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ENVIRONMENTAL IMPACT ASSESSMENT

For

Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Hectares), Pitas, Sabah

Final Report

Our Ref: CK/EV403-4278/15
Date: January 2017

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Date: 24 January 2017

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Sabah Malaysia
Attn: Tn. Hj. Mohd Yusrie Abdullah

Dear Sir,

Project: Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Hectares), Pitas, Sabah

Subject: Acknowledgement on Understanding of the EIA Report

Your Terms of Reference (TOR) approval letter [ref. no.: JPAS/PP/15/600-1/01/3/60 (6)] dated 10th March 2016 is referred to.

Kindly be informed that we are pleased to acknowledge that we have gone through the contents of the EIA report with our environmental consultant, i.e. Chemsain Konsultant Sdn Bhd. The environmental consultant has also consulted and explained to us on the proposed mitigation measures and monitoring programmes, which we have agreed to adhere to once the project commences following the EIA report approval.

Thank you.

Yours faithfully,

.....

Glen MacNair
Director

cc. Chemsain Konsultant Sdn Bhd
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Abbreviations

AMSL	Above Mean Sea Level
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DOE	Department of Environment
EIA	Environmental Impact Assessment
EPD	Environment Protection Department
FCC	Faecal Coliform Count
FMP	Forest Management Plan
FMU	Forest Management Unit
HCV(F)	High Conservation Value (Forest)
IUCN	International Union for the Conservation of Nature
ITP	Industrial Tree Plantation
NWQSM	National Water Quality Standards for Malaysia
RIL	Reduced Impact Logging
SAFODA	Sabah Forestry Development Authority
SAMM	Skim Akreditasi Makmal Malaysia
SFD	Sabah Forestry Department
SFMLA	Sustainable Forest Management License Agreement
TCC	Total Coliform Count
TOR	Terms of Reference
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
WTP	Water Treatment Plant
WWF	World Wildlife Fund
WQI	Water Quality Index
ZOI	Zone of Impact

CHAPTER ONE

Executive Summary

Chapter 1 Executive Summary

1.1 Introduction

The title of this Environmental Impact Assessment is **"Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Hectares), Pitas, Sabah"**. The Project Proponent is **Gerak Saga Sdn Bhd**. The Project will involve forestry development and operations over an area of more than 500 hectares. The Project is therefore classified as a prescribed activity under the Second Schedule of the Environment Protection (Prescribed Activities) (Environmental Impact Assessment) Order, 2005, under Items 2(i) and 2(ii).

1.2 Project Location and Size

The project site covers an area of approximately 6,467 Ha, comprising the 6,270 Ha Bengkoka Forest Reserve and the 197 Ha Tambalugu Forest Reserve (**Figure 3.2.1**). For operational purposes the two forest reserves will be managed as a single Forest Management Unit (FMU) and will be divided into four (4) Coupes, Coupes 1-3 (Bengkoka Forest Reserve) and Coupe 4 (Tambalugu Forest Reserve). The Project Proponent holds the license for management operations in both forest reserves from Sabah Forestry Department, whom have allocated the combined area of 6,467 Ha to the Project Proponent for Industrial Tree Plantation (ITP) (**Annex 2.1**).

Throughout this report the term "project site" will refer to the total area for the Project, i.e. 6,467 Ha, comprising the entire Bengkoka and Tambalugu Forest Reserves. Where required the forest reserves will also be referred to individually.

The Bengkoka Forest Reserve is accessible off Jalan Mongkubou Laut, approximately 25 km north of Pitas Town, less than a kilometre north of Kg. Bongkol. The Tambalugu Forest Reserve is located approximately 4 km north-east of the Bengkoka Forest Reserve, and is accessible from Kg. Serupil following the existing roads north, connecting to Jalan Suang Duyung to access the project site.

Refer to **Figure 3.2.1**.

1.3 Project Status

Project Site

At the time of EIA preparation, development activities for this Project had not commenced on the project site.

As described in **Section 3.4** in **Chapter 3**, the project site is in a deteriorating state due to previous overexploitation, lack of management, forest fire, droughts and disease. The natural vegetation has given way to invasive *Acacia mangium* and *Acacia sp.*, which is in poor state and dominating large areas of the project site. In some areas the *Acacia mangium* and *Acacia sp.* have been attacked by fungus (*Ceratocystis sp.*) and have also been subjected to numerous fires throughout the years, and there are large areas dominated by dead or dying trees. In other areas, particularly in the east of the Bengkoka Forest Reserve *Imperata sp.* Grass (lalang) dominates.

Table ES 1.3.1: Status of Project Documents

No.	Relevant Documents	Status
1	Forest Management Plan (FMP)	❖ A Forest Management Plan (FMP) has been produced for this Project, this has been submitted to Sabah Forestry Department and subsequently accepted via letter ref. JPHTN/PP 700-2/1/63/JLD.2(8), dated 25/07/16 (**Annex 2.2**). The FMP has been referenced in the production of this EIA report and is attached in **Annex 2.3**.
2	Development/ Layout Plan	❖ The proposed development plan for the Project is illustrated in **Figure 3.7.1**. The development proposals are detailed in the FMP which has been approved by Sabah Forestry Department, as noted above.

1.4 Project Concept

The Project Proponent proposes to establish an Industrial Tree Plantation (ITP) of Eucalyptus on the project site. The plantation will be managed on a 10-year rotation basis with the objective of producing small timber and chip-wood from the Eucalyptus.

Due to the deteriorating state of the project site, it is expected that there are no existing areas of significant ecological value and no riparian reserves have been established during previous operations. The majority of the project site area is covered with invasive Acacia and has been degraded through overexploitation, lack of management, forest fire, droughts and disease. Alongside establishing the ITP the Project Proponent therefore also intends to create and rehabilitate conservation and water catchment areas and riparian reserves. Under normal circumstances existing vegetation in riparian zones for example would have to be retained, however due to their deteriorated state on the project site the Project Proponent intends to enhance these areas through enrichment and rehabilitation planting with local forest species, in order to restore ecological function.

The proposed development plan for the project site is shown on **Figure 3.7.1**. The entire project site covers an area of 6,467 Ha. Based on the latest information from the Project Proponent the total area considered to be plantable for ITP is approximately 5,625 Ha. The remaining area has been allocated by the Project Proponent to the following land uses:

1. **Water Reservoirs and Water Catchments**

Following preliminary mapping and development planning the Project Proponent has identified 72 Ha to serve as water reservoirs and 371 Ha to serve as water catchment (**Figure 3.7.1**). As detailed in the FMP (**Annex 2.3**) the Project Proponent will ensure proper management and protection of these areas.

The areas identified for water catchment include the existing water catchment for the SAFODA dam, constructed within the project site on Sg. Bongkol for water supply to SAFODA and Kg. Bongkol via an established water treatment plant (**Figure 3.2.1**).

2. **Riparian Buffer Zone**

Following preliminary mapping and development planning the Project Proponent has identified 285 Ha of riparian reserves, comprising the provision of a 30 m buffer on each bank of all permanent watercourses within the project site (**Figure 3.7.1**).

3. **Mangrove Forest**

The project site within the Tambalugu Forest Reserve contains approximately 12 Ha of mangrove forest, which has encroached from the neighbouring Bengkoka Peninsula Forest Reserve (Class V – Mangrove Forest Reserve) (**Figure 3.7.1**). This area will be excluded from the ITP area and from all project activities, and will be preserved as a conservation area.

4. **Roads**

The existing road network covers approximately 15 Ha within the project site. The intended road network for this Project will be approximately 151 km in total length and will cover approximately 90.6 Ha. The proposed road network is shown on **Figure 3.7.1**.

These areas will be confirmed through detailed survey and ground truthing prior to the commencement of project activities. The total area to be planted for ITP is subject to change, depending on ground conditions, however the minimum areas stated above for water reservoirs, water catchment and riparian reserve will not be affected and where possible these will also be allocated larger areas.

The Project will also include the establishment of the required facilities for project development. These are described in more detail in **Section 3.9.1**, in **Chapter 3**.

The Project will not require significant earthwork as there will be no terracing. Earthwork may be required for the development of facilities and infrastructure, however this will be minor and will be less than 40,000 m^3.

1.5 Existing Environment

Table ES 1.5.1: Existing Environment

Parameters	Description
Physical Environment	
Topography	❖ The Bengkoka Forest Reserve is situated on gently undulating terrain with predominantly gentle slopes (i.e. < 15°). Some short steep slopes do occur, some of which are greater than 25°, however these are limited to minor areas along the southern boundary and in the east of Coupe 2. Only 17 Ha of the project site is estimated to have slopes over 25°. The elevation in the Bengkoka Forest Reserve ranges from 10 m AMSL along the base of valleys, and 130 m AMSL on the highest hills. ❖ The Tambalugu Forest Reserve is predominantly flat, with elevation ranging from 10 m AMSL to 30 m AMSL in the south-east of the site. ❖ Refer to **Figure 3.10.1** and **Figure 3.10.2**.
Hydrology	❖ There are a number of rivers and streams within the Bengkoka Forest Reserve. The main rivers are Sg. Kandang, Sg. Malubang, Sg. Liu, Sg. Kisorong, Sg. Bongkol and Sg. Kakarangan. The remaining rivers and streams within the Bengkoka Forest Reserve are unnamed. ❖ All rivers and streams within the Bengkoka Forest Reserve flow out of the project site into the adjacent forestry operations, predominantly Acacia plantations, and small scale oil palm plantation. The rivers and streams flowing east will eventually drain to the Sulu Sea, and the rivers and streams flowing west will eventually drain to the South China Sea. ❖ There are several unnamed streams within the Tambalugu Forest Reserve, these all converge into one stream which discharges north into the adjacent mangrove forest reserve and into the Sulu Sea. ❖ Many of the streams within the project site (Bengkoka and Tambalugu Forest Reserves) are seasonal and flow will reduce significantly or dry up during the dry months. ❖ The widths of the rivers and streams also varies within the project. The rivers and streams observed within the project site during the site visit ranged from < 3 m to > 5 m in width. ❖ Refer to **Figure 3.10.1**.
Geology and Soil	❖ The Bengkoka Forest Reserve is predominantly underlain by soil of the Maliau Association, with the parent materials of sandstone and mudstone, and Brantian Association in the north, with the parent material of alluvium. ❖ Some minor areas of Kinabatangan and Tuaran Associations also occur in the north and east, respectively, of the Bengkoka Forest Reserve, with alluvium as the parent material for both. ❖ The Tambalugu Forest Reserve is predominantly underlain by soil of the Brantian Association, with some areas of Tuaran Association soils in the north and east.

Parameters	Description
	❖ The soils in the area are suitable for the plantation of fast growing species including *Eucalyptus pellita*. ❖ The entire project site is underlain by geology of the Kudat Formation, from the Oligocene period. The lithology comprises sandstone, shale, mudstone, siltstone, conglomerate and limestone. ❖ A small portion of the Bengkoka Forest Reserve in the east is underlain by geology of the Bongaya formation. ❖ A minor portion of the project site along the northern boundary of the Tambalugu Forest Reserve is underlain by recent coastal and riverine alluvium deposits. ❖ Refer to **Figure 3.10.3** and **Figure 3.10.4**.
Water Quality Analysis	❖ Baseline water quality sampling was conducted at five (5) locations (W1 – W5) in the rivers and streams which flow through the project site in the Bengkoka Forest Reserve (**Figure 3.10.1**). ❖ Sampling was also attempted in the Tambalugu Forest Reserve, in the main unnamed stream flowing north through the forest reserve into the adjacent mangrove forest, however during the day of sampling the stream was dry. ❖ All the parameters, with the exception of Total Suspended Solids (TSS), Turbidity, Total Coliform Count (TCC) and Faecal Coliform Count (FCC), were within the limits of Class IIB of the NWQSM (**Annex 1.3**). Traces of the agrochemicals tested for were found, although these were at minimal levels. ❖ Elevated TSS and Turbidity levels are likely to be from upstream riverbank erosion, following poor previous management of riparian reserves. ❖ Elevated TCC and FCC levels may potentially be from human waste, animal waste of microorganisms. ❖ Refer to **Section 3.10.1.6** in **Chapter 3** for further details.
Air and Noise Quality	❖ Baseline air quality sampling for Total Suspended Particulates (TSP) and baseline noise monitoring were conducted at the nearest receptor of Kg. Serupil (A1/N1). See **Section 3.10.1.7** and **Section 3.10.1.8** in **Chapter 3**. ❖ The result shows that the present TSP level in the air at the sample points is well below the stipulated 260 $\mu g/m^3$ level of the Malaysian Ambient Air Quality Guidelines (see **Annex 1.6**). During the day of sampling there were some rain showers. ❖ The results show that both the day time and night time noise levels at Kg. Serupil were high and above the prescribed limits when compared to Schedule 1 of the Planning Guidelines for Environmental Noise Limit and Control, for Noise Sensitive Areas (**Annex 1.8**). The elevated noise levels were recorded to be contributed mainly by the sound of wind and human activities.
Biological Environment	
Flora and	❖ As part of their pre-development activities the Project Proponent has

Parameters	Description
Fauna	undertaken flora and fauna studies on the Bengkoka Forest Reserve between October and November 2015, and Tambalugu Forest Reserve between 02nd and 24th March 2016. ❖ In terms of flora, the project site is in a poor state, with very little diversity. The natural vegetation which once existed on the project site has given way to invasive *Acacia mangium* and *Acacia sp.*, which now covers the majority of the project site. In many areas of the project site the Acacias have suffered from extensive forest fires and fungus (*Ceratocystis sp.*), and there are subsequently large areas of dead or dying trees. ❖ Although the project site is in a degraded state, with little floral diversity, it is still able to support a reasonable population of wildlife which thrive in the area, including deer, bear, boar etc. ❖ Refer to **Section 3.10.2** in **Chapter 3** and **Annex 2.5** and **Annex 2.6** for further details.
Land Uses and Human Environment	
Surrounding Areas	❖ There are no settlements within the project site. There are however a number of settlements located in the vicinity of the project site. ❖ The nearest villages to the Bengkoka Forest Reserve are Kg. Kakarangan (200 m east), Kg. Serupil (200 m west/ south) and Kg. Kapok (300 m west). The nearest houses to the project site however are within Kg. Serupil, located within 50 m of the project site boundary. It is also noted that Kg. Serupil is located along the existing access road to the project site, i.e. Jalan Mongkubou Laut. ❖ The nearest village to the Tambalugu Forest Reserve is Kg. Suang Duyang (500 m North/ North west). ❖ There are a number of existing structures within the project site in Bengkoka Forest Reserve which are remaining from previous forestry operations and existing forest management, such as workers huts and two (2) fire watch towers. ❖ There are no existing structures within the project site in Tambalugu Forest Reserve ❖ There is also a small dam within the Bengkoka Forest Reserve along the southern boundary near Kg. Bongkol. This dam was constructed by SAFODA and provides water to SAFODA and Kg. Bongkol. ❖ The Bengkoka Forest Reserve is predominantly surrounded by forestry operations, predominantly Acacia plantations with the Sabah Forestry Development Authority (SAFODA) area. The operator in these areas is Acacia Forest Industries Sdn Bhd. There are also some areas of small scale oil palm plantations. ❖ The Tambalugu Forest Reserve is bordered to the east, south and part of the west by forestry operations, predominantly Acacia plantations operated by Acacia Forest Industries Sdn Bhd. Also bordering the project site to the west there is some small scale oil palm plantation operated by the local communities.

Parameters	Description
	❖ Bordering the Tambalugu Forest Reserve to the north is the Bengkoka Peninsula Mangrove Forest Reserve (Class V). ❖ The surrounding land use is described in more detail in **Section 3.10.4** in **Chapter 3** and is illustrated on **Figure 3.2.1**.

1.6 Findings

The main environmental issues identified for this project are as follows: Soil Erosion and Water Pollution; Waste Generation and Management; and Fire Hazard. Other identified environmental impacts are: Ecological Impacts; Noise and Air Pollution; Traffic and Transportation Impacts; Socio-Economic Impacts; and Closure and Potential Abandonment.

Table ES 1.6.1 summarises the environmental impacts and mitigation measures, as well as the monitoring programmes during the project implementation.

The monitoring programmes recommended should be compiled with in the form of a compliance monitoring report which should be submitted to the Environment Protection Department (EPD). The monitoring programme should be completed on a quarterly basis during plantation establishment, then twice yearly (during dry and wet season) for the following 3 years of the operational phase, then annually in the middle of the rainy season thereafter.

Table ES 1.6.1: Environmental Impacts and their corresponding Mitigation and Monitoring Programmes

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
1.0	**Soil Erosion and Water Pollution**		
1.1	The project boundary should be clearly demarcated on the ground prior to any work commencing on the site. Clearing should not be conducted beyond the project site boundary and should be limited to where necessary for the project development. Clearing should not be conducted within any of the identified conservation areas, with the exception of the removal of degraded trees and vegetation for enrichment and rehabilitation planting with natural forest species, where necessary and permitted.	Site layout plan showing the project site boundary and photographs (with dates and GPS coordinates) to show the clear demarcation of the project site boundary on the ground.	
		Photographs (with dates and GPS coordinates) following the completion of clearing in a cleared area to show the boundary between the cleared area and adjacent non-cleared area, to demonstrate that non-cleared areas, i.e. conservation areas and outside the project site boundary, are left intact.	
		Visual inspection to ensure that vegetation clearing is only been conducted within the project site boundary, only where necessary for development, and not within the conservation areas, with the exception of the removal of degraded trees and vegetation for enrichment and rehabilitation planting.	
1.2	Vegetation clearing should be completed in phases according to the compartment/ blocking plan and schedule detailed in the Coupe Development Plans, which will be submitted with the Annual Work Plans to Sabah Forestry Department. Each coupe will divided into compartments of 200 to 600 Ha, which will be further sub-divided into Blocks of approximately 24 Ha each. Salvage logging should also follow the detailed scheduled in the Coupe Development Plans.	Compartment/ blocking plan with schedule, demonstrating phased implementation of the Project within each Coupe. The plans and schedule should demonstrate that the total contiguous area being cleared at any one time does not exceed 100 Ha, and that for larger cleared areas mosaic patterns are being implemented, with suitable buffer or in a chequered pattern.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
1.3	The total contiguous area of land to be cleared at any one time should not exceed 100 Ha. Once the maximum 100 Ha has been cleared, operations must start in that area, including planting, before clearing commences in adjacent areas. Large areas must be subdivided into mosaic patterns separated by at least 50 m buffers or in a chequered pattern.	Refer to **Item 1.2**.	
1.4	Cleared planting areas shall be planted with the final crop as soon as possible acknowledging the fact that clearing is recommended to be done during the dry season and that planting is only done during the rainy season. Linkages to seedling production, which is also seasonal, shall also be taken into account.	Schedule for clearing and planting, demonstrating that the time between clearing and planting is minimized as far as possible. Photographs (with dates and GPS coordinates) should be provided when planting has been completed in one cleared area, to demonstrate the completion of the planting activity.	
1.5	The weather should be taken into account during site clearing, i.e. land clearing activities should be confined to dry periods only (if possible).	None.	
1.6	Bulldozers should not be used for site clearing, as these are damaging to the soil surface. Alternative, less damaging machinery, such as excavators should be used.	Photographs (with dates and GPS coordinates) demonstrating that bulldozers are not being used for site clearing, and that less damaging machinery such as excavators are being employed.	
1.7	Biomass generated from site clearing and salvage logging should be left in-situ to decompose. Patches of more significant quantities of residual biomass, which are in danger of producing piles of biomass, should be spread and crushed with an excavator.	Photographs (with dates and GPS coordinates) showing biomass being left in-situ to decompose naturally following clearing. Photographs should also show crushing and spreading where biomass load is more significant and in danger of producing piles of biomass.	
1.8	Where applicable for project operations, Reduced Impact Logging (RIL) should be implemented as detailed in the License Agreement.	None.	
1.9	Road gradients should not exceed 8° (15%), in order to avoid excess surface erosion.	Photographs (with dates and GPS coordinates), demonstrating that road gradients do not exceed 8° (15%).	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
1.10	Where stream crossing is required proper culverts of bridges should be constructed. Blocking of the water course if prohibited, and construction should be completed without machinery and equipment entering the water course.	Site layout plan and photographs (with dates and GPS coordinates) showing all stream crossings within the project site, and their structure and condition.	
1.11	Areas within the project site with a slope gradient of more than 25° these should be excluded from development activities and preserved as conservation areas (**Figure 6.2.1**). Delineation of steep slope areas should be based on physical conditions in the field rather than on topographic maps.	Site layout plan and photographs (with dates and GPS coordinates) showing any identified areas with slope > 25°, excluded from development activities.	
1.12	Where development on slopes is required, the slope length should be minimised as far as possible using accepted methods such as cross-drains, and cross-slope clearing patterns. Terracing however is prohibited within the project site, i.e. a licensed forest reserve area.	Photographs (with dates and GPS coordinates) showing any measures in place to reduce slope length, where required.	
1.13	Where soil erosion is identified on the project site, appropriate erosion control measures should be implemented, such as temporary protection with plastic sheets, turfing etc., as appropriate to the situation on site.	Refer to **Item 1.15**.	
1.14	Proper roadside drainage should be implemented along all roads within the project site. The roadside drainage system should be equipped with basic earthen construction sedimentation traps at intervals, which should discharge to vegetated areas and not directly to the rivers and streams on site.	Refer to **Item 1.15**.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
1.15	A proper drainage system should be established at the main basecamp. The basecamp drainage system should discharge to vegetated areas. Discharging directly to rivers or streams is prohibited.	Photographs (with dates and GPS coordinates) showing the provision of a proper drainage system at the main basecamp, roadside drainage including sediment control measures, and the implementation of erosion control measures where soil erosion has been identified on site (if any). Photographs should demonstrate drainage to vegetated areas.	
1.16	All drainage systems should be maintained regularly, or immediately after a heavy downpour to maintain their effectiveness.	Visual inspection of the drainage systems provided on the project site. This is to ensure that they are fit for purpose, properly constructed, properly maintained, free from any blockage and able to operate at maximum efficiency.	
1.17	All permanent rivers and streams within the project site should be provided with a suitable width riparian reserve, which is determined based on the width of the river/ stream. A 30-m wide riparian reserve should be provided on each bank of the main permanent rivers and streams identified within the project site, as shown on **Figure 6.2.1**. All remaining streams, should be provided with the appropriate riparian reserves in accordance to Sabah Forestry Department requirements for forest reserves (**Figure 6.2.1**) (**Table 5.2.1**). Riparian reserve requirements should be finalised through ground truthing for each Coupe, with the finalised requirements being detailed in the Coupe Development Plans. Although not a requirement to provide riparian reserves on non-permanent water courses, it is recommended to do so.	Site layout plan and photographs (with dates and GPS coordinates) showing the provision and clear demarcation of riparian reserves on rivers and streams within the project site.	
		Visual inspections of the riparian reserves provided on the project site, ensuring these are properly demarcated on the ground and are the correct width.	
1.18	All riparian reserves should be clearly demarcated on the ground with sign posts and red paint, prior to the commencement of site clearing activities.	Refer to **Item 1.17**.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
1.19	The water catchment areas shown on **Figure 6.2.1** should be clearly demarcated on the ground. Project activities within these areas, with the exception of enrichment and rehabilitation planting with natural forest species, are prohibited.	Site layout plan and photographs (with dates and GPS coordinates) showing the provision and clear demarcation of water catchment areas within the project site.	
1.20	The mangrove forest within the project site should be provided with a 50-m buffer zone around its perimeter within the project site (**Figure 6.2.1**). The buffer zone and mangrove forest should be clearly demarcated on the ground. Project activities within these areas, with the exception of enrichment and rehabilitation planting preferably with mangrove species where conditions are suitable or other natural forest species within the buffer zone, are prohibited.	Site layout plan and photographs (with dates and GPS coordinates) showing the clear demarcation of mangrove areas within the project site, and the provision and clear demarcation of a 50 m buffer around the perimeter of the mangrove areas.	
		Visual inspection to ensure the provision and proper demarcation of the 50 m buffer around the perimeter of the mangrove areas within the project site.	
1.21	The water reservoirs as shown on **Figure 6.2.1** should be provided with a 50-m buffer zone around their perimeter within the project site. The water reservoir and buffer zone should be clearly demarcated on the ground. Project activities within these areas, with the exception of enrichment and rehabilitation planting with natural forest species within the buffer zone, are prohibited.	Site layout plan and photographs (with dates and GPS coordinates) showing the clear demarcation of water reservoirs within the project site, and the provision and clear demarcation of 50 m buffer around the perimeter of the water reservoirs.	
		Visual inspection to ensure the provision and proper demarcation of the 50 m buffer around the perimeter of the water reservoirs within the project site.	
1.22	Agrochemicals and other hazardous substances such as fuel and oil should be stored according to current government regulations and should be handled with care. Any used containers are either to be returned to the supplier(s) or collected for disposal via government approved disposal routes. Storage areas should be a minimum of 50 m away from the nearest natural water course, and should be provided with suitable bund, drainage systems with oil traps and be sheltered.	Site layout plan and photographs (with dates and GPS coordinates) showing the storage area for agrochemicals and hazardous substances, in compliance with all applicable government regulations. Layout plan and photographs should demonstrate that the storage area is a minimum of 50 m from the nearest natural water course, bunded, sheltered and provided with suitable drainage system.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
1.23	The use of agrochemicals should be controlled, with emphasis on the amount and timing of application. The management team should closely supervise and regulate the method, dosage, timing and frequency of agrochemical application in order to save cost and minimise wastage and environmental pollution.	None.	
1.24	Where possible organic fertilisers should be used to minimise the use of chemicals.	None.	
1.25	The indiscriminate spraying of agrochemicals onto neighbouring lands, conservation areas and rivers or streams is strictly prohibited and spraying operations close to these areas should be closely monitored.	None.	
1.26	The usage of agro-chemicals must be according to the rules and regulations as stipulated under the Pesticides Act 1974. The use of pesticides, weedicides and similar substances is to be minimised as far as possible. Priority should be given to biological control and manual weeding, where possible.	None.	
1.27	While fertilisers and agrochemicals should be applied on wet surfaces to have maximum effect, care must be taken to apply these compounds at times where surface run-off is minimal.	None.	
1.28	The main basecamp and smaller camps located within the plantation should be located a minimum of 30 m away from the nearest natural water course, and should not be located within a conservation area.	Site layout plan and photographs (with dates and GPS coordinates) showing that the main basecamp and smaller camps are located a minimum distance of 30 m from the nearest natural water course, and not located within a conservation area	
1.29	The mitigation measures detailed in **Item 2.0** should be implemented to minimise water pollution from waste generated on the project site.	Refer to **Item 2.0**.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
1.30	All relevant complaints from local communities conceming water pollution should be logged and promptly addressed.	A record of all relevant complaints from local communities relating to water pollution, with details of the actions taken	
1.31	Regular water quality monitoring should be conducted the rivers and streams within the project site.	Regular monitoring of water quality should be conducted in the rivers and streams within the project site. The monitoring locations are shown on **Figure 6.2.1**. The monitoring schedule will be developed to ensure that the monitoring is undertaken in the active areas of the project site, i.e. monitoring will not be undertaken in areas of the project where project activities have yet to commence. The sampling requirements are presented in **Table 6.2.1** in **Chapter 6**. The results will be compared to Class IIB of the National Water Quality Standards Malaysia (NWQSM) (**Annex 1.3**).	
2.0	**Waste Generation and Management**		
Biomass			
2.1	Biomass generated from site clearing and salvage logging should be left in-situ to decompose. Patches of more significant quantities of residual biomass, which are in danger of producing piles of biomass, should be spread and crushed with an excavator.	Photographs (with dates and GPS coordinates) showing biomass being left in-situ to decompose naturally following clearing. Photographs should also show crushing and spreading where biomass load is more significant and in danger of producing piles of biomass.	
2.2	Burning of biomass is strictly prohibited. Zero-burning policy should be implemented.	Visual inspection for any signs of open burning on the project site.	
2.3	All conservation areas, rivers and streams should be clear of biomass. Disposal of biomass into these areas is strictly prohibited. Any biomass entering natural water courses should be immediately removed.	None.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
Solid/ Domestic Waste			
2.4	Good housekeeping and waste management practices should be implemented at all times on the project site, including at the main basecamps and smaller camps that will be established throughout the plantation. Waste bins with lids must be provided and used and recycling facilities should also be provided.	Photographs (with dates and GPS coordinates) demonstrating that general waste disposal and recycling facilities are provided on the project site.	
		Visual inspection of the general cleanliness of the project site.	
2.5	The waste dumping pit provided on site should be located a minimum of 50 metres away from nearest natural water course. The dumping pit should be properly managed and maintained to ensure that it does not become overfilled and to ensure the area around the pit remains free from waste. The dumping pit should not be located within any conservation area (**Figure 6.2.1**).	Site layout plan and photographs (with dates and GPS coordinates) showing the location of the waste dumping pit, located a minimum of 50 m away from the nearest natural water course and not within any identified conservation area.	
		Visual inspection of the condition of the waste disposal and recycling facilities, including the disposal pit, to ensure they are being managed to a good standard.	
2.6	The indiscriminate disposal of waste to land, conservation areas, natural water course and drainage systems is strictly prohibited.	Photographs (with dates and GPS coordinates) of any observed indiscriminate disposal of waste to land, conservation areas, natural water course and drainage systems.	
		Visual inspection to ensure that waste, including biomass, solid waste, scheduled waste and sewage is not been indiscriminately disposed to land, conservation areas, site drainage or natural water courses.	
2.7	The main basecamp and smaller camps located within the plantation should be located a minimum of 30 m away from the nearest natural water course, and should not be located within a conservation area (**Figure 6.2.1**).	Site layout plan and photographs (with dates and GPS coordinates) showing the main basecamp and smaller camps located at least 30 m away from the nearest natural water course and not within a conservation area.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
2.8	The waste management hierarchy should be implemented on site, i.e. avoid (where possible avoid waste generation), reduce (if waste generation cannot be avoided then it should be reduced), reuse (where possible waste, such as plastic bottles, should be reused), recycle (if waste cannot be reused it should be recycled), dispose (only if the waste cannot be reused or recycled, then it should be disposed). Recycling facilities should be provided on site.	None.	
Scheduled Waste			
2.9	The generation of any scheduled waste should be notified in writing to the Director General of the Department of Environment (DOE). The notification should be completed in the form prescribed in the Second Schedule (Notification of Scheduled Wastes).	A record of all scheduled waste generated on site, including a copy of the notifications given to DOE.	
2.10	Scheduled waste, including spent oil, (if any) must be stored as per the requirements of the Environmental Quality (Scheduled Waste) Regulations 2005 and its subsequent 2007 amendment. Scheduled waste must be stored in suitable containers with proper labelling in a bunded and sheltered area. The storage area must be located at least 50 metres away from any natural water course, and should comply with the guidelines on Export, Import and Storage of Scheduled Wastes in Malaysia.	Site layout plan and photographs (with dates and GPS coordinates) showing the provision and location of the scheduled waste storage area (if required), a minimum of 50 m away from any natural water course. The photographs should demonstrate all the storage area features required to satisfy legal requirements, such as a proper bund and shelter.	
		Visual inspection of the scheduled waste and hazardous substances storage areas to ensure that they are fit for purpose.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
2.11	Permanent and temporary oil and fuel storage tanks must be placed on a firm, dry base, bunded and be surrounded by drains and sumps. Fire fighting equipment such as fire extinguishers, fire blankets, etc. must be fully functional and readily accessible near to oil and fuel storage facilities at all times. The storage area should be located at least 50 metres away from any natural water course.	Site layout plan and photographs (with dates and GPS coordinates) showing the location of permanent and temporary fuel and oil storage tanks located at least 50 m from any natural water course, demonstrating that these are placed on a firm, dry base, bunded and surrounded by drains and sumps. The photographs should also show that fully functional firefighting equipment is readily accessible near to the oil and fuel storage facilities.	
2.12	All scheduled waste shall be disposed of by DOE licensed transporters in accordance with the Environmental Quality (Scheduled Waste) Regulations 2005 and its subsequent 2007 amendment.	None.	
2.13	The direct discharge of scheduled waste to land, natural water course or drains is strictly prohibited.	Refer to **Item 2.6**.	
Sewage			
2.14	Proper sanitary facilities, i.e. toilets with septic tanks should be provided at the main basecamp and smaller basecamps established within the plantation. These facilities must be at least 50 metres away from the nearest natural water course.	Photographs (with dates and GPS coordinates) showing the provision of proper sanitary facilities, i.e. toilets with septic tanks.	
2.15	Sewage treatment systems should comply with Standard B of the Environmental Quality (Sewage) Regulations 2009 (**Annex 1.10**); these should be maintained routinely.	None.	
2.16	The discharge of raw sewage directly to ground, drains or natural water courses is strictly prohibited at all times.	Refer to **Item 2.6**.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
3.0	**Fire Hazard**		
3.1	The Fire Management Plan should be completed and implemented prior to the commencement of project activities on the project site. A copy of the Fire Management Plan should be provided to the relevant authorities as per their requirements, and Environment Protection Department.	Copy of the Fire Management Plan, including fire prevention plan. Copies of correspondence relating to these plans demonstrating submission and approval from relevant authorities such as Bomba, Sabah Forestry Department and District Officer.	
3.2	The Fire Management Plan should provide details on annual, daily and special fire preparedness and fire prevention.	Refer to **Item 3.1**.	
3.3	Fire-fighting equipment should be provided at suitable locations within the project site. This should be routinely inspected and maintained.	Photographs (with dates and GPS coordinates) showing the provision of firefighting equipment at suitable locations within the project site.	
3.4	As part of annual preparedness prior to the dry season, all fire-fighting equipment should be in good working order; regular fire drills should be conducted; critical access roads should be in good condition; water sources and water points should be checked; and all plans and procedures should be updated and briefed to staff.	None.	
3.5	A fire prevention plan should be produced and reviewed with Bomba, Sabah Forestry Department and District Officer.	Refer to **Item 3.1**.	
3.6	A fire danger rating system should be adopted as a daily fire prevention tool, and detailed in the Forest Management Plan.	Refer to **Item 3.1**.	
3.7	The Forest Fire Rescue Officer, and his team, should be appointed and be responsible for all fire preparedness and prevention within the project site.	Details of the Forest Fire Rescue Officer and his team.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
3.8	Water bodies should be established within the project site for easy access in the event of a fire, this includes the identified water reservoirs as shown on **Figure 6.2.1**. Water holes should be constructed at strategic locations for water storage.	Site layout plan and photographs (with dates and GPS coordinates) showing the provision of water bodies and water storage within the project site.	
3.9	The existing fire watch towers within the Bengkoka Forest Reserve should be retained and used to give early warning of a fire on site (**Figure 6.2.1**). Watch towers should also be established in suitable locations in the Tambalugu Forest Reserve and if deemed necessary additional watchtowers should be established in the Bengkoka Forest Reserve. Watch tower location should be identified in the Fire Management Plan.	Site layout plan and photographs (with dates and GPS coordinates) showing the provision of fire watch towers within the project site.	
3.10	All staff should be made aware of the risk of fire, and trained in fire prevention and control.	None.	
3.11	Open burning is strictly prohibited.	Visual inspection for any signs of open burning.	
3.12	An under-storey of green vegetation consisting of soft weeds should be maintained throughout the plantation.	Photographs (with dates and GPS coordinates) showing the provision of an under-storey of green vegetation.	
3.13	Roads should be maintained to ensure that they are effective as fire-breaks. Requirement for any additional fire breaks should be determined prior to the commencement of work on the project site, and should be detailed in the Fire Management Plan and detailed Coupe Development Plan.	Site layout plan and photographs (with dates and GPS coordinates) showing the provision and maintenance of roads as fire breaks, and any additional fire breaks established by the Project.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
4.0	**Ecological Impacts**		
4.1	Vegetation clearing should be minimised as far as possible and completed in phases according to the compartment/ blocking schedule detailed in the Coupe Development Plans. Where possible directional clearing and planting should be implemented. Clearing should be completed toward adjacent forested areas, and as stated in the Licence Agreement towards wildlife protection areas, to prevent wildlife becoming isolated and trapped within the project site.	Compartment/ blocking plan with schedule, demonstrating phased implementation of the Project within each Coupe. The plans and schedule should demonstrate that the vegetation clearing is directional and has been determined and executed to allow wildlife ample time and escape routes to flee to neighboring areas. Where possible photographs (with dates and GPS coordinates) should be provided to demonstrate the implementation of these methods on site.	
4.2	The mangrove forest within the project site should be provided with a 50-m buffer zone around its perimeter within the project site (**Figure 6.2.1**). The buffer zone and mangrove forest should be clearly demarcated on the ground. Project activities within these areas, with the exception of enrichment and rehabilitation planting preferably with mangrove species where conditions are suitable or other natural forest species within the buffer zone, are prohibited.	Site layout plan and photographs (with dates and GPS coordinates) showing the clear demarcation of mangrove areas within the project site, and the provision and clear demarcation of a 50 m buffer around the perimeter of the mangrove areas.	
		Visual inspection of all of all conservation areas and buffer zones, to ensure that they have been implemented and are in good condition, and to ensure that no development, activities, and waste storage and disposal is taking place within these areas.	
4.3	Riparian reserves should be implemented as detailed in **Item 1.0**.	Refer to **Item 1.0**.	
4.4	The Sabah Wildlife Department must be informed if there are any encounters with protected/endangered wildlife within the project site, so that appropriate actions can be taken. If protected/endangered wildlife are encountered, project activities must cease in that area until Sabah Wildlife Department can be consulted.	A copy of all notifications given to Sabah Wildlife Department for project commencement, wildlife encounters, wildlife fatalities or injuries, and wildlife rescue. Details and records of actions taken, where applicable must be recorded.	
4.5	Sabah Wildlife Department must be notified not less than 30 days before any land clearing and conversion takes place.	Refer to **Item 4.4**.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
4.6	Sabah Wildlife Department should be notified immediately in the event that wildlife needs to be rescued. This may occur if the wildlife becomes trapped and unable to move into safer areas. Wildlife rescue and translocation is at the cost of the Project Proponent. Sabah Wildlife Department should also be notified immediately in the event that wildlife become injured or killed due to project activities.	Refer to **Item 4.4**.	
4.7	Where *Shorea kudatensis* and other protected or endangered species of flora are identified within the project site, these should be protected from project activities.	Site layout plan and photographs (with dates and GPS coordinates) showing the location and protection of endangered plant species that have been identified within the project site during operations (if any).	
4.8	Fishing within the project site is prohibited, unless permission is obtained from the Director of Sabah Forestry Department. Appropriate signage should be erected.	Photographs (with dates and GPS coordinates) of no hunting and fishing signs provided within the project site.	
4.9	Hunting within the project site is prohibited, and appropriate signage should be erected on site. Site workers are prohibited from carrying weapons that can be used for hunting.	Refer to **Item 4.8**.	
4.10	The Project Proponent must take adequate action to prevent illegal hunting in the project site, including the provision of guard houses at all entrances to control entry and exit, regular patrols and training to educate staff and workers. The Project Proponent should iiaise closely with Sabah Forestry Department and Sabah Wildlife Department where necessary.	Site layout plan and photographs (with dates and GPS coordinates) showing the provision of guard houses, signs and other measured to prevent illegal hunting within the project site.	
4.11	The mitigation measures identified in **Item 1.0** should be implemented to minimise ecological impact from water pollution.	Refer to **Item 1.0**.	
4.12	The mitigation measures identified in **Item 2.0** should be implemented to minimise ecological impact through improper waste management.	Refer to **Item 2.0**.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
4.13	The mitigation measures identified in **Item 3.0** should be implemented to minimise ecological impact from forest fires.	Refer to **Item 3.0**.	
5.0	**Noise and Air Pollution**		
5.1	To minimise dust dispersion, vehicle speed within 100 m either site of Kg. Serupil along Jalan Mongkubou Laut should be limited to 30 km/h. Appropriate signage should be erected.	Photographs (with dates and GPS coordinates) showing the provision of signboards indicating a 30 km/h speed limit within 100 m either site of Kg. Serupil along Jalan Mongkubou Laut.	
5.2	The use of old and run-down vehicles and machinery should be avoided, as these tend to generate excessive noise. Vehicles and machinery should be regularly maintained and fitted with mufflers to reduce noise propagation where appropriate.	Visual inspection of the vehicles on site to ensure that these are not old and run-down.	
5.3	If generator sets are required, these shall be enclosed to reduce noise propagation. Before generator sets can be used, permission to do so should be obtained from the Department of Environment (DOE) Sabah.	Photographs (with dates and GPS coordinates) showing the location of the generator sets (if required), in enclosed areas. Permits to operate the generators, from the DOE, should also be presented.	
		Visual inspection of any generators used on site, to ensure these are enclosed and in good condition.	
5.4	For their safety and comfort, all workers working in high noise level areas should be provided with appropriate Personal Protective Equipment (PPE), such as ear-plugs or ear-muffs. Workers should not be exposed to noise levels exceeding the equivalent continuous sound of 90 dB(A) for a period of 8 hours or more or exceeding the limits specified in the First Schedule of the Factories and Machinery (Noise Exposure) Regulation, 1989.	Photographs (with dates) showing the provision and use of PPE in high noise producing areas.	
5.5	Open burning is strictly prohibited.	Visual inspection for any signs of open burning.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
5.6	All relevant complaints from local communities and road users concerning noise and air pollution should be logged and promptly addressed.	A record of all relevant complaints from local communities and road users relating to air and noise pollution, with details of the actions taken.	
5.7	Noise and air monitoring should be conducted at the nearest receptor to the project site.	Regular noise and air monitoring should be carried out at the nearest receptor to the project site, i.e. the nearest house in Kg. Serupil. The monitoring locations are shown on **Figure 6.2.1**. **Table 6.2.2** and **Table 6.2.3** in **Chapter 6** summarize the monitoring requirements.	
6.0	**Traffic and Transportation Impacts**		
6.1	Vehicle speed should be limited to 30 km/h within 100 m either site of Kg. Serupil along Jalan Mongkubou Laut. Within the project site vehicle speed should be limited to 50 km/h for general plantation roads and 15 km/hr at or near camps. Appropriate signage should be erected.	Photographs (with dates and GPS coordinates) showing the provision of appropriate speed limit signboards within the project site and in the vicinity of Kg. Serupil along Jalan Mongkubou Laut.	
6.2	Sign boards should be erected at all entrances to the project site, and along Jalan Mongkubou Laut and Jalan Suang Duyang, particularly where project site roads connect to these main public roads. This signs should warn road users of the Project activities and the movement of slow heavy vehicles (**Figure 6.2.1**).	Photographs (with dates and GPS coordinates) showing the provision of signboards at all entrances to the project site, and along Jalan Mongkubou Laut and Jalan Suang Duyang, particularly where project site roads connect to these main public roads. This signs should warn road users of the project activities and the movement of slow heavy vehicles.	
6.3	Transportation activities involving heavy vehicles along the main public roads should be scheduled to avoid peak traffic hours and to ensure the volume generated is not concentrated over a short period of time. The movement of heavy vehicles on public roads should be staggered throughout the day, to reduce the impact on traffic flow and road safety.	None.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
6.4	Trucks should never be overloaded and all loads should be properly secured, and where necessary covered, to prevent spillage onto the public roads.	Photographs (with dates and GPS coordinates) demonstrating that trucks are not overloaded and that loads are properly secured and covered as required.	
6.5	On the public roads, vehicle drivers should comply with all the traffic requirements of the Public Works Department, Road Transport Department and Local Authorities.	None.	
6.6	All relevant complaints from members of the public relating to road safety and site transportation activities should be logged and investigated, with appropriate actions being taken.	A record of all relevant complaints from members of the public relating to road safety and site transportation activities, with details of the actions taken.	
6.7	Any damage caused to the public roads of Jalan Mongkubou Laut and Jalan Suang Duyang by project transportation activities should be repaired immediately.	Photographs (with dates and GPS coordinates) of the general condition of Jalan Mongkubou Laut and Jalan Suang Duyang where they provide access to the project site and will be utilised by project vehicles.	
		Visual inspection of the condition of the project site access roads of Jalan Mongkubou Laut and Jalan Suang Duyang, where they provide access to the project site and will be utilised by project vehicles.	
7.0	**Socio-Economic Impacts**		
7.1	The mitigation measures in **Item 1.0** should be implemented to minimise social economic impacts from water pollution, and to protect water supply to the surrounding communities.	Refer to **Item 1.0**.	
7.2	The mitigation measures in **Item 2.0** should be implemented to minimise social economic impact from improper waste management.	Refer to **Item 2.0**.	
7.3	The mitigation measures in **Item 3.0** should be implemented to minimise social economic impacts from fire hazards.	Refer to **Item 3.0**.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
7.4	The mitigation measures in **Item 5.0** should be implemented to minimise social economic impacts from air and noise pollution.	Refer to **Item 5.0**.	
7.5	The mitigation measures in **Item 6.0** should be implemented to minimise social economic impacts from transportation activities.	Refer to **Item 6.0**.	
7.6	Priority for employment should be given to the local communities. Where skills are lacking appropriate training should be provided.	A record of workers employed on the project site.	
7.7	The Project Proponent should resolve any issues with local communities and relevant authorities, relating for forest resources (if any), prior to the commencement of project activities.	None.	
7.8	The Community Development Programme, implemented through the Community Development Team, should be designed to achieve the following: • Identify viable economic activities that would have strong impact on the social economic well-being of the rural communities in the project areas; • Identify the main social and physical infrastructure requirements to improve the quality of life of the rural communities; to enhance accessibility in area of difficult communication and to facilitate economic development; • Identify and quantify socio-economic parameters that measure impacts of various initiatives to be implemented by the Project Proponent; and • Be consistent with generally accepted, international standards governing forest plantation certification, i.e. no activity shall be carried out that directly prevents future certification.	None.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
7.9	All relevant complaints from the local communities regarding any element of the project should be recorded and action should be taken to rectify the issues.	A record of any relevant complaints from the local communities and details of the actions taken.	
8.0	**Closure and Potential Abandonment**		
8.1	The Project Proponent should abide by all conditions of the License Agreement before the end of the license period. This includes not completing any felling within thirty (30) days of the license expiry date, and removal of all felled logs within one (1) month after final felling.	Operations schedule demonstrating that felling is not being completed within 30 days of license expiry, and that all felled logs will be removed from the site within one (1) month after final felling.	
8.2	Upon expiry or early termination of the license agreement the Project Proponent shall leave in good a safe order all fixed assets, such as roads base-camp facilities and infrastructure etc., which will subsequently become property of the Sabah State Government. This is as per the conditions in the license agreement.	Site layout plan and photographs (with dates and GPS coordinates) showing the location of all fixed assets, retained on the project site in good condition.	
		Visual inspection to ensure that all fixed assets are retained on site in good condition.	
8.3	In the unlikely event of abandonment or early termination of the license agreement, an abandonment plan or equivalent should be prepared as per the requirements of the Sabah Forestry Department, to ensure the site is left in a stable condition, i.e. replanted ITP, for future management.	Copy of the abandonment plan or equivalent, in the unlikely event of abandonment or early termination of the license agreement.	
8.4	A closure or abandonment report should be prepared for EPD not later than two calendar months after the date of closure or abandonment.	Copy of the closure or abandonment report prepared for EPD.	
8.5	All machinery and equipment which is the property of the Project Proponent should be removed from the project site.	Photographs (with dates and GPS coordinates) showing the project site after abandonment, demonstrating that all machinery, equipment, waste and contaminated soils have been removed.	

No.	Environmental Impacts, Mitigation and Control Measures	Monitoring Programmes	Field Inspection Remarks
		Visual inspection of the abandoned area to ensure that all machinery and equipment, as well as scheduled wastes have been removed.	
8.6	All waste should be removed from the site and disposed of according to the relevant local authority regulations depending on the waste type. All scheduled waste must be removed by DOE licensed transporters, to a DOE approved disposal site. Decomposable material, for example wood, may be left on the ground within the site to decompose naturally, providing that the material is not contaminated in any way.	Visual inspection of the abandoned area to ensure that there are no areas of contaminated soil or waste.	
8.7	Any contaminated soil, particularly at the camps, should be cleaned or removed.	Refer to **Item 8.6**.	
8.8	Areas within the site that have been cleared of vegetation should be re-vegetated with local species.	Visual inspection of the abandoned area to ensure that exposed surfaces have been re-vegetated.	
8.9	A site visit should be carried out two (2) months after abandonment (if any). This is to ensure that the site has been left in a state that does not pose any health, safety or environmental impacts on the site or in the surrounding area.	A copy of the site inspection report.	
		Visual inspection of the abandoned area to ensure that it has been properly rehabilitated and is not hazardous to the public. A visual check should also be completed after two (2) months to ensure that the site is not hazardous.	

BAB SATU

Ringkasan Eksekutif

Bab 1

Ringkasan Eksekutif

1.1 Pengenalan

Tajuk Penilaian Kesan Alam Sekitar ini adalah **"Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Hectares), Pitas, Sabah"**. Penggerak Projek adalah **Gerak Saga Sdn Bhd**. Projek ini akan melibatkan pembangunan dan operasi perhutanan di kawasan melebihi 500 hektar. Justeru itu, Projek ini diklasifikasikan sebagai aktiviti yang ditetapkan di bawah Jadual Kedua Akta Perlindungan Alam Sekitar (Aktiviti yang Ditetapkan) (Penilaian Kesan Alam Sekitar), 2005, di bawah Perkara 2 (i) dan 2 (ii).

1.2 Lokasi dan Saiz Projek

Tapak projek meliputi kawasan kira-kira seluas 6,467 Ha yang terdiri daripada Hutan Simpan Bengkoka 6,270 Ha dan Hutan Simpan Tambalugu 197 Ha (**Figure 3.2.1**). Bagi tujuan operasi, kedua-dua hutan simpan ini akan diuruskan sebagai suatu Unit Pengurusan Hutan (FMU) dan akan dibahagikan kepada empat (4) *Coupe*, *Coupe* 1-3 (Hutan Simpan Bengkoka) dan *Coupe* 4 (Hutan Simpan Tambalugu). Penggerak Projek memegang lesen untuk operasi pengurusan di kedua-dua kawasan hutan simpan daripada Jabatan Perhutanan Sabah, yang telah memperuntukkan jumlah gabungan kawasan seluas 6,467 Ha untuk Penggerak Projek bagi *Industrial Tree Plantation (ITP)* (**Annex 2.1**).

Dalam laporan ini, istilah "tapak projek" akan merujuk kepada jumlah kawasan untuk Projek, iaitu 6,467 Ha, yang terdiri daripada keseluruhan Hutan Simpan Bengkoka dan Hutan Simpan Tambalugu. Di mana diperlukan rizab-rizab hutan juga akan dirujuk secara individu.

Hutan Simpan Bengkoka boleh diakses dari Jalan Mongkubou Laut, kira-kira 25 km ke utara Pekan Pitas, kurang daripada satu kilometer dari utara Kg. Bongkol. Hutan Simpan Tambalugu terletak kira-kira 4 km timur laut Hutan Simpan Bengkoka, dan boleh diakses dari Kg. Serupil melalui jalan raya sedia ada di utara, yang bersambung ke Jalan Suang Duyung untuk mengakses tapak projek.

Rujuk **Figure 3.2.1**.

1.3 Status Projek

Tapak Projek

Pada masa penyediaan EIA ini, aktiviti pembangunan untuk projek ini belum dimulakan di tapak projek.

Seperti yang dihuraikan dalam **Section 3.4** dalam **Chapter 3**, tapak projek ini adalah dalam keadaan yang semakin merosot akibat eksploitasi berlebihan sebelumnya, kurang pengurusan, kebakaran hutan, kemarau dan penyakit. Tumbuh-tumbuhan semula jadi telah memberi laluan kepada *Acacia mangium* dan *Acacia sp.* yang invasif, di mana ia dalam keadaan buruk dan mendominasi kawasan-kawasan tapak projek. Di sesetengah kawasan, *Acacia mangium* dan *Acacia sp.* telah diserang oleh kulat (*Ceratocystis sp.*) dan juga telah mengalami banyak kebakaran di sepanjang tahun, dan terdapat kawasan yang besar didominasi oleh pokok-pokok yang mati atau hamper mati. *Imperata sp.* rumput (lalang) mendominasi kawasan-kawasan lain, terutama di timur Hutan Simpan Bengkoka.

Jadual RE 1.3.1: Status Dokumen Projek

No.	Dokumen Berkaitan	Status
1	Pelan Pengurusan Hutan	❖ Pelan Pengurusan Hutan (FMP) telah dihasilkan untuk projek ini, ini telah dikemukakan kepada Jabatan Perhutanan Sabah dan kemudiannya diterima melalui surat ref. JPHTN/PP 700-2/1/63/JLD.2(8), dated 25/07/16 (**Annex 2.2**). FMP ini telah dirujuk dalam penghasilan laporan EIA ini dan dilampirkan dalam **Annex 2.3**.
2	Pelan Pembangunan/ Susun Atur	❖ Pelan pembangunan yang dicadangkan untuk Projek diilustrasikan dalam **Figure 3.7.1**. Cadangan pembangunan telah diperincikan dalam FMP yang telah diluluskan oleh Jabatan Perhutanan Sabah, seperti yang dinyatakan di atas.

1.4 Konsep Projek

Penggerak Projek bercadang untuk menubuhkan *Industrial Tree Plantation (ITP)* bagi Eucalyptus di tapak projek. Perladangan akan diurus dengan berasaskan pergiliran 10 tahun dengan tujuan untuk mengeluarkan kayu yang kecil dan cip kayu dari Eucalyptus.

Oleh sebab keadaan tapak projek yang semakin merosot, dijangka tidak ada kawasan sedia ada mempunyai nilai ekologi penting dan tiada rizab riparian yang telah ditubuhkan semasa operasi sebelumnya. Majoriti kawasan tapak projek ini diliputi dengan Akasia yang invasif dan telah reput melalui eksploitasi berlebihan, kurang pengurusan, kebakaran hutan, kemarau dan penyakit. Di samping mewujudkan ITP, Penggerak Projek juga bercadang untuk mewujudkan dan memulihkan kawasan pemuliharaan dan kawasan tadahan air dan rizab riparian. Dalam keadaan biasa sebagai contoh, tumbuh-tumbuhan di zon riparian sedia ada perlu dikekalkan, namun

disebabkan oleh keadaan semakin merosot di tapak projek, Penggerak Projek bercadang untuk meningkatkan kawasan-kawasan ini melalui pengayaan dan rehabilitasi tanaman dengan spesies hutan tempatan bagi mengembalikan fungsi ekologi.

Pelan pembangunan yang dicadangkan untuk tapak projek telah ditunjukkan dalam **Figure 3.7.1**. Keseluruhan tapak projek meliputi kawasan seluas 6,467 Ha. Mengikut informasi terkini daripada Penggerak Projek, jumlah kawasan yang dianggap boleh ditanam dan dibangunkan sebagai ITP adalah kira-kira 5,625 Ha. Kawasan selebihnya telah diperuntukkan oleh Penggerak Projek untuk kegunaan tanah berikut:

1. **Takungan Air dan Tadahan Air**

   Berikutan pelan pemetaan dan pembangunan awal, Penggerak Projek telah mengenal pasti 72 Ha untuk dijadikan sebagai takungan air dan 371 Ha untuk dijadikan sebagai kawasan tadahan air (**Figure 3.7.1**). Seperti yang dijelaskan dalam FMP (**Annex 2.3**) Penggerak Projek akan memastikan pengurusan dan perlindungan yang baik di kawasan-kawasan ini.

   Kawasan-kawasan yang dikenalpasti untuk tadahan air termasuk kawasan tadahan air sedia ada untuk empangan SAFODA yang dibina dalam tapak projek di Sg. Bongkol untuk membekalkan air kepada SAFODA dan Kg. Bongkol melalui loji rawatan air yang telah dibina (**Figure 3.2.1**).

2. **Riparian Zon Penampan**

   Berikutan pemetaan awal dan rancangan pembangunan Penggerak Projek telah mengenal pasti 285 Ha rizab riparian yang terdiri daripada peruntukan 30 m penampan bagi setiap dan semua tebing alur air kekal dalam tapak projek (**Figure 3.7.1**).

3. **Hutan Bakau**

   Tapak projek dalam Hutan Simpan Tambalugu mengandungi lebih kurang 12 Ha hutan bakau, yang telah masuk daripada Hutan Simpan Bengkoka Peninsula (Kelas V - Hutan Simpan Bakau) bersebelahan (**Figure 3.7.1**). Kawasan ini akan dikecualikan dari kawasan ITP dan dari semua aktiviti projek, dan akan dikekalkan sebagai kawasan pemuliharaan.

4. **Jalan Raya**

   Rangkaian jalan sedia ada meliputi kira-kira 15 Ha dalam tapak projek. Rangkaian jalan raya yang dicadangkan untuk Projek ini adalah kira-kira 151 km panjang dan akan melibatkan kira-kira 90.6 Ha. Rangkaian jalan raya yang dicadangkan adalah seperti ditunjukkan di **Figure 3.7.1**.

Kawasan-kawasan ini akan disahkan melalui kajian terperinci dan pengenalpastian tanah sebelum memulakan aktiviti projek. Jumlah kawasan untuk ditanam dengan ITP

adalah tertakluk kepada perubahan, bergantung kepada keadaan tanah, walaubagaimanapun, kawasan minimum yang dinyatakan di atas untuk takungan air, kawasan tadahan air dan rizab riparian tidak akan terjejas dan di mana mungkin, kawasan yang lebih besar akan di diperuntukkan.

Projek ini akan melibatkan pembinaan kemudahan-kemudahan yang diperlukan untuk pembangunan projek. Ini telah diterangkan dengan lebih terperinci dalam **Section 3.9.1**, di dalam **Chapter 3**.

Projek ini tidak akan melibatkan kerja tanah yang banyak kerana tiadanya peneresan. Kerja tanah mungkin diperlukan bagi pembangunan kemudahan-kemudahan dan infrastruktur, namun ini adalah kecil dan kurang daripada 40,000 m^3.

1.5 Persekitaran Sedia Ada

Jadual RE 1.5.1: Persekitaran Sedia Ada

Parameter	Penerangan
Persekitaran Fizikal	
Topografi	❖ Hutan Simpan Bengkoka terletak di kawasan yang beralun landai dengan sebahagian besar cerunnya tidak curam (iaitu <15°). Terdapat sesetengah cerun pendek yang curam di mana sebahagiannya adalah lebih curam daripada 25°, walaubagaimanapun ini adalah terhad kepada beberapa kawasan yang kecil di sepanjang sempadan selatan dan di timur Coupe 2. Hanya 17 Ha tapak projek dianggarkan mempunyai cerun melebihi 25°. Ketinggian di Hutan Simpan Bengkoka adalah antara 10 m AMSL sepanjang lembah, dan 130 m AMSL di bukit yang tertinggi. ❖ Hutan Simpan Tambalugu kebanyakannya rata, dengan ketinggian antara 10 m AMSL hingga 30 m AMSL di tenggara tapak. ❖ Rujuk **Figure 3.10.1** dan **Figure 3.10.2**.
Hidrologi	❖ Terdapat beberapa sungai dan anak sungai di dalam Hutan Simpan Bengkoka. Sungai-sungai utama ialah Sg. Kandang, Sg. Malubang, Sg. Liu, Sg. Kisorong, Sg. Bongkol dan Sg. Kakarangan. Sungai-sungai dan anak sungai yang lain di dalam Hutan Simpan Bengkoka adalah tidak bernama. ❖ Semua sungai dan anak sungai dalam aliran Hutan Simpan Bengkoka daripada tapak projek ke dalam operasi perhutanan bersebelahan, terutamanya ladang Acacia, dan perladangan kelapa sawit kecil-kecilan. Sungai-sungai dan anak sungai yang mengalir ke arah timur akan mengalir ke Laut Sulu, dan sungai-sungai dan anak sungai yang mengalir ke arah barat akan mengalir ke Laut China Selatan. ❖ Terdapat beberapa anak sungai yang tidak bernama di dalam Hutan Simpan Tambalugu, ini semua berkumpul menjadi satu aliran yang mengalir ke utara ke hutan bakau bersebelahan dan ke Laut Sulu. ❖ Kebanyakan sungai dalam tapak projek (Hutan Simpan Bengkoka dan Tambalugu) adalah bermusim dan aliran akan berkurang atau kering semasa musim kering.

Parameter	Penerangan
	❖ Kelebaran sungai-sungai dan anak-anak sungai juga berbeza dalam projek itu. Sungai-sungai dan anak sungai yang diperhatikan dalam tapak projek semasa lawatan tapak adalah di antara < 3 m ke > 5 m lebar. ❖ Rujuk **Figure 3.10.1**.
Geologi dan Tanah	❖ Hutan Simpan Bengkoka didominasi oleh lapisan tanah Asosiasi Mallau, dengan bahan induk batu pasir dan batu lumpur, dan Asosiasi Brantian di utara, dengan bahan induk aluvium. ❖ Asosiasi Kinabatangan dan Tuaran juga masing-masing terdapat di sesetengah kawasan kecil di bahagian utara dan timur di Hutan Simpan Bengkoka, dengan aluvium sebagai bahan induk bagi kedua-keduanya. ❖ Hutan Simpan Tambalugu didominasi oleh lapisan tanah Asosiasi Brantian, dengan beberapa kawasan tanah Asosiasi Tuaran di utara dan timur. ❖ Tanah di kawasan ini adalah sesuai untuk penanaman spesies yang bertumbuh dengan cepat termasuk *Eucalyptus pellita*. ❖ Seluruh tapak projek adalah dilapisi oleh geologi Formasi Kudat, dari tempoh *Oligocene*. Litologi adalah terdiri daripada batu pasir, syal, batu lumpur, batu lodak, konglomerat dan batu kapur. ❖ Sebahagian kecil daripada Hutan Simpan Bengkoka di timur adalah dilapisi oleh geologi Formasi Bongaya. ❖ Sebahagian kecil tapak projek di sepanjang sempadan utara Hutan Simpan Tambalugu adalah dilapisi oleh deposit aluvium pantai dan sungai yang kebelakangan. ❖ Rujuk **Figure 3.10.3** dan **Figure 3.10.4**.
Analisis Kualiti Air	❖ Persampelan garis dasar kualiti air telah dijalankan di lima (5) lokasi (W1 - W5) di sungai-sungai dan anak sungai yang mengalir melalui tapak projek di Hutan Simpan Bengkoka (**Figure 3.10.1**). ❖ Persampelan juga telah dicuba di Hutan Simpan Tambalugu, di aliran utama yang tidak bernama yang mengalir ke arah utara melalui hutan simpan ke hutan bakau bersebelahan, walaubagaimanapun aliran adalah kering pada hari persampelan. ❖ Semua parameter, dengan pengecualian Jumlah Pepejal Terampai, kekeruhan, *Total Coliform Count* (TCC) dan *Faecal Coliform Count* (FCC), adalah dalam had Kelas IIB dalam NWQSM (**Annex 1.3**). Kesan agrokimia adalah ditemui dalam ujian dan ini adalah pada tahap yang minimum. ❖ Peningkatan tahap Jumlah Pepejal Terampai dan kekeruhan mungkin disebabkan oleh hakisan di hulu tebing sungai, berikutan pengurusan rizab riparian yang tidak baik sebelum ini. ❖ Tahap TCC dan FCC yang tinggi mungkin sekali berpunca daripada najis manusia, mikroorganisma daripada najis haiwan. ❖ Rujuk **Section 3.10.1.6** dalam **Chapter 3** untuk maklumat lanjut.

Parameter	Penerangan
Kualiti Udara dan Bunyi	❖ Persampelan garis dasar kualiti udara untuk Jumlah Zarahan Terampai dan pemantauan garis dasar bunyi telah dijalankan di reseptor terdekat Kg. Serupil (A1 / N1). Lihat **Section 3.10.1.7** dan **Section 3.10.1.8** dalam **Chapter 3.** ❖ Hasil kajian menunjukkan bahawa tahap Jumlah Zarahan Terampai semasa di udara di tempat pensampelan adalah jauh di bawah tahap 260 $\mu g/m^3$ yang ditetapkan dalam *Malaysian Ambient Air Quality Guidelines* (lihat **Annex 1.6**). Terdapat beberapa kali hujan di sepanjang hari pensampelan. ❖ Keputusan bunyi bising menunjukkan bahawa waktu siang dan malam pada kedua-kedua di Kg. Serupil adalah tinggi dan melebihi had yang ditetapkan jika dibandingkan dengan Jadual 1 *Planning Guidelines for Environmental Noise Limit and Control, for Noise Sensitive Areas* (**Annex 1.8**). Tahap bunyi bising tinggi yang telah direkodkan disebabkan oleh bunyi angin dan aktiviti manusia.
Persekitaran Biologi	
Flora dan fauna	❖ Sebagai sebahagian daripada aktiviti pra-pembangunan, Penggerak Projek telah menjalankan kajian flora dan fauna di Hutan Simpan Bengkoka antara bulan Oktober dan November 2015, dan Hutan Simpan Tambalugu antara 2 dan 24 hb Mac 2016. ❖ Dari segi flora, tapak projek berada dalam keadaan teruk, dengan kepelbagaian yang sangat sedikit. Tumbuh-tumbuhan semula jadi yang pernah wujud di tapak projek telah memberi laluan kepada *Acacia mangium* dan *Acacia sp.* yang invasif, di mana kini meliputi majoriti tapak projek. Di kebanyakan kawasan tapak projek, Akasia telah mengalami kebakaran hutan yang luas dan kulat (*Ceratocystis sp.*), dan sesudah itu, pokok-pokok yang mati atau hampir mati didapati di kebanyakan kawasan besar. ❖ Walaupun tapak projek berada dalam keadaan tidak baik, dengan sedikit kepelbagaian floranya, ia masih mampu untuk mempunyai populasi hidupan liar yang hidup di dalam kawasan itu, termasuk rusa, beruang, babi dan lain-lain. ❖ Rujuk **Section 3.10.2** dalam **Chapter 3** dan **Annex 2.5** dan **Annex 2.6** untuk maklumat lanjut.
Persekitaran Guna Tanah dan Manusia	
Kawasan Persekitaran	❖ Tiada penempatan dalam tapak projek. Walau bagaimanapun terdapat beberapa penempatan yang terletak di sekitar tapak projek. ❖ Kampung-kampung yang berhampiran dengan Hutan Simpan Bengkoka ialah Kg. Kakarangan (200 m timur), Kg. Serupil (200 m barat / selatan) dan Kg. Kapok (300 m barat). Rumah-rumah yang berhampiran dengan tapak projek adalah berada dalam Kg. Serupil, yang terletak dalam lingkungan 50 m dari sempadan tapak projek. Kg. Serupil juga didapati terletak di sepanjang jalan masuk sedia ada ke tapak projek, iaitu Jalan Mongkubou Laut. ❖ Kampung paling hampir dengan Hutan Simpan Tambalugu adalah Kg. Suang Duyung (500 North / Barat laut).

Parameter	Penerangan
	❖ Terdapat beberapa struktur yang sedia ada di dalam tapak projek di Hutan Simpan Bengkoka dimana ini ialah tinggalan daripada operasi perhutanan sebelumnya dan pengurusan hutan yang sedia ada, seperti pondok pekerja dan dua (2) menara tinjauan api. ❖ Tiada struktur yang sedia ada dalam tapak projek di Hutan Simpan Tambalugu ❖ Terdapat juga sebuah empangan kecil di dalam Hutan Simpan Bengkoka di sepanjang sempadan selatan berhampiran Kg. Bongkol. Empangan ini telah dibina oleh SAFODA dan membekalkan air untuk SAFODA dan Kg. Bongkol. ❖ Hutan Simpan Bengkoka kebanyakannya dikelilingi oleh operasi perhutanan, terutamanya ladang Acacia dengan kawasan Lembaga Pembangunan Perhutanan Sabah (SAFODA). Pengurus di kawasan ini Acacia Forest Industries Sdn Bhd. Terdapat juga beberapa kawasan ladang kelapa sawit secara kecil-kecilan. ❖ Hutan Simpan Tambalugu di sebelah timur, selatan dan bahagian barat adalah bersempadan dengan operasi perhutanan, terutamanya ladang Acacia dikendalikan oleh Acacia Forest Industries Sdn Bhd. Juga bersempadan dengan tapak projek di sebelah barat ialah beberapa ladang kelapa sawit kecil dikendalikan oleh masyarakat tempatan. ❖ Bersempadan Hutan Simpan Tambalugu ke arah utara adalah Hutan Simpan Bengkoka Semenanjung Mangrove (Kelas V). ❖ Guna tanah kawasan sekeliling diterangkan dengan lebih terperinci dalam **Section 3.10.4** dalam **Chapter 3** dan digambarkan dalam **Figure 3.2.1.**

1.6 Penemuan

Isu-isu utama alam sekitar yang dikenal pasti untuk projek ini adalah seperti berikut: Hakisan Tanah dan Pencemaran Air; Penghasilan dan Pengurusan Sisa; dan Bahaya Kebakaran. Kesan alam sekitar yang lain yang dikenalpasti adalah: Impak Ekologi; Pencemaran Bising dan Pencemaran Udara; Impak Trafik dan Pengangkutan; Impak Sosio-Ekonomi; dan Penamatan dan Potensi Peninggalan.

Jadual RE 1.6.1 meringkaskan kesan alam sekitar dan langkah-langkah mitigasi, dan juga program-program pemantauan dalam pelaksanaan projek.

Program pemantauan disyorkan perlu dilengkapkan dalam bentuk laporan pemantauan pematuhan yang perlu dikemukakan kepada Jabatan Perlindungan Alam Sekitar (JPAS). Program pemantauan harus dijalankan **setiap suku tahunan semasa penubuhan ladang** dan **setiap enam (6) bulan (pada musim kering dan hujan) selama 3 tahun semasa operasi perladangan, dan seterusnya setahun sekali pada musim hujan.**

Jadual RE 1.6.1: Impak Alam Sekitar, Langkah Mitigasi dan Program Pemantauan

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
1.0	**Hakisan tanah dan Pencemaran Air**		
1.1	Sempadan tapak projek perlu ditandakan dengan jelas di atas tanah sebelum sebarang kerja bermula di tapak ini. Pembersihan tumbuhan harus dihadkan di kawasan-kawasan yang perlu bagi pembangunan dan tidak melebihi sempadan tapak projek. Pembersihan tidak boleh dijalankan di dalam mana-mana kawasan pemuliharaan yang dikenal pasti, dengan pengecualian pembuangan pokok reput dan tumbuh-tumbuhan untuk pengayaan dan rehabilitasi tanaman dengan spesies hutan semula jadi, di mana perlu dan dibenarkan.	Pelan susun atur tapak menunjukkan sempadan tapak projek dan gambar (dengan tarikh dan koordinat GPS) untuk menunjukkan penandaan yang jelas di atas tanah di sempadan tapak projek.	
		Gambar (dengan tarikh dan koordinat GPS) untuk menunjukkan kawasan yang dibersihkan selepas pembersihan tapak bagi menunjukkan sempadan di antara kawasan yang dibersihkan dan kawasan bersebelahan yang tiada dibersihkan, supaya menunjukkan kawasan pemuliharaan dan luar sempadan tapak projek adalah dibiar dan tidak dibersihkan	
		Pemeriksaan visual untuk memastikan bahawa pembersihan tumbuh-tumbuhan hanya dihadkan di dalam sempadan tapak projek, dan hanya di mana perlu untuk pembangunan, dan bukan dalam kawasan pemuliharaan, dengan pengecualian pembuangan pokok reput dan tumbuh-tumbuhan untuk pengayaan dan rehabilitasi tanaman.	
1.2	Pembersihan tumbuh-tumbuhan perlu disiapkan secara berperingkat mengikut pelan *'compartment/ blocking'* dan jadual yang diperincikan dalam Pelan Pembangunan Coupe, yang mana akan dikemukakan dengan Rancangan Kerja Tahunan ke Jabatan Perhutanan Sabah. Setiap coupe akan dibahagikan kepada petak dari 200 hingga 600 Ha, yang mana ia akan dibahagikan ke dalam blok-blok lebih kurang seluas 24 Ha setiap satu. Pembalakan *salvage* juga perlu mengikut jadual yang terperinci di dalam Pelan Pembangunan Coupe.	Pelan *compartment/ blocking* dan jadual menunjukkan pembersihan tumbuh-tumbuhan dijalankan secara berperingkat dalam setiap Coupe. Pelan-pelan dan jadual ini harus menunjukkan bahawa jumlah kawasan berdampingan yang dibersihkan tidak melebihi 100 Ha pada satu-satu masa, dan corak mozek adalah dilaksanakan bagi pembersihan kawasan yang lebih besar, dengan penampan yang sesuai atau dalam corak berpetak-petak.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
1.3	Jumlah kawasan tanah bersebelahan untuk dibersihkan pada satu masa tidak boleh melebihi 100 Ha. Setelah maksimum 100 Ha telah dibersihkan, operasi mesti bermula di kawasan itu, termasuk penanaman, sebelum pembersihan bermula di kawasan bersebelahan. Kawasan yang besar perlu dibahagikan kepada corak mozek yang berpisah sekurang-kurangnya 50 m dengan penampan atau dalam corak berkotak-kotak.	Rujuk **Perkara 1.2**.	
1.4	Permukaan tanah yang telah dibersihkan perlu ditanam dengan tanaman terakhir secepat mungkin bagi menyatakan hakikatnya pembersihan adalah disyorkan untuk dijalankan pada musim kering dan penanaman hanya dijalankan pada musim hujan. Hubungan pengeluaran anak benih yang dimananya juga bermusim juga harus diambil kira.	Jadual pembersihan dan penanaman untuk menunjukkan masa antara pembersihan dan penanaman adalah dikurangkan sejauh mungkin. Gambar (dengan tarikh dan koordinat GPS) juga diperlukan selepas penanaman telah dijalankan di suatu kawasan yang telah dibersihkan, bagi menunjukkan penyelesaian activity penanaman.	
1.5	Cuaca perlu diambil kira semasa pembersihan tapak, iaitu aktiviti pembersihan tapak harus terhad kepada musim kering sahaja (jika boleh).	Tiada.	
1.6	Jentolak tidak boleh digunakan untuk pembersihan tapak, kerana ini adalah merosakkan permukaan tanah. Sebagai alternatif, jentera yang kurang merosakkan, seperti jengkaut boleh digunakan.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan jentolak tidak digunakan untuk pembersihan tapak, dan jentera yang kurang merosakkan seperti jengkaut digunakan.	
1.7	Biomas yang dijana daripada pembersihan tapak dan pembalakan *salvage* harus dibiarkan mengurai di tapak. Tampalan dengan kuantiti sisa biomas yang lebih besar, yang berisiko menghasilkan timbunan biomas, harus disebarkan dan dihancurkan dengan jentolak.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan biomas ditinggalkan di tapak untuk penguraian semula jadi. Gambar-gambar juga perlu menunjukkan penghancuran dan penyebaran biomas yang lebih besar dan berisiko menghasilkan timbunan biomas.	
1.8	Di mana yang berkenaan untuk operasi projek, *Reduced Impact Logging (RIL)* perlu dilaksanakan seperti yang diperincikan dalam Perjanjian Lesen.	Tiada.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
1.9	Kecerunan jalan tidak boleh melebihi 8° (15%), untuk mengelakkan hakisan permukaan yang berlebihan.	Gambar (dengan tarikh dan koordinat GPS), menunjukkan kecerunan jalan tidak melebihi 8° (15%).	
1.10	Di mana lintasan anak sungai diperlukan, pembetung jambatan yang sesuai perlu dibina. Penyekatan laluan air adalah dilarang sama sekali, dan pembinaan perlu diselesaikan tanpa memasukkan jentera dan peralatan ke dalam laluan air.	Pelan tapak susun atur dan gambar (dengan tarikh dan koordinat GPS) menunjukkan semua lintasan anak sungai dalam tapak projek dengan keadaannya dan strukturnya.	
1.11	Kawasan di dalam tapak projek dengan gradien cerun melebihi 25° harus dikecualikan daripada aktiviti pembangunan dan dipelihara sebagai kawasan pemuliharaan (**Figure 6.2.1**). Persempadanan kawasan cerun curam perlu berdasarkan keadaan fizikal di tapak dan bukan pada peta topografi.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) yang menunjukkan mana-mana kawasan yang dikenal pasti dengan cerun > 25°, dikecualikan daripada aktiviti pembangunan.	
1.12	Di mana pembangunan di lereng diperlukan, panjang cerun harus dikurangkan sebanyak mungkin dengan menggunakan kaedah yang diterima seperti rentasan parit, dan kaedah pembersihan rentasan cerun. Peneresan adalah dilarang dalam tapak projek, iaitu kawasan hutan simpan yang dilesenkan.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan apa-apa langkah yang diambil bagi mengurangkan panjang cerun di mana yang perlu.	
1.13	Di mana hakisan tanah didapati di tapak projek itu, langkah-langkah kawalan hakisan yang sesuai perlu dilaksanakan, seperti perlindungan sementara dengan helaian plastik, *turfing* dan lain-lain, yang sesuai dengan keadaan di tapak.	Rujuk **Perkara 1.15**.	
1.14	Perparitan di tepi jalan yang sesuai perlu disediakan di sepanjang semua jalan dalam tapak projek. Sistem perparitan di tepi jalan perlu dilengkapi dengan perangkap mendapan di setiap selang, dan harus dilepaskan ke ke kawasan tumbuh-tumbuhan dan bukan terus ke dalam sungai dan anak sungai di tapak.	Rujuk **Perkara 1.15**.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
1.15	Sistem saliran yang sesuai perlu diwujudkan di kem utama. Sistem saliran di kem haruslah dilepaskan ke kawasan tumbuh-tumbuhan. Pelepasan terus ke sungai-sungai atau anak-anak sungai adalah dilarang sama sekali.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan sistem perparitan yang baik di kem utama, tepi jalan termasuk langkah-langkah kawalan sedimen dan pelaksanaan langkah-langkah kawalan hakisan di mana hakisan tanah telah dikenal pasti di tapak (jika ada). Gambar harus menunjukkan pelepasan sistem perparitan di kem utama ke kawasan tumbuh-tumbuhan	
1.16	Semua sistem-sistem perparitan perlu dikekalkan secara tetap, atau sejurus selepas hujan lebat untuk mengekalkan keberkesanannya.	Pemeriksaan visual terhadap sistem perparitan yang disediakan di tapak projek. Ini adalah untuk memastikan bahawa ia adalah sesuai untuk tujuan, dibina dengan baik, dijaga dengan baik, bebas daripada apa-apa sekatan dan dapat beroperasi pada kecekapan maksimum.	
1.17	Semua sungai-sungai dan anak-anak sungai kekal dalam tapak projek perlu disediakan dengan kelebaran rizab riparian yang sesuai, yang telah ditentukan berdasarkan kelebaran sungai/ anak sungai. 30-m lebar rizab riparian perlu disediakan di setiap tebing sungai dan anak sungai utama kekal yang dikenal pasti dalam tapak projek, seperti yang ditunjukkan dalam **Figure 6.2.1**. Semua anak sungai yang lain harus disediakan dengan rizab riparian yang sesuai mengikut keperluan Jabatan Perhutanan Sabah untuk hutan simpan (**Figure 6.2.1**) (**Table 5.2.1**). Keperluan rizab riparian perlu dimuktamadkan melalui pengenalpastian di tapak bagi setiap Coupe, dengan keperluan muktamad diperincikan dalam Pelan Pembangunan Coupe. Walaupun ia bukan satu keperluan untuk menyediakan rizab riparian di saluran-saluran air yang tidak kekal, tetapi adalah disyorkan untuk berbuat demikian.	Pelan tapak susun atur dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan dan sempadan yang jelas rizab riparian di sungai-sungai dan anak sungai dalam tapak projek.	
		Pemeriksaan visual terhadap rizab riparian yang disediakan di tapak projek untuk memastikan ia ditandakan dengan jelas di atas tanah dan kelebaran yang betul.	
1.18	Sebelum aktiviti pembersihan tapak bermula, semua rizab riparian hendaklah ditandakan dengan jelas di atas tanah dengan papan tanda dan cat merah.	Rujuk **Perkara 1.17**.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
1.19	Kawasan-kawasan tadahan air yang ditunjukkan pada **Figure 6.2.1** hendaklah ditandakan dengan jelas di atas tanah. Aktiviti projek dalam kawasan-kawasan ini, dengan pengecualian pengayaan dan rehabilitasi tanaman dengan spesies hutan semula jadi, adalah dilarang sama sekali.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) yang menunjukkan penyediaan dan penandaan yang jelas kawasan-kawasan tadahan air di dalam tapak projek.	
1.20	Hutan bakau dalam tapak projek itu harus disediakan dengan 50-m zon penampan di sekeliling perimeter dalam tapak projek (**Figure 6.2.1**). Zon penampan dan hutan bakau hendaklah ditandakan dengan jelas di atas tanah. Aktiviti projek dalam kawasan-kawasan ini, dengan pengecualian pengayaan dan rehabilitasi tanaman sebaik-baiknya dengan spesies bakau yang sesuai atau spesies hutan semula jadi di dalam zon penampan, adalah dilarang sama sekali.	Pelan tapak susun atur dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penandaan kawasan hutan bakau yang jelas dalam tapak projek ini, dan penyediaan dan penandaan penampan 50 m yang jelas di sekitar perimeter kawasan bakau.	
		Pemeriksaan visual untuk memastikan penyediaan dan penandaan penampan 50 m di sekitar perimeter yang sesuai di kawasan bakau dalam tapak projek.	
1.21	Takungan air seperti yang ditunjukkan pada **Figure 6.2.1** harus disediakan dengan 50-m zon penampan di sekitar perimeternya dalam tapak projek. Takungan air dan zon penampan hendaklah ditandakan dengan jelas di atas tanah. Aktiviti-akitiviti projek dalam kawasan ini, dengan pengecualian pengayaan dan rehabilitasi tanaman dengan spesies hutan semula jadi di dalam zon penampan, adalah dilarang sama sekali.	Pelan tapak susun atur dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penandaan jelas takungan air di dalam tapak projek dan peruntukan dan penandaan 50 m penampan yang jelas di sekeliling perimeter takungan air.	
		Pemeriksaan visual untuk memastikan penyediaan dan penandaan penampan 50 m yang sesuai di sekitar perimeter takungan air di dalam tapak projek.	
1.22	Bahan agrokimia dan bahan berbahaya yang lain seperti bahan api dan minyak perlu disimpan mengikut peraturan kerajaan semasa dan perlu ditangani dengan baik. Sebarang bekas yang terpakai harus dikembalikan kepada pembekal-pembekal atau dikumpulkan untuk pelupusan melalui laluan pelupusan yang diluluskan oleh kerajaan. Kawasan penyimpanan hendaklah sekurang-kurangnya 50 m dari saluran air semulajadi yang terdekat, dan harus disediakan dengan benteng yang sesuai, sistem perparitan dengan perangkap minyak dan terlindung.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan kawasan penyimpanan untuk bahan agrokimia dan bahan-bahan berbahaya mematuhi semua peraturan-peraturan kerajaan yang berkenaan. Pelan susun atur dan gambar harus menunjukkan kawasan penyimpanan adalah sekurang-kurangnya 50 m dari saluran air semulajadi yang terdekat, dibendung, terlindung dan disediakan dengan sistem saliran sesuai.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
1.23	Penggunaan bahan agrokimia perlu dikawal, dengan menitikberatkan jumlah dan masa penggunaan. Pasukan pengurusan harus menyelia dengan ketat dan mengawal kaedah, dos, masa dan kekerapan penggunaan agrokimia untuk menjimatkan kos dan mengurangkan pembaziran dan pencemaran alam sekitar.	Tiada.	
1.24	Jika boleh baja organik boleh digunakan untuk mengurangkan penggunaan bahan kimia.	Tiada.	
1.25	Semburan agrokimia berleluasa ke tanah bersebelahan, kawasan-kawasan pemuliharaan dan sungai-sungai atau anak-anak sungai adalah dilarang sama sekali dan operasi menyembur berhampiran dengan kawasan-kawasan ini perlu dipantau dengan teliti.	Tiada.	
1.26	Penggunaan bahan agrokimia mestilah mengikut peraturan-peraturan dan undang-undang yang ditetapkan di bawah Akta Racun Makhluk Perosak 1974. Penggunaan racun perosak, racun rumpai dan bahan-bahan yang sama harus dikurangkan sebanyak mungkin. Keutamaan harus diberikan kepada kawalan biologi dan kawalan rumput secara manual, di mana yang mungkin.	Tiada.	
1.27	Walaupun baja dan bahan agrokimia perlu diaplikasikan pada permukaan basah untuk kesan maksimum, penjagaan perlu diambil untuk mengunakan sebatian ini pada masa-masa di mana larian permukaan adalah minimum.	Tiada.	
1.28	Kem utama dan kem-kem yang lebih kecil yang terletak di dalam ladang perlu diletakkan sekurang-kurangnya 30 m dari saluran air semulajadi yang terdekat, dan tidak boleh terletak dalam kawasan pemuliharaan.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan bahawa kem utama dan kem-kem kecil terletak sekurang-kurangnya 30 m dari saluran air semulajadi yang terdekat, dan tidak terletak di dalam kawasan pemuliharaan.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
1.29	Langkah-langkah mitigasi yang diperincikan dalam **Perkara 2.0** perlu dilaksanakan untuk mengurangkan pencemaran air dari sisa yang dihasilkan di tapak projek.	Rujuk **Perkara 2.0**.	
1.30	Semua aduan yang berkaitan daripada masyarakat tempatan mengenai pencemaran air perlu direkod dan segera ditangani.	Rekod semua aduan berkaitan daripada masyarakat tempatan tentang pencemaran air, dengan butir-butir tindakan yang diambil.	
1.31	Rutin pemantauan kualiti air perlu dijalankan di sungai dan anak sungai dalam tapak projek.	Rutin pemantauan kualiti air perlu dijalankan di sungai-sungai dan anak-anak sungai dalam tapak projek. Lokasi pemantauan adalah ditunjukkan dalam **Figure 6.2.1**. Jadual pemantauan akan dihasilkan untuk memastikan pemantauan dijalankan di kawasan-kawasan aktif tapak projek, iaitu pemantauan tidak akan dilaksanakan di kawasan projek di mana aktiviti-aktiviti projek masih belum dimulakan. Keperluan persampelan telah dibentangkan dalam **Table 6.2.1** dalam **Chapter 6**. Keputusan akan dibandingkan dengan Kelas IIB *National Water Quality Standards Malaysia (NWQSM)* (**Annex 1.3**).	
2.0	**Penghasilan Sisa dan Pengurusan**		
Biomas			
2.1	Biomas dihasilkan daripada pembersihan tapak dan pembalakan *salvage* harus dibiarkan mengurai di tapak. Tampalan dengan kuantiti sisa biomas yang lebih besar, yang berisiko menghasilkan timbunan biomas, harus disebarkan dan dihancurkan dengan jentolak.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan biomas ditinggalkan di ditapak untuk penguraian secara semula jadi. Gambar-gambar juga perlu menunjukkan penghancuran dan penyebaran biomas yang lebih besar dan berisiko menghasilkan timbunan biomas.	
2.2	Pembakaran biomas adalah dilarang sama sekali. Polisi pembakaran sifar perlu dilaksanakan.	Pemeriksaan visual bagi sebarang tanda pembakaran terbuka di tapak projek.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
2.3	Semua kawasan pemuliharaan, sungai-sungai dan anak-anak sungai perlu bebas daripada sisa biomas. Pelupusan biomas ke dalam kawasan-kawasan ini adalah dilarang sama sekali. Mana-mana biomas memasuki laluan air semulajadi harus segera dikeluarkan.	Tiada.	
Sisa Pepejal/ Domestik			
2.4	Amalan *good housekeeping* dan pengurusan sisa yang baik patut dilaksanakan pada setiap masa di semua kemudahan tapak, termasuk kem utama. Tong sampah dengan penutup perlu disediakan dan digunakan.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan pelupusan sisa am dan kemudahan kitar semula disediakan di tapak projek.	
		Pemeriksaan visual terhadap kebersihan umum tapak projek.	
2.5	Tempat pembuangan sisa disediakan di tapak perlu terletak sekurang-kurangnya 50 meter dari saluran air semulajadi terdekat. Tempat pembuangan perlu diuruskan dengan baik dan dikekalkan untuk memastikan bahawa ia tidak menjadi penuh sehingga melimpah dan untuk memastikan sekitar kawasan tempat itu bebas daripada sisa. Tempat pembuangan tidak boleh terletak di kawasan pemuliharaan (**Figure 6.2.1**).	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan lokasi pembuangan sisa terletak sekurang-kurangnya 50 m dari saluran air semulajadi yang terdekat dan tidak berada dalam kawasan pemuliharaan yang dikenal pasti.	
		Pemeriksaan visual terhadap keadaan kemudahan pembuangan sisa dan kitar semula, termasuk tapak pembuangan untuk memastikan ia diurus dan diselenggara ke tahap yang baik.	
2.6	Pelupusan sisa berleluasa ke tanah, kawasan pemuliharaan, saluran air semulajadi dan sistem perparitan adalah dilarang sama sekali.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan sebarang pelupusan sisa berleluasa ke tanah, kawasan pemuliharaan, saluran air semulajadi dan sistem saliran.	
		Pemeriksaan visual untuk memastikan sisa, termasuk biomas, sisa pepejal, sisa terjadual dan kumbahan tidak sewenang-wenangnya dilupuskan ke tanah, kawasan pemuliharaan, saliran tapak atau saluran air semulajadi.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
2.7	Kem utama dan kem-kem yang lebih kecil yang terletak di dalam ladang perlu terletak sekurang-kurangnya 30 m dari saluran air semulajadi yang terdekat, dan tidak boleh terletak dalam kawasan pemuliharaan (**Figure 6.2.1**).	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan kem utama dan kem-kem yang lebih kecil yang terletak sekurang-kurangnya 30 m dari saluran air semulajadi yang terdekat dan tidak berada dalam kawasan pemuliharaan.	
2.8	Hierarki pengurusan sisa perlu dilaksanakan di tapak, iaitu mengelakkan (jika boleh elakkan penjanaan sisa), mengurangkan (jika penjanaan sisa tidak dapat dielakkan maka ia perlu dikurangkan), penggunaan semula (jika boleh sisa, seperti botol plastik, boleh digunakan semula), kitar semula (jika sisa tidak boleh digunakan semula ia perlu kitar semula), melupuskan (hanya jika sisa tidak boleh digunakan semula atau dikitar semula, maka ia harus dilupuskan). kemudahan kitar semula harus disediakan di tapak.	Tiada.	
Sisa Terjadual			
2.9	Generasi sebarang buangan terjadual hendaklah dimaklumkan secara bertulis kepada Ketua Pengarah Jabatan Alam Sekitar (JAS). Pemberitahuan perlu dilengkapkan dalam borang yang ditetapkan dalam Jadual Kedua (Pemberitahuan Buangan Terjadual).	Rekod semua sisa terjadual di tapak, termasuk satu salinan pemberitahuan diberikan kepada Jabatan Alam Sekitar.	
2.10	Sisa terjadual, termasuk minyak terpakai, (jika ada) hendaklah disimpan sebagai satu keperluan Peraturan-Peraturan Kualiti Alam Sekeliling (Buangan Terjadual) 2005 dan pindaan 2007. Buangan terjadual hendaklah disimpan dalam bekas yang sesuai dengan pelabelan yang betul di kawasan dibendung dan terlindung. Kawasan penyimpanan mesti terletak sekurang-kurangnya 50 meter jauh dari mana-mana saluran air semula jadi, dan hendaklah mematuhi garis panduan mengenai Eksport, Import dan Penyimpanan Buangan Terjadual di Malaysia	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan dan lokasi kawasan penyimpanan sisa terjadual sekurang-kurangnya 50 m dari saluran air semulajadi yang terdekat. Gambar-gambar hendaklah menunjukkan semua cirri-ciri yang diperlukan untuk kawasan penyimpanan untuk memenuhi keperluan undang-undang, seperti benteng yang betul dan tempat terlindung.	
		Pemeriksaan visual terhadap kawasan penyimpanan sisa terjadual dan bahan-bahan berbahaya untuk memastikan ia adalah sesuai untuk tujuannya.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
2.11	Tangki minyak dan penyimpanan bahan api kekal dan sementara hendaklah ditempatkan di sebuah tapak yang stabil, kering, dibendung dan dikelilingi oleh parit dan penakung minyak. Peralatan memadam kebakaran seperti alat pemadam api, selimut kebakaran, dan lain-lain mestilah berfungsi sepenuhnya dan mudah diakses berhampiran dengan kemudahan minyak dan penyimpanan bahan api pada setiap masa. Kawasan penyimpanan harus terletak kurangnya 50 meter dari saluran air semulajadi yang terdekat.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan lokasi tangki minyak dan penyimpanan bahan api tetap dan sementara terletak sekurang-kurangnya 50 m dari mana-mana saluran air semulajadi, dan menunjukkan ia terletak di sebuah tapak yang stabil, kering, dibendung dan dikelilingi oleh parit dan penakung minyak. Gambar-gambar juga perlu menunjukkan peralatan memadam api adalah berfungsi sepenuhnya dan boleh diakses berhampiran dengan kemudahan penyimpanan minyak dan bahan api.	
2.12	Semua sisa terjadual hendaklah dilupuskan oleh pengangkut JAS berlesen mengikut Peraturan-Peraturan Kualiti Alam Sekeliling (Buangan Terjadual) 2005 dan pindaan 2007.	Tiada.	
2.13	Pelupusan sisa terjadual ke tanah, saluran air semulajadi atau longkang adalah dilarang sama sekali.	Rujuk **Perkara 2.6.**	
Sisa Kumbahan			
2.14	Kemudahan kebersihan yang baik, iaitu tandas dengan tangki septik perlu disediakan di kem utama dan kem-kem kecil yang diwujudkan dalam ladang. Kemudahan ini mestilah sekurang-kurangnya 50 meter dari saluran air semulajadi yang terdekat.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan lokasi tandas dan kemudahan rawatan kumbahan.	
2.15	Sistem rawatan kumbahan perlu mematuhi Piawai B Peraturan-Peraturan Kualiti Alam Sekeliling (Kumbahan) 2009 (**Annex 1.10**); ini perlu diselenggara secara rutin.	Tiada.	
2.16	Pelepasan kumbahan mentah terus ke tanah, longkang atau saluran air semulajadi adalah dilarang pada setiap masa.	Rujuk **Perkara 2.6.**	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
3.0	**Bahaya Kebakaran**		
3.1	Pelan Pengurusan Kebakaran perlu disiapkan dan dilaksanakan sebelum permulaan aktiviti projek di tapak projek. Salinan Pelan Pengurusan Kebakaran perlu diberikan kepada pihak berkuasa yang berkaitan mengikut keperluan mereka, dan Jabatan Perlindungan Alam Sekitar.	Salinan Pelan Pengurusan Kebakaran, termasuk pelan pencegahan kebakaran. Salinan surat-menyurat yang berkaitan dengan pelan-pelan ini menunjukkan penyerahan dan kelulusan daripada pihak berkuasa yang berkaitan seperti Bomba, Jabatan Perhutanan Sabah dan Pegawai Daerah.	
3.2	Pelan Pengurusan Kebakaran haruslah memberi butir-butir mengenai persediaan kebakaran tahunan, harian dan khas dan pencegahan api.	Rujuk **Perkara 3.1**.	
3.3	Peralatan memadam kebakaran perlu disediakan di tempat yang sesuai dalam tapak projek. Ini perlu diperiksa dan diselenggara secara rutin.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan peralatan memadam kebakaran di lokasi yang sesuai dalam tapak projek.	
3.4	Sebagai sebahagian daripada persediaan tahunan sebelum musim kering, semua peralatan memadam kebakaran haruslah berada dalam keadaan yang baik; latihan kebakaran tetap perlu dijalankan; jalan akses kritikal perlu berada dalam keadaan yang baik; sumber-sumber air dan mata air perlu diperiksa; dan semua pelan dan prosedur perlu dikemaskini dan diberi taklimat kepada kakitangan.	Tiada.	
3.5	Satu pelan pencegahan api hendaklah disediakan dan diterima dan diperiksa dengan Bomba, Jabatan Perhutanan Sabah dan Pegawai Daerah.	Rujuk **Perkara 3.1**.	
3.6	Sistem penilaian bahaya kebakaran perlu diguna pakai sebagai alat pencegahan kebakaran harian, dan diperincikan dalam Pelan Pengurusan Hutan.	Rujuk **Perkara 3.1**.	
3.7	Pegawai Penyelamat Api Hutan dan pasukannya haruslah dilantik dan bertanggungjawab terhadap semua persediaan kebakaran dan pencegahan dalam tapak projek.	Maklumat Pegawai Penyelamat Api Hutan dan pasukannya.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
3.8	Alur air perlu diwujudkan dalam tapak projek untuk mudah akses sekiranya berlaku kebakaran, ini termasuk takungan-takungan air seperti yang ditunjukkan dalam **Figure 6.2.1**. Pintu masuk air perlu dibina di lokasi-lokasi strategik untuk menyimpan air.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan alur air dan penyimpanan air di dalam tapak projek.	
3.9	Menara-menara tinjauan api yang sedia ada di dalam Hutan Simpan Bengkoka perlu dikekalkan dan digunakan untuk memberi amaran awal kebakaran di lokasi (**Figure 6.2.1**). Menara tinjauan juga perlu diwujudkan di lokasi yang sesuai di Hutan Simpan Tambalugu dan jika diperlukan, menara tinjauan tambahan perlu diwujudkan di Hutan Simpan Bengkoka. Lokasi menara tinjauan perlu dikenal pasti dalam Pelan Pengurusan Kebakaran.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan menara tinjauan api dalam tapak projek.	
3.10	Semua kakitangan perlu diberi kesedaran tentang risiko kebakaran, dan terlatih dalam pencegahan dan kawalan api.	Tiada.	
3.11	Pembakaran terbuka adalah dilarang sama sekali.	Pemeriksaan visual bagi sebarang tanda pembakaran terbuka.	
3.12	Tumbuh-tumbuhan hijau tingkat rendah yang terdiri daripada rumpai lembut perlu dikekalkan sepanjang perladangan.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan peruntukan tumbuh-tumbuhan hijau tingkat rendah.	
3.13	Jalan-jalan perlu dikekalkan untuk memastikan ia berkesan sebagai pemutus api. Keperluan bagi sebarang tambahan pemutus api perlu ditentukan sebelum memulakan kerja di tapak projek itu, dan perlu diperincikan dalam Pelan Pengurusan Kebakaran dan Pelan Pembangunan Coupe.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan dan penyelenggaraan jalan raya sebagai pemutus api, dan sebarang pemutus api tambahan dianggap diperlukan untuk projek ini.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
4.0	**Impak Ekologikal**		
4.1	Pembersihan tumbuh-tumbuhan harus dikurangkan sebanyak mungkin dan diselesaikan secara berperingkat mengikut jadual *compartment/ blocking* yang diperincikan dalam Pelan Pembangunan Coupe. Di mana mungkin, pembersihan dan penanaman berarah perlu dilaksanakan. Pembersihan perlu disiapkan ke arah kawasan hutan bersebelahan, dan seperti yang dinyatakan dalam Perjanjian Lesen ke arah kawasan-kawasan perlindungan hidupan liar, untuk mengelakkan hidupan liar diasingkan dan terperangkap dalam tapak projek.	Pelan *compartment/ blocking* dengan jadual, menunjukkan Projek dijalankan secara berperingkat dalam setiap Coupe. Pelan-pelan dan jadual harus menunjukkan pembersihan tumbuh-tumbuhan adalah berarah dan telah ditentukan dan dilaksanakan untuk memberi masa yang mencukupi dan laluan kepada hidupan liar melarikan diri ke kawasan-kawasan bersebelahan. Di mana mungkin, gambar (dengan tarikh dan koordinat GPS) harus disediakan bagi menunjukkan pelaksanaan kaedah ini di tapak.	
4.2	Hutan bakau dalam tapak projek ini harus disediakan dengan 50-m zon penampan di sekeliling perimeter dalam tapak projek (**Figure 6.2.1**). Zon penampan dan hutan bakau hendaklah ditandakan dengan jelas di atas tanah. Aktiviti-aktiviti projek dalam kawasan-kawasan ini, dengan pengecualian pengayaan dan rehabilitasi tanaman sebaik-baiknya dengan spesies bakau yang sesuai atau spesies hutan semula jadi di dalam zon penampan, adalah dilarang.	Pelan tapak susun atur dan gambar (dengan tarikh dan koordinat GPS) menunjukkan penandaan kawasan hutan bakau yang jelas dalam tapak projek ini, dan peruntukan dan penandaan penampan 50 m yang jelas di sekitar perimeter kawasan bakau.	
		Pemeriksaan visual terhadap semua kawasan pemuliharaan dan zon penampan, untuk memastikan ia telah dilaksanakan dan berada dalam keadaan baik, dan memastikan ia tidak ada pembangunan, aktiviti, dan penyimpanan dan pelupusan sisa berlaku dalam kawasan-kawasan tersebut.	
4.3	Rizab riparian perlu dilaksanakan seperti yang dinyatakan dalam **Perkara 1.0**.	Rujuk **Perkara 1.0**.	
4.4	Jabatan Hidupan Liar Sabah perlu dimaklumkan jika terdapat sebarang penemuan hidupan liar yang terlindung/ terancam dalam tapak projek itu, supaya tindakan sewajarnya dapat diambil. Jika hidupan liar yang terlindung/ terancam ditemui, aktiviti-aktiviti projek mesti dihentikan di kawasan itu sehingga mendapat kebenaran daripada Jabatan Hidupan Liar Sabah.	Salinan semua pemberitahuan diberikan kepada Jabatan Hidupan Liar Sabah bagi pelaksanaan projek, penemuan hidupan liar, kematian atau kecederaan hidupan liar, dan penyelamatan hidupan liar. Dengan butiran dan rekod tindakan diambil di mana yang berkenaan.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
4.5	Jabatan Hidupan Liar Sabah mestilah diberitahu tidak kurang daripada 30 hari sebelum sebarang pembersihan dan penukaran tanah berlaku.	Rujuk **Perkara 4.4.**	
4.6	Jabatan Hidupan Liar Sabah perlu dimaklumkan dengan segera sekiranya hidupan liar perlu diselamatkan. Ini mungkin berlaku jika hidupan liar terperangkap dan tidak dapat bergerak ke kawasan yang lebih selamat. Kos penyelamatan hidupan liar dan translokasi adalah daripada Penggerak Projek. Jabatan Hidupan Liar Sabah juga perlu dimaklumkan dengan segera sekiranya hidupan liar menjadi cedera atau terbunuh akibat aktiviti-aktiviti projek.	Rujuk **Perkara 4.4.**	
4.7	Di mana *Shorea kudatensis* dan spesies-spesies flora lain yang terlindung atau terancam dikenal pasti dalam tapak projek, ia perlu dilindungi daripada aktiviti projek.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan lokasi dan tempat perlindungan spesies tumbuhan terancam yang dikenal pasti dalam tapak projek semasa operasi (jika ada).	
4.8	Memancing dalam tapak projek itu adalah dilarang, kecuali dengan kebenaran bertulis daripada Pengarah Jabatan Perhutanan Sabah. Papan tanda yang sesuai perlu didirikan.	Gambar-gambar papan tanda dilarang memburu dan memancing disediakan di tapak.	
4.9	Memburu dalam tapak projek adalah dilarang, dan papan tanda yang sesuai perlu didirikan di tapak. Pekerja tapak dilarang membawa senjata yang boleh digunakan untuk memburu.	Rujuk **Perkara 4.8.**	
4.10	Penggerak Projek mesti mengambil tindakan yang mencukupi untuk mencegah pemburuan haram di tapak projek, termasuk penyediaan rumah pengawal di semua pintu masuk bagi mengawal masuk dan keluar, rondaan tetap dan latihan untuk mendidik kakitangan dan pekerja. Penggerak Projek perlu berhubung rapat dengan Jabatan Perhutanan Sabah dan Jabatan Hidupan Liar Sabah di mana yang perlu.	Pelan susun atur tapak, gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan rumah pengawal, papan tanda dan tindakan lain yang diambil untuk mencegah memburu dalam tapak projek.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
4.11	Langkah-langkah mitigasi yang dikenal pasti dalam **Perkara 1.0** perlu dilaksanakan untuk mengurangkan kesan ekologi daripada pencemaran air.	Rujuk **Perkara 1.0**.	
4.12	Langkah-langkah mitigasi yang dikenal pasti dalam **Perkara 2.0** perlu dilaksanakan untuk mengurangkan kesan ekologi daripada pengurusan sisa yang tidak baik.	Rujuk **Perkara 2.0**.	
4.13	Langkah-langkah mitigasi yang dikenal pasti dalam **Perkara 3.0** perlu dilaksanakan untuk mengurangkan kesan ekologi daripada kebakaran hutan.	Rujuk **Perkara 3.0**.	
5.0	**Pencemaran Bunyi dan Udara**		
5.1	Untuk mengurangkan penyebaran habuk, kelajuan kenderaan di sepanjang Jalan Mongkubou Laut dalam 100 m di kedua-dua belah Kg. Serupil harus dihadkan kepada 30 km/j. Papan tanda yang sesuai perlu didirikan.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan papan tanda yang menunjukkan had laju 30 km/j dalam 100 m di sepanjang Jalan Mongkubou Laut di kedua-dua belah Kg. Serupil.	
5.2	Penggunaan kenderaan dan jentera usang dan daif harus dielakkan, kerana ini cenderung untuk menghasilkan bunyi bising yang berlebihan. Kenderaan dan jentera hendaklah sentiasa diselenggara dan dilengkapi dengan *mufflers* untuk mengurangkan propagasi bunyi.	Pemeriksaan visual terhadap kenderaan di tapak untuk memastikan ia bukan usang dan daif.	
5.3	Jika set penjana diperlukan, harus dipagarkan untuk mengurangkan propagasi bunyi. Sebelum set penjana digunakan, kebenaran hendaklah diperolehi daripada Jabatan Alam Sekitar (JAS) Sabah.	Gambar (berserta tarikh dan koordinat GPS) yang menunjukkan lokasi set penjana (jika perlu), di kawasan tertutup. Permit untuk mengendalikan penjana, dari Jabatan Alam Sekitar, perlu juga dikemukakan.	
		Pemeriksaan visual ke atas penjana yang digunakan di tapak, bagi memastikan ia tertutup dan dalam keadaan baik.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
5.4	Untuk keselamatan dan keselesaan, semua pekerja yang bekerja di kawasan tahap bunyi bising yang tinggi perlu diberikan Peralatan Perlindungan Peribadi (PPE), seperti alat pelindung telinga. Pekerja tidak boleh terdedah kepada tahap bunyi melebihi bunyi berterusan 90 dB (A) selama 8 jam atau lebih atau melebihi had-had yang dinyatakan dalam Jadual Pertama dalam Peraturan-Peraturan Kilang dan Jentera (Pendedahan Bunyi Bising) 1989.	Gambarfoto (berserta tarikh) menunjukkan peruntukan dan penggunaan PPE di kawasan penghasilan bunyi bising.	
5.5	Pembakaran terbuka adalah dilarang sama sekali.	Pemeriksaan visual untuk memastikan pembakaran terbuka tidak diamalkan.	
5.6	Semua aduan yang berkaitan daripada masyarakat setempat dan pengguna jalan raya mengenai bunyi bising dan pencemaran udara perlu dicatatkan dan segera ditangani.	Rekod tentang semua aduan yang berkaitan daripada masyarakat setempat dan pengguna jalan raya yang berkaitan dengan pencemaran udara dan air, dengan butir-butir tindakan yang diambil.	
5.7	Pemantauan bunyi dan udara perlu dijalankan di reseptor yang paling dekat dengan tapak projek.	Pemantauan bunyi dan udara yang kerap perlu dijalankan di reseptor yang terdekat dengan tapak projek, iaitu rumah yang terdekat di Kg. Serupil. Lokasi pemantauan ditunjukkan dalam **Figure 6.2.1**. **Table 6.2.2** dan **Table 6.2.3** dalam **Chapter 6** merumuskan keperluan pemantauan.	
6.0	**Trafik dan Impak Pengangkutan**		
6.1	Kelajuan kenderaan di sepanjang Jalan Mongkubou Laut dalam 100 m di kedua-dua belah Kg. Serupil harus dihadkan kepada 30 km/j. Dalam tapak projek, kelajuan kenderaan harus dihadkan kepada 50 km/j untuk jalan perladangan umum dan 15 km/j di atau dekat dengan kem. Papan tanda yang sesuai perlu didirikan.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan papan tanda had laju yang sesuai dalam tapak projek dan di sekitar Kg. Serupil sepanjang Jalan Mongkubou Laut.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
6.2	Papan tanda perlu didirikan di semua pintu masuk ke tapak projek, dan di sepanjang Jalan Mongkubou Laut dan Jalan Suang Duyang, terutamanya di mana jalan-jalan tapak projek bersambung ke jalan raya awam utama. Tanda-tanda ini harus memberi amaran kepada pengguna jalan raya tentang aktiviti projek dan kenderaan berat yang bergerak perlahan (**Figure 6.2.1**).	Gambar (dengan tarikh dan koordinat GPS) menunjukkan penyediaan papan tanda di semua pintu masuk ke tapak projek, dan di sepanjang Jalan Mongkubou Laut dan Jalan Suang Duyang, terutamanya di mana jalan-jalan tapak projek bersambung ke jalan raya awam utama. Tanda-tanda ini harus memberi amaran kepada pengguna jalan raya tentang aktiviti projek dan kenderaan berat yang bergerak perlahan.	
6.3	Aktiviti-aktiviti pengangkutan yang melibatkan kenderaan berat di sepanjang jalan raya awam utama perlu dijadualkan untuk mengelakkan waktu trafik puncak dan untuk memastikan jumlah yang dihasilkan tidak tertumpu dalam tempoh masa yang singkat. Pergerakan kenderaan berat di atas jalan raya awam perlu diatur secara berperingkat di sepanjang hari, untuk mengurangkan impak ke atas aliran trafik dan keselamatan jalan raya.	Tiada.	
6.4	Trak tidak boleh melebihi muatan dan semua muatan perlu dilindungi dengan baik, dan tertutup di mana yang perlu untuk mengelakkan tumpahan ke atas jalan raya awam.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan bahawa trak tidak melebihi muatan dan muatan adalah dilindungi dengan baik dan ditutup seperti yang dikehendaki.	
6.5	Di jalan raya awam, pemandu kenderaan perlu mematuhi semua keperluan trafik dari Jabatan Kerja Raya, Jabatan Pengangkutan Jalan dan Pihak Berkuasa Tempatan.	Tiada.	
6.6	Semua aduan yang berkaitan daripada orang awam yang berkaitan dengan aktiviti pengangkutan tapak dan keselamatan jalan raya perlu dicatat dan disiasat, dengan tindakan yang sewajarnya diambil.	Suatu rekod tentang semua aduan yang berkaitan daripada orang awam yang berkaitan dengan aktiviti pengangkutan tapak dan keselamatan jalan raya, dengan butir-butir tindakan yang diambil.	
6.7	Sebarang kerosakan ke atas Jalan raya awam seperti Jalan Mongkubou Laut dan Jalan Subang Duyan yang disebabkan oleh aktiviti pengangkutan perlu dibaiki segera.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan keadaan umum Jalan Mongkubou Laut dan Jalan Suang Duyang di mana ia memberikan akses ke tapak projek dan akan digunakan oleh kenderaan Projek.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
		Pemeriksaan visual terhadap Jalan Mongkubou Laut dan Jalan Suang Duyung daripada jalan masuk ke tapak projek, di mana ia memberi akses ke tapak projek dan akan digunakan oleh kenderaan projek.	
7.0	**Impak Sosio-Ekonomi**		
7.1	Langkah-langkah mitigasi dalam **Perkara 1.0** perlu dilaksanakan untuk mengurangkan kesan ekonomi sosial daripada pencemaran air, dan untuk melindungi bekalan air kepada masyarakat sekeliling.	Rujuk **Perkara 1.0**.	
7.2	Langkah-langkah mitigasi dalam **Perkara 2.0** perlu dilaksanakan untuk mengurangkan kesan sosio ekonomi daripada pengurusan sisa yang tidak baik.	Rujuk **Perkara 2.0**.	
7.3	Langkah-langkah mitigasi dalam **Perkara 3.0** perlu dilaksanakan untuk mengurangkan kesan ekonomi sosial daripada bahaya kebakaran.	Rujuk **Perkara 3.0**.	
7.4	Langkah-langkah mitigasi dalam **Perkara 5.0** perlu dilaksanakan untuk mengurangkan kesan ekonomi sosial daripada pencemaran udara dan bunyi.	Rujuk **Perkara 5.0**.	
7.5	Langkah-langkah mitigasi dalam **Perkara 6.0** perlu dilaksanakan untuk mengurangkan kesan ekonomi sosial daripada aktiviti pengangkutan.	Rujuk **Perkara 6.0**.	
7.6	Keutamaan bagi pekerjaan perlu diberikan kepada masyarakat setempat. Di mana kemahiran adalah kekurangan, latihan yang bersesuaian perlu disediakan.	Rekod pekerja yang bekerja di tapak projek.	
7.7	Penggerak Projek hendaklah menyelesaikan sebarang isu dengan komuniti tempatan dan pihak berkuasa berkenaan, yang berkaitan dengan sumber-sumber hutan (jika ada), sebelum permulaan aktiviti projek.	Tiada.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
7.8	Program Pembangunan Komuniti, dilaksanakan melalui Pasukan Pembangunan Masyarakat, perlu direka untuk mencapai yang berikut: • Mengenal pasti aktiviti-aktiviti ekonomi yang berdaya maju yang akan mempunyai kesan yang kuat ke atas sosial ekonomi kesejahteraan masyarakat luar bandar di kawasan projek; • Mengenal pasti keperluan infrastruktur sosial dan fizikal utama untuk meningkatkan kualiti hidup masyarakat luar bandar; untuk meningkatkan akses di kawasan komunikasi yang sukar dan memudahkan pembangunan ekonomi; • Mengenal pasti dan mengukur parameter sosio-ekonomi yang menilai kesan-kesan pelbagai inisiatif yang akan dilaksanakan oleh Penggerak Projek; dan • Konsisten dengan piawai antarabangsa yang diterima umum yang mengawal pensijilan ladang hutan, iaitu tiada aktiviti yang dijalankan yang secara langsungnya menghalang pensijilan masa depan.	Tiada.	
7.9	Semua aduan yang berkaitan daripada masyarakat setempat mengenai sebarang elemen projek itu hendaklah direkodkan dan tindakan perlu diambil untuk membetulkan isu-isu.	Rekod tentang sebarang aduan yang berkaitan daripada masyarakat tempatan dan butir-butir tindakan diambil.	
8.0	**Penutupan dan Potensi Peninggalan**		
8.1	Penggerak Projek perlu mematuhi semua syarat-syarat Perjanjian Lesen sebelum tempoh akhir lesen. Ini termasuk tidak menyiapkan sebarang penebangan dalam tempoh tiga puluh (30) hari dari tarikh tamat tempoh lesen, dan mengeluarkan semua kayu balak ditebang dalam tempoh satu (1) bulan selepas penebangan akhir.	Operasi jadual menunjukkan penebangan yang tidak disiapkan dalam masa 30 hari dari tarikh tamat tempoh lesen, dan semua kayu balak yang ditebang akan dikeluarkan dari tapak dalam tempoh satu (1) bulan selepas penebangan akhir.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
8.2	Setelah tamat tempoh atau penamatan awal perjanjian lesen, Penggerak Projek hendaklah meninggalkan dengan baik dan selamat, semua aset tetap seperti jalan raya, kemudahan dan infrastruktur pangkalan kem dan lain-lain, yang kemudiannya akan menjadi harta Kerajaan Negeri Sabah. Ini adalah seperti mana syarat-syarat dalam perjanjian lesen.	Pelan susun atur tapak dan gambar (dengan tarikh dan koordinat GPS) menunjukkan lokasi bagi semua harta tetap, dikekalkan di tapak projek itu dalam keadaan baik.	
		Pemeriksaan visual untuk memastikan semua aset tetap dikekalkan di tapak dalam keadaan baik.	
8.3	Apabila berlaku peninggalan atau penamatan awal perjanjian lesen, pelan peninggalan atau yang sepadan perlu disediakan seperti mana keperluan Jabatan Perhutanan Sabah, untuk memastikan tapak tersebut ditinggalkan dalam keadaan yang stabil, iaitu ITP penanaman semula, untuk pengurusan masa depan.	Salinan pelan peninggalan atau sepadannya apabila terjadinya hal peninggalan atau penamatan awal perjanjian lesen.	
8.4	Laporan penutupan atau peninggalan perlu disediakan untuk JPAS tidak lewat daripada dua bulan selepas tarikh penutupan atau peninggalan.	Salinan laporan penutupan atau peninggalan yang disediakan untuk JPAS.	
8.5	Semua jentera dan peralatan yang dimiliki Penggerak Projek perlu dikeluarkan dari tapak projek.	Gambar (dengan tarikh dan koordinat GPS) menunjukkan semua jentera, peralatan, tanah yang tercemar dan sisa-sia telah dikeluarkan dari tapak projek selepas peninggalan.	
		Pemeriksaan visual terhadap kawasan yang ditinggalkan untuk memastikan semua jentera dan peralatan, serta buangan terjadual telah dikeluarkan.	
8.6	Semua sisa perlu dikeluarkan dari tapak ini dan dilupuskan bergantung kepada jenis sisanya mengikut peraturan-peraturan pihak berkuasa tempatan yang berkaitan. Semua sisa terjadual mesti dikeluarkan oleh pengangkut berlesen Jabatan Alam Sekitar ke tapak pelupusan yang diluluskan oleh JAS. Bahan yang boleh mengurai, contohnya kayu, boleh ditinggalkan di atas tanah dalam tapak ini untuk penguraian secara semula jadi, asalkan bahan tersebut tidak tercemar dengan apa-apa.	Pemeriksaan visual terhadap kawasan peninggalan bagi memastikan kawasan-kawasan tidak ada sisa atau tanah tercemar.	

No.	Impak Alam Sekitar, Langkah Mitigasi dan Kawalan	Program Pemantauan	Catatan Pemeriksaan Tapak
8.7	Sebarang tanah yang tercemar, terutamanya di kem, perlu dibersihkan atau dilupuskan.	Rujuk **Perkara 8.6.**	
8.8	Kawasan-kawasan dalam tapak ini yang telah dibersihkan haruslah ditanam semula dengan spesies tempatan.	Pemeriksaan visual terhadap kawasan yang ditinggalkan untuk memastikan permukaan yang terdedah telah ditanam semula.	
8.9	Lawatan tapak hendaklah dijalankan dua (2) bulan selepas peninggalan (jika ada). Ini adalah bagi memastikan bahawa tapak projek ditinggalkan dalam keadaan yang tidak menimbulkan impak kesihatan, keselamatan atau alam sekitar di sekitarnya.	Satu salinan laporan pemeriksaan tapak.	
		Pemeriksaan visual terhadap tapak projek yang ditinggalkan untuk memastikan bahawa ia telah dipulihkan dengan betul dan tidak berbahaya kepada orang ramai. Pemeriksaan visual juga perlu dijalankan selepas dua (2) bulan untuk memastikan bahawa tapak tidak merbahaya.	

CHAPTER TWO

General Information

Chapter 2 General Information

2.1 Introduction

This chapter introduces the project title, the Project Proponent and the Environmental Consultant.

2.2 Project Title

This EIA is for the Project titled "**Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Hectares), Pitas, Sabah**". For brevity, it shall be referred to as the "Project" throughout this EIA.

Throughout this report the term "project site" will refer to the total area for the Project, i.e. 6,467 Ha, comprising the entire Bengkoka and Tambalugu Forest Reserves. Where required the forest reserves will also be referred to individually.

2.3 Land Owner

Sabah State Government, under the jurisdiction of:

Sabah Forestry Department

Ibu Pejabat Perhutatan Sabah,

KM 11, Jalan Utara,

Beg Berkunci 68,

90009 Sandakan, Sabah.

Telephone No. : 088 – 242 500

Fax No. : 088 – 671 303

2.4 License Holder/ Project Proponent

Gerak Saga Sdn Bhd

L-70-7 KK Times Square,

Off Jalan Coastal,

88100, Kota Kinabalu, Sabah.

Telephone No. : 088 – 486 240

Fax No. : 088 – 486 241

Contact Person	: **(1) Mr. Glen MacNair**
	: **(2) Mr. Christopher Garside**
Designation	: **(1) Director**
	: **(2) Consulting and Technical Services Director**

2.5 Environmental Consultant

Chemsain Konsultant Sdn. Bhd.

Lots 2 & 7, Lorong Suria, Off Lorong Buah Duku 1,

Taman Perindustrian Suria, Jalan Kolombong,

88450 Kota Kinabalu, Sabah.

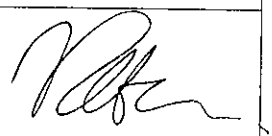
Telephone No.	: 088 – 381 277 / 381 278
Fax No.	: 088 – 381 280

EPD Registration No.	: F001
Registration Expiry Date	: 30.09.2018

Contact Person(s)	: **Mdm. Rebecca Poong / Mr. Richard Rhodes**
Designation(s)	: **Director / Senior Environmental Executive**

The team of consultants involved with the preparation of the EIA report and their fields of expertise together with their registration details are shown in **Table 2.5.1**.

Table 2.5.1: List of Consultants

No.	Personnel	Qualifications	Registered Areas	Signature
1.	Rebecca T. F. Poong Reg. No: S 0008 Expiry Date: 30.09.18	B. Sc. Environmental Science	Land Use	
2.	Eivind Oluf Kofod Reg. No: S0187 Expiry Date: 07.02.17	M.Sc. (Forest and Natural Resources Management)	Forestry	
3.	Cyril Jinusie Reg. No: S 0155 Expiry Date: 18.11.18	M. Sc. (Industrial Chemistry)	Scheduled Waste Management, Air & Water Quality	
4.	Lee Kuok Chiang Reg. No: S 0136 Expiry Date: 20.05.17	B. Eng. (Hons) Civil (Environmental)	Hydrology	
5.	Joyce Chin Fui Fun Reg. No: S 0186 Expiry Date: 07.02.17	B. Eng. (Hons) Chemical	Waste Management & Chemical Processes	
6.	Agatha Anak Francis Nasin Reg. No: S 0100 Expiry Date: 23.03.17	B. A (Hons) Public Management	Socio-Economy	

List of team members for the EIA study not registered with EPD:

No.	Personnel	Qualifications	Report Contribution
1.	Richard Rhodes	B.Sc. (Hons) Geological Sciences	Assistant to land use

CHAPTER THREE

Project Description

Chapter 3 Project Description

3.1 Introduction

Chapter 3 describes the legislation with which this Project is required to comply with; the statement of need of the Project; the main project activities; and the existing environmental conditions within the project site.

3.2 Project Location

The project site covers an area of approximately 6,467 Ha, comprising the 6,270 Ha Bengkoka Forest Reserve and the 197 Ha Tambalugu Forest Reserve (**Figure 3.2.1**). For operational purposes the two forest reserves will be managed as a single Forest Management Unit (FMU) and will be divided into four (4) Coupes, Coupes 1-3 (Bengkoka Forest Reserve) and Coupe 4 (Tambalugu Forest Reserve). The Project Proponent holds the license for management operations in both forest reserves from Sabah Forestry Department, whom have allocated the combined area of 6,467 Ha to the Project Proponent for Industrial Tree Plantation (ITP) (**Annex 2.1**).

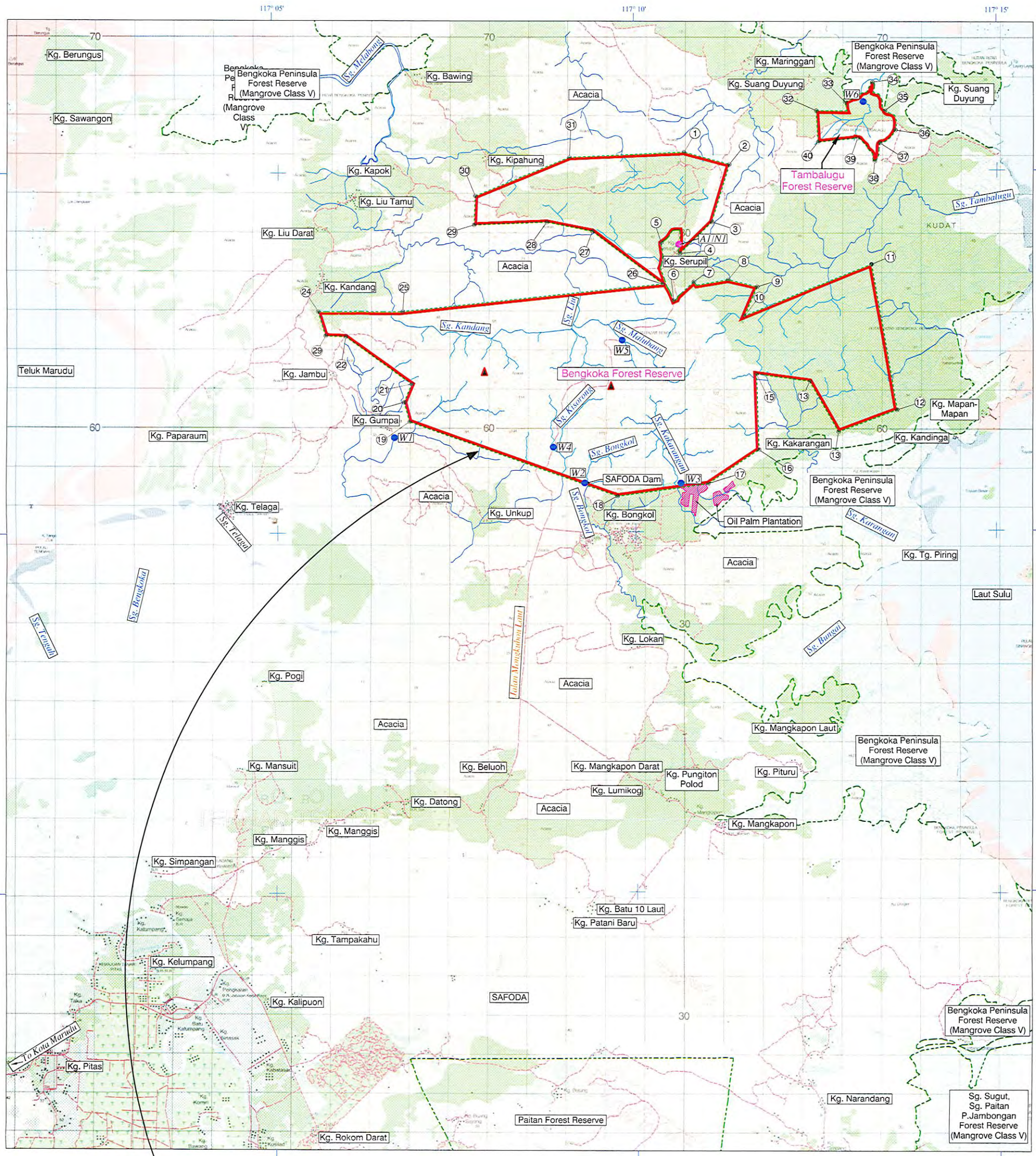
Throughout this report the term "project site" will refer to the total area for the Project, i.e. 6,467 Ha, comprising the entire Bengkoka and Tambalugu Forest Reserves. Where required the forest reserves will also be referred to individually.

The Bengkoka Forest Reserve is accessible off Jalan Mongkubou Laut, approximately 25 km north of Pitas Town, less than a kilometre north of Kg. Bongkol (**Plate 3.1**). The Tambalugu Forest Reserve is located approximately 4 km north-east of the Bengkoka Forest Reserve, and is accessible from Kg. Serupil following the existing roads north, connecting to Jalan Suang Duyung to access the project site (**Plate 3.2**).

Refer to **Figure 3.2.1**.

Plate 3.1: Junction to Kg. Bongkol, off Jalan Mongkubou Laut at N06°50'2.86", E117°8'43.62".

Plate 3.2: Jalan Suang Duyung, which is the main access to the Tambalugu Forest Reserve.



Point	Coordinates	
1	6° 55' 15.96"N	117° 10' 41.16"E
2	6° 55' 05.50"N	117° 11' 18.64"E
3	6° 54' 17.64"N	117° 11' 04.20"E
4	6° 53' 51.72"N	117° 10' 37.56"E
5	6° 54' 00.60"N	117° 10' 22.23"E
6	6° 53' 12.12"N	117° 10' 32.16"E
7	6° 53' 27.96"N	117° 10' 49.08"E
8	6° 53' 29.40"N	117° 11' 17.52"E
9	6° 53' 23.49"N	117° 11' 41.24"E
10	6° 52' 59.16"N	117° 11' 30.48"E
11	6° 53' 42.00"N	117° 13' 15.96"E
12	6° 51' 40.68"N	117° 13' 36.12"E
13	6° 51' 22.68"N	117° 12' 47.88"E
14	6° 52' 04.80"N	117° 12' 24.12"E
15	6° 52' 11.19"N	117° 11' 40.10"E
16	6° 51' 07.92"N	117° 11' 42.00"E
17	6° 50' 39.87"N	117° 10' 59.84"E
18	6° 50' 29.84"N	117° 09' 44.92"E
19	6° 51' 32.40"N	117° 06' 52.92"E
20	6° 51' 48.60"N	117° 06' 48.60"E
21	6° 52' 03.72"N	117° 06' 54.72"E
22	6° 52' 43.32"N	117° 06' 00.36"E
23	6° 52' 44.04"N	117° 05' 43.76"E
24	6° 53' 04.20"N	117° 05' 37.68"E
25	6° 53' 03.97"N	117° 06' 47.64"E
26	6° 53' 26.16"N	117° 10' 23.52"E
27	6° 54' 10.30"N	117° 09' 25.30"E

Point	Coordinates	
28	6° 54' 18.00"N	117° 08' 47.54"E
29	6° 54' 15.94"N	117° 07' 47.34"E
30	6° 54' 39.96"N	117° 07' 48.36"E
31	6° 55' 11.98"N	117° 09' 06.26"E
32	6° 55' 49.77"N	117° 12' 30.76"E
33	6° 55' 56.48"N	117° 12' 54.87"E
34	6° 56' 13.20"N	117° 13' 17.27"E
35	6° 55' 49.54"N	117° 13' 27.32"E
36	6° 55' 33.83"N	117° 13' 35.89"E
37	6° 55' 23.02"N	117° 13' 23.23"E
38	6° 55' 07.85"N	117° 13' 18.86"E
39	6° 55' 27.14"N	117° 13' 04.83"E
40	6° 55' 23.94"N	117° 12' 32.20"E

LEGEND:

- Project Boundary (Bengkoka Forest Reserve and Tambalugu Forest Reserve)
- Forest Reserve Boundary
- Primary Forest
- Secondary Forest
- Oil Palm Plantation
- Unsealed Road
- River/Stream
- A1/N1 Air & Noise Baseline Sampling Point
- W1-W6 Water Baseline Sampling Points
- River/Stream within Project Site
- Fire Watch Tower

SOURCE : Adapted from
SERIES T738
SHEET 7731, 7732, 7831 & 7832
EDITION 1-PPNM
GRID
–The numbered lines indicate the WGS84 datum latitude & longitude
0 1 2 3 4 5Km
SCALE IN KILOMETRES (1:100,000) – A3 MEDIUM

ENVIRONMENTAL IMPACT ASSESSMENT
Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Ha), Pitas, Sabah.

Project Site Location, Surrounding Land Use and Baseline Sampling Points

Figure: 3.2.1

3.3 Legal Requirements

The Project will involve forestry development and operations over an area of more than 500 hectares. The Project is therefore classified as a prescribed activity under the Second Schedule of the **Environmental Protection (Prescribed Activities) (Environmental Impact Assessment) Order, 2005**:

SECOND SCHEDULE

2. FORESTRY

(i) Felling or extraction of timber covering an area of 500 hectares or more; or

(ii) Development of forest plantation or reforestation covering an area of 500 hectares or more.

The above Order requires an EIA report to be submitted to the Environment Protection Department (EPD) for approval prior to project implementation. The Terms of Reference (TOR) for the Project has been approved by EPD Sabah on the 10th March 2016 (Ref: JPAS/PP/15/600-1/01/3/60 (6). See **Annex 4.0**.

3.4 Project Aim/ Statement of Need

The Bengkoka Forest Reserve and Tambalugu Forest Reserve are Class II Forest Reserves covering an area of approximately 6,270 Hectares and 197 Hectares, respectively, within Pitas District, Sabah. Refer to **Figure 3.2.1** for the location.

The forest reserves are deteriorating due to previous overexploitation, which is understood to have started as early as the 1970's, lack of management, forest fire, droughts and disease. The natural vegetation has given way to invasive *Acacia mangium* and *Acacia sp.* which is dominating large areas. In some areas the Acacia have been attacked by fungus (*Ceratocystis* sp.) and have also been subjected to several fires (**Plate 3.3** to **Plate 3.6**). The area is therefore at risk from invasion of Imperata grass. If this happens, biodiversity will be almost none and further attempts to include the area in biological, social or economic productivity will be prohibitively expensive.

The forest reserves are predominantly surrounded by forestry operations, mostly Acacia plantations. There are also some areas of small scale oil palm plantations to the south of the Bengkoka Forest Reserve and to the west of the Tambalugu Forest Reserve. Acacia is known to be an aggressive invasive species on degraded land but does not readily establish itself in the shade of well-established forest stands. Acacia has this trait in common with Imperata as both species require direct sunlight for establishment.

Both forest reserves were previously classified as Class I Protected Forest Reserve, however as they have not be able to be rehabilitated, they have been reclassified as Class II Commercial Forest (refer to the licence agreement in **Annex 2.1**). The Sabah State Government, through the Sabah Forestry Department has identified the need to

properly manage both forest reserves, to prevent their further degradation and promote the rehabilitation of conservation areas.

The Sabah State Government, through the Sabah Forestry Department has therefore allocated both the Bengkoka and Tambalugu Forest Reserves, with a combined are of 6,467 Ha to the Project Proponent, for the purpose of Industrial Tree Plantation (ITP). The Project Proponent has entered into a 100 year Sustainable Forest Management License Agreement (SFMLA) with the Sabah State Government (**Annex 2.1**).

The Project Proponent, who will manage the Bengkoka and Tambalugu Forest Reserves, sees three options:

1. Do nothing: If the current fire cycle is allowed to continue without intervention the diseased Acacia would almost certainly be consumed over time, resulting in highly degraded Imperata grassland of little or no ecological value.

2. Restore the natural forest over the entire area: Due to the pioneering nature of Acacia and the presence of surrounding Acacia plantations, it is believed this option would be prohibitively expensive and not viable.

3. Create an actively managed, productive forest: The current Acacia stands are relatively low yielding and yields will continue to decline as the Ceratocystis gets worse. With careful planning to identify and protect areas where ecological functions could be restored, the balance of the area could be converted to manage Eucalyptus plantations. An active presence would help protect the area from further degradation through burning and will create an economic justification for control of Acacia regeneration in riparian zones.

In line with the requirements of the SFMLA with Sabah State Government, the Project Proponent will convert the majority of the project site to productive stands of *Eucalyplus* spp. (ITP), while simultaneously re-establishing riparian reserves and conservation areas. The project concept is further described in **Section 3.8**. The proposed Project concept is detailed in the Forest Management Plan (FMP) (**Annex 2.3**), which has been accepted and approved by Sabah Forestry Department (**Annex 2.2**).

3.5 Project Status

Project Site

At the time of EIA preparation, development activities for this Project had not commenced on the project site.

As described in **Section 3.4**, the project site is in a deteriorating state due to previous overexploitation, lack of management, forest fire, droughts and disease. The natural vegetation has given way to invasive *Acacia mangium* and *Acacia sp.*, which is in poor state and dominating large areas of the project site. In some areas the *Acacia mangium* and *Acacia sp.* have been attacked by fungus (*Ceratocystis sp.*) and have also been subjected to numerous fires throughout the years, and there are large areas dominated

by dead or dying trees (**Plate 3.3** to **Plate 3.6**). In other areas, particularly in the east of the Bengkoka Forest Reserve *Imperata sp*. Grass (lalang) dominates.

Forest Management Plan (FMP)

A Forest Management Plan (FMP) has been produced for this Project, this has been submitted to Sabah Forestry Department and subsequently accepted via letter ref. JPHTN/PP 700-2/1/63/JLD.2(8), dated 25/07/16 (**Annex 2.2**). The FMP has been referenced in the production of this EIA report and is attached in **Annex 2.3**.

Development/ Layout Plan

The proposed development plan for the Project is illustrated in **Figure 3.7.1**. The development proposals are detailed in the FMP which has been approved by Sabah Forestry Department, as noted above.

Plate 3.3: Fire damaged invasive *Acacia mangium* and *Acacia sp.* within the project site (western half of Bengkoka Forest Reserve).

Plate 3.4: Invasive *Acacia mangium* and *Acacia sp.* with fungus (*Ceratocystis* sp.) (Bengkoka Forest Reserve).

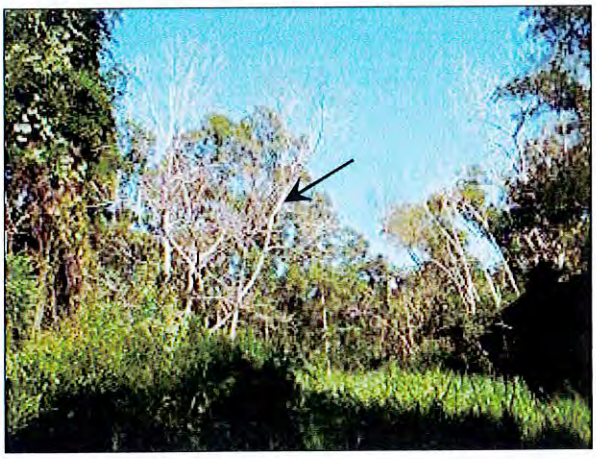


Plate 3.5: Invasive *Acacia mangium* and *Acacia sp.* with fungus (*Ceratocystis* sp.) (arrow) (Tambalugu Forest Reserve).

Plate 3.6: View of the north-western boundary of the Tambalugu Forest Reserve, showing *Acacia mangium* and *Acacia sp.*

3.6 Land Status and Zoning

The project site, comprising the Bengkoka and Tambalugu Forest Reserves, is zoned as Class II Commercial Forest, following reclassification from Class I, as detailed in **Section 3.4**.

The land is owned by Sabah State Government under the jurisdiction of the Sabah Forestry Department. The Project Proponent, Gerak Saga Sdn Bhd, is the license holder for the Bengkoka and Tambalugu Forest Reserves and will manage the area for 100 years. A copy of the Sustainable Forest Management License Agreement (SFMLA) between the Sabah State Government and the Project Proponent is attached in **Annex 2.1**.

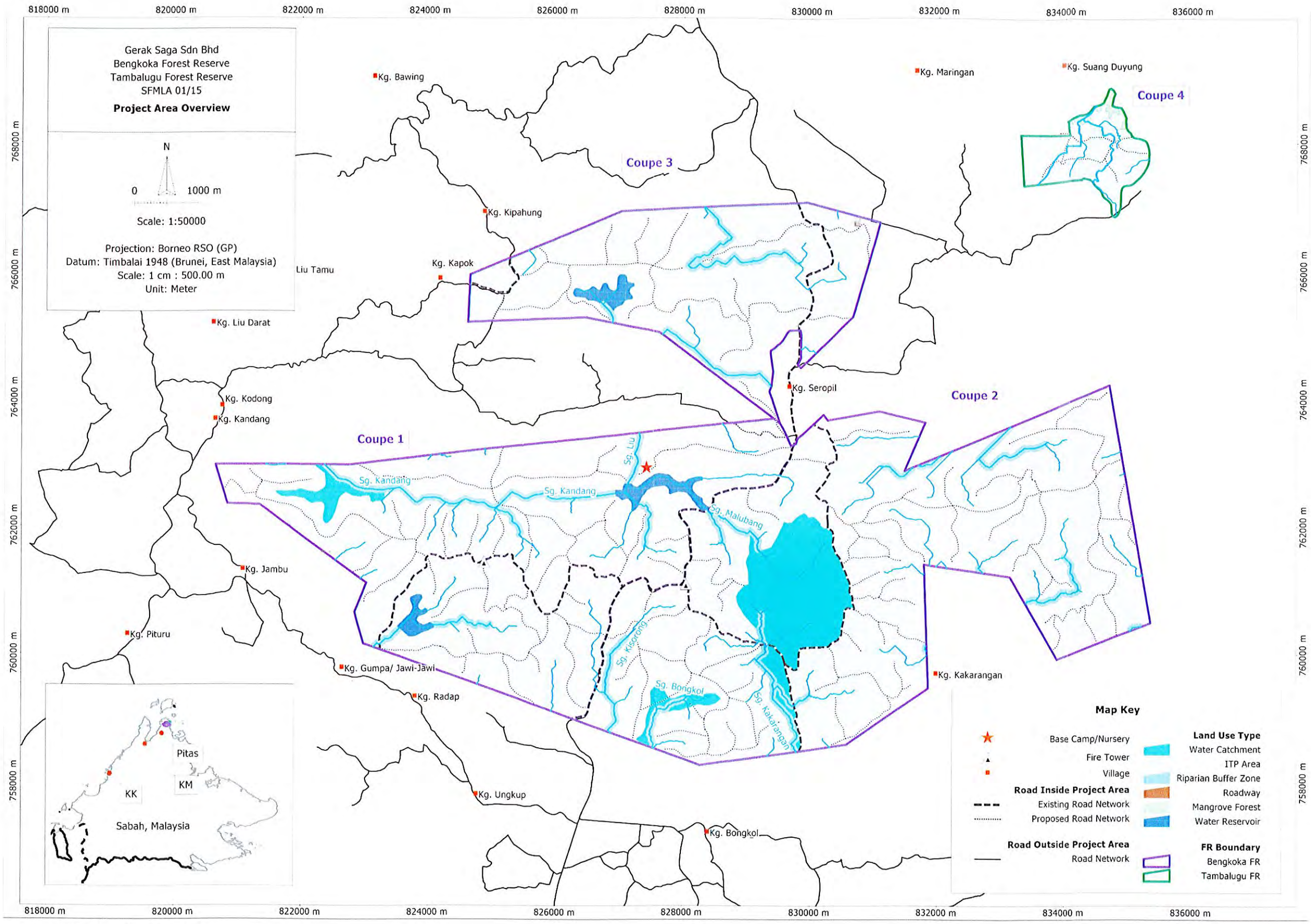


Figure 3.7.1: Project Site Development Plan

3.7 Project Concept

As described in **Section 3.4** the best management option for the project site is to create an actively managed productive forest. The Project Proponent therefore proposes to establish an Industrial Tree Plantation (ITP) of Eucalyptus on the project site. The plantation will be managed on a 10-year rotation basis with the objective of producing small timber and chip-wood from the Eucalyptus.

Due to the deteriorating state of the project site, as described in **Section 3.4**, it is expected that there are no existing areas of significant ecological value and no riparian reserves have been established during previous operations. The majority of the project site area is covered with invasive Acacia and has been degraded through overexploitation, lack of management, forest fire, droughts and disease. Alongside establishing the ITP the Project Proponent therefore also intends to create and rehabilitate conservation and water catchment areas and riparian reserves. Under normal circumstances existing vegetation in riparian zones for example would have to be retained, however due to their deteriorated state on the project site the Project Proponent intends to enhance these areas through enrichment and rehabilitation planting with local forest species, in order to restore ecological function.

The proposed development plan for the project site is shown on **Figure 3.7.1**. The entire project site covers an area of 6,467 Ha. Based on the latest information from the Project Proponent the total area considered to be plantable for ITP is approximately 5,625 Ha. The remaining area has been allocated by the Project Proponent to the following land uses:

1. **Water Reservoirs and Water Catchments**

Following preliminary mapping and development planning the Project Proponent has identified 72 Ha to serve as water reservoirs and 371 Ha to serve as water catchment (**Figure 3.7.1**). As detailed in the FMP (**Annex 2.3**) the Project Proponent will ensure proper management and protection of these areas.

The areas identified for water catchment include the existing water catchment for the SAFODA dam, constructed within the project site on Sg. Bongkol for water supply to SAFODA and Kg. Bongkol via an established water treatment plant (**Figure 3.2.1**).

2. **Riparian Buffer Zone**

Following preliminary mapping and development planning the Project Proponent has identified 285 Ha of riparian reserves, comprising the provision of a 30 m buffer on each bank of all permanent watercourses within the project site (**Figure 3.7.1**).

3. **Mangrove Forest**

The project site within the Tambalugu Forest Reserve contains approximately 12 Ha of mangrove forest, which has encroached from the neighbouring Bengkoka Peninsula Forest Reserve (Class V – Mangrove Forest Reserve) (**Figure 3.7.1**). This area will be excluded from the ITP area and from all project activities, and will be preserved as a conservation area.

4. **Roads**

The existing road network covers approximately 15 Ha within the project site. The intended road network for this Project will be approximately 151 km in total length and will cover approximately 90.6 Ha. The proposed road network is shown on **Figure 3.7.1**.

These areas will be confirmed through detailed survey and ground truthing prior to the commencement of project activities. The total area to be planted for ITP is subject to change, depending on ground conditions, however the minimum areas stated above for water reservoirs, water catchment and riparian reserve will not be affected and where possible these will also be allocated larger areas.

The Project will also include the establishment of the required facilities for project development. These are described in more detail in **Section 3.9.1**.

The Project will not require significant earthwork as there will be no terracing. Earthwork may be required for the development of facilities and infrastructure, however this will be minor and will be less than 40,000 m^3.

3.8 Project Implementation Schedule

The time frame for the establishment of the Eucalyptus plantation over the project site is approximately 6 years, commencing in 2017 following EIA approval. As described in **Section 3.7** the plantation is expected to be managed on a 10-year rotation basis.

As previously described the project site has been divided into four (4) coupes, with Coupes 1-3 (Bengkoka Forest Reserve), and Coupe 4 (Tambalugu Forest Reserve) (**Figure 3.7.1**). Prior to the commencement of site operations the coupes will be further divided into Compartments of 200 to 600 Ha each. Each compartment will be further sub-divided into Blocks of approximately 24 Ha each.

Detailed Coupe Development Plans will be completed annually for the following year, and will be submitted with the Annual Work Plans to Sabah Forestry Department. The Coupe Development Plans will detail the specific location of all proposed development areas as detailed in **Section 3.7**, for that particular coupe. Compartments and Blocks will be determined during the production of each Coupe Development Plan, and are therefore not available at this stage.

Table 3.8.1 shows the latest project implementation schedule for the main plantation activities, i.e. salvage logging and planting. As salvage logging precedes planting by at least 2 months, each operation has its own production schedule.

All project activities are described in more detail in **Section 3.9** along with the sequence of work.

Table 3.8.1: Project Implementation Schedule

Activity	2017	2018	2019	2020	2021	2022	Total
Salvage Logging (Ha)	500	1,100	1,100	1,100	1,100	725	5,625
Planting (Ha)	500	1050	1050	1050	1050	925	5,625

3.9 Project Stages and Activities

The Project will involve three main stages, i.e. Plantation Establishment; Plantation Operation; and Replanting. Potential abandonment and license expiry/ project closure will also be covered. The key activities within each stage are listed below and described in the following sections. Each activity will be completed in sequence on a coupe-by-coupe basis according to the Coupe Development Plans, as described in **Section 3.8**, with minimal delay between each stage. For further details on each stage refer to the FMP in **Annex 2.3**.

1. **Plantation Establishment**

- Determination of suitable planting area;
- Salvage logging;
- Recruitment of labour force;
- Establishment of site facilities and infrastructure;
- Mobilisation of equipment and machinery;
- Production of planting material;
- Establishment of conservation areas;
- Site clearing; and
- Planting.

2. **Plantation Operation**

- Plantation maintenance; and

- Harvesting.

3. **Replanting**

3.9.1 Plantation Establishment

3.9.1.1 Determination of planting area

As stated in **Section 3.7**, approximately 5,625 Ha of the project site will be developed for ITP. The remaining areas will comprise water reservoirs, water catchments, riparian buffer zones, mangrove forest and roads. These areas are shown on **Figure 3.7.1**.

Initial planning has been completed using LIDAR technology to accurately map the topographical and hydrological features. Based on this information a general development plan has been produced, as shown on **Figure 3.7.1**. Detailed Coupe Development Plans for each coupe will be completed prior to the commencement of work in that particular coupe, the details plans will supplement the LIDAR derived data with further ground investigation and ground truthing.

As described in **Section 3.8** the detailed Coupe Development Plans will be completed annually and submitted with the Annual Work Plans, ready for development in that coupe the following year. The Coupe Development Plans will detail the specific location of all proposed development areas, including suitable planting areas for ITP, water reservoirs, water catchments, riparian buffer zones, mangrove forest and roads.

3.9.1.2 Salvage Logging

During site clearing any standing trees of commercial value will be felled. It is anticipated however that this will be minimal. The majority of the existing tree stands are not thought to have much commercial value, due to small size and disease. Nevertheless there is the potential for some salvage logging operations. As described in **Section 3.8** logging will commence at least 2 months before planting in each coupe. Logs will no commercial value will be cut and crushed and left in-situ for natural decomposition.

3.9.1.3 Recruitment of labour force

Approximately 178 staff and workers will be required during plantation establishment. During plantation operation and replanting the number of workers is expected to reduce, to approximately 125.

The Project Proponent will take appropriate steps to employ Malaysian professionals, with specific preference to Sabahans that have experience in forestry and/ or agriculture plantation management. The Project Proponent will also provide training to staff and workers where necessary to ensure that the local population are qualified to work in forest management. The use of labour from outside the area, and foreign labour, will be minimised. The Project Proponent will respect Malaysian requirements for minimum wages and social benefits for all staff and workers, whether Malaysians or foreign. A repatriation scheme will be implemented for all non-local staff and workers.

3.9.1.4 Establishment of site facilities and infrastructure

The Project Proponent will establish a main basecamp in Coupe 1. The proposed location is shown on **Figure 3.7.1**. The proposed layout is shown on **Figure 3.9.1**.

As shown on **Figure 3.9.1**, the main basecamp will comprise the following facilities:

- Office and office parking;
- Management house;
- Nursery;
- Water storage;
- Stores (including chemical store, fertiliser store, tool store, fire store, general store and fuel store);
- Toilet and shower facilities;
- Genset house;
- Senior quarters;
- Sport arena;
- Parking;
- Workers quarters;
- Canteen;
- Security guard house; and
- Dumpsite pit.

In addition to the main basecamp, smaller camps are also envisaged to provide accommodation, secure storage and fire depot facilities. These camps will be established in the area of operation on the project site, and their location will be finalised during the detailed planning stage for each Coupe and shown on the Coupe Development Plans. These smaller camps will temporary, and will move around within the site depending on where operations are taking place.

A road network will also be established within the project site. This will utilise the existing roads, and establish new roads branching off from these. The proposed road network is illustrated on **Figure 3.7.1**. As stated in **Section 3.7**, the road network on the project site will be approximately 151 km in length and occupy approximately 90.6 Ha of land. The

road network will be finalised and developed on a coupe by coupe basis in accordance with the planting schedule, and the final road layout for each coupe will be shown on the Coupe Development Plans. The classification and specification of the roads to be developed is detailed in the FMP (**Annex 2.3**). The main roads will be subject to a maintenance schedule.

Bridges will also be constructed over streams and rivers, although every effort will be made by the Project Proponent when designing the road layout to minimise stream and river crossings. Bridges will be permanent and of steel, Bailey bridge type.

In terms of utilities, as shown on **Figure 3.9.1** a generator house (i.e. diesel generator), will be provided at the basecamp in Coupe I, to supply electricity to the basecamp facilities. Water supply will be from the nearest water reservoir within the project site, located south of the main basecamp. Water from the reservoir will stored at the basecamp in the water storage area (**Figure 3.9.1**).

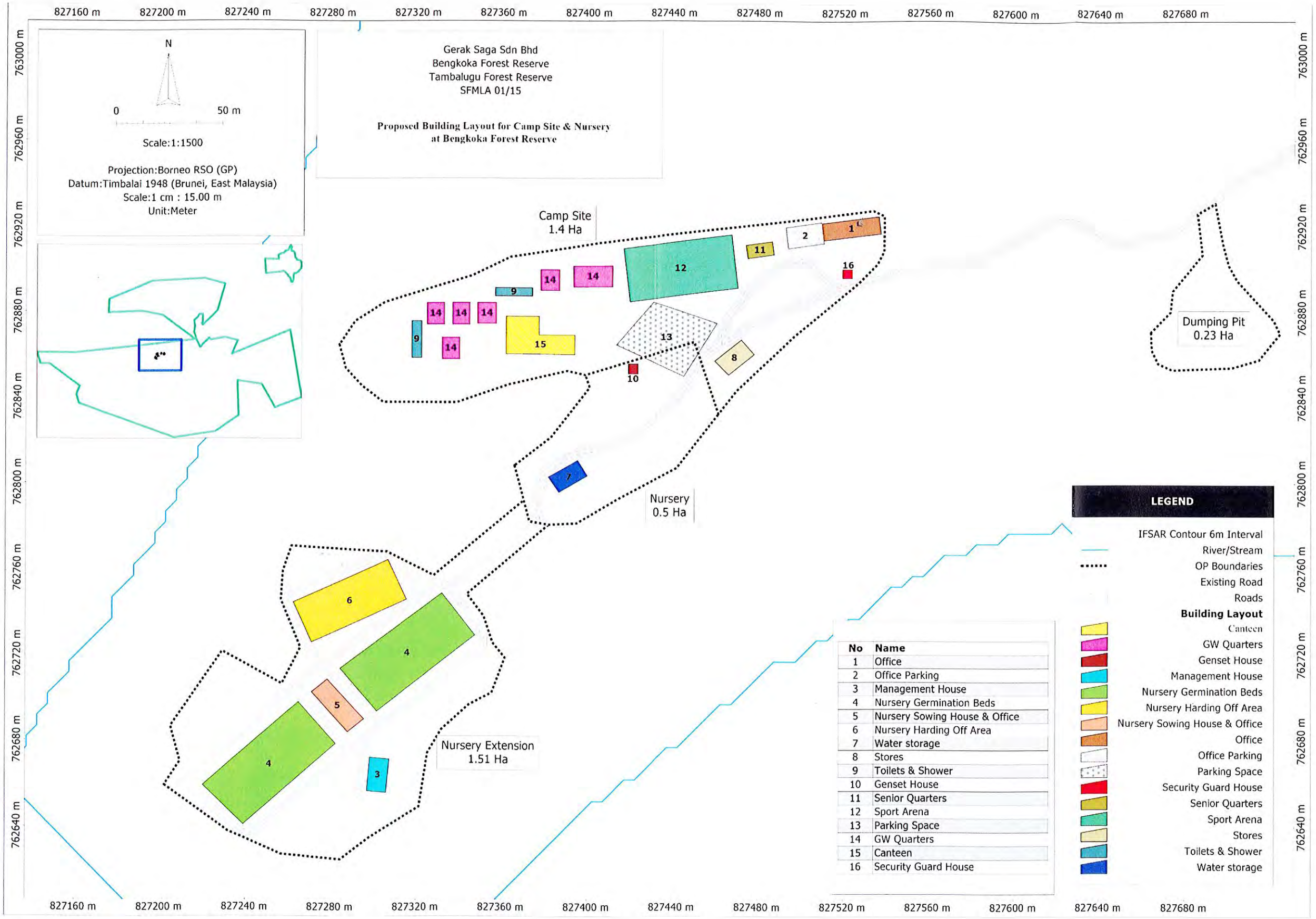


Figure 3.9.1: Site Layout Plan

3.9.1.5 Mobilisation of equipment and machinery

Machinery and equipment will be mobilised to the project site when it is required for each stage of the project development. The equipment required for site clearing and salvage logging will be mobilised to the project site first, this will include heavy machinery such as excavators, which will be used for clearing.

Other machinery and equipment will be mobilised to the project site as and when required. All machinery and equipment will be stored on site for the duration of its requirement.

3.9.1.6 Production of planting materials

The Project Proponent will source seedlings for this Project from their sister company for the first 6 to 9 months, from an established nursery off-site. A holding nursery will be constructed on site at the main base-camp, where plants from the external nursery will complete their final hardening off before dispatch to the field. This arrangement will be used for the plantation establishment stage.

The Project Proponent will however implement a full production nursery within or close to the project site by the time of the first replanting. It is noted however that the full production nursery may be constructed sooners, depending on the efficiency of the interim supply plan. The proposed nursery location is shown on **Figure 3.7.1** and **Figure 3.9.1**. The production nursery will include the following facilities:

- Germination beds (shaded germination area);
- Sewing house and office; and
- Hardening off area.

The nursery processes for the production of seedling at the production nursery are detailed in the FMP (**Annex 2.3**). The process involves the use of fertilisers. Slow releasing NPK fertiliser is mixed into the growth media of the seedling; during the seedling germination phase preventive fungicide will be applied once per week, with broad spectrum fungicides being applied on alternative weeks; and during seedling open growth phase fertilisers are applied 3-5 times per week with water at low concentrations using complete (NPK and trace elements) fertiliser.

At the holding nursery which will be located on the project site for plantation establishment, seedlings will arrive from the external nursery during the open growth phase. Therefore at the holding nursery complete fertiliser (NPK and trace elements) will be applied 3-5 times per week with water at low concentrations, until the seedlings are ready to be planted in the field.

The nursery will utilize river water which will be stored at the nursery in a water tank, and distributed by water pump through an irrigation system.

3.9.1.7 Establishment of conservation areas

The Project Proponent has conducted floral and faunal surveys over the project site and performed an evaluation against the WWF High Conservation Value (HCV) Toolkit. The findings of the surveys and outcome of the HCV assessment are presented in **Sections 3.10.2** and **3.10.3**.

All identified conservation areas, including riparian reserves, water catchments, water reservoirs and mangrove forest, will be clearly demarcated on the ground on a coupe-by-coupe basis prior to the commencement of project activities in each coupe. As described in **Section 3.8** the detailed Coupe Development Plans submitted with the Annual Work Plans, will detail the specific location of all conservation areas within each coupe.

Due to the degraded nature of much of the project site, including riparian reserves and identified water catchment areas, the establishment of proper and effective conservation areas will require more than simply excluding these areas from the Project. As such the Project Proponent will also conduct enrichment and rehabilitation planting with local forest species in these areas, as listed in **Table 3.9.1**. Prior to this, removal of invasive diseased or fire damaged Acacia may also be required from the conservation areas.

For enrichment and rehabilitation planting the Project Proponent will engage with Yayasan Sabah, which has indigenous species nurseries from which seedlings can be obtained.

Table 3.9.1: Enrichment Planting Species

HABITAT	STRUCTURE	FAMILY	SPECIES
Dryland	Main Canopy	Anacardiaceae	Gluta oba
		Burseraceae	Canarium osperum
		Dipterocarpaceae	Cotylelobium melanoxylon
		Dipterocarpaceae	Shorea beccariana
		Dipterocarpaceae	Shorea multiflora
		Elaeocarpaceae	Elaeocarpus pedunculatus
		Ixonanthaceae	Ixonanthes reticulata
		Leguminosae	Koompassia malaccensis
		Sapotaceae	Palaquium rostratum
		Theaceae	Adinandra dumosa
	Middle Storey	Anacardiaceae	Mangifera parvifolia
		Anacardiaceae	Parishia insignis
		Chrysobalanaceae	Licania splendens
		Dipterocarpaceae	Vatica micrantha
		Euphorbiaceae	Chaetocarpus castanocarpus
		Guttiferae	Calophyllum tetrapterum
		Lauraceae	Dehaasia caesia
		Myrtaceae	Syzygium caudatilimbum
		Myrtaceae	Syzygium napiformis
		Myrtaceae	Syzygium tawahense
		Polygalaceae	Xanthophyllum affine
		Sapotaceae	Madhuca pallida
	Under Storey	Dipterocarpaceae	Hopea beccariana
		Euphorbiaceae	Cleistanthus gracilis
		Euphorbiaceae	Pimeleodendron griffithianum
		Güttiferae	Garcinia miqueli
		Oleaceae	Chionanthus laxiflorus
Riparian and Dryland	Main Canopy	Dipterocarpaceae	Dryobalanops beccarii
		Myrtaceae	Tristaniopsis obovata
	Middle Storey	Lecythidaceae	Barringtonia lanceolata
	Under Storey	Euphorbiaceae	Baccaurea sumatrana
Riparian	Moin Canopy	Dipterocarpaceae	Shorea mecistopteryx
	Middle Storey	Dipterocarpaceae	Dipterocarpus oblongifolius

3.9.1.8 *Site clearing and preparation*

As described in **Section 3.4**, the project site is deteriorated and the majority of the project site is now covered with invasive *Acacia mangium* and *Acacia sp.* The identified ITP area, approximately 5,625 Ha, needs to be cleared prior to planting.

Site clearing will commence in January each year, on a coupe-by-coupe basis as per the implementation schedule and Annual Work Plan. All remaining vegetation after salvage logging will be felled with the exception of the identified conservation areas. All felled

vegetation will be left *in-situ* for natural decomposition, and where heavy residual biomass is produced this will be crushed and spread.

Prior to planting, herbicides will be applied to the ground to prevent weed growth. The estimated herbicide requirement for this stage is detailed in **Table 3.9.2**.

Table 3.9.2: Pre-Planting Chemical Requirements

Year	Roundup (litre/month)	Ally (grams/month)
2017	224	2,550
2018	471	5,350
2019	471	5,350
2020	471	5,350
2021	471	5,350
2022	415	4,715

Planting points will be marked on the ground with a tree spacing of 2 m x 3 m. This spacing will give 1,667 planting points per hectare. Holes will be prepared on the planting points, ready for planting operations.

3.9.1.9 Planting

The primary species identified for this Project is *Eucalyptus pellita*. During plantation establishment suitable seedlings will be dispatched from the holding nursery to the prepared planting blocks.

Planting will normally be carried out throughout the year, however most of the planting will take place during the rainy season. The seedlings will be hand planted and during planting 85 g of DAP (Di-Ammonia Phosphate) together with 7 g of Boron will be applied to each panting hole. The annual fertiliser requirement during planting is summarised in **Table 3.9.3**.

Table 3.9.3: Fertiliser Requirements during Planting

Year	DAP Fertiliser (kg/month)	Boron Fertiliser (kg/month)
2017	7,240	867
2018	15,203	1,820
2019	15,203	1,820
2020	15,203	1,820
2021	15,203	1,820
2022	13,394	1,603

Approximately one (1) month after planting, the planted stock will be surveyed to identify any stock failures, i.e. through poor initial stocking or seedling mortality. Where areas of poor stock quality are identified, supplemental planting will be completed.

3.9.2 Plantation Operation

3.9.2.1 *Plantation maintenance*

Weeding

Weeding will be carried out to control grass such as *Imperata cylindrical*, *Pennisetum polystachion* and *Ischaemum muticum* and climbers, which will directly compete with newly planted seedlings for nutrients, moisture and light.

Chemical weeding will be carried out for the first year after planting, following which weeding operations will be carried out where necessary until the plants are clear of competition in the second year. Eucalyptus species are sensitive to competition and therefore up to four rounds of chemical spraying or slashing may be required before canopy closure. The Project Proponent proposes to use two (2) herbicide products, Roundup and Basta 5. The annual herbicide requirements are detailed in **Table 3.9.4**.

Table 3.9.4: Herbicide Requirements for Weeding

Year	Roundup (litre/month)	Basta 5 (litre/month)
2017	854	74
2018	1,794	155
2019	1,794	155
2020	1,794	155
2021	1,794	155
2022	1,580	137

Thinning

As stated in **Section 3.9.1**, the planting density will be 1,667 trees per hectare. It is anticipated that 1,200 trees per hectare (with dbh > 16 cm) will be left for harvesting. The remaining trees will be thinned or removed, which may begin at 4 years after planting. Trees to be removed will be those that have diseases, bad growth or deformities.

Pest and Disease Management

The Project Proponent will take all necessary precautions to maintain an ecological balance within the project site, in order to prevent outbreaks of insects and diseases. Continuous monitoring and research of pests and diseases will be carried out as part of the standard forest plantation management practices.

3.9.2.2 *Harvesting*

As the plantation will be developed on a 10 year rotation basis, the first round of harvesting will take place 10 years after plantation establishment. As mentioned in

Section 3.9.2.1 it is anticipated that 1,200 trees per hectare will be harvested, following thinning.

3.9.3 Replanting, Closure or Potential Abandonment

Replanting

Harvested areas will immediately be re-planted, most likely with the same species, i.e. *Eucalyptus pellita*. The vegetative residue from harvesting is significantly less than for the clearing of existing vegetation during initial establishment of the plantation, therefore minimal land clearing is required during this phase.

Closure/ Potential Abandonment

As described in **Section 3.6**, the License Agreement is valid for a 100 year period, after which time the license may be extended at the discretion of the Chief Minister. If the license is not extended, the Project Proponent must implement all Sabah Forestry Department closing procedures, after which time the working area will effectively be closed for all access and work for an entire rotation cycle. The Project Proponent must also adhere to EPD requirements to ensure that abandoned structures, equipment etc. have no significant adverse impact on the environment after closure.

As per the conditions of the License Agreement (**Annex 2.1**), the Project Proponent may not fell any trees within thirty (30) days of the license expiry date, unless an extension has been granted. Extraction and hauling of logs should be completed within one (1) month after the final felling.

It is unlikely that the Project will be abandoned mid-way through the license period, however there is still a chance that abandonment may occur due to a change in policy and management objectives for the project area. In such cases the Sabah Forest Department closing procedures will apply, as well as EPD requirements.

3.9.4 Anticipated Waste Generation

During plantation establishment stage, the following waste will be generated:

- **Biomass:** Biomass generated from site clearing and salvage logging will be left *in-situ* to decompose. Patches of heavy residual biomass will be spread and crushed with an excavator.

- **Solid Waste:** Solid waste produced during project development will be in the form of general waste from the workers, mostly produced at the main basecamp. A waste dumping pit will be provided at the basecamp to ensure proper management of waste.

- **Scheduled waste:** Oil and grease waste from the maintenance of machinery and equipment at the workshop in the main basecamp, will need to be disposed of properly as scheduled waste.

- **Construction waste:** A small amount of construction waste may be generated during the construction of the site facilities at the main basecamp.

- **Sewage:** Sewage generated at the main basecamp, and toilet facilities at the smaller camps within the plantation area will need to be treated and disposed of properly.

During the plantation operation stage solid waste, scheduled waste and sewage will continue to be generated at the main basecamp and smaller camps, as described above. Biomass will also be generated, however this will be limited to a small amount of biomass from weeding and thinning during plantation maintenance.

More biomass is expected to be generated during replanting following harvesting after 10 years. Although this will be limited to minor clearing for preparation of new planting holes, and will be significantly less than clearing during plantation establishment.

All waste generated during all stages of the Project will need to be managed and disposed of appropriately in accordance with all applicable legislation.

3.10 Existing Environment

3.10.1 Physical / Chemical Environment

3.10.1.1 Meteorology

The project area generally experiences an equatorial climate, with uniform temperature, high humidity and a substantial amount of rainfall throughout the year. Rainfall data for the project site was obtained from the nearest meteorological station at Pertanian, Pitas (**Annex 1.1**). Between 2006 and 2015 (10-year period) the average total annual rainfall was 2,829.4 mm.

3.10.1.2 Topography and Slope

Bengkoka Forest Reserve

This area is situated on gently undulating terrain with predominantly gentle slopes (i.e. < 15°). Some short steep slopes do occur, some of which are greater than 25°, however these are limited to minor areas along the southern boundary and in the east of Coupe 2 (**Figure 3.10.2**). Only 17 Ha of the project site is estimated to have slopes over 25°. The elevation in the Bengkoka Forest Reserve ranges from 10 m AMSL along the base of valleys, and 130 m AMSL on the highest hills (**Figure 3.10.1**).

Tambalugu Forest Reserve

This area is predominantly flat, with elevation ranging from 10 m AMSL to 30 m AMSL in the south-east of the site (**Figure 3.10.1**).

3.10.1.3 Hydrology

Bengkoka Forest Reserve

There are a number of rivers and streams within the Bengkoka Forest Reserve. The main rivers are Sg. Kandang, Sg. Malubang, Sg. Liu, Sg. Kisorong, Sg. Bongkol and Sg. Kakarangan. The remaining rivers and streams within the Bengkoka Forest Reserve are unnamed (**Plate 3.7 Plate 3.8**). All rivers and streams within the Bengkoka Forest Reserve flow out of the project site into the adjacent forestry operations, predominantly Acacia plantations, and small scale oil palm plantation. The rivers and streams flowing east will eventually drain to the Sulu Sea, and the rivers and streams flowing west will eventually drain to the South China Sea.

Sg. Bongkol, has been dammed within the Bengkoka Forest Reserve for water supply for Kg. Bongkol by SAFODA. As discussed in **Section 3.7.1** and shown on **Figure 3.7.1**, the water catchment for the dam has been excluded from all project activities as a water catchment conservation area.

Tambalugu Forest Reserve

There are several unnamed streams within the Tambalugu Forest Reserve, these all converge into one stream which discharges north into the adjacent mangrove forest reserve and into the Sulu Sea (**Plate 3.9**).

Many of the streams within the project site (Bengkoka and Tambalugu Forest Reserves) are seasonal and flow will reduce significantly or dry up during the dry months. The widths of the rivers and streams also varies within the project. The rivers and streams observed within the project site during the site visit ranged from < 3 m to > 5 m in width (**Plate 3.7**, **Plate 3.8** and **Plate 3.9**).

The main rivers and streams are illustrated on **Figure 3.10.1**.

Plate 3.7: Sg. Malubang within the project site (Bengkoka Forest Reserve) flowing beneath Jalan Mongkubou Laut in the central area.

Plate 3.8: Unnamed tributary of Sg. Kisorong within the project site (Bengkoka Forest Reserve) flowing beneath Jalan Mongkubou Laut in the south.

Plate 3.9: Existing unnamed stream within the project site (Tambalugu Forest Reserve) flowing north (dry during site visit).

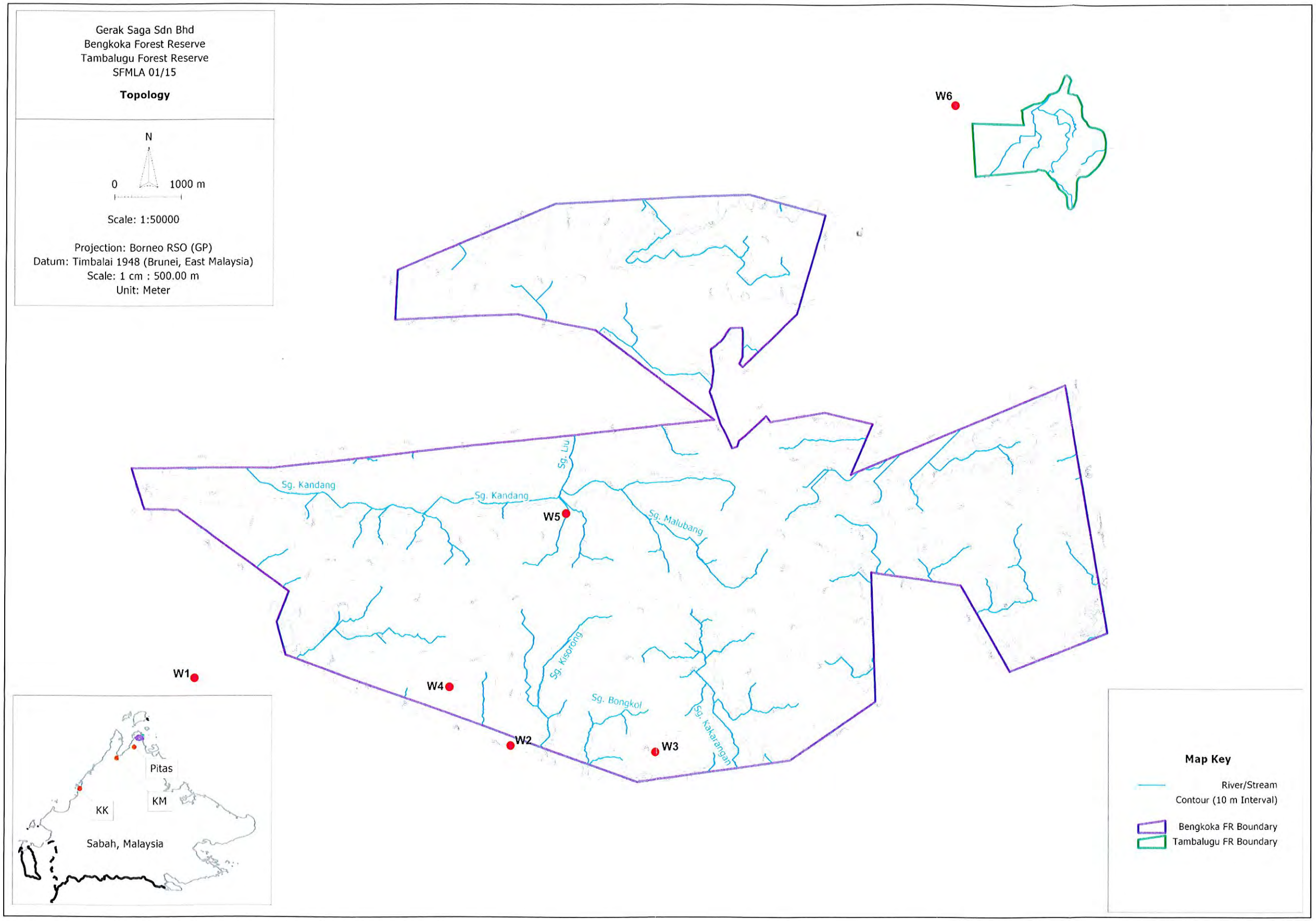


Figure 3.10.1: Topographical and Hydrological Characteristic of the Project Site

Gerak Saga Sdn Bhd
Bengkoka Forest Reserve
Tambalugu Forest Reserve
SFMLA 01/15

Topology

N

0 1000 m

Scale: 1:50000

Projection: Borneo RSO (GP)
Datum: Timbalai 1948 (Brunei, East Malaysia)
Scale: 1 cm : 500.00 m
Unit: Meter

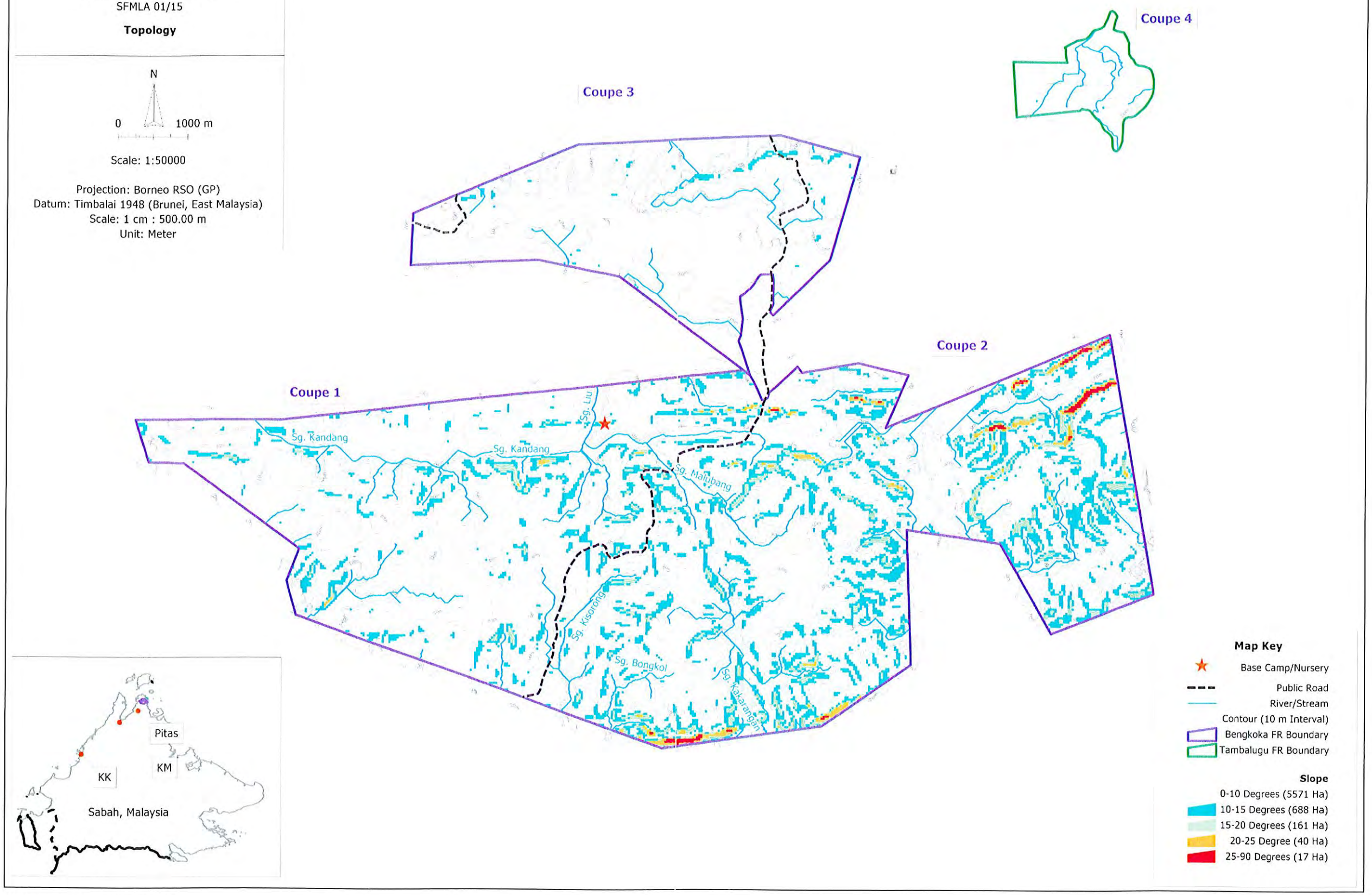


Figure 3.10.2: Slope Classification Map

3.10.1.4 Soil

Bengkoka Forest Reserve

As shown on **Figure 3.10.3**, the Bengkoka Forest Reserve is predominantly underlain by soil of the Maliau Association, with the parent materials of sandstone and mudstone, and Brantian Association in the north, with the parent material of alluvium.

Some minor areas of Kinabatangan and Tuaran Associations also occur in the north and east, respectively, with alluvium as the parent material for both.

Tambalugu Forest Reserve

As shown on **Figure 3.10.3**, the Tambalugu Forest Reserve is predominantly underlain by soil of the Brantian Association, with some areas of Tuaran Association soils in the north and east.

In terms of implications on the Project, as detailed in the FMP (**Annex 2.3**), the soils in the area are suitable for the plantation of fast growing species including *Eucalyptus pellita*.

3.10.1.5 Geology

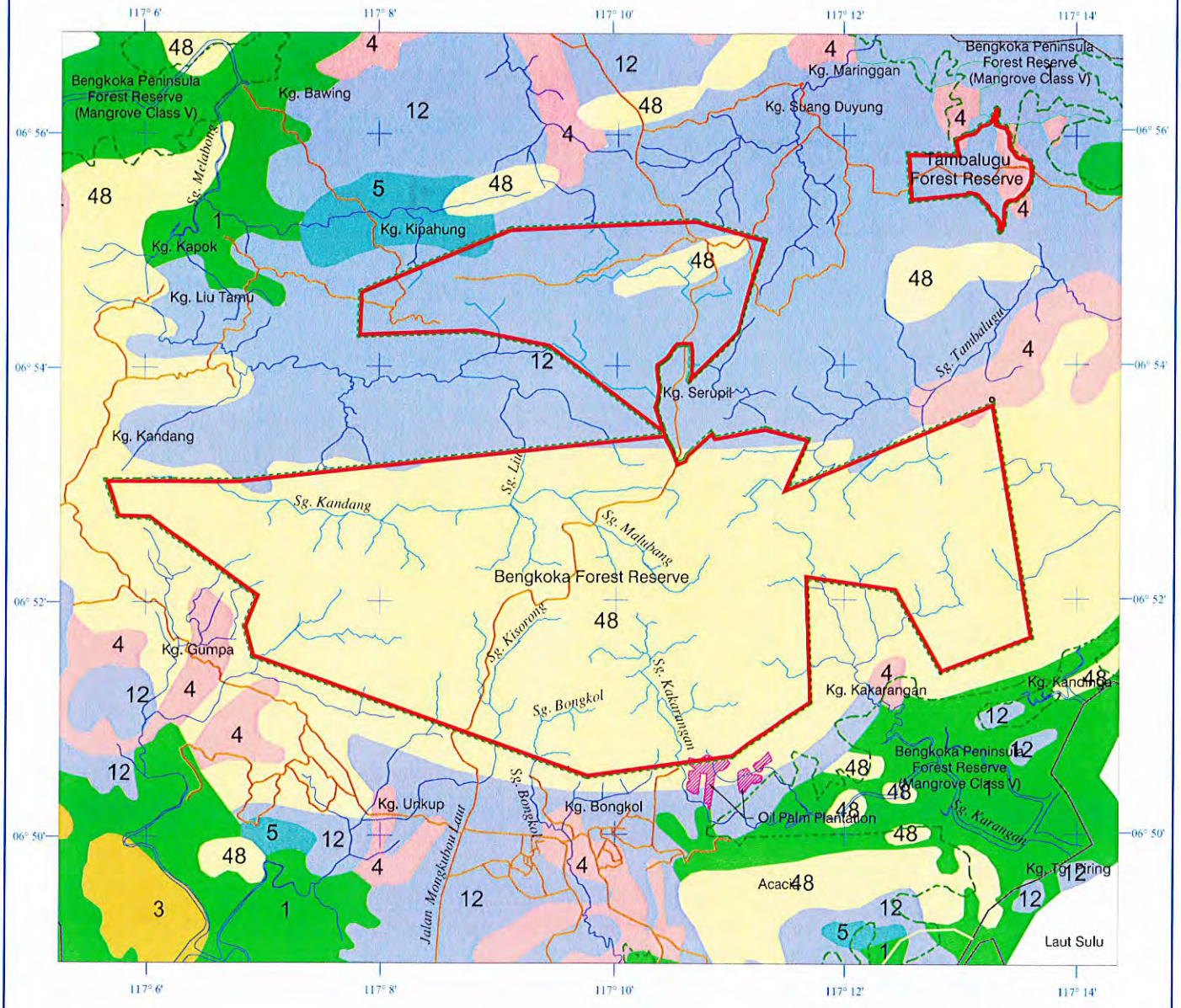
The entire project site is underlain by geology of the Kudat Formation, from the Oligocene period (**Figure 3.10.4**). The lithology comprises sandstone, shale, mudstone, siltstone, conglomerate and limestone.

A small portion of the Bengkoka Forest Reserve in the east is underlain by geology of the Bongaya formation, from the middle Miocene-pliocene period (**Figure 3.10.4**). The lithology comprises sandstone, mudstone, siltstone, shale, conglomerate and lignite with minor limestone and tuff.

A minor portion of the project site along the northern boundary of the Tambalugu Forest Reserve is underlain by recent coastal and riverine alluvium deposits, which dominate the coastal zone to the north.

3.10.1.6 Baseline Water Quality

Baseline water quality sampling was conducted at five (5) locations (W1 – W5) in the rivers and streams which flow through the project site in the Bengkoka Forest Reserve. The sample point locations are shown on **Figure 3.10.1** and detailed in **Table 3.10.1**. Sampling was also attempted in the Tambalugu Forest Reserve, in the main unnamed stream flowing north through the forest reserve into the adjacent mangrove forest, however during the day of sampling the stream was dry (**Plate 3.9**).



ENVIRONMENTAL IMPACT ASSESSMENT
Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Ha), Pitas, Sabah.

KEY	ASSOCIATION	LANDFORM	PARENT MATERIALS	MAIN SOIL UNITS
1	Weston	Tidal swamps	Sulphidic alluvium, sulphidic peat and alluvium	Thionic; Dystric Histosol; Thionic Gleysol
3	Tanjong Aru	Beaches	Alluvium	Dystric and Eutric Regosols; Humic, Dystric and Eutric Gleysols; Gleyic Podzol
4	Tuaran	Meander Belts	Alluvium	Eutric Fluvisol; Gleyic, Dystric and Eutric Cambisols; Humic, Dystric and Eutric Gleysols
5	Kinabatangan	Floodplains	Alluvium	Gleyic Acrisol; Gleyic Luvisol; Humic, Dystric and Eutric Gleysols
12	Brantian	Terraces	Alluvium	Orthic, Ferric and Gleyic Acrisols; Gleyic Podzol
48	Maliau	Mountain cuetas	Sandstone and mudstone	Orthic Acrisol; Dystric Cambisol; Gleyic Podzol; Humic Gleysol; Lithosol

SOURCE : Adapted from
THE SOILS OF SABAH
SYIT TANAHTANI - SUGUT
SOILS SHEET - NB-50-7

LEGEND:

- Project Boundary (Bengkoka Forest Reserve and Tambalugu Forest Reserve)
- Forest Reserve Boundary
- Road
- River/Stream

N

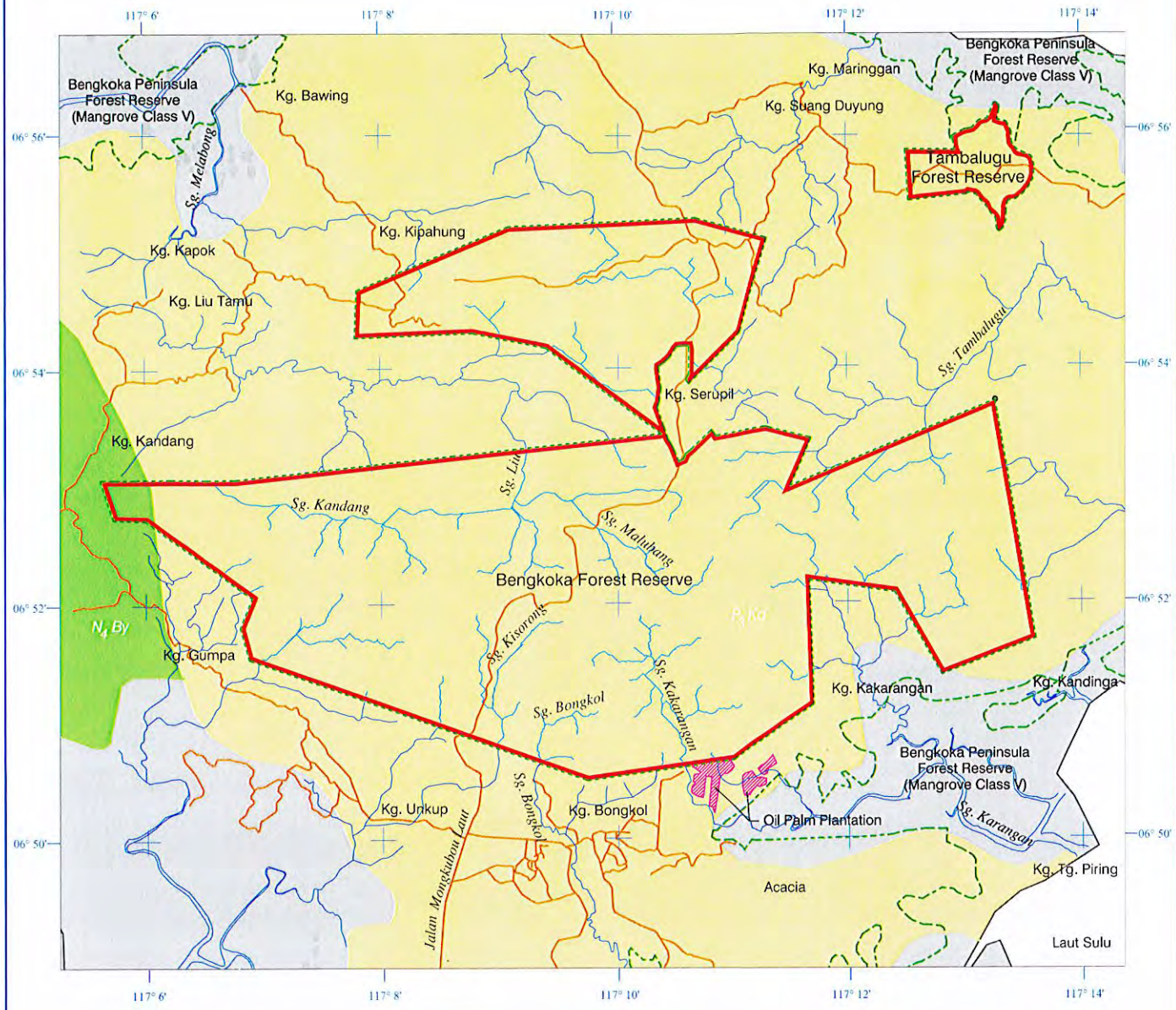
GRID
-The numbered lines indicate the WGS84 datum latitude & longitude

0 1 2 3 4 5Km

SCALE IN KILOMETRES (1:100,000) – A4 MEDIUM

Soil Classification of the Project Area

Figure: 3.10.3



ENVIRONMENTAL IMPACT ASSESSMENT
Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Ha), Pitas, Sabah.

LEGEND:

- Project Boundary (Bengkoka Forest Reserve and Tambalugu Forest Reserve)
- Forest Reserve Boundary
- Road
- River/Stream

SEDIMENTARY & SEDIMENTARY-VOLCANIC ROCKS		
	LITHOLOGY	FORMATION
	RECENT Coastal and riverine alluvium	
N_4 By	MIDDLE MIOCENE-PLIOCENE Sandstone, mudstone, siltstone, shale, conglomerate and lignite with minor limestone and tuff	Bongaya (N_4 By)
P_3 Kd	OLIGOCENE Sandstone, shale, mudstone, siltstone, conglomerate and limestone	Kudat (P_3Kd)

SOURCE : Adapted from
GEOLOGICAL MAP OF SABAH
THIRD EDITION, 1985
SCALE 1:500,000

N

GRID
–The numbered lines indicate the WGS84 datum latitude & longitude

0 1 2 3 4 5Km

SCALE IN KILOMETRES (1:100,000) – A4 MEDIUM

Geological Formation of the Project Area

Figure: 3.10.4

Table 3.10.1: Baseline Water Sampling Locations

Sample Point	Location	Sampling Date / Time	Weather During / 24 hours before	Type
W1: Unnamed stream downstream of Bengkoka Forest Reserve at Kg. Gumpa	N06°51'18.9", E117°06'41.1"	17/12/15 / 10:25	Cloudy / Rain	Stream
W2: Sg. Bongkol downstream of SAFODA dam within Bengkoka Forest Reserve	N06°50'40.6", E117°09'18.6"	17/12/15 / 11:15	Cloudy / Rain	River
W3: Sg. Kakarangan downstream of Bengkoka Forest Reserve	N06°50'40.1", E117°10'38.2"	17/12/15 / 11:50	Cloudy / Rain	River
W4: Unnamed tributary of Sg. Kisorong within Bengkoka Forest Reserve	N06°51'10.4", E117°08'52.6"	17/12/15 / 13:05	Cloudy (after rain) / Rain	Stream
W5: Sg. Malubang within Bengkoka Forest Reserve	N06°52'39.3", E117°09'49.8"	17/12/15 / 14:35	Cloudy / Rain	River

Plate 3.10: Water Sampling at W1.

Plate 3.11: Water Sampling at W2.

Plate 3.12: Water Sampling at W3.

Plate 3.13: Water Sampling at W4.

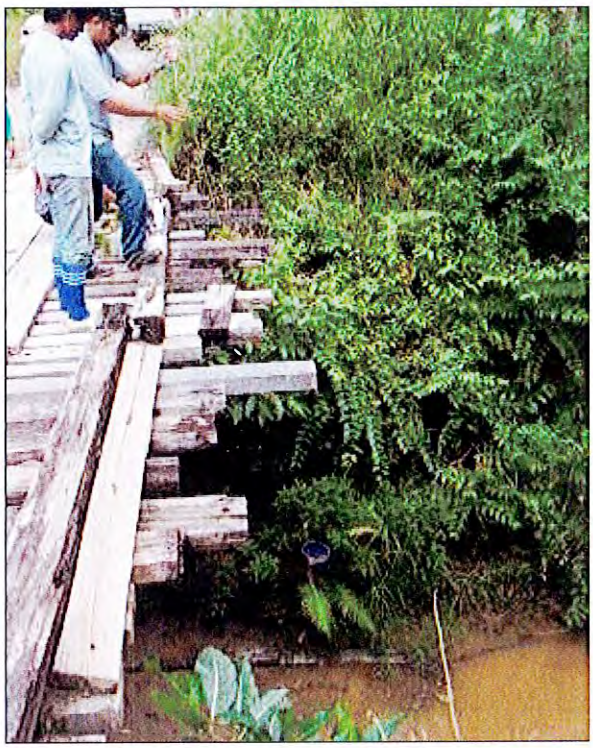


Plate 3.14: Water Sampling at W5.

Table 3.10.2 lists the parameters tested for baseline water quality analysis, the methods used and the results of the analysis. The full test reports are presented in **Annex 1.2**. All water samples were tested *in-situ* for Dissolved Oxygen (DO), pH and temperature, before they were sent to a SAMM accredited laboratory to test for other parameters as listed in **Table 3.10.2**.

Based on the Water Quality Index (WQI), all the rivers and streams sampled within the project site are considered to be clean, falling into Class II of the National Water Quality Standards of Malaysia (NWQSM) (**Annex 1.3** and **Annex 1.4**). The results of the baseline water quality analysis were therefore compared to **Class IIB** of the NWQSM.

Table 3.10.2: Baseline Water Quality Results

Parameter	Method	W1 Result	W2 Result	W3 Result	W4 Result	W5 Result	NWQSM (Class IIB)
pH Value (in-situ / 17.12.15)	APHA 4500-H^+ B, 2012	6.23	6.72	6.24	6.40	6.94	6 – 9
Temperature, °C (in-situ / 17.12.15)	APHA 2550 B, 2012	29.7	29.5	29.7	29.1	26.5	-
Dissolved Oxygen, mg/L (in-situ / 17.12.15)	APHA 4500-O G, 2012	5.45	5.9	5.15	5.15	5.30	5 – 7
Biochemical Oxygen Demand (BOD) in 5 days @ 20°C, mg/L	APHA 5210 B & 4500-O G, 2012	<1.00	<1.00	<1.00	<1.00	<1.00	3
Chemical Oxygen Demand (COD), mg/L	APHA 5220 C, 2012	18.8	12.5	<10.0	<10.0	18.8	25
Total Suspended Solids (TSS), mg/L	APHA 2540 D, 2012	<5.00	<5.00	9.00	9.00	**53.0**	50
Turbidity (NTU)	APHA 2130 B, 2012	7.4	5.3	29	4.7	**65**	50
Ammoniacal-Nitrogen, (as NH_3-N), mg/L	In-House Method 0554 based on Methrom Technical Note	<0.05	<0.05	<0.05	<0.05	<0.05	0.3
Oil and Grease, mg/L	APHA 5520 B, 2012	<1.50	<1.50	<1.50	<1.50	<1.50	40; N
Total Coliform Count, MPN/100 ml, 35±0.5°C/48 h	APHA 9221B, 2012	**$7.9x10^2$**	**$4.9x10^2$**	**$5.4x10^3$**	**$9.2x10^3$**	**$9.2x10^3$**	400
Faecal Coliform Count, MPN/100 ml, 44.5±0.2°C/24 h	APHA 9221E, 2005	94	49	**$5.4x10^3$**	$1.4x10^3$	**$9.2x10^3$**	5000
Paraquat, mg/L	Colorimetric	<0.01	<0.01	<0.01	<0.01	<0.01	10
Glyphosate, mg/L	HPLC	<0.02	<0.02	<0.02	<0.02	<0.02	-
Aminomethylphosphonic Acid, mg/L	HPLC	<0.02	<0.02	<0.02	<0.02	<0.02	-
Methamidophos, mg/L	GC	<0.001	<0.001	<0.001	<0.001	<0.001	-

Shaded cells indicate result has exceeded the prescribed limits.

All the parameters, with the exception of Total Suspended Solids (TSS), Turbidity, Total Coliform Count (TCC) and Faecal Coliform Count (FCC), were within the limits of Class IIB of the NWQSM (**Annex 1.3**). Traces of the agrochemicals tested for were found, although these were at minimal levels.

Total Suspended Sediments and Turbidity

TSS and turbidity were recorded at levels exceeding the prescribed limits of Class IIB at sample point W5. W5 was taken in Sg. Malubang which crosses beneath Jalan Mongkubou Laut in the centre of the Bengkoka Forest Reserve. During sampling the stream was visibly turbid by suspended sediment (**Plate 3.7** and **Plate 3.11**).

The sediment is likely to be from river bank erosion upstream of the sample point. Due to the degraded state of riparian zones following previous forestry activities, the river banks in many areas are left with minimal vegetative protection and are therefore susceptible to erosion, particularly during heavy rain and storm events. It is noted that in the days before the site visit, and during the site visit, the area had received periods of heavy rain.

Total Coliform Count and Faecal Coliform Count

TCC was recorded at levels above the prescribed limits of Class IIB at all sample points. FCC was also recorded at levels above the prescribed limits of Class IIB at W3 and W5.

Total coliform count (TCC) and Faecal coliform count (FCC) measure the levels of coliform bacteria. The origins of faecal coliform are more specific than total coliform, and the presence of faecal coliforms indicate that faecal waste from humans or animals is entering the water body.

The elevated levels of FCC in W3 and W5, suggests the presence or animal or human waste in these streams. W3 was taken in Sg. Kakarangan within the project site, just upstream of the neighbouring oil palm plantation. It is possible that human activity associated with the oil palm plantation may have contributed to the FCC in the water, through the introduction of human waste. It is believed that there are no other upstream human activities.

As described above W5 was taken in Sg. Malubang which crosses beneath Jalan Mongkubou Laut in the centre of the project site. It is likely FCC levels in this sample were the result of animal waste, as there are no identifiable upstream human activities.

The contribution of animal or human waste to the elevated levels of TCC in W1, W2 and W4 is considered to be minimal, as FCC levels were low in these samples. The elevated levels of FCC in W1, W2 and W4 therefore is likely to have resulted from the presence of microorganisms from soil and plants within Bengkoka Forest Reserve.

3.10.1.7 Baseline Air Quality

Baseline air quality sampling for Total Suspended Particulates (TSP) was conducted at Kg. Serupil, which is the nearest sensitive receptor to the project site (Bengkoka Forest Reserve). The sample location is shown on **Figure 3.2.1** and detailed in **Table 3.10.3**.

Table 3.10.3: Baseline Air Quality Sampling Locations

Sample Point	Location	Sampling Date / Duration	Weather During Sampling	Parameter
A1: Kg. Serupil	N06°53'59.4", E117°10'35.7"	16/12/15 – 17/12/15 24 hrs	Some rain showers	Total Suspended Particulates (TSP)

As per **Table 3.10.3** TSP sampling was conducted for a period of 24 hours using Ambient Air Sampler (Tisch Environmental Model: TE 5005).

Plate 3.15: Air Sampling (TSP) at A1, Kg. Serupil.

Table 3.10.4 presents the results of the TSP sampling and compares these results to the Malaysian Ambient Air Quality Guidelines. The full test report is attached in **Annex 1.5**.

Table 3.10.4: Baseline Air Quality Results

Sampling Point	Total Suspended Particulate (TSP), µg/m^3	Malaysian Ambient Air Quality Guidelines µg/m^3
A1	39.0	260.0

The result shows that the present TSP level in the air at the sample point is well below the stipulated 260 µg/m^3 limit of the Malaysian Ambient Air Quality Guidelines (see **Annex 1.6**).

3.10.1.8 Baseline Noise Level

Baseline noise monitoring was conducted at the same location and on the same day as the TSP sampling, in Kg. Serupil (N1). The sampling location is illustrated on **Figure 3.2.1** and detailed in **Table 3.10.5**.

Table 3.10.5: Baseline Noise Monitoring Locations

Sample Point	Location	Sampling Date / Duration	Weather During Sampling	Parameter
N1: Kg. Serupil	N06°53'59.4", E117°10'35.7"	16/12/15 – 17/12/15 24 hrs (Day time/ night time)	Some rain showers	L_{eq}, L_{90}, L_{10}, L_{max}, L_{min}

Plate 3.16: Noise Monitoring at N1, Kg. Serupil.

The results are presented in **Table 3.10.6** and the full analysis reports are presented in **Annex 1.7**. The results were compared against the recommended noise level for Noise Sensitive Areas, Low Density Residential, under Schedule 1 of the Planning Guidelines for Environmental Noise Limit and Control (**Annex 1.8**).

Table 3.10.6: Baseline Noise Level Results

Sample Point	Day-Time (0700 – 2200) Result dB(A)	Schedule 1 Recommended Noise Level, (L_{Aeq}), dB(A)	Night-Time (2200 – 0700) Result dB(A)	Schedule 1 Recommended Noise Level, (L_{Aeq}), dB(A)
N1	54.7	50	45.7	40

The results show that both the day time and night time noise levels at Kg. Serupil were high and above the prescribed limits when compared to Schedule 1 of the Planning Guidelines for Environmental Noise Limit and Control, for Noise Sensitive Areas (**Annex 1.8**). The elevated noise levels were recorded to be contributed mainly by the sound of wind and human activities.

3.10.2 Biological Environment

As part of their pre-development activities the Project Proponent has undertaken flora and fauna studies on the Bengkoka Forest Reserve between October and November 2015, and Tambalugu Forest Reserve between 02nd and 24th March 2016. These surveys were undertaken under the initiative of the Project Proponent in consultation with SFD. The purpose of the studies was to assess the diversity of wildlife in the Bengkoka and Tambalugu Forest Reserves and identify any potential areas of high conservation value and forest for protection. These data will be used for future management of the forest reserve under this Project, for the identification of conservation areas for rehabilitation, as described in **Section 3.4** and **Section 3.7**.

The full flora and fauna surveys are attached in **Annex 2.5** and **Annex 2.6**, and the key findings are summarised below.

3.10.2.1 Flora

In terms of flora, the project site is in a poor state, with very little diversity. As described in **Section 3.4**, the natural vegetation which once existed on the project site has given way to invasive *Acacia mangium* and *Acacia sp.*, which now covers the majority of the project site. In many areas of the project site the Acacias have suffered from extensive forest fires and fungus (*Ceratocystis sp.*), and there are subsequently large areas of dead or dying trees (**Plate 3.3**, **Plate 3.4** and **Plate 3.5**). Some common native secondary plant species can be found interspersed within the Acacia, however these do not form healthy stands. The Project Proponent has conducted flora surveys of the project site, in both the Bengkoka and Tambalugu Forest Reserves. The EIA Consultant also made observations on the floral diversity during site visits. The findings of these surveys are summarised below, see **Annex 2.5** and **Annex 2.6** for further details.

Bengkoka Forest Reserve

The flora survey of the Bengkoka Forest Reserve was conducted using recce walks along transect lines, and secondary sources such as Sabah Forestry Department.

As described above the project site within the Bengkoka Forest Reserve is dominated by invasive *Acacia mangium* and *Acacia sp.* It is estimated that approximately 79% of the Bengkoka Forest Reserve is covered with Acacia, the majority of which (approximately 67%) is wild region, i.e. invasive Acacia, and represents no economic value. Only a small proportion is planted Acacia (approximately 12%), which has suffered from poor management. Approximately 19% of the remaining area within the Bengkoka Forest Reserve, mostly in the east, has degraded to non-forest, as a result of fires, fungus and poor management. This area is mostly covered by *Imperata sp.* Grass (lalang) or braken ferns. Only a small portion of the Bengkoka Forest Reserve (< 2%) contains natural forest, however these are small, scattered isolated patches, which on their own offer very little ecological significance or benefit (**Figure 3.10.5**).

There is no indication of any plant species or plant communities of any conservation value within the project site, with the exception of *Shorea kudatensis* (Yellow Meranti), a few of which were identified within a riparian zone on the project site during a limited study by SFD. *Shorea kudatensis* is critically endangered and endemic to Bengkoka peninsular. All observed locations are within the areas identified for riparian reserve within the project site, and will therefore be protected.

There are a number of secondary plant species within the Bengkoka Forest Reserve, which are interspersed with the Acacia, these include, *Alstonia spathulata, Decaspermum fruticosum, Ficus indica, Fordia splendidissima, Glochidiun rubrun, Macaranga hypoleuca, Macaranga tanarius, Melastoma malabathricum, Nauclea subdita, Neolamarckia cadamba, Trema orientalis, Veronia arborea* and *Vitex pubescens.* As noted earlier however these species do not form healthy stands.

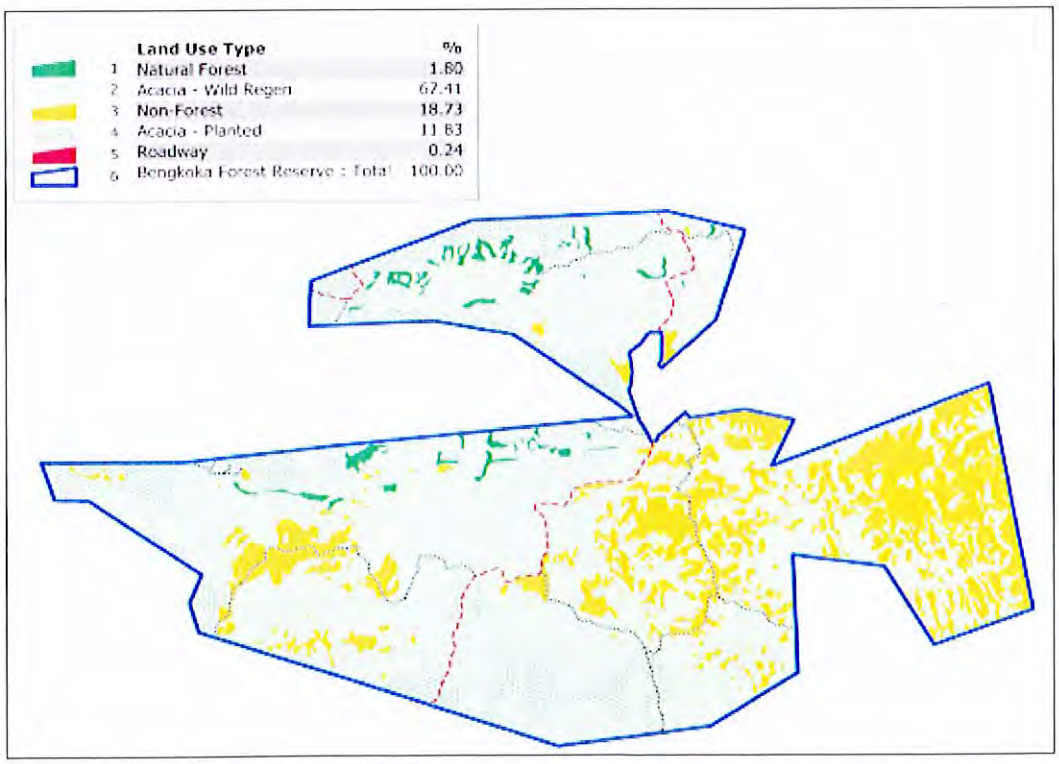


Figure 3.10.5: Existing Vegetation Cover within the Bengkoka Forest Reserve.

Tambalugu Forest Reserve

The flora survey of the Tambalugu Forest Reserve was conducted using recce walks along transect lines.

The survey within the Tambalugu Forest Reserve identified two distinct types of forest vegetation, secondary lowland acacia forest and wetland mangrove forest. The flora species identified within the Tambalugu Forest Reserve are listed in **Table 3.10.7**. Items 13 to 17 in **Table 3.10.7** were all identified within the Mangrove area.

Table 3.10.7: Flora Species Identified in Tambalugu Forest Reserve (Coupe 4)

No.	Species	
	Scientific Name	**Local Name**
1	*Stachytarpheta dichotoma*	Bunga Biren
2	*Lantana camara*	Bunga tahi ayam
3	*Evatamia divaricate*	Pokok restong
4	*Dillenia suffruticosa*	Buan/ Rungin
5	*Aplinia galangal*	Lengkuas
6	*Psidium guajava*	Jambu batu
7	*Melastoma malabathricum L.*	Senduduk/ Gosing
8	*Eurycoma longifolia*	Tongkat Ali
9	*Blumea balsamifera*	Subong
10	*Chromolaena odorata*	Lohunoi/ Lahunai
11	*Houttuynia cordata Thunb.*	Kenemek Jantan
12	*Acacia mangium*	Sabah salwood
13	*Licuala sp.*	
14	*Livistona chinensis*	Chinese fan palm
15	*Rhizophora apiculate*	Bakau minyak/ Akit
16	*Heritiera littoralis Aiton*	Dungun
17	*Acrostichum sp.*	Piyai Raya laut

Flora species within the acacia forest are scattered and widely spread inside the forest. *Acacia mangium*, *Lantana camara* and *chromolaena odorata*, for example, can be found almost anywhere in the acacia forest.

Acacia trees dominate the acacia forest, while the forest floor is predominantly covered by shrubs, *Zingiberceae* and climbers.

Flora in the acacia forest is very important to the ecosystem, providing habitat and food to other wildlife. Most of the flora identified are angiosperms which are flowering plants and fruit bearing plants that provide fruit and nectar for feeding animals and insects. For example *Lantana camara*, *Melastoma malabathricum* and *Psidium guajava* are flowing and fruit bearing plants, providing both nectar for bees, butterflies and other insects and fruit/ seeds for bird species such as spiderhunters, bulbuls and flowerpeckers.

As previously described the mangrove forest in the north of the Tambalugu Forest Reserve (about 12 ha) will be excluded from all project activities as a conservation area. The mangrove forest is an important ecosystem, supporting a variety of plant and animal life. In addition mangroves are important natural barriers protecting the coastal zones.

3.10.2.2 Fauna

As previously mentioned the Project Proponent has conducted fauna surveys of the project site, in both the Bengkoka and Tambalugu Forest Reserves. The findings of these surveys are summarised below, see **Annex 2.5** and **Annex 2.6** for further details.

Methodology

The following techniques were used to collect data during the fauna surveys in Bengkoka and Tambalugu Forest Reserves. The techniques used conform to SFD standards and best practice for fauna survey in forest reserve. Refer to **Annex 2.5 and 2.6** for further details and description.

1. Recce Walks: Recce walks were conducted along transect lines within the forest. The transect lines followed paths of least resistance through the forest understorey. During the recce walks details of vegetation, topography, canopy and any signs of wildlife, were recorded. The transect lines are detailed in **Table 3.10.8**.

Table 3.10.8: Transect Line Details

Transect	Location	Starting Point	Ending Point
Bengkoka Forest Reserve			
1	Coupe 1	N06°51'46.9", E117°08'28.7"	N06°51'38.2", E117°08'04.7"
2	Coupe 1	N06°51'49.8", E117°07'08.8"	N06°51'45.2", E117°07'15.3"
3	Coupe 2	N06°52'39.1", E117°09'35.5"	N06°52'52.8", E117°09'21.3"
4	Coupe 2	N06°51'10.1", E117°08'52.5"	N06°50'56.3", E117°08'47.8"
5	Coupe 3	N06°54'16.6", E117°08'29.8"	N06°54'16.7", E117°08'50.0"
Tambalugu Forest Reserve			
1	Coupe 4	N6°55.890' E117°12.781'	N6°55.737' E117°13.352'
2	Coupe 4	N6°55.729' E117°13.447'	N6°55.847' E117°12.827'
3	Coupe 4	N6°55.893', E117°13.084'	N6°55.910', E117°12.751'

Transect	Location	Starting Point	Ending Point
4	Coupe 4	N6°55.838', E117°12.832'	N6°55.870', E117°12.599'
5	Coupe 4	N6°55.874', E117°12.618'	N6°55.882', E117°12.784'
6	Coupe 4	N6°55.852', E117°13.188'	N6°56.006', E117°13.244'
7	Coupe 4	N6°55.842', E117°13.146'	N6°55.986', E117°13.216'

2. Road Survey: Road surveys by foot were conducted for the Bengkoka Forest Reserve. Road surveys were not conducted in the Tambalugu Forest Reserve as there are no existing roads. The road segment used for the survey in Bengkoka Forest Reserve covered a total length of 7 km. During the road survey any signs of wildlife were recorded, including footprints, faeces etc. Road survey by vehicle was also carried out and was carried out at night. Road surveys by vehicle were conducted over the SFD recommended area of 10 to 20 km. The road survey segments are detailed in **Table 3.10.9**.

Table 3.10.9: Road Survey Segment in Bengkoka Forest Reserve

Segment	Location	Starting Point	Ending Point
1	Coupe 1	N06°51'46.4", E117°08'28.7"	N06°51'38.2", E117°08'04.7"
2	Coupe 1	N06°52'01.1", E117°09'06.5"	N06°52'15.1", E117°08'09.8"
3	Coupe 2	N06°52'39.0", E117°09'35.5"	N06°52'52.8", E117°09'21.3"
4	Coupe 2	N06°50'56.3", E117°08'47.8"	N06°52'01.1", E117°09'06.5"
5	Coupe 3	N06°54'15.6", E117°08'49.0"	N06°54'16.5", E117°08'29.8"

3. Mist Netting: Mist netting was used to study the diversity of bird species within the Bengkoka and Tambalugu Forest Reserves. The mist net locations are detailed in **Table 3.10.10**. Birds were identified, photographed and recorded before being released.

Table 3.10.10: Mist Netting Locations

Net	Coordinate	Opening Date	Closing Date
Bengkoka Forest Reserve			
1	N06°52'01.1", E117°09'06.5"	27/10/15	31/10/15
2	N06°52'19.0", E117°07'57.5"		
3	N6°52.232', E117°08.197'		
4	N06°51'33.5", E117°10'15.0"	04/11/15	04/11/15
5	N6°52.233', E117°08.182'		
6	N06°52'17.4", E117°08'28.5"	05/11/15	09/11/15
7	N6°52.238', E117°08.207'		
Tambalugu Forest Reserve			
1	N06°55'43.9", E117°13'21.2"	05/03/16	05/03/16
2	N06°56'01.8", E117°12'54.0"	06/03/16	06/03/16

Net	Coordinate	Opening Date	Closing Date
3	N06°55'53.6", E117°12'45.4"	22/03/16	22/03/16
4	N06°55'49.7", E117°12'50.4"	22/03/16	22/03/16
5	N06°55'52.1", E117°13'58.2"	22/03/16	22/03/16
6	N06°55'43.3", E117°13'26.0"	22/03/16	22/03/16

4. Stream Transect: Stream transects were used to study reptiles and amphibians in the freshwater ecosystem in the Bengkoka Forest Reserve. A transect line was established in a stream during the night. Stream Transect was not conducted in the Tambalugu Forest Reserve as the streams were dry during the survey period.

5. Camera Trapping: Camera traps were established in ten (10) locations throughout the Bengkoka and Tambalugu Forest Reserves. The camera trap locations detailed in **Table 3.10.11**.

Table 3.10.11: Camera Trap Locations

Camera	Coordinate
Bengkoka Forest Reserve	
1	N06°51'44.8", E117°07'15.4"
2	N06°52'46.3", E117°09'28.2"
3	N06°51'27.3", E117°10'13.2"
4	N06°52'17.8", E117°08'20.6"
5	N06°54'43.1", E117°10'28.2"
6	N06°51'00.5", E117°08'54.2"
Tambalugu Forest Reserve	
1	N06°55'38.3", E117°13'07.3"
2	N06°55'43.8", E117°12'50.3"
3	N06°56'00.4", E117°13'14.7"
4	N06°56'01.6", E117°12'54.8"

Findings: Bengkoka Forest Reserve

Table 3.10.12 lists the wildlife identified within the Bengkoka Forest Reserve during the fauna survey, via the methods described above, further details on the nature of the identification and the method can be referred to in **Annex 2.5**.

Table 3.10.12: Wildlife Identified in the Bengkoka Forest Reserve

No	Common Name	Scientific Name	IUCN Red List Status	Wildlife Conservation Enactment 1997 Status
Mammals				
1	Lows Squirrel	*Sundasciurus lowii*	Least Concern	None
2	Common Treeshrew	*Tupaia picta*	Least Concern	None
3	Bearded Pig	*Sus Barbatus*	Vulnerable	Schedule 3 – Protected, hunting license required
4	Sambar Deer	*Cervus timorensis*	Vulnerable	Schedule 3 – Protected, hunting license required
5	Mouse Deer	*Tragulus sp.*	Least Concern	Schedule 3 – Protected, hunting license required
6	Lesser-mouse Deer	*Tragulus javanicus*	Data Deficient	Schedule 3 – Protected, hunting license required
7	Bornean Red-Muntiac/ Common barking deer	*Muntiacus muntiac*	Least Concern	Schedule 3 – Protected, hunting license required
8	Pangolin	*Manis javanica*	Critically Endangered	Schedule 2 – Protected
9	Civets	Unidentified	Unidentified	Unidentified
10	Malay Civet	*Viverra tangalunga*	Least Concern	Schedule 2 – Protected
11	Red giant-flying squirrel	Unidentified	None	Schedule 2 – Protected
12	Pig-tailed macaque	*Macaca nemestrina*	Vulnerable	Schedule 2 – Protected
13	Sun Bear	*Helarctos malayanus*	Vulnerable	Schedule 1 – Totally Protected
Birds				
14	Black-capped babbler	*Pellorneum pyrrogenys*	Least Concern	None
15	Buff-necked Woodpecker	*Meiglyptes tukki*	Near Threatened	None
16	Buff-rumped Woodpecker	*Meiglyptes tristis*	Least Concern	None
17	Nightjar	Unidentified	Unidentified	Unidentified

No	Common Name	Scientific Name	IUCN Red List Status	Wildlife Conservation Enactment 1997 Status
18	Cream-vented Bulbul	*Pycnonotus Simplex*	Least Concern	None
19	Emerald Dove	*Chalcophaps indica*	Least Concern	Schedule 2 – Protected
20	House Swift	*Apus Affinis*	Least Concern	None
21	Little Spiderhunter	*Arachnothera logirostra*	Least Concern	None
22	Long-billed Spiderhunter	*Arachnothera crassirostris*	Least Concern	None
23	Pied Fantail	*Rhipodura javanica*	Least Concern	None
24	Red-eyed Bulbul	*Pycnonotus brunneus*	Least Concern	None
25	Rufous-backed Kingfisher	*Ceyx rufidorsa*	Least Concern	None
26	White-chested babbler	*Trichastoma rostratum*	Near Threatened	Schedule 2 – Protected
27	White-crowned Shama	*Copsychus striklandii*	Least Concern	None
28	Yellow-vented Bulbul	*Pycnonotus goiavier*	Least Concern	None
29	Streaked Bulbul	Unidentified	Unidentified	Unidentified
Reptiles and Amphibians				
30	Tree frog	*Rana megalonesa*	Not Assessed	None
31	Four-lined tree frog	*Rana baramica*	Least Concern	None
32	Dwarf soft-shelled turtle	*Dogania subplana*	Lower Risk/ Least Concern	None
33	Green vine snake	*Ahetulla prasina*	Not Assessed	None
34	Striped bronzeback tree snake	*Dendrelaphis caudolineatus*	Not Assessed	None
35	Striped tree skink	*Apterygodon vittatus*	Not Assessed	None
36	River Salamander	*Sphenomorphus multisquamatus*	Not Assessed	None

No	Common Name	Scientific Name	IUCN Red List Status	Wildlife Conservation Enactment 1997 Status
Other				
37	Pill millipede	Unidentified	Unidentified	Unidentified

A total of 37 species of wildlife were identified within the Bengkoka Forest Reserve, as shown in **Table 3.10.12**.

Only one species within the forest reserve falls under Schedule 1 of the Wildlife Conservation Enactment 1997, i.e. totally protected, which is Sun Bear. Sun Bear is also classified as a vulnerable on the IUCN Red List.

There are a number of other species identified which are listed as protected under Schedule 2 of the Wildlife Conservation Enactment, these include Pangolin; Malay Civet; Red giant-flying squirrel; Pig-tailed macaque; Emerald Dove; and White-chested babbler. Pangolin is also classified as critically endangered on the IUCN Red List, while Pig-tailed macaque is listed as vulnerable and White-chested babble is listed as near threatened.

In addition Bearded Pig and Sambar Deer are listed as vulnerable on the IUCN Red List, and fall under Schedule 3 of the Wildlife Conservation Enactment 1997, i.e. protected, hunting license required. The buff necked woodpecker is listed as near threatened in the IUCN Red List, however is not listed in the Wildlife Conservation Enactment.

Findings: Tambalugu Forest Reserve

Table 3.10.13 lists the wildlife identified within the Tambalugu Forest Reserve during the fauna survey, via the methods described above, further details on the nature of the identification and the method can be referred to in **Annex 2.6**.

Table 3.10.13: Wildlife Identified in the Tambalugu Forest Reserve

No	Common Name	Scientific Name	IUCN Red List Status	Wildlife Conservation Enactment 1997 Status
Mammals				
1	Sun bear	*Helarctros malayanus*	Vulnerable	Schedule 1 – Totally Protected
2	Bearded pig	*Sus barbatus*	Vulnerable	Schedule 3 – Protected, hunting license required
3	Sambar deer	*Cervus unicolor*	Vulnerable	Schedule 3 – Protected, hunting license required
4	Barking deer	*Muntiacus muntjac*	Least Concern	Schedule 3 – Protected, hunting license required
5	Long-tailed macaque	*Macaca fascicularis*	Least Concern	Schedule 2 - Protected

No	Common Name	Scientific Name	IUCN Red List Status	Wildlife Conservation Enactment 1997 Status
6	Small-toothed palm civet	*Arctogalidia trivirgata*	Least Concern	Schedule 2 - Protected
7	Malay civet	*Viverra tangalunga*	Least Concern	Schedule 2 - Protected
Birds				
8	Little spiderhunter	*Arachnothera longisostra*	Least Concern	None
9	Blue eared kingfisher	*Alcedo meninting*	Least Concern	None
10	Common flameback	*Dinopium javanense*	Least Concern	None
11	Grey capped Emerald Dove	*Calcophaps indica*	Least Concern	Schedule 2 – Protected
12	Red-eyed Bulbul	*Pycnonotus brunneus*	Least Concern	None
13	Collared kingfisher	*Todiramphus chloris*	Least Concern	None
Reptiles and Amphibians				
14	Four lined tree frog	*Polypedetes leucomystax*	Least Concern	None
15	Lesser swamp frog	*Limnonectes paramacrodon*	Near Threatened	None
16	Malayan box turtle	*Cuora amboinensis kamaroma*	Vulnerable	None
17	Monitor Lizard	*Varanidae sp.*	Not Available	Schedule 2 – Protected
Insects				
18	Emerald swallowtail	*Papilio palinurus*	Not Available	None
19	Common mormon	*Papilio polytes*	Not Available	None
20	Rajah Brooke's Birdwing	*Trogonoptera Brookiana*	Not Available	Schedule 2 – Protected
21	Horsefiled's Baron	*Tanaecia lapis*	Not Available	None
22	Common tree nymph	*Idea Stolli*	Not Available	None

No	Common Name	Scientific Name	IUCN Red List Status	Wildlife Conservation Enactment 1997 Status
23	Blue glassy tiger	*Ideopsis vulgaris macrina*	Not Available	None
24	Striped blue crow	*Euploea facricius*	Not Available	None
25	Common four ring	*Ypthima horsfieldii*	Not Available	None
26	Common grass yellow	*Eurema hecabe*	Not Available	None
Mollusca				
27	Marsh clam	*Polymesoda expansa*	Least Concern	None
28	Belongkeng	*Cassidula aurisfelis*	Least Concern	None

A total of 28 species of wildlife were identified within the Tambalugu Forest Reserve, as shown in **Table 3.10.13**.

In terms of mammals, the identified species were similar to those found in Bengkoka Forest Reserve, with the addition of Long-tailed macaque and Small-toothed palm civet. It is noted that long-tailed macaque prefer habitat near water source, therefore forest near lakes, rivers of coastal areas, and in particular mangrove forest, as found within the project site, are ideal habitat. The long-tailed macaque and small-toothed palm civet are listed under Schedule 2 of the Wildlife Conservation Enactment 1997, i.e. protected, and are of least concern on the IUCN Red List.

Only one species within the forest reserve falls under Schedule 1 of the Wildlife Conservation Enactment 1997, i.e. totally protected, which is Sun Bear. Sun Bear is also classified as vulnerable on the IUCN Red List. Bearded pig and sambar deer are also listed as vulnerable on the IUCN Red List. These species are vulnerable to environmental changes and human threats, i.e. poaching.

In terms of the birds identified, only the grey capped emerald dove is listed as a protected species under Schedule 2 of the Wildlife Conservation Enactment 1997, and all birds identified are of least concern on the IUCN Red List.

From the amphibians and reptiles identified within the Tambalugu Forest Reserve, the lesser swamp frog and Malaysian box turtle are listed as near threatened and vulnerable, respectively, on the IUCN Red List. It is also noted that monitor lizard is a protected species listed under Schedule 2 of the Wildlife Conservation Enactment 1997. The treats to these species mostly come from humans.

All the identified insects were butterflies, which are noted to be in abundance within the Tambalugu Forest Reserve. Although not listed on the IUCN Red List, butterflies in general can be considered vulnerable, as the decline of butterfly species over the last few decades has been fast. Butterflies are an important part of an ecosystem, and they

need resources that only an intact ecosystem can provide. The abundance of butterflies in the forest can therefore be a good indicator of forest health.

Molluscs were also identified in the mangrove area within the project site.

Conclusion

Although the project site is in a degraded state, with little floral diversity, it is still able to support a reasonable population of wildlife which thrive in the area, including deer, bear, boar etc. These animals may feed outside the project site, however the project site provides a refuge for them. It is important therefore to put measures in place to protect sensitive species, i.e. through the provision of suitable conservation areas and riparian reserves for example. This is discussed in detail in **Section 3.10.3**.

3.10.3 Conservation Areas

As previously described it is the Project Proponent's intention to identify and protect areas where ecological functions can be restored within the project site, including the re-establishment of riparian reserves and any other identified conservation areas. The purpose is to develop a well-managed, commercially productive forest which also poses a thriving ecology. It is noted that the management intensions of the Project Proponent will significantly enhance the flora and fauna diversity in the project site, and in the long term be ecologically beneficial to the forest reserves.

Following the completion of the flora and fauna surveys of the project site, as described in **Section 3.10.2** and detailed in **Annex 2.5** and **Annex 2.6**, the Project Proponent has evaluated the findings of these and other surveys against the WWF High Conservation Value (HCV) Toolkit, to identify areas of High Conservation Value Forest (HCVF).

The objectives of the HCV assessment are as follows:

1. Identify and protect rare and threatened flora and fauna;

2. Identify and demarcate wildlife habitat, watershed areas and culturally significant sites; and

3. Encourage long-term stability of wildlife biodiversity and incorporate this factor into the decision-making process.

There are six (6) main types of HCVF forest, these are discussed below for the project site, based on the findings of the Project Proponent's assessment. Further details of the findings can be referred to in the FMP (**Annex 2.3**).

HCV 1: Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values

HCV 1.1: Protected areas

There are no protected areas within the Bengkoka and Tambalugu Forest Reserves. As previously described the forest reserves have been re-classified from Class I Protected Forest to Class II Commercial Forest, due to degradation of the forest to predominantly wild acacia and grassland.

HCV 1.2, 1.3: Threatened, endangered and endemic species

As described in **Section 3.10.2** a number of vulnerable and protected species have been identified within the project site. A limited study by SFD also identified a few *Shorea kudatensis* (Yellow Meranti), within a riparian zones on the project site, which is critically endangered and endemic to Bengkoka peninsular.

HCV 1.4: Critical temporal use

All remaining forest on the Bengkoka Peninsular, including within the project site, is considered to provide significant refuge for the areas remaining wildlife, due to the amount of crop cultivation and expanding areas of Imperata grassland in the region.

In addition the SAFODA dam exists on the southern boundary of the Bengkoka Forest Reserve, the reservoir for which may support migratory and resident wildlife populations.

HCV 2, 3: Globally, regionally or nationally significant large landscape-level forests/ Forest areas that are in or contain rare, threatened or endangered ecosystems

As previously described, the natural forests areas within the Bengkoka and Tambalugu Reserves are fragmented and cover less than 2% of the total area.

There is however a small, continuous fringe of mangrove forest along the northern boundary of the Tambalugu Forest Reserve, which will be preserved.

HCV 4: Forest areas that provide basic services of nature in critical situations

HCV 4.1: Forests critical to water catchments

Although the entire Bengkoka Peninsular consists of low lying, rolling terrain, the Bengkoka Forest Reserve itself contains the most elevated topography of the peninsular, and as such functions as a catchment for many small streams flowing to the coast. There are no water catchments identified within the Tambalugu Forest Reserve.

HCV 4.2: Forests critical to erosion control

The forests within the project site are not considered to be regionally significant to erosion control, however the forests adjacent to all streams in the project site will function as erosion control buffers, protecting the stream from sedimentation.

HCV 4.3: Forests providing barriers to destructive fire

As the project site is dominated by Acacia forest which has a relatively open canopy, the forest floor is often dry with significant fine fuel loadings. This is exacerbated by the amount of dead and dying trees. Consequently the forested reserves do not currently function as a fire break.

HCV 5, 6: Forest area fundamental to meeting basic needs of local communities (e.g. subsistence, health)/ Forest areas critical to local communities' traditional cultural identity

There are no communities located within the project site and the vegetation within the project site is similar to that within the immediately surrounding Acacia plantations. There are therefore no fundamental subsistence or cultural identity values identified within the project site.

Based on the HCVF assessment summarised above, HCV areas 1.2, 1.3, 1.4, 3, 4.1 and 4.2 are all present within the project site, while HCV areas 1.1, 2, 4.3, 5 and 6 are not present. Based on this assessment and surveys of the project site, the Project Proponent has identified a number of conservation areas which will be excluded from project activities and preserved within the project site. The identified conservation areas for the Project which will be implemented by the Project Proponent, are shown on **Figure 3.7.1** and detailed in **Table 3.10.14**. The 285 Ha of riparian reserve is limited to the main water courses within the project site, which are considered to be permanent. Further investigation with ground truthing is required to determine riparian reserve requirements for other rivers and streams on the project site.

Table 3.10.14: Conservation Areas within the Project Site

Conservation Area	Total Area/ Size	Location
Riparian Reserves	30 m (285 Ha)	Bengkoka and Tambalugu Forest Reserves
Water Catchment	371 Ha	Bengkoka Forest Reserve
Mangrove Forest	12 Ha	Tambalugu Forest Reserve
Water Reservoir	72 Ha	Bengkoka Forest Reserve

The fauna survey completed for the Bengkoka Forest Reserve identifies management recommendations for the identified HCV features, as described above. These have been incorporated where applicable into the recommended mitigation measures in **Chapter 5** of this EIA report.

3.10.4 Land Use and Human Environment

Bengkoka Forest Reserve

There are no settlements within the project site in the Bengkoka Forest Reserve. There are however a number of settlements located in the vicinity of the project site, which are located within the Acacia Forest Industries Sdn Bhd estate. These settlements are listed in **Table 3.10.15** and illustrated on **Figure 3.2.1**.

The nearest villages to the project site are Kg. Kakarangan (200 m east) comprising scattered houses, Kg. Serupil (200 m west/ south) and Kg. Kapok (300 m west). The nearest houses to the project site however are within Kg. Serupil, located within 50 m of the project site boundary. It is also noted that Kg. Serupil is located along the existing access road to the project site, i.e. Jalan Mongkubou Laut.

There are a number of existing structures within the project site in Bengkoka Forest Reserve which are remaining from previous forestry operations and existing forest management, such as workers huts and two (2) fire watch towers (**Plate 3.20**).

There is also a small dam within the project site along the southern boundary near Kg. Bongkol (**Figure 3.2.1**) (**Plate 3.18**). This dam was constructed by SAFODA and provides water to SAFODA and Kg. Bongkol. The Water Treatment Plant (WTP) for the reservoir is located approximately 200 m south of the project site boundary (**Plate 3.24**). It is also noted that Kg. Serupil uses a natural pond for washing purposes, which is in close proximity to the project site boundary (**Plate 3.19**).

The Bengkoka Forest Reserve is predominantly surrounded by forestry operations, predominantly Acacia plantations with the Sabah Forestry Development Authority (SAFODA) area (**Plate 3.21**). The operator in these areas is Acacia Forest Industries Sdn Bhd. There are also some areas of small scale oil palm plantations (**Plate 3.22**).

The surrounding land use is listed in **Table 3.10.15** and shown on **Figure 3.2.1**.

Table 3.10.15: Land Use Features in the Vicinity of the Project Site (Bengkoka Forest Reserve)

Land Use Feature	Distance from Project Site Boundary (m)	Direction from Project Site Boundary
Settlements		
Kg. Serupil	200 (< 50 m for nearest house)	West/ South
Kg. Kakarangan	200	East
Kg. Kapok	300	West
Kg. Gumpa (**Plate 3.23**)	400	South
Kg. Radap	400	South
Kg. Kandang	500	North

Land Use Feature	Distance from Project Site Boundary (m)	Direction from Project Site Boundary
Kg. Kipahung	600	North
Kg. Kodong	650	North
Kg. Bongkol (**Plate 3.25** and **Plate 3.26**)	700	South
Kg. Jambu	700	South
Kg. Unkup	1,100	South
Others		
Bengkoka Peninsula Forest Reserve (Class V – Mangrove Forest Reserve)	500 m South-east	
SAFODA Dam/ Reservoir	Within the project site on the southern boundary	
Water Treatment Plant	200 m South	
Sabah Forestry Development Authority (SAFODA) Area/ Acacia Plantation (Acacia Forest Industries Sdn Bhd)	Surrounding the project site	
Oil Palm Plantation	Bordering the project site to the south	

Tambalugu Forest Reserve

There are no settlements within the project site in the Tambalugu Forest Reserve. There are however a number of settlements located in the vicinity of the project site, the closest of which is Kg. Suang Duyang (500 m North/ North west) (**Plate 3.27** and **Plate 3.28**), as listed in **Table 3.10.16** and illustrated in **Figure 3.2.1**. There are approximately 20 houses of Kg. Suang Duyang located to the north and north-west of the project site, along Jalan Suang Duyung (**Plate 3.27**).

The only other village in the vicinity of the Tambalugu Forest Reserve is Kg. Maringgan, located approximately 1.6 km north-west of the project site boundary (**Plate 3.29**).

Part of Kg. Suang Duyang is also located on the coastline approximately 2 km to the east of the project site (**Figure 3.2.1**).

There are no existing structures within the project site in Tambalugu Forest Reserve.

The Tambalugu Forest Reserve is bordered to the east, south and part of the west by forestry operations, predominantly Acacia plantations operated by Acacia Forest Industries Sdn Bhd. Also bordering the project site to the west there is some small scale oil palm plantation operated by the local communities (**Plate 3.30**). Bordering the site to

the north is the Bengkoka Peninsula Mangrove Forest Reserve (Class V), as shown on **Figure 3.2.1 (Plate 3.31)**.

The surrounding land use is listed in **Table 3.10.16** and shown on **Figure 3.2.1**.

Table 3.10.16: Land Use Features in the Vicinity of the Project Site (Tambalugu Forest Reserve)

Land Use Feature	Distance from Project Site Boundary (m)	Direction from Project Site Boundary
Settlements		
Kg. Suang Duyang	500	North / North-west
	2,000	East
Kg. Maringgan	1,600	North-west
Others		
Bengkoka Peninsula Forest Reserve (Class V – Mangrove Forest Reserve)	Bordering the project site to the north	
Sabah Forestry Development Authority (SAFODA) Area/ Acacia Plantation (Acacia Forest Industries Sdn Bhd)	Bordering the project site to the east, south and west	
Oil Palm Plantation	Bordering the project site to the west	

Plate 3.17: Kg. Serupil, located 50 m east of the project site (Bengkoka Forest Reserve).

Plate 3.18: SAFODA dam within the project site (Bengkoka Forest Reserve) at N06°50'31.8", E117°09'19.3".

Plate 3.19: Natural pond at Kg. Serupil.

Plate 3.20: Existing fire watch tower within the Bengkoka Forest Reserve at N06°52'13.6", E117°07'54.9".

Plate 3.21: Forest management operations to the north of the project site (Bengkoka Forest Reserve).

Plate 3.22: Oil palm plantation bordering the project site (Bengkoka Forest Reserve) to the south.

Plate 3.23: Kg. Gumpa, located 500 m south of the project site (Bengkoka Forest Reserve).

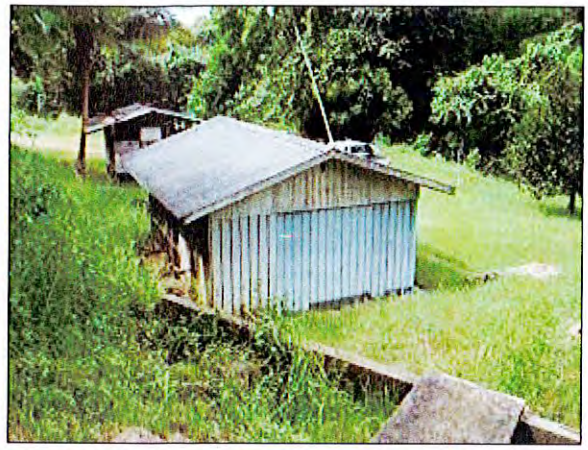


Plate 3.24: Water Treatment Plant for SAFODA Dam, located 200 m south of the project site (Bengkoka Forest Reserve).

Plate 3.25: Kg. Bongkol, located 700 m south of the project site (Bengkoka Forest Reserve).

Plate 3.26: Kg. Bongkol community area in Kg. Bongkol.

Plate 3.27: Nearest house to the Tambalugu Forest Reserve, Kg. Suang Duyang, located 250 m north of the project site boundary.

Plate 3.28: Kg. Suang Duyang church.

Plate 3.29: Kg. Maringgan, located 2 km north-west of the project site (Tambalugu Forest Reserve).

Plate 3.30: Oil Palm Plantation bordering the project site (Tambalugu Forest Reserve) to the west.

Plate 3.31: Bengkoka Peninsula Mangrove Forest Reserve (Class V).

3.10.5 Socio-Economic Environment

As described in **Section 3.10.4**, there are no settlements within the project site, in Bengkoka or Tambalugu Forest Reserves, however there are a number of settlements in the vicinity of the project site.

As detailed in the FMP (**Annex 2.3**), the Project Proponent has compiled socio-economic data on the surrounding communities, through engagement with the local communities via the Project Proponent's community representative. In addition the EIA Consultant had engaged with the Project Proponent's Community Officer and representatives from the local communities during the site visit. The key findings are summarised in this section.

The population of the adjacent villages, as listed in **Table 3.10.15** and **Table 3.10.16,** ranges from 35 to 203 individuals, with an average family size of 5-6 people. All villages have access to schools within 20 km distance of the village. Most of the adjacent villages have electricity supplied by Sabah Electricity Sdn Bhd. It is noted however that Kg. Serupil does not yet have electricity supply, although during the site visit the

infrastructure for electricity supply, i.e. poles and power cable, was being established. The households currently rely on generators.

The surrounding villages also have community facilities such as community halls, and have access to health-care in the larger villages such as Kg. Bongkol, and the main hospital in Pitas.

The majority of the working population of the adjacent villages are self-employed, involved in either agricultural farming or small scale vendors.

In terms of water supply, the majority of the adjacent villages reply on rain-water and rivers as their primary water source. The majority of the rivers utilised by the adjacent communities originate from within the project site, specifically the Bengkoka Forest Reserve. Kg. Bongkol for example get their water supply from the SAFODA dam located on Sg. Bongkol within the Bengkoka Forest Reserve. As per the FMP, it is believed that during the dry season some water supplies to villages may dry up, causing villages to walk to alterative water sources. The water sources for the Kg. Gumpa and Kg. Bongkol, which are noted to be located immediately downstream of rivers/ streams within the project site, and the nearest settlement of Kg. Serupil, are summarised in **Table 3.10.17**. It is also noted that Kg. Kandang is located downstream of Sg. Kandang, and so is likely to obtain their water supply from this river. Refer to **Figure 3.2.1**.

As previously described, water catchments within the project site will be excluded from project activities, this will ensure that the water supply to surrounding villages is not impacted by the Project. Refer to **Section 3.10.3** and **Figure 3.7.1**.

Table 3.10.17: Water Use in Surrounding Settlements

Settlement	Water Source	Usage
Kg. Gumpa	Rainwater	Consumption/ cooking.
	River water	Bathing/ washing
Kg. Bongkol	River water (SAFODA dam)	All domestic use
Kg. Serupil	Wells and natural pond (**Plate 3.19**)	All domestic use

None of the settlements in the vicinity of the Tambalugu Forest Reserve, i.e. Kg. Suang Duyung and Kg. Maringgan utilise water from streams within the forest reserve. As shown on **Figure 3.10.1**, the streams within the Tambalugu Forest Reserve, converge in the centre of the project site and flow north into the neighbouring Bengkoka Peninsula Mangrove Forest Reserve and the Sulu Sea. There are no settlements located close to these streams and during the site visit it was noted that they can be dry during dry periods.

As previously described, the nearest houses to the project site are within Kg. Serupil, located within 50 m of the project site boundary. It is also noted that Kg. Serupil is located along the existing access road to the project site, i.e. Jalan Mongkubou Laut.

It is anticipated therefore that the houses of Kg. Serupil will receive the most impact from project activities. These potentially include noise and air pollution, traffic impacts, waste management and potential impact from forest fire. These and other potential impacts will be assessed in **Chapter 4**.

The Project Proponent has engaged residents of Kg. Serupil on the proposed Project, and has conducted a Community Census in the village (**Annex 2.7**). The main findings from the census are summarised below. **Table 3.10.18** summarises the key census information for Kg. Serupil.

Table 3.10.18: Kg. Serupil Census Data

Kg. Serupil Community Census Data: 25th August 2014	
Age of village	35 years
Population	175 (26 families)
Number of houses	21
Source of income	Rubber, oil palm, forest products and vegetables.
Public Facilities	Community hall, Church
Public Services	Medical staff from Pitas will visit every 6 months.
Electricity	No supply yet, although pylons are in place along the main road. Some homes have small generators.
Water	Villagers obtain water from wells and ponds. No supply from river or gravity supply.
Health	Common illness includes fever, malaria and dengue.
Waste	Common toilet with no septic tank. Solid waste is burned in open pits.
Transport	Villages only travel to the nearest town (Pitas) 2-3 times per month using private car. No public transport available. Gravel road provided.
Food	Sources of food are abundant.
Skills and Capacity	Residents mostly have natural skills such as farming, crafts, carpentry and construction. There is currently no business or trade within the village.

In terms of the villager's views of the forest reserve and the proposed Project, the following information was obtained during the census (**Annex 2.7**):

- The villagers identified the opportunity to work with the Project Proponent for forest reserve development, and the opportunity to get more land for farming activities, as having the potential to increase income. As mentioned in **Table 3.10.18**, the village is dependent on farming activities for income, and there is currently no trade or business within the village.

- As the villagers depend on farming activities, i.e. oil palm, rubber, vegetables and forest products, the Bengkoka Forest Reserve is important to them.

- The villagers are still pending grants from the Forestry Department to be resettled from the Bengkoka Forest Reserve. The villagers do not have land titles. To date 10 families have received 2.5 hectares each, and assistance with seedlings for fruit and rubber from the Forestry Department. As mentioned above the villagers identified the need for land provision so that they can earn income from farming activities. The village has applied for 500 acres of land from the Forestry Department, comprising 15 acres per family (approximately 400 acres) and 100 acres of reserve.

- The villagers hope that the Project Proponent is considerate to the rights of the villagers, gives priority for employment to the villagers and aids with the provision of basic infrastructure to the village.

- The villagers identified the existing environment (nature and land), and the rights of the villages and indigenous people as their main concerns in relation to the proposed Project. The villages suggested that the Project Proponent can assist the village through social development and the development of cultural, economic and natural resources.

The potential social economic impacts are assessed in detail in **Chapter 4**, with appropriate mitigation and monitoring measures recommended in **Chapters 5** and **6**, respectively.

CHAPTER FOUR

Impact Prediction and Evaluation

Chapter 4 Impact Prediction and Evaluation

4.1 Introduction

The following sections will outline and discuss the environmental impacts posed by the proposed project development and highlight the potential adverse impacts that may occur. The impact will be discussed for each stage of the project development, including plantation establishment, plantation operation and replanting.

4.2 Environmental Impacts

The following environmental impacts have been identified for this Project.

Main environmental impacts:

- Soil Erosion and Water Pollution;
- Waste Generation and Management; and
- Fire Hazard.

Other potential impacts:

- Ecological Impacts;
- Noise and Air Pollution;
- Traffic and Transportation Impacts;
- Socio-Economic Impacts; and
- Closure and Potential Abandonment.

4.3 EIA Matrix

The EIA Matrix in **Table 4.3.1** highlights the potential environmental impacts and classifies them numerically in relation to four (4) criteria:

- ❖ The magnitude of the possible changes.
- ❖ The permanence of project-related impacts.
- ❖ The reversibility of the project-related impacts.
- ❖ Cumulative impacts over time, if any.

Table 4.3.1: EIA Matrix

Impacts	Magnitude	Permanence	Reversibility	Cumulative
Key Environmental Impacts				
Soil Erosion and Water Pollution	2	2	2	2
Waste Generation and Management	2	2	2	2
Fire Hazard	2	1	1	1
Other Environmental Impacts				
Ecological Impact	2	1	1	1
Noise and Air Pollution	2	1	1	1
Traffic and Transportation Impacts	2	1	1	1
Socio-Economic Impacts	2	1	1	1
Closure and Potential Abandonment	1	1	1	1

Legend	**Number(s)**		
Criteria	**1**	**2**	**3**
Magnitude *Measure of the importance of the condition in relation to spatial boundaries*	Change/effect within project site only	Change/effect to local conditions and/or to areas immediately outside	Regional/national/ international change/effect
Permanence *To define whether the condition is temporary or permanent*	No change/not applicable	Temporary	Permanent
Reversibility *Measure of the control over the effect of the applied condition*	No change/not applicable	Reversible	Irreversible

Cumulative *Measure of whether the effect will be a single effect or a cumulative effect over time or a synergistic effect with other conditions*	No change/not applicable	Non-cumulative/ single	Cumulative

4.4 Zone of Impact

Table 4.4.1 below outlines the Zone of Impact (ZOI) for this Project by listing nearby land use features and identifying how these may potentially be impacted by project activities. The ZOI will be slightly different for each of the identified impacts, as listed in **Section 4.2**; therefore the ZOI is discussed in more detail in **Sections 4.5** and **4.6**, where it is addressed specifically for each different identified impact. The main ZOI for this Project will be rivers and streams which flow through the project site and any potential downstream water users **Table 4.4.1**.

Table 4.4.1: Zone of Impact

Zone of Impact	Location and Distance From Project Boundary	Potential Impact From the Project
Bengkoka Forest Reserve		
Rivers and streams	Within the project site	• Soil Erosion and Water Pollution • Waste Generation and Management • Ecological Impacts (Aquatic)
SAFODA Dam/ Reservoir	Within the project site	• Water Pollution
Kg. Serupil	50 m West	• Socio-Economic Impacts • Noise and Air Pollution • Fire Hazard • Traffic and Transportation Impacts • Waste Generation and Management
Kg. Bongkol	700 m South (Downstream of Sg. Bongkol)	• Soil Erosion and Water Pollution • Socio-Economic Impacts • Traffic and Transportation Impacts
Kg. Ungkup	1,100 m South (Downstream of unnamed streams)	
Kg. Gumba	400 m South (Downstream of unnamed streams)	• Soil Erosion and Water Pollution • Socio-Economic Impacts
Kg. Kandang	500 m North (Downstream of Sg. Kandang)	
Other surrounding settlements	Within 1,000 m of the project site boundary	
Existing fauna within the project site	Within the project site	• Ecological Impact • Fire Hazard
Tambalugu Forest Reserve		
Rivers and streams	Within the project site	• Soil Erosion and Water Pollution • Waste Generation and Management • Ecological Impacts (Aquatic)
Kg. Suang Duyang	500 m North / North-west	• Traffic and Transportation Impacts • Socio-Economic Impacts

Zone of Impact	Location and Distance From Project Boundary	Potential Impact From the Project
Existing fauna within the project site	Within the project site	• Ecological Impacts • Fire Hazard
Mangrove Vegetation	Within the project site	• Soil Erosion and Water Pollution
Bengkoka Peninsular Mangrove Forest Reserve (Class V)	Bordering the project site to the north	

4.5 Key Environmental Impacts

4.5.1 Soil Erosion and Water Pollution

During the plantation establishment stage, vegetation clearing will be required for the establishment of site facilities and infrastructure, including roads; and for the preparation of the planting area for ITP. Removal of vegetation will expose the soil surface to the elements, particularly rainfall, resulting in soil erosion. The establishment of site facilities, roads and drainage may also require minor earthwork, which will further loosen the soil surface, increasing the risk of erosion. Eroded sediments will be carried by surface run-off into the rivers and streams on the project site, increasing the Total Suspended Solids (TSS) content and turbidity of the receiving water, deteriorating water quality and resulting in sedimentation.

In addition to increased TSS, turbidity and sedimentation from soil erosion, water quality can also be impacted by improper waste management; leaks and spills from machinery and storage areas; and agrochemical usage.

The specific impacts from this project are discussed in detail below.

Zone of Impact

Increased Turbidity, TSS and Sedimentation:

As described in **Section 3.10.1.3** in **Chapter 3**, there are a number of rivers and streams within the project site (**Figure 3.10.1**). The main rivers in the Bengkoka Forest Reserve are Sg. Kandang, Sg. Malubang, Sg. Liu, Sg. Kisorong, Sg. Bongkol and Sg. Kakarangan. The remaining rivers and streams within the Bengkoka Forest Reserve are unnamed. All rivers and streams within the Bengkoka Forest Reserve flow out of the project site into the adjacent forestry operations, predominantly Acacia plantations, and small scale oil palm plantation. The rivers and streams flowing east will eventually drain to the Sulu Sea, and the rivers and streams flowing west will eventually drain to the South China Sea.

The unnamed streams in the Tambalugu Forest Reserve converge into one stream which discharges north into the adjacent mangrove forest reserve and into the Sulu Sea.

As described above exposed soil surfaces following the completion of site clearing will be subject to erosion. Eroded sediments will be washed into the rivers and streams on the

project site, as mentioned above, which will result in an increased Total Suspended Solids (TSS) content and turbidity of the receiving water course, this in turn will lead to sedimentation. In addition, the loss of valuable topsoil via erosion can be detrimental to the success of the plantation, as eroded soil will carry away nutrients essential for the ITP development. The potential impacts from erosion and the release of sediment are described below:

- Sediments suspended in the water column can reduce visibility and light penetration. This can have a significant impact on ecology in the rivers and streams within the project site. This will particularly affect the process of photosynthesis in aquatic flora, which may also impact on aquatic fauna which rely on aquatic flora for habitat, shelter and food source. These impacts may also occur downstream in the mangrove area of the Tambalugu Forest Reserve.

- Sedimentation can also have ecological impacts by smothering benthic organisms in the rivers and streams, damaging their habitat. A build-up of sediment on the bed of the river/ stream can also impact on fish feeding and breeding grounds. These impacts may also occur downstream in the mangrove area of the Tambalugu Forest Reserve.

- Sedimentation can also reduce the carrying capacity of the river/ stream. A build-up of sediment on the river/stream bed can potentially result in localized flooding, particularly during storm events.

- Sedimentation can also result in a change in the river profile, potentially affecting natural erosion and deposition, and in the long term contributing the changes in river alignment. The scale and significance of this impact will be determined by the amount of sediment released into the water course, which will in turn depend on the extent of site clearing, the methods used and the measures put in place to protect the soil from erosion and protect the rivers and streams from the sediment in surface run-off.

- High levels of TSS and turbidity can also impact on water supply. Water with a higher sediment content will require additional filtration prior to consumption, and may reduce the lifespan and effectiveness of existing filtration and treatment systems. Significant quantities of sediment in the water would render the water unsuitable for consumption and unfeasible to treat.

- High sediment content in the water will also reduce the aesthetic value of the water course.

- The eroded soil/ sediment may contain nutrients or pollutants, either naturally occurring from vegetation, or from site clearing operations. When eroded sediment enters the river/ stream, the water course will be polluted by these nutrients and pollutants, impacting on water quality, aquatic ecology and downstream water users.

With no measures in place to minimise soil erosion and protect the rivers and streams within the project site from sediment, the impacts as described above could be

significant. Of particular concern will be the potential impacts on downstream water supplies and aquatic ecology.

As described in **Section 3.10.5** in **Chapter 3**, the majority of the surrounding villages rely on rain-water and river-water as their primary water source, and the majority of the rivers used originate from within the project site, specifically the Bengkoka Forest Reserve. This includes Kg. Bongkol and Kg. Gumpa. Increase sediment content of the water will therefore make water treatment difficult, i.e. at the SAFODA Water Treatment Plant, and potentially contaminate the water supply, both through elevated sediment levels and also potential nutrients.

It terms of ecology, whilst a number of the streams on site are small, and may dry up during the dry season, it is noted that the larger rivers, such as Sg. Bongkol and Sg. Kandang will be home to more significant aquatic life. Increased sediment loads will therefore impact on this aquatic life, as described above. If fish feeding and breading grounds are affected this may have socio-economic impacts on the local communities who fish in the rivers. It is noted however that fishing activities within the project site are limited, as the project site is a managed forest reserve area. However it is anticipated that local communities do fish downstream of the project site, so any impacts on fish stocks within the project site will potentially affect these activities.

Potential flooding and hydrological changes from sedimentation are only likely to impact within the smaller rivers and streams on the project site itself, and any downstream impacts on settlements located close to the rivers would be minimal.

Any potential impact from sediments however is considered to be short term, whilst the plantation is being established. Once the plantation has been established, the risk of soil erosion will be reduced, as much of the ground will be covered by Eucalyptus. It is also noted that the rehabilitation and preservation of riparian reserves, as described in **Section 3.10.3** in **Chapter 3**, which were previously degraded in many areas, will further reduce the erosion risk. It was noted that during baseline water quality sampling, some of the streams on site contained elevated quantities of sediment (refer to **Section 3.10.1.6** in **Chapter 3**), this is likely due to upstream erosion of the riparian zones which would be reduced once the plantation has been established and is properly managed.

The Project Proponent will put measures in place to minimise erosion and sedimentation, thereby minimising the risk of the impacts described above and their potential severity. The main measures are for river protection, and include the provision of riparian reserves on all rivers and streams within the project site as described above and in **Chapter 3**. Other mitigation measures are detailed in **Chapter 5**. It is believed that with the implementation of proper measures to minimise soil erosion and protect the rivers and streams on site, sedimentation will be minimal. In the long term, the operation of the properly managed plantation with well-established riparian reserves will offer better protection to the rivers and streams in the area, compared to the lack of protection that the rivers and streams have currently.

Water Pollution from Agrochemicals:

Agrochemicals will be applied during the plantation establishment and plantation operation stages, as described in **Section 3.9** in **Chapter 3**. Chemical application will take place both at the nursery and in the field.

Agrochemicals can enter water courses in a number of ways. They may leak from agrochemical storage areas, they may be inadvertently sprayed directly into water courses during application, or they may be leached out of the soil or washed off the soil surface into water courses. This can occur during Project activities within the project site, or at the nursery within the project site.

The introduction of harmful chemicals, such as phosphate, contained in the agrochemical product, can impact on river ecology and also human health where the river water is used for domestic purposes within the site or downstream. A high level of nutrients in the water from fertilisers will accelerate the natural process of eutrophication and this phenomenon is usually associated with negative impacts towards the surrounding ecosystem such as an increase in phytoplankton biomass and the depletion of dissolved oxygen in the water.

Fish and other aquatic organisms may be harmed by pesticide-contaminated water. Pesticide from surface runoff can cause harm to fish in a particular area, if the levels are high enough. Pesticides can accumulate in bodies of water over time, eventually reaching levels that harm zooplankton, the main source of food for young fish. Pesticides can also cause harm to insects on which some fish feed, causing the fish to travel further in search of food and exposing them to greater risk from predators.

The application of agrochemicals must be done in a properly managed and controlled manner, and their storage must comply with all applicable regulations and guidelines. Any poor management of agrochemicals will potentially lead to water pollution, as described above, of the rivers and streams within the project site, as previously listed.

As described in **Section 3.10.5** in **Chapter 3**, the majority of villages surrounding the project site rely on river water for their water supply, and the majority of the rivers utilised by the communities originate from within the project site. This includes Kg. Bongkol, which obtains water from the SAFODA dam located on Sg. Bongkol within the Bengkoka Forest Reserve. Water pollution of the rivers and streams within the project site will therefore potentially have a significant impact on water supply downstream, as well as water supply to the Project basecamp on site, which will obtain water from the water reservoir proposed to be established at upstream Sg. Kandang.

In addition to the impacts on water supply, the aquatic ecology of the river and streams on site is also at risk from agrochemicals. As previously described, the introduction of nutrients from agrochemicals into the river or stream will accelerate the natural process of eutrophication, which will impact on the ecosystem of the river/ stream, including increasing the phytoplankton biomass and depleting dissolved oxygen in the water. Terrestrial fauna who rely on the river/ streams within the project site as a source of water, will also be affected should they consume the contaminated water.

If agrochemical application is poorly managed and there are no measures in place to protect the rivers and streams within the project site, the impacts as described above could be significant. Of particular concern will be the potential impacts on downstream water supplies and aquatic ecology.

The first step in proper agrochemical management is to minimise the need for agrochemicals in the first place. In order to do this, the Project Proponent will implement proper waste management practices, particularly for biomass and where possible use biological pest controls, as per the recommendations in **Chapter 5**.

The Project Proponent will ensure the proper management and application of fertilizers, as per the requirements detailed in **Chapter 5**, to ensure that their storage and use does not impact on the environment. If used in a suitable quantity for the area of application it is noted that the fertilizer should be completely absorbed by the seedlings, minimising the likelihood of fertilizer being released into surface water.

It is noted however that the Project Proponent will exclude the Sg. Bongkol water catchment from the Project. In addition the Project Proponent proposes to establish a water reservoir on the unnamed stream upstream of Kg. Gumpa, and a water catchment areas will be established within the project site upstream of Sg. Kakarangan and on Sg. Kandang (**Figure 3.7.1**). These measure will be implemented to protect downstream water supplies. Riparian reserves will also be established on all permanent rivers and streams within the site, to protect the water courses.

With the implementation of the measures described above and the mitigation measures described in **Chapter 5**, water pollution from agrochemical contamination is expected to be minimal.

Water Pollution from Waste, Leaks and Spill:

The indiscriminate disposal of waste into the rivers and streams within the project site will cause water pollution, impacting on downstream water users and aquatic ecology. The wastes anticipated to be generated during plantation establishment are biomass, solid/ domestic waste, construction waste, sewage and scheduled waste. Sewage and scheduled waste in particular have the potential to cause significant water pollution if not managed properly on site. The potential impacts from improper waste management are described in **Section 4.5.2**.

Leaks and spills from machinery involved in the Project may also impact on water quality, if the substance enters the water course. Leaks and spills can reach the water course directly, via site drainage, or via ground water flow if leaks to ground leach into the soil and ground water. This is a concern if the machinery and equipment used is in poor condition, or if maintenance is not conducted in a proper workshop area with impermeable floor and suitable drainage. Leaks and spills may also occur if properly bunded and sheltered storage areas for fuel, oils etc. are not provided, and do not contain adequate drainage with oil traps.

Water quality deterioration from the sources described above can have a significant impact on downstream water supply, as described above, including Kg. Bongkol and other surrounding villages. At particular risk will be the settlements downstream Sg. Kandang, i.e. Kg. Kandang, at the Basecamp where hazardous substances will be stored, is located upstream of this river. Poor waste management practices and no proper mitigation and protection measures can therefore lead to a significant impact on water quality, aquatic ecology and downstream water users.

It is imperative therefore that project activities do not cause water pollution and that proper waste management practises are in place (**Chapter 5**). In terms of oil, fuel and other hazardous substances, proper storage facilities and workshop should be provided as per the requirements in **Chapter 5.** With proper management practices and mitigation measures in place, it is likely that any potential impact on water quality will be minimal.

4.5.2 Waste Generation and Management

4.5.2.1 Biomass

The improper management and disposal of biomass can lead to the following impacts:

- Water pollution of the rivers and streams within the project site. The indiscriminate disposal of biomass into water courses will result in water pollution through the introduction of increased amounts of organic matter. The breakdown of this organic matter will utilise oxygen, therefore depleting the oxygen levels in the water which will impact negatively on aquatic ecology.

- The indiscriminate disposal of biomass to land can also attract pests, which will impact on the site workers and potentially residents of nearby settlements such as Kg. Serupil (50 m away from the Bengkoka Forest Reserve), as they will be a nuisance and may carry diseases. It is important therefore that biomass is properly spread evenly over the ground for natural decomposition, to avoid the build-up of large amounts of biomass in one place.

Biomass will be produced from the clearing of existing vegetation for the project development. Clearing will be minimised where possible, and will be limited to areas where necessary for the project development. Clearing will be required for the planting of Eucalyptus, the establishment of the basecamp and road establishment.

The total area identified for ITP within the project site is approximately 5,625 Ha, this includes the area identified for the basecamp. The quantity of biomass generated over this area through clearing, can be calculated based on the assumption that clearing will generate 185 tonnes of biomass per hectare[1]. Based on this approximately 962,000 tonnes of biomass is anticipated to be generated during site clearing within the area identified for ITP.

[1] *Biomass calculation is based on biomass generation from land clearing for the development activities (Mohamad Husin et al, 1986).*

If proper mitigation measures and biomass management are not implemented, the potential impacts as described above could be significant, due to the large amount of clearing required over 5,625 Ha. It is therefore imperative for the biomass to be appropriately managed. As described in **Chapter 3**, all biomass will be left in-situ for natural decomposition. Where there are patches of heavy residual biomass, this will be spread and crushed using an excavator, however where possible the Project Proponent will minimise machine contact on the ground. Natural decomposition will benefit the soil quality and protect the exposed soil surface. The Project Proponent will also adopt the zero-burning policy.

Providing that the mitigation measures in **Chapter 5** are implemented, any impact from biomass is expected to be minimal.

4.5.2.2 *Solid/Domestic Waste*

Solid and domestic waste will be generated by the workers on the project site at the main basecamp, including site office, workers' quarters etc. Improper management and disposal of solid/ domestic waste can lead to the following impacts:

- Water pollution. The indiscriminate disposal of solid waste into the rivers, streams and drains within the project site can lead to water pollution. This can impact on the aquatic ecology of the rivers and potentially the water quality for human use.

- Waste that is not disposed of into waste bins will attract pests such as rats and dogs (if present). These pests may carry diseases, which will impact on the health and safety of site workers, and potentially nearby communities such as Kg. Serupil.

- The improper storage and disposal of waste on site will be an eye sore, create an unpleasant odour and impact on the aesthetic value of the site. All of which will impact on the site workers at the basecamp.

As stated in **Section 3.9.1** in **Chapter 3** approximately 178 staff and workers will be required during plantation establishment. This number will be reduced to approximately 125 during plantation operation and replanting. Based on the assumption that 0.87 kg of waste is generated per person per day, it is estimated that 154.9 kg of waste will be generated per day during plantation establishment and 108.8 kg per day during operation and replanting stage. If this waste is not properly managed, the impacts as described above may result, however with the estimated quantities, it is not anticipated that this impact would be significant.

As stated in **Section 3.9.1** in **Chapter 3** a waste dumping pit will be established within the project site, which will be utilised for disposing general domestic solid waste. The location is shown on **Figure 3.9.1**. The Project Proponent will also implement recycling on site to minimise the quantity of waste generated, as described in the FMP (**Annex 2.3**).

Providing that solid/ domestic waste is managed properly on the project site, and that the mitigation measures in **Chapter 5** are implemented, the impact from solid/ domestic waste will be minimal.

4.5.2.3 Scheduled Waste

Utilization and storage of scheduled waste and hazardous materials such as lubricant, oil, fuel etc. at the workshop and agro-chemicals at the chemical/ fertiliser storage area, can potentially pollute the surrounding environment especially the soil if there is accidental spillage or leakage incidents. These materials could possibly end up in the waterways if washed away during heavy rainfall or used in a large volume. The impact from these contaminants is significant and harmful to aquatic life as oxygen would be blocked by the contaminants. Moreover, the spillage of oil and grease would be unsightly.

The zone of impact associated with scheduled waste and hazardous substances would be the rivers and streams within the project site. The release of scheduled waste and other hazardous substances into the rivers and streams on the site would pollute the water, having a significant impact on the aquatic flora and fauna, terrestrial wildlife that consume the water, and human water usage downstream (refer to **Section 4.5.1** for water pollution impacts).

As described in **Chapter 3**, the basecamp will be located in Coupe 1, in the vicinity of the unnamed stream flowing west out of the project site. Any accidental releases of spills at the basecamp could potentially pollute this stream. This may affect the downstream water catchment area on Sg. Kandang within the project site, which in turn will affect the water supply to downstream settlements, i.e. Kg. Kandang.

The potential impact from scheduled waste management is therefore significant, particularly concerning water pollution, however providing that proper waste storage facilities are provide, and scheduled waste is managed properly as per the measures in **Chapter 5**, the impact will be minimal.

4.5.2.4 Sewage

The release of untreated sewage into site drains or natural water courses can cause significant water pollution, by increasing the BOD and the amount of *E.coli*. The introduction of untreated sewage will cause eutrophication and the spread of pathogens that are detrimental to human and animal health. Sewage may carry pathogenic organisms that can transmit diseases to humans and animals. Contaminants in sewage water such as BOD, COD and pathogenic micro-organisms may result in the growth of algae and weeds. This can cause the degradation of water quality, reduction of oxygen levels and create an aesthetically unappealing environment.

The proposed Project will contribute to increased levels of BOD accumulation in the nearby rivers and streams within the project site. This water pollution may become a potential health hazard to the workers residing within the project site at the basecamp, and potentially downstream water users, as described in **Section 4.5.1**.

Sewage will be generated on site at toilet facilities blocks provided at the main basecamp, as described in **Section 3.9.1** and illustrated on **Figure 3.9.1**. The main basecamp will be located in Coupe 1, upstream of Sg. Kandang flowing west out of the project site. Any release of untreated sewage may therefore find its way, through surface run-off, tributary streams or through ground leaching, into this stream. This will lead to water pollution of the river as described earlier, and may also affect the downstream water catchment area within the project site, which in turn will affect the water supply to downstream settlements, i.e. Kg. Kadang. It is important therefore that sewage is properly treated and managed.

If the sanitary facilities provided are not sufficient and/ or not maintained, the effluent released into the nearby streams and rivers may contain approximately 9.091 kg/day of BOD, or an instantaneous increase of BOD level of 0.210 mg/l. This is based on an estimated population of 178 (See **Table 4.5.1** and detailed BOD loading calculation in **Annex 2.4**).

It is important to note that any deterioration of natural waterways, no matter how small, will eventually present a health hazard to humans, aquatic flora and fauna, and terrestrial fauna that drink from the rivers, as previously described. It is therefore important that the Project Proponent implement suitable sewage treatment systems, such as septic tanks, at all facilities on the project site, to avoid pollution of the rivers and streams within the site and downstream. Proper mitigation measures must therefore be implemented, as described in **Chapter 5**.

Table 4.5.1: Estimated BOD for Treated and Untreated Sewage

Estimated Population[1]	Effluent Characteristics[1]	Estimated BOD Loading (kg/day)	Instantaneous Increase of BOD Level (mg/L)
178	Untreated Sewage BOD = 225 mg/l	9.091	0.210
178	Treated to Standard B BOD = 50 mg/l	2.020	0.047
178	Treated to Standard A BOD = 20 mg/l	0.808	0.019

4.5.3 Fire Hazard

As described in **Chapter 3**, the project site has been subject to severe forest fires in the past, and therefore the risk of forest fire is high. The ENSO (El Nino Southern Oscillation) phenomenon is the primary driver of fire risk within the project areas, and causes prolonged dry periods resulting in very dry forest conditions. This normally occurs 2-3 times a decade.

Fires in forested areas can also be human caused, particularly where fire is used for shifting cultivation activities, these fires may become out of control and spread to forested areas. Fires can also be established in camps by workers to clear areas for the planting of crops, and may also become out of control and spread to adjacent forested

areas. Thousands of hectares of forest in Sandakan and Tawau were destroyed in the 80s and 90s by forest fires.

The impacts from fires are significant. Fire-induced loss of soil-cover and the negative affect on hydrological regimes and soil properties, leads to severe erosion and loss of productive topsoil. Besides local impact, forest fires also exert regional and global environmental impacts. Large-scale forest fires reduce air quality and affect human health. They can also result in the loss of property and lives.

Once the plantation is established, fire can have a serious impact on the ITP operations within the project site and surrounding plantations and forest reserves. There is also the potential to impact on Kg. Serupil, the nearest houses of which are located within 50 m of the project site boundary, potentially resulting in damage to property and risk of life. If fire were to spread into the bordering Acacia plantations surrounding the project site, the nearby settlements located in this area, such as Kg. Kakarang and Kg. Kapok may also be affected.

It is anticipated however that with the implementation of this Project, the risk of fire will be significantly reduced. In its present conditions the forest within the project site is severely degraded, with dead or dying trees and grassland areas. The forest canopy is relatively open and the forest floor is often dry with significant fine fuel loadings from dead leaf material.

The likelihood of fire is expected to be highest during prolonged drought periods, i.e. between February and May. The Project Proponent therefore proposes to undertake a number of measures for fire prevention and control; these are detailed in the FMP (**Annex 2.3**) and in **Chapter 5**. The Project Proponent will produce a Fire Management Plan during the Project planning stage, prior to the implementation of activities on the project site.

4.6 Other Potential Impacts

4.6.1 Ecological Impacts

As described in **Section 3.10.2** the majority of the project site has very poor flora diversity. The majority of the project site is covered with invasive Acacia, which in many areas has suffered from extensive forest fires and fungus (*Ceratocystis sp.*). Although there are some common native secondary plant species within the project site, these do not form healthy stands.

It is noted however that during a limited study SFD identified *Shorea kudatensis* (Yellow Meranti), within the identified riparian zone on the project site, which is critically endangered and endemic to Bengkoka peninsular. It is also noted that along the northern boundary of the Tambalugu Forest Reserve, within the project site, there is an area of Mangrove. In addition within the Tambalugu Forest Reserve, there are some flowing and fruit bearing plants, which provide fruit and nectar to feeding animals and insects.

The Project Proponent will exclude the mangrove area from the Project, and will identify endangered and protected trees within the project site where these are found. It is believed however, that as the majority of the project site is Acacia, the impact on flora diversity during project implementation will be minimal. As the Project Proponent will protect and enhance degraded conservation areas within the project site, such as riparian reserves and water catchment areas, the floral diversity of the project site will be improved.

Although the majority of the project site is in a degraded state, and floral diversity is poor, it is still able to support a reasonable population of wildlife, as detailed in **Section 3.10.2** in **Chapter 3**. A number of the species identified within the project site are listed as vulnerable or near threatened on the IUCN Red List, including Sambar Deer, Pig-tailed macaque, buff-necked Woodpecker and Sun Bear. Sun Bear is also listed as totally protected under Schedule 1 of the Wildlife Conservation Enactment 1997. A number of other species identified within the project site are listed as protected species under Schedule 2 of the Wildlife Conservation Enactment 1997, including Pangolin, which is also listed as critically endangered on the IUCN Red List. It was also noted in the fauna surveys that the Tambalugu Forest Reserve is home to butterflies, which are considered to be an important part of an ecosystem.

The clearing of the existing vegetation for the establishment of ITP will have a significant impact on the habitat of these wildlife species, and others found within the site, including birds. Habitat and food sources will be destroyed, forcing the wildlife to seek refuge elsewhere and find alternative food sources. While most species may be able to tolerate this and escape, some species that are habitat sensitive will inevitably not survive.

During site clearing, there is also a risk that wildlife will become trapped within the project site, on isolated patches of vegetation. The clearing and replanting programme therefore should be arranged to ensure that wildlife are able to leave the project site. Development should be in phases, and should be directional toward surrounding undisturbed forested areas, in order to ensure wildlife escape in this direction to new habitat. To facilitate the movement of wildlife through the site, it is important that areas of natural vegetation are maintained, such as riparian reserves.

The migration of larger wildlife and birds to adjacent areas will put additional strain on these areas, and there will be direct competition with the existing wildlife in these areas for territory, habitat, food sources etc. In addition it is noted that the surrounding land use is mostly acacia plantations, therefore available habitat in surrounding areas will be limited and subject to change. Smaller animals may find it harder to migrate, and therefore will rely on the provision of conservation areas within the project site, including riparian reserves and water catchment areas. Beneficial insects and those even smaller, may suffer and vanish as the vegetative waste disappears and with it their shelter.

The Project may also impact on aquatic ecology in the river and streams within the project site and downstream, as described in **Section 4.5.1**. It is important therefore that proper measures are in place to protect the natural water courses.

As detailed in **Section 3.10.3**, the Project Proponent has conducted a HCVF assessment of the project site, which includes the determination of areas of biodiversity value, which

should be preserved within the project site. Based on the outcome of this assessment the Project Proponent will demarcate approximately 740 Ha of the project site area for conservation purpose, and this includes riparian reserves, water catchment, mangrove forest and water reservoirs. Where necessary the Project Proponent will also enhance these areas with local forest species where they have become degraded, to restore ecological function, as described in **Section 3.9.1**. The proposed management of the HCV areas is detailed in the FMP (**Annex 2.3**).

It is noted that the management intensions of the Project Proponent will significantly enhance the flora and fauna diversity in the forest, and in the long term be ecologically beneficial. Although there will inevitably be a reduction in habitat which may result in the eventual loss of individual species during plantation establishment, once the plantation is established the Project will enhance floral diversity within certain areas of the project site, creating more habitat and providing more food sources for wildlife.

In addition, the existing and sometime sparse Acacia mangium forest will be replaced with closely planted Eucalypt species. Eucalyptus grows more quickly and closed canopy is achieved more quickly and no less than 70% of the ITP area should be under closed canopy conditions and remain that way for the rotation period. This will be beneficial to the wildlife within the project site.

In order to reduce any impact to the fauna within the project site, all the recommended mitigation measures detailed in **Chapter 5** should be implemented.

4.6.2 Noise and Air Pollution

During site clearing activities for the establishment of ITP, fugitive dust from the cleared vegetation and exposed soil may be carried by the wind to the nearest receptor of Kg. Serupil (50m away). Dust may cause a nuisance and potential health risk to the residents. There may also be dust impact on the main road, i.e. Jalan Mongkubou Laut, reducing visibility and creating unsafe driving conditions.

The operation of machinery during site clearing will also generate noise which, depending on the levels generated, may also cause a nuisance to nearby residents.

Baseline air sampling for Total Suspended Particulates (TSP) and baseline noise monitoring were conducted in Kg. Serupil. TSP levels were well within the prescribed limits; however the noise levels were currently relatively high i.e. above the prescribed limits for noise sensitive areas. The elevated noise levels can be attributed to the wind and human activities, as detailed in **Section 3.10.1** in **Chapter 3**.

It is anticipated however that dust and noise impacts from the Project will be minimal.

During clearing the Project Proponent will minimize disturbance to the soil surface, and leave the biomass waste crushed in-situ to protect the soil surface. Dust generation from the exposed soil during clearing will therefore be minimal.

The noise generated during clearing is also anticipated to be minimal, and will only be audible when operations are in the vicinity of the houses in Kg. Serupil. In addition operations will be limited to daylight hours. Dust and noise from construction and operations at the basecamp within the site will not have any impact on the neighbouring communities, and the basecamp is located a significant distance (> 3 km) from the surrounding settlements.

Nevertheless to minimize any potential impact from dust and noise, the mitigation measures in **Chapter 5** should be implemented.

There is also the potential for air pollution on a local and regional scale from forest fires, as described in **Section 4.6.3**.

4.6.3 Traffic and Transportation Impacts

As described in **Chapter 3**, Jalan Mongkubou Laut passes through the project site and provides access to the project site in Bengkoka Forest Reserve, and ultimately the Tambalugu Forest Reserve via Jalan Suang Duyang.

Jalan Mongkubou Laut will be utilized for project activities within the Bengkoka Forest Reserve, and the internal road network, as shown on **Figure 3.7.1**, will branch off from Jalan Mongkubou Laut. The internal road network within the project site in Tambalugu Forest Reserve will connect to Jalan Suang Duyang, which does not pass through the project site.

The majority of the transportation activities for this Project will be limited to within the Project Site on the internal road networks, which within the Bengkoka Forest Reserve will include Jalan Mongkubou Laut. Transportation activities will also take place between the Bengkoka and Tambalugu Forest Reserve, utilizing Jalan Mongkubou Laut and Jalan Suang Duyang. The following transportation activities will be associated with this Project:

1. **Mobilisation of workers, machinery, equipment and construction materials to the project site.**

   When the project commences workers, machinery, equipment and construction materials will need to be transported to the project site, primarily for the establishment of the required site facilities at the main basecamp.

2. **Transportation of seedlings from the off-site production nursery to the on-site holding nursery, and then to the field.**

   During plantation establishment, seedlings will be transported from an existing off-site nursery to the holding nursery which will be established at the basecamp. Form the holding nursery they will then be transported to the field.

3. **Transportation of harvested logs.**

   During harvesting stage, logs will be transported from the project site to buyers. Logs will also be transported from the site during the salvage logging stage during plantation establishment.

4. **General operations.**

   Site clearing, preparation and planting activities will require the movement of vehicles within the project site and along connecting roads between the Bengkoka Forest Reserve and the Tambalugu Forest Reserve, i.e. Jalan Mongkubou Laut and Jalan Suang Duyang. Plantation maintenance will also require the use of these roads.

5. **Transportation of waste from the site.**

   As previously described the Project Proponent will establish a waste dumping pit within the project site and the main basecamp, and biomass will be left in-situ for natural degradation. The removal of waste from the project site to off-site waste disposal facilities will therefore be limited to scheduled wastes.

Jalan Mongkubau Laut passess through Kg. Serupil, and is also used to access other nearby villages such as Kg. Bongkol and Kg. Ungkup. Jalan Suang Duyang passes through Kg. Suang Duyang (**Figure 3.2.1**). There is the potential for the transportation activities listed above to impact these settlements and other road users as follows:

- Increased traffic flow and traffic congestion, impacting on the daily routine of the residents and road users.
- Increased risk to the safety of residents and other road users from increased congestion and the movement of heavy vehicles.
- Damage to the road surface from the movement of heavy vehicles.
- Dust dispersion on the road surface, affecting visibility of the road and impacting on nearby residents.

It is noted that the road surface of Jalan Mongkubau Laut and Jalan Suang Duyang within and in the vicinity of the project site is unmade, i.e. gravel and dirt. Impacts from dust and damage to the road surface are therefore more likely to occur and affect the residents of Kg. Serupil and Kg. Suang Dayang, and other road users. Consideration should be given to improving the road surface along these routes, with the permission of the local authority and land owners.

The traffic impact from general operations within the site during plantation establishment and plantation operation, is considered to be minimal. Although activities will utilize Jalan Mongkubou Laut and Jalan Suang Duyang to access the project site, once on site the

Project Proponent will establish small camps from which operations in each area will be conducted, this will minimize transportation activities.

The traffic impacts from mobilization, seedling transport and harvesting may potentially be more significant, as these activities involve transportation to and from the project site utilizing the main road of Jalan Mongkubau Laut, which may impact on other settlements along the road to the south of the project site, including Kg. Beluoh, Kg. Darong, Kg. Manggis and potentially Pitas Town. It is noted however that these operations will be short term during that particular phase of the Project.

Providing that the mitigation measures in **Chapter 5** are implemented, the impacts from traffic and transportation activities is considered to be minimal.

4.6.4 Socio-Economic Impacts

As described in **Section 3.10.5** in **Chapter 3**, there are a number of settlements in the vicinity of the project site, the closest of which are Kg. Serupil (200 m west/ south), Kg. Kakarangan (200 m east) and Kg. Kapok (300 m west). The nearest houses to the project site however are within Kg. Serupil, located within 50 m of the project site boundary (Bengkoka Forest Reserve). The nearby settlements, in particular Kg. Serupil, may receive the following impacts from project activities:

- ***Air and noise pollution:*** The generation of dust and noise during plantation establishment, has the potential to impact on houses located close to the project site boundary. This impact is assessed in **Section 4.6.4**.

- ***Traffic and Transportation Impacts:*** Transportation activities associated with the project along Jalan Mongkubou Laut and Jalan Suang Duyang, may impact on the settlements along these routes, including Kg. Serupil and Kg. Suang Duyang. Transportation activities may cause traffic congestion, safety issues and damage to the road surface, which will impact on the nearby residents and other road users. This impact is assessed in **Section 4.6.5**.

- ***Waste Generation and Management:*** Kg. Serupil and other surrounding settlements, may be affected if waste within the project site is not managed correctly, for example through pest infestation from improper management of biomass. The impacts from waste are discussed in **Section 4.5.2**.

- ***Fire Hazard:*** Due to the proximity of Kg. Serupil to the project site boundary, forest fires within the project site may spread to the village. Other surrounding villages may also be affected is the fire were to spread to adjacent Acacia plantation areas. The risk of forest fire is assessed in **Section 4.6.3**.

One of the key social and economic concerns for the surrounding villages however is the potential impact on water supply, from pollution of the rivers and streams within the project site. Kg. Serupil utilize wells and a natural pond within the village for water supply, and so are unlikely to be affected by water pollution on the project site. As described in **Section 3.10.5** in **Chapter 3** however, the majority of the adjacent villages

reply on rain-water and rivers as their primary water source. The majority of the rivers utilised by the adjacent communities originate from within the project site, specifically the Bengkoka Forest Reserve. Kg. Bongkol for example get their water supply from the SAFODA dam located on Sg. Bongkol within the Bengkoka Forest Reserve.

Water pollution of the rivers and streams utilized by surrounding settlements can have a significant impact on the lives and health of the communities, whether through body contact with contaminated water or consumption. Water pollution is assessed in **Section 4.5.1**.

In addition to the impacts described above, the Community Census survey conducted by the Project Proponent on Kg. Serupil identified that one of the main concerns of the residents was the impact that the Project would have on their livelihood and land. The residents of Kg. Serupil identified that the villagers are dependent on the land within the Bengkoka Forest Reserve, as they are depending on rubber, oil palm, forest products and vegetables for income. The villagers are currently pending grants from the Forestry Department to be excised from the forest reserve and allocated grants and land with land titles.

The residents anticipate that the Project Proponent will offer employment to the local population, aid with basic infrastructure, promote social and economic development, and provides land for farming.

The Project Proponent recognizes that the Project will have an impact on the surrounding communities. The Project Proponent will therefore work closely with the local communities to ensure minimal impact on them from the Project, and where possible to determine how the Project and other initiatives can help the local communities, socially and economically. As detailed in the FMP (**Annex 2.3**), the Project Proponent will determine what socio-economic impacts the Project may have on local communities, and determine how to minimize these and improve the socio-economic status. This includes the provision of, where required, resources within the project area to which local communities may be entitled to. The Project Proponent will institute a Community Development Programme, which will identify potential socio-economic impacts and potential socio-economic improvements, as detailed **Annex 2.3**, and summarized in **Chapter 5**.

It was also identified in the Community Census at Kg. Serupil that there are limited trade and business within Kg. Serupil. It is expected therefore that the Project will have a positive impact on Kg. Serupil, by providing employment and business opportunities to the residents, and where required the provision of land to farm. Initiatives will be implemented through the Community Development Programme.

It is anticipated that with the implementation of proper mitigation measures, as detailed in **Chapter 5**, and the Project Proponent's intentions to work closely with surrounding communities through a Community Development Programme, negative socio-economic impacts should be minimal. It is anticipated through the implementation of community development initiatives, that the Project will be beneficial to the local community.

4.6.5 Closure and Potential Abandonment

The license for the management and operation of the Bengkoka and Tambalugu Forest Reserves is for 100 years (**Annex 2.1**), after which time the decision will be taken to either extend the license or cease operation. If the license is extended then the area will continue operation and be replanted as per the established 10 year rotation cycle. If the decision is taken to cease operation, then the project site will be closed. If the license if not extended, the Project Proponent must implement all Sabah Forestry Department closing procedures, after which time the working area will effectively be closed for all access and work for an entire rotation cycle. The Project Proponent must also adhere to EPD requirements to ensure that abandoned structures, equipment, scheduled wastes, etc. have no significant adverse impact on the environment after closure, as per the measures in **Chapter 5**.

The Project may also be abandoned during implementation and operation as a result of certain circumstances, such as funding issues, due to a change in policy and management objectives, or a change in the overall plan for the project area. It is unlikely however that the Project will be abandoned mid-way through the license period however, as the license has been awarded to the Project Proponent by Sabah Forestry Department, whom are driving the rehabilitation and management of the Bengkoka and Tambalugu Forest Reserves. If abandonment does occur however, the Sabah Forest Department closing procedures will apply, as well as EPD requirements.

The environmental impact from project abandonment will depend on what stage the Project is abandoned. If the Project is abandoned following site clearing, for example, then areas of the project site may be left in an exposed and degraded state, which may result in soil erosion, a reduction in soil quality and water pollution through sedimentation. The open forest and exposed ground would also represent a significant fire risk, provides less preferred habitat for wildlife and lead to further Acacia invasion. If the Project is abandoned during other stages, i.e. planting/ operation, the site will also decline further into a degraded state.

Abandonment of the Project during the maintenance stage, or after the license expiry, will likely be less damaging to the environment. By this time the area will have been planted and the planted trees are likely to be partially or fully established.

When the Project is abandoned, a restoration programme shall be executed to ensure that the site is left in a stable condition of replanted ITP, where environmental impact is minimal.

CHAPTER FIVE

Recommended Mitigating Measures

Chapter 5 Recommended Mitigation Measures

5.1 Introduction

The following recommended mitigation measures are outlined in accordance with the environmental impacts presented and discussed in **Section 4.5** and **Section 4.6** in **Chapter 4**.

The Project Proponent must adhere to all the conditions detailed in the License Agreement (**Annex 2.1**) during the Project. The relevant measures from the license agreement have also been included in the sections below.

5.2 Key Mitigation Measures

5.2.1 Soil Erosion and Water Pollution

The following mitigation measures should be implemented to minimise soil erosion and water pollution:

- The project boundary should be clearly demarcated on the ground prior to any work commencing on the site. Clearing should not be conducted beyond the project site boundary and should be limited to where necessary for the project development. Clearing should not be conducted within any of the identified conservation areas, with the exception of the removal of degraded trees and vegetation for enrichment and rehabilitation planting with natural forest species, where necessary and permitted.

- Vegetation clearing should be completed in phases according to the compartment/ blocking plan and schedule detailed in the Coupe Development Plans, which will be submitted with the Annual Work Plans to Sabah Forestry Department. Each coupe will divided into compartments of 200 to 600 Ha, which will be further sub-divided into Blocks of approximately 24 Ha each. Salvage logging should also follow the detailed scheduled in the Coupe Development Plans.

- The total contiguous area of land to be cleared at any one time should not exceed 100 Ha. Once the maximum 100 Ha has been cleared, operations must start in that area, including planting, before clearing commences in adjacent

areas. Large areas must be subdivided into mosaic patterns separated by at least 50 m buffers or in a chequered pattern.

- Cleared planting areas shall be planted with the final crop as soon as possible acknowledging the fact that clearing is recommended to be done during the dry season and that planting is only done during the rainy season. Linkages to seedling production, which is also seasonal, shall also be taken into account.

- The weather should be taken into account during site clearing, i.e. land clearing activities should be confined to dry periods only (if possible).

- Bulldozers should not be used for site clearing, as these are damaging to the soil surface. Alternative, less damaging machinery, such as excavators should be used.

- Biomass generated from site clearing and salvage logging should be left in-situ to decompose. Patches of more significant quantities of residual biomass, which are in danger of producing piles of biomass, should be spread and crushed with an excavator.

- Where applicable for project operations, Reduced Impact Logging (RIL) should be implemented as detailed in the License Agreement.

- Road gradients should not exceed 8° (15%), in order to avoid excess surface erosion.

- Where stream crossing is required proper culverts of bridges should be constructed. Blocking of the water course if prohibited, and construction should be completed without machinery and equipment entering the water course.

- Areas within the project site with a slope gradient of more than 25° these should be excluded from development activities and preserved as conservation areas (**Figure 6.2.1**). Delineation of steep slope areas should be based on physical conditions in the field rather than on topographic maps.

- Where development on slopes is required, the slope length should be minimised as far as possible using accepted methods such as cross-drains, and cross-slope clearing patterns. Terracing however is prohibited within the project site, i.e. a licensed forest reserve area.

- Where soil erosion is identified on the project site, appropriate erosion control measures should be implemented, such as temporary protection with plastic sheets, turfing etc., as appropriate to the situation on site.

- Proper roadside drainage should be implemented along all roads within the project site. The roadside drainage system should be equipped with basic earthen construction sedimentation traps at intervals, which should discharge to vegetated areas and not directly to the rivers and streams on site.

- A proper drainage system should be established at the main basecamp. The basecamp drainage system should discharge to vegetated areas. Discharging directly to rivers or streams is prohibited.

- All drainage systems should be maintained regularly, or immediately after a heavy downpour to maintain their effectiveness.

- All permanent rivers and streams within the project site should be provided with a suitable width riparian reserve, which is determined based on the width of the river/ stream. A 30-m wide riparian reserve should be provided on each bank of the main permanent rivers and streams identified within the project site, as shown on **Figure 6.2.1**. All remaining streams, should be provided with the appropriate riparian reserves in accordance to Sabah Forestry Department requirements for forest reserves (**Figure 6.2.1**) (**Table 5.2.1**). Riparian reserve requirements should be finalised through ground truthing for each Coupe, with the finalised requirements being detailed in the Coupe Development Plans. Although not a requirement to provide riparian reserves on non-permanent water courses, it is recommended to do so.

Table 5.2.1: Riparian Reserve Guidelines

River Width (m)	River Reserve Width
> 5	30 m
< 5	5 m

- All riparian reserves should be clearly demarcated on the ground with sign posts and red paint, prior to the commencement of site clearing activities.

- The water catchment areas shown on **Figure 6.2.1** should be clearly demarcated on the ground. Project activities within these areas, with the exception of enrichment and rehabilitation planting with natural forest species, are prohibited.

- The mangrove forest within the project site should be provided with a 50-m buffer zone around its perimeter within the project site (**Figure 6.2.1**). The buffer zone and mangrove forest should be clearly demarcated on the ground. Project activities within these areas, with the exception of enrichment and rehabilitation planting with natural forest species within the buffer zone, are prohibited.

- The water reservoirs as shown on **Figure 6.2.1** should be provided with a 50-m buffer zone around their perimeter within the project site. The water reservoir and buffer zone should be clearly demarcated on the ground. Project activities within these areas, with the exception of enrichment and rehabilitation planting with natural forest species within the buffer zone, are prohibited.

- Agrochemicals and other hazardous substances such as fuel and oil should be stored according to current government regulations and should be handled with care. Any used containers are either to be returned to the supplier(s) or collected for disposal via government approved disposal routes. Storage areas should be

a minimum of 50 m away from the nearest natural water course, and should be provided with suitable bund, drainage systems with oil traps and be sheltered.

- The use of agrochemicals should be controlled, with emphasis on the amount and timing of application. The management team should closely supervise and regulate the method, dosage, timing and frequency of agrochemical application in order to save cost and minimise wastage and environmental pollution.

- Where possible organic fertilisers should be used to minimise the use of chemicals.

- The indiscriminate spraying of agrochemicals onto neighbouring lands, conservation areas and rivers or streams is strictly prohibited and spraying operations close to these areas should be closely monitored.

- The usage of agro-chemicals must be according to the rules and regulations as stipulated under the Pesticides Act 1974. The use of pesticides, weedicides and similar substances is to be minimised as far as possible. Priority should be given to biological control and manual weeding, where possible.

- While fertilisers and agrochemicals should be applied on wet surfaces to have maximum effect, care must be taken to apply these compounds at times where surface run-off is minimal.

- The main basecamp and smaller camps located within the plantation should be located a minimum of 30 m away from the nearest natural water course, and should not be located within a conservation area.

- The mitigation measures detailed in **Section 5.2.2** should be implemented to minimise water pollution from waste generated on the project site.

- All relevant complaints from local communities concerning water pollution should be logged and promptly addressed.

- Regular water quality monitoring should be conducted the rivers and streams within the project site, as per **Table 6.2.1** in **Chapter 6**.

5.2.2 Waste Generation and Management

Biomass

The following mitigation measures should be implemented to minimise impacts from the generation and management of biomass:

- Biomass generated from site clearing and salvage logging should be left in-situ to decompose. Patches of more significant quantities of residual biomass, which

are in danger of producing piles of biomass, should be spread and crushed with an excavator.

- Burning of biomass is strictly prohibited. Zero-burning policy should be implemented.

- All conservation areas, rivers and streams should be clear of biomass. Disposal of biomass into these areas is strictly prohibited. Any biomass entering natural water courses should be immediately removed.

Solid / Domestic Waste

The following mitigation measures should be implemented to ensure that solid / domestic waste is managed properly, to avoid any adverse impact on the environment:

- Good housekeeping and waste management practices should be implemented at all times on the project site, including at the main basecamps and smaller camps that will be established throughout the plantation. Waste bins with lids must be provided and used and recycling facilities should also be provided.

- The waste dumping pit provided on site should be located a minimum of 50 metres away from nearest natural water course. The dumping pit should be properly managed and maintained to ensure that it does not become overfilled and to ensure the area around the pit remains free from waste. The dumping pit should not be located within any conservation area (**Figure 6.2.1**).

- The indiscriminate disposal of waste to land, conservation areas, natural water course and drainage systems is strictly prohibited.

- The main basecamp and smaller camps located within the plantation should be located a minimum of 30 m away from the nearest natural water course, and should not be located within a conservation area (**Figure 6.2.1**).

- The waste management hierarchy should be implemented on site, i.e. avoid (where possible avoid waste generation), reduce (if waste generation cannot be avoided then it should be reduced), reuse (where possible waste, such as plastic bottles, should be reused), recycle (if waste cannot be reused it should be recycled), dispose (only if the waste cannot be reused or recycled, then it should be disposed). Recycling facilities should be provided on site.

Scheduled Waste

The following mitigation measures should be implemented to ensure scheduled waste is managed properly, to avoid any adverse impact on the environment:

- The generation of any scheduled waste should be notified in writing to the Director General of the Department of Environment (DOE). The notification

should be completed in the form prescribed in the Second Schedule (Notification of Scheduled Wastes).

- Scheduled waste, including spent oil, (if any) must be stored as per the requirements of the Environmental Quality (Scheduled Waste) Regulations 2005 and its subsequent 2007 amendment. Scheduled waste must be stored in suitable containers with proper labelling in a bunded and sheltered area. The storage area must be located at least 50 metres away from any natural water course, and should comply with the guidelines on Export, Import and Storage of Scheduled Wastes in Malaysia. These requirements include:
    - A concrete floor and roof.
    - The entire storage area should be surrounded by a concrete dyke or other equivalent structure designed to contain waste under the worst spillage condition (110% of the capacity of the largest tank).
    - The dyked area to be graded to a sump.
    - There should be no openings in the dyke that may allow surface runoff to enter and leave the site.
    - An area should be designated for loading and unloading containers so that any spill will be contained.
    - Skid tanks and fuel depot should contain any spills.
- Permanent and temporary oil and fuel storage tanks must be placed on a firm, dry base, bunded and be surrounded by drains and sumps. Fire fighting equipment such as fire extinguishers, fire blankets, etc. must be fully functional and readily accessible near to oil and fuel storage facilities at all times. The storage area should be located at least 50 metres away from any natural water course.
- All scheduled waste shall be disposed of by DOE licensed transporters in accordance with the Environmental Quality (Scheduled Waste) Regulations 2005 and its subsequent 2007 amendment.
- The direct discharge of scheduled waste to land, natural water course or drains is strictly prohibited.

Sewage

The following mitigation measures should be implemented to ensure that sewage is managed and treated properly, to avoid any adverse impact on the environment:

- Proper sanitary facilities, i.e. toilets with septic tanks should be provided at the main basecamp and smaller basecamps established within the plantation. These facilities must be at least 50 metres away from the nearest natural water course.

- Sewage treatment systems should comply with Standard B of the Environmental Quality (Sewage) Regulations 2009 (**Annex 1.10**); these should be maintained routinely.

- The discharge of raw sewage directly to ground, drains or natural water courses is strictly prohibited at all times.

5.2.3 Fire Hazard

The following mitigation measures should be implemented to minimise the risk from fire:

- The Fire Management Plan should be completed and implemented prior to the commencement of project activities on the project site. A copy of the Fire Management Plan should be provided to the relevant authorities as per their requirements, and Environment Protection Department.

- The Fire Management Plan should provide details on annual, daily and special fire preparedness and fire prevention.

- Fire-fighting equipment should be provided at suitable locations within the project site. This should be routinely inspected and maintained.

- As part of annual preparedness prior to the dry season, all fire-fighting equipment should be in good working order; regular fire drills should be conducted; critical access roads should be in good condition; water sources and water points should be checked; and all plans and procedures should be updated and briefed to staff.

- A fire prevention plan should be produced and reviewed with Bomba, Sabah Forestry Department and District Officer.

- A fire danger rating system should be adopted as described below as a daily fire prevention tool, and detailed in the Forest Management Plan.

Table 5.3.1: Fire Danger Rating and Prevention Activities

Fire Danger Rating System	Prevention Activities
Low	Activate Level 1: Enhanced staff/ public awareness
Moderate	Activate Level 2: Notify kampongs/ staff/ Contractors regarding fire danger
High	Activate Level 3: Ban all fires; notice to be given to all communities to discourage any burning. Patrol to enforce.

Fire Danger Rating System	Prevention Activities
Extreme	Activate Level 4: Consider shutting down all activities in the project area. Place all on standby.

- The Forest Fire Rescue Officer, and his team, should be appointed and be responsible for all fire preparedness and prevention within the project site.

- Water bodies should be established within the project site for easy access in the event of a fire, this includes the identified water reservoirs as shown on **Figure 6.2.1**. Water holes should be constructed at strategic locations for water storage.

- The existing fire watch towers within the Bengkoka Forest Reserve should be retained and used to give early warning of a fire on site (**Figure 6.2.1**). Watch towers should also be established in suitable locations in the Tambalugu Forest Reserve and if deemed necessary additional watchtowers should be established in the Bengkoka Forest Reserve. Watch tower location should be identified in the Fire Management Plan.

- All staff should be made aware of the risk of fire, and trained in fire prevention and control.

- Open burning is strictly prohibited.

- An under-storey of green vegetation consisting of soft weeds should be maintained throughout the plantation.

- Roads should be maintained to ensure that they are effective as fire-breaks. Requirement for any additional fire breaks should be determined prior to the commencement of work on the project site, and should be detailed in the Fire Management Plan and detailed Coupe Development Plan.

5.3 Other Potential Impacts

5.3.1 Ecological Impacts

The following mitigation measures should be implemented to ensure minimal ecological impact:

- Vegetation clearing should be minimised as far as possible and completed in phases according to the compartment/ blocking schedule detailed in the Coupe Development Plans. Where possible directional clearing and planting should be implemented. Clearing should be completed toward adjacent forested areas, and as stated in the Licence Agreement towards wildlife protection areas, to prevent wildlife becoming isolated and trapped within the project site.

- The mangrove forest within the project site should be provided with a 50-m buffer zone around its perimeter within the project site (**Figure 6.2.1**). The buffer zone

and mangrove forest should be clearly demarcated on the ground. Project activities within these areas, with the exception of enrichment and rehabilitation planting preferably with mangrove species where conditions are suitable or other natural forest species within the buffer zone, are prohibited.

- Riparian reserves should be implemented as detailed in **Section 5.2.1**.

- The Sabah Wildlife Department must be informed if there are any encounters with protected/endangered wildlife within the project site, so that appropriate actions can be taken. If protected/endangered wildlife are encountered, project activities must cease in that area until Sabah Wildlife Department can be consulted.

- Sabah Wildlife Department must be notified not less than 30 days before any land clearing and conversion takes place.

- Sabah Wildlife Department should be notified immediately in the event that wildlife needs to be rescued. This may occur if the wildlife becomes trapped and unable to move into safer areas. Wildlife rescue and translocation is at the cost of the Project Proponent. Sabah Wildlife Department should also be notified immediately in the event that wildlife become injured or killed due to project activities.

- Where *Shorea kudatensis* and other protected or endangered species of flora are identified within the project site, these should be protected from project activities.

- Fishing within the project site is prohibited, unless permission is obtained from the Director of Sabah Forestry Department. Appropriate signage should be erected.

- Hunting within the project site is prohibited, and appropriate signage should be erected on site. Site workers are prohibited from carrying weapons that can be used for hunting.

- The Project Proponent must take adequate action to prevent illegal hunting in the project site, including the provision of guard houses at all entrances to control entry and exit, regular patrols and training to educate staff and workers. The Project Proponent should liaise closely with Sabah Forestry Department and Sabah Wildlife Department where necessary.

- The mitigation measures identified in **Section 5.2.1** should be implemented to minimise ecological impact from water pollution.

- The mitigation measures identified in **Section 5.2.2** should be implemented to minimise ecological impact through improper waste management.

- The mitigation measures identified in **Section 5.2.3** should be implemented to minimise ecological impact from forest fires.

5.3.2 Noise and Air Pollution

The following mitigation measures should be implemented to minimise noise and air pollution:

- To minimise dust dispersion, vehicle speed within 100 m either site of Kg. Serupil along Jalan Mongkubou Laut should be limited to 30 km/h. Appropriate signage should be erected.

- The use of old and run-down vehicles and machinery should be avoided, as these tend to generate excessive noise. Vehicles and machinery should be regularly maintained and fitted with mufflers to reduce noise propagation where appropriate.

- If generator sets are required, these shall be enclosed to reduce noise propagation. Before generator sets can be used, permission to do so should be obtained from the Department of Environment (DOE) Sabah.

- For their safety and comfort, all workers working in high noise level areas should be provided with appropriate Personal Protective Equipment (PPE), such as ear-plugs or ear-muffs. Workers should not be exposed to noise levels exceeding the equivalent continuous sound of 90 dB(A) for a period of 8 hours or more or exceeding the limits specified in the First Schedule of the Factories and Machinery (Noise Exposure) Regulation, 1989.

- Open burning is strictly prohibited.

- All relevant complaints from local communities and road users concerning noise and air pollution should be logged and promptly addressed.

- Noise and air monitoring should be conducted as per the requirements outlined in **Section 6.2.5** in **Chapter 6**. The monitoring locations are shown on **Figure 6.2.1**.

5.3.3 Traffic and Transportation Impacts

The following mitigation measures should be implemented to minimise impacts from traffic and transportation activities:

- Vehicle speed should be limited to 30 km/h within 100 m either site of Kg. Serupil along Jalan Mongkubou Laut. Within the project site vehicle speed should be limited to 50 km/h for general plantation roads and 15 km/hr at or near camps. Appropriate signage should be erected.

- Sign boards should be erected at all entrances to the project site, and along Jalan Mongkubou Laut and Jalan Suang Duyang, particularly where project site

roads connect to these main public roads. This signs should warn road users of the Project activities and the movement of slow heavy vehicles (**Figure 6.2.1**).

- Transportation activities involving heavy vehicles along the main public roads should be scheduled to avoid peak traffic hours and to ensure the volume generated is not concentrated over a short period of time. The movement of heavy vehicles on public roads should be staggered throughout the day, to reduce the impact on traffic flow and road safety.

- Trucks should never be overloaded and all loads should be properly secured, and where necessary covered, to prevent spillage onto the public roads.

- On the public roads, vehicle drivers should comply with all the traffic requirements of the Public Works Department, Road Transport Department and Local Authorities.

- All relevant complaints from members of the public relating to road safety and site transportation activities should be logged and investigated, with appropriate actions being taken.

- Any damage caused to the public roads of Jalan Mongkubou Laut and Jalan Suang Duyang by project transportation activities should be repaired immediately.

5.3.4 Socio-Economic Impacts

The following mitigation measures should be implemented to minimise any social or economic impacts:

- The mitigation measures in **Section 5.2.1** should be implemented to minimise social economic impacts from water pollution, and to protect water supply to the surrounding communities.

- The mitigation measures in **Section 5.2.2** should be implemented to minimise social economic impact from improper waste management.

- The mitigation measures in **Section 5.2.3** should be implemented to minimise social economic impacts from fire hazards.

- The mitigation measures in **Section 5.3.2** should be implemented to minimise social economic impacts from air and noise pollution.

- The mitigation measures in **Section 5.3.3** should be implemented to minimise social economic impacts from transportation activities.

- Priority for employment should be given to the local communities. Where skills are lacking appropriate training should be provided.

- The Project Proponent should resolve any issues with local communities and relevant authorities, relating for forest resources (if any), prior to the commencement of project activities.

- The Community Development Programme, implemented through the Community Development Team, should be designed to achieve the following:

    - Identify viable economic activities that would have strong impact on the social economic well-being of the rural communities in the project areas;

    - Identify the main social and physical infrastructure requirements to improve the quality of life of the rural communities; to enhance accessibility in area of difficult communication and to facilitate economic development;

    - Identify and quantify socio-economic parameters that measure impacts of various initiatives to be implemented by the Project Proponent; and

    - Be consistent with generally accepted, international standards governing forest plantation certification, i.e. no activity shall be carried out that directly prevents future certification.

- All relevant complaints from the local communities regarding any element of the project should be recorded and action should be taken to rectify the issues.

5.3.5 Closure and Potential Abandonment

Upon license expiry, or in the unlikely event of early termination of the license agreement of abandonment, the following measures should be implemented, which includes measures as stipulated in the License Agreement:

- The Project Proponent should abide by all conditions of the License Agreement before the end of the license period. This includes not completing any felling within thirty (30) days of the license expiry date, and removal of all felled logs within one (1) month after final felling.

- Upon expiry or early termination of the license agreement the Project Proponent shall leave in good a safe order all fixed assets, such as roads base-camp facilities and infrastructure etc., which will subsequently become property of the Sabah State Government. This is as per the conditions in the license agreement.

- In the unlikely event of abandonment or early termination of the license agreement, an abandonment plan or equivalent should be prepared as per the requirements of the Sabah Forestry Department, to ensure the site is left in a stable condition, i.e. replanted ITP, for future management.

- A closure or abandonment report should be prepared for EPD not later than two calendar months after the date of closure or abandonment.

- All machinery and equipment which is the property of the Project Proponent should be removed from the project site.

- All waste should be removed from the site and disposed of according to the relevant local authority regulations depending on the waste type. All scheduled waste must be removed by DOE licensed transporters, to a DOE approved disposal site. Decomposable material, for example wood, may be left on the ground within the site to decompose naturally, providing that the material is not contaminated in any way.

- Any contaminated soil, particularly at the camps, should be cleaned or removed.

- Areas within the site that have been cleared of vegetation should be re-vegetated with local species.

- A site visit should be carried out two (2) months after abandonment (if any). This is to ensure that the site has been left in a state that does not pose any health, safety or environmental impacts on the site or in the surrounding area.

CHAPTER SIX

Recommended Monitoring Programmes

Chapter 6 Recommended Monitoring Programmes

6.1 Introduction

This chapter outlines the methods to monitor compliance with the recommended mitigation measures in **Chapter 5**, and to monitor the effectiveness of those measures. The monitoring programme is necessary to ensure that the mitigation measures are being implemented, that they are effective and practical and that where necessary improvements can be made.

There are two types of monitoring proposed for the Project:

1. **Compliance Monitoring.** Compliance monitoring is a one-time or periodic gathering of evidence to ensure compliance with the recommended mitigation measures.

2. **Impact Monitoring**. Impact monitoring is designed to monitor the effectiveness of the mitigation measures through sampling, monitoring and visual inspections. The impact monitoring locations are illustrated on **Figure 6.2.1**.

6.2 Monitoring Programme

The following sections describe the compliance and impact monitoring requirements for this Project. The monitoring programme should be completed on a quarterly basis during plantation establishment, then twice yearly (during dry and wet season) for the following 3 years of the operational phase, then annually in the middle of the rainy season thereafter.

6.2.1 Soil Erosion and Water Pollution

6.2.1.1 Compliance Monitoring

- Site layout plan showing the project site boundary and photographs (with dates and GPS coordinates) to show the clear demarcation of the project site boundary on the ground.

- Photographs (with dates and GPS coordinates) following the completion of clearing in a cleared area to show the boundary between the cleared area and

adjacent non-cleared area, to demonstrate that non-cleared areas, i.e. conservation areas and outside the project site boundary, are left intact.

- Compartment/ blocking plan with schedule, demonstrating phased implementation of the Project within each Coupe. The plans and schedule should demonstrate that the total contiguous area being cleared at any one time does not exceed 100 Ha, and that for larger cleared areas mosaic patterns are being implemented, with suitable buffer or in a chequered pattern.

- Schedule for clearing and planting, demonstrating that the time between clearing and planting is minimized as far as possible. Photographs (with dates and GPS coordinates) should be provided when planting has been completed in one cleared area, to demonstrate the completion of the planting activity.

- Photographs (with dates and GPS coordinates) demonstrating that bulldozers are not being used for site clearing, and that less damaging machinery such as excavators are being employed.

- Photographs (with dates and GPS coordinates) showing biomass being left in-situ to decompose naturally following clearing. Photographs should also show crushing and spreading where biomass load is more significant and in danger of producing piles of biomass.

- Photographs (with dates and GPS coordinates), demonstrating that road gradients do not exceed 8° (15%).

- Site layout plan and photographs (with dates and GPS coordinates) showing all stream crossings within the project site, and their structure and condition.

- Site layout plan and photographs (with dates and GPS coordinates) showing any identified areas with slope > 25°, excluded from development activities.

- Photographs (with dates and GPS coordinates) showing any measures in place to reduce slope length, where required.

- Photographs (with dates and GPS coordinates) showing the provision of a proper drainage system at the main basecamp, roadside drainage including sediment control measures, and the implementation of erosion control measures where soil erosion has been identified on site (if any). Photographs should demonstrate drainage to vegetated areas.

- Site layout plan and photographs (with dates and GPS coordinates) showing the provision and clear demarcation of riparian reserves on rivers and streams within the project site.

- Site layout plan and photographs (with dates and GPS coordinates) showing the provision and clear demarcation of water catchment areas within the project site.

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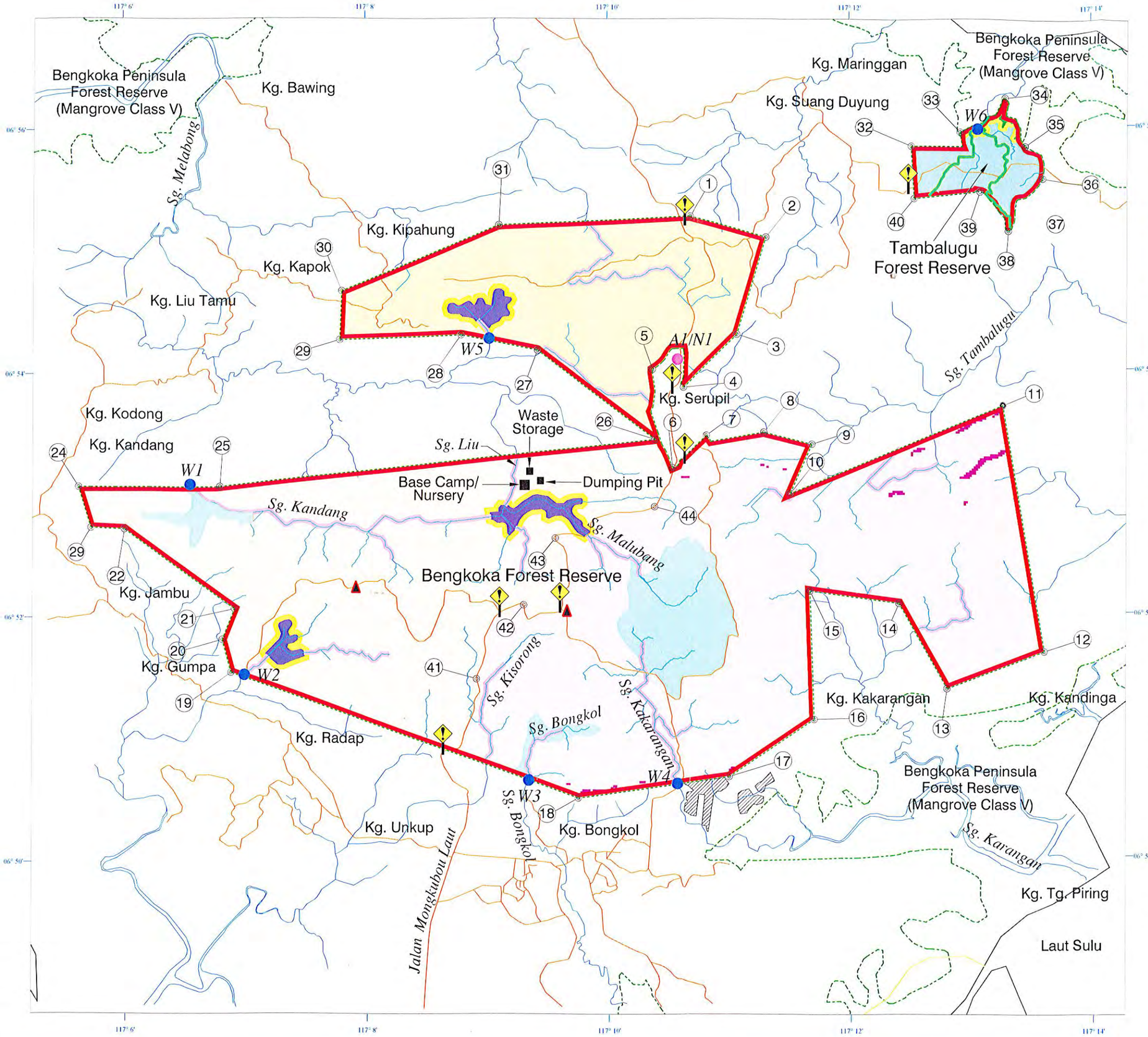
ENVIRONMENTAL IMPACT ASSESSMENT

Forest Management of Bengkoka and Tambalugu Forest Reserves (6,467 Ha), Pitas, Sabah.



LEGEND:

- Project Boundary (Bengkoka Forest Reserve and Tambalugu Forest Reserve)
- Forest Reserve Boundary
- Road
- River/Stream
- A1/N1 Air & Noise Monitoring Point
- W1-W6 Water Monitoring Points
- 30m Riparian Reserve
- 50m Buffer Zone
- 5m Riparian Reserve
- Traffic Signage
- Bengkoka Peninsula Forest Reserve (Mangrove Class V)
- Water Catchment - Approx. 371 Ha (to be confirmed through ground assessment)
- Water Reservoir - Approx. 72 Ha) (to be confirmed through ground assessment)
- >25° Slope - Approx. 17 Ha (to be confirmed through ground assessment)
- Coupe 1
- Coupe 2
- Coupe 3
- Coupe 4
- Oil Palm Plantation
- Existing Fire Towers

Point	Coordinates	
1	6° 55' 15.96" N	117° 10' 41.16" E
2	6° 55' 05.50" N	117° 11' 18.64" E
3	6° 54' 17.64" N	117° 11' 04.20" E
4	6° 53' 51.72" N	117° 10' 37.56" E
5	6° 54' 00.60" N	117° 10' 22.23" E
6	6° 53' 12.12" N	117° 10' 32.16" E
7	6° 53' 27.99" N	117° 10' 49.08" E
8	6° 53' 29.40" N	117° 11' 17.52" E
9	6° 53' 23.49" N	117° 11' 41.24" E
10	6° 52' 59.16" N	117° 11' 30.48" E
11	6° 53' 42.00" N	117° 13' 15.96" E
12	6° 51' 40.68" N	117° 13' 36.12" E
13	6° 51' 22.68" N	117° 12' 47.88" E
14	6° 52' 04.80" N	117° 12' 24.12" E
15	6° 52' 11.19" N	117° 11' 40.10" E
16	6° 51' 07.92" N	117° 11' 42.00" E
17	6° 50' 39.87" N	117° 10' 59.84" E
18	6° 50' 29.84" N	117° 09' 44.92" E
19	6° 51' 32.40" N	117° 06' 52.92" E
20	6° 51' 48.60" N	117° 06' 48.60" E
21	6° 52' 03.72" N	117° 06' 54.72" E
22	6° 52' 43.32" N	117° 06' 00.36" E
23	6° 52' 44.04" N	117° 05' 43.76" E
24	6° 53' 04.20" N	117° 05' 37.68" E
25	6° 53' 03.97" N	117° 06' 47.64" E
26	6° 53' 26.16" N	117° 10' 23.52" E
27	6° 54' 10.30" N	117° 09' 25.30" E

Point	Coordinates	
28	6° 54' 18.00" N	117° 08' 47.54" E
29	6° 54' 15.94" N	117° 07' 47.34" E
30	6° 54' 39.96" N	117° 07' 48.36" E
31	6° 55' 11.98" N	117° 09' 06.26" E
32	6° 55' 49.77" N	117° 12' 30.76" E
33	6° 55' 56.48" N	117° 12' 54.87" E
34	6° 56' 13.20" N	117° 13' 17.27" E
35	6° 55' 49.54" N	117° 13' 27.32" E
36	6° 55' 33.83" N	117° 13' 35.89" E
37	6° 55' 23.02" N	117° 13' 23.23" E
38	6° 55' 07.85" N	117° 13' 18.86" E
39	6° 55' 27.14" N	117° 13' 04.83" E
40	6° 55' 23.94" N	117° 12' 32.20" E
41	6° 51' 28.56" N	117° 08' 54.57" E
42	6° 52' 04.84" N	117° 09' 18.05" E
43	6° 52' 37.74" N	117° 09' 33.88" E
44	6° 52' 53.04" N	117° 10' 23.14" E

GRID
-The numbered lines indicate the WGS84 datum latitude & longitude

0 0.5 1 1.5 2 2.5 3Km

SCALE IN KILOMETRES (1:58,000) – A3 MEDIUM

Proposed Mitigation Measures and Monitoring Locations

Figure: 6.2.1

- Site layout plan and photographs (with dates and GPS coordinates) showing the clear demarcation of mangrove areas within the project site, and the provision and clear demarcation of a 50 m buffer around the perimeter of the mangrove areas.

- Site layout plan and photographs (with dates and GPS coordinates) showing the clear demarcation of water reservoirs within the project site, and the provision and clear demarcation of 50 m buffer around the perimeter of the water reservoirs.

- Site layout plan and photographs (with dates and GPS coordinates) showing the storage area for agrochemicals and hazardous substances, in compliance with all applicable government regulations. Layout plan and photographs should demonstrate that the storage area is a minimum of 50 m from the nearest natural water course, bunded, sheltered and provided with suitable drainage system.

- Site layout plan and photographs (with dates and GPS coordinates) showing that the main basecamp and smaller camps are located a minimum distance of 30 m from the nearest natural water course, and not located within a conservation area.

- A record of all relevant complaints from local communities relating to water pollution, with details of the actions taken.

- Refer to **Section 6.2.2** for waste generation and management monitoring requirements, which are also associated with water pollution.

6.2.1.2 Impact Monitoring

- Visual inspection to ensure that vegetation clearing is only been conducted within the project site boundary, only where necessary for development, and not within the conservation areas, with the exception of the removal of degraded trees and vegetation for enrichment and rehabilitation planting.

- Visual inspection of the drainage systems provided on the project site. This is to ensure that they are fit for purpose, properly constructed, properly maintained, free from any blockage and able to operate at maximum efficiency.

- Visual inspections of the riparian reserves provided on the project site, ensuring these are properly demarcated on the ground and are the correct width.

- Visual inspection to ensure the provision and proper demarcation of the 50 m buffer around the perimeter of the mangrove areas within the project site.

- Visual inspection to ensure the provision and proper demarcation of the 50 m buffer around the perimeter of the water reservoirs within the project site.

- Regular monitoring of water quality should be conducted in the rivers and streams within the project site. The monitoring locations are shown on **Figure 6.2.1**. The monitoring schedule will be developed to ensure that the monitoring is undertaken in the active areas of the project site, i.e. monitoring will not be undertaken in areas of the project where project activities have yet to commence. The sampling requirements are presented in **Table 6.2.1**. The results will be compared to Class IIB of the National Water Quality Standards Malaysia (NWQSM) (**Annex 1.3**).

Table 6.2.1: Proposed Water Quality Monitoring Programme

Sampling Point	Parameters	Compliance	Sampling Commencement	Frequency
W1	pH, Temperature, DO, BOD, COD, TSS, Turbidity, Ammoniacal Nitrogen, Oil and Grease, Total Coliform Count, Faecal Coliform Count, Phosphorus, Potassium, Paraquat.	Class IIB of the NWQSM	Upon commencement of Project	Quarterly during plantation establishment stage. Twice yearly during the first 3 years of plantation operation (in wet and dry season). Annually in the middle of the rainy season after 3 years of operation.
W2			Upon commencement of activities in Coupe 1	
W3			Upon commencement of activities in Coupe 2	
W4				
W5			Upon commencement of activities in Coupe 3	
W6			Upon commencement of activities in Coupe 4	

All chemical analyses will be carried out by laboratories accredited under Skim Akreditasi Makmal Malaysia (SAMM), by the Department of Standards Malaysia.

6.2.2 Waste Generation and Management

6.2.2.1 Compliance Monitoring

Biomass

- Photographs (with dates and GPS coordinates) showing biomass being left in-situ to decompose naturally following clearing. Photographs should also show crushing and spreading where biomass load is more significant and in danger of producing piles of biomass.

Solid/ Domestic Waste

- Photographs (with dates and GPS coordinates) demonstrating that general waste disposal and recycling facilities are provided on the project site.

- Site layout plan and photographs (with dates and GPS coordinates) showing the location of the waste dumping pit, located a minimum of 50 m away from the nearest natural water course and not within any identified conservation area.

- Photographs (with dates and GPS coordinates) of any observed indiscriminate disposal of waste to land, conservation areas, natural water course and drainage systems.

- Site layout plan and photographs (with dates and GPS coordinates) showing the main basecamp and smaller camps located at least 30 m away from the nearest natural water course and not within a conservation area.

Scheduled Waste

- A record of all scheduled waste generated on site, including a copy of the notifications given to DOE.

- Site layout plan and photographs (with dates and GPS coordinates) showing the provision and location of the scheduled waste storage area (if required), a minimum of 50 m away from any natural water course. The photographs should demonstrate all the storage area features required to satisfy legal requirements, such as a proper bund and shelter.

- Site layout plan and photographs (with dates and GPS coordinates) showing the location of permanent and temporary fuel and oil storage tanks located at least 50 m from any natural water course, demonstrating that these are placed on a firm, dry base, bunded and surrounded by drains and sumps. The photographs should also show that fully functional firefighting equipment is readily accessible near to the oil and fuel storage facilities.

Sewage

- Photographs (with dates and GPS coordinates) showing the provision of proper sanitary facilities, i.e. toilets with septic tanks.

6.2.2.2 *Impact Monitoring*

- Visual inspection of the condition of the waste disposal and recycling facilities, including the disposal pit, to ensure they are being managed to a good standard.
- Visual inspection to ensure that waste, including biomass, solid waste, scheduled waste and sewage is not been indiscriminately disposed to land, conservation areas, site drainage or natural water courses.
- Visual inspection for any signs of open burning on the project site.
- Visual inspection of the general cleanliness of the project site.
- Visual inspection of the scheduled waste and hazardous substances storage areas to ensure that they are fit for purpose.

6.2.3 Fire Hazard

6.2.3.1 *Compliance Monitoring*

- Copy of the Fire Management Plan, including fire prevention plan. Copies of correspondence relating to these plans demonstrating submission and approval from relevant authorities such as Bomba, Sabah Forestry Department and District Officer.
- Details of the Forest Fire Rescue Officer and his team.
- Photographs (with dates and GPS coordinates) showing the provision of firefighting equipment at suitable locations within the project site.
- Site layout plan and photographs (with dates and GPS coordinates) showing the provision of fire watch towers within the project site.
- Photographs (with dates and GPS coordinates) showing the provision of an under-storey of green vegetation.
- Site layout plan and photographs (with dates and GPS coordinates) showing the provision of water bodies and water storage within the project site.

- Site layout plan and photographs (with dates and GPS coordinates) showing the provision and maintenance of roads as fire breaks, and any additional fire breaks established by the Project.

6.2.3.2 *Impact Monitoring*

- Visual inspection for any signs of open burning.

6.2.4 Ecological Impacts

6.2.4.1 *Compliance Monitoring*

- Compartment/ blocking plan with schedule, demonstrating phased implementation of the Project within each Coupe. The plans and schedule should demonstrate that the vegetation clearing is directional and has been determined and executed to allow wildlife ample time and escape routes to flee to neighboring areas. Where possible photographs (with dates and GPS coordinates) should be provided to demonstrate the implementation of these methods on site.

- Site layout plan and photographs (with dates and GPS coordinates) showing the clear demarcation of mangrove areas within the project site, and the provision and clear demarcation of a 50 m buffer around the perimeter of the mangrove areas.

- A copy of all notifications given to Sabah Wildlife Department for project commencement, wildlife encounters, wildlife fatalities or injuries, and wildlife rescue. Details and records of actions taken, where applicable must be recorded.

- Site layout plan and photographs (with dates and GPS coordinates) showing the location and protection of endangered plant species that have been identified within the project site during operations (if any).

- Photographs (with dates and GPS coordinates) of no hunting and fishing signs provided within the project site.

- Site layout plan and photographs (with dates and GPS coordinates) showing the provision of guard houses, signs and other measured to prevent illegal hunting within the project site.

6.2.4.2 *Impact Monitoring*

- Visual inspection of all of all conservation areas and buffer zones, to ensure that they have been implemented and are in good condition, and to ensure that no development, activities, and waste storage and disposal is taking place within these areas.

6.2.5 Noise and Air Pollution

6.2.5.1 Compliance Monitoring

- Photographs (with dates and GPS coordinates) showing the provision of signboards indicating a 30 km/h speed limit within 100 m either site of Kg. Serupil along Jalan Mongkubou Laut.

- Photographs (with dates and GPS coordinates) showing the location of the generator sets (if required), in enclosed areas. Permits to operate the generators, from the DOE, should also be presented.

- Photographs (with dates) showing the provision and use of PPE in high noise producing areas.

- A record of all relevant complaints from local communities and road users relating to air and noise pollution, with details of the actions taken.

6.2.5.2 Impact Monitoring

- Visual inspection for any signs of open burning.

- Visual inspection of the vehicles on site to ensure that these are not old and run-down.

- Visual inspection of any generators used on site, to ensure these are enclosed and in good condition.

- Regular noise and air monitoring should be carried out at the nearest receptor to the project site, i.e. the nearest house in Kg. Serupil. The monitoring locations are shown on **Figure 6.2.1**. **Table 6.2.2** and

  Table 6.2.3 below summarize the monitoring requirements. All results shall be submitted to the Environment Protection Department (EPD).

Table 6.2.2: Proposed Noise Level Monitoring Programme

Sampling Point	Parameters	Compliance (Schedule 1)	Frequency
N1 (Kg. Serupil)	L_{90} dB(A)	Day Time (7 am – 10 pm): 50 dB(A) Night Time (10 pm – 7 am) 40 dB(A)	Quarterly (Plantation Establishment)

Table 6.2.3: Proposed Air Quality Monitoring Programme

Sampling Point	Parameters	Compliance	Frequency
A1 (Kg. Serupil)	Total Suspended Particulates	260 µg/m^3	Quarterly (Plantation Establishment)

6.2.6 Traffic and Transportation Impacts

6.2.6.1 Compliance Monitoring

- Photographs (with dates and GPS coordinates) showing the provision of appropriate speed limit signboards within the project site and in the vicinity of Kg. Serupil along Jalan Mongkubou Laut.

- Photographs (with dates and GPS coordinates) showing the provision of signboards at all entrances to the project site, and along Jalan Mongkubou Laut and Jalan Suang Duyang, particularly where project site roads connect to these main public roads. This signs should warn road users of the project activities and the movement of slow heavy vehicles.

- Photographs (with dates and GPS coordinates) demonstrating that trucks are not overloaded and that loads are properly secured and covered as required.

- A record of all relevant complaints from members of the public relating to road safety and site transportation activities, with details of the actions taken.

- Photographs (with dates and GPS coordinates) of the general condition of Jalan Mongkubou Laut and Jalan Suang Duyang where they provide access to the project site and will be utilised by project vehicles.

6.2.6.2 Impact Monitoring

- Visual inspection of the condition of the project site access roads of Jalan Mongkubou Laut and Jalan Suang Duyang, where they provide access to the project site and will be utilised by project vehicles.

6.2.7 Socio-Economic Impacts

6.2.7.1 Compliance Monitoring

- A record of workers employed on the project site.

- A record of any relevant complaints from the local communities and details of the actions taken.

6.2.7.2 *Impact Monitoring*

- None.

6.2.8 Closure and Potential Abandonment

6.2.8.1 *Compliance Monitoring*

- Operations schedule demonstrating that felling is not being completed within 30 days of license expiry, and that all felled logs will be removed from the site within one (1) month after final felling.
- Site layout plan and photographs (with dates and GPS coordinates) showing the location of all fixed assets, retained on the project site in good condition.
- Photographs (with dates and GPS coordinates) showing the project site after abandonment, demonstrating that all machinery, equipment, waste and contaminated soils have been removed.
- Copy of the abandonment plan or equivalent, in the unlikely event of abandonment or early termination of the license agreement.
- Copy of the closure or abandonment report prepared for EPD.
- A copy of the site inspection report.

6.2.8.2 *Impact Monitoring*

- Visual inspection to ensure that all fixed assets are retained on site in good condition.
- Visual inspection of the abandoned area to ensure that exposed surfaces have been re-vegetated.
- Visual inspection of the abandoned area to ensure that all machinery and equipment, as well as scheduled wastes have been removed.
- Visual inspection of the abandoned area to ensure that there are no areas of contaminated soil or waste.
- Visual inspection of the abandoned area to ensure that it has been properly rehabilitated and is not hazardous to the public. A visual check should also be completed after two (2) months to ensure that the site is not hazardous.

ANNEXES

Annex 1

Baseline Environmental Conditions

Annex 1.1: Meteorological Data

Annex 1.2: Baseline Water Quality Results

Annex 1.3: National Water Quality Standards Malaysia (NWQSM)

Annex 1.4: Water Quality Index (WQI)

Annex 1.5: Baseline Air Quality Results

Annex 1.6: Malaysian Ambient Air Quality Guidelines

Annex 1.7: Baseline Noise Level Results

Annex 1.8: Planning Guidelines for Environmental Noise Limits and Control, 2007

Annex 1.9: Environmental Quality (Sewage) Regulations, 2009

Annex 1.1

Meteorological Data

JABATAN METEOROLOGI MALAYSIA
MONTHLY SUMMARY OF RAINFALL FOR PERTANIAN PITAS

YEAR: 2006 – 2015

YEAR		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	WET DAYS
2006	Millimetres	433.7	564.7	203.4	86.2	235.3	184.3	40.2	110.4	169.3	67.5	108.3	1028.6	3231.9	
	Days	22	18	9	8	11	11	4	9	13	9	7	18		139
2007	Millimetres	739.1	411.3	131.3	90.2	98.3	173.3	78.9	337.8	169.9	77.8	233.7	609.7	3151.3	
	Days	21	14	9	4	11	13	7	13	11	9	8	19		139
2008	Millimetres	739.1	851.0	281.0	80.1	0.3	61.7	266.1	124.0	77.1	10.4	294.4	490.0	3275.2	
	Days	21	13	11	10	2	9	13	7	4	5	11	19		125
2009	Millimetres	1487.0	201.0	91.9	115.2	51.4	47.1	121.0	176.0	205.0	125.2	344.8	259.6	3225.2	
	Days	19	10	9	6	7	6	5	9	6	7	16	15		115
2010	Millimetres	493.5	10.0	112.2	128.0	163.3	246.3	156.2	290.6	208.2	81.0	256.0	206.0	2351.3	
	Days	15	3	8	8	8	11	8	10	11	7	16	14		119
2011	Millimetres	868.0	407.0	766.0	206.1	89.1	54.2	30.2	234.3	74.5	89.2	213.7	537.9	3570.2	
	Days	19	12	16	8	7	5	5	8	8	7	19	20		134
2012	Millimetres	440.4	337.2	188.2	207.6	46.0	33.1	106.6	68.2	84.6	173.6	470.0	592.9	2748.4	
	Days	13	12	14	14	4	4	9	6	12	15	24	19		146
2013	Millimetres	327.0	273.7	46.3	184.4	186.4	31.0	43.5	232.5	35.3	10.1	259.6	373.9	2003.7	
	Days	18	17	5	17	18	5	11	12	7	2	25	26		163
2014	Millimetres	436.7	344.6	105.2	64.2	181.7	199.2	67.5	160.6	11.2	161.3	274.5	679.1	2685.8	
	Days	25	13	11	6	12	6	10	16	3	17	16	19		154
2015	Millimetres	680.7	68.4	23.1	48.4	132.2	50.0	144.1	138.3	28.4	213.4	260.8	263.3	2051.1	
	Days	19	10	3	7	10	9	10	11	7	10	19	20		135
Average (mm)		664.5	346.9	194.9	121.0	118.4	108.0	105.4	187.3	106.4	101.0	271.6	504.1	2829.4	137

Source: Malaysian Meteorological Services Department

Annex 1.2

Baseline Water Quality Results

CHEMSAIN KONSULTANT SDN BHD *(130904-U)*

Lots 2 & 7, Lorong Suria, Off Lorong Buah Duku 1, Taman Perindustrian Suria,
Jalan Kolombong, 88450 Kota Kinabalu, Sabah, Malaysia.
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TEST REPORT

* NOT FOR ADVERTISEMENT PURPOSES *

Customer	:	Gerak Saga Sdn Bhd L-70-7 KK Times Square Off Jalan Coastal 88100 Kota Kinabalu, Sabah	Lab No. Type (No.) of Sample Date Received Date of Report Project Code	: CK/CL405/4586/15 : River Water (5) : 18th December 2015 : 28th December 2015 : CK/EV403-4278/15

Lab No.:	4586-1	4586-2	*Test Method*
Parameter(s)	W1 Date: 17/12/15 Time: 10.25 am	W2 Date: 17/12/15 Time: 11.15 am	
pH Value (in-situ / 17.12.15)	6.23	6.72	*APHA 4500-H⁺ B, 2012*
Temperature, °C (in-situ / 17.12.15)	29.7	29.5	*APHA 2550 B, 2012*
Dissolved Oxygen, mg/L (in-situ / 17.12.15)	5.45	5.90	*APHA 4500-O G, 2012*
Biochemical Oxygen Demand in 5 days @ 20°C, mg/L	<1.00	<1.00	*APHA 5210 B & 4500-O G, 2012*
Chemical Oxygen Demand, mg/L	18.8	12.5	*APHA 5220 C, 2012*
Total Suspended Solids, mg/L	<5.00	<5.00	*APHA 2540 D, 2012*
Turbidity, NTU	7.4	5.3	*APHA 2130 B, 2012*
Ammoniacal-Nitrogen (as NH_3-N), mg/L	<0.05	<0.05	*In-House Method 0554 based on Methrom Technical Note*
Oil & Grease, mg/L	<1.50	<1.50	*APHA 5520 B, 2012*

CHEMSAIN KONSULTANT SDN BHD *(130904-U)*

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Email: laboratory.kk@chemsain.com

TEST REPORT

* NOT FOR ADVERTISEMENT PURPOSES *

Lab No.: CK/CL405/4586/15

Lab No.:	4586-3	*Test Method*
Parameter(s)	W3 Date: 17/12/15 Time: 11.50 am	
pH Value (in-situ / 17.12.15)	6.24	*APHA 4500-H+ B, 2012*
Temperature, °C (in-situ / 17.12.15)	29.7	*APHA 2550 B, 2012*
Dissolved Oxygen, mg/L (in-situ / 17.12.15)	5.15	*APHA 4500-O G, 2012*
Biochemical Oxygen Demand in 5 days @ 20°C, mg/L	<1.00	*APHA 5210 B & 4500-O G, 2012*
Chemical Oxygen Demand, mg/L	<10.0	*APHA 5220 C, 2012*
Total Suspended Solids, mg/L	9.00	*APHA 2540 D, 2012*
Turbidity, NTU	29	*APHA 2130 B, 2012*
Ammoniacal-Nitrogen (as NH_3-N), mg/L	<0.05	*In-House Method 0554 based on Methrom Technical Note*
Oil & Grease, mg/L	<1.50	*APHA 5520 B, 2012*

Lab No.:	4586-4	*Test Method*
Parameter(s)	W4 Date: 17/12/15 Time: 1.05 pm	
pH Value (in-situ / 17.12.15)	6.40	*APHA 4500-H+ B, 2012*
Temperature, °C (in-situ / 17.12.15)	29.1	*APHA 2550 B, 2012*
Dissolved Oxygen, mg/L (in-situ / 17.12.15)	5.15	*APHA 4500-O G, 2012*
Biochemical Oxygen Demand in 5 days @ 20°C, mg/L	<1.00	*APHA 5210 B & 4500-O G, 2012*
Chemical Oxygen Demand, mg/L	<10.0	*APHA 5220 C, 2012*
Total Suspended Solids, mg/L	9.00	*APHA 2540 D, 2012*
Turbidity, NTU	4.7	*APHA 2130 B, 2012*
Ammoniacal-Nitrogen (as NH_3-N), mg/L	<0.05	*In-House Method 0554 based on Methrom Technical Note*
Oil & Grease, mg/L	<1.50	*APHA 5520 B, 2012*

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TEST REPORT

* NOT FOR ADVERTISEMENT PURPOSES *

Lab No.: CK/CL405/4586/15

Lab No.:	4586-5	*Test Method*
Parameter(s)	W5 Date: 17/12/15 Time: 2.35 pm	
pH Value (in-situ / 17.12.15)	6.94	*APHA 4500-H⁺ B, 2012*
Temperature, °C (in-situ / 17.12.15)	26.5	*APHA 2550 B, 2012*
Dissolved Oxygen, mg/L (in-situ / 17.12.15)	5.30	*APHA 4500-O G, 2012*
Biochemical Oxygen Demand in 5 days @ 20°C, mg/L	<1.00	*APHA 5210 B & 4500-O G, 2012*
Chemical Oxygen Demand, mg/L	18.8	*APHA 5220 C, 2012*
Total Suspended Solids, mg/L	53.0	*APHA 2540 D, 2012*
Turbidity, NTU	65	*APHA 2130 B, 2012*
Ammoniacal-Nitrogen (as NH_3-N), mg/L	<0.05	*In-House Method 0554 based on Methrom Technical Note*
Oil & Grease, mg/L	<1.50	*APHA 5520 B, 2012*

Date of commencement of BOD_5 analysis: 18th December 2015

CHEMSAIN KONSULTANT SDN. BHD. Laboratory Kota Kinabalu (130904-U)

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TEST REPORT

* NOT FOR ADVERTISEMENT PURPOSES *

Customer : Gerak Saga Sdn Bhd
L-70-7 KK Times Square,
Off Jalan Coastal,
88100 Kota Kinabalu, Sabah

Lab No. : CK/ML405/4585/15
Type (No.) of Sample : River Water (5)
Date Received : 18th December 2015
Date of Report : 22nd December 2015
Project Code : CK/EV403-4278/15

Lab No.:	4585-1	4585-2	*Test Method*
Parameter(s)	W1 Date: 17/12/15 Time: 10.25 am	W2 Date: 17/12/15 Time: 11.15 am	
Total Coliform Count MPN/100ml, 35±0.5°C/48 h	7.9×10^2	4.9×10^2	*APHA 9221B, 2012*
Fecal Coliform Count MPN/100ml, 44.5±0.2°C/24 h	94	49	*APHA 9221E, 2005*

Lab No.:	4585-3	4585-4	*Test Method*
Parameter(s)	W3 Date: 17/12/15 Time: 11.50 am	W4 Date: 17/12/15 Time: 1.05 pm	
Total Coliform Count MPN/100ml, 35±0.5°C/48 h	5.4×10^3	9.2×10^3	*APHA 9221B, 2012*
Fecal Coliform Count MPN/100ml, 44.5±0.2°C/24 h	5.4×10^3	1.4×10^3	*APHA 9221E, 2005*

Lab No.:	4585-5	*Test Method*
Parameter(s)	W5 Date: 17/12/15 Time: 2.35 pm	
Total Coliform Count MPN/100ml, 35±0.5°C/48 h	9.2×10^3	*APHA 9221B, 2012*
Fecal Coliform Count MPN/100ml, 44.5±0.2°C/24 h	9.2×10^3	*APHA 9221E, 2005*

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TEST REPORT

* NOT FOR ADVERTISEMENT PURPOSES *

Customer	:	Gerak Saga Sdn Bhd L-70-7 KK Times Square Off Jalan Coastal 88100 Kota Kinabalu, Sabah	Lab No.	:	CK CL105 93638 15
			Type (No.) of Sample	:	Water (5)
			Date Received	:	22nd December 2015
			Date of Report	:	12th January 2016
Attn	:	Mr. Chris Garside	Reference No.	:	CK CL405-4586-15
			Project Code	:	CK-EV403-4278-15

Lab No.	93638-1	93638-2	93638-3	93638-4	93638-5
Parameter (s)	W1 Date : 17-12-15 Time : 10.25 am	W2 Date : 17-12-15 Time : 11.15 am	W3 Date : 17-12-15 Time : 11.50 am	W4 Date : 17-12-15 Time : 1.05 pm	W5 Date : 17-12-15 Time : 2.35 pm
Herbicides					
Paraquat, mg/L *(Method: Colorimetric)*	<0.01	<0.01	<0.01	<0.01	<0.01
Glyphosate, mg/L *(Method: HPLC)*	<0.02	<0.02	<0.02	<0.02	<0.02
Aminomethylphosphonic Acid, mg/L *(Method: HPLC)*	<0.02	<0.02	<0.02	<0.02	<0.02
Organophosphorated Pesticides					
Methamidophos, mg/L *(Method: GC)*	<0.001	<0.001	<0.001	<0.001	<0.001

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Annex 1.3

National Water Quality Standards for Malaysia

National Water Quality Standards for Malaysia

PARAMETER	UNIT	CLASS				
		I	IIA/IIB	III#	IV	V
Al	mg/l		-	(0.06)	0.5	
As	mg/l		0.05	0.4 (0.05)	0.1	
Ba	mg/l		1	-	-	
Cd	mg/l		0.01	0.01* (0.001)	0.01	
Cr (IV)	mg/l		0.05	1.4 (0.05)	0.1	
Cr (III)	mg/l		-	2.5	-	
Cu	mg/l		0.02	-	0.2	
Hardness	mg/l		250	-	-	
Ca	mg/l		-	-	-	
Mg	mg/l		-	-	-	
Na	mg/l		-	-	3 SAR	
K	mg/l		-	-	-	
Fe	mg/l		1	1	1 (Leaf) 5 (Others)	
Pb	mg/l		0.05	0.02* (0.01)	5	
Mn	mg/l		0.1	0.1	0.2	
Hg	mg/l		0.001	0.004 (0.0001)	0.002	
Ni	mg/l		0.05	0.9*	0.2	
Se	mg/l		0.01	0.25 (0.04)	0.02	
Ag	mg/l		0.05	0.0002	-	
Sn	mg/l		-	0.004	-	
U	mg/l		-	-	-	
Zn	mg/l		5	0.4*	2	
B	mg/l		1	(3.4)	0.8	
Cl	mg/l		200	-	80	
Cl_2	mg/l		-	(0.02)	-	
CN	mg/l		0.02	0.06 (0.02)	-	
F	mg/l		1.5	10	1	
NO_2	mg/l		0.4	0.4 (0.03)	-	
NO_3	mg/l		7	-	5	
P	mg/l		0.2	0.1	-	
Silica	mg/l		50	-	-	
SO_4	mg/l		250	-	-	
S	mg/l		0.05	(0.001)	-	
CO_2	mg/l		-	-	-	
Gross-α	Bq/l		0.1	-	-	
Gross-β	Bq/l		1	-	-	
Ra-226	Bq/l		< 0.1	-	-	
Sr-90	Bq/l		< 1	-	-	
CCE	µg/l		500	-	-	-
MBAS/BAS	µg/l		500	5000 (200)	-	-
O & G (Mineral)	µg/l		40; N	N	-	-
O & G (Emulsified Edible)	µg/l		7000; N	N	-	-
PCB	µg/l		0.1	6 (0.05)	-	-
Phenol	µg/l		10	-	-	-
Aldrin/Dieldrin	µg/l		0.02	0.2 (0.01)	-	-
BHC	µg/l		2	9 (0.1)	-	-
Chlordane	µg/l		0.08	2 (0.02)	-	-
t-DDT	µg/l		0.1	(1)	-	-
Endosulfan	µg/l		10	-	-	-
Heptachlor/Epoxide	µg/l		0.05	0.9 (0.06)	-	-
Lindane	µg/l		2	3 (0.4)	-	-
2, 4-D	µg/l		70	450	-	-
2,4, 5-T	µg/l		10	160	-	-
2,4, 5-TP	µg/l		4	850	-	-
Paraquat	µg/l		10	1800	-	-

NATURAL LEVELS OR ABSENT

LEVELS ABOVE IV

Notes :
* = At hardness 50 mg/l $CaCO_3$
# = Maximum (unbracketed) and 24-hour average (bracketed) concentrations
N = Free from visible film sheen, discolouration and deposits

Annex 1.4

Water Quality Index (WQI)

1.4. Water Quality Index (WQI)

Table A 1.4.1: Water Quality Index and Classification Tool

Site	DO%	BOD	COD	SS	pH	NH3-NL	WQI	CLASS	WQ STATUS
W1	71.73	1.00	18.80	5.00	6.23	0.05	88.46	II	C
W2	77.38	1.00	12.50	5.00	6.72	0.05	91.75	II	C
W3	67.78	1.00	10.00	9.00	6.24	0.05	88.88	II	C
W4	67.08	1.00	10.00	9.00	6.40	0.05	88.89	II	C
W5	65.92	1.00	18.80	53.00	6.94	0.05	83.67	II	C

Legend:

Water Quality Index (WQI)

Range	90 - 100	70 – 90	50 - 70	25 – 50	0 - 25
Quality	Excellent	Good	Medium	Bad	Very Bad

WQ Status

C = Clean
SP = Slightly Polluted
P = Polluted

Verified by,

Cyril Jinusie
M.Sc (Industrial Chemistry)
Reg. No. S 0155 (Scheduled Waste Management and Water Quality)

Annex 1.5

Baseline Air Quality Results

CHEMSAIN KONSULTANT SDN BHD *(130904-U)*

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Jalan Kolombong, 88450 Kota Kinabalu, Sabah, Malaysia.
Tel: +60-88-389671 / 381278 **Fax:** +60-88-381280
Email: laboratory.kk@chemsain.com

TEST REPORT

* NOT FOR ADVERTISEMENT PURPOSES *

Customer	:	Gerak Saga Sdn Bhd L-70-7 KK Times Square Off Jalan Coastal 88100 Kota Kinabalu, Sabah	Lab No. Type (No.) of Sample Date Received Date of Report Project Code	: CK/CL405/0032/16 : Total Suspended Particulates (1) : 05th January 2016 : 07th January 2016 : CK/EV403-4278/15

Identification of Sample(s)	Total Suspended Particulates, $\mu g/m^3$ *(Test Method: AS/NZS 3580.9.3: 2003)*
Location : A1 Date of Sampling : 16/12/15 - 17/12/15 Time of Sampling : 3.00 pm - 3.00 pm	39.0

CHEMSAIN KONSULTANT SDN BHD (130904-U) Laboratory Kota Kinabalu

SHIERLY BINTI SULAIMAN
B. Sc. (Hons)
LMIC (1824/6031/11)
CHEMIST

Annex 1.6

Malaysian Ambient Air Quality Guidelines

Malaysian Ambient Air Quality Guidelines

Recommended Guidelines for Gaseous Pollutants (at 25 ^{0}C and 101.13 kPa)

Pollutant and Method	Averaging Time	Malaysian Guidelines (ppm)	(µg/m^3)	Target Year For Compliance
Ozone	1 hour	0.10	200	1995
AS 2524	8 hour	0.06	120	
Carbon Monoxide (CO)	1 hour	30	35 mg/m^3	1995
AS 2629	8 hour	9	10 mg/m^3	
Nitrogen Dioxide (NO_2)	1 hour	0.17	320	1990
AS 2447				
Sulphur Dioxide (SO_2)	10 Minutes	0.19	500	1990
AS 2523	1 hour	0.13	350	
	24 hour	0.04	105	
Particulates	***24 hour***	-	***260***	***1990***
AS 2724.3	***annual***	-	***90***	
Particulate Matter as PM_{10}	24 hour	-	150	1995
AS 2724.6	1 year	-	50	
Lead	3 month	-	1.5	1991
AS 2800				

PM_{10} = Particulate Matter Less than 10 Micrometers.

Notes:

i) Other Recognised Standards are EEC, EPA(USA), World Bank and WHO

ii) The recommended Malaysian annual and daily guidelines for Total Suspended Particulates (TSP) are 90 µg/m^3 and 260 µg/m^3 (mean of 24-hour measurement), respectively.

Annex 1.7

Baseline Noise Level Results

ENVIRONMENTAL NOISE MEASUREMENT REPORT

Measurement Details		
Client Name	:	Gerak Saga Sdn Bhd
Project Code	:	CK/EV403-4278/15
Location	:	N1
Description	:	Ambient Daytime-Nightime Noise Level
Date of Measurement	:	16.12.2015 – 17.12.2015
-		
Instrumentation Details		
Model No.	:	Lutron SL-4033SD
Serial No.	:	I.340043
Asset Tag	:	EV4 – NM - 2015
Date of Calibration	:	-
Measurement Data		
Level Range	:	30-120 dB (Auto range)
Frequency Weighting	:	Fast (A)
No. of Measurements	:	1
Total Duration	:	24:00:00
No. of Measurements:		

Monitoring Location	Date	Time (hh:mm:ss)	Run Duration (hh:mm:ss)	Leq,dB(A)	L_{min}, dB(A)	L_{90}, dB(A)	L_{10}, dB(A)	L_{max}, dB(A)
N1(Night)	16.12.2015	22:00:00	09:00:00	45.7	41.3	51.5	44.2	70.3

Monitoring Location	Date	Time (hh:mm:ss)	Run Duration (hh:mm:ss)	Leq,dB(A)	L_{min}, dB(A)	L_{90}, dB(A)	L_{10}, dB(A)	L_{max}, dB(A)
N1(Day)	16.12.2015	07:00:00	15:00:00	54.7	43..9	58.7	50.4	82.7

Assessment made by: Vivian Lojuki/Brian Hannis

Annex 1.8

Planning Guidelines for Environmental Noise Limits and Control, 2007

THE PLANNING GUIDELINES FOR ENVIRONMENTAL NOISE LIMITS AND CONTROL

Scope

1. This document presents guidance and recommendations for

(a) specifying noise limits in the environment for the protection of the public from excessive noise;
(b) procedures on environmental noise measurements and impact assessment;
(c) noise parameters for the assessment of different noise sources; and
(d) noise abatement through planning and control.

For the purpose of these guidelines, definitions used are consistent with those given in ISO 1996/1, BS 661, and BS 3015. A glossary of definitions is also included in this document.

2. These guidelines present noise acceptance criteria upon which a quantitative assessment of noise could be made. This eliminates subjective judgment of parties involved, ambiguity in defining a disturbance, and places the assessment of a noise source on a measurement basis.

Purpose

3. The purposes of these guidelines are:

(a) for planning purposes, typically by project proponents, local authorities, and consultants;
(b) to be used in noise impact assessments, and pre- and post EIA compliance verification;
(c) in quantifying a noise disturbance on a quantitative manner; and
(d) to offer an introductory treatise in environmental noise control.

Legislative Background

4. The Environmental Quality Act 1974 allows the Minister after consultation with the Environmental Quality Council, to define objectionable noise and to prescribe standards for tolerable noise. The Act also stipulates that *"no person shall, unless licensed, emit or cause or permit to be emitted any noise greater in volume, intensity or quality in contravention of the acceptable conditions"*.

The Environmental Quality (Amendment) Act 1985 makes it mandatory for an Environmental Impact Assessment (EIA) on various activities scheduled by the Minister. Approval of such EIA and the projects in particular usually include maximum permissible noise limits at the affected areas that must be complied with during the construction phase of the project, and upon completion of the project.

5. The Department of Environment in these guidelines present recommendations upon which acceptable noise limits could be specified. In instances of new noise sources or projects, compliance to these limits may be made mandatory using legislative instruments available to the Department of Environment, and other authorities (Local Authorities, City Halls, etc).

6. Prior to these guidelines as presented here, acceptable limits had been set based on "Guidelines for Sitting and Zoning of Industries", and "Guidelines an Application for Permission to Install Generator Sets". These current guidelines supercedes noise limits set in the above documents; and presents a comprehensive and unambiguous manner upon which noise could be measured and assessed against the prescribed standards for all applications.

Noise Limits

7. Noise limits may be set based on either of the following, depending on circumstances:

(a) an absolute limit based on the average level of noise which should not be exceeded in a specified time period;

(b) a relative limit based on the permitted increase in noise level with respect to the background level.

8. These limits may either be a single value over the relevant time periods, or different values for day and night. It may also be appropriate to set an evening value where the noise source lends itself to such control. The setting of an absolute limit is often desirable, but would require care in noise monitoring and assessment to ensure that unrelated or extraneous noises (which will increase the measured noise level) do not influence the assessment.

Relative limits in general are not appropriate where the permitted increase in noise over background is substantial, for example 15 dB or more. Because background noise varies during the day, the background noise level determined should be representative of a typical quiet period during the working day.

9. Acceptance limits for noise should be consistent with the environmental noise climate that currently exists at a location - such that an adverse impact on the environment and affected property are avoided, and at the same time maintain a reasonable balance with physical development and/or activities.

10. Recommended maximum permissible sound levels as measured at the real property boundary, and assessed under the respective land use, are given in Annex A.

Under normal circumstances, these sound levels shall apply to outdoor locations at the real property boundary of the receiver (typically residential areas, or other noise sensitive area). This shall include assessment of sound levels from road traffic, railways and other noise source(s). In instances of industrial noise sources in an industrial zone, the sound level shall be at the property boundary of the industrial site or plant under assessment.

11. Schedule 1 of Annex A prescribes maximum permissible sound level (L_{Aeq}) by receiving land use for planning purposes and new development. These limits should be used for new industrial, commercial or housing areas; and/or development affecting such areas. Such limits are deemed to be a requisite in protecting public health and welfare with an adequate margin of safety.

12. For new development (industrial, transportation: roads, rails) in areas of existing high environmental noise climate, the maximum permissible sound level (L_{Aeq}) at the receiver locations should not be higher than noise limits prescribed in Schedule 2. This schedule presents an absolute limit for the noise level L_{Aeq} based on the existing ambient percentile index L_{90} plus an allowable noise increment.

13. In instances where the existing noise climate (L_{Aeq}) is higher than the planning values of Schedule1; or when the noise limits ($L_{Aeq} = L_{90}$ + Factor) prescribed in Schedule 2 are lower than the existing noise climate, an acceptance criteria based on maintaining a noise level similar to the existing noise climate (existing L_{Aeq}) may be more appropriate. This acceptance criterion is tabulated in Schedule 3.

14. Recommended limiting sound levels (L_{Aeq}) from road traffic for proposed new roads and/or redevelopment of existing roads are given in Schedule 4.

15. Recommended limiting sound levels (L_{Aeq}) from railways including transit trains for new development or re-alignments are given in Schedule 5. A maximum permissible instantaneous maximum sound pressure levels for the transient pass-by noise is also stipulated. This is the single event maximum instantaneous noise limit permissible for the entire measurement duration.

16. Due to the intrusive but temporal nature of construction noise, maximum permissible sound levels (statistical centile L_{90}, L_{10}, and maximum instantaneous sound pressure level) for construction, maintenance and demolition works should be observed. These limits are stipulated in Schedule 6.

Assessment of the L_{10} and L_{max} levels are generally intended for impulsive or fluctuating noise sources (for example piling, pneumatic tools, etc).

Noise Measurements

17. Measurements of noise levels are often necessary for any of the following purpose:

(a) assessing the existing noise climate.

(b) assessing compliance to noise limits for noise limits for noise source(s) and/or project development.

(c) assessing environmental impact and potential community response.

18. Noise measurements usually include the following:

(a) background (ambient) sound pressure levels at a receiver location(s) and/or at the real property boundary of a noise source(s). These may be undertaken at a location(s) prior to a project development. It could also be undertaken in the absence of the noise source(s) (example with a plant or facility not operating).

(b) sound pressure levels at a receiver location (s) and/or at the real property boundary of a noise source with the plant or facility operating and/or completion and operation of a project (highway, transit trains, industrial plant, etc.).

(c) sound pressure levels of each noise source as may be required to evaluate the contribution of each source.

19. Noise measured indoors may also be undertaken, but is usually not desirable for environmental impact assessments of project development or noise source(s) unless otherwise required by prior conditions or assessment requirements. Measurement indoors is governed by the severity of noise source, the sound insulation properties of the building, and acoustic characteristics of the interior space.

20. Procedures for measurement of sound levels in the environment and noise source(s) severity assessment as described in Annex B should be used. Guidance on the use and selection of an appropriate noise measurement parameter (indices) and sampling methods are also given in Annex B.

21. Because noise vary over time and have different characteristics, several indices are available to describe noise levels. The equivalent continuous noise level over a time period T ($L_{Aeq,T}$) is the preferred general purpose index for environmental noise. For road traffic noise $L_{A10,\ 18h}$ is still widely used; and to describe background noise $L_{A90,\ T}$ is appropriate.

22. To describe the sound insulation of a component of a building envelope (e.g. window) the acoustic rating R_w (BS 5821: Part 3: 1984) is appropriate. It is more difficult to specify the insulation of the whole building envelope because the value depends on different insulation values for the various building elements such as windows, walls and roof structure, as well as the type of noise source and its location.

Monitoring point(s)

23. Normally the noise assessment will be at the nearest noise-sensitive premises and the best position for the monitoring point(s) will often be outside the sensitive premises at the real property boundary. This however does not mean that the monitoring point must always be close to the premises. Noise assessment at times may refer only to noise from the source under consideration and not to the total measured value which may include, for example, traffic noise.

24. In situations when extraneous noise makes monitoring difficult it may be easier to monitor a suitably adjusted level at the

boundary of the site instead of outside the premises to be protected. This approach requires that the noise level at the boundary monitoring point is a reliable indicator of the level at the building to be protected and this may not be the case if the noise source is mobile. Monitoring points should be accessible to all parties concerned.

Noise Severity and Impact Assessment

25. Noise could be assessed against an absolute numerical noise limit (as proposed in Annex A), or alternatively assessed based on the relative increase of the noise levels with respect to a background noise level.

26. Assessment of noise levels against a noise limit is fairly straight forward, as it merely requires comparison of the measured noise level against the permissible sound pressure levels. Assessment of the impact of a noise level in the environment, and the anticipated community response to the noise could also be made by evaluating the magnitude by which the assessed noise level exceeds the existing ambient sound level.

27. The use of ISO-R 1996 Acoustics – "Assessment of Noise with Respect to Community Response" are recommended for community annoyance response evaluation. Procedures as adopted from ISO-R 1996 are described in Annex C.

Noise and Planning

28. The impact of noise should be considered in the planning of a project development, and in general be guided by these Guidelines.

For the purpose of the consideration of noise in planning, the following information may reasonably require:

(i) the existing daytime and night-time (L_{Aeq}) equivalent sound levels for a representative sample of locations, existing noise zones; identification of the major sources of sound;

(ii) any projected or proposed new or expanded sources of sound which may affect exposure of the site during three years following completion of the project and the projected future daytime and night-time (L_{Aeq}) equivalent sound levels; projected noise contours; and changes to existing noise zones at the site resulting from these new or expanded sources;

(iii) where applicable, plans for noise attenuation measures on the site and/or of the structure proposed to be built, and the amount of sound attenuation anticipated as a result of these measures.

29. The Project Proponent and any other Person(s) who would operate or cause to operate equipment, plant, process or activity with noise generation should undertake all reasonable measures to control the source of, or limit exposure to, noise. Such measures should be proportionate and reasonable, and may include one or more of the following:

(a) land use compatibility: proposed operations shall be compatible with designated land use;

(b) layout : adequate distance between source and noise-sensitive neighbours, building or area; the usage and designation of buffer zones shall be in accordance to Planning Guidelines issued by the Department of Environment from time to time; screening by barriers, (natural, man-made or otherwise) and other buildings;

(c) engineering measures: reduction of sound at point of generation, containment of noise generated by adequate design of building envelope, and protection of adjacent noise-sensitive buildings by sound insulation or screening of the buildings;

(d) administrative measures: limiting the operating time of noise source(s); restricting the activities and ensuring acceptable sound emission limits of noise source.

30. In instances where noise would be potential concern, the Project Proponent and/or parties responsible for the noise source or emissions should undertake sound propagation predictions to the environment using acoustic modelling techniques and/or algorithms such that the impact of noise could be assessed. The parameters used in the analysis shall include but are not limited to sound power level emissions (actual or estimated), directivity factors, ground effects, distance, meteorological influences, and transmission path.

Noise Control

31. The Project Proponent, and/or any other occupier of any industrial or trade premises, construction sites, and/or person(s) responsible for excessive sound generation should use the "best practical means" to minimise the sound generation and reduce its propagation to the environment.

32. Excessive sound generation is deemed to occur when noise levels above the noise limits prescribed in these Guidelines are exceeded. "Best practical means" in the context of these guidelines, shall include but not limited to:-

(i) the size, design and inherent operation characteristics of the plant, equipment, process or activity;

(ii) the adjustment of operational parameters to limit the intensity of sound emissions,

(iii) the selection and usage of low sound power levels equipment;

(iv)the provision if necessary, and appropriate use of sound attenuators, acoustic plenum, and other acoustic filtering devices;

(v)the provision if necessary, and appropriate use of acoustic enclosures and other sound enclosing devices;

(vi)the provision if necessary, and appropriate use of screening barriers (man-made, natural or otherwise);

(vii) the proper conduct and adequate supervision of operation; and

(viii) regular and efficient plant and control equipment.

33. In instances of high noise severity, the Department of Environment at its discretion may make it mandatory for the Project Proponent and/or noise source originator or person(s) responsible for the excessive sound generation to institute measures for reducing sound levels to comply with limits as prescribed in these Guidelines.

GLOSSARY

"commercial area/zone" A designated area/zone as approved or gazetted by the local authority under the relevant act, regulations, rules and by-laws made thereunder for the purpose of business, trading, financial, commercial and other similar activities.

"community" The body of people gathered or living in the same locality.

"construction" Any site preparation, assembly, erection, substantial repair, alteration, refurbishment, renovation or similar action, but excluding demolition, for or of public or private rights of-way, structures, utilities or similar property.

"dB (A)" The decibel unit of measurement of sound level corrected to the "A" weighted scale.

"decibel (dB)" A unit of measurement of sound level equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure of 20 micropascals.

"demolition" Any dismantling, intentional destruction or removal of structures, utilities, public or private right-of-way surfaces, or similar property.

"emergency work" Any work performed for the purpose of preventing or alleviating the physical trauma or property damage threatened or caused by an emergency.

"equivalent A-weighted sound level (L_{Aeq})" The constant sound level that, in a given situation and time period, conveys the same sound energy as the actual time-varying A-weighted sound. For the purpose of these Guidelines, the day time L_{Aeq} is the equivalent A-weighted sound level for the day time period of 7.00 am to 10.00 pm (0700 to 2200 hours) and the night time L_{Aeq} is the equivalent A-weighted sound level for the night time period of 10.00 pm to 7.00 am (2200 to 0700 hours).

"impulsive sound" Sound of short duration, usually less than one second, with an abrupt onset and rapid decay. Examples of sources of impulsive sound are explosions, drop hammer or driven impacts, and the discharge of firearms.

"industrial area" A designated area as approved or gazetted by the local authority for the purpose of siting industrial, manufacturing or processing plants, factories or facilities.

"licensing authority" The local authority or state agencies or agents of the State that grants licence, approval or similar permission for a specific activity.

"local authority" The local planning authorities, agencies, or agents of the State as defined in the Town and Country Planning Act, 1976 and such rules, regulations and by-laws made thereunder. These include City Halls, City Councils, Municipal Councils, Town Council and District Councils.

"mixed development area" A designated area as approved or gazetted by the local authority under the relevant act, regulations, rules and by-laws made thereunder, permitting business, commercial, trading or similar activities, together with residential uses.

"noise sensitive area or zone" Low density residential areas, schools, hospitals, and nursing homes, places of worship, religious buildings and courts of law.

"pure tone" Any sound which can be distinctly heard as a single pitch or a set of single pitches. A pure tone exist if the one-third octave band sound pressure level in the band with the tone exceeds the arithmetic average of the sound pressure levels of the two contiguous one-third octave bands by 5 dB for centre frequencies of 500 Hz and above, and by 8 dB for centre frequencies between 160 and 400 Hz, and by 15 dB for centre frequencies less than or equal to 125 Hz.

"real property boundary" An imaginary line along the ground surface, and its vertical extension, which separates the real property owned by one person from that owned by another person, but not including intra-building real property divisions, as delineated in the land title appearing in the Certificate of Title.

"residential area" A designated area as approved or gazetted by the local authority for the purpose of human dwellings and residence. **"low density residential areas"** is defined as areas with a population of less than 75 persons per acre; "suburban residential (medium density) areas" is defined as areas with a population of 75 to 200 persons per acre; and "urban residential (high density) areas" is defined as areas with a population exceeding 200 persons per acre.

"rms sound pressure" The square root of the time averaged square of the sound pressure, denoted as P_{rms}.

"sound attenuator" or **"sound dissipative device"** An acoustic filtering device for the attenuation of sound energy for airborne sound as transmitted to the atmosphere or surroundings of an equipment or sound source; such as muffler as used for engines exhausts, and silencer for air distribution equipment or enclosures.

"sound emission" Sound as emitted or discharged from a sound source(s).

"sound immission" Sound as propagated onto and received by a receiver from source(s) external to the receiver or real property boundary.

"sound level" The weighted sound pressure level obtained by the use of a sound level meter and frequency weighting network, such as A, B, or C as specified for sound level meters. If the frequency weighting employed is not indicated, the linear non-weighting level shall apply.

"sound pressure level" 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure to the reference pressure of 20 micropascals. The sound pressure level is denoted Lp or SPL and is expressed in decibels.

ANNEX A SCHEDULE OF PERMISSIBLE SOUND LEVELS

SCHEDULE 1

MAXIMUM PERMISSIBLE SOUND LEVEL (L_{Aeq}) BY RECEIVING LAND USE FOR PLANNING AND NEW DEVELOPMENT

Receiving Land Use Category	Day Time 7.00 am - 10.00 pm	Night Time 10.00 pm - 7.00 am
Noise Sensitive Areas, Low Density Residential, Institutional (School, Hospital), Worship Areas.	50 dBA	40 dBA
Suburban Residential (Medium Density) Areas, Public Spaces, Parks, Recreational Areas.	55 dBA	45 dBA
Urban Residential (High Density) Areas, Designated Mixed Development Areas (Residential - Commercial).	60 dBA	50 dBA
Commercial Business Zones.	65 dBA	55 dBA
Designated Industrial Zones	70 dBA	60 dBA

SCHEDULE 2

MAXIMUM PERMISSIBLE SOUND LEVEL (L_{Aeq}) OF NEW DEVELOPMENT (ROADS, RAILS, INDUSTRIAL) IN AREAS OF EXISTING HIGH ENVIRONMENTAL NOISE CLIMATE

Receiving Land Use Category	Day Time 7.00 am - 10.00 pm	Night Time 10.00 pm - 7.00 am
Noise Sensitive Areas, Low Density Residential	L_{90} + 10 dBA	L_{90} + 5 dBA
Suburban and Urban Residential Areas	L_{90} + 10 dBA	L_{90} + 5 dBA
Commercial, Business	L_{90} + 10 dBA	L_{90} + 10 dBA
Industrial	L_{90} + 10 dBA	L_{90} + 10 dBA

L_{90} is the measured ninety percentile sound level for the respective time period of the existing areas of interest in the absence of the proposed new development.

SCHEDULE 3

MAXIMUM PERMISSIBLE SOUND LEVEL (L_{Aeq}) TO BE MAINTAINED AT THE EXISTING NOISE CLIMATE

Existing Levels	New Desirable Levels	Maximum Permissible Levels
L_{Aeq}	L_{Aeq}	L_{Aeq}+3 dBA

SCHEDULE 4

LIMITING SOUND LEVEL (L_{Aeq}) FROM ROAD TRAFFIC (FOR PROPOSED NEW ROADS AND/OR REDEVELOPMENT OF EXISTING ROADS)

Receiving Land Use Category	Day Time 7.00 am - 10.00 pm	Night Time 10.00 pm - 7.00 am
Noise Sensitive Areas Low Density Residential Areas	55 dBA	50 dBA
Suburban Residential (Medium Density)	60 dBA	55 dBA
Urban Residential (High Density)	65 dBA	60 dBA
Commercial, Business	70 dBA	60 dBA
Industrial	75 dBA	65 dBA

SCHEDULE 5

LIMITING SOUND LEVEL (L_{Aeq}) FOR FROM RAILWAYS INCLUDING TRANSITS (FOR NEW DEVELOPMENT AND RE-ALIGNMENTS)

Receiving Land Use Category	Day Time 7.00 am - 10.00 pm	Night Time 10.00 pm - 7.00 am	L_{Amax} (Day & Night)
Noise Sensitive Areas, Low Density Residential Areas	60 dBA	50 dBA	75 dBA
Suburban and Urban Residential Areas	65 dBA	60 dBA	80 dBA
Commercial, Business	70 dBA	65 dBA	80 dBA
Industrial	75 dBA	65 dBA	NA

SCHEDULE 6

MAXIMUM PERMISSIBLE SOUND LEVELS (PERCENTILE L_N AND L_{MAX}) OF CONSTRUCTION, MAINTENANCE AND DEMOLITION WORK BY RECEIVING LAND USE

Receiving Land Use Category	Noise Parameter	Day Time 7.00 am - 7.00 pm	Evening 7.00 pm - 10.00 pm	Night Time 10.00 pm - 7.00 am
Residential (Note 2 **)	L_{90}	60 dBA	55 dBA	* (Note 1)
	L_{10}	75 dBA	70 dBA	*
	L_{max}	90 dBA	85 dBA	*
Commercial (Note 2 **)	L_{90}	65 dBA	60 dBA	NA
	L_{10}	75 dBA	70 dBA	NA
Industrial	L_{90}	70 dBA	NA	NA
	L_{10}	80 dBA	NA	NA

NOTES

*1. At these times the maximum permissible levels as stipulated in the Schedule 1 for the respective residential density type shall apply. This may mean that no noisy construction work can take place during these hours.

**2. A reduction of these levels in the vicinity of certain institutions such as schools, hospitals mosque and noise sensitive premises (apartments, residential dwellings, hotel) may be exercised by the local authority or Department of Environment.

Where the affected premises are noise sensitive, the limits of the Schedule 1 shall apply.

3. In the event that the existing ambient sound level (L_{90}) without construction, maintenance and demolition works is higher than the L_{90} limit of the above Schedule, the higher measured ambient L_{90} sound level shall prevail. In this case, the maximum permissible L_{10} sound level shall not exceed the Ambient L_{90} level + 10 dBA, or the above Schedule L_{10} whichever is the higher.

4. NA = Not Applicable.

Annex 1.9

Environmental Quality (Sewage) Regulations 2009

Environmental Quality (Sewage) Regulations 2009

SECOND SCHEDULE

[Regulation 7]

ACCEPTABLE CONDITIONS OF SEWAGE DISCHARGE OF STANDARDS A AND B

*** New Sewage Treatment System**

	Parameter	Unit	Standard	
			A	B
i.	Temperature	°C	40	40
ii.	pH Value	-	6.0-9.0	5.5-9.0
iii.	BOD_5 at 20°C	mg/L	20	50
iv.	COD	mg/L	120	200
v.	Suspended Solids	mg/L	50	100
vi.	Oil and Grease	mg/l	5.0	10.0
vii.	Ammoniacal Nitrogen (Enclosed water body)	mg/L	5.0	5.0
viii.	Ammoniacal Nitrogen (River)	mg/L	10.0	20.0
ix.	Nitrate-Nitrogen (River)	mg/L	10.0	10.0
x.	Nitrate-Nitrogen (Enclosed water body)	mg/L	5.0	10.0
xi.	Phosphorus (Enclosed water body)	mg/L	5.0	10.0

Standard A is applicable to discharges into any inland waters within catchment areas listed in the Third Schedule while Standard B is applicable to any other inland waters or Malaysian waters.

Annex 2

Methodology and Analysed Data

Annex 2.1: Licence Agreement

Annex 2.2: Relevant Correspondences

Annex 2.3: Forest Management Plan (FMP)

Annex 2.4: BOD Calculation

Annex 2.5: Bengkoka Forest Reserve Wildlife Survey

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Licence Agreement

ORIGINAL

SFMLA : 01/2015

THE GOVERNMENT

OF

THE STATE OF SABAH

SUSTAINABLE FOREST MANAGEMENT LICENCE AGREEMENT (SFMLA)

(Section 15(1) Forest Enactment, 1968)

LICENSEE: GERAK SAGA SDN BHD

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LICENCE AGREEMENT

THIS LICENCE AGREEMENT made on the 26 day of October, 2015

October 2015

BETWEEN

THE CHIEF MINISTER OF THE STATE OF SABAH (hereinafter referred to as "the Chief Minister" and which expression shall include its successors in title), of the one part.

AND

GERAK SAGA SENDIRIAN BERHAD [Com. No. 1098208 - V], a company incorporated in Malaysia and having its registered office at 3rd Floor, Wisma gek Poh, No. 18, Jalan Haji Saman, 88000 Kota Kinabalu, Sabah Malaysia (hereinafter referred to as "the Licensee" which expression shall where the context so admits be deemed to include its permitted/authorized agents and employees) of the other part.

WHEREAS the Chief Minister is desirous of granting permission to the Licensee to plant, rehabilitate and harvest forests under the principles of sustainable forest management and environmental conservation for economic, environmental and social purposes, in a certain Forest Reserve area in the State of Sabah as defined herein below, in consideration of the payment of all dues and royalties by the Licensee to the Government of the State of Sabah (hereinafter referred to as "the Government"); and

WHEREAS the Licensee is desirous of managing and securing wood resources on a long term basis in a certain Forest Reserve area in the State of Sabah as defined herein below for the purpose of sustainable production of timber and natural forest produce and for harvesting, distributing, processing and export of such timber, forest industrial products and other relevant materials or products as may be available for the Licensee from its activities in such Forest Reserve area, and on the term and conditions herein provided.

NOW THEREFORE the parties hereto mutually covenant and agree as follows:

PART 1

PARTIES, RIGHTS AND RESPONSIBILITIES

1. In this Licence Agreement, unless the context otherwise requires:

Definition/ Interpretation

(1) "Annual Work Plan" means an operational plan prepared by the Licensee describing the enrichment planting, silvucultural treatments, harvesting operations, and road and skid train construction to be conducted within the Licensed Area during one calendar year. Annual Work Plan shall conform to the provisions contained in the Forest Management Plan and the Compartment Register;

(2) "Authorized Officer" means any authorized officer authorized by the Director of Forestry Department to exercise all or any of the powers and duties conferred on the Director of Forestry Department by this Licence Agreement;

(3) "Block" means a permanent unit for forest plantation management and accounting purposes within which all plantation activities are planned and conducted;

(4) "Clause" means a clause of this Licence Agreement;

(5) "Compartment" means a permanent unit for forest management and accounting purposes within which enrichment planting, silvicultural treatments and timber harvests are planned and conducted. A compartment comprises a logical terrain unit of generally between 200 and 600 hectares bounded by physical features and uniform in topography to the extent practical. Compartments may be sub-divided to account for small-scale geologic, ecologic, or stocking variations;

(6) "Compartment Register" means a record of all information on the compartment, including maps, concerning (a) site and stands conditions, (b) decisions made for forest operations including locations designated for harvesting, silvicultural treatments and enrichment planting, and (c) all management activities conducted during the planning period;

(7) "Converted Timber" means any timber that has been subject to any manufacturing process and includes boards, planks, scantlings, veneer and plywood, and also machine sawn flitches, balks and cants of whatever size each with ninety degrees corners and cut to pieces not more than 30.5 centimetres in thickness and is ready for structural use with minor reprocessing required such as edging and cutting to the standard dimensions for their end use;

(8) "Crop Tree" means a tree forming or selected to form a component of the final crop, generally selected in a young stand or plantation for carrying through to the end of the rotation;

(9) "dbh" means diameter in breast height which is measured one hundred and forty centimeters from the ground according to the definition of "breast height" in Rule 2 of the Forest Rules, 1969

(10) "Director" means the Director of Forestry Department appointed under Section 3 of the Forest Enactment 1968 and includes a Forest Officer duly authorized by the Director to act on his behalf;

(11) "Enrichment Planting" means planting done with high-value, primarily indigenous timber species for the purpose of rehabilitating logged-over forest and not to establish a mono-species plantation. Planting accommodates existing vegetation and maintains forest structure, and may occur in lines or irregularly in gaps left by nature or past harvests;

(12) "Felling Cycle" means the interval that elapses between successive felling in the same area;

(13) "Forest Management Plan" means a document containing required information on how an area within the Commercial Class II Forest Reserves will be managed on an ecologically sustainable basis over the medium-term of not less that 10 years. The boundary of a Forest Management Plan shall be determined by the Director, and shall encompass an environmentally and economically sustainable unit capable of producing high-quality timber products over the long term. The boundary may include, but is not necessarily limited to the area covered by a Timber Licence. The area covered by a Forest Management Plan is subdivided into Compartments for planning and management purposes;

(14) "Felling Series" means a forest area forming the whole or part of a working circle and delimited so as to –

a. distribute felling and regeneration to suit local conditions; and
b. maintain or create the normal distribution of each class or each gradation;

(15) "Forest Management" means the concept of forest resources planning in a particular area;

(16) "Forest Officer" means any person appointed under Section 3 of the Forest Enactment 1968;

(17) "Forest Produce" means produce as defined in Section 2 of the Forest Enactment 1968;

(18) "Forest Reserve" means a forest reserve declared as such under Section 12 of the Forest Enactment 1968 and includes a forest reserve constituted under any written law;

(19) "Fuelwood" means any timber that is to be used as fuel;

(20) "Government" means the Government of the State of Sabah and includes an officer duly authorized to act on behalf of the Government by the Chief Minister;

(21) "Harvest" means the removal or extraction of logs from the felling area;

(22) "Insolvent" means being unable to make the full payment of debts as and when such debts fall due;

(23) "Log" means the product of a tree after cross-cutting;

(24) "Logging" (syn. "harvesting") means the felling of a tree and conversion into logs, and removal from the felling area;

(25) "Merchantable Timber" means commercial species as defined by Schedule C;

(26) "Minister" means the Minister for the time being responsible for matters relating to natural resources;

(27) "Minor Forest Produce" means all forest produce other than timber of hewn wood;

(28) "Plant" means to rehabilitate by enrichment planting or any acceptable silvicultural treatment;

(29) "Plantation Development Plan" means an operational plan as part of the Annual Work Plan further specified in Clause 52(ii) (c) and prescribing plantation activities within the Plantation Area of the Production Area during one calendar year. The Plantation Development Plan shall conform to the provisions contained in the Plantation Development Programme.

(30) "Plantation Development Programme" means a strategic plan as part of the Forest Management Plan further described in Clause 81 and Chapter 5 item 4 of Schedule D and covering those compartments or a portion of compartments designated for conversion and management as plantations for a medium-term of not less than 10 years;

(31) "Prohibited Species" means any tree as defined in Schedule B;

(32) "Residual Crop" means the tree crop of commercial species in a vigorous stage of growth;

(33) "Sawlog" means any timber log produced from cross-cutting the stem of a tree with top end diameter of 40 centimeters and above and having not less than three cubic metre of wood volume;

(34) "Schedule" means a Schedule appended to this Licence Agreement;

(35) "Silviculture" means the practice of growing forest crops under a designed pattern namely the methods of regenerating and tending;

(36) "Silviculture Treatment" means activities intended to liberate marked crop trees and release regeneration groups from competition by girdling, cutting or otherwise removing climbers and climbing bamboo;

(37) "Timber" means any tree which has been felled or which has fallen and any part of any tree which has been cut or has fallen off and all round, sawn, split or hewn wood and any wood which has been hollowed or fashioned into boats or boat shape;

(38) "Tree" includes any tree shrub or bush or any kind of seedlings, sapling or reshoot of any age, root, stump, stem, branch, palm cane, climber or any part of any of those.

Period during which Agreement in Force and Provision for Extension,

2. (i) Subject to Clause 2 (ii), this Licence Agreement shall be in force for a period of hundred (100) years commencing on 26.6.2015 and ending on 31.12.2115. Unless it is terminated earlier under any provisions of this Licence Agreement in which case it shall end on the date such termination becomes effective.

(ii) This Licence Agreement may be extended upon expiry of the period of hundred (100) years in Clause 2(i) at the absolute discretion of the Chief Minister.

3. (i) In consideration of the payment of all dues, royalties, charges, costs or premiums and due performance on fulfillment by the Licensee of all terms and conditions of this Licence Agreement but subject to the conditions, limitations and restrictions hereinafter provided, the Chief Minister hereby grants the Licensee permission to enter upon the Forest Reserve area comprising 6,467 (hectares) more or less and whose locations are as shown and defined in Schedule A hereinafter referred to as "Licensed Area" and therein to undertake managing, planting and silvicultural treatments of natural and plantation forests or timber trees, and further to undertake felling, cutting, collecting, removing and converting trees and other forest produce, logs and timbers, within the said Licensed Area as detailed in the Forest Management Plan as specified in Clause 46 of this Licence Agreement.

Licensed Area – Permission to Enter, Extract, Process, Convert, Sell and Plant.

(ii) Subject to the provisions hereinabove and hereinafter provided, the Licensee shall be entitled and is hereby authorized and permitted by the Government to process convert, sell and export processed or converted timbers or merchantable timbers to local or overseas buyers.

4. (i) The boundaries of the Licensed Area are to be delineated by the Licensee on the most accurate maps available at the date of the execution of this Licence Agreement (which maps with digitalized bearings and distances are deposited with the Forestry Department Sandakan).

Survey and Demarcation of Boundaries

(ii) Should the need arise for any further surveying and laying on the ground of the boundaries of the Licensed Area it shall be done under the supervision of a Registered Surveyor and the cost of surveying and laying on the ground of the boundaries of the Licensed Area shall be borne by the Licensee. The survey report of the said boundaries shall be submitted to the Director for approval. In case of any dispute in regard to the survey, the decision of the Director of Lands and Surveys shall be final and binding on the Licensee.

(iii) The boundaries demarcated and cleared shall be satisfactorily maintained by the Licensee at its cost throughout the period of this Licence Agreement.

5. The Licensee shall clearly demarcate within the Licensed Area, areas proposed for Community Forestry. The Licensee shall obtain explicit approval from the Director in regard to the quantum of area to be earmarked for Community Forestry.

Area under Community Forestry.

6. (i) The Licensee shall have no right over forest produce currently licensed to third party within the Licensed Area until such licence expires. After expiry the Director shall not renew or reissue such licence.

Rights Withheld

(ii) The Director for reason of silviculture or any reason that the Government may approve and without prejudice to the existing Licence Agreement may prohibit or restrict operations in the Licensed Area by any particular person/class or persons or sub-contractors.

(iii) The Director shall have the right to impose restriction on exploitation of particular species, particular qualities such as pulpwood etc. and in regard to specified quantities.

(iv) The Director shall have the right to issue permits or licence for collection and removal of Minor Forest Produce not granted to the Licensee and not planted by the Licensee as provided by Section 41 of the Forest Enactment, 1968. Such collection and removal shall not interfere with the operation of the Licensee.

(v) The Licensee shall have no mining and drilling rights in the Licensed Area and such rights shall continue to remain vested with the Government.

7. (i) The Licensee shall, as a condition precedent to the commencement of any work under this Licence Agreement deposit with the Director a Performance Bond in the sum of Ringgit Malaysia One Million (RM1,000,000.00) in cash or in the form of a Treasury's Deposit, Banker's Draft or an approved Banker's Guarantee. The Licensee agrees that the Performance Bond given in this Licence Agreement shall, upon failure on its part to perform all and singular conditions and requirements herein set forth or made part thereof, be retained either wholly or in part by the Government. The Licensee further agrees that should the surety on the Performance Bond delivered therewith or any Performance Bond delivered hereafter in connection with this Licence Agreement become unsatisfactory to the Government, the Licensee shall within thirty(30) days of receipt of demand from the Government deliver a new Performance Bond of a similar amount with surety solvent and satisfactory to the Government. Performance Bond

(ii) The Director shall have access to such Performance Bond for recovery of full or partial compensation to the Government in regard to lapses/breaches of the terms of this Licence Agreement on the part of the Licensee. In the event the Director receives any payment thereunder for non-fulfillment of obligation under this Licence Agreement the amount thereof shall be replenished to its original value by the Licensee.

8. In the event of inclusion by in advertence in the Licensed Area, of any area or areas over which it may subsequently be proved that the Licensee is not entitled to operate on or of area in which the operational rights have already been granted to other individuals or companies, this Licence Agreement shall be deemed to have been amended by the exclusion from the Licensed Area of any such area or areas from the date of such proof or grant. Areas included by Inadvertence.

9. The Licensee shall furnish notice to the Government or its authorized representative viz. the Director particularly of any fresh issues of shares or additional capital which may be done by them from time to time and any alteration which may be in the Memorandum and Articles of Association or in the Constitution of the Company, prior to commencement and/or during the operation in the Licensed Area. Notice of Fresh Issue of Capital and Changes of Constitution.

10. The Licensee shall from time to time furnish to the Director the names and addresses of its executives in the State of Sabah and under whose supervision and responsibility the operation in the Licensed Area is to be conducted. Submission of Names and Addresses of Executives.

11. (i) The Director may direct the Licensee that workers of any particular class or working in any particular area shall be provided with the Certificate of Identity as such signed by the Licensee and countersigned by Forest Officers in Form III as provided under Rule 5 of the Forest Rules 1969 and thereafter the Licensee shall be held responsible for the act of such workers. Certificate of Identity.

(ii) The person named in the Certificate of Identity issued under Clause 11(i) shall keep the same upon the person while at work and at other times have it in his possession and shall produce such Certificate of Identity on demand made by any Forest Officers.

12. The Licensee shall at all times indemnify the Chief Minister, the Government, the Director, their representatives and every public officer against any additional costs, charges, claims and demands whatsoever which may be brought by any third person or party in connection with anything done or purported to be done by the Licensee in the Licensed Area. Indemnity against 3rd. Party Claim.

13. The Government or its authorized representative reserves the right of access to the Licensed Area for the purposes of any investigation it wishes to make or in connection with the investigation, supervision or control of the Licensee's operation or for any other purposes related to this Licence Agreement. Access to Licensed Area for Investigation, Supervision etc.

14. (i) The Government or its authorized representative shall have the power and authority at all times during the period of this Licence Agreement to resume any part or parts of the Licensed Area for exploration and/or extraction of any coal, minerals, precious stones or mineral oil, provided always that the timber affected shall remain the property of the Licensee. Power to Resume Part or Parts of Licensed Area.

(ii) No compensation shall be payable to the Licensee in regard to part or parts of the Licensed Area resumed, except for any capital or development costs, if any, that the Licensee may have reasonably expended in the areas so resumed.

(iii) In the event of Government resuming any part of the Licensed Area or parts under this Clause, the terms and conditions of this Licence Agreement shall be renegotiated.

15. This Licence Agreement shall be transferable and negotiable upon written application to the State Cabinet. Transferability of Granted Rights.

16. The Government or its authorized representative shall have the right to issue from time to time any directives of general or special nature to define measures, methods or procedures for carrying out and implementing the terms and conditions of this Licence Agreement and to impose or award penalties/remedies for non-performance of provisions under this Licence Agreement and/or non-compliance with any regulations in force and to prescribe practices, standards and criteria for Forest Management, Forest Exploitation, Forest Plantation and for control and supervision in accordance with the State Government Policies. Right to Issue Additional Implementing Measures.

17. It may be included in the Licensed Area, Protection Forest Reserves, Wildlife Reserves, Virgin Jungle Reserves etc. to which the Licensee shall have no right whatsoever and the Licensee shall take all possible precautions to protect such areas from fire, encroachment and poaching. Protection Forest, Wildlife and Virgin Jungle Reserves.

18. (i) A strip of thirty (30) meters in width shall be maintained along either side of all perennial streams and rivers as a protected riparian reserve. The width shall be measured along the surface of the ground beginning from the edge of the watercourse bank. Riparian Reserves.

(ii) The Licensee shall not fell any trees within the riparian reserve.

(iii) The Government undertakes in respect of any riparian reserve which may intervene between the Licensed Area and any river within the Licensed Area, if requested to do so by the Licensee, to grant the right to occupy any portion in such area, upon such terms as shall be agreed between the Licensee and the Collector of Land Revenue in consultation with the Director for the purpose of erecting temporary buildings, loading ramps or for any other purpose which the Collector of Land Revenue in consultation with the Director agrees is necessary for the performance of the rights and duties of the Licensee under this Licence Agreement. In any such event, the Licensee will not allow any discharge into the river of any substance liable to cause pollution of water or do any act liable to cause silting or interference with the normal flow of water.

A4

19. The Licensee shall take reasonable steps and appropriate actions to assure: Forest Protection

(i) that there shall be no illegal logging or any boundary infringement by third party inside the Licensed Area;

(ii) that there shall be no hunting of wildlife in the Licensed Area, including such wildlife as protected by the Wildlife Conservation Enactment, 1997 and any other written laws;

(iii) that there shall be no fishing within the Licensed Area except to the extent specifically permitted by the Director;

(iv) that explosives or poisons shall not be used for the cleaning of waterways or any other purpose without the expressed consent of the Director and any other State or Feceral Departments/Agencies which may have jurisdiction with respect thereto;

(v) that the Licensee shall provide all the required assistance to the Director in developing the flora and fauna of the Licensed Area and in protecting the Licensed Area from potential damage.

A4

20. The Government undertakes in respect of any State land as defined in the Land Ordinance, if requested to do so by the Licensee, to mark out means of approach or access to and from the areas subject to the provisions of this Agreement, and in particular to convenient places on the sea coasts, as may appear reasonably necessary for the purpose of the removal from the Licensed Area of any timber cut and collected under this Agreement and the Licensee shall there upon be entitled to the use and benefit of such means of approach or access: provided that should such access as aforesaid be over a right of way on any State land which has already been made up into a road by some other party the Licensee will pay its share of the cost of making up and of maintaining such road; Access.

Provided further that if such means of approach or access shall be required over land other than State land as aforesaid then the Government undertakes, if requested to do so by the Licensee and upon an undertaking being given by the Licensee to pay any compensation which may be necessary, or may be assessed, to invoke the provisions of the Land Ordinance in order to provide means of approach or access as if such land were State Land as hereinbefore mentioned.

21. (i) The Licensee shall provide right of way over roads in the Licensed Area to all Government officials and those with written Governmental authorization. Right of Way.

(ii) The Licensee shall provide right of way for any lawful purpose to parties whose access to their area may be blocked or impeded by the configuration of the Licensed Area.

(iii) The Licensee shall provide right of way for any lawful purpose to the local population on all roads constructed by the Licensee.

(iv) Subject to permission granted by the Director and with prior written concurrence from the Licensee the neighbouring logging companies shall have the right to construct if required, their own logging roads through the Licensed Area and vice versa, provided always that forest produce extracted along the right of way shall remain the property of the Licensee.

(v) The Licensee shall provide right of way to other private companies such as mining firms etc. subject to permission being granted to them by the Director and with the concurrence of the Licensee, provided always that the Licensee shall approve the location of the right of way and that the timber and other forest products along the right of way shall remain the property of the Licensee.

22. (i) Subject to the approval and control of the Director, the Licensee or such other person as may be authorized in that behalf by the Government shall be at liberty to make dams across streams, construct canals, watercourses, roads, bridges, railways and trainways and undertake any other work useful or necessary for the purpose of business of the Licensee in or upon the Licensed Area and also with the like consent widen or deepen existing watercourses, channels or waterways for the purposes of the said business subject to the following: Control on construction, Works and cultivation.

(a) The Licensee shall, subject to the condition that no interference is cause to its legitimate business, give such facilities as the Government deems reasonable on such terms and conditions as may be agreed between the Licensee and the Government for the use of such roads and paths constructed by it, to all persons duly authorized;

(b) No permission shall be granted to any persons to construct railway tracks in the Licensed Area without affording the Licensee the opportunity of stating its objections, of any, to the alignment proposed thereof; and

(c) Reasonable facilities for dragging logs across the said railway tracks by means of level crossing be provided. It will rest with the Government to decide each case on its own merits as to whether the Licensee shall or shall not be responsible for the whole or any part of the cost of constructing and maintaining such level crossings.

(ii) Subject to the approval of the Government, the Licensee may clear and cultivate reasonable areas in the Licensed Area to provide fresh vegetables or other food crops for employees living in or upon the Licensed Area, provided that such area or areas shall on abandonment of cultivation be planted by a tree crop of commercial species and plantation established to the satisfaction of the Government. If the Licensee fails to carry out these provisions, the Government may arrange for planting of such area or areas and the expenses of such replanting shall be payable by the Licensee on demand in writing.

23. The rights and privileges of the natives under the existing laws and regulations, including Customary Law, are not affected or limited in any respect under this Licence Agreement. The Licensee shall recognize such rights and privileges including, without limitation to those relating to entry into the Licensed Area to collect certain wood species and exploit Minor Forest Produce (as allowed and defined in the Forest Enactment 1968 and Forest Rules 1969) for its own personal use and not for business purposes. Native Law.

24. The Licensee shall, assist the Government in the implementation of community/labour welfare schemes within or adjacent to the Licensed Area. The welfare scheme would, inter alia, include: Community Development

a. establishment of work place for the community;

b. development of education and medical facilities;

c. provision of communication facilities; and

d. active participation in the community development projects.

25. The Licensee will take appropriate steps to employ bumiputras in accordance with the National Development Policy. Employment Preference.

26. The Licensee shall employ Malaysian Nationals with specific preference to Malaysians of Sabah origin to perform all work and to render all services within Sabah, except to the extent that the Licensee shall reasonably demonstrate to the satisfaction of Government that qualified and suitable Malaysian Nationals are not available thereof. Notwithstanding the foregoing, the employment of non-Malaysians is subject to the approval of all State/Federal Government Departments/Agencies having jurisdiction with respect thereto. As a condition precedent to the Licensee's right to demonstrate that Malaysians are not available, the Licensee shall prove that it has conducted and is continuing to conduct a broad and vigorous recruiting and training programme for Malaysian personnel. Employment and Training

27. (i) Notwithstanding anything to the contrary herein, the Licensee shall employ Malaysian Nationals for not less than the following employment classifications and sub-classifications within the periods set forth below, after the execution of this Licence Agreement in the case of operations of logging and wood processing plants: Minimum Employment of Malaysian Personnel.

		3 yrs %	5 yrs %
(1)	Semi skilled labour	100	100
(2)	Skilled labour	80	100
(3)	Clerical, Administration & Supervisory	85	95
(4)	Technical	80	95
(5)	Professional	75	90
(6)	Management –		
	Junior Executive	80	95
	Senior Executive	75	90

(ii) The above percentages must be achieved by the end of the respective period.

(iii) The Licensee shall employ professional foresters and forestry technicians that are trained from the Forestry Training Institute of the Forestry Department.

28. The Licensee shall submit a comprehensive programme for recruitment, training and instruction and maximum number of Malaysian Nationals to resume positions within the shortest permissible period. Training and instruction shall be both on the job and in educational or professional institutions in Malaysia or abroad so as to develop capabilities of local staff and to transfer the technical and managerial skills. — Recruitment And Training Programme.

29. Subject to Clause 25 of this Licence Agreement, the Licensee and its sub-contractors may bring into Sabah such non-Malaysian nationals as in the Licensee's judgment are required to carry out the operations efficiently and successfully. — Other Personnel.

30. Equal right shall be accorded at all times to all employees in the same job classification regardless of race and religion. However, preference in employment and training shall be given to Malaysians of Sabah origin. — Equal Rights.

31. The Licensee shall effect and maintain insurance to cover adequate compensation for death or injury by accident for its labour force and other employees and third parties liability. — Employees and Labour Force.

32. The Licensee shall establish reasonable facilities for its employees and labour force such as housing schemes and medical services in accordance with the existing laws governing housing and medical facilities. — Employees Housing.

33. The Licensee may provide proper facilities for appropriate instruction and training for its forest workers and other employees. — Instruction and Training.

34. The Licensee shall observe reasonable measures for the protection of the general health and safety of its employees. The Licensee shall install and utilize machinery which confirm to the safety standards as regulated under any laws for the time being in force. All such measures, precautions, equipment and safety devices shall be subject to the requirement and approval of the relevant authorities. — Health and Safety Measures.

35. The Licensee shall provide medical facilities and/or benefits to all its employees personnel and its dependants and bear all the costs of owning and operating such facilities. Members of the local community even though non-employees, may be allowed to use the medical facilities of the Licensee at a reasonable rate and subject to the capacity of its medical facilities. — Medical Facilities.

28. The Licensee shall submit a comprehensive programme for recruitment, training and instruction and maximum number of Malaysian Nationals to resume positions within the shortest permissible period. Training and instruction shall be both on the job and in educational or professional institutions in Malaysia or abroad so as to develop capabilities of local staff and to transfer the technical and managerial skills. — Recruitment And Training Programme.

29. Subject to Clause 25 of this Licence Agreement, the Licensee and its sub-contractors may bring into Sabah such non-Malaysian nationals as in the Licensee's judgment are required to carry out the operations efficiently and successfully. — Other Personnel.

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31. The Licensee shall effect and maintain insurance to cover adequate compensation for death or injury by accident for its labour force and other employees and third parties liability. — Employees and Labour Force.

32. The Licensee shall establish reasonable facilities for its employees and labour force such as housing schemes and medical services in accordance with the existing laws governing housing and medical facilities. — Employees Housing.

33. The Licensee may provide proper facilities for appropriate instruction and training for its forest workers and other employees. — Instruction and Training.

34. The Licensee shall observe reasonable measures for the protection of the general health and safety of its employees. The Licensee shall install and utilize machinery which confirm to the safety standards as regulated under any laws for the time being in force. All such measures, precautions, equipment and safety devices shall be subject to the requirement and approval of the relevant authorities. — Health and Safety Measures.

35. The Licensee shall provide medical facilities and/or benefits to all its employees personnel and its dependants and bear all the costs of owning and operating such facilities. Members of the local community even though non-employees, may be allowed to use the medical facilities of the Licensee at a reasonable rate and subject to the capacity of its medical facilities. — Medical Facilities.

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36. The Licensee may establish educational institutions in conjunction with the Education Department for the education of the employees children and the children of the surrounding population provided always that the Education Department deems it necessary to establish such a school and that the Licensee's contribution is restricted to financing the construction of the buildings thereof. Educational Facilities.

37. Federal Law and/or State Laws, Ordinances including but not limited to the Workmen's Compensation Act shall apply to accidents occurring to employees of the Licensee and to all other matters affecting employees to which it is, by its terms applicable. Applicable Laws Involving Accident.

38. When in the course of carrying out the various operations or activities under this Licence Agreement, the Licensee or its agents negligently cause damage to any property belonging to the Government or to any other parties, the Licensee shall be liable to make good such damage or damages. Damage to Third Parties Property.

39. The Licensee shall, subject to price being competitive and supply being available, give preference to the purchase and use of equipment, supplies and materials manufactured or produced in Malaysia and encourage local manufacturers in the production of such equipment, supplies and material if they are not already available in adequate quantity, by providing technical assistance, advice and all relevant specifications thereto. Such preference shall also include professional services required by the Licensee. Local Materials.

40. The Licensee shall give preference to prequalified Malaysian contractors and suppliers to the maximum extent provided that the supply of such equipment and materials are available locally. Contractors and Suppliers.

41. The Licensee shall make available for sale to Malaysian purchasers a reasonable proportion of the products produced by it in Malaysia, at competitive terms and prices in order to encourage such purchasers to expand their trade, business or industrial activities. Sales of Products.

42. When chartering vessels from non-affiliated organization, the Licensee shall use Malaysian Flag vessels for the purpose of transporting cargo which it ships to, from and within Malaysia to the maximum extent that adequate facilities are available for this purpose at competitive world market rates and condition prevailing at the time of charter. The Licensee shall also recommend the use of Malaysian Flag vessels by third parties purchasing and transporting products produced by the Licensee or imported by it. Shipping.

PART 2: SUSTAINABLE FOREST MANAGEMENT

CHAPTER 1: FOREST MANAGEMENT PLANNING

43. The Licensee shall undertake all operations and activities under this Licence Agreement in accordance with sound forestry practices and principles. In order to carry out the above-mentioned obligation the Licensee shall without limiting its obligations under this Licence Agreement:- Implementation of Obligation in Accordance with Forestry Principles

(i) Apply appropriate forest management which will not irreversibly reduce the potential of the forest to produce marketable timber and other produce;

(ii) Ensure the perpetuity of the forest as natural resource by undertaking, in the manner and means presently or from time to time prescribed by the Director:

(a) appropriate forest management practices which will include planting, regenerating, harvesting, silvicultural treatments of residual stand and forest protection;

(b) consistent with, and recognizing the limitations on the capacity of the forest to produce a sustainable flow of products:

- the optimum continuous yield of valuable timber of local consumption, the domestic wood working industry and export;
- the maintenance of a high degree of species and structural diversity consistent with indigenous forestry types;
- the improvement of the standard of living of the native population; and
- the creation of income and employment opportunities for the natives;

(c) optimum utilization of timber by -

- establishing an integrated wood processing industry;
- production of value added forest products.

44. (i) The Licensee shall prepare the Forest Management Plan and reconcile the Plan with the Director within one (1) year from the date of commencement of this Licence Agreement. Forest Management Plan, Costs

(ii) In the event that the Forest Management Plan is prepared by the Director, the Licensee shall bear all costs of preparing and completing the Forest Management Plan.

45. (i) Within the Forest Management Plan the Director shall establish the goals and actions for managing the Commercial Class II Forest Reserves on an ecologically sustainable and economically substantiated basis. Sustainability shall be defined in terms of balanced nutrient cycles, conserving forest structure and biodiversity, maintaining forest function, and support of socio-economic needs. Goal of Forest Management Plan.

(ii) Emphasis shall be placed on all aspects of forest management including silvicultural treatment and enrichment planting, and not solely on timber harvesting.

(iii) The Forest Management Plan shall be based on complete forest inventory data properly collected and compiled to a standard set by the Director.

46. Forest Management Plan shall contain the following specific information in text and map form, as further specified in the guidelines as annexed to this Agreement as Schedule D: Content of Forest Management Plan

(a) A policy statement reflecting and strategic goals and objectives for sustainable forest management over the life of the Licence and a medium-term horizon of 10 years;
(b) A description of the area covered by the plan;
(c) Zoning of forest lands according to land capability and function, as further specified in Clause 49;
(d) Sub-division of the area into compartments and portions of compartments (e.g. blocks in plantation areas) for forest planning, management and accounting purposes;
(e) A description of site and stand conditions;
(f) A description and appraisal of previous management activities;
(g) An evaluation of the forest resource base including growing stock;
(h) Plans for:
- Conservation Areas (see clause 49(i));
- Production Areas, including natural forests and timber plantations (see clause 49(ii));
- Community Areas (see clause 49(iii));
- Recreation Areas (see clause 49(iv));
- Infrastructure including the network of primary and secondary roads;
- Manpower and budget;

(i) Designation of areas for timber harvest, silvicultural treatment and enrichment planting;

(j) Forest management standards;

(k) Implementation and control procedures;

(l) An Environmental Impact Assessment of the proposed management prescriptions. Impact assessment shall be conducted during the planning process and shall consist of:

- identification of potentially significant environmental impacts that could reasonably be expected to result from the proposed management activities;
- a description of the alternatives considered during the planning process to reduce the adverse environmental impacts of proposed management activities;
- the identification of mitigation measures which will be applied to avoid or reduce adverse environmental impacts to levels of insignificance; and

(m) Other matters as determined by the Director concerning staffing, communication, fire prevention, record-keeping, financial and budgetary aspects.

47. (i) Forest Management Plan shall be reviewed after five years and updated every ten years, or at any time the Director finds conditions within the planning area have significantly changed; Review and Revision of Forest Management Plan.

(ii) All revisions to the Forest Management Plan shall form a part of this Agreement and shall be binding on the Licensee provided that the plan has been duly approved.

48. No timber harvest shall be conducted in the Licensed Area until the Forest Management Plan has been approved by the Director. No Harvest until Forest Management Plan Approved.

49. The Licensed Area shall for management purposes be zoned as Conservation Area, Production Area, Community Area, or Recreation Area, if applicable. The forest zones shall be designated according to the following criteria: Forest Zoning Criteria.

(i) Conservation Area:
- Areas over 25 degrees slope, or

- Areas with less than 25 degrees slope, but special importance for watershed protection or for the conservation of plant and wildlife habitat.

Permitted uses shall be limited to non-timber forest produce. The area is to be protected totally from commercial timber harvesting.

(ii) Production Area:

(a) Natural Forests:
- Areas less than 25 degrees slope unless Conservation Area.

Permitted uses shall be limited to the production of timber by means of natural regeneration and/or line planting of high value timber species and the production of non-timber forest produce.

(b) Timber Plantations:
- Areas less than 25 degrees slope unless Conservation Area.
- Degraded forest land having no exploitable volume of trees greater than 60 cm dbh, and insufficient regeneration, but not exceeding 25 degrees slopes.

Permitted uses shall be limited to planting and management of short rotation, single-or mixed species industrial timber plantations (ITP), and/or long rotation timber plantations with high-value, indigenous or foreign tree species. Plantations shall be managed in conformance with the Plantation Development Programme and standards specified in Chapter 3 of Part 2 of this Licence Agreement.

(iii) Community Area:
Area which may encompass Conservation Area and Production Forest in the direct vicinity of settlements where the local population exercises customary rights (timber, non-timber forest produce, hunting etc.). Permitted uses shall be limited to community use.

(iv) Recreation Area:
Areas with recreational potential, e.g. waterfalls, caves.
Permitted use shall be limited to development for local recreation and tourism.

50. (i) All data collection by the Licensee and on which the Forest Management Plan is based shall be made available to the Director. Forest Management Plan, Data and Research.

(ii) The Director shall have the right of access to all research and experiments conducted by the Licensee in the Licensed Area and the Licensee shall make it available as and when requested, provided that the Director shall always strictly observe the proprietary rights of the Licensee over the information made available.

51. (i) The Licensee shall prepare and submit to the Director for approval each year an Annual Work Plan which describes the work to be conducted during the following calendar year to implement the Forest management Plan. The Annual Work Plan shall be prepared under the supervision of a professional forester. Annual Work Plan.

(ii) Upon the approval of the Forest Management Plan, the Annual Work Plan shall be submitted to the Director by December 1st. of each year, except that, during the first year of this Agreement, the Annual Work Plan shall be submitted and approved before the commencement of any operations. The Annual Work Plan shall be approved by the authorized officer. In case the Annual Work Plan is rejected, it shall be resubmitted after correction and then approved by the authorized officer.

52. The Annual Work Plan shall contain maps and text describing the types of operations and total work area proposed for operations during the next calendar year. The Annual Work Plan shall contain the following elements: Contents of Annual Work Plan.

(i) A designation of the compartments or portions of compartments proposed for:

- Timber Harvesting
- Silvicultural Treatment
- Enrichment Planting and/or
- Plantation Development

(ii) An operations plan for each proposed activity, consisting of, as appropriate:

(a) A Timber Harvest Plan containing:
(i) A list of trees marked in accordance with silvicultural requirements prescribed in the Forest Management Plan, and their approximate volume, prepared in the format specified in Schedule G.
(ii) A map indicating:
- Stocking: the location and distribution of marked trees.
- Roads and landings: indicating location of main and secondary roads, provisional alignments of feeder roads, skid trails, landings as and/or skyline corridors specified in Schedule E. The road network shall be based on the stock map and the major alignments designated in the Forest Management Plan;
- Designation of the stream network, riparian reserves, areas of 25 degrees slope and above, stream crossing, bridges, culverts, ponds and wet areas;
- Other operational features such as research plots, skyline logging areas etc.

(b) A Silvicultural Treatment Plan designating the location and description of treatments to be applied as specified in Clause 76 and Schedule I.

(c) An Enrichment Planting Plan designating the location and description of enrichment planting activities as specified in Clause 77 and Schedule J.

(d) A Plantation Development Plan designating the location and activities to be conducted in the plantation area. The Plantation Development Plan shall specifically elaborate on:
- survey and demarcation of plantation area
- nursery operations
- site preparation
- Establishment operations
- silvicultural treatments (e.g. weeding, replanting etc.) as further specified in Chapter 3 of Part 2 of this Licence Agreement. In addition the Director may require the Licensee to submit an estimate of the annual budget on the various plantation operations.

53 The Licensee shall undertake any diagnostic surveys necessary to determine the plantable areas suitable for enrichment planting, silvicultural treatment and plantation activities. Diagnostic Survey.

54. Annual Work Plan may include work in one or more compartments or portions of compartments, but in all cases shall contain areas designated for silvicultural treatment and enrichment planting, as well as timber harvest. Required Silvicultural Treatment and Planting Area.

(i) The area planned for silvicultural treatment and enrichment planting each year shall comprise an area at least equal to that proposed for timber harvest;

(ii) To the extent feasible and where silviculturally appropriate, silvicultural treatments and enrichment plantings shall be coordinated with timber harvesting in order to take advantage of equipment and road systems already in place.

55. The Licensee, in close cooperation with supervising Forest Officer, shall maintain and regularly update the Compartment Register for each compartment contained within the Licensed Area. The Compartment Register serves as a permanent record of site and stand conditions, management prescriptions specified by the Forest Management Plan, and all management activities undertaken. The Register shall be maintained in the format specified in Schedule E. The Register shall be subject to review by the Director at any time. Compartment Register.

56. (i) On December 1st. of each year, and each subsequent year thereafter, the Licensee shall submit, together with the Annual Work Plan for the next year pursuant to clause 51(ii), a Compliance Report to the Director indicating that the work described in the prior year's Annual Work Plan has been completed. The Compliance Report shall be verified by field inspection by a representative of or any third party commissioned by the Director. Compliance Report and Certificate.

(ii) After having received the Compliance Report, and following field verification, the Director shall issue a Compliance Certificate, certifying that -

(a) the silvicultural treatments and enrichment planting specified in the Annual Work Plan have been completed;

(b) the timber harvesting operations comply with specifications in the Forest Management Plan, Annual Work Plan, and the specifications for reduced impact logging (see Schedule F).

57. Timber harvest shall not begin in any area until a Compliance Certificate for the prior year's Annual Work Plan has been issued. This provision shall take effect at the beginning of the third year of this Agreement; that is no harvest shall commence in the third year until a Compliance Certificate has been issued for work conducted in the second year. Harvest not to Commence until Compliance Certificate is Issued.

58. A Compliance Certificate shall not be issued in case the field inspection has revealed that the specifications given in the Forest Management Plan and the Annual Work Plan have not been adhered to. The commencement of timber harvest on any area prior to the issuance of the required Compliance Certificate pursuant to Clause 56(ii) is considered a breach and will lead to a cancellation of the Licence Agreement by the Director without payment of compensations of any kind. Breach of Contract, Cancellation of Licence Agreement.

59. Annual Work Plan may be amended upon mutual agreement between the Licensee and Director, but in no case shall previously unauthorized timber harvests be permitted unless: Amendments to Annual Work Plan.

(i) the proposed timber harvest conforms with the Forest Management Plan;

(ii) the silvicultural treatment and enrichment plantings required in the current Annual Work Plan have been completed; and

(iii) additional areas for silvicultural treatment and enrichment planting are designated in the amendment, comprising an area at least as large as that proposed for additional timber harvest.

CHAPTER 2: FORESTRY OPERATIONS IN NATURAL FORESTS

SECTION 1: TIMBER HARVEST AND REDUCED IMPACT LOGGING

60. (i) Timber harvesting shall be restricted to areas zoned as Production Area pursuant to Clause 49, and as designated in the Annual Work Plan. General Limitations on Timber Harvesting

(ii) Felling shall not be conducted until the Annual Work Plan has been approved pursuant to Clause 56(ii).

61. Timber harvesting is prohibited on the following locations within the designated harvest areas: Limitations on Location of Timber Harvesting.

(i) Localized sites greater than 25 degrees slope which are not indicated in the Forest Management Plan and which would require tractors to leave designated skid trails for yarding;

(ii) Areas which are insufficiently stocked with regeneration of desired species and no enrichment planting is intended;

(iii) Within the riparian reserve of perennial streams and rivers wherever they appear on the ground;

62. (i) Felling of the following trees is prohibited: Felling Limitations

(a) Trees less than 60 cm dbh or greater than 120 cm dbh;
(b) Prohibited species and fruit trees pursuant to Schedule B;
(c) Defective trees or logs having one-half or more of their cross-section unmerchantable.

(ii) The minimum diameter shall be measured at breast height or above the buttresses.

(iii) Trees shall be felled as near the ground as possible taking into account buttresses;

(iv) With the exception of trees specified in Clause 62 (i), and consistent with all other provisions of this Licence Agreement, the Licensee shall fell all marketable trees of commercial species. The standard of marketable and minimum requirement of utilizable tree species may be revised from time to time by mutual agreement;

(v) Subject to Clause 62(i), species which do not belong to a commercial category may be utilized if it is not prohibited by the Forest Management Plan or by any existing law.

63. Yarding shall be limited to the following methods: Limitations on Yarding Methods.

(i) Ground skidding using tractors shall be limited to areas less than 15 degrees slope;

(ii) Integrated use of airborne (e.g. skyline) and tractor yarding shall be used in areas 16-25 degrees slope;

64. The Licensee shall not fell any tree within the riparian reserve. Heavy equipment crossings of watercourses shall be limited to those designated in the Annual Work Plan or as approved by the supervising Forest Officer. Where temporary fill is placed or log extraction conducted across a watercourse, the watercourse must be reopened to free passage of water when extraction is completed. Operations within Riparian Reserve.

65. The Licensee shall not cause any avoidable obstruction on any road, path or boundary or in any stream, and shall immediately remove any obstruction, whether avoidable or unavoidable, and in any case within such period as the Director may specify in writing. Removal of Obstruction.

66. (i) Timber harvest and extraction shall be conducted according to the provisions of Reduced Impact Logging (RIL) as specified below and in the standards annexed to this Licence Agreement as Schedule F. Reduced Impact Logging Standards.

(ii) The RIL standards form an enforceable part of the Licence and any deviations must be approved by the authorized officer. Violations are subject to penalty and may cause for an immediate stop of the operation.

67. RIL operations shall minimize the environmental impact of harvesting and damage to the residual stand by providing for: Minimizing Environmental Impact through RIL.

(i) Pre-Operational Planning and Layout of the Harvest Area.

This shall be conducted during preparation of the Annual Work Plan pursuant to Clause 52 and Schedule F, and shall generally consist of:
(a) designation of areas proposed for timber harvest;

(b) inventory, marking and preparation of a stock map indicating trees to be felled;

(c) flagging and mapping of road and skid trail alignments;

(d) designation of activities requiring a long lead time;

(ii) Reduced Impact Logging and Extraction of Logs.

Harvesting and extraction shall be conducted in such a manner as to reduce soil disturbance and damage to residual trees by controlling felling, tractor operations, road and skid trail construction, landing and protecting riparian and other buffers.

(iii) Post-Harvest Operations.

Post-felling and extraction operations shall include removal of stream crossing structures, ripping and re-shaping of landings, and construction of cross drains to restore natural drainage patterns.

68. (i) The Licensee shall avoid unnecessary damage to standing trees during the felling and extraction operations. — Damage to Residual Stand.

(ii) The Licensee shall be penalized for all damaged standing trees (greater 10 cm dbh) exceeding 20 percent of the residual stem number and for logs damaged or broken by careless felling and logging pursuant to item (g) to Clause 111(i).

69. The Director shall have the right to restrict the felling and extraction of trees, or prescribe special harvesting and skidding methods beyond the requirements of the Forest Management Plan if, in the opinion of the Director, this is necessary to protect regeneration or provide soil or water conservation. — Director's Authority to Limit Timber Harvest.

70. (i) The Licensee shall construct and maintain all roads and skid trails to the standards specified for Reduced Impact Logging and in accordance with the Forest Management Plan and Annual Work Plan. — Road Construction And Maintenance.

(ii) The Licensee shall ensure that all roads required for operation within the Annual Work Plan area are ready for use at least six months before the commencement of the harvesting.

71. The Licensee shall be responsible for taking the necessary measures to ensure minimization/prevention of landslide and environmental pollution in accordance with the Environmental Quality Act, 1974, Environmental Quality (prescribed Activities)(Environmental Impact Assessment) Order, 1987 and any other relevant environmental laws as may be enacted from time to time. — Environmental Quality Act, Etc.

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72. The Licensee shall not fell any tree within thirty(30) days of the date of expiration of the Licence (i.e. ~~31-12-2061~~) unless an extension of time is approved by the Director. Extraction and hauling of all logs should be completed within one month of the felling of such trees. — Time Limit for Felling and Extraction.

73. (i) The Licensee shall maintain a register of harvested logs (log register) in the format provided in Schedule H to this Licence Agreement and shall submit a copy of the same to the Director for record; — Log Register.

(ii) The Licensee shall submit to the Director an abstract of the trees marked and felled in the format provided in Schedule G to this Licence Agreement. Such format duly completed shall be submitted every month.

(iii) The Licensee shall in the format provided in Schedule K to this Licence Agreement maintain a register indicating the disposal of logs from the stumping point. Details of such register shall be submitted to the Director each month. In addition the Licensee shall submit to the Director every month the details of the stump log book maintained by the Licensee at their stumping point.

74. (i) The Licensee shall mark and measure all logs at the place where felled or at a determined checking point or points. The logs shall be marked by the Licensee with a hammer-mark approved and authorized by the Director. — Hammer Mark.

(ii) The Licensee shall number with a scribe or punch all logs before they are presented for royalty assessment. The log numbers so marked shall be in a continuous series which may be split periodically in a manner approved by the Government.

75. The Licensee shall remove the logs from each timber harvest area to the checking station or stations as specified in writing by the Director, provided that the Licensee may in the Licensed Area use, without bringing to a checking station any timber which it is entitled to extract under this Licence Agreement for railways, bridges, buildings, loading ramps or works (other than temporary works) constructed and maintained by it for the purposes of the business and any tops and branches of trees felled for firewood or charcoal for domestic use.

Exemption for Logs Used in Construction.

SECTION 2: SILVICULTURAL TREATMENT AND ENRICHMENT PLANTING

76. The Licensee shall apply silvicultural treatments as prescribed in the Forest Management Plan and the Annual Work Plan. Silvicultural Treatments shall serve to improve the stocking and growth of commercial timber species through the liberation of potential crop trees and release of young generation of commercial species. Silvicultural treatment operations shall utilize girdling, cutting and/or removal of competing tree species, climbers and climbing bamboo in conformance with standards appended to this Licence Agreement as Schedule I.

Silvicultural Treatment.

77. The Licensee shall conduct enrichment planting activities pursuant to requirements specified in the Forest Management Plan. Enrichment plantings shall serve to rehabilitate heavily degraded logged-over forest and re-establish a good stocking of commercial timber species. Enrichment planting operations shall conform to standards appended to this Licence Agreement as Schedule J and shall:

Enrichment Planting.

(i) utilize seed and/or seedlings of appropriate species and quality;

(ii) utilize a sufficient number of seeds and/or seedlings to attain the enrichment planting objectives specified in the Forest Management Plan; and

(iii) provide sufficient maintenance of planted areas, including silvicultural treatments, to ensure successful restocking.

CHAPTER 3: PLANTATION DEVELOPMENT AND OPERATIONS

78. Timber Plantations may be developed only in areas zoned for plantation forestry in the Forest Management Plan.

Permitted Location.

79. Before any conversion to plantation use the Licensee shall submit a 10-year Plantation Development Programme as part of the Forest Management Plan pursuant to Chapter 5 item 4 of Schedule 2, and covering those compartments or portions of compartments designated for conversion and management as plantations.

Plantation Development Programme.

80. (i) No clear-felling, site preparation or planting activities shall be conducted in the proposed plantation area until the Plantation Development Programme and a Plantation Development Plan have been approved by the Director, unless allowed otherwise by the Director.

Limit on Plantation Activities.

(ii) All plantation activities shall be conducted in strict accordance with the Plantation Development Plan and all standards pertaining to plantations contained in this Licence Agreement. Any deviation thereto shall only be with the explicit written approval of the Director.

81. The Plantation Development Programme shall contain the following information in text and map form:

Contents of Plantation Development Programme.

(i) A description of the area covered by the plan including size, location, name;

(ii) Maps, text, and timber inventory data demonstrating that the proposed conversion area meets the criteria for timber plantations listed in Clause 49 (ii)(b);

(iii) A policy statement providing a silvicultural and economic justification for the proposed land conversion from natural forest to timber plantations;

(iv) A description of the silvicultural characteristics of the species selected for plantation production and a justification for their selection. The justification shall include literature citations and/or results of field tests demonstrating the suitability of the selected species to the site and soil conditions of the conversion area;

(v) A discussion of the proposed utilization of plantation wood products. Discussion shall include estimates of anticipated wood volume, projected length of rotation; capacity and availability of facilities needed for processing and shipping, and other financial and infrastructural aspects;

(vi) A description of the resource-base of the site including existing vegetation and timber inventory, regeneration status, geology and soils, climate, site productivity, utilization by wildlife and other resource characteristics;

(vii) A conversion and development element indicating the location and timing of timber clear-felling operations; estimated volume of logs to be removed; annual planting area; methods and equipment to be used in site preparation; layout of the plantation; road network; location and operations of nurseries; materials, equipment and labour requirements; availability of planting stock; pre-planting operations and other site development activities; and

(viii) A management and operations element indicating management activities following plantation establishment; record-keeping and control; contingency plans for controlling pest outbreaks; and other management activities.

82. Maps included in the Plantation Development Programme shall comprise: Required Maps.

(i) A Plantation Locality Map indicating the compartments, or portions of compartments intended for conversion and management as a timber plantation;

(ii) A Plantation Soil and Planting Suitability Map indicating existing soil types and suitability of the site for supporting the proposed plantation species;

(iii) A Timber Harvest, Site Preparation and Planting Map indicating:

(a) the present status of the site;
(b) the subdivision of the site into blocks delineating clear-felling units;
(c) the progression and timing of timber harvest and land clearing operations;
(d) the location and timing of site preparation and planting activities;

(iv) A Fire Protection Map indicating:

(a) access points for fire suppression equipment;
(b) location of equipment storage and maintenance yards and a list of fire suppression equipment that will be maintained in operating condition and available for fire suppression; and
(c) operational plans for fire prevention and suppression;

(v) A Plantation Organization and Road Map indicating the present and planned road network, nurseries and overall plantation layout.

83. Areas selected for plantation activities shall be divided into compartments for management and accounting purposes. Compartments shall be divided into blocks for purposes of managing clear-felling and subsequent planting operations. Delineation of Plantation Area into Compartments And Blocks.

84. (i) The Plantation Organization and Road Map shall include a descriptive text and map of the road network needed to serve the plantation when fully developed. Plantation Road Network and Classification

(ii) The road network shall utilize a system of road classes designed to meet the needs for planting, fires, suppression and efficient supervision. Road classification shall consist of the following:

(1) Main Roads
These are all-weather roads which serve as the main access from the highway or public road system.

(2) Secondary Roads
These are all-weather roads which serve to move traffic from the main road to the planting area and provide the major access system within each annual planting area.

(3) Feeder Roads

These serve as basic utility roads designed to move planting and tending crew to work sites.

(4) Planting Tracks

These serve the basic needs of planting and tending and consist of simple bulldozed and leveled traces with a minimum number of culverts and bridges.

85. Following approval of the Plantation Development Programme the Licensee shall clearly mark on the ground the area(s) designated for plantations. The Licensee shall maintain the boundaries in a cleared condition to the satisfaction of the Director until the cessation of operations. If required by the Director, the Licensee shall reestablish such boundaries upon the cessation of plantation operations. Demarcation of Plantation Boundaries.

86. During the conversion from natural forest to forest plantations the Licensee shall utilize forest practices that minimize impacts on soil compaction, soil fertility, erosion, water quality and fire hazard. Forest Practices During Land Conversion.

87. (i) Only areas designated for timber plantations may be clear felled. No clear-felling is to be conducted in areas identified for natural forest management or other land classification; Clear-felling.

(ii) Clear-felling of the timber plantation area shall be conducted in such a manner that easily accessible sites are worked simultaneously with areas where extraction is more difficult and expensive, on a scale appropriate to the distribution of sites within the plantation area;

(iii) Clear-felling should progress in the direction towards wildlife protection areas.

88. (i) Reduced Impact Logging practices relating to (1) road and skid-trail construction, (2) felling and (3) skidding as specified in Schedule F shall be implemented during all clear-felling operation; — Reduced Impact Logging Practices (RIL).

(ii) Blading of topsoil, except for road construction, is prohibited;

(iii) No harvesting or ground disturbance shall occur within the riparian reserve of perennial streams and rivers as specified in Clause 18.

(iv) A comprehensive harvesting plan or CHP which shall include a tree retention map, shall be prepared by the Licensee for approval by the Director, prior to clearing.

(v) Non-conformance to the CHP shall render the Licence to termination.

89. Areas of natural forest vegetation shall be retained in bands or groups interspersed within plantation blocks to serve as habitat for natural pest control agents. — Retention of Natural Forest.

90. (i) Burning after clear-felling shall be used only under limited conditions as specified in the Plantation Development Programme. Burning shall be conducted using "prescribed (cold) burning" methods. — Burning.

(ii) Burning shall be conducted in a direction away from wildlife protection areas.

91. (i) The Licensee shall not fell new blocks for plantation activities unless the plantation activity in the previous year's block has been completed to the satisfaction of the Director, with the exception of the first and second year. The Licensee shall start logging the third-year block only if the first-year block has been completely planted, and logging into the fourth-year block only after the second-year block has been completely planted, and so forth. — Restriction on Felling of New Blocks.

(ii) Each block shall be inspected by the Director or his authorized representative. New blocks shall not be entered until after issuance of a Compliance Certificate to the Licensee indicating the work in new blocks may commence.

92. The Licensee shall use certified seeds for purposes of planting. — Use of Certified Seeds.

93. The Licensee shall undertake research in plantation silviculture, and develop and apply technologies to improve plantation productivity, disease and pest treatments, and utilization of residual wood. — Research.

94. (i) The Licensee shall take all reasonable precautions to prevent an outbreak of fire and in the event of any forest fire shall employ all labour and equipment available for controlling and extinguishing such fire and in guarding against any recurrence. Any outbreak of fire in the Licensed Area, however small, shall be immediately reported to the Director with details of its locality and extent; — Fire Prevention.

(ii) In the event of an outbreak of forest fire due to wilful or negligent action or omission of the Licensee, the Licensee shall be liable to pay compensation to the Government for damage to the forest caused by the fire and costs of suppression. The amount of the damages assessed and the compensation shall be determined by the Director whose decision shall be final.

95. (i) If the Licensee fails in tending or maintaining the plantation the Director shall have the right to stop the Licensee from further plantation operations until the tending and maintenance of the plantation has been fully attended to the satisfaction of the Director. — Failure of Plantation.

(ii) If the Licensee fails to undertake the plantation in the area clear-felled for the purpose, the Director may, at his discretion, arrange for planting such area or areas and the expenses of such replanting shall be payable by the Licensee on demand in writing.

(iii) Failure to plant a clear-felled area may be construed a breach on the part of the Licensee and as such will be subject to penalties as provided under this Licence Agreement.

96. Under no circumstances shall the Licensee convert an area marked for plantation activity into any other use. Any attempt to do so will constitute a breach under this Licence Agreement. — Conversion of Plantation to Other Use.

97. The Licensee may clear-fell all the trees in the block unless some or particular tree species specified by the Director are prohibited from felling. — Trees Exempted from Felling.

98. All provisions contained in other portions of this Licence Agreement concerning log removal, delivery to checking stations, hammer marks, log numbering, record-keeping, method of measurement of timber, and other matters which apply to the harvesting and removal of logs from natural forests shall also apply to harvesting and removal of logs during land conversion to timber plantations. Applicability of Harvesting, Log Extraction, Marking, Delivery and Other Standards.

99. (i) All plantation species harvested from the first rotation shall be assessed for royalty at not less than 50% of the prevailing royalty rates. Subsequent harvesting from the second rotation onwards shall be subject to charges at the full royalty rate. Charges for Plantation Logs.

(ii) As soon as a forest rent as outlined in Clause 101 and Schedule L is in force this Clause becomes obsolete.

PART 3: ROYALTY MATTERS, PENALTIES AND OTHER CONTRACTUAL PROVISIONS

100. The method of measurement of timber and minor forest produce shall be: Method of Measurement of Timber and Minor Forest Produce.

(i) Sawlogs:

(a) Measurement will be in metric system. All measurements are to be made on the assumption that all barks have been removed.

(b) Measurement of length:
Length shall be the shortest distance between the ends of the logs, measured along the axis of the logs. Length shall be taken to the nearest 0.2 metre i.e. part of metre less than 0.1 will be ignored while 0.1 metre or more will be taken as 0.2 metre.

(c) Calculation of volume:
Volume shall be expressed in cubic metre using tables published by the Sabah Forestry Department.

(ii) Pulpwood and fuelwood:
By weigh bridge at pulpmill log yard.

(iii) Minor forest produce:
By weight

(iv) The Government may require the Licensee to produce a correct specification of species, measurements and volumes from all the logs in any raft or part of raft. Such specifications shall be in a Form approved by the Government and may be verified by such percentage check as the Director shall direct. The specifications shall not be accepted if the result of percentage check falls outside any limits of variation determined by the Director.

101. (i) All marketable trees which have been felled shall be subject to royalty payment irrespective of the fact that the materials have been left in the timber harvest area. Royalty Assessment and Forest Rent.

(ii) The Licensee is aware that the current system of royalty assessment is under review and may be substituted within five (5) years by a forest rent as outlined in Schedule L. Such forest rent system shall also cover produce derived from forest plantations established by the Licensee. The Licensee agrees that it will support the introduction of the new forest rent system by providing reliable economic data and information required to calculate such forest rent as outlined in Schedule L.

(iii) During the transition period prior to the introduction of the forest rent system all marketable trees which have been felled shall be subject to royalty payment and any other charges.

102. (i) Within thirty(30) days from the dates respective on which measurement statements of timber which has been removed to the checking station have been furnished to the Licensee by the Government, the Licensee shall pay or cause to be paid to the Director on behalf of the Government royalty in respect thereof at the rates calculated as per the established produce. Royalty Rates and Payment.

(ii) If any timber is subsequently removed by the Licensee, royalty shall be paid thereon at the following rates: For timber logs for export, converted timber or timber log for processing, the rate specified in the Royalty Rate List in Schedule II of the Forest Rules 1969 as amended from time to time.

(iii) The Licensee shall promptly pay the Government all forest charges and fees as stipulated by the Forest Enactment 1968 and Forest Rules 1969 or as per the stipulations laid down by the Director from time to time.

103. The Director shall be at liberty to call upon the Licensee to extract timber from within the Licensed Area for research purposes after due notice and on payment of reasonable charges at mutually agreed rates to be fixed from time to time provided that such timber shall not be required from the Licensee in such quantities as to render it impossible for the Licensee to meet contractual obligation than it would otherwise have been possible for them to meet. Extraction of Timber for Government Use.

104. (i) All timber that has been measured for royalty may at the Government's discretion be marked by an officer of the Forestry Department at the time of measurement with a Government royalty hammer mark denoting that the timber has been so measured and after such hammer marking or if hammer marking is not required, after payment of royalty and after the full discharge of any penalty leviable under this Agreement, the timber shall become the property of the Licensee. Marking of Timber. Timber is Government Property until Payment of Royalty and Other Dues.

(ii) Until royalty has been paid or such hammer marking as required by the Government has been carried out and penalties, if any, fully discharged by the Licensee the timber shall be deemed to be the property of the Government and the Licensee shall have no right to sell, mortgage or hypothecate it or create any charge or lien thereon.

105. No timber shall, except with the permission in writing of the Director, be removed from the checking station or stations until royalty has been paid on it and if the Government so requires, has been marked with a Government royalty hammer mark and until all penalties under this Agreement have been fully discharged by the Licensee. Timber not to be Removed

106. In case of default in payment of royalty the Director shall have right to stop the harvesting operations until full payment of existing dues have been made by the Licensee. Default in Payment of Royalty.

107. The Licensee warrants and represents that it has extensive experience and proven technical and financial capabilities in the field of planting, harvesting, transporting, producing, processing and marketing of forest products. Licensee's Warranty as to Experience.

108. Subject to the laws and regulations in force, the paid up capital of the Licensee in any joint venture shall not be less than 51 percent owned by Malaysians of which a minimum of 30 percent shall be held by Bumiputras of Sabah origin. Equity Structure.

109. The term "events of default" shall mean each of the following events: Events of Default by Licensee.

(i) Any material breach of the Licence Agreement by the Licensee or any failure to perform or abide by any of its material terms or covenants or any failure to satisfy conditions, warranties or representations of this Licence Agreement;

(ii) Failure by the Licensee to prepare the Forest Management Plan and Annual Work Plan and reconcile the Plan with the Director;

(iii) Failure by the Licensee to implement the Forest Management Plan or Annual Work Plan or both;

(iv) If the Licensee shall commit an anticipatory breach of the Licence Agreement;

(v) If the Licensee shall become insolvent, or admit in writing their inability to pay their debts as they mature, or apply for, to, or acquiesce in the appointment of a trustee or receiver for the Licensee or any of their property; or

(vi) If the Licensee is in breach of any of the terms and conditions and covenants of this Licence Agreement.

110. Without prejudice to the generality of the foregoing Clause 109, a breach of a material term or covenant of this Licence Agreement shall be deemed to have occurred upon the happening of any of the following events: Material Breaches.

(i) The licensee's failure to pay any forestry charges and fees as provided under Clauses 101 and 102; or

(ii) The Licensee's failure to make concrete efforts at implementing the Forest Management Plan and the Annual Work Plan as required under Clauses 44 and 51.

111. (i) In the event of any default or breach of a material term or covenant by the Licensee as referred to in Clauses 109 and 110, the Government shall be entitled to give notice thereto in writing to the Licensee and if the Licensee fails to remedy the default within thirty (30) days from the date notice was given, the Government shall have the right to forthwith terminate this Licence Agreement. General Penalty and Power of Government to Terminate Agreement.

(ii) Notwithstanding Clause 111 (i), for the following particulars of events of default or breach of this Licence Agreement by the Licensee, the Government shall have the right to fix in its absolute discretion such penalty not exceeding the amounts shown below and the Licensee shall be required to pay such amount to the Government :

Particulars		Penalty
a)	Attempting and/or unauthorized export of logs;	2 times export royalty rate and/or forfeiture of logs involved.
b)	Felling undergirth trees;	2 times export royalty rate.
c)	Felling of prohibited species;	RM5,000.00/tree
d)	Felling outside boundary of Licensed Area/coupe area;	2 times export royalty rate and/or forfeiture of logs involved.
e)	Failing to report worked area and leave the area properly inspected for closing harvesting inspection by the Forestry Department;	RM5,000.00/tree
f)	Felling in violation of Reduced Impact Logging specifications;	RM5,000.00/tree
g)	Felling in violation of Annual Work Plan provision;	RM5,000.00/tree

h)	Felling after the Licensed Area is Closed;	2 times export royalty rate and/or forfeiture of logs involved.
i)	Leaving high stumps;	RM100.00/stump.
j)	Delay in extracting felled trees;	RM1,000.00/tree or full export royalty
k)	Failure to remove merchantable timber (abandoned logs);	Full export royalty rate
l)	Using poles of commercial species for temporary works;	RM500.00/pole
m)	Failing to submit an Annual Work Plan or a complete Annual Work Plan by the date specified;	RM10,000/month or part of a month during which the plan remains unsubmitted.
n)	Failing to submit details of outbreaks of fire;	RM10,000.00 or assessed value of damaged forest property
o)	Production of an inaccurate specification for any raft or part of a raft;	Confiscation of timber logs involved
p)	Unauthorized removal of logs from checking station;	Confiscation of timber logs involved
q)	Incorrect declaration of species of logs to evade full royalty payment.	Confiscation of timber logs involved or proceeds of sales.
r)	Illegal logging or any boundary infringement by third party within the forest Licensed Area.	RM10,000 or assessed value of damaged forest property.

(iii) Where a penalty imposed under Clause 111 (ii) exceeds Ringgit Malaysia Five Hundred Thousand (RM500,000.00) in the aggregate, the Licensee shall have the right of appeal to the Minister. Such appeal shall be made to the Chief Minister within one(1) month from the date of the letter from the Government on the penalty imposition.

(iv) In the event of repeated or further default or breach under Clause 111(ii) perpetuated by the Licensee, the Government shall be entitled to give notice in writing to the Licensee to seek justification for such default or breach within thirty (30) days from the date of sending such notice. If the justification so provided by the Licensee is not acceptable to the Government, the Government shall have the right to terminate this Licence Agreement without further notice and without payment of compensation of any kind to the Licensee.

112. (i) Subject to Clause 112(ii), in the event that the Licensee believes it is necessary to suspend temporarily, operations in whole or in part because of economic or other conditions, they shall promptly give the Government a notice in writing of such intention and upon the giving of such notice the Licensee may suspend such operations for a period of not exceeding three months. Temporary Suspension.

(ii) In the event that the Minister should determine, within three months from the date of giving such notice, that such suspension was not justified by legal, economic or other grounds stated in such notice, they shall have the right to hold the Licensee liable for any penalties prescribed by the Government.

(iii) In the event that such suspension of operations continues for a period in excess of three months and the suspension is not attributable to any force majeure, it may be treated by the Government as an abandonment of the operations.

113. In the event of the termination for default or surrender for cause of this Licence Agreement the Licensee shall nevertheless continue to have obligation in regards to commitments before the termination of this Licence Agreement. Obligation After Default.

114. Upon the expiry or earlier termination as a result of default or surrender for cause of this Licence Agreement and of any extensions or renewals thereof: Disposition of Property.

(i) The licensee shall leave in good and safe order all fixed assets such as buildings, roads, warehouse, railroads, airstrips, harbours, and docks constructed by the Licensee within the Licensed Area and the same shall become the property of the Government without compensation to the Licensee; and

(ii) Subject to any claim which the Government may have against the Licensee arising under this Licence Agreement or otherwise, all normal stockpiles and other liquid assets used by the Licensee in connection with its operations and activities under this Licence Agreement shall remain the property of the Licensee and may be freely withdrawn, exported, sold or otherwise disposed off provided, however, that the Government would have the first right to purchase at a fair price to be determined among the parties, not exceeding the cost to the Licensee, any such stockpiles and assets. Provided further that the Government shall exercise such right or purchase within 90 (ninety) days after the termination. In the event that the Government opts not to exercise this option, the Licensee may remove such stockpiles and other assets from the Licensed Area.

115. (i) Any failure by the Director or any of its instrumentalities or sub-divisions or by the Licensee to carry out their obligation under this Licence Agreement shall not be deemed a breach of contract or default if such failure is caused by force majeure or reasons beyond the parties control. If performance is delayed, curtailed or prevented by any such causes, then anything in this Licence Agreement to be contrary notwithstanding, the time for carrying out the obligation thereby and the term of this Licence Agreement specified under Clause 2 shall each be extended for a period equal to the total of the periods during which such causes of their effects were operative; Force Majeure.

(ii) For the purpose of this Licence Agreement, force majeure shall include wars, insurrections, disturbance, earthquakes, storm, flood, explosions, fires, lightning, riots, blockades, epidemics, Acts of God or the public enemy over which the affected party has no control and which must be of such a nature as to delay, curtail, or make timely compliance with its obligations under this Licence Agreement impossible for the party affected;

(iii) The party whose ability to performs its obligation if affected by force majeure shall notify forthwith the other party thereof in writing, stating the cause and the party shall endeavor to do all that is reasonably possible within its power to remove such cause.

(iv) Economic downturn, non-availability or insufficient fund or lack of financing on the part of the Licensee shall not constitute an event of Force Majeure.

116. (i) The Licensee shall keep and maintain at its principal place of business in Sabah, Malaysia throughout the term of this Licence Agreement and have available for a period of at least 10 (ten) years thereafter, complete, true and accurate books as are necessary so that they can demonstrate and so that the Government can determine the Licensee's performance and compliance under this Licence Agreement; Records and Audit.

(ii) The Government shall have the right to request for full free access to all such records, including the right to make copies thereof, or extracts there from. In addition, upon the written request of the Government, the Licensee shall make available at their expenses such records at such places and times as shall be requested for the use of any State or Federal Department. The Licensee shall also make available, at their expenses, such of their officers and employees as the Government may require to discuss the Licensee's finances, accounts and affairs. Such officers or employees shall if requested by the Government thereof produce such records as may be specified;

(iii) The books of account of the Licensee shall be maintained in accordance with the accepted accounting principles applied on a consistent basis and shall contain all information, correctly stated, and to facilitate the determination of all matters relating to payments, taxes and to such other matters in which payments may be due to the Government. Within a reasonable time after the end of fiscal year, the Licensee shall submit to the Government a balance sheet, a statement of sources and application of funds for the preceding year

Such financial statements shall be prepared in accordance with the accepted accounting principles applied on a consistent basis and shall be certified by a firm of independent certified public accountancy.

117. (i) The Director shall retain the right to supervise and inspect the operations in the Licensed Area. He may also commission a third party on his behalf to carry out inspection and management audits. In any case the Licensee shall provide all reasonable assistance and facilities to obtain an effective and orderly supervision, inspection or management audit. Supervision.

(ii) The Director shall stipulate, in more detail than provided in Part 2 of this Licence Agreement, the procedures and rules of sound forestry practices concerning planning, forestry operations, reporting and supervision. Guidelines on sustainable forest management approved to be applicable to the Licensed Area and/or, from time to time, amended by the Director form part of this Licence Agreement.

(iii) The Licensee shall use measurement method and devices that have been certified as valid by the Director so as to provide reliable results in the measurement of materials logged, processed, transported and marketed;

(iv) With this Licence Agreement, the Licensee binds himself to execute all provisions stated in this Licence Agreement, to comply with all regulations in force concerning forest utilization and are obligated to maintain an accurate administration and book-keeping complete with date off their exploitation, production, inventory, sales, expansion, development and operational cost and to write a report which is to be submitted to the Government when asked to do so.

(v) If after an inspection, the finding of the Director proves that the Licensee failed to perform or perform sufficiently the provisions stated in this Licence Agreement, then the Director on the instruction of the Government has the right to carry out or to improve the execution of the said provisions by using its own apparatus or assisted by third parties, with all costs to be borne by the Licensee.

118. (i) Without prejudice to the generality of the foregoing, no rights are hereby granted with respect to minerals, oils, natural gas, chemicals, precious or semi-precious products, and any other natural resources; General Provision.

(ii) The Government reserves the right to examine and to redetermine the amount of consideration involved in any forest and forest products transactions in order that the Government may be assured that the consideration reflected in the books of the Licensee reflects the true value of such transactions rather than the consideration specified.

The foregoing provision shall be interpreted to give the Government such powers as is necessary to ensure that all transactions will be reflected in the books of the Licensee in accordance with the true consideration and to prevent the Licensee from avoiding payments of the full bona fide amount due to the Government.

(iii) The Licensee shall have the sole right to collect, remove and utilize all forest produce planted by them subject to the payment of royalties and other charges and subject to the terms and conditions of this Licence Agreement and the provisions of Forest Enactment 1968 and rule made thereunder.

119. Time whenever mentioned in this Licence Agreement shall be of the essence. Time

120. Any notice or other communication to be given under this Licence Agreement to the Government or the Licensee may be given by delivering or posting the same to the office of the Director or the principal office of business of the Licensee in the State of Sabah, as the case maybe. Notices.

121. This Licence Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective successors and assignees but the Licensee shall not assign, charge or part with any rights or privileges thereunder without the previous sanction in writing of the Minister. Non-Assignability.

122. The headings appearing in this Licence Agreement are inserted for convenience only and shall not affect the meaning or interpretation of this Licence Agreement or any provision thereof. Marginal Headings.

123. The validity, interpretation, construction, performance and effect hereof and each and every term of the covenant, provision, condition hereof, and each and all the rights and remedies arising hereunder, and in any proceeding shall be governed by the State Laws of Sabah including the Federal Laws of Malaysia applicable to Sabah. Governing Law.

124. This Licence Agreement shall be construed in accordance with and subject to the provisions of any laws for the time being in force in the State of Sabah and the Federation of Malaysia and anything contained in this Licence Agreement shall not be deemed to relieve the Licensee, its agencies and servants from complying therewith. Agreement to be Construed in Accordance with And Subject to The Laws of the State of Sabah.

125. (i) The following documents shall be deemed to form and be read, construed and interpreted as part of this Licence Agreement; Documents and Schedules.

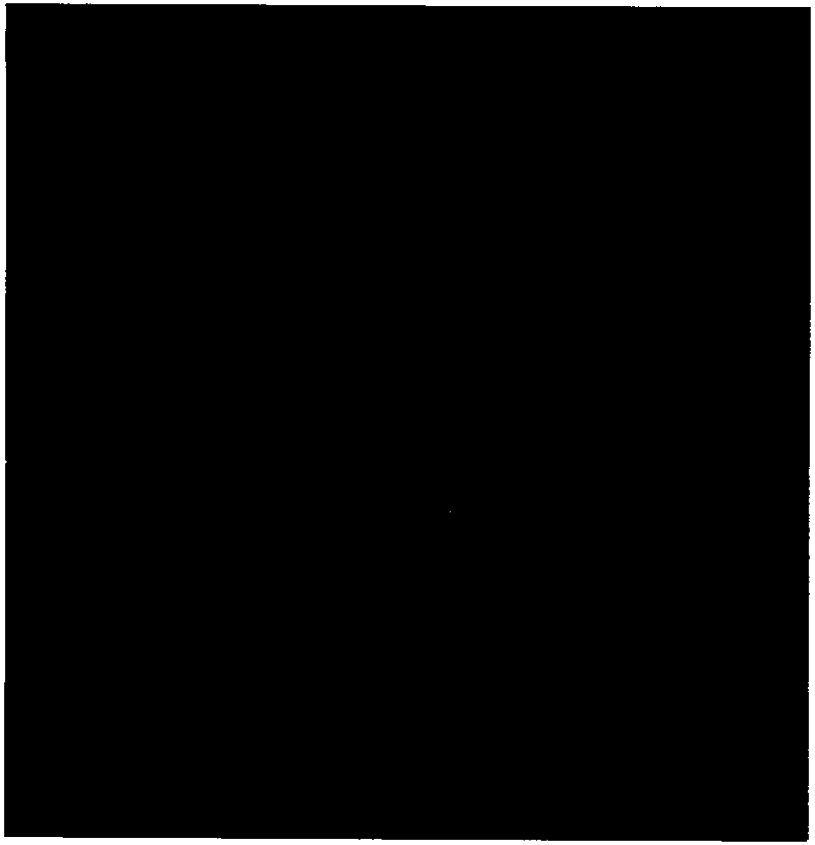
a. Timber Licence Agreement Map (Schedule A) with Map FD MAP NO. 7/37, and

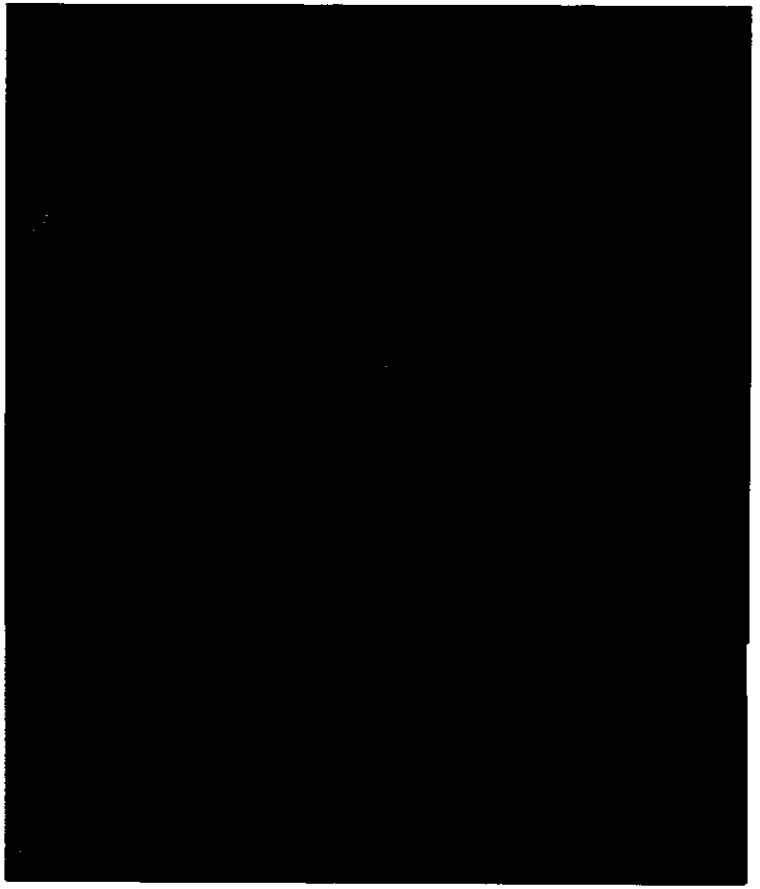
b. Schedules B to L

(ii) Terms used in this Licence Agreement and not herein defined in Clause 1 or any of the schedules appended to this Licence Agreement shall be interpreted by the Director and such interpretation shall be considered final or as much as possible defined in accepted forest terminology.

126. Any alterations, additions, deletions or variations to this Licence Agreement if considered necessary and agreed by both parties may be included as an addendum to this Licence Agreement. Such alterations, additions, deletions or variations shall be duly executed by both parties and shall form part of this Licence Agreement. Addendum.

127. Knowledge or acquiescence by the Government of any breach of any of the conditions or covenants contained or any indulgence given by the Government shall not operate as or be deemed to be a waiver of such conditions or covenants or any of them and notwithstanding such knowledge or acquiescence or indulgence given the Government shall be entitled to exercise its rights under this Licence Agreement and to require strict performance by the Licensee of the terms and conditions herein. No waiver of conditions or covenants due to knowledge or acquiescence by the Government.





IN WITNESS HEREOF Secretary of Natural Resources of the State of Sabah has hereunder set his hand and inure the Public Seal of the State of Sabah and the Licensee has caused its common seal to be hereunto affixed the day and year first above written.

(PUBLIC SEAL)

SIGNED, SEALED AND DELIVERED]
BY AMAT MD. YUSOF]
SECRETARY OF NATURAL RESOURCES]
PURSUANT TO THE DELEGATION OF]
POWERS MADE UNDER SECTION 4 OF]
THE DELEGATION OF POWERS]
ENACTMENT 1963]

IN THE PRESENCE OF:

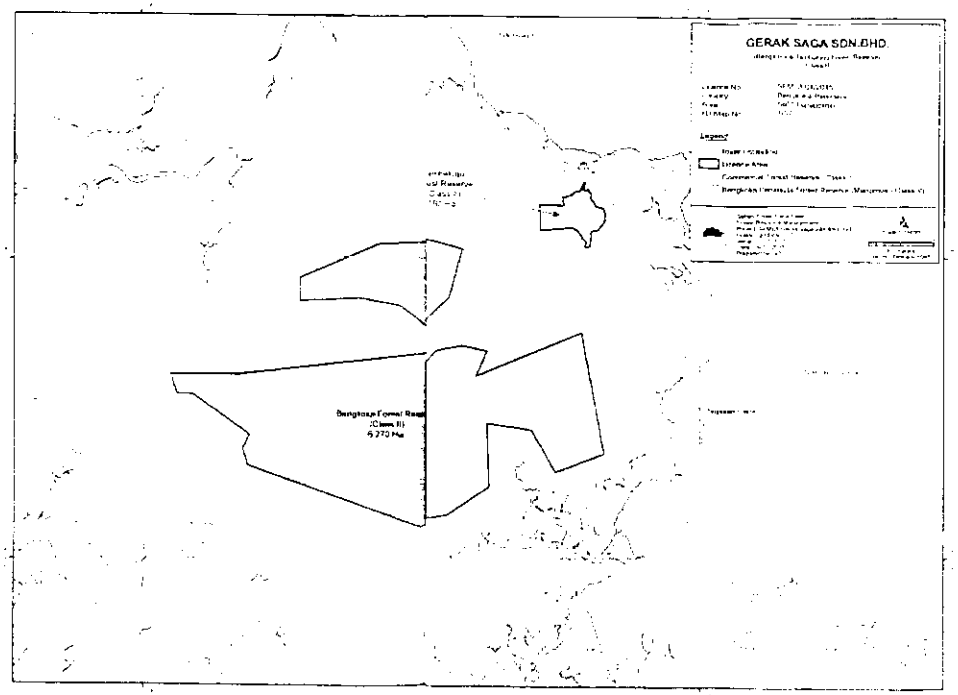
THE COMMON SEAL OF]
]
]

LICENSEE

SCHEDULE A

(Clause 3(i))

Map and Boundaries of Licensed Area



SCHEDULE B

(Clause 1 (31))

Prohibited Species

"Prohibited species" means the following trees:

1. Mangrove
2. Any tree marked for retention by the Director
3. Any tree of the genera specified in Schedule I of the Forest Rules 1963 if the diameter is less than the minimum diameter prescribed unless marked for felling by the Director.
4. All Tengkawang/Kawang species including Shorea macrophylla, Shorea gysbertiana, Shorea pinangah
5. All Mangifera species (Asam family – manga or mangong hutan)
6. All Durio species (Durian)
7. All species of Kedondong (Triomma species, Dacryodes species, and Santiria species, except Canarium species)
8. All Dracontomelon species (Sengkuang)
9. All Lansium species (Langsat)
10. All Baccaurea species (Tampoi Rambai and Belimbing Hutan)
11. Paratocarpus species. (Terap)
12. Nephelium species. (Meritam)
13. Paranephelium species. (Mata Kuching)
14. Koompassia excelsa (Mengaris)
15. Gaharu/Karas (Aquilaria malaccensis)
16. All Merbau species including Merbau Laiat.
17. All Belian species.
18. All trees excluded from the CHP Harvest Tree list.
19. All trees declared not to be felled by the Director.

SCHEDULE C

(Clause 1 (25))

Commercial Species

Commercial species means any tree of the following genera, not being a prohibited species:

1. Anisoptera
2. Cedrela
3. Cratoxylon
4. Dactylocladus
5. Dipterocarpus
6. Dryobalanops
7. Dyera
8. Eusideroxylon
9. Fagrea
10. Gonystylus
11. Hopea
12. Intsia
13. Koompassia
14. Lumnitzera
15. Octomeles
16. Palaquium
17. Parashorea
18. Payena
19. Shorea
20. Sindora
21. Tarrietia
22. Vatica

SCHEDULE D

(Clause 46)

CONTENT OF FOREST MANAGEMENT PLAN

Forest Management Plan is a structured process for making decisions about the sustainable management of forest resources. Forest Management Plan set out the goals for natural forest management, describe the resource base and its history, provide an evaluation of alternative forest use options, and propose the forest management practices that best meet the goals.

Forest Management Plan shall conform to the following format:

Chapter 1: Policy Statement and Management Objectives

Sets out the vision for sustainable management of the planning area over the duration of the Licence Agreement and a medium-term (10-year) planning horizon. The objectives should clearly reflect the Sabah Forestry Policy on sustainable forest management, ITTO Guidelines, the Sabah Conservation Strategy, Federal Malaysian Forest Policy, the incorporation of Environmental Impact Assessment findings, and other relevant policies.

Charter 2: General Information

Describes the:

1. Name, location and legal status of the planning area.

2. Ecological Environment: Climate, geology, soils and site conditions, topography and hydrology, vegetation types, faunal diversity.

3. Forest Area Classification:

   - Zoning of the forest area according to function as Conservation Area, Production Area (natural forest and forest plantation area), Community Area, and Recreation Area according to criteria specified below and in Clause 49.
   - Computation of net production area (gross production area minus roads and riparian reserves).

4. Infrastructure: Description of existing roads by class, buildings, equipment and mechanization, and manpower of District Forest Office.

5. Socio-Economic Environment: Population, infrastructure and social services, economic activity, impact on the forest planning area.

Chapter 3: Past Management

1. History of the plan area.
2. Prior management: Working blocks, licensing history
3. Production volumes
4. Silvicultural systems used
5. Infrastructure:Road systems (Main, Secondary, Feeder); buildings
6. Mechanization used
7. Organization and Manpower
8. Implications for future management: need for forest rehabilitation, infrastructure improvement, manpower and budget needs.

Chapter 4: Forest Resource Base

1. Growing stock in the production forest (natural forest and forest plantations area): Species, diameter, basal area, volume, number, log quality etc.
2. Aerial Photo Interpretation: stocking by strata
3. Regeneration: trees per hectare by size class and quality
4. Growth Statistics: utilizing growth models
5. Wildlife: Status, distribution and abundance by habitat, limiting factors etc.
6. Non-timber forest products
7. Management Restrictions

Chapter 5: Planning

1. Forest Land use Plan:
   - Subdivision of the area into compartments or portions of compartments for forest planning, management and accounting purposes as defined in Clause 1 (3) and (5);
2. Conservation Area: objectives and management
3. Production Area: Natural Forest :
   - Objectives, yield regulation based on recognized calculatory procedures as developed by the Forestry Department, harvesting schedule.
   - Silvicultural measures
4. Production Area: Plantation (Plantation Development Programme as given in Clause 81):
   - Objectives, supervisory control
   - Species, establishment, yield regulation based on recognized calculatory procedures, harvesting schedule, silvicultural measures
5. Community Area:
   - General planning
   - Forestry extension services
6. Recreation Area:
   - Management objectives, supervisory control
   - Measures to sustain the recreational value
7. Infrastructure:
   - Network of main and secondary roads
   - Entry points to licensed area and delivery points
   - Location of major bridges
   - Calculation of road density
   - Buildings
8. Forest Protection:
   - Control of boundaries
   - Wildlife protection
   - Watershed management
   - Fire control
   - Pest and disease Control

9. Manpower and Budget:

Chapter 6: Environmental Impact Assessment and Forest Management Standards

1. Environmental Impact Assessment:

   - Identification of potentially significant adverse environmental impacts
   - Description of alternatives considered during the planning process to avoid or reduce adverse impacts
   - Identification of mitigations measures which will be implemented to avoid or reduce adverse impacts to levels of insignificance.

2. Management Standards: Indicators and standards used to evaluate the attainment of forest management goals.

Chapter 7: Implementation and Control

1. Responsibilities of Sabah Forestry Department to implement the Plan; staffing requirements and authorities.

2. Responsibilities of Licensee to implement the Plan; needs for professional forestry staff or consultants.

3. Periodic review of the Plan: every 5 years, and as necessary whenever conditions have significantly changed.

SCHEDULE E

(Clause 55)

COMPARTMENT REGISTER

A Compartment Register shall be maintained by the Licensee for each compartment within the Licensed Area.

Compartment Register

The Compartment Register shall conform to the attached format and include:

1. Description of the site and stand;

2. Description of planned tree marking, harvesting, tending and planting activities by year, area, manpower, material and costs;

3. Description of implementation of forest management activities including:

   a. Timber harvest by year, area, volume and revenue;

   b. Stand improvement (silvicultural treatment and enrichment planting) by year, type of operation and cost.

COMPARTMENT REGISTER

MANAGEMENT UNIT:	
FOREST RESERVE:	
COMPARTMENT:	
BLOCK:	
AREA (ha):	

1. DESCRIPTION

1.1 Site:

Elevation (m)	Topography	Steepness in Degrees	Drainage Type	Forest Function

1.2 Stand:

Forest Stratification:

Stratum	Volume/ha	Area (ha)	Volume (>60cm dbh)
Total			

Result of Tree-Marking:

< 60cm dbh			> 60 cm dbh				Volume Marked for Removal (% of total)
< 20 cm	20-39 cm	40-59 cm	Retention		felling		
N/ha	N/ha	N/ha	N/ha	V/ha	N/ha	V/ha	

2. PLANNING

Year	Tree Marking	Harvesting	Tending	Rehabilitation
Area (ha)				
Man-Power				
Material				
Costs (RM)				
Remarks				

3. IMPLEMENTATION

3.1 Harvesting

Year	Area (ha)	Harvested Volume (m^3) Timber Class										Total (m^3)	Revenue (RM)
		A	B	C	D	E	F	G	H	I	J		

3.2 Stand Improvement (Tending, Planting):

Year	Type of Operation	Area (ha)	Cost (RM) Ha.	Cost (RM) Total	Remarks

SCHEDULE F

(Clause 66)

TECHNICAL SPECIFICATIONS FOR REDUCED IMPACT LOGGING

The objective of Reduced Impact Logging (RIL) is to minimize the environmental impact of harvesting and maximize the utilizable timber volume. This is to be achieved through:

a) appropriate pre-operational planning;
b) careful implementation of harvesting operations, and
c) post-operational restoration and maintenance.

The following standards provide practical guidance to personnel involved in timber harvest operations.

1.0 TREE MARKING AND STOCK MAPPING

Tree marking and stock mapping are pre-operational activities that are conducted in preparation for timber harvesting and layout of road and skid trail alignments. Tree marking and mapping should be conducted as part of the ongoing process of planning and operational activities that are embodied in the Annual Work Plan.

1.1 Products of Tree Marking

The products of tree marking include:

1. The marking and numbering of trees to be felled;
2. The marking of trees to be retained;
3. A list of marked trees indicating tree number, species and diameter;
4. A stock map indicating the location and distribution of tree marked for harvest.

1.2 Objectives of Tree Marking

The objectives of tree marking are:

1. Identify trees for harvesting which represent the accumulated capital growth of the forest while retaining a forest structure which is consistent with the objectives of sustained yield management;

2. Comply with environmental standards including protection of riparian reserves, minimizing of erosion, retention of protected species, maintenance of biodiversity, and minimizing of logging damage to adjacent trees;

3. Encourage natural regeneration in accordance with sustained yield management; and

4. Manage species composition to improve growth and wood quality.

1.3 Tree Marking Rules

In order to attain these objectives, tree marking shall be conducted according to the following rules:

Rule 1:
Retain all trees which are needed to produce future harvests, especially those trees needed as a seed source in areas where regeneration of commercial species is insufficient. The retention of additional merchantable stems is not desirable unless they are necessary for fulfilling Rules 2, 3 and 4.

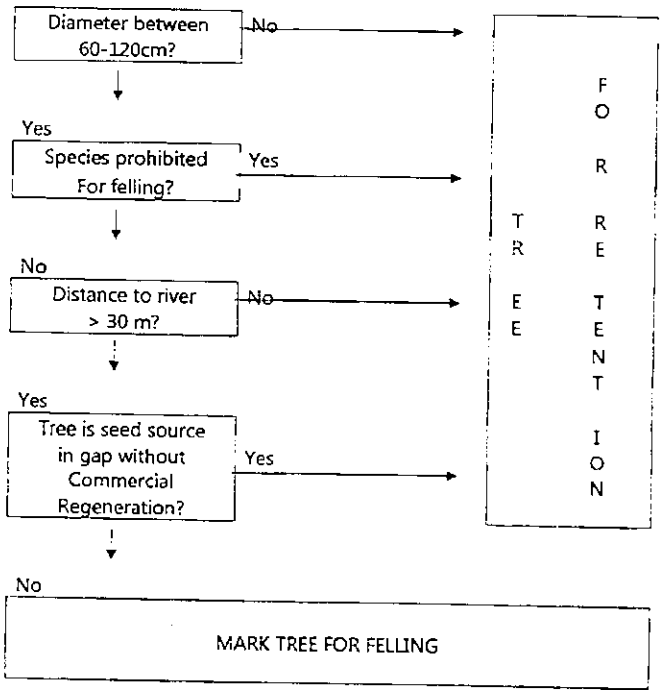
Rule 2:
Retain all trees within a distance of 30 metres on each side of perennial streams and rivers.

Rule 3:
Open up the canopy to not more than 50% with individual gaps not exceeding 0.1ha. in size.

Rule 4:
Retain all trees which exceed a diameter of 120 cm and those tree species which are prohibited for felling (as specified by the Sabah Forestry Department).

These rules are further represented in the following Tree Marking Decision Chart :

TREE MARKING DECISION CHART
FOR TIMBER HARVESTING



1.4 Procedures for Tree Marking and Stock Mapping

During tree marking, a field crew guided by a forester or forest ranger shall carry out the following operations:

1. Tree marking for felling:
Trees to be felled are marked with a horizontal strip of white paint at breast height and labeled with a number.

2. Tree marking for retention:
Trees required for retention are commercial species with good bole form, undamaged and of good vigor (potential crop trees of sizes above 10 cm dbh). These trees are marked by painting a continuous ring of red paint around the trunk at breast height.

3. Stock Mapping and Record-Keeping:
Tree markers should keep a record of the size and species of all trees marked for felling and retention, and prepare to stock map.

2.0 ROADS AND SKID TRAILS

2.1 Pre-Operational Planning

Road and skid trail alignments shall be planned to minimize incidental harvesting damage to soil, residual trees, seedlings and water quality. Roads and skid trails should generally be located on ridges to avoid steep grades, facilitate uphill skidding, minimize skidding distances, minimize stream crossings, and reduce sidecast soil entering streams. The stock map prepared during tree marking should be used to help determine the location and density of roads and skid trails.

- The alignment of feeder roads and skid trails shall be flagged or otherwise marked on the ground. A map showing the alignment of the feeder roads and skid trails shall be contained in the Annual Work Plan.

- The density of major logging roads shall not normally exceed 20 metres per hectare on tractor skidding area and 5 metres per hectare on skyline yarding area except where local conditions so require.

- To the extent feasible, roads shall avoid areas of weak, unstable or saturated soils. Exceptions shall be approved if those areas are unavoidable, and if site-specific measures to minimize slope instability are specified in the Annual Work Plan.

- Roads shall not be located on slopes over 60% except where such areas are unavoidable, and where justified and approved in the Annual Work Plan.

- New roads shall not exceed a grade of 8.50 degrees slope, except that pitches of up to 11.8 degrees slope shall be allowed not to exceed 150 continuous metres.

- Roads shall be planned to achieve as close a balance between cut volume and fill volume as is feasible.

- Skid trails shall not follow streams or drainage lines.

- Skidding shall generally be conducted in an uphill direction. Where skidding downhill is necessary, skid trials should be located in a manner which will minimize earth works and facilitate adequate drainage at the time of construction.

2.2 Construction of Feeder Road

- Feeder roads shall conform to the alignment shown on the map and marked in the field.

- The width of feeder roads shall not exceed 6 m.

- The road bed of feeder roads shall be shaped and compacted to facilitate drainage, reduce erosion, and improve safety of logging vehicles.

- Drainage ditches and embankments shall be shaped to provide drainage.

2.3 Skid Trails and Skidding

- Skid trails shall conform to the alignment shown on the map and marked in the field.

- The width of skid trails should not exceed 4.5 m on slopes up to 20 degrees and 5 m. on slopes above 20 degrees.

- Trees above 10 cm DBH to be removed for skid trail construction must be cut by chainsaw. Commercial species above 40 cm DBH must be extracted and delivered to the log pond. They are accounted for as harvesting volume.

- Blading is permitted only on skid trails > 15 degrees slope.

- Side cutting shall be minimized and is permitted only on slopes > 25 degrees.

- Bladed earth shall not be pushed into normally wet streams except during skid trail construction.

- Tractor operators shall not leave skid trails without permission of an authorized representative to the Director.

- Tractor operators should travel in reverse down steep skid trails to avoid damage to soil and surrounding trees.

- The use of the blade is prohibited during extraction except for stabilizing the tractor during winching operations.

- Logs shall be winched from the stump site towards the skid trail.

- Skidding must be stopped as soon as there is noticeable surface run-off from rainfall. Skidding may only resume 6 hours after cessation of rainfall.

3.0 LANDINGS

- Where possible, all landing operations should be carried out on existing roads. Landings from previous logging operations shall be used where such use will result in less environmental impact to soils, streams and tree regeneration than construction of new landings.

- Where required by the Director, Licensee shall locate and mark landings on the ground prior to the skidding operation. Landings should be located on ridges to ensure uphill skidding which is desirable for dispersing drainage.

- Landings shall not exceed 0.18 ha (e.g. 30m x 60m)

- Clearing for landings shall be reduced to the minimum necessary and indiscriminate and unnecessary swamping or damming of existing drainage courses shall be prevented.

4.0 RIPARIAN RESERVE AND WATERCOURSE CROSSINGS

- The Licence shall not fell any trees within the Riparian Reserve.

- Stream crossings shall be marked in the Annual Work Plan.

- Heavy equipment crossings of watercourses shall be limited to those designated in the Annual Work Plan or as approved by the supervising Forest Officer. Wherever temporary fill is placed or logs are extracted across a watercourse, the watercourse must be reopened to free passage of water when extraction is completed.

5.0 TREE FELLING

- The purpose of directional felling is to minimize damage to regeneration and PCTs' and reduce ground disturbance cause by turning of logs during skidding.

- All marked trees are to be felled in the indicated direction of fall, except with prior approval of an authorized representative of the Director who will record the tree number and reason for the alteration.

- Felling wedges shall be used for effective control of direction of fall. Trees shall be felled away from reserved or marked trees and clumps of young growth and not into or across such clumps.

- Fellers shall be trained in the use of wedges and be equipped with them.

- Fellers will assist in RIL by planning and opening up chokerman tracks that will facilitate and encourage the winching of logs for up to 30 metres from the felled position. They will also define and mark clearly the minor skid trails as well as trail endings.

- Stems should be cross cut into logs to reduce skidding damage. Bucking should result in maximum utilization of the stem.

6.0 POST-HARVEST OPERATIONS

Abandonment of roads, watercourse crossing and landings shall be planned and conducted in a manner which provides for permanent maintenance-free drainage, minimizes concentration of runoff, reduces soil erosion and slope instability, promotes regeneration, and protects the quality and beneficial uses of water.

The following practices shall be conducted immediately following the completion of the harvesting operation:

- Obstructions to natural drainage channels shall be removed and natural drainage patterns restored to prevent ponding and permit forest regeneration.

- All temporary stream crossing structures shall be removed.

- Logs landings shall be ripped to 25 cm and reshaped to secure adequate surface drainage. Logging debris from the perimeter shall be redistributed over the landing.

- Cross drains shall be constructed on skid trails as marked by supervising SFO personnel. Cross drains shall be greater than 0.5 m and constructed at an angle of 45 degrees to the skid trail alignment.

- Feeder roads shall be fully reconditioned to restore natural drainage patterns.

SCHEDULE G

(Clause 52 (ii) (a))

List of Trees Marked for Felling

Compt No : .....

Sub-Unit No : .....

Tree No.	Species	Diameter (cm)	Height (m)	Volume (m3)

SCHEDULE H

(Clause 73 (i))

Log Register

Tree No.	Species	Grade	Length (m)	Diameter (cm)			Volume M3	Remarks
				d1	d2	avg.		

SCHEDULE I

(Clause 76)

TECHNICAL STANDARDS FOR SILVICULTURAL TREATMENTS

Silvicultural treatments serve to remove competing vegetation and thereby improve the growth and stocking of commercial timber species. Silvicultural treatments are a necessary component of a complete forest management program and should be considered equal in importance to timber harvesting.

A Silvicultural Treatment Plan shall be submitted annually as part of the Annual Work Plan. Plans designate the locations and types of treatments to be applied, and shall conform to the requirements in the Timber Licence Agreement concerning the size of area to be treated each year. Plans shall be based on field assessment of forest conditions determined during pre-harvest tree-marking and post-harvest assessment.

Silvicultural treatments shall consist of:

a) the liberation of potential crop trees, and
b) the release of young regeneration of commercial species.

Treatments shall be conducted according to the following standards:

1. Silvicultural treatments shall be carried out approximately 5 months after harvesting.

2. Marked crop trees shall be liberated by:

   - Girdling of competitors bigger than 10 cm dbh.
   - Cutting of competitors smaller than 10 cm dbh.
   - Removal of competing climbers and climbing bamboo.

3. Release of young regeneration of commercial species shall consists of:

   - Girdling of competitors bigger than 10 cm dbh
   - Cutting of competitors smaller than 10 cm dbh
   - Removal of competing climbers and climbing bamboo which endanger the survival of regeneration groups.

4. Mechanical means of girdling and cutting shall be used to the extent feasible, except bio-degradable chemicals shall be used in cases where mechanical treatments will result in unavoidable damage to potential crop trees.

SCHEDULE J

(Clause 77)

TECHNICAL STANDARDS FOR ENRICHMENT PLANTING

Enrichment plantings serve to re-establish good stocking of commercial timber species within heavily degraded and logged-over forests. Forest rehabilitation should be considered a management activity equal in importance to timber harvesting.

Enrichment Planting Plans shall be submitted annually as part of the Annual Work Plan. Plans shall designate the locations and types of plantings to be conducted, and shall conform to provisions in the Licence Agreement concerning the size of area required to be planted and maintained each year. Plans shall be based on field assessment of forest conditions determined during diagnostic field surveys.

Species to be planted shall be selected from the list of suitable species contained in the Forest Management Plan. Standards for enrichment planting will depend upon local site conditions and the growing requirements of the species selected for planting. Plans for enrichment planting shall specify:

1. The species to be planted and the justification for their choice;

2. The quantity and quality of seeds and/or seedlings that are necessary to attain the enrichment planting objectives specified in the Forest Management Plan;

3. The source and handling of seeds and/or seedlings;

   a) The source of seeds, and/or source and size of seedlings to be used;
   b) The method of transport and storage of seedlings;
   c) The maximum time permitted for transport between nursery and planting site (e.g. 2 days)

4. Methods of site preparation and shade regulation:

   a) Planting lines or spots shall follow contour lines and be cut into secondary vegetation;

   b) The width of the planting lines shall be at least 1.5 m; if cluster planting is applied, the planting spot must be opened in a 2.5 x 2.5m square approximately.

   c) The planting lines or spots shall be cleared of debris. Trees shall be felled away from the line or spot. Trees leaning over the line or spot shall be brought down.

   d) Secondary vegetation larger than 6 cm diameter within the planting line or spot shall be girdled;

e) Secondary vegetation outside the planting line or spot which directly affects the planting site shall be girdled.

f) All climbing bamboo along the planting line or at the planting spot must be cut, especially those clumps which shade out the location of the plant. As far as possible, all culms in a bamboo clump should be cut. The point of cut is close to the base.

5. Planting of seedlings:

a) Planting shall commence not later than 2 months after the opening of the planting line or spot. Planting should be carried out during wet periods.

b) Planting holes shall be dug at specified locations; they shall be sufficient in size to accommodate the root of the seedling without damage (e.g. 20 cm in depth and 15 cm in diameter);

c) Seedling shall be carried from the access road to the planting hole;

d) Polybags shall only be removed immediately before planting;

e) Seedlings, with the polybag removed, shall be placed into planting holes. They shall be planted at the same level as they are grown in the polybag.

f) Soil shall be backfilled into the hole and tamped down with foot-steps;

g) The planting hole shall be covered with leafy debris to protect the soil from erosion and moisture loss (mulching).

h) The polybag shall be fixed on top of a peg/stick which shall be placed near to the planted seedling.

6. Maintenance of young plants:

The maintenance of young plants is a post-planting treatment to be carried out repeatedly on areas which have been planted in the previous years to ensure their successful establishment. The Enrichment Planting Plan shall specify the maintenance program that will be implemented covering in particular the following operations:

a) All dead and seriously damaged seedlings shall be replaced by new seedlings.

b) The formation of "tunnels" from secondary vegetation over young plants must be strictly prevented. Secondary vegetation forming tunnels or throwing too much shade has to be girdled or removed and piled up in between the planting lines.

c) Climbers using the young plants as physical support must be removed including their roots, as far as possible.

d) Weeds, undergrowth and climbing bamboo in close vicinity to the young plants and hampering their growth must be removed on a circle of about 1 metre in diameter around the plant (circle weeding).

SCHEDULE K

(Clause 73 (iii))

REGISTER SHOWING THE DISPOSAL OF LOGS FROM THE STUMPING POINT

Date of Disposal	Transit Pass No.	Species	Grade	Quantity disposed of		Dispatch To	Remarks
				No. of Logs	Volume (m^3)		

SCHEDULE L

(Clause 101(ii))

ASSESSMENT SCHEME FOR A FOREST RENT

The current royalty for log extraction is a tax the license holder has to pay for the use of a State owned commodity. This tax does not account for investments to sustain the resource. Therefore, it is unsuitable for sustainable forest management, where considerable investments into the resource are imposed on the license holder.

The current system of royalty assessment is under review and will be modified in due time. Royalties will be substituted by a forest rent. The forest rent taxes the net profit from the entire concession area including land, forest stands, roads, bridges, buildings and the costs of forest operations. It will be based on the productivity of the forest land in terms of the sustainable timber yield and reflects the market price for timber and the new management costs.

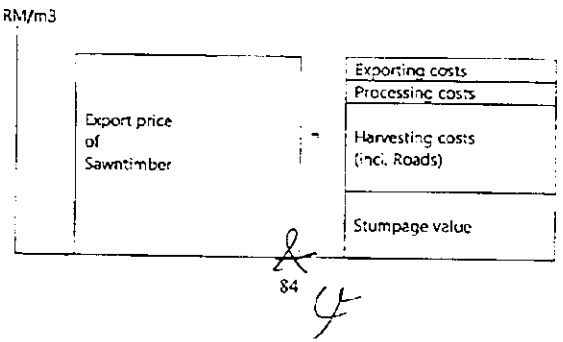
The forest rent(r) will be calculated by using the formula.

$$r = [\, AAC^{*}SV - (COP + CAD) \,]^{*} f \;(RM/yr)$$

The formula includes:

AAC – Annual Allowable Cut (m3/yr)
The AAC is determined by resource inventory and yield regulation and is documented in the medium-term Forest Management Plan. It reflects the long-term productivity of the forest area and quantifies the annual saleable log volume in line with the management objectives. Every 10 years the AAC is subject to revision based on a new resource assessment.

SV – Stumpage value (RM/m3)
The stumpage value equals the sawntimber price minus all harvesting, processing and exporting costs according to the following scheme:



At present, the calculation of stumpage values is based on the export price of sawntimber. Sawntimber is the product of the earliest processing stage for which a competitive market exists since about half of Sabah's annual log production is exported as sawntimber. Consequently, sawntimber export prices are considered the most reliable calculation base to properly reflect market conditions.

As the yield calculation reveals the volume portion of the different species groups ('harvest composition table'), stumpage values are calculated according to these species groups.

COP – Cost of silvicultural operation (RM/yr)
Cost of silvicultural operations are the costs of -

- seedling production in forest nurseries or purchase of seedlings,
- rehabilitation measures in heavily degraded and logged over forest areas,
- silvicultural treatment to improve the growth and stocking of commercial tree species.

The Annual Work Plan to be provided by the concessionaire supports the calculation of these costs.

CAD – Administration costs (overheads, RM/yr)
Overhead costs are the costs of

- forest inventory, management plan and consultancies
- investments for machinery, buildings and other equipment
- manpower, workforce and material
- general administration
- borrowed capital

f – Reduction factor (in decimal notation, e.g. 0.25)
The reduction factor equals the portion of the net profit claimed by the State Government for transferring the right to use the forest resource to the license holder.

The methodology to determine the forest rent is relatively simple. The product of AAC*SV is the total annual yield. The sum of COP + CAD are the total annual costs of the forest concession. The difference between both results in the annual sustainable net profit. Reducing the annual net profit by a certain factor results in the forest rent to be paid by the licence holder to the State Treasury. The rent is calculated on an annual basis in order to avoid the application of uncertain discount rates for future yields and costs. It is determined individually for each single forest concession. In case the forest land does not yield any net profits due to its state of depletion, the licence holder is exempted from rent payments and entitled to deduct the investments into sustainable forest management from profits made in other business ventures following the regulations of the Promotion of Investments Act, 1986.

The essential problem is to fill the formula with reliable data on yields and costs of sustainably managed forest concessions and to negotiate the portion of the net profit claimed by the State Government. These rates will be determined in close consultation with representatives from various wood-based industries, STIDC, the Forestry Department and other government agencies in charge of the timber industry.

Annex 2.2

Relevant Correspondences

JABATAN PERHUTANAN SABAH
(SABAH FORESTRY DEPARTMENT)
Laman Web (*Website*): www.forest.sabah.gov.my

Ibu Pejabat Perhutanan
(Forestry Headquarters)
Km 11, Jalan Utara
Beg Berkunci (*Locked Bag*) 68
90009, Sandakan
Sabah, Malaysia
Tel: +6089-242500
Fax: +6089-671303/672579

Sila catat rujukan kami apabila menjawab surat ini. *(Please quote this reference in any reply to this letter).*

Ruj. Tuan:
(Your Ref.)

Ruj. Kami:
(Our Ref.) JPHTN/PP 700-2/1/63/JLD.2(8)

25.7.2016

Gerak Saga Sdn Bhd
L-70-7 KK Times Square
Off Coastal Highway
88100 KOTA KINABALU

Fax: 088 – 486241

Sir,

GERAK SAGA SDN BHD: SFMLA.1/2015: DRAFT OF FOREST MANAGEMENT PLAN

1. Badly written FMP is difficult and slow to go through.

2. A good report is a breeze to read and understand.

3. Your latest draft is an excellent piece of work and well done.

4. Therefore, the second FMP draft is hereby approved.

5. Please forward (12) copies for our endorsement and circulation.

6. The following are also to be added at the appropriate pages:
   (1) Forest Zoning
   - Tabulate the size (approx.) of each type of land use.
   - E.g. catchment – x ha, ITP – Y ha, riparian – z ha. etc. (figure 4.1)

   (2) Table 5.3 – Operations
   - Give an approximate (gross) volume of the salvage logging for each year's harvesting of the Acacias at site.
   - This can be split into pulpwood/mechanical wood/logs.

   (3) Thinning: 5.11.2
   - 1667 s/ha is higher than P. radiata at 1000 s/ha initially, reduced to 250 s/ha at final felling with 2 thinnings.

...2/

- This is your call but is this not excessive? Does Eucalypts require that close a spacing initially?

(4) Manpower
- Please give priority to Sabahans.

and

(5) Sabah Society Report On The Sabah Megapod At Bengkoka
- There is only one species in Borneo and also found in Tambalugu.
- Please see the attached.
- This should be highlighted somewhere as it is rare.
- Its habitats are to be left for conservation.

7. Please also expedite the JV agreement with RBJ and the EIA approval.

Thank you.

"WE AIM TO BE THE BEST"

(DATUK SAM MANNAN)
DIRECTOR OF FORESTRY

s.k. K(FRM)

s.k. K(SFM)
- Anything else to add? Advice them quickly. Thank you.

s.k. Pegawai MCEE Wilayah Kudat
Fax: 088 – 663523

s.k. Pegawai Perhutanan Daerah Pitas
Fax: 088 – 621812

DSM/pf.

Annex 2.3

Forest Management Plan (FMP)

GERAK SAGA SDN BHD

BENGKOKA FOREST RESERVE
TAMBALAGU FOREST RESERVE
SFMLA 1/15

FOREST MANAGEMENT PLAN

October 26th 2015 to December 31st 2025

Endorsement Page

In compliance with provisions of the Sustainable Forest Management License Agreement 01/2015, this 10-year Forest Management Plan (FMP) in respect of Gerak Saga Sdn Bhd, is approved for the period commencing from October 26th 2015 to December 31st, 2025.

This FMP is prepared by:

(Glen MacNair - Director)
Gerak Saga SDN BHD.

This FMP is approved by:

Datuk Sam Mannan - Director
Sabah Forestry Department

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LIST OF ABBREVIATIONS

A.S.L.	Above Sea Level
BFR	Bengkoka Forest Reserve
DBN	Diameter ot brEast Height
EIA	Environmental Impact Assessment
FMP	Forest Management Plan
FMU	Forest Management Unit
GSSB	Gerak Saga Sdn Bhd
Ha	Hectare
HCV	High Conservation Value
IRR	Internal Rate of Return
ITP	Industrial Tree Plantation
Kg.	Kampong
NPV	Net Present Value
PACOS	Partners of Community Organizations
SFD	Sabah Forestry Department
SDN BHD	Sendirian Berhad
Sg.	Sungai
SMK	Sekolah Menangah Kebangsaan
SFM	Sustainable Forest Management
TFR	Tambalagu Forest Reserve

Executive Summary

The Sabah State Government has allocated both the Bengkoka and Tambalagu Forest Reserves, a combined area of 6,467ha, to Gerak Saga Sdn Bhd for the purpose of industrial tree plantation development. Both forest reserves will be managed as a single FMU and divided into 4 Coupes. The current timber stocking in both forest reserves is relatively poor due to the effects of fire and disease. Both areas are dominated by variable stands of Acacia mangium and open grassland. In order to restore the timber production of the Project Area, Gerak Saga Sdn. Bhd. will establish an industrial tree plantation by planting mainly *Eucalypt species* with a rotation period of 10 yeors. The net plantable area is approximately 5208.8ha.

This Forest Management Plan (2015-2025) provides a comprehensive source of information and defines the broad development and management objectives and standards to be applied by Gerak Saga Sdn. Bhd. This plan is organized into 10 core Chapters or Parts. Part 1 is the introduction, which highlights the background of the project, policy statements and objectives. Part 2 describes the general information of the Project Area, which contains amongst others the physical features of the Project area, vegetation types, wildlife resources, sacio and cultural aspects of the local communities living in the vicinity and within the Project Area and high conservation value forests. Part 3, in general, highlights the current scenarios of the forest resource base whereas, Port 4 provides the medium-Term directions/actions for forest Conservation and Protection, Timber management, Wildlife management and managing high conservation value forests. Part 5 highlights the forest plantation development program, which is the core activity of Gerak Saga Sdn. Bhd. during the plan period. Parts 6 – 10 prescribe on the issues of fire management, manpower requirement. financial analysis, environmental impact assessment and monitoring.

Gerak Saga's planning provides that that not all of the project area will be developed for ITP. The FMU is therefore zoned into two classes – Conservation Areas and Industrial Tree Plantation Areas (ITP Areas). The focus of management in the ITP zone will be on the establishment, maintenance and utilization of plantations for timber production. The Conservation Areas will consist of totally protected land, such as riparian zones, water catchment areas, high conservation value areas and land that is either too steep or too nutrient poor for plantation development.

Most of the designated Conservation Areas are currently populated with Acacia mangium trees. However, the little remaining natural forest does have small stands and individual trees of species Shorea kudatensis. which is critically endangered. Gerak Saga will work with the Sabah Forestry Department to design measures to ensure that these stands are protected and that species population health improves over the project lifetime. There are no fences around the project. As such the FMU's wild Acacia forests farm, together with the surrounding plantations, a continuous habitat for numerous species. As with neighboring estates, the ITP to be established on the FMU will have mixed age classes, with approximately 70% of the land remaining under a closed canopy of at lEast 10m height at all times.

There are no settlements within the FMU boundary. However there are 7 villages adjacent to the Project Area. Working with the managers of neighboring plantation estates, Gerak Saga Sdn Bhd intends to perform a detailed socio-economic survey to determine the needs of the local communities. This study will be used to guide company-community partnerships aimed at supporting existing livelihoods, increasing ecanomic opportunities, providing access to education and generally raising living standards through improved communications, access to health services, water and electricity supply and sanitation.

Approximately RM100 million is required to finance the initial establishment phase from Year 2016 to Year 2026. Harvesting commences in 2027 and the project will be self-funding from that point forward. Approximately RM70 Million will be generated through log sales and the balance of funds, approximately RM30 Million, will come from the project principals.

PART 1: INTRODUCTION

1.1 General Background

Gerak Saga Sdn. Bhd has entered into a 100 year, Sustainable Forest Management License Agreement numbered 01/2015 ("the SFMLA") with the Government of the State of Sabah, to develop an industrial tree plantation (ITP) on 6,467 ha (hereinafter referred to as the "Project Area") of land in the Bengkoka and Tambalugu Forest Reserves located near Pitas, Sabah (see Map 1- Locality Plan of the Project Area). Pursuant to the terms of the SFMLA, Gerak Saga Sdn Bhd (hereinafter referred to as the "Company") will undertake, inter-alia, the extraction of residual timber, establishment of a managed forest plantation and restoration of natural forest areas.

This Forest Management Plan ("FMP") has been prepared pursuant to Clause 50 of the SFMLA which prescribes that the Company must prepare and submit to the Director of Forestry a 10-year FMP prepared in accordance with Schedule D of the SFMLA and which specifically defines all elements of the Plantation Development Programme to be undertaken in the Project Area.

This FMP sets out the Company's forest management policies and describes the operational programs, schedules and standards to be met through the plan period.

The FMP and all further plans compiled and submitted by the company take cognisanse of the fact that plantation forestry is a resource intensive business which requires good planning, realistic costings, significant amounts of specific know-how, and involves several factors of risk that could possibly lead to failure. The costs incurred include procurement of healthy seedlings, site preparation, initial fertilization, and weeding. Other critical elements at planting time that will affect future plantation performance are the quality of seed, seedlings, the timing of planting, proper spacing and keeping the planted area weed free until canopy closure. Once the early survival of a plantation stand is assured, treatment operations involving new costs continue in the form of thinning, and pruning and some additional fertilization. Also, throughout the life of a plantation, the Compony must provide for protection against hazards and external and internal risks (e.g., fires, diseases and pests and community conflicts), and for the maintenance of machinery, equipment and infrastructure permitting the continuing management of the plantation operation. It is for these reasons that this FMP was carefully prepared. The Company has adapted a management planning approach that includes consultation with stakeholders particularly the local communities who are residing within and adjacent to the project area.

1.2 Policy Statement

The Company is committed to the basic principles of well managed forest, by ensuring that activities in the Project Area are environmentally appropriate, socially beneficial, and economically viable. The Company's forestry policy statements are as follows:

- The Project Area will be managed under sound ITP practices based on operational efficiency and in accordance with the Forest Stewardship Council (FSC) Principle No. 10 and in conformity with the existing State forest policies, environmental policies and legislation and regulations;

- The Company is committed to support the policy of the State Government to increase timber production from industrial tree plantation to meet the decline in raw materials supply from natural forests;

- The Company is committed to support the commitment of the State Government of Sabah to the expansion of the state's wood processing industry with particular emphasis on long-term sustainable wood processing industries based on wood supply from ITP;

- The Company shall maintain and enhance areas identified as 'high conservation value forests' (HCVF) for the protection of biodiversity, wilderness, soil, and water resources;

- The Company will endeavor to protect the environment in which it operates by both abiding the legislative requirements of the State and by the application of the conditions that have been set and agreed to by the applicable Federal and State's statutory bodies. In addition, the Company will endeavor to continually improve its capacity to reduce environmental impacts and to optimize the utilization of its wood resources by testing productivity against international benchmarks and incorporating any relevant improvements in a logical and well-planned manner, whether such plans are short, medium or long term;

- The Company shall optimize its economic returns, as well as, to its JV Partners and the State on a long-term basis by optimizing the utilization and efficient use of raw materials from the Project Area while maintaining conservation and environmental values, and providing social benefits. Social benefits will include job opportunities and socio- economic development activities, particularly for the local communities who are living within and at the periphery of the Project Area, to improve their living standards.

1.3 Management Objectives

Taking into account the Company's policy and long-term goals, the specific objectives for managing the Project Area are as follows:

- To convert the underutilized forest area to a more productive use thereby enhancing the timber production function of the Project Area in a short period of time;
- To actively and efficiently managed the Project Area for commercial production of high volume of wood for industrial use;
- To integrate all forest operational activities within the concept of conservation and protection so as to reduce the impact to the environment from fire and encroachment;
- To enhance the socio-economic of the local communities by involving them in the implementation of development projects or forestry activities in the Project Area.

1.4 Legal Framework

Existing laws and regulations on forestry are the legal instruments by which all forestry related activities are governed and regulated. Forest legislation reflects the principles of sustainability in order to support implementation of forest policy. Management guidelines, on the other hand, provide advice and promote more extensive application of forest management practices. In this context, the following are legal documents and guidelines, which are to be taken into consideration by the Company in managing the Project Area:

- State Forest Policy, 1954;
- Forest Enactment, 1968;
- Forest Rules, 1969;
- Environmental Protection Enactment, 2002;
- Environmental Protection Enactment (Prescribed Activities/Environmental Impact Assessment) 2005
- Park Enactment, 1984
- Wildlife Conservation Enactment, 1997;
- Land Ordinance, 1930;
- Water Resources Enactment, 1998;
- State Cultural Heritage (Conservation) Enactment, 1997;
- Sabah Conservation Strategy, 1992;
- Biodiversity Enactment, 2000;
- Environmental Quality Act, 1985;
- RIL Operational Guide Book, 2009;
- Labour Ordinance (Sabah) Cap. 67;
- Employment Act, 1955;
- Occupational Safety and Health Act, 1994
- Occupational Safety and Health (use and Standards of Exposure of Chemicals Hazardous to Health) Regulations, 2000
- International agreements such as CITES, ILO Conventions, ITTA, and Convention on Biological Diversity.
- United Nations Convention on Biological Diversity, 1992;
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2000;
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971;
- International Tropical Timber Agreement, 1994;
- United Nations Framework Convention on Climate Change, 1992;
- The Kyoto Protocol to the Convention on Climate Change, 1997;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973;
- Core International Labour Organization (ILO) Conventions;
- United Nations Declaration of the Rights of Indigenous Peoples, 2007.

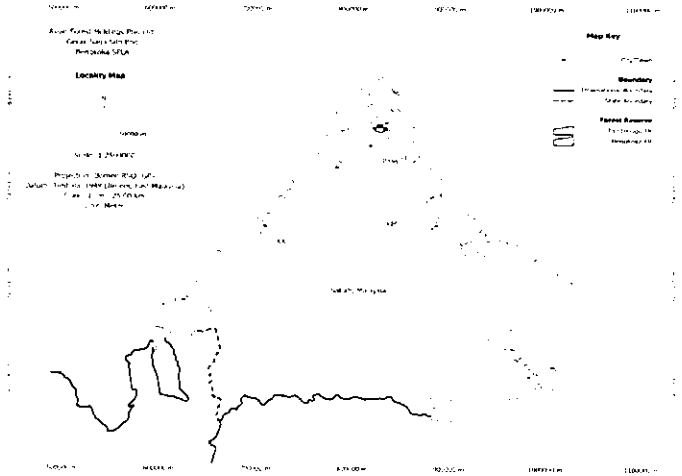
PART 2: GENERAL INFORMATION

2.1 Name, Location and Legal Status

The project area is known as Gerak Saga Sdn. Bhd. Tree Plantation License Area.

The Bengkoka peninsula occupies the Northernmost part of the Borneo Island in the Malay Archipelago between 6'40" and 7'01" degrees North, 117'01" and 117'15" East covering roughly an area of 640km 2. It is bordered on the West and North by the South China Sea, on the East by the Sulu Sea and on the South by foothills of Crocker Range.

Figure 2.1 Location of project area



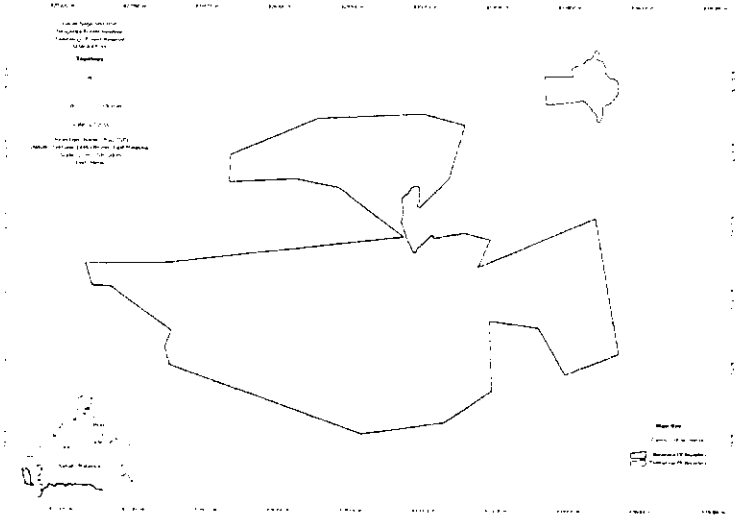
2.2 Access

The primary access to the Bengkoka Peninsular is via the main highway connecting Kota Marudu and Pitas. Currently there is a JKR gravel road bisecting the project area an a North-South alignment. An additional tarred JKR road leaves the main Pitas route just before it enters the FMU and then proceeds around the Western and Northern boundary. This simple network of JKR roads connects the Northern-most Kampongs to Pitas town.

2.3 Physical Features

2.3.1 Topography

Figure 2.2: Topography of project area (see Section 11.1)

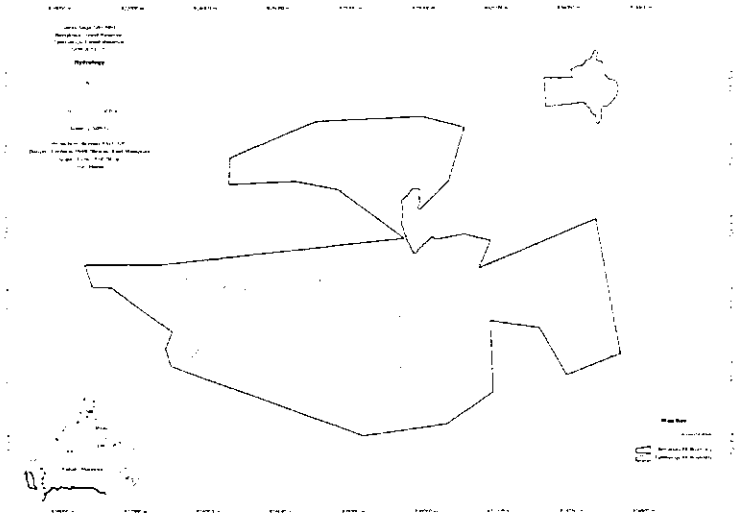


The topography in the project area consists of gently undulating terrain with some low broken ridges. Some short steep slopes occur next to rivers but the slopes are predominantly under 25 degrees. Elevations range from 26m to 130 m above sea level.

2.3.2 Hydrology

The plantation area is drained by several small streams forming dendritic drainage pattern typical for sandstone formation. Notable streams include Sg.Bongkol, Sg.Telaga, Sg.Melubang, Sg.Karangan, Sg.Mengkapon and Sg.Muning. Most of these streams are seasonal and flow will reduce significantly or stop during the dry months. Currently only one man-made reservoir has been constructed and is used as the primary water supply for the neighboring Bonkol settlement in the South East.

Figure 2.3: Hydrology in the project area (see Section 11.1)



2.3.4 Climate

The Bengkoka peninsula according to the Köppen classification belongs to Tropical Rainforest Climate (AF) characterized by distinct dry season lasting from April to October and wet season lasting from November to March. The peninsula features distinctly wetter and drier months, with April through August being the driest months. However, in none of these months does average precipitation fall below 60 mm, hence the tropical rainforest categorization. The average annual precipitation for the last 10 year period is 2881 mm. Precipitation during January and December is generally 5 times larger than evaporation causing severe water surplus that result in damage to the forest from flooding, ponding, landslides and excessive soil wetness.

2.3.5 Rainfall

The SouthWest monsoon that occurs in May to August usually brings more rains to the West coast of Sabah and less in the East coast, while the NorthEast monsoon that occurs in November to February brings rains to the East coast and less in the West coast. This can be seen in Table 2.1 with accompanying chart.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	601.8	665.1	191.9	265.7	71.0	142.5	57.0	97.4	166.3	134.7	161.4	229.8	**2784.6**
2001	526.2	112.8	356.2	91.4	12.0	170.2	0.8	159.6	282.2	168.0	391.0	303.5	**2573.9**
2002	212.6	78.0	161.0	0.0	191.0	194.5	0.0	282.4	89.4	24.2	294.3	227.2	**1754.6**
2003	421.4	18.9	163.8	66.0	139.0	87.0	149.4	151.1	60.4	134.0	166.3	602.4	**2159.7**
2004	173.3	99.6	166.9	38.8	109.4	16.8	95.7	102.2	669.8	341.4	764.1	1362.1	**3940.1**
2005	403.3	0.2	105.1	8.2	141.3	188.5	62.2	96.0	48.3	67.5	143.1	478.5	**1742.2**

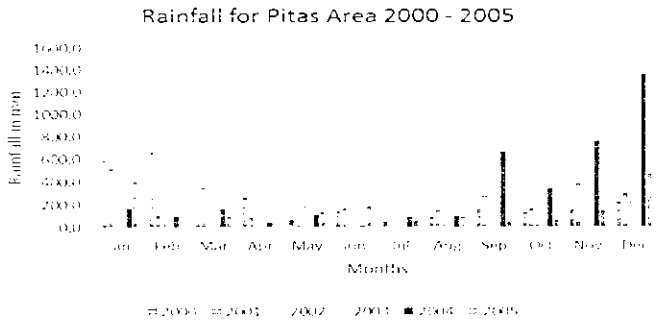


Table 2.1: Rainfall Record of Pitas Weather Station Showing Average Monthly Rainfall (2000 - 2005)

2.3.6 Temperature

The highest and loWest mean temperature annually recorded since 1968-1998 in the Project Area is 36.5 C and 19.4°C respectively. In terms of humidity, the mean was 83.5% in the same period 1968-1998.

2.4 Geology

The Bengkoka peninsula lies on the Northern tip of Borneo on the Eurasian Plate and its geology is represented by Tertiary sedimentary formation that extends to the mainland Asia. Clastic sedimentary rocks make the majority of the peninsular interior while riverine and coastline alluvial deposits make its exterior. The major E-W trending structure of the plantation area consists of moderate hills, cuestas and ridges. Several major faults dominate the plantation area including the SouthEastern Petani Baru fault, central Nuri Harapan fault, Telago fault dominates the Western part of the area and Kg. Bongol fault dominates North-central part.

2.5 Soils

Soil survey showed several types of soils including Orthic Acrisols/Ustols being dominant type formed on sandstone parent material. Minor soils are represented by Orthic Cambisols/Typic Dystrochrepts formed on sandstone parent material, Gleyic Cambisols/Fluventic Dystrustepts formed on alluvium parent material and Orthic Podzols/Orthods formed on sondstone parent. The soils of the plantation being under first rotation of mature Acacia mangium forests have similar properties to the natural forests with increased biological activity owing to N-fixing ability of the Acacia mangium. The quality of the plantation soils must be properly managed to assure long term sustainability of the plantation.

2.5.1 Managerial Implications of Geology, Soil and Hydrology

Based on surveys of the adjacent plantation development by AFI in the Bengkoka Peninsula, the land is appropriate for plantation development with fast growing species including Eucalypts such as E.pellita. The soils are not stony, so easy to plant and growth rates have been in the range of 15 m3 to 25 m3/ha/year, with minimal application of fertilizer and other agro-chemicals. Although, the soils in the Project Area are still considered relatively poor, the reasonable growth rates obtained are more a testimony to the efficiency of the tree species (Acacia mangium and E. pellita) than the soil fertility. Nevertheless, the Company will have to ensure that the growth of trees to be planted in the Project Area would have to be improved. Consequently the Company will:

- Perform soil and foliar analysis to fine tune fertilizer composition to match site conditions;
- Assess the viability of a mid-rotation fertilization

It is also noted that the soils are fragile and that significant damage can be done through poor harvesting practices. This damage could ultimately affect the success of the plantation. Therefore, the project management team is committed to implementing low impact practices wherever feasible

2.6 Vegetation Types

The Bengkoka peninsula was originally covered in tropical rainforest however forest clearing for cultivation started over 80yrs ago. Approximately 30 years ago, clearing commenced for the purpose of plantation establishment. Only scattered remnants can be seen of the original forest although the coastal zone remains fringed with mangrove forest. Today most of the area is under commercial plantations of tropical timber, oil palm, and rubber and subsidence agriculture of dry and wet paddy.

The FMU is predominantly covered by Acacia mangium forests of mixed ages and densities. There have also been many wild fires through the area leaving padangs barren of trees, vegetated only with grasses and ferns. Finally there are also small patches of Natural indigenous forest most found in the riverine areas.

2.7 Fauna and Flora

2.7.1 Wildlife Habitat

As mention before most of the project area is covered with Acacia mangium and small patches of Natural indigenous forest and for this reason the quality and extent of wildlife habitat has been severely depleted.

The company is currently not aware of any specific habitat studies done in the Project area. For the purpose of the FMP a preliminary survey was conducted. The emphasis was to see what large mammals and birds are found in the project area. This was carried out by erecting movement sensor cameras, large mammal tracks, vocalization, feaces identification, claw marks, nests and direct sightings.

2.7.2 Wildlife Diversity

Despite the fact that the project area has been heavily degraded there is still quite a high species diversity. The quantity of wildlife though has been impacted by regular fires, hunting and trapping.

Some of the major species which have been observed by our survey are listed in Tables 2.2, 2.3 and 2.4. Both the Barking Deer and the Monitor Lizard are known to be present but were not observed during the study period.

Table 2.2: List of large Mammals found in the Project Area.

No	Identification / Species				
	Common Name	Scientific Name	Frequency	IUCN Status	Method
1	Bearded Pig	Sus barbatus	7	Vulnerable (Decreasing)	Camera trap
2	Pig-tailed Macaque	Macaca nemestrina	10	Vulnerable (Decreasing)	Camera trap
3	Malay Civet	Viverra tangalunga	3	Vulnerable (Decreasing)	Camera trap/ Direct Sighting
4	Lesser Mause Deer	Tragulus javanicus	3	Least concern (Stable)	Camera trap
5	Bornean Red-Muntjac/Commom	Muntiacus muntjac	4	Least concern (Decreasing)	Camera trap
6	Sun Bear	Helarctus malayanus	2	Vulnerable (Decreasing)	Camera trap
	Total		29		

Table 2.3: List of Birds found in the Project Area.

No	Common name	Scientific name	Frequency
1	Black capped babbler	Pellorneum pyrrogenys	1
2	Buff-necked Woodpecker	Megilyptes tukki	2
3	Buff-rumped Woodpecker	Megilyptes tristis	3
4	Collard Nightjar	Gactornis enarratus	4
5	Cream-vented Bulbul	Pycnonotus simplex	1
6	Emerald Dove	Chalcophaps indica	1
7	House Swift	Apus affinis	1
8	Little Spiderhunter	Atachnotera logirostra	1
9	Long-billed Spiderhunter	Atachnotera crassirostris	1
10	Pied Fantail	Rhipiodura javanica	1
11	Red-eyed Bulbul	Pycnonotus brunneus	1
12	Rufus-backed Kingfisher	Ceyx rufidorsa	2
13	White-chested babbler	Trichastoma rostratum	1
14	White-crowned Shama	Copsychus stiklandii	1
15	Yellow-vented bulbul	Pycnonotus goiavier	1
		Total	**22**

Table 2.4: List of Amphibians and Reptiles found in the project area

No	Identification/Species			
	Common Name	Scientific Name	Family	Frequency
1	Tree frog	Rana megalonesa	Ranidae:Rana	1
2	Four-lined tree frog	Rana baramica	Ranidae: Rana	2
3	Dwarf soft-shelled turtle	Dogania subplana	Trionychidae	1
4	Green vine snake	Ahetulla prasina	Colubridae	1
5	Striped bronzeback tree snake	Dendrelaphis caudolineatus	Colubridae	1
6	Striped tree skink	Apterygodon vittatus	Scincidae	3
7	River Salamander	Sphenomorpus multisquamatus	squamata: scincidae	1
			Total	**10**

2.8 Infrastructure

2.8.1 Forest roads

Currently three minor forestry roads branch off East and West from the main JKR gravel road and provide limited access to the FMU interior. The condition of these access roads is poor however and will require upgrading for reliable service. Although the development plan spans several years, primary access to each Coupe will need to be restored at the outset to support fire protection activities.

2.8.2 Buildings

The project area has not yet been developed as a plantation estate. So at the moment there is very little building infrastructure in the project area. There are two fire towers erected by and currently under the management of the Sabah Forestry Department.

2.9 Socio-economic environment.

2.9.1 Local Community Settlement.

No local community settlements are situated within the project area. There are seven formal settlements, namely Kg Kapok, Kg Kodong, Kg Kandang, Kg Jambu, Kg Gumpa, Kg Radap and Kg Kakarangan, found adjacent to the project area. All are located within the boundaries of the Acacia Forest Industries Sdn Bhd estate. However it is important for Gerak Saga Sdn Bhd to recognize that these communities may be affected and could also benefit from the project.

Consequently, Gerak Saga will institute a Community Development Program with the following areas of focus:

- Identifying viable economic activities that would have strong impact on the social and economic well-being of the rural communities in the Project Area;
- Identifying the main social and physical infrastructure requirements to improve the quality of life of the rural communities; to enhance accessibility in areas of difficult communication and to facilitate economic development;
- Identification and quantification of socio-economic parameters that measure the impacts of various initiatives to be implemented by the Company;
- Meeting international standards governing forest plantation certification.

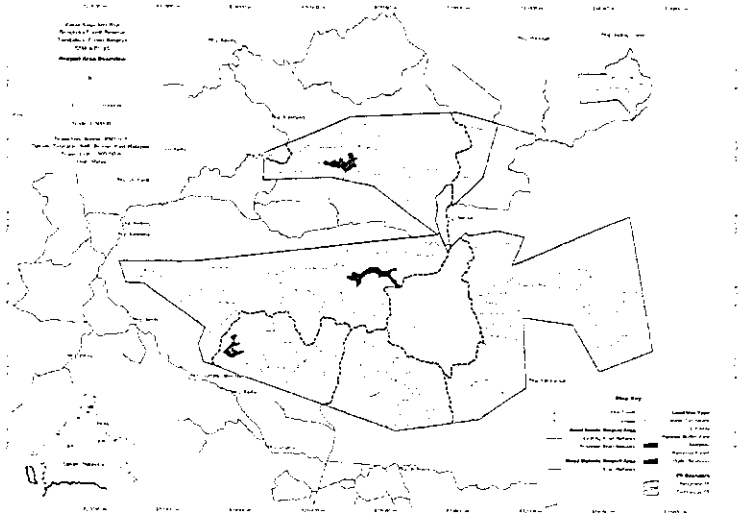


Figure 2.4: Location of identified Settlements within and adjacent to the project area. (see Section 11.1)

Kampong Seropil

2.9.2 Population and Ethnic Composition

Table 2.5 List of Ethnic groups in and adjacent to project area

Village Name	RUNGUS	TEMBENUA	DUSUN	No of HOUSE	POPULATION
Kg. Gumpa/ Jawi-Jawi	100%			30	150
Kg. Jambu					
Kg. Kapok	100%			14	116
Kg. Kakarangan					
Kg. Kandang	100%			42	203
Kg. Radap		100%		15	35
Kg. Seropil	50%		50%	18	60

Table 2.5 above illustrates that the adjacent communities are dominated by the Rungus, Tembenua and Dusun ethnic groups. It should be noted that there are approximately 63 formal settlements on the entire Bengkoka Peninsular North of Pitas town with an estimated population of twelve thousand people.

2.9.3 Demographics

The population of the adjacent villages ranges from 35 to 203 individuals with an average family size of about 5-6 people. The population cohorts are slightly skewed due to out migration of teenagers who go to high school and young adults who move to urban areas in seek of employment and better way of life. However because most communities are reasonably accessible by road, many people return to the area on weekends and traditional holidays.

2.9.4 Education

Most communities have a primary school within two hours walking distance or there is a hostel where the children can stay. This also possible for secondary education. As can be seen in Table 2.6, the education centers are to be found in the bigger villages of Kg Bongkol and Kg Telaga.

Table 2.6: List of Schools found near to project area.

Village Name	Secondary School Name	Nearest Secondary School (km)	Primary School Name	Nearest Primary School (km)
Kg. Gumpa/ Jawi-Jawi	SMK Bongkol	7.72	SK Bongkol	7.72
Kg. Jambu	SMK Telaga	5.72	SK Telaga	5.72
Kg. Kapok	SMK Telaga	19.34	SK Bawing	6.1
Kg. Kakarangan	SMK Bongkol	6.07	SK Bongkol	6.07
Kg. Kandang	SMK Telaga	8.17	SK Telaga	8.17
Kg. Radap	SMK Bongkol	6.89	SK Bongkol	6.89
Kg. Seropil	SMK Bongkol	12.52	SK Bongkol	12.52

2.9.5 Economic Indicators and Infrastructure

2.9.5.1 Housing and Water Supply

Most families live in a separate house together with their immediate family including children and parents, often as many as 6-10 individuals. Houses vary but are generally constructed of waod or bamboo sourced from the forest with a zinc roof. There are however some houses constructed with bricks and mortar. The conditions of the houses varied but although basic, they are generally of fair condition and clean.

Housing in Kg Seropil

Villages closer to Pitas obtain their water from public utilities. However, most villages rely on rain-water harvesting and river flow as their primary supply. Due to the pronounced dry season and hot weather on the peninsular, we believe continuous water supply is an issue in most villages while gravity feed water sources often dry up seasonally. In such cases, community members will have to walk to an alternative source, which is quite far away from their village.

2.9.5.2 Transportation Access

In terms of road access, the main entrance road going North consists of potholed gravel, badly broken tar and short sections of tar in reasonable condition. Some sections can be slippery in the wet season. However, most of the villages on the Western side of the project area serviced by a tar road with some potholes. Of the adjacent villoges, the only Village that is serviced by a gravel road is Kg Seropil, which is in a relatively good state but can be a problem in the wet season. The bridges are also in a good condition but can be a problem in high rainfall if flooding occurs. The bridges and road going up North to Kg Seropil will be maintained by the Company.

2.9.5.3 Electricity Supply

Most of the villages bounding the Project Area do receive proper electricity supply supplied by Sabah Electricity Sdn. Bhd. Kg Seropil, being the most remote village does not have electricity supply. There are however poles and power cable being erected but the supply has not yet been connected.

2.9.5.4 Telecommunication

Telecommunication in the area is relatively good with 2 cellular towers providing telephone coverage. Certain parts of the project area however do not have signal.

2.9.5.5 Schools

Schools are divided into two categories - primary and secondary. As mentioned already Primary Schools and Secondary Schools are located mainly in the two bigger villages namely Kg Bongkol and Kg Telaga.

2.9.5.6 Religious Buildings and Burial Grounds

The adjacent communities are a mix of Dusun and Rungus groups of both Christian and Muslim faiths. As such, there are a number of churches/chapels and mosques within the area. Each village has its own burial ground.

2.9.5.7 Community Halls, Health Services and Market Place

All the villages that were surveyed have either a community hall or a balairaya for communitygatherings and social activities. Health services are available in the bigger villages of Kg Bongkol and Kg Telaga. For bigger emergencies and more serious health issues patients can be taken to the main hospital in Pitas. Sundry shops are also being set-up by the local villagers in most of the villages. With public transport made available, most of the villagers regularly visit Pitas tobuy their household needs.

2.9.5.8 Economic Activities

The survey focused on the employable work force, which accounts for approximately 50% of the population. About 70% of the employable work force are self-employed, involved in either agricultural farming or small scale vendors. Another 10% work in the Government sectors; 5% ae employed by private companies.

Table 2.7: List of Health Care Clinic's near project area

GIS Village Name	Health Clinic Name	Nearest Health Clinic (km)
Kg. Gumpa/ Jawi-Jawi	Poliklinik Komuniti Bongkol	6.11 Km
Kg. Jambu	Poliklinik Komuniti Telaga	5.72 Km
Kg. Kapok	Klinik Desa Bawing	6.1 Km
Kg. Kakarangan	Poliklinik Komuniti Bongkol	5.5 Km
Kg. Kandang	Poliklinik Komuniti Bongkol	8.17 Km
Kg. Radap	Poliklinik Komuniti Bongkol	5.58 Km
Kg. Seropil	Poliklinik Komuniti Bongkol	11.66 Km

Housewives and unemployed categary account for 15 % of the surveyed population. The housewives category is for women doing fulltime housework, whilst the unemployed group consists mainly of school-leavers in the process of seeking employment and those who are too weak to work.

2.9.5.9 Legal Status and Land Tenure

The most pressing concern of the local communities is their right to land. They are very concerned with the acquisition or rights by outside parties over lands which they have occupied. Although the majority of the local communities have been living on the land for generations, few have land titles. Consequently, they fear that they will never get a land title in spite of the fact that they have made application. Nevertheless, they treat the land, which they have occupied, as their own through Native Customary Right. Importantly, the Bengkoka and Tambalagu Forest Reserves do not fall inside native customary rights areas and there is very little encroachment with the reserves.

2.9.5.10 Forests as Part of the Traditional Way of Life

The company recognizes that surrounding communities do use the forests of the Bengkoka and Tambalagu Forest Reserves for collection of some non-timber forest products ("NTFP"). In particular, collection of honey from hives located in some the remaining natural forest trees, remains popular. In order to continue to support NTFP collection, the company will maintain the natural forest bearing riparian zones in excess of the prescribed standards and work with communities to enrich and rehabilitate these areas for enhanced services. Wild honey collection is a significant fire risk for the plantations and as such efforts will be made to make it more secure.

2.10 Impact of Local Community on Forest Management

The Company recognizes the concern and rights of the communities living adjacent the Project Area and is dedicated to minimizing and offsetting any social and environmental impacts of the project on their livelihoods. Development planning includes areas set aside for permanent protection, mostly due to the role they play in the collection and protection of water resources. The company will also seek to create small dams at selected sites in order to ensure a continuous water supply is possible during dry periods.
The company will also investigate the use of a small part of the ITP area for conversion to cash crop, such as Hevea brasiliensis for the benefit of immediately adjacent communities.

2.11 Past Management

2.11.1 Past Production

It is understood that commercial exploitation in the Project Area started as early as the 1970s' where the total area was logged over. This area was then reseeded with Acacia mangium, mostly through natural dispersion which has germinated very unevenly. Thus the area has many uneven aged trees with big variations is size. There are also small patches of planted Acacia mangium in the project area which are in relatively good condition as far as size and form goes.

2.11.2 Silviculture and Management

An area of approximately 700.00 hectares was cleared and planted by Acacia Forest Industries Sdn Bhd approximately 18 years ago. It is probable that these areas were weeded. Additionally a small natural forest restoration project was performed by the SFD in conjunction with local communities. During this project, indigenous species were planted into riparian zones.

Aside from these two interventions, the existing forest estate is a product of cyclical fires resulting in extensive Acacia mangium regrowth and areas of Imperata grassland.

2.12 Environmental Issues

As the area has not been managed and operated in, there are no immediate environmental issues on the project. However the protection of water resources and protection against fire will be primary focus areas for the company.

PART 3: FOREST RESOURCE BASE

3.1 Forest Stratification

Decades of fire events and a lack silvicultural intervention has impacted the forest strata composition. The vegetation in the project can be described as a Fire Climax Plant Community i.e. fire events largely dictate and maintain the current plant composition in the past few years. Natural Forest is less than 2% of the area while Acacia mangium makes up 80% of the forest strata. Annual fires are allowing Imperata grasslands to dominate in places and currently 18% of the area is non-forested. The unmanaged Acacia mangium is under fungal attack and as much as 40% of the trees in certain areas have died. It is almost certain that the balance of tree are also infected.

3.2 Current Forest Stocking

Both remote sensing analysis and field cruising have been conducted to determine the current forest composition and approximate yield. Table 3.1 below illustrates these findings.

Table 3.1 Forest Stratification and Yield

	Gross Area		Plantable Area		Avg. Yield	Approx. Vol.
	Ha	%	%	Ha	cu.m.sob/ha	cu.m.sob
Unmanaged Acacia						
Planted	743	11.5%	100.0%	743.0	230	170,890
High Yield	918.3	14.2%	88.0%	808.1	207	167,278
Low Yield	3490.7	53.9%	80.0%	2,792.6	148	413,299
Non-Forest	1184.5	18.3%	75.0%	888.4		
Mangrove Forest	12.1	0.2%				
Natural Forest	112.8	1.7%				
Roadway	14.9	0.2%				
	6476.3	100%		5,232.0		751,466.41

Due to the effects of fire on the age class profile of the wild Acacia forest, significant variability was encountered within each cruise plot and also within the strata allocated during the remote sensing phase. The low density of timber in some areas combined with the increasing quantity of dead or dying trees suggests that it may not be economically viable to extract all of the standing timber.

3.3 Environment and High Conservation Value Forests

As mentioned before this project area has been severely degraded by previous logging and then by subsequent operations to try and bring this area back to a productive plantation. Also occurrence of many fires have added to the problem. Leaving the project area with very little if any Environment and High Conservation Value Forest. There are small patches of remnant forest.

3.3.1 Environmental Issues

Frequent burning is a constant threat to all plant and animal species trying to establish themselves in the reserve. The fires have also progressively destroyed seed banks of natural species and even the Acacia has been replaced by Imperata grasslands in some areas. The Acacia has been significantly impacted by Ceratocystis fungus are in some areas up to 50% of the trees are dead. This open canopy and increase in litter load makes the area more susceptible to burning.

3.3.2 Environmental Impact Assessment

The Company through its appointed consultant - CHEMSAIN KONSULTANT SON BHD - will conducted an EIA in the Project Area to evaluate the impacts of forest management on the environment. The EIA report will define management objectives to support sustainable forest management based on the principles of multiple use, sustained yield of resources for economic, social & environmental purposes.

3.3.3 Wildlife

As mentioned before because of the frequent burning and the area being made up of mainly Exotic forest there are not many animal species left in the project area. The company has completed a bose line wildlife survey in order try and get a better idea as to what animal species are still to be found in the project area. The inventory data for Tambalagu has been included in Section 11.2.

3.3.4 High Conservation Value Forest (HCVF)

The company has conducted preliminary floral and faunal surveys over the FMU and performed an evaluation against the WWF HCV Toolkit. Table 3.2 illustrates these findings. Due to the limited nature of the surveys, the HCV evaluation and management prescriptions defined in Section 4.4 err on the side of caution.

Table 3.2 Evaluation of HCV Areas

HCV	Description		Evaluation
1	Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values		
	1.1	Protected areas	Not Present.
	1.2	Threatened and endangered species	Present.
	1.3	Endemic species	Present.
	1.4	Critical temporal use	Present.

2	Globally, regionally or nationally significant large landscape-level forests		Not Present.
3	Forest areas that are in or contain rare, threatened or endangered ecosystems		Present.
4	Forest areas that provide basic services of nature in critical situations		
	4.1	Forests critical to water catchments	Present.
	4.2	Forests critical to erosion control	Present.
	4.3	Forests providing barriers to destructive fire	Not Present.
5	Forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health)		Not Present.
6	Forest areas critical to local communities' traditional cultural identity		Not Present.

HCV 1.1

The significant degradation of the Acacia forest and its gradual transition to grassland resulted in the reclassification of the Bengkoka and Tambalagu Forest Reserves from Class I Protected Forest Reserve to Class II Commercial Forest Reserve. Consequently, there are no fully protected areas on the Bengkoka Peninsular apart from specific HCV set-asides.

HCV 1.2, 1.3

Limited studies performed previously by the Sabah Forestry Department and the Company have identified several Vulnerable (Sambar Deer and Malayan Sun Bear) and one Critically Endangered species (Shorea kudatensis).

In a limited study Sabah Forestry Department found individuals of Shorea kudatensis (Yellow Meranti) located in a riparian zone of the FMU. S.kudatensis is both Critically Endangered and Endemic to the Bengkoka peninsular.

HCV 1.4

Due to the volume of crop cultivation and the expanding areas of Imperata grassland, all forests on the Bengkoka Peninsular are significant refuges for the areas remaining wildlife. The predominant forest type across all FMU's and State Land on the peninsular is Acacia mangium in either wild or managed form with limited and fragmented patches of natural secondary forest remaining. This mix and subsequent aggregation of biodiversity values persists into the Bengkoka and Tambalagu reserves. A small but permanent lake exists on the southern boundary of the BFR which may also support both migratory and resident populations.

HCV 2, 3

As described under HCV 1.4, the natural forests of the Bengkoka and Tambalagu Reserves are fragmented and in fact cover less than 2% of the area. A small, contiguous fringe of mangrove forests forms the Northern Boundary of the Tambalagu Reserve.

HCV 4.1

Although the entire Bengkoka Peninsular consists of low lying, rolling terrain, the Bengkoka Forest Reserve itself contains is the most elevated and consequently functions as a catchment for many small streams flowing to the coast.

HCV 4.2

Although not regionally significant, the forests adjacent to all streams in the FMU will function as erosion control buffers thereby ensuring improved water quality in the outflowing streams.

HCV 4.3

As the FMU is dominated by Acacia forests which have a relatively open canopy, the forest floor is often dry with significant fine fuel loadings. This is exacerbated by the amount of dead and dying trees. Consequently the reserves do not currently function as a fire break.

HCV 5, 6

As there are no communities contained within the forest reserves and considering that the forest reserve vegetation is similar to that within the immediately surrounding Acacia plantations, no fundamental subsistence or cultural identity values are known to be derived from the FMU beyond those provided in the region generally.

PART 4: MANAGEMENT PRESCRIPTIONS

4.1 Forest Zoning

As stated earlier, the State Government allocated a gross total area of 6,476 ha for the project subject to final survey. Of this area 77.1% will be managed ITP area with the balance falling under roadways, conservation and catchments, water reservoir and riparian buffer zones.

Figure 4.1 Map of land use in project area. (see Section 11.1)

4.2 Water Catchments and Conservation Areas

4.2.1 Management Objectives

Preliminary mapping and development planning has identified 72ha to serve as water reservoirs fed by water catchments extending over approximately 700ha. In addition to the catchments, another 285ha of forest will be contained in riparian reserves. The objectives of managing these areas are:

- To ensure their sound physical condition and safeguarding the environmental quality of the areas. These areas are also fundamental to the management of the watershed areas of the main rivers;
- To protect and conserve ecosystems and to maximize the protection and conservation afforded for forest resources, soil, water and bio-diversity;
- To identify opportunities for public access to unique natural sites for recreational purposes.

4.2.2. Focus of Management

Management will be confined to boundary protection and the prevention of ony activities particularly fires, illegal encroachments, logging and hunting, which disturb the natural succession of the existing vegetation and wildlife population. Riparian reserves of 30 m wide on each side of the permanent watercourses will be protected in all compartments within the ITP zone. Where possible, mini catchments or water off-take points for the use of the local communities would be identified and protected.

Besides boundary protection, the Company also identified a number of conservation - based activities, which will be initiated during the plan period. These activities are as fallows:

- Small mammal monitoring;
- Orchid ex-situ conservation;
- Sustainable use of the *Tagal* fish rearing system that has proven successful in other parts of Sabah;
- Public awareness.
- Public talks on various aspects of flora and fauna conservation;
- Workshops on sustainable use and management of fish and wildlife;
- Wildlife workshops.
- Conservation awareness programs for the communities; such as
- Community employment in flora and tauna biodiversity assessment;
- Wildlife-related health issues and community welfare.

4.3 ITP Zone

4.3.1 Focus of Management

The focus of management in the ITP zone (Project Area) will be on timber production. There are 3 Coupes, which have been designated for timber production. The forestry activity in these compartments during the plan period will be ITP development.

4.3.2 ITP Objectives

The objectives of the Company to develop the Project Area under ITP component are as follows:

- To improve and enhance the commercial timber productivity of the approx. 5,200ha, which was set aside for ITP by planting fast growing timber species, namely *Eucalyptus species* and *Acacia mangium* (preferably *Acacia and Euc* hybrids).
- To ensure a continuous and sustainable production of high quality timber of *Eucalyptus Species* and *Acacia mangium*(hybrids) based on an 10-year rotation to supplement the Log output from the natural forests;
- To secure adequate and consistent supply of high quality timber for the downstream industry;
- To promote employment and business opportunities.

4.3.3 Plantation Establishment and Management

Forest plantation development is acknowledged to be a key forest management strategy to address the problem of diminishing supply of timber from the natural forests. Forest plantations have the potential to provide a rich and sustainable source of timber and renewable energy. Forest plantations can also provide social benefits and environmental services such as, carbon sequestration, soil protection and water conservation. In order to realize this potential, a number of requisites and supporting mechanisms must be put in place by the Company. It is also recognized that the establishment of successful forest plantations requires good planting techniques and high standards of Silviculture practices. Therefore, plantation establishment and management would have to be carefully planned in order to ensure success. This will be prescribed in details in part 5 of this plan.

4.4 Management of HCVFs

The Company will adopt all mandated and additional voluntary measures to ensure HCV's and other areas of important social or ecological function are protected. These measures will include:

- Adoption of a minimum Riparian Zone width in excess of mandated requirements in recognition of the role of the FMU as a catchment for some of the peninsular

- Identification and protection of designated catchment areas

- Enrichment and rehabilitation of voluntary catchment areas and riparian zones with natural forest species.

- Boundary marking and sign-boarding of all protected areas

- Monitoring and protection of protected areas against encroachment or exploitation.

- Incorporation of inventory study outcomes into development and operational planning

- Maintaining as much of the forest in a closed canopy state as possible within the context of a working plantation.

- Compilation of a Conservation Master Plan encompassing:
- Extended biological inventory studies
- Directed inventory to quantify and understand the population and distribution of Endangered and Critically Endangered species.
- Establishment of long term monitoring regimes for Endangered and Critically endangered species
- Where appropriate and practical, development of seed collection and enrichment programs designed to support populations of endangered and critically endangered species as well as other food source species.
- Formation of conservation partnerships with institutions, agencies and adjacent communities for collaboration on specific programs.
- Establishment of an internal review process to ensure conservation and protection goals are being met.

4.5 Community Forestry

Based on the socio-economic situations of the local communities, the dire needs of the local communities are multi-dimensional encompassing livelihoods, economic opportunities to earn reasonable income, access to education, and quality of life in terms of communication, access to health services, improved water, electricity supply and sanitation. Therefore, the Company would take appropriate actions on the following:

- Determination of the socio-economic impact of all plantation development activities;
- Focus on skills development (vocational training) and employment to improve their quality of life;
- Support the exclusion of NCR lands from Project Area that community members are entitled to, if any.

4.5.1 Community Development Initiatives

During the plan period, the community development progroms that will be initiated by the Company amongst others include the following:

- To develop and nurture the trust between communities and the Compony through enhanced communication and community-Company partnerships;
- To assist the local communities in their economic projects (e.g., agriculture projects, agroforestry, livestock and fisheries projects, small-scale food production projects, cottage industry) to raise income;
- To assist in social infrastructure projects (e.g., water supply, kampong roads, bridges, recreational activities, kindergarten s, etc.) to improve the quality of life of communities;
- To assist in institutional strengthening and enhancing the capacity building forcommunity leaders and project leaders.

The above listed initiatives will be implemented in close coordination with the District Offices of Pitas. The Company will also establish a number of small partnerships with local and international NGOs to maximize the positive impact of the proposed initiatives.

4.5.2 Financial Implication

The proposed initiatives listed above need to take many factors into account and therefore, would have to be thoroughly assessed far their feasibility priar to implementation.

Another factor that needs to be considered is financial implication (budget). Regardless of the exact projects implemented, the total estimated expenditure to deliver a comprehensive community development programs is not less than RM 0.5 million. To address the shortfall of financial resources, the Company will seek assistance from government agencies and in-house rural development expe1ts.

4.5.3 Program Priority and Villages Involved

The efforts of the Company during the first year would be to focus on enhancing community- Company partnerships. The target communities are those communities that are open to working with the Company and are geographically located in proximity to the project area. Based on the community data obtained from the social survey, there are 7 villages in the vicinity of the project area with a total population of approximately 720 people.

4.5.4 Establishment of a Dedicated Community Development Team

A dedicated community development team will be developed to address the following tasks:

- Completian of a baseline survey and needs assessment of the communities located in and around the project area;
- Development of a Master Community Development Plan for the project area;
- To develop and implement sustainable strategies for the target communities in order to create self-sustaining social, cultural and economic development;
- To document the physical, social and economic changes accurately throughout the project period using videography, photography, a website and written documentation.

4.6 Forest Protection

4.6.1 Control of Boundaries

The Company will, in collaboration with its neighbors, establish security checkpoints in strategic locations. These checkpoints will help to control the flow of people and forest products to and from the interior of the Project Area.

In places where the marked boundary is readily accessible and thus, where encroachment is more likely, regular patrals will be carried out in order to detect early encroachment.

4.6.2 Forest Encroachment by Local Communities

The communities have practiced shifting agriculture in locations outside of their traditional land. In order for a contiguous and economically viable forest plantation to be developed in the Project Area, it is essential that new land encroachment is to be stopped. However, the Company acknowledges the complexity of this challenge and intends to approach it based on the following mechanisms:

- The Company will actively engage and communicate with local communities regarding their needs and claims and the Company's development planning;
- The Company will actively seek apportunities to collaborate with the local communities on plantotion development in areas where they have legal standing;

- The Company will actively seek the assistance of government agencies, particularly the Sabah Lands and Surveys Department, the Sabah Forestry Department and the District Officers of Pitas in

order to resolve issues in a manner that is consistent with the laws and regulations of the Sabah Gavernment and provides far a secure and mutually beneficial future.

4.6.3 Soil Protection

Plantation companies are, first and foremost, protectors of the sites under their care. Care of the soils is paramount to long term sustainability and, therefore, will always a high priority of the Company. Also, plantation development is by nature a significant, if short lived, disturbance and, therefore, the Company would make every effort to mitigate the effects thereof. The primary impacts to be avoided are:

- Prolonged exposure of soils to precipitation thraugh aperational delays;
- Soil compaction through poor machine management;
- Soil scarification through excessive ground disturbance;
- Soil sterilization through poor fire management.

Mitigating measures to be taken are described in details in PART 9 (Section 9.2) of this plan.

4.6.4 Wildlife Protection

The fauna inside the Project Area have been impacted by the conversion of habitats from natural forest to cultivated and fallow areas. The local population and migrant workers employed in the oil palm estates has also put pressure on wildlife populations throughhunting.

The Company will implement a plantation design that together with the mitigation measures prescribed in the EIA that will create a landscape level mosaic of forest types. Contiguous areas of protected and hence, recovering natural forests will be created in which, fauna populatians can occupy and migrate through the forest reserves. Significantly, a "No Hunting" policy will be enforced.

4.6.5 Protection from Fire

It is understood that there is little, if any, organized fire management infrastructure or cooperation existing within the Project Area. Given past fire occurrence and the large number of local population on the borders of the project area, this represents a significant risk to forest plantation in the area. Consequently, the Company will implement a comprehensive fire prevention, detection and suppression strategies. These strategies are prescribed in PART 6 of this plan.

4.7 Infrastructure Management

4.7.1 Roads and Bridges

Roads should provide access to all plantation areas during all weather. Therefore, there will be three types of all-weather roads to be constructed during the plan period. These types of roads are as listed down in Table 4.1 below. A fourth class of road is a temporary track, which will also be constructed where required, for planting or harvesting access.

Class	Density	Description
I	8 m/ha	Permanent; Connect project interior to the perimeter providing access to the Project Area
II	10 m/ha	Permanent; Connects Class I roads to the individual plantation blocks
III	24 m/ha	Permanent; Connect Class II roads to a group of stands
IV	5 m/ha	Temporary; Connect Class III roads to landings in a stand

Figure 4.1: General road classes and densities (see Section 11.1)

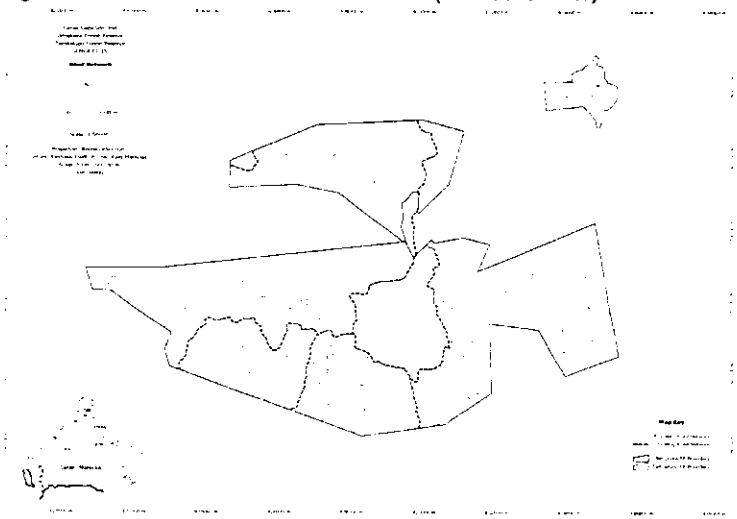


Table 4.1: Road Classes to be constructed during the Plan Period

Harvesting and tronsportation often make up 60% of the cost. The plantation design, particularly the road layout, should therefore enable efficient extraction, loading and transporting of logs. As far as possible, the following guidelines should be followed:

- Maximum distance between roads (300m) to allow efficient log extraction;
- Roads should loop as far as possible to allow easy rotation of trucks;
- Roads should avoid excessive stream crossings and steep terrain;
- Roads should provide access to all plantation areas during all weather.

In addition, each road class must be constructed to specification in order to support the massloading and traffic frequency that will be required of it.

Table 4.2 shows the road specifications and approximate cost per kilometer for construction and annual maintenance.

Table 4.2: Road Class Specifications

Specification	Class I	Class II	Class III
Required For Phase	Harvesting	Establishment	Establishment
Density	8m/ planted ha	10m/ planted ha	24m/ planted ha
Tonnage	145,000t per annum for 4-6yrs out of 8 yrs	145,000t per annum for 2-4 yrs out of 8 yrs	50,000t for 1-2 out of 8 years
Corridor: Width	30 m	20 m	10 m
Roadway: Width	8 m	6 m	6 m
Sub-Base/Base:	30 cm	30cm	10 cm
Surface: Width	5 m	4 m	3 m
Surface: Depth	12.5 cm	10 cm	5 cm
Max Gradient	8%	10%	15%
Camber	4%	4%	4%
Construction Cost	RM 88,802/km	RM 160,427/km	RM40,156/km
Maint. % Per Annum	60%	50%	20%
Maintenance Cost	RM25,867/km/yr	RM 11, 154/km/yr	RM8112/km/yr

As shown in Table 4.3 below, the total road requirement in the Project Area is approximately 130 km. An annual road construction program of 32.5 km will be required during the first 4 years followed by upgrading of some Class II Roads to Class I Roads during the first harvest rotation (10 years). From initial construction, all Class 1, II and III Roads will be subject to a maintenance schedule.

Table 4.3: Estimated Road Construction and Upgrading by Class

Year	Class III	Class II	Class I
2016	17.5 km	7.5 km	10 km
2017	17.5 km	7.5 km	10 km
2018	17.5 km	7.5 km	10 km
2019	17.5 km	7.5 km	
Total	**70 km**	**30 km**	**30 km**

Bridges will be of a permanent type (Steel, Bailey bridge), as illustrated in Figure 4.2, in order to provide year round access

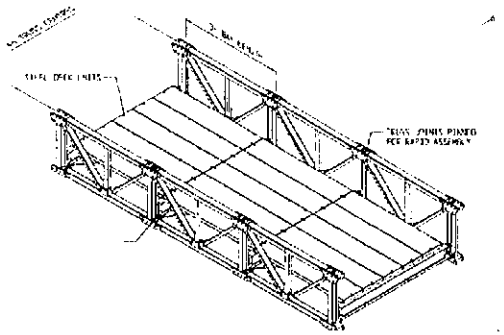


Figure 4.2: Rapid Deployment Bridge

4.7.2 Buildings and Basic Facilities

It is the Company's intention to establish a main base camp which is located at Coupe 1. This base camp will service the initial development period and will consist of the following infrastructure:

- Water Collection Ponds
- Water Treatment Plant
- Power Generation Plant
- Accommodation
- Fuel Store
- Chemical Stores
- General Store
- Refueling Area
- Workshop

- Office
- Rest House
- Fire Depot
- Waste Disposal area

In addition to the main base camp, a further area camps are envisaged. These are very small camps whose purpose is to provide accommodation, secure storage and fire depot facilities once operations move into that particular compartment/area. These camps are to be identified during the plan period.

PART 5: PLANTATION DEVELOPMENT PROGRAM

5.1 Why Invest in ITP

The area, which the State Government set aside for ITP is highly degraded due to common occurrence of fires and fungal attack on existing trees and bad previous logging practices. Therefore, one of the ways to manage these degraded areas in order to produce a high volume of quality wood in a short period of time is through ITP.
Other reasons are the following:

5.2 Alternative to Indigenous Wood

Timber production from Sabah's natural forests has declined in recent years and there is a deficit of woad raw materials supply to supply the State's timber processing industries. Consequently, this acute wood shortage has given rise to the opportunity to establish large scales tree plantation to secure sustainable supply of raw material. Besides, plantation woods are now getting more acceptable in the market, especially now when large consistent volume of plantation woods becoming available. The wood processing technology has also advanced to utilize small diameter plantation wood. For example, the Acacias which were initially grown for chip wood, have now extend into sawmill and plywood mill. *Acacia mangium and Eucalyptus pellita* woods are now well sought after for truck flaoring, furniture and plywood.

5.3 Produce Environmentally Friendly Wood

Biodiversity conservation and other environment issues are setting new demands for forest management practices around the world and indigenous tropical forests will provide decreasing volumes to international wood markets. Environmental and competitiveness factors are increasingly influencing wood supply strategies. Fast growing plantations in the tropics and subtropics are in a favorable position to match the standards of environmentally sound low cost wood. Sustainable wood source, gives the wood product a *'green image'*, which enables it to campete in international market favorably. This environmental friendly status of plantation wood is an added advantage to manufacturer who depends on export for their product.

5.4 Provide Renewable Wood Resources

Forest plantation provides sustainable raw material for various purposes, such as, sawn timber, veneer, plywood, laminated veneer lumber, fiberboard and pulp. Once established, the forest plantation provides a perpetual renewable source of raw material cheaply, over a relatively short period of time. The technology and know-how is available for establishment of large scale forest plantation of fast growing species such as, *Acacia mangium and Eucalyptus pellita*. Sabah has an appropriate growing condition for forest

plantation, the growth rate is faster here and cost is lower.
The Company expects to produce a yield 104,000m3.p.a. on a 10 year rotation and off a planted area of 5208.8 ha.

5.5 Provide Uniform Raw-Materials

Forest plantations produce large volumes of uniform raw material, which will improve recovery rate in the processing, thus reduce processing cost, and enhancing uniformity of product. It also offers opportunity for better product pricing. Production of high quality timber products for the export market requires the production of consistent quality, which implies a high degree of uniformity of raw material. The present mixed tropical hardwood is not a uniform mixture of wood species. It comprises of between 200 - 300 different species from different locations, which will create problems due to variability of the log on a day-to-day, even hour-to-hour basis. The production of high quality timber product would be enhanced by the switch to a more homogenous plantation wood. Indeed, the long term viability of our project depends on the ability to produce cheap homogeneous wood and expanding the production base by taking advantage of availability of more wood from the forest plantation.

5.6 Market Prices of Plantation Wood

Generally log prices are more stable than the commodity price for agricultural crops. However, the current forest plantation log prices are still generally much lower than the log price from the natural forests. However, as the supply of tropical hardwoods becomes more constrained, it is anticipated that plantation wood will achieve parity with current mid-grade tropical hardwood prices. As larger, more consistent volumes of plantation wood become available, so manufacturers gain the confidence required to invest in dedicated small wood processing equipment.

5.7 Species Choice

To invest in a major ITP project, where the investment is huge and the rotation age is long; one cannot afford to take chances. Among the many factors influencing successful tree planting, soil and climate are perhaps the least amenable to change. Therefore, planting the right species on the right site is the utmost important factor to ensure the success of tree plantation investment. Suitable species must adapt to the soil and climatic condition well. This is to ensure higher yield, reduce pest and disease outbreak and minimize Silviculture cost. Species that are fast growing, can colonize the site quickly and able to market internationally with good demand and price, are favored.

In Sabah, the mast commonly planted ITP species are Albizia paraserianthes (Batai), Hevea brasiliensis (rubber), Acacia mangium, Eucalyptus pellita which is exotic to Sabah is the primary species selected for the project. As can be seen in table below Acacia mangium and Eucalyptus pellita have the right qualities to be planted in plantation form.

Table5.1: Properties of Acacia mangium and Eucalyptus pellita

Properties	Acacia mangium	Eucalyptus pellita
Rapid growth	yes	yes
Tolerance to varying site conditions	yes	yes
Utilizable as veneer/saw timber	yes	yes
The ability to fix nitrogen	yes	no
Utilizable for honey production	yes	yes
Intolerance to shade	yes	yes
Uses very little water	yes	yes

Acacia mangium grows very well on the soils of the Project Area but at this time is susceptible to the fungal disease Ceratocystis. Research is ongoing to produce a disease resistant hybrid and because of Acacia mangium's good properties, the Company may yet plant the specie. There are also other Eucalyptus species and Batai that show great potential and which will be thoroughly trialed prior to extensive commercial adoption. Taxa trials will be immediately established to test specific species site performance. These trials will include indigenous species such as Larang and Binuang.

5.8 Procurement of Planting Materials

To ensure that a commercial plantation provides ever increasing yields of higher quality timber, it is necessary to use improved material for planting. The Company will source the most appropriate genetic material as advised and approved by the Director of Forestry. It is envisaged, however, that the project will leverage the products of existing research and breeding programs carried out by the Forest Research Centre in Sepilok and the members companies of the Borneo Forestry Cooperative ("BFC"). This genetic material will include selected Acacia mangium and Eucalyptus pellita provenances, as well as hybrids. The BFC's breeding program is extensive and is beginning to yield improved material suitable for planting in local conditions.

5.9 Nursery Infrastructure

As this is a relatively small project and the cost installing a production nursery is relatively high, the Company has decided to source its seedling from its sister company for the first 6 to 8 months. A holding nursery will constructed where plants will complete their final hardening off before dispatch to the field.

A centralized nursery is preferred rather than many smaller nurseries as it facilitates tighter control over the genetic material developed from the tree

improvement program and leads to better quality seedlings. The Company's main nursery facility will initially be the primary supplier of seedlings and cuttings used on the ITP project. However by the time of the first replanting or perhaps sooner, the company will establish a full production nursery on or close to the FMU.

This production nursery will be equipped with basic facilities and will adhere to strict nursery procedures. The facilities to be provided in the nursery amongst others will consist of the following:

- Potting shed
- Seedling benches/beds
- Store room
- Pump house/water pump and irrigation system
- Water tank
- Pipe lines and sprinklers
- Generator
- Nursery office

5.9.1 Nursery Procedure

Figure 5.1 Below illustrates the nursery process for the propagation of seedling and is applicable to most commercial Acacia and Eucalyptus species.

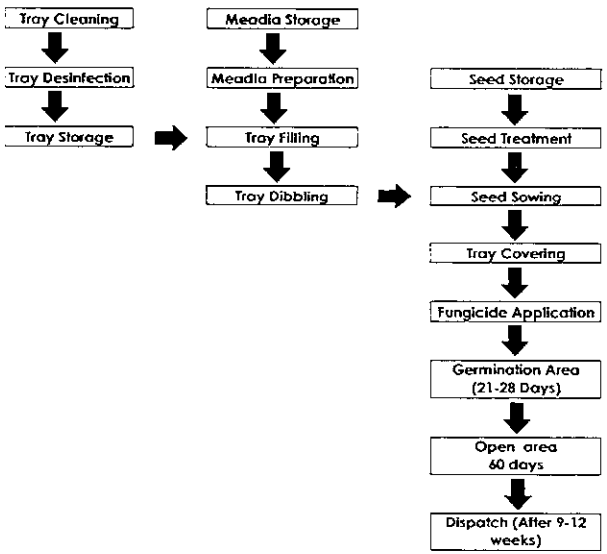


Figure 5.1: Nursery Process for the Propagation of Seedlings

5.9.2 Growth Media

- The primary media components to be used coco peat.
- All media components must be stored in a designated area where there is no risk of contamination from chemicals, fuels and oils.
- Media preparation is to take place as close as possible to the time of sowing.
- Slow releasing NPK fertilizer is to mix into the medium.

5.9.3 Tray Management and Filling

- The Company will utilize the BCC Tray and Tube System.
- Emptied trays and tubes will be manually brushed and washed before storage.
- Near to the time of sowing, trays and tubes will be washed under high pressure and then sanitized in hot water (65-70 °C for 30 secands).
- Tray filling will be done by hand using the prepared media.
- Tubes will be randomly quality checked for correct compaction.
- Each tube will be dibbled (holed) to ensure proper seed placement.

5.9.4 Seed Storage, Treatment and Sowing

- All seeds to be stored in seed fridges at ± 4 °C and 8% relative humidity.
- *Acacia mangium* seeds will be treated before sowing by immersion in 70 °C water for I minute.

5.9.5 Seedling Germination Phase (21-28 days)

- The seedling germination area must be covered with plast sheet to provide 50% shade and wind shelter.
- The *Acacia mangium and Eucalyptus pellita* seeds can be sown directly into the germination trays.
- Watering is done 2-3 times per day.
- Preventive fungicide will be applied once per week with various broad spectrum fungicides being applied on alternative weeks.
- Before being moved into the open area, trays are sorted and consolidated.

5.9.6 Seedling Open Growth (60 days)

- The open area should have no shade, which provides a more natural environment where seedlings can harden in preparation for transplanting.
- Watering is done 3-5 times per day.

- Fertilization is done 3-5 times per week at low concentrations 'using complete (NPK + trace elements) fertilizer.
- First grading and spacing takes place at 6-7 weeks. Tubes are re-spaced in the trays to a 33% - 50% trays stocking.
- Second grading and first selection is performed at 9-10 weeks. Seedlings selected here are sent for dispatch.
- Final selection and dispatch takes place at 10-12 weeks and selected seedlings are sent for dispatch.
- During grading, seedlings will be checked for disease and fungi.
- During selection, seedlings will be checked for quality (height 25-30 cm, stem collar lignification, good root to shoot ratio).

5.9.7 Seedling Dispatch

- Seedling root plugs are to be kept wet before and during transportation to the field.
- Seedlings are to be protected from wind as far as possible during transportation.

5.10 Plantation Establishment

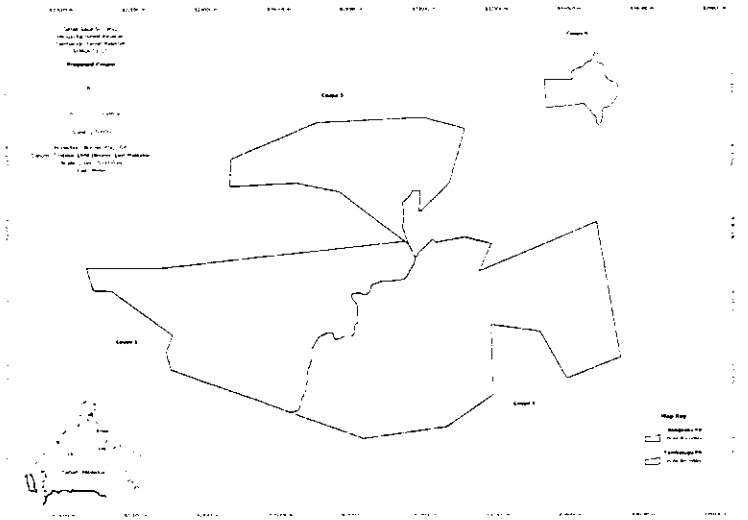
5.10.1 Extent

Table 3.1 illustrates that although the gross FMU area is 6,476ha, not all of it can be planted. It is essential that we estimate the Net ITP area as closely as possible, taking into account all anticipated area losses incurred during the conversion process. At the time of writing, the company estimates a net planted area of 5,200ha.

The entire FMU is divided into 4 Coupes with internal Coupe boundaries based on natural barriers such as watersheds and roads. Coupes are further divided into Compartments of 200 to 600 hectares each.

Each year, the planning unit will survey and compile the detailed Coupe Development Plans for following year and which will accompany the Annual Work Plan submissions. These plans will detail the specific location of area to be kept under Conservation zoning, ITP zone (the land to be converted to ITP) and the location of infrastructure and other protected areas.

Figure 5.2: Location of Coupes in project area



5.10.2 Site Preparation

Site preparation will commence in January each year. All remaining vegetation after logging will be felled except in riparian reserves, wildlife corridors. All felled vegetation will be left on site and crushed by excavator.

Once an area has been cleared and crushed a pre plant chemical spray will be carried out. Then planting points will be marked on the ground. The spacing between trees is 2m x 3m. This means that there will be 1,667 planting points per hectare. On these planting points holes will be prepared for the planting operation.

5.10.3 Planting Materials and Planting

As describe in Section 5.3, seedlings will be dispatched to the field after 9 weeks. The seedlings to be planted should have the following characteristics:

- Height: 25-30 cm
- Root collar: Partially lignified
- Root Plug and Media: Well-formed with media intact and well-watered
- Shoots: reasonably vigorous leafing

- Disease: No sign of disease present

Planting will normally be carried out throughout the year. However, most of the plantings should be carried out during the rainy season. Plants will be transported to the site in their polythene tubes. The individual plants are then hand planted in the prepared spot circle. During planting, 85 g of DAP (Di-Ammonia Phosphate) together with 7g Boron is applied per planting hole.

5.10.4 Planting Schedule

Each Coupe is further divided into Blocks averaging at 25ha per black. All production and quality management takes places against individual Blocks.

As salvage logging precedes planting by at lEast 2 months, each operation has its own production schedule.

Tables 5.3: Planned Operations Schedules.

Hectares	2016	2017	2018	2019	2020	2021	2022	TOTAL
Salvage Logging	200	1,000	1,000	1,000	1,000	1,000		5,200
Planting	100	850	850	850	850	850	850	5,200

5.10.5 Supplemental Planting

All planting is subject to both quality and quantity surveys. The quality survey in particular will identify stocking failures, either because of poor initial stocking or seedling mortality. Therefore, the survey or census will be done one (1) months after planting. Blanking should be carried out in case that the mortality rate is over 10%. All stands will be blanked (restocked) until aminimum of 95% stocking is achieved. Seedlings, which are healthy and much bigger than theseedlings from the first planting, will be used for re-filling. Supplemental planting will be carried out at praper weather conditions.

5.10.6 Fertilizer Treatment

During planting, 85 g of DAP (Di-Ammania Phosphate) together with 7g Boron is applied per planting hole. Research has shown that Fertilizing Eucalyptus species has shown significant improvement in growth. It must be mentianed that after fertilizing area must be kept weed free.

5.11 Silviculture Regime

The primary species identified for this project is Eucalyptus pellita. This species is fast growing in the tropics, such that a rotation of 10 years will yield a volume of veneer logs and pulp logs in commercially viable quantities. Slightly longer rotations with additional thinning and pruning treatments could increase the round log volume and quality. However, there is relatively little empirical data on the best timings and specifications for these treatments. The final regime choice is also a function of the anticipated log grade pricing. Current pricing for Acacia and Eucalyptus round logs does not encourage additional treatments. However, it is the Company's contention that prices will increase in concert with declining tropical hardwood supplies and that longer rotations aimed at producing a peeler logs and saw logs will become viable.

5.11.1 Maintenance

Weeding activities are focused on controlling grass such as, Imperata cylindrical, Pennisetum polystachion and Ischaemum muticum and climbers, which will directly compete with newly planted seedlings. Scheduled chemical weeding will be carried out for the first year but thereafter, weeding operations will be carried out where necessary until the plants are clear of competition in the second year. Removal of weeds is necessary when the tree is still small in order to eliminate competition for nutrients, maisture and prevent the sapling from been shaded out by the tall weeds and climbers. Eucalypt species are more sensitive to competition and up to four rounds of chemical spraying or slashing may be required before canopy closure.

5.11.2 Thinning

As indicated earlier, the planting density at the initial stage is 1667 trees/ha. However, it is anticipated that about 1200 trees (with dbh > 16 cm) are left for harvesting. This means that there will be about 467 trees to be thinned or removed. However, thinning at the early age (2 years) may not be a good indicator. Therefore, Silviculture thinning may begin at year 4. Trees to be removed are those having diseases, bad growth and deformed.

When marking for thinning, the workers will be trained in tree selection and the important principle of keeping canopy gaps as small as possible. Large gaps cause the wind to swirl and vortex amongst the tree which can cause extensive damage.

5.11.3 Pests and Diseases

Timber plantations create conditions that favor insects and diseases development. Care and precaution, therefore, must be taken to maintain an ecological balance so as to minimize such outbreaks. Continuous monitoring and research in pests and diseases will be carried out as part of the standard forest plantation management practices.

Other initiatives that will be considered for implementation during the plan period include the following:

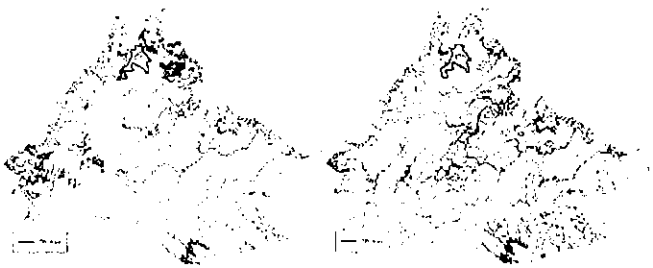
- Provide training ta all the Company's contractors and own operation staff to become "biological observers".
- An external consultant will be engaged to produce a Pests & Diseases (P&D) Field Book complete with colour plate examples and undertake initial P&D training programs.
- Based on field reports, data on the significance and extent of P&D attacks and/or nutrient problems observed in the field will be compiled and quantified.
- Whenever necessary, professional and scientific support to establish and carry outremedial actions will be obtained

PART 6: FOREST FIRE MANAGEMENT

6.1 Introduction

The ENSO (El Nino Sauthern Oscillation) phenomenon is the primary driver of fire risk in the Project Area. The ENSO phenomenon causes prolonged dry seasons, which can caused very dry forest conditions. This phenomenon happens 2-3 times a decade. The frequency and severity of these events seems to be increasing.

In some years, this has contributed to large fires occurrences throughout the State of Sabah. The most significant fires were in 1983, followed by those in 1997/1998. Figure 6.1 below shows the extent of fires in those years, whereby, it can be seen that the Project Area is at risk.



1983 Fire Extent *1998 Fire Extent*

Figure 6. 1: Extent of Fire Occurred m 1983 and 1998 (Maps: Sabah Forestry Department: CAIMS Site)

One important task for forest plantation is the protection of the forest resource base. Out of many sources of attacks against the forest, fire is often the most dangerous. Therefore, it is quite clear that fire prevention and control should receive top priority by the Company. The principles of this strategy are discussed briefly here. The details will be prescribed in the Fire Management Plan, which to be prepared during the plan period.

6.2 Operating Principles

The following operating principles have been identified to provide a high level of understanding of the purpose of the plan:

- A prevented fire is the lEast costly
- Detect and attack fires when they are small
- Anticipate and respond to problems early
- Always ensure personnel safety and well being

6.3 Objectives

The objectives of the fire management plan are to ensure that the Company is well prepared for the suppression of wild fires and to reduce the risk of fire occurrence in the project area through fuel reduction, prescribed burning and community engagement.

6.4 Fire Prevention and Control

There are five aspects of fire prevention and control. They are:

- Fire preparedness measures
- Fire prevention;
- Early fire detection and reporting;
- Fast comprehensive fire attack;
- Fire crews and organization charts.

This framework is a basis for continuing improvement in preventing and controlling fires. It is important that efforts in prevention are to be evaluated for their success every year. Likewise, every unwanted fire should be attacked aggressively and the efforts evaluated and improvements are made.

6.4.1 Preparedness

The main objective of preparedness is to anticipate and prepare for successful prevention and attack on fires threatening the Project Area especially during the dry season. There are three levels of preparations annual preparations, daily activities and special preparations. In the forest plantation, buffers, green belts and plantation roads are located strategically within the blocks and project boundary to serve as fire breaks. All natural water bodies located within the Project Area will be identified and water fill points will be constructed. Some permanent streams dammed up.

6.4.1.1 Annual Fire Preparedness

Annual preparations are required to check that the Company is ready for any upcoming fires season. Most of the works should be done in the last months of the wet season, probably November and December. Table 6.1 shows the checklists as reference for the annual fire preparedness management in the upcoming drought season.

Table 6.1: Checklists for Annual Preparation to Fire Preparedness

Activity	Time of Year
Update Fire Prevention and Contral Plan and communicate to staff	Nov - Dec
Conduct regular practices for fire crews	Jan - Dec
Refurbish, repair, test and purchase fire equipment/tool	Nov - Dec
Check and repair critical access roads	Jan - Oct
Check and repair strategic water sources or water points	Jan - Oct
Update emergency contact lists	Nov - Dec
Update the procedures, communication plan and command	Nov - Dec

Fire training in preparation for fire season

Meanwhile, Table 6.2 shows the various fire tools and equipment required for firefighting. These tools and equipment must be constantly check and maintained to ensure that they are in good condition at all times. A complete testing, maintenance, repair and replacement for firefighting equipment should be carried out in November/December of each year. Hoses and mechanical equipment/tools should be cleaned, repaired and tested after every use.

Table 6.2: Basic Forest Fire Tools and Equipment

Hand Tool	Water Delivery System	Others
Shovels	Water pumps	Mobile phone or Radios
Pulaski(s)	Hand tank pumps	Chainsaws
Mattocks (Cangkul)	Water hoses	Brush saws
Axes, Chainsaw	- 11/2" x 30m (Lined)	Torch light(Night Operation)
Drip torch(s)	- 5/8" x 15m	Canvas pail

6.4.1.2 Daily Preparedness Activities

Daily fire preparedness especially during the drought season is very important activity. Therefore, the suggested fire preparedness activities, which are to be implemented by the Company, are listed in Table 6.3 below.

Table 6.3: Fire Preparedness Activities during Dry Season

Fire danger Level	Low		High	
Colour Code	Green	Blue	Yellow	Red
		Activate lookout	Inform all no unnecessary burning	All available fire equipment prepared for immediate deployment
Fire Controllability Guide.	Fires are not likely to start. If started, fire spread is very slow or may go out without suppression forces. There would be little flaming combustion and intensity is low under all conditions. Control is readily achieved and little or no mopping up is required.	Ignition may take place near prolonged heat sources (campfires etc). Spread is slow in forest, moderate in open areas. There are light surface fires, with low flames. Control is readily achieved by direct manual attack methods and with minimum forces. Some difficulty may be experienced on exposed dry slopes and some light mopping up will be necessary.	Flaming torches, etc may start first. Mature grassland and forest litter will burn readily, spread is moderate in forests, fast in open areas. Fires burn on surface with moderate flames. Control is not direct and indirect attack with fire truck and labour should not be necessary. Light to moderate mopping up will be necessary.	Ignition can occur readily, spread may be fast in the forest although not for sustained periods. Grass fires could outstrip forces with a spread of 7 km/h. Fires may be very hot with local crowning and "short to medium range" spotting. Control will be very difficult and indirect attack methods with major assistance are necessary. Mopping up may require an extended effort.

6.4.1.3 Special Preparation

The company will ensure that its staff and appointed contractors will undertake the following measures:

- Adhere to all fire prevention, management and suppression prescriptions described Work Standards.
- Develop and distribute an annually updated Fire Plan document.
- Establish a well-equipped and well trained response capacity.
- Further public awareness to reduce or eliminate manmade wild fire through training, inforest controls and community participation.
- Perform fire weather monitoring and make the use of Fire Danger sign boards etc. to alert the public of periods of high fire danger.
- Perform co-operative burning programs with neighboring farmers to control and eliminate wild fire spread from uncontrolled agricultural burn offs.
- Define rules and procedures to control and stop all external fires.
- Limit access to plantations during periods of high Fire Danger.

6.4.2 Fire Prevention

As 90% - 100% of fires in any single fire season are attributable to human activity, it follows that fire prevention initiatives must be centered around communication with and monitoring of staff, workers, contractors and communities living in and within the vicinity of the Project Area during times of elevated danger. The main objective of prevention is to reduce the number of unwanted fires in the Project Area. The Company will assign a Forest Fire Officer, who will be responsible for annual fire prevention activities. These annual routine activities are shown in Table 6.4.

Table 6.4: Annual Prevention Activities Checklists

Check	Activity	Time of Year
✓	Review fire prevention successes and new fire causes, threats or problems.	Nov - Dec
✓	Update daily prevention activities and annual prevention activities.	Nov - Dec
✓	Meet with Bomba, the Forestry Department and District Office to review prevention program.	Nov - Dec
✓	Meet with Fire Protection Cooperative member (if any) to discuss new issues and programs.	Jan - Dec
✓	Maintain fire danger and prevention signs.	Nov - Dec

6.4.2.1 Prevention Planning

In order to develop a fire prevention plan one should look back at all previous fires and do a complete post mortem on these fires. In doing so one can learn from this and put in better preventative measures in your fire prevention plan. In the post mortem one should look at the following criteria:

- The fire causes and group(s) responsible for fires;
- Estimated time and date of the fires (weather/fire danger level);

- Location of the fires;
- In what was fires burning in (fuel type);
- Who discovered / reported the fires;
- Fire size and investments lost;
- Total cost of the fire.

6.4.2.2 Daily Prevention Activities

Based on the Fire Danger Rating determined by the Forest Fire Officer, the prevention activities showed in Table 6.5 will be implemented effectively.

Table 6.5: Annual Fire Prevention Activities

Fire Danger Rating System	Prevetion activities
Low	**Activate Level 1**: Prevetion activties: Enhance staff/public awarness
Moderate	**Activate Level 2**: Prevetion activties: Notify Kampongs/staff/contractors regarding fire danger.
High	**Activate Level 3**: Prevetion activties: Ban all fires, notice to be given to all cummunitties to discaourge any burning. Patrol to enforce.
	Activate Level 4: Prevetion activties: Consider shutting down all activities in project area. Place all on standby.

6.4.2.3 Fire Danger Boards

Fire danger boards will be displayed at strategic areas in the Project Area and updated on a daily basis. The Forest Fire Officer and weather personnel should work closely to ensure the staff responsible for updating the fire danger information is doing his job in a timely manner.

6.4.3 Fire Detection and Patrol

The main objective of fire detection is to detect all fires at the earliest possible stage. This will allow for rapid and effective initial attack resulting in relatively easy suppression. In this case, forest fire control measures are most successful when they are carried out in a focused and coordinated manner. Early detection allows for rapid fire suppression, less cost in fire suppression and damage. This means that fire must be detected early and attacked aggressively but safely. A wide range of fire detection options exists, including look-out towers, ground patrols, satellites, and information provided by the general public. There are already 2 fire lookouts in the project area which will be operational during high fire danger days.

Two Lookout Towers in project area

By consistently improving on the quickest detection and attack possible, the spread of fire will be reduced and the time spent to control the fire and damage will be minimized. When a fire has been detected all Company staff must be notified immediately through radio or at check points. In order that fire detection is effectively implemented, the Company must ensure that:

- Patrols by vehicle are an effective detection and prevention tools, however their effectiveness is limited by road access. Where and when fire tower viewing is not effective due to inadequate coverage, haze or cloud / morning fog patrols should be considered. Patrols provide an opportunity to inform other staff, contractors and residents in and around the Project Area about the fire danger level, forest fire prevention and reporting of fires;

- Patrols routes should be planned considering in areas of potential fire risk;

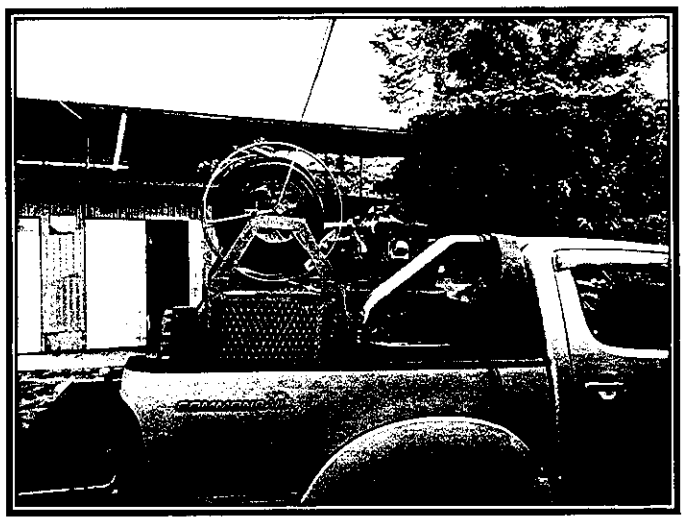
- In high fire danger and patrolling is required one can use office staff to assist in patrolling;

- A basic radio communication network will be installed in the Project Base Camp to facilitate communication between fire tower observers and the fire control room.

Prior to leaving on patrol, the checklist as shown in Table 6.6 could be of useful guideline for the Forest Fire Officer to consider and get himself prepared.

Table 6.6: Fire Patrol Equipment Checklist

✓	Mobile phone capable of communicating with Forest Fire Office, Camp and head office
✓	Maps showing Project area, Kampong, Roads, Rivers, Dams, Elevation contours and location of Contractors camps
✓	Binoculars
✓	Fire incident report with pencil
✓	Basic firefighting equipment Pickup fire unit, Wayjax pump, Shovel, Axe, Parang



Fast Attack Fire Unit

Patrols should be activated when Fire Danger is high. During periods of high wind or when Fire Danger is high, patrols should be conducted with fire crews in order that the fires can be extinguished on discovery. Patrols should not be deactivated until the Fire Danger returns to Low.

6.4.4 Fire Attack/Suppression

The fire crew leader will assume command of the fire attack upon arrival. If the fire becomes bigger, the Forest Fire Officer will notify and seek help immediately from the Sabah Forestry Department and BOMBA.

6.4.4.1 Steps in Suppression and Controlling Fires

Successful initial attack is a key to minimizing cost and damage from fire. Fire crew readiness is determined by the Fire Danger Rating. The following steps should be taken once a fire crew arrives at the fires site in order to assess and develop a suppression plan.

- Determine the Extent of the fire, small or big;
- Determine in what the fire is burning e.g. Plantation trees, grass;
- Determine the fire behavior, rate of spread and direction;
- Determine what level of threat to loss e.g. low level , high level;
- Determine if more resources will be required;
- Determine suppression plan always with safety of crew in mind;
- Inform Forest Fire Officer of your plan and update the Forest Fire Officer as the situation changes.
- Completely guard the fire using either hand tools or a bulldozer. The fire must have a guard completely around it (down to mineral soil).
- Burn off all fuel between the fire guard and the fire to ensure there is an adequate guard to prevent the fire from escaping the area.
- Once the fire is contained outline a plan for mop-up. Mop-up is an important component to successful fire suppression and is to be taken seriously. No fire should restart because of poor mop-up or patrol. Do not leave the fire until the area is completely mopped-up;
- During Mop up check the area for small spot fires outside the guard as well as inside the fire guard that may rekindle after mop-up is completed;
- Prior to leaving ensure the fire is cold. Check the fire area with bare hands to ensure it is cold.
- Patrol the fire in the morning, during the heat of the day, and during windy periods until the fire danger is low or the Forest Fire Officer declares the fire out.
- Ensure all equipment has been collected from the fire area.
- Equipment should be cleaned, tested and made ready for another deployment;

6.4.4.2 Extended Fire suppression:

If a fire cannot be contained, senior management must notify the Forestry Department or other agencies immediately for whatever resources available to assist in extinguishing the fire

6.4.4.3 Post Mortem

Once the fire is extinguished a thorough Post Mortem of the fire must be undertaken in the form of a fire report. This a fire report must be submitted to the Forest Fire Officer. The report should contain amongst others the following information:

- Date and time the fire was reported;
- Who reported the fire?
- Location of the fire;
- The cause of the fire
- Fire area by forest/land type;
- Total damage of the fire with maps;
- Cost of suppressing the fire and asset value lost;
- General description of the events and assessment of actions;
- How can this type of fire be prevented from re-occurring?
- What mistakes were made if any during fire suppression that one can learn from?
- Is there better ways or improvement that could be put in place to better the fire prevention and suppression operation.
- All resources used at fire listed.

6.5 Fire Management Organization

The proposed organization for fire crews in the Project Area is shown in Figure 6.2. The Fire Management Structure consists of two pairs:

- A fixed representation of the structure with only key staff identified.
- A regularly updated roster of staff on duty as crew boss and workers on duty as members.

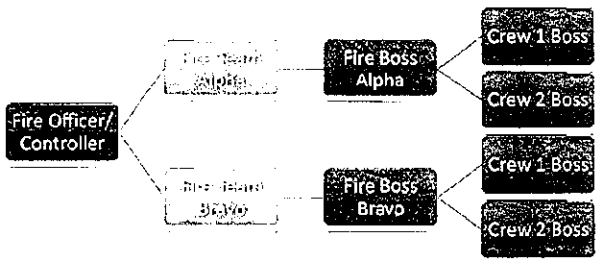


Figure 6.2: Proposed Fire Organization Structure in the Project Area

The fire crews will not be full time. They can also do ar work in any plantation activities during the wet season or when there is no danger of fire occurrence.

6.6 Fire Management Plan

A Forest Fire Management Plan will be developed for the Project Area during the plan period. The plan will be comprehensive in order to reduce risk of Asset loss by fire.

The plan will specify the following

- Fire Management Organization;
- Fire Management Map with a scale 1: 50,000;
- Fire Prevention Plan;
- Fire Preparedness Plan;
- Fire Management Zones - access routes by vehicle, road and track network;
- Location of fire towers and existing water points;
- Equipment resources statement and specifications for procurement of new equipment.

PART 7: MANPOWER REQUIREMENT

7.1 Introduction

The implementation of ITP requires people trained in forestry. ITP also requires staff that competent in a broad range of work skills and a significant compliment of daily paid and piece rated workers.

The Company believes that an ongoing commitment to human resource development and training is necessary to both improve the performance of experienced people and to produce a new generation of staff.

7.2 Manpower Requirement

The Company will take appropriate steps to employ Malaysian professionals with specific preference to Sabahans that have vast experience in forestry and/or agriculture plantation management. Approximately 178 staff and workers will be required to execute the establishment program. This estimate includes people working directly on the project plantation and staff providing supporting services (office). There will be approximately 125 workers from the own operations directly involved with re-establishment operations.

If skills for certain tasks are not available, then training programs should be initiated and supported to ensure that local people are qualified and capable of participating in the wide range of forest management activities to be implemented.

The use of labour from outside the project area (particularly use of foreign labour) will be minimized in the interest of creating positive benefits for local communities and reducing possible social conflicts and other related problems.

7.3 Organization

Due to the intensive nature of planted forest management and the amount of resources expended per hectare of production, a tiered structure organization for the Project Area is suggested. This structure is typical of forest plantation projects and will provide a framework against which all planning, work execution and auditing can take place. The structure is illustrated in Figure 7.1.

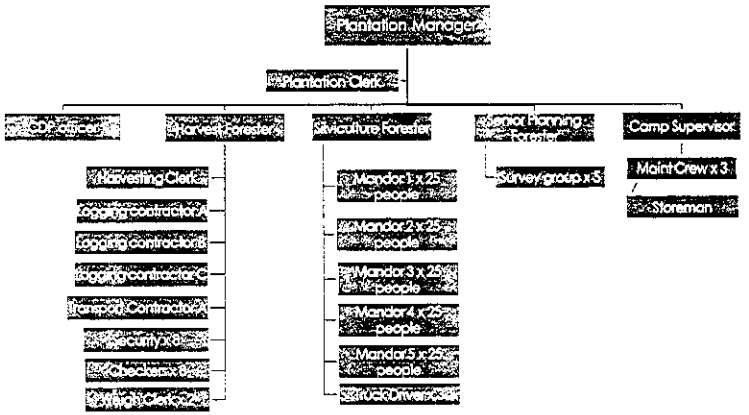


Figure 7.1: Forest Divisions and Management Structure

7.4 Training Needs and Policy

Under the Human Resource Development – Training Program (TP), the Company will design, develop, and deliver international level knowledge and skills sets to ensure a multi-skilled work force possessing prerequisite knowledge and competencies that capable of managing the present and meeting the challenges of the future. The various training components include:

- Vocational Training;
- Forest Management Training;
- Further Education, Industrial Attachment, Internship;
- Youth Development Scheme;
- Community Skills Training;
- Environment, Safety & Health;
- Fire Management, including: Forest Fire, Emergency Response;
- Plantation Accreditation;
- Plantation Forest Harvesting including: chainsaw operation & tree felling, heavy equipment operator training and heavy equipment trainer training;

- Road Construction;
- Forest Workshops.

Identification and accelerated training for key operations personnel will be carried especially or plantation development and future harvesting requirements. In addition, a significant portion of human resource development will be allocated to tertiary level and professional training. This is important in order to develop and nurse graduate level managers who are required to manage the project

PART 8: PROJECT COST AND RETURN OF INVESTMENT

8.1 Introduction

Development of industrial tree plantations is an expensive undertaking, requiring significant amounts of capital, a tolerance for risk and commitment to the long gestation period typical of forestry investments. However, tree plantations are certainly profitable when good growing conditions, professional management and inherent feasibility are present.

8.2 Financial Analysis

The Company's shareholders have developed a detailed financial and physical feasibility model which is used to assess projects prior to investment. Extensive financial analysis has been performed on the entire project cash-flow as well as on a 'single hectare, single rotation' basis. A discounted cash flow method has been used.

8.3 Funding

Approximately RM91million is required to finance the initial establishment phase from Year 1 to Year 10 (2025). Harvesting commences in 2026 and the project will be self-funding from that point forward. Income of approximately RM70million from the sale of salvaged Acacia log volumes will be reinvested to offset the capital costs of development. The balance of any funding required will be raised from shareholder capital.

8.4 Assumptions

For the purpose of this analysis a number of assumptions have been used as follows:

Table 8.1: Establishment and Operational Cost Assumptions

GROUP	Element	UOM	REGIME 1 Eucalypt TP
ESTABLISHMENT AND MAINTENANCE COSTS	Establishment	RM/ha	3,960
	Re-Planting	RM/ha	2,350
	Weed I	RM/ha	370
	Weed II	RM/ha	370
	Single/Tip Prune	RM/ha	175
	Weed III	RM/ha	370
	Prune I	RM/ha	237
	Weed IV	RM/ha	370
	Prune II	RM/ha	327
ROTATION	Crop Rotation	Years	10
NET PLANTED HA	Net Planted Area	Ha	
PLANTATION YIELD TABLE SCALE	Percentage of Base	%	95%
TRANSPORT	Average Lead Distance	km	15
	Transport Unit Rate	RM/t/km	0.85
MARKETING	Saw Log Price	RM/cu.m	265
	Real Annual Price Increment	%	0.5%
	Increment Cap	%	30%
	Chip Log Price	RM/cu.m	200
	Real Annual Price Increment	%	0.5%
	Increment Cap	%	30%
HARVESTING	Cable Yarding Fraction	%	60%
	Ground Contact Fraction	%	40%
	Cable Yarding Cost	RM/cu.m	69
	Ground Contact Cost	RM/cu.m	59
	Roundwood Losses	%	5%
	Chipwood Losses	%	10%
	Old Acacia Volume	AVG.M3/HA	120
	Old Acacia Premium	NET RM/M3	108.00
ESTABLISHMENT ROADING	Main Road Density	m/pltd ha	0
	Secondary Road Density	m/pltd ha	2
	Feeder Road Density	m/pltd ha	10
	Spur Road Density	m/pltd ha	15
	% Secondary Road cost share	%	1
	% Feeder Road cost share	%	1
	% Spur Road cost share	%	0
HARVESTING ROADING	Main Road Density	m/pltd ha	0
	Secondary Road Density	m/pltd ha	6
	Feeder Road Density	m/pltd ha	12
	Spur Road Density	m/pltd ha	20
ROAD CONSTRUCTION COSTING	Main Road	RM/km	120000
	Secondary Road	RM/km	75000
	Feeder Road	RM/km	45000
	Spur Road	RM/km	15000
ROAD MAINTENANCE COSTING	Main Road	RM/km/yr	15000
	Secondary Road	RM/km/yr	11000
	Feeder Road	RM/km/yr	7000
	Spur Road	RM/km/yr	3500
ROAD MAINTENANCE (% of inventory maintained in any one year)	Main Road	%	1
	Secondary Road	%	0.6
	Feeder Road	%	0.5
	Spur Road	%	0.2

Table 8.2: Steady State Cash-flow (from 2035 onward)

	RM.p.a.	Area (ha)	RM/ha
Cash Flow from Operations			
Revenues: To P&L	30,403,550	520	58,468
Indirect Operating Expenses	(226,000)	520	(435)
Indirect Operating Expenses (Road Maint.)	(475,196)	520	(914)
COGS: Harvesting Management Fees	(1,126,496)	520	(2,166)
COGS: Harvesting Costs	(7,322,222)	520	(14,081)
COGS: Transport Costs	(1,436,282)	520	(2,762)
COGS: Royalty Costs	(1,508,478)	520	(2,901)
EBITDA	18,308,877	520	35,209
Tax	(3,494,546)	520	(6,720)
Net Cash Flow from Operations	***14,814,331***	***520***	***28,489***
Cash Flow from Investing			
Other Capital Expenditure	(1,500)	520	(3)
PDE: Estate Management & Program Fees	(3,165,311)	520	(6,087)
PDE: Silviculture - Establishment	-	520	-
PDE: Silviculture - Maintenance	(870,480)	520	(1,674)
PDE: Silviculture - Replanting	(1,222,000)	520	(2,350)
PDE: Land and License	(32,250)	520	(62)
PDE: Road and Bridge Construction	-	520	-
Net Cash Flow from Investing	***(5,291,541)***	***520***	***(10,176)***
Net Cash Flow from Operations and Investing	**9,522,791**		**18,313**

8.5 Results of Financial Analysis

The financial analysis project's worth is measured in terms of Net Present Value (NPV) and Internal Rate of Return (IRR). Sensitivity analysis was also conducted to examine changes in returns with possible changes in the main variables.

8.5.1 Returns on Total Investment

Based on the estimated costs of operations, the projected prices of round wood and chips wood, and log volume that can be extracted, an IRR of 20.2% is projected off Free Cash Flow.

At a discount rate of 10%, the project has a positive NPV of RM23.9million.

8.5.2 Sensitivity Analysis

A sensitivity analysis has been computed for a different range of scenarios, which con seriously affect the returns of investment. The NPV obtained from these changes were then compared to the base case.

Predictably, the market price for logs is the factor with the most influence on project returns. A 10% drop from the assumed log prices would reduce project returns to 17.9%.

Similarly, a 10% drop in the expected plantation yield would result project returns reducing to 18.32%.

It should be noted however that the Company has mitigated the impact of a price drop by using relatively conservative prices and yields.

Importantly, a 15% rise in plantation costs drops the project returns to 17.0%. This robustness will allow application of the correct Silviculture in response to the needs of the plantation.

PART 9: EIA AND FOREST MANAGEMENT STANDARDS

9.1 Environmental Impact Assessment (EIA)

The environmental issues in the Project Area will be addressed by the Company in an integrated and holistic manner. The Company is committed to safeguard and protect the ecology and all the forest functions and services for society by implementing the eco-friendly forestry approach in accordance with the requirements of an EIA mandated by the *Conservation of Environment (Prescribed Activities) Order 1999*. In this regard, the Company has appointed a consultant (CHEMSAIN KONSULTANT SON BHD) to conduct an EIA in the Project Area. A report will be prepared and will be submitted for approval to the Environment Protection Department (EPD).

9.2 Environmental Mitigation

It is the intention of the company to consider all recommendations in the EIA report for the mitigation of adverse environmental impacts including implementing a formal Environmental Management System (EMS) to structure and position the project for the purpose of pursuing an internationally acceptable forest certification.

Amongst the issues and mitigation measures the Company consider are the following:

9.2.1 Soil Erosion and Slope Stability

Among the measures that can be implemented to reduce the amount of runoffs from the Project Area once development begins are:

- Minimize the lag time between the planting of seedlings and cover crops to reduce the exposure time of the soil to any degradation.

9.2.2 Sedimentation Trap

To minimize sediment yield, riparian reserves/buffer zones should be set aside and demarcated along the major rivers within the Project Area. These riparian reserves should be maintained as they will serve as natural filters for surface runoff from the Project Area, playing a major role in the protection of the banks along the tributaries and water quality as well.

From site investigation, all the major rivers within the Project Area have an average river width between 15 m - 20 m. Based on the guidelines by the Department of Irrigation and Department (DID) Sabah (see Table 9.1), the riparian reserve for rivers with the width of 15 m - 20 m should be at lEast 20 m for each bank.

Any other streams (ephemeral stream, intermittent stream) found within site should be provided with appropriate riparian reserves, marked, painted and sign-posted.

Table 9.1: Guideline for Riparian Reserves

River Width (m)	Riparian Reserve For Each Bank (m)	Remarks
>40	50	DID Guideline Bil. 1, 2000
>20 - <40	40	DID Guideline Bil. 1, 2000
>3 - <20	20	Section 40, Sabah Water Resource Enactment, 1998
<3	5	DID Guideline Bil. 1, 2000

9.2.3 Management of Agrochemicals

Management measures amongst athers include the following:

- Agro-chemicals are to be stored properly and handle with care. Any used containers are either to be returned to the supplier(s) or collected for proper disposal.

- The use of pesticides, weedicides and similar substances are to be minimized and limited to serious cases of infestation. Priority must be given to biological control and manual weeding, where possible.

- The implementation of chemical control will depend on the economic threshold af the pests. Pesticides selection, application techniques, spraying volume and timing of the application must be carefully and strictly fallowed (as prescribed by the manufacturers) in order to reduce the adverse effects on the environment.

- The usage of agro-chemical shall strictly adhere to the rules and regulations asstipulated under the pesticides act 1974.

9.2.4 Waste Generation and Management Issues

Management measures amongst others include:

- Sewage should not be discharged directly into any water intakes or stream here it may pose a health risk to camp personnel or to nearby communities.

- Minimize waste at base camp generation by avoiding disposal items.

- Any workshop for maintenance of vehicles and machinery must be located at leat 50 m from any source of surface water.

- Disposal of waste into waterways is strictly prohibited.

9.2.5 Stream Crossings

- Adequate provisions sholl be made for stream crossings such as culvert or bridge; no blocking or diversion of river/stream is allowed. Each crossing should have dimensians similar or larger than the existing river/stream it crosses. Culverts and crossings are best constructed with an excavator as it can easily complete all operations without entering the watercourse.
- All stream crossings should be marked on maps and also marked and sign posted on-site. Site for crossing should be excluded from initial alignment clearing and disturbance to avoid soil being bared and debris being pushed into the watercourse.

9.2.6 Forest Fire

- A Forest Fire Management Plan will be prepored.
- Fire prevention and control systems will be established.
- Open burning on-site for wastes, garbage and biomass disposol will be prohibited.

Greater focus will be placed on adopting preventive measures to mitigate negative environmental effects at the source. Steps to foster closer cooperation and coordination with the local communities in addressing the environmental cancerns arising from forestry activities will be given emphasis. Environmental auditing will be increasingly applied in evaluating and mitigating the socio-economic and environmental impacts caused by the forestry activities. In addition, capacity development programs will be undertaken to generate more trained human resources in environmental and natural resource management in the Project Area

PART 10: IMPLEMENTATION AND MONITORING

10.1 Responsibility for Implementation

The responsibility for project implementation as prescribed in this FMP rests directly with the staff of the Company particularly the Plantation Manager. The Plantation Manager is also responsible to submit progress reports to the Management, as well as, to the respective government agencies such as the EPD and the SFD once in three months.

At all times however, the Plantation Manager will be responsible for the nature, quantity and quality of works performed on the project. All works will be controlled through issuance of Work Orders from the Plantation Control System and no work, either by Own Production Teams or Contractor Production Teams, will take place without an approved Work Order.

10.2 Monitoring and Auditing

The basis for any internal monitoring is the establishment of a detailed plan prior to the commencement of operations. This plan forms a framework of areas and boundaries which are used for scheduling and control. Work Orders will then be issued against the plan and every Production Team is required to report their production estimates against each open Work Order on a daily basis to the Plantation Manager. This is an essential practical aspect of forest management that forms the basis for compliance and transparent accountability of operational activities.

When the Work order has been completed, the Production Team will request for audit in order for the work to be verified before payment can take place. Verification of work can take two forms, Quantity Survey and Quality Control and all audit standards, data storage and processing will be contained within the Plantation Control System.

Where quantity survey has been performed, the GPS data will be processed through the GIS system to compare the perimeters and lengths of completed work against the original plan. Any deviations from the original plan will be investigated for cause through follow-ups with the Production Team.

10.3 Reporting

10.3.1 Responsibility

The Company will be responsible for all reports. Reporting should be both written and oral, in order that specific problems, unexpected achievements or any other aspects of management can be discussed (e.g. performance variance) and any necessary action that is required that to be taken quickly. Where the report investigation and write up has been outsourced (e.g. the Environmental Monitoring Report), it will remain the Company's responsibility to ensure that the report is completed and submitted on time.

10.3.2 Reporting Frequency

The frequency of reporting should be related to the nature of the topic being reported on. Reporting should be at lEast monthly, weekly or even daily. The Company will generate reports as listed in Table I 0.1 below.

Table 10.1: Project Reporting Schedule

Recipient	Schedule	Report Description
Internal	Weekly	Weekly Production Report
Internal	Monthly	Monthly Progress Report
Environment Protection Department	Quarterly	Quarterly Environmental Monitoring
Sabah Forestry Department	Quarterly	Quarterly Progress Report
Internal	Annual	Annual Progress Report
Sabah Forestry Department	Annual	Annual or Compliance Report

10.3.3 Reporting Formats

In order to keep the reporting process efficient and the reports useful, all reports will be as brief and succinct as possible. A convenient way of reporting achievements for many forest operations is to use a tabular format that summarizes operational prescriptions on one side of the form and operational achievements on the other. Photos and maps are to be included in the report. However, the Company will comply with the format as provided for by the Sabah Forestry Department from time to time.

10.4 Block Register Book

The maintenance of a current, complete and accurate stand register is of the utmost importance for a plantation operator. The traditional 'book' used in the past has now been replaced by computer databases and applications that integrate both financial and physical information.

The Company will implement an advanced Plantation Control System (PCS) that will also store all stand information. While the PCS will store the text attributes of stands and crops, it will be linked to the Geographic Information System which will be used to store and maintain the stand maps.

10.5 Plan Review

This medium-term FMP will be reviewed in 2020. The review process provides for the refinement of management prescriptions (plan versus actual analysis) and zoning scheme in response to new information or changes in the Company's and/or government policies, technology and market conditions. However, any refinement or changes to the plan should not be disruptive to planning and operations.

Annex 2.4

BOD Calculation

2.4 BOD Loading

Total PE	=	178				
BOD concentration	=	225	mg/l			
BOD after treatment (standard B)	=	50	mg/l			
BOD after treatment (standard A)	=	20	mg/l			
Sewage discharge per person	=	227	l/d			
Total Sewage Discharge per day	=	227 l/d x	30			
	=	40406	l/d			
a) Amount BOD discharge per day without treatment	=	40406	l/d x	225	mg/l	
	=	9091350	mg/d			
	=	**9.091**	**kg/d**			
b) Amount BOD discharge after treatment (standard B)	=	40406	mg/d x	50	mg/l	
	=	2020300	mg/d			
	=	**2.020**	**kg/d**			
c) Amount BOD discharge after treatment (standard A)	=	40406	mg/d x	20	mg/l	
	=	808120	mg/d			
	=	**0.808**	**kg/d**			
Assummed River Flowrate	=	0.5	m^3/sec			

Instantaneous increase for (a) = $\frac{\textbf{9.091}\ \text{kg/d}}{0.5\ \text{cu-m/sec}} \times \frac{1}{86400}\ \text{sec}$

30* = 2.104×10^{-4} kg/cu-m

= **0.210 mg/l**

Instantaneous increase for (b) = $\frac{\textbf{2.020}\ \text{kg/d}}{0.5\ \text{cu-m/sec}} \times \frac{1}{86400}\ \text{sec}$

= 4.677×10^{-5} kg/cu-m

= **0.047 mg/l**

Instantaneous increase for (c) = $\frac{\textbf{0.808}\ \text{kg/d}}{0.5\ \text{cu-m/sec}} \times \frac{1}{86400}\ \text{sec}$

= 1.871×10^{-5} kg/cu-m

= **0.019 mg/l**

Verified by,

Cyril Jinusie
M. Sc (Industrial Chemistry)
Reg. No. S 0155 (Scheduled Waste Management, Air and Water Quality)

Annex 2.5

Bengkoka Forest Reserve Wildlife Survey

CHAPTER 1

INTRODUCTION

1.1 Wildlife in Mega-diversity Ecosystem

Malaysia as one of 12 mega-diversity country are blessed with species richness and ecosystem diversity which not only important resource for development but also unique heritage of wildlife not only for Malaysia but to the world as a whole. It is recorded that over 15,000 flowering plants, 1500 terrestrial vertebrates and 150, 000 invertebrates found and identified in Malaysia (MOSTE, 1997). In Malaysia, one of the most important ecosystem located in the East which are in Sabah and Sarawak. In East Malaysia itself, the species richness per square kilometre are higher than the average of the whole Malaysia (BBEC, 2003).

Despite the tremendous biodiversity and ecosystem in Malaysia, development has been the threat to the unique heritage of mother-nature to this country. The East Malaysia is no exception especially in Sabah. With more than 40% of the forests in Sabah was lost for various utilisation purposes in the past century (SFD, 2013). Palm oil plantations, logging and massive land clearing for settlement and buildings construction are identified to be the worst human activities for the exploitations of the nature in Sabah.

According to IUCN (1992), the decrease rates of forests are the highest in Sabah. As the home of diverse species of flora and fauna, in Sabah, there are 4 plants species totally protected and 13 more are protected 6 totally protected and 65 more protected species of mammals, 131 totally protected and 8 protected species of birds, 3 totally protected and 7 protected species of reptiles are identified as these species are facing great threat especially from anthropogenic threat.

Wildlife in the forest ecosystem is one of the crucial elements which ensure the integrity of the forests is maintained. In ensuring that the wildlife in the forest ecosystem are conserved and protected, various ways have been introduced by various body and organisation whether from the government. The Wildlife Conservation Enactment (WCE, 1997) that was enacted by the Sabah State Government is aiming to protect endangered species of flora and fauna in Sabah and

also the trading of the species in the international level. Sabah Wildlife Department (SWD) which in charge of the enforcement however cannot cover and protect all the wildlife habitats in Sabah as many of the habitats is outside of the protected areas.

Due to that, the responsibilities to protect and conserve wildlife in Sabah forest relies on everybody hands which includes the stakeholders such as the private sector, local communities and other Governmental and Non-Governmental Organisations (NGOs). Nowadays in Sabah, more forest plantations company are introduced to fulfil the forestry-based industries requirements. As the stakeholders, forests plantation or management company is responsible to take care of the wildlife at their areas.

As the industries have moved to more ethical practices, sustainability models are more accepted and applied by may company related to the environment, forestry and et cetera. As one of forest management company, Forest Solutions Malaysia (FSM) is also included to the demand of protecting the wildlife in its area with referring to the sustainability concept that was implemented in the company. The establishment of the Department of Conservation in FSM under the Asian Forestry Company Sabah (AFCS) project shows the commitments of the company in protecting and conserving the ecosystem in its area.

With the newly opened project area in Bengkoka Forest Reserve (BFR), located in Pitas District, it means that there is another area of wildlife protection under the monitoring of this company. In order to fulfil the WCE, 1997, and also the commitment of the company to protect the wildlife in its area, wildlife survey in BFR was carried for the first time in October to November to collect the baseline data of wildlife and the ecosystem in the area. In this report, the methodology, and result from the survey are compiled as the baseline data of the project area.

1.2 Objectives

The assessment in Bengkoka Forest Reserve embarks the following objectives:

i. To assess the diversity of wildlife in Bengkoka Forest Reserve
ii. To provide baseline data (wildlife) of Bengkoka Forest Reserve for Forest Management Plan
iii. To identify any potential High Conservation Values Area/ Forest for protection

CHAPTER 2

METHODOLOGY

2.1 Project Area: Bengkoka Forest Reserve

Bengkoka Forest Reserve (BFR) is a forest reserve situated in Pitas classified as Class I forest reserve protection (SFD, 2008). The forest area is classified as secondary forests with mostly the area are dominated with acacia forest and several riparian forests. this forest reserve was first gazetted as forest reserve in October 1968 and reclassified as Protection Forest Reserve Class I in 1984 (www.sabah.gov.my, 2015)The forests are located in lowland area with slope less than 15° and most of the terrain at 30-90m above sea level (www.sabah.gov.my, 2015). Most of the time in a year, the area have low humidity and dry atmosphere.

The area are surrounded with villages from the community project by the SFD in 1997 with the many agricultural activities developed from the project such as rubber plantations and fruit project outside the forest reserve (SFD, 2008). BFR is the new industrial tree plantation manages by FSM under Gerak Saga Sdn. Bhd. with total area of approximately 6000 ha which are divided into three coupes namely Coupe 1, 2, and 3. As new project area, there are no survey yet carried out for wildlife and plantations in the area and therefore surveillance and assessment of wildlife and the habitats are required to develop management plans in the area. This first assessment of wildlife in BFR was carried out in October to November 2015 and will be used as the baseline data to be incorporated in the forest management plans as well as for the future monitoring and reference.

Vegetation in BFR is mainly dominated by *Acacia mangium* and *Acacia Sp* with the forest floor usually vegetated with ferns. As forests fire are the main threats in BFR, there are several more secondary plants habituating the area such as *Alstonia sphatulata, Vernonia arborea, Trema orientalis and Macaranga tanarius* (www.sabah.gov.my, 2015). In term of the diversity of fauna, there was no record or survey report done whether from SFD or other stakeholders in this area. Therefore, this survey of wildlife in BFR is the first done by FSM which will serve as the baseline data of wildlife in the area.

2.2 Wildlife Surveillance and Monitoring

Monitoring wildlife methods in this case are mostly by referring the methods from the field manual book by Sabah Forestry Department (2013). The wildlife monitoring can be divided into 6 methods namely recce walks (establishing transect line), road survey by foot and by vehicles, mists-netting, stream transect method, and camera-trapping method.

2.2.1 Recce walks

The concept in recce walks is to collect the information of wildlife through walking along a chosen transect which least resistance through the forest understorey (SFD, 2013). In this monitoring, recce walks was carried out on 23rd-25th October 2015. Transect line was established from the walks. The detail of the vegetation, topography, canopies, animal signs and sights as well as signs of disturbances was recorded by the collector in the field manual books during the walks and not after the recce. In addition, any animals sighted in transect line also recorded during the survey. The recce walks starting and ending coordinate, date and time was tabulated in table 2.1 below.

Table 2.1 Transect Line Coordinates in BFR

No.	Transect Name	Location	Date	Starting Point	Ending Point	Length (m)
1	Transect 1	Coupe 1	23/10/2015	N06°51'46.9" E117°08'28.7"	N06°51'38.2" E117°08'04.7"	1000
2	Transect 2	Coupe 1	24/10/2015	N06°51'49.8" E117°07'08.8"	N06°51'45.2" E117°07'15.3"	320
3	Transect 3	Coupe 2	24/10/2015	N06°52'39.1" E117°09'35.5"	N06°52'52.8" E117°09'21.3"	620
4	Transect 4	Coupe 2	25/10/2015	N06°51'10.1" E117°08'52.5"	N06°50'56.3" E117°08'47.8"	850
5	Transect 5	Coupe 3	26/10/2015	N06°54'16.6" E117°08'29.8"	N06°54'16.7" E117°08'50.0"	700

2.2.2 Road Survey (by Foot and by Vehicles)

Road survey by foot was carried out 4 times which was from 23rd-26th October 2015. SFD recommended that ideal length of road segment for road survey by foot was 5 km which in this assessment, the length of road segment by total is approximately 7 km, more than the ideal road length segment suggested by SFD. Road presence in the Bengkoka Forest Reserve can increase the chance to observe certain species as some species such as the primates may be attracted to the road as it can increase their chance search for food. On the contrary, some other big species may avoid themselves from the road to avoid themselves from being seen in open area. Any animal's signs such as footprints, faeces, and call or direct observation, during the survey were recorded.

In the survey by vehicles, assessment was carried out on 3rd and 4th November 2015. The assessment of wildlife was carried at night as the chance of observing animals on the road are high during the night time. More data collector is needed for the survey by using vehicles compared to the survey by foot. The ideal road segment suggested by the SFD for road survey by vehicles is from 10-20 km. All the observed animals during the survey area recorded in the manual books. In the road survey by foot and vehicles below are the materials and device used:

i. GPS
ii. Field manual
iii. Spot light (50000 kw)
iv. Vehicle (4-wheel drive)

Table 2.2 Road Survey Segment

No.	Segment	Coupe	Date	Starting Point	Ending Point
1	1	Coupe 1	23/10/2015	N06°51'46.4" E117°08'28.7"	N06°51'38.2" E117°08'04.7"
2	2	Coupe 1	25/10/2015	N06°52'01.1" E117°09'06.5"	N06°52'15.1" E117°08'09.8"
3	3	Coupe 2	24/10/2015	N06°52'39.0" E117°09'35.5"	N06°52'52.8" E117°09'21.3"
4	4	Coupe 2	25/10/2015	N06°50'56.3"	N06°52'01.1"

				E117°08'47.8"	E117°09'06.5"
5	5	Coupe 3	26/10/2015	N06°54'15.6" E117°08'49.0"	N06°54'16.5" E117°08'29.8"

2.2.3 Mists-Netting

Mists-netting method was carried out to study the bird species diversity in BFR for 13 days from 27-31 October 2015, 4th November 2015 and from 5-8 November 2015. Five mists-nets were used in five different locations in Coupe 1 labelled as net 1, 2, 3, 4, and 7 respectively. The coordinate locations of each of the nets was recorded and tabulated as in table 2.3 below. The net was opened not late than 7.00 am every day and was checked every two hours and finally closed at 5.00 pm to avoid any animals trapped in the net during the night time. Birds were released back after being identified, photographed, and recorded. Figure 2.1 shows the illustration of mists net that was used using the survey. The materials involved in mist-netting are:

i. Mists-net
ii. Wooden poles
iii. Field manual
iv. GPS

Table 2.3 Mists-net Coordinate in BFR

No.	Net Number	Coordinate	Opening Date	Closing Date
1	1	N06°52'01.1" E117°09'06.5"	27/10/2015	31/10/2015
2	2	N06°52'19." E117°07'57.5"		
3	3	N06°52'13.9" E117°08'11.8"		
4	4	N06°51'33.5" E117°10'15.0"	04/11/2015	04/11/2015
5	5	N06°52'13.9" E117°08'11.8"		
6	6	N06°52'17.4"		09/11/2015

		E117°08'28.5"	05/11/2015	
7	7	N06°52'13.9" E117°08'11.8"		

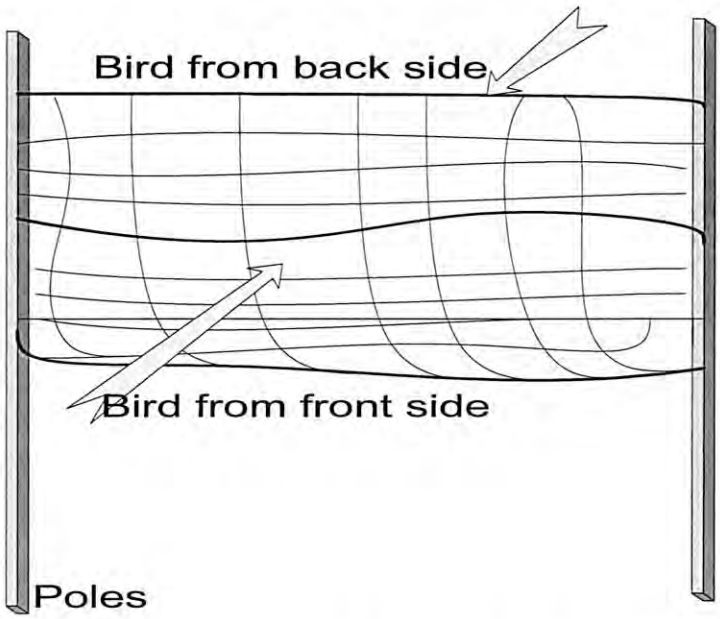


Figure 2.1 Mists-net used for bird survey

2.2.4 Stream-Transect

Stream transect is a method to study the diversity of reptiles and amphibians in the freshwater ecosystem and in BFR, the stream is small river in lowland forests. The basic concept of stream-transect is to establish a transect line in a stream to do the survey for amphibians especially frogs during the night time. Torch light was used to torch the eyes of frogs as it reflects the light directed to the eyes. Once the frog was captured, it was captured inside plastic bag for a while and being released back after being identified and photographed. Frogging was carried out on 30th October 2015 and 6th November starting from 7.30 pm to 9.00 pm. Materials involved in the stream transect method are listed as below:

i. Torch light
ii. Field manual
iii. Rubber band
iv. Plastic bags

2.2.5 Camera-Trapping

One of the common methods used in assessing the diversity of mammal species is the camera-trapping method. Camera trap was installed in all three coupe in BFR labelled as BKK 1-6. The digital image of animals from the camera traps was used as the result in the survey. The camera trapping method is specially used to study the mammals of large size (more than 5 kg). Table 2.4 shows the coordinate locations of the camera traps in BFR. In the camera-trapping method, camera traps and GPS were the only two device used in the assessment. Locations of camera trap and mist-nets are map-out in Appendix I.

No.	Camera No (BKK)	Coordinate
1	1	N06°51'44.8" E117°07'15.4"
2	2	N06°52'46.3" E117°09'28.2"
3	3	N06°51'27.3" E117°10'13.2"
4	4	N06°52'17.8" E117°08'20.6"
5	5	N06°54'43.1" E117°10'28.2"
6	6	N06°51'00.5" E117°08'54.2"

CHAPTER 3

RESULT AND DISCUSSION

3.1 Baseline Data

Since this assessment is the first assessment carried out in BFR, there are no data that can be use as the comparison with the result obtained. The data will be a baseline data for the area for future references. The results in this survey are presented in the next section.

3.2 Transect Description

From the recce walks, topography data, forest type, and plants physical description was collected and recorded. All five transects of the track are shown from the GPS track layout in Appendix II. Meanwhile, direct observation of animals from the transect line are presented in table 3.1.

Table 3.1 Direct Observation of Animals from Transect Line

Transect	Common Name/Species Name	Number of Individuals Seen	Estimated Individuals	Perpendicular Distance (m)
1	i. Buff-rumped Woodpecker	1	1	5
2	i. Low's Squirrel/ *Sundasciurus lowi*	1	1	7
3	i. Common Treeshrew	1	1	5
4	i. Common Treeshrew/ ii. Streaked Bulbul	3 3	3 3	4 5
5	i. Bearded Pig/ *Sus Barbatus*	1	1	15

	ii. Common Treeshrew/ *Tupaia picta*	1	1	7
	iii. Buff-rumped Woodpecker/	1	1	9

3.3.1 Road Survey by Foot

From the road survey by foot, animal signs and observation were recorded and the results are tabulated as in table 3.2 below:

Table 3.2 Animals Signs and Observation from the Survey by Foot

Segment	Species	Number of Signs				Total
		Footprint	Faeces	Call	Direct Sighting	
1	i. Bearded Pig/ *Sus Barbatus*	7				7
	ii. Buff-rumped Woodpecker/ *Meiglyptes tristis*				1	1
2	i. Bearded Pig/ Sus Barbatus	9				9
	ii. Sambar Deer/ *Cervus timorensis*	3				3
3	i. Bearded Pig/ *Sus Barbatus*	3				3
	ii. Common Treeshrew/ *Tupaia picta*				1	1
4	i. Tragulus *Sp.*		1			1
	ii. Pangolin/ *Manis*		1			1

	javanica iii. Civets (unidentified)		1			1
5	i. Pill millipede				1	1
Total		22	3	0	3	**28**

The result from the survey shows that 78.57% (22 footprints) of the animal signs are obtained from the footprints found on the ground and meanwhile, animal's sign from faeces and direct observation both having percentage of 10.71 % with 3 observations. From 22 footprints recorded at the road segments, 19 footprints belong to the bearded pig. It is not a surprise that most of the footprints belong to bearded pig as bearded pig has good adaptations in the forests. Payne and Francis (2007) stated that in the areas where the forests have been fragmented into patches, small populations appears to be resident and adapt to secondary growth and gardens. It is estimated that the pig populations the footprints seen mostly are seen in a group from 3 (a family unit) to 9 individuals. Footprints seen on the road are seen after rainy days whereby the bearded pigs come to the puddle of water on the road for relaxing.

Faeces of animals recorded were only three from the road survey. Animals usually search for food at the area nearby the road as it may increase their chance to obtain food from there whether from feeding plants and other animals or getting food from human garbage thrown along the road. From the observation, the JKR road in BFR area often is the victim of garbage dumping by the populations residing the area. Litters can be seen as you travel along the JKR road such as aluminium can, plastic bags, and other domestic wastes. Direct sighting in the road survey by foot also recorded a low frequency. This is due to the behaviour and activity of animals. For large animals such as bearded pigs and several more animals, they are avoiding the road during the day time to avoid being seen from human which are threats to them. Only small animals such as treeshrews, squirrels and birds are often seen on a survey by foot. However, for this type of animals, it is hard to identify the animals especially if the animals are too far or it move away too quick.

3.3.2 Road Survey by Vehicles

For the road survey by vehicles, there are only few animals spotted during the survey and the result is tabulated as in table 3.3 below.

Table 3.3 Animal spotted during road survey by vehicle

No.	Species Identifications	Direct Sighting/ footprints	Frequency
1	Malay Civet	Direct Sighting	3
2	Red giant-flying squirrel	Direct Sighting	2
3	Collared Nightjar	Direct Sighting	4

3.3.3 Bird Diversity

During the survey, the main method used in studying the population of birds in BFR was the mist-net method. However, birds from direct observation and also from the digital image recorded by the camera traps also recorded as result in the assessment. Below is the bird species recorded:

Table 3.4 Bird Species in BFR

No.	Common Name	Scientific Name	Frequency
1	Black-capped babbler	*Pellorneum pyrrogenys*	1
2	Buff-necked Woodpecker	*Megilyptes tukki*	2
3	Buff-rumped Woodpecker	*Meiglyptes tristis*	3
4	Collared Nightjar	*Gactornis enarratus*	4
5	Cream-vented Bulbul	*Pycnonotus Simplex*	1
6	Emerald Dove	*Chalcophaps indica*	1
7	House Swift	*Apus Affinis*	1
8	Little Spiderhunter	*Atachnotera logirostra*	1
9	Long-billed Spiderhunter	*Arachnothera crassirostris*	1
10	Pied Fantail	*Rhipodura javanica*	1
11	Red-eyed Bulbul	*Pycnonotus brunneus*	1
12	Rufous-backed Kingfisher	*Ceyx rufidorsa*	2
13	White-chested babbler	*Trichastoma rostratum*	1
14	White-crowned Shama	*Copsychus striklandii*	1
15	Yellow-vented Bulbul	*Pycnonotus goiavier*	1
	Total		23

* Note: yellow labelled species are nearly threatened species and green labelled species are the least concern species.

Survey of bird population in BFR shows less diverse species in the area. However, this does not reflect that the bird population is exactly less varied in species. From direct observation, the population of birds in the area are diverse. However, less was caught in the mist net. This may due to the opening of the forest.

3.3.4 Large Mammals Diversity in BFR

Large mammals are mammals having mass more than 5 kg which being aimed to be captured digitally using camera trap. From the camera trap image, below are the mammals that were identified:

Table 3.5 Large mammal result from camera-trap

No	Identification/Species		Frequency	IUCN Status	Method
	Common Name	Scientific Name			
1	Bearded Pig	*Sus barbatus*	7	Vulnerable (Decreasing)	Camera-trap
2	Pig-tailed macaque	*Macaca nemestrina*	10	Vulnerable (Decreasing)	Camera-trap
3	Malay Civet	Viverra tangalunga	3	Vulnerable (Decreasing)	Camera-trap and Direct Sighting
4	Lesser-mouse Deer	Tragulus Javanicus	3	Least concern (Stable)	Camera-trap
5	Bornean Red-Muntjac/ Common barking deer	*Muntiacus muntjac*	4	Least concern (Decreasing)	Camera-trap
6	Sun Bear	*Helarctos malayanus*	2	Vulnerable (Decreasing)	Camera-trap
Total			**29**		

3.3.5 Amphibians and Reptiles in BFR

Table 3.6 Result of Amphibian and Reptile

No	Identification/Species		Family	Frequency
	Common Name	Scientific Name		
1	Tree frog	*Rana megalonesa*	Ranidae:Rana	1
2	Four-lined tree frog	*Rana baramica*	Ranidae: Rana	2
3	Dwarf soft-shelled turtle	*Dogania subplana*	Trionychidae	1
4	Green vine snake	*Ahetulla prasina*	Colubridae	1
5	Striped bronzeback tree snake	*Dendrelaphis caudolineatus*	Colubridae	1
6	Striped tree skink	*Apterygodon vittatus*	Scincidae	3
7	River Salamander	*Sphenomorpus multisquamatus*	squamata: scincidae	1
Total				**10**

CHAPTER 4

HCVs & MANAGEMENT RECOMMENDATION

4.1 High Conservation Values (HCVs) Forest

High Conservation Value forests are defined by the Forest Stewardship Council (FSC) as forests of outstanding and critical importance due to their high environmental, socio-economic, biodiversity or landscape values. HCVs comprise the crucial forest areas and values that need to be maintained or enhanced in a landscape and are found within a wide range of forest conditions. Under this, forest managers are required to identify any HCVs that occur within their individual forest management units and manage them to maintain or enhance the values identified. HCV identification was done in Bengkoka Forest Reserve from October – November 2015 using the HCVF Toolkit for Malaysia as guidelines and recommendation for HCV management in the area are associated here.

4.2 Objectives of HCVs Identification

I. To identify and protect rare and threatened flora and fauna in Bengkoka Forest Reserve
II. To identify and demarcate wildlife habitat, watershed area and cultural significant sites and places in Bengkoka Forest Reserve
III. To encourage the long-term stability of wildlife biodiversity and incorporate this factor into the decision-making process

4.3 Assessment of Potential HCV Attributes

4.3.1 Background of Bengkoka Forest Reserve (BFR)

The Bengkoka Forest Reserve (*hereinafter also refer as Project Area*) is located within the Pitas district and was gazette as a forest reserve in 25/10/1968 and then reclassified as Protection Forest Reserve Class 1 in 1984. In 1995, an area of 86 ha was excised for villagers, leaving 6,270 ha of the BFR. Access to the reserve is available through an all-weather graveled road from the Pitas-Kanibongan main road. The main graveled road from Pitas to Kanibongan runs through the BFR mainly in the north-south direction. There are other secondary roads in the north and south that lead to various villages near the BFR.

The human settlement located within the BFR is Kg. Sorupil and Kg. Suang Duyung. Shifting cultivation is the main activity for the people or communities within and adjacent to the BFR.

The physical environment of the BFR, in term of topography, has gentle slopes of less than 15° and most terrain at 30 – 90 m above sea level.

The BFR is generally well-drained; the main river is an unnamed river in the north-west flowing out to South China Sea. River Karangan in the east and River Bungai and Bongkol in the south of BFR flowing out to Sulu Sea.

The forest type in the BFR is secondary vegetation mainly dominated by *Acacia mangium* and*Acacia* sp. It is estimated that the *Acacia mangium* and *Acacia* spp. (including *Acacia* hybrid) plantation forest comprising approximately 90% of the BFR. The element of kerangas plant species is no longer significant (for e.g. *Tristaniopsis* sp.) as the areas are overgrown with acacia. Within the BFR, there are several secondary plants species interspersed within the acacia forest such as *Alstonia spathulata, Decaspermum fruticosum, Ficus indica, Fordia splendidissima, Glochidion rubrum, Macaranga hypoleuca, Macaranga tanarius, Melastoma malabathricum, Nauclea subdita, Neolamarckia cadamba, Trema orientalis, Vernonia arborea* and *Vitex pubescens*. The major threat of this area is forest fire.

4.3.2 Potential HCVs Attributes

HCV identification and wildlife survey was carried out in October – November 2015 in part of Bengkoka FR as the first step to develop appropriate management strategies to ensure the identified HCVs remains intact. Based on the ground assessment, the forest reserve still holds fairly good wildlife diversity and important ecosystem that has crucial service to the environment especially as water catchment for some communities that are settling in Bongkol, Pitas. The potential HCV attributes that were identified (presence) during the field survey in are HCV 1, and HCV 4 describe as;

HCV 1 - Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species) and;

Based on the findings from the field survey, Project Area provides habitat and refuge of wildlife particularly with presence of CR, EN and VU large mammals as listed in the IUCN Red List such as sun bear, civets, deer; bearded pig and primate such as pig-tailed macaque (Please refer Chapter 3 for details of the findings).

HCV 4 - Forest areas that provided basic services of nature in critical situations

Parts of the Project Area are recognized / identified as water catchments which are of crucial roles to provide water to the communities residing adjacent to the Bengkoka FR. These areas are presented in Appendix V.

For other HCVs attributes;

HCV 2 – Forest containing globally, regionally or nationally large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance

As stated earlier, the Project Area is mainly covered with secondary vegetation and dominated by Acacia sp. No forest within the Project Area can be considered to exist in nationally significant natural patterns especially due to rapid forest fires in the area every year during drought season.

HCV 3 – Forest areas that are in contain rare, threatened or endangered ecosystems

Due to repeated burning during drought season the forests of the Project Area are covered with secondary vegetation and dominated by Acacia sp. and not known to have contained rare, threatened or endangered ecosystems such as lowland dipterocarp forests, peat swamps and limestone habitats.

HCV 5 – Forest area is fundamental to meeting basic needs of local communities

The human settlement located within the FR is Kg. Sorupil and Kg. Suang Duyung. Shifting cultivation is the main activity for the people or communities within and adjacent to the FR. An area of 86 Ha was excised for the villagers in year 1995.

HCV 6 – Forest area is critical to local communities' traditional cultural identity

So far, no important cultural sites have been identified inside the Project Area. Nevertheless, the Company will set aside and protect any area known to contain sites important to a local community's cultural, ecological, or religious activity.

4.4 Key Threats to the Project Area

The Project Area is easily accessible for forest encroachment to seek out land for farming, illegal exploitation and illegal hunting. Encroachment for crop cultivation is often a threat to biodiversity loss which soon leads to a highly fragmented landscape.

Besides that, forest fires are also considered as major threat to the Project Area. This is because the Project Area is not highly forested (secondary vegetation) and dry land with high potential of forest fires during the long drought season/ events, which associated with atmospheric and oceanic anomaly known as El-Nino – Southern Oscillation (ENSO) phenomenon that may increase the susceptibility of vegetation to wildfire. The threats become serious during this drought.

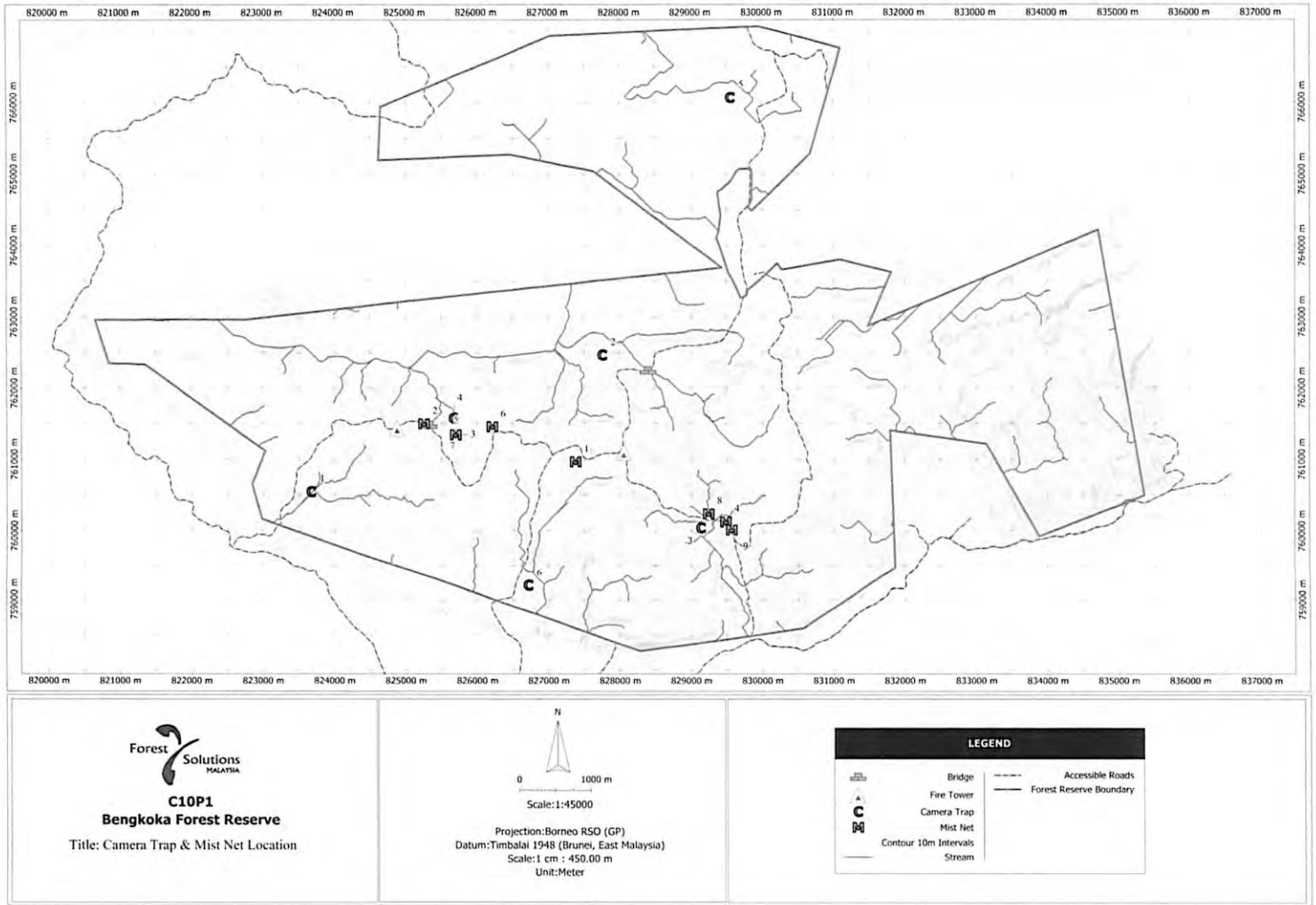
Therefore, forest fires and excessive wildlife hunting are the two main threats to flora and fauna sustainability in the Project Area.

4.5 HCVs Management Recommendation

HCV Features	Management Recommendations	Remarks
Threatened and Endangered Species of Flora and Fauna	• In conjunction with relevant NGOs and researchers, develop and implement wildlife monitoring strategy • Conduct wildlife monitoring with collection and analysis of observations through space and time to ensure that formulated management standards are being maintained • Maintain a wildlife data base • Develop management plan that makes specific reference to the threatened species and specific management measures for these species should be identified • Key wildlife components and features that need to be protected are identified and will be the focus of management action. • Prevent poaching, illegal logging and encroachment by implementing No Hunting Policy in the Project Area • Develop and implement surveillance strategy (patrolling) • Critical sites for protection i.e. saltlicks, fruit trees, hollow logs, wallows, burrows and prohibit tree-	Wildlife monitoring should documented threats, results of management activities and biodiversity inventory Example of key features found in the Project Area - sun bear and waterfall in one of the water catchment area. Cooperate with neighbouring concession for wildlife conservation - monitoring

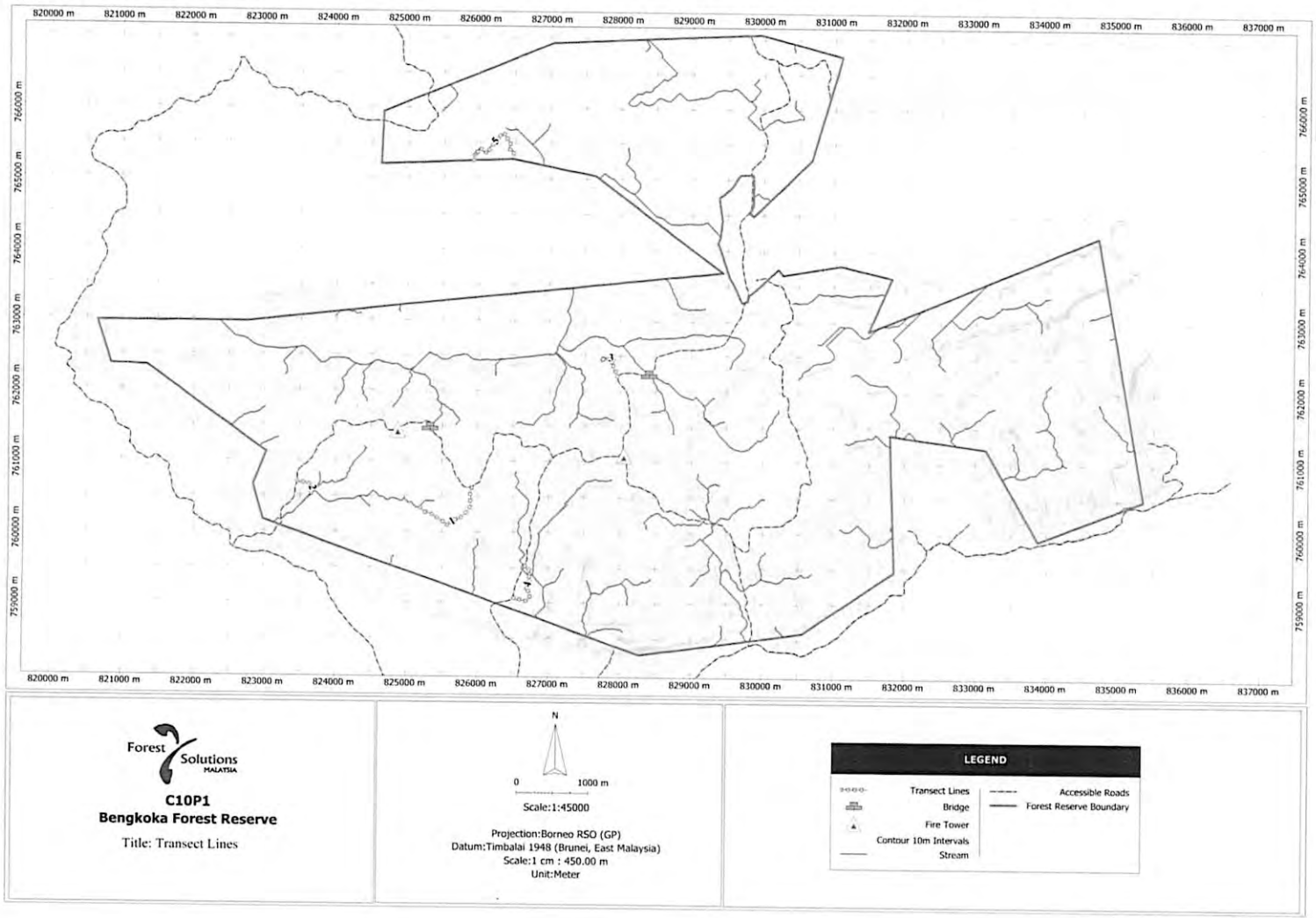
	felling and disturbance in these areas	
Water Catchment / Watershed Areas	• Improve wildlife habitat conservation by undertake planting in high priority areas • Create greater awareness and importance of the conservation of natural resources • Improve forest structure to increase carbon storage and resilience to fire • Improve forest fire response capacity by developing and implementing a strategy to develop local forest fire suppression	Forest restoration in water catchment areas and riparian buffer zones To prevent poaching in Project Area – establish gate at key entry points and field station in conservation areas
Indigenous community	• In liaison with neighbouring communities, develop and implement a strategy for engagement with local communities to establish positive and cooperative relationships with neighbours • Implementation of community projects with NGOs and relevant agencies	Include biodiversity, ecological and environmental education in the Project Area; -to enable community to understand and appreciate the complex nature of the ecosystem/environment as well as role played by a properly managed ecosystem/environment in economic development

Appendix I



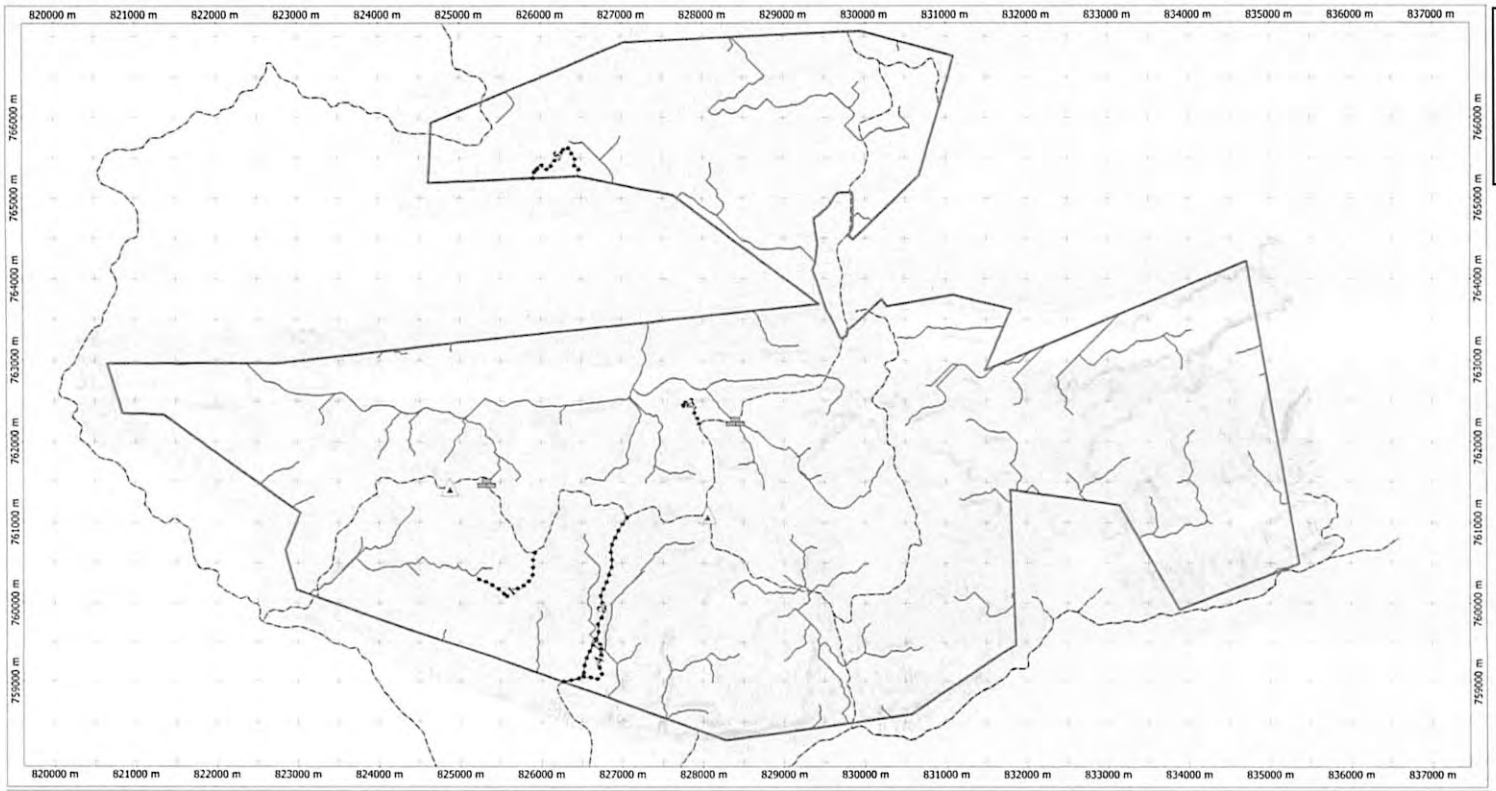
Map 1: Location of camera traps and mist nets

Appendix II



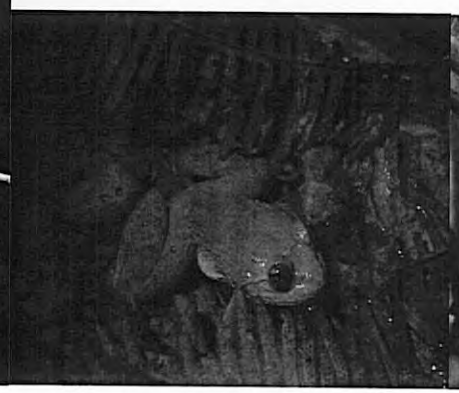
Map 2: Transect for recce walk

Appendix III

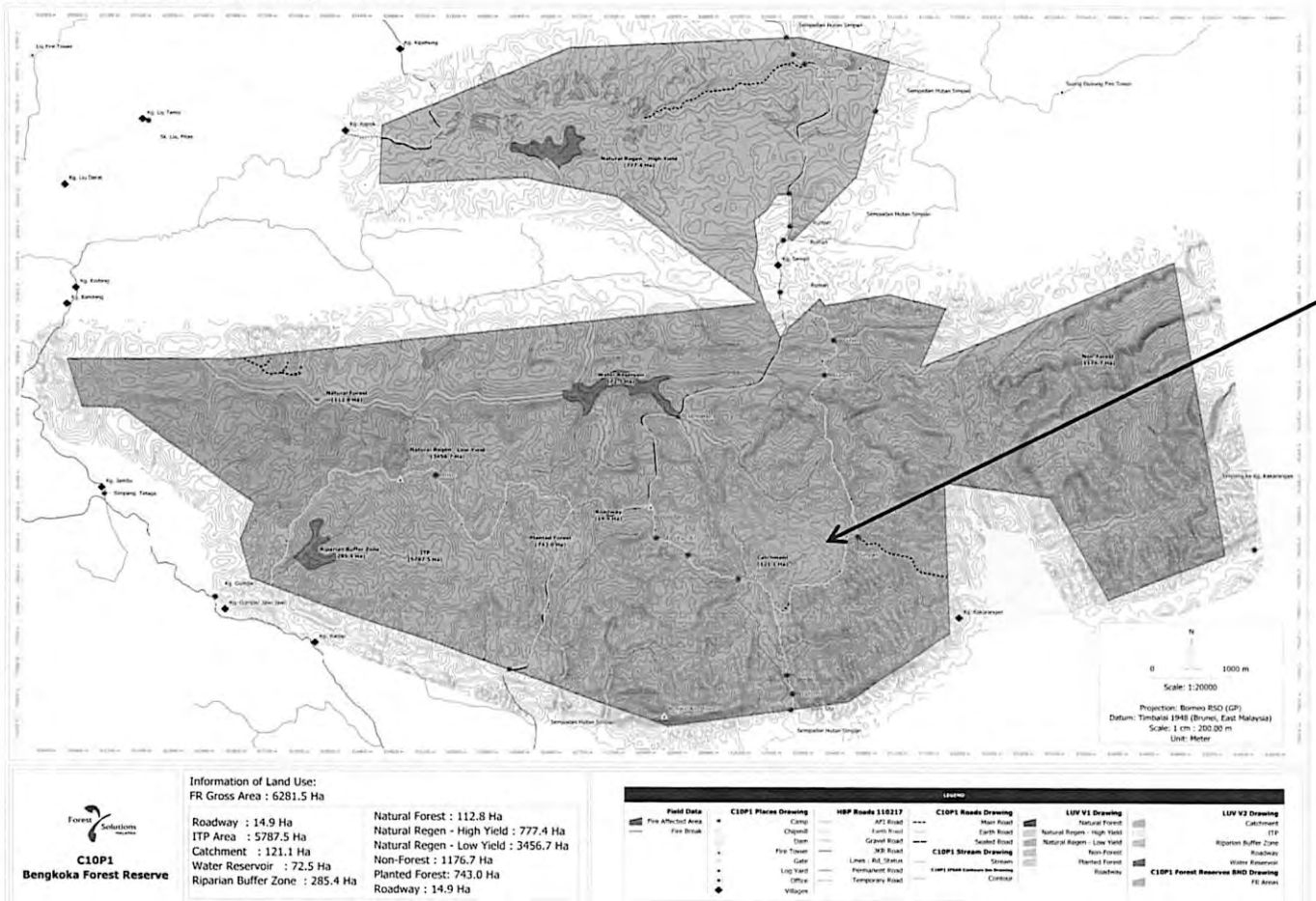


Map 3: Location road segment surveyed by foot and vehicle

Appendix IV – Photos of flora and fauna



Appendix V – Map of Bengkoka FR



Annex 2.6

Tambalugu Forest Reserve Wildlife Survey

FLORA AND FAUNA SURVEY
TAMBALUGU FOREST RESERVE
COUPE 4, GERAK SAGA
PITAS.

02nd - 24th MARCH 2016

Prepared by	Name	Signature
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CONSERVATION SECTION
PROJECTS DIVISION
FOREST SOLUTIONS MALAYSIA

Table of Content

1.0 INTRODUCTION: PROTECTED AREA CONSERVATION

Deficiency on resources for conservation has become one of the biggest threat to the conservation programmes worldwide. Degradation of lands to fulfil the demand for foods, developments, and industrialisation has become the centre of much attention not only to conservations but also to politicians, scientists, agricultural and energy sector, non-governmental organisation (NGO) as well as the governments (Gibbs and Salmon, 2015). South East-Asia forests especially are facing serious threats as the region has the highest deforestation of any tropical region (Laurance, 1999; 2007). According to Achard *et al.* (2002) and Sodhi and Brook (2006), the deforestation rates in South East-Asia which is by 0.71% per year is two and three times higher compared to the other region with tropical forests and form the current rates, it is predicted that by 2100, the region's forests will be cleared (Brook *et al.*, 2003).

Due to the threats, the world is moving towards environmental sound practices which includes the movement toward establishment of global conservation prioritising. Sabah, Borneo as one of the islands located in South East-Asia has moved towards a more environmental sound practices by enacting a law for forests management through the Sabah Forest Enactment 1968. The enactment provides the guidelines and provisions which includes about forest reserve gazetting, their management and also for cutting and removal of forest from State land (www.forest.sabah.gov.my, 2016). Since then, many land was gazetted becoming forest reserve for various purposes.

One of the forest reserve gazetted is Tambalugu Forest Reserve, located at Pitas, the North part of Sabah. Under legal classification, this forest reserve was classified as Class I Protection Forest reserve (FR). In 1971, Tambalugu FR was gazetted as forest reserve but under Class II and reclassified again as Protection Reserve Class I in 1984 (www.sabah.gov.my, 2016). Current use of the forest is a proposed forest plantation by Gerak Saga, a subsidiary of Forest Solutions Malaysia. As the company is committed in sustainability practices, conservation aspect is one of the elements that the company emphasized. Thus, monitoring of wildlife, landscape and the ecosystem always been practiced and maintained.

As one of the area under the responsibility of the company, practices towards sustainability on Tambalugu FR was initialised with taking data of landscape, geography and the wildlife in the forest reserve. Survey was carried out to collect the baseline data of the area. Thus, in this paper will report the findings from the survey that was completed as well as the methodology and the conservation plan for the area.

1.1 Objectives

This study in Tambalugu Forest Reserve embarks on the following objective:

i. To identify the species of flora and fauna as baseline data
ii. To suggest conservation management plan of the area.

2.0 METHODOLOGY

Assessment of flora and fauna was carried out at Coupe 4, Tambalugu Forest Reserve, Pitas from 2nd March 2016 until 23rd March 2016. Different methods are used for the assessment of flora and fauna in the area. Section 2.1-2.6 listed the methodology used in the survey.

2.1 Flora Survey

Recce walk was the method used in assessing flora diversity in the area. Transect line was established from the recce whereby flora along the transect line was identified and photographed. Some sample of plants was taken to be further identified. The layout of transect lines established from the recce is shown in *Appendix 5a*. Two materials involved in the flora assessment was:

i. GPS-Garmin
ii. Reference book

2.2 Fauna Survey

The target fauna for the survey are classified into mammals, birds, amphibians and reptiles, insects and molusca. Generally, recce walk was applied to assess all the target fauna roughly, whereby few more specific methods was applied to assess specific target fauna such as camera trapping for mammal and mist-netting for bird survey. The layout of transect line for fauna survey are the same as in the flora survey (refer *Appendix 5d*).

2.2.1 Camera Trapping

Camera trapping technique is the method specific for mammal especially large size mammals (bigger than 5 m). However, any image of non-volant mammals and other animals such as reptiles or birds for example, will also be identified. Four sets of camera traps was placed in four different locations whereby two camera was placed in lowland acacia forest and the other two in mangrove forest. Two materials involved in camera trapping:

i. Four sets of Bushnell HD camera trap
ii. GPS-Garmin Montana

The coordinate of each camera trap was recorded by using the GPS device and also recorded in the field data sheet. Table 2.0 shows the coordinate of all four camera traps. Layouts of camera trap are shown in *Appendix 5b*.

Table 2.0 Coordinate of camera traps

Camera trap No.	Coordinate	Forest type	Date set	Date removed
1	N06°55'38.3" E117°13'07.3"	Lowland acacia forest	5/03/16	21/03/16
2	N06°55'43.8" E117°12'50.3"		5/03/16	21/03/16
3	N06°56'00.4" E117°13'14.7"	Mangrove forest (wetlands)	6/03/16	21/03/16
4	N06°56'01.6" E117°12'54.8"		6/03/16	6/03/16

2.2.2 Mist-netting

In order to assess the diversity of birds in the study area, mist-net was used as it gives more reliable results than direct sighting. 6 mist nets were used and opened at different locations for 3 days. Wooden poles was used to tie the mist net. GPS coordinate was taken using the GPS device and tabulated as in table 2.1. Layout of the location of mist-netting is shown in *Appendix 5c*.

Table 2.1 Mist-net coordinate

Mists-net No.	Coordinate	Forest type	Date set	Date removed
1	N06°55'43.9" E117°13'21.2"	Lowland acacia forest	5/03/2016	5/03/16
2	N06°56'01.8" E117°12'54.0"	Mangrove forest (wetland)	6/03/16	6/03/16
3	N06°55'53.6" E117°12'45.4"	Acacia forest (paddy field)	22/03/16	22/03/16
4	N06°55'49.7" E117°12'50.4"	Lowland Acacia forest	22/03/16	22/03/16
5	N06°55'52.1" E117°13'58.2"	Lowland acacia forest	22/03/16	22/03/16
6	N06°55'43.3" E 117°13'26.0"	Lowland acacia forest	22/03/16	22/03/16

3.0 FLORA DIVERSITY

From the survey, flora and fauna in Coupe 4, in Tambalugu forest reserve was identified. For flora, major differences of plants was observed as the survey moved from lowland acacia forest to mangrove forests. Since the forest in this area can be divided majorly into secondary lowland acacia forest and wetland which is a mangrove forest, the vegetation can easily be differentiated. From the assessment, the acacia forest is much drier compared to the mangrove forest especially in dry-season when this survey was done.

Table 3.0 is the results for flora identified in Coupe 4. Photograph of flora identified is attached in *Appendix 1*.

Table 3.0 Flora species identified in Coupe 4, Tambalugu forest reserve

No.	Species		Family	Forest Type
	Scientific name	**Local name**		
1	*Stachytarpheta dichotoma*	Bunga Biren	Verbenaveae	Lowland acacia forest
2	*Lantana camara*	Bunga tahi ayam		
3	*Evatamia divaricata*	Pokok restong	Apocynaceae	
4	*Dillenia suffruticosa*	Buan/Rungin	Dilleniaceae	
5	*Aplinia galanga*	Lengkuas	Zingiberaceae	
6	*Psidium guajava*	Jambu batu	Myrtaceae	
7	*Melastoma malabathricum L.*	Senduduk/Gosing	Melastomataceae	
8	*Eurycoma longifolia*	Tongkat Ali	Simaroubiaceae	
9	*Blumea balsamifera*	Subong	Compositae	
10	*Chromolaena odorata*	Lohunoi/Lahunai		
11	*Hauttuynia cordata Thunb.*	Kenemek Jantan	Saururaceae	
12	*Acacia mangium*	Sabah salwood	Fabaceae	
13	*Licuala sp.*			
14	*Livistona chinensis*	Chinese fan palm	Arecaceae	Mangrove forest (Wetland)
15	*Rhizophora apiculata*	Bakau minyak/Akit	Rhizophoraceae	
16	*Heritiera littoralis Aiton*	Dungun	Malvaceae	
17	*Acrostichum sp.*	Piyai Raya laut	Pteridaceae	

Almost all the canopy for acacia forest is open canopy type whereby for the mangrove forest, the canopy type is majorly a closed type. Flora species in the acacia forest are scattered and widely spread inside the forest. For example, *acacia mangium, lantana camara, and chromolaena odorata* can be found almost everywhere in the acacia forest. Acacia trees dominated the trees found in the acacia forests with the forest floor are covered with shrubs, *zingiberceae* and climbers. Floras in the acacia forest are very important to the ecosystem. It provide habitat and food to other wildlife. Most of the flora identified are angiosperms which are flowering plants and fruit bearing plants that gives fruits and nectar for animal/insects feeding. For example, *lantana camara, melastoma malabathricum* and *psidium guajava* are flowering and fruit bearing plants which the flowers

No.	Species		Camera No.	Frequency
	Scientific name	Common name		
1	Helarctos malayanus	Sun bear	1	1
2	Sus barbatus	Bearded pig	2	1
3	Cervus unicolor	Sambar deer	2	2
4	Muntiacus muntjac	Barking deer	1	1
5	Macaca fascicularis	Long-tailed macaque	1,3	9
6	Arctogalidia trivirgata	Small-toothed palm civet	2	1
7	Viverra tangalunga	Malay civet	4	1
	Total			16

*Note: Yellow marked row indicates vulnerable (Vu) species under the IUCN redlist while green indicates least concern (LC) species.

compared to the true mangrove.

The importance of mangrove forest not just to the wildlife, landscape, human, and the ecosystem as a whole is no longer a marginal information to the scientific world and to the society. Mangrove forest is a natural barrier to protect the coastal area from rapid erosion and gives protection against natural disaster such as tsunami and excessive rise of water level. On the other hand, mangrove is a habitat for various types of wildlife such as long tailed macaque, malay civets, mollusc, fish, crustaceans and birds. Mangrove trees also have commercial values. Thus, this forest should be protected in order to protect the wildlife and ecosystem in the area.

Seven species of mammals were identified from the digital image with the total frequency of 16 individuals. Long-tailed macaque makes dominated the frequency of mammals identified with the percentage of 56.25% or 9 out of 16 the individual number. It is common that long-tailed macaque found abundant at the forest especially at the mangrove forest. Out of 9 long-tailed macaque, 8 of them were captured (digitally) at the mangrove swamp (camera trap 3). According to Rowe (1996) and Supriatna *et al.* (1996), long-tailed macaque lives in secondary, primary forest and mangrove swamp for they prefer habitat near to water source and found in higher number in riverbank, lakeshores and along the coastal area (van Schaik *et al.*, 1996).

Apart from that, long-tailed macaque also prefer habitats closer to human settlement borders, where they have access to garden, crop-aid farm (Sussman and Tattersall, 1986). Moreover, Wich *et al.* (2002) suggested that long-tailed macaque is frugivorous which in Borneo, the macaque obtain their diet 66.7% from ripe and fleshy fruit. The studies by Rowe (1996), Supriatna *et al.* (1996), van Schaik *et al.* (1996), Sussman and Tattersall (1986) and Wich *et al.* (2002) explain why long-tailed macaque in Coupe 4 is significantly higher in number as the geography in Tambalugu Forest Reserve is near to coastal area consisting of mangrove forest and nearby to human settlement.

Besides the long-tailed macaque, other mammals found with only 1 frequency except for sambar deer with the frequency of 2. Three out of seven of the species identified is labelled as vulnerable by the IUCN which include sun bear, bearded pig and sambar deer. All three mammals are large size mammals which are vulnerable not only to the environmental changes but also facing threats from prey especially human threats (poaching). In comparison with the study by McShea *et al.* (2009) on mammals in acacia and secondary forest, the survey of mammals in Tambalugu Forest Reserve also shows similar result where the number of mammals found in secondary forests are significantly higher. On the other extend, the study also suggested that some species such as bearded pigs, and civets/mongooses preferred planted acacia forest more compared to the natural secondary forest meanwhile ungulate mammals such as sambar deer can sustain in acacia forest. From there, they makes suggestion that bearded pigs, sambar deer, civets and mongoose are responsive to the amount of secondary forest in the area which indicates the potential to maintain and conserve the populations of the respective species in the acacia forest.

3.3 Birds

Most of the canopy in Coupe 4 is open canopy type with less vegetation per square meter, and it will influence the movement of bird as suggested by (Van Hora and Donovan, 1994). Although there are lot sighted birds during the survey, only a few species of bird are captured using mist net and the other are identified by direct sighting. Mist nets positions are shown in *Appendix 5c*.

Table 3.2 Bird species identified

No.	Species		Method		Frequency
	Scientific Name	Common Name	Mist Net (Net No.)	Direct sighting	
1	*Arachnothera longisostra*	Little spiderhunter	1		1
2	*Alcedo meninting*	Blue eared kingfisher	5	1	2
3	*Dinopium javanense*	Common flameback		1	1
4	*Chalcophaps indica*	Grey capped Emerald Dove	4		1
5	*Pycnonotus brunneus*	Red-eyed Bulbul	4		1
6	*Todiramphus chloris*	Collared Kingfisher	4		2
	Total				**8**

There are 6 species of birds that was identified by the team during the survey with the total frequency of 8 birds. 6 of the birds was caught using mist nets and 2 were identified from direct observation. All 8 birds was caught/sighted at the acacia forest which means there was no bird identified at the mangrove forest whereby all 8 birds are under the category of least concern by the IUCN redlist species.. However, it does not indicates the real population

of bird in the mangrove area. Many bird are sighted at the mangrove forest but none of the bird was managed being identified as the perpendicular distance between the observer and the bird was far. Bias of data also comes from the distribution of mist-nets. From the survey, only one mists-net was opened at the mangrove area and the duration of opening also was short which leads to data bias. Nevertheless, as a baseline study, this data should be sufficient given the time limitation and further surveys will be conducted in the future.

When it comes to the factor affecting bird diversity in any area, the first thing that will be suggested is the geographical landscape of the area. Different bird species and different diversity of birds can be observed in different geographical area. However, another important key to the diversity of bird in any area is the bird's bill. How birds adapted to its habitat depends on its bill, where the size, shape and strength of the bill will determine the bird's diet. (Proctor and Lynch, 1993). In Tambalugu Forest Reserve, clear example can be seen on the species of birds adapted to the lowland forest. Kingfisher are the species of birds seen to be dominating the species of bird identified. From the morphology of kingfisher, it has strong and bigger/longer bill suitable for fish/prawn/skink/lizards hunting in the swamp and river area of Tambalugu Forest Reserve. Kingfisher's flight is fast and direct which excavate nest hole with strong bill and feet. It dive steeply into water to catch fish, small invertebrates and invertebrates (Myers, 2009).

Availability of food also affecting the diversity and species richness in the study area besides the morphological of the birds itself. Gill (1975) stated that most bird's diet are seasonal where they feed variety of food according to season. Thus, in dry season when the food resources are declining, most birds will move to new feeding area. Similar observation was made from the survey in Tambalugu, during the dry season at the time of the survey where less bird was caught. Kingfisher was exception as it tends to stay at the area during dry season as the chance to catch fish on really shallow water. Other factor such as the habitat heterogeneity which include the vegetation cover, plants species, physical forms and local variation also should be emphasized in determining the diversity of birds.

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3.4 Amphibians and Reptiles

Among the sensitive group of animals is the amphibians and reptiles. The assessment of amphibians and reptiles therefore is important in habitat/wildlife assessment in any area. From the frogging and direct sighting of amphibians and reptiles from transect line; there are 4 species of amphibians and reptiles identified as in table 3.3.

Table 3.3 Amphibians and reptiles identified in Coupe 4

No.	Species		Family	Frequency	Forest type
	Scientific Name	Common name			
	Amphibians				
1	*Polypedetes leucomystax*	Four lined tree frog	Rhacophoridae	1	Lowland acacia forest
2	Limnonectes paramacrodon	Lesser swamp frog	Ranidae	1	
	Reptiles				
3	*Cuora amboinensis kamaroma*	Malayan box turtle	Geoemydidae		
4	*Varanidae sp.*	Monitor lizard	Varanidae	1	

*Note: Species marked bright yellow represents vulnerable (VU) species by IUCN whereby pale yellow represent near threatened, and white for unknown population trend.

A complete species list identified tabulated in the table shows two of the species are amphibians and the other two are reptiles. The highlight of species for amphibians and reptiles is the lesser swamp from and the Malayan box turtle where they are listed as near threatened and vulnerable species respectively. According to Halliday (2008), compared to mammals, birds, birds and other vertebrates, amphibians declining rates is the highest as amphibians is very sensitive to anything that adversely affect either their habitats or to their kind itself. Since amphibian lives on land and in water, the threats comes at greater sides whereby destruction/disturbances on water body and on land will affect amphibians on both side. The lack of protective outer layer for amphibians makes it vulnerable to various threats from the environment. Not only themselves but their eggs also lack of protective layer such as shell to protect the eggs from physical and chemical threats.

Differ to amphibians, reptiles have more physical protection feature which enhance their survival upon harsh environment. Their protection layer such as their shell (turtle, tortoise) and hard scale (monitor lizard) gives them strong protection especially from physical threats. However, the threats for reptiles usually comes from human. Reptiles such as box turtle usually taken by human either kept as pet or being eaten. Due to the vulnerability of amphibians and reptiles, they requires safer habitat.

3.5 Insects and Mollusca

Other fauna that should be considered during the survey is the insects and molluscs.

From the observation, insects such as butterflies are found abundant in Coupe 4 whereby two molluscan were identified in the mangrove area. Table 3.4 lists the insects and molluscs identified during the survey.

Table 3.4 Insects and molluscs Identified in Coupe 4.

No.	Species		Family
	Scientific Name	Common Name	
	Insects		
1	*Papilio palinurus*	Emerald swallowtail	Papilionidae
2	*Papilio polytes*	Common mormon	
3	*Trogonoptera Brookiana*	Rajah Brooke's Birdwing	
4	*Tanaecia iapis*	Horsefiled's Baron	
5	*Idea Stolli*	Common tree nymph	
6	*Ideopsis vulgaris macrina*	Blue glassy tiger	Nymphalidae
7	*Euploea facricius*	Striped blue crow	
8	*Ypthima horsfieldii*	Common four ring	
9	*Eurema hecabe*	Common grass yellow	Pieridae
	Mollusca		
10	*Polymesoda expansa*	Marsh clam	Cyrenidae
11	*Cassidula aurisfelis*	Belongkeng	Ellobiidae

All insect species that was identified in the survey are butterfly by 55.56% came from the family of nymphalidae, 33.33% from Papilionidae and 11.11% from pieridae. Diverse butterfly species can be observed from the result and as the surveying team moved along the transect line, it was observed that the number of butterflies in the coupe is high. The IUCN status of the butterflies species however is not available and the status of each of the butterfly identified is unknown (unexcessible). Over 60 species of butterflies declared extinct over the last decades and this indicates that the decline of butterfly species is very fast and they are vulnerable. One might not realise the value of butterfly is not just for the scenery or intrinsic value, but they also have the aesthetic, ecosystem and scientific value.

Studies show that butterfly actually is an important bio-indicator. This is because, butterfly needs resources that only found in intact ecosystem (Nelson and Andersen, 1999). In landscape conservation, butterfly was used as indicator for logging impacts (Clery, 2004), wetlands type and restoring monitoring (Lomov *et al.*, 2006). Thus, the abundance of butterfly in Coupe 4 can be a good indicator for the state of "health" of the forest. On the other extend, butterfly is important as pollination agent as they feed on plant material to the lowland as well as higher trophic level plants. In plant conservation, butterfly therefore important as natural "breeding" agent for plants.

As for the molluscs, two species was identified and both are species of least concern under the IUCN red list of threatened species. Even though both species are least concern, they also required protection as the species may be excessively exploited by human for the species have commercial value to human. Local people usually sell the Marsh clam and Belongkeng or consuming it for themselves. Signs of excessive exploitations of the marsh clam was observed and photographed where abundant clam shell found piled up in the mangrove area. Due to this, conservation action should be taken to preserve the species in the coupe.

4.0 Recommendation and Conclusion

There are patches of mangrove trees occurring along the boundary of the Tambalugu Forest Reserve. During the survey period, this area has been surveyed by our surveyor and the size of the mangrove area is 12.12 Ha; boundary demarcation has also been completed. *Appendix 4* shows the location of the mangrove area in Tambalugu FR.

Mangroves are unique ecosystems occurring along the sheltered inter-tidal coastlines, mudflats, riverbanks in association with the brackish water margin between land and sea in tropical and subtropical areas. They sustain diverse flora and fauna species in large proportion as well as providing many ecosystem services such as coastal protection from storm, reduction of shoreline and riverbank erosion, stabilizing sediments and absorption of pollutants.

In Tambalugu FR, the major genera that represent the mangrove species is identified as *Rhizophora*. Nevertheless, there could also be different generas such as *Bruguiera, Avicennia and Sonneratia*. Further research to identify the variation and distribution of mangroves species occurring in Tambalugu FR should be carried out to increase the understanding of values, functions and attributes of mangrove ecosystems and the role they play in providing important ecological services and livelihoods for the mangrove associated communities.

Apart from research on mangrove species, other conservation effort such as replanting or restoration of mangrove trees to connect the patches may be recommended for rehabilitation. The recommendation is to plant approximately 2.9 Ha to connect the patches of mangroves forest (*See Appendix 5e*). Being a sensitive ecosystem, restoration technique should be practiced with well-planned system while taking the site specific conditions. Common approach in mangroves restoration is by involving the communities located around mangroves area as this will raise the awareness of the importance of mangroves and to practice sustainable ways to harvest any products from the mangroves area such as aquatic species for food, vines for handicrafts, bark for tannin, fuel-wood and et cetera.

In addition for wildlife conservation, it is recommended to make a buffer 20-30 m from river as riparian reserves and could act as wildlife corridor in the forest reserve.

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APPENDICES

Appendix 1: Flora Species

Appendix 1a: Lengkuas

Appendix 1b: Bunga tahi ayam

Appendix1c: Rhizophora apiculata seedling

Appendix 1d: Guava tree covered with Climbers

Appendix 1e: Chinese fan palm

Appendix 1f: Acacia mangium tree

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Appendix 2: Fauna Species

Appendix 2a: Sun bear

Appendix 2b: Adult sambar deer

Appendix 2c: Small-toothed palm civet

Appendix 2d: Malay civet

Appendix 2e: Female long-tailed macaque carrying infant macaque

Appendix 2f: Male pig-tailed macaque

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Appendix 2g: Back side view of bearded pig

Appendix 2h: Bearded pig head figure

Appendix 2i: Sambar deer

Appendix 2j: Closed up image of sambar deer

Appendix 2k: Blue-eared Kingfisher

Appendix 2l: Little Spiderhunter

Appendix 2m: Collared Kingfisher

Appendix 2n: Red-eyed Bulbul

Appendix 2o: Emerald Dove

Appendix 2p: Malayan box turtle

Appendix 2q: Striped blue crow

Appendix 2r: Blue glassy tiger

Appendix 2s: Emerald swallowtail

Appendix 2t: Common four ring

Appendix 2u: Common mormon

Appendix 2v: Marsh clam

Appendix 2w: Belongkeng

Appendix 2x: Belongkeng underpart view

Appendix 3: Vegetation

Appendix 3a: Mangroves area

Appendix 3b: *Rhizophora sp.*

Appendix 3c: Forest dominated by *Acacia sp.*

Appendix 4: Survey Activities

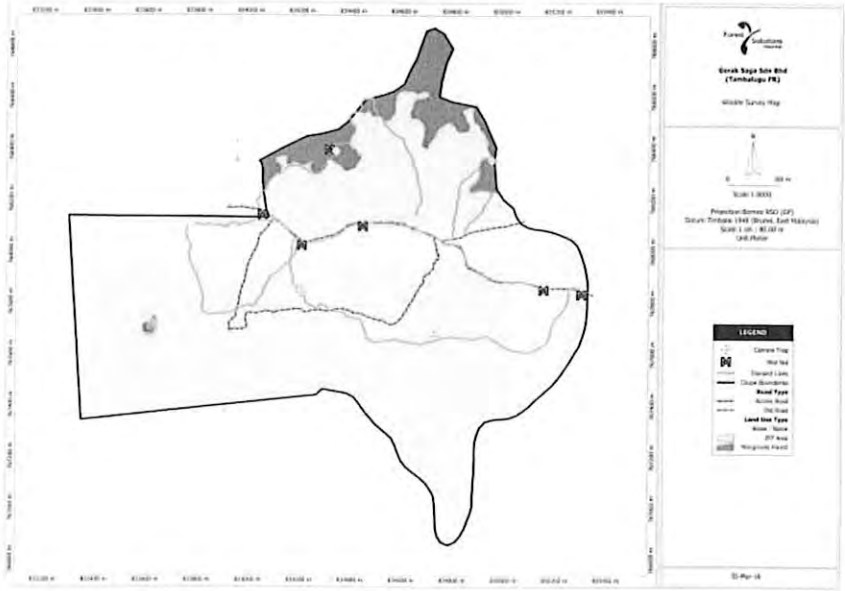
Appendix: 4a: Big fan palm

Appendix 4b: Installing camera trap

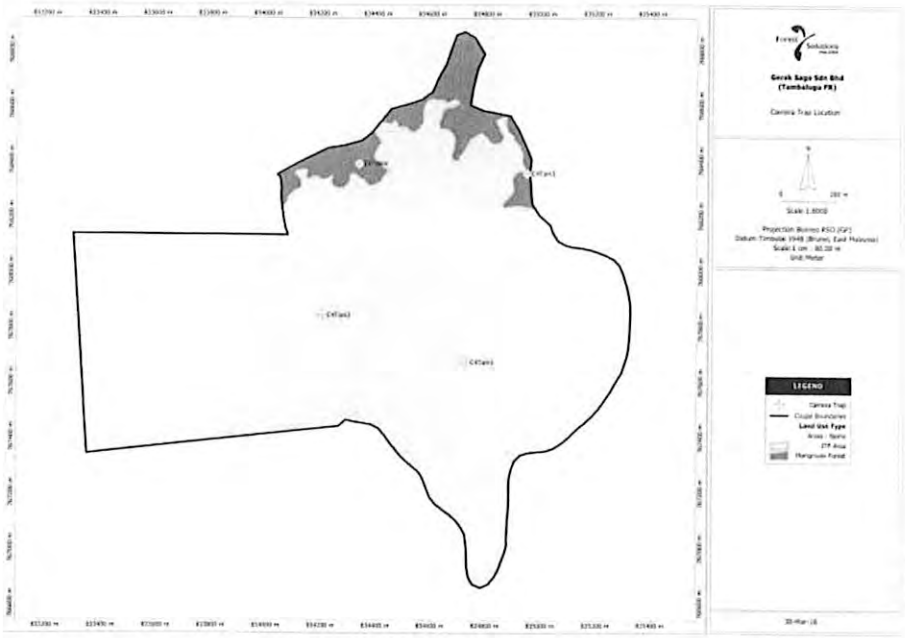
Appendix 4c: Setting-up mist net

Appendix 4d: Mammal footprint (Deer)

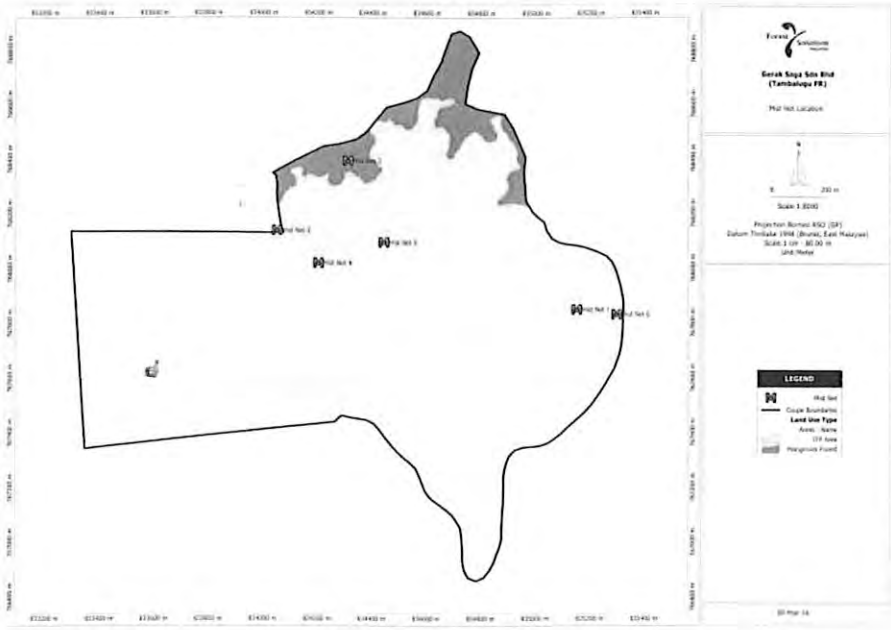
Appendix 5: Layout Maps



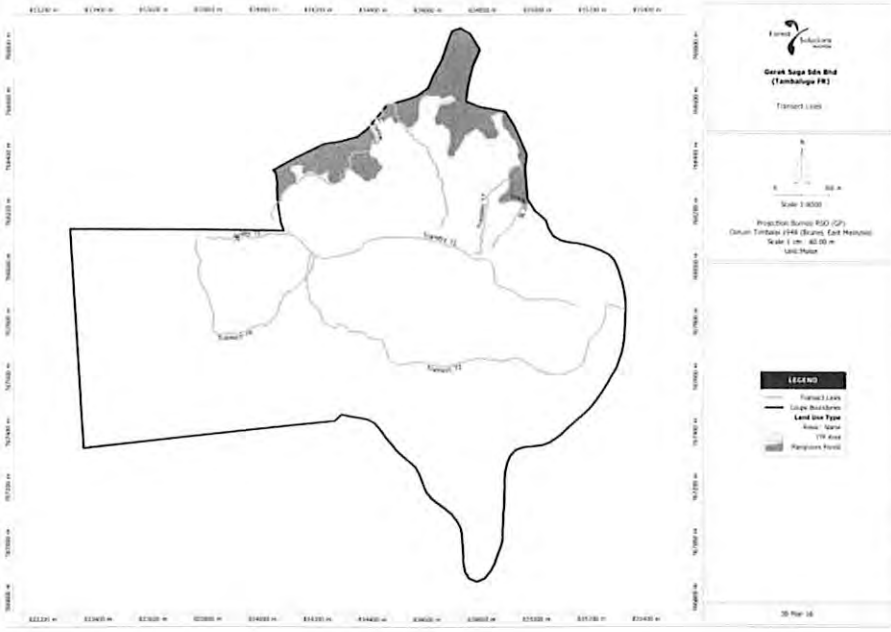
Appendix 5a: Land-use map showing Mangrove Forest (Dark Green); Size: 12.12 Ha.



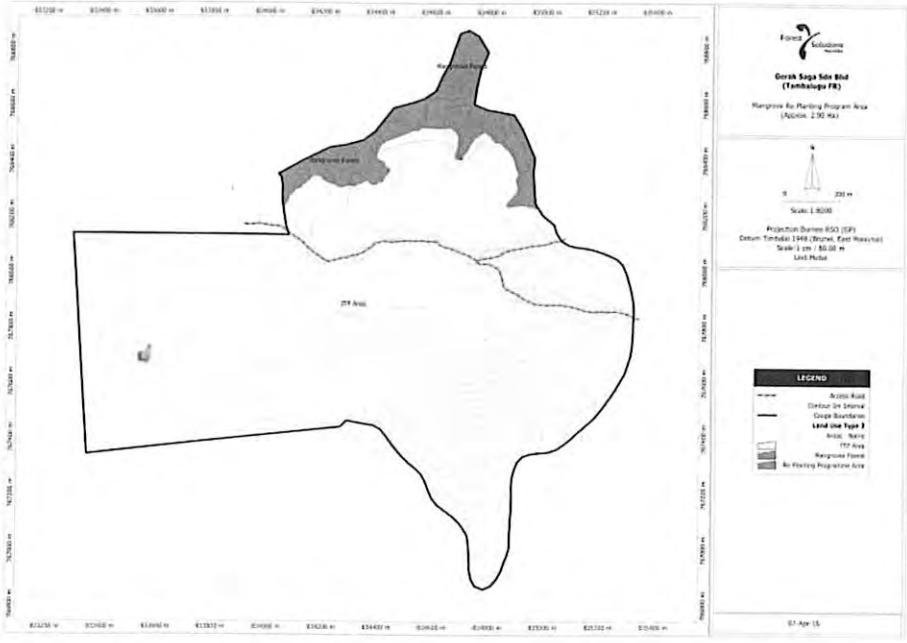
Appendix 5b: Land-use map showing the location of camera traps.



Appendix 5c: Land-use map with the location of mist nets installed for bird survey.



Appendix 5d: Land-use map showing the transect lines surveyed for flora and fauna.



Appendix 5e: Land-use map showing the recommended area for the replanting program (mangrove species).

Annex 2.7

Kg. Serupil Community Census

Please complete the survey as thoroughly as possible. Leaders first, but it is also important to check with other members of the community. This is especially important for socio-economic questions and questions 13-15.

1. **Name of Surveyor : Parasul, Rohaidi, Ronnie**

   Census Date : 18-03-2015

2. **Village Profile**

Kg. Name	Kg. Age	GPS Location	District	Distance to Road(KM)
Kg. Sorupil	35 years	N 06 [illegible] E117 [illegible]	Pitas	7 Km from Pitas
Origin of Name:	Based on the name of a big tree found in the village			

3. **Contacts**

Contacts	Name	Contact Number If available	Year in role
Ketua Kampung	Togendang Yabur	019-8019776	8 years
PJKKK	Jonius Togendang	019-88[illegible]	7 years
Teacher	No		
Community	Jinpani Togendang	019-5558239	
Other	No		

3. Socio-economy/ Sources of Livelihood/Income (Interview a minimum of 6 families)

Main Sources of Income (describe)	Monthly Income (Average)	Monthly Expenses	Monthly Saving
Jinpani Togendang Sadah Kulambi Kasim Rake Juani Togendang Ubud Singgayun Aibin Togendang	700.00	700.00	0
	200.00	200.00	0
	600.00	600.00	0
	1,000.00	1,000.00	0
	300.00	300.00	0
	200.00	200.00	0
	Avg. Of 6 families	Avg. Of 6 families	Avg. Of 6 families
	566.00	566.00	0
Is there any loan or credit scheme? No	Comment: [illegible]		

Alternative Sources of Income	Comment:

4. Demographics

Total	M	F	0-15 F	0-15 M	# of Families	# of Houses	Language	Ethnicity	Religion
Number of families with < 5 children							Number of families with ≥ 5 children		
What was the population 5 years ago?							What was the population 10 years ago?		

a) Are there any outsider residing near the village? How many?

b) What is the situation of these outsiders? What is your opinion of them?

5. Level of Education in the village

Level of education Completed	% of Eligible Males	% of Eligible Females	Total %
Primary			
Secondary			
College/Technical School			
University			

6. Public Services/Facilities

Public Services Facilities	Description (size, services, condition-poor, fair, good?)	Date Built	Location (Name of Kg.)	Distance from Kg. Nearest To town (KM or time)	Photo	GPS Location
Community Hall						
Library						
Market						
Sundry Shop						
Kindergarten						

Primary School	No					
High School	No					
Medical clinic	No					
Church	[illegible]	1992			Yes	
Hospital	No					
Telephone	No					
River	No	N/A				
Visiting Medical staff	Yes __ No __ If yes describe Frequency and services provided.	Health Officer of the Hospital Pitas will visit every [illegible] months in the village, especially from Vector Borne Disease Treatment Department (RPBV)				

7. Electricity

% of Houses with Electricity	Source of Electricity	Frequency of power interruptions	Comments:
0%	Some homes have small generators		Electric poles have been installed but the cable not yet connected to any home

8. Water

% of Houses with Running Water	Source(s) of Water	Quality of Water (clear, cloudy)	Avail of water- plentiful, Limited, seasonal	Avg distance to water (KM or Time)	Comments:
100%	Well and pond inside village. [illegible]	Cloudy	Limited	[illegible] km	[illegible] method is to build [illegible] and storage tanks for clean water

9. Health

Most common Illness	Cases of Malaria per year	Date of last malaria case	Comment:
Fever, Malaria & Dengue	Once in every 5 years	1 cases in 2011	Cases such as this is normal and just have no control and inspection of cleanliness of the village

10. Waste Disposal

% of Households with toilet	Common Type of Toilet	Method of solid waste disposal	Comment:

11. Transportation

Quality of Roads	# of motor bikes	# of cars	Public Transport	Cost to school (RM)	Cost to town (RM)	Comments:
Always Accessible Yes No						
River Crossing Yes No						

12. Food and Animals

Sources of Food	Availability (abundant, seasonal)	Increasing or Decreasing?	Price to sell at market (RM/kg)
Type of Wildlife	**Frequency of Sighting (rare, occasional, frequent)**	**Increasing or Decreasing?**	**Is it a food source?**

13. Skill and Capacity

a) Skill available in the village (construction, healing, teacher, local, handicraft)
Residents only have natural skills such as farming skills, make crafts and skills in carpentry and construction

b) Courses or training ever undergone
There are two people who have courses in Urat Mara as mechanics and carpentry, 1 women studying nursing in college at this time

c) Trade or business in the village
None at the moment

d) What is in the village that has the potential to increase or add the income of villagers?
The opportunity to work with the company as developer for forest reserve area and an opportunity to get more land for farming purposes

14. Land/Forest Resources (Use and Ownership)

a) How important is the forest/land to you or your village?
As we see now, the population is dependent on agriculture for a living for the family. This forest area is still very important and should be protected and conserved

b) What is the current land situation ?
They still have not received grants even been excised from the forest reserve by the Forestry Department

c) How many villagers have land ownership? How Many hectares in total? Since when?
They still do not have land titles, In 2007 there were 70 families that have received assistance seedlings of fruit and rubber trees from the Forestry Department, with an area of 2.5 hectares of land per family

d) How many hectares of land have been requested (per family and total)?
They have applied for 400 acres of 15 acres per family and 100 acres of reserve land to be used as a village. The whole area is 500 acres

15. Views and Aspirations of Village

a) What is your opinion of AFCS? Do not know yet
b) Can you relate any experiences that you or the village had with AFCS? Population open to share their experiences with the company
c) What is your hope towards AFCS? Residents hope the company gives priority to human rights villagers and can provide employment opportunities and basic infrastructure to the community
d) What are the major issues affecting the village? Land, Nature, Rights and indigenous of villagers
e) Suggest activities that can be implemented together with AFCS. Social development and cultural, economic and natural resources

Prepared by:

(Parasul Basang)
Senior CDP Liaison Officer
Community Development Programme (CDP)

Checked by,

Clive Scheapers
Project Manager

Annex 3

List of References

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2. ***Environmental Impact Assessment (EIA) Guidelines for Forest Harvesting (Logging) and Forest Plantation Establishment*** published by Environment Protection Department (EPD, January 2012).

3. ***Handbook of EIA Guidelines*** published by Department of Environment (DOE), 1995.

4. ***Guidance Document for Addressing Soil Erosion and Sedimentation Control Aspects in Environmental Impact Assessment (EIA) Report*** by Department of Environment (DOE), 2010.

5. ***Cadastral Maps*** *from Lands and Surveys.*

6. ***SABAH 1:50,000 Topographical Maps*** *from Jabatan Pemetaan Negara.*

7. ***Geological Map of Sabah, Third Edition, 1985, Scale 1:500 000.***

8. ***Soils Map of Sabah*** by Department of Agriculture.

Annex 4

TOR and TOR Approval

JABATAN PERLINDUNGAN ALAM SEKITAR
(ENVIRONMENT PROTECTION DEPARTMENT)
Tingkat 1 - 3, Wisma Budaya
Jalan Tunku Abdul Rahman
Beg Berkunci 2078
88999 Kota Kinabalu, Sabah, Malaysia
No. Tel. : 088-251290/251291/267572/268572
No. Faks : 088-238120/238390 E-mel : jpas@sabah.gov.my
http://www.sabah.gov.my/jpas
(Sila catatkan Rujukan fail Jabatan ini *apabila menjawab)*

Rujukan : JPAS/PP/15/600-1/01/3/60(6)
Tarikh : 10 Mac 2016

Pengarah Urusan
Gerak Saga Sdn Bhd
L-70-7 KK Times Square
Off Jalan Coastal
88100 KOTA KINABALU **Faks: 088-486241**
(u.p.: Encik Christopher Garside)

Tuan,

KELULUSAN BIDANG RUJUKAN (TOR) BAGI "FOREST MANAGEMENT OF BENGKOKA AND TAMBALUGU FOREST RESERVES, PITAS, SABAH"

Dengan hormatnya, saya diarah merujuk surat Chemsain Konsultant Sdn. Bhd. bil.:CK/EV403-4278/0084/16 bertarikh 05 Februari 2016 mengenai TOR kajian EIA bagi projek tersebut di atas.

2. Bidang Rujukan (TOR) tersebut telahpun diteliti dan diluluskan tertakluk kepada syarat-syarat berikut:

2.1 Garispanduan *'Handbook on Environmental Impact Assessment (EIA) in Sabah (Second Edition), 2005'* yang dikeluarkan oleh Jabatan ini hendaklah dipatuhi;

2.2 *'Garispanduan Penyediaan Dan Pengemukaan Laporan EIA'* yang dikeluarkan kepada semua perunding alam sekitar melalui surat rujukan: JKAS/PP/100/600-4/13/1(28) bertarikh 25 Januari 2010 hendaklah dipatuhi;

2.3 Senarai pakar yang terlibat dengan kajian EIA ini hendaklah bersesuaian dengan aktiviti projek, memegang sijil amalan yang sah dan kepakaran yang terlibat hendaklah sama sebagaimana dinyatakan dalam sijil amalan tersebut. No. pendaftaran serta tarikh tamat sijil firma dan pakar hendaklah juga dinyatakan;

2.4 Pakar Biologi yang berdaftar dengan jabatan ini hendaklah dilibatkan dalam kajian EIA ini;

2.5 Tajuk Laporan EIA/ projek hendaklah memasukkan keluasan tapak projek dalam unit hektar;

2.6 Setiap penjuru sempadan kompartmen hendaklah diberikan bacaan koordinat latitud dan longitud dan dipetakan dengan jelas dalam Laporan EIA;

2.7 'Zone of impact (ZOI)' hendaklah dikenalpasti dan dikaji serta dibincang dengan terperinci dalam Laporan EIA. ZOI hendaklah disediakan dalam bentuk 'Table' yang mengandungi maklumat seperti berikut: i. Senarai ZOI, ii. Lokasi, iii. Jarak, iv. Impak yang dijangka dan kesemua senarai ZOI ini dipetakan dengan jelas dalam 'Existing Land Use Map'. Langkah-langkah kawalan dan pemantauan berkesan hendaklah dicadangkan;

2.8 Langkah-langkah kawalan, perlindungan dan pemantauan yang dicadangkan dalam Laporan EIA hendaklah diselaraskan dengan "Reduce Impact Logging (RIL) Method" yang akan dilaksanakan;

2.9 Semua cadangan lokasi rumah pekerja, pejabat, bengkel dan semua kemudahan lain yang berkaitan dalam kawasan projek hendaklah dikenalpasti lebih awal dan dibincang dengan terperinci dalam Laporan EIA. Langkah kawalan dan pemantauan berkesan hendaklah dicadangkan dalam Laporan EIA;

2.10 Kesan projek terhadap tanah bersempadan, kawasan perkampungan yang terdekat seperti Kg. Serupil, Kg. Gumpa, Kg. Bongkol, kawasan sensitif serta kawasan berisiko tinggi seperti kawasan tadahan dan sumber air paip graviti, sungai-sungai dalam kawasan tapak projek, cerun curam, Empangan SAFODA, Hutan Simpan Bengkoka, Hutan Simpan Tambalugu dan Hutan Simpan Bakau Semenanjung Bengkoka dan lain-lain berkaitan, langkah-langkah perlindungan dan pemantauan termasuklah keperluan penyediaan "buffer zone" hendaklah dikaji dan dibincangkan dalam Laporan EIA;

2.11 Risiko "fire hazard", langkah kawalan dan pemantauan hendaklah dibincang dalam Laporan EIA;

2.12 Sisa yang terhasil dikenalpasti dan lokasi serta kaedah pengurusan sisa seperti sisa pepejal, sisa biomas, sisa kumbahan dan sisa minyak daripada projek ini hendaklah dibincangkan dalam Laporan EIA;

2.13 Kajian *"social-survey"* yang terperinci hendaklah dijalankan merangkumi temubual dengan wakil para penduduk di sekeliling tapak projek dan mengambil sampel responden pada piawai sekurang-kurangnya 10% atau lebih. Kajian ini hendaklah mengambilkira kesan projek terhadap penduduk kampung yang tinggal di dalam dan sekitar kawasan projek terutama hilir sungai, sumber air dan takat pengambilan air (water intake). Lokasi punca air graviti / bekalan air bersih penduduk kampung hendaklah juga dikenalpasti dan dipetakan. Langkah kawalan dan program pemantauan hendaklah dibincangkan dengan terperinci dalam Laporan EIA;

2.14 Status terkini simpanan sungai yang terdapat dalam kawasan projek hendaklah dibincangkan dalam Laporan EIA. Kajian terperinci mengenai perlindungan sungai dan jarak simpanan sungai yang terletak dalam kawasan projek hendaklah dibuat. Cadangan penyediaan jarak simpanan sungai hendaklah praktikal;

2.15 Pelaksanaan konsep "Forest Restoration and Enrichment Planting", "sequence of work" dan maklumat pelan "sequence of work" aktiviti pembalakan dan perladangan hutan, langkah-langkah kawalan dan pemantauan berdasarkan "sequence of work" tersebut hendaklah dibincang dalam Laporan EIA;

2.16 Semua pelan susunatur (layout plan) bagi cadangan langkah kawalan dan program pemantauan hendaklah dibuat berdasarkan keadaan dan sempadan sebenar kawasan projek di lapangan yang telah diukur dan ditanda. Bacaan koordinat latitud dan longitud setiap penjuru sempadan projek yang telah diukur ini hendaklah diberikan;

2.17 Nama dan tandatangan perunding/pakar yang menyediakan dan menganalisa 'baseline data'(e.g. water, noise, hidrology, ecological survey, flora/fauna survey, socio-economy survey, BOD loading calculation, slope risk assessment) hendaklah diberikan dan direkodkan dalam lampiran-lampiran pada Laporan EIA; dan

2.18 Menyertakan satu Laporan EIA dalam bentuk digital semasa menyerahkan Laporan EIA ke jabatan ini.

3. Pihak perunding juga hendaklah bertanggungjawab untuk meneliti dan menilai mana-mana isu alam sekitar yang berkaitan yang didapati semasa kajian di lapangan.

4. Surat akuan daripada **pemaju atau kontraktor yang melaksanakan kerja-kerja di lapangan** yang menyatakan telah diberi penerangan oleh perunding alam sekitar mengenai isi kandungan Laporan EIA tersebut dan memahaminya hendaklah dilampirkan dalam Laporan EIA. Surat akuan ini hendaklah **ditandatangani oleh pegawai yang berjawatan Pengarah syarikat, Pemilik syarikat atau Setiausaha syarikat bertauliah dan merupakan pekerja tetap syarikat berkenaan** dan **mengandungi nama penandatangan, jawatan, tarikh dan cop syarikat**.

5. Tempoh kelulusan TOR kajian EIA ini adalah **enam (6) bulan** dari tarikh surat ini dan Laporan EIA berkenaan hendaklah dikemukakan ke Jabatan ini dalam tempoh tersebut.

Rujukan : **JPAS/PP/15/600-1/01/3/60(6)**
Tarikh : **10 Mac 2016**

6. Adalah dimaklumkan bahawa **tuan dilarang** untuk **menjalankan sebarang aktiviti pembalakan dan perladangan hutan serta aktiviti yang berkaitan sebelum Laporan EIA bagi projek ini diluluskan**. Kegagalan tuan mematuhi larangan ini akan menyebabkan tindakan undang-undang di bawah **Seksyen 12A(2)(a), Enakmen Perlindungan Alam Sekitar 2002** boleh diambil dan jika disabitkan, boleh **didenda tidak melebihi satu ratus ribu ringgit (RM100,000) atau dipenjarakan bagi tempoh tidak melebihi lima (5) tahun atau kedua-duanya sekali**.

7. Sila lengkapkan '**Senarai Semak Pengemukaan Laporan EIA**' seperti di '**Lampiran A**' dan dikemukakan bersama semasa pengemukaan Laporan EIA di jabatan ini.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA DENGAN BERSIH, CEKAP DAN AMANAH"
"DO MORE, DO IT BETTER"

Saya yang menurut perintah,

(DAISY ALOYSIUS)
b.p. Pengarah

s.k: Setiausaha Tetap
Kementerian Pelancongan, Kebudayaan Dan Alam Sekitar
Tingkat 5-7, Blok A, Wisma Tun Fuad Stephens
KOTA KINABALU **Faks: 088-236005**

Pengarah
Jabatan Perhutanan Sabah
Beg Berkunci No. 68
90009 SANDAKAN **Faks: 089-671303**

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88450 KOTA KINABALU **Faks: 088-381280**

DAA/RMT/raa

LAMPIRAN A

Senarai Semak Pengemukaan Laporan EIA

Pengarah
Jabatan Perlindungan Alam Sekitar

KELULUSAN BIDANG RUJUKAN (TOR) BAGI "*Rujuk syarat 2.5...*"

Adalah disahkan bahawa **syarat-syarat kelulusan Bidang Rujukan (TOR)** yang dikeluarkan oleh Jabatan Perlindungan Alam Sekitar rujukan : **JPAS/PP/15/600-1/01/3/60(6) bertarikh 10 Mac 2016** seperti berikut **telahpun dipatuhi**:

No. syarat *(Merujuk kepada nombor syarat yang dinyatakan dalam para 2 dan 3)*	Syarat-syarat *(Perincian syarat seperti dalam para 2 dan 3)*	Bab/perenggan ia dinyatakan dalam Laporan EIA	Tandakan (/)
2.3	Senarai pakar yang terlibat dengan kajian EIA ini hendaklah bersesuaian dengan aktiviti projek, memegang sijil amalan yang sah dan kepakaran yang terlibat hendaklah sama sebagaimana dinyatakan dalam sijil amalan tersebut. No. pendaftaran serta tarikh tamat sijil firma dan pakar hendaklah juga dinyatakan.		(_____)
2.4	Pakar Biologi yang berdaftar dengan jabatan ini hendaklah dilibatkan dalam kajian EIA ini.		(_____)

Tandatangan : _____

Nama : _____ Cop Syarikat : _____

Tarikh : _____

***Penerimaan Laporan EIA tidak akan diproses sekiranya syarat-syarat di atas tidak dipatuhi.*

Chemsain Konsultant Sdn Bhd

Lots 2&7, Lorong Suria, Off Lorong Buah Duku 1
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Environmental Impact Assessment

Forest Management of Bengkoka and Tambalugu Forest Reserves, Pitas, Sabah

Terms of Reference

[redacted]

Prepared by:

Chemsain Konsultant Sdn Bhd

February 2016

Our Ref: CK/EV403-4278/15

Project Proponent:

Gerak Saga Sdn Bhd

L-70-7 KK Times Square,
Off Jalan Coastal,
88100 Kota Kinabalu, Sabah
Tel: 088 – 486 240
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Written/compiled by	Richard Rhodes/ Eivind Oluf Kofod	January, 2016
Reviewed/ approved by	Rebecca Poong	February, 2016

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List of Abbreviations and Acronyms

A.M.S.L.	Average Mean Sea Level
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DID	Drainage and Irrigation Department
DO	Dissolved Oxygen
DOE	Department of Environment
EIA	Environmental Impact Assessment
EPD	Environment Protection Department
JKR	Jabatan Kerja Raya
JUPEM	Jabatan Ukur dan Pemetaan Malaysia
NWQSM	National Water Quality Standards Malaysia
SAFODA	Sabah Forestry Development Authority
SAMM	Skim Akreditasi Makmal Malaysia
TOR	Terms of Reference
TSS	Total Suspended Solids
TSP	Total Suspended Particulates
ZOI	Zone of Impact

1 Introduction

1.1 Project Title

These Terms of Reference are prepared for the submission of an Environmental Impact Assessment (EIA) for a Project titled "**Forest Management of Bengkoka and Tambalugu Forest Reserves, Pitas, Sabah**". The title will be fine-tuned once the overall area is confirmed. For brevity, this will be referred to as the "Project" in this document. The Bengkoka and Tambalugu Forest Reserves will be referred to as the "project site" in this document.

1.2 Land Owner

Sabah State Government, under the jurisdiction of:

Sabah Forestry Department

Ibu Pejabat Perhutanan Sabah,

KM 11, Jalan Utara,

Beg Berkunci 68,

90009 Sandakan, Sabah.

Telephone No. : 089 – 242 500

Fax No. : 089 – 671 303

1.3 License Holder/ Project Proponent

Gerak Saga Sdn Bhd

L-70-7 KK Times Square,

Off Jalan Coastal,

88100, Kota Kinabalu, Sabah.

Telephone No. : 088 – 486 240

Fax No. : 088 – 486 241

Contact Person : **Mr. Christopher Garside**

Designation : **Project Manager**

1.4 Environmental Consultant

Chemsain Konsultant Sdn Bhd

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88450, Kota Kinabalu, Sabah

Telephone No. : 088 – 381 277 / 381 278

Fax No. : 088 – 381 280

E-mail Address : consult.kk@chemsain.com

EPD Reg. Number : F001

Reg. Expiry Date : 30.09.2016

Contact Person(s) : **Mdm. Rebecca Poong / Mr. Richard Rhodes**

Designation(s) : **Director / Environmental Executive**

The team of individual consultants involved with the preparation of the EIA report and their fields of expertise together with their registration details are listed below. Consultant Registration Certificates are attached in **Appendix 1**.

No.	Personnel	Qualifications	Registered Areas
1.	Rebecca T. F. Poong Reg. No: S 0008 Expiry Date: 30.09.16	B. Sc. Environmental Science	Land Use
2.	Eivind Oluf Kofod Reg. No: S0187 Expiry Date: 07.02.17	M.Sc. (Forest and Natural Resources Management)	Forestry
3.	Cyril Jinusie Reg. No: S 0155 Expiry Date:18.11.16	M. Sc. (Industrial Chemistry)	Scheduled Waste Management, Air & Water Quality
4.	Lee Kuok Chiang Reg. No: S 0136 Expiry Date: 20.05.17	B. Eng. (Hons) Civil (Environmental)	Hydrology
5.	Joyce Chin Fui Fun Reg. No: S 0186 Expiry Date: 07.02.17	B. Eng. (Hons) Chemical	Waste Management & Chemical Processes

List of team members for the EIA study (not registered with EPD):

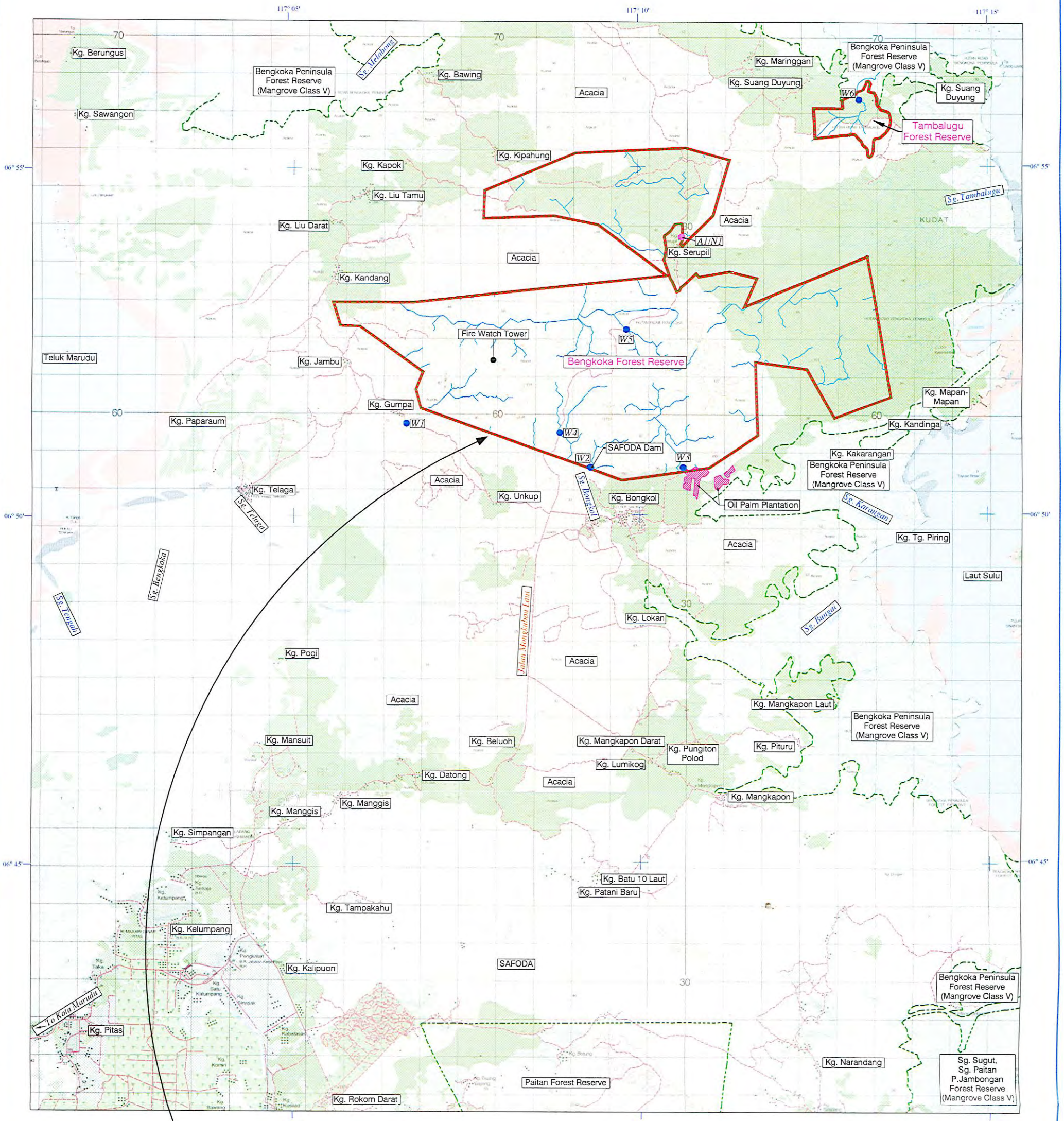
No.	Personnel	Qualifications	Report Contribution
1.	Richard Rhodes	B.Sc. (Hons) Geological Sciences	Assistant to Land Use, Slope and Soil

1.5 Project Aim/ Statement of Need

The Bengkoka Forest Reserve and Tambalugu Forest Reserve are Class II Forest Reserves covering an area of approximately 6,270 Hectares and 197 Hectares, respectively, within Pitas District, Sabah. Refer to **Figure 1.0** for the location.

The forest reserves are deteriorating due to previous overexploitation, lack of management, forest fire, droughts and disease. The natural vegetation has given way to invasive *Acacia mangium* and *Acacia sp.* which is dominating large areas. In some areas the Acacia has been attacked by fungus (*Ceratocystis sp.*) and has also been subjected to wildfires several times. The area is therefore at risk from invasion of Imperata grass. If this happens, biodiversity will be almost none and further attempts to include the area in biological, social or economic productivity will be prohibitively expensive.

The forest reserves are predominantly surrounded by forestry operations, mostly Acacia plantations. There are also some areas of small scale oil palm plantations to the south of the Bengkoka Forest Reserve. Acacia is known to be an aggressive invasive species on degraded land but does not readily establish itself in the shade of well-established forest stands. Acacia has this trait in common with Imperata as both species require direct sunlight for establishment.



LEGEND:

- Project Boundary (Bengkoka Forest Reserve and Tambalugu Forest Reserve)
- Forest Reserve Boundary
- Primary Forest
- Secondary Forest
- Oil Palm Plantation
- Unsealed Road
- River/Stream
- A1/N1 — Air & Noise Baseline Sampling Point
- W1-W6 — Water Baseline Sampling Points
- River/Stream within Project Site

SOURCE : Adapted from
SERIES T738
SHEET 7731, 7732, 7831 & 7832
EDITION 1-PPNM
GRID
–The numbered lines indicate the WGS84 datum latitude & longitude
0 1 2 3 4 5Km
SCALE IN KILOMETRES (1:100,000) – A3 MEDIUM

ENVIRONMENTAL IMPACT ASSESSMENT
Forest Management of Bengkoka and Tambalugu Forest Reserves, Pitas, Sabah

Project Site Location, Surrounding Land Use and Baseline Sampling Points

Figure: 1.0

Both forest reserves were previously classified as Class I Protected Forest Reserve, however as they have not be able to be rehabilitated, they have been reclassified as Class II Commercial Forest (**Appendix 2**).

The Project Proponent, who will manage the Bengkoka and Tambalugu Forest Reserves, sees three options:

1. Do nothing: If the current fire cycle is allowed to continue without intervention the diseased Acacia would almost certainly be consumed over time, resulting in highly degraded Imperata grassland of little or no ecological value.

2. Restore the natural forest over the entire area: Due to the pioneering nature of Acacia and the presence of surrounding Acacia plantations, it is believed this option would be prohibitively expensive and not viable.

3. Create an actively managed, productive forest: The current Acacia stands are relatively low yielding and yields will continue to decline as the Ceratocystis gets worse. With careful planning to identify and protect areas where ecological functions could be restored, the balance of the area could be converted to manage Eucalyptus plantations. An active presence would help protect the area from further degradation through burning and will create an economic justification for control of Acacia regeneration in riparian zones.

The plan is thus to convert the majority of the forest reserve area to productive stands of *Eucalyplus spp.*, while simultaneously re-establishing riparian reserves and conservation areas. The project concept is further described in **Section 2.1**.

1.6 Site Visit

Date: 16th to 17th December 2015

Participants:

- Project Proponent's representative: Mr. Clive Scheepers (Operations Manager), Mr. Parasul (Community Officer).

- EIA consultant team: Mr. Richard Rhodes, Mr. Vivian Lojuki, Mr. Brian Hannis.

Main points of the site visit:

- Observation of the existing conditions, general site conditions, hydrological features, ecological environment and surrounding land use.

- Discussion with the Project Proponent on overall development concept.

2 Background Information

2.1 Project Description

2.1.1 Project Location

The project site covers an area of approximately 6,467 Ha, comprising the 6,270 Ha Bengkoka Forest Reserve and the 197 Ha Tambalugu Forest Reserve. The exact project site area will be finalised in the EIA report, and the EIA title will be modified accordingly. The Project Proponent holds license for management operations in both forest reserves (Refer to **Section 2.4**).

The project site is located approximately 25 km north of Pitas Town along Jalan Mongkubou Laut, near Kg. Bongkol (**Figure 1.0**).

2.1.2 Project Concept

As described in **Section 1.5** the best management option for the project site is to create an actively managed productive forest.

The Project Proponent proposes to plant Eucalyptus over the majority of the project site area. The remaining area will be set aside for conservation/ water catchment, water reservoirs and riparian reserves. The proposed development plan for the Bengkoka Forest Reserve is illustrated in **Figure 2.0**, where the Eucalyptus plantation is shown as "Managed ITP". The proposed development plan for the Tambalugu Forest Reserve is currently being produced by the project proponent. The plantation is expected to be managed on a 10-year rotation basis with the objective of producing small timber and chip-wood from the Eucalyptus.

Due to the deteriorating state of the project site, as described in **Section 1.5**, it is expected that there are no existing areas of significant ecological value and no riparian reserves have been established. Almost the entire project site area is covered with invasive Acacia and has been degraded through overexploitation, lack of management, forest fire, droughts and disease. The Project Proponent therefore intends to create and rehabilitate conservation/ water catchment areas and riparian reserves. Under normal circumstances existing vegetation in riparian zones for example would have to be retained, however due their deteriorated state on the project site the Project Proponent intends to enhance these areas by introducing indigenous species in order to restore ecological function. Further details will be provided in the EIA.

The Project Proponent also intends to create water reservoirs, both for water supply to Project operations, and for their ecological value.

The enhancement of riparian zones and conservation areas will be done in phases. Due to the size of the project site, the site will be divided into coupes, or blocks, with each block being developed in turn, including Eucalyptus planting and the enhancement of riparian reserves and conservation areas.

The Project will also include the establishment of infrastructure including a road network, temporary and central landings, camps and workshops, and facilities for the production of planting material, whether based on seeds or vegetative propagation, including a nursery.

The Project will not require significant earthwork as there will be no terracing. Earthwork may be required for the development of facilities and infrastructure, this will be minor and will be less than 40,000 m^3.

Slope limits and plantable areas will be investigated with reference to requirements from the relevant agencies.

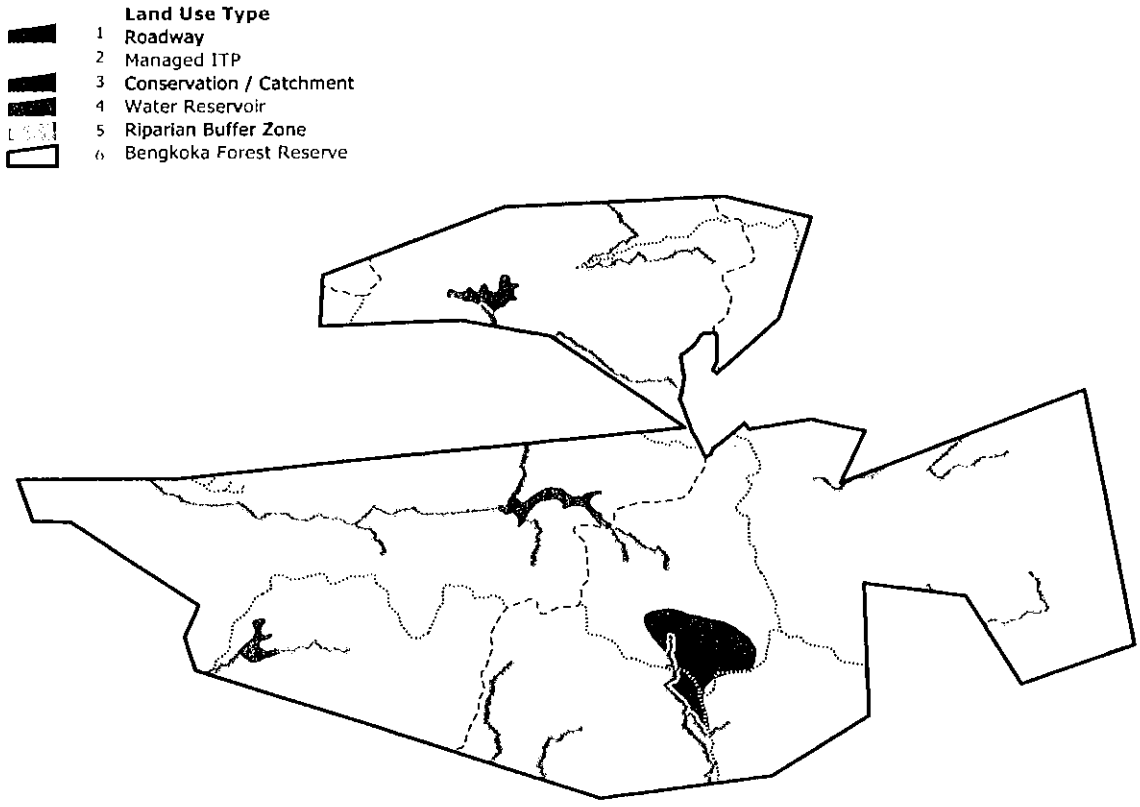


Figure 2.0: Proposed Development Plan (Bengkoka Forest Reserve)

2.2 Legal Requirement

The Project will involve forestry development and operations over an area of more than 500 hectares. The Project is therefore classified as a prescribed activity under the Second Schedule of the **Environmental Protection (Prescribed Activities) (Environmental Impact Assessment) Order, 2005**:

SECOND SCHEDULE

2. FORESTRY

(i) Felling or extraction of timber covering an area of 500 hectares or more; or

(ii) Development of forest plantation or reforestation covering an area of 500 hectares or more.

The above Order requires an EIA report to be submitted to the Environment Protection Department (EPD) for approval prior to project implementation.

The purpose of these Terms of Reference is to describe the requirements for the EIA study and for the preparation of an EIA report in accordance to the guidelines prescribed by EPD.

2.3 Project Status

Project Site

Development activities for this Project have not commenced on the project site.

As described in **Section 1.5**, the project site is in a deteriorating state due to previous overexploitation, lack of management, forest fire, droughts and disease. The natural vegetation has given way to invasive *Acacia mangium* and *Acacia sp.*, which is in poor state and dominating large areas of the project site. In some areas the *Acacia mangium* and *Acacia sp.* have been attacked by fungus (*Ceratocystis sp.*) and have also been subjected to numerous wildfires throughout the years, and there are large areas dominated by dead or dying trees (**Plate 8-1** to **Plate 8-2**). In other areas, particularly in the east of the Bengkoka Forest Reserve *Imperata sp.* Grass (lalang) dominates.

Forest Management Plan (FMP)

A Forest Management Plan (FMP) has been produced for this Project, this has been submitted to Sabah Forestry Department and is pending approved. The FMP will be incorporated into the EIA report.

Development/ Layout Plan

The proposed development plan for the Bengkoka Forest Reserve is illustrated in **Figure 2.0**. The proposed development plan for the Tambalugu Forest Reserve and the final development/ blocking plan is currently being finalised by the Project Proponent and will be provided in the EIA report.

2.4 Land Tenure, Legal Status and Zoning

The project site, comprising the Bengkoka and Tambalugu Forest Reserves, is zoned as a Class II Commercial Forest. As detailed in Section 1.5.

The land is owned by Sabah State Government under the jurisdiction of the Sabah Forestry Department. The Project Proponent, Gerak Saga Sdn Bhd, is the license holder for the Bengkoka and Tambalugu Forest Reserves. A copy of the Sustainable Forest Management License Agreement (SFMLA) between the Sabah State Government and the Project Proponent is attached in **Appendix 2**.

2.5 Project Implementation Schedule

The time frame for the establishment of the Eucalyptus plantation over the project site is 6 years, commencing in the 2nd quarter of 2016. As described in **Section 2.1** the plantation is expected to be managed at a 10-year rotation basis.

2.6 Project Activities

The project site will be divided into blocks, or coupes, and the Project will be implemented on a coupe-by-coupe basis. The development/ blocking plan will be provided in the EIA report.

The main activities for the implementation of the Project are as follows:

1. Determination of Suitable Planting Areas;
2. Site Preparation;
3. Production of planting material;
4. Establishment of Conservation Areas;
5. Site Clearing;
6. Salvage Logging;
7. Planting;
8. Maintenance and Harvesting; and
9. Replanting or abandonment.

2.6.1 *Determination of Suitable Planting Areas*

Prior to any activities commencing on the project site the following areas need to be determined and mapped out:

- Suitable planting area for Eucalyptus;
- Riparian reserves;
- Conservation areas, including water catchments;
- Water reservoir areas, if required;
- Base camp including nursery; and
- Road network.

The Project Proponent will use LIDAR technology to accurately map the topographical and hydrological features in order to produce all the necessary plans and maps. Based on this information a general development/ blocking plan and layout plan will be produced for the entire project site; however this will be subjected to change depending on conditions on the ground when the Project Proponent enters the site. Detailed plans will be produced for each coupe/ block on a coupe-by-coupe basis, prior to the commencement of activities in each coupe/ block.

2.6.2 *Site Preparation*

Site preparation will include the establishment or all the necessary site facilities and infrastructure including the following:

- **Base Camp:** A base camp will be established on the project site, from which all project operations will be coordinated. The base camp will include: site office; workers quarters; workshop; storage areas etc.

- **Facilities for the production of planting material:** These requirements will be detailed in the EIA report; however it is likely a nursery will be required.

- **Road network:** A road network will be established across the project site branching off from the existing main JKR roads. There are some existing roads within the project site which have been used for previous forestry operations, these will be improved and new roads will be developed.

- **Utilities:** A water and electricity supply will be required for the project base camp. Depending on the location of the base camp, electricity will either be from government mains supply or generator sets. The Project Proponent may create a reservoir to supply water to the plantation.

Other facilities will also be required throughout the project site, including, but not limited to: temporary and permanent field camps; and temporary and central landing areas. The locations of these can only be determined once Project operations commence, on a coupe-by-coupe basis. Suitable locations will be determined based on ground conditions and logistical convenience.

2.6.3 *Production of Planting Material*

Following the establishment of the site facilities, the production of suitable planting material will commence. Planting material will either be based on seeds or vegetative propagation.

2.6.4 *Establishment of Conservation Areas*

Prior to the commencement of site clearing, the proposed conservation areas will be confirmed on the ground and properly demarcated. This demarcation will be done on a coupe-by-coupe basis according to the plantation schedule.

As described in **Section 2.1**, due to the deteriorated state of the project site, the Project Proponent will create and rehabilitate conservation areas, including water catchment areas and riparian reserves. The Project Proponent intends to enhance these areas by introducing indigenous species in order to restore their ecological function. As described in **Section 2.1**, this will be done on in phases, based on the proposed coupe-by-coupe implementation schedule.

Riparian reserves will be provided on all rivers and streams within the project site according to the requirements of the Sabah Forestry Department. Conservation areas will be provided where necessary, primarily for areas identified for water catchment either for the Project's own use or for surrounding settlements. These areas will be detailed in the EIA report.

2.6.5 *Site Clearing*

As described in **Section 1.5**, the project site is deteriorated and the majority of the project site is now covered with invasive *Acacia mangium* and *Acacia sp.* In order to eradicate the Acacia and the associated disease, site clearing is required.

In order to minimise the impact of clearing such a large area, as previously described the Project will be implemented on a coupe-by-coupe basis. In addition debris from clearing will be left in situ for natural decomposition, either in windrows or spread and crushed over the plantation area.

Some clearing will also be required in riparian zones and potentially in conservation areas, as the diseased Acacia has also invaded these areas. It is necessary to selectively clear certain species from these areas so that their rehabilitation, as described in **Section 2.6.4**, is successful and the ecology can thrive.

2.6.6 Salvage Logging

During site clearing any standing trees of commercial value will be felled. It is anticipated however that this will be minimal. The majority of the existing tree stands are not thought to have much commercial value, due to small size and disease. Nevertheless there is the potential for some salvage logging operations.

2.6.7 Planting

Following site clearing operations in each coupe the field will be prepared for planting. Planting material will be brought to the field from the onsite facilities. Further details on the planting methods will be provided in the EIA report. Slope limits and plantable areas will be investigated with reference to requirements from the relevant agencies.

2.6.8 Maintenance and Harvesting

Maintenance of the planted Eucalyptus will involve silvicultural practices such as weeding, thinning, pruning and the potential use of agrochemicals to fight weeds and pests. The maintenance schedule will be discussed further in the EIA report, including agrochemical application.

Harvesting of the Eucalyptus will commence once the trees have reached maturity. It is anticipated that at first harvesting will be a labour intensive operation, however activities will increasingly become mechanised, reducing the manual labour requirement.

2.6.9 Replanting or Abandonment

Replanting

Harvested areas will immediately be re-planted with the same species. The residue from harvesting is significantly less than for the clearing of natural vegetation, therefore minimal land clearing is required during this phase.

Abandonment

Abandonment can occur at any stage of the Project. It may take place if it is deemed that the Project is no longer economically, environmentally of socially sustainable. The environmental impact from project abandonment will depend on what stage the Project is abandoned. If the Project is abandoned following site clearing, for example, then areas of the project site may be left in an exposed and degraded state, which may result in soil erosion, a reduction in soil quality and water pollution through sedimentation. This may also lead to further Acacia invasion and the potential for forest fires. If the Project is abandoned in other stages, planting/ operation, the site will also decline further into a degraded state.

When the Project is abandoned, a restoration programme shall be executed to ensure that the site is left in a stable condition where environmental impact is minimal, and ensure the suitability of the project site for future use.

2.7 Labour Force

The required labour force is not known at this stage. The estimated labour force will be provided in the EIA report.

2.8 Use of Energy

During project development and operation electricity will either be provided by generator or from mains supply. Diesel fuel will be required for the machinery and equipment employed during the Project.

2.9 Waste

The following types of waste will be generated during project development:

- Biomass: Biomass generated from site clearing will need to be managed properly to prevent any impact on the environment. The biomass will be left *in-situ* for natural decomposition, either in windrows or chipped and spread and crushed over the plantation area.

- Solid waste: Solid waste produced during project development will be in the form of general waste from the workers.

- Scheduled waste: Oil and grease waste from the maintenance of machinery and equipment on site (if required) will need to be disposed of properly as scheduled waste.

- Sewage: Sewage generated from the site office and workers quarters will need to be treated and disposed of properly.

3 Preliminary Description of the Existing Environment

3.1 Human Environment Component

3.1.1 Administrative Unit

The proposed Project is located within the Bengkoka and Tambalugu Forest Reserves (Class II Commercial Forest), which are under the jurisdiction of Sabah Forestry Department (SFD). The license and management arrangements are explained in **Section 2.4**.

3.1.2 Land Use, Settlements and Demography

There are no settlements within the project site. There are however a number of settlements located in the vicinity of the project site, the closest of which is Kg. Serupil (**Plate 8-3**), as listed in **Table 3.1.1** and illustrated in **Figure 1.0**. As per the topographical map that is made available at present, Kg. Serupil is seen to be located approximately 50 m west of the project site boundary (Bengkoka Forest Reserve), however this will be confirmed in the EIA report following survey and ground truthing. As per the Project Proponent, the proposed plantation area will exclude the settlements (if any) found within the project site. Kg. Serupil is a sparsely populated village along Jalan Mongkubou Laut.

There are a number of existing structures within the project site which are remaining from previous forestry operations and existing forest management, such as workers huts and fire watch towers (**Plate 8-4**).

There is also a small dam within the project site, specifically the Bengkoka Forest Reserve, along the southern boundary near Kg. Bongkol (**Figure 1.0**) (**Plate 8-5**). This dam was constructed by SAFODA and provides water to SAFODA and Kg. Bongkol. It is also noted that Kg. Serupil uses a natural pond for washing purposes, which is in close proximity to the project site boundary (**Plate 8-6**).

The project site is predominantly surrounded by forestry operations, predominantly Acacia plantations with the Sabah Forestry Development Authority (SAFODA) Area. There are also some areas of small scale oil palm plantations.

The surrounding land use will be further investigated and confirmed during the EIA study.

Table 3.1.1: Surrounding Land Use within the vicinity of the project site boundary

Land Use Feature	Distance from Project Site Boundary	Direction from Project Site Boundary
Settlements		
Kg. Serupil	50 m	West
Kg. Bongkol	700 m	South
Kg. Kipahung	800 m	North
Kg. Kandang	600 m	North
Kg. Jambu	1,000 m	South
Kg. Gumpa	500 m	South
Kg. Unkup	1,500 m	South
Kg. Suang Duyang	600 m	North-west
Kg. Maringgan	2,000 m	North-west
Kg. Suang Duyung	2,000 m	East
Others		
Bengkoka Forest Reserve	Within the project site	
Tambalugu Forest Reserve	Within the project site	
Bengkoka Peninsula Forest Reserve (Class V – Mangrove Forest Reserve)	Bordering the project site (Tambalugu Forest Reserve) to the north	
SAFODA Dam	Within the project site (Bengkoka Forest Reserve) on the southern boundary	
Sabah Forestry Development Authority (SAFODA) Area/ Acacia Plantation	Surrounding the project site	
Oil Palm Plantation	Bordering the project site (Bengkoka Forest Reserve) to the south	

3.1.3 Access

The Bengkoka Forest Reserve is accessible off Jalan Mongkubou Laut, approximately 25 km north of Pitas Town, less than a kilometer north of Kg. Bongkol. The Tambalugu Forest Reserve is accessible from Kg. Serupil following existing roads approximately 4 km north-east (**Figure 1.0**).

3.2 Physical Environment Component

3.2.1 Topography

The project site is situated on hilly terrain with predominantly gentle slopes (i.e. < 15°), with most of the area ranging in elevation from approximately 30 m to 90 m AMSL in the Bengkoka Forest Reserve, and slightly lower elevations in the Tambalugu Forest Reserve. Further details will be provided in the EIA report, where a detailed topographical survey plan will be provided.

3.2.2 *Hydrology*

There are a number of rivers and streams within the project site, the majority of which, based on available topography data, are unnamed (**Plate 8-7**). The main rivers in the Bengkoka Forest Reserve are an unnamed river flowing west through the project site out to the South China Sea; Sg. Bonkol flowing south into Sg. Bungai and the Sulu Sea; and the upper reaches/ tributaries of Sg. Karangan; Sg. Bungai; Sg. Tambalugu and Sg. Telaga. Sg. Karangan, Sg. Bungai and Sg. Tambalugu ultimately flow east into the Sulu Sea, whereas Sg. Telaga flows west into the South China Sea.

The main river in the Tambalugu Forest Reserve is an unnamed river flowing north through the project site and into the Sulu Sea.

The main rivers are illustrated on **Figure 1.0**. A detailed survey plan will be provided in the EIA report, showing all rivers and streams.

3.3 Biological Environment Component

3.3.1 *Vegetation and Fauna*

As described in **Section 1.5**, the natural vegetation has given way to invasive *Acacia mangium* and *Acacia sp.*, which now covers the majority of the project site. In some areas the *Acacia mangium* and *Acacia sp.* have been attacked by fungus (*Ceratocystis sp.*) and have also been subjected to numerous wildfires throughout the years, and there are large areas dominated by dead or dying trees (**Plate 8-1** to **Plate 8-2**). In other areas, particularly in the east of the Bengkoka Forest Reserve *Imperata sp.* Grass (lalang) dominates.

There are a number of secondary species interspersed within the Acacia, however these do not form healthy stands. Further details will be provided in the EIA report. There is no indication of any plant species of plant communities of any conservation value within the project site.

Earlier management for land conservation has disregarded the need for riparian reserves and cleared all the way down to the water courses. There are therefore only a few, currently inaccessible, places where there is some natural riparian vegetation.

In terms of fauna the Project Proponent, with the permission of SFD, has undertaken a faunal survey of the Bengkoka Forest Reserve, in October to November 2015. The survey identified numerous species of birds, mammals, reptiles and amphibians. Some of the key mammal species identified included Macaque, Bearded Pig, Deer and Sun Bear. Further details will be provided in the EIA, along with details of the Tambalugu Forest Reserve.

It is also anticipated that the rivers and streams within the site support aquatic life, and are also important as a source of water to terrestrial fauna.

4 Scope of the Environmental Impact Assessment

The scope of the Environmental Impact Assessment (EIA) report is the project activities as described in **Section 2.6** of this TOR.

4.1 Main Environmental Impacts

- Soil Erosion;
- Water Pollution; and
- Waste Generation and Management.

4.2 Other Potential Impacts

- Ecological Impacts;
- Socio-Economic Impacts;
- Fire Hazard;
- Noise and Air Pollution;
- Traffic and Transportation Impacts; and
- Potential Abandonment.

4.3 Scoping Matrix

Table 4.3.1 below outlines the Scoping Matrix for this Project by listing the potential impacts and scoring them according to magnitude, permanence, reversibility and cumulative.

Table 4.3.1: Scoping Matrix of Environmental Issues

Impacts	Magnitude	Permanence	Reversibility	Cumulative
Key Environmental Impacts				
Soil Erosion	2	2	2	2
Water Pollution	2	2	2	2
Waste Generation and Management	2	2	2	2
Other Environmental Impacts				
Ecological Impacts	1	1	1	1
Socio-Economic Impacts	2	1	1	1
Fire Hazard	2	1	1	1
Noise and Air Pollution	2	1	1	1
Traffic and Transportation Impacts	2	1	1	1
Potential Abandonment	1	1	1	1

Legend	Number(s)		
Criteria	**1**	**2**	**3**
Magnitude *Measure of the importance of the condition in relation to spatial boundaries*	Change/effect within project site only	Change/effect to local conditions and/or to areas immediately outside	Regional/national/ international change/effect
Permanence *To define whether the condition is temporary or permanent*	No change/not applicable	Temporary	Permanent
Reversibility *Measure of the control over the effect of the applied condition*	No change/not applicable	Reversible	Irreversible
Cumulative *Measure of whether the effect will be a single effect or a cumulative effect over time or a synergistic effect with other conditions*	No change/not applicable	Non-cumulative/ single	Cumulative

4.4 Zone of Impact

Table 4.4.1 below outlines the Zone of Impact (ZOI) for this Project by listing nearby land use features and identifying how these may potentially be impacted by project activities. The ZOI will be slightly different for each of the identified impacts, as listed in **Section 4.1** and **4.2**; therefore the ZOI is discussed in more detail in **Section 5**, where it is addressed specifically for each different identified impact.

The main ZOI for this Project will be rivers and streams which flow through the project site and any potential downstream water users (**Table 4.4.1**).

Table 4.4.1: Zone of Impact

Zone of Impact	Location and Distance From Project Boundary	Potential Impact From the Project
Rivers and streams	Within the project site	• Soil Erosion • Water Pollution • Waste Generation and Management • Ecological Impacts
SAFODA Dam	Within the project site	• Water Pollution • Waste Generation and Management
Kg. Bongkol	700 m South	• Water Pollution • Socio-Economic Impacts
Kg. Gumpa	500 m South	
Kg. Serupil	50 m West	• Socio-Economic Impacts • Noise and Air Pollution • Fire Hazard • Water Pollution • Traffic and Transportation Impacts • Waste Generation and Management
Bengkoka Forest Reserve (Class II) Flora and Fauna	Within the project site	• Ecological Impacts • Fire Hazard
Tambalugu Forest Reserve (Class II) Flora and Fauna		
Bengkoka Peninsular Mangrove Forest Reserve (Class V)	Bordering the project site (Tambalugu Forest Reserve) to the north	• Ecological Impacts

5 Proposed Methodology for the Assessment Study

5.1 Assessment of Environment Impacts

The potential environmental impacts arising from this proposed project development are summarised in the following tables.

Table 5.1.1: Soil Erosion

Soil Erosion	
Zone of Impact Description	The Project will involve site clearing for the establishment of the Eucalyptus plantation and for the establishment of site facilities and infrastructure. The removal of vegetation will leave the soil surface exposed to erosion, particularly during periods of heavy rain. If no mitigation is implemented, the eroded sediments will be carried by surface run-off down-slope and into the existing rivers and streams on the project site, resulting in water quality deterioration as described in **Table 5.1.2**. Erosion rates will be higher on the slopes within the project site. Soil erosion will result in the loss of very valuable top soil for future planting. The Project Proponent therefore will implement all necessary measures to minimise soil erosion during site clearing, including spreading biomass evenly across the ground to protect the soil surface following clearing. As previously described, terracing will not be implemented on site, therefore it is anticipated that earthwork activities will be minimal, and limited to minor earthwork required for the establishment of site facilities and infrastructure. This will minimise the potential for soil erosion across the project site.
Aim of Mitigation	To minimise and mitigate soil erosion during project development.
Assessment Methodology	• Conduct baseline water quality sampling in the rivers and streams within the project site. • Review of project development/ blocking plan, site layout plan, drainage plan (if any) and rainfall data from the nearest meteorological station (if any). • Discussion with Project Proponent on development concept, methodology and implementation schedule.
References	• National Water Quality Standards for Malaysia (NWQSM). • Guidelines and criteria by SFD, DID and other relevant authorities.
Data/Information Required	• Development/ blocking plan and site layout plan. • Temporary drainage plans (if any). • Implementation schedule. • Photographs of the existing project site conditions. • Baseline water sampling results and rainfall data from the nearest meteorological station (if any).

Table 5.1.2: Water Pollution

Water Pollution	
Zone of Impact Description	As previously described there are a number of rivers and streams within the project site, which flow out to the South China Sea and Sulu Sea. Project development activities have the potential to pollute the water courses within the project site, as follows: • ***Water Pollution from Soil Erosion:*** Site clearing required for the Project will expose the soil surface to erosion, as described in **Table 5.2.1**. Eroded sediments will be carried by surface run-off into the nearest water course resulting in sedimentation. • ***Water Pollution from Waste:*** The indiscriminate disposal of waste into the rivers and streams within the project site will cause significant water pollution. • ***Water Pollution from Leaks and Spills:*** Leaks and spills from machinery involved in the project development may also impact on water quality, if the substances enter the water course. • ***Water Pollution from Agrochemicals:*** Agrochemicals are anticipated to be used during planting and maintenance, particularly to deter weeds and pests. The release of these chemicals into rivers and streams within the project site can lead to water pollution, including increased levels of phosphate and ammonium. Water pollution from the above listed sources can potentially impact on downstream water users. As previously described Kg. Bongkol obtain their water supply from the SAFODA dam located within the project site, therefore pollution of any of the rivers and streams within the dam's catchment area will impact on the villages water supply. It is also noted that Kg. Serupil obtain their water supply from a natural pond within the village (outside the project site boundary), run-off from the project site may carry pollutants into this pond, contaminating the villages water supply. Although it is noted that the pond water is only used for washing, as rainwater is used for consumption. It is noted that other surrounding villages, including Kg. Gumpa, may also utilize water from rivers and streams within their settlement, which originate from the project site. River water is mostly used for washing, while rainwater is used for consumption. This will be investigated further in the EIA report. Water pollution can also impact on aquatic ecology, as described in **Table 5.1.4**.
Aim of Mitigation	To ensure that water pollution generated by site activities is minimized and mitigated.
Assessment Methodology	• Conduct baseline water quality sampling in the rivers and streams within the project site. • Identification and assessment of potential sources of water pollution, and assessment of potential mitigation measures. • Identification of receiving water courses and water bodies. • Identification of downstream water users. • Consultation with relevant stakeholders on downstream water use.
References	• Environmental Quality (Sewage) Regulations 2009. • National Water Quality Standards for Malaysia (NWQSM). • Environmental Quality (Scheduled Waste) Regulations 2005.
Data/Information Required	• Baseline water quality sampling results. • Photographs of project site and receiving water courses. • Information from consultations held.

Table 5.1.3: Waste Generation and Management

Waste Generation and Management	
Zone of Impact Description	The following types of waste will be generated during project development: • Biomass: Biomass generated from site clearing will need to be managed properly to prevent any impact on the environment. The biomass will be left in situ for natural decomposition, either in windrows or spread and crushed over the plantation area. • Solid waste: Solid waste produced during project development will be in the form of general waste from the workers. • Scheduled waste: Oil and grease waste from the maintenance of machinery and equipment on site (if required) will need to be disposed of properly as scheduled waste. • Sewage: Sewage generated from the site office and workers quarters will need to be treated and disposed of properly. The indiscriminate disposal of this waste to land or natural water courses can cause significant pollution. Pollution of the rivers and streams within the site will impact on downstream water users, including Kg. Bongkol via the SAFODA dam, and aquatic ecology. The waste will also be an eye-sore, produce unpleasant odours, promote pest infestations and be a risk to the health and safety of workers on the site and potentially the nearby Kg. Serupil. Improper waste management may also impact on the Bengkoka Peninsular Mangrove Forest Reserve (Class V), which is bordering the project site to the north.
Aim of Mitigation	To ensure that all waste is managed, stored, treated and disposed of properly, according to the applicable regulations for each particular type of waste.
Assessment Methodology	• Conduct baseline water quality sampling in the rivers and streams within the project site. • Assessment of the types of waste to be generated. • Onsite observations with reference to the site layout plan. • Review Project Proponent's waste management plan, if any.
References	• National Water Quality Standards for Malaysia (NWQSM). • Environmental Quality (Sewage) Regulations 2009. • Environmental Quality (Scheduled Waste) Regulations 2005. • Relevant authority requirement including SFD and Health Department.
Data/Information Required	• Baseline water sampling results. • Visual observations and photographs. • Site Layout Plan. • Waste management plan, if any.

Table 5.1.4: Ecological Impacts

Ecological Impact	
Zone of Impact Description	Site clearing will remove the existing flora on the project site, potentially reducing floral diversity in the Bengkoka and Tambalugu Forest Reserves (Class II) and reducing habitat for forest fauna. As previously described however, there is very minimal floral diversity within the project site, with the majority of the project site being covered with invasive *Acacia mangium* and *Acacia sp.*, much of which is diseased and has been ravaged by forest fires. It is also noted that there are no conservation areas, or areas of significant ecological value in terms of flora, within the project site. Previous operations within the project site did not implement proper riparian reserves; therefore Acacia have developed in many areas close the banks of rivers and streams within the project site. As previously described the Project Proponent will create an actively managed, productive forest, with the intention of having a positive impact on site vegetation. The Project Proponent will identify and protect areas where ecological functions could be restored. The Project Proponent intends to enhance conservation areas and riparian zones by introducing indigenous species in order to restore their ecological function. It is anticipated therefore that the Project will have a positive impact on flora within the Bengkoka and Tambalugu Forest Reserves, and by enhancing the riparian zones will also protect aquatic flora and fauna. There is the potential however for project activities to impact on the fauna within the project site. Although the existing vegetation is degraded, it is still home to a number of faunal species. This habitat will be lost during site clearing. It is noted however that project development on a coupe-by-coupe basis will give fauna time to migrate out of the area. Once the project is underway and the flora across the entire project site is enhanced with healthy forest, conservation areas and restored riparian reserves, the forest will provide a better future habitat for fauna, protecting the fauna diversity that already exists and promoting further growth. Any water pollution resulting from project activities, as described in **Table 5.1.2**, will potentially impact on the aquatic flora and fauna in the rivers and streams on site. Sediments in the water column for example can reduce light penetration impacting on photosynthesis in aquatic flora. Sedimentation can also smother any benthic organisms and impact on feeding and breeding grounds. A high level of nutrients in the water from wastes and fertilisers will accelerate the natural process of eutrophication and this phenomenon is usually associated with the negative impact towards the surrounding ecosystem, such as an increase in phytoplankton biomass and the depletion of dissolved oxygen in the water. There is also the potential for downstream ecological impact from water pollution in the Bengkoka Peninsular Mangrove Forest Reserve, as some of the rivers and streams will eventually drain to this area prior to discharging into the Sulu Sea. The ecology within the site is also at risk from fire, as described in **Table 5.1.6**.
Aim of Mitigation	To ensure ecological impacts from the Project are minimised. Possibility of forest connectivity will be proposed for holistic management of ecology, if found relevant and necessary.

Assessment Methodology	• Field observations and consultation with Project Proponent to identify the flora and fauna species in the project area, in particular any protected or endangered species. • Consultation with Sabah Forestry Department and Sabah Wildlife Department on existing flora and fauna within the Bengkoka and Tambalugu Forest Reserves. • Review of previous assessments and studies conducted in the area, including the fauna survey conducted by the Project Proponent. • Discussion with the Project Proponent on the concept for ecological protection and enhancement. • Review of implementation schedule and development/ blocking plan to ensure safe escape route for wildlife, in relation to the surrounding land uses.
References	• Guidelines and criteria accepted by the Sabah Forestry Department, Sabah Wildlife Department, Environment Protection Department (EPD), Department of Environment (DOE) and other relevant authorities.
Data Required	• Field observations. • Previous studies and assessments. • Site implementation schedule, project concept and development/ blocking plan.

Table 5.1.5: Socio-Economic Impacts

Socio-Economic Impacts	
Zone of Impact Description	The following social and economic impacts are anticipated from this Project: • **Air and Noise Pollution:** Kg. Serupil is located within 50 m of the project site boundary. Project activities, particularly site clearing, may generate dust and noise which will be a nuisance to the villagers. Refer to **Table 5.1.7**. • **Impacts on water supply:** As previously discussed water pollution on the project site may impact on downstream water users such as Kg. Bangkol, which obtains water from SAFODA dam located within the project site. Refer to **Table 5.1.2**. • **Traffic and Transportation Impacts:** The Project will utilize Jalan Mongkubou Laut. Kg. Serupil is located along this road and may therefore my impacted by the transportation activities. Refer to **Table 5.1.8**. It is also anticipated that there will be some social and economic benefits to the Project. The Project for example will generate employment and business opportunities, benefiting the local population. In addition the development of a properly managed forest will reduce the risk of fires, which can potentially impact on the local population, and improve the aesthetic value of the forest be removing fire damaged and diseased trees. Appropriate mitigation and monitoring will be recommended to minimise social economic impacts.
Aim of Mitigation	To minimise the adverse socio-economic impacts in the local area.
Assessment Methodology	• Consultation with local authorities and villagers. • Consultation with Project Proponent Community Officer. • Review of community census information obtained by Project Proponent Community Officer for Kg. Serupil. • Field observations.
References	• Individual assessment of impacts with socio-economic consequence. • Community census survey data for Kg. Serupil.
Data/Information Required	• Photographs of the surrounding area, residences, land use etc. • Community census survey data for Kg. Serupil.

Table 5.1.6: Fire Hazard

Fire Hazard	
Zone of Impact Description	As previously described the project site has suffered from forest fires, there is therefore a risk of fire during project development. The risk of fire is particularly great in cleared areas where the ground is exposed and dry. This risk is further multiplied when open burning is practiced, however it should be noted that the Project Proponent will not practice open burning. The impacts from fires are significant. Fire-induced loss of soil-cover and the negative impacts on the hydrological regimes and soil properties, leads to severe soil erosion and loss of productive topsoil. Besides the local impact, forest fires can also have regional and even global environmental impacts. Large-scale forest fires reduce air quality and affect human health. They can also result in the loss of property and lives. Fire within the project site will impact on the existing flora and fauna and potentially the nearby Kg. Serupil. If the fire were to spread it would also impact on adjacent lands such as the Acacia and oil palm plantations. It is anticipated however the implementation of the Project will reduce fire risk in the area, which has been subject to poor management and deterioration. Whilst there may be a risk during site clearing, this will be temporary and overall the implementation of proper management practices within the forest will protect from fires in the long term. The Project Proponent will implement all necessary measures to protect against fires, including the provision of fire breaks (i.e. roads and trenches). All the measures to minimise the risk of fire will be detailed in the EIA report.
Aim of Mitigation	To minimise the risk of fire within the project site.
Assessment Methodology	• Reference to guidelines from the relevant authorities, including Sabah Forestry Department. • Assessment of the potential risk of fire within the project area, through consultation with relevant stakeholders including Sabah Forestry Department. • Consultation with Project Proponent on site layout plan and development/ blocking plan and review of Fire Risk Management Plan (if any).
References	• Guidelines and information from the relevant authorities. • Fire Risk Management Plan (if any).
Data/Information Required	• Fire Risk Management Plan (if any). • Site layout and development/ blocking plan.

Table 5.1.7: Noise and Air Pollution

Noise and Air Pollution	
Zone of Impact Description	During project development there will be some generation of dust and noise from site clearing activities. There are no residential areas within the project site, however Kg. Serupil is located 50 m west of the project site boundary, and along the access road. The village may therefore be impacted by dust and noise generated on the project site. There is also the potential for air pollution on a local and regional scale from forest fires, as per **Table 5.1.6**.
Aim of Mitigation	To control and minimise noise and dust impact on the surrounding areas.
Assessment Methodology	• Conduct baseline noise level monitoring (L_{eq}, L_{min}, L_{max} etc.) at the nearest receptor, i.e. Kg. Serupil. • Conduct baseline air sampling for Total Suspended Particulates (TSP) at the nearest receptor, i.e. Kg. Serupil. • Assessment of acceptable noise levels at the nearest receptor. • Assessment of prevailing wind direction and wind speed to assess likely zone of impact from particulates.
References	• DOE Planning Guidelines for Environmental Noise Limits and Controls, 2007. • Malaysian Ambient Air Quality Guidelines. • Meteorological data.
Data/Information Required	• Baseline noise level monitoring results. • Baseline air quality monitoring results. • Prevailing wind direction. • Site clearing plans.

Table 5.1.8: Traffic and Transportation Impacts

Traffic and Transportation Impacts	
Zone of Impact Description	The transportation activities associated with the Project, including the transportation of equipment, machinery, workers and construction materials to the site during site preparation, and transportation during harvesting, will potentially increase traffic flow along existing access roads including Jalan Mongkubou Laut. Jalan Mongkubau Laut is a gravel road within the Project site, and also passes through Kg. Serupil. The following impacts are anticipated from transportation activities: • Increase traffic flow leading to traffic congestion along existing access roads including Jalan Mongkubau Laut, impacting on other road users such as residents of Kg. Serupil. • Increase traffic congestion may lead to an increased risk of road traffic accidents. • The movement of heavy vehicles may damage the existing road surface. Proper mitigation measures will be implemented to minimise impacts from traffic and transportation.
Aim of Mitigation	To minimise impacts caused by traffic and transportation activities associated with the Project.
Assessment Methodology	• Observations of existing traffic conditions, road conditions and traffic signs. • Review/ assessment of proposed transportation routes and proposed road network within the project site.
References	• Local authority requirements and consultation including Pitas District Office and JKR.
Data/Information Required	• Visual observations and photographs of existing access route and traffic conditions. • Proposed road network plan and transportation route. • Project implementation schedule.

Table 5.1.9: Potential Abandonment

Potential Abandonment	
Zone of Impact Description	Abandonment can occur at any stage of the Project. It may take place if it is deemed that the Project is no longer economically, environmentally of socially sustainable. The environmental impact from project abandonment will depend on what stage the Project is abandoned. If the Project is abandoned following site clearing, for example, then areas of the project site may be left in an exposed and degraded state, which may result in soil erosion, a reduction in soil quality and water pollution through sedimentation. This may also lead to further Acacia invasion and the potential for forest fires. If the Project is abandoned in other stages, planting/ operation, the site will also decline further into a degraded state. When the Project is abandoned, a restoration programme shall be executed to ensure that the site is left in a stable condition where environmental impact is minimal, and ensure the suitability of the project site for future use.
Aim of Mitigation	To minimise the potential impacts in the event of project abandonment.
Assessment Methodology	• Onsite observations with reference to the development/ blocking plan and site layout plan. • Review of Forest Management Plan (FMP) and any potential future land use plans. • Consultation with relevant stakeholders, including Sabah Forestry Department and Project Proponent to ensure the area is rehabilitated accordingly for future land use.
References	• Criteria and guidelines accepted by approving local authorities.
Data/Information Required	• Photographs of the existing site conditions. • Development/ blocking plan. • Site layout plan. • Forest Management Plan (FMP).

5.2 Plan Adjustment and Mitigation

Wherever possible, measures will be proposed to avoid or minimise detrimental environmental impacts originating from the project activities. These measures shall be seen as proposals for changes to the original plan in order to bring this in line with the objectives of sustainable use of resources as well as corporate responsibility and citizenship.

Where residual, negative impact is unavoidable, measures to mitigate or compensate losses or inconveniencies will be proposed.

Activities and measures for improved environmental and social management and mitigation shall be formulated in an operational form, i.e. in an environmental management plan. If necessary, this plan may include organisational requirements.

5.3 Proposed Monitoring Programmes

The impact assessment will identify indicators for the project's impact on the environment. Other indicators will be identified for compliance with the Agreement of Environmental Conditions, i.e. the environmental management plan.

Indicators will be quantitative as well as qualitative, objectively verifiable and they shall relate to place (geo-referencing) and time.

A monitoring system, which allows monitoring information to be included in government system will be devised. Monitoring shall cover impact monitoring as well as compliance monitoring. To each monitoring parameter and monitoring site, an initial set of base-line data will be provided from the description of the existing environment.

Monitoring parameters, sites, scope and frequency may change during the lifespan of the Project. This will be addressed in the monitoring plan.

6 Data Collection

6.1 Description of the Project Plan

6.1.1 Physical Project Results

The project location, size, layout and concept will be obtained from the Project Proponent.

6.1.2 Technologies and Methodologies

The methods that will be used during Project activities will be obtained from the Project Proponent.

6.1.3 Project Policies

The Project Proponent does not have any social or environmental policies of his own regarding the proposed project. However, the Project Proponent will comply with the relevant guidelines from the local authorities in order to minimize the environment impact resulting from the project activities.

6.2 Baseline Environmental Data

6.2.1 Physical Environment

6.2.1.1 Climate

Meteorological data for the project site will be obtained from the Malaysian Meteorological Services Department, for the nearest meteorological station at Pitas.

6.2.1.2 Soil

The geological and soil characteristics of the project site will be obtained from the Geological Map of Sabah, Third Edition 1985, and the Soils of Sabah Map, respectively.

6.2.1.3 Topography

The detailed site survey plan will be obtained from the Project Proponent.

6.2.1.4 Hydrology

Hydrological features of the project site will be obtained from the detailed site survey plan provided by the Project Proponent, with reference to the topographical map published by JUPEM.

6.2.1.5 Water Quality

Baseline water quality sampling will be conducted in the rivers and streams within the project site or downstream of the project site. The proposed locations are illustrated on **Figure 1.0**. Baseline water samples will be tested *in-situ* for dissolved oxygen (DO), pH and temperature. Samples will also be sent to a SAMM accredited laboratory to test for Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), Turbidity, Ammoniacal Nitrogen, Oil and Grease, Total Coliform Count, Faecal Coliform Count, Paraquat, Glyphosate, Aminomethylphosphonic Acid and Methamidophos.

6.2.1.6 Air Quality

Baseline air quality sampling for Total Suspended Particulates (TSP) will be conducted at the nearest receptor to the project site, i.e. Kg. Serupil. The proposed location is illustrated on **Figure 1.0**. The equipment that will be used for this sampling is an Ambient Air Sampler (Tisch Environmental Model: TE 5005), for a period of 24 hours.

6.2.1.7 Noise Level

Baseline noise level monitoring will be conducted in the same location as baseline air sampling, i.e. Kg. Serupil. Monitoring will be using a Sound Level Meter, Cirrus research (model CR 261) for a period of 24-hours.

6.2.2 Biological Environment

6.2.2.1 Flora and Fauna

The assessment of the existing biological environment within the project site will be made based on site observations and consultation with the Project Proponent, subject matter experts and relevant government agencies. The Project Proponent has conducted a faunal survey within the Bengkoka Forest Reserve in October and November 2015, with the permission of SFD, this will be incorporated into the EIA report. Secondary information in the form of previous assessments of the area will also be referred where applicable.

6.2.3 Socio-Economic Environment

The socio-economic environment shall be described based on the existence of human settlements surrounding the project site and downstream of existing rivers within the project site, and through consultation with the Project Proponent and relevant stakeholders.

The Project Proponent has undertaken a community census survey with the nearest settlement to the project site, i.e. Kg. Serupil, this will be incorporated into the EIA report. Relevant stakeholders will also be engaged to determine if any of the villages located downstream of the rivers and streams within the project site, including Kg. Bongkol, use the river water, and for what purpose. A full socio-economic survey of the other villages in the area surrounding the project site is not deemed necessary.

6.2.3.1 Public Administration

The information concerning public administration can be obtained via government website as well as correspondence with the local authorities.

6.2.3.2 Land Use

Information on land use within the anticipated zone of impact for the proposed project site will be obtained from site investigation and with reference to Google Earth and through consultation with relevant stakeholders.

6.2.3.3 Main Economic Activities

The main economic activities surrounding the proposed project site will be surveyed through site investigation. This will also include consultation with relevant stakeholders.

6.3 Consultation with Relevant Authorities

Discussions and meetings will be held with relevant Government agencies, particularly with the authorities involved in the approval of the EIA report. The main aim of the meetings will be to determine the concerns of these departments/ agencies so that these can be addressed in the EIA report. This includes consultation with (not necessary limited to) the:

- Sabah Forestry Department;
- Sabah Wildlife Department;
- Environment Protection Department (EPD);
- Department of Environment (DOE);
- Department of Irrigation and Drainage (DID);
- Pitas District Office;
- Town and Regional Planning Department;
- Lands and Surveys Department;
- Public Works Department; and
- Others.

6.4 References and Guidelines

The EIA study and report shall be undertaken in accordance to the guidelines issued by the Environment Protection Department (EPD) and the Department of Environment (DOE). These include:

a) ***Handbook for Environmental Impact Assessment (EIA) in Sabah*** published by Environment Protection Department, November 2005.

b) ***A Handbook of EIA Guidelines*** published by the Department of Environment, 1995.

c) ***Environmental Impact Assessment (EIA) Guidelines for logging and forest clearance activities*** published by Environment Protection Department, January 2002.

6.5 Scoping Activities Undertaken

6.5.1 Data Collection / Site Visit

Data collection for scoping includes observations of existing site conditions, hydrological features, ecological environment and surrounding land use, and discussions with the Project Proponent on the overall project concept. The preliminary site visit was conducted on the 16th to 17th December 2015.

7 Work Programme and Schedule for the Environmental Impact Assessment

The activities and schedule for the EIA study is shown below in **Table 7.1.1**.

Table 7.1.1: EIA Work Schedule

Activity	Tentative Date
Appointment and Mobilisation	09/11/15
Data Procurement and Collation	09/11/15 – 04/02/16
Submission of Terms of Reference to EPD and the Project Proponent	04/02/16
Field Work	16/12/15 – 17/12/15
Laboratory Analysis	17/12/15 – 15/01/16
Data Analysis and interpretation	15/01/16 – 04/02/16
Report Drafting	04/02/16 – 19/02/16
Submission of Draft EIA Report to the Project Proponent	19/02/16
Review with Project Proponent	23/02/16
Submission of Final EIA Report to EPD	29/02/16

8 Plates

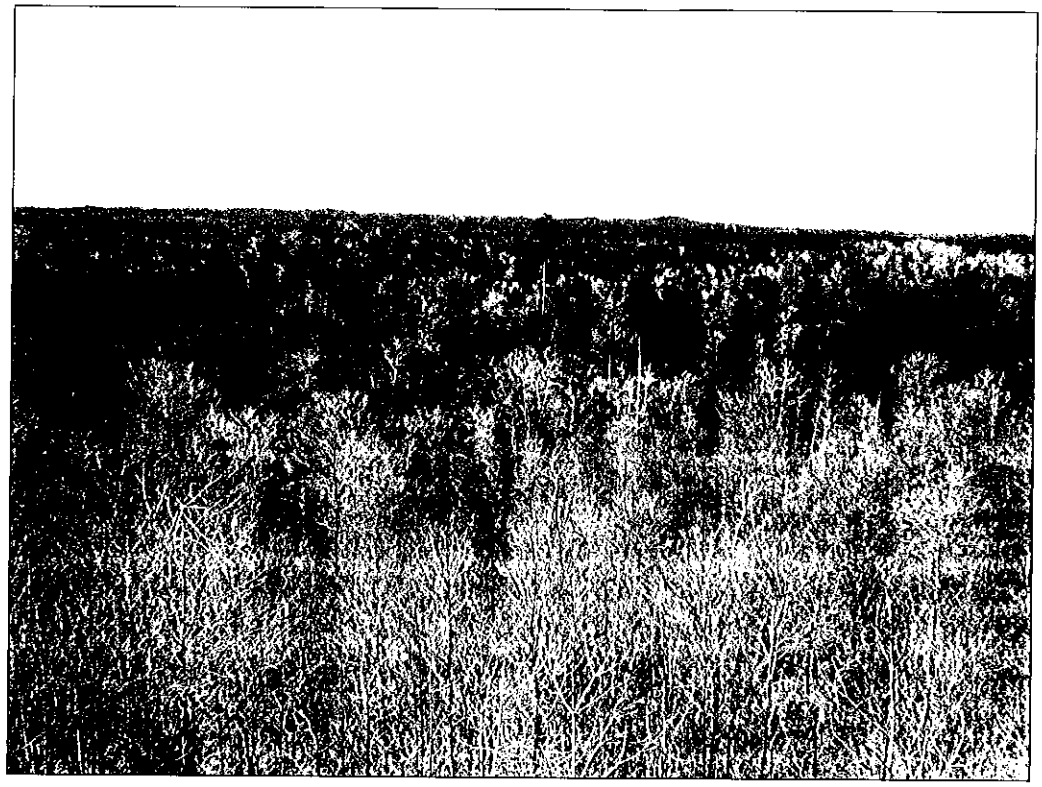


Plate 8-1: Fire damaged invasive *Acacia mangium* and *Acacia sp.* within the project site (western half of Bengkoka Forest Reserve).

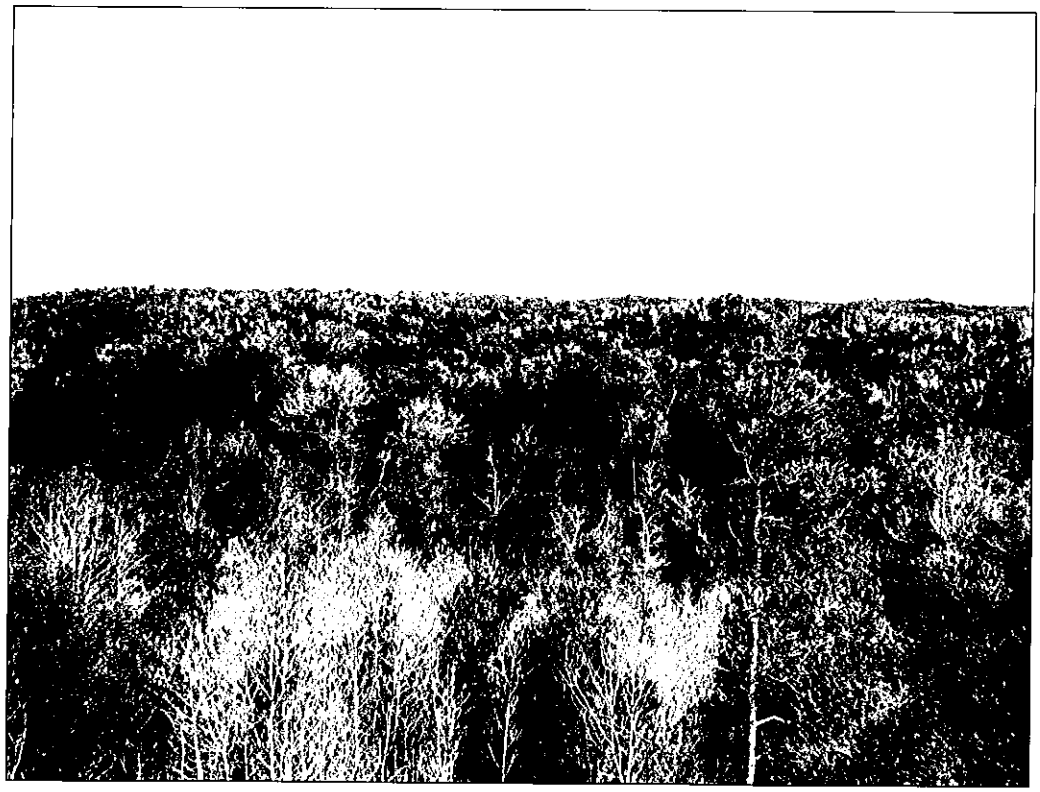


Plate 8-2: Invasive *Acacia mangium* and *Acacia sp.* with fungus (*Ceratocystis sp.*) (Bengkoka Forest Reserve).

Plate 8-3: Kg. Serupil, located 50 m west of the project site boundary.

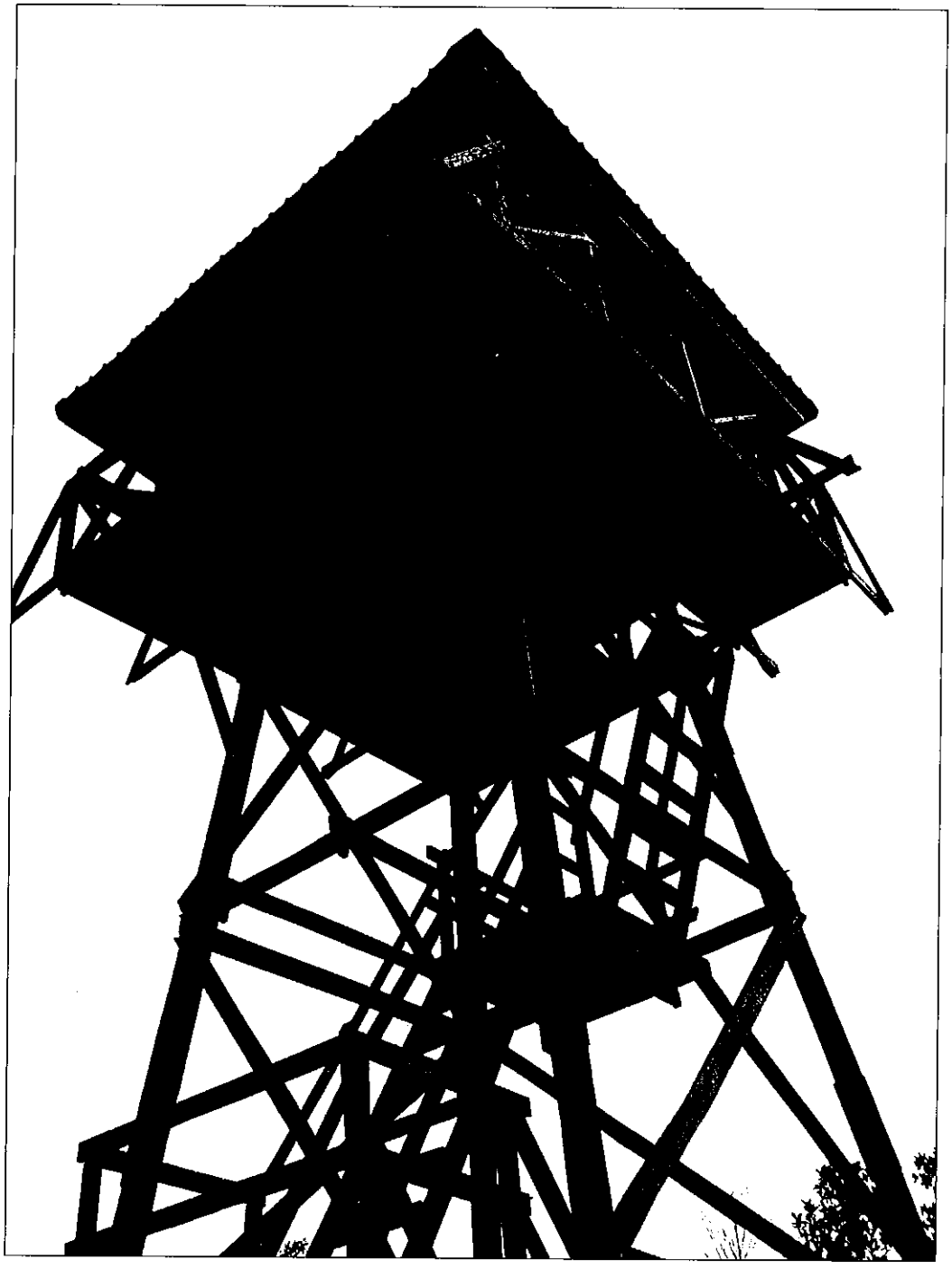


Plate 8-4: Existing fire watch tower within the project site at N06°52'13.6", E117°07'54.9" (Bengkoka Forest Reserve).

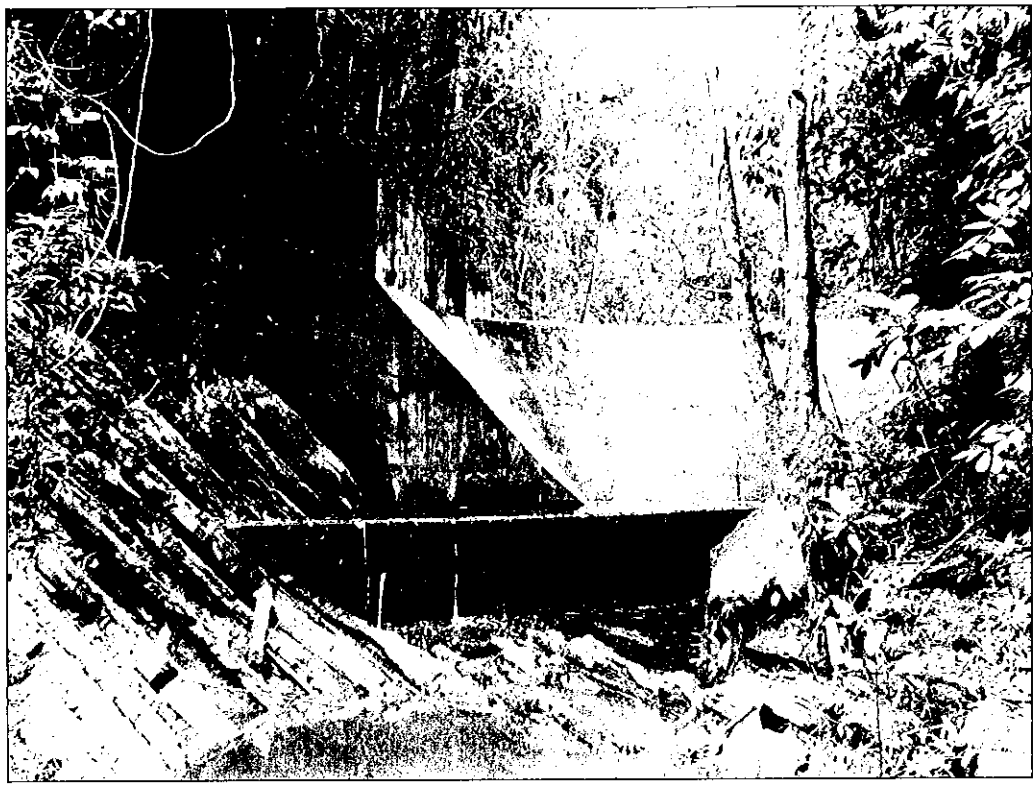


Plate 8-5: SAFODA dam within the project site at N06°50'31.8", E117°09'19.3" (Bengkoka Forest Reserve).

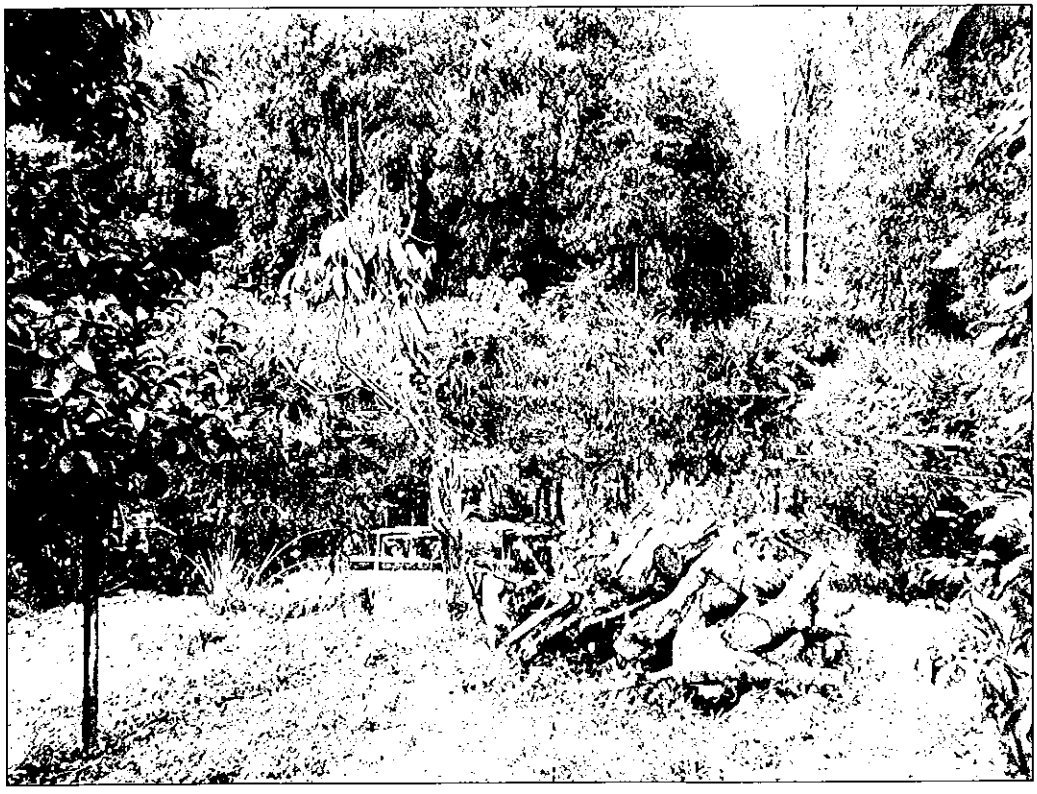


Plate 8-6: Natural pond at Kg. Serupil.

Plate 8-7: Existing stream within the project site (Bengkoka Forest Reserve).

Appendix 1. Consultant Registration Certificates

JABATAN PERLINDUNGAN ALAM SEKITAR NEGERI SABAH

SIJIL AMALAN

No. Pendaftaran : F001

Selaras dengan peruntukan di bawah Kaedah-Kaedah Perlindungan Alam Sekitar (Pendaftaran Perunding Alam Sekitar) 2005

Dengan ini diperakukan

CHEMSAIN KONSULTANT SDN. BHD.

Adalah perunding alam sekitar yang berdaftar dengan Jabatan Perlindungan Alam Sekitar Negeri Sabah dalam menjalankan Kajian Penilaian Kesan Alam Sekitar (EIA)

Tempoh sah : **01 Oktober 2014 hingga 30 September 2016**

.....

DATUK YABI YANGKAT
Pengarah
Jabatan Perlindungan Alam Sekitar Negeri Sabah

JABATAN PERLINDUNGAN ALAM SEKITAR NEGERI SABAH

SIJIL AMALAN

No. Pendaftaran : S0187

Selaras dengan peruntukan di bawah Kaedah-Kaedah Perlindungan Alam Sekitar (Pendaftaran Perunding Alam Sekitar) 2005

Dengan ini diperakukan

EIVIND OLUF KOFOD (P:200973314)

Adalah pakar yang berdaftar dengan Jabatan Perlindungan Alam Sekitar Negeri Sabah dalam menjalankan Kajian Penilaian Kesan Alam Sekitar (EIA)

Bidang Kepakaran : **Forestry**

Tempoh sah : **08 Februari 2015 hingga 07 Februari 2017**

.....

DATUK YABI YANGKAT
Pengarah
Jabatan Perlindungan Alam Sekitar Negeri Sabah

JABATAN PERLINDUNGAN ALAM SEKITAR NEGERI SABAH

SIJIL AMALAN

No. Pendaftaran : S0186

Selaras dengan peruntukan di bawah Kaedah-Kaedah Perlindungan Alam Sekitar (Pendaftaran Perunding Alam Sekitar) 2005

Dengan ini diperakukan

JOYCE CHIN FUI FUN (KP:830717-12-5154)

Adalah pakar yang berdaftar dengan Jabatan Perlindungan Alam Sekitar Negeri Sabah dalam menjalankan Kajian Penilaian Kesan Alam Sekitar (EIA)

Bidang Kepakaran : **Waste Management & Chemical Processes**

Tempoh sah : **08 Februari 2015 hingga 07 Februari 2017**

.....

DATUK YABI YANGKAT
Pengarah
Jabatan Perlindungan Alam Sekitar Negeri Sabah

JABATAN PERLINDUNGAN ALAM SEKITAR NEGERI SABAH

SIJIL AMALAN

No. Pendaftaran : S0008

Selaras dengan peruntukan di bawah Kaedah-Kaedah Perlindungan Alam Sekitar (Pendaftaran Perunding Alam Sekitar) 2005

Dengan ini diperakukan

REBECCA POONG TCHU FOH (KP:760609-12-5164)

Adalah pakar yang berdaftar dengan Jabatan Perlindungan Alam Sekitar Negeri Sabah dalam menjalankan Kajian Penilaian Kesan Alam Sekitar (EIA)

Bidang Kepakaran : **Land Use**

Tempoh sah : **01 Oktober 2014 hingga 30 September 2016**

.....

YABI YANGKAT
Pengarah
Jabatan Perlindungan Alam Sekitar Negeri Sabah

JABATAN PERLINDUNGAN ALAM SEKITAR NEGERI SABAH

SIJIL AMALAN

No. Pendaftaran : S0136

Selaras dengan peruntukan di bawah Kaedah-Kaedah Perlindungan Alam Sekitar (Pendaftaran Perunding Alam Sekitar) 2005

Dengan ini diperakukan

LEE KUOK CHIANG (KP:800703-13-5119)

Adalah pakar yang berdaftar dengan Jabatan Perlindungan Alam Sekitar Negeri Sabah dalam menjalankan Kajian Penilaian Kesan Alam Sekitar (EIA)

Bidang Kepakaran : **Hydrology**

Tempoh sah : **21 Mei 2015 hingga 20 Mei 2017**

.....

DATUK YABI YANGKAT
Pengarah
Jabatan Perlindungan Alam Sekitar Negeri Sabah

JABATAN PERLINDUNGAN ALAM SEKITAR NEGERI SABAH

SIJIL AMALAN

No. Pendaftaran : S0155

Selaras dengan peruntukan di bawah Kaedah-Kaedah Perlindungan Alam Sekitar (Pendaftaran Perunding Alam Sekitar) 2005

Dengan ini diperakukan

CYRIL BIN JINUSIE (KP: 780902-12-5081)

Adalah pakar yang berdaftar dengan Jabatan Perlindungan Alam Sekitar Negeri Sabah dalam menjalankan Kajian Penilaian Kesan Alam Sekitar (EIA)

Bidang Kepakaran : **Scheduled Waste Management, Air & Water Quality**

Tempoh sah : **19 November 2014 hingga 18 November 2016**

.....

JAMMY GABRIEL
Timbalan Pengarah
Jabatan Perlindungan Alam Sekitar Negeri Sabah

Appendix 3. Site Assessment Report

Site Assessment Report

Table below summarised the activities that were carried out during the preliminary site visit.

Travelling Mode	
From Office to project site	Land transport
At the site	Land transport
Duration of Site Visit	2 days
Data Collection	
Physical Environment	The project site is in a deteriorating state due to previous overexploitation, lack of management, forest fire, droughts and disease. The natural vegetation has given way to invasive *Acacia mangium* and *Acacia sp.*, which is dominating large areas of the project site. In some areas the *Acacia mangium* and *Acacia sp.* has been attacked by disease and fires. The project site is situated on hilly terrain with predominantly gentle slopes (i.e. < 15°), whereby most of the area ranging in elevation from approximately 30 m to 90 m AMSL, with lower elevation areas in the Tambalugu Forest Reserve. There are a number of rivers and streams within the project site, flowing out of the site to the north, south, east and west to the South China and Sulu Sea.
Human Environment	There are no settlements within the project site. There are however a number of settlements located in the vicinity of the project site, the closest of which is Kg. Serupil (50 m west of the project site boundary).
Biological Environment	The natural vegetation has given way to invasive *Acacia mangium* and *Acacia sp.*, which now covers the majority of the project site. There are a number of secondary species interspersed within the Acacia; however these are not known to be protected or endangered species. In terms of fauna the Project Proponent, with the permission of SFD, has undertaken a faunal survey of the Bengkoka Forest Reserve. The survey identified numerous species of birds, mammals, reptiles and amphibians. It is also anticipated that the rivers and streams within the site support aquatic life, and are also important as a source of water to terrestrial fauna.

Name of Consultant's Team : Mr. Richard Rhodes, Mr. Vivian Lojuki, Mr. Brian Hannis
Date of Site Visit : 16th to 17th December 2015
Project Proponent Contact : Mr. Clive Scheepers, Mr. Parasul