PUBLIC SUMMARY

Forest Plantation Management Plan
for
LPF/0014 – SEGAN

Version 2
(Revised 15 November 2013)

Subject to annual review

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Forest Plantation Management Plan
for
LPF/0014 – SEGAN

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5. Work Instructions
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8. Safety and Health Handbook
9. Waste Management Policy
10. Contracts
11. Geographic Information System (GIS)
12. Enterprise Resource Planning system (ERP)
13. Integrated PSP & Sustainable Allowable Annual Cut (SAAC) based Harvest Plan (soft copy)
14. Annual Budget (soft copy)
15. Environmental Management Plan (EMP)
16. Annual Work Plan
17. Management of Hazardous Waste
18. Road Plan

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) – an international forestry and forest products manufacturing company. SST is a member of the Samling Group which is head-quartered in Miri, the largest city in the north of the State of Sarawak, East Malaysia.

SEGAN is located 12 to 25km south of Bintulu which is some 200km south south-west of Miri. The licence area comprises three geographically discrete blocks: the North Block which fronts onto the Kemena River some 10-12km upstream of Bintulu Town and the West and East blocks which lie about 8km due south-east and south, respectively, of the North Block.

From an operational perspective, SST’s objective is to produce a sustainable, economic supply of logs from the Segan ITP which will help to support its downstream wood processing activities – plywood, sawn timber, fibre board and furniture components – located in Bintulu.

SST is an equal opportunity employer that operates an active safety and health management system. Additionally, SST also recognises the value of, and importance, of its environmental and social responsibilities.
3. **Malaysian Timber Certification Scheme (MTCS)**

3.1 **Our Commitment**

SST is committed to develop and conform to the principle of sustainability for the ITP established under LPF/0014 and, in so doing, to complying with the Malaysian Criteria & Indicators for Forest Management Certification (Forest Plantations) – the *MC & I (Forest Plantations)* of the Malaysian Timber Council (MTC). 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 seen as a key to the future of SST. It creates potential marketing and economic advantages for its forest products and, more importantly, it will help ensure that management of its resources is carried out under MTCS principles thereby helping to ensure sustainability of supply.

3.2 **Certification Requirements**

The MTCS requires:

1) Practicing the guidelines and requirements set out by the ten principles of the MTCS.

2) Developing a sound policy base derived from the ten principles, 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 use of sound, proven and economically viable forest plantation management, environmental, financial and social practices that protect the sustainability of the resources.

NB. The *MC & I (Forest Plantations)* of the MTCS is currently under review with completion expected by June 2014.
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 Forests (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 like SST by the use of such documents as resource consents. These two pieces of legislation therefore act as a method of controlling the potential for adverse management effects.

Other Acts and Regulations that form the basis of forest plantation management practices at SEGAN include (bold type face refers to the related Principle):

- Sarawak State Constitution – P1
- Forests Ordinance, 1954 (Cap 126) – P1, P2, P10
- Forest Rules, 1962 – P1
- Labour Ordinance, 1952 (Sarawak Cap. 76) – P1, P4
- Land Code, 1958 (Cap. 81) – P1, P2, P3, P10
- Native Courts Ordinance, 1992 – P1, P3, P10
- Native Courts Rules, 1993 – P1, P3, P10
- Native Customs (Declaration) Ordinance, 1996 – P1, P3, P10
- Notification pertaining to legal or customary tenure or use rights of local communities, in Sarawak Government Gazette – P2, P3
- Natural Resources and Environment (Prescribed Activities) Order, 1994 – P1, P6
- Natural Resources and Environment (Fire Danger Rating System) Order, 2004 – P1
- Sarawak Biodiversity Centre Ordinance, 1997 – P1
- Sarawak Cultural Heritage Ordinance, 1993 – P1
- Sarawak Rivers Ordinance, 1993 (Cap. 4) – P1
- Water Ordinance, 1994 – P1
- Wild Life Protection Ordinance, 1998 (Cap. 26) – P1
- Wild Life Protection Rules, 1998 – P1
- Statement of Forest Policy, 1954 – P1
- National Agriculture Policy, 1992-2010 – P1
- National Policy on Biological Diversity, 1998 – P1
- National Policy on Environment, 2002 – P1
- Federal Constitution – P1, P4 (Article 74(2) stipulates that land and natural resources are under the legislative authorities of the State i.e. state matters: each state can formulate its own forest policy and enact forestry laws.)
- Employers’ Social Security Act, 1969 – P1, P4
- Employees’ Social Security (General Regulations), 1971 – P1, P4
- Environmental Quality Act, 1974 – P1
- Environmental Quality (Scheduled Wastes) Regulations, 1989 – P1, P4
- Factories and Machineries Act, 1967 – P1, P4
- Human Rights Commission of Malaysia Act, 1999 – P1, P4
- Industrial Relations Act, 1967 – P1, P4
- Occupational Safety and Health Act, 1994 – P1, P4
- Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations, 2000 – P1, P4
- Pesticides Act, 1974 – P1, P4
- Plant Quarantine Act, 1976 – P1
- Trade Unions Act, 1959 (Act 262) – P1, P4
- Workmen’s Compensation Act, 1952 – P1, P4
- Minimum Wage Order 2012 – P1, P4
- Master Plan for Wildlife in Sarawak, 1996 – P1
- IUCN Red List of Threatened Species/Threat Status for Mammals in Peninsular Malaysia – P1

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
- conduct forestry operations in a manner that does not impact negatively on the well being 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
- 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 remaining natural forest on both the peat and mineral soils has a long history of repeated heavy logging. The ITP is established in clearly defined areas by complete clearing of this residual forest and salvaging chip logs when economically feasible.

Special Management Zones (SMZ) have been, and continue to be, identified (see Section 4.4). 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 biodiversity. To date the area under SMZs represent 20% 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 key agreements include:

- ASEAN Agreement on Trans-boundary Haze Pollution, 2002 – P1
- Convention on Biological Diversity, 1992 – P1
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2000 – P1, P6
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971 – P1
- Core International Labour Organization (ILO) Convention – P1, P4
- International Tropical Timber Agreement, 1994 – P1
- United Nations Declaration of the Rights of Indigenous Peoples, 2007 – P1
- United Nations Framework Convention on Climate Change, 1992 – P1
- The Kyoto Protocol to the Convention Climate Change, 1997 – P1

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 those areas of logged-over 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 1 below have been identified as occurring with SEGAN to date. The burial sites mentioned in the EIA are both outside the licence area and the salt lick referred to in the EIA was said to be outside the licence area - unfortunately consultation of local knowledge failed to confirm its existence in any location.

Table 1: Special Management Zones (SMZs) occurring within SEGAN

<table>
<thead>
<tr>
<th>Zone Types</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Riparian buffer – mandatory; to EIA prescribed widths determined by the water course width</td>
<td></td>
</tr>
<tr>
<td>Swampy (marshland on mineral soil)</td>
<td></td>
</tr>
<tr>
<td>Rocky (skeletal soils)</td>
<td></td>
</tr>
<tr>
<td>Steep areas – mandatory; upper slopes &gt;35° (away from water courses)</td>
<td></td>
</tr>
<tr>
<td>Gulley – steep riverside areas outside the mandatory buffer zone</td>
<td></td>
</tr>
<tr>
<td>Conservation – voluntarily designated as such; otherwise it would probably have been planted</td>
<td></td>
</tr>
</tbody>
</table>

A zone type may be mandatory e.g. a riparian buffer must be established along permanent water courses – see Table 2. Steep areas in excess of 35° must not be cleared for planting. Elective zone types are those such as conservation areas where at the manager’s discretion a wildlife corridor has been demarcated on otherwise plantable land. And there are ‘Hobson’s choice’ zone types where the physical characteristic s of the site preclude the option of planting, e.g. marshland and skeletal soils.

Table 2: Recommended Widths for Riparian Buffer Zone

<table>
<thead>
<tr>
<th>Width of Water Course (m)</th>
<th>Width of Buffer Zone (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;40</td>
<td>50</td>
</tr>
<tr>
<td>20 - 40</td>
<td>40</td>
</tr>
<tr>
<td>10 - 20</td>
<td>20</td>
</tr>
<tr>
<td>5 - 10</td>
<td>10</td>
</tr>
<tr>
<td>&lt;5</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Table 4.3 C4-15 in Segan EIA Jan 2000, Ecosol Consultancy S/B

The types are not mutually exclusive: e.g., a riparian 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 mixed swamp forest that once dominated much of the area. Significant lengths of the riparian buffer zones along the four boundary forming rivers: Btg Kemana, Sg. Binais, Sg. Segan and Sg. Sebas, and of Sg Silas, are more or less pure nipah. Nipah provides a valuable breeding ground for a number of aquatic species and also yields non-timber products (sugar, salt and attap). However, it should be noted that, although an inspection carried out by SST in March 2012 revealed almost no incursion into the buffer zones, apart from Sg Segan, numerous, contiguous small parcels of titled land have been granted over the greater part of the river bank areas. SST is unable to demarcate riparian buffer
boundaries in such circumstances. It is noteworthy that in places the alienated land appears to extend into the Segen F.R.

The surveys covering social, environmental and wildlife elements have yet to be completed. Should it identify other SMZ types, e.g. areas of cultural importance or HCVF these will be added to Table 1 and any management requirements specific to these new areas will be introduced into Section 4.4.2 when the FPMP is revised.

4.4.2 Management of SMZs

The major SMZ type is that of the riparian buffer zone (RBZ). However, the same guiding management principles are common to all SMZs that currently occur in SEGAN.

The zones will first be 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 riparian buffers must be carefully located to ensure compliance. Once clearly demarcated all SMZs are protected and, apart from the removal of any planted merchantable exotic trees, no human activity, apart from access by local people for traditional purposes, is allowed.

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 native tree deemed to have been avoidably damaged within the zone.

Following demarcation and the removal of any merchantable exotic trees, no further invasive action in these zones is allowed. The SMZs will be allowed to develop in structure and bio-diversity. It is proposed that the change over time of these two attributes will be monitored by means of PSPs established for this purpose by a university department. The details of this arrangement will be developed once the fauna and flora survey has been completed.
5. Resource Description

5.1 History

The North Block, comprising almost entirely shallow peat soils, was logged many years ago under various timber licences.

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...” (C3-21).

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

In the West Block and East Block the commercial content of the mixed dipterocarp forest (MDF) that once comprised almost all of the original vegetation on the mineral soils was extracted many years ago under various timber licences. Apart from the areas yet to be brought under plantations, there are small, heavily disturbed MDF remnants within SMZs - in conservation areas, riparian buffers, and steep areas and on the fringes of swampy mineral soil areas.

The administrative and support facilities for the LPF are situated at what is known as Sg Mas camp.

Unsurprisingly the authors of the EIA, (ibid.) conclude 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 FDS timber licence within the LPF and, as might be expected given the various comments in the EIA regarding the residual forest, there is no intention that this will occur.

The area licensed for ITP is State land; it encompasses parts of the gazetted areas known respectively as Buan F.R (G.N. 809, 9-1-1977), Segan F.R. (G.N. 24 11-12-1930) and Bukit Minah F.R. (proposed).

5.1.1 Conversion of primary forest

As has been noted in the preceding section the natural forest within the LPF has 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 – 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 lease over land on which it is licensed to establish an ITP. The lease (LPF/0014) was issued on 27th January 1999. The leased land is in three discrete blocks some 15 to 35km south east of Bintulu, in the Bintulu District and Sebauh Sub-District of Bintulu Division. As stated earlier the three blocks are known individually as: the West, East and North blocks and are referred to as such in this management plan. A statement of land types and land use is given in Table 3 (see following page).
Table 3: SEGAN (LPF/0014) – Land Type and Land Use Statement at June 2013

<table>
<thead>
<tr>
<th>Land Type</th>
<th>Gross Area ha</th>
<th>Non-Productive Area</th>
<th>ITP Productive Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Non-Forested Areas</td>
<td>Protected Forested Area – Special Management Zone (SMZ)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SA</td>
<td>Water</td>
</tr>
<tr>
<td>Nipah</td>
<td>250</td>
<td>2.3%</td>
<td>5</td>
</tr>
<tr>
<td>PSF</td>
<td>3,104</td>
<td>28.5%</td>
<td>1,23</td>
</tr>
<tr>
<td>Mineral</td>
<td>7,555</td>
<td>69.3%</td>
<td>1,56</td>
</tr>
<tr>
<td>Total</td>
<td>10,909</td>
<td>7%</td>
<td>19</td>
</tr>
<tr>
<td>% distribution – LPF</td>
<td>26%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>% distribution – non-productive &amp; productive areas</td>
<td>59%</td>
<td>4%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Sources: LPF Licence; Block Master & LPF area analysis Seggan 2013; File Ref : Seggan Man Plan Tabs 1 & 2

Notes to Table 3
1. **Gross Area** as stated above is slightly larger than that given in the LPF licence. This is a result of mapping revisions based on improved accuracy. Revision is ongoing.
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 nipah given in Table 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) recent 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. Most of the nipah area is on land alienated several years ago. The FDS has yet to excise these areas from the LPF licence.
3. **SA** is shifting cultivation as defined by government in Map C2 attached to the LPF licence with additional areas subsequently interpreted from various sets of imagery.
4. **RBZ** – riparian buffer zone; strips of land along permanent water courses of a width dependent on the water course width
5. **Planted** - includes R&D trial areas, most of which will yield timber. There is currently an inevitable discrepancy between the GIS areas and the ERP areas. This is in great part due to the ongoing re-survey and revision of the mapping of the three component blocks of the LPF. As areas are re-surveyed and the information entered into the ERP the discrepancy will reduce and will eventually disappear when the GIS becomes directly linked to the management system (ERP).
6. **Plantable** – includes temporary unplanted areas (TUP) following harvest & areas which appear to be technically plantable.
7. **Potential** – areas which might become available for planting following investigation.
8. **Other** – refers to rocky areas, non-tree swamp, fruit tree orchard & log stack areas.
5.3 **ITP Resource**

Table 4 shows the species and year of planting (YOP) of the planted areas of the ITP forest resource at 30 June 2013 as extracted from the Block Master at that date.

**Table 4: Species and Year of Planting for SEGAN (LPF/0014) at 30 June 2013**

<table>
<thead>
<tr>
<th>Species</th>
<th>Year of Planting (Year runs July to June)</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. crassicarpa</td>
<td>126.9</td>
<td>0.0</td>
</tr>
<tr>
<td>A. hybrid</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>A. mangium</td>
<td>18.7</td>
<td>726.8</td>
</tr>
<tr>
<td>Acacia other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. deglupta</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>Euc. other</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>E. pellita</td>
<td>1.2</td>
<td>84.3</td>
</tr>
<tr>
<td>G. arborea</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>H. brasiliensis</td>
<td>11.3</td>
<td></td>
</tr>
<tr>
<td>K. senegalensis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. falcataria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>10.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Totals</td>
<td>30.1</td>
<td>740.1</td>
</tr>
</tbody>
</table>

Source: Segan Block Master June 2013 File: Segan FPMP Tab 1 & 2

NB. The areas in Table 4 are those which have passed post-plant QC. Excluded are areas in the harvesting and replanting cycle which are actually under harvest or temporary unplanted (TUP). Table 4 also includes a few small areas which are planted but are considered to have failed and which might be re-planted before rotation age – i.e. ‘rehabbed’.

The age class distribution of the resource – for the three major species planted and all others species combined – is given in Figure 1.

**Figure 1: Age Class Distribution for the major species - SEGAN (LPF/0014) 30 June 2013**

![Age Class Distribution](source)

Source: Segan Block Master June 2013
6. Environmental Considerations

6.1 Environmental Limitations
There are few environmental limitations for ITP in the 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. 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 by NREB and shown in Table 2.

The average annual rainfall recorded over 11 years at Segan nursery is 4,150mm. It has ranged from a low of 2,948mm (2005) to a high of 4,943mm (2003) and has averaged 16.6 rain days a month and 183 days a year. This relatively high annual rainfall with frequent rain days impacts heavily on the efficient use of labour and equipment and thus on operational costs.

The high level and frequency of the rainfall and steep terrain can make access to some areas difficult especially during the wetter season (October to January inclusive) when ungraveled roads can quickly become slippery and temporarily unusable. Similarly, harvesting and transporting on a year round basis in an attempt to ensure regular log supplies to downstream mills is difficult. Ideally buffer stocks should be built up at the mills before the onset of the wetter season.

Harvesting is predominantly by cable yarding. This allows access to the broken terrain whilst minimising the environmental impact especially soil disturbance that can lead both to compaction and to increased erosion. Ground skidding is used in the few areas where the topography restricts the efficient use of cable yarding.

6.2 The Environmental Management Plan (EMP)
The EMP is a stand alone document. 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

6.3.1 Soil erosion
Mechanised operations in areas of steep slopes and high rainfall inevitably give rise to soil erosion. This is kept to a minimum by good road alignment and construction both of which must conform to the FDS standards in order to obtain a PEC to harvest. Extensions of spur roads and landings to facilitate extraction and loading are kept to the minimum necessary for efficient operation.

Section 10.2 describes the yarrer system that is the main extraction method. The use of this system minimises soil erosion by reducing the need to enter the harvest block with ground based machinery.

6.3.2 Water quality
Maintenance of water quality is 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.

To date pesticides have not been used in the field in SEGAN. However, experience with gmelina in other ITPs indicates that there might be a need for very restricted use of a termaticide applied in response to attack.

Sewage disposal in the camp is by means of cess pits and in the plantation by long drop latrines. The work shop uses a two stage silt trap and all used oil from in-field oil changes is brought back to the workshop for controlled recycling.

Water quality is monitored by means of water sampling whereby samples are collected twice a year from sampling points identified by the EIA. These samples are analysed by an external laboratory with the results submitted to NREB and
presented within the external consultant’s six monthly Environmental Monitoring Report (EMR). Reference to these reports will confirm that, to date, the results have been within NREB acceptable parameters and in other ways compliant with the standards set in the EIA.

6.3.3 Riparian buffer zones (also known as river buffer zones) – RBZ
Riparian buffer zones are established in accordance with the EIA recommendation (See EMP and Table 2). The objective is to establish a well defined strip of land – a buffer - that will help to protect the river bank and the river bank 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 riparian 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 mangium burning for second rotation site preparation usually results in very dense natural regeneration of mangium. 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 burn 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
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.

6.4 Environmental Safeguards
6.4.1 Environmental Monitoring Report (EMR)
Ecolsol Consultancy Sdn Bhd is contracted to monitor and review SEGAN’s compliance with the recommendations set out in the EIA. The results of their investigation as are presented in an Environmental Monitoring Report (EMR) which is produced by the consultant each year for the periods April to September and October to March.

6.4.2 Use of chemicals
As stated in 6.3.5 chemicals are used in both in the nursery and in the blocks.

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 guidelines and protocols for the proper use of chemicals, for environmental incidents 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 is required to monitor water quality of the LPF’s water courses. This is done twice a year with analysis undertaken by an independent laboratory with the results reported in the EMR.

6.4.4 Monitoring and control of exotic species

Monitoring is by observation. Only four exotic genera (Acacia, Eucalyptus, Gmelina and Paraserianthes) are currently planted commercially (as opposed to trialed). All four are known to regenerate naturally, to a greater or lesser degree, under SEGAN conditions but this not is considered to be an adverse environmental impact. To date only A. mangium has established itself outside of the LPF. It is a short lived light demander and is only known to regenerate in open areas, e.g. burnt over SA. On areas of SA within the hill padi cropping cycle it may be considered as beneficial because it both protects and improves the soil. As the local demand for mangium logs increases this might also create economic opportunities for SEGAN’s communities and if the nearby Samarakan pulp mill should go ahead this could improve local opportunities even more as the local communities might be able to participate in supplying chip logs - as has happened for those living nearby the Sipitang pulp mill (Sabah).

Unfortunately, other than those of the four genera listed above, not one of the almost 50 exotic species trialed to date has, as yet, proven successful enough to regenerate naturally and thus none poses any degree of environmental risk.

6.5 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 dependant on the residual natural forest in the riparian buffer zones and in any HCVF that the study might identify. 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 bio-diversity.

The residual forest has been logged over in varying degrees of intensity. As stated in the EIA report logging has been very wide spread and very heavy (to such an extent that it will be difficult, if not impossible, to identify areas of HCVF under HCV 4). As already mentioned, the protected residual forest falls into several mapping units which together are termed Special Management Zones (SMZ) – see Table 1.

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 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 riparian 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. 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.

The SEGAN plantation maps (1:10,000) show that the SMZs are widely distributed throughout the LPF. Currently they represent more than 14% of the whole LPF - including SA - (Table 3). It is expected that this percentage will increase over time as the pre-harvest GPS survey better defines the land categories. At present the area designated as SMZ represents more than 20% of the total forested area.
6.6 **Residual Natural Forest**

As mentioned earlier the EIA has recorded 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 of the flora it 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 primary forest types remain unknown. It is now a question of protecting those areas of residual forest that have been designated as SMZs. 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 species are recruited into the SMZs by various means of seed dispersal.

6.7 **High Conservation Value Forest (HCVF)**

Studies have been commissioned to assess SEGAN in terms of HCVF under HCV categories 1 to 6. Once the results of the study are available, and should any HCVF have been identified, then measures for its protection and management will be incorporated into the FPMP when next revised.
7. Socio-Economic Context

7.1 Contribution by Current and Future Forest Operations

The net plantable area for the nine ITP (including planted oil palm) in the Bintulu District was 285,230ha (December 2011). With only 5,000 ha currently planted under ITP, SEGAN is a very small contributor to the District’s ITP total. The area of SEGAN’s neighbour, Sarawak Planted Forest, alone is in excess of 125,000 ha planted (but not all is in the Bintulu District).

The SEGAN resource is however important to SST 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. There is a dedicated small-log sawmill adjacent to the Bintulu fibre board mill. Chip logs and residues from processing plantation logs by both the sawmill and the ply mill are supplied for the manufacture of fibre board. The fibre board is further processed in-house into door skins - primarily for export. The entire log production from Segan ITP is therefore utilised locally, i.e. within the District.

Harvesting of *A. crassicarpa* on the mineral soil working circle started in 2009. The species had not performed well. It was of particularly poor form and was sent for fibreboard.

Harvesting of *A. mangium* started in late 2010. Harvest planning is based on a forecasted sustainable allowable annual cut (SAAC) of 42,000 metric tonnes from the mineral soil working circle. Harvest volumes have been well below the SAAC. In 2012-13 only 20,553 metric tonnes were trucked to mill. Over time there is potential to increase this SAAC through additional planting of the ‘Potential’ area (Table 3). The peat soil working circle will also add to the SAAC.

Maintaining a sustainable flow of logs suitable to our downstream requirements is a key management objective at SEGAN. However, whilst the upper level of SAAC is determined by the need for sustainability, the lower level of the annual cut will always be determined by SST’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 logs. The determination of the SAAC is based on the most recent PSP results. 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 SAAC (mill gate volume) are then indentified.

It can be seen from Figure 1 that the age class distribution is significantly skewed towards older areas. Restricting the annual cut to around 42,000MT should bring the ITP on the mineral soils into a more or less normal forest structure over the next 10 years, i.e. more or less over the second rotation.

Based on a long term, sustainable cut philosophy, the SAAC will continue to be reviewed an annual basis, with the objective of ensuring a sustainable harvest volume from a forest of normal structure.

7.2 Employment and Services

Segan employed, at 30 June 2013, 25 full time staff at senior supervisor level and above of whom 7 are expatriates. A further 41 locals are employed in administration, R&D, nursery and operations with the balance comprising 113 Indonesians on two year contracts. The competition for local workers from offshore oil and gas employment and the oil palm industry (both own planting and estates) is such that it is not possible to source many workers locally. However, of the 86 Sarawakians employed 32 (almost 50%) can be considered as ‘local’, e.g. Ulu Sebauh Road, JKR Samarakan Road etc. Segan is an equal opportunity employer: of the Sarawakian work force 42 are male and 24 are female.

Recruiting sufficient workers is an ongoing problem for the plantation industries and is one which is being examined at the highest level.

Most of the establishment and maintenance work in Segan is done using in-house workers with harvesting and trucking done by a mixture of in-house and contractors. The greater part
of the logistical support is supplied locally from Bintulu; e.g. engineering, spares, supplies and waste disposal.

7.3 Adjacent Lands

SEGAN ITP was established primarily 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 Kemenan.

In addition to the above mentioned adjacent areas SEGAN’s boundaries also abut on to, or pass through, what is categorised as areas of shifting agriculture (SA) much of which is in fact settled agriculture with the agriculture sometimes extending well inside the LPF area.

There are no immediate neighbouring suburban or residential developments which would be important for the consideration of aesthetic values and 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.

7.4 The Value of Forest Services

As the draft of the Socio-economic Profiling Study clearly shows there is virtually no demand for forest services in the form of non-timber forest products 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 in Bintulu Town with few off shore. (Firm statistics are not available owing to the reluctance of interviewees to provide such information.) These wage earners return home either at weekends or as shore leave allows. When at home more effort seems to be expended on helping to establish and tap rubber 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 and pineapples, hold far greater attraction than do traditional 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 there 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 at this level. However, it appears that the government actively assists with very small scale rubber planting. The interest in oil palm has resulted in occasional encroachment into riparian buffer zones. When encroachment is noted by SEGAN staff a report is made to the authorities (FDS & NREB) who generally respond quite quickly to inspect and to talk to the perpetrators.

7.5 Socio-economic survey

7.5.1 No significant impact

From the preliminary results of the SFC Socio-economic Profiling Study (Draft) it is abundantly clear that the socio-economic impact of the SEGAN ITP on the community 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. An identifiable positive economic impact results from employment provided by SEGAN with 32 local people employed by SST. Opportunities for further employment are created in the downstream activities that process the logs from SEGAN.
Apart from providing employment for local people in the SEGAN ITP perhaps the greatest impact has been as a result of SEGAN giving assistance with preparing sites for new housing. However, this assistance has necessarily been quite restricted because the requesting communities are very often a) not registered with the District Office, and b) are actually on land licensed to others – quite frequently SEGAN’s neighbour, SPF.

7.5.2 Consultations

The number of communities actually within the LPF is very small: in the Sebauh area - 3, and in the Samarakan area - 3. 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 by the LPF. Consultations are usually in the form of the negotiations that precede obtaining permission to clear residual forest for new planting. It follows from this, as explained in 7.5.1, that the ITP operation has little or no social, or environmental, impact - either direct or indirect - on the various communities.
8. Establishment and Silvicultural Systems

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 agencies. 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 as 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. 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. To this end SST is in the process of joining the Borneo Forestry Co-operative which has several members from Sabah but none yet in Sarawak.

8.2 Choice of Species

8.2.1 Background

When planting started in 1999/2000 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 and, generally, it still is. 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.

The initial dependence on a single species is recognised by Samling as a flawed policy and R & D’s search for alternative species continues with a recently increased momentum. R&D’s aim is to achieve 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.

8.2.2 Site species matching

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

There will no doubt be subtleties provided by differing chemical characteristics of the various series and associations of the mineral soils but Samling’s recognition of any such subtleties and the ability to make use of them is some way off. With the exception of the associations that include the Bako series, all the major mineral soil associations are capable of supporting ITP species. However, the Bako series – which gives rise to kerangas – is only a minor component of each of the two associations in which it is has been recorded.

Over time the planted species diversity might better reflect the probable diversity of planting sites available. But any successful increase in diversity will require: a) a wider range of economic species than has currently been identified; and, b) a much greater knowledge of both the soils and of the requirements of the economic species that might be best suited to them. Soil maps are available but these are based on reconnaissance level surveys and produced at a scale of 1:50,000.
8.2.3 **Planting of native species**
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 entity has 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.

8.2.4 **Utilisation of species selected – end uses**
Table 5 shows the end uses for the species that are currently being harvested or which will harvested in the next 2-3 years. Also shown are the possible end uses for the two species which have recently become operational species. Gmelina has already been subject to peeling trials and is satisfactory and it is known to be a medium quality sawn timber with good properties. Falcata is well known as a peeler species but downstream will need to run tests to confirm acceptability for sawing and use in high density fibreboard.

### Table 5: End uses of operationally planted species

<table>
<thead>
<tr>
<th>Species</th>
<th>Plywood</th>
<th>Sawn timber</th>
<th>Fibreboard/dorskins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crassicapra</td>
<td>Yes?</td>
<td>Yes?</td>
<td>Yes</td>
</tr>
<tr>
<td>Mangium</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Acacia hybrid</td>
<td>Yes?</td>
<td>Yes?</td>
<td>Yes</td>
</tr>
<tr>
<td>Pellita</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Recent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gmelina</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Falcata</td>
<td>Yes</td>
<td>Yes?</td>
<td>Yes?</td>
</tr>
</tbody>
</table>

SEGAN has recently sent both crassicarpa and Acacia hybrid logs to downstream for testing as to suitability for plywood.

8.2.5 **BORNEOTEAK**
Although Table 5 lists the species name ‘mangium’ this species is actually sold as BORNEOTEAK to the downstream mills.

SST has applied to the Registry of Malaysian Trade Marks to register the marks:

![BORNEOTEAK](image)

8.3 **Current Establishment and Silvicultural Regimes**

8.3.1 **Acacia mangium**
As may be noted in Table 5 the intention is to produce logs that will be suitable for peeling and for sawing. The determinant of suitability is primarily diameter - currently >18cm sed - with grading for roundness and straightness undertaken after felling. Whatever is unsuitable (due to size or form) for these processes will be chipped for fibreboard.

**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 Superbulk seed from elite trees or from the newly established clonal seed orchard which comprises only clones of elite Superbulk trees. (Superbulk is the name originally given to some of the mangium seed produced by Borneo Tree Seeds Sdn Bhd in which Samling has a holding.)

**Site Preparation and Establishment**
Before planting takes place some site preparation is necessary. This usually involves a herbicide application to kill any emergent weeds, particularly natural regeneration of mangium, thereby preventing 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.

**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**

As mentioned earlier - the initial objective was to produce chip logs. Three or so years later this was revised to producing logs for solid timber use. Early plantings were therefore pruned late and not to 6m. Much of the first rotation mangium was thinned relatively very late with some blocks being 5 or more years old at the time of thinning.

The intensive silviculture regime with 4 pruning lifts was intended to produce trees with a significant volume of “clear wood” in the butt log. These butt logs should have knots restricted to a small DOS core along the pruned length and should yield a proportion of face and back veneer.

The rationale behind producing stands with 90% of stems pruned to 6.0m is to allow pruned butt-logs with a minimum small end diameter (sed) of >18cm to yield two peeler logs each of 8 ft (2.5m) with an allowance for end splitting.

**Eucalyptus species**

As originally planned the value of the eucalyptus resource would be maximised by:

Aiming to produce a crop that has a stocking of approximately 600 sph of good form and which have at least 90% of these stems pruned to 6.0m or more.

The regime designed to achieve this is summarised in the following table. It is essentially the same as that for mangium except we expect the rotation length to be about 10 years.

**Good Quality Stock**

As a matter of course Segen will only plant cuttings from selected clones based on R&D recommendations. It is acknowledged that most of the clones are unproven operationally. However, given the need to diversify into eucalyptus clonal material and the fact that the clones have been selected from our own elite trees following R&D trials we consider any downside risk to be acceptable. As soon a clone is shown to be susceptible to canker the propagation and planting of that will clone cease immediately.

**Site Preparation and Establishment**

Before planting takes place some site preparation is necessary. This usually involves a herbicide application to kill any emergent weeds, particularly natural regeneration, therefore preventing 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 weed growth allowed to time to flush with new growth before spraying.

**Maintenance**

Conditions for weed growth are excellent. 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 peeler logs. The intensive silvicultural regime with 4 pruning lifts was designed to produce trees with a significant volume of “clear wood” in the butt log. These butt logs should have primarily green knots restricted
to a small DOS core along the pruned length and were expected to yield a proportion of good quality face and back veneer.

As was the case for mangium the rationale behind producing stands with 90% of stems pruned to 6.0m is to allow pruned butt-logs with a minimum small end diameter (sed) of >18cm to yield two peeler logs each of 8 ft (2.5m) with an allowance for end splitting.

8.3.3 Other species

*Albizia crassicarpa* represents just over 17% of the LPF planted area. Further planting has been discontinued at least until downstream trials confirm its suitability as a species for solid wood use.

*Gmelina arborea* and *Paraserianthes falcataria* (syn. *Falcataria moluccana*) are now planted operationally.

Other species are also 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 remaining species, including all R&D planting, represents just under 6% 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 defective core (determined by diameter over stub, or DOS, at time of pruning) is essential.

In order to have an easily measured criterion that reduce the dangers of both over-pruning (which can impact significantly on increment, particularly on eucalyptus) and under-pruning (which results in an increased DOS and loss of log quality) the 5cm gauge standard was introduced in 2010 and applied to Prune 1 and 2 scheduling. Scheduling for Prune 3 and 4 is by manager’s visual assessment pending development of a standard criterion.

Schedules are produced by the Segan LPF manager and checked by the visiting HQ manager.

8.5 Alternative Regimes

SEGAN acknowledges that ITP silviculture for the production of mangium logs, as well as logs of other species, for solid, as opposed to chip, use is a very new subject both to SST and within Sarawak, and indeed within Malaysia, and that there is much that is not known. A flexible approach is therefore taken towards the use of a particular establishment or silvicultural regime. Although there are core regimes (set out above) there is very much a “horses for courses” dynamic in place at SEGAN. If a block or species warrants a different or more appropriate regime to be used then it might well be used.

A good example of this is on the some of the older mangium blocks where the final pruning lifts had not been done by Year 4 and it was decided that no further pruning would be done. It was considered that the investment of time and money into these blocks in an attempt to produce a high quality clear wood product was not justified.

Moreover, SEGAN is committed to employing the best practice avenues for all its resource and is open to employing new or innovative or ideas if they are proven to be appropriate and exceed the performance boundaries of currently accepted best practice.
9. Monitoring Forest Growth and Dynamics

9.1 Permanent Sample Plots
SST is active in the use of permanent sample plots (PSPs) to monitor the growth and to develop growth models. The LPF licence conditions require that one plot is established for every 5 ha planted. This is done usually when the block is 12 months old. However, there was a delay in establishing PSPs in the earlier plantings. The PSP data is used to construct yield tables, to maintain an updated estimate of the sustainable allowable annual cut (SAAC), to determine which blocks should be harvested in any one year to achieve the SAAC and for long term production forecasts. P&D information is also collected at the time of assessment.

SEGAN has established, maintains and regularly measures an intensive allocation of PSPs to monitor forest growth and dynamics. There are currently some 600 plots distributed over the mineral soil. (As has already been mentioned, a labour shortage has meant that work on the peat area is on hold at the time of revision.)

Following initial establishment the PSP plots should be measured annually thereafter following a strict internally developed measurement protocol.

The SST measurement protocol can be simply described: subsequent re-measurement is done on the anniversary of the first measurement over the length of the whole rotation. As the data base builds up the need to continue the initial, very high, level of sampling intensity will be reviewed.

The location of each plot is randomly (with restriction) chosen within a block before field work commences. Regardless of where it falls the plot centre is established at the predetermined GPS point. The only exception being to ensure that a plot does not encroach on to a road-line or any non-productive area that has been GPSd and excluded from the productive area statement.

PSP measurements are recorded on a paper based system and uploaded electronically to be processed later on Excel spread sheets. Use of a dedicated PSP data processing package is currently under discussion.

9.2 Taper Functions & Volume Equations
A taper function has been developed for *Acacia mangium* (mangium) based on SEGAN volume sample trees and an interim volume equation has been developed for SEGAN *Eucalyptus pellita* (pellita).

Taper functions will be developed for pellita and other species when there is a sufficient number of representative trees old enough to provide the required DBH range for felling as sample trees.

9.3 Result of Monitoring Tree Growth and Site Productivity

9.3.1 Mangium
The first coupe, Coupe 1, has now been harvested and, with the exception of Blocks 17 and 18, all production has been trucked and weighed. The area harvested was almost 520 ha. The final weighted values from the 133 PSPs established (average PSP plot age at date of last measurement was 10.0 years) were: standing volume to 5cm sed -172m3/ha with an average DBH of 26.7cm and a stocking of 347SPH. The MAI was 17m3/ha/yr at the last measurement when the CAI was just over 4m3/ha with a number of plots negative. Mortality between the last and penultimate measurements averaged 13% and, for individual blocks, ranged from 4% to 35%.

Actual harvest production averaged 125MT/ha. Assuming 15% logging losses and a conversion of 1.0MT to 1.1m3 this equates to a standing volume of 162m3/ha - just under 6% below that estimated by means of the PSPs data. (A factor of at least 1:1.1 was applicable as a large proportion of the production was not weighed until at least six months after felling. The standard factor for fresher felled logs is 1:1 and this is also the official factor.)
9.3.2 Pellita

The growth of pellita is quite variable with large differences between the PSP results for plots of the same age. The increment between sequential measurements of the same plot can also vary widely from one year to the next. The harvest age has yet to be determined. The oldest blocks of pellita are just 8 years old and are represented by only 9 plots.

The determination of rotation length is dependent on a robust PSP data base something which is currently lacking. With no applicable information available from elsewhere, an MAI of 12m³/ha has been assumed for volume forecasts. This assumption will be continually reviewed, and as more PSP data from older trees become available, both from SEGAN and Samling’s other LPFs, more detailed analysis will be undertaken, in discussion with downstream, to determine the optimum rotation length.
10. Sustainability: Annual Cut, Harvesting Plan & System, Financial

Sustainability: an enduring value. Sustainable [forest] management is a beguiling term and open to many interpretations. It contains many uncertainties and ambiguities. • Duncan Poore, 2003

10.1 Sustainable Allowable Annual Cut (SAAC)

The SAAC is currently 42,000MT/year. This is based on the area of mangium planted on mineral soils together with a contribution from mixed species, primarily pellita. (Full details are given in the soft copy - see 10.2.) The area planted on mineral soil continues to increase consequent of successful discussion with local land claimants. This is a very slow process but the new planting on such areas, together with improvement of both genetic material and management practice should in due course allow an increase in the SAAC.

The area planted on peat is, in terms of the overall size of SEGAN, substantial - more than 1,300ha. Unfortunately the crassicarpa which represents about 50% of the peat planting proved to be surprisingly prone to severe wind blow. Pending further assessment it is has been assumed that these areas will not yield a commercial harvest. There will however certainly be a small, mainly chip log, volume recovered as a salvage operation prior to replanting. In any event this crassicarpa was, as is that on the mineral soil, of very poor form. Even without the wind blow it would have produced very little potential peeler grade material and only a small volume of saw logs. At present there are no data on the growing stock of the other species, mangium, hybrid and pellita, on the peat. Once the PSP data are to hand the SAAC will be reviewed.

Apart from maintaining the SAAC it is necessary to ensure the sustainability of mangium log delivery for solid wood use. Given that downstream has been developing the processing of mangium logs and the marketing of mangium products for some time it is essential that the mangium log supply is sustained.

10.2 Harvest Plan

The harvest plan is in soft copy only (/SEGAN volume forecast) allowing for easy and continual revision as new and revised 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 SAAC. 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 has been determined taking into account the mineral soil areas (i.e., the West and East blocks only). The age class structure is heavily skewed towards the older years (see Figure 1). A management objective is to achieve a normal forest age class structure whilst at the same time maintaining an even and regular flow of mangium logs to downstream. This means that some blocks will be harvested when older than their optimum rotation age.

10.3 Harvest System

Due to the steep, broken terrain the primary harvesting system used at SEGAN is cable yarding. As well as being economically more efficient the use of this system also helps to protect the fragile soils and in particular reduce compaction. The latter effect is of particular importance when replanting with eucalypts.

Currently SEGAN uses semi-mobile integral tower skyline yarders of its own manufacture. These yarders run cable systems that enable partial or full suspension of felled trees when yarded to a landing for partial processing. SST uses a combination of in-house and contractor crews to achieve the targeted SAAC of 42,000MT/year.

Other benefits of a skyline cable logging system include:

- Reduced disturbance to soils on steep erodible sites.
- They can be used from high vantage points minimising construction of new road infrastructure (this helps maintains water quality and minimises site disturbance).
- They allow access to otherwise inaccessible areas.

SEGAN has only just started harvesting the first rotation of ITP that was planted on logged over MTH areas. Full use is made of existing logging roads and skid trials and little new roading is required other than the extension of access spur roads. These are constructed following approval by SFC and prior to obtaining approval to commence harvesting - (Op.5 in the current PEC system).

10.4 Financial Sustainability
SEGAN is the smallest of eight ITPs licensed to the Samling Group. The Group has clearly been financially supportive of SEGAN for the past 13 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 cash flow positive for the remainder of the 60 year licence period with net revenue from log sales covering replanting and overhead costs. (See Annual Budget – soft copies held in SEGAN & HQ Miri.)

11. Spatial Information and Management Systems
SST currently has a GIS that contains detailed spatial information data layers for the LPF. Data is captured by the QS team using hand held GPS Garmin 76CSx and by our own LIDAR - 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 in ArcGIS 9.3 for further processing and mapping. Our current GIS allows SST to produce a variety of maps displaying an array 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 by the GIS with LIDAR providing contouring at 5m intervals.

GPS tracks are backed up at SEGAN. After arrival Miri HQ they are checked and cleaned and then saved on both Refor hard drives and SST’s local server.

Paper based copies are held as further “backup” should the electronic systems fail.

Whilst the Group’s ERP system has a strong accounting function SEGAN is somewhat constrained by the system’s inherent limitations in terms of its forest management capability. Currently the purchase of a dedicated forest management system is under investigation. This would require a direct, real-time link between the GIS and the management system.
12. Rare, Threatened and Endangered Species

Given the past history of wide spread, heavy logging with multiple re-entry it is not surprising that undisturbed primary forest has yet to be identified within the ITP. Further - as reference to Map 1 clearly shows - apart from the boundaries formed by Btg Kemena, Sg. Segan and Sg. Binia most of the LPF boundaries are mutual with oil palm estates (or areas designated to become oil palm estates), shifting or settled agriculture or with the Sarawak Planted Forest’s ITP.

The EIA states that there are no salt licks within the ITP and subsequent enquires have reinforced this statement.

However limited the potential might be SEGAN recognises it has an obligation and commitment to incorporate into its management practices protocols for the identification and protection of rare, threatened and endangered 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 logging.

To this end, and following discussions with FDS, SFC and other parties, a flora and fauna survey has been commissioned. This will provide a framework for the LPF in terms of its biodiversity and of its rare, threatened and endangered species in particular. The management implications and requirements arising from the results of this survey will be incorporated into the next revision of the FPMP.

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 rare, threatened, and endangered species have been identified. (SPF has a long and valuable history of undertaking - with the assistance of NSSB - the field work necessary to identify these species and SEGAn expects to share some the SPF experience and findings.) This information has been incorporated into the SEGAn GIS.

As mentioned earlier, apart from the degraded residual forest resulting from repeated heavy logging over three to four decades there are no further MTH areas to be harvested in SEGAn. Where possible SEGAn will protect those remnant MTH areas that have been identified as conservation areas, as opposed to riparian buffer zones the establishment of which is a mandatory requirement. Full protection of these conservation areas will allow them to continue to recover and develop their diversity and potential functions as refuges and ecological corridors - not only for any rare, threatened or endangered species but for all wildlife in the LPF and adjoining areas.

SST considers that anyone associated with the company should be involved with the process of protecting rare, endangered or threatened species. Currently contractors are asked to note, either verbally or in writing, the location and type of any rare or threatened species they come across in their day to day activities.

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

“Sites which are known to be culturally sensitive or are known to contain rare 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.”

In conjunction with this SST is also liaising with NSSB, SPF, FDS and SFC. A few rare, threatened or endangered species have been identified within SPF but none are in conservation areas close to or abutting SEGAn.

The EIA identified the protected, or totally protected, fauna listed in Table 9 (next page), as occurring within the LPF.

The work to be undertaken under the above mentioned investigation is intended to help confirm the existence and status of any rare, threatened and endangered species.
To assess the status of rare, threatened and endangered species in Segan LPF, including any listed in Table 9, specific survey methodologies that have already been well field tested in SPF will be used.

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).

Table 9: List of Protected Fauna Observed in Segan LPF (EIA, 1999)

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Status*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accipiter trivirgatus</td>
<td>Kite</td>
<td>P</td>
</tr>
<tr>
<td>Anorrhinus galeritus</td>
<td>Bushy-crested hornbill</td>
<td>TP</td>
</tr>
<tr>
<td>Anthracoceros malayanus</td>
<td>Black hornbill</td>
<td>TP</td>
</tr>
<tr>
<td>Anthracoceros coronatus</td>
<td>Pied hornbill</td>
<td>TP</td>
</tr>
<tr>
<td>Blythicus rubiginosus</td>
<td>Woodpecker</td>
<td>P</td>
</tr>
<tr>
<td>Buceros rhinoceros</td>
<td>Rhinoceros hornbill</td>
<td>TP</td>
</tr>
<tr>
<td>Gracula religiosa</td>
<td>Hill myna</td>
<td>P</td>
</tr>
<tr>
<td>Halcyon chloris</td>
<td>Kingfisher</td>
<td>P</td>
</tr>
<tr>
<td>Lacedo pulchella</td>
<td>Kingfisher</td>
<td>P</td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arctictis binturong</td>
<td>Bear Cat</td>
<td>P</td>
</tr>
<tr>
<td>Cynocephalus variegates</td>
<td>Flying lemur</td>
<td>P</td>
</tr>
<tr>
<td>Felis bengalensis</td>
<td>Leopard cat</td>
<td>TP</td>
</tr>
<tr>
<td>Helarctos malayanus</td>
<td>Bear</td>
<td>P</td>
</tr>
<tr>
<td>Hylobates muelleri</td>
<td>Bornean gibbon</td>
<td>TP</td>
</tr>
<tr>
<td>Hystrix brachyura</td>
<td>Porcupine</td>
<td>P</td>
</tr>
<tr>
<td>Manis javanica</td>
<td>Pangolin</td>
<td>P</td>
</tr>
<tr>
<td>Nycticebus coucang</td>
<td>Slow loris</td>
<td>TP</td>
</tr>
<tr>
<td>Petinomys setosus</td>
<td>Temminck’s flying squirrel</td>
<td>P</td>
</tr>
<tr>
<td>Presbytis cristata</td>
<td>Langur</td>
<td>TP</td>
</tr>
<tr>
<td>Ratufa affinis</td>
<td>Giant tree squirrel</td>
<td>TP</td>
</tr>
<tr>
<td>Tupai glis</td>
<td>Tree shrew</td>
<td>P</td>
</tr>
<tr>
<td>Tupai tana</td>
<td>Tree shrew</td>
<td>P</td>
</tr>
<tr>
<td><strong>Reptiles</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varanus dumerii</td>
<td>Tree monitor lizard</td>
<td>P</td>
</tr>
<tr>
<td>Geochelone emys</td>
<td>Spiny terrapin</td>
<td>P</td>
</tr>
<tr>
<td>Crocodylus porosus</td>
<td>Crocodile</td>
<td>P</td>
</tr>
</tbody>
</table>

Source: Table 3.6, Segan EIA July 1999

* Status of protection is classified according to the listing in *Wildlife Protection Ordinance of Sarawak (1998).*

P = protected; TP = totally protected
13. Social Multiple-Use

Personal safety on logging roads is an unavoidable issue and security of both the company’s and contractors’ equipment and workers’ property is an ongoing 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 will only serve to further our knowledge of the area’s biodiversity.

Whilst there is as yet no formal arrangement SEGAN hosts students from UPM (Bintulu) from time to time providing the opportunities for various study aspects.

Hunting is prohibited other than by members of the local community and then only for personal consumption. The opportunities for fishing within the LPF are very limited. Where Sg Segen 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. Some very limited use is made of the nipah fringe on the Btg. Kemen, Sg. Segen, Sg. Silas and Sg. Binai by people from Kpg. Kuala Segen which lies downstream of the LPF. Although there is very small sago ‘factory’ just downstream of Kuala Segan there is no evidence that use is made of sago from within the LPF.

Whilst not multi-use of the forested area, the use of the old established SA areas within the LPF still continues – often in a more settled manner with oil palm and rubber planted by individuals as opposed to estate operators.

14. Cultural and Historic Values

No sites of cultural or historic value were identified within SEGAN by the EIA. None has been subsequently identified and local knowledge, as currently available to SST, indicates that there are none with SEGAN LPF.

15. Forest Plantation Management Plan – Review and Revision

ITP is still a very young industry in Malaysia. Planting only started in SEGAN in 2000. The Samling downstream mills that are using Segen’s ITP logs are only just starting to understand and address the technical challenges and changes required by plantation log processing and in marketing the products made there from.

In order to take into account new knowledge, our own R&D findings and developments within the ITP sector & to ensure that as far as is possible SEGAN meets downstream’s evolving requirements a formal annual review of the FPMP is necessary for the next few years. This will be followed by revisions as deemed appropriate. This somewhat frequent review schedule is recognised by SST as being an important part of an ongoing learning and implementation process. This process will assist in ensuring continual improvement of the management of SEGAN ITP and in, in particular, the achievement of the primary management objective.

Reviews and revisions will be conducted as follows:

Compulsory Review: An annual review of the SEGAN Forest Plantation Management Plan will take place. A revision may follow if deemed necessary.

Ad-hoc Revision: In order to incorporate any major policy change in the management plan a specific revision may be required. As with a revision following the compulsory review process, this will be entered into the log or on a file note.

The need for revision of the FPMP 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 during senior management discussions; and
- Changes in downstream planning or requirements.

The General Manager Refor is required to approve any revision and all such revisions will be endorsed by the Samling Group Chief Operating Officer.