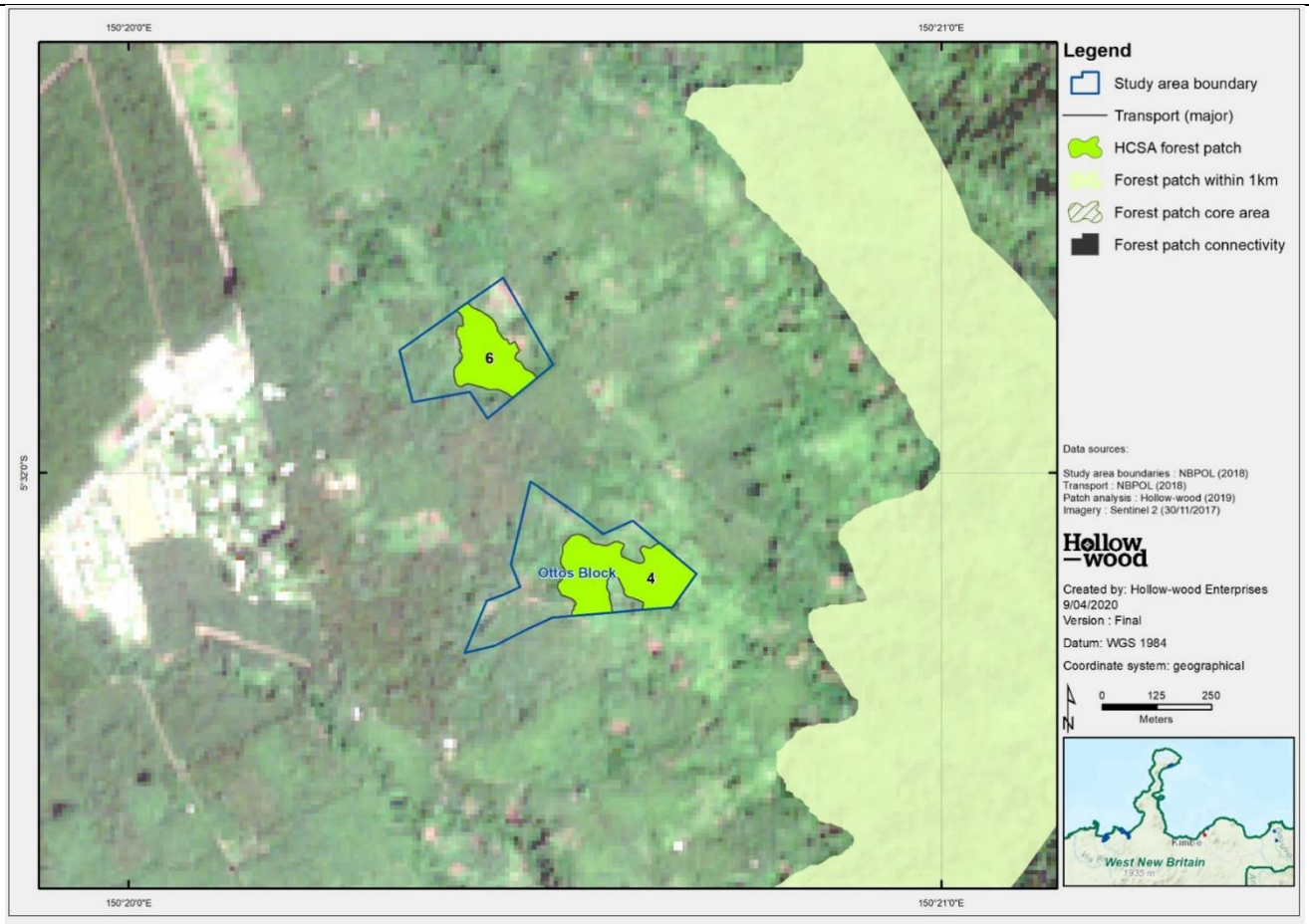

**Map 13. Patch analysis decision tree results for the Kandoka study area. NOTE THAT THE PATCH 14 (IN THE EAST OF THE CONCESSION) IS ONE CONTIGUOUS PATCH.**



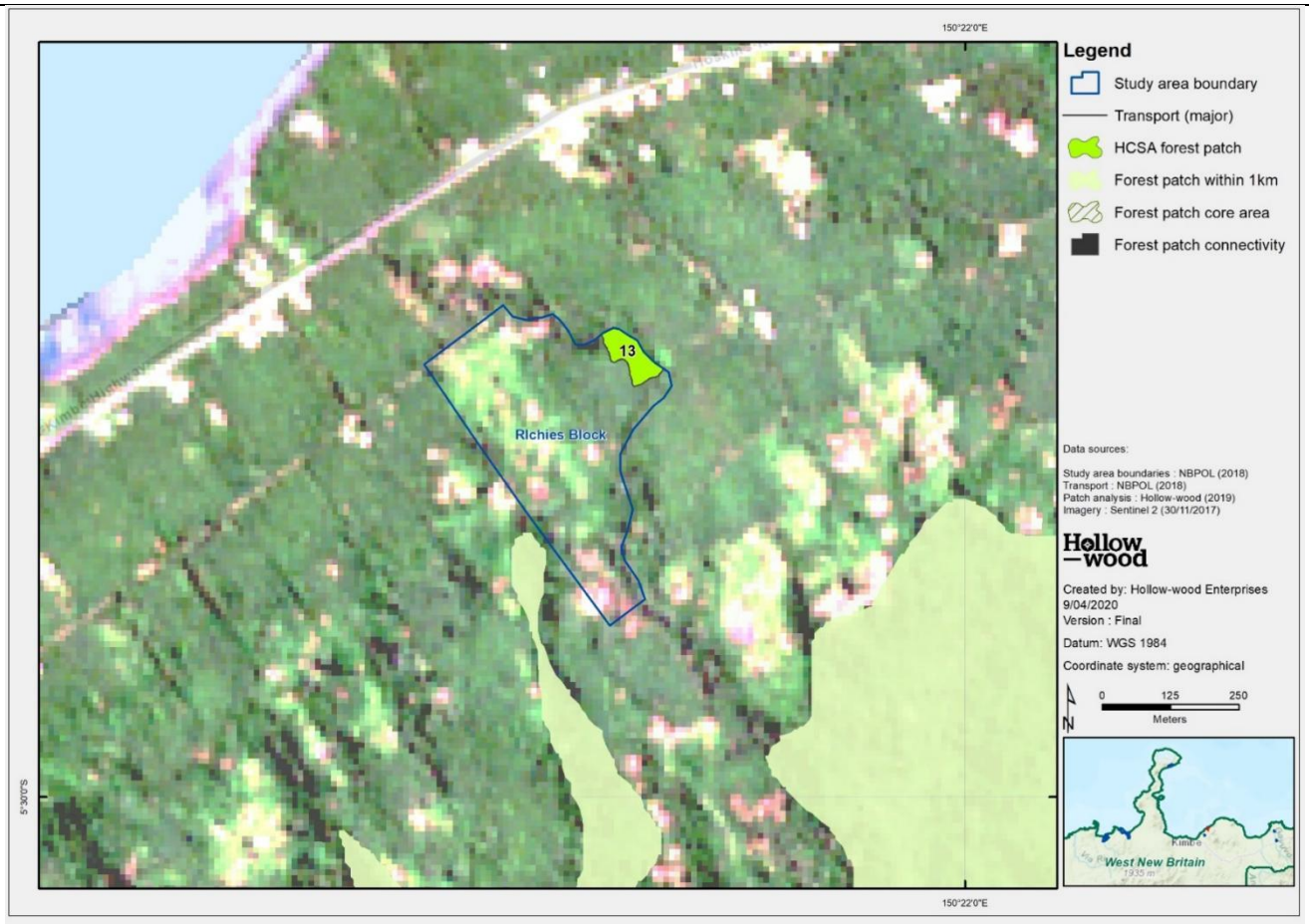

**Map 14. Patch analysis decision tree results for the Kintakiu study area.**



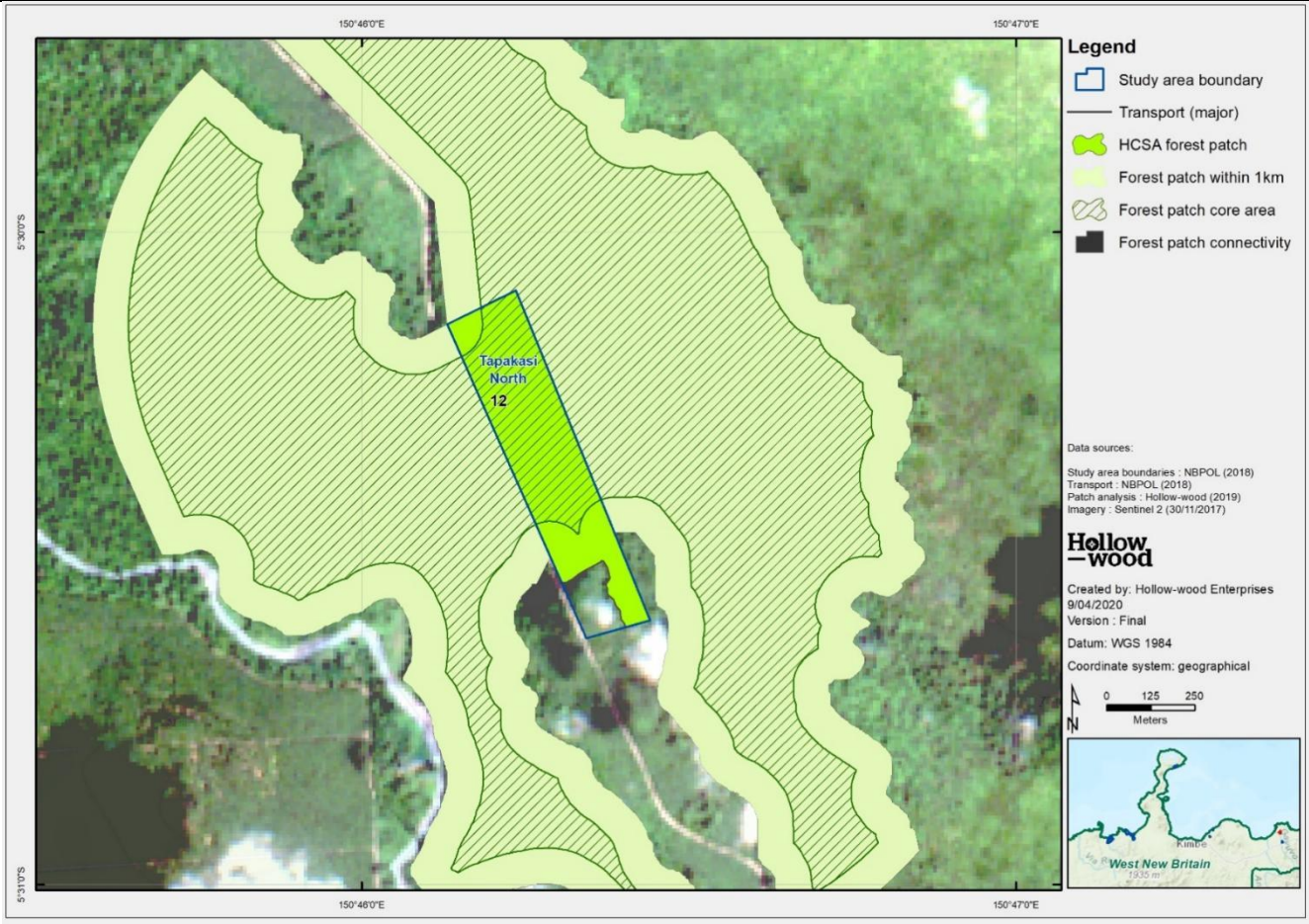

**Map 15. Patch analysis decision tree results for the Linga Linga study area.**



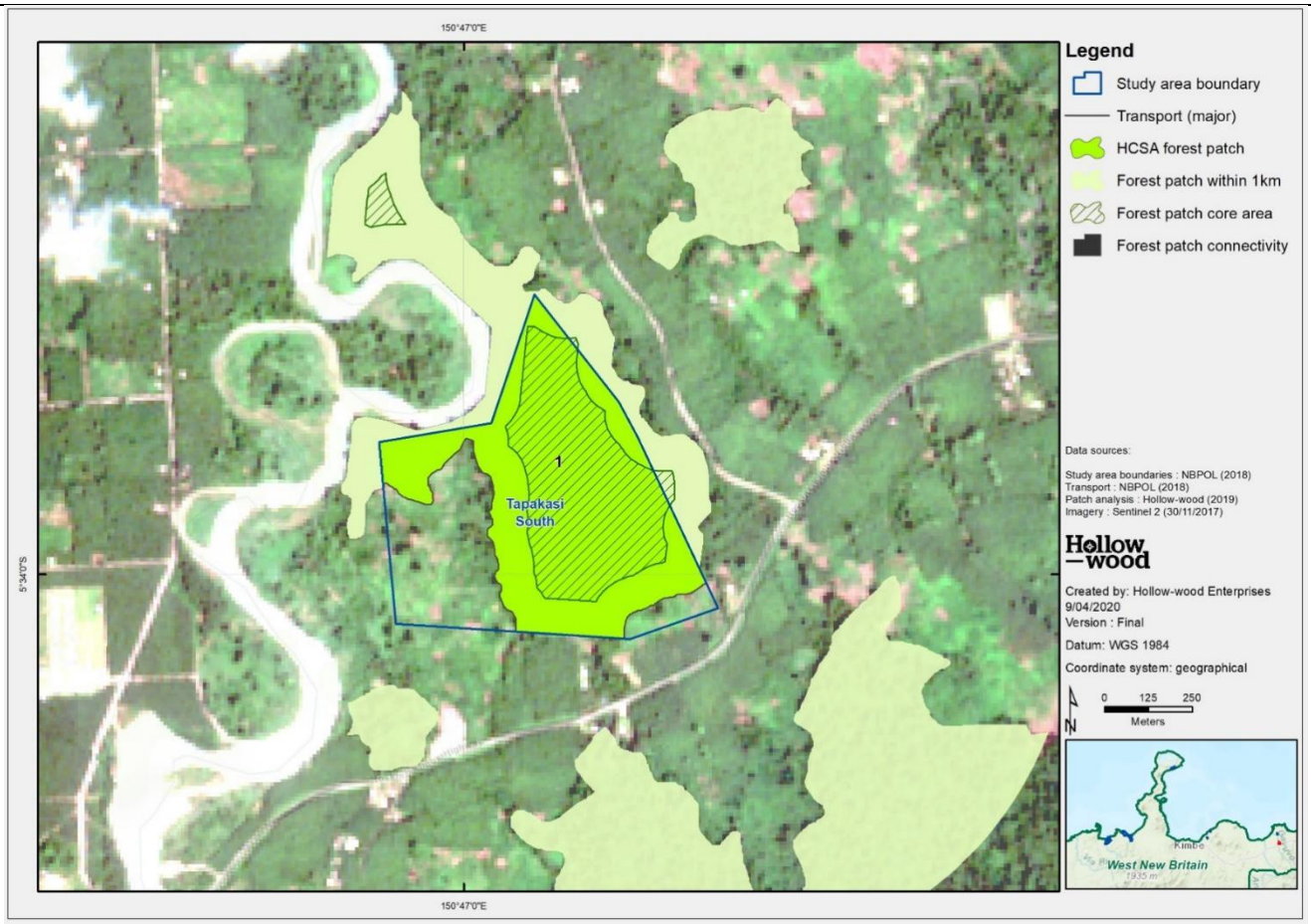

**Map 16. Patch analysis decision tree results for the Otto's Block study area.**



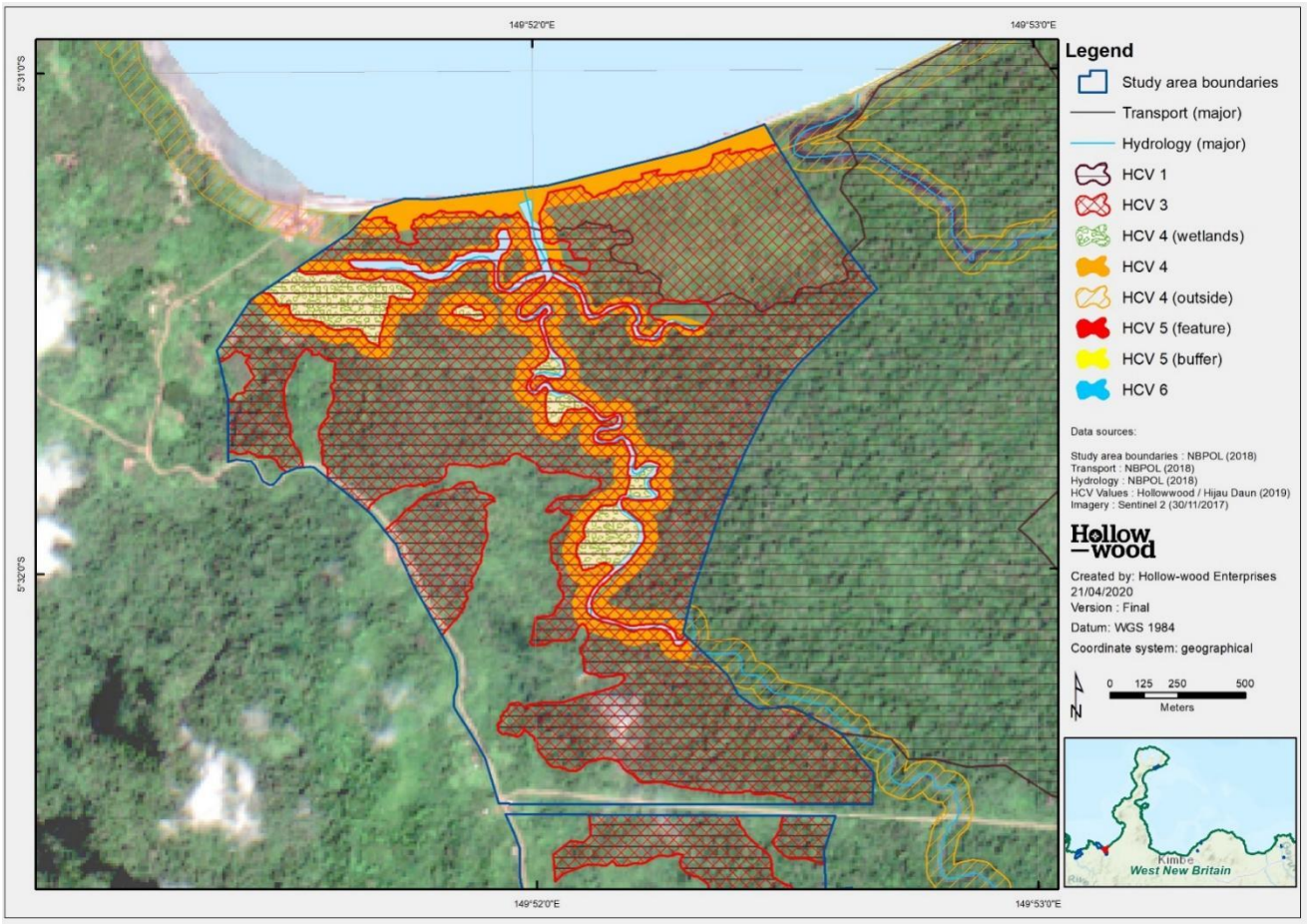

**Map 17. Patch analysis decision tree results for the Ritchie's Block study area.**



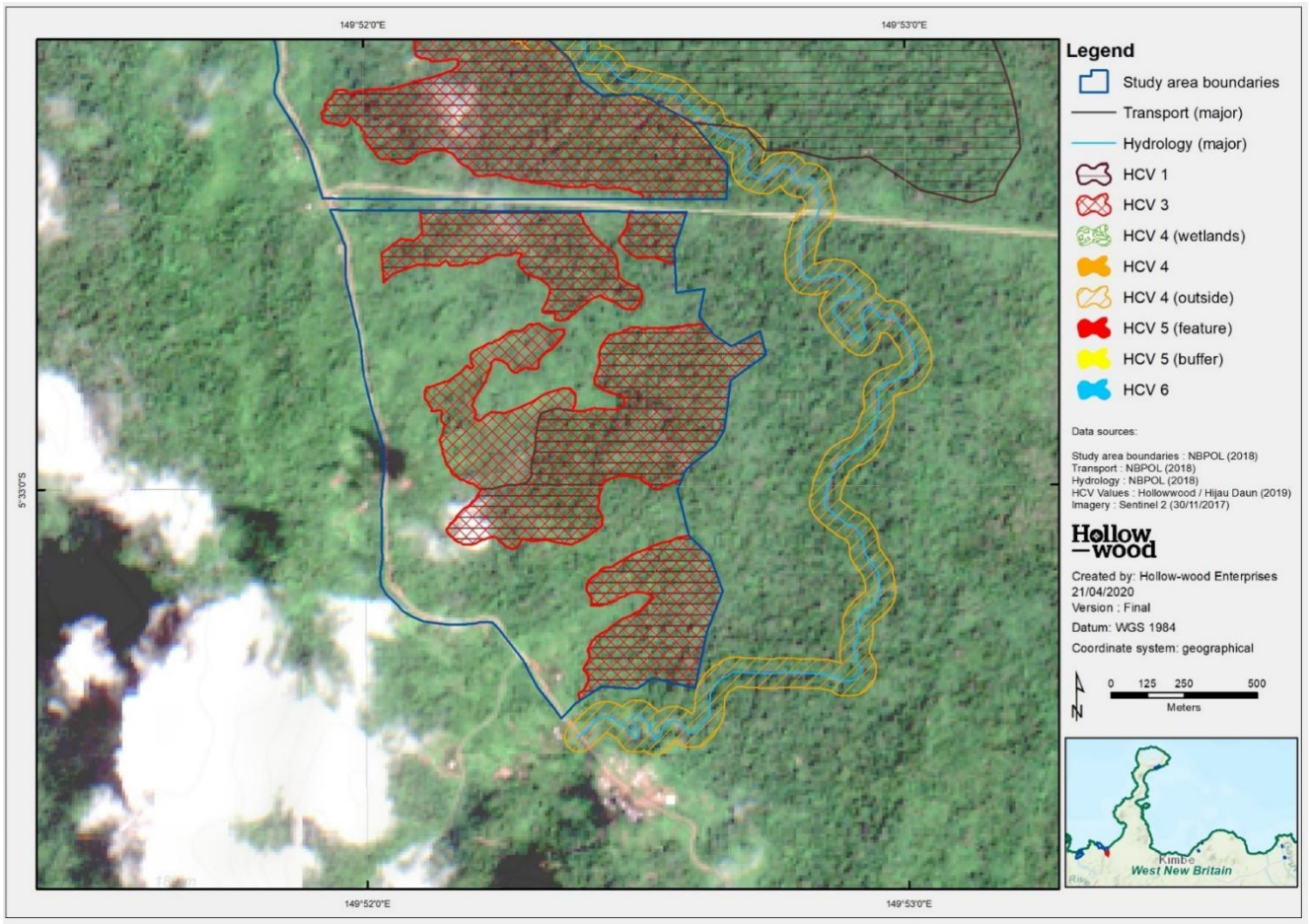

**Map 18. Patch analysis decision tree results for the Tapakasi North study area.**



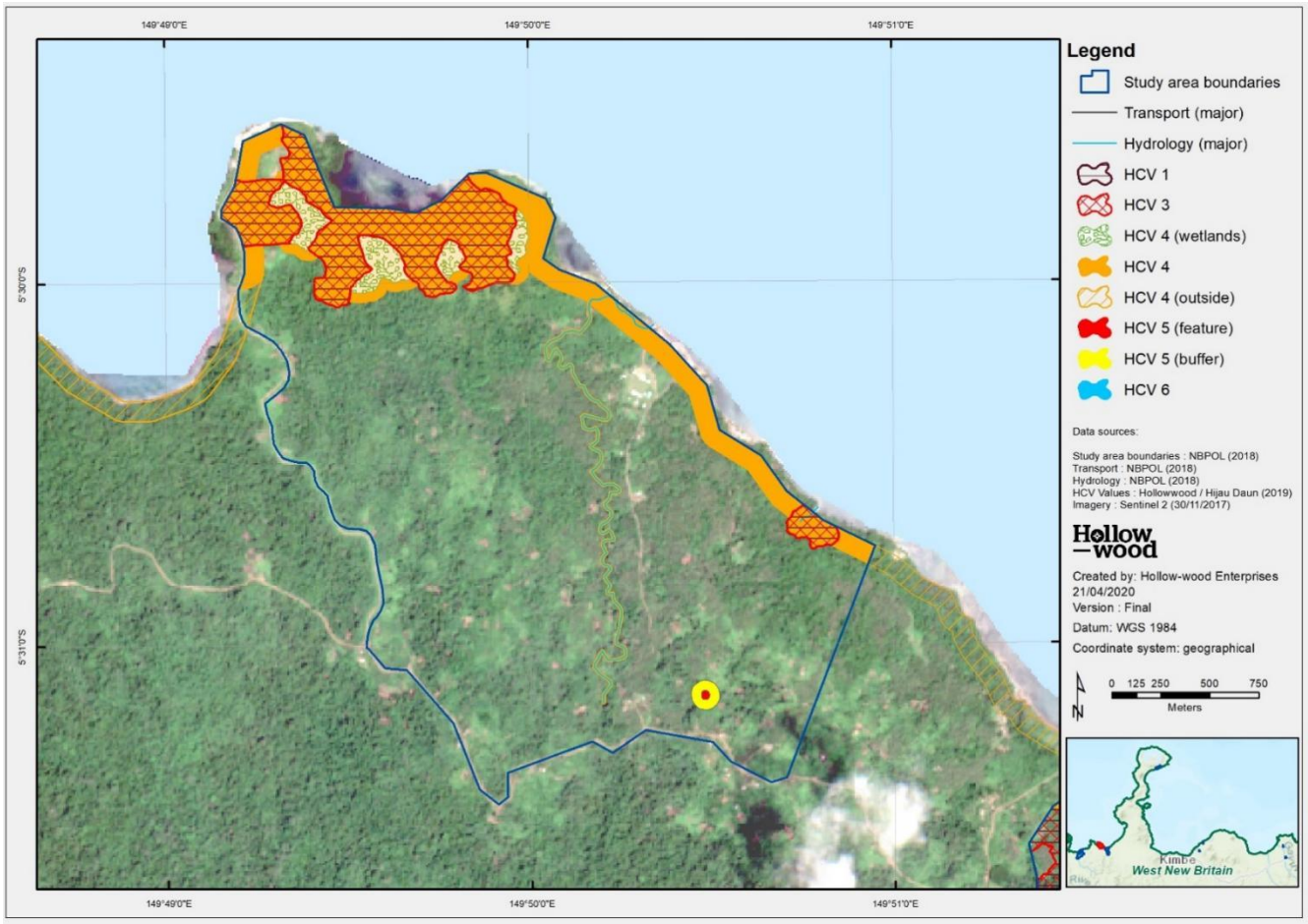

**Map 19. Patch analysis decision tree results for the Tapakasi South study area.**



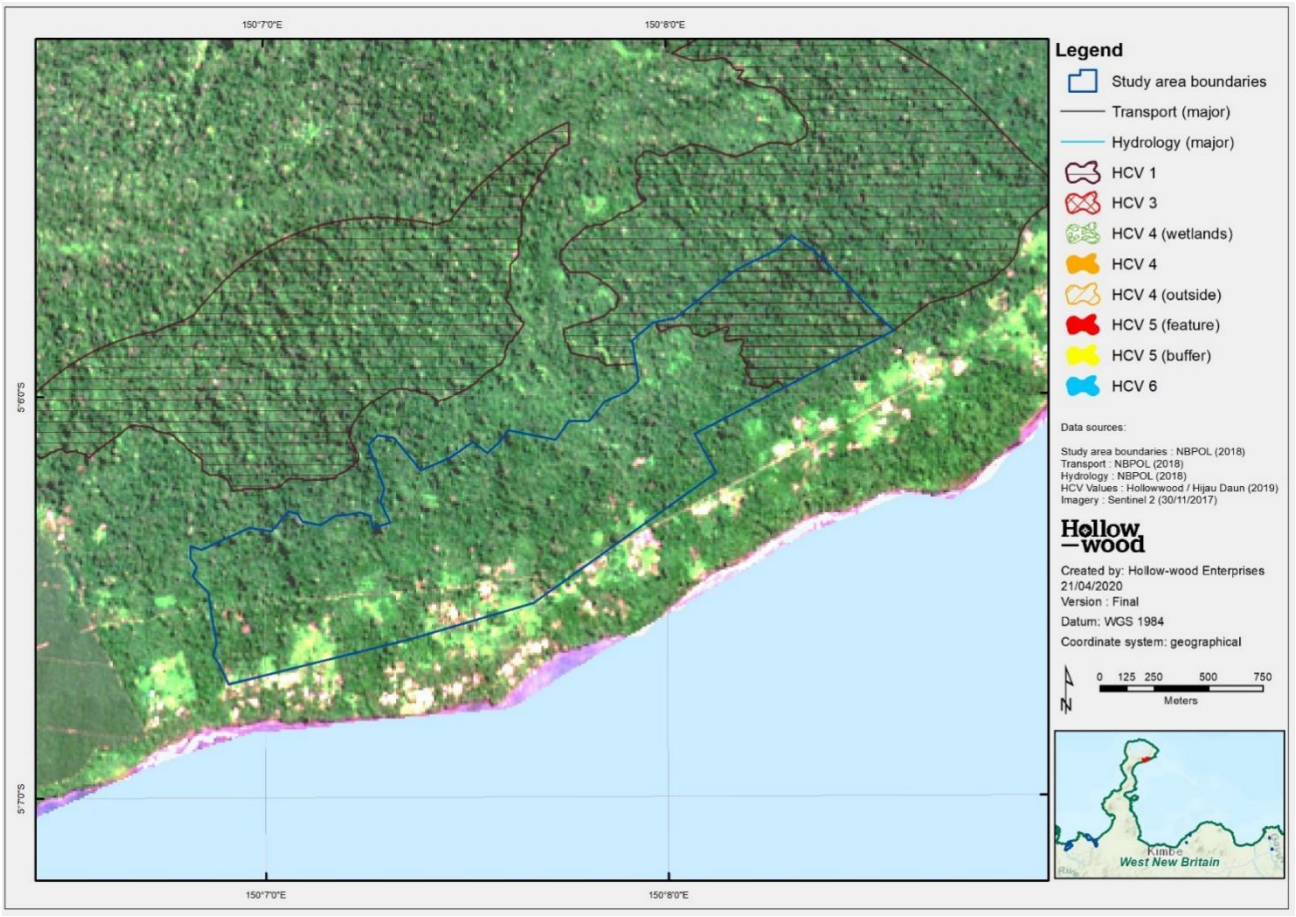

**Map 20. Balave North, which shows only a small developable area (56.18 ha). This area is swamp forest, with the areas east of the river being in good condition. The areas mapped as developable are areas that are in poor condition following the 2015 fires.**



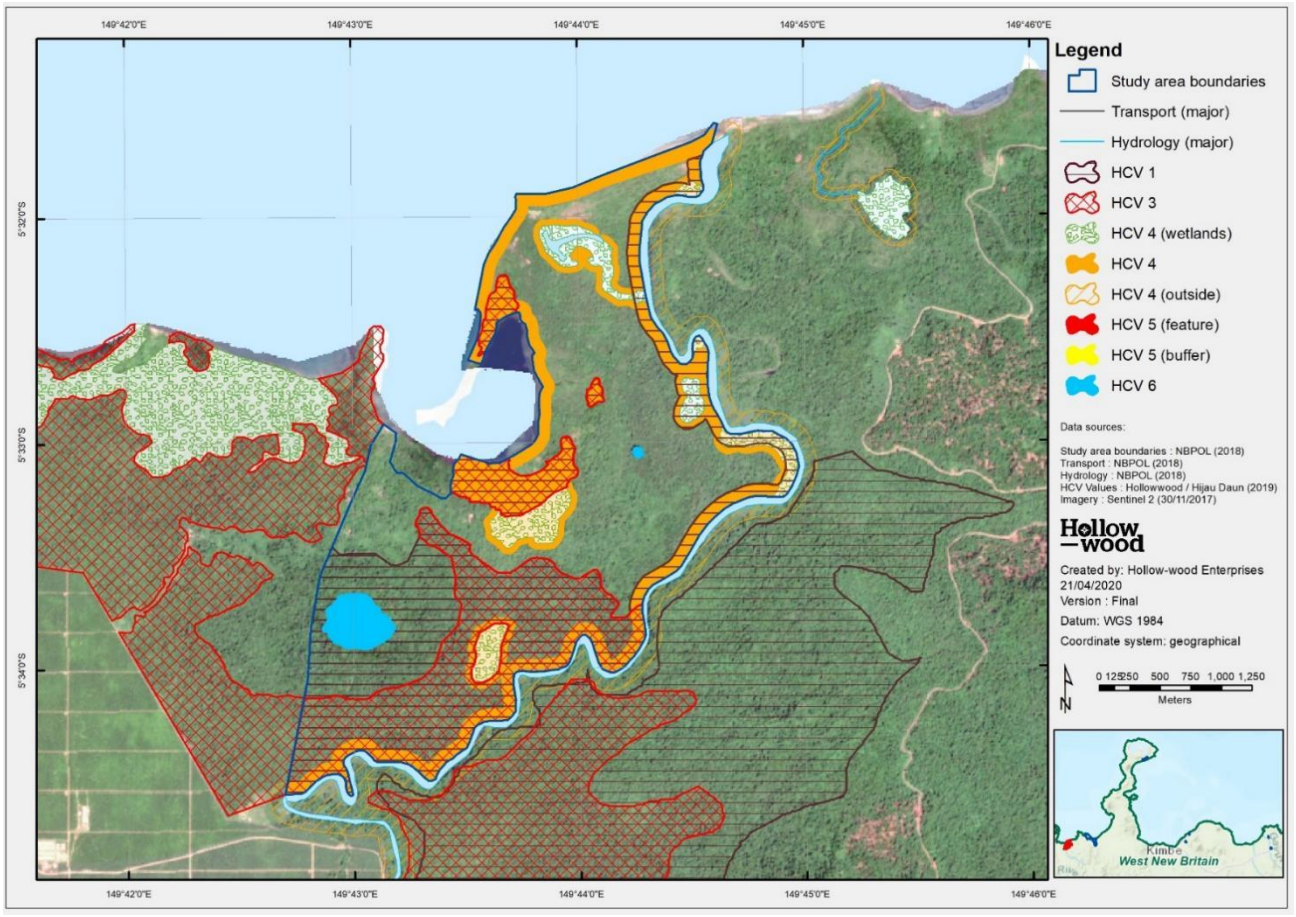

**Map 21. Balave South, which shows only a small developable area (88.69 ha). This area is swamp forest. The areas mapped as developable are areas that are in poor condition following the 2015 fires.**




**Map 22. Kandoka. There is a substantial area for development in this area (350.53 ha). This is primarily a community garden area with areas of semi-abandoned coconut plantations. There are areas of better quality forest, mangroves and sago swamps in the north west.**



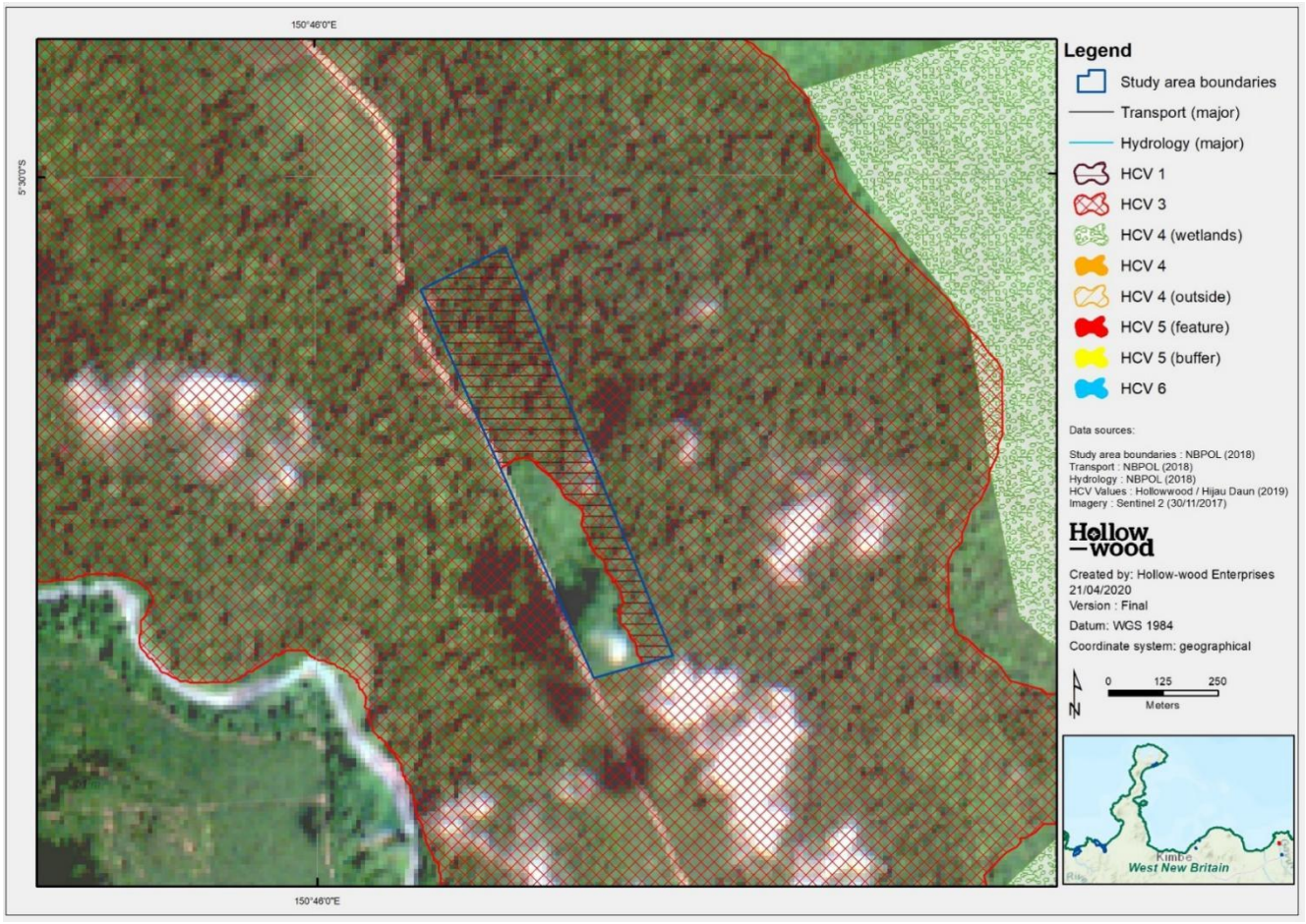

**Map 23. Kintakiu - the area available for development is 120 ha. This consists of ex-garden areas and forest areas that have been burnt in the 2015 fires. The forest gets progressively better further east.**



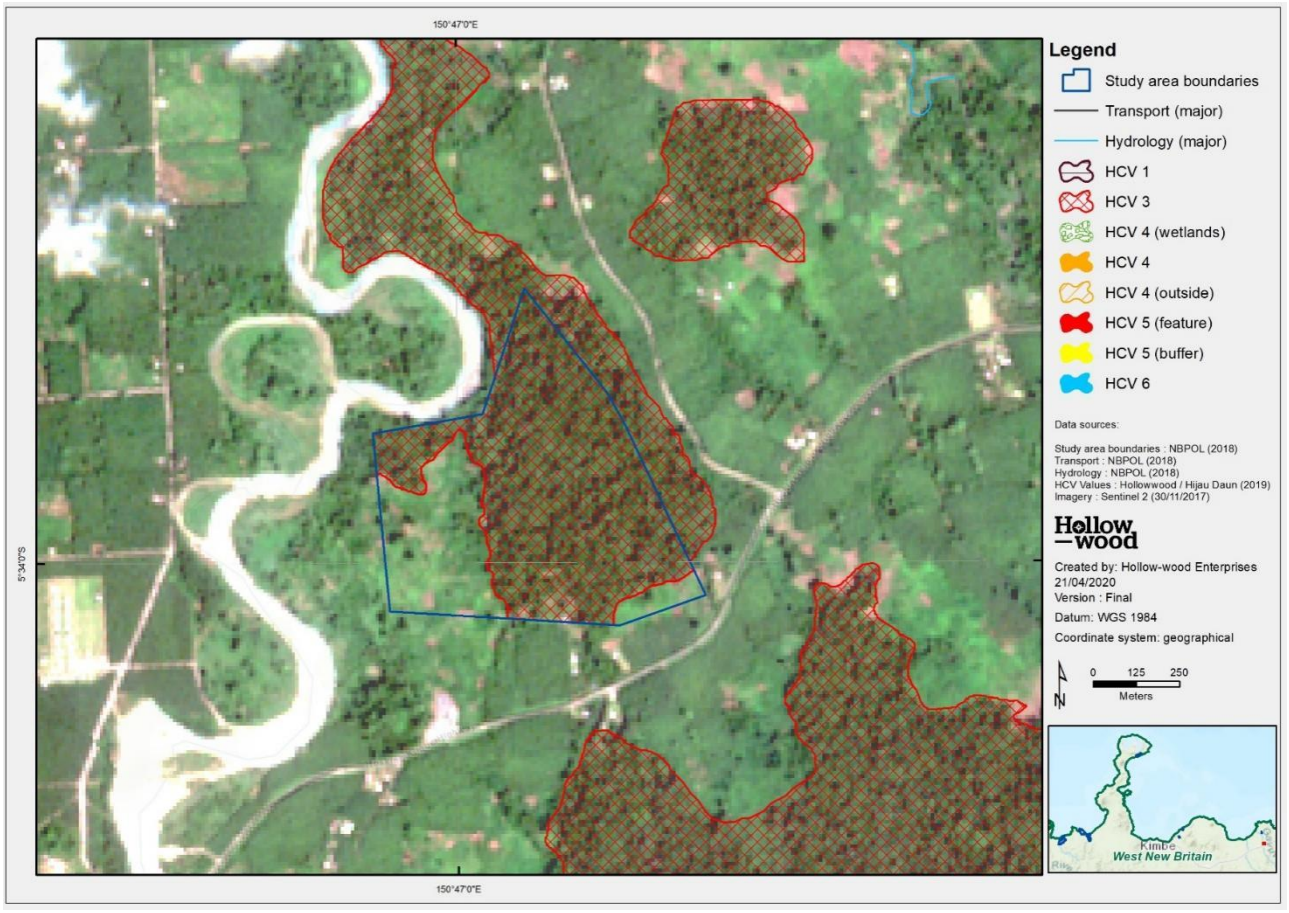

**Map 24. Lingalinga – there are 324.25ha available for development. These are ex-coconut plantations. The area in the south is a sacred mountain as well as intact forest.**


**Map 25. Otto's Block. The full area is available for development (15.32 ha). It is a mix of gardens and coconut plantation.**

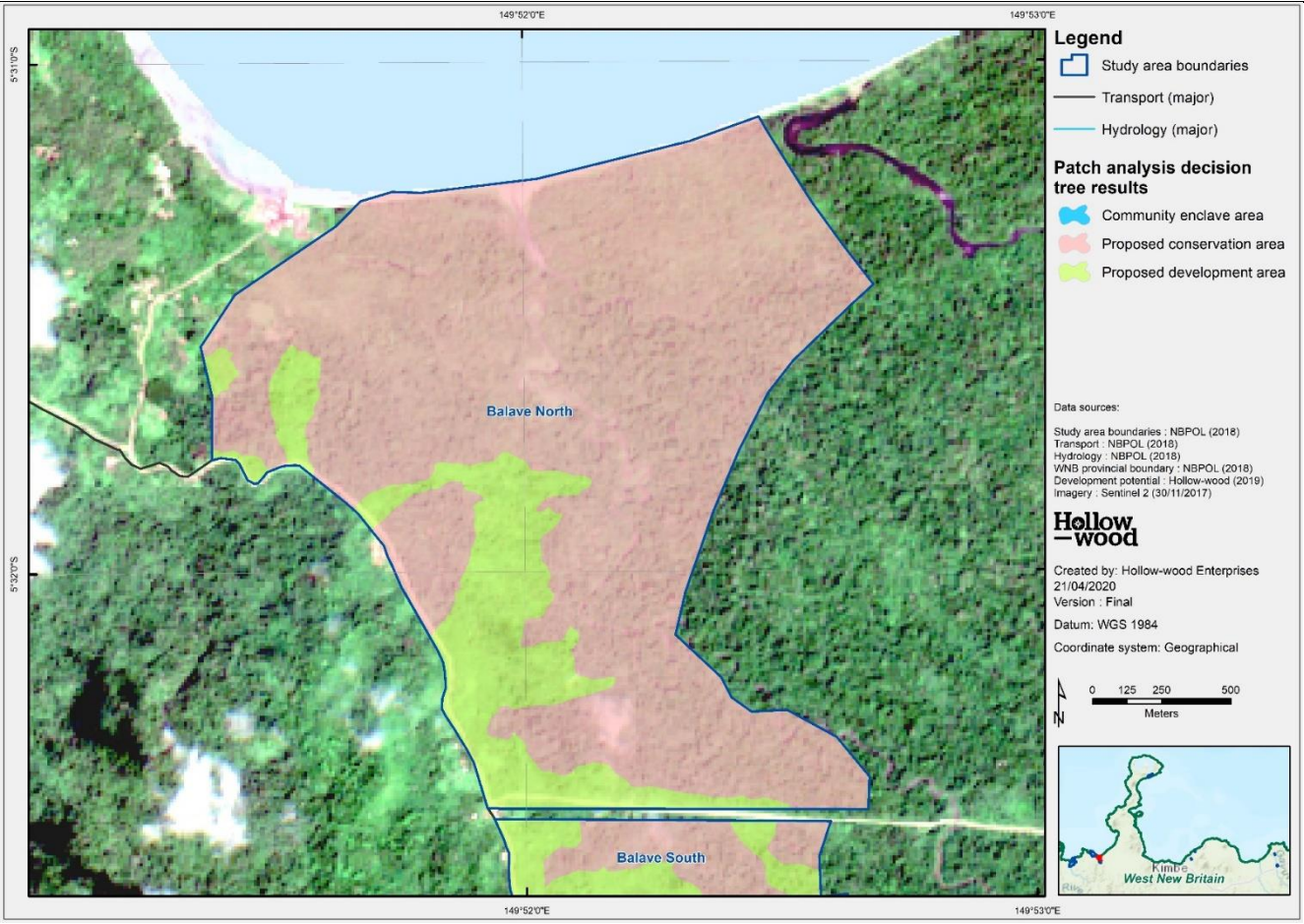

**Map 26. Richie's Block. The full area is available for development (12.89 ha). It is primarily a garden site.**



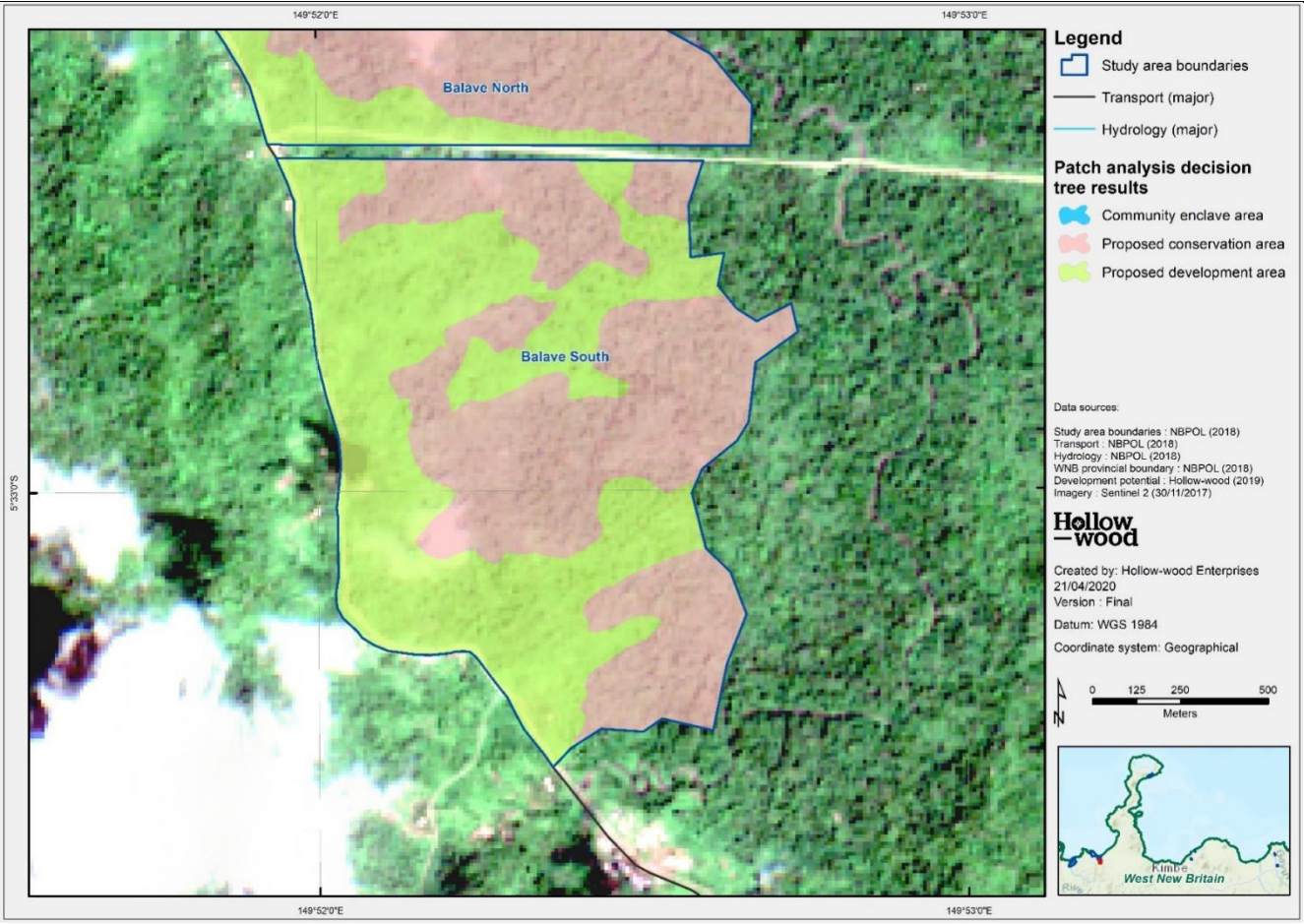

**Map 27. Tapakasi North. The developable area (2.0 ha) is an ex-garden site. The rest is forest in good condition.**



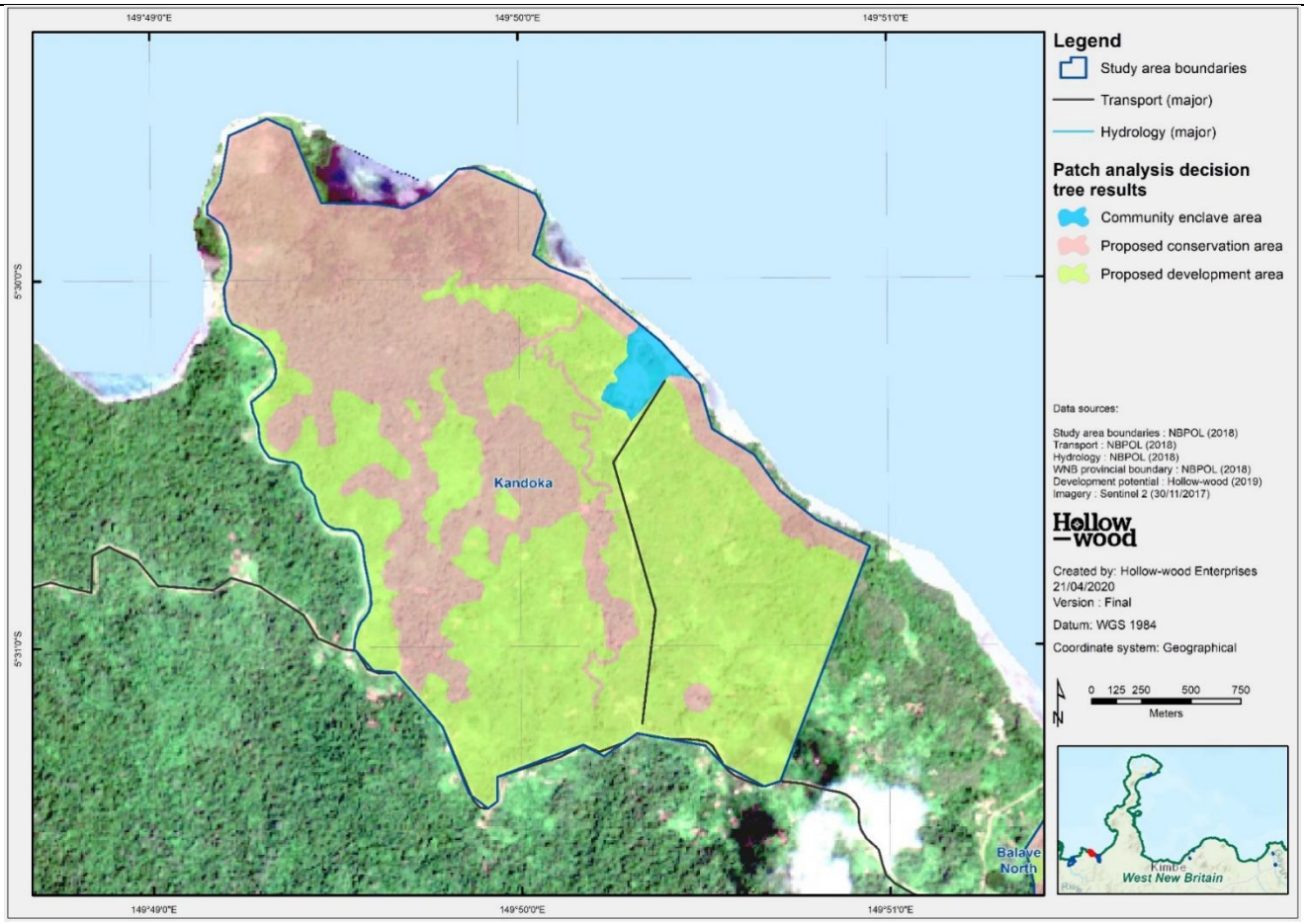

**Map 28. Tapakasi South. The developable area (14.67 ha) is a garden site.**



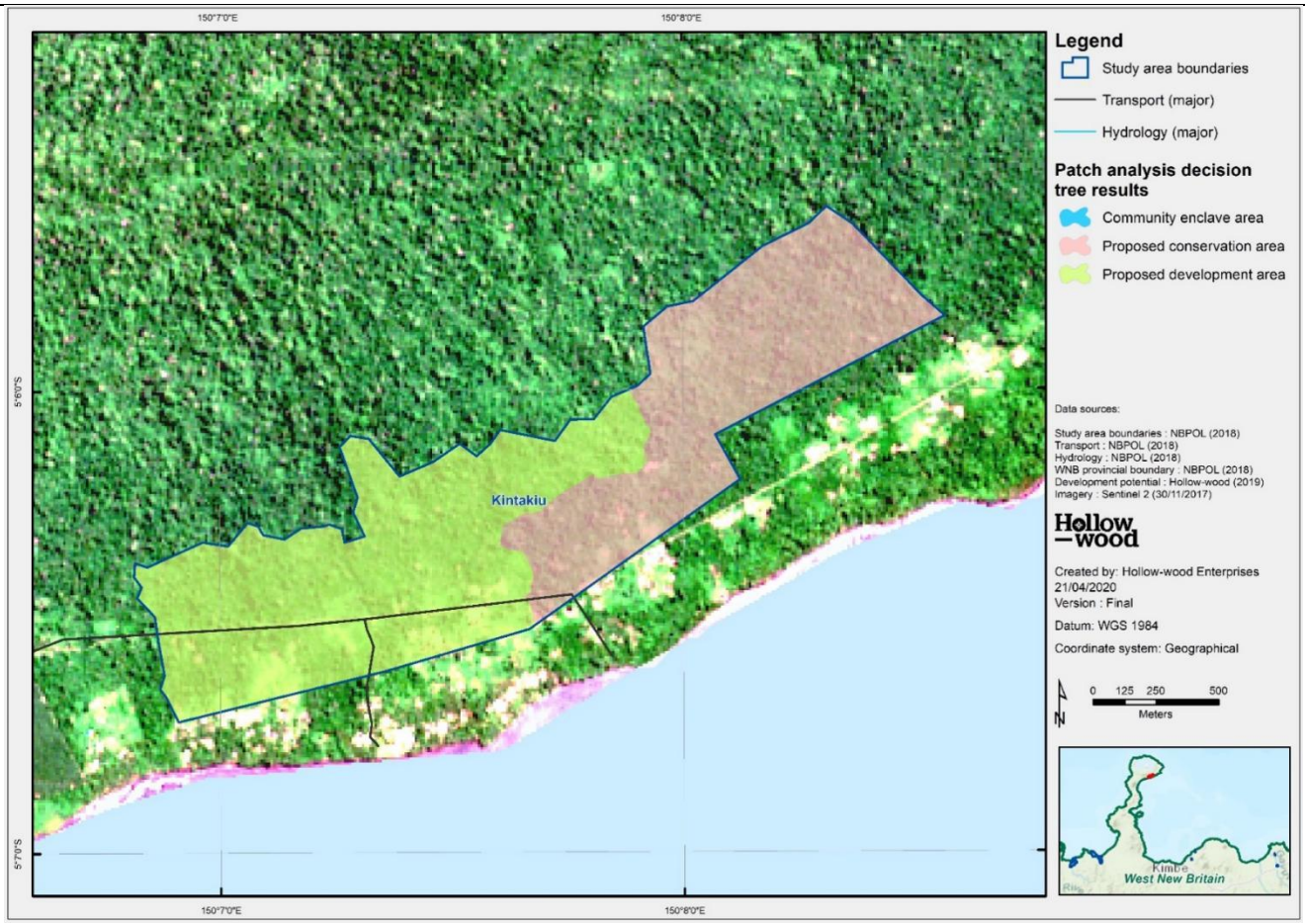

**Map 29. Development potential for Balave North**



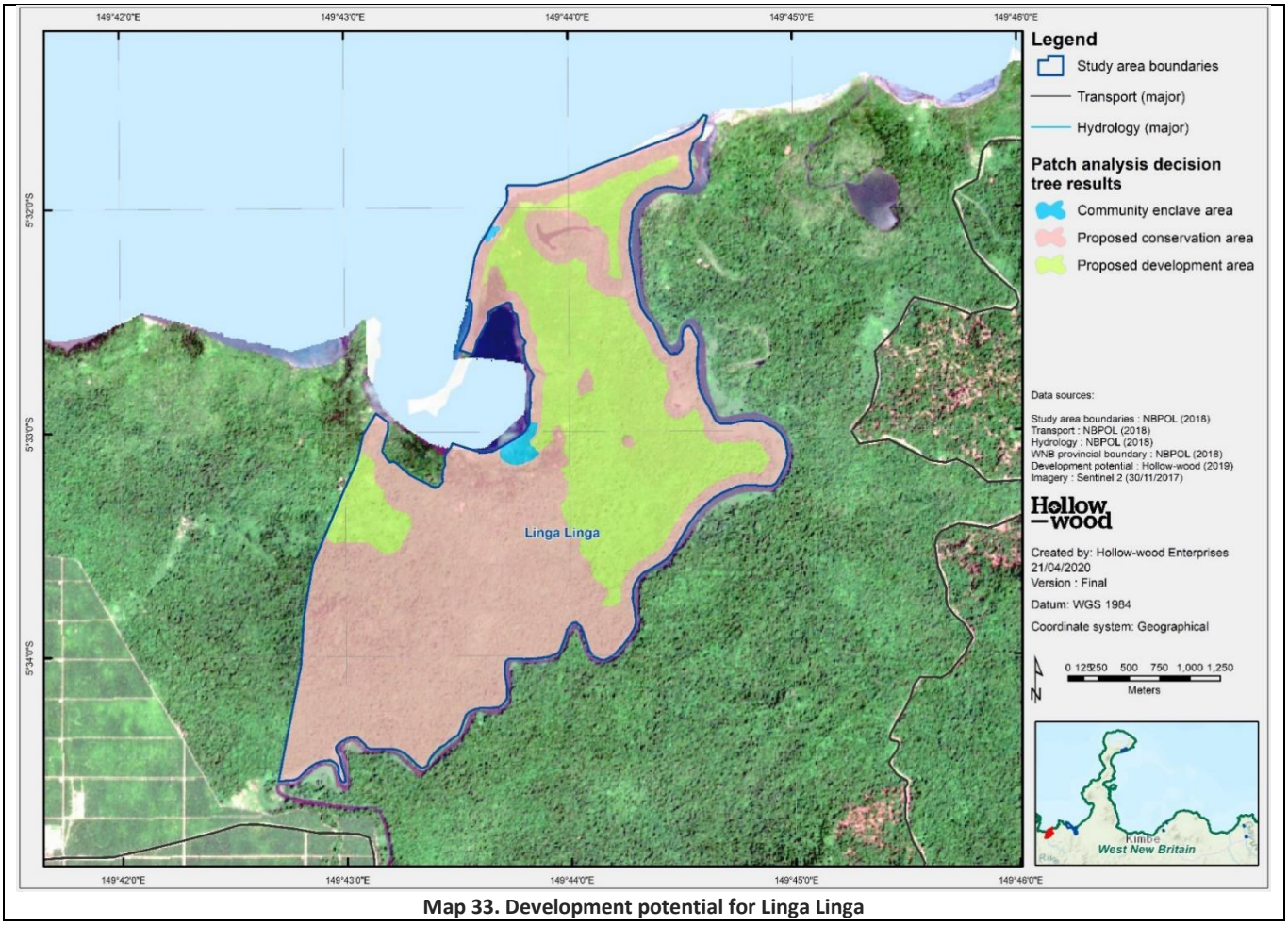

**Map 30. Development potential for Balave South**



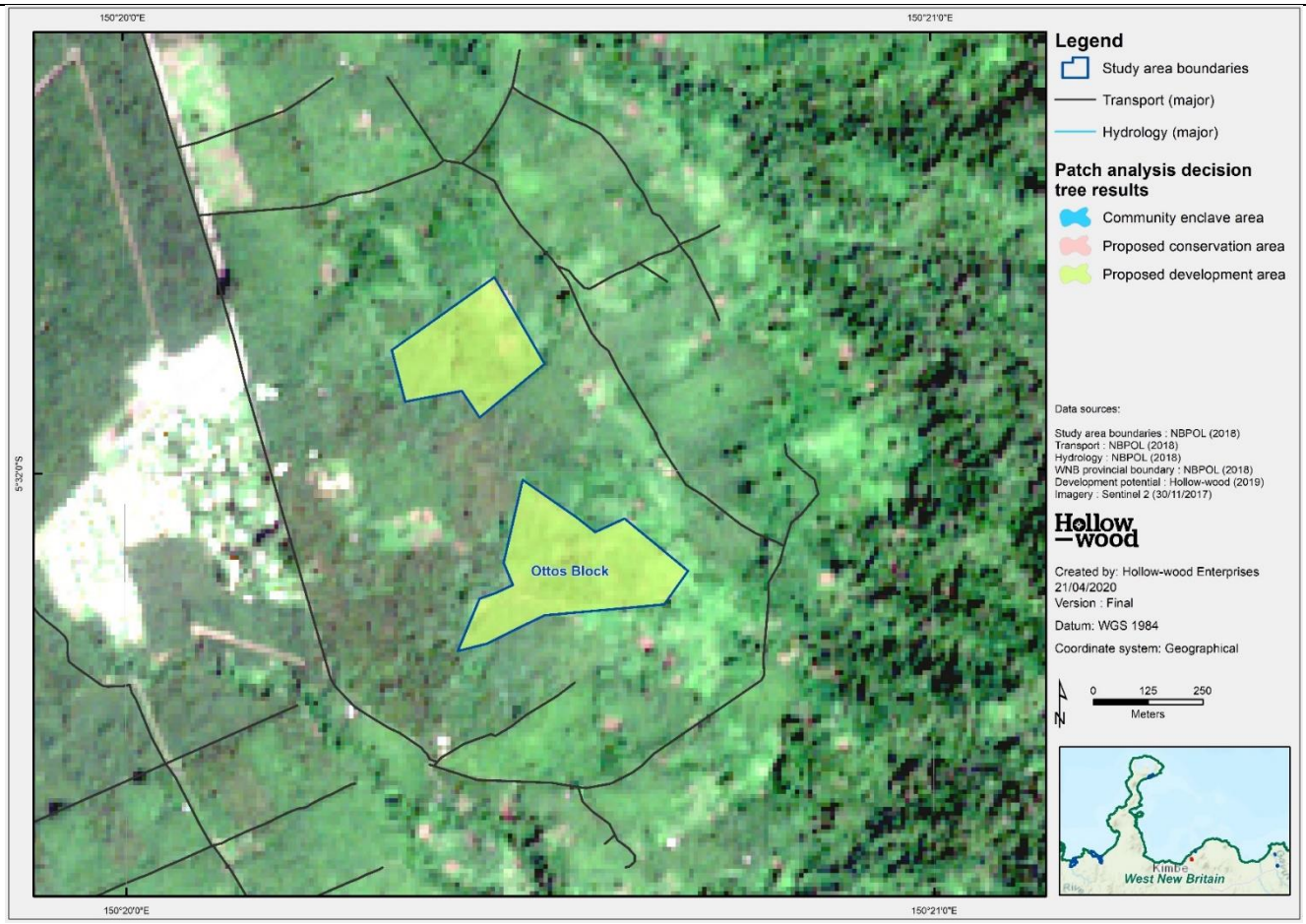

**Map 31. Development potential for Kandoka**



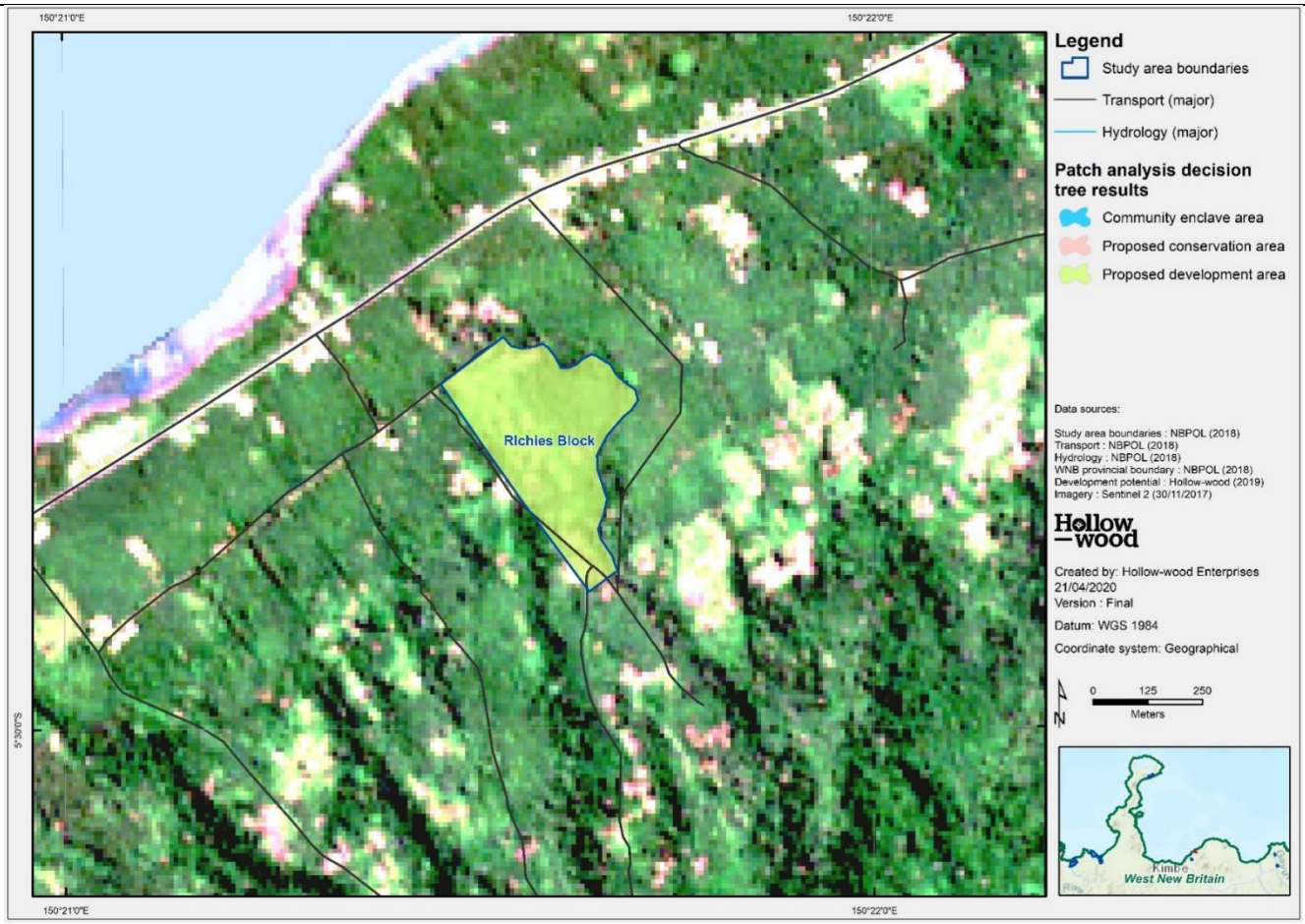

**Map 32. Development potential for Kintakiu**




**Map 33. Development potential for Linga Linga**

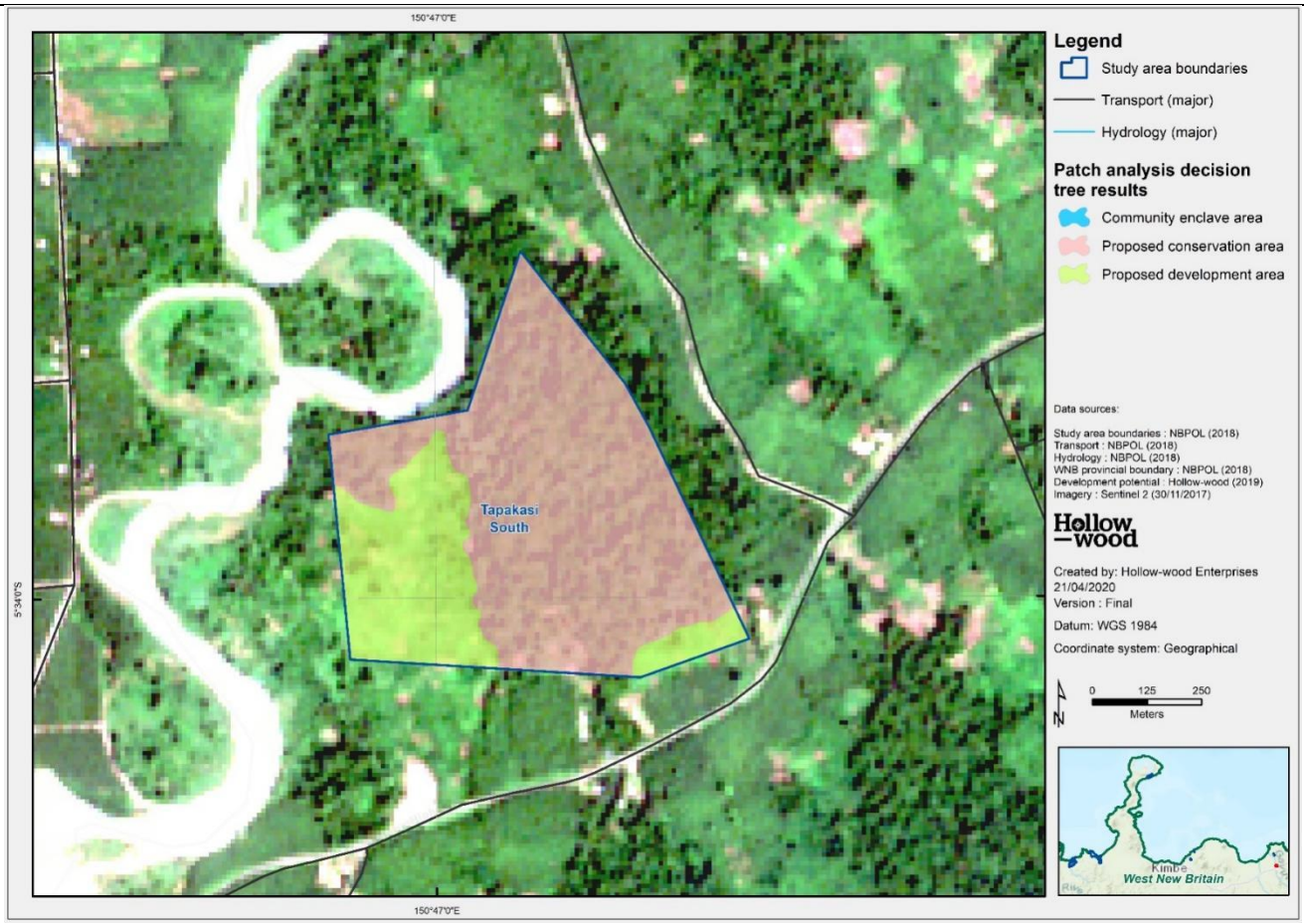



**Map 34. Development potential for Otto's Block**




**Map 35. Development potential for Ritchie's Block**


**Map 36. Development potential for Tapakasi North**




**Map 37. Development potential for Tapakasi South**

**Table 6. Development Programme**

| Location | Proposed Time Plan for Development | | Approx. size of clearing |
|---|---|---|---|
| | Month | Year | |
| **Tapakasi North** | **Jan** | **2024** | **2.03** |
| **Tapakasi South** | **Jan** | **2024** | **14.67** |
| Lingalinga | Jan | 2024 | 324.25 |
| Kintakiu | Jan | 2024 | 120 |
| Balave North | Jan | 2024 | 56.18 |
| Balave South | Jan | 2024 | 88.69 |
| Kandoka | Jan | 2024 | 350.53 |
| Richard's Block | Jan | 2024 | 15.32 |
| Otto's Block | Jan | 2024 | 12.89 |

Tapaksi North and Tapaksi South is included in this report only as transparency initiative. These two locations are not required to undergo the NPP process as it is within a certified area. The proposed development area is 964.86Ha which will undergo the NPP process.

**Section 3: SEIA**

*Guidance Note: This section is where the summary findings of SEIA is captured. References and pictorial evidence are recommended. What are the methodology(ies), people involved in the process, date of assessment and findings? Note: Should an assessment carried out by internal staff, just fill the name of the staff and his/her designation.*

Date of assessment:

| Activity | Timing |
|---|---|
| **Scoping** | 16 – 20th October 2017. |
| **Full Assessment field work** | 30th April – 19th May 2018 |

Name of Assessor: Jules Crawshaw (Consultant)
Assessor Designation and Company: PT Hijau Daun

**Table 7. Assessment team**

| Name | Assessment role | Qualifications |
|---|---|---|
| **Jules Crawshaw** | Lead Assessor and Social Team Leader | • B.For.Sc., M.Bus.Sys<br>• ALS Fully Licensed Assessor (ALS14006JC)<br>• HCS Register Practitioner. |
| **Michael Hansby** | Biodiversity Team Leader | • BSc (Forest Science)<br>• Grad Dip (Bushfire management)<br>• HCS Registered Practitioner.<br>• ALS Provisionally Licensed Assessor |
| **Jeffery Lawrence** | Vegetation Expert | • BSc Degree in Forestry<br>• Expert in tree identification<br>• FSC experience<br>• HCV and HCS experience |
| **Clement Bailey** | Vegetation Expert | • BSc (Hons) Forestry<br>• Expert in tree identification<br>• FSC experience<br>• HCV and HCS experience |
| **Mellie Musonera** | Birds and Mammals Expert | • Masters in Conservation Biology.<br>• 4 HCV assessments<br>• Biodiversity Assessments in PNG |
| **Narua Lovai** | Social Expert | • Bachelor of Science in Applied Chemistry, 1984, PNG University of Technology<br>• Master of Engineering Science in Hydrology and Water Resources Management (Hydro-chemistry), 1999, University of Adelaide,<br>• Diploma of Professional Writing and Editing (2012), Australian College QED, Sydney, Australia |
| **Juliana Mohe** | Social Expert | • BSc Degree in Geography and Environmental Science<br>• Experience with social research and social surveys |

## Methods

The methodology has been prepared to meet the requirements of the Principles and Criteria for the Production of Sustainable Palm Oil. The methodology has also been informed by best practice principles articulated by the International Association for Impact Assessment (IAIA).[5]

***Scoping Study***

The objectives of the scoping study were to identify the project's area of influence, available information and initial stakeholder concerns; enabling the assessor to identify information gaps, high priority issues and to inform the methodology for the field assessment and the team required.

The scoping study took place between 16 – 20th October 2017. This was done by Jules Crawshaw. This involved the following activities:

- Travelling around the assessment area and visiting each of the proposed areas and looking at issues for each element of the New Planting Procedure (NPP).
- Review of the extensive secondary data that NBPOL had available. This included:
    - Species lists
    - Landcover and land use mapping
    - GIS files
- A number of reports (including past SEIA, HCV reports) that had been written over the years field visit to each assessment area to determine which experts will be required to undertake the full assessment.

***Secondary Data***

**Environmental Data**

Secondary Environmental data was developed using the following methods.

- For **vegetation** this involved making up a species list of threatened species based on the IUCN redlist. An additional species search was made for species that were listed as present and were threatened based on cross referenced against the digital herbarium records at the Forest Research Institute at Lae.
- For **birds** this involved compiling a species list from lists of endemic birds and field guides ((Coates & Peckover, 2001) and (Beehler, Pratt, & Zimmerman, 1986)). Similar approaches were used for **mammals, amphibians and reptiles**.

The following NBPOL Standard Procedures were also examined:

- MG 01A New Developments (dated May2016)
- MG 03 - Pesticide Practices (dated April2017)

These SOPs deal with how to develop and maintain the plantation in a way that minimises the environmental impacts.

**Social Data**

The following documents provided important sources of secondary data:

- The 2011 nation-wide Census;
- Social research undertaken by Curtin University
- Social and economic statistics prepared by the World Bank.
- In-house data sets (e.g. Social Impacts Register)
- In-house reports
    - Social Impact assessment (Loxley & Puzyreva, 2007)
    - Billum Index Reports - is conducted annually by the Sustainability Department in order to provide information to the Management of NBPOL regarding the different levels of income and

expenditures necessary for its lowest paid staff living in our compounds to achieve fair and decent living conditions.
    - Habitat Management Plans
    - Social Management Plan
- Standard Procedures
    - Land Acquisition
    - Smallholders
- Employment, health, production and other statistics;
- Land use assessments for each site;

***Primary Data***

## Environmental Data

Environmental data was collected using the technique of in-field surveys. This was divided into separate surveys for vegetation, birds, mammals, amphibians and reptiles.

- For **vegetation** this involved measuring 201 HCS field plots[6]. From this data a species list was derived which was cross-checked against IUCN and CITES threatened species lists[7].
- For **birds**, a line transect sampling method was employed, where the observer walks along a designated path (in this case it was mostly existing tracks or roads through the study areas) and pauses for five to ten minutes at regular intervals. At each interval, bird species are either recognised by their calls or if they are sighted. Bird species identified by either vocalization or sightings are recorded as well as a tally drawn for the number of individuals of each unique species seen or heard (Bibby, Jones, & Marsden, 1998)(Imanuddin, S. Percy, D. Priatna, L. D'Arcy, L. Sadikin, 2013).
- Presence of **Mammals** was mainly determined by speaking with the NBPOL employees and the local villagers. Both groups were invaluable in providing information of extant mammals in the areas of interest; based on their observations. Day walks were taken through the areas of interest and were designed to maximize observations within various forest strata and/or grassland.
- **Amphibian and reptile** species were more likely to be encountered at night. Night trips were taken to survey for amphibians and reptiles and this occurred concurrently with spotlighting for mammals. The same survey routes were used to search for both reptiles and amphibians as well as for mammals. Amphibians or frogs were found by following their calls and searching for them in the understorey.

**Social Data**

The primary technique for collecting social data was through face-to-face interviews. During the scoping study interviews were undertaken with the following key stakeholders:

- Village leaders and ordinary villagers
- NGOs and Government Departments
- Company staff, especially those from the Sustainability and Lands Departments

Combined with this, the assessors walked through the assessment areas to gain an understanding of the terrain and the natural landscape that will be converted. Observations were made about the villages, rivers and other natural habitats. This was focused on areas where natural resources were being used (e.g. fishing or cutting timber).

For the full SEIA; questions were prepared for meetings at the village level to understand and evaluate

- The current situation within the proposed development areas. Particularly with reference to:
    - The communities' awareness and preparation for the development.

[5] (Vanclay et al., 2015).

[6] The procedure is provided in Rosoman, G. et al, (2017).

[7] There are no nationally protected threatened vegetation species.

    - Economic development and stability
    - Access to government services (e.g. education, health, infrastructure)
- The dependency of community members on natural ecosystems to fulfil basic needs and identify any important cultural sites.
- How the customary land would be managed after it had been converted.

In all cases, meetings were attended by the clan leaders and other interested parties. Regarding the number of people attending; a member of the NBPOL Sustainability Department contacted each village beforehand and organised the community meeting. NBPOL encouraged as many people to join as possible, but ultimately couldn't force anyone to come. No percentage attendance was aimed for.

In each interview a general introduction to the purpose and context of this SEIA was made. This was followed by a Focus Group Discussion (FGD) in order to collect data on social and cultural aspects. There was also a general discussion about the important natural resources in the area and changes to resource availability over the last twenty years. Following the FGD, a series of one-on-one interviews took place, where the assessors interviewed community members about their personal circumstances (e.g. source of income, expenditure, number of family members) in order to build up a more complete picture of the community. The interviews all took place in Tok Pisin and were undertaken by a native speaker.

Following this the assessors went for a walk around the village and the gardens to observe things like the quality and type of construction of the houses, water sources, gardens (making note of the crops that were being grown and the level of maintenance within the gardens).

**Figure 1. Focus Group discussion underway in Kae Village.**

**Participatory Mapping**

At each village interview the communities were asked to mark up the complete area of their land to ensure (1) that the oil palm development did not impact on their gardening area, (2) if it did overlap with their gardening area that this would not force them to go and open up areas of forest elsewhere and (3) if there were any resources that were likely to be affected by oil palm development (e.g. hunting areas). Additionally, any areas of community set asides, within the assessment area, were asked to be mapped out.

Following this the assessors went to have a look at the areas of interest within the area. Examples of areas of interest would be:

- Springs
- Sak-sak areas
- Cultural sites

Having studied these maps and digitised all the data on marked up maps into the GIS, the assessor found some inconsistencies and some of the data was incomplete. During the final consultation the assessor asked the communities more questions and asked further clarifications in order to resolve the inconsistencies.


**Figure 2. Reconfirming some of the results of the Participatory Mapping (Tapakasi).**


**Figure 3. Marking boundaries on prepared maps.**

Following the identification of management strategies, the impact significance is reassessed to indicate the residual impact significance. This allows an assessment of the effectiveness of the proposed management strategies. The residual impact significance is also assessed on the likelihood and consequence of impacts occurring, as described above.

**Table 8. Positive Impacts of development**

| Ref | Impact | Details | Consequence | Likelihood | Significance |
|---|---|---|---|---|---|
| 1 | Increased income levels and improved employment conditions | • This will enable approximately 1000 ha be to be developed. Using a ratio of 4 ha per worker. The equivalent of 200 workers will be employed on a full-time basis. Household income levels are expected to rise significantly, providing employees and their families with opportunities to enhance their living standard.<br>• Landowners must be provided with current contracts relevant to their engagement with NBPOL. This will be either a land rental and royalty payments contract (for ME) or a FFB supply contract. All pricing mechanisms must be clearly documented in these contracts. Levies must not be charged unless they are included in the contracts.<br>• Landowners should be encouraged to purchase trucks so that they can manage their own FFB delivery. | 4 | 5 | **20** |
| 2 | Improved access to health services for employees and their families | NBPOL provides health services to employees and their families. For people living in remote areas such as Kintakiu the road will be upgraded, enabling better access to health services. | 3 | 5 | **15** |
| 3 | Improved access to schools | Similar to health services. If the road to remote areas is upgraded then it will be easier for children to get to school. | 3 | 5 | **15** |
| 4 | Improved housing for employees and their families | For the employees who work on Lingalinga, these people will be housed in workers compounds. The improvement in housing, and particularly the provision of running water and toilets, is expected to provide a more sanitary and hygienic environment, that is expected to contribute to positive long term health outcomes among workers (who reside within the estates) and their families.<br><br>For the other areas, additional income should enable better quality housing. | 3 | 4 | **12** |
| 5 | Increased skill levels among employees | NBPOL must provide adequate training to all employees and smallholders so they can safely and effectively complete the work required of them. The application of training packages undertaken elsewhere by NBPOL will increase skill levels among many employees and for some, will provide opportunities for them to gain employment in other industries or other parts of Papua New Guinea in the future. | 2 | 3 | **6** |

| Ref | Impact | Details | Consequence | Likelihood | Significance |
|---|---|---|---|---|---|
| 6 | Reduction in subsistence resources | • Provide housing and gardening areas for employees who live in work compounds (relevant to Lingalinga)<br>• Establish a plan for the provision of firewood and low combustion stoves to estate workers and their families (relevant to Lingalinga)<br>• Develop a program of development support for local communities to build strong relationships.<br>• Hopefully this will cause a reduction in exploitation of natural resources (e.g. marine resources and hunting) which will enable these ecosystems to recover.<br>• Back load steamed buns (EFB) out to communities so that they can be spread on their gardens. Ideally the addition of these as a source of fertiliser will reduce the need to clear more forest. | 2 | 3 | 6 |

**Table 9. Negative Impacts of development**

| Ref | Social / Environmental Impact | Proposed Management Strategy | Responsibility | Timeframe | Impact Significance | | |
|---|---|---|---|---|---|---|---|
| | | | | | Consequence | Likelihood | Significance |
| 7 | Roading in Sensitive areas (particularly relevant to the Kapuluk River road) | • Ensure the road is gravelled and well maintained.<br>• Build silt traps so that run-off does not enter the river directly.<br>• Water monitoring –<br>  ○ Of particular concern is the runoff from the Kapuluk River road. This will require taking water samples upstream of the estate (as a control) and downstream of the road. If sediment loads are above acceptable limits corrective action must take place.<br>  ○ Other sensitive areas include the Balave River, where a similar strategy must be employed.<br>• Ensure a lining of native vegetation is maintained between the Kapuluk River road and the river. | NBPOL | Ongoing | 3 | 4 | **12** |

| Ref | Social / Environmental Impact | Proposed Management Strategy | Responsibility | Timeframe | Impact Significance | | |
|---|---|---|---|---|---|---|---|
| | | | | | Consequence | Likelihood | Significance |
| 8 | Concerns regarding the quality of drinking water | • Test water quality where villages source drinking water nearby the plantation. This would be most relevant to Kandoka and Kintakiu<br>• Conduct a regular water quality monitoring program<br>• Provide awareness on the results<br>• Assist communities in developing safe drinking water supplies (e.g. rain water tanks or bores). Rather than being a requirement, this could be part of the CSR program. | NBPOL | Should be started before land clearing in order to establish a baseline. | 3 | 3 | **9** |
| 9 | Concerns regarding air quality | • Reduce speed limits in the vicinity of villages, schools and other facilities | NBPOL | Ongoing | 1 | 2 | **2** |
| 10 | An increase in injuries caused as a result of increased vehicular traffic | • Ensure all drivers are adequately trained and awareness provided on the importance of maintaining good relationships with local communities. (e.g. driving very slowly during dry season so that dust is minimised). NB: all drivers must have a valid PNG drivers license, which is a government responsibility. However, reinforcing safety issues to drivers (e.g. through toolbox talks is required).<br>• Conduct awareness within villages about keeping small children off the roads.<br>• Impose and enforce speed limits near all villages. Again speed limits are ultimately a government responsibility, but there should be constant reinforcement to drivers about driving slowly near villages and being very aware of people running onto the road. | NBPOL | Ongoing | 4 | 1 | **4** |
| 11 | Social problems as a result of increased employment and more people living on | • Give employment preference to local residents and boost local employment by targeted training programs. | NBPOL | As | 3 | 3 | **9** |

| Ref | Social / Environmental Impact | Proposed Management Strategy | Responsibility | Timeframe | Impact Significance | | |
|---|---|---|---|---|---|---|---|
| | | | | | Consequence | Likelihood | Significance |
| | the estates (this is probably most applicable to Lingalinga where there will have to be a significant number of workers brought into the area. In the other areas, the workers would come from the villages). | • Ensure only workers and their immediate families live on the estates<br>• Provide awareness to workers on the importance of maintaining good relationships with local communities | | | | | |
| 12 | Social problems resulting from alcohol and drug abuse, as a result of higher income levels | • Ensure only workers and their immediate families live on the company managed compounds (keeping squatters and passengers out)<br>• Provide financial literacy and healthy living awareness to employees and their families, which will include and encourage saving practises, healthy diets and responsible behaviour<br>• Provide packages of resources that can be bought with FFB income (e.g. water reticulation infrastructure such as water tanks and pumps, toilets other than bush toilets) | NBPOL | Ongoing | 3 | 2 | **6** |
| 13 | Reduction in subsistence resources (this is a positive impact) | • Provide housing and gardening areas for employees who live in work compounds (relevant to Lingalinga)<br>• Establish a plan for the provision of firewood and low combustion stoves to estate workers and their families (relevant to Lingalinga)<br>• Develop a program of development support for local communities to build strong relationships with the community (e.g. assisting communities install water tanks or ground water pumps). | NBPOL | Ongoing | 2 | 3 | 6 |
| 14 | Provide assistance with the management of ILGs ( Incorporated Land Group) to increase the chance that | • Facilitate visits to established ILGs ( Incorporated Land Group) that have been successful to inspire community members so that they can see what can be achieved. | NBPOL | Should be suggesting this to ILGs ( Incorporated | 4 | 4 | 16 |

| Ref | Social / Environmental Impact | Proposed Management Strategy | Responsibility | Timeframe | Impact Significance | | |
|---|---|---|---|---|---|---|---|
| | | | | | Consequence | Likelihood | Significance |
| | they are properly administered | • Make professional staff available to assist with ensuring that the required meetings take place and reports get produced. Ultimately, NBPOL cannot "force" staff upon the community, but as part of CSR, they could offer and provide assistance.<br>• Provide professional staff to assist with running meetings, taking notes and producing reports.<br>• Encourage the members to have any payments to be made to members bank accounts directly | | Land Group) now. | | | |

**Section 4: HCV-HCSA Assessment; OR**

**ALS HCV and Standalone HCSA assessment**

*RSPO Note: This section will be used to analyse that there has been no land clearing in the area before the NPP is submitted. Arrangement should be following the proxy dates indicated in section 2.2.7 of the current NPP Document. Please ensure that the minimum resolution is 300 dpi. What are the methodology(ies), people involved in the process, date of assessment and findings? Note: Should an assessment carried out by internal staff, just fill the name of the staff and his/her designation.*

Date of RSPO approval as satisfactory: Jan 2020
Name of Assessor: Jules Crawshaw
Assessor Designation and Company: Jules Crawshaw - Consultant – PT Hijau Daun

- Fully Licensed Assessor (ALS14006JC)

**Table 10. Independent consultants engaged to undertake the integrated HCV-HCSA assessment**

| Name | Assessment role | Qualifications | Experience with HCV and HCS / Languages |
|---|---|---|---|
| Jules Crawshaw | Lead Assessor and Social Team Leader | • B.For.Sc., M.Bus.Sys<br>• ALS Fully Licensed Assessor (ALS14006JC)<br>• HCS Register Practitioner. | • PNG, Indonesia, Solomon Is, Myanmar, Malaysia<br>• English, Indonesian |
| Michael Hansby | Biodiversity Team Leader<br>Forest Inventory | • BSc (Forest Science)<br>• Grad Dip (Bushfire management)<br>• HCS Registered Practitioner.<br>• ALS Provisionally Licensed Assessor | • PNG, Solomon Is, Cambodia<br>• English<br>• Remote sensing / GIS |
| Jeffery Lawrence | Vegetation Expert Forest Inventory | • BSc Degree in Forestry<br>• Expert in tree identification<br>• FSC experience<br>• HCV and HCS experience | • PNG<br>• English, Tok Pisin |
| Clement Bailey | Vegetation Expert Forest Inventory | • BSc (Hons) Forestry<br>• Expert in tree identification<br>• FSC experience<br>• HCV and HCS experience | • PNG<br>• English, Tok Pisin |
| Mellie Musonera | Birds and Mammals Expert | • Masters in Conservation Biology.<br>• 4 HCV assessments<br>• Biodiversity Assessments in PNG | • PNG, Solomon Is<br>• English, Tok Pisin |
| Narua Lovai | Social Expert | • Bachelor of Science in Applied Chemistry, 1984, PNG University of Technology<br>• Master of Engineering Science in Hydrology and Water Resources Management (Hydro-chemistry), 1999, University of Adelaide,<br>• Diploma of Professional Writing and Editing (2012), Australian College QED, Sydney, Australia | • PNG<br>• English, Tok Pisin |
| Juliana Mohe | Social Expert | • BSc Degree in Geography and Environmental Science<br>• Experience with social research and social surveys | • PNG<br>• English, Tok Pisin |

**Table 11. Field team of NBPOL staff, who assisted with the fieldwork component of the assessment**

| Name | Assessment Role | NBPOL Position | Qualifications |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **Diane Mirio** | Social specialist-FPIC | Community Engagement and Development Officer | • Masters in Management Studies– University of Natural Resources & Environment VUDAL PNG (Ongoing)<br>• Course work, Elements of Public Administration, UPNG<br>• 7.5 years Community Engagement Officer, NBPOL<br>• 11 years Alumni Member - Leadership PNG & 4 years Alumni Member Emerging Pacific Leaders Dialogue<br>• 6.5 years FSC Certification Support, FORCERT |
| **Kadijah Barrah** | Social | New Development Officer | • Bachelor of Science in Agriculture |
| **Lillian Holland** | Social – FPIC (Negotiation & Lands Advisory) | Senior Lands Officer | • Bachelor of Lands Studies, PNG University of Technology |
| **Brian Balib** | Biodiversity | GIS Officer-Smallholders Affairs Department | • Diploma in Tropical Agriculture, 2010,PNG University of Natural Resources & Environment-Vudal Campus |
| **Richard Mova** | Biodiversity (Flora) | Assistant Lands Officer | • Bachelor in Environmental Sciences & Geography-University of Papua New Guinea<br>• Certificate in Land Administration & Documentation Processes-PNG University of Technology.<br>• Certificate in GIS Level II-PNG University of Technology. |
| **Joshua Kialo** | Biodiversity assessment - NPP | Projects Officer | • Diploma in Forestry Science – University of Technology, Lae - PNG |
| **Wilfred Tangole** | Assist in Social Awareness-FPIC | Head Of Small Holder's Affairs Department. | • Currently undertaking Postgraduate – Masters in Management Studies– University of Natural Resources & Environment VUDAL PNG-(*Final Write up of thesis*)<br>• Graduate Certificate In Managements Studies-( 2002)<br>• University Of Natural Resources –(2002)<br>• Diploma In Tropical Agriculture ,University Of Natural Resources- (1995) |
| **Ashley Barnes** | Logistics co-ordinator | Head of Mini Estates | • Roseworthy College Diploma of Agric. & Roseworthy Coll. Diploma of Agric. Technology (recognised as Agric. Degree)<br>• 20 years with PNG Dept. of Agric, incl 3 years lecturer at Vudal Agric College, ENB & 10 years as Oil Palm Coord'tor. HKN & Bialla smallholder projects.<br>• Six years Hargy Oil Palms, Bialla - smallholders; 1 year plantn Manager.<br>• 18 years NBPOL Mini Estate establishment, Lands. |

| | | | |
|---|---|---|---|
| **Michael Bragg** | Biodiversity and Social | Sustainability Manager - WNB | • Bachelor of Systems Agriculture with a Major in Agronomy University of western Sydney (NSW)<br>• Honours in International Development University of Western Sydney (NSW)<br>• HCVRN Training Course with Wild Asia<br>• 1.5 Yrs. Sustainability Manager - WNB |

**Table 12. Timelines associated with this integrated assessment ( refer to table 5. Integrated HCV /HCS Assessment Report)**

| Step | Step description | Dates undertaken/scheduled |
|---|---|---|
| **1** | Compilation of secondary and available primary data, including preliminary stakeholder consultation during a short, initial visit to the license areas (Scoping Study) | 16 – 20th October 2017 |
| **2** | Developing a proposal and contracting | October – December 2017 |
| **3** | Team formation and briefing on project scope | February-March 2018 |
| **5** | Planning for fieldwork and agreement on field methods for primary data collection | January-April 2018 |
| **6** | Fieldwork and primary data collection, including direct stakeholder consultation | 28th April – 20th May 2018 |
| **7** | Data analysis and interpretation | May 2018 – February 2019 |
| **8** | Preparation of a Draft Report, including HCVA maps and management and monitoring recommendations (phase 1) | May 2018 – February 2019 |
| **8a** | Writing a Social and Environmental Impact Assessment, - which included a land tenure and social baseline study.(Appendix 14.20)[5] . | May 2018 – February 2019 |
| **9** | Public consultation to report interim HCV findings and refine threat assessment Consultation with NGOs | 7th March – 15th Mar 2019<br>12th November 2019 |
| **10** | Amend the draft report based on the Public Consultation | November 2019 – January 2020 |
| **11** | Meeting with neighbours of smallholder blocks. | January 2020 |
| **12** | Submission of the HCV/S Report to HCVRN | January 2020 |

## Social methods

***Literature review and use of secondary data***

There was a wealth of secondary data available in this area from various sources including:

- Satellite images (ranging in dates from 2017 in early 2018)
- Academic papers (e.g. research from Curtin University, Australian National University) – these ranged in dates from 2002 – 2017. The individual references are included in this section
- Census (Papua New Guinea National Statistical Office, 2011) – this is the latest census
- Data from government departments (e.g. Education, Health, Police) – these were ad hoc data sets that they kept and were ongoing data from the last couple of years (e.g. no. of schools).
- Knowledgeable individuals in the area

The fact that some of the datasets (especially the census) are now quite dated can be seen as a limitation of the study. Secondary data for the assessment of HCV 5 and 6 were available from EIAs and Habitat Assessment reports provided by the company from other areas in the WNB where NBPOL has its main operations. These described a range of social and economic classes, livelihoods, and village infrastructure. There was no secondary data relevant to this particular area.

At the same time as the HCV / HCS assessment was being done, data was being collected for the SEIA – which included a land tenure and social baseline study.

## Social methodology

*FPIC*

This study is one step in the FPIC process. There have been a number of FPIC activities that have spanned many years for each of the projects that are being considered. While each group differs; the main activities are (1) an initial request for development from the community, (2) socialisation with the community, (3) a land investigation report and (4) NBPOL support with establishing an Incorporated Land Group ( ILG).

*Social Fieldwork*

The social methods are based on the Common Guidance. However, the assessor does use a method from the PNG Toolkit to add extra detail on resource usage, this is a level of dependency table.

Using the CG as a reference, questions were prepared for meetings at the village level to evaluate the dependency of community members on natural ecosystems to fulfil basic needs (HCV 5) and identify any important cultural sites (HCV 6).

**Table 13. List of all affected communities for each site. (see Table 4 for mapping between sites, villages and clans)**

| Site name | Affected communities |
|---|---|
| **Tapakasi North and South** | Tarobi, Kae and Sismi Villages – located nearby the sites |
| **Lingalinga** | No affected communities at Lingalinga – the only person living in the area is the caretaker and his family. The owner has an agreement that the caretaker will return to his village when development takes place.<br>The social AOI does overlap with Talegone village land (Information on this group is provided in the level of dependency table) |
| **Kintakiu** | Kintakiu Village – next to the site |
| **Balave** | Kandoka Village– next to the Balave and Kandoka sites |
| **Kandoka** | |
| **Richard's Block** | Richard and Land Settlement Scheme neighbours– next to the site |
| **Otto's Block** | Otto and his neighbours (who are also Otto's family) – next to the site |

The data capture method varied across the proposed development areas involved **participatory mapping and Focus Group Discussions augmented by household interviews**. This involved all the affected communities:

1. Five village interviews being undertaken in the villages directly affected by the development (see Appendix 14.2 of WNB_HCS_HCVRN for attendance lists). Generally, the interviews were done at the village-wide level. During the interviews, maps of both the development area and the wider landscape were used as the basis for participatory mapping. At each interview with all the affected communities during the full assessment the assessor asked the communities whether there was anyone that objected to the survey. No one objected in any of the interviews to the survey taking place. The assessor noted this. This information was augmented by permission being given by all the communities at NBPOL meetings. The assessor wrote this in his notebook that there was no objection to the survey. The assessor considers no objection to be consent. Note that consent is not defined in the HCVRN documentation.
2. After the village interviews, Hijau Daun interviewed a sample of families separately.

3. Three village interviews with villages located within the wider landscape that could in some way be affected by the development.
4. An interview regarding Lingalinga, which is freehold land and owned by an individual. In this case the owner, Julius Ngatia, his son and an employee were interviewed about the area.
5. Two smallholder interviews (Richard's and Otto's Blocks).

Regarding the number of people attending the interviews, a sample invitation letter was provided by Hijau Daun to NBPOL. This letter was to be sent to each group (specifying that it did not just want to meet leaders but woman and other groups also). As well as this an NBPOL staff member followed-up with the villages, organising a daily schedule. Hijau Daun encouraged as many people to join as possible, but ultimately couldn't *force* anyone to come. The sampling method did not aim for a percentage attendance, the method was just to get input from as many people as possible.

Especially given that the clans had contacted NBPOL and requested plantation development, there was a good turn-out at every meeting (Figure 4). Meetings were attended by the clan leader and many other interested parties (e.g. women, younger people, farmers). In each interview a general introduction to the purpose and context of HCV was made. The assessor did not go into complex explanations but introduced the purpose in terms of the company's "no deforestation commitment" and reviewing the community's reliance on natural resources to ensure that the development doesn't interfere with this. The biodiversity team worked in the area at the same time as the social team. An explanation was made of the biodiversity team's activities and several members of the community joined the biodiversity team to act as guides and help with the measurements.

This was followed by a Focus Group Discussion (FGD) in order to collect data on social and cultural aspects. The FGD approach is an effective way to collect information on social and cultural dimensions of village life in an informal setting that permits discussion and exchange of ideas between group members. As part of the social survey questions were asked to identify groups within the community (that might result from such things as income disparity, ethnicity or religion). It was recognised that it was important to ensure representatives from all groups were present.

At the clan level meeting, typically it was the leaders that answered most of the questions. For this reason, following the clan-based interview, family level interviews took place. The method was basically a random walk and ask someone to do a family-based interview. These interviews continued until it was confirmed the results were similar (most people in these villages lived very similar lifestyles). The people doing the interviews were PNG nationals that deliberately targeted a cross section of the community (e.g. youths, elderly, mothers as well as leaders). Typically, there were 4 - 6 family-based interviews accompanying the clan-based interview. The reason that 4 – 6 families were interviewed was that it was found that the responses were very similar among families. So the assessors continued to interview families until the assessors felt (based on their professional opinion) that they had a reasonable data set that covered the situation in the village. At the family-based interview more specific questions relating to subsistence at family level were asked. Similarly, people were queried about their understanding of the oil palm development. One of the observations made here was that there was almost no percolation of information down from the clan leaders to the family level. This is an important observation, which feeds into the way that NBPOL must communicate with these villages.

Regarding the sampling size – the FGD was the whole community – basically everyone from the community came to the meeting. As such it can be regarded as a "census" not a sample. For the family level interviews the assessors

kept sampling until they felt that all the results were similar (i.e. confirmed that no one was saying anything significantly different from previous interviews).

**Figure 4. Focus Group Discussion taking place at Kintakiu**

The interviews all took place in Tok Pisin (the PNG lingua franca), which is widely spoken in the area. Occasionally questions and important points were translated into a local dialect.

Additionally, clan members joined the HCV / HCS survey team when the team surveying the blocks. During this time informal discussions took place about a range of topics (e.g., land ownership, disputes, resource use, population expansion and cultural identification with natural areas). This was very useful supporting information for the survey. While surveying the blocks, clan members were asked to take the team to cultural sites and places of interest. GPS points were taken where appropriate (e.g. graveyards) or, where a creek was used for taking water, this was marked on the survey map. Similarly, the clan leaders were asked to mark-up on maps the complete extent of their lands. This was used to confirm there would be sufficient land after oil palm development for gardens. Also areas where other resources were located was also marked on the maps.

At the end of each meeting next steps were discussed. These were (1) writing a draft report which will map out the GO / NO GO areas and (2) returning to the village to socialise the results of the mapping and seek feedback / approval from the communities.

In the case of Richard's Block the interview was mainly to find out about the ownership and the land use on the area.
Limitations of these methods may have been that the assessment team missed some key point because someone didn't speak up or that someone was in town and missed the meeting. However the team visited each village at

least three times and gave everyone the opportunity to raise questions or concerns. So, it was felt that the assessor had undertaken “best endeavours” to collect and fairly represent the information.

**Figure 5. Marking up the extent of the clan's lands at Balave. The community were asked to mark up the complete extent of their clan’s land on maps. The maps had the proposed development area and satellite images of the surrounding area on them.**

**Figure 6. Household interviews were undertaken after the clan based interviews. These were used to get more personal information and confirm peoples' understanding of the potential oil palm development.**

**Table 14. How consent from other affected communities were obtained, verified and documented.**

| Site name | Affected communities | Initial FPIC to the continuation of the process[8] | The specification of mechanisms for subsequent interactions between communities and the company |
|---|---|---|---|
| **Tapakasi North and South**<br><br>**Clan Names: Kambulbulu, Ilalau, Baumumu** | Kae and Sismi Villages – located nearby the sites | An interview during the full assessment was held with the affected communities. The assessor asked about the information that had been provided about the survey by NBPOL. The assessor noted that the community had an adequate understanding of the assessment process and understood that the area may be converted to OP. The assessor asked these parties whether the assessment team had the community's consent to start working on their lands and engaging with them. To which the community replied "Yes". The assessor took this as being consent and noted it.<br><br>NBPOL had a procedure whereby minutes of company meetings were taken at every meeting with attendance lists. Copies of the minutes | The community are setting up an ILG ( Incorporated Land Group).Letters should be addressed to the chairman otherwise village meetings were OK. The assessor noted this. |

[8] The incredibly vague statement was interpreted by a third party social expert as meaning "informed consent from the communities is needed before the assessor starts working on their lands and engaging with them."

| | | | |
|---|---|---|---|
| | | were subsequently sent back to the village. The villagers were able to show the assessor a dossier of these records. Which the assessor verified. | |
| **Lingalinga**<br>**Freehold owned by an individual** | No affected communities at Lingalinga – the only person living in the area is the caretaker and his family. The owner has an agreement that the caretaker will return to his village when development takes place.<br>The social AOI does overlap with Talegone village land (Information on this group is provided in the level of dependency table) | An interview during the full assessment was held with the owner of the site. The assessor asked about the information that had been provided about the survey by NBPOL. The assessor noted that the owner had an adequate understanding of the assessment process and understood that the area may be converted to OP. The assessor asked the owner whether the assessment team had the owner's consent to start working on his lands and engaging with him. To which the owner replied "Yes". The assessor took this as being consent and noted it.<br>NBPOL had a procedure whereby minutes of company meetings were taken at every meeting with attendance lists. Copies of the minutes were subsequently sent back to the owner. The owner was able to show the assessor a dossier of these records. Which the assessor verified. | The owner said just to ring him or send an email. The assessor noted this. |
| **Kintakiu**<br>**Clan : Lobe and Poligokoru** | Kintakiu Village – next to the site | An interview during the full assessment was held with the affected communities. The assessor asked about the information that had been provided about the survey by NBPOL. The assessor noted that the community had an adequate understanding of the assessment process and understood that the area may be converted to OP. The assessor asked these parties whether the assessment team had the community's consent to start working on their lands and engaging with them. To which the community replied "Yes". The assessor took this as being consent and noted it.<br>NBPOL had a procedure whereby minutes of company meetings were taken at every meeting with attendance lists. Copies of the minutes were subsequently sent back to the village. The villagers were able to show the assessor a dossier of these records. Which the assessor verified. | The community are setting up an ILG ( Incorporated Land Group).Letters should be addressed to the chairman otherwise village meetings were OK. The assessor noted this. |
| **Balave**<br>**Clan : Loko**<br>**Kandoka**<br>**Clan : Kandoka and Loko** | Kandoka Village– next to the Balave and Kandoka sites | An interview during the full assessment was held with the affected communities. The assessor asked about the information that had been provided about the survey by NBPOL. The assessor noted that the community had an adequate understanding of the assessment process and understood that the area may be converted to OP. The assessor asked these parties whether the assessment team had the community's consent to start working on their lands and engaging with them. To which the community replied "Yes". The assessor took this as being consent and noted it.<br>NBPOL had a procedure whereby minutes of company meetings were taken at every meeting with attendance lists. Copies of the minutes | The community are setting up an ILG. Letters should be addressed to the chairman otherwise village meetings were OK. The assessor noted this. |

| | | | |
|---|---|---|---|
| | | were subsequently sent back to the village. The villagers were able to show the assessor a dossier of these records. Which the assessor verified. | |
| **Richard's Block**<br>**Freehold (owned by an individual)** | Richard and Land Settlement Scheme neighbours– next to the site | An interview was held with Richard as well as the neighbours. The assessor asked about the information that had been provided about the survey by NBPOL. The assessor noted that the community had an adequate understanding of the assessment process and understood that the area may be converted to OP. The assessor asked these parties whether the assessment team had the community's consent to start working on their lands and engaging with them. To which the community replied "Yes". The assessor took this as being consent and noted it.<br>NBPOL had a procedure whereby minutes of company meetings were taken at every meeting. with attendance lists. Copies of the minutes were subsequently sent back to the village. The villagers were able to show the assessor a dossier of these records. Which the assessor verified. | Richard said just to ring him or send an email. The assessor noted this. |
| **Otto's Block**<br>**Clan : Hie** | Otto and his neighbours (who are also Otto's family) – next to the site | CLUA | Otto said he lived next door to the office and they could call out to him if they wanted to discuss something. The assessor noted this. |

***Participatory mapping***

At each village interview the communities were asked to mark up the complete area of their land to ensure (1) that the oil palm development did not impact on their gardening area, (2) if it did overlap with their gardening area that this would not force them to go and open up areas of forest elsewhere and (3) if there were any resources that were likely to be affected by oil palm development (e.g. hunting areas). Additionally, any areas of community set asides, within the assessment area, were asked to be mapped out.

Following this the assessors went to have a look at the areas of interest within the area. Examples of areas of interest would be:

- Springs
- Sak-sak areas
- Cultural sites

Having studied these maps, the assessor found some inconsistencies and some of the data was incomplete. During the final consultation the assessor asked the communities more questions and asked further clarifications.

## Environmental methods

***Literature review and use of secondary data***

***Vegetation survey***

Much of this phase of the assessment sought to understand if any species likely to be found within the study areas are listed under various international agreements or are protected under any national legislation. Any potential species found during this phase of the assessment were cross referenced against the digital herbarium records at the Forest Research Institute (FRI) at Lae (Papua New Guinea) for records of listed species occurring in the Bismarck Archipelago and then specifically on New Britain Island. From this search, a potential candidate species list was formed, which was further refined by general habitat and elevation (where possible). Resources utilised during the desktop review are listed in Table 38. The results of the IUCN red list search are provided in Table 39 of WNB_HCS-HCV-HCVRN.

**Table 38. Major information sources used to perform desktop review.**

| Resource | Comment |
|---|---|
| **National herbarium – Lae (digital)** | This resource was used to understand the potential presence or absence of RTEs identified by the PNG HCV National Interpretation, or individuals found from the area-based search of the CITES or IUCN databases. Record data (if present) was interrogated to understand potential location, habitat and growth form of the species. The online herbarium is not complete, but provides an excellent starting point for understanding the potential distribution and ecology of RTE's. |
| **Relevant field guides** | Once the indicative list was compiled, the following references were interrogated to understand any information about the identified species (full bibliographic entry in the reference list);<br>• Peekel, P. G (1984). *Flora of the Bismarck Archipelago*<br>• Verdcourt, B. (1979). *A manual of New Guinea legumes*<br>• Baker, W. J and Dransfield, J. (2006). *A field guide to the palms of New Guinea*.<br>• Lewis, B. A and Cribb, P. J.(1991). *Orchids of the Solomon Islands and Bougainville*.<br>• Handbooks of the flora of Papua New Guinea Vols 1, 2 and 3 |
| **IUCN Red list** | An area-based search using the IUCN online database was performed before the commencement of field work in May, 2018. A list of all flora species with an IUCN rating of vulnerable or greater (i.e. inclusive of endangered or critically endangered), was collated. The area of focus was the Papua New Guinea in general, with further investigation determining the relevance of each listed species to the WNB Province context |
| **CITES prohibited** | An area-based search using the CITES online database was performed before the commencement of field work May, 2018. The area of focus was the Papua New Guinea in general, with further investigation determining the relevance of each listed species to the Bismarck Archipelago and New Ireland Province., |
| **Nationally protected species** | Little guidance is provided by the Papua New Guinea government as to the formal protection of particular plant species, but the HCV toolkit for Papua New Guinea (PNG FSC, 2005) provides a range of species that a considered rare, threatened or endangered by IUCN or prohibited for trade under the CITES convention. |

It should be acknowledged that the understanding about the ecology or distributions of much of the PNG rainforest flora is imperfectly known, with many species' descriptions being known only from original type specimens that are housed in various herbaria in Australia and Papua New Guinea.

This component of the field assessment was integrated with the requirements of the HCS approach field assessment, with each field team being equipped with the list of target species and searches being carried out in the vicinity of each HCS plot and on the traverse between.

Of the 18 species identified broadly identified for consideration, a short list of 8 species were identified as high priority for targeted species searching, due to their known location being New Britain Island, or as a conservative measure, from the Bismarck Archipelago broadly. Of this list, three are considered endangered (EN) and five considered vulnerable (VU). Interrogation of herbarium records held at Lae and other botanical references such as Womersley (1995) indicated the high likelihood of occurrence within remnant forest across the AOI, and were therefore given the highest priority for targeted searching.

All CITES Appendix 1 species were orchids and their habitats were confined to rocky or montane areas (which are not present in the assessment area). It is of interest to note that listed species are climax community species mostly present in large expanses of relatively undisturbed forests.

The broad, initial species selection is shown in Table 39, with the high priority target species shown in red.

**Table 39. RTE tree species identified for targeted species searching across the assessment areas ( refer to HCV/HCS Assessment Report).**

| Family | Binomial | Red List status | Red List criteria | Location 1 |
|---|---|---|---|---|
| MELIACEAE | *Aglaia barbanthera* | VU | A1c | Papuan Islands |
| MELIACEAE | *Aglaia rubrivenia* | VU | A1c | North Solomons |
| CALOPHYLLACEAE | *Calophyllum waliense* | EN | B1+2abcde | Bismarck Archipelago |
| EBENACEAE | *Diospyros gillisonii* | EN | A1cd+2cd, C2a | Louisiade Archipelago |
| EBENACEAE | *Diospyros insularis* | EN | A1cd+2cd, B1+2c | New Ireland |
| SAPINDACEAE | *Guioa novobritannica* | VU | D2 | West New Britain |
| PROTEACEAE | *Helicia neglecta* | VU | A1cd, C2a | New Britain |
| PROTEACEAE | *Helicia polyosmoides* | CR | B1+2abcde | Manus Island |
| FABACEAE | *Intsia bijuga* | VU | A1cd | Bismarck Archipelago |
| ANACARDIACEAE | *Mangifera altissima* | VU | A1d | Bismarck Archipelago |
| RUBIACEAE | *Mastixiodendron stoddardii* | VU | A1cd+2cd, B1+2abcde | New Britain |
| MYRISTICACEAE | *Myristica polyantha* | VU | D2 | Goodenough Island |
| MYRISTICACEAE | *Myristica psilocarpa* | VU | D2 | Manus Island |
| ARALIACEAE | *Osmoxylon lanceolatum* | VU | D2 | New Ireland |
| ORCHIDACEAE | *Paphiopedilum bougainvilleanum* | CR | A2acd+3cd+4acd; B1ab(ii,iii,v)+2ab(ii,iii,v); C1+2a(i,ii); D | Bougainville Island |
| ORCHIDACEAE | *Paphiopedilum wentworthianum* | CR | A2acd+3cd+4acd; C1+2a(i) | Bougainville Island |
| ARECACEAE | *Drymophloeus hentyi* | EN | A1a+2c | East New Britain |
| COMBRETACEAE | *Terminalia archipelagi* | EN | A1cd+2cd, C2a | Bismarck Archipelago |

***Bird Survey ( refer to 8.1.121 - HCV/HCS Assessment Report)***

Information on species that were potentially present within the areas of interest were collated from field guides ((Coates and Peckover, 2001) and (Beehler, Pratt and Zimmerman, 1986)), documentation on Endemic Birds Areas and from previous field experience in similar geographical areas within WNB. This resulted in a list of potentially present bird species.

***Mammal Survey ( refer to 8.1.1.3 - HCV/HCS Assessment Report)***

Mammal species were mainly identified by speaking with the NBPOL employees and the local villagers. Both groups were invaluable in providing information of extant mammals in the areas of interest; mainly based on their past experience. Day walks taken through the areas of interest were designed to maximize observations within various forest strata and/or grassland.

***Reptiles and Amphibians Survey ( refer to 8.1.1.4 - HCV/HCS Assessment Report)***

A desktop review of current and relevant literature was conducted to collate data on extant reptile and amphibian species which may likely be encountered within the areas of interest

***Slope Analysis ( ( refer to 8.1.1.5 - HCV/HCS Assessment Report)***
Excessive slope (i.e. that greater than 25º) is an operational constraint (prescribed by RSPO) needing to be factored into decision making, although the paucity of topographic data available for this study made this process difficult within the GIS environment. Slope analysis was performed using the Synthetic Aperture Radar (SAR) derived ALOS PALSAR as an input, then using the 'slope' (spatial analyst) tool within ArcGIS to convert elevation values to slope values. While the ALOS PALSAR dataset is useful to understand relative elevation differences, its use in higher resolution, operational planning is limited.

***Environmental field work ( refer to 8.1.2 - HCV/HCS Assessment Report)***
Based on the information gleaned from the secondary data as well as the assessment team's experience with similar surveys in other parts of PNG it was decided that the focus of the environmental survey should be on forest areas. The environmental survey therefore focussed on forest areas, however the assessment team still passed through areas of cultivation, grassland, bareland and village areas in the process of accessing the forest and was constantly vigilant regarding sighting of species of interest in these land cover types. The birds and mammals surveyor frequently walked along forest edges where birds were more easily able to be seen. Similarly the vegetation team walked through all landcover types and was vigilant for any species of interest in all landcovers. Though, as predicted, the vegetation of interest for HCV was located in the forest areas.

***HCSA forest assessment and vegetation survey ( refer to 8.1.2.1 - HCV/HCS Assessment Report)***
The in-field vegetation survey was combined with the HCS plot data collection. The survey focussed on forested areas. Grasslands were not considered a priority, given the small extent of this community across the study areas (37ha), with those present being either coastal grasslands (within 100m of the shore), swamp grasslands (buffered by riparian zones) or of anthropogenic origin – this is not to say these areas were ignored, these areas were still surveyed but from the surveyors' experience they were less likely to harbour HCV vegetation species and for surveying efficiency focused on other areas. Coastal grasslands and swamp grassland were already protected by other HCVs anyhow. HCS plot measurement involved assessing fixed area plots (described in more detail below) and searching for Rare, Threatened or Endangered (RTE) vegetation in the vicinity of and whilst walking between plots.

The field inventory performed for this project was primarily used to:

- Collect HCSA plot data
- Ground truth the output of the initial image classification and to quantify the above-ground woody biomass (i.e. that within trees) found within each of the strata, across the study areas
- Actively search for RTE species listed under national or international acts or conventions within the study areas and adjacent landscape.
- Verify the ecosystems that were described as present based on the secondary data review. Where possible, refine the boundaries and better describe these ecosystems.
- Develop a vegetation species list.
- Develop a description of the forest associations in the area, along with information on levels and type of disturbance and threats.

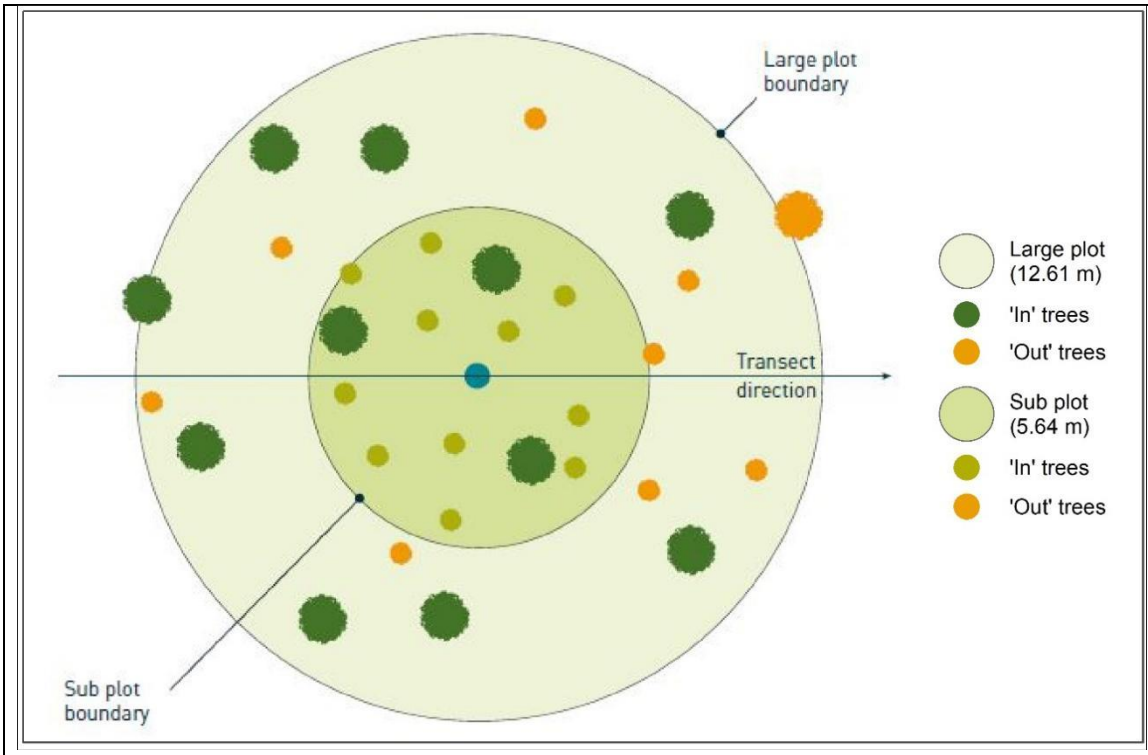



**Figure 7. Stylised representation of HCSA plot used during this assessment.**

***HCSA plot sampling design ( refer to 8.1.2.2 - HCV/HCS Assessment Report)***

Plot sample design was conducted in accordance with the HCSA Toolkit Version 2, Module 4, and sought to develop statistically separate mean biomass values that are ascribed to the HCSA strata defined during image classification, to a 90% confidence interval.

Mean biomass and standard deviation values from previous field assessments in other parts of Papua New Guinea and the Solomon Islands were used as inputs into this process, with both the equation from pp 27 (see below) in HCSA Toolkit Version 2, Module 4 and the 'winrock sample plot calculator spreadsheet tool'[9] were tested to compare the sample sized needed for this assessment (Table 15).

$$N = t^2 s^2 / E^2$$

Where:
t = t-value from Student's t-test table for 90% confidence interval
s = standard deviation based on existing datasets from similar forest types
E = probable error, expressed as a percentage of the estimated mean value (from existing datasets)

[9] https://www.winrock.org/document/winrock-sample-plot-calculator-spreadsheet-tool/

**Table 15. HCSA plot sample size derived from various methods ( refer to table 40 of HCV/HCS Assessment Report).**

| Strata | Mean biomass (t/ha) | Standard deviation (t/ha) | N (HCSA equation) | N (winrock sample plot calculator) |
|---|---|---|---|---|
| **HCS forest** | 278.1 | 169.5 | 102 | 124 |
| **Young regenerating forest** | 129.5 | 76.3 | 95 | 35 |
| **Scrub** | 42.1 | 22.1 | 75 | 10 |
| **Total** | | | 274 | 166 |

A sample of 263 HCSA plots was planned, a large survey effort given assessment time constraints, weather related downtime and logistical complications, such as distance between study areas and limitations on accommodation. Due to access constraints for some of the study areas (Linga Linga in particular) a combination of both stratified random sampling (using 'create random point' in ArcGIS) and systematic sampling on transects was used, with sampling transects planned across gradients where they were identifiable during the field assessment planning. Table 41 shows the breakdown of plots by strata measured during the field assessment, with map 34 to map 42 of WNB_HCS-HCV-HCVRN showing the plot locations.

It should also be noted that the field work for this assessment was part of a larger program, where the field assessment for two separate report submissions (17 sites in total) was conducted concurrently, mainly due to the logistical challenges described above. This particular assessment equates to 9 of the 17 individual study areas that were surveyed, and the locations of the other sample points are provided in Appendix 29.

Minimal biomass sampling was undertaken in Non-HCS vegetation, as in the context of this assessment, such vegetation was generally treeless or non-woody vegetation such as active gardens, grassland areas or areas dominated by palms, such as Coconut or Sago. Non-HCS vegetation is usually encountered for one of the following reasons; a) a change in landcover has occurred since the mapping was conducted (e.g. a new garden has been established) or b) because of poor or incorrect classification.

This approach is consistent with pp 27 in Module 4 of the HCSA toolkit (Rosoman, *et al.*, 2017), which states:

*'Although Scrub (S) and Open Land (OL) are likely to contain very low levels of carbon, the HCS assessment process does seek to sample a limited number of field plots to confirm this assumption. Other classes, such as existing plantation areas (e.g. oil palm and food crops), and areas not to be developed including community areas, peatlands, and HCV areas, are generally not assessed as it is expected that these areas are separately demarcated unless required for carbon accounting'*.

**Table 41. Planned and measured HCS plots for this assessment.( refer to HCV/HCS Assessment Report)**

| Strata | Plots planned | Plots measured |
|---|---|---|
| **HCS forest** | 103 | 77 |
| **Young regenerating forest** | 78 | 50 |
| **Scrub** | 74 | 60 |
| **Non-HCS vegetation** | 8 | 14 |
| **Total** | **263** | **201** |

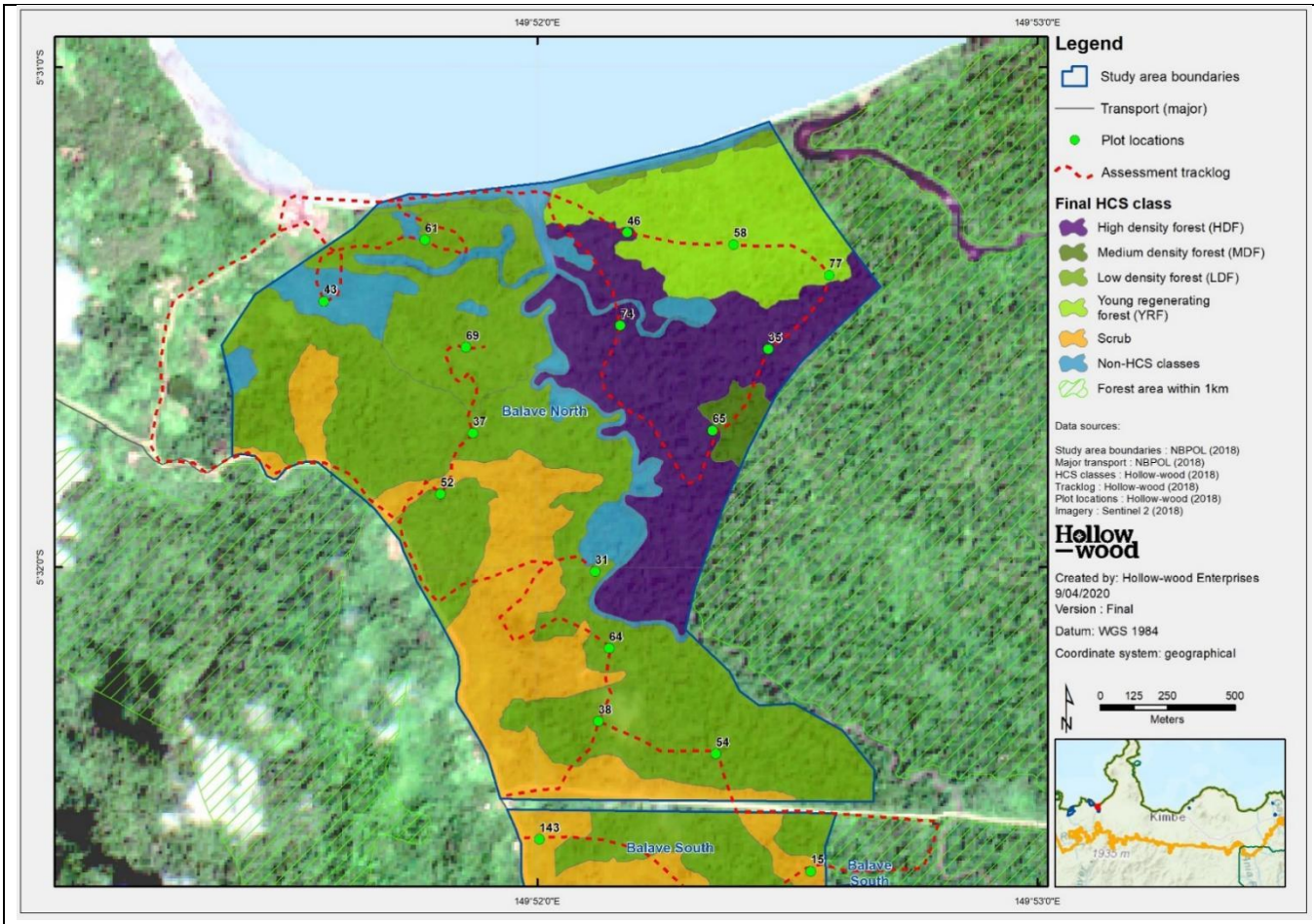



**Figure 8. Final HCS class, plot locations and track log for the Balave Nth study area.**

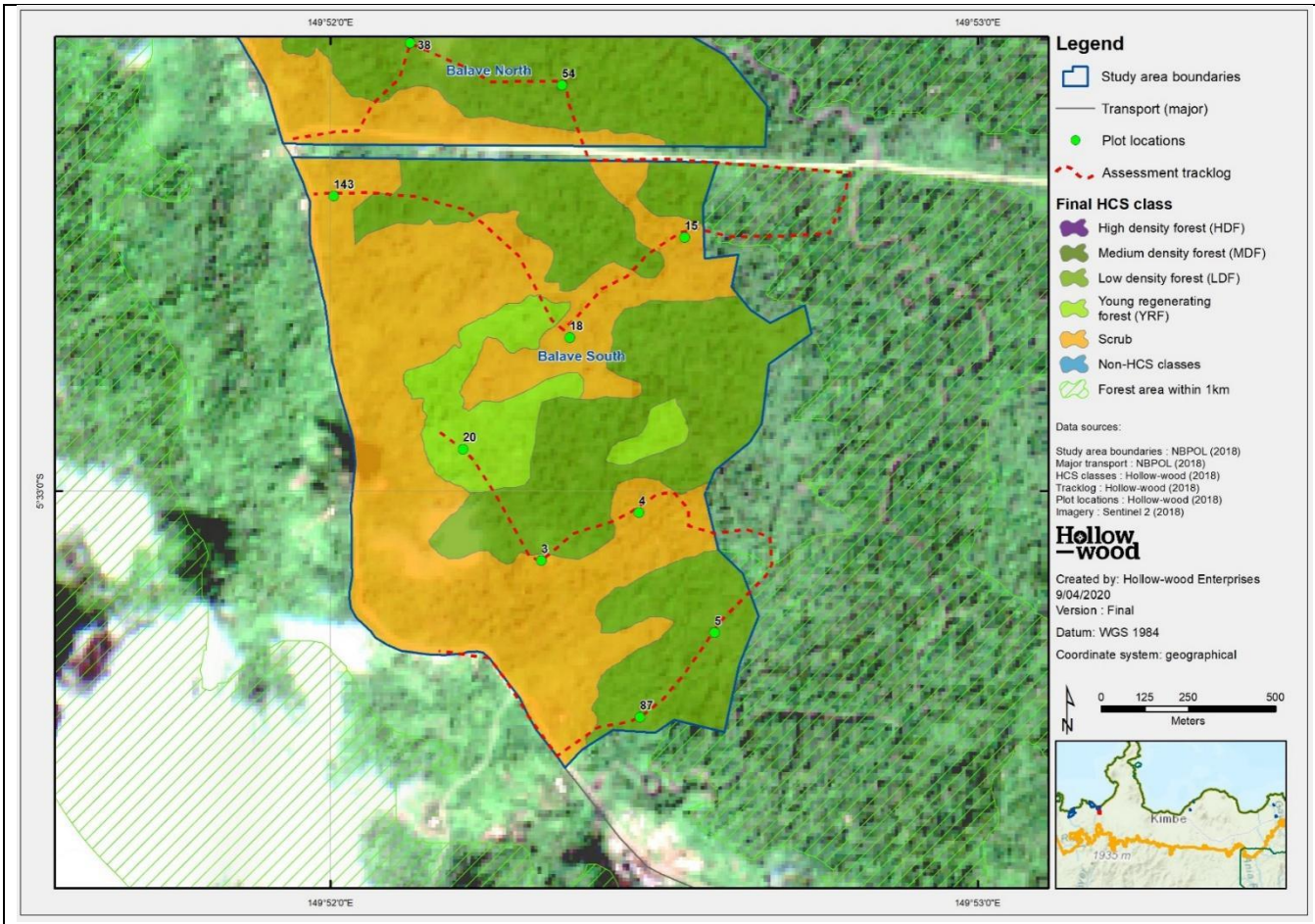



**Figure 9. Final HCS class, plot locations and track log for the Balave Sth study area.**

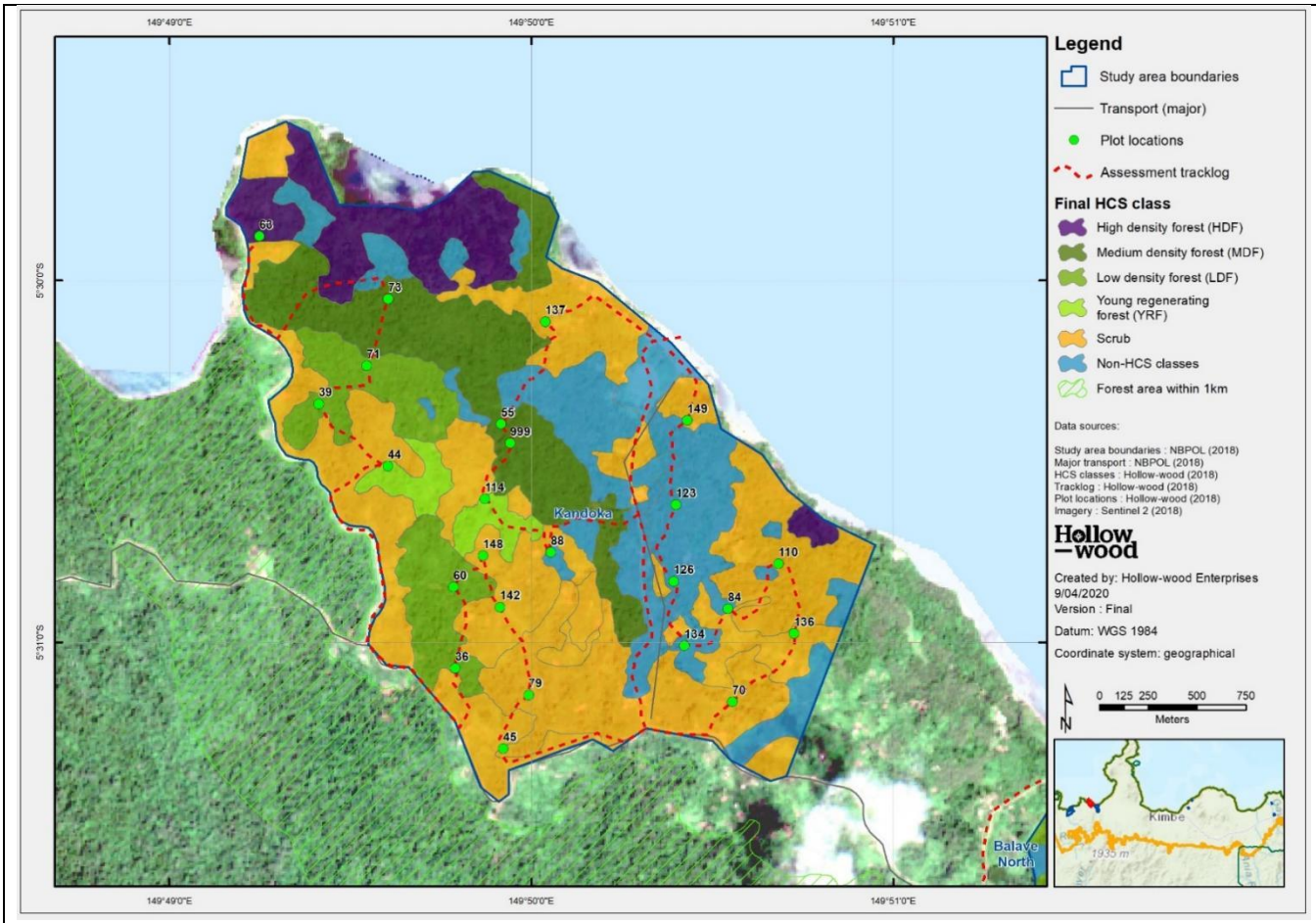



**Figure 10. Final HCS class, plot locations and track log for the Kandoka study area.**

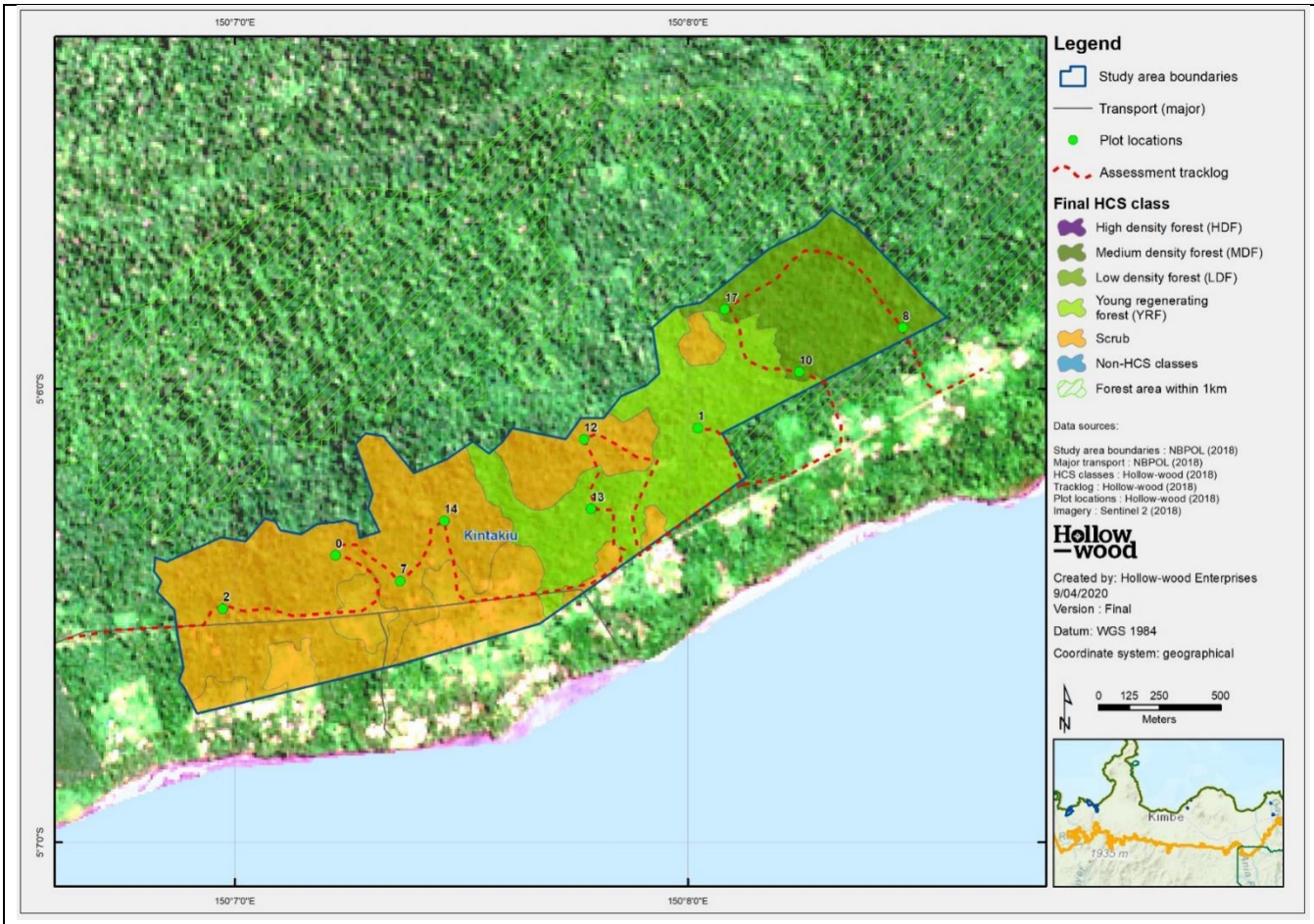



**Figure 11. Final HCS class, plot locations and track log for the Kintakiu study area.**

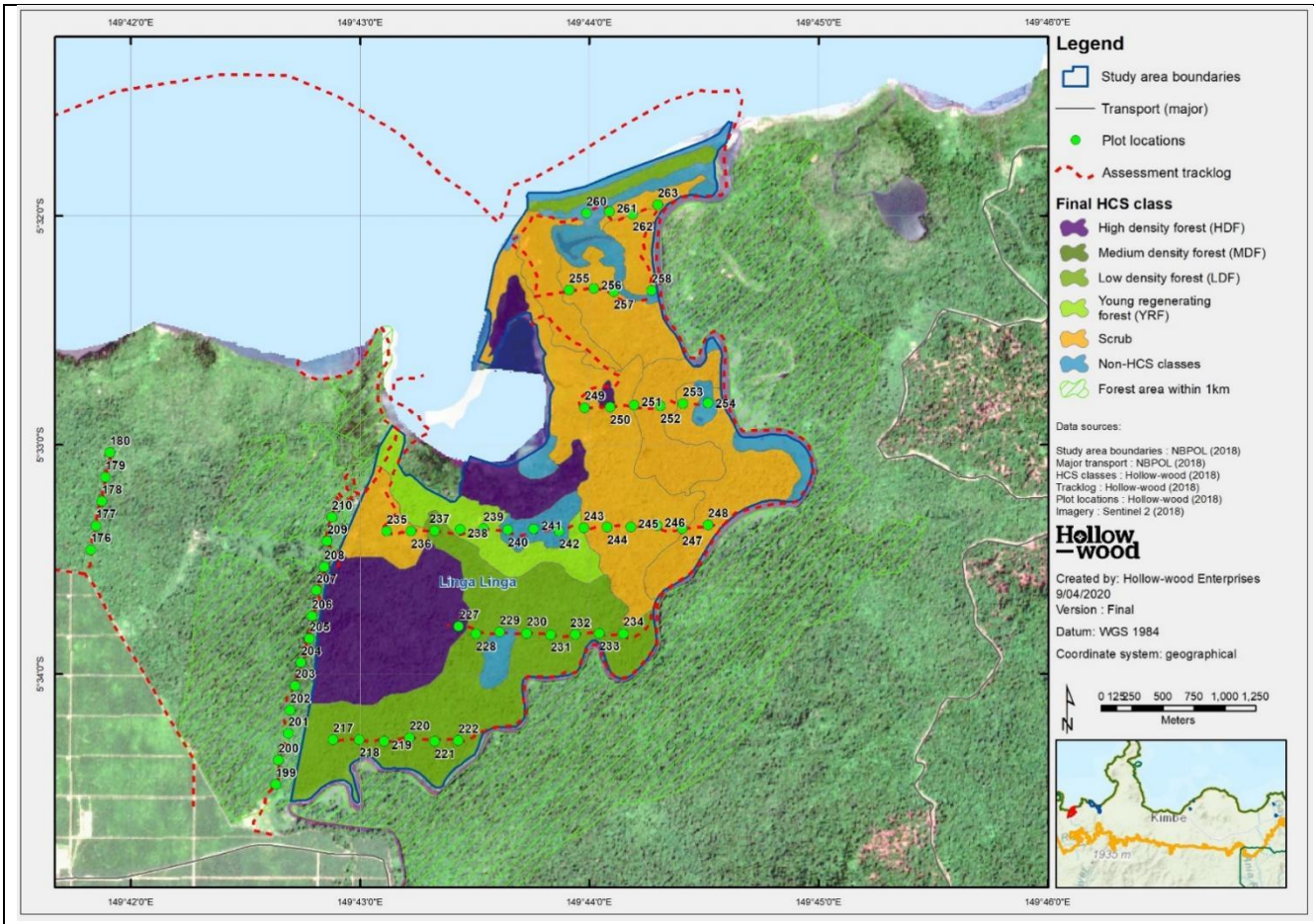



**Figure 12. Final HCS class, plot locations and track log for the Linga Linga study area.**

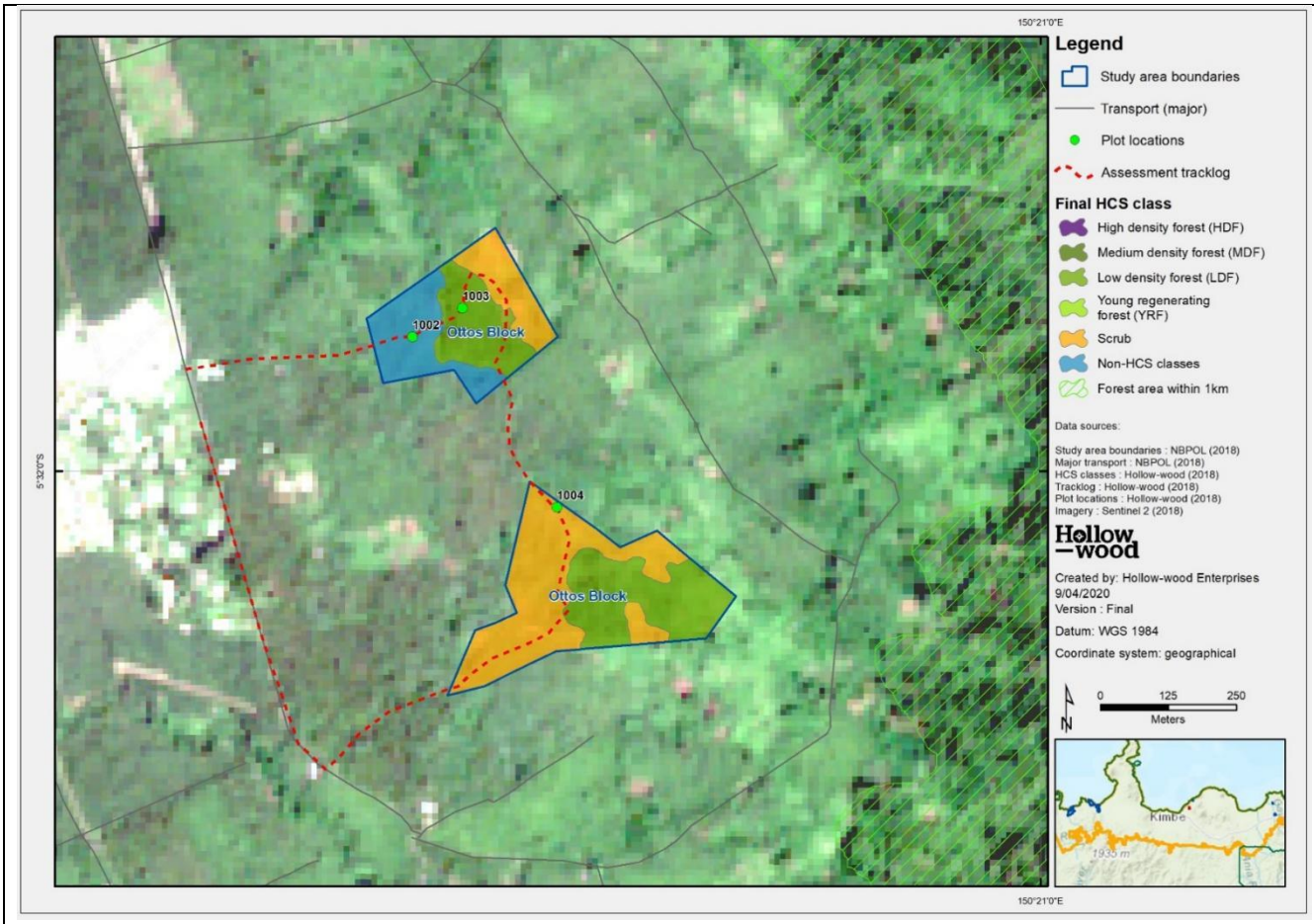



**Figure 13. Final HCS class, plot locations and track log for the Ottos Block study area.**

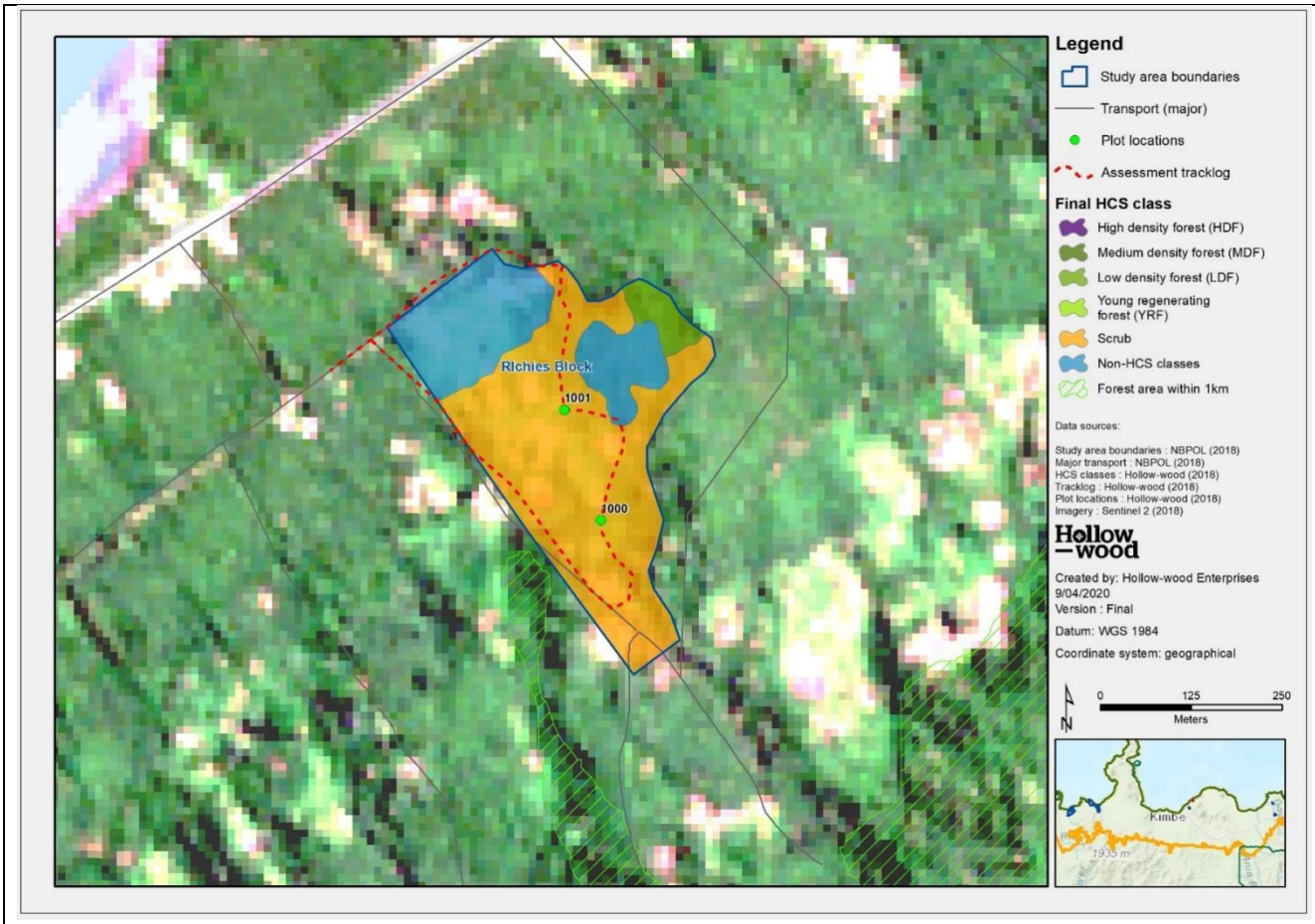



**Figure 14. Final HCS class, plot locations and track log for the Ritchies Block study area.**

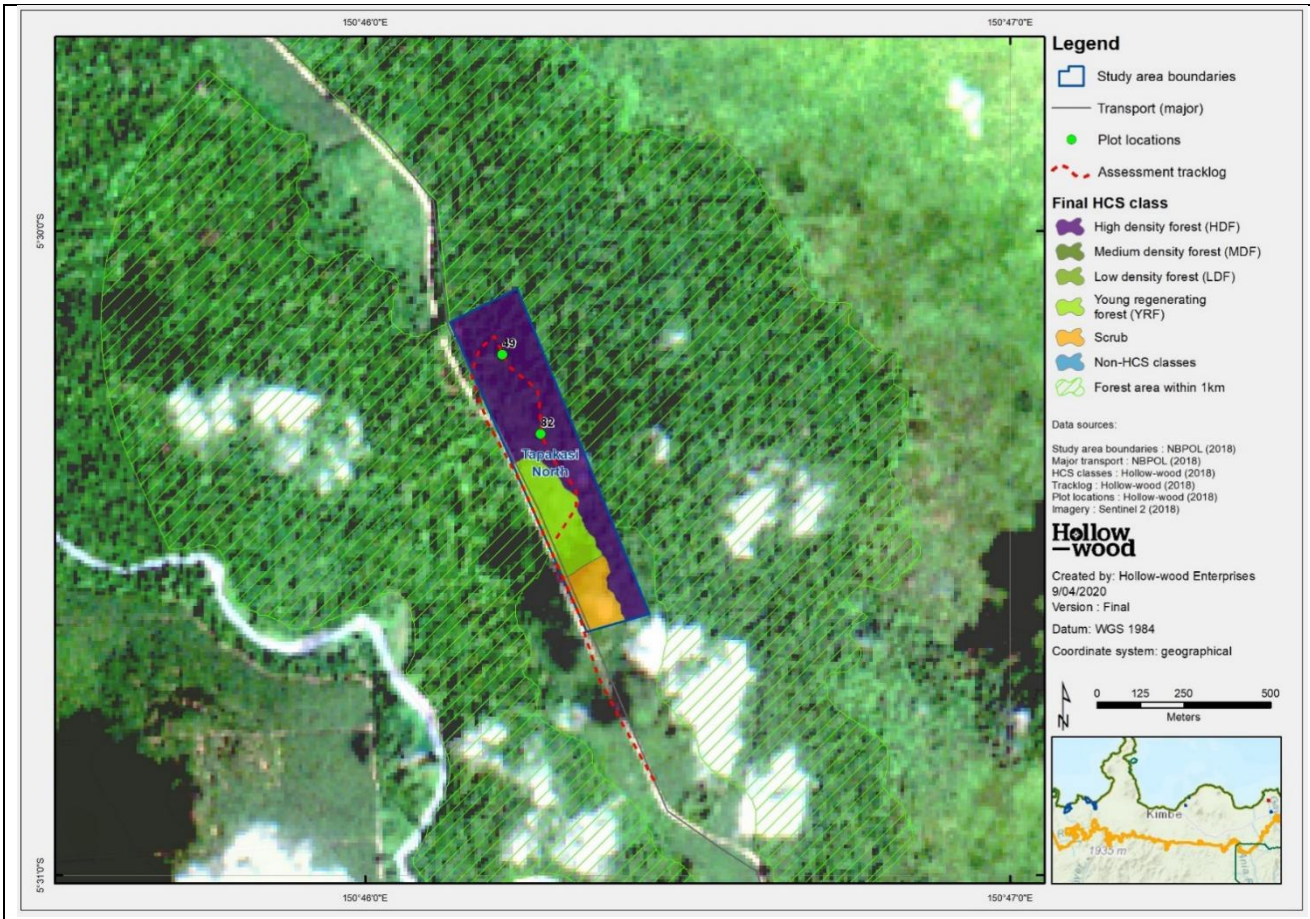



**Figure 15. Final HCS class, plot locations and track log for the Tapakasi Nth study area**

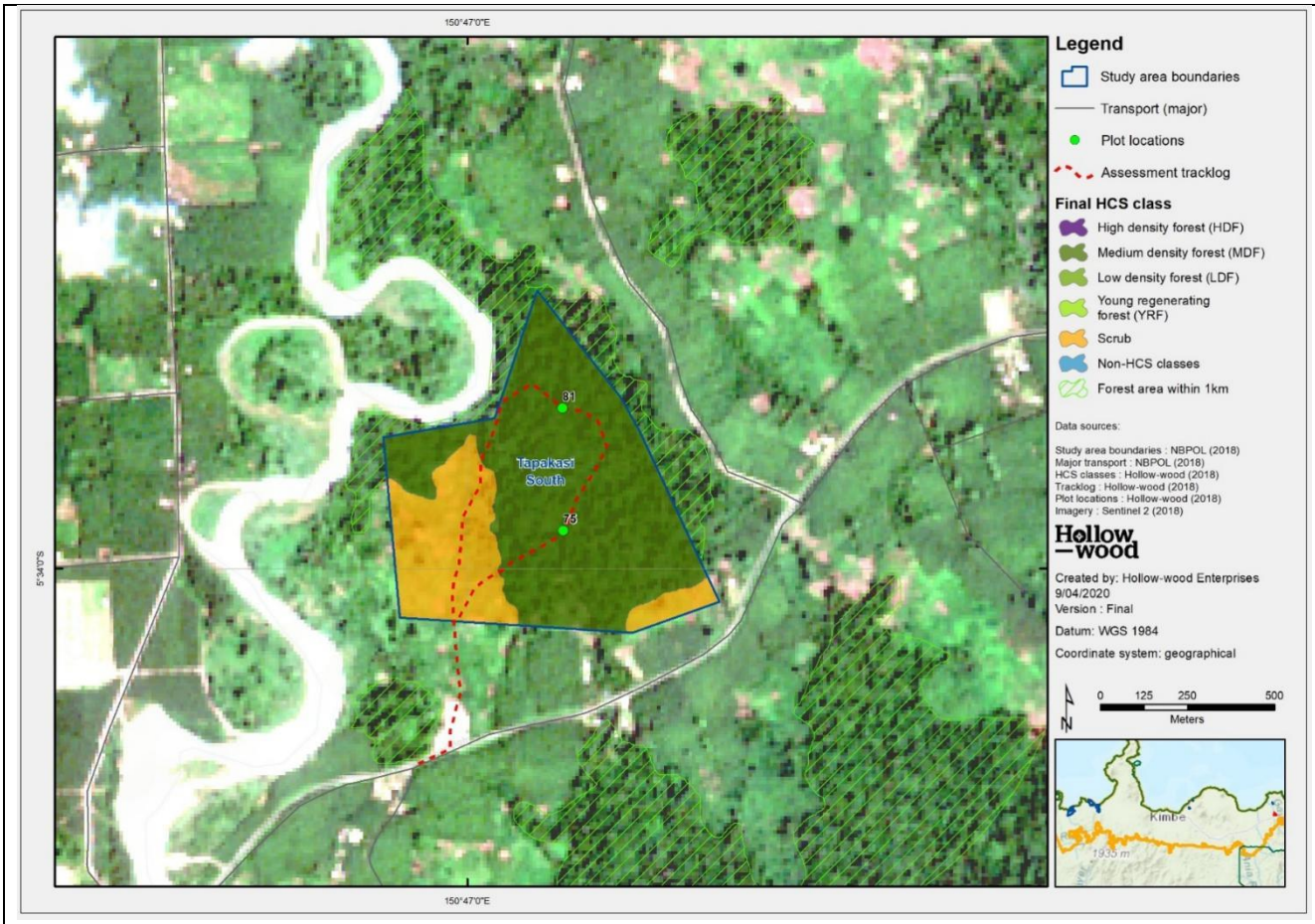



**Figure 16. Final HCS class, plot locations and track log for the Tapakasi Sth study area**

***Inventory method ( refer to 8.1.2.3 - HCV/HCS Assessment Report)***

All field inventory was performed in March 2018, and was done as per the methodology set out in Module 4, HCSA (2017). This inventory method consists of two nested circular plots with plot radii of 5.64m and 12.61m, equating to 100m2 and 500m2 respectively. Trees between 5 -14.9 cm are measured within the 5.64m plot and all trees >15.0 cm are measured within the 12.61m plot. Further detail can be found in HCSA (2017).

While HCSA plot data generally has a focus relating to determining above ground woody biomass, a range of other data is collected at each plot, such as species information, vegetation type, vegetation condition, stand structure and disturbance history, all of which proved to be a useful aid in determining the vegetation likely to be encountered during this assessment.

***Carbon calculation and data analysis ( refer to 8.1.2.4 - HCV/HCS Assessment Report)***

All plot data was analysed with 'R' statistical software package. Main outputs were summary statistics and the Scheffe post-hoc ANOVA. A summary of this analysis can be seen below in Section 9.4.

All biomass calculations were performed according to the method outlined in Chave *et al.*, (2014). This method is a two-step approach and utilises two models, Equation 4 and Equation 6a. Both models are pan-tropical allometrics, with equation 4 being a biomass allometric and equation 6a being a diameter / height allometric.

Critical to Equation 6a is a climatic variable or 'E-value'. This value is a co-efficient that is derived from the combination of both temperature seasonality (TS) and climatic water deficit (CWD). The E-value increases with both increasing TS and increasing CWD, with equation 6a predicting that tree height for a given diameter will decline with increasing

water and temperature stress (Chave *et al.*, 2014). The E-value dataset is supplied in raster format at resolution of 2.5 arc seconds (approximately 4.5km x 4.5km at latitude of the AOI), and the spatial locations of each of the HCSA plots were used to extract the appropriate E-value for each.

***Faunal survey methods ( refer to 8.1.2.4 - HCV/HCS Assessment Report)***

Faunal survey locations are shown below on Maps 43 – 48. Day time surveys (birds and mammals) utilised the track created by HCS / vegetation survey plot work, usually the next day, in order to minimise the chance of disturbing target taxa. Nocturnal amphibian and reptile surveys were mostly undertaken along the same routes.

A river-based survey (bird search) was conducted on the Kapaluk River, the eastern boundary of the Linga Linga study area.

Bird survey

In surveying birds, the line transect sampling method was employed where the observer walks along a designated path (in this case it was mostly existing tracks or roads through the study areas) and pauses for five to ten minutes at regular intervals. At each interval, bird species are either recognised by their calls or if they are sighted. Bird species identified by either vocalization or sightings are recorded as well as a tally drawn for the number of individuals of each unique species seen or heard(Bibby, Jones and Marsden, 1998)(Imanuddin, S. Percy, D. Priatna, L. D'Arcy, L. Sadikin, 2013).

Observations commenced between 5:30 AM and 6:00 AM. During the day, opportunistic sightings and other interesting observations made of birds were also recorded. An audio recorder (Zoom H1) was also used to capture bird calls. The audio records were analyzed post-survey to ascertain the presence of bird species at each location as well as identify other birds that may have been overlooked during the field surveys. A pair of binoculars (Olympus, 10 x 50 magnification) was used to visually identify birds while a point-and-shoot camera (Sony Cybershot DSC-RX100) was used to photograph birds, whenever possible, including the habitats in which birds were observed.

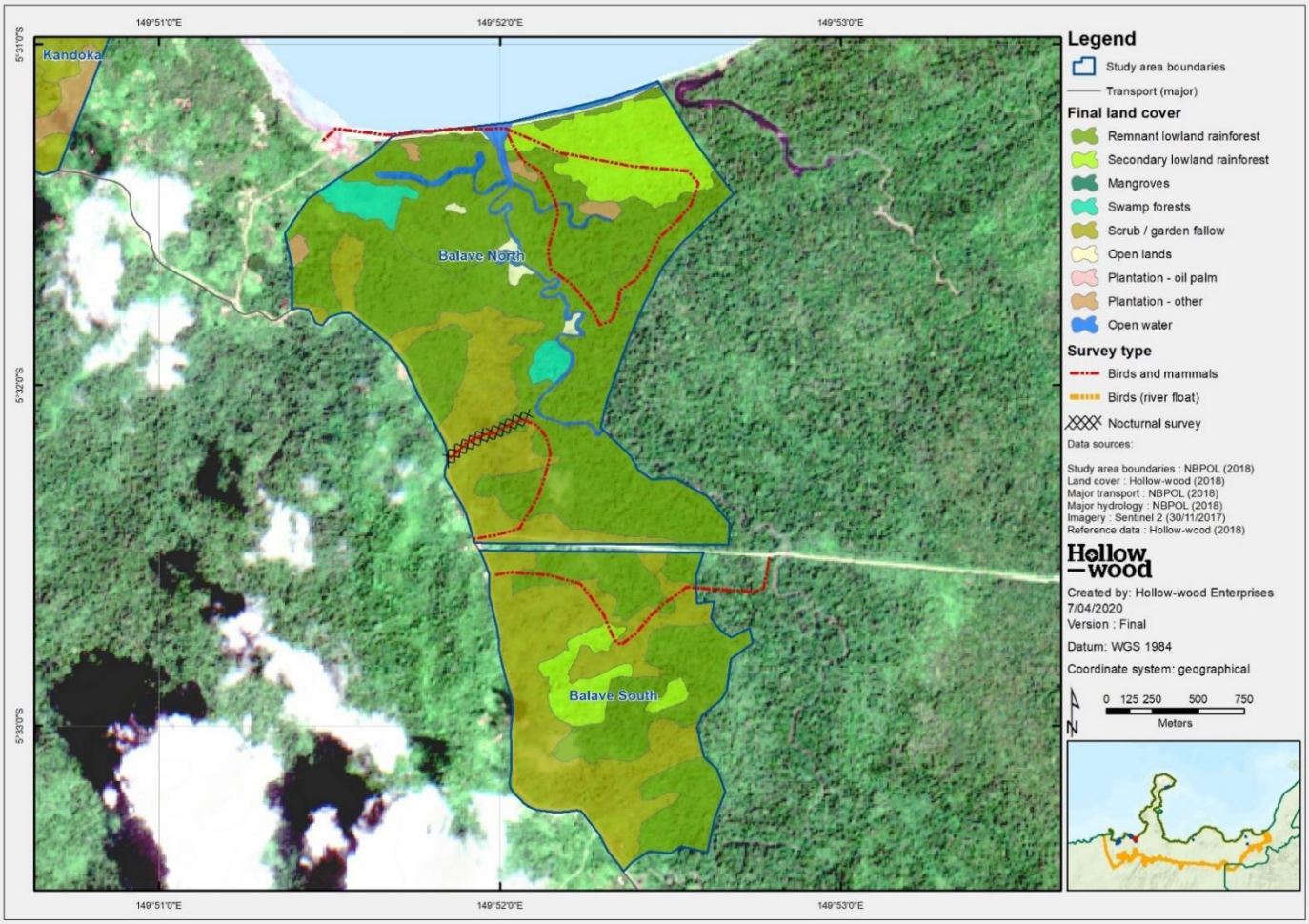
A comprehensive guide of the birds of Melanesia (Dutson, 2011) was used during informal interviews with members of the communities visited to verify the presence or absence of birds as well as collect local names of birds. During the survey, attempts were made to survey as many different habitat types as possible so as to affirm the extant species in these habitats as well as to find species that were included in the expected list of birds.

Mammal survey

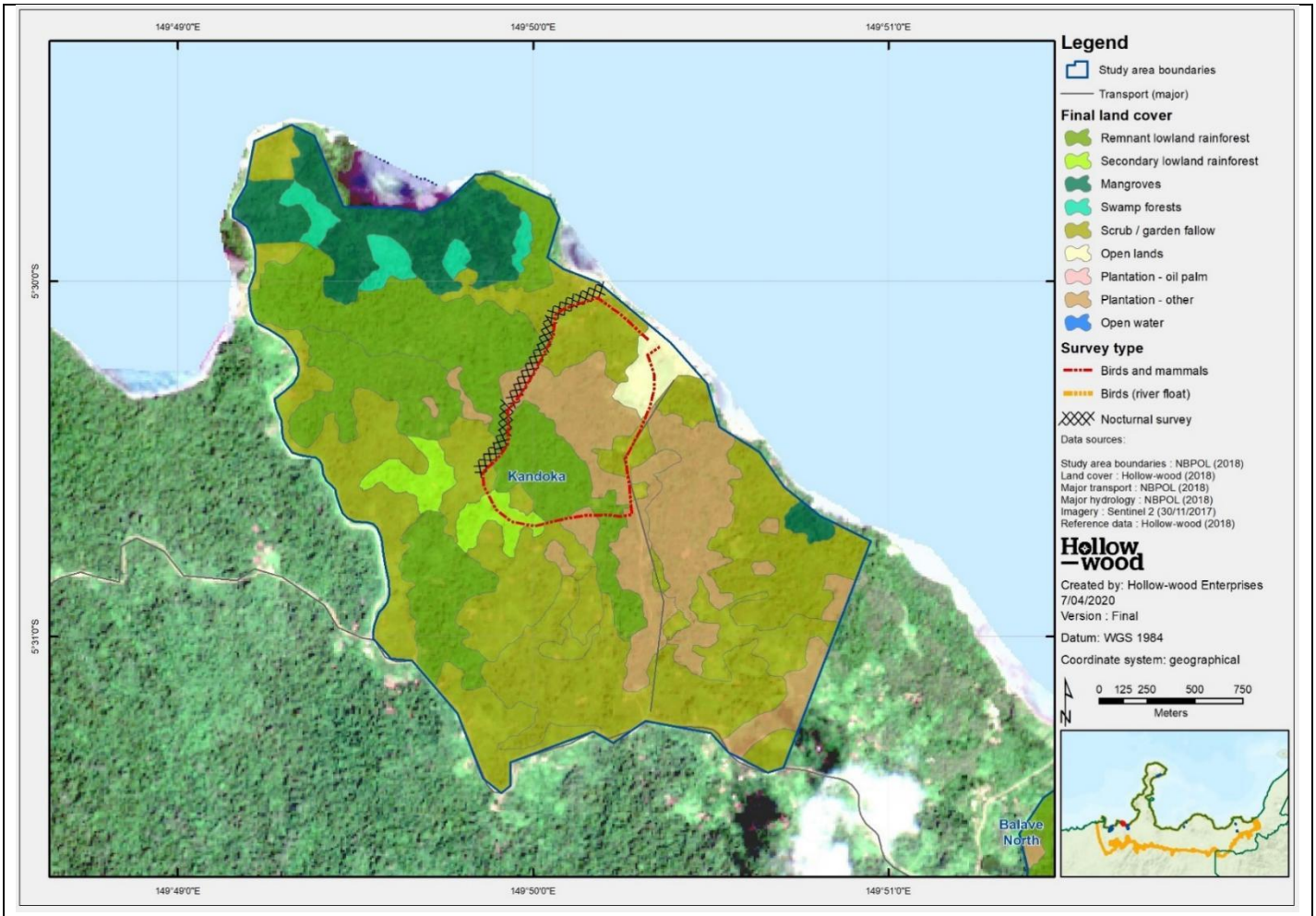
Mammal species were mainly identified by speaking with the NBPOL employees and the local villagers. Both groups were invaluable in providing information of extant mammals in the areas of interest; mainly based on their past experience. Day walks taken through the areas of interest were designed to maximize observations within various forest strata and/or grassland.

Reptiles and amphibians

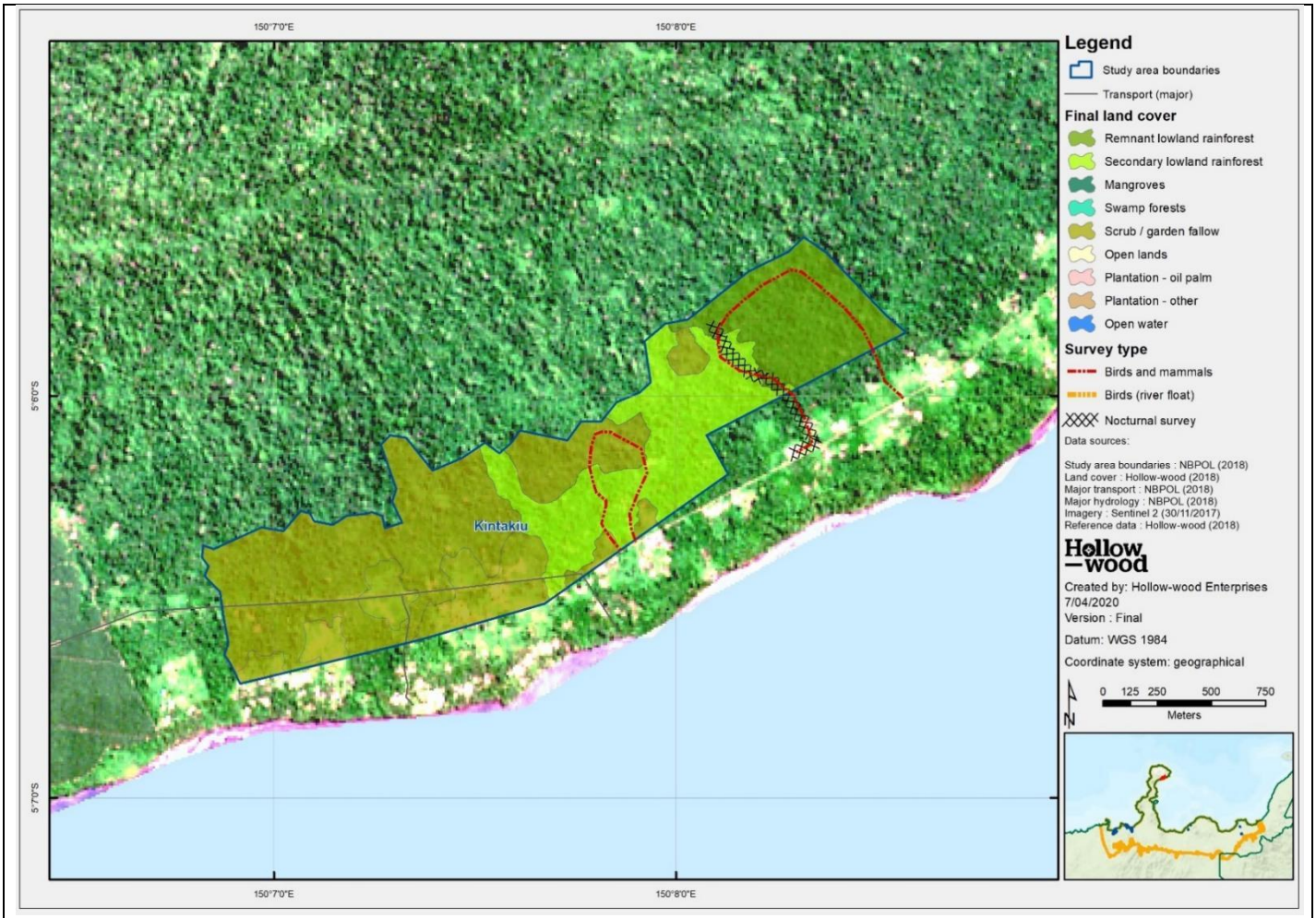
Amphibian and reptile species were more likely to be encountered at night. Night trips were taken to survey for amphibians and reptiles and this occurred concurrently with spotlighting for mammals. The same survey routes were used to search for both reptiles and amphibians as well as for mammals. Amphibians or frogs were found by following their calls and searching for them in the understory as well as under bush. An audio recorder (ZOOM H1) was also used to record frogs calling. The search for reptiles was done using a spotlight (Coleman HCX – 450 Lumens), hand-held LED torches and headlamps. The survey teams kept a close eye on the roads followed at night since snakes especially have a tendency to lie across the road at night. When a snake was spotted, photographs were taken and the species identified and recorded. Local denizens were also asked to recount any encounters they have had with reptiles or amphibian species in the past.



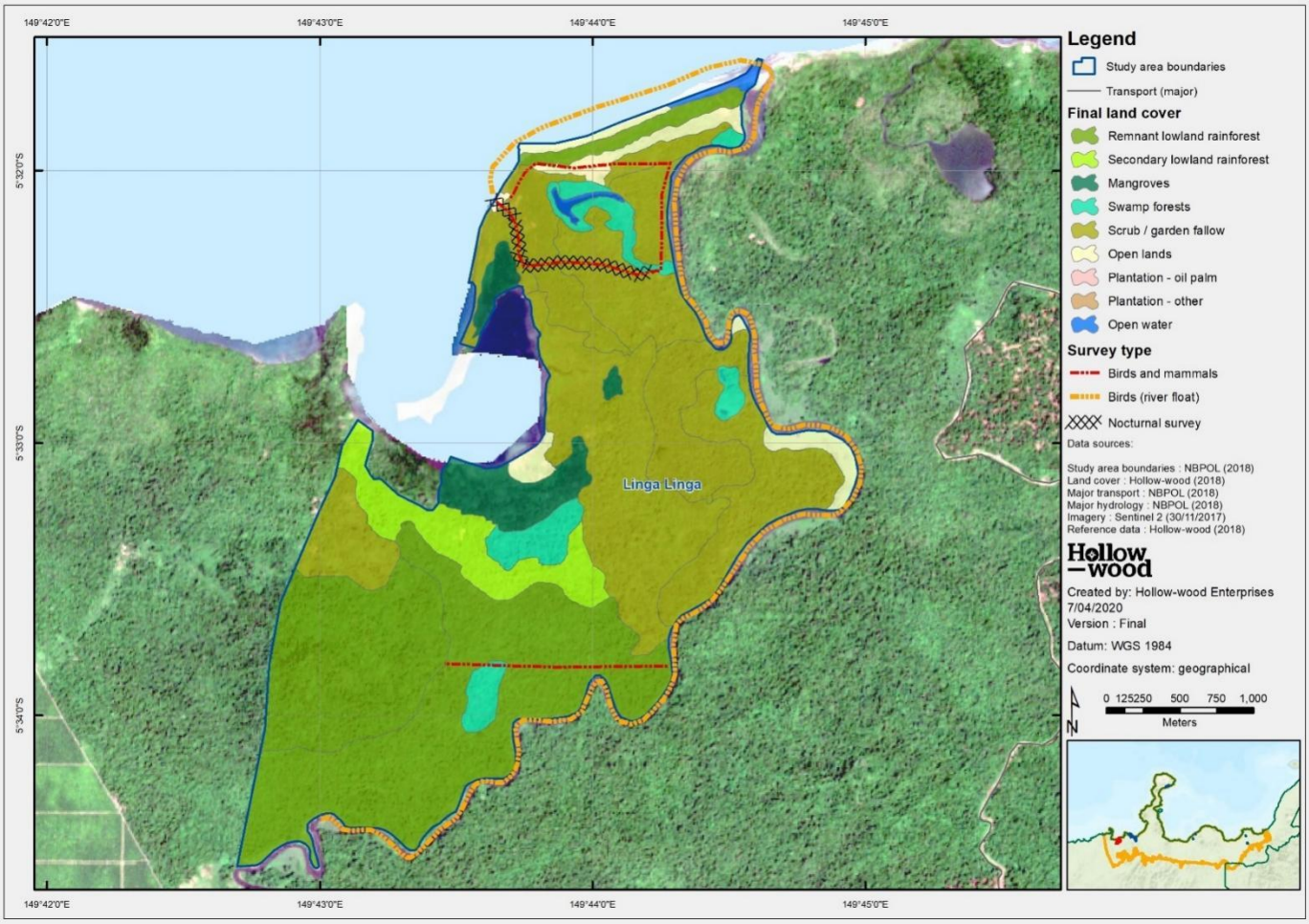

**Map 38. Faunal survey location for Balave North and Balave South study areas.**



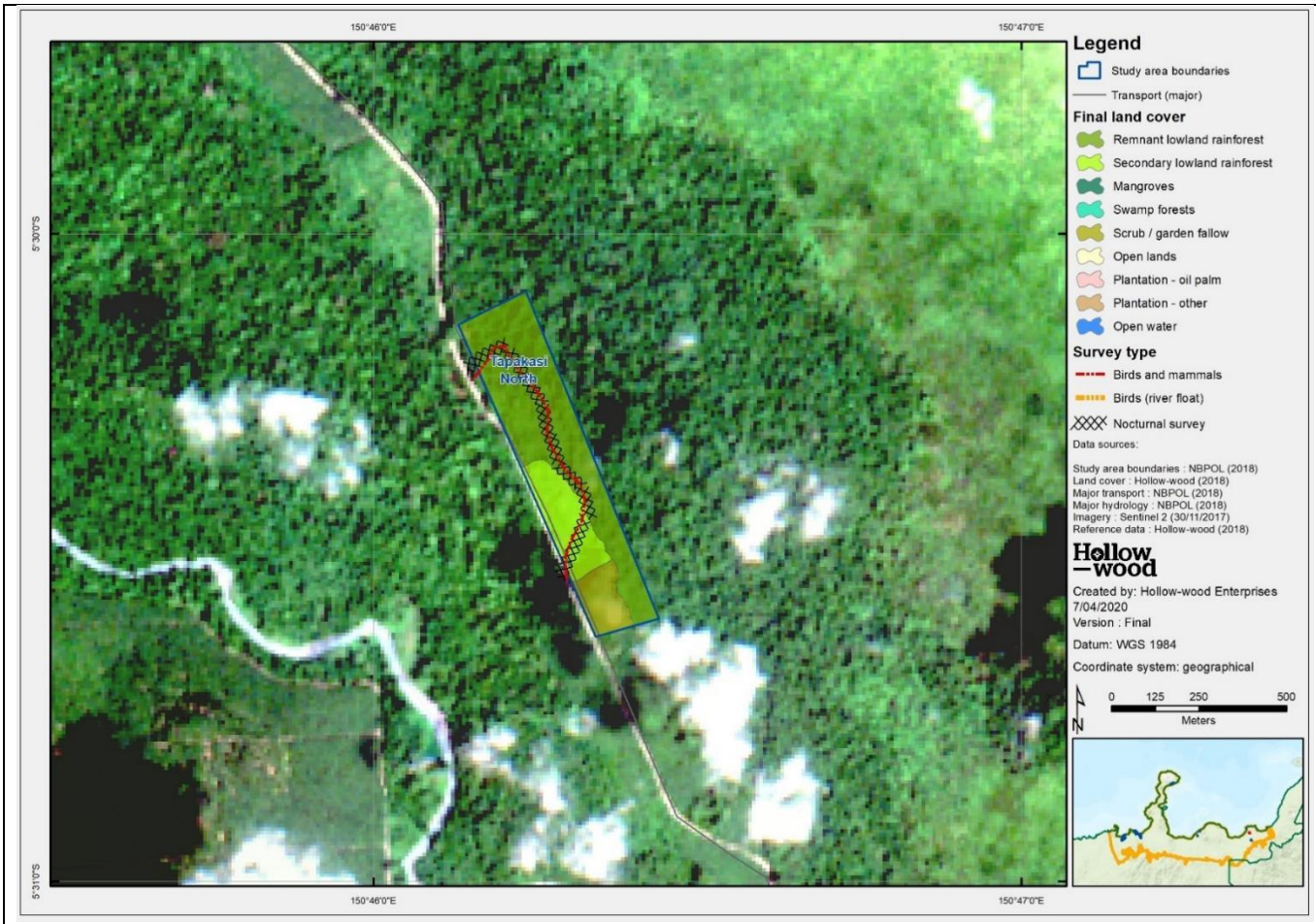

**Map 39. Faunal survey location for Kandoka study area.**



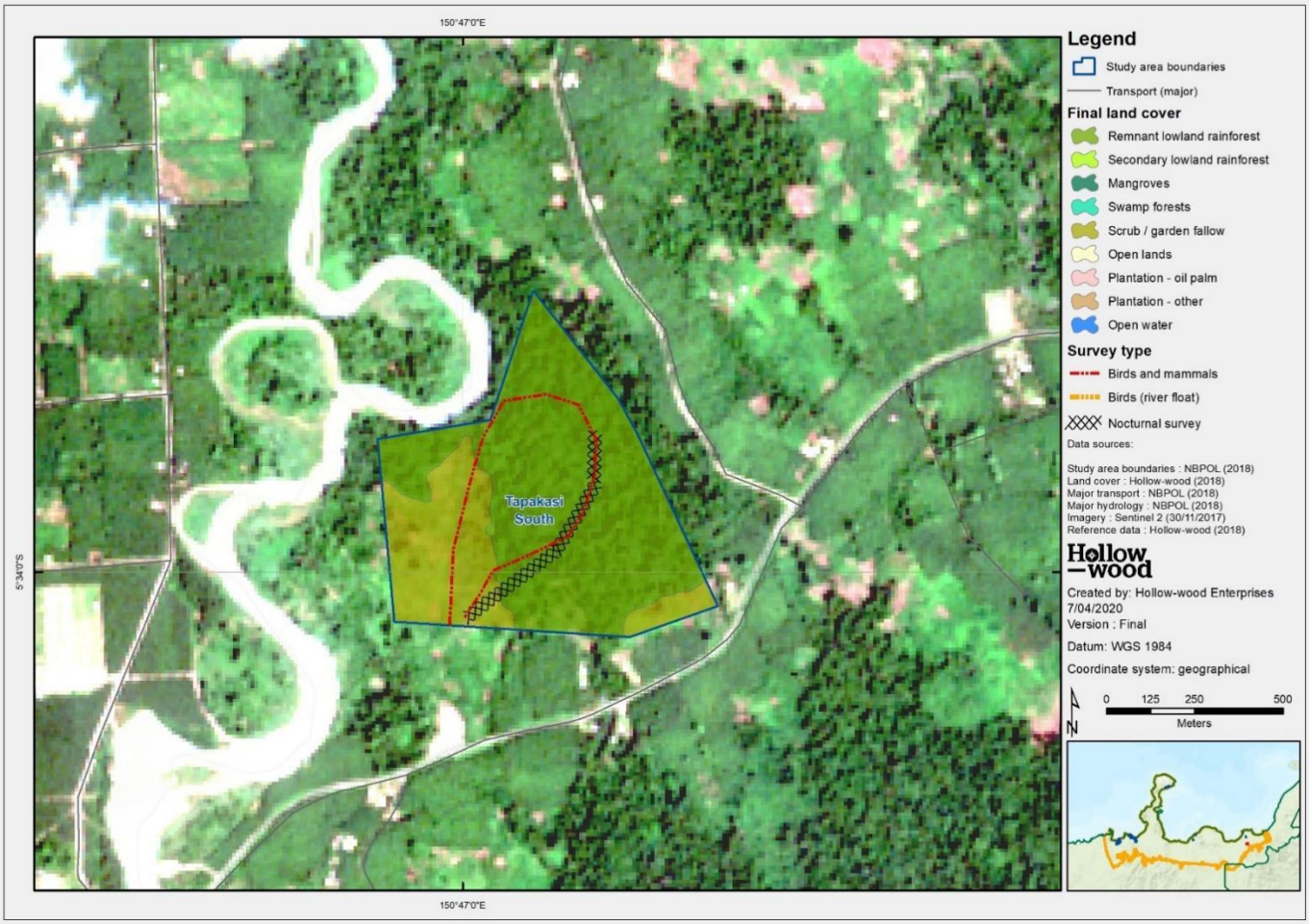

**Map 40. Faunal survey location for Kintakiu study area.**




**Map 41. Faunal survey location for Linga Linga study area.**




**Map 42. Faunal survey location for Tapakasi North study area.**




**Map 43. Faunal survey location for Tapakasi South study area.**

## Environmental HCV and HCS forest results

***HCSA forest classification and carbon assessment ( refer to 8.2.2 - HCV/HCS Assessment Report)***

Field inventory sought to develop distinct classes, with statistically separate mean values, to a 90% confidence level, consistent with the requirements of HCSA (2017). Areas of each class that are relevant to the statistical analysis are provided in Table 17 and descriptive statistics for these classes shown in Table 18. The results of the post-hoc Scheffe analysis of variance are provided in Table 19 to Table 21. and respectively.

The mean above ground carbon (ABC) values reported here are consistent with previously published carbon studies relevant to the PNG context, such as Fox *et al.*, (2010) and Arihafa *et al.*,(2015).

The results of the analysis of variance (ANOVA) test were positive with 'P-value' for the analysis being <.01, and the 'null hypothesis' rejected, indicating that overall variation between mean biomass values can be explained by HCS class. The results of the Scheffe, multiple comparison test, however, indicate variability present in the data, with no statistically significant separation being present between the YRF and Scrub, although 90% confidence interval error bars around the means do not overlap.

Although the results of the Scheffe test for this comparison returned at negative result, the fact that the 'P-value' for this comparison was very close to that needed to pass the test (0.12 when the value needed to pass the test is <=0.1, see Table 20) and that 90% CI error bars around the strata means do not overlap, indicates that the results are close and that there is likely some separation between these classes.

Separation between the HCSA forest classes (i.e MDF, LDF and YRF), was variable, with the relatively small sample in the MDF possibly contributing to this result.

Further analysis into the root causes driving the Scheffe analysis results revealed the following:

1. Scheffe analysis only considers the above ground carbon value, and does not take other factors, such as disturbance history and/or species composition at the plot level into account. The analysis is therefore only reporting on part of the factors that drive HCS plot classification, a serious limitation of this analysis.
2. Variation in the mean values reported for each HCS class is largely driven by variation in DBH at the plot level, and the presence of outliers within each HCS class. The scrub class has a very high concentration of trees with DBH <= 10cm, as to be expected for young, highly disturbed vegetation. There are, however, many trees with larger DBH present in the scrub class, a situation that accurately reflects the on-ground reality of delineating this class within the context of PNG. For example, it is very common for larger shade-bearing or fruit trees to be present in abandoned or fallow gardens (scrub class). If such trees fall within the pre-located plot, they are routinely measured and included in the analysis for that plot. The presence of such large trees could be eliminated by a number of approaches, such as moving the plot, not measuring such trees in the field, or removing 'outliers' during analysis. Such approaches represent poor inventory practice, and will have the effect of introducing unnecessary bias to the data, a situation not supported by the assessment team.

Advice Note 03: HCV – HCSA Assessment (HCSA, 2020) states the following:

*'Insignificant difference under the Scheffe test is not necessarily a failure unless there is some other contributing factor, such as poor stratification or sampling design'*.

This being the case, and the fact the strata descriptions are accurate and based on field observation, a two sample, unequal variance Students T-Test was performed, using 0.05, a higher confidence interval than prescribed in the Scheffe test (Table 16). This test returned a positive result and thus indicate significant difference between these two mean values.

**Table 16. Results of Students T-Test, comparing mean above ground carbon values between the 'Scrub' and 'YRF' classes ( ( refer to table 42, 8.2.2 - HCV/HCS Assessment Report).**

| t-Test: Two-Sample Assuming Unequal Variances | | |
|---|---|---|
| | ***Scrub*** | ***YRF*** |
| **Mean** | 38.68 | 80.26 |
| **Variance** | 1789.24 | 5356.28 |
| **Observations** | 53 | 50 |
| **df** | 77 | |
| **t Stat** | -3.5036 | |
| **P(T<=t) one-tail** | 0.0004 | |
| **t Critical one-tail** | 2.3758 | |
| **P(T<=t) two-tail** | 0.0008 | |
| **t Critical two-tail** | 2.6412 | |

**Table 17. Area of HCSA classes by study area. ( refer to table 44, 8.2.2 - HCV/HCS Assessment Report)**

| Final HCSA class | Balave North | Balave South | Kandoka | Kintakiu | Linga Linga | Ottos Block | Ritchies Block | Tapakasi North | Tapakasi South | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **High density forest (HDF)** | 68.54 | 0.00 | 55.01 | 0.00 | 168.02 | 0.00 | 0.00 | 13.67 | 0.00 | 305.24 |
| **Medium density forest (MDF)** | 4.63 | 0.00 | 93.28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 39.89 | 137.80 |
| **Low density forest (LDF)** | 157.73 | 70.89 | 54.99 | 35.94 | 240.11 | 5.88 | 0.54 | 0.00 | 0.00 | 566.07 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Young regenerating forest (YRF) | 39.84 | 15.80 | 16.85 | 54.43 | 55.46 | 0.00 | 0.00 | 3.94 | 0.00 | 186.31 |
| Scrub | 56.96 | 89.33 | 273.86 | 121.18 | 400.29 | 7.08 | 8.59 | 2.18 | 15.02 | 974.49 |
| Non-HCS | 35.57 | 0.00 | 124.51 | 0.00 | 94.08 | 2.37 | 3.76 | 0.00 | 0.00 | 260.29 |
| Grand Total | 363.26 | 176.02 | 618.50 | 211.55 | 957.96 | 15.32 | 12.89 | 19.78 | 54.90 | 2430.19 |

**Table 18. Summary of statistical analysis of carbon stocks per vegetation class ( refer to table 45, 8.2.2 - HCV/HCS Assessment Report)**

| Land cover class | Area (ha) | Plot # (n) | Mean Carbon stock (tC/ha) | Carbon stock standard error (tC/ha) | Confidence limits (90%) (tC/ha) | | Total Carbon stocks (tC) |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| HDF | 305.24 | 20 | 185.55 | 24.17 | 145.91 | 225.19 | 56636.67 |
| MDF | 137.80 | 12 | 140.92 | 21.72 | 105.30 | 176.55 | 19418.59 |
| LDF | 566.07 | 45 | 111.69 | 11.45 | 92.91 | 130.47 | 63224.01 |
| YRF | 186.31 | 50 | 80.26 | 10.35 | 63.29 | 97.24 | 14953.56 |
| Scrub | 974.49 | 53 | 38.68 | 5.81 | 29.15 | 48.20 | 37693.12 |
| Non-HCS | 260.29 | 12 | 91.07 | 18.43 | 60.85 | 121.29 | 23704.17 |
| Total | 2430.19 | | | | | | 215630.11 |

**Table 19. Results of ANOVA test ( refer to table 46, 8.2.2 - HCV/HCS Assessment Report)**

| ANOVA | | | | | |
|---|---|---|---|---|---|
| Source | SS | df | MS | v.r | Sig Diff (F pr.) |
| Model | 378765 | 5 | 75753 | 14.92 | Yes (<0.1) |
| Error | 944150 | 186 | 5076 | | |
| Total | 1322916 | 191 | | | |

**Table 20. Scheffe post hoc analysis results ( refer to table 47, 8.2.2 - HCV/HCS Assessment Report)**

| | Difference | Lower 90% | Upper 90% | t | P-value | Significant (p – value <0.1) |
|---|---|---|---|---|---|---|
| Comparison | | | | | | |
| Scrub vs YRF | -41.59 | -84.6 | 1.46 | -2.961 | 0.1246 | no |
| Scrub vs LDF | -73.01 | -117.3 | -28.75 | -5.056 | 0.0002 | yes |
| Scrub vs MDF | -102.25 | -172.1 | -32.44 | -4.489 | 0.0017 | yes |
| Scrub vs HDF | -146.87 | -204.2 | -89.57 | -7.855 | 0 | yes |
| YRF vs LDF | -31.43 | -76.3 | 13.44 | -2.147 | 0.4681 | no |
| YRF vs MDF | -60.66 | -130.9 | 9.53 | -2.649 | 0.225 | no |
| YRF vs HDF | -105.29 | -163.1 | -47.52 | -5.586 | 0 | yes |
| LDF vs MDF | -29.24 | -100.2 | 41.71 | -1.263 | 0.9011 | no |
| LDF vs HDF | -73.86 | -132.5 | -15.18 | -3.858 | 0.0131 | yes |
| MDF vs HDF | -44.62 | -124.4 | 35.11 | -1.715 | 0.7088 | no |

**Table 21. Significant differences from Scheffe post hoc analysis ( refer to table 48, 8.2.2 - HCV/HCS Assessment Report)**

| Land cover class | HDF | MDF | LDF | YRF | Scrub |
|---|---|---|---|---|---|
| HDF | | NO | YES | YES | YES |
| MDF | | | NO | NO | YES |
| LDF | | | | NO | YES |
| YRF | | | | | NO |
| Scrub | | | | | |

The total area for conservation is 1445.62 ha of the 2430.18 ha that were assessed. This is 59% of the area is for conservation. This reflects that there is a very high level of forest cover in this landscape.

| | Presence | Area (ha) | Justification |
|---|---|---|---|
| **HCV 1** | Present | 896.65 | The Blue Eyed Cockatoo, New Britain Sparrowhawk, Bismarck Kingfisher, Red-knobbed Imperial Pigeon (all IUCN:VU) and Blyth's Hornbill (Protected GoPNG) were sighted in and around the assessment areas. The vegetation species of interest are Diospyrus insularus (IUCN:EN), Pterocarpus indicus (IUCN:VU) and Intsia bijua (IUCN:VU).<br><br>Mangroves identified during image analysis at two sites (Linga linga and Kandoka)<br><br>HCV1 was mapped in six sites: Balave North, Balave South, Kintakiu, Kandoka, Lingalinga and Tapakasi North. This was based on the presence of the previously mentioned species.<br><br>Therefore, HCV 1 was deemed present in six sites: Balave North, Balave South, Kandoka, Kintakiu, Linga linga and Tapakasi North. |
| **HCV 2** | Not Present | 0 | There is no intersection between the assessment area with intact forested landscapes (nor any forested landscapes of the required threshold size). The New Britain Sparrowhawk, an HCV 2 indicator species, was sighted in Balave. However, in recent years the IFL that once existed nearby Balave has been pushed back several kilometres. These intact forest dependent species have probably not adjusted to the loss of forest habitat. For this reason, HCV 2 is deemed Not Present. |
| **HCV 3** | Present | 736.61 | The endangered ecosystems that overlap with the assessment area are mangroves, swamp forests and "lowland rainforest (plains and fans)." These are present in all the blocks (except Otto's and Richard's Block and Kintakiu) HCV3 is therefore deemed Present. |
| **HCV 4** | Present | 475.94 | There are many rivers, swamps and mangroves in the assessment area. Additionally, many of the estates are on the coast. All these require buffers that are considered HCV 4.<br><br>Additionally areas with slopes greater than 25 degrees are considered HCV 4. Therefore, HCV 4 was deemed present in three sites: Balave North, Lingalinga and Kandoka |
| **HCV 5** | Present | 1.71 | In Richard's block HCV 5 is deemed to be absent because it is essentially a vacant block with no one living or using this area.<br><br>For the other areas. The communities living in and around the assessment areas are reliant on natural areas for meeting their basic needs. Of note are timber for house construction, drinking water, fish the occasionally hunted animal for eating and fuel wood. Most of these resources are currently sourced throughout the whole landscape at a very low extraction density. The plan is that all these resources will be sourced external to the development area. HCV 5 is mapped over the areas external to the assessment area. Additionally, HCV 5 is mapped within the assessment area over the swamps, springs and rivers; these areas are important as a source of fish and water (drinking water was typically taken from ground water). Therefore HCV 5 is deemed Present. |
| **HCV 6** | Present | 21.13 | In the Kintakiu there is Lake Dakataua which is outside the assessment area and the large strangler fig and sacred hill in Lingalinga. Therefore HCV 6 is deemed to be Present. |

| | | | |
|---|---|---|---|
| **HCS Forest** | Present | 1196.85 | In every block there are forested patches that are considered HCS forest. |

*Table 22. Area Statement (ha) . The locations of the HCV areas are mapped in( refer to 10.4 - HCV/HCS Assessment Report)*

| Area Type | Area (ha) |
|---|---|
| **HCV1** | 896.65 |
| **HCV2** | 0 |
| **HCV3** | 736.61 |
| **HCV4** | 475.94 |
| **HCV5** | 1.71 |
| **HCV6** | 21.13 |
| HCS | 1196.85 |
| **Total Conservation Area** | 1445.62 |
| **Total Developable Area** | 967.86 |
| **Total Assessment Area** | 2430.18 |

**Section 5: FPIC**

*Guidance Note: This section is where the information on stakeholder mapping is put and all required information that the building blocks for FPIC have been conducted. References and pictorial evidence are recommended. What are the methodology(ies), people involved in the process, date of assessment and findings?*

FPIC Prior to the HCV-HCS Study

There had been many community meetings, dating back as far as eight years (in some cases). So, the assessor was convinced that every member of the community was well informed about oil palm development. A chronology of meeting is available in Appendix 14.6. Permission to undertake the survey is documented in meeting notes - 14.25. Hard copies of these were provided during Scoping and FA. The following is documentation of FPIC at the time of the assessment start.

**Balave / Kandoka**

| DOCUMENTATION SUMMARY ON PROPOSED BALAVE PROJECT | |
|---|---|
| | |
| **Date** | Description |
| **Jun-09** | Initial Interest (Verbal)_refer to 1st Inspection Report dated 24/05/2010. |
| **24/05/2010** | 1st Inspection report, inspection conducted on 13/05/2010 |
| **26/05/2018** | Awareness Meeting at Kandoka with Loko Clan members -Minutes yet to compile |
| **19/11/2013** | Brief update & map on Balave HCV field investigation |
| **19/05/2018** | Minutes - Meeting with Balave clan leaders on 19/04/18 |
| **19/01/2018** | Report on Land Investigation performed by Provincial Lands Office for the application of Customary Land Title (VCLR) by Loko ILG ( Incorporated Land Group) |
| **18/05/2017** | Follow up on status of NBPOL's Pre-Assessement reports |
| **14/01/2016** | Internal email correspondence regarding NBPOL's pre-assessment of HCS on Balave project |

| | |
|---|---|
| **13/01/2016** | Meeting Minutes - regarding HCS assessments as per NPP requirements and the likely outcome of this assessment over Balave project |
| **10/'04/2013** | FPIC Meeting at Kandoka village |
| **01/11/2014** | 2nd Inspection report |
| **10/12/2011** | Balave HCVF field work payment record |

**Kintakiu**

| DOCUMENTATION SUMMARY ON PROPOSED KINTAKIU PROJECT | |
|---|---|
| **Date** | Description |
| **15/01/2008** | Intial Interest Letter |
| **28/09/2009** | 1st Inspection report, inspection conducted on 17/09/2009 |
| **28/02/2011** | FPIC meeting held at Kintakiu Village on 16/02/2011 |
| **24/09/2011** | Email conversation re WNB HCV assessments by Lewie Dekker |
| **13/04/2016** | Meeting with Kintakiu Landowners RSPO |
| **12/'04/2010** | 2nd Inspection report with map, inspection conducted on 17/03/2010 |
| **09/'08/2011** | Record of RHCV payments & field work done by S.Keu |
| **4/12/2018** | Meeting Minutes - Meeting with Kintakiu Leaders at Mosa |
| **5/1/2018** | Email conversation with B.Mane re dispute over Kintakiu |
| **5/1/2018** | Meeting with Kintakiu landowners at Kintakiu village - Minutes yet to complete |
| **5/7/2014** | RSPO NPP - Draft Summary Report of HCV & SEIA |
| **Feb-12** | HCVF report by A.J.F.M Dekker |
| **Oct-11** | Report on Rapid HCV assessment on Kintakiu by S.Keu |
| **Oct-11** | Report on Preliminary HCV assessment on Kintakiu by S.Keu |
| **8/5/2011** | Draft report on RHCVF |

16/01/08

MR. ESHLEY BARNES
MANAGER MINI - ESTATE:
MOSA - N.B.P.O.L
WEST NEW BRITIAN
15/01/08

MORO - NGAVA CLAN
GROUP BULUMURI - VILLAGE
TALASEA
W.N.B P.
15/1/08.

REF: PROPOSE - COMM - PLANTING

1) Mi OLSEM CHAIRMAN, Mipela lgat Bikpela Hamamas Tru long Joinim olspela Community - PLANTING, SCHEME.

2) Mipela i Laik Bai You Yet MANAGER, Bai You Kam Daon Na Lukim olspela GRAUN we mipela i Laik PLANIM Palm LONG en.

3) Bikos Mipela i SAVE olsem olspela PROGRAMME Bai i HELPim MIPELA Gut Tru.

4) Mipela Bai Amamas Tasol LONG BIHAINim OL Guidelines we Yupela Bai Setim LONG en

THANK You:
CHAIRMAN:
SIGN JOE NGAVA

Love Clan

**Figure 17. Initial Expression of Interest letter from the community regarding Kintakiu (dated 15-01-08)**

**Lingalinga**

| DOCUMENTATION SUMMARY OF PROPOSED LINGALINGA PROJECT | |
|---|---|
| **Date** | Description |
| **5/12/2008** | Initial Interest Letter |
| **19/04/2018** | Meeting with Julius Ngatia re NPP Assessments over Lingalinga Plantation - Minutes yet to compile |
| **27/07/2016** | Email Correspondence - Oil palm development & RSPO assessments |
| **Oct-14** | Full High Conservation Value Assessment Report for Lingalinga - By Ted Mamu |
| **12/7/2012** | Email Correspondence - HCV & Social Impact Assessment over Lingalinga Pltn |
| **Jun-12** | Proposed New Mill Site Assessment Report |
| **18/12/2010** | Email Correspondence - Lingalinga |
| **30/03/2010** | Email Correspondence regarding Julius Ngatia's Request for support letter to attach with his bid for an Ausaid project at Bialla |
| | Draft letter |
| | Draft letter |
| | Maps |

**Tapakasi North and South**

| No. | Activity | Date | Time | Venue |
|---|---|---|---|---|
| | | | | |
| **1** | Tapakasi Letter to SHA, | 30/06/2016 | | |
| | NBPOL | | | |
| **2** | Joint Lands & Sustainability | | | |
| | Village meeting Pre-NPP | | | |
| | Consultant Visit Meeting | | | |
| | plan | | | |
| **3** | Tapakasi Sketch Map | | | |
| | | | | |
| **4** | Summary of Events leading | | | |
| | up to May 2018 NPP | | | |
| | Assessments | | | |
| **5** | Application for Timber Rights | 20/04/2016 | | |
| | Permit | | | |
| **6** | Tapakasi North & South | | | |
| | sketch maps | | | |
| **7** | FPIC Engagement-HCV 5- | | | |
| | Notes | | | |
| **8** | Schedules of Owners, | | | |
| | Status and Rights to the | | | |
| | Land | | | |
| **9** | NPP Scoping Entry Meeting | 16/10/2017 | 8.00 am-9.55am | Mosa, Lands |
| | | | | Conference Room |

| | | | | |
|---|---|---|---|---|
| **10** | NPP Scoping Assessment | 16/10/2017 | 1.00-4.00 pm | Tapakasi |
| | | | | North/South Project |
| | | | | area |
| **11** | FFPIC Meeting | 11/04/2018 | 1.35-2.35pm | Mosa, Lands |
| | | | | Conference Room |
| **12** | Social Assessment report | 14/06/2018 | Whole Day | Kae, Sisimi, Taborbi |
| | | | | Villages |
| **13** | FPIC Meeting | 17/04/2018 | 10.15 am-12.00 | Moroa Plantation |
| | | | pm | Office |
| **14** | Brief History of Baumumu | 07.09.18 | | |
| | Clan | | | |

At the actual assessment the following procedures were used for the final consultation. The procedure for the communities was for a member of the NBPOL Sustainability Department to visit each of the communities one week prior to the assessor visiting them and give them a copy of the map (Conserve / Develop Map) which showed the results of the assessment that was relevant to their land. This would give them time to look at the map and consider their options.

Additionally, the assessor used this opportunity to check the outputs of the Participatory Mapping. Especially regarding the complete extent of clan's land, sometimes this didn't make sense, so the assessor went back to the clan to reconfirm it. Additionally, the assessor explained the methods and the results of the assessment to the communities and answered any questions. Finally asking the communities if they understood the results and agreed with the outcome (which, in all cases they accepted the outcome).

All clans had the next steps explained. The assessor pointed out this involved getting the report reviewed by HCVRN. This took a long time and suggested the community start negotiating with NBPOL regarding the terms and condition of their agreements.

**Table 23. Final Consultation Results (these were group meetings)**

| Community | Date | No. Attending[10] | Discussion | Assessor Response |
|---|---|---|---|---|
| **Tapakasi North and South** | 12.3.2019 | 4 | 1. This area is mired in internal land disputes. In Tapakasi North there are 4 clans (Ilaolao, Mararea, Hailili and Ugeuge). As well as this Jacob Patore had tried to develop Tapakasi North with no proper consultation with the villages involved. At this stage Kosmos Bubu stated that he wanted to see no development of the area.<br>2. In Tapaksi South the area was being disputed by Camilus Kaore. There was a court | 1. The assessor stated that this was the communities' opportunity to get some development. If they didn't resolve their internal problems then this window of opportunity would rapidly close. |

[10] Not including company staff

| | | | | |
|---|---|---|---|---|
| | | | dispute over the area and up for land mediation. Up till now there is no resolution.<br>3. A second meeting was undertaken with the other clan members. Unfortunately, Jacob Patore had told all the other members to go home. There were only 4 people left. This was seen as evidence of the divisions relating to this land. | |
| **Kintakiu** | 13.3.2019 | 33 | 1. Some clan members didn't attend because they had other affairs to attend to, but they had discussed the map and the members that were present were given the approval to go ahead.<br>3. The community were in general keen to go ahead with the development of the Kintakiu land. They wanted to know what they could do in the conservation area. Was limited timber extraction permissible. The assessor replied that he was currently following up on this issue because he was unsure himself.<br>4. Was land rental going to be paid over the protected area?<br>5. The community requested help marking up the conservation area. NBPOL agreed that a team could be sent out with some materials to assist.<br>6. The community were keen to use the "give and take" option. They marked up the approximate areas of "give and take" and asked that the assessor balanced the areas appropriately. | 1. The assessor mentioned that their village was in a KBA and asked whether the people were aware of this. They mentioned that a scientist had told them about it but never sought their approval nor had anyone consulted them.<br>2. Regarding land rental – The assessor replied that this was something that would have to be negotiated with NBPOL.<br>3. The assessor said theat he would incorporate their "give and take" into the final result. |
| **Otto's Block** | 14.3.2019 | 1 | 1. Questioned why it was taking so long. Could he go ahead and develop the area now. | The assessor replied that if he went ahead NBPOL wouldn't be able to buy fruit off him. |
| **Richie's Block (sometimes referred to** | 14.3.2019 | 1 | 1. There were no questions or concerns. | Noted |

| | | | | |
|---|---|---|---|---|
| **as Richards Block – these terms are used interchangeably)** | | | | |
| **Lingalinga** | 14.3.2019 | 2 | 1.Regarding conservation in the area. He had a caretaker in the area and that is why for the last 40 years the area had been conserved and was in good condition.<br>2.The area of the access road would be excised from the conservation area.<br>3.Questions were raised the national highway that was to be built through the area | The assessor said that if a national highway were put through the area, he assumed this would be a forced sale and this would be outside the owner's control and would not affect HCV/S commitments. |
| **Kandoka** | 15.3.2019 | | 1.Explanation that even though the Kandoka clan is owned by the Loko Clan, as a result of intermarriage there is a very close relationship between the two clans. As such they have agreed to give them the right to utilise the area. This would be done under a CLUA.<br>3.The community also asked what does conservation mean; e.g. can they take bird watchers down tracks, could they extract trees.<br>4.There was a discussion about the "give and take" options. The community highlighted some example areas, but said they preferred that the assessor rebalanced the development and conservation and gave the plan back to them. | 1.The assessor mentioned that if they went ahead with the development they wouldn't be able to utilise the conservation land. That would mean that they would have to walk a long way to open up new gardens. The assessor made two suggestions. Either (1) they expand the community use area to give themselves enough space for gardens or (2) or they use a LSS model of 4 ha oil palm and 2 ha garden. The community responded that they would have to get back to the assessor on this.<br>2. The assessor explained that bird watchers were fine, however, extracting trees and opening gardens was not OK.<br>3. The assessor said he would give the plan back to them when it was complete. |
| **Balave** | 15.3.2019 | | 1.There was some discussion over the total area and the effect potential other areas along the roadline would have on their developable area.<br>3. In the rivers in the conservation area they take crabs and harvest sago. This was confirmed to be permissible. | 1. The assessor walked into some of the areas along the roadline in order to confirm the status of the vegetation.<br>2. Regarding leasing of the conservation area. It was stated that this was an issue for Lands Department. It was part of FPIC. |

| | | | | |
|---|---|---|---|---|
| | | | 4. Questions were also asked whether NBPOL would lease the conservation area.<br>5. The community stated that they were happy with what was proposed and just wanted to see development. | |
| **Otto's Block** | 20.1.2020 | | There was a discussion about resource use and sacred sites in the block. The neighbours (Otto's relatives) said they gardened and collected resources from their own land. However, they had opened some areas and collected a few coconuts from Otto's land. This was only incidental use. There were no sacred sites present. | With the aid of hard copy landcover maps (that were relevant to the Otto's Block) we pointed out that we had not mapped any HCV/S area. We also mentioned that no RTE species of plants, birds and mammals had been sighted. In all the interviews people were asked if they had any questions or comments about the outcome of the process. In all cases there were no questions nor comments. Additionally, the community conveyed information about the absence of use of natural resources and about the absence of sacred sites. This information was used to confirm (at the end of the interview) that HCV 5 and 6 were not present in the assessment area. This was agreed by the community. At the end of the interview, after all the data had been collected, it was agreed as a form of meeting wrap-up, by all the participants that the use of natural resources within the AOI was confined to their own land. |
| **Richie's Block** | 20.1.2020 | | There was a discussion about resource use and sacred sites in the block. The neighbours said they gardened and collected resources from their own land. There were no sacred sites present. | With the aid of hard copy landcover maps (that were relevant to the Richie's Block) we pointed out that we had not mapped any HCV/S area. We also mentioned that no RTE species of plants, birds and mammals had been sighted. In all the interviews people were asked if they had any questions or comments about the outcome of the process. In all cases there were no questions nor comments. Additionally, the community conveyed information about the absence of use of natural resources and about the absence of sacred sites. This information was used to |

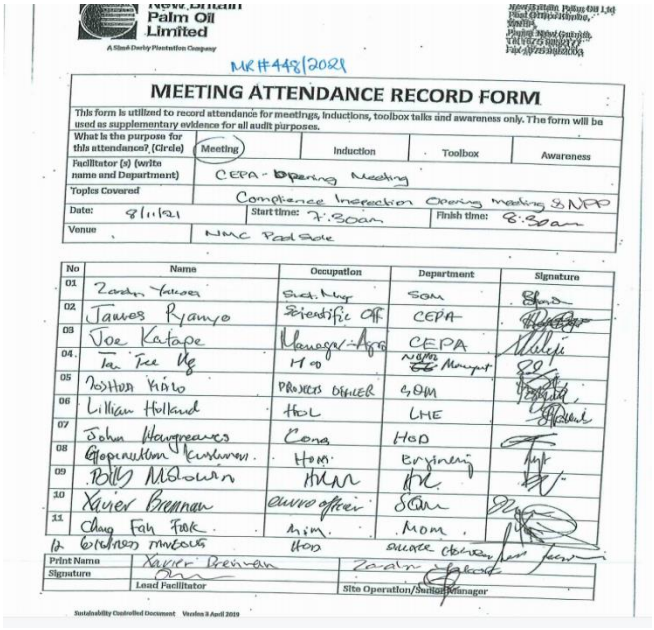
| | | | | |
|---|---|---|---|---|
| | | | | confirm (at the end of the interview) that HCV 5 and 6 were not present in the assessment area. This was agreed by the community. At the end of the interview, after all the data had been collected, it was agreed as a form of meeting wrap-up, by all the participants that the use of natural resources within the AOI was confined to their own land. |

A follow-up meeting to discuss the results of the integrated assessment was requested. However, NBPOL informed Hijau Daun that this was not possible as all the public servants in Kimbe had been stood down and were in the process of re-applying for their jobs. Hijau Daun sought further clarification and was told that the government offices were empty and there was no one to meet there.

CEPA – (PNG Conservation and Environment Protection Authority) – a meeting was requested by NBPOL in Port Moresby with this organisation to present the results of the survey. After two requests were sent with no adequate response from CEPA; it was deemed that CEPA did not consider this survey of being of sufficient importance and no further requests were made.

It is recommended that NBPOL follow up with the government when it is possible and socialise the results of the assessment and seek comments and suggestions.

Another follow up on the request by NBPOL was made to CEPA (PNG Conservation and Environment Protection Authority). During the NBPOL WNB annual compliance inspection on 08/11/21, meeting and site visit was than carried out by CEPA (Conservation and Environment Protection Authority) .



New Britain Palm Oil Limited
A Sime Darby Plantation Company

MR#448/2021

**MEETING ATTENDANCE RECORD FORM**

This form is utilized to record attendance for meetings, inductions, toolbox talks and awareness only. The form will be used as supplementary evidence for all audit purposes.

| | | | | |
|---|---|---|---|---|
| What is the purpose for this attendance? (Circle) | Meeting | Induction | Toolbox | Awareness |
| Facilitator (s) (write name and Department) | CEPA - Opening Meeting | | | |
| Topics Covered | Compliance Inspection Opening meeting & NPP | | | |
| Date: 8/11/21 | Start time: 7:30am | | Finish time: 8:30am | |
| Venue | NMC Pool Side | | | |

| No | Name | Occupation | Department | Signature |
|---|---|---|---|---|
| 01 | Zaan Yauwa | Sust. Mgr | SOM | |
| 02 | James Ryanyo | Scientific Off | CEPA | |
| 03 | Joe Katape | Manager-Agro | CEPA | |
| 04 | Ian Tee Ng | MD | NBPOL Manager | |
| 05 | Joshua Kiato | PROJECTS OFFICER | C,OM | |
| 06 | Lillian Holland | HOL | LHE | |
| 07 | John Hargreaves | Cona | HOD | |
| 08 | Gopinathan Kuruvan | Hom | Engineering | |
| 09 | Billy McGowan | HMM | HR | |
| 10 | Xavier Brennan | Envro officer | SOM | |
| 11 | Chang Fah Fook | Mgr. | MOM | |

| Print Name | Xavier Brennan | Zaan Yauwa |
|---|---|---|
| Signature | | |
| | Lead Facilitator | Site Operation/Sustain Manager |

Sustainability Controlled Document Version 3 April 2019

**Summary**

The assessor considered the consultations have covered sufficient representation of relevant stakeholders within the defined AOI because all affected communities were visited and there was a good turnout to all meetings. Clearly

there were difficulties dealing with the government; however the assessor undertook best endeavours to schedule meetings. The fact that no one was at work can be considered a limitation of the assessment. Forcert – the only NGO that is active in the area was consulted, as was Cecile Benjamin – who is community advocate and had worthwhile comment about the survey.

**Section 6: Soil and topography**

*RSPO Note: This section should indicate the type of soil identified and the area of it. Sampling points should be indicated. Topographic maps will be included here as well. Any potential areas identified as steep terrain according to the P&C 2018 definition should be mentioned accordingly. What are the methodology(ies), people involved in the process, date of assessment and findings? Note: Should an assessment carried out by internal staff, just fill the name of the staff and his/her designation*

.Suitability is rated against the following matrix :

**Table 24. Soil suitability matrix.**

| Order | Class | Definition |
|---|---|---|
| S (suitable) | S1 (highly suitable) | Land having no or only minor limitations to sustain cultivation of oil palm or any other crop for that matter |
| | S2 (moderately suitable) | Land having limitations that in aggregate are moderately severe for sustained oil palm cultivation. Productivity will be smaller and inputs will be more costly that S1 |
| | S3 (marginally suitable) | Land having limmitations that in aggregate are moderatey severe for sustained oil palm cultivation. Productivity will be reduced and input costs so great that use of this land may not be marginally justified. |
| N (not suitable) | N (Not suitable) | Land qualities are not suitable for sustained oil palm cultivation. |

**Lingalinga**

Date of Assessment: August 2018

Name of Assessor: Dr Murom Barnabas

Assessor Designation and Company: Head of Agronomy -PNG OPRA ( externally)

Methodology

The soils survey comprised several stages including :

a) background literature review and preparation of maps,

b) a scoping visit to proposed areas for detailed survey planning

c) carrying out the actual field survey and collecting soil samples for chemical analysis and

d) reporting the survey results.

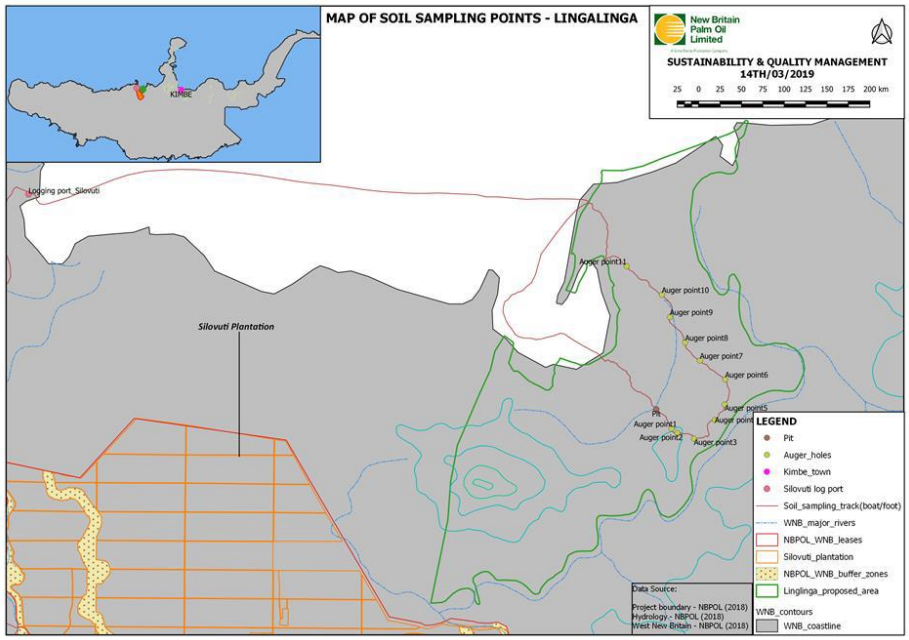



**Figure 18. Soil sampling points.**

**Table 25. Soil Survey results for Lingalinga**

| *Characteristics* | *Flat alluvial plains* | *Suitability* | *Wet alluvial plains* | *Suitability* | *Ridges and slopes* | *Suitabili* |
|---|---|---|---|---|---|---|
| ***Climate*** | | | | | | |
| *Annual rainfall (mm)* | *3,700* | *S1* | *3,700* | *S1* | *3,700* | *S1* |
| *Dry season (months)* | *nil* | *S1* | *nil* | *S1* | *nil* | *S1* |
| *Mean annual max. temp. (°C)* | *29+* | *S1* | *29+* | *S1* | *29+* | *S1* |
| *Mean annual min. temp. (°C)* | *20+* | *S1* | *20+* | *S1* | *20+* | *S1* |
| *Mean annual temp. (° C)* | *25+* | *S1* | *25+* | *S1* | *25+* | *S1* |
| *Sunshine hours hrs/day* | *4.5* | *S2* | *4.5* | *S2* | *4.5* | *S2* |
| ***Topography*** | | | | | | |
| *Slope (%)* | *Flat* | *S1* | *Flat* | *S1* | *>45* | *NS* |
| ***Soil wetness*** | | | | | | |
| *Drainage Class* | *poorly drained* | *S3* | *very poor* | *NS* | *well drained* | *S1* |
| *Flooding* | *Not flooded* | *S1* | *moderate to severe* | *NS* | *not flooded* | *S1* |
| ***Soil physical conditions*** | | | | | | |
| *Texture* | *SCL* | *S2* | *No detailed survey* | | *SCL* | *S2* |
| *Structure* | *moderately developed* | *S1* | *No detailed survey* | | *moderately developed* | *S1* |
| *Depth (cm)* | *70-100* | *S2* | *Under water* | *NS* | *>100* | *S1* |
| *Depth to top of sulfuric horizon (cm)* | *N/A* | | *No detailed survey* | | *N/A* | |
| *Thickness of Peat (cm)* | *N/A* | | *No detailed survey* | | *N/A* | |
| ***Chemical conditions*** | | | | | | |
| *Effective CEC* | *>30* | *S1* | *No detailed survey* | | *>28* | *S1* |
| *Base saturation in A horizon* | *>70* | *S1* | *No detailed survey* | | *>75* | *S1* |
| *Organic C in A horizon* | *>3.0* | *S1* | *No detailed survey* | | *>3.0* | *S1* |
| *Salinity 50 cm depth* | *N/A* | | *N/A* | | *N/A* | |
| *Micronutrients* | *N/A* | | *N/A* | | *N/A* | |

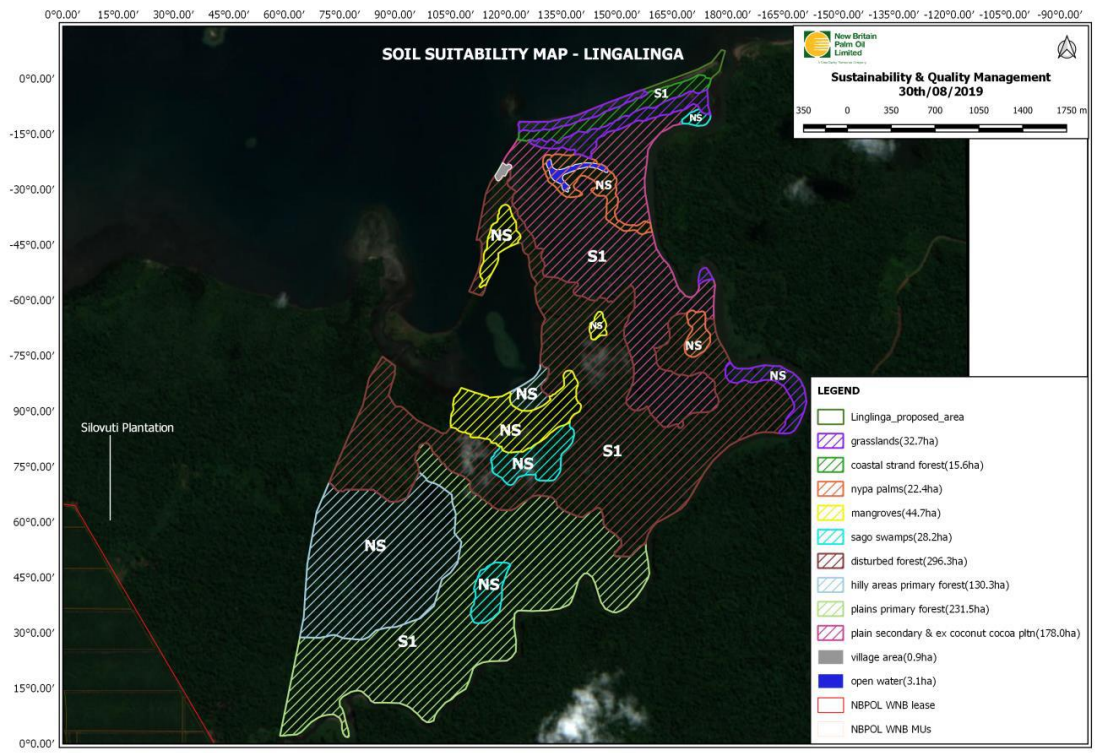



**Figure 19. Soil suitability map - Linglinga**

## Results

- There is surplus water throughout the year and proper drainage system is required.
- No peat in the plain suited for oil palm production.
- N and K fertilisers will be major nutrients required
- Proper roads and drainage system to be established before field planting
- The wet areas around the lagoon and river banks to be avoided
- Approximately 474.3 ha is suitable for oil palm cropping.

## Balave and Kandoka

Date of Assessment: March 2022

Name of Assessor: Dr Murom Barnabas

Assessor Designation and Company: Head of Agronomy – PNG OPRA ( externally)

## Methodology

The soils survey comprised several stages including :

a) background literature review and preparation of maps,

b) a scoping visit to proposed areas for detailed survey planning

c) carrying out the actual field survey and collecting soil samples for chemical analysis and

d) reporting the survey results.

**Soil Sampling Points**

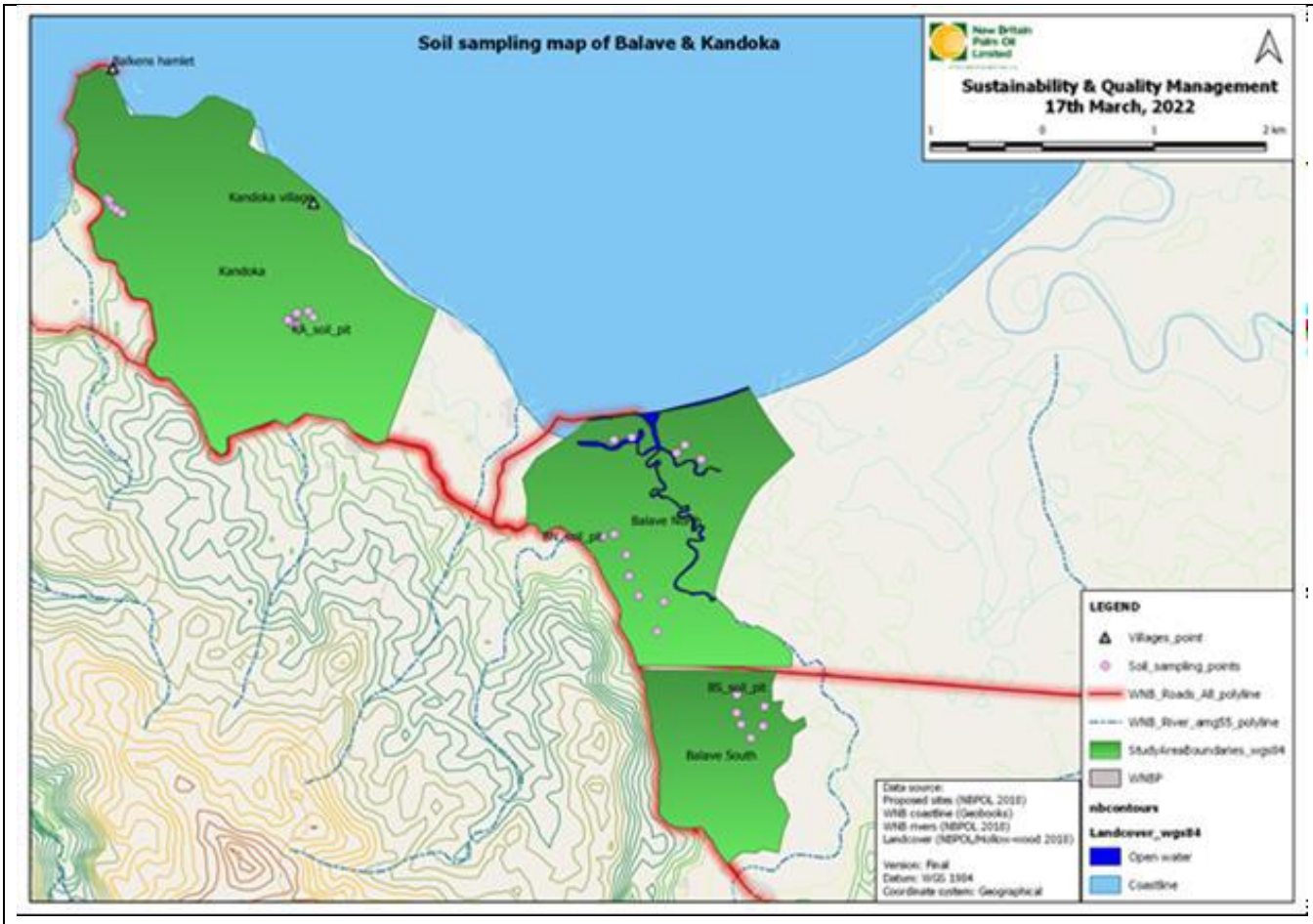



**Figure 20. Soil Sampling Points Kandoka and Balave.**

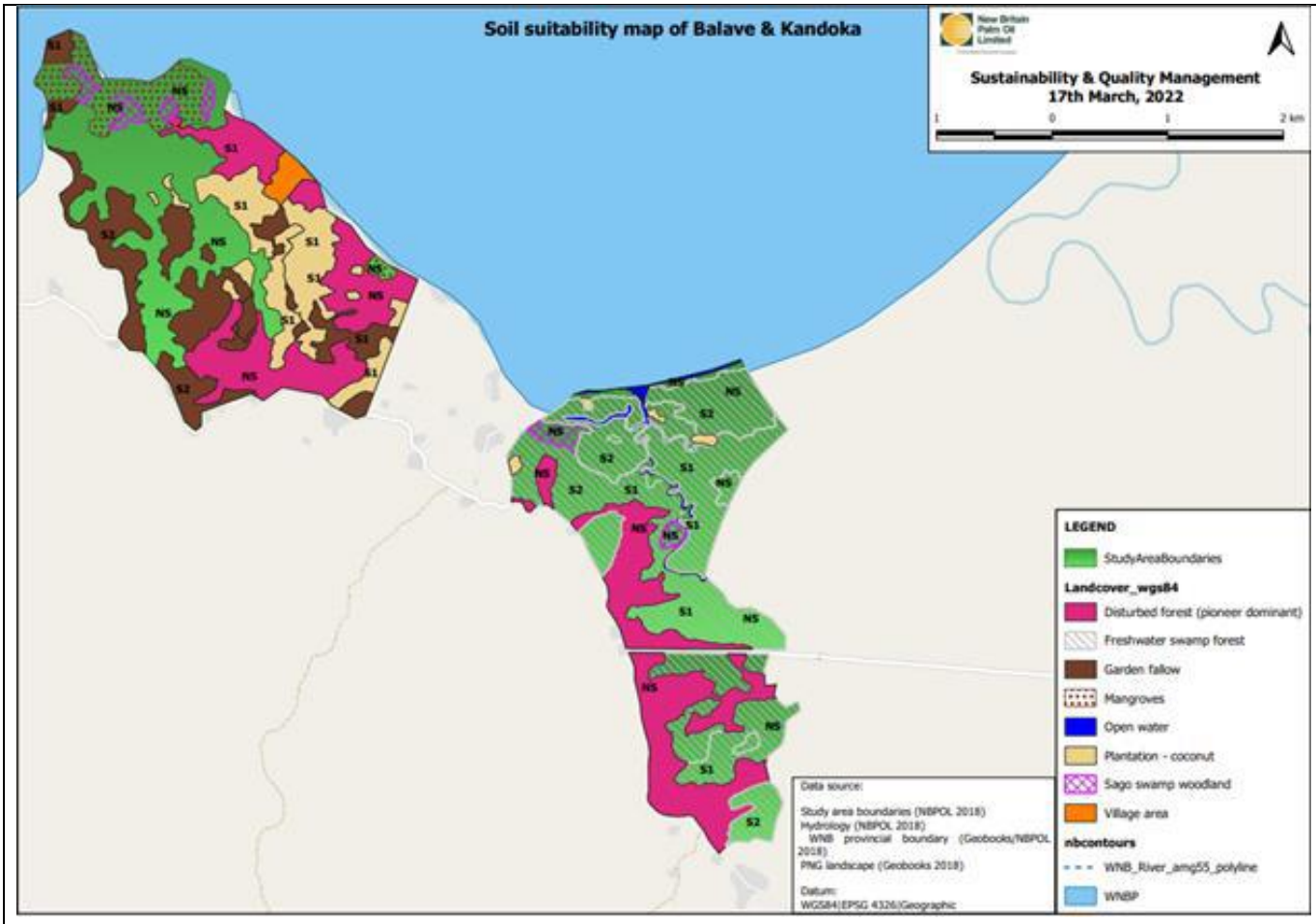



**Figure 21. Soil suitability map**

**Table 26. Balave North Soil Suitability.**

| Characteristics | Alluvial plains | | Slope hilly areas | | Steep hilly ridges | |
|---|---|---|---|---|---|---|
| | Site values/observations | Suitability | Site values/observations | Suitability | Site values/observations | Suitability |
| **Climate** | | | | | | |
| Annual rainfall (mm) | 4,223 | S2 | 4,223 | S2 | 4,223 | S2 |
| Dry season (months) | nil | S1 | nil | S1 | nil | S1 |
| Mean annual max. temp. (°C) | 29+ | S1 | 29+ | S1 | 29+ | S1 |
| Mean annual min. temp. (°C) | 20+ | S1 | 20+ | S1 | 20+ | S1 |
| Mean annual temp. (° C) | 25+ | S1 | 25+ | S1 | 25+ | S1 |
| Sunshine hours hrs/day | 4.5 | S2 | 4.5 | S2 | 4.5 | S2 |
| **Topography** | | | | | | |
| Slope (%) | Generally flat (0-5) | S1 | Gentle to moderate slopes | S2 | Steep slopes | NS |
| **Soil wetness** | | | | | | |
| Drainage Class | Poorly drained | S2 | Well drained | S1 | Well drained | S1 |
| Flooding | Not flooded | S1 | Not flooded | S1 | Not flooded | S1 |
| **Soil physical conditions** | | | | | | |
| Texture | Mostly sandy clay loam | S2 | Mostly sandy clay loam | S2 | Mostly sandy clay loam | S2 |
| Structure | Moderately developed | S1 | Moderately developed | S1 | Moderately developed | S1 |
| Depth (cm) | 70-110 cm | S1 | 140 cm + | | | |
| Depth to top of sulfuric horizon (cm) | N/A | | | | | |
| Thickness of Peat (cm) | N/A | | | | | |
| **Chemical conditions** | | | | | | |
| Effective CEC (cmol/100g) | 23 | S1 | | | | |
| Base saturation in A horizon (%) | 65 | S1 | | | | |
| Organic C in A horizon (%) | >3.0 | S1 | | | | |
| Salinity 50 cm depth (ds/m) | N/A | | | | | |
| Micronutrients | N/A | | | | | |

**Table 27 Balave South Soil Suitability.**

| Characteristics | Alluvial plains | | Slope hilly areas | | Steep hilly ridges | |
|---|---|---|---|---|---|---|
| | Site values/observations | Suitability | Site values/observations | Suitability | Site values/observations | Suitability |
| **Climate** | | | | | | |
| Annual rainfall (mm) | 4,223 | S2 | 4,223 | S2 | 4,223 | S2 |
| Dry season (months) | nil | S1 | nil | S1 | nil | S1 |
| Mean annual max. temp. (°C) | 29+ | S1 | 29+ | S1 | 29+ | S1 |
| Mean annual min. temp. (°C) | 20+ | S1 | 20+ | S1 | 20+ | S1 |
| Mean annual temp. (° C) | 25+ | S1 | 25+ | S1 | 25+ | S1 |
| Sunshine hours hrs/day | 4.5 | S2 | 4.5 | S2 | 4.5 | S2 |
| **Topography** | | | | | | |
| Slope (%) | Generally flat (0-5) | S1 | Gentle to moderate slopes | S2 | Steep slopes | NS |
| **Soil wetness** | | | | | | |
| Drainage Class | Well drained | S1 | Well drained | S1 | Well drained | S1 |
| Flooding | Not flooded | S1 | Not flooded | S1 | Not flooded | S1 |
| **Soil physical conditions** | | | | | | |
| Texture | Sandy clay to sandy clay loam | S2 | Sandy clay to sandy clay loam | S2 | | S2 |
| Structure | Moderately developed | S1 | Moderately developed | S1 | | S1 |
| Depth (cm) | 180 cm | S1 | 180 cm + | S1 | | |
| Depth to top of sulfuric horizon (cm) | N/A | | | | | |
| Thickness of Peat (cm) | N/A | | | | | |
| **Chemical conditions** | | | | | | |
| Effective CEC (cmol/100g) | >23 | S1 | | | | |
| Base saturation in A horizon (%) | >80 | S1 | | | | |
| Organic C in A horizon (%) | >3.0 | S1 | | | | |
| Salinity 50 cm depth (ds/m) | N/A | | | | | |
| Micronutrients | N/A | | | | | |

## Recommendations for Kandoka and Balave

- There is surplus water throughout the year and proper drainage system is required.
- No peat in the alluvial plains suited for oil palm production.
- N and K fertilisers will be major nutrients required and best applied between May and September.
- Proper roads and drainage system to be established before field planting
- The wet areas around sago palms and river/creek banks to be avoided
- Approximately for Balave North 56.2 ha, Balave South 88.7 and Kandoka 350.5 ha are suitable for oil palm cropping.

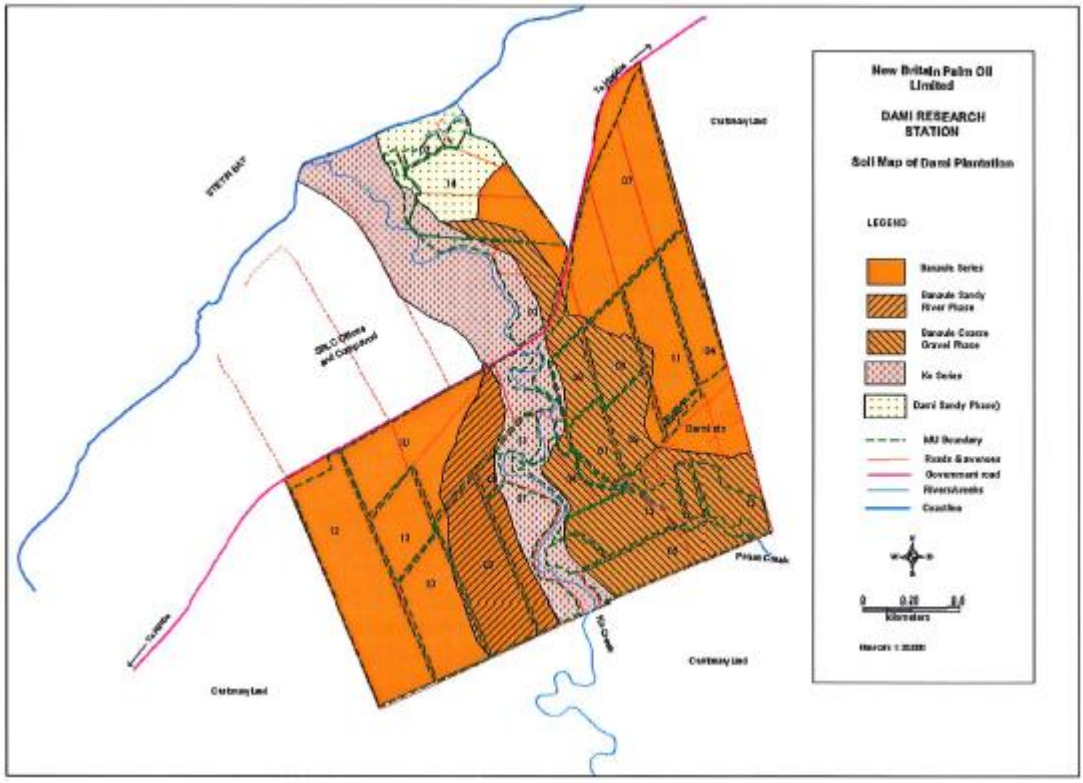
## Ottos and Richie's Blocks

Date of Assessment: June 2004

Name of Assessor: Thomas Betitis

Assessor Designation and Company: Head of Agronomy – Dami Research Station

A report on the soils of Dami Plantation were used for these blocks. These blocks are on the border of Dami Plantation.




Results : The soils of Dami are generally young free-draining pumiceous soils. Physical description indicates very low clay content within the soil profile with soil textures mostly medium to coarse. Organic matter is within the medium range, this is an important source of N and must be sustained through organic matter management. Soil L and Mg appear to be generally low and are reflected in the visual deficiency symptoms. It is important that fertilser applications continue in the drier months.

**Kintakiu**

Date of Assessment: August 2018

Name of Assessor: Dr Murom Barnabas

Assessor Designation and Company: Head of Agronomy – PNG OPRA ( externally)

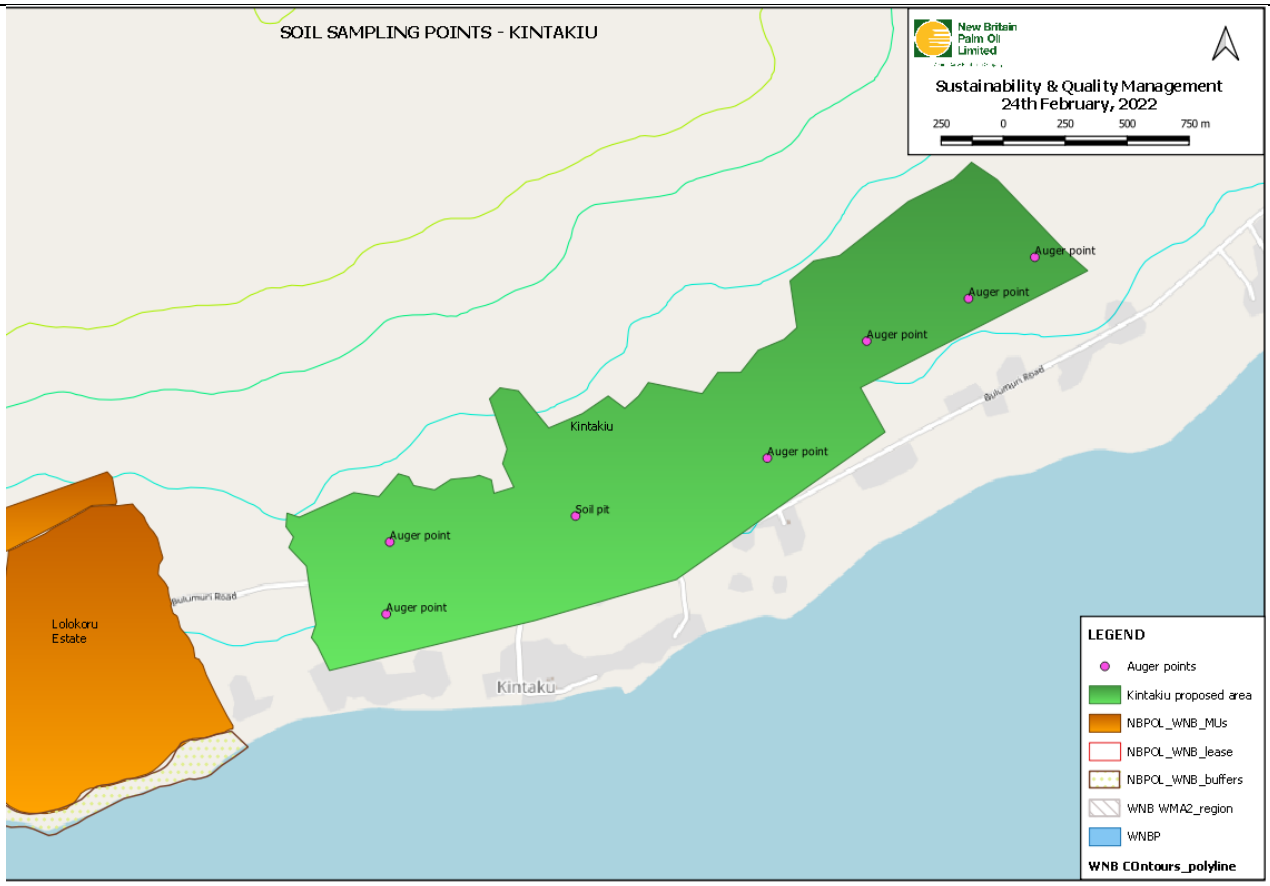



**Figure 22. Soil sampling points – Kintakiu**

Table 28. Soil suitability results - Kintakiu

| Characteristics | Site values/observations | Suitability |
|---|---|---|
| **Climate** | | |
| Annual rainfall (mm) | 4,877 | S2 |
| Dry season (months) | nil | S1 |
| Mean annual max. temp. (°C) | 29+ | S1 |
| Mean annual min. temp. (°C) | 20+ | S1 |
| Mean annual temp. (° C) | 25+ | S1 |
| Sunshine hours hrs/day | 4.5 | S2 |
| **Topography** | | |
| Slope (%) | Generally flat (0-5) | S1 |
| **Soil wetness** | | |
| Drainage Class | Well drained | S1 |
| Flooding | Not flooded | S1 |
| **Soil physical conditions** | | |
| Texture | Mostly loamy sand | S2 |
| Structure | weakly - moderately developed | S1 |
| Depth (cm) | 120 + | S1 |
| Depth to top of sulfuric horizon (cm) | N/A | |
| Thickness of Peat (cm) | N/A | |
| **Chemical conditions** | | |
| Effective CEC (cmol/100g) | >20 | S1 |
| Base saturation in A horizon (%) | >70 | S1 |
| Organic C in A horizon (%) | >3.0 | S1 |
| Salinity 50 cm depth (ds/m) | N/A | |
| Micronutrients | N/A | |

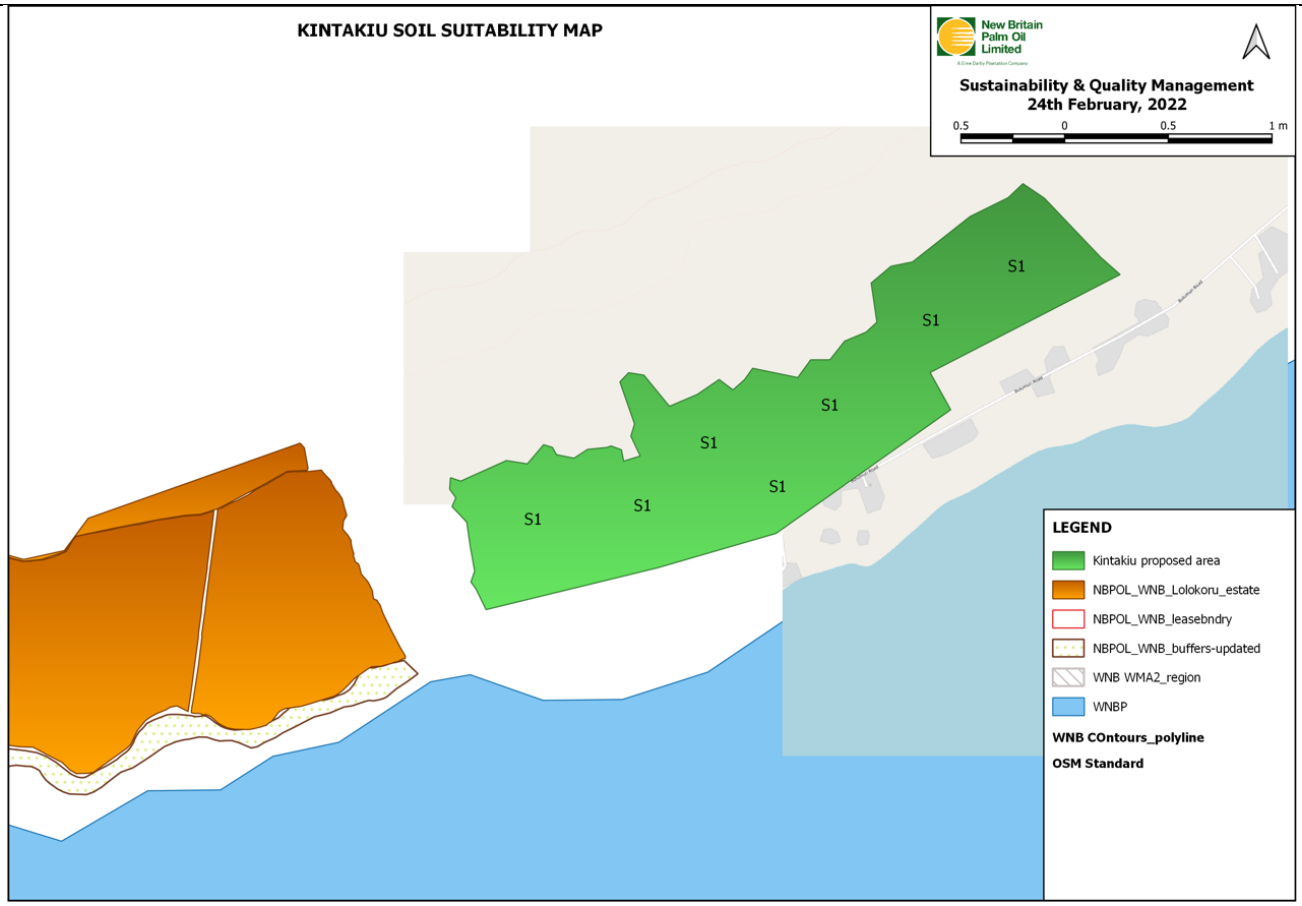



**Figure 23. Soil Suitability**

### Kintakiu Results

- Soils and climate are highly suitable for oil palm production.
- Site is generally flat to gently sloping and is highly suitable for cropping
- Soils are weakly-moderately developed and require good field establishment and topsoil management to minimise soil erosion
- Soils are well drained and do not have peat soils
- N and K fertilisers will be major nutrients required
- Soluble fertiliser application to be applied from May to August to minimise leaching
- Approximately 211.6 ha is suitable for oil palm cropping.

### Tapakasi

No formal soil survey was undertaken in Tapakasi because it is a very small area but secondary data was relied upon Tapakasi North was mapped as a freshwater swamp and that is the reason why most of the area was not suitable for development.

Tapakasi South is over “silty loams to clay loams over gravels and sands”. The parent material is volcanic ash, pumice and sand.

**Table 29. Peat and Slope summary by block**

| Block | Slopes | Peat |
|---|---|---|
| Lingalinga | All flat in the development area | No Peat |

| | | |
|---|---|---|
| Balave | All flat | No Peat |
| Kandoka | Rolling but less than 25 degrees | No Peat |
| Otto's Block | All flat | No Peat |
| Richie's Block | All flat | No Peat |
| Kintakiu | All flat | No Peat |
| Tapakasi North and South | All flat | No Peat |

**Section 7: Greenhouse Gas (GHG)**

RSPO Note: this section should be used to explain the findings that come out from the usage of the New Development GHG calculator. Please include what are the significant sources and type of emissions expected from this area. What are the methodology(ies), people involved in the process, date of assessment and findings? Note: Should an assessment carried out by internal staff, just fill the name of the staff and his/her designation.

*Date of Assessment: July 2019*

*Name of Assessor: Jules Crawshaw*

*Assessor Designation and Company: External Consultant – PT Hijau Daun and Hollow-wood Enterprise*

**Table 30. Carbon /GHG assessment team members and qualifications**

| Name | Organisation | Qualifications | Role |
|---|---|---|---|
| **Michael Hansby** | Hollow-wood Enterprises | BSc (*Forest Science*), Grad Dip (*Bushfire Management*) | GHG Lead. Forest Inventory and GIS manager |
| **Jules Crawshaw** | PT. Hijau Daun | Bachelor of Forestry Science and Master of Business Systems | Report and data review |
| **Jeffery Lawrence** | Independent consultant | BSc (*Forestry*) | Field team member |
| **Clement Bailey** | Independent consultant | BSc (*Forestry*) | Field team member |
| **Michael Bragg** | NBPOL | Bachelor of Systems Agriculture with a Major in Agronomy<br>Honours in International Development | Field team member |
| **Joshua Kialo** | | Diploma in Forestry Science | Field team member |
| **Richard Mova** | | Bachelor in Environmental Sciences & Geography | Field team member |

**Methods and procedures used for conducting the carbon stock and GHG assessments**

The following section has been taken from the Integrated HCV/HCS assessment (Hijau Daun, 2019) that was conducted in May (2018) as part of NBPOL's commitment to 'No Deforestation'. This section deals with the methods utilised for imagery analysis and field inventory.

**Image analysis.**

The study areas for this assessment were a series of polygon boundaries supplied to the assessment team by NBPOL. It was decided that two sources of satellite imagery were to be used for the project:

Sentinel 2 (freely available from European Space Agency (ESA))

High resolution World View imagery purchased by NBPOL for the purpose of the project.

Recent Sentinel 2 was used to gain an understanding of the vegetation present across the broader landscape and was the primary imagery dataset used for land cover classification during the early stages of the project (i.e. preparing for the scoping study and fieldwork). The higher resolution World View 2 satellite imagery was used for refinement of the initial land cover classification, based on field observation and the current condition of the site shown in Sentinel 2. The World View imagery will also be a key tool in deriving test points for the final accuracy assessment.

Based on previous experience, it is the opinion of the assessor that an integrated approach to land cover mapping provides the most accurate representation of the vegetation present across a study area. Supervised image classification (further detail below) was performed to derive an initial mapped extent of relevant land cover classes.

Analysis of plot data and interrogation of higher resolution imagery is then used to inform polygon line work using aerial photograph interpretation (API) techniques, such as those outlined in Kuchler and Zonneveld (1988). The output of this combined approach, utilising field observation and both image classification and interpretation is ultimately the dataset that land use planning maps and recommendations are derived from for this study. Optical and radar derived datasets used for this project are shown below in Table 2.

**Table 31. Radar and optical satellite datasets utilised during this integrated assessment**

| Data source | Image identifier | Capture date | Resolution (m) | Cloud cover (%) |
|---|---|---|---|---|
| **Sentinel 2** | T56 MKU | 09/01/2018 | 10 | <20 |
| | T55 MHP | 30/11/2017 | 10 | <20 |
| | T55 MGP | 22/08/2017 | 10 | <20 |
| | T55 MHQ | 22/08/2017 | 10 | <20 |
| **World View 2** | 17AUG25002822-S2AS-057849605010 | 25/08/2017 | 0.5 | <20 |
| | 17MAY30003626-S2AS_R1C1-057849605010 | 30/05/2017 | 0.5 | <20 |
| | 17MAY30003608-S2AS-057849605010 | 30/05/2017 | 0.5 | <20 |
| | 17JUN21002315-S2AS-057849605020 | 21/06/2017 | 0.5 | <20 |
| | 17AUG31003649-S2AS-057849605030 | 31/08/2017 | 0.5 | <20 |
| | 17DEC28003036-S2AS-057849605040 | 28/12/2017 | 0.5 | <20 |
| | 17OCT14004232-S2AS-057849605050 | 14/10/2017 | 0.5 | <20 |
| **ALOS - PALSAR** | AP_11938_FBS_F7060_RT1 | 2011 | 12.5 | n/a |
| | AP_11938_FBS_F7070_RT1 | 2011 | 12.5 | n/a |
| | AP_13477_FBS_F3720_RT1 | 2011 | 12.5 | n/a |
| | AP_13477_FBS_F3730_RT1 | 2011 | 12.5 | n/a |
| | AP_13477_FBS_F3740_RT1 | 2011 | 12.5 | n/a |

| | | | | |
|---|---|---|---|---|
| | AP_13703_FBD_F7080_RT1 | 2011 | 12.5 | n/a |
| | AP_13951_FBD_F7070_RT1 | 2011 | 12.5 | n/a |
| | AP_14374_FBD_F7070_RT1 | 2011 | 12.5 | n/a |
| | AP_14870_FBS_F7060_RT1 | 2011 | 12.5 | n/a |
| | AP_14870_FBS_F7070_RT1 | 2011 | 12.5 | n/a |

**Pre-processing (Sentinel 2)**

Imagery utilised for this assessment was obtained as tiled, raster datasets. All Sentinel 2 datasets were downloaded from the 'Copernicus' website maintained by the European Space Agency (ESA) and proprietary images (WV 2) were obtained under licence by an Australian third-party provider.

Three key applications were used perform pre-processing:

'Sen2Cor' atmospheric correction toolbox found in the ESA 'SNAP' image processing software package;

The 'composite bands' function in ArcGIS 10.5.1 and

The 'Seamless mosaic' workflow in ENVI 5.1

The 'Sen2Cor' function converts a Level 1C dataset (i.e. top of atmosphere corrected, orthorectified image) into a 2A dataset, i.e. a bottom of atmosphere (BOA) corrected reflectance product. No atmospheric correction was performed on the World View data, as such processing had already been completed by the provider.

The processed image bands were then combined into a single, 7 band image, utilising the 10m resolution (RGBI) bands of the Sentinel 2 sensor as well as a 20m resolution bands, 'red edge' band (Band 5) and short wave infrared 1 (SWIR 1) (Band 11).

Seamless mosaic tool was used to create a single image mosaic that extended across the assessment AOI. The 'cloud' (QI) dataset the is part of the Sentinel 2 information package for each scene was used as a mask, and any clouded pixels were removed from the mosaic, within the limits of this approach.

**Use of high-resolution World View 2 imagery**

The World View 2 scenes that were utilised during this study were all captured in either October 2015 or April 2016. These two capture dates were chosen as they possessed the lowest percentage cloud cover over the study area. It is acknowledged that the large difference in capture times between the images is problematic for broad scale image classification, with this fact being the main reason for the difficulty in producing a seamless, colour-balanced raster mosaic across the study area. Due to this inconsistency, this imagery was primarily used for visual interpretation, relying on the knowledge of the analyst and ground truthed points (HCSA plots) to inform the interpretation.

**Band combinations, ratios and indices**

During the initial image classification, and range of band ratios, combinations and Indicies were explored to find the greatest contrast between the classes of interest. These can be seen below

**Table 32. Band ratios, combinations and Indices utilised for this study.**

| Name | Purpose | Bands used |
|---|---|---|
| **True colour** | Visual interpretation | Red, green, blue |
| **Colour infrared** | Vegetation vs non-vegetation | Near-infrared, red, green |
| **Vegetation classification** | Contrast between vegetation types, with SWIR responding to increasing soil moisture | Short-wave infrared, near infrared, blue |
| **Normalised differential vegetation index (NDVI)** | Measures water content (or turgor) within vegetation, with actively growing vegetation showing higher values than bare ground or dead vegetation | (NIR – Red) / (NIR + Red) |
| **Simple vegetation ratio** | Contrast between vegetation types | NIR / Red |

### Training sample preparation

Initial training samples for image classification were prepared based on the assessment team's prior knowledge of PNG vegetation communities and the data gained by the lead assessor (GPS points and pictures) during the scoping study.

Training samples sought to create spectrally separate land cover classes, consistent with the requirements of Rosoman et al., (2017a). At the initial stage, no attempt was made to separate High, Medium or Low Density forest types, as per Table 1 in Rosoman et al (2017), with the focus being on identifying and separating 'remnant' or 'HCSA' forest from 'young regenerating forest' and 'scrub'. Given the threshold for development, the assessor feels that adequate separation between 'young regenerating forest' and 'scrub' is most critical, but often the most difficult to separate spectrally. Other land classes were also defined due to their occurrence across the landscape, these included mangroves, swamp woodlands (Metroxylon sagu dominated areas), wetlands and oil palm plantations. Training samples aimed to capture between 600 - 1000 pixels, amounting to 0.6 – 1 ha sample for each class.

### Image classification

Once adequate training samples were developed, the 'maximum likelihood classification' method was used to provide an initial, classified image. Initial classification was performed using supervised classification, utilising a range of functions found within the ArcGIS 'spatial analyst' extension. The output of this process was used to inform aspects of sample design such as sample intensity and plot location.

### Field Inventory

The field inventory performed for this project sought to ground truth the output of the initial image classification and to quantify the above-ground woody biomass (i.e. that within trees) found within each of the strata, across the study areas.

### Sample design

Sample intensity (sample size) for each of the classes identified during image analysis was determined by:

- The area of the strata
- The mean and standard deviation values of HCSA strata captured during previous fieldwork in Papua New Guinea and the Solomon Islands (Hollow-wood, 2016; TFT, 2016)

Mean biomass and standard deviation values from previous field assessments in other parts of Papua New Guinea and the Solomon Islands were used as inputs into this process, with both the equation from pp 27 (see below) in HCSA Toolkit Version 2, Module 4 and the 'winrock sample plot calculator spreadsheet tool' were tested to compare the sample sized needed for this assessment (Table 5).

N= t^(2 ) s^2/E^2

Where:

t = t-value from Student's t-test table for 90% confidence interval

s = standard deviation based on existing datasets from similar forest types

E = probable error, expressed as a percentage of the estimated mean value (from existing datasets)

**Table 33. HCSA plot sample size derived from various methods**

| Strata | Initial Estimate of Mean biomass (t/ha) | Initial Estimate of Standard deviation (t/ha) | N (HCSA equation) | N (winrock sample plot calculator) |
|---|---|---|---|---|
| **HCS forest** | 278.1 | 169.5 | 102 | 124 |
| **Young regenerating forest** | 129.5 | 76.3 | 95 | 35 |
| **Scrub** | 42.1 | 22.1 | 75 | 10 |
| **Total** | | | 274 | 166 |

A sample of 263 HCSA plots was planned, a large survey effort given assessment time constraints, weather related downtime and logistical complications, such as distance between study areas and limitations on accommodation.

Due to access constraints for some of the study areas (Linga Linga in particular) a combination of both stratified random sampling (using the random point generator tool in ArcGIS) and systematic sampling on transects was used. Transect traverses were planned across ecological gradients where they were able to be identified during field assessment planning

Table 34 shows the breakdown of plots by strata measured during the field assessment.

**Table 34. Planned and measured HCS plots for this assessment.**

| Strata | Plots planned | Plots measured |
|---|---|---|
| **HCS forest** | 103 | 77 |
| **Young regenerating forest** | 78 | 50 |
| **Scrub** | 74 | 60 |
| **Non-HCS vegetation** | 8 | 14 |
| **Total** | **263** | **201** |

Note that the values used represent mean Above Ground Biomass for the whole survey area. This survey area includes a number of other blocks that were later separated from the scope of this survey. However, the assessor believes

that the forest association present in the blocks were sufficiently similar and has included this data in order to reduce the standard deviation.

**Inventory method**

All field inventory was performed in 28th April – 20th May 2018, and was done as per the methodology set out in HCSA Toolkit Version 2 – Module 4 (Rosoman et al., 2017).

This inventory method consists of two nested circular plots with plot radii of 5.64m and 12.61m, equating to 100m2 and 500m2 respectively. Trees between 5 -14.9 cm are measured within the 5.64m plot and all trees >15.0 cm are measured within the 12.61m plot. Further detail can be found in Rosoman et al., (2017).

All field data was collected digitally, using a data collection form specific to HCSA assessment, designed by Hollow-wood. Information collected during field inventory can be seen below in Table 35.

**Table 35. Data collected during HCSA field inventory.**

| | Attribute | Value | Method |
|---|---|---|---|
| Plot Attributes | **Date** | dd/mm/yyyy | Form calculation |
| | **Assessors** | initials | User entry |
| | **Location** | Easting / Northing | Form calculation |
| | **Elevation** | Meters above sea level | Form calculation |
| | **Plot number** | Integer | User entry |
| | **Assessment area name** | Text | User entry |
| | **Canopy cover** | Projected foliage cover (%) | Visual estimate |
| | **Canopy height** | Site tall tree (m) | Clinometer / rangefinder |
| | **Mid height** | Mid strata mean (m) | Clinometer / rangefinder |
| | **HCSA strata** | Class from initial classification | Presence / absence |
| | **Site slope** | Site slope (degrees) | Clinometer |
| | **Basal area** | m ha $^{-1}$ | Dendrometer |
| | **Plot comments** | text | User entry |
| | **Photo #1 (north)** | Photo identifier | User entry |
| | **Photo #2 (south)** | Photo identifier | User entry |
| | **Photo #3 (canopy)** | Photo identifier | User entry |
| Tree data | **Plot type (i.e. radius)** | m | Plot radii chain |
| | **DBHOB** | cm | Diameter tape |
| | **Species** | Genus / species | User entry |

**Data Analysis.**

All biomass calculations were performed according to the method outlined in Chave et al., (2014). This method is a two-step approach and utilises two models, Equation 4 and Equation 6a. Both models are pan-tropical allometrics, with equation 4 being a biomass allometric and equation 6a being a diameter / height allometric.

Critical to Equation 6a is a climatic variable or 'E-value'. This value is a coefficient that is derived from the combination of both temperature seasonality (TS) and climatic water deficit (CWD). The E-value increases with both increasing TS and increasing CWD, with equation 6a predicting that tree height for a given diameter will decline with increasing water and temperature stress (Chave et al., (2014). The E-value dataset is supplied in raster format at resolution of 2.5 arc seconds (approximately 4.5km x 4.5km at latitude of the AOI), and the spatial locations of each of the HCSA plots were used to extract the appropriate E-value for each.

All biomass values calculated using this method were converted to carbon content using a factor of 0.47 as per Rosoman et al., (2017) pp 37.

Below-ground biomass was calculated using root to shoot ratio of 0.21 as reported in Mokany et al, (2006) for moist tropical rainforests.

Above ground biomass in grassland communities was calculated using the default value of 7 t/ha, as published by the Climate Change and Development Authority, (2017), and the belowground biomass value was calculated using tropical grassland root to shoot ratio of 1.887, as published by Mokany et al, (2006)

***Land conversion scenarios***

In order to assess the emissions potential of the proposed development, the net areas to be managed (Table 36) are tested through 4 different scenarios. Each conversion scenario makes a different assumption regarding the type of conservation type which will be retained or converted into oil palm. All of the scenarios assume that there will be no methane capture during the first rotation of the oil palm plantation, though this may change depending on financing. The scenarios that were tested are described in Table 37, with the area-based results in Table 36. Emissions (tC) and areas per land cover class per scenario.

**Table 36. Results of the 'patch analysis decision tree' (ha)**

| Study Area | Balave North | Balave South | Kandoka | Kintakiu | Linga Linga | Ottos Block | Ritchies Block | Tapakasi North | Tapakasi South | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Proposed conservation area** | 304.79 | 86.64 | 219.92 | 90.99 | 624.14 | - | - | 17.61 | 39.89 | **1383.98** |
| **Community enclave area** | - | - | 9.73 | - | 7.29 | - | - | - | - | **17.02** |
| **Proposed development area** | 58.31 | 89.29 | 388.49 | 120.56 | 325.60 | 15.32 | 12.89 | 2.18 | 15.02 | **1027.65** |
| **Total Area** | **363.11** | **175.93** | **618.12** | **211.55** | **957.02** | **15.32** | **12.89** | **19.78** | **54.90** | **2428.64** |

**Table 37. Land conversion scenarios. HCVMA = 'High Conservation Value Management Area', HCSF = 'High Carbon Stock Forest'**

| Scenario | Description |
|---|---|
| **Scenario 1** | Develop all landcover classes. No 'HCVMA' are conserved. No 'HCSF' areas are conserved, all other classes are developed (excluding 'Village areas' and 'Open water'). No Methane capture is installed in the next 5 years. |

| | |
|---|---|
| **Scenario 2** | Only areas indicated as 'HCSF' are conserved. No 'HCVMA' areas are conserved, all other classes are developed (excluding 'Village areas' and 'Open water'). No Methane capture is installed in the next 5 years. |
| **Scenario 3** | Only areas classified as 'HCVMA' are conserved. No HCSF areas are conserved. All other classes are developed (excluding 'Village areas' and 'Open water'). No Methane capture is installed in the next 5 years. |
| **Scenario 4** | All areas classified as 'Community enclave', 'HCVMA' or 'HCSF' are conserved. All other classes are developed (excluding 'Village areas' and 'Open water'). No Methane capture is installed in the next 5 years. |

**Table 38. Summary of conversion scenarios. Preferred scenario outlined in yellow.**

| Classification | Scenario 1 | | Scenario 2 | | Scenario 3 | | Scenario 4 | |
|---|---|---|---|---|---|---|---|---|
| | Conserve | Develop | Conserve | Develop | Conserve | Develop | Conserve | Develop |
| **High density forest** | - | 305.00 | 305.00 | - | 302.88 | 2.12 | 305.00 | - |
| **Medium density forest** | - | 137.74 | 58.01 | 79.73 | 137.74 | | 137.74 | - |
| **Low density forest** | - | 565.71 | 498.69 | 67.02 | 520.76 | 44.95 | 533.35 | 32.36 |
| **Young regenerating forest** | - | 186.22 | 61.82 | 124.41 | 164.14 | 22.08 | 164.14 | 22.08 |
| **Swamp woodland** | - | 72.95 | 72.95 | | | 72.95 | 72.95 | - |
| **Scrub** | - | 973.86 | 111.79 | 862.08 | 5.87 | 968.00 | 117.65 | 856.21 |
| **Grasslands** | - | 37.34 | 25.35 | 11.99 | | 37.34 | 25.35 | 11.99 |
| **Plantation - oil palm** | - | 3.76 | | 3.76 | 0.00 | 3.76 | - | 3.76 |
| **Plantation - coconut** | - | 108.58 | 7.55 | 101.04 | - | 108.58 | 7.55 | 101.04 |
| **Open lands** | 20.47 | - | 20.47 | - | - | 20.47 | 20.47 | - |
| **Open water** | 17.00 | - | 17.00 | - | 17.00 | | 17.00 | - |
| **Grand Total** | **37.47** | **2391.16** | **1178.62** | **1250.02** | **1148.39** | **1280.25** | **1401.20** | **1027.43** |

***Results of the greenhouse gas emissions scenario modelling.***

The land conversion scenarios were utilised as basic inputs into modelling the potential Green House Gas emissions resulting from the implementation of each scenario. The following tables summarise the results of modelling obtained by using the RSPO New Development Greenhouse Gas Calculator RSPO-PRO-T04-003 V2.0 ENG and utilising the above land cover classifications coupled with the carbon density values found during the High Carbon Stock study. Note that for each scenario a different amount of land is assumed to be put into conservation. Table 39 summarises net field emissions and sinks results of the 4 land conversion scenarios.

## Measures taken to maintain and enhance carbon stocks within the new development areas

After consideration of the lands that have been made available by land owner consent and the removal of areas that are either High Conservation Value or High Carbon Stock, Scenario 4 has been chosen as the preferred development option. The greatest contributor to reduction of GHG emissions from the new development is through avoided emissions that would have been derived from land use change through the application of the High Carbon Stock Approach and the protection of High Conservation Values.

By the application of the HCSA 'patch analysis decision tree', a range of land use types have been excluded from development. This includes any areas of high conservation value or natural vegetation classes with a carbon density higher than that of 'scrub', patches of 'young regenerating forests' with a core less than 10ha or outside of the 200 meter proximity of forest patches containing significant carbon. This has greatly reduced the potential emissions from land use change. Figure 24 - Figure 26 illustrate the emissions of Scenario 4 as estimated by the GHG calculator.

Scenario 4 also accounts for the 1401 ha of High Conservation Value Management Area (HCVMA) and High Carbon Stock Forest (HCSF) NBPOL have committed to the lease and management of. Such areas include riparian zones, wetland areas and a significant area of native forest that will be regenerated using native forest species seed of local provenance.

It should be noted that the effect of the 'conservation credit' that is reported in Table 39 is derived from the default estimated carbon sequestration rate (for South-east Asia) of 2.5 tC/ha/yr. The area that is 'set aside' for conservation purposes in each of the scenarios is accounted for as a conservation credit.

Table 39. Results of the greenhouse gas emissions scenario modelling, yellow box indicating preferred Development Scenario. Field emissions and sinks assume vigorous growth for oil palm, used by large scale operations. Data derived from RSPO GHG Calculator (RSPO-PRO-T04-003 V2.0 ENG).

| | Scenario 1 | | | Scenario 2 | | | Scenario 3 | | | Scenario 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Field emissions & sinks** | **tCO2e** | **t CO2e/ha** | **tCO2e/tFFB** | **t CO2e** | **t CO2e/ha** | **t CO2e/t FFB** | **t CO2e** | **t CO2e/ha** | **t CO2e/t FFB** | **t CO2e** | **t CO2e/ha** | **t CO2e/t FFB** |
| Land clearing | 35,722.76 | 15.76 | 0.64 | 11,815.26 | 9.97 | 0.41 | 9,833.86 | 8.24 | 0.34 | 7,651.70 | 7.86 | 0.32 |
| Crop sequestration | -21,218.41 | -9.36 | -0.38 | -11,092.24 | -9.36 | -0.38 | -11,178.86 | -9.36 | -0.38 | -9,117.10 | -9.36 | -0.38 |
| Fertilisers | 1,643.51 | 0.73 | 0.03 | 859.17 | 0.73 | 0.03 | 865.88 | 0.73 | 0.03 | 706.18 | 0.73 | 0.03 |
| N2O | 2,122.13 | 0.94 | 0.04 | 1,109.38 | 0.94 | 0.04 | 1,118.04 | 0.94 | 0.04 | 911.84 | 0.94 | 0.04 |
| Field fuel | 162.64 | 0.07 | 0.00 | 85.02 | 0.07 | 0.00 | 85.69 | 0.07 | 0.00 | 69.88 | 0.07 | 0.00 |
| Peat | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Conservation credit | 0.00 | 0.00 | 0.00 | -2,946.55 | -2.49 | -0.10 | -2,922.14 | -2.45 | -0.10 | -3,503.01 | -3.60 | -0.15 |
| Total | 18,432.64 | 8.13 | 0.33 | -169.96 | -0.14 | -0.01 | -2,197.54 | -1.84 | -0.08 | -3,280.51 | -3.37 | -0.14 |
| **Mill emissions & credit** | **tCO2e** | **t CO2e/ha** | **tCO2e/tFFB** | **t CO2e** | **t CO2e/ha** | **t CO2e/t FFB** | **t CO2e** | **t CO2e/ha** | **t CO2e/t FFB** | **t CO2e** | **t CO2e/ha** | **t CO2e/t FFB** |
| POME | 10,884.69 | 4.80 | 0.20 | 5,690.14 | 4.80 | 0.20 | 5,734.57 | 4.80 | 0.20 | 4,676.92 | 4.80 | 0.20 |
| Mill fuel | 429.66 | 0.19 | 0.01 | 224.61 | 0.19 | 0.01 | 226.37 | 0.19 | 0.01 | 184.62 | 0.19 | 0.01 |
| Purchased electricity | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Credit (excess electricity exported) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Credit (sale of biomass for power) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | 11,314.36 | 4.99 | 0.20 | 5,914.75 | 4.99 | 0.20 | 5,960.94 | 4.99 | 0.20 | 4,861.54 | 4.99 | 0.20 |
| **Total emissions, tCO2e (field and mill)** | 29,747 | | | 5,745 | | | 3,763 | | | 1,581 | | |
| **t CO2e/t CPO** | 2.00 | | | 0.74 | | | 0.48 | | | 0.25 | | |
| **t CO2e/t PK** | 2.00 | | | 0.74 | | | 0.48 | | | 0.25 | | |

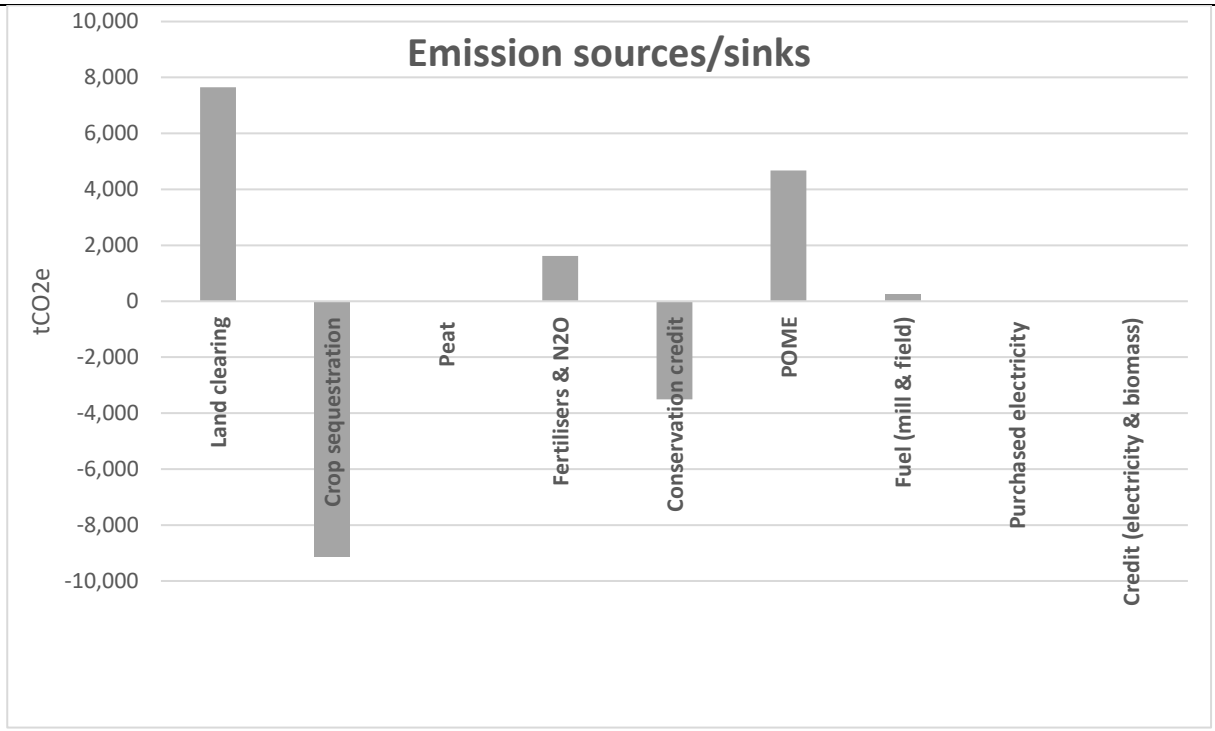



**Figure 24. Carbon (tons of $CO_2$ equivalents) emission sinks and sources from Development Scenario 4**

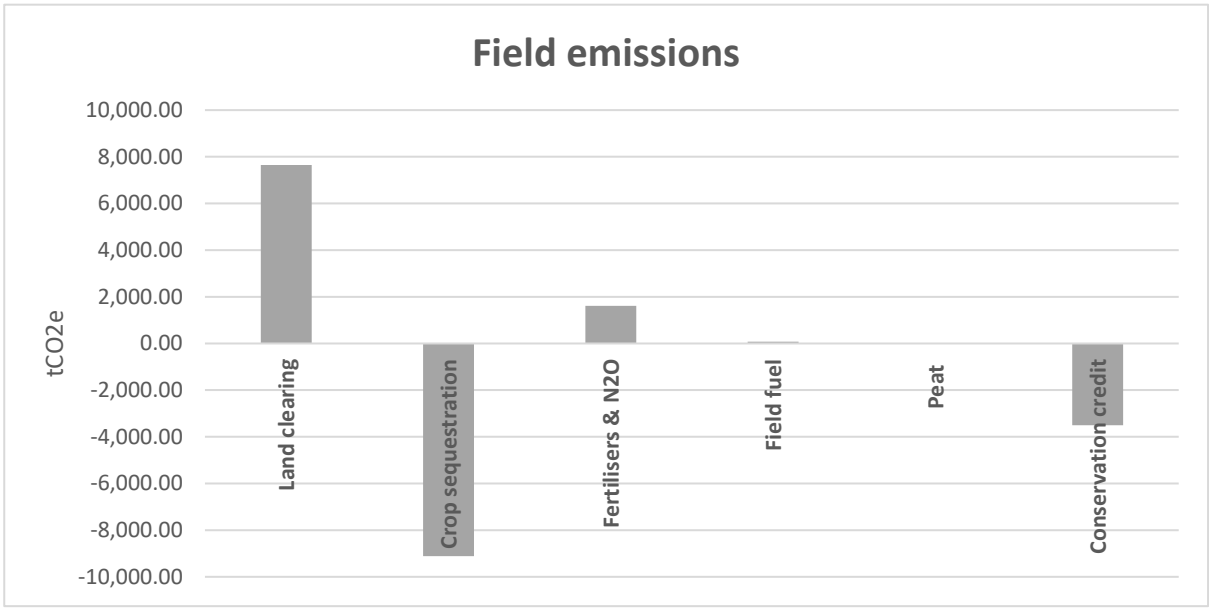



**Figure 25. Field based emissions from Development Scenario 4**

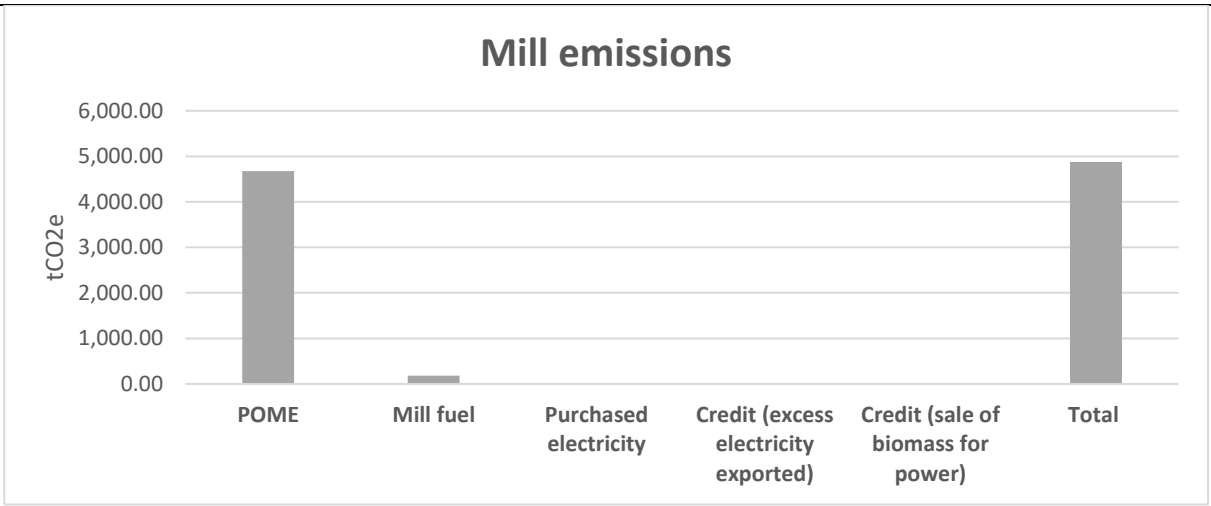



**Figure 26. Mill emissions from Development Scenario 4**

***Justification for the selection of optimal development scenario***

The selection of Development Scenario 4 is the result of a long process of engagement with the land owners. During this process information regarding the biophysical limitations to development of their lands (i.e. HCVMA or HCSA), were shared with them and the implications that this would have on their options for income generation were discussed. Utilising this information, the landowners took an informed decision to indicate which lands they would set aside for their own use and which lands they would authorise NBPOL to develop.

Table 37 shows crop and plantation sequestration to be an important emissions sink, with this fact balancing carbon emissions from land use change to the point that (based on the assumptions of the GHG calculator) Development Scenario 4 is slightly carbon emission positive, with an estimated emission of 1581 $tCO_2e$.

It should also be acknowledged that this emission estimate is likely to be a conservative over-estimate, as it does not factor in operational constraints like slope or soil type, and as such the areas identified for conversion in Scenario 4 should be considered 'gross area' of potential, rather than an operational reality.

Other measures that may be taken into consideration to mitigate the net GHG emissions are methane capture at the palm oil mill, local sourcing of fertilisers, reducing usage of inorganic fertilisers (i.e. using Empty Fruit Bunches), reducing fuel consumption when deemed economically feasible as per Principle 3 of the RSPO.

When the above discussed factors are taken into consideration, the company considers the development across the West New Britain New Plantings project area, that is consistent with that set out in Scenario 4, is justified.

**Section 8: Land Use Change Analysis (LUCA)**

*RSPO Note: This section will be used to analyse that there has been no land clearing in the area before the NPP is submitted. Arrangement should be following the proxy dates indicated in section 2.2.7 of the current NPP Document. Please ensure that the minimum resolution is 300 dpi. What are the methodology(ies), people involved in the process, date of assessment and findings? Note: Should an assessment carried out by internal staff, just fill the name of the staff and his/her designation.*

Date of RSPO approval as satisfactory: Not reviewed because there is no land clearance

Name of Assessor: Jules Crawshaw

Assessor Designation and Company: Consultant – PT Hijau Daun

Methodology involved the following steps :

1. Less cloud composite data development within Earth Engine
2. Imagery clip
3. Geometric correction
4. Radiometric correction
5. Segmentation
6. Define the segmentation classes
7. Object oriented classification on each period
8. Change detection

*The sample locations for the training are as follows:*

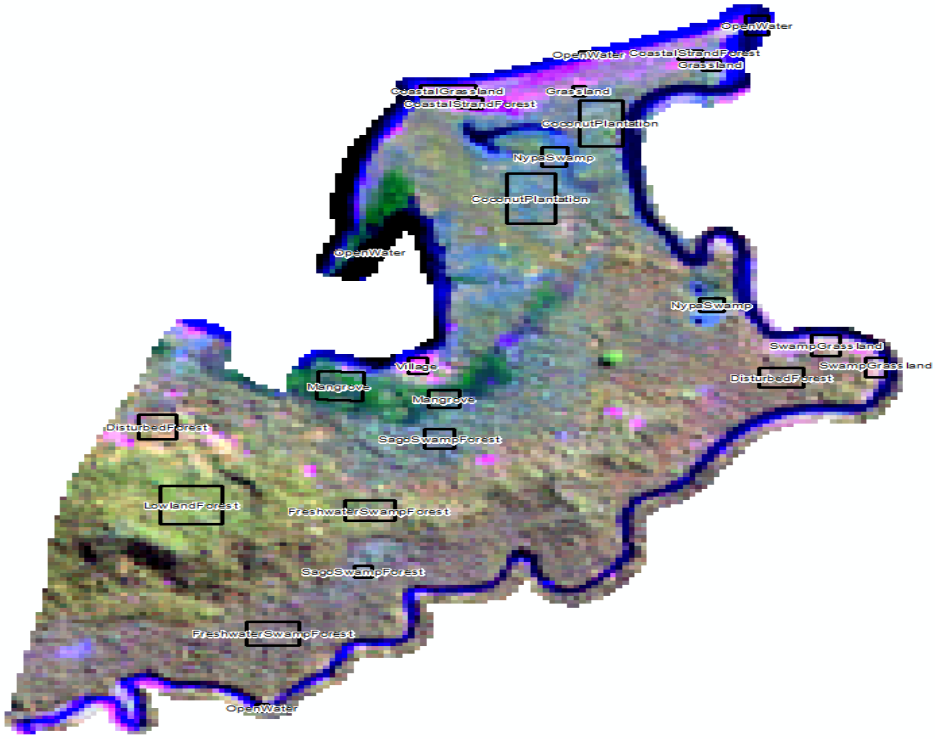



**Figure 27. Examples of training sample locations - Lingalinga**

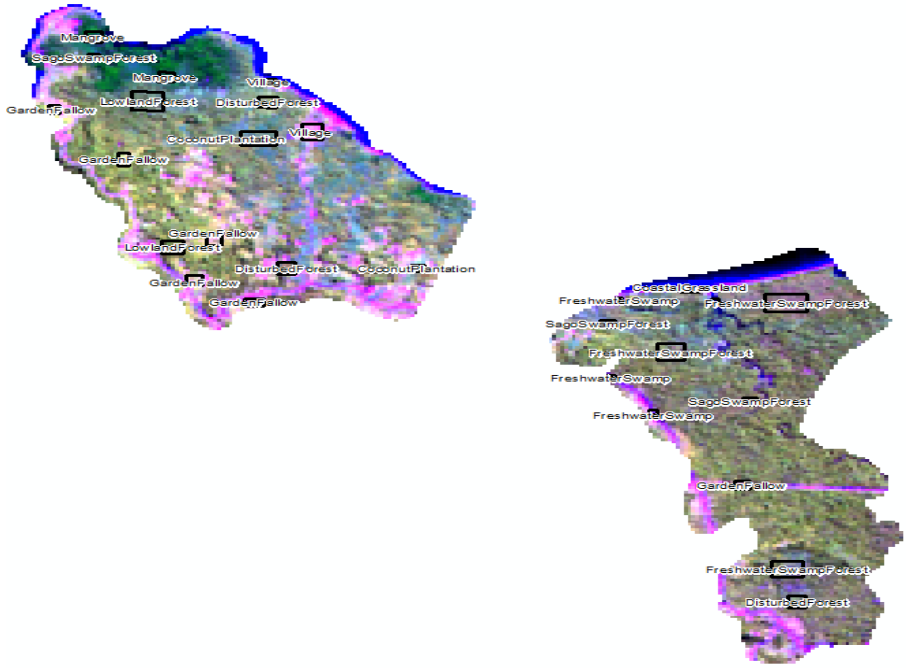



**Figure 28. Examples of training sample locations – Balave and Kandoka**

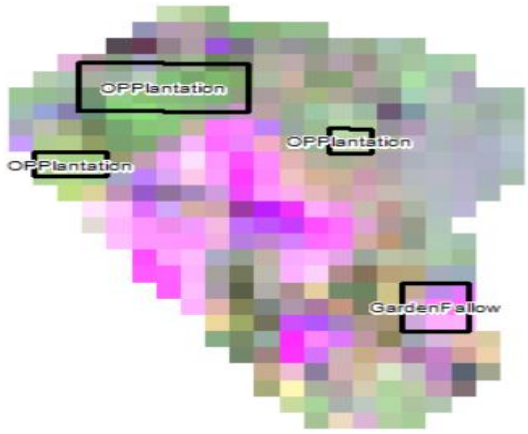


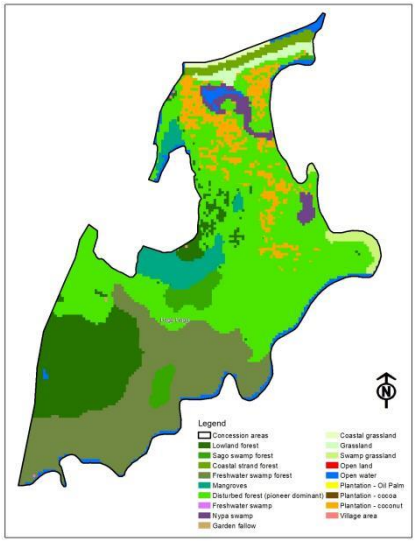
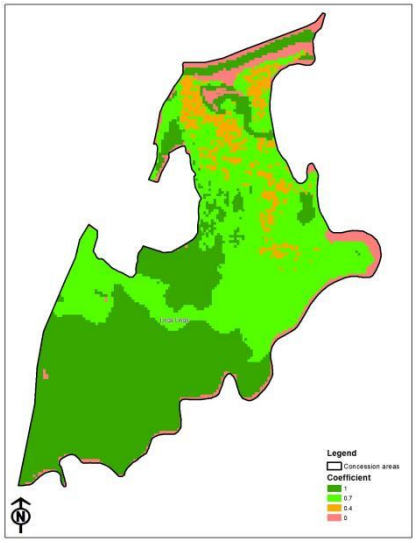
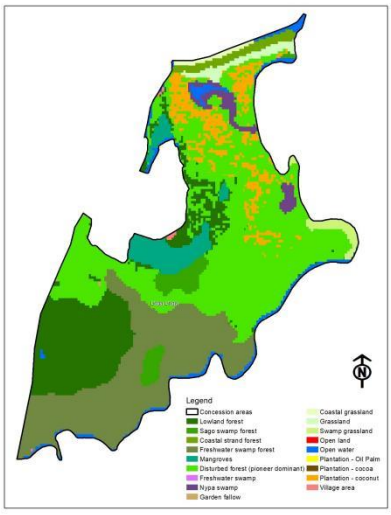
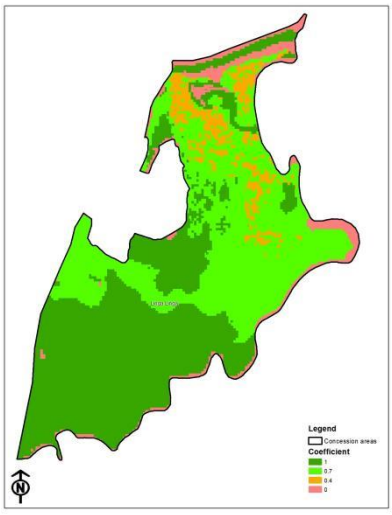

**Figure 29.Examples of training sample locations – Richie's Block**

**Table 40. Coefficients and definitions of landcovers**

| Land Cover | Coef | Description |
|---|---|---|
| **Coastal grassland** | 0 | Grassland along the coastal area |
| **Coastal strand forest** | 1 | Forest along the coastal area |
| **Disturbed forest (pioneer dominant)** | 0.7 | Disturbed forest, less density |
| **Freshwater swamp** | 0 | Inundated area with freshwater, either permanently or seasonally. |
| **Freshwater swamp forest** | 1 | Forests which are inundated with freshwater, either permanently or seasonally. |
| **Garden fallow** | 0 | Garden fallow |
| **Grassland** | 0 | Grassland |
| **Lowland forest** | 1 | Lowland forest is an ecological community of forest and some related, structurally complex forms of dry forest |
| **Mangroves** | 1 | Mangroves are a group of trees and shrubs that live in the coastal intertidal zone. |
| **Nypa swamp** | 1 | Nypa forest is a swampy area with brackish water. |
| **Open land** | 0 | No vegetated / cleared area. |
| **Open water** | 0 | River, lake, sea |
| **Plantation - cocoa** | 0 | Cocoa plantation |
| **Plantation - coconut** | 0.4 | Coconut plantation, some vegetation may live beneath it. |
| **Plantation - Oil Palm** | 0 | Oil palm plantation |
| **Sago swamp forest** | 1 | The sago palm, Metroxylon sagu, is part of tropical lowland forest and freshwater swamps acrossSoutheast Asia and New Guinea and is the primary source of sago. It tolerates a wide variety of soils and may reach 30 meters in height (including the leaves). |

| | | |
|---|---|---|
| **Swamp grassland** | 0 | Grassland within the swampy area. |
| **Village area** | 0 | Settlement |

**Table 41. Lingalinga**

| *Period* | *Land Cover* | *Vegetation Coefficient* |
|---|---|---|
| *2005* |  |  |
| *2007* |  |  |

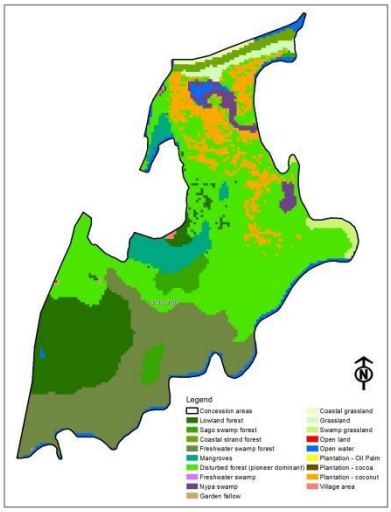
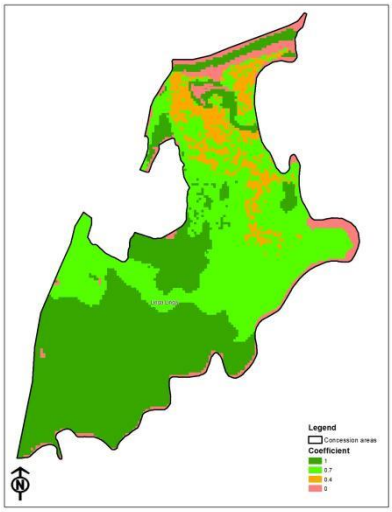
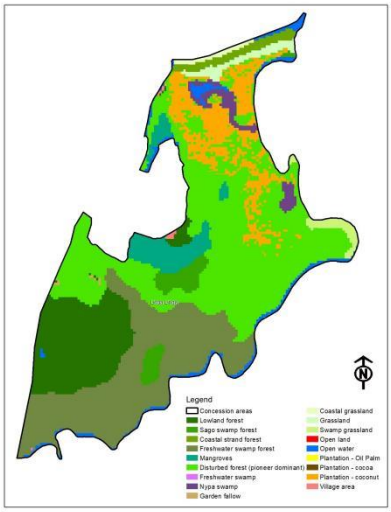
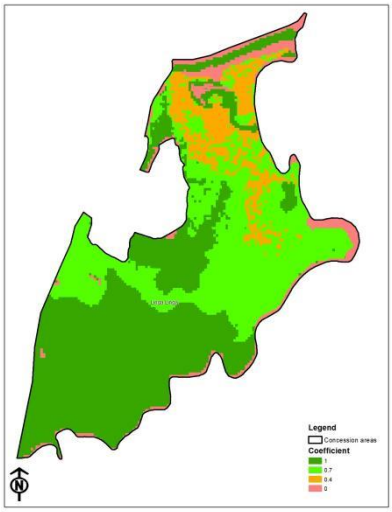
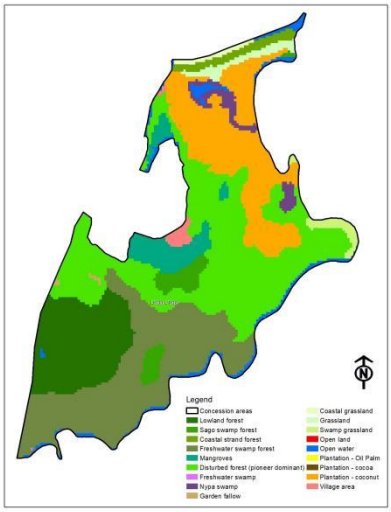
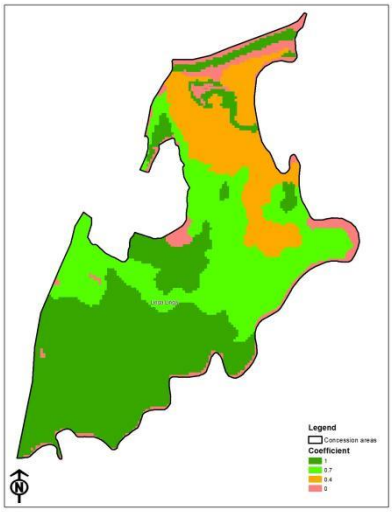
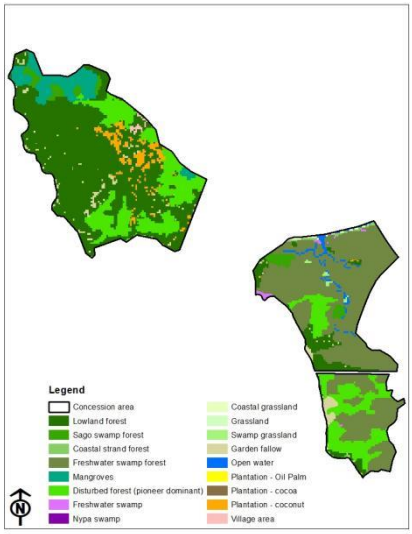
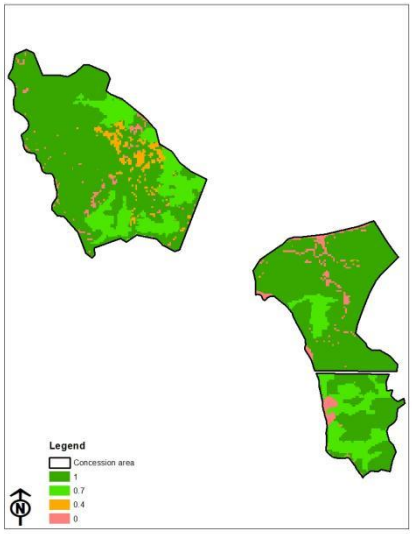
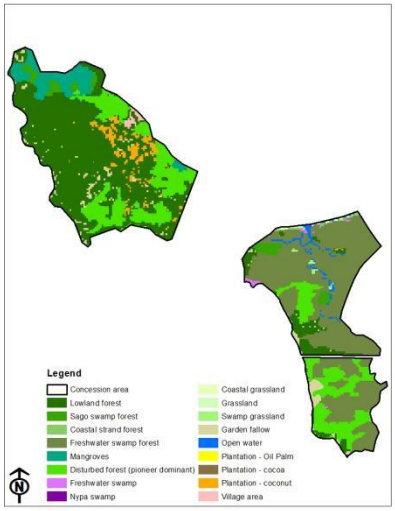
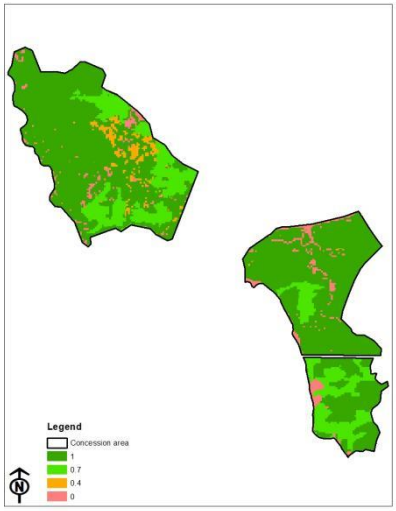
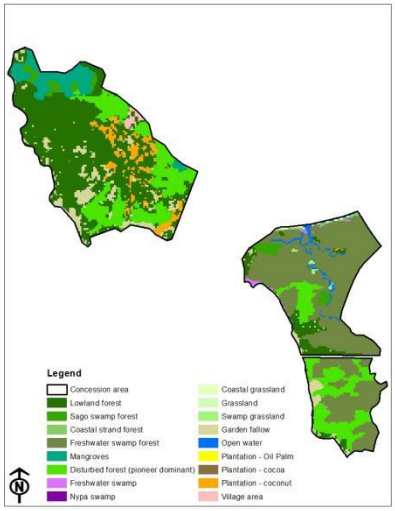
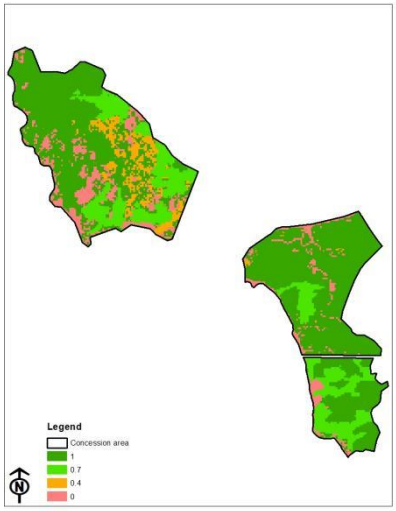
| | | |
|---|---|---|
| *2009* |  |  |
| *2014* |  |  |
| *2019* |  |  |

**Table 42. Balave and Kandoka**

| *Period* | *Land Cover* | *Vegetation Coefficient* |
|---|---|---|

| | | |
|---|---|---|
| *2005* |  |  |
| *2007* |  |  |
| *2009* |  |  |

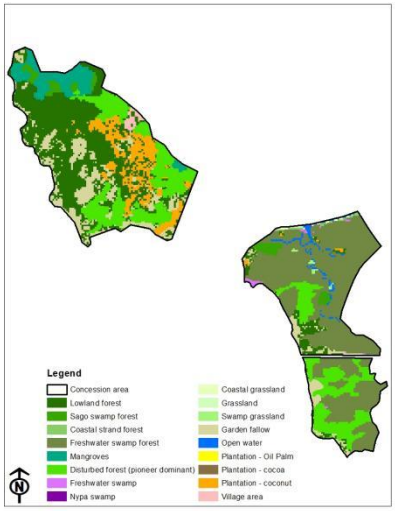
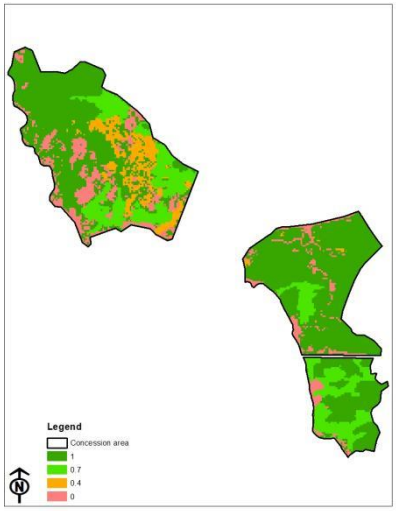
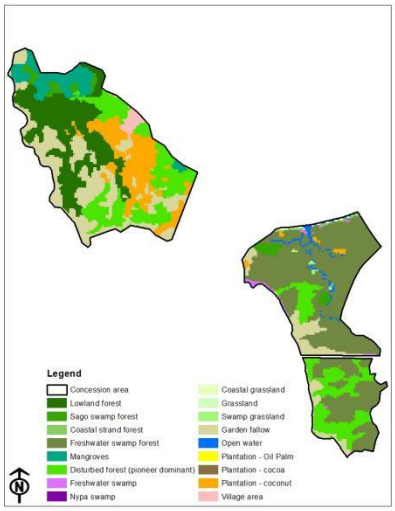
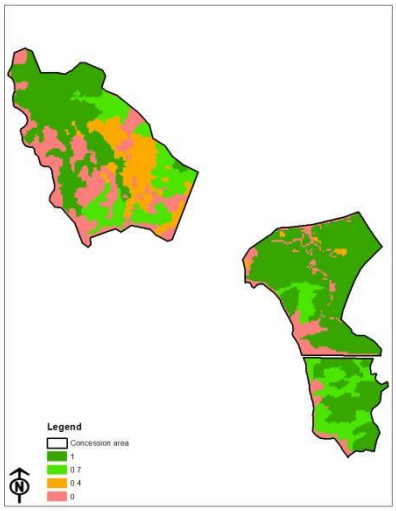
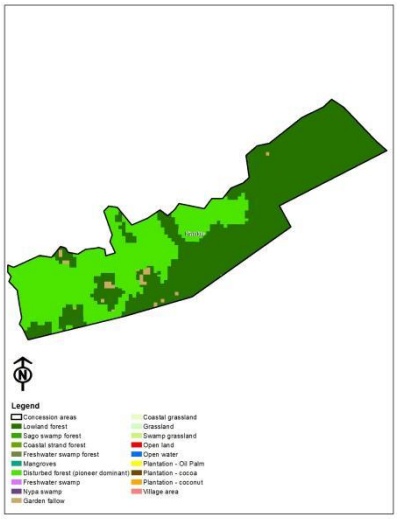
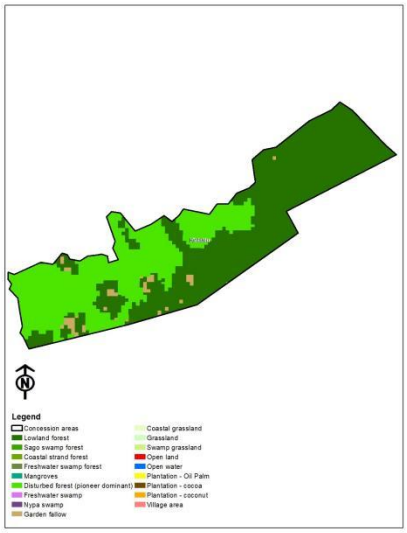
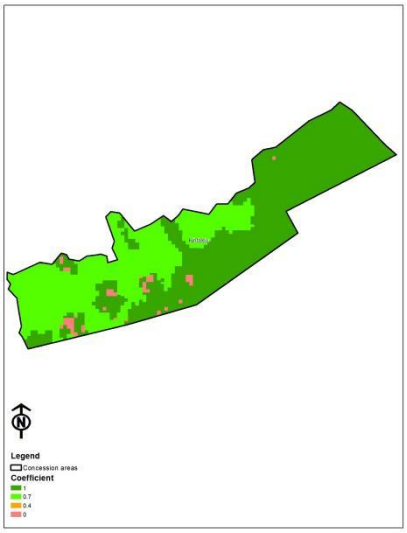
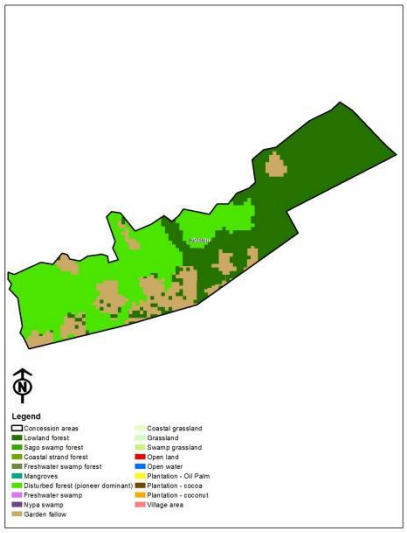
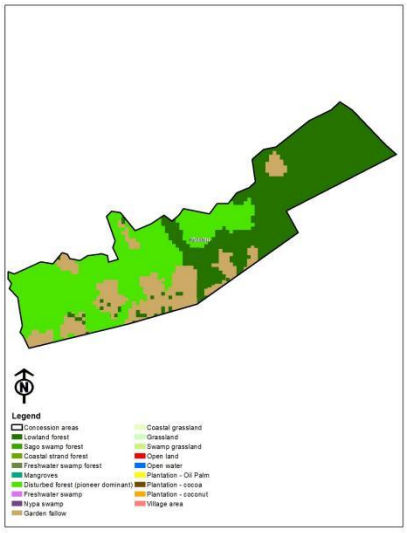
| | | |
|---|---|---|
| *2014* |  |  |
| *2019* |  |  |

**Table 43. Kintakiu**

| *Period* | *Land Cover* | *Vegetation Coefficient* |
|---|---|---|
| *2005* |  |  |

| | | |
|---|---|---|
| *2007* |  |  |
| *2009* |  |  |
| *2014* |  |  |

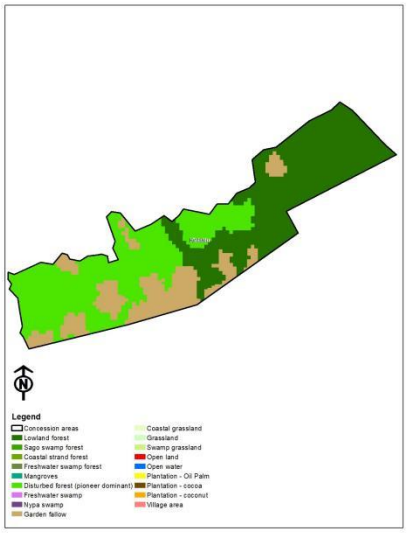
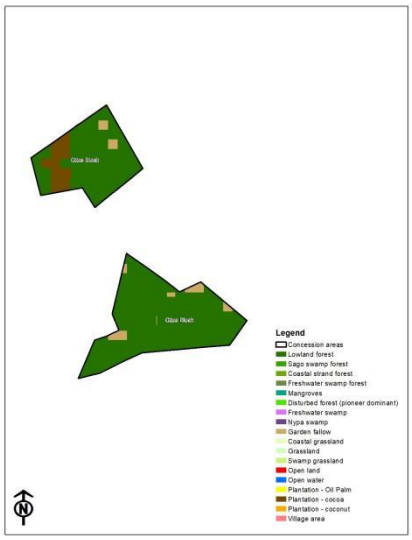
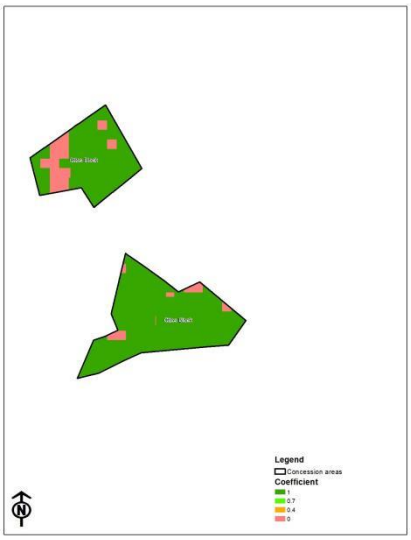
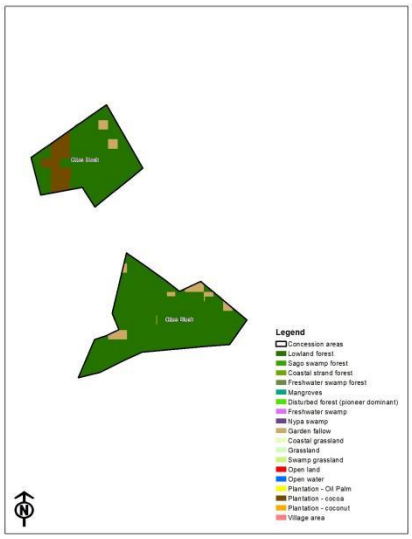
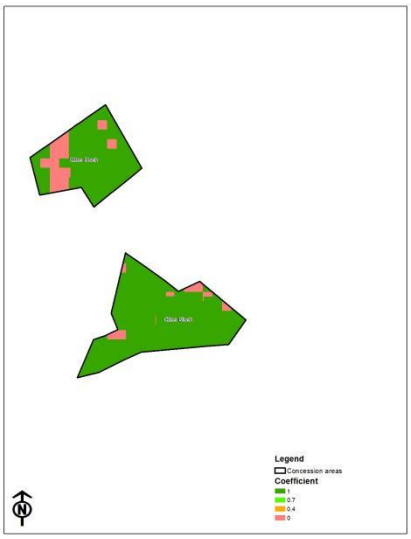
| | | |
|---|---|---|
| *2019* |  |  |

**Table 44. Otto's Block**

| *Period* | *Land Cover* | *Vegetation Coefficient* |
|---|---|---|
| *2005* |  |  |
| *2007* |  |  |

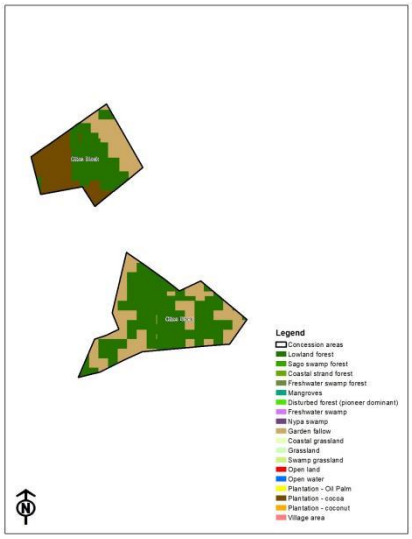
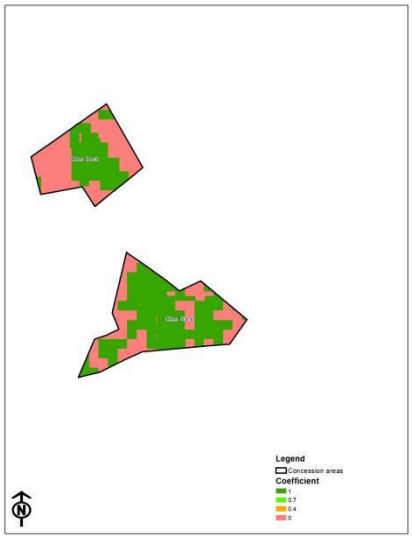
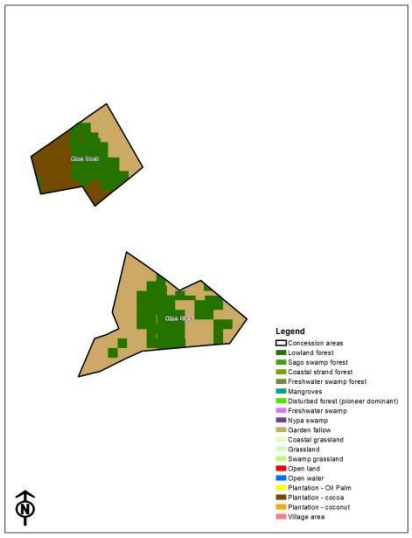
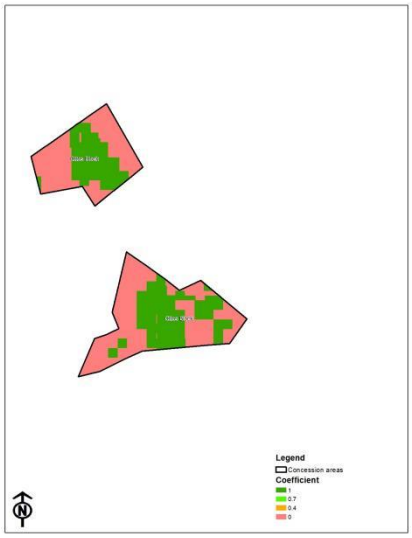
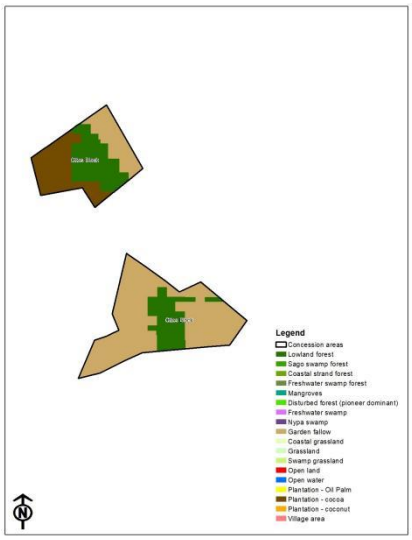
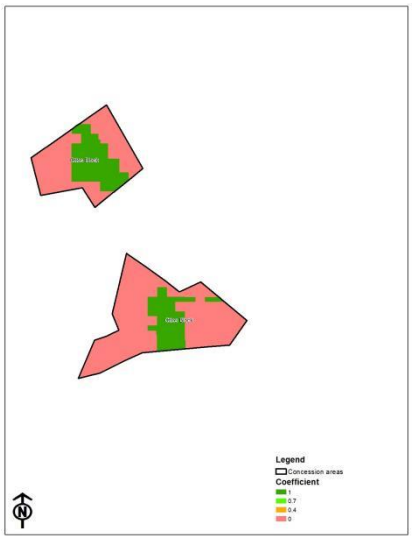
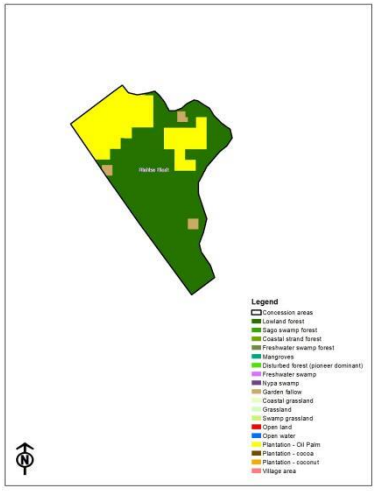
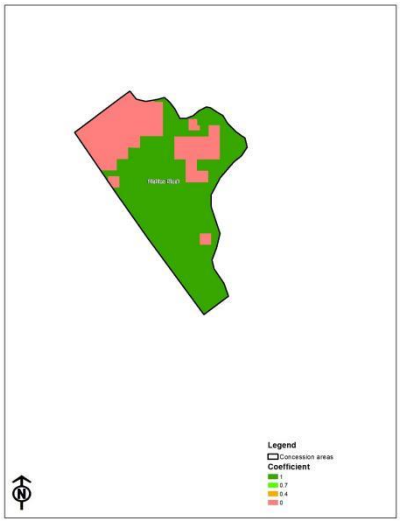
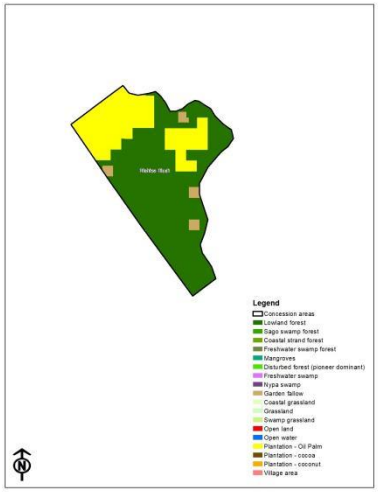
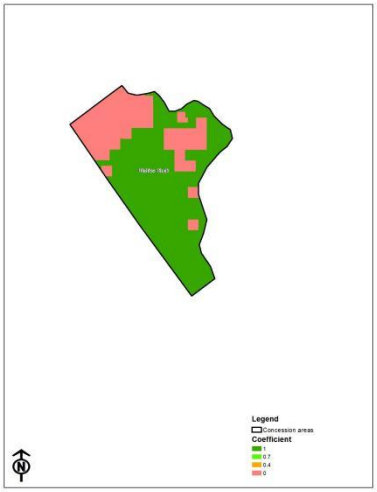
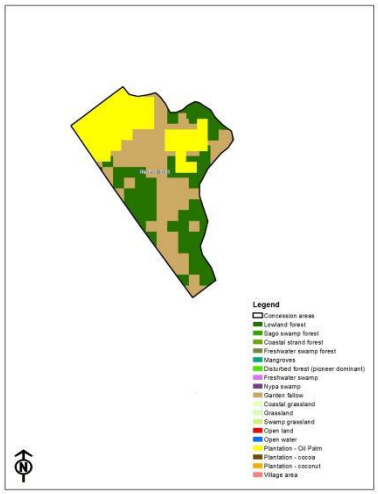
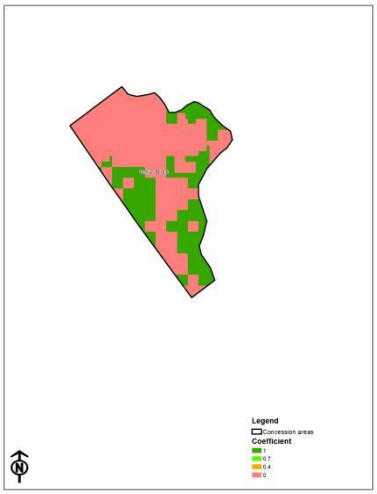
| | | |
|---|---|---|
| *2009* |  |  |
| *2014* |  |  |
| *2019* |  |  |

**Table 45. Richies's Block**

| *Period* | *Land Cover* | *Vegetation Coefficient* |
|---|---|---|

| | | |
|---|---|---|
| *2005* |  |  |
| *2007* |  |  |
| *2009* |  |  |

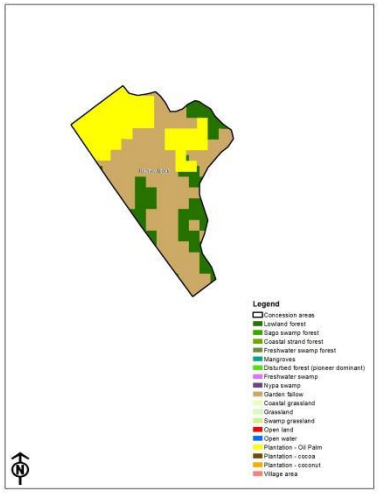
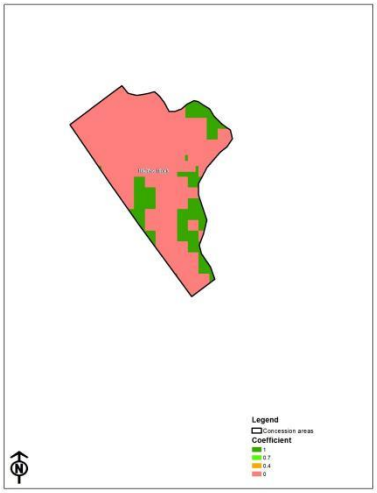
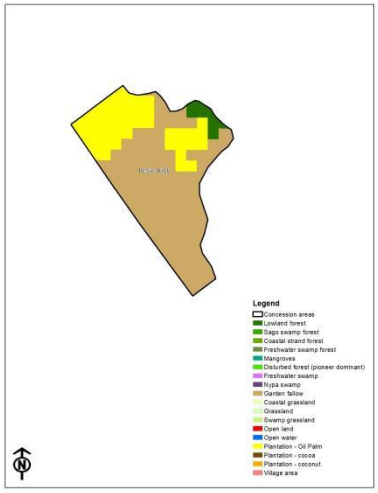
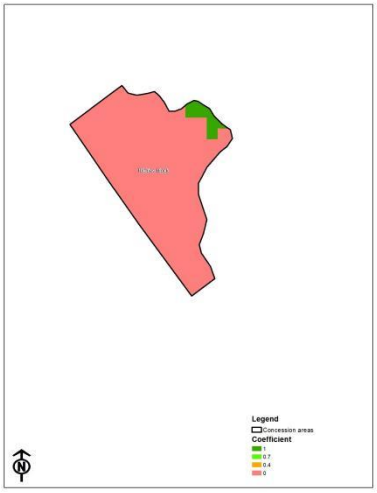
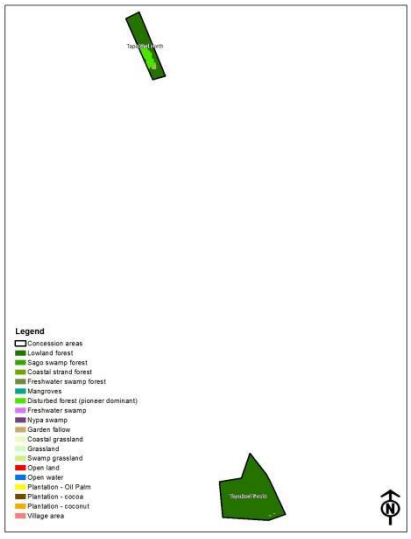
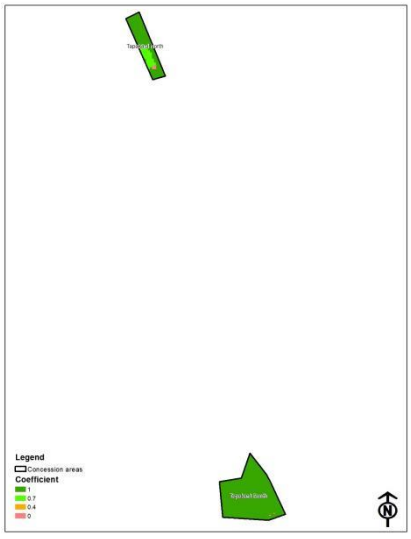
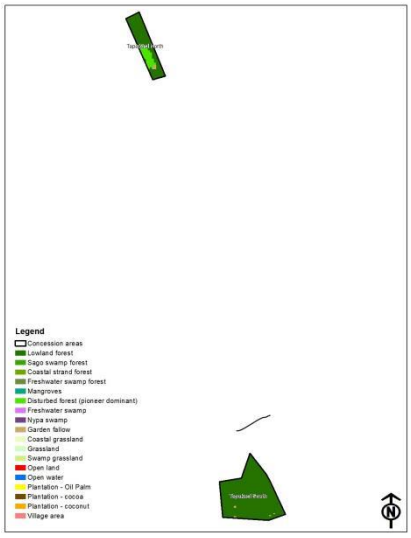
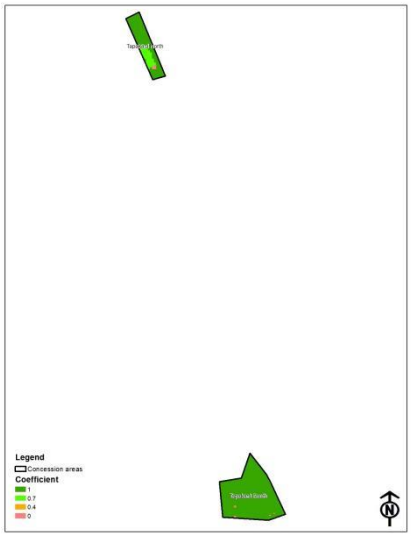
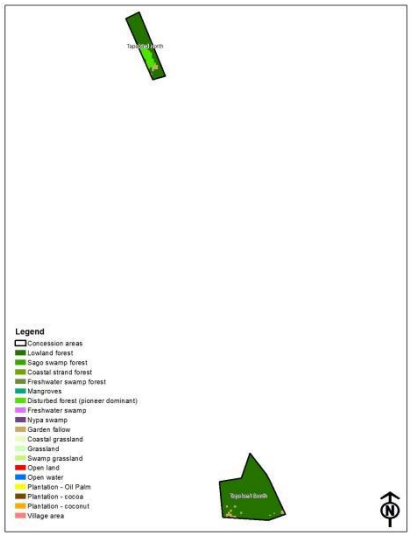
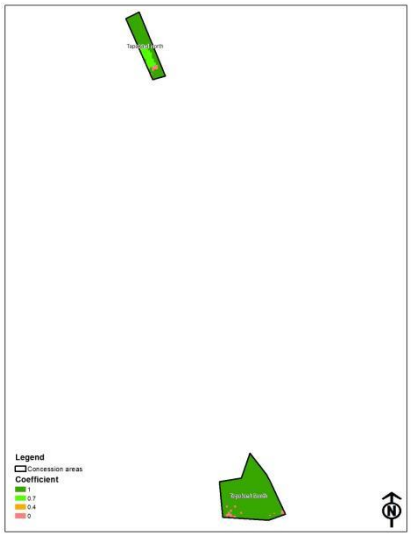
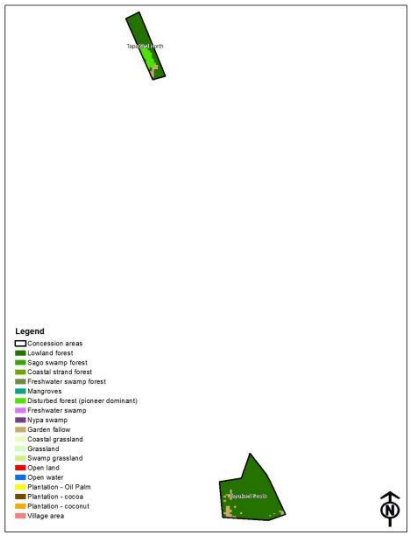
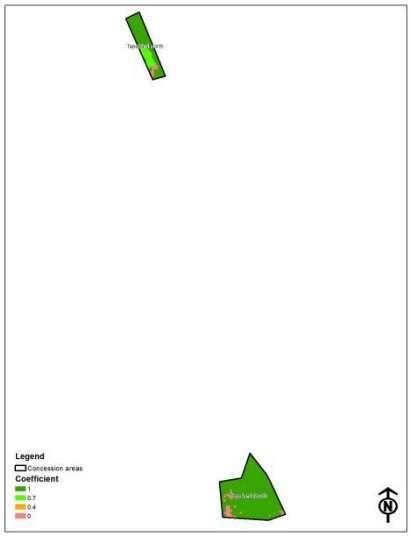
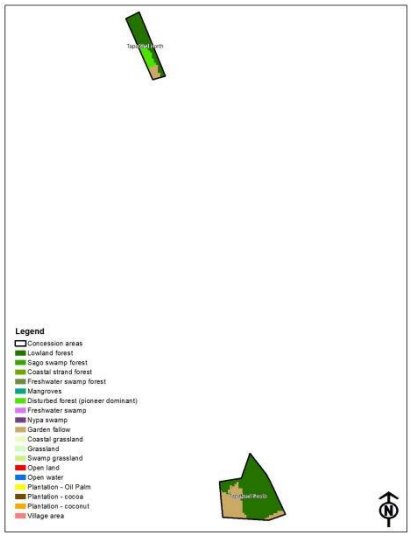
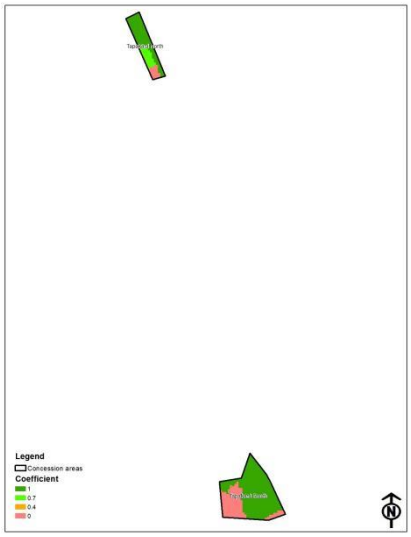
| | | |
|---|---|---|
| *2014* |  |  |
| *2019* |  |  |

**Table 46. Tapakasi**

| *Period* | *Land Cover* | *Vegetation Coefficient* |
|---|---|---|
| *2005* |  |  |

| | | |
|---|---|---|
| *2007* |  |  |
| *2009* |  |  |
| *2014* |  |  |

| | | |
|---|---|---|
| *2019* |  |  |

*Environmental remediation*

**Table 47. Environmental remediation is zero hectares in every year because there has been no corporate land clearance.**

| Period | Peat | Riparian | Slope | Total |
|---|---|---|---|---|
| After May 9, 2014 | 0 | 0 | 0 | 0 |
| April 2011 to May 9, 2014 | 0 | 0 | 0 | 0 |
| Jan 1, 2010 to April, 2011 | 0 | 0 | 0 | 0 |
| Dec 1, 2007 to Dec 31, 2009 | 0 | 0 | 0 | 0 |
| Nov 1, 2005 to Nov 30, 2007 | 0 | 0 | 0 | 0 |
| Total (sum of row) | 0 | 0 | 0 | 0 |

**Table 48. Raw liability - this is zero hectares in every year because there has been no corporate land clearing.**

| Land cover class | Vegetation Coefficient | Nov 1, 2005 to Nov 30, 2007 | Dec 1, 2007 to Sept 2008 | Sept 2008 to 2009 | 2009 to May 9, 2014 | After May 9, 2014 |
|---|---|---|---|---|---|---|
| One or more land cover classes which fulfill the criterion of vegetation coefficient 1.0 | 1.0 | 0 | 0 | 0 | 0 | 0 |
| One or more land cover classes which fulfill the criterion of vegetation coefficient 0.7 | 0.7 | 0 | 0 | 0 | 0 | 0 |
| One or more land cover classes which fulfill the criterion of | 0.4 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| vegetation coefficient 0.4 | | | | | | |
| One or more land cover classes which fulfill the criterion of vegetation coefficient 0.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total (sum of row) | | 0 | 0 | 0 | 0 | 0 |

**Table 49. Final Compensation Liability - this is zero hectares in every year because there has been no corporate clearing.**

| Period | Land controlled by a non-member at time of clearance | Land controlled by an RSPO member at the time of clearance. This includes land acquired from other RSPO members |
|---|---|---|
| After May 9, 2014 | 0 | 0 |
| April 2011 to May 9, 2014 | 0 | 0 |
| Jan 1, 2010 to April, 2011 | 0 | 0 |
| Dec 1, 2007 to Dec 31, 2009 | 0 | 0 |
| Nov 1, 2005 to Nov 30, 2007 | 0 | 0 |
| Total (sum of row) | 0 | 0 |

**Section 9: Conclusions**

*RSPO Note: Please conclude all the findings of the assessment and how this will be translated into a management plan. If there is any known significant issue, the RSPO member needs to acknowledge its existence and ensure it is a priority for the management to address those issues.*

Medium and high forest cover landscapes, such as New Britain, pose a difficult situation for RSPO certified companies, as the no deforestation, peat or exploitation polices (NDPE) inherent in sustainability certification effectively restrict sustainable developments to anthropogenic grasslands or highly degraded scrublands. This situation is clearly evident across the study area landscape, with only previously degraded vegetation proving suitable for establishment of industrial Oil Palm.

From a development potential standpoint, the findings of this assessment indicate mixed results, with approximately 60% of the area proposed for development being excluded for either community use or not available due to the presence of HCV management areas or HCS forest. The assessment team considers areas that are classified as 'indicative develop' suitable for conversion to oil palm, provided that the recommendations of this integrated HCV/HCSA report are implemented.

The assessment team found that the condition of vegetation within the proposed development areas was related to previous land use history and proximity to villages, with areas close to village areas or having long land use histories being in a severely degraded condition.

The rapid faunal assessment generally found impoverished faunal assemblages across the study areas, mainly due to the interrelated factors of long land use history, vegetation condition and proximity to settlements. From a biodiversity perspective the main recommendations are to prevent encroachment and fire within the areas. Tropical forest will recover very quickly in this fertile area.

All the communities were very keen to see development as soon as possible. The success of the project will require benefits of development to be shared equitably. This in turn involves running the ILGs ( Incorporated Land Group) properly and transparently. If the governance breaks down the conservation areas are likely to be compromised. It is both the responsibility of the individual ILGs ( Incorporated Land Group) as well as NBPOL to ensure this is successfully undertaken. Some communities are a long way down the track in developing an ILG ( Incorporated Land Group), whilst others are mired in disputes.

There are no really significant issues but this development will require careful management and findings will be translated into management plan.

**Table 50. Threats to biodiversity and social values.**

| Value identified | Threat | Management | Monitoring |
|---|---|---|---|
| **HCV 1** | • Hunting<br>• Fire<br>• Invasive species<br>• Logging<br>• Agricultural clearance<br>• National road through Lingalinga | • Agreements with the community about no hunting of birds / mammals in the HCV areas nor logging.<br>• Awareness raising in villages to discourage random fire lighting. Enforcement of the "No Burn Policy"<br>• Very little can be done about invasive species.<br>• Agreements with the community about no clearance / logging within the HCV areas. This is especially relevant to the national road through Lingalinga. | • Undertake bird / mammals surveys to measure changes in bird mammal abundance / presence.<br>• Map out areas of burns.<br>• Recording the presence of invasive species.<br>• Monitoring using a combination of monitoring from satellite images as well as on the ground patrols and being informed by staff working in the village about encroachment or logging.<br>• Existing road in Lingalinga will have to have security to ensure that people do not enter the area and cut timber from the adjacent HCV area. |
| **HCV 2** | • Not present in the assessment area | | |
| **HCV 3** | • These follow HCV1 and are not repeated. | | |
| **HCV 4** | • Burning to assist agricultural development within the riparian buffer strip.<br>• Lack of awareness by company employees and contractors about HCV 4, particularly small river riparian buffers and | • Ensure that the communities realise that the riparian buffers are not empty land available for agriculture. This should be specifically stated in agreements and socialized to the community.<br>• A slope survey and demarcating areas greater than 25 degrees to be reserved from development.<br>• Existing road in Lingalinga will require special management to ensure run-off from the road is | • Monitoring using a combination of monitoring from satellite images as well as on the ground patrols and being informed by staff working in the village about encroachment or logging.<br>• Monitoring of land clearing to ensure buffers and steep areas are not cleared.<br>• Water quality monitoring. |

| | | | |
|---|---|---|---|
| | mismanagement of high risk activities within buffer areas (e.g building roads through riparian areas, clearing of steep slopes).<br>• People constructing huts and living (permanently or temporarily) and making gardens in riparian areas.<br>• River changing course and destroying riparian areas<br>• Fire – this will stop tree lined riparian strips being established / maintained.<br>• There is an existing road through the riparian buffer in Lingalinga . It has to be recognized that this road goes through the riparian buffer and requires special attention. | filtered before it enters the Kapulok River. This is provided in detail in the SEIA. | |
| **5 (internal)** | • Agricultural chemicals in the ground water (relevant to Kintakiu and Kandoka).<br>• Claims and disputes on land. | • Ensuring the spring in Kandoka is mapped and buffered prior to land clearing.<br>• Ensuring adequate areas are available for the community to garden and collect natural materials (outside the lease area).<br>• Mapping of clans' lands (not just those areas to be leased) and assisting to have the land included in the ILGs ( Incorporated Land Group). This is to ensure security of the land and right to use the land in the future.<br>• Ensuring all claims and disputes are registered under the company's grievance process. | • Monitor against HCS metrics of 0.5 ha of garden land per person available.<br>• Monitoring recommendations for HCV 1 & 4 will overlap with HCV 5 and are not repeated.<br>• Ground water monitoring points should be established along with weather stations. A relationship between rainfall and water table level should be established. Establishing this immediately will enable a baseline to be developed. As the palms grow changes in the water table can be monitored.<br>• Keeping abreast of disputes and providing assistance to the communities where possible or necessary. |
| **5 (external)** | • Overfishing.<br>• Deforestation in the catchment causing | • Currently people have stated that the level of fishing is not degrading marine resources. With the development of OP, hopefully | • Monitoring the prevalence of marine indicator species also the size of catches.<br>• Recording problems with settlers. |

| | | | |
|---|---|---|---|
| | siltation of the marine areas.<br>• Continued agricultural expansion putting increased pressure on natural areas. Most likely this will be caused by oil palm companies that are not RSPO members nor have a "no deforestation commitment"<br>• Fires in el nino years.<br>• Settlers (or other parties) buying land in undocumented / illegal deals. | this will reduce the pressure on marine resources.<br>• Really this is in the hands of the community as it is their land. It is hard to say whether it is inevitable as the community are desperate for development.<br>• Agreements within the community | • Mapping of the number and size of fires. |
| **6** | • Accidental clearing of cultural sites by NBPOL staff.<br>• Fires that may burn these sites. | • Demarcation in the field prior to land clearing and planting. Including an appropriate buffer to make sure these areas are not disturbed by operations.<br>• Demarcation on operational maps<br>• Documentation of cultural and historical values<br>• Awareness raising with the communities to try to discourage them lighting fires.<br>• On-going fire-fighting to put out fires before they get large and uncontrollable. | • Checks to make sure enclaved areas are still clearly delineated.<br>• Mapping of the number and size of fires. |
| **Peat** | • Not present in the assessment areas | | |
| **HCS forest** | • These follow HCV1 and are not repeated here | | |

**Table 51. Summary of environmental and social values (in hectares) identified during this assessment**

| Environmental and social values to be conserved | Balave North | Balave South | Kandoka | Kintakiu | Linga Linga | Ottos Block | Ritchies Block | Total |
|---|---|---|---|---|---|---|---|---|
| **HCS forest areas** | 271.82 | 87.3 | 221.39 | 91.55 | 466.81 | - | - | **1138.87** |
| **HCV 1** | 256.2 | 73.63 | 55.38 | 36.15 | 461.51 | - | - | **882.87** |
| **HCV 2** | - | - | - | - | - | - | - | |
| **HCV 3** | 269.24 | 87.3 | 55.38 | - | 270.68 | - | - | **682.6** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **HCV 4** | 82.14 | - | 113.57 | - | 280.23 | - | - | **475.94** |
| **HCV 5** | - | - | 1.71 | - | - | - | - | **1.71** |
| **HCV 6** | - | - | - | - | 21.13 | - | - | **21.13** |
| **Total HCV area (all overlaps removed)** | 307.1 | 87.32 | 115.29 | 36.15 | **578.43** | - | - | **1124.29** |
| **Area enclaved for community usage** | - | - | 9.73 | - | 7.29 | - | - | **17.02** |
| **Totals (ha). Conservation + enclave areas with all overlaps removed.** | 307.1 | 87.32 | 267.96 | 91.55 | 633.71 | 0 | 0 | **1387.64** |
| **Total Area** | 363.28 | 176.01 | 618.49 | 211.55 | 957.96 | 15.32 | 12.89 | **2355.5** |
| **Total Developable Area** | **56.18** | **88.69** | **350.53** | **120** | **324.25** | **15.32** | **12.89** | **967.86** |

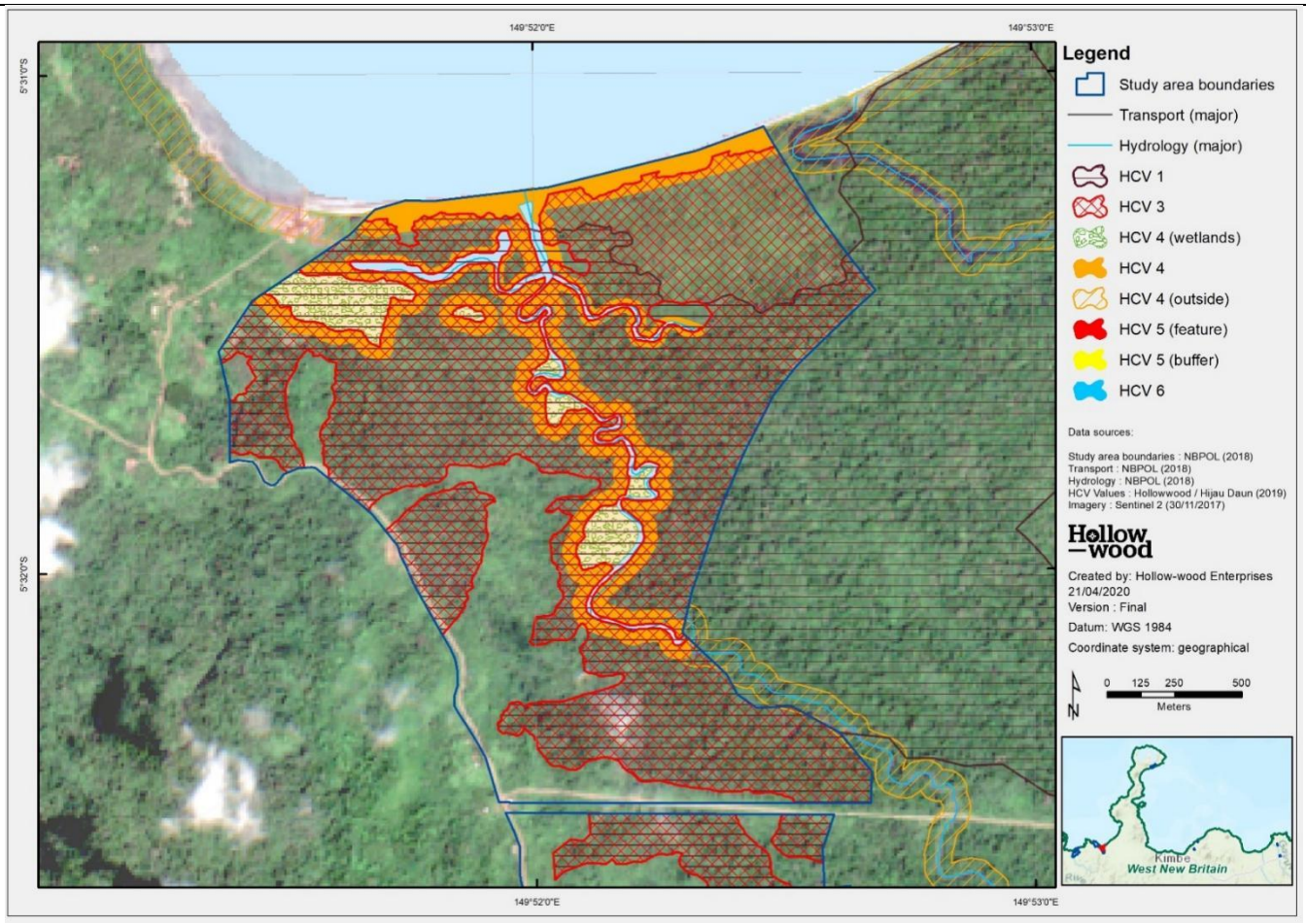



**Figure 30. Balave North, which shows only a small developable area. This area is swamp forest, with the areas east of the river being in good condition. The areas mapped as developable are areas that are in poor condition following the 2015 fires.**

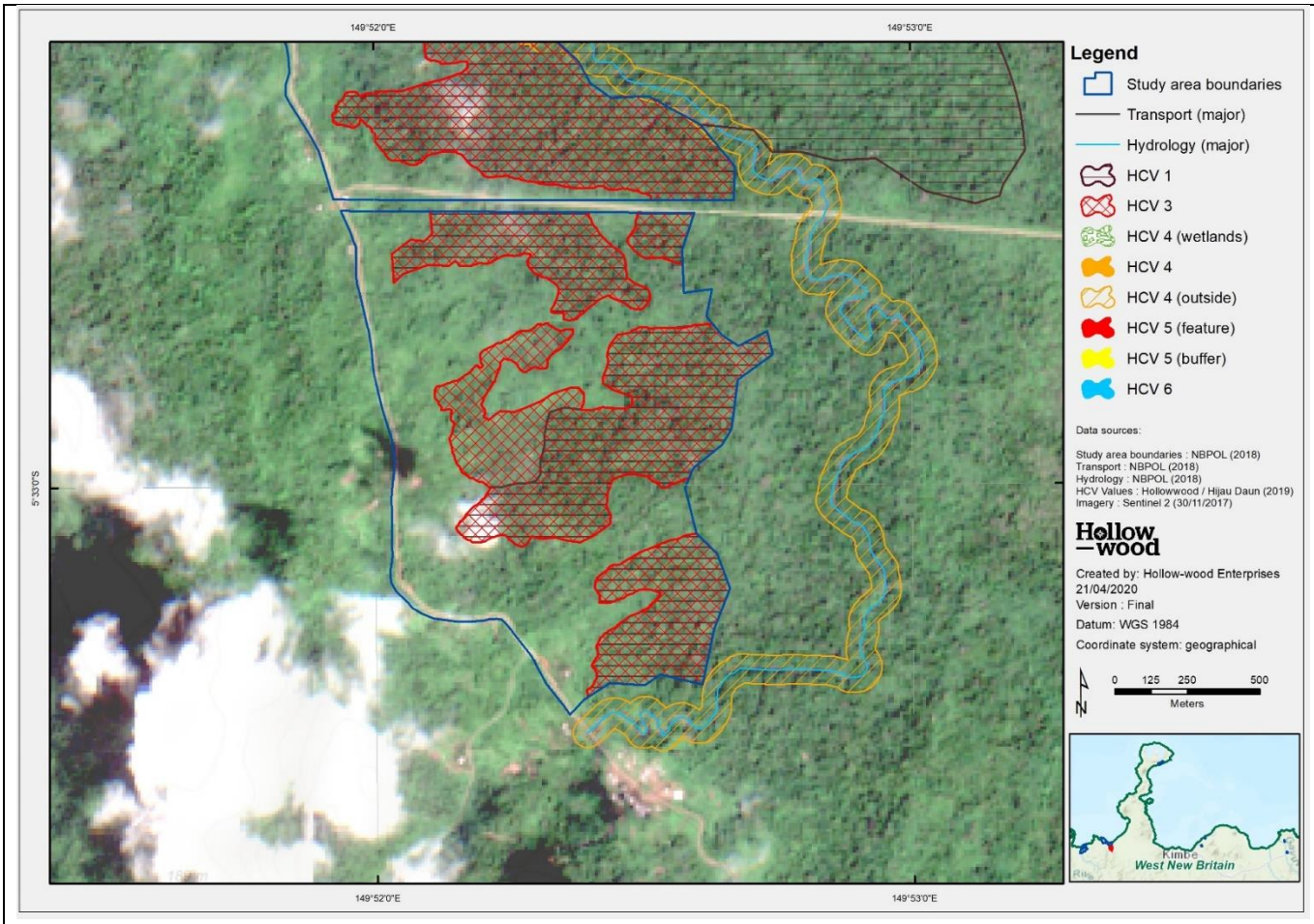



**Figure 31. Balave South, which shows only a small developable area (88.69 ha). This area is swamp forest. The areas mapped as developable are areas that are in poor condition following the 2015 fires.**

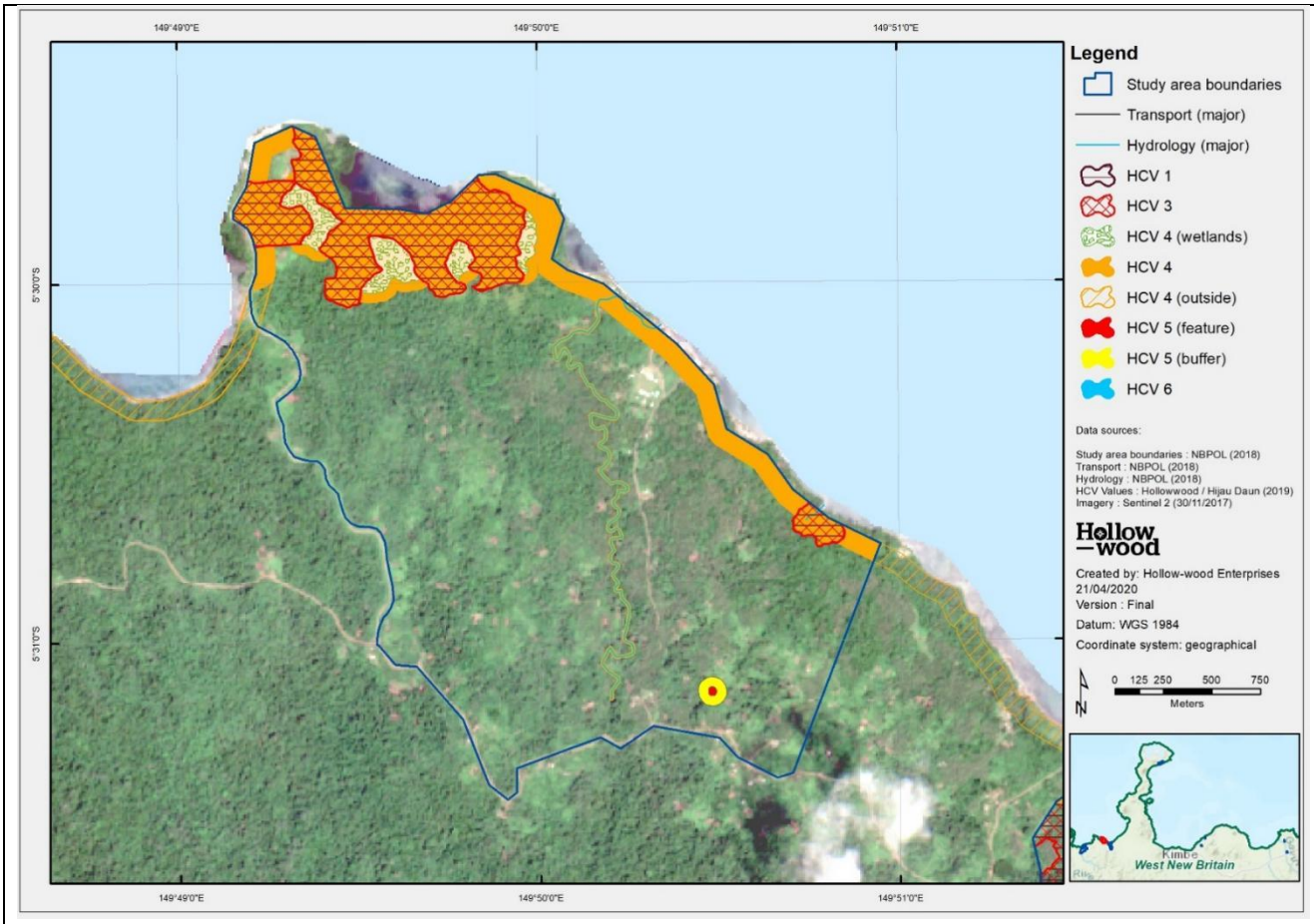



**Figure 32. Kandoka. There is a substantial area for development in this area. This is primarily a community garden area with areas of semi-abandoned coconut plantations. There are areas of better quality forest, mangroves and sago swamps in the north west.**

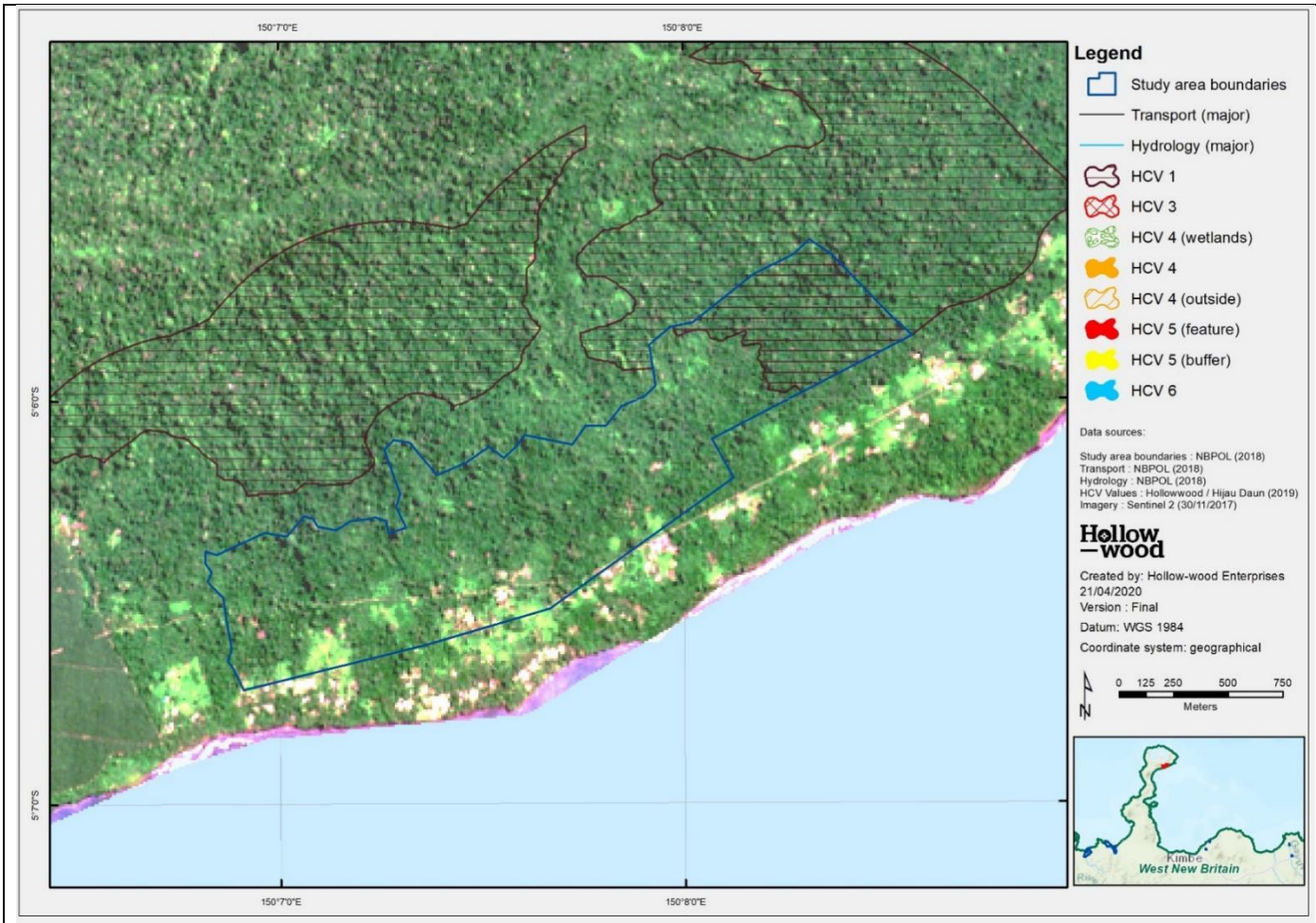



**Figure 33. Kintakiu. The development area consists of ex-garden areas and forest areas that have been burnt in the 2015 fires. The forest gets progressively better further east.**

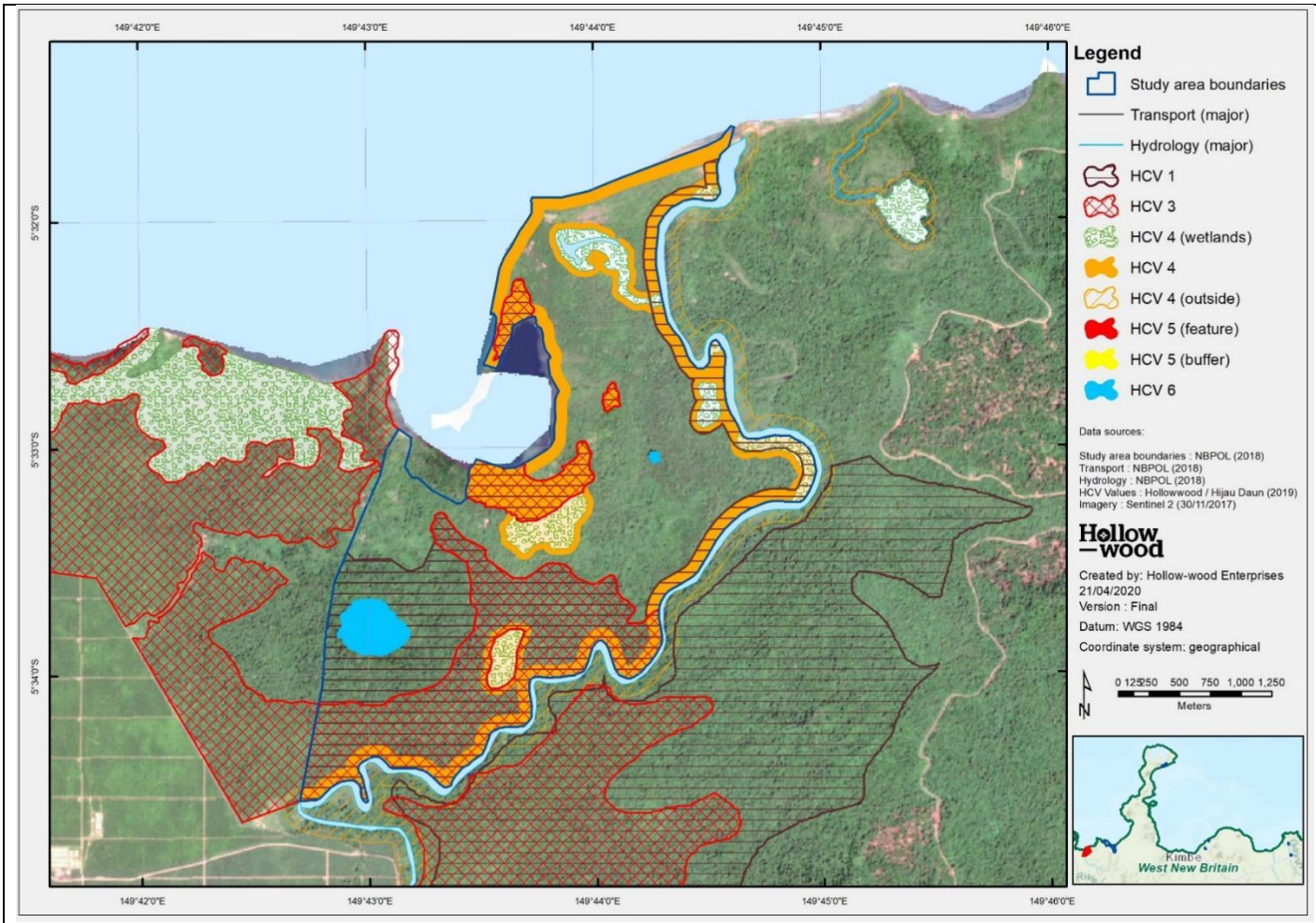



**Figure 34. Lingalinga –Development areas are ex-coconut plantations. The area in the south is a sacred mountain as well as intact forest.**

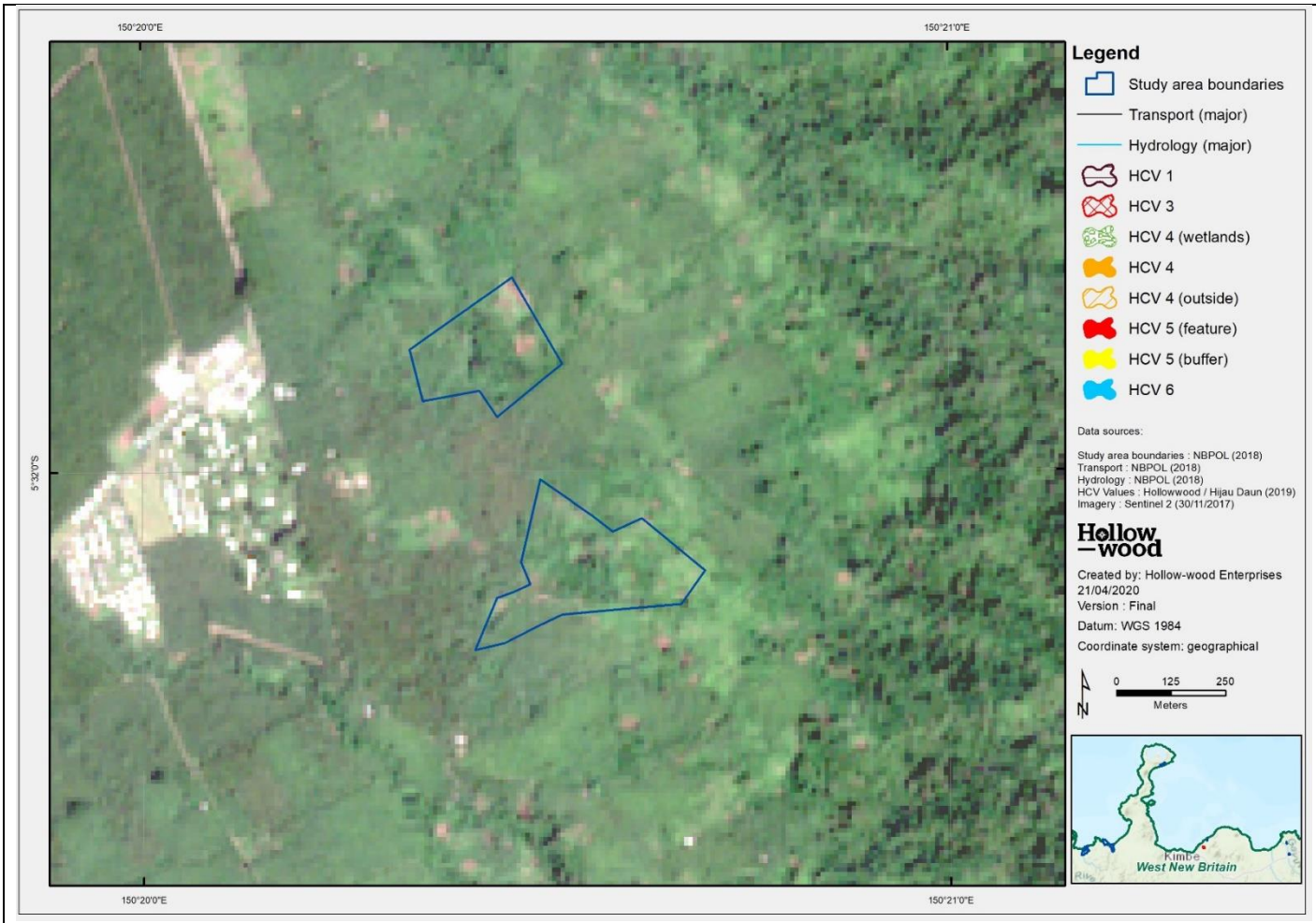



**Figure 35. Otto's Block. The full area is available for development. It is a mix of gardens and coconut plantation.**

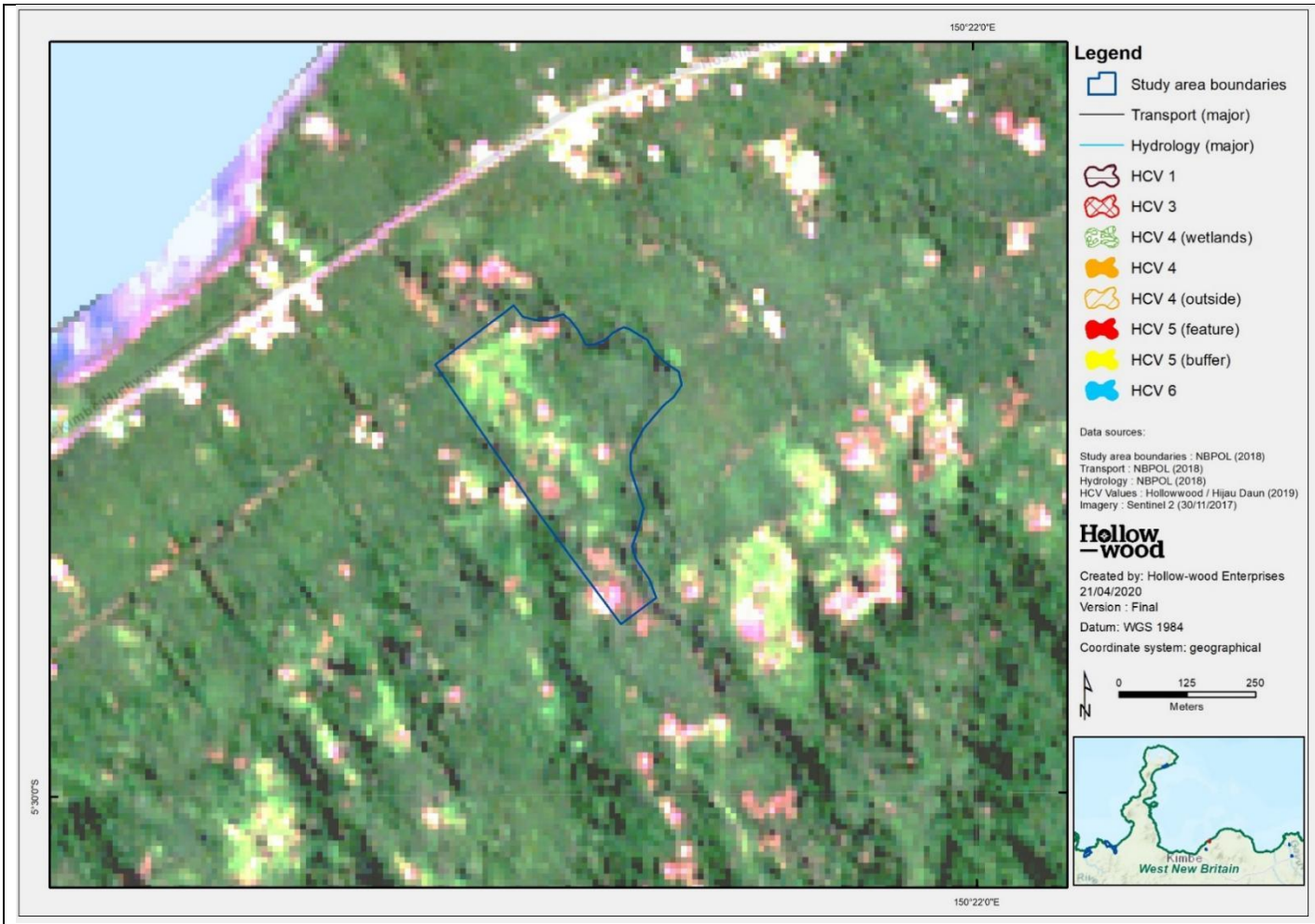



**Figure 36. Richie's Block. The full area is available for development. It is primarily a garden site.**

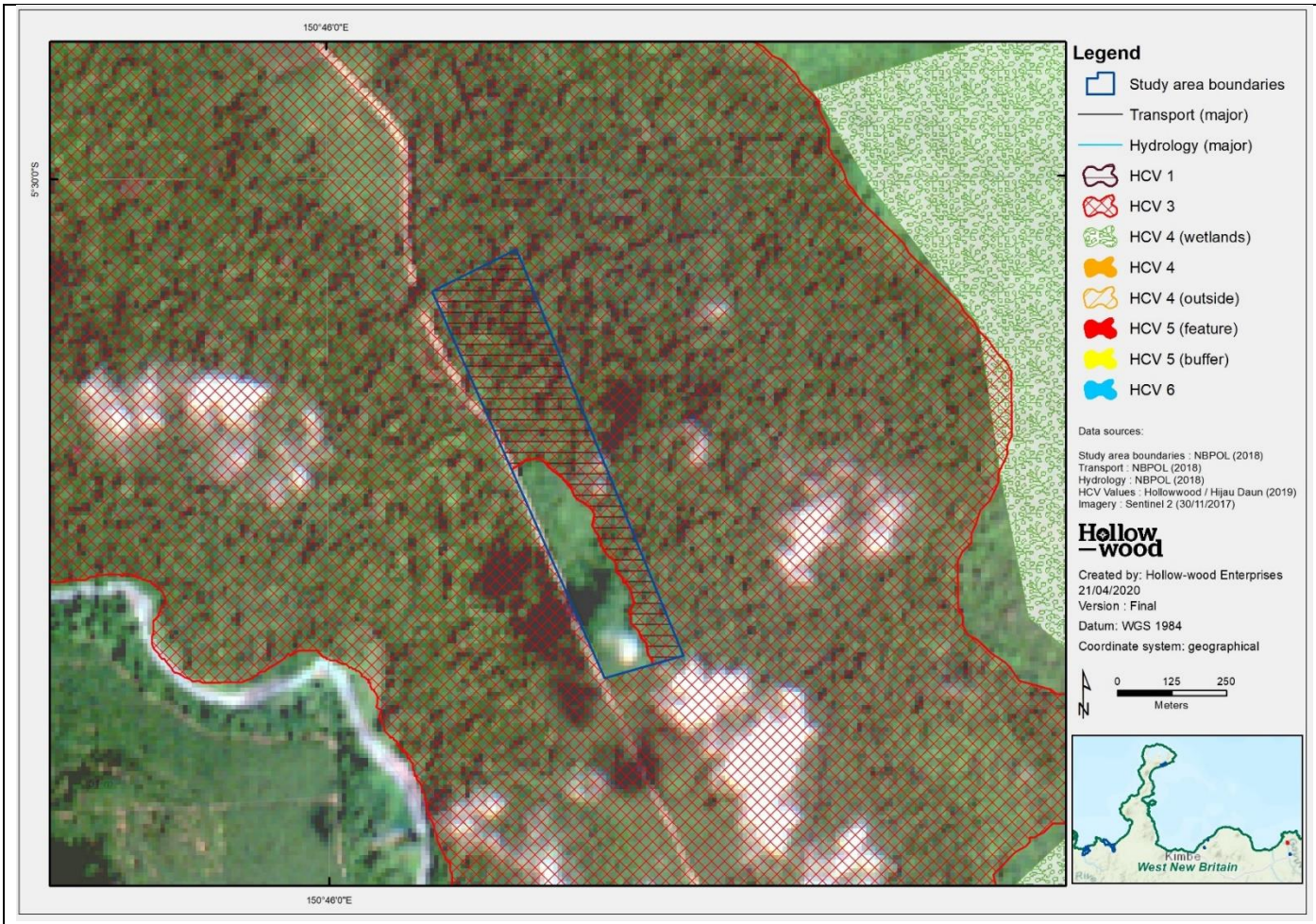



**Figure 37. Tapakasi North. The developable area is an ex-garden site. The rest is forest in good condition**

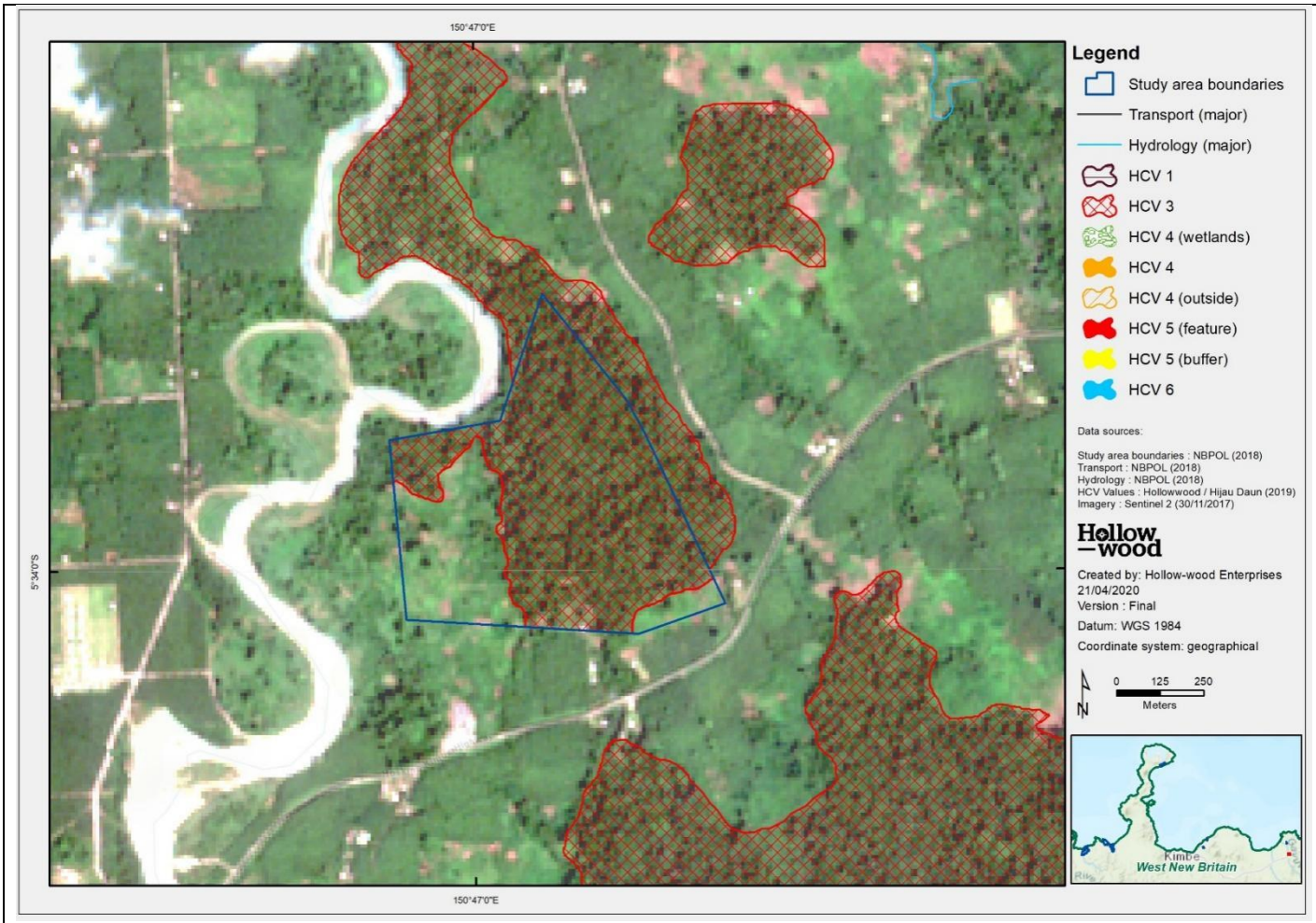



**Figure 38. Tapakasi South. The developable area is a garden site.**

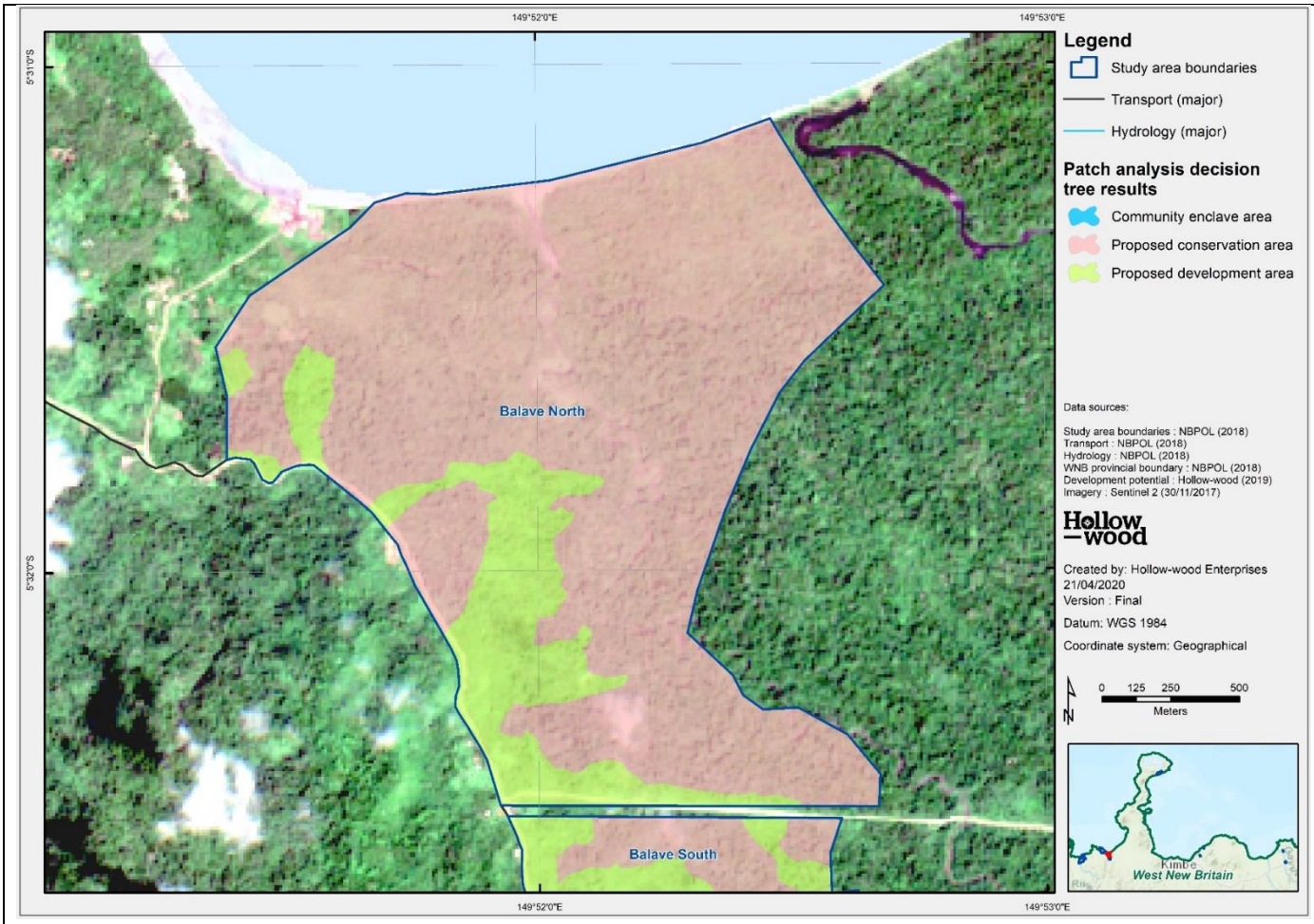



**Figure 39. Development potential for Balave North – this is all the area that is neither HCV nor HCS.**

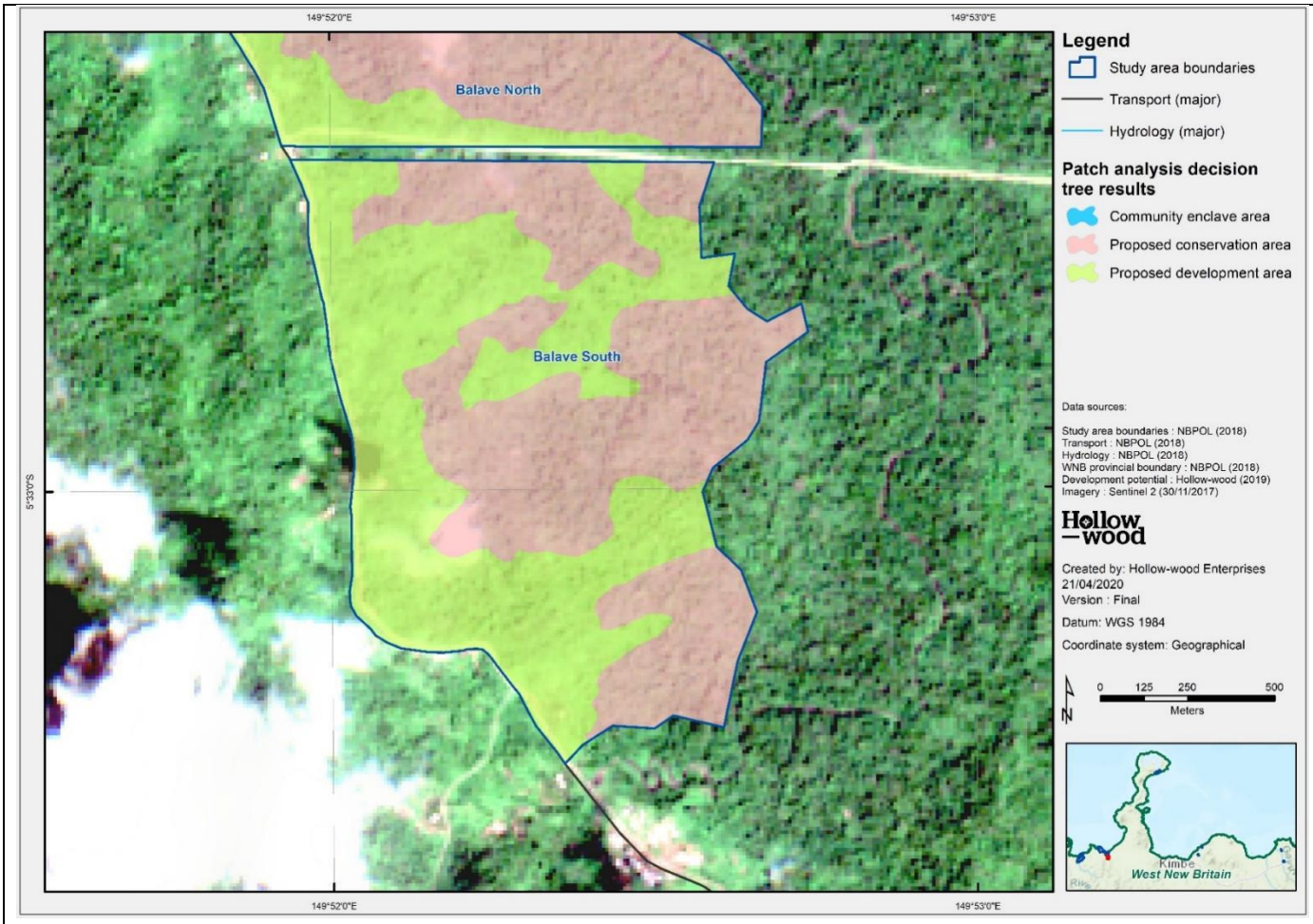



**Figure 40. Development potential for Balave South – this is all the area that is neither HCV nor HCS.**

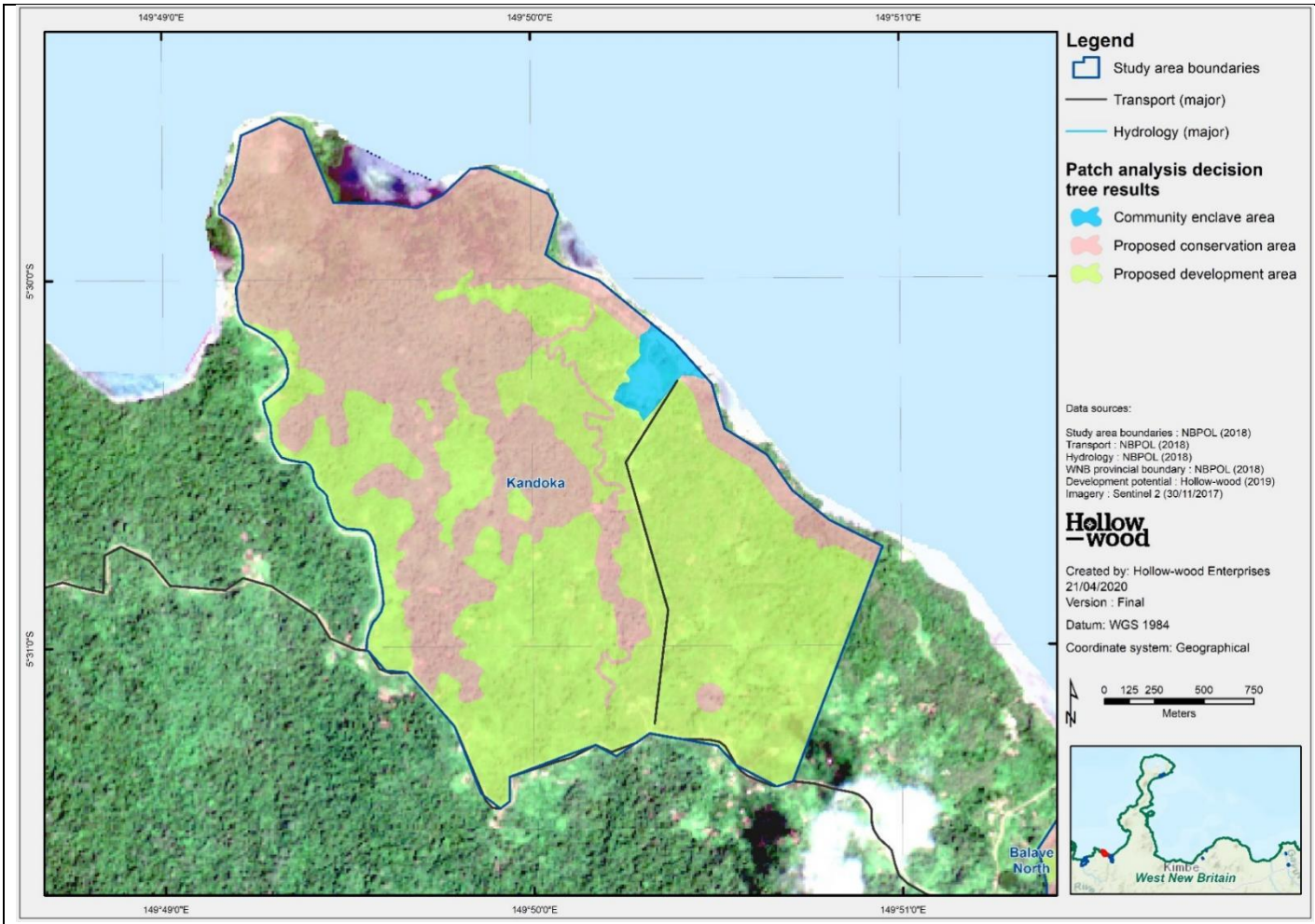



**Figure 41. Development potential for Kandoka – this is all the area that is neither HCV nor HCS.**

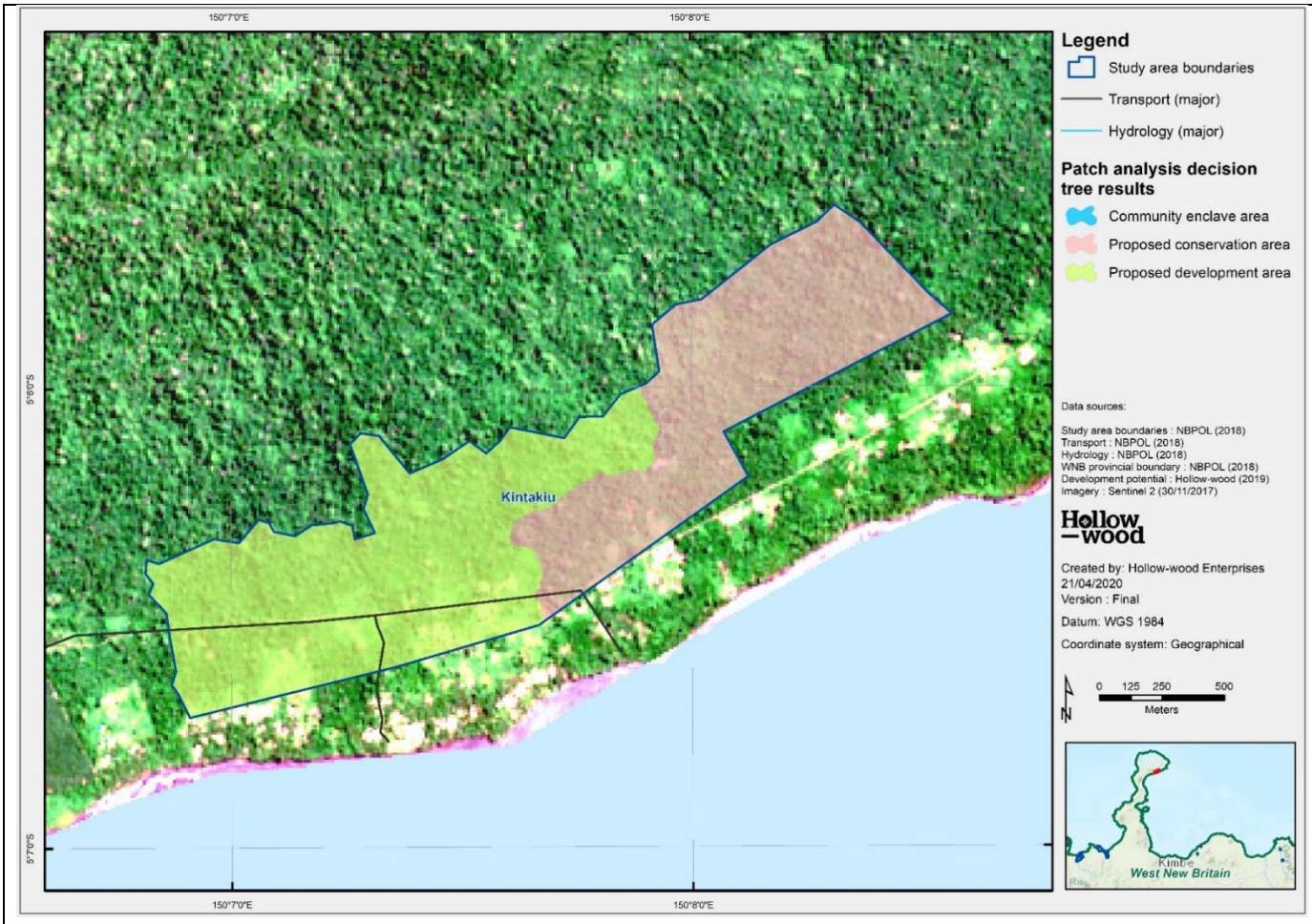



**Figure 42. Development potential for Kintakiu – this is all the area that is neither HCV nor HCS.**

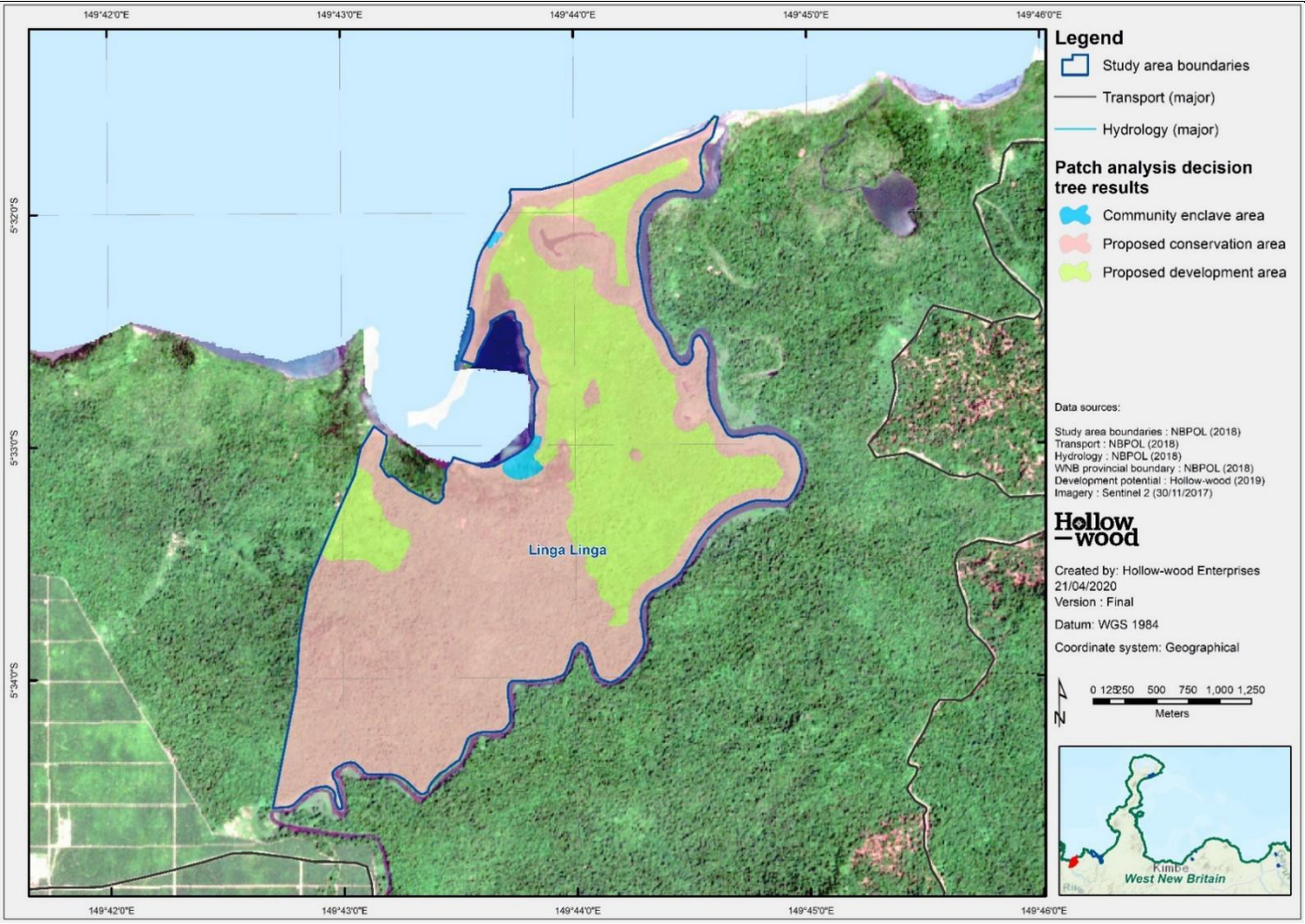



**Figure 43. Development potential for Linga Linga – this is all the area that is neither HCV nor HCS.**

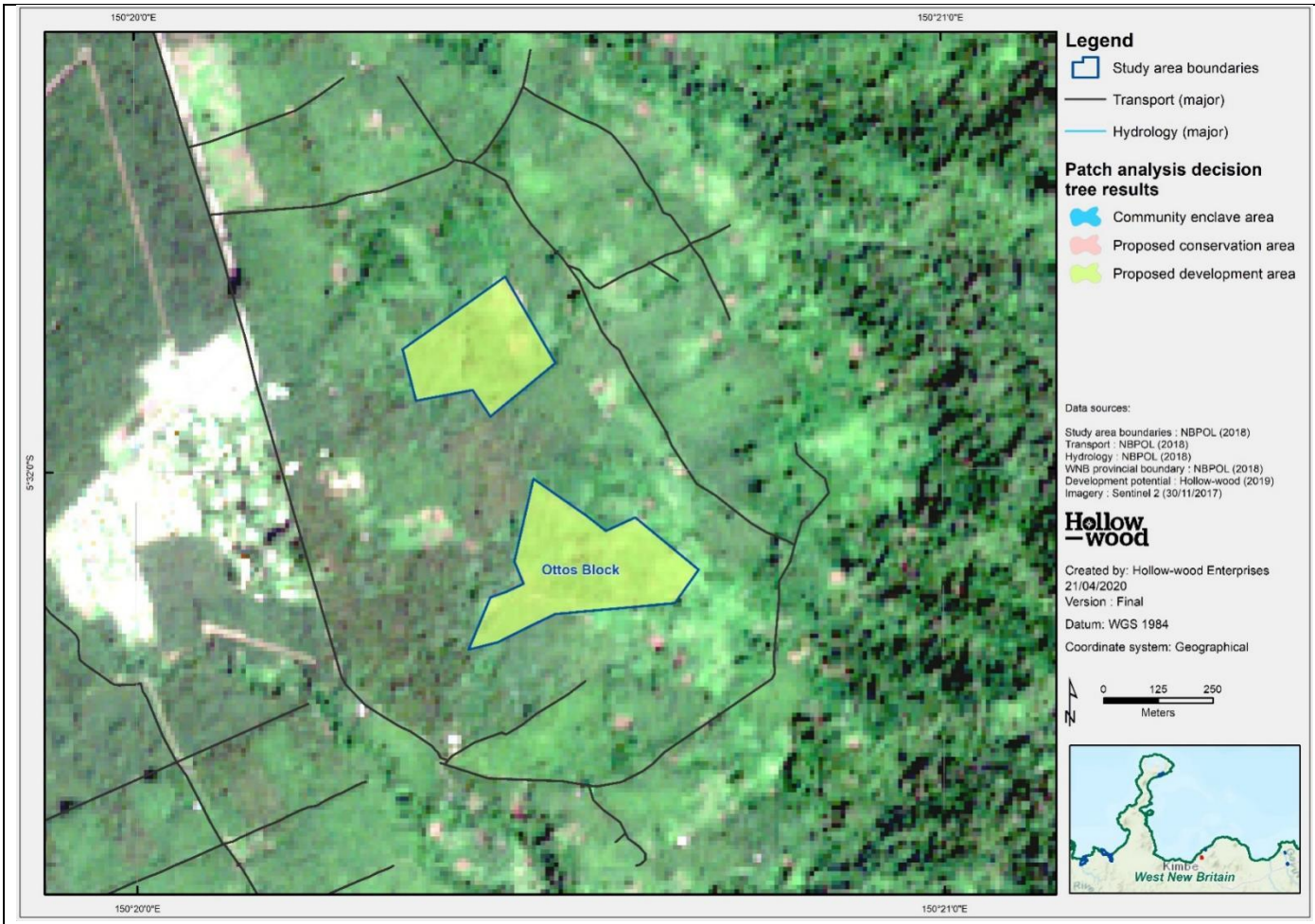



**Figure 44. Development potential for Otto's Block – this is all the area that is neither HCV nor HCS.**

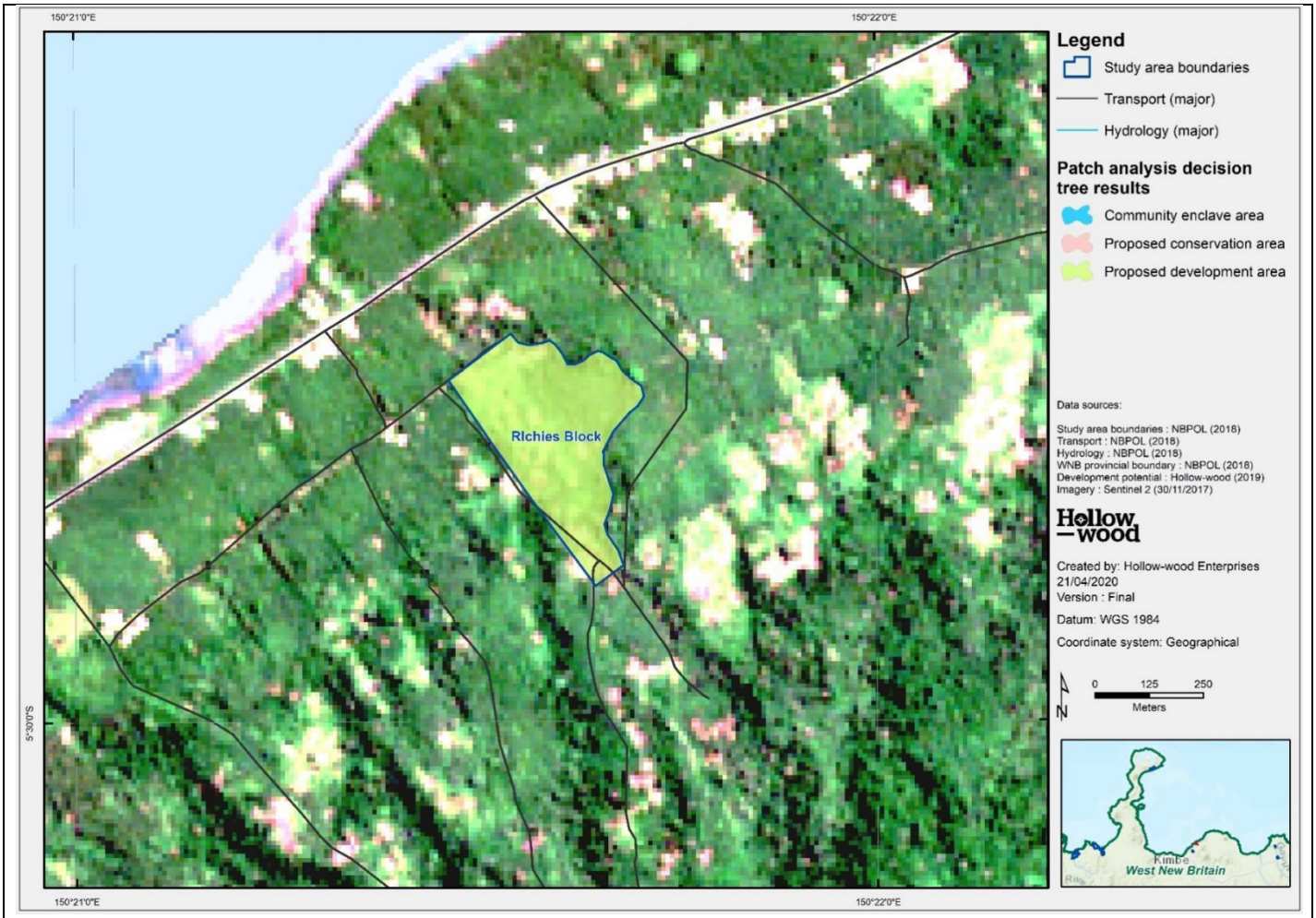


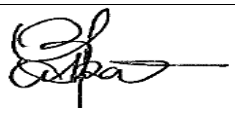

**Figure 45. Development potential for Ritchie's Block – this is all the area that is neither HCV nor HCS.**


**Figure 46. Development potential for Tapakasi North – this is all the area that is neither HCV nor HCS.**


**Figure 47. Development potential for Tapakasi South – this is all the area that is neither HCV nor HCS.**

## Section 10: Confirmation of Report

*This confirms that all findings are accepted by the grower and NBPOL – West New Britain Region – the company will be responsible for its ownership and development process for as long as it is within the company's control. NPP site verification completed, 29th August 2022.*

| | |
|---|---|
| Signature |  |
| Name | Zaralyn Yakopa |
| Position | Sustainability Manager - WNB |