



Syarikat Samling Timber Sdn Bhd
A member of Samling Group of Companies

PUBLIC SUMMARY

Forest Plantation Management Plan

For SEGAN Industrial Tree Plantation LPF/0014

1st July 2023 to 31st October 2033

Warning: This Public Summary is presented here only for the purpose of complying with the requirements of the Malaysian Timber Certification Scheme and the associated standard MTCS ST 1002:2021

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Yap Fui Fook
Chief Operating Officer

1.Related Documents and Systems

There are numerous the related documents and systems used in the management of the Segan LPF. These are listed in the Document Register held in the Segan LPF office.

2.The Company

Segan Licensed Planted Forest (SEGAN) is an industrial tree plantation (ITP) operating under a government licence (LPF/0014) held by Syarikat Samling Timber Sdn Bhd (SST) – a forestry and forest products manufacturing company. Samling Reforestation (Bintulu) Sdn. Bhd. (SRB) is the contracting company engaged to undertake all reforestation work in SEGAN. SST and SRB, both members of the Samling Group which is head-quartered in Miri, the largest city in the north of the State of Sarawak, East Malaysia, are jointly referred to here as Samling.

Samling aims to produce an economically sustainable supply of logs from the SEGAN ITP which will help to support its downstream wood processing activities – plywood, sawn timber, fibre board, furniture components and wood pellets – located in Bintulu.

Samling is an equal opportunity employer that operates an active safety and health management system.

Samling also recognises the value of, and the importance of, its environmental and social responsibilities.

3. Malaysian Timber Certification Scheme (MTCS)

3.1 Our Commitment

Samling is committed to develop and conform to the principle of sustainability on all forested land and potentially forested land held under LPF/0014 and, in so doing, to comply with the Malaysian Criteria & Indicators for Forest Plantation Management Certification – the MC&I ST 1002:2021 (SFM) of the Malaysian Timber Certification Council (MTCC). It is intended that the ethos of MTCS compliance should be embedded in SEGAN’s management culture.

Certification of forest plantation management - and therefore of the plantation logs produced for in-house processing – is very important to the future of Samling. It creates potential marketing and economic advantages for its wood-based products and, more importantly, it will help ensure that management of its resources is carried out under MTCS principles thereby helping to ensure sustainability.

3.2 Certification Requirements

The MTCS requires:

1. Practicing the guidelines and requirements set out by the nine principles of the MTCS.
2. Developing a sound policy base derived from the nine principles and ensuring they are communicated and followed in the workplace.
3. Developing open lines of communication involving employees and stakeholders in the development of economically sustainable forest plantation management practices.
4. Using best practice guidelines in its management regimes. This includes the implementation and continued use of sound, proven and economically viable forest plantation management, environmental, financial and social practices that protect the sustainability of the resources

3.3 Certification Status

SEGAN was successfully audited for compliance with the MTCS by SIRIM QAS International Sdn Bhd in December 2013 with SIRIM's Certificate for Forest Management (Forest Plantation) No. FPMC 0002 being issued on 18 July 2014. (It should be noted that the delay between the audit and issuing the certificate was not due to any problems in implementing the MTCS at Segan.)

The first surveillance audit was carried out by SIRIM QAS International Sdn Bhd on 22-24 October 2014.

The first recertification audit was carried out by SIRIM QAS International Sdn Bhd on 2nd December 2016. The new certificate was issued on 16th June (sic) 2017 with expiry on 17th July 2020.

The second recertification audit was carried out by SIRIM QAS International Sdn Bhd on 21st February 2020. The new certificate was issued on 16th July 2020 with expiry on 17th July 2025.

The third recertification audit was carried out by SIRIM QAS International Sdn Bhd on 14th January 2025. The new certificate was issued on 18th April 2025 with expiry on 17th July 2030.

4. Forest Plantation Management

4.1 Statutory Framework

In the main the most recent legislation that effects ITP and environmental management is contained within the Forest (Planted Forests) Rules, 1997 and the Natural Resources and Environment Ordinance, 1993 (Cap. 84).

The outcomes should always adhere to the principle of sustainable ITP management and are controlled in companies such as Samling by the use of these documents as resource consents. These two pieces of legislation therefore act as a method of controlling adverse management effects.

Numerous other Acts and Regulations form the basis of forest plantation management practices at Segan LPF. These are listed in the Document Register held in the Segan LPF office.

SST's legal department will advise SEGAN of relevant changes in existing legislation and of new legislation as appropriate.

SEGAN keeps "hard" copies of legislation key to its business and management practices on site in the Segan office and at the Miri HQ. In some cases, the legislation is held in PDF format where hard copies are not available. However, amendments to legislation are relatively frequent and there is access to up-to-date acts of parliament through the internet. (Full copies of these acts of parliament may be found at www.agc.gov.my and www.federalgazette.agc.gov.my.)

4.2 Forest Plantation Management Objectives

The forest management objective was originally the economic production of pulpwood. Some 3-4 years after planting started this was changed to the **economic production of logs for supply to Samling downstream**. This supply is primarily for solid use, i.e., peeler logs and saw logs with logs unsuited to these purposes chipped (for in-house fibre board manufacture). This still remains the primary objective. However, in achieving this primary objective there are several important supplementary objectives. These are listed below, not in any order of priority:

- maintain the ecological productivity of the ITP – thereby assist to maintain the value of the forest services.
- ensure a sustainable level of log production at the group level.

- conduct forestry operations in a manner that does not impact negatively on the wellbeing of those people living within and nearby the LPF;
- safeguard the environment of the LPF - thereby assist to maintain the value of the forest services.
- ensure that natural forest areas are protected from human interference in any Conservation Area SMZs; and
- to minimise harvest waste.

4.3 Forest Plantation Management Strategy

SST uses the MTCS principles and criteria to formulate the management strategy for SEGAN to be employed in achieving the objectives set out above.

As clearly stated in the EIA the natural forest on both the peat and mineral soils has a long history of repeated heavy harvesting. This heavy harvesting gave rise to a residual forest with few attributes of the original natural forest. The ITP was established in areas allocated and controlled by the Forest Department by means of their Permit to Enter Coupe (PEC) system. Areas approved for planting were completely cleared of the above-mentioned residual forest. Chip logs were salvaged when economically feasible and sent to the Samling HDF door skin plant in Bintulu.

Special Management Zones (SMZ) have been, and continue to be, identified. The SMZs invariably contain residual forest which, as it is protected within the SMZ, has a protective function and contributes to the conservation and enhancement of the LPF’s bio-diversity. To date the area under SMZs has increased a little to almost 16% of the total forested area of the LPF.

SST also recognises the importance and significance of international agreements in its management. It will give governing authorities as much cooperation as possible to enforce the regulations of such agreements.

The text of these agreements and conventions can also be accessed through some excellent websites dedicated specifically to them or through association with Sarawak government departments such as that of the Natural Resources and Environment Board (NREB).

4.4 Special Management Zones (SMZs)

4.4.1 Zone types occurring in SEGAN

SMZs are generally, but not necessarily, those areas of heavily harvested natural forest (now described as residual forest) which do not form a part of the ITP planted area for reasons other than being designated as SA (shifting agriculture) or under land claim. R&D areas, although under special management, are within the ITP management area. Within Sarawak there are a number of possible zone types but only those listed in Table 4.1 below have been identified as occurring within SEGAN to date. The two burial sites mentioned in the EIA are both outside the licence area. The salt lick referred to in the EIA was said to be outside the licence area and consultation of local knowledge unfortunately failed to confirm its existence.

Table 4.1: Special Management Zones (SMZs) occurring within SEGAN

Zone Types
River buffer (RBZ) - mandatory; to EIA prescribed widths determined by the water course width
Swampy (mineral soil)
Rocky (skeletal soils)
Steep areas >35° – mandatory as TCIV; upper slopes (i.e. outside river buffers)
Gulley - steep riverside areas outside the mandatory buffer zone

Conservation – including areas which might be voluntarily designated as such and which otherwise might have been planted

A zone type may be mandatory, e.g., a river buffer zone must be established along all permanent water courses – see Table 4.2 – and steep areas of 35° or more must not be cleared for planting. Elective zone types are those where, for example, at the manager’s discretion a wildlife corridor has been demarcated on otherwise plantable land. This would be classed as a conservation area. And there are ‘Hobson’s choice’ zone types where the physical characteristics of the site preclude the option of planting, e.g., marshland and skeletal soils and steep and /or rocky areas. In reality all the above SMZs are effectively conservation areas in which NTFPs may be collected but where encroachment is prohibited. When a case of encroachment cannot be satisfactorily resolved in discussion with those involved then a report must be made to the relevant government agencies.

Table 4.2: Recommended Widths for River Buffer Zones

Width of Water Course (m)	Width of River Buffer Zone (m)
40	50
20 - 40	40
10 - 20	20
5 - 10	10
<5	5

Source: Table 4. SEGAN EIA 2000, Ecosol Consultancy Sdn Bhd

The types are not mutually exclusive: e.g., a river buffer may contain marshland or even steep areas. By virtue of being demarcated on the ground, GPSd and mapped and then protected from most human activity, SMZs, of whatever type, play a role in the conservation of SEGAN’s bio-diversity.

The North Block comprises mainly peat soils dominated by the Anderson Series that gave rise to the mixed peat swamp forest the once dominated much of the area. The vegetation of significant lengths of the river buffer zones along the four boundary forming rivers, viz. Btg Kemana, Sg. Binai, Sg. Segan and Sg. Sebas, and of Sg Silas, are more or less pure nipah palm (*Nypa fructicans*). Nipah provides a valuable breeding ground for a number of aquatic species and also yields NTFPs (sugar, salt and attap). However, it should be noted that, although an inspection carried out by SEGAN staff in revealed almost no incursion into the buffer zones of the above rivers (apart from the true right bank of Sg Segan) numerous, contiguous small parcels of titled land have been granted over much of the river bank areas. SST is unable to demarcate river buffer zone boundaries in such circumstances. The alienated land, most of which was unoccupied at the time of inspection, also appears to extend into Segan F.R...

4.4.2 Management of SMZs

The major SMZ type is that of the river buffer zone (RBZ) which represents almost 10% of the gross LPF area. (This represents a slight increase – a direct result of improved management.) However, the guiding management principles are common to all SMZs that are currently identified in SEGAN.

The zones are first identified and then demarcated on the ground. Although they must still be demarcated, the boundaries of steep areas, skeletal soils and marshland are more or less self-defining whilst the boundaries of river buffers must be carefully located to ensure compliance. Once clearly demarcated on the ground all SMZs are protected and, apart from the felling and extraction of any planted merchantable exotic trees and access by local people for traditional purposes (and

such use is negligible), there should be no human activity within them. However, incursion can and does take place but most in cases management does not have the authority to take any action and can only make an official report to the relevant government agency.

Where mangium (or any other exotic ITP species) was originally planted in the RBZ the intention is to remove it with minimum damage leaving the residual vegetation to recover and to continue to develop over the ensuing years. The removal of the exotics can be considered as assisting the natural process of recovery and reversion. When extracting the planted trees entry into the RBZ by machinery, other than for chain saws, is prohibited. A contractor who transgresses may be fined RM5,000.00 should he allow machinery to enter the SMZ and RM100.00 for any indigenous tree deemed to have been damaged within the zone.

Following demarcation and the removal of any merchantable exotic trees, no further invasive action in these zones is allowed. This protection will allow the SMZs to develop in structure and biodiversity. (The change of these two attributes over time is monitored by means of the PSPs established by the Department of Forest Science of UPM, Bintulu.)

4.4.3 Natural Forest Areas

About 15% of the LPF area is natural forest, with most (7%) of it in the RBZs. Almost all, if not all, these areas of natural forest have been harvested at varying intensities and without doubt the structure of what was primary forest has been changed, in varying degrees, as a result. Whilst it is certain that most of the larger, merchantable trees will have been removed (harvested), the change in frequency and abundance of a particular species will never be known as a base line was never established. However, from empirical evidence, both casual and documented, it is known with certainty that the forest structure will recover – given time; a *Shorea bracteolata* sapling requires an unknown number of, but certainly many, decades to reach a not unusual DBH of, say, 130 cm. Clearly, for these residual areas to recover to a state resembling primary forest in terms of structure requires time. Time is assured by providing protection and not by intervention. Designation as an SMZ should ensure protection for the validity of the LPF licence. Areas within SMZs that might be considered to be heavily degraded will also be left to recover without human intervention. Such areas add additional pools of biodiversity for both the LPF's flora and its fauna as the structure and species composition (of both flora and fauna) change over the undoubtedly lengthy process of recovery and reversion.

5 Resource Description

5.1 History

Segan North comprising almost entirely shallow peat soils was logged many years ago under various timber licences. The last of these licences -T/0103 and T/0119 - expired in July and June 1999 respectively.

This history of heavy logging no doubt led the authors of the EIA report dated June 1999, to conclude of the North Block: "...Due to past heavy logging, the forest is no more intact with remnants of mostly medium sized trees occurring in patches..." (EIA Report, C3-21).

Along parts of the rivers of Segan North (Btg Kemena, Sg Segan and Sg Silas) there is a mosaic of alienated land. Given that the greater part of the alienated land is on what should be river buffer zone, or is SA, there are no direct consequences arising from this alienation for the management of the LPF.

In both Segan West and Segan East the commercial content of the mixed dipterocarp forest (MDF) that once comprised almost all of the original vegetation was extracted many years ago under various

timber licences: T/0143, T/0283 and T/4148. Apart from the small areas yet to be brought under ITP, there are heavily disturbed MDF remnants within SMZs - in conservation areas, river buffer zones, steep areas and on the fringes of swampy mineral soil areas. By far the largest licensed area was T/0283 issued to Limbang Trading (Bintulu) Sdn Bhd in 1980. This is a related company which ceased operations, in what was to become the LPF area, in 2000. (The licence expired subsequently.) Two other licences, (T/0143 and T/4148) issued over parts of what became the LPF, both expired prior to the issue of LPF/0014.

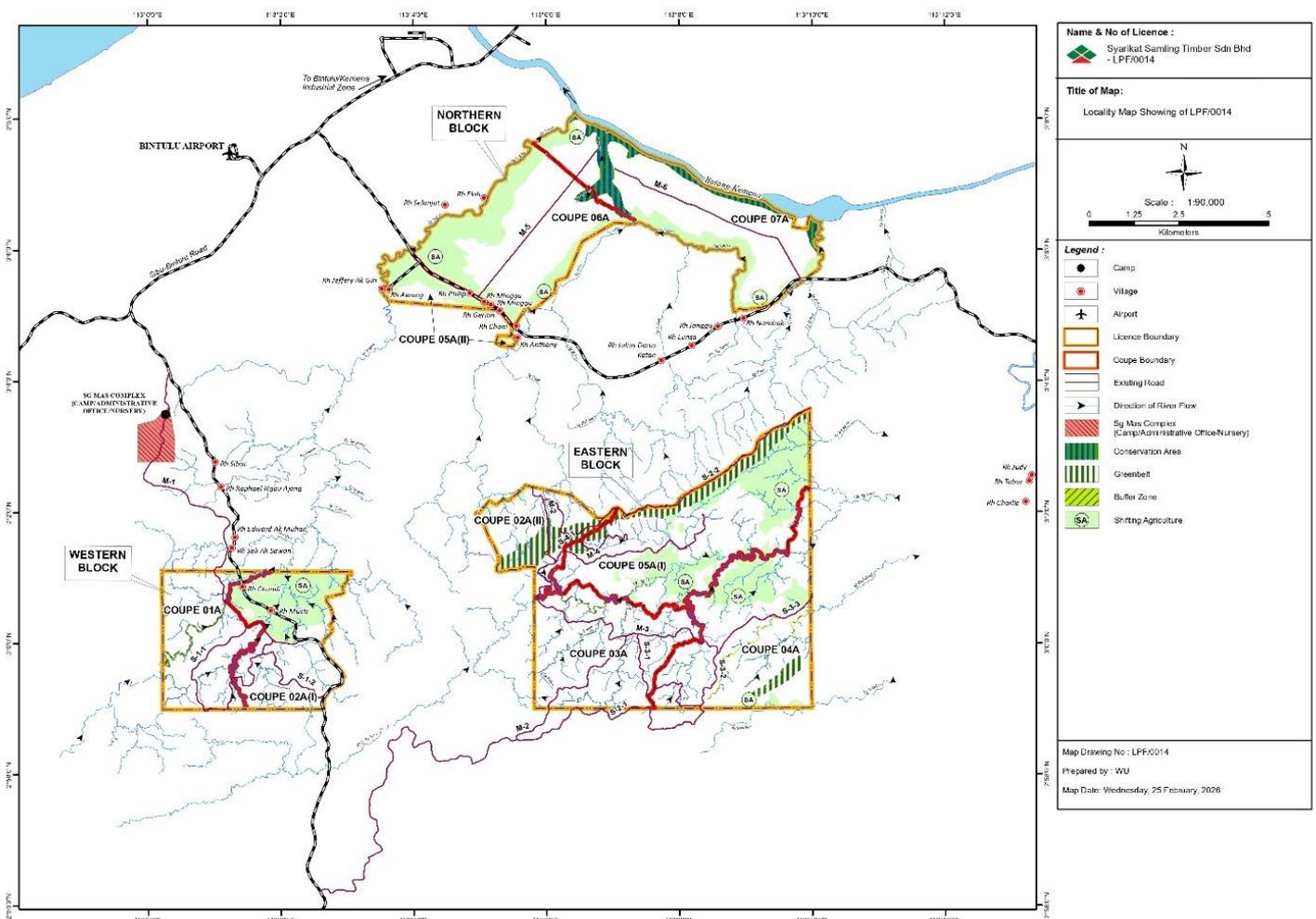
Unsurprisingly the authors of the EIA, (ibid.) concluded of the mineral soil area that: "...this MDF has also been subject to heavy logging in the past to the extent that the forest is no more ecologically intact..." C3-22).

There is currently no harvesting of MTH under forest timber licences (FTL) within the LPF.

The area licensed for ITP encompasses parts of the gazetted area known as Segan F.R. (G.N. 24 11-12-1930) and a part of Bukit Minah F.R. (proposed).

The administrative, technical and logistical support for SEGAN lie without the LPF in Sg Mas camp. Sg. Mas camp is within Buan F.R. and the Director of Forests has given permission (WPO/P/295(V)-77 of 11th August 2015) for these functions to remain at Sg Mas camp and for the camp to remain within Buan F.R. (G.N. 809, 9-1-1977). The permission is subject to several conditions the most important of which is that the permission is only valid whilst the licence for LPF/0014 remains in force.

Map 5.1: Segan FPMU Locality Map



As has been noted in the preceding section the natural forest within the LPF had been subjected to repeated heavy logging for almost forty years to the extent that no primary forest was known to remain at the time the LPF licence was issued in 1999.

This means that no primary forest has been, or is still available to be, converted to ITP within the LPF area.

5.2 Land Use

SST holds a 60-year licence over land on which it is licensed to establish an ITP. The licence (LPF/0014) was issued on 27th January 1999. The leased land is in three discrete areas some 15 to 35km south east of Bintulu, in the Bintulu District and Sebauh Sub-District of Bintulu Division. The three areas are known individually as Segan West, Segan East and Segan North and are referred to as such in this management plan. Table 5.1 shows the gross areas and basic soil types of all the coupes in Segan and their locations – Segan West, Segan East and Segan North.

An area statement showing land types and land uses is given in Table 5.2.

Table 5.1: Segan LPF/0014 - coupe areas, location and soil type

Coupe No	Gross Area (Ha)	Block Location	Soil Type	In MTCS Area
COUPE 01A	863	West	Mineral	Yes
COUPE 02A	985	West	Mineral	Yes
COUPE 02A	559	East	Mineral	Yes
COUPE 03A	1,247	East	Mineral	Yes
COUPE 04A	1,584	East	Mineral	Yes
COUPE 05A	1,799	East	Mineral	Yes
COUPE 05A	266	North	Peat	Yes
COUPE 06A	1,440	North	Peat	Yes
COUPE 07A	1,535	North	Peat	Yes
Coupe 01A - 07A	10,278	Total Coupe Area		Yes
Total LPF	10,278	LPF Gross Area		Yes

Sources: Based on FD Revised LPF/0014 Licence Boundary (14th Sep 2023)
 Layer used : C:\Mapping\Document\L14_TPP_Revised_2023\Geodatabase\TPP_Revised_2023_RSO.gdb\Basemap\14_lic_cp_bnd_p_for_gp

5.3 Industrial Tree Plantation (ITP) Resource

5.3.1 Resource Utilisation

Harvesting started in 2008-09 when blocks of *A. crassiparva* with low stocking were cleared. This continued through 2009-10 with the level of harvesting only starting to increase in 2010-11, when the harvesting of *A. mangium* started.

5.3.2 Species Distribution

Table 5.3 (page C 5-7) shows the planted areas by species and the financial year of planting (YOP) for at 12th June 2024 as extracted from the Block Master. Two acacia species, mangium and crassiparva, account for 94% of the planted area and it is intended that crassiparva will become the main species.

The areas in Table 5.3 are those which have passed post-plant QC. Areas in the harvesting and replanting cycle – i.e., temporarily unplanted (TUP) - are included in the *Plantable* category in Table 5.3. Table 5.3 also includes a few small areas which are planted but are considered to have failed and which might be re-planted before rotation age is reached (Rehabed). The age class distribution of the resource – for six named species and all other species combined – is shown in Figure 5.1 (page C 5-7).

5.3.3 Sustainability of production

When considering sustainability of production, it should be kept in mind that Samling's downstream is also supported by log production from Samling's other ITPs. In order to ensure a more or less regular log flow to the mills it is, therefore, Samling's *total log flow* that must be sustainable and not necessarily that of any individual LPF. (See also Ch.10).

5.3.4 Risks faced by the resource.

Disease

The *Ganoderma* rot rotting fungus has been present in SEGAN LPF for some time. The wilt disease *Ceratocystis* is of more recent occurrence. Together these two diseases have resulted in the death of a large number of *A. mangium*. Management must always be aware of the possibility that the incidence of damage and death will reach the epidemic proportions already experienced in Sumatra and, to a lesser extent, in Sabah and of the impact that this will have on the AAC – and on species selection. Already the emphasis is on planting *Crassicarpa* which is said to be more resistant than mangium to both these diseases.

Fire

All forest plantations are at serious risk to fire at some stage in their development. It is the responsibility of management to reduce the risk where possible and be prepared to deal with any incidence of fire that might be within its area of responsibility and to assist in dealing with fire in nearby neighbouring areas.

Flood

Coupes 6 and 7, the peat areas, being adjacent to the Btg Kemena flood from time to time, especially when high rainfall coincides with the King tides, but serious, prolonged flooding, to the extent that the planted trees die, has yet to be experienced.

Wind blow

Experience on the peat at Segan has shown that wind damage can be severe. Mangium and its hybrid might be more prone: a stark example of this was observed with two adjacent blocks, one of pellita and the other of mangium: the latter was flattened but the former remained standing. Elsewhere pellita is seen to suffer but, perhaps surprisingly, not from uprooting but from both stem break and the stems bending - something from which they did not recover. However, if the water table is too high then blow may occur.

However, on the mineral soils of SEGAN LPF, wind damage, whilst it might be severe very locally, has not yet been widespread. When wind blow does occur, it gives the impression that the trees have been struck by a strong wind on a very narrow front – a line squall. But, of course, the damage is accumulative over the rotation period and could have a significant effect on harvest yield.

5.4 Forest Carbon Stocks and High Carbon Stock Areas

5.4.1 Forest Carbon Stocks

The previous edition of the MTCC's MC&I (MC&I Forest Plantation.v2) did not stipulate any requirements regarding forest carbon stock. The revised version, the MC&I ST 1002:2021 (SFM), which came into force 1st January 2021, does mention forest carbon stocks under Indicator 6.1.2 in terms consideration of the impacts [of the LPF's activities] on forest carbon stocks. The 1,461 ha (14.0%) of the MTCS area that is protected as SMZs, is a significant, in terms of the SEGAN LPF, forest carbon stock that increases as the heavily disturbed areas of MDF continue to recover, grow and to sequester carbon dioxide in the process.

5.4.2 High Carbon Stock Areas (HCS)

High carbon stock is mentioned under Indicator 6.12 with specific reference made only to *afforestation of non-forest lands*. It is therefore deemed not relevant to SEGAN LPF.

Table 5.2: SEGAN (LPF/0014) - Land Type and Land Use Statement at 31st December 2025 (hectares)

Land Type	Gross Area	Non-productive Area ⁴										ITP Production Area						
		Non-forested Areas					Protected Forested Area					Total	Planted ²	Plantable ³	TUP	Investigation Required	Total ⁶	
		Shifting Agriculture	Water	Road line	Others ¹	Total Non-Forested Area	Conservation ⁵	River Buffer Zone	Gully	Steep	Total Protected Area							
Nipah	240 2.3%	0	0	0	0	0	240	0	0	0	0	240	240	0	0	0	0	0
PSF	3,000 29.2%	1,094	158	52	222	1,526	0	62	0	0	62	1,587	1,359	0	53	0	0	1,412
Mineral	7,038 68.5%	1,424	25	151	1,044	2,643	409	619	4	183	1,214	3,858	3,089	0	92	0	0	3,180
Total	10,278	2,518	183	203	1,266	4,169	649	680	4	183	1,516	5,685	4,448	0	145	0	0	4,592
% Distribution - Certification Area		24%	2%	2%	12%	41%	6%	7%	0%	2%	15%	55%	43%	0%	1%	0%	0%	45%
% Distribution - Non-productive ⁴ & ITP Productive Area		44%	3%	4%	22%	73%	11%	12%	0%	3%	27%	100%	97%	0%	3%	0%	0%	100%

Sources: LPF Licence, Block Master 08th July 2025

Layer used: C:\Mapping\Temp\2026\01_January\MTCS\L14\l14_block_update_20251231_mtcs.shp

1) Rocky, swampy & sandy areas, proposed nursery, temuda claim & others

2) See Note in Chapter 5, regarding the minor discrepancy between this figure & that shown in Table 5.4

3) Approved under PEC Opt5 on or before 31st December 2010; assessed as plantable but still not recorded as planted at map record date

4) Non-productive as in not producing industrial timber

5) International Buffer Zone, kerangas forest, green belt & water catchments

6) This is lower than the approved PEC gross operable area because the latter is gross & includes unplanted areas

Notes to Table 5.1

1. **Gross Area** as stated above is slightly larger than that given in the LPF licence which was itsel recently revised. This is a result of mapping revisions based on improved accuracy. Revision is on-going.

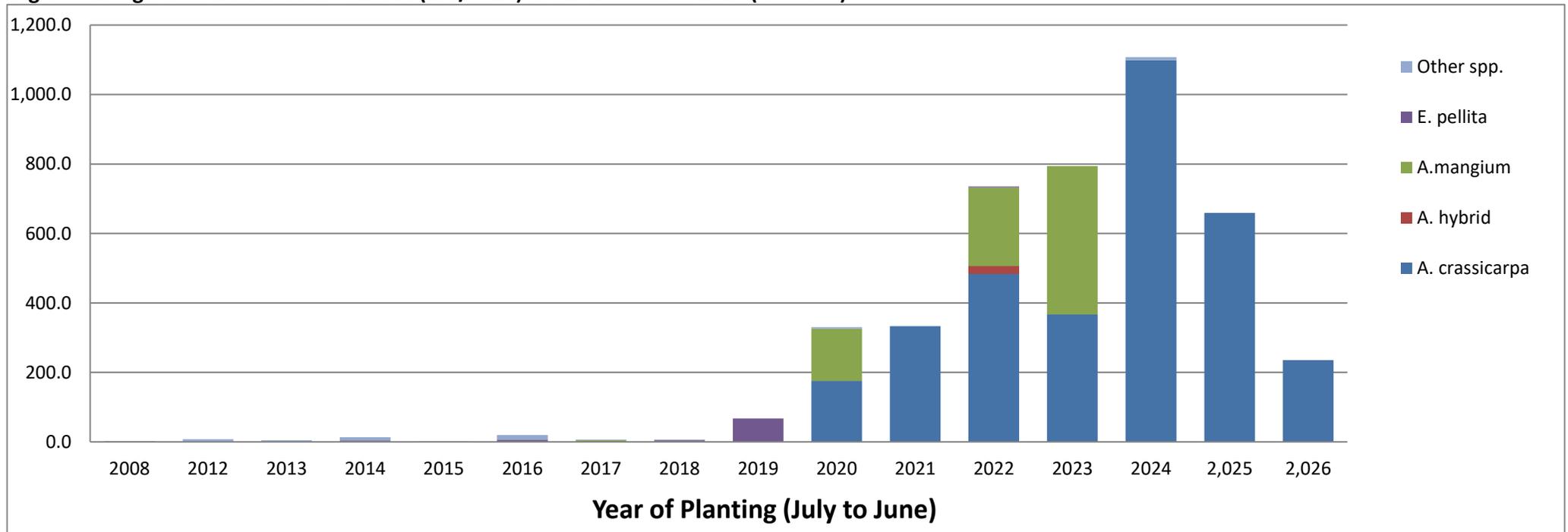
2. **Nipah** (*Nypa fruticans*) is a stem-less palm. Here it forms a narrow strip along most of the licence boundary formed by the Btg Kemena. Nipah also occurs as river edge strips along the lower reaches of Sg Segan, Sg Binai and Sg Silas. The area of nipa given in Table 5.3 of the LPF licence has been used here as: a) it has not been possible to differentiate it on the imagery available and b) inspection shows there has been little or no disturbance of the nipah. This means that the extent of the nipah should be little changed from that determined from the aerial photo interpretation by FDS that was used, presumably, in preparing Map C2 of the LPF licence. A large part of the nipah area is on land alienated several years ago. The FDS has yet to excise these areas from the LPF licence

Table 5.3: Species and Year of Planting for SEGAN (LPF/0014) at 31st December 2025 (hectares)

Species	Year of Planting (YOP)																Grand Total	%
	2008	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2,025	2,026		
A. crassicarpa	-	-	-	-	-	-	-	3.0	-	175.7	332.9	483.6	366.7	1,098.4	659.2	235.7	3,355.2	75.4
A. hybrid	-	-	-	-	-	-	-	-	-	-	-	22.4	-	-	-	-	22.4	0.5
A.mangium	-	-	-	-	-	-	5.9	-	-	150.1	-	226.3	427.2	-	-	-	809.5	18.2
E. pellita	-	-	-	4.3	-	6.6	-	2.7	67.2	-	-	3.1	-	-	2.0	-	86.1	1.9
Other spp.	0.9	7.5	5.1	9.1	1.7	12.8	1.3	1.6	-	4.3	-	-	-	9.1	47.5	73.5	174.4	3.9
Grand Total	0.9	7.5	5.1	13.4	1.7	19.4	7.2	7.3	67.2	330.1	332.9	735.5	793.9	1,107.4	708.7	309.2	4,447.7	100

Layer used: C:\Mapping\Temp\2024\12_Dec\L14\MTCS\Shp\14_block_update_p_20241231_mtcs.shp

Figure 5.1: Age Class Distribution - SEGAN (LPF/0014) at 31st December 2025 (hectares)



6. Environmental Considerations

6.1. Environmental Limitations

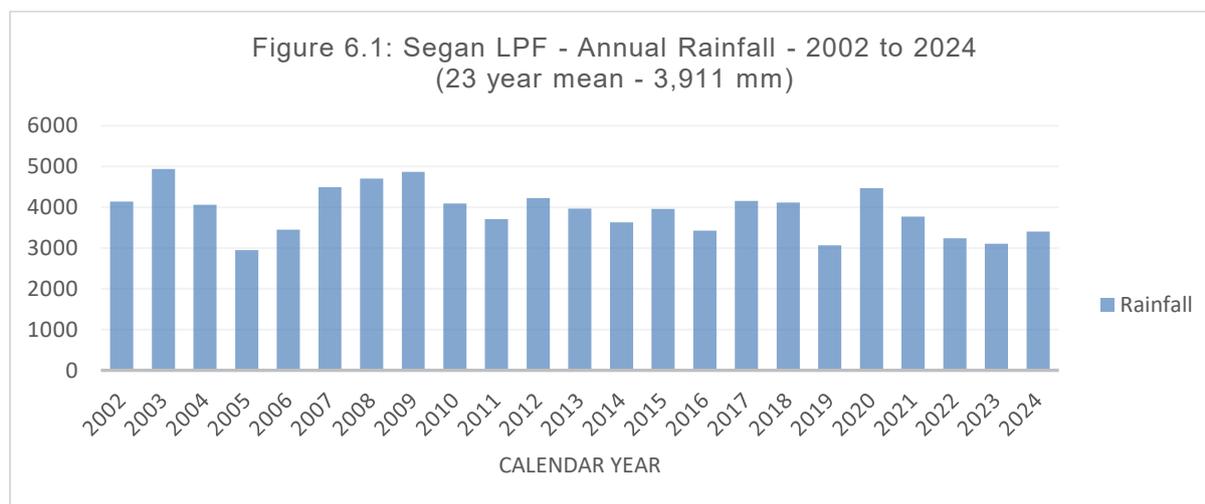
6.1.1 Introduction

There are few environmental limitations for ITP in this licence area. The main limitation is the somewhat broken terrain with short, steep slopes on relatively fragile soils leading to a potential for increased erosion. A further limitation is that the combination of high rainfall and broken terrain gives rise to intricate networks of small streams. There are thus numerous water courses that must be buffered with protective strips of residual natural forest or unplanted land of widths determined by the prescription set out in the EIA and shown in Table 4.2.

6.1.2 Rainfall

The average annual rainfall recorded from 2002 to 2023 at Segan nursery is shown in Figure 6.1. Over 22 years it has averaged 3,934 mm a year. It has ranged from a low of 2,948mm (2005) to a high of 4,943mm (2003) and averaged 16 rain days a month and 202 rain days a year. This relatively high annual rainfall with frequent rain days impacts heavily on the efficient use of both labour and equipment and thus on operational costs.

Figure 6.1: Segan LPF – Annual Rainfall - 2002 to 2024 (mm) (23 year mean - 3,911 mm)



Source: Rainfall LPFs.xlsx

Table 6.1 shows the average rainfall and number of rain days per month. Whilst any month of a given year might be the driest or the wettest month in that year October to early February might be thought of as being the wetter season as the figures below indicate.

Table 6.1: Segan LPF – Average Monthly Rainfall and Rain Days 2002 to 2024

Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Aver	Annual
mm	521	315	259	271	275	277	279	282	289	347	384	426	327	3911
days	20	16	14	15	14	15	14	15	16	18	21	23	17	201

Source: Rainfall LPFs.xlsx

6.1.3 Access

The high level and the high frequency of rainfall together with the steep terrain can make access to some areas difficult especially during the wetter season. At this time ungravelled roads can quickly become slippery and temporarily unusable. Harvesting and transporting on a year-round basis to ensure regular log supplies to downstream mills is impossible under these circumstances. Log stocks must be built up at an all-weather depot, or at the mills, before the onset of the wetter season.

6.1.4 Harvesting

Segan used mix of fully mobile double winch yarders and shovel yarders. This is the system that enable partial or full suspension of felled trees when yarded to a landing for partial processing. Site damage will be limited by the use of shovel mounted grapples.

6.2. The Environmental Impact Assessment (EIA)

The Environmental Impact Assessment (DOC(ASSMNT)01) is a study used as a planning tool during the plan of a project to predict the likely environmental consequences of proposed development project. The objective of Environmental Impact Assessment is in line with Section 11A of Natural Resources and Environment Ordinance 1958, where the prescribed activities (forest plantation) is required to carry out environmental impact assessment so that the environmental issues are addressed and appropriate abatement and mitigating measures are identified. The recommended mitigation measure in EIA is summaries in Table 6.2.

The EMP (DOC(PLAN)02) is a stand-alone document to which reference should be made for details. Elements of the EMP are referred to in various sections of this FPMP. Some of the essential points regarding environmental impact mitigation measures are restated in Section 6.3.

6.3. Environmental Impact Mitigation Measures

6.3.1. Soil erosion

Mechanised operations in areas of steep slopes and high rainfall inevitably give rise to increased soil erosion. This is kept to a minimum by good alignment and by construction of new roads; both of which must conform to the FDS standards in order to obtain a PHC (Permit to Harvest Coupe). Extensions of spur roads and clearing of new landings to facilitate extraction and loading are kept to the minimum necessary for efficient operation.

The double winch system is the main extraction method. The use of this system minimises soil erosion and compaction by reducing the need to enter the harvest block with ground-based machinery.

6.3.2. Water quality

Maintenance of water quality is in part achieved by minimising soil erosion (6.3.1) and by keeping fertiliser leaching and herbicide run off to the minimum. Fertiliser use is exceptionally low - less than 70kg/ha. The herbicide load is also low with 4 to 5 litres/ha applied each round. The active ingredient of the main herbicide used is glyphosate which is generally considered to be toxicologically and environmentally more benign than most of the other herbicides currently available.

To date SEGAN has not used pesticides other than weed killers in the field. However, experience with gmelina in other ITPs indicates that there might be a need for very restricted use of a termaticide applied but it only would be used in response to attack.

Sewage disposal in the camp is by means of cess pits and in the plantation by long drop latrines. All used oil from in-field oil changes is brought back to the workshop for controlled recycling.

Previously, water quality is monitored by means of water sampling whereby samples are taken quarterly from sampling points identified by the EIA and EMP. These samples are analysed by an external laboratory with the results submitted to NREB and presented within the external consultant's quarterly Environmental Monitoring Report (EMR). Reference to these reports will confirm that, to date, the results have almost always been within NREB acceptable parameters or in other ways compliant with the standards set in the EIA bearing in mind the highly acidic nature of peat soil. (The most recent monitoring results appear in the Samling website).

In Environmental Compliance Audit, the water sample result (environmental status) will be incorporated in Chapter 5 of audit report. The water sampling will be undertaken and the water

sample (for ex-situ parameter) shall be forwarded to an accredited laboratory registered with NREB for analysis.

6.3.3. River buffer zones (also known as riparian buffer zones) – RBZ

River buffer zones are established in accordance with the EIA recommendation (See the EMP and Table 2). The objective is to establish a well-defined strip of land – a buffer - that will help to protect the riverbank and the riverbank eco-system at least for the currency of the LPF. This will reduce soil erosion and thereby reduce the amount of sediment moving into the water courses. Establishing and then protecting river buffer zones also maintains, and over the longer term enhances, the biodiversity of the area.

6.3.4. Zero burning

A ‘zero burn policy’ is in place for the preparation of second rotation sites for re-planting. This practice has the benefit of reducing air pollution, conserving the organic carbon content of the top soil and improving the overall nutrient status and condition of the soil. (Where the first crop was Acacia then burning for second rotation site preparation usually results in very dense natural regeneration of acacia seedlings. This gives rise to very heavy competition for the planted seedlings.)

‘Zero burn’ also removes the ever-present danger of a controlled burn getting out of hand. However, there are negative factors arising from a ‘zero burn’ policy: planting is much more difficult than would be the case on a clean burnt area, especially where a very thick fern layer has built up. Furthermore, in dry periods the presence of large amounts of flammable debris presents a serious fire hazard that remains for some time after planting.

6.3.5. Use of chemicals and integrated pest management framework

Apart from the insecticides and fungicides used, unavoidably, in the nursery only herbicides and fertiliser are used in the plantation. As stated in 6.3.2, both are used at low, or very low, rates of application. In order to review its use of chemicals in ITP, and in an attempt to further reduce such usage, Samling commissioned an Integrated Pest Management Framework (Lawson, S. December 2022).

6.4. Environmental Safeguards

6.4.1. Environmental Quality Monitoring (EQM)

Previously, Environmental Monitoring Report (EMR), which was submitted quarterly to NREB reports on the environmental status of a project. With the full implementation of the NRE (Audit) Rules 2008, EMR will be migrated to Environmental Compliance Audit, Chapter 5: Environmental Status. Table below showing the result of water quality sampling as of 30th October 2025.

Table 6.3: Result of water quality sampling as of 30th October 2025.

Parameters	Unit	Compliance Limits*	2nd IECA						
			SSE1	SSE2	SSE3	SSE4	SSE5	SSE6	SSE7
			30/Oct/2025						
pH Value*	-	6 – 9	5.9	5.9	5.5	5.8	5.6	5.9	-
Dissolved Oxygen*	mg/L	5 – 7	3.3	3.5	3.3	3.8	3.6	3.4	-
Temperature*	°C	-	27.0	27.1	26.9	27.0	27.0	26.9	-
Turbidity*	NTU	50	802.0	17.4	11.7	34.9	12.9	3.8	-
Biochemical Oxygen Demand	mg/L	3	N.D (<2)	-					
Chemical Oxygen Demand	mg/L	25	14	16	11	18	12	9	-
Total Suspended Solid	mg/L	50	1370	28	23	41	17	10	-
Total Dissolved Solid	mg/L	-	13.7	21.0	18.3	39.4	32.1	14.3	-
Ammoniacal Nitrogen	mg/L	0.3	N.D(<0.2)	N.D(<0.2)	N.D(<0.2)	N.D(<0.2)	N.D(<0.2)	N.D(<0.2)	-
Nitrate Nitrogen	mg/L	7	0.2	0.067	N.D (<0.04)	N.D (<0.04)	N.D (<0.04)	N.D (<0.04)	-
Phosphate	mg/L	0.2	N.D(<0.008)	N.D(<0.008)	N.D(<0.008)	0.049	N.D(<0.008)	0.2	-
Oil & Grease	mg/L	40	N.D(<1)	N.D(<1)	N.D(<1)	N.D(<1)	N.D(<1)	N.D(<1)	-
Total Coliform Count	MPN/100 ml	5000	920	70	49	79	49	49	-
Faecal Coliform Count	MPN/100 ml	400	220	33	23	33	17	17	-

6.4.2. Use of chemicals

As stated in Section 6.3.5 Samling now has an Integrated Pest Management (IPM) Framework. This covers IPM in the plantation and nursery, pest detection and monitoring, chemical usage documentation and training. Also stated in 6.3.5 is the fact that although chemicals are used in both in the nursery and in the blocks, this is at very low rates of application.

SEGAN acknowledges that under current best practice, applications of herbicides are necessary to ensure an acceptable survival rate as well as prevent increment loss through the competitive effects of weeds. The ERP (Enterprise Resource Planning) system records the type and quantity of chemicals used in forest operations and the rate of application is recorded on a block-by-block basis with the results reported monthly in the Block Consumption Report.

However, SEGAN will always actively seek management practices that reduce the amount of chemical entering the environment of its LPF. This is of benefit not only to the environment but also to SST as chemicals are expensive to procure and apply. Reducing these activities would have a substantial financial as well as environmental benefit to SEGAN.

Training also provides best practice guidelines and protocols for the proper use of chemicals in terms of human and environmental safety and economic application and for the safe disposal of the containers in which chemicals were supplied.

6.4.3. Water course quality

As mentioned in 6.3.2 under the LPF licence conditions SEGAN was required to monitor water quality of the LPF's water courses. This is done four times a year with analysis undertaken by an independent laboratory and the results reported in the EMR and placed on the Samling website.

6.4.4. Monitoring exotic plant introductions

SEGAN's management is aware of the potential problems that might arise from the introduction of exotic species. However, no exotic species grown by SST has been identified as an invasive plant pest by any government agency. Furthermore, only two exotic genera, *Acacia* and *Eucalyptus*, are now planted¹ commercially (as opposed to trialled) in Segan. Both are known to regenerate naturally, to a greater or lesser degree, under SEGAN's conditions but this is not considered to be an adverse environmental impact. To date only *A. mangium* has established itself outside of the LPF. However, it is a pioneering, short lived light demander and generally only regenerates in open areas, e.g. burnt over SA. In the hill padi cropping cycle areas of SA it may be considered as beneficial because it both protects and, as nitrogen fixer, improves the soil. As the local demand for mangium logs increases this might also create economic opportunities for SEGAN's communities. If the nearby Samarakan pulp mill should eventuate this could improve local opportunities even more as the local communities might be able to participate in supplying chip logs. (This is the case for those living near the Sipitang pulp mill and in the Hijauan Bengkoka/*Acacia* Forest Industries area - both of which are in Sabah.)

Unfortunately, other than those of the two genera listed above, not one of the almost 90 exotic species trialled to date has, as yet, proven successful enough to regenerate naturally and thus none poses any degree of environmental risk.

Monitoring is by observation.

6.5. Fire prevention and Control

The SEGAN FPMU has a detailed fire plan covering fire prevention and control. Sections 3 & 4 cover the description of the FPMU, rainfall records and trends and vegetation and boundaries and neighbours. Sections 5 and 6 cover the prescription for firebreaks and the potential fire risk areas and the fire danger rating system. Sections 8 and 9 cover vehicles and equipment. Sections 12.1 and 12.2 cover the management of the situation should a fire occur. Section 13 covers post fire activities.

6.6. Conservation of Bio-diversity

This has been briefly referred to in Section 4.4. Conservation of the bio-diversity as represented by the gene pools of SEGAN's flora and fauna, and of the ecosystems in which they are found, is very much dependent on the residual natural forest in the river buffer zones and the conservation areas which, together, represent about 16% of the gross area of the LPF. There will be, as yet unidentified, contributions to bio-diversity from the *planted* forest areas. Indeed, even the areas of SA in their various stages have a part to play in contributing to the overall bio-diversity of an area.

The residual forest has been logged over in varying degrees of intensity. As stated in the EIA report (see extracts from EIA quoted in Section 5.1) logging has been very widespread and usually very intense. No types of either PSF or MDF have been identified within Segan that are not also widely represented elsewhere within Sarawak. As already mentioned, the residual or remnant forest falls into several mapping units which together are termed Special Management Zones (SMZ) – see Table 5.1 - all of which are protected to the extent that the LPF management's authority allows.

Since the start of harvesting the process of re-demarcating SMZ areas on the ground and their subsequent GPS tracking has been carried out with far greater diligence than was the case previously. This is in part due to the availability of GPS devices – most of the original blocks were established using chain and compass. The result of this increased diligence can be seen in the West Block where in particular the river buffer zone system is now well identified. As harvesting proceeds through SEGAN the re-survey of the coupes and blocks will result in a similar mosaic of SMZs within the operational area being established.

¹The planting of both *Gmelina* and *Falcataria* (*Paraserianthes*) has been discontinued.

As stated in Section 4.2.2, the SMZs are protected areas. This protection should ensure that the current level of bio-diversity does not diminish; indeed, over time the diversity of the flora should increase with the arboreal component developing in terms of DBH and height (i.e. structure) with the species composition becoming, albeit very slowly, more diverse (Section 6.7, Residual Natural Forest).

The SEGAN plantation maps (1:10,000) show that the SMZs are widely distributed throughout the LPF. Currently they represent almost 16% of the *whole* LPF - including SA - (Table 5.2). It is expected that this percentage will continue to increase over time as the pre- and post-harvest GPS surveys continue to better define the land categories. Between first drafting of the FPMP in mid-2013 and this latest revision the area protected under SMZs has already increased from 14.5 to 15.9% - representing an increase of almost 10%.

6.7. Residual Natural Forest

6.7.1 Background

The EIA stated that both the MDF on the mineral soil and the PSF on the peat have been subject to very heavy logging in the past.

The residual natural forest is very much secondary in physical structure although in terms of genetic diversity its flora on the mineral soils is probably little changed. However, as no study was undertaken prior to logging to establish baselines the original levels of diversity of the flora (and of the fauna) of the no longer extant primary forest types remain unknown. It is now a question of protecting those areas of residual forest that have been designated as SMZs. Continued protection will, over time, allow the forest to recover in terms of structure: i.e., only time will allow the full expression of those species that are genetically pre-disposed to grow to a large size. Similarly, over time genetic diversity should increase – slowly – as new species are recruited into the SMZs by various means of seed dispersal.

6.7.2 Monitoring and Research

In collaboration with Dr Ong Kian Huat² the *establishment* of a network of 25 PSPs, each of 400 square metres was completed in October 2015. The initial objective is to monitor the development of the structure and composition of the residual natural forest under protection as a SMZ. The development (growth) of individual trees and any changes in arboreal species diversity will be recorded. It is Samling's expectation that this will be a long-term project running for at least the currency of the LPF licence and any extensions thereto. It is also expected that UPM, and others, will make use the PSP network for research into the many other areas of interest that are presented by these PSPs and the conservation areas.

6.8. Adjacent Lands

SEGAN ITP was established on degraded forest land and the adjacent lands have a similar history. Much of the common boundary is shared with Sarawak Planted Forest Sdn Bhd where, in the West Block, there is sometimes a mutual riparian buffer zone or conservation area, albeit of very heavily disturbed remnant mixed dipterocarp forest. A significant length of the LPF's common boundary is shared with two oil palm estates. Most of the balance of the LPF boundary is formed by either Sg Segan or Btg Kemena.

In addition to the above-mentioned adjacent areas SEGAN's boundaries also abut on to, or pass through, what is categorised as shifting agriculture (SA) much of which is in fact settled agriculture rather than 'shifting'. Particularly in the Northern Block this settled agriculture sometimes extends well inside the LPF area.

²Faculty of Agriculture and Food Sciences, Universiti Putra Malaysia, Bintulu Sarawak Campus.

There are no immediate neighbouring suburban or residential developments which would be important for the consideration of aesthetic values and additional safety considerations during forest operations. The proposed Samarakan Township is to the south of the West and East blocks and does not impinge directly on the ITP.

7. Socio-Economic Context

7.1 Contribution by Current and Future Forest Operations

The net plantable area for the nine ITPs (including their oil palm component) in the Bintulu District was 285,230ha in December 2011. With only about 4,448 ha currently planted SEGAN is a very small contributor to the District's ITP total. The area of SEGAN's immediate neighbour, Sarawak Planted Forest, is, alone, in excess of 125,000 ha planted (although not all is in the Bintulu District).

The SEGAN resource is however important to Samling and to the district's economy as it only produces logs for Samling's own downstream operations: peeler logs for Samling's plywood mills and saw logs and chip logs for Samling's Grand Paragon Sdn. Bhd. The sawn timber is further processed by Samling Housing Products Sdn Bhd (located at Kuala Baram). Grand Paragon now has a dedicated small-log sawmill adjacent to the fibre board mill. Chip logs and residues from processing plantation logs by both the sawmill and the ply mill are supplied to Grand Paragon for the manufacture of fibre board. The fibre board is further processed in-house into door skins - primarily for export. Thus, the entire log production from Segan ITP is currently utilised locally, i.e., within the Bintulu District.

Harvesting of *A. crassicarpa* on the mineral soil working circle started in 2009. The species had not performed well although this might be a reflection on the seed sources rather than the species itself. It was of particularly poor form and was initially sent for chipping at TreeOne Megapellet. Currently Crassicarpa logs are sorted and transported along with the Mangium.

Harvesting of *A. mangium* started in late 2010. Harvest planning is based on a sustainable allowable annual cut (SAAC) of 56,000 metric tonnes from the mineral soil working circle. To date the accumulated trucked production has been well below the AAC:

Over time there is potential to increase this AAC through additional planting of the 'Plantable' and 'Potential' areas. The peat soil working circle should also add to the AAC.

Maintaining a sustainable flow of logs suitable for Samling's solid wood downstream requirements is the key management objective at SEGAN. However, whilst the upper level of AAC is determined by the need for sustainability, the lower level of the annual cut will always be determined by Samling's downstream demand which in turn is governed by the export demand for their products. Should the export market demand fall away in response to international market fluctuations then there will be a corresponding fall in the demand for SEGAN's logs.

The determination of the AAC is based on:

- the historical and most recent PSP results;
- rotation length; and
- the need to normalise the plantation.

A reduction factor, derived from historic *actual* harvest production and the *estimated* standing volume for the historic harvested area, is applied to the block estimate, based on PSP data, for areas to be harvested. The blocks that will yield the required total AAC (mill gate volume) are then identified.

It can be seen from Figure 5.1 that the age class distribution is now approaching normality.

Although based on a long term, sustainable cut philosophy, the AAC will continue to be reviewed on an annual basis. The objective is to ensure a sustainable harvest volume from a forest of normal structure.

7.2 Employment and Services

Table 7.1 shows the current employment situation and the monitoring of its change over time.

A total of 123 employees with 31% were full time staff at supervisor level and above; of these 28% were Sarawakian (Local and Other). However, only 11% of the 85 strong in-house worker force were locals. The competition for local workers from offshore oil and gas employment and the oil palm industry (both own planting and estates) is strong. Segan is an equal opportunity employer: 66% of the local Sarawakian work force is female – primarily employed in the nursery.

Establishment, plantation maintenance and harvesting in SEGAN is done using a mix of contractors and in-house labour; trucking is mainly by contractors. The greater part of the logistical support is supplied locally from Bintulu, e.g. engineering, spares, supplies and waste disposal.

7.3 The Value of Forest Services

As the Socio-economic Profiling Study clearly shows there is virtually no demand for forest services in the form of NTFPs such as fish, wild meat, honey, boat and house building materials, sago, nipah, rattan etc. A significant proportion of the nearby active population comprises wage earners – some with Samling but more are in Bintulu Town with a few offshore. (Reliable figures are not available owing to the reluctance of interviewees to provide such information.) Many of these wage earners return home either at weekends or as shore leave allows. When at home considerably more effort seems to be expended on helping to establish and tap rubber and establish and harvest oil palm than on the more traditional pursuits. For contract workers between contracts, older people and those not working away from home, it seems that in addition to rubber and oil palm other agriculture activities, e.g., hill and wet rice, pepper and pineapples, hold far greater attraction than do more traditional forest-based activities such as collection and preparation of rattan for basket and *tikar* weaving.

No felling of trees for the purpose of providing timber for own use in boat building, house building and repair has been observed in the LPF, and specifically in the SMZs, for some time.

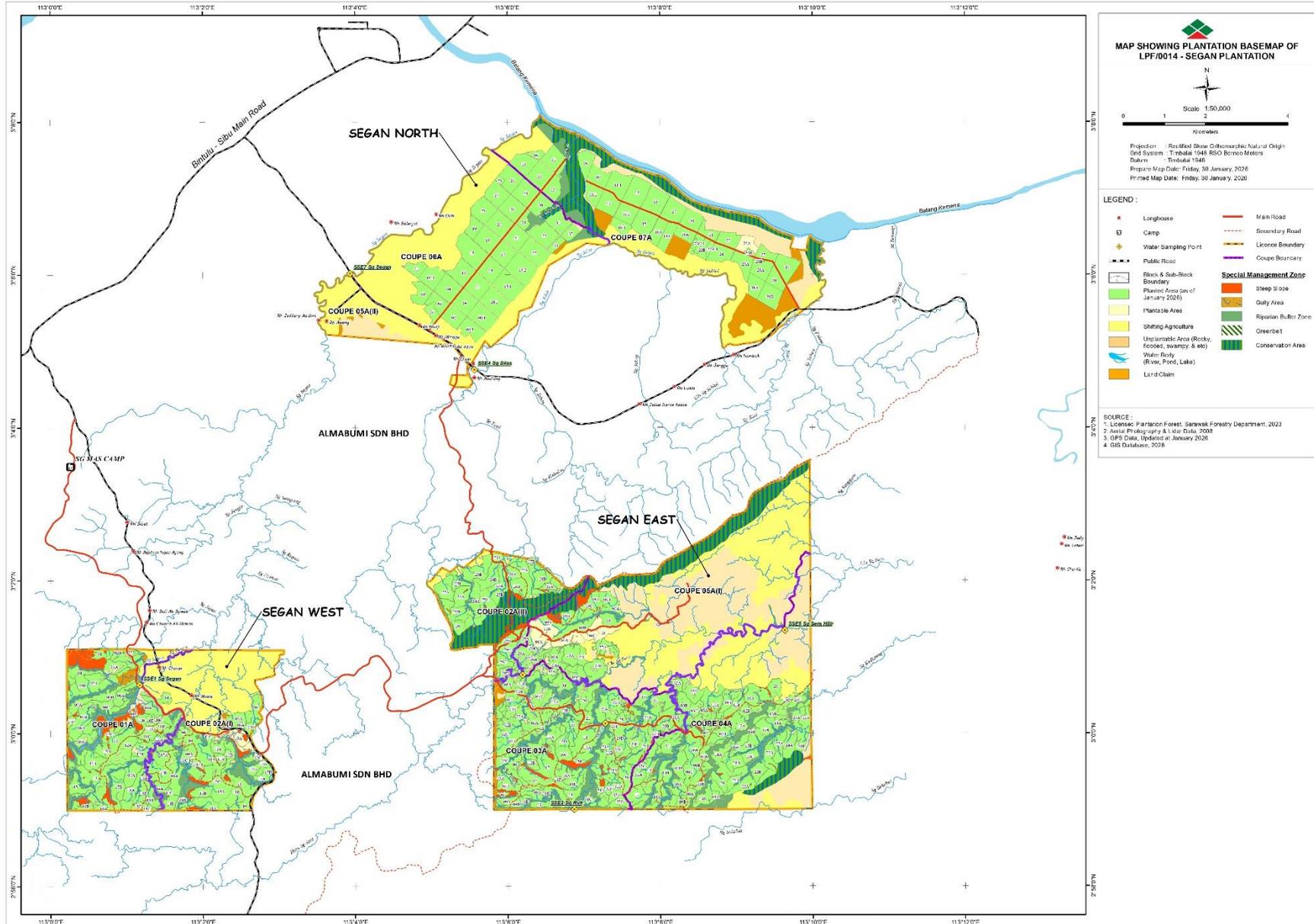
Where terrain is deemed suitable the community use of these areas tends to be for oil palm where individual ownership ranges from 100 to 1,200 palms. There appears to be little government assistance with oil palm at this level. However, the government actively assists with very small-scale rubber planting. The interest in oil palm has resulted in occasional encroachment into demarcated river buffer zones. When encroachment is noted by SEGAN staff, a report is made to the authorities (FDS and NREB) who generally respond quite quickly to inspect and to talk to the perpetrators.

7.4 Socio-economic Survey and Social Impact Assessment

7.4.1 Locations of the communities

Map 7.1 shows the locations of the various communities or settlements. There are only seven settlements within the LPF, and all are within areas of shifting agriculture.

Map 7.1: Segan FPMU Map showing the location of 23 villages.



7.4.2 Main findings of the social studies

From the results of the Socio-economic Profiling Study undertaken by SFC (2013) and the Social Impact Assessment (SIA) undertaken by UPM (2021) it is clear that the socio-economic impact of the SEGAN ITP on these communities has not been, and is unlikely ever to be, very significant. Furthermore, as the existing population ages what impact there has been - whether negative or positive - will lessen to the extent that an ever-larger proportion of the community will work away from the area, and some will move right away - perhaps eventually breaking all ties to the land.

However, some negative comments were recorded during the SIA (2021). These can be briefly summarised as referring to:

- river water quality (mainly with reference to events of 30 years ago, prior to the LPF start up)
- water pollution (stated as mainly caused by the oil palm plantations)
- job opportunities (but it is recorded that most of the unemployed are more than 60 years old)

The SIA (2021) also recorded somewhat illogical and negative comments regarding roads and road access in that only Rh Eloh and RH Selanjat are not adjacent to or very close to sealed government roads (both are on the lower reaches of Sg Segan).

The SIA (2021) confirmed earlier findings that dependency on the forest resources within the LPF was low and noted agreement that boundaries of the land used for ITP were well defined and that this resulted in few, or no, land disputes.

Whilst acknowledging the earlier comment regarding job opportunities, it should be noted that an identifiable positive economic impact results from the employment provided, with 17 local people directly employed in SEGAN (almost 16% of the payroll – see Table 7.1). Further opportunities for employment have been created in the downstream activities that process the logs from SEGAN in the Bintulu District.

Apart from providing employment for local people in SEGAN LPF, another positive impact has been as a result of SEGAN giving assistance with preparing sites for new housing. However, this assistance has necessarily been restricted because the requesting communities are very often:

- a) not registered with the District Office; and /or
- b) are actually on land licensed to others – quite frequently SEGAN’s neighbour, Sarawak Planted Forest – LPF/0043.

Table 7.1: Segan LPF/0014 Social and economic monitoring – employment (2013 – 2018)

Category	Sex	2013		2014		2015		2016		2017		2018	
		n	%	n	%	n	%	n	%	n	%	n	%
Sarawakian-local	M	0	0.0	0	0.0	1	50.0	1	50.0	1	50.0	2	66.7
	F	0	0.0	0	0.0	1	50.0	1	50.0	1	50.0	1	33.3
	M+F	0	0.0	0	0.0	2	100.0	2	100.0	2	100.0	3	100.0
Sarawakian-other	M	15	71.4	16	72.7	18	78.3	19	79.2	23	74.2	23	76.7
	F	6	28.6	6	27.3	5	21.7	5	20.8	8	25.8	7	23.3
	M+F	21	100.0	22	100.0	23	100.0	24	100.0	31	100.0	30	100.0
Other Malaysian	M	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	50.0
	F	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	1	50.0
	M+F	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	2	100.0
Foreigners	M	6	100.0	6	100.0	5	100.0	5	100.0	4	100.0	4	100.0

	F	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	M+F	6	100.0	6	100.0	5	100.0	5	100.0	4	100.0	4	100.0
Staff - total Malaysian & Foreigners		27	14.0	28	14.5	30	15.5	31	16.1	38	19.7	39	20.2
Worker													
Sarawakian-Local	M	4	66.7	4	57.1	4	44.4	0	0.0	6	60.0	11	55.0
	F	2	33.3	3	42.9	5	55.6	0	0.0	4	40.0	9	45.0
	M+F	6	100.0	7	100.0	9	100.0	0	0.0	10	100.0	20	100.0
Malaysian-other	M	6	42.9	8	40.0	8	40.0	8	36.4	13	44.8	17	51.5
	F	8	57.1	12	60.0	12	60	14	63.6	16	55.2	16	48.5
	M+F	14	100.0	20	100.0	20	100	22	100.0	29	100.0	33	100.0
Foreign	M	115	95.8	113	95.0	87	92.6	52	83.9	14	56.0	17	65.4
	F	5	4.2	6	5.0	7	7.4	10	16.1	11	44.0	9	34.6
	M+F	120	100.0	119	100.0	94	100.0	62	100.0	25	100.0	26	100.0
Worker - total Malaysian & Foreigners		140	22.0	146	23.0	123	19.3	84	13.2	64	10.1	79	12.4
All employees - Summary													
	M	146	87.4	147	84.5	123	80.4	85	73.9	61	59.8	75	63.6
	F	21	12.6	27	15.5	30	19.6	30	26.1	41	40.2	43	36.4
	M+F	167	100.0	174	100.0	153	100.0	115	100.0	102	100.0	118	100.0
	*local	6	3.6	7	4.0	11	7.2	2	1.7	12	11.8	23	19.5
	other Mal	35	21.0	42	24.1	43	28.1	46	40.0	61	59.8	65	55.1
	foreigners	126	75.4	125	71.8	99	64.7	67	58.3	29	28.4	30	25.4
	All	167	100.0	174	100.0	153	100.0	115	100.0	102	100.0	118	100.0

Source: Segan Payrolls

Table 7.1: Segan Social and economic monitoring – employment (conc.) (2019 – 2025)

Category		2019		2020		2021		2022		2023		2024		2025		
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Staff	Sarawakian - local ³	M	1	1	1	1	1	1	1	1	1	1	1	1	2	2
		F	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		M+F	2	2	2	2	2	2	2	2	2	2	2	2	3	2
Sarawakian - other		M	19	17	17	14	22	27	19	23	16	15	20	19	25	20
		F	7	6	9	8	6	7	6	7	5	5	6	6	7	6
		M+F	26	23	26	22	28	35	25	30	21	20	26	24	32	26
Malaysian - Other		M	0	0	1	1	0	0	1	1	1	1	0	0	2	2
		F	1	1	1	1	1	1	2	2	1	1	1	1	1	1
		M+F	1	1	2	2	1	1	3	4	2	2	1	1	3	2
Foreign		M	4	4	4	3	1	1	0	0	1	1	2	2	0	0
		F		0		0		0	0		0		0		0	0

³ Sarawakian local referring to the employee originated from 23 villages in SIA.

	M+F	4	4	4	3	1	1	0	0	1	1	2	2	0	0
Staff - total Malaysian & Foreigners		33	29	34	28	32	40	30	36	26	25	31	29	38	31
Worker															
Sarawakian – local	M	11	10	11	9	1	1	1	1	3	3	6	6	4	3
	F	8	7	4	3	5	6	5	6	10	10	9	8	9	7
	M+F	19	17	15	13	6	7	6	7	13	12	15	14	13	11
Sarawakian - other	M	0	0	0	0	0	0	0	0	0	0	0	0	19	15
	F	0	0	0	0	0	0	0	0	0	0	0	0	12	10
	M+F	0	0	0	0	0	0	0	0	0	0	0	0	31	25
Malaysian - other	M	17	15	18	15	14	17	16	19	17	16	25	23	0	0
	F	10	9	14	12	11	14	15	18	11	10	11	10	0	0
	M+F	27	24	32	27	25	31	31	37	28	27	36	34		0
Foreign	M	25	22	30	25	18	22	17	20	36	34	23	21	38	31
	F	9	8	9	8	0	0	0	0	2	2	2	2	3	2
	M+F	34	30	39	33	18	22	17	20	38	36	25	23	41	33
Worker - total Malaysian & Foreigners		80	71	86	72	49	60	54	64	79	75	76	71	85	69
All employees - Summary															
	M	77	68	82	68	57	70	55	65	75	71	77	72	90	73
	F	36	32	38	32	24	30	29	35	30	29	30	28	33	27
Male & female	M+F	113	100	120	100	81	100	84	100	105	100	107	100	123	100
	*local	21	19	17	14	8	10	8	10	15	14	17	16	16	13
	other Sar													63	51
	other Mal	54	48	60	50	54	67	59	70	51	49	63	59	3	2
	foreigner	38	34	43	36	19	23	17	20	39	37	27	25	41	33
Mal'sian & foreign	All	113	100	120	100	81	100	84	100	105	100	107	100	123	100

*local Sarawakian mean 23 villages in SIA.

7.4.2 Engagement (Consultations)

The number of communities actually within the LPF is very small. In the each of the Sebauh and Samarakan areas there are only three. Without exception these are all within SA, as are all the other nearby communities. This means that the ITP operations have little or no direct physical impact on any communities within or close to the LPF. Engagement is usually in the form of the negotiations that precede obtaining permission to clear degraded residual forest – termed as either old or new temuda - for new planting. It follows from this, as stated in 7.4.1, that, other than the provision of employment, the SEGAN ITP operation has little or no social, or environmental, impact - either direct or indirect - on the various nearby communities.

7.5 Stakeholder Engagement (Consultation)

7.5.1 Introduction

Stakeholder engagement, often somewhat misleadingly termed *consultation*, should assist in the development of constructive and productive relationships over the long term. It should also result in a relationship with mutual benefits. It helps to identify trends and emerging challenges which are currently, or which will in the future, impact the management of the LPF in some way.

7.5.2 Communities

Consultation, or engagement, is usually in the form of meetings to ensure the LPF's compliance with the various requirements of the MC&I ST 1002:2021 (SFM); e.g., awareness of the LPF's operations that might affect the community and dissemination of the relevant results of social and wildlife monitoring, or awareness of the objectives of the MTCS.

Community engagement also takes place when:

- (a) a grievance arises and a *Borang Aduan* is completed and submitted to the LPF manager for further action - which might include community consultation and discussion as an aid to resolution; or
- (b) a community wants to request some form of assistance that might trigger a CSR response. For this a *Borang Memohon Bantuan* should be completed and submitted to the LPF manager or put in the box provided outside the office.

The conflict resolution mechanism is available on Samling's website with QR code for ease of the public access to the complaint/ request form using mobile phone.

7.5.3 Government departments and agencies

Engagement and consultations with FDS, SFC and other government departments and agencies take place on an *ad hoc* basis - as and when required by either party.

7.5.4 Non-government organisations

Samling, through the AGM Refor, engages regularly with the STA's Plantation Committee.

Samling Refor, as a member, also engages fully with the Borneo Forestry Cooperative (BFC).

Other NGOs are engaged from time to time as they or Samling might require, e.g. WWF, Mighty Earth, Aidenvironment.

7.6 Social Impact Monitoring (SIM)

7.6.1 Introduction

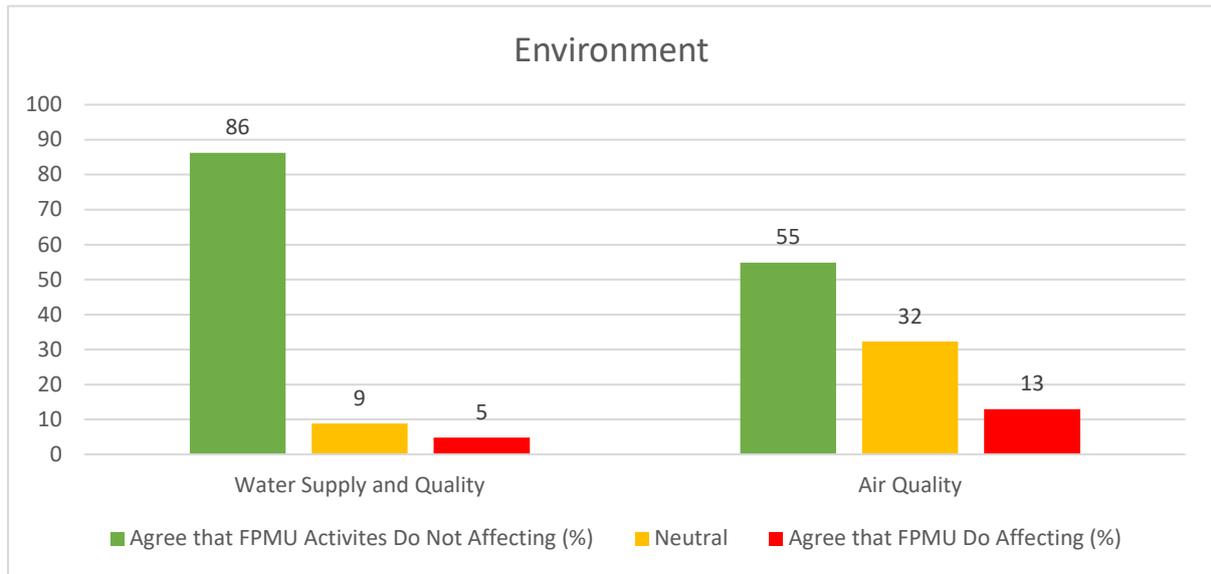
Social Impact Monitoring is undertaken once a year. The main findings of SIM (2025) are set out below.

7.6.2 Water Supply and Quality and Air Quality

As can be seen in Figure 7.1, the majority of the local communities agree that their water supply and quality are not much affected by LPF's activities with 81% of the assessed local communities agreeing with the statement that the '*LPF activity does not negatively affect river water quality*'.

As for air quality, the 86% of the assessed local communities agree that '*the air quality is not affected by the LPF's activities*'.

Figure 7.1: Water Supply and Quality

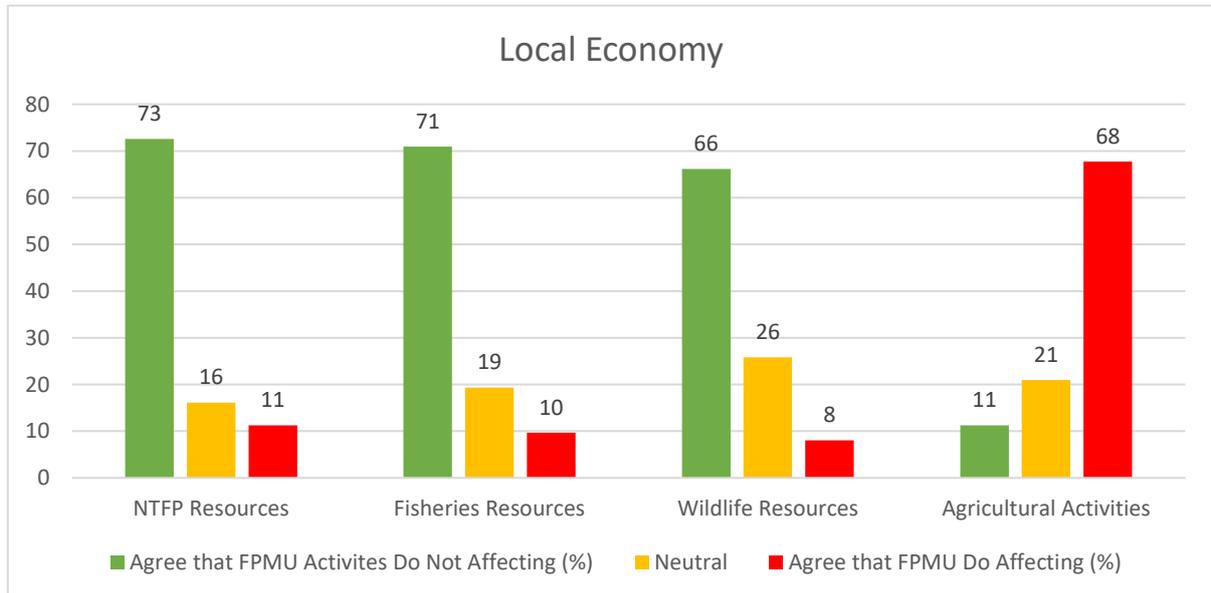


7.6.3 Local Economy

The SIM (2025) result revealed that 73% of local communities agree that ‘the LPF’s activities have no negative impact on the availability of NTFPs’.

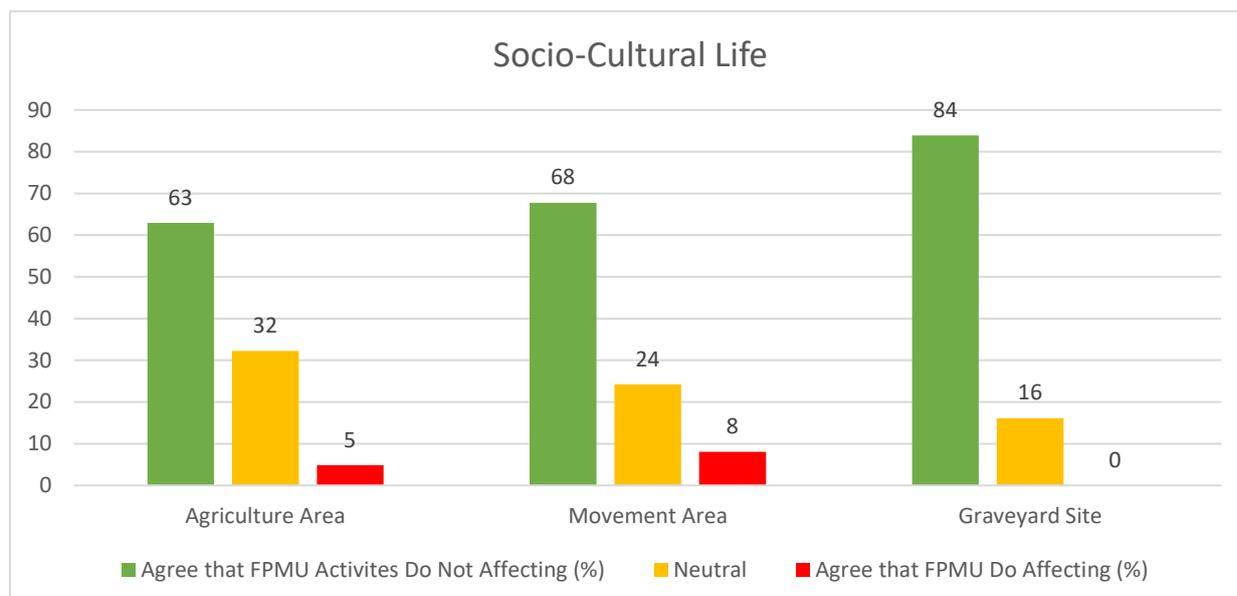
The SIM (2025) results also showed that Segan operations does not effect on fisheries resources and wildlife resources. For the agricultural activities, 68% respondent agreed that this activities are effected by Segan operation. The shifting agriculture (SA) area excluded from FPMU productive area and no operation area allowed in SA area.

Figure 7.2: Local Economy



7.6.4 Socio-Cultural Life

From socio-cultural life aspect of the local communities, results of the social impact monitoring conducted shows the higher percentage on the respondents agree that LPF activities does not affected them negatively. On the aspect of agricultural, 5% of the respondents mentioned that their agricultural area is limited as they only able to cultivate within their gazetted area while the agriculture area of the remaining 63% is not affected by LPF operation. Based on the social impact monitoring questionnaire, it is clear in Figure 7.3 that the LPF’s activities have no impact on community’s graveyard sites or on their movement area.

Figure 7.3: Socio-cultural life

8. Establishment and Silvicultural Regimes

8.1 General

After SPF the SEGAN LPF was one of the earliest ITPs to be established in Sarawak with the first planting in 1999/2000. Whilst the establishment regime for mangium is reasonably well known the most appropriate silvicultural regime required to produce peeler and saw logs, as opposed to chip logs, has yet to be proven. There is little information available in terms of the methodologies and economics of such practices from either the private sector (forest industry and research cooperatives) or government agencies⁴. SEGAN is a leader in developing the management practices required to satisfy this objective. (The SPF objective was to produce chip wood - for a pulp mill that has yet to be built near Samarakan.)

The Sarawak Timber Association (STA) has a Plantation Committee on which SST is represented. This committee is charged primarily with representing the industry in meetings with government to discuss, improve and resolve technical and common management issues. It also provides a valuable forum for discussion and exchange of ideas and practices. STA also organises overseas study tours that present a useful opportunity to learn from longer established ITP based industries. Late in 2012 a tour was made in Sabah and in 2013 a study tour visited New Zealand. A study tour of the growing and utilisation of eucalyptus in Guangxi, China, was undertaken in late 2015. Apart from the STA meetings there is only limited interaction between ITP companies in Sarawak, but SST is proactive in trying to widen the interaction in order to observe, discuss and exchange ideas on forest plantation management practices.

8.2 Choice of Species

8.2.1 Background

When planting started in 2000 the management objective was to produce only chip wood. This objective was revised 3-4 years later to the current objective. At that time mangium was the species of choice throughout Malaysia. The perceived wisdom at the time was that mangium would 'grow well - anywhere'. Time has clearly shown that this is not correct. Although it has performed reasonably well in SEGAN mangium's performance to date has been well below the forecasts made prior to start-up of the LPF.

⁴ The report SFC commissioned by SFC and entitled: "The Establishment & Management of *Acacia mangium* for solid wood products." by Boden, D. and Molony, K. (August 2015) is not especially informative as there is little or no factual information that is applicable to Sarawak regarding mangium and solid wood use. Indeed, the authors conclude that this use of mangium cannot be recommended at present!

Other than *Acacia mangium*, *A. crassicarpa*, acacia hybrid and *Eucalyptus pellita*, not one of the more than eighty species trialled⁵ in SEGAN to date has shown any promise for use in solid wood ITP.

Mangium suffers from high early mortality. This is in great part due to a high susceptibility to root rots (*Ganoderma* spp.) which experience elsewhere indicates increases in severity with each succeeding rotation. In March 2013, following the identification of a *Ceratocystis* sp. infesting a second rotation block (1A/04) when about 9 months old, planting of mangium was suspended. Planting of mangium was resumed, but only on first rotation sites, after two years of intensive monitoring of 1A/04 indicated that whilst *Ceratocystis* was obviously a problem it could not yet be considered serious in SEGAN or in any of Samling's other LPFs. However, the mortality rate from *Ceratocystis* sp. has increased since 2013 to the extent that the earlier conclusion has been revised. *A. crassicarpa* is now the species of choice and R&D has established a seed orchard with the objective of being self-sufficient for seed.

A. crassicarpa will now be planted on peat and mineral soils using improved seed source from the Segan seed orchard.

The initial dependence on a single species is recognised by Samling - and by much of the ITP industry in Sarawak - as a flawed policy. Species new to Samling are occasionally brought in to be trialled by R&D with the aim of achieving a degree of species diversity that will help mitigate the risk from pest and disease attack whilst still meeting the objective of economically producing peeler logs of acceptable size and quality. But, after trialling more than eighty species, it is recognised that efforts to develop and improve pellita, mangium and *A. crassicarpa*, with some new work on hybrids of eucalyptus, are currently the more promising routes to be taken by R&D.

8.2.2 Site-species matching

The peat soils are physically and chemically very different to the mineral soils and, with the exception of *Melaleuca* spp., no species has been identified that is particularly better suited to peat than to mineral soils.

8.2.3 Planting of native species

The Sarawak Forest Department has long extolled kelampayan (*Neolamarckia cadamba*) as an ITP species. Without doubt the form, growth rate and peeling qualities of this are all very positive attributes of this species. However, in Sarawak to date there is insufficient knowledge of seed sources and related genetics, nursery practice through to ITP silviculture for this species. There has been at least one relatively large-scale failure and a success in Sarawak at an operational ITP level is unknown - to Samling at least. An earlier trial of this species in Segan was a failure but Samling continues to plant it, and *N. macrophylla*, on very limited areas of selected sites elsewhere.

Pterygota alata was introduced in 2011 and from the outset suffered badly in Segan from an insect defoliator; the good early day performance shown in other Samling LPF's generally failed to follow through. Similarly, with *Alstonia macrophylla* where the good early day performance in Segan did not continue. In 2013 *Endospermum malaccense* and *Dyera costulata* were brought in as tissue culture ramets but did not progress beyond the nursery.

Trials of other species of *Alstonia* have been failures as was that of *Octomeles sumatrana*. (Despite the early failures, in 2015 two seed lots of *Octomeles* were obtained from Sabah for further trial.) *Casuarina equisetifolia* (Coupe1/13E) has shown very variable performance with some well grown individuals and others stunted and moribund. A temporary growth plot established in coastal natural regeneration on reclaimed land showed satisfactory growth performance over almost two years (the annualised DBH PAI was about 4cm over a range of diameters). Peeling tests also were satisfactory.

⁵ both native and exotic, see Appendix 1

Its high basic density means that it can be used for construction grade plywood. Given this information and the need to identify a species that will perform on kerangas and kerangas type sandy soils (e.g., Bako series - 8.2.1) trials of Casuarina, (not necessarily confined to *C. equisetifolia*), might justifiably be undertaken.

Samling has spent much time and money on trials of native species. However, at the present time neither Samling nor - so it would appear - any other company in Sarawak has accessed sufficient and reliable information on the use of Sarawak native species in ITP for SEGAN to adopt any other choice of species scenario than that described here.

In Chapter 9, Plantations, in '*A Review of Dipterocarps*'⁶, Weinland restates a conclusion drawn by Kollert *et al* (1994) "...The establishment and management of [dipterocarp] plantations are uneconomical on financial terms alone." This conclusion was drawn more than 20 years ago. With the changes that have occurred since, particularly in wood processing technology, the possibility that one or more of the dipterocarps, e.g. *S. parvifolia*, might prove to be an economic plantation species is recognised by Samling. There is however more than 100 years of literature on the subject of dipterocarps as plantation species and a review is required before moving to the problem of sourcing seed and then moving to trials can be considered.

8.2.4 Utilisation of species selected – end uses

Table 8.1 shows the end uses for the species that have been planted in SEGAN including the possible end uses for the two species which have recently become operational species. Gmelina has already been subject to downstream peeling trials and was satisfactory. It is known to be a versatile species for processing and is a medium quality sawn timber. Falcata is well known in Java as a peeler species but downstream will need to run tests to confirm acceptability for sawing and use in high density fibreboard.

Table 8.1: End uses of species planted operationally by Samling

	Plywood	Sawn timber	HDF/door skins/pellet
Long Established			
Mangium	Yes	Yes	Yes
Crassicarpa	Yes	Yes	Yes
Pellita	Yes	Yes	Yes
Recently Established			
Gmelina	Yes	Yes	Yes
Falcata	Yes	Yes?	BD (kg/m ³) - 270 cf mangium 460 Possibly too light?

8.3 Current Establishment and Silvicultural Regimes

8.3.1 *Acacia crassicarpa* (Ac) and *A. mangium* (Am)

AC represents just over 70% of the LPF planted area. Given its alleged better resistance to *Ceratocystis* sp. and *Ganoderma* sp. it is planted in preference to mangium on second and subsequent rotation sites.

As may be noted in Table 8.1, the intention is to produce logs that will be suitable for peeling and for sawing. The determinant of suitability is primarily diameter – currently >15cm sed with an expectation that this will be reduced in time - with grading for roundness, straightness and internal defect (centre rot and hollow) undertaken after felling. Logs that are unsuitable for solid wood use will be chipped for Samling's HDF and pellet plant.

⁶ Eds. Appanah, S & Turnbull, J. M. 1998 CIFOR

Table 8.2: Typical Establishment and Silviculture Regime for *A. crassicarpa* & *A. mangium*

Operation	Approx. Year in Rotation	Operation Requires
Site Preparation	-1	Prepare for planting in order to create conditions for good survival
Planting & fertilise	0	Stock the site 1,667 SPH; fertiliser to SOP
Weed	0 -1	Manual weed & herbicide to keep newly planted stock weed free
Access prune & single	0.5	Remove multiple stems, forks, rogue & dead branches
Prune 1	1 to 1.5	Prune to 3m
Harvest	5-6	Clear fell

Good quality stock

As a matter of course Segan will only plant selected stock with good genetic characteristics, with preference given to seedlings from in-house collections of seed from the clonal seed orchards which, in the case of mangium, comprises only clones of elite Superbulk trees⁷.

Site preparation and establishment

Before planting takes place some site preparation is necessary. This usually involves an herbicide application to kill any emergent weeds, particularly natural regeneration of mangium, thereby reducing competition to newly planted seedlings. Labour shortage often results in the time elapsed between completion of harvest and the commencement of site preparation being overly long. This means that prior to spraying the site must be slashed and time allowed for new growth to flush before spraying.

SEGAN plants Ac and Am at 1,667 SPH (2mx3m) and considers a block to be established when a survival rate of 90% or more is achieved 30 days after passing planting QC.

Maintenance

Conditions are very conducive to vigorous weed growth. Circle weeding, slashing and herbicide spray are all used at a frequency that is determined by the rate of weed growth relative to that of the trees.

Silviculture

The objective is to produce primarily logs for solid use. Samling downstream has undertaken peeling trials of SEGAN mangium logs. On the logs there was negative comment on the form, the small diameter and the existence of dead knots; all of which can be influenced by silviculture. The results of both the sawing and KD trials was reasonably positive.

Where rotation length allowed an intensive silvicultural regime with 4 pruning lifts was designed to produce trees with a significant volume of “clear wood” in the lower stem. Logs from the lower stem would have primarily green knots restricted to a small DOS core along the pruned length and are expected to yield a significant proportion of face and back veneer. With the 5 to 6-year rotation and an initial 1,667 SPH this will no longer be the case.

8.3.2 Other species

Falcataria moluccana (syn. *Paraserianthes falcataria*) and *Gmelina arborea* are no longer planted operationally.

⁷ Superbulk is the name given to some of the mangium seed produced by Borneo Tree Seeds Sdn Bhd in which Samling has a holding.

Other species may also be planted by operations but as extensions of R&D trials following R&D recommendation. The area is very limited in extent: if the three acacia species and *E. pellita* are excluded

(see Table 4), then the balance of area planted to other species, including all R&D planting, represents around 3% of the total planted area.

8.4 Scheduling of Silvicultural Operations

Apart from the need to ensure that early competition from weeds is kept to minimum the key driver behind the silvicultural schedules of those species to be pruned is the timing (but see below). As SEGAN is aiming to produce clear wood material in order to maximize veneer recovery and quality, the minimisation of the knotty core (determined by diameter over stub, or DOS, at time of pruning) is essential.

Schedules are produced by the Segan LPF manager and checked by the visiting HQ manager. The recognition of *Ceratocystis* in mangium and a stem canker in *pellita* – both in 2012-13 - means that the progress in the relationship between pruning and the incidence of these two diseases must be closely monitored.

8.6 Planting Material Production

8.6.1 The Nursery

The Segan nursery includes germination house, utility building, adjustable shade growing area and fertilizer dosing system.

8.6.2 Potting Tray

Pot-trays will be used for seedling production. This method uses cocopeat as a potting mixture and the pot is designed to prevent roots from growing spirally. The dimensions of pot-trays are given in Table 8.4 below.

8.6.3 Potting Mixture

Cocopeat as a mixture with fertilizer is used as potting mixture. This provides a stable growing medium in which the seedlings have the best chance to grow to a good quality seedling to be transplanted in field.

8.6.4 Seed Handling

Upon receiving a consignment, the seed information will be entered into the seed register. Short viability seeds will be sown immediately. Seeds which can endure longer storage can be kept in cold storage with temperature between 5°C to 10°C. The seeds will be kept in the moisture proof clear plastic bags and properly labelled with seed lot code, species names, provenance, date of receipt etc. The storage temperature will be checked at regular intervals.

8.6.5 Sowing

Large-sized seeds such as Acacias will be sown directly into pots and small-sized seeds will be broadcast and later pricked onto the pot-trays. Sowing will be done inside the permanent germination house equipped with misting system. The humidity inside the germination house will be maintained at between 60 to 100%. The sowing box which is made of plastic material will be cleaned after use to prevent the growth of fungi. The size of the sowing box will be 25 to 34 cm and the height 12.5 cm. There should be enough holes at the bottom of the box to drain excess water out. Hard shell seeds will be scarified before sowing. After sowing the seeds will be covered with a layer of 2 mm fine sand to prevent movement during watering.

8.6.6 Pricking-out

Pricking is the removal of germinated seedlings from the sowing place and transferring on to a potting tray. The best time for pricking-out is when the germling has reached its ideal size and age. This will be determined by its physical appearance judged by the present of lateral roots. This is checked by lifting some samples.

The potting mixture will be well watered before transplanting. Pricking will be done under 50% shade. If germination is even, the germination boxes may be brought to the shaded area. If germination is uneven, the older germlings will be selected first for pricking, placed in the basin filled with water and then brought out to the shaded area. It is estimated that the work output per man day will vary from 1,500 - 2,000 seedlings. Immediately after transplanting, the seedlings will be watered with a fine nozzle watering can. Seedling mortality will be kept at less than 5%.

8.6.7 Watering

Misting is performed manually. The misting schedule is set by the Nursery Executive / Nursery Supervisor depending on the temperature and humidity changes.

8.6.8 Pest and Disease Control

Measures will be taken to eliminate conditions at the nursery which will allow fungi, insects and weeds to flourish. Practices such as controlling the humidity and light penetration in the germination and green house, avoiding over watering and high growing density and cleaning of sowing and cutting tools and equipment would be adopted to prevent growth of fungi. All dead seedlings must be disposed of properly. If fungi attack, fungicides can be used effectively with only one application.

Weeding must be done continuously not only to remove undesirable vegetation but also to reduce breeding places for insects. The insect population in the germination and green house can also be controlled through regular and judicious use of insecticide by implementing the Integrated pest management.

8.6.9 Fertilizer Regime

Fertilizer applications will be done according to the standard nursery practice of the species selected for the proposed project.

8.6.10 Culling

Culling is carried out to ensure that only healthy and vigorous seedlings are selected for out planting. The following are the criteria for selection:

- The height of the seedling should be 25 to 35 cm depending on species.
- The rootball is firm and compact.
- The stem is firm and strong with a minimum root collar diameter of 2.5 to 3.5 mm.
- The seedling is healthy and in good condition.

8.6.11 Tissue Culture

The Samling's management is committed to ensure the sustainability of the Industrial Tree Plantation project by investing and focusing into the improvement of planting material through R&D and migrating from seeds based to Tissue Culture based. Samling's first Tissue Culture lab has come into full operation on June 2025. The Tissue Culture lab is responsible to produce improved plantlet from the hybridization program. The plantlet is raised and nursed at Segan nursery. Thereafter, the "Ready to Plant" seedling will be distributed to the 5 LPFs for planting.

9. Monitoring Plantation Forest Dynamics, Pests and Diseases

9.1 Permanent Sample Plots

SEGAN is active in the use of permanent sample plots (PSPs). The LPF licence conditions require that one plot be established for every 20 hectares planted. From the start of PSP measurement this was

reduced to one plot per 5 hectares and this has been maintained in order to build up a strong data base in a reasonable time. On mineral soils there is a strong network of PSPs in both first and second rotation blocks and this now continues into the third rotation. PSPs are now established in blocks on the peat soils of Coupes 6 and 7.

At the outset PSPs were established when the trees were 24 months old. However, there was a delay in establishing PSPs in the earlier plantings which resulted in a data gap for two and three-year-old mangium of the first rotation.

PSP establishment is now at 12 months old. This, in part, reflects the change to a 5 to 6-year rotation. The PSP data are used to construct a Series file which lists the summary of the measurements captured over time for each block in which PSPs have been established. The PSP block summary data are also entered into a growth and yield file (/PSP NEW MASTER GROWTH SEGAN). This information is used to construct yield tables and growth models for each species. The processed information in the growth and yield file is also used to:

- maintain an updated estimate of the allowable annual cut (AAC);
- determine which blocks should be harvested in any one year to achieve the AAC;
- form the basis of the annual harvest plan; and
- prepare long term production forecasts.

It can be seen that somewhat unusually the PSPs serve two functions: growth modelling and inventory at the level of the area to be harvested annually. The sampling intensity is too low (1.0%) to give volume estimates at the block level – something that must always be kept in mind when reviewing the actual block production in the Trucked Yarded reports.

P&D information is also collected at the time of PSP assessment.

Following initial establishment of the PSP subsequent re-measurement should be done on the anniversary of the first measurement over the length of the whole rotation. As the data base strengthens the need to continue the current, very high, level of sampling intensity will be reviewed for each species.

In the Miri office plot locations are determined randomly (but with the restriction that no two plots can be closer than 200 m) within the planted productive area recorded in the GIS. The co-ordinates are then provided to the PSP crew leader. In the field, regardless of where it falls, the plot centre is established at the predetermined GPS point. The only exception allowed is to ensure that no part of a plot encroaches on to a road-line or any non-productive area that has been GPSd and excluded from the productive planted area statement.

PSP measurements are recorded on a paper-based system and then entered into Excel for processing in Miri.

9.2 Taper Functions and Volume Equations

A taper function has been developed for *Acacia mangium* (mangium) based on SEGAN volume sample trees. This is also used for the *A. crassicarpa* (Ac). An interim volume equation has been developed for Samling's *Eucalyptus pellita* (pellita). Samling contributed sample tree data to BFC who commissioned the development of volume and taper functions which the consultant confirmed were applicable to Samling's pellita.

A taper function has been developed for Samling's Pellita, in collaboration with Borneo Forestry Cooperative (BFC). Taper functions for other species will be developed when there is a sufficient number of representative trees old enough to provide the required full DBH range of sample trees.

At a later stage of plantation development, it will be necessary to test the applicability of a single taper function for each species to all LPFs.

9.3 Results of Monitoring Tree Growth and Site Productivity

9.3.1 Mangium

The harvested area of Coupe 1 (R.1) was almost 520 ha. The final weighted values from the 133 PSPs established were:

- average PSP plot age at date of last measurement -10.0 years;
- standing volume to 5 cm sed -172 m³/ha;
- average DBH - 26.7 cm;
- stocking – 347 SPH;
- MAI – 17 m³/ha/year;
- CAI at Year 10 was just over 4 m³/ha with many plots negative.
- mortality between the last and penultimate measurements was 13% and, for individual blocks, ranged from 4% to 35%.

All the Rotation 1 (R.1) areas on mineral soil have now been harvested. Productivity for this area, shown graphically below in Graph 9.1, peaks between Year 8 to 10 at 160 m³/ha and declines thereafter as mortality increases and negative increment sets in.

Figure 9.1: Segan – Mangium productivity - R.1 mineral soil Coupes 1 to 5.

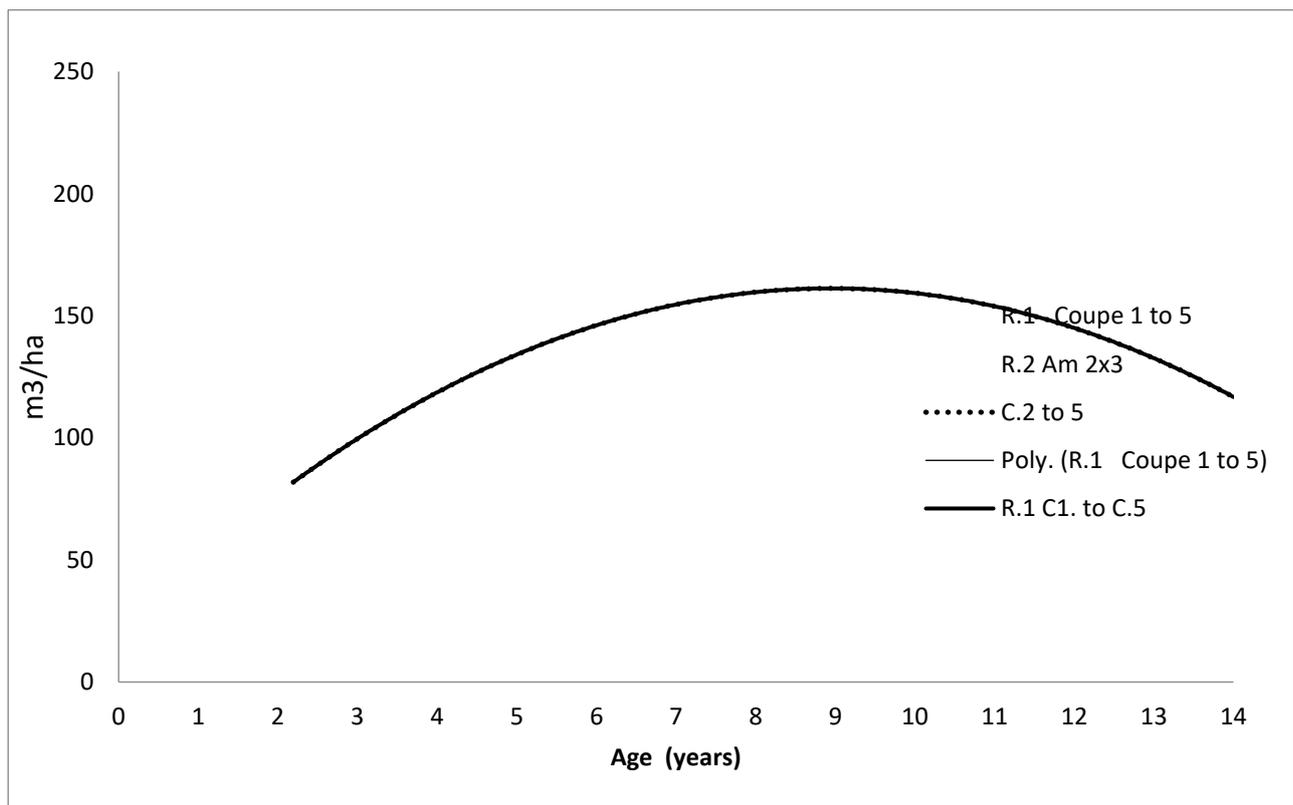


Figure 9.2: Segan – Mineral – Am 2m x 3m –Rotation 2 analysis as of 31st December 2025

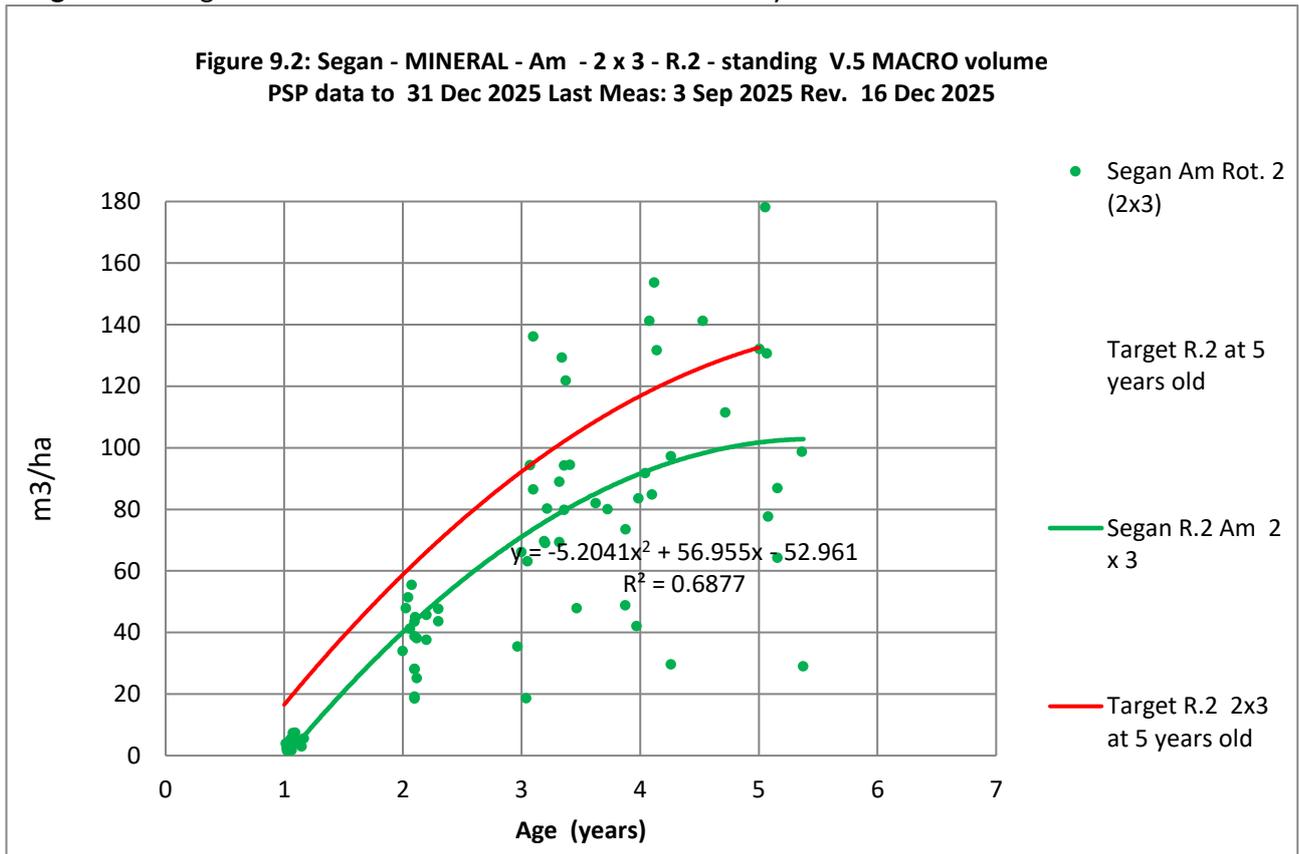


Figure 9.3: Segan – Mineral – AC 2m X 3m – Rotation 2 analysis as of 31st January 2026.

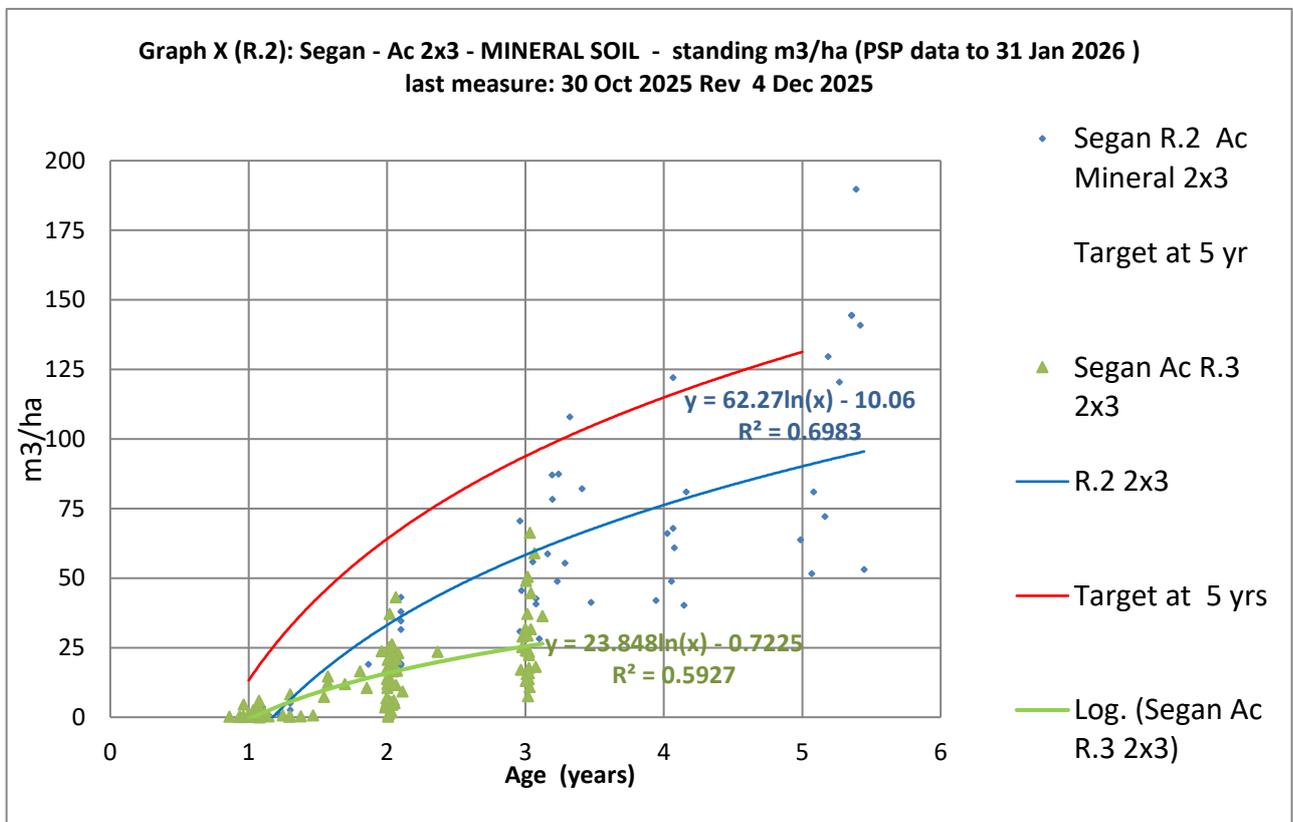
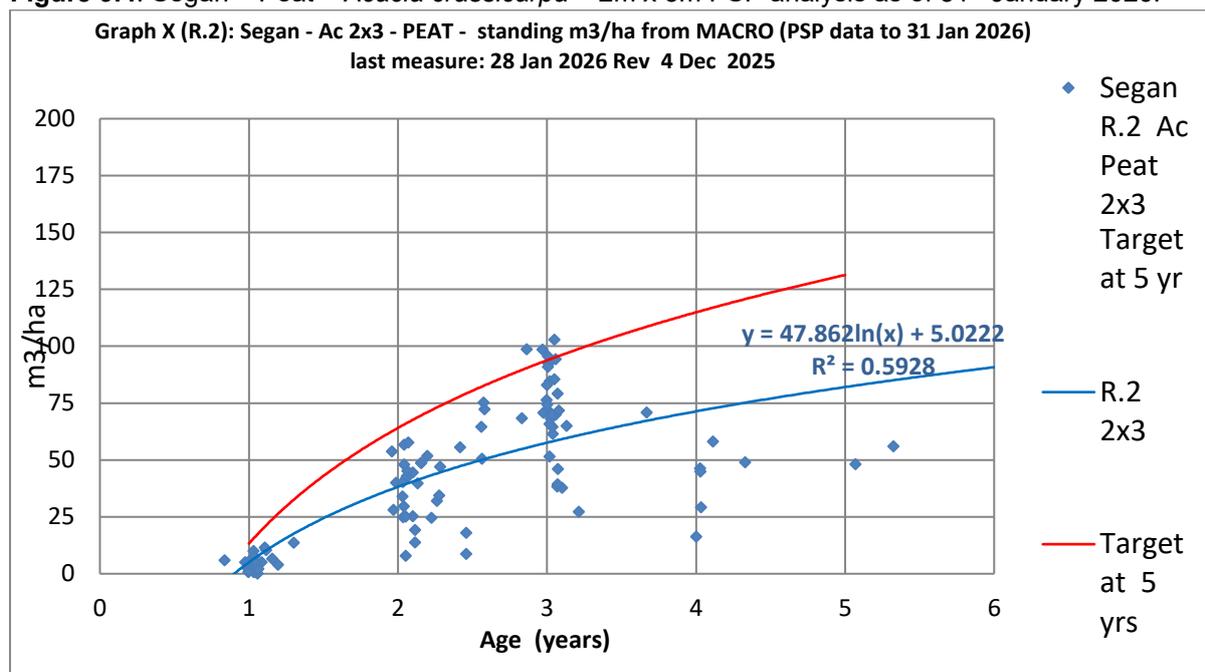


Figure 9.4: Segan – Peat – *Acacia crassicarpa* – 2m x 3m PSP analysis as of 31st January 2026.

The R^2 in Figure 9.2 is quite strong at 0.6877 and the Year 5 extrapolated value of 103 m³/ha should be reasonably reliable for use in calculating the AAC (Ch. 10) while the measurement of Rotation is inadequate to demonstrate the yield table to rotation age. It is currently assumed that the mangium growth model is also applicable to *crassicarpa*.

Crassicarpa

Figure 9.3 and Figure 9.4 shows that the PSP result for *crassicarpa* where the measurement has extended beyond five years of stand age.

9.3.2 Pellita

It is not planned to plant a significant area of pellita in the second Rotation 2 (R.2). Indeed, there has been no planting of pellita in the last four years.

However, as a matter of record some information on the growth of pellita in Rotation 1 is given here. Growth was extremely variable with large differences between the PSP results for plots of the same age. The increment between sequential measurements of the same plot could also vary widely from one year to the next.

The average harvest age over 235.3ha harvested was 12.6 years. The decision to harvest was determined by the need to clear and replant what were generally the non-performing areas pellita.

By converting trucked weight to volume and allowing 10% H&T losses the standing volume was determined as 82m³/ha – an MAI of 6.5m³/ha/yr.

9.4 Monitoring of Pests and Disease

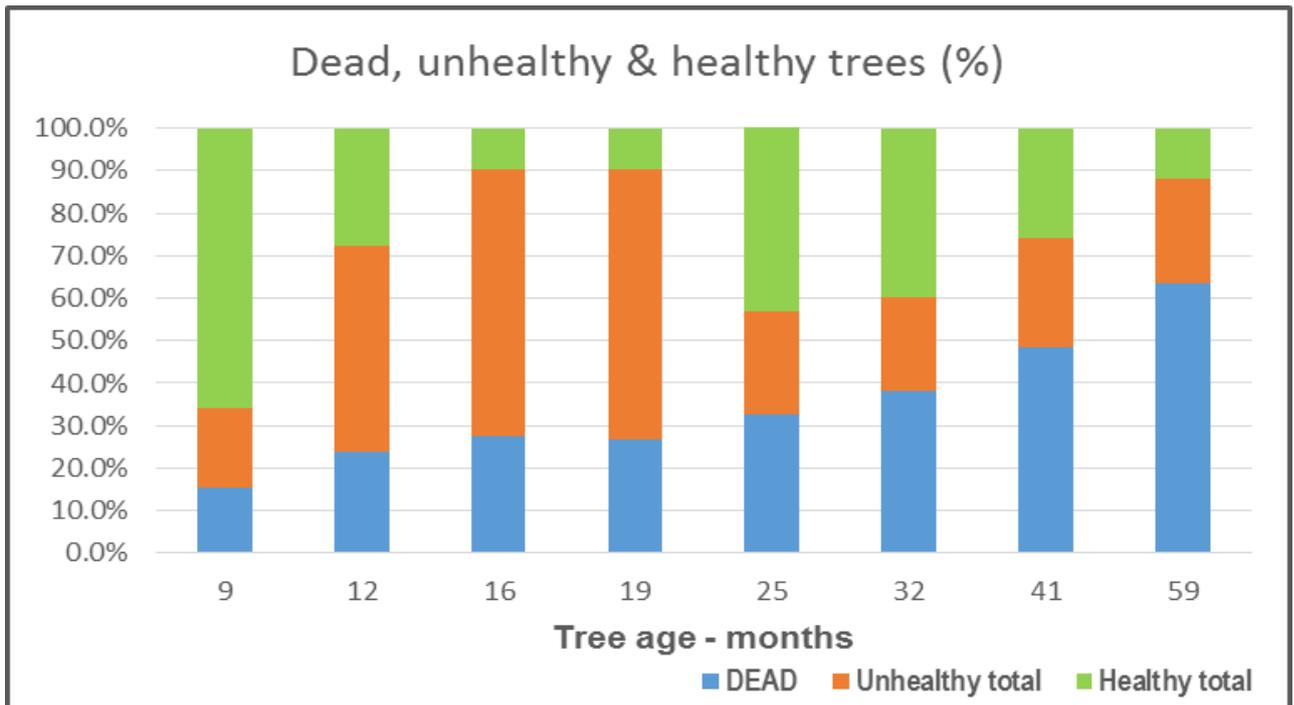
9.4.1 Regular monitoring

Regular monitoring is undertaken by the PSP crew at the time of establishing or re-measuring the PSP plot. Only the occurrence of what are considered to be the more important P&D factors is recorded.

9.4.2 Ad hoc monitoring

Ad hoc monitoring is undertaken for specific purposes as and when management deems necessary. Figures 9.2 and 9.3 show the results of long-term *ad hoc* monitoring of pests and disease (P&D).

Figure 9.5 – Survival and mortality by age in 2nd rotation *Acacia mangium* in Segan 01A/04

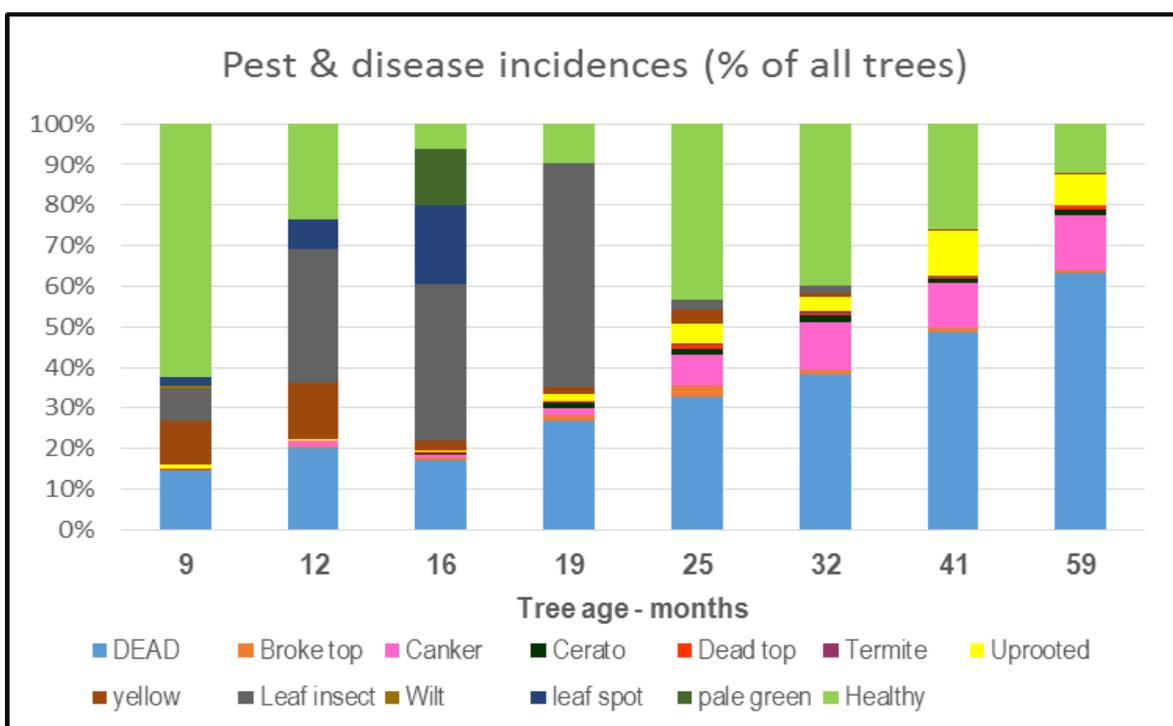


Source: R&D trial #079 Report '17-09

The main focus was primarily to monitor the progress of the *Ceratocystis* sp. which had been identified in C.01/4B in 2013.

As may be noted in Figure 9.3 over the sequential monitoring up to 59 months old the incidence of *Ceratocystis* sp. had yet to become a significant contributor to mortality although at 59 months mortality was already very high. However, when harvested at 9.9 years old the standing volume (converted from millgate tonnes) for the whole block was 74m³/ha – an MAI of only 7.5m³/ha/yr but still higher than might be expected from the high level of mortality recorded in the R&D trial.

Figure 9.6 – Mortality and contributing factors in 2nd rotation *Acacia mangium* in Segan 01A/04 from age 9 to 59 months



Source: R&D TRIAL #079 Report '17-09

10. Sustainability: Annual Cut, Harvesting Plan & System, Financial

10.1.1 Past harvesting – Financial Years 2012 – 2024

Harvesting started in earnest in FY 2012. (Only 19,942 m³ were harvested in the initial 3 years prior to FY2012). As shown in Table 10.1, harvesting if the AAC was achieved in FY 2017 and was almost achieved in FY 2022. Overall, in the thirteen years from FY 2012 to FY 2024, SEGAN LPF was undercut by 81,222 m³. ie only 87% of the AAC was harvested.

Table 10.1: Past Harvesting - AAC (Planned harvest) and actual harvest (m³)

Harvest	Financial Years (July to June) m ³													Annual Average Harvest		
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24		2024-25	Total to-date
Actual	27,071	16,025	32,860	27,587	31,501	43,639	66,150	62,114	48,631	48,903	69,272	43,088	55,639	51,011	623,891	44,564
AAC	18,000	18,000	42,000	42,000	42,000	42,000	69,996	69,996	69,600	69,600	69,600	44,191	55,860	55,860	708,703	50,622
Act-Plan	9,071	-1,975	-9,140	-14,013	-10,499	1,639	-3,846	-7,882	-20,969	-20,697	-328	-1,103	-221	-4,849	-84,812	-6,058

Source: a) Trucked Yarded Segan as of 30th June 2024; b) Refor Harvesting Plan

10.1.2 10-year harvest plan for Financial Years 2024 to 2033

As can be seen in Table 10.2, the planned AAC averages 70,328 m³ a year over the 5-year harvest plan.

Table 10.2: AAC (5-year harvest plan) (m³)

Harvest	Financial Years (July to June) m ³					Total to-date	Annual Average Harvest
	2025-26	2026-27	2027-28	2028-29	2029-30		
Actual	26,527					26,527	26,527
AAC	56,640	59,000	72,000	82,000	82,000	351,640	70,328
Act-Plan	-30,113					-30,113	-30,113

Source: a) Trucked Yarded Segan as of 31st Jan 2026; b) Refor Harvesting Plan

10.1.3 AAC validation

Table 10.3 shows a rather crude validation of the AAC using the current estimate of future productivity and the current planted area. But it should be noted that at present that there are still insufficient PSPs established for the older plantings of *A. crassicaarpa* consequently the present AAC estimate is based on the mangium model. For the next 5 years the AAC is about 11% below the modelled yield as shown in table 10.3. Through improvements in the genetics of the planting material and further improvements in silviculture, it is expected that the yield will increase with 6 to 10%.

Table 10.3: AAC validation

Species	Area (ha)	Rot'n (Yrs)	Annual Cut Area (ha/yr)	Modelled		Annual (m ³ /yrs)
				m ³ /ha	Source	
Am/Ac	4,473	5	894	88	model 2x3	78,672
Total	4,473	5	894	88		78,672

Source: a) Segan FPMP table 5.2; b) PSP Summary 202603 FB

10.2 Harvest Plan

FDS requires a five-year harvest plan. The in-house harvest plan is dynamic. It is held in soft copy format allowing for easy and continual revision as new and revised PSP information is generated. It consists of a register of blocks planned for harvest in each of the next ten budget years; the blocks listed against each budget year will be the source of that year's harvest volume. The register is updated to reflect the reduction factor that takes into account the variance of the actual yield from that estimated for harvest planning purposes.

The sustainable annual cut for the ITP should determine by considering both the mineral and peat soil areas as alluded to in Section 10.1.3. The age class structure is now much closer to a normal forest age class structure (see Figure 5.1). This means that most blocks will now be harvested at their target rotation age.

10.3 Harvest System

Because of the steep and broken terrain, double winch system is the primary harvesting system to be used at SEGAN. As well as being economically more efficient the use of this system also helps to protect the fragile soils and reduce erosion and compaction. Avoidance of the latter effect is of particular importance when replanting with eucalypts.

SEGAN uses in-house crews for harvesting and a mix of fully mobile double winch yarders and shovel yarders. This is a system that enable partial or full suspension of felled trees when yarded to a landing for partial processing. Economics demands that extraction of trees harvested near the roadsides must be ground based. Site damage will be limited by the use of shovel mounted grapples.

Other benefits of a yarding system include:

- reduced disturbance to soils on steep erodible sites;
- reduced compaction when compared to a ground-based system;
- it can be used from high vantage points minimising construction of new road infrastructure (this helps maintains water quality and minimises site disturbance); and
- it allows access to otherwise economically inaccessible areas.

SEGAN completed harvesting of the first rotation of ITP that was planted on residual and degraded MTH mineral soil areas. Full use was made of existing logging roads and skid trails and little new roading was required other than the extension of access spur roads. These were constructed following approval by SFC and prior to obtaining approval to harvest - (Operation 5 in the current PHC system. Now all applications for Ops 1 to 5 are submitted to FDS for approval). Currently, SEGAN is harvesting the second rotation of ITP.

10.3.1 Pre-harvesting activities

The pre-harvesting activities involves the submission of Tree Harvesting Plan (THP) to the Forest Department. THP show the mature planted forests Coupe layout, road networks & numbered in the order which they will be harvested. This is followed by the submission of Annual Harvesting Plan (AHP). The purposes are:

- a. To determine the locality and size of plantation forest to be harvested.
- b. To ensure that buffer zone & conservation area are protected.
- c. To ensure only approved road networks are used to facilitate harvesting operations.
- d. To ensure approved harvesting methods are used.
- e. To specify the purpose of the used of the planted timber.

The submission of Annual Harvesting Plan (AHP) is followed by the issue of Permit to Harvest Coupe (PHC). Prior the issuance of PHC, the Regional Forest Office will conduct on field verification on Coupe/ Block Boundary, Protection area, Conservation area and road network in place.

10.3.2 Harvesting activities for Harvesting Segan LPF/0014

Tree feller is required to complete a safety and health training course, including the provision of the first aid. Before the beginning any cutting work, tree fellers are responsible for ensuring that their chainsaw and other tools are full functional and safe to use. Additionally, competence in directional tree felling is mandatory, with critical practices including verifying and adjusting the intended felling direction, assessing the tree's natural lean, and avoiding tree falls across valleys, broken terrain or into designated buffer zones. A safe working area must be cleared, an escape path prepared, and

any attached wood climbers cut before proceeding with tree felling. Furthermore, tree felling operations must be suspended during wet weather. No felling activity carried out in exclusion zones of Segan LPF/0014, e.g. Special Management Zone (Steep slope (slope limit 35°), Conservation Area (Green Belt), river buffer). The protected tree species such as Tapang (*koompassia excelsa*) and *Ficus* spp. are not allowed to be felled.

Extraction of Planted Timber: The machine operators are required to hold valid training certification in log extraction and choker setting / winching. For the roadside landing, the extracted logs are to be trimmed, graded and segregate into log grading. Trim is to remove the rejected portion of the log end with a chainsaw. In this process, all remaining limbs and stubs have to be trimmed. Cross-cut made horizontally through the trunk of a tree that utilized as much of the tree as possible, taking into consideration of the grading specification (Peeler, Saw logs and Chip). Offcuts, remnants, bark, and canopy debris must not be burned or pushed into waterways.

Log transportation: The personnel in-charge of the harvesting activities shall be present to observe the loading process. The loading activities carried out by log loaders using excavator and only allowed during day light hours excluding period of poor visibility.

10.3.3 Post-Harvesting Activities

The Regional Forest Office (RFO) will conduct ground verification to ensure all activities are carried out in compliance. Upon verification, the RFO will issue the Block Clearance Certificate (BCC) and Coupe Clearance Certificate (CCC).

10.4 Financial Sustainability

SEGAN is the smallest of the five operating ITPs licensed to the Samling Group. The Group has clearly been financially supportive of SEGAN for the past 23 years and of the other ITPs since their start-ups. It should be assumed this will continue to be so for the foreseeable future. However, when combined with the downstream's revenue, SEGAN should be in a cash flow positive position for the remainder of the 60-year licence period with net revenue from log sales and processing covering replanting and overhead costs.

10.5 Non-Timber Forest Products (NTFPs)

Currently there are no non-timber forest products extracted commercially.

11. Spatial Information and Management Systems

11.1 Spatial Information

With the ATLAS GeoMaster Samling has a GIS that contains detailed spatial information for the SEGAN LPF. Data are captured by the QS team using Garmin 76CSx and by LiDAR commissioned by Samling - both enhanced by the use of *ad hoc* satellite imagery. GPS tracks are downloaded using OziExplorer. Tracks are then cleaned and processed using Quantum GIS. GIS data is then held by GeoMaster for further processing and mapping. The GIS allows Samling to produce a variety of maps displaying an array of information including legal, coupe and block boundaries, protected areas, land-use and related spatial information, such as contours and transportation features. Harvest planning is currently done manually on maps generated from the GIS with LiDAR providing contours at 5m intervals.

EOS Sentinel 2 imagery is used to monitor encroachment into the LPF area. When this is identified Miri HQ will make a report to FDS so that they can investigate as required.

11.2 Management Systems

Plantation event information is captured by the SEGAN office through the use of Project Job Order (PJO) forms in the Enterprise Resource Planning System (ERP) - Microsoft Dynamics AX. At Miri HQ a copy of this event information is then updated into ATLAS GeoMaster. Plantation executives may

download the event information into the GeoMaster Mobile app and then view the event information onsite using a smart phone.

Payroll and financial information, stock ordering and stock control are managed using the ERP system.

12. Conservation, Conservation Areas and High Conservation Value Areas

12.1 Conservation

Given the past history of widespread, heavy harvesting with multiple re-entry it is not surprising that undisturbed primary forest has yet to be identified within the ITP. Furthermore - as reference to Map 5.1 shows - apart from the boundaries formed by Btg Kemena, Sg. Segan and Sg. Binai most of the LPF boundaries are common with oil palm estates (or areas designated to become oil palm estates), shifting or settled agriculture or with Sarawak Planted Forest's ITP (LPF/0043).

This history, its small size and the occupations of its neighbours, all mitigate against, but do not necessarily preclude, Segan having much relevance to conservation in general and as a haven for endangered, rare, threatened species (RTE) in particular. This is of course especially true for larger animals. But however, limited the potential might be SEGAN recognises it has an obligation and commitment to incorporate into its management practices a system that takes into account the need for conservation awareness and for the identification and protection of RTE species. It also recognises the importance of indigenous biodiversity and the need to protect some areas of indigenous vegetation which might have the potential to recover, albeit over a long time, in both structure and biodiversity, to something approximating that which existed prior to the start of harvesting of the natural forest.

Some information from the adjoining ITP, the state government's Sarawak Planted Forest (SPF), has been obtained in order to identify actual or potential cross border conservation areas and areas in which RTE species have been identified. (SPF has a long and valuable history of undertaking with third parties the field work necessary to identify these species and SEGAN expects to share some of the SPF experience and findings. SPF has identified a few RTE species within their LPF, but none is in a conservation area close to or abutting SEGAN. Information on adjoining wildlife corridors has been incorporated into the SEGAN GIS. Samling also liaises with other stakeholders regarding conservation matters: FDS, SFC and WWF.

As mentioned earlier there are no areas of undisturbed primary MTH have been identified in SEGAN. Those areas of remnant MTH that have been designated as conservation areas, as opposed to riparian buffer zones (the establishment of which is a mandatory), will be protected as SMZs. Full protection of the conservation areas and other SMZs will allow them to continue to recover and develop their biological diversity. They will also provide refuges and ecological corridors for any RTE species and all other wildlife in the LPF and adjoining areas.

It is Samling's policy that anyone working in SEGAN should have a positive approach to conservation and be involved with the process of protecting RTE species. Contractors are asked to note, either verbally or in writing, the location and type of any RTE species they come across in their day to day activities.

For example, all establishment, silviculture and harvesting contracts contain the following clause:

"Sites which are known to be culturally sensitive or are known to contain rare, threatened or endangered species are surveyed and placed on SEGAN maps. If these areas are identified on any map(s) issued with the Work Order, it is the responsibility of the Contractor to ensure his workers have been informed of them before work commences. Any new sites or species encountered will be reported to SEGAN management immediately."

The EIA identified some of the protected and totally protected fauna that occur within the LPF (Appendix 2) and the HCV 1 to 4 study, referred to in Section 12.2, contains further information and should be referred to for detail.

As a forestry company with increasing ITP interests, SST also views its forest plantations as a contributor to reducing pressures on the harvesting of MTH in Sarawak and Malaysia (and therefore globally).

12.2 High Conservation Value Areas

A document entitled 'An Assessment of the Potential for Designating Areas as High Conservation Value Forest [*sic*] within Segan LPF/0014'⁸ was submitted to SIRIM on 29th March 2014. This was done in response to the auditors' findings during the Stage 2 audit and to close the NCR raised then. (The NCR was raised only because the assessment of HCV 1-4 was still on-going at the time of the Stage 2 audit. The report on HCV 5-6 - socio-economic study - was available to the auditors.) The document gives a detailed summary of the HCV status of Segan following completion of the HCV 1-4 study. It is based on two reports: 'HCV 1-4 Assessment - Flora and Fauna Survey' by Joanes Unggang *et al* (March, 2014)⁹ and the 'HCV 5-6 Socio-economic Study' by SFC (November, 2013)¹⁰.

Assessment of HCV followed the WWF Toolkit for Malaysia¹¹. The main headings are given below to reinforce management's awareness of the breadth of HCVs. For detail the above two reports should be consulted.

Procedure for Monitoring and Management Measures of High Conservation Value Areas (HCVAs); and Process of Discovery and Demarcation of New HCVAs used by the LPF as a guide. Its outlines the frequency, monitoring scope, discovery process, demarcation and reporting. Section 12.2 had mentioned that the HCVA identified was categorised by as SMZs by LPF management as it providing an equal level of protection as would be accorded an area declared as an HCV area.

HCV 1 Biodiversity Values *Forest area contains globally, regionally or nationally significant biodiversity values (e.g. endemism, endangered species, and sites of critical temporal use)*

HCV 1.1 Protected Areas

HCV 1.2 Threatened and Endangered Species

HCV 1.3 Endemism

HCV 1.4 Critical Temporal Use

HCV 2 Landscape-level Forest *Forest area contains globally, regionally or nationally significant large landscape level forest where significant populations of most if not all naturally occurring wildlife species exist in natural patterns and abundance.*

HCV 3 Ecosystems *Forest area contains or is part of a threatened or endangered ecosystem.*

HCV 4 Services of Nature *Forest area provides basic services of nature in critical situations.*

HCV 4.1 Watershed Protection

HCV 4.2 Erosion Control

HCV 4.3 Barriers to Destructive Fire

HCV 5 Basic Needs of Local Communities *Forest area is fundamental to meeting basic need of local communities.*

HCV 6 Cultural Identity of Local Communities *Forest area is critical to local communities' traditional cultural identity.*

What follows is a slightly edited version of the conclusion drawn in the document submitted to SIRIM on 29th March 2014 and referred to earlier in this section:

⁸ DOC0014

⁹ DOC0015

¹⁰ DOC0013

¹¹ First Edition 2009 WWF-Malaysia

“Some important points made elsewhere are restated here:

1. the area had been very heavily disturbed by logging prior to the issue of the LPF licence.
2. further salvage logging took place prior to the release of coupes for LPF operation;
3. the LPF has been in continuous operation for 15 years.
4. harvesting has been in progress for almost 6 years also as a continuous operation and will continue in perpetuity.
5. a high percentage - almost 22% - of the forested LPF area (excluding forested belukar) is designated as SMZ. This means there is a large, forested area under protection. hunting by Samling employees and contractors is prohibited and there is almost no interest shown by locals in hunting and fishing for their own consumption within the LPF.

The first four points above are, without doubt, ‘conservational negatives’ but it is quite clear from the EIA and the HCV 1-4 report that, despite these negatives, an interesting degree of biological diversity has been maintained.

The fifth point - that such a high proportion of the area has SMZ status and is therefore already protected from invasive human activity – together with the sixth point will surely lead to the existing diversity, already quite considerable, being quantitatively and qualitatively further enhanced over time.

The HCV 1-4 report shows that the Segan LPF does have some HCV attributes, e.g., the existence of RTE species and of some species endemic to Borneo. However, when the qualitative and quantitative aspects of these attributes are viewed in the context of relevance either to Sarawak’s needs or to those of the Segan LPF itself, there is no justification for elevating any of Segan LPF’s numerous conservation areas from their current protected status and according to them HCV status. This point is reinforced by the SMZs providing an equal level of protection as would be accorded an area declared as an HCV area.

Management prescription of Special Management Zone (SMZ) within Segan FPMU:

Zone Types	Action taken by Segan FPMU												
Riparian buffer (RBZ)	<p>a. River Buffer Zone of permanent water courses are demarcated on the ground with blue marking and on Lana MTCS Map. Any encroachment detected will be reported to FDS Enforcement Unit. Conversion or planting should not be carried out at river buffer zone. Monitoring: The scheduled patrolling is conducted twice a month covering the detection of illegal hunting, road conditions, encroachment, damage of special management zone, safety and health, community interaction, invasion of exotic species and other suspicious activities.</p> <table border="1" data-bbox="783 1783 1430 2051"> <thead> <tr> <th data-bbox="788 1783 1090 1861">Width of water course (m)</th> <th data-bbox="1090 1783 1425 1861">With of River Buffer Zone (m)</th> </tr> </thead> <tbody> <tr> <td data-bbox="788 1861 1090 1899">>40</td> <td data-bbox="1090 1861 1425 1899">50</td> </tr> <tr> <td data-bbox="788 1899 1090 1937">20-40</td> <td data-bbox="1090 1899 1425 1937">40</td> </tr> <tr> <td data-bbox="788 1937 1090 1975">10-20</td> <td data-bbox="1090 1937 1425 1975">20</td> </tr> <tr> <td data-bbox="788 1975 1090 2013">5-10</td> <td data-bbox="1090 1975 1425 2013">10</td> </tr> <tr> <td data-bbox="788 2013 1090 2051"><5</td> <td data-bbox="1090 2013 1425 2051">5</td> </tr> </tbody> </table> <p>Source: Segan EIA Report</p>	Width of water course (m)	With of River Buffer Zone (m)	>40	50	20-40	40	10-20	20	5-10	10	<5	5
Width of water course (m)	With of River Buffer Zone (m)												
>40	50												
20-40	40												
10-20	20												
5-10	10												
<5	5												

Steeps areas: $\geq 35^\circ$ rare mandatory; upper slopes	b. It is mandatory to exclude this area from ITP productive area. Demarcation on the ground with blue marking and on Segan MTCS Map. Any encroachment detected will be reported to FDS Enforcement Unit. Conversion, clearing or planting should not occur on the steep terrain $\geq 35^\circ$. Monitoring: The scheduled patrolling is conducted twice a month covering the detection of illegal hunting, road conditions, encroachment, damage of special management zone, community interaction, invasion of exotic species and other suspicious activities.
Gulley: Steep riverside areas outside the mandatory buffer zone	c. Due to its steep slope, this part of the area is excluded from ITP productive area and then it protected under special management zone. Demarcation on the ground with blue marking and on Segan Basemap Map. Any encroachment detected will be reported to FDS Enforcement Unit. Conversion, clearing or planting should not occur in protected area. Monitoring: The scheduled patrolling is conducted twice a month covering the detection of illegal hunting, road conditions, encroachment, damage of special management zone, community interaction, invasion of exotic species and other suspicious activities.
Conservation: voluntary designated as such; otherwise it might have been planted.	a. Same as other zone types, this area is demarcated on the ground and on the map. The clearing, conversion and planting activities are strictly prohibited in conservation area.

The HCV 5-6 Socio-Economic Report (November 2013) by SFC showed that there was almost no interaction between the local population and the forested areas inside the LPF. This was reinforced by a later Social Impact Assessment undertaken by UPM (May 2021).

There is no evidence or claim to date of any sites within the LPF having any historical or current cultural relevance.

The following guideline and procedures are used as a guide in managing and demarcating of Special Management Zone (SMZ):

- a) Operational Procedure No.: SST/RP/QS/01 River Buffer Zone
- b) Operational Procedure No.: SST/RP/OP/01 Quantity Survey and GIS Mapping
- c) The Guidelines for Fauna Conservation and Ecosystem Management
- d) Procedure for Identifying and Demarcating Sensitives Areas for the Protection of Soil and Water (FDS);
- e) Procedure for Monitoring and Management Measures of High Conservation Value Area (HCVAs); and Process of Discovery and Demarcation of New HCVAs (FMC-2023). (Samling Natural Forest)

12.2.2 Wildlife Monitoring

Fauna

The presence or absence of fauna within the plantation is monitored by means of sightings and camera trapping. Table 12.1 and 12.2 on the next page shows the annual summaries of the sightings and camera trapping for the various animals whose presence in the plantation had in some way been noted.

Flora

Twenty-five PSPs were established by SEGAN in conjunction with UPM during 2015. These were 400m² in which all living trees \geq 10cm DBH were measured and identified in most cases to species level. In total some 923 individual trees were tagged with the following distribution:

Families - 49

Genera - 127

Species - 300

By far the most dominant family is the Dipterocarpaceae with 253 individuals recorded followed by the Euphorbiaceae with 53 individuals recorded. Interestingly seven of the dipterocarps identified are in the Sarawak Plant Red List with an additional four in the Malaysian Plant Red List.

Table 12.1: Segan wildlife monitoring (Year 2014-2025) – Summary of annual sightings¹²

Annual Summary of Sightings															
Common/Local Name	Scientific name	YEAR													
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTAL	
Mammalia															
All civets (Musang)	<i>Family Viverridae</i>	0	0	0	0	0	0	0	0	1	1	0	1	3	
Pangolin (Tenggiling)	<i>Manis javanica</i>	0	0	0	0	0	0	0	0	0	0	2	0	2	
Barking Deer (Kijang)	<i>Muntiacus muntjak</i>	0	0	3	3	3	4	0	0	1	1	1	3	19	
Bearded Pig (Babui/Babi hutan)	<i>Sus barbatus</i>	6	4	7	4	8	22	38	5	5	5	15	1	120	
Flat-headed Cat (Jelu mayau/Kucing hutan)	<i>Felis planiceps</i>	1	1	0	0	0	1	0	0	0	1	1	0	5	
Long-tailed Macaque (Kera)	<i>Macaca fascicularis</i>	1	1	8	1	1	0	0	17	7	108	68	212		
Malay Weasel	<i>Mustela nudipes</i>	0	0	0	0	0	0	0	0	2	0	0	2		
Malayan Porcupine (Landak)	<i>Hystrix brachyura</i>	2	3	5	6	5	4	0	0	0	0	1	0	26	
Mouse Deer (Pelandok)	<i>Tragulus napu</i>	1	2	0	0	0	5	0	0	0	0	1	0	9	
Otter (Memerang)	<i>Family Lutrinae</i>	0	0	0	0	0	0	0	0	1	0	0	2	3	
Bornean Gibbon	<i>Hylobates muelleri</i>	0	0	0	0	0	0	0	0	0	0	0	11	11	
Pig-tailed Macaque (Nyumboh/Beruk)	<i>Macaca nemestrina</i>	3	3	0	0	7	10	9	1	7	0	0	8	48	
Plaintain Squirrel (Tupai pinang)	<i>Calloscirus notatus</i>	2	2	2	6	10	10	2	0	4	10	9	15	72	
Prevost Squirrel (Tupai gading)	<i>Calloscirus prevostii</i>	0	3	0	0	0	21	1	0	1	3	0	0	29	
Giant Squirrel (Kerabak)	<i>Ratufa affinis</i>	0	0	0	0	0	0	0	0	0	0	0	2	2	
Sambar Deer (Payau/Rusa)	<i>Cervus unicolor</i>	7	3	3	2	3	6	5	2	11	16	47	18	123	
Short-tailed mongoose	<i>Herpestes brachyurus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	
Slow Loris (Bengkang/Kongkang)	<i>Nycticebus coucang</i>	2	2	0	4	5	11	0	0	0	1	0	0	25	
Sun Bear (Jugam/Beruag madu)	<i>Helarctus malayanus</i>	1	0	0	0	0	0	0	0	0	0	2	3	6	
Reptilia															
All snakes (Ular)	-	0	0	0	0	0	0	2	0	1	0	2	8	13	
Common Cobra (Ular tedung)	<i>Naja spp.</i>	0	0	0	0	0	0	0	0	1	0	0	2	3	
Malayan Water Monitor Lizard (Biawak)	<i>Varanus salvator</i>	0	0	0	0	0	0	6	0	9	11	15	14	55	
Saltwater Crocodile (Buaya air masin)	<i>crocodylus porosus</i>	0	0	0	0	0	0	0	0	0	0	1	0	1	
Python (Ular sawa)	<i>Python curtus breitensteini</i>	2	2	0	2	2	3	0	0	0	0	1	0	12	
Aves															
All eagles (Menaul/Lang)	Family Acciptridae	0	0	0	0	0	4	1	2	10	15	0	2	34	
All owls (Burung hantu)	-	0	0	0	0	0	1	0	1	0	1	0	0	3	
All swiftlets (Lelayang)	-	0	0	0	0	0	0	7	0	0	0	0	0	7	
All woodpeckers (Belatuk)	-	0	0	0	0	0	0	0	0	0	1	0	0	1	
All Kingfishers (Burung Pekaka)	Family Alcedinidae	0	0	0	0	0	0	0	0	0	0	0	1	1	
Asian Glossy Starling (Meperling mata merah)	<i>Aplonis panayensis</i>	0	0	0	0	0	0	0	0	0	0	2	0	2	
Stork-billed kingfisher	<i>Pelargopsis capensis</i>	0	0	0	0	0	0	0	0	0	0	2	0	2	
White breasted waterhen (Burung Wak-wak)	<i>Amaurornis phoenicurus</i>	0	0	0	0	0	0	0	0	0	0	2	0	2	
Black Hornbill (Burung rangak)	<i>Anthracoceros malayanus</i>	9	4	11	2	5	13	12	13	11	29	8	18	135	
Blue-breasted quail (Puyuh/Pikau)	<i>Coturnix chinensis</i>	0	0	0	0	0	0	0	0	0	3	0	0	3	
Great Argus (Ruai)	<i>Argusianus argus</i>	1	0	0	0	0	0	0	0	0	0	0	0	1	
Greater Coucal (Bubut)	<i>Centropus sinensis</i>	0	0	0	0	0	0	5	0	0	5	3	0	13	
Hanging Parrot (Burung bayan/Serindit)	<i>Loriculus galgulus</i>	0	0	0	0	0	6	4	4	0	0	0	4	18	
Hill Myna (Burung tiong)	<i>Gracula religiosa</i>	0	0	0	0	0	0	1	0	0	0	0	0	1	
Imperial Pigeon (Pergam)	<i>Ducula spp.</i>	0	0	0	0	0	0	0	0	1	0	0	0	1	
Little Egret (Bangau)	<i>Egretta garzetta</i>	0	0	0	0	0	1	14	0	250	0	45	70	380	
Munia (Pipit)	<i>Lonchura spp.</i>	0	0	0	0	0	2	21	0	3	0	0	0	26	
Nightjar (Burung tukang)	<i>Eurostopodus temminckii</i>	0	0	0	0	0	0	0	1	0	3	0	0	4	
Oriental magpie-robin (Burung murai)	<i>Copsychus saularis musicus</i>	0	0	0	0	0	0	2	1	0	1	0	0	4	
Pigeon (Empuna/Punai)	<i>Treron spp.</i>	0	0	0	0	0	1	25	2	0	1	0	0	29	
Rhinoceros Hornbill (Kenyalang)	<i>Buceros rhinoceros</i>	1	1	0	0	0	0	0	0	2	0	11	16	31	
Wrinkled Hornbill (Enggang berkedut)	<i>Aceros corrugatus</i>	1	0	1	0	0	0	0	0	0	0	0	0	2	
Yellow-vented Bulbul (Empulu/Merbah)	<i>Pycnonotus goiavier</i>	0	0	0	0	0	1	4	0	0	1	0	0	6	
Insecta															
Rajah Brooke's Birdwing	<i>Trogonoptera brookiana</i>	0	0	0	0	0	0	0	0	0	1	1	0	2	

Source: Incidental Wildlife Sighting 2025

¹² As recorded through any evidence of existence eg sighting, spoor, droppings, calls, scratchings, etc. etc.

Table 12.2: Segan wildlife monitoring Year 2025 – Camera Trapping Result

No	Common Name	Scientific Name	Count of Days Captured	Max No.	WLPO 1998	CITES	IUCN
1	Binturong	<i>Arctictis binturong</i>	1	1	P	App. III	VU
2	Plaintain Squirrel	<i>Callosciurus notatus</i>	2	2	-	-	LC
3	Rusa/Payau	<i>Rusa unicolor</i>	4	5	-	-	VU
4	Bornean Sunbear	<i>Helarctos malayanus</i>	1	1	-	App. I	VU
5	Long-tailed Macaque	<i>Macaca fascicularis</i>	1	1	P	App. II	EN
6	Pig-tailed Macaque	<i>Macaca nemestrina</i>	1	2	P	App. II	EN
7	All Mice	Family Muridae	1	1	-	-	-
8	Marbled Cat	<i>Pardofelis marmorata</i>	1	1	TP	App. II	NT
9	Plain Treeshrew	<i>Tupaia longipes</i>	4	4	P	App. II	LC
10	Lesser Treeshrew	<i>Tupaia minor</i>	1	1	P	App. II	LC
11	Painted Treeshrew	<i>Tupaia picta</i>	1	1	P	App. II	LC
12	Short-tailed Mongoose	<i>Urva brachyurus</i>	3	3	-	NL	NT
13	Little Spiderhunter	<i>Arachnothera longirosta</i>	1	1	-	NL	LC
14	Greater Coucal	<i>Centropus sinensis</i>	1	1		NL	LC
15	Emerald Dove	<i>Chalcophaps indica</i>	1	1	P	NL	
16	White-rumped Shama	<i>Copsychus malabaricus</i>	1	1	P	NL	LC
17	Bornean Crested Fireback	<i>Lophura ignita</i>	14	30	P	NL	VU
18	Short-tailed Babbler	<i>Trichastoma malaccense</i>	2	2	-	NL	NT

19	White-chested Babbler	<i>Trichastoma rostratum</i>	2	2	-	NL	NT
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Source: Camera Trapping record for year 2025

12. 4 Social Impacts

12.4.1 Assessment

A Social Impact Assessment (SIA) was undertaken in September 2020. A report on the assessment entitled: ‘*Social Impact Assessment Report for Samling’s Segan Licensed Planted Forest (LPF/0014)*’ was produced in 22 February 2021. The assessment was guided by the ‘*Guidelines and Procedures for Social Impact Assessment and Monitoring of Forest Operations (Peninsular Malaysia)*’ (UPM 2012).

12.4.2 SIA Report and Analysis

The SIA stated the objectives of the assessment as: “*to assess the social impact by the forest plantation operations on the communities living within and adjacent to Samling’s Segan Licensed Planted Forest (LPF/0014)*”, in which management actions needed to mitigate and monitor social impacts of forest management operations were also recommended.

The assessment identified and addressed three main points of impact arising from the forest plantation activities within the ITP:

1. Water Supply and Quality

The previous logging upstream and agricultural projects near the Segan LPF have degraded water quality. Oil palm plantations adjacent to the Segan LPF are pointed to as the primary water pollution cause. Changes in water levels, including increased river flow and flooding during rainy periods, have become more frequent. The increase in in water levels during droughts and wet seasons have been observed.

2. Local Economy

a) Occupation and income

In 2020, seventeen (17) of the Sarawakian employee are local. Report stated that the respondent agreed that Samling’s Segan LPF has not provided enough job opportunities for the local communities. Some communities have been employed by the oil palm plantation company nearby or by local contractor. Other work in Bintulu town and commute daily from their respective villages. The low participation rate of locals in the workforce reflects the availability of other competing job opportunities. Some communities are self-employed, where mostly involved in small scale farming and fishing to support their family.

b) Forest resources

The SIA (2021) confirmed earlier findings that dependency on the forest resources within the LPF was low and noted agreement that boundaries of the land used for ITP were well defined and that this resulted in few, or no, land disputes.

c) Accessibility

The report notes that the availability of the tar sealed road has led to various improvements, including improved local access and education, as well as increased workplace accessibility. Additionally, regular visits from government agencies have become more frequent. However, there are the downside of the road assess availability such as increase in social problem and open assess to outsider to collect forest produce and hunting.

3. Socio-cultural Livelihood

The changes in the surrounding environment have triggered a change in the socio-culture life style. It is increasingly common for communities to migrate to urban areas, where growing living costs and rising household expenses lead many, particularly school leavers, to move to cities in search of better-paying jobs and opportunities in the developing economy.

Traditional Knowledge: The respondents generally had a neutral perception about the impact of Samling's Segan operations on their traditional knowledge.

Safety and Health: Heavy machinery and high traffic can lead to road safety problems, air pollution, and poor air quality.

Land Claim: Respondent agreed that well defined boundaries alienation between land used for forest plantation and the village are has contributed to such situation. The SIA stated that *'Respondents noted that the forest plantation company does not encroach into lands delineated as agricultural land and graveyard used by the village residents.'*

12.4.3 Recommended Mitigation and Enhancement Measures

Previous forest timber licence holders had exercised conventional logging operations that caused adverse impacts on forest resources, water quality and environment. Thus, affecting the local communities' livelihood and their dependency on jungle produces. It is noted that any unsatisfactory feeling and lack of trust by local communities could be due to the past history and any project or development taken over will be affected. Therefore, Segan ITP needs to restore that trust and foster a good relationship with the local communities. Based on the SIA assessment conducted, there is a need to alleviate the impacts from prior damage resulted from logging operations by former license holders and on-going plantations operations.

The components needing mitigation and enhancement measures identified in the three key social impacts are listed as the following:

1. Water supply and quality
2. Local economy – occupation and income
3. Local economy – forest resources
4. Local economy – accessibility
5. Socio-cultural livelihood – Urban migration
6. Socio-cultural livelihood – indigenous knowledge and skills
7. Socio-cultural livelihood – land use and forest aesthetics

Measures for mitigation and enhancement relating to the components identified in the three key social impact are specified and discussed.

Measures to mitigate adverse social impact and enhancement of water supply and quality

As there are no community water catchment areas or water intake points within the MTCS area, or even in the ITP for that matter, there is little that the LPF management can do.

SEGAN ITP is to strictly adhere to mitigation measures recommended in the EIA report for environmental effect and that could affect the community water supply. Replanting program using native species should be carried out along the disturbed buffer zone area to assist and improve

buffering function. It should be highlighted that, when the heavy machinery involved, oil and grease leakage need to be controlled at the source.

SEGAN ITP is to strictly adhere to the standard operating procedures for harvesting operations with requirements as accorded in the MC&I SFM to minimise soil erosion and other adverse environmental impacts.

Measures to mitigate adverse social impact and enhancement of local economy

Occupation and income

Under Criterion 4.1 of the MC&I SFM, it is stated '*The communities within or adjacent to the FPMU shall be given priority and opportunity for employment, training and other services*' Samling's Segan LPF should promote and match suitable and competent candidates who have qualification and experience with local communities in their manpower plan.

Forest resources

As recommended in the SIA, the protection of forest resources, namely the available wildlife could be enhanced through: (i) awareness programmes, and (ii) increase enforcement operation. The SEGAN LPF appointed Honorary Wildlife Ranger can play a more prominent role in wildlife protection and conservation.

Measures to mitigate adverse social impact and enhancement of socio-cultural life

Urban migration

Skill development is very important to survive in this modern and advancing age. Local youth must be provided with the proper and necessary skill to enable better exploration of employment and economic opportunities as well as to compete with those coming from the urban setting.

Indigenous knowledge and skills

Documentation of traditional knowledge and skills must be initiated to avoid them from being neglected, fading away and finally forgotten. Living skills and traditional culture should be taught and expanded in schools as part of the school education curriculum. However, the dependency of forest resources is low as most forested areas surrounding their village are diminishing. The forest can still provide firewood and wild vegetables for domestic use by the local communities.

Land use and forest aesthetics

Identification, conservation and preservation of the area that have high conservation values is the important strategy the management can use. Any HCV area identified in the future, should be demarcated on the ground and map.

13. Social Multiple-Use

13.1 By the Local Population

13.1.1 Recreational Pursuits

Personal safety on logging roads is an unavoidable issue and security of both the company's and contractors' equipment and workers' property is an on-going problem. This leaves little opportunity for recreational pursuits within the LPF by the general public. Members of NSSB and other such organizations are of course encouraged to approach SST to discuss arranging visits which should serve to further our knowledge of the area's biodiversity.

13.1.2 Hunting and Fishing

Hunting is prohibited other than for members of the local community and then only for personal consumption. The opportunities for fishing within the LPF are very limited. Where Sg Segan forms the LPF boundary the actual water course lies outside of the LPF; where it passes through Coupe 1

access is by boat as road access is restricted but the river here is generally very shallow and boulder strewn making boat travel difficult.

13.1.3 Other

In Segan North very limited use is made of the nipah that grows on the fringes (Table 5.2) of Btg. Kemena, Sg. Segan, Sg. Silas and Sg. Binai. This usage is by people from various kampongs on the Btg Kemena (all of which are outside of the LPF). There is very small sago 'factory' just downstream of Kuala Segan but there is no evidence that use is made of very limited sago areas within Segan North.

Whilst not multi-use of the *forested* area, the use of the long-established SA areas within the LPF (but which are excluded from the plantable area statement in LPF licence) still continues - often in a more settled manner with oil palm and rubber planted by individuals as opposed to estate operators.

13.2 By Others

Samling has an arrangement with the Faculty of Agriculture and Food Sciences, Universiti Putra Malaysia, Bintulu, Sarawak Campus for the establishment of a monitoring network of PSPs (see 6.6.2). It is Samling's hope that this will be a very long term monitoring project that will provide numerous areas of research for MSc and PhD students.

SEGAN also hosts students from this faculty from time to time giving them work experience and insights to a career in tropical forestry.

SEGAN has been providing field assistance to research workers from the Biotechnology Program of the Faculty of Engineering, Computing & Science (Swinburne University of Technology Sarawak Campus). This is in support of a project entitled: *An Ecosystem Approach towards Formulation of a Biofertiliser Containing Growth-Enhancing Rhizospheric Microorganisms for Silviculture of Neolamarckia cadamba and Eucalyptus pellita*, in which both the Sarawak Forestry Corporation (SFC) and Sarawak Timber Association (STA) are collaborators.

On 29th January 2016 Samling, along with other companies involved with ITP in Sarawak, entered into a long-term, co-operative R&D project with SFC. Unfortunately, after three quite productive years, the project no longer had the full support of SFC and effectively lapsed.

14. Cultural and Historic Values

14.1 Cultural and Historic Values

No sites of cultural or historic value were identified within SEGAN LPF by the EIA (Ecosol, 1999); nor were any identified by either the HCV assessment (Unggang, 2014) or the SIA (UPM, 2021). None has been subsequently identified on the ground and local knowledge indicates that there are none. The EIA states that there are no salt licks within the ITP and subsequent studies and more recent studies and enquires have reinforced this statement by confirming that there are none known within the LPF or nearby.

15. Occupational Safety and Health

15.1 Introduction

In the conduct of forestry operations, a safe and healthy work place, as far as practicable, is assured by compliance with the Occupational Safety and Health Act 1994 and the relevant legislative regulations and guidelines that are applicable to the respective work places.

15.2 Safety, Health and Environment (SHE) Policy Statement

The LPF management is committed to the following principles:

- Provision of systems of work, work environment, plant, equipment and the maintenance of the same, in so far as practicable, that are safe and without risk to health and adverse impact to the environment;
- Provision of adequate welfare, religious and recreational facilities for all employees without adverse impact to the environment;
- Provision of a safe means of access, egress to and from work places, emergency response (ERT) for rescue, control of environmental spill and natural disaster in so far as practicable;
- Provision of information, work instruction, training and supervision for all staff to enhance work competencies, skills and awareness in SHE, and the implementation of Best Management Practices (BMPs) in the industry;
- Review the SHE standards and practices periodically to ensure continued relevance and appropriate to the organisation.

15.3 Safety Practice Guidelines for Forestry Activities

Safety practice is the responsibility of both the management and employees regardless of level or job designation. All employees must be mindful at all times of the Safety Practice Guidelines (Appendix VII).

However, the camp management is required to play an active role in carrying out measures to ensure the safety and health of all employees in the work areas.

Within the framework of the Safety Practice Guidelines, camp management must take due consideration of all employees' health and safety during tree felling, skidding, log handling and scaling, land and river transportation, road construction and maintenance, and of those working in the camp office and workshop or in any of Samling's working areas located within the FMU. Where practicable relevant salient points reflecting those set out above, will be incorporated into work instructions.

15.4 Training of Forest Workers

As required under The Forests (Trained Workmen) Rules, 2015, workers who are engaged in any one of the following: tree felling, log extraction or log loading, must be trained by STA Training Sdn Bhd trainers or by other STA or FDS approved trainers.

15.5 In-house Training for Occupational Safety and Health

15.5.1 Safety and Health Committee

A Safety and Health Committee (SHC) comprises: (a) Chairman; (b) Secretary; (c) representatives of employer; and (d) representatives of employees.

15.5.2 DOSH Guidelines

DOSH's *Guidelines for Occupational Safety and Health in the Logging Industry* are used as the basis to develop the Safety Practice Guidelines for the better prevention of injury and health problems in harvesting operations. It provides training information and guidelines for risk control in the core activities of the upstream timber industry which are primarily: tree felling, ground-based and cable log extraction, loading and transportation of logs by road, road building and maintenance.

16. Monitoring

16.1 Introduction

This is the first full revision of the SEGAN FPMP as required for the second ten-year period 1st July 2023 to 31st October 2033. The elements monitored, and the location of the results, are referred to in the following section.

16.2 Elements to be Monitored.

The following elements are monitored:

- a) **Yield of forest products** (logs) harvested is monitored through the daily trucking reports. These reports are summarised by year in Section 10.1 of Chapter 10. Table 10.1 shows the monitoring of the past log production. Figure 10.1 shows the result of monitoring the accumulated production to date and comparing it against the ACC.
- b) **Growth rates** are monitored through a strong network of PSPs. The actual growth rates of mangium based on the real production and that for pellita based on PSP data are discussed in Chapter 9.
- c) By means of planting records and maps the composition and changes of the **flora are monitored** and recorded over time.
- d) The annual summaries for the **monitoring of fauna** are shown in Table 12.1
- e) As the EIA (1999), SFC's social profiling study (2013) and SIA (2021) and attest, SEGAN LPF is not in any way fundamental to meeting the basic needs of the communities within or nearby, and so there is little to actually monitor in this respect. What absolutely minimal current use is made of the LPF in terms of NTFPs will surely lessen as the population of the nearby communities ages, continues to decline and to change its consumption patterns to a more modern way of life.
- f) The extracts from the annual **Social Impact Monitoring** report show that the **impact of harvesting and operating** in ITP area has no, or negligible, social impact other than in providing employment for those with the relevant skills or for those who wish to obtain such skills. Employment levels are monitored by recording the actual numbers of locals employed each year – see Table 7.1.
- g) Monitoring of the **environmental impacts of harvesting** and other operations and of compliance with the EIA requirements is monitored by the implementation of **Environmental Compliance Audit (ECA)**¹³.
- h) Productivity (for harvest productivity this has already been covered in volumetric terms in Chapter 10) and the efficiency of forest management are **monitored by budgetary controls** under the HQ accounts section.
- i) The risk of **invasion**¹⁴ **by exotic species** planted by SEGAN or of invasion of the LPF by exotic species planted by external third parties is **monitored** during the regular patrol reports. To date no invasion of significance has been note as attested by the patrol reports.
- j) **Regular monitoring of pests and diseases** is through information captured at the time of PSP measurement together with *ad hoc* monitoring.

17 Climate Change - Adaption, Mitigation and Monitoring

17.1 Introduction

Forests has a significant function in climate change mitigation by acting as “sinks”, i.e., absorbing carbon from the atmosphere and storing it in biomass and soils. However, when the forests are cleared or degraded, they are also significant sources of greenhouse gas emissions. Forests, therefore, are important components in strategies for adapting to climate change.

¹³ The water sampling will be carried out and the result will be incorporated in the Chapter 5 of Environmental Compliance Audit (ECA) report.

¹⁴ 'Invasion' here means an exotic species is growing where it was not intended that it should.

Sustainable Forest Management (SFM) can help reduce the negative effects of climate change on forests and forest-dependent people. SFM is consistent with climate adaptation and mitigation whereby the planning will factor climate change and the management practices will be adjusted accordingly. The planning will put greater emphasis on risk management and to weigh the costs of changes in forest management against the likely benefits.

In 2010, the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) adopted a decision on reducing emissions from deforestation and on the conversion of forests, sustainable management of forests, and enhancement of forest carbon stocks, usually known as *REDD+*. The accessibility of benefits from *REDD+* activities to individual forest managers would depend on the arrangements in place in the country for *REDD+* benefit-sharing.

Last but not least, the forest management should also be aware of the policy incentives instituted by governments, or market incentives, such as carbon credits or demand for bio-energy. Forestry projects are favoured by the voluntary carbon markets because of their additional social and environmental benefits (known as co-benefits).

17.2 Policies on Climate Change

Forest management is affected by climate change policies made at the national and global levels. Under the Malaysian Timber Certification Scheme (MC&I SFM 1/2020), forest management shall comply with the National Policy on Climate Change, 2002 and the UN Framework Convention on Climate Change, 1992.

17.3 Adaptation and Mitigation in Forestry

Adaptation and mitigation are the two main responses to climate change. The mitigation addresses the causes of climate change whereas the adaptation on its impacts.

In the forest sector, adaptation encompasses changes in management practices design to decrease the vulnerability of forests to climate change and interventions intended to reduce the vulnerability to climate change.

Mitigation strategies in the forest sector can be grouped into four categories: reducing emissions from deforestation; reducing emissions from forest degradation; enhancing forest carbon sinks and product substitution.

17.4 Adaption Actions

The actions for adaptation to climate change should address the risks or impacts. These actions are drawn mostly from existing forest management practices.

17.5 Mitigation Actions

Mitigation actions on climate change shall focus reducing **Green House Gases (GHG)** emissions by source and increasing GHG removals by sinks. These actions can be grouped into four general categories:

- Maintaining the area under forest by reducing deforestation and promoting forest conservation and protection.
- Increasing the area under forest (e.g. through afforestation and reforestation);
- Maintaining or increasing carbon density at the stand and landscape level by avoiding forest degradation and managing timber sustainably; and through the restoration of degraded forests, e.g. enrichment planting; and

- REDD+ activities / Voluntary carbon markets as a means to sell carbon credits for carbon sequestered by the forests.

17.6 Monitoring and Evaluation

Monitoring climate change adaptation and mitigation actions is an additional and significant burden. Nevertheless, the existing databases, criteria and indicator processes and forest certification schemes can form a framework for monitoring.

Regardless of the scale of monitoring required, forest management should take a precautionary approach and involve local people when addressing possible social and environmental impacts.

Monitoring will require the collection of data on indicators of climate-induced impacts (e.g., forest productivity, forest health and forest pests). Many of these data will normally be collected in a standard forest inventory.

For biodiversity, the ideal species for monitoring are those that are expected to be vulnerable to climate change and that are also easy to census. Ideally, such species will also be species of special concern.

For water monitoring, dry season base flow and suspended sediments during periods of low flow might be the most appropriate indicators. Macro-invertebrates in streams can serve as good indicators of ecological integrity.

For fire susceptibility, monitoring fuel loads and moisture content are the first steps in assessment.

Social factors can be monitored during the program of community awareness and engagement.

Where forest carbon needs to be monitored this will almost certainly be a requirement for the continued verification of validated carbon project registered under the likes of Verra. Such a project would require a Carbon Licence issued by FDS and would be outside the scope of a forest management certification program such as the MTCS.

17.7 Greenhouse Gas (GHG) Inventory Accounting

The initiative to reduce GHG emissions in Samling's timber operations started in 2023 with the baseline accounting of GHG emissions for Scope 1 and Scope 2 for the year 2022. This in-house accounting reporting exercise was conducted by a third-party consultant engaged to ensure that the scope coverage, methodologies and verifications used in the accounting exercise were in accordance with the:

- GHG Protocol Corporate Accounting Reporting Standard, covering Scope 1 and Scope 2,
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories ("2006 IPCC Guidelines"); and the
- 2019 Refinement to the 2006 IPCC Guidelines.

Scope 3 studies will be developed at a later stage.

17.8 Conclusion

Forests provide a wide range of goods and ecosystem services to the stakeholders and climate change, combined with deforestation, forest degradation and population pressure, may threaten the continuity of such provision.

Measures should be taken to ensure any adaption process adopted is compatible and aligned with established SFM practices in order to meet the economic, social and environmental needs of stakeholders. SFM practices can also help reduce the economic, social and environmental vulnerability of forest and forest-dependent people to climate change.

Climate change mitigation programs (e.g. REDD+) are emerging that can increase the stock of carbon in forests. These can help offset the costs of actions (by the sale of carbon credits) to reduce GHG emissions due to deforestation and forest degradation.

18. Cost Benefit Analysis

18.1 Costs Relating to LPF Development

18.1.1 Financial Costs

- Temuda compensation
- Land rent and license fee
- Plantation establishment and infrastructure costs

18.1.2 Non-Financial Costs

- Change in environment and landscape – from residual natural forest to ITP monoculture
- Change in social dynamics

18.2 Benefits Relating to LPF Development

18.2.1 Financial Benefits

- Residual logging income from preparing the sites for planting
- ITP production revenue

18.2.2 Non-Financial Benefits

- Sustainability log supply for Sarawak's timber industry
- Alleviates the pressure on the natural forest
- Employment opportunities for locals near the LPF and for other Sarawakians
- Development of the local economy
- MTCS certification will bring
 - Improved environmental safeguards
 - Increased biodiversity

18.3 Social Aspects

The ITP of Samling's Segan LPF will contribute to the livelihood of local communities. Local communities welcome the employment and the income-generation opportunities presented. It also contributes to the local and State economy. However, at a local level negative impacts may arise from the LPF's activities; this usually relates to stream and river water quality. Cooperation between the LPF management, the relevant government agencies and the community will help to minimise any negative impacts and also to increase the benefits arising from the LPF's operations.

18.4 Financial Sustainability

SEGAN is the smallest of the five ITPs licensed to the Samling Group and where harvesting takes place. The Group has clearly been financially supportive of SEGAN for the past 22 years and of the other ITPs since their start-ups. It should be assumed this will continue to be so for the foreseeable future. However, SEGAN should be in a cash flow positive position for the remainder of the 60-year licence period with net revenue from log sales covering replanting and overhead costs.

19. Forest Plantation Management Plan – Review and Revision

19.1 Background

ITP is still a relatively very young industry in Malaysia. Planting only started in SEGAN in 2000. The Samling downstream mills that use Segan's ITP logs are still addressing the technical challenges and changes required when processing plantation logs and in marketing the products made from BORNEOTEAK®. The recent change of emphasis from mangium to crassicarpa will give Samling's downstream further exploratory work to do.

To take into account new knowledge, Samling's R&D findings, developments within the ITP sector and to ensure that as far as is possible SEGAN meets downstream's evolving requirements, an annual review of the FPMP may, at management's discretion, still be necessary. This will be followed by revisions as deemed appropriate. This somewhat frequent review schedule is recognised by Samling as being an important part of an on-going learning and implementation process. This process will assist in ensuring continual improvement of the management of SEGAN ITP and, in particular, the achievement of the primary management objective.

19.2 Review and Revision

Reviews and revisions will be conducted as in the following sections.

19.2.1 Optional Review

An annual review of the SEGAN Forest Plantation Management Plan will be considered and undertaken if thought appropriate. A revision may follow if deemed necessary.

19.2.2 Revisions

The FPMP will be reviewed and revised as deemed necessary in the last year of this 10-year plan. In order to incorporate any major policy change in the management plan a specific *ad hoc* revision may be required.

Other than a mid-term or end of term review that indicates the need for a revision of the FPMP a revision may result from any one of a number of triggers such as:

- new information from operational monitoring or research becoming available and being used to make significant improvements or necessary changes;
- new information becoming available to senior management and resulting in policy change;
- biotic or weather events the nature of which have or might have a significant impact on the management objectives;
- changes in downstream planning or requirements; and
- new or revised regulations imposed by the government.

20. Internal Audit and Management Review

20.1 Introduction

Forest management activities are subject to internal audit and management review at planned intervals as required under Malaysian Criteria & Indicator (MTCS ST 1002:2021 SFM) of the Malaysian Timber Certification Scheme) for sustainable forest management. Both internal audit and management reviews will ensure that there is continual improvement in the management system.

The Internal Audit and Management Review Procedure is used as the basis for the annual internal audit. It outlines the frequency, methods, responsibilities, planning requirements and reporting of the internal audit process.

20.2 Internal Audit

The internal audit shall be planned and conducted once a year. The objectives of the audit plan shall ensure that the FMU:

- (a). meets the requirements of its management system; and
- (b). its management system conforms to the requirements of MC&I ST 1002:2021 (SFM).

The internal audit plan shall define the audit criteria and scope of each audit. The auditors conducting the audit must ensure objectivity and impartiality of the audit process. The results of the audit will be presented during the management review meeting. All information gathered during the internal

audit should be documented and retained as evidence of the implementation of the audit program and of the audit's results.

20.3 Management Review

The Management Review shall be conducted annually and shall include at least the following:

- (a). The status of actions from previous management reviews;
- (b). Changes in external and internal issues that are relevant to the management system;
- (c). Information on the FMU's performance, including trends in:
 - Non-conformities and corrective actions;
 - Monitoring and measurement results;
 - Audit results.
- (d). Opportunities for continual improvement.

20.4 Non-conformity and Corrective Action

When any non-conformity is encountered, applicable action shall be taken to control and correct it. The consequence shall also be dealt with. The non-conformity shall be reviewed and the causes of it shall be determined. The need for the action shall be evaluated to eliminate the causes of the non-conformity and ensure that similar non-conformity does not recur or occur elsewhere.

Any action needed shall be implemented and the effectiveness of any corrective action taken should be reviewed. Changes shall be made to the management system, if necessary.

Corrective actions shall be appropriate to the effects of the non-conformity encountered. Information as evidence of the nature of the non-conformity and any subsequent action taken including the results of any corrective action shall be documented and retained.

20.5 Continuous Improvement

By undertaking the annual internal audit and management review, the sustainable management of the forest shall be continuously improved by addressing the suitability, adequacy and the effectiveness of the sustainable management system. The sustainable management system shall also conform to the Malaysian Criteria and Indicators for Sustainable Forest Management (MC&I MTCS ST 1002:2021 -SFM) under the Malaysian Timber Certification Scheme.

20.6 Risk and Opportunity Assessments

20.6.1 Risk assessment

Risk assessment is done to understand the internal elements (strengths and weaknesses) and external factors (opportunities and threats) which impact on the business strategic direction. All the relevant issues of internal strengths and weaknesses should be identified. Those items of potential high risk should be discussed and evaluated during the management review meeting before approval.

20.6.2 Opportunity assessment

All relevant opportunities identified should be analysed and be managed in order to maximize the benefits to the company.

20.7 Internal Audit and Management Review Procedure

The Internal Audit and Management Review Procedure is used as the basis to the annual internal audit. It outlines the frequency, methods, responsibilities, planning requirements and reporting of the internal audit process.