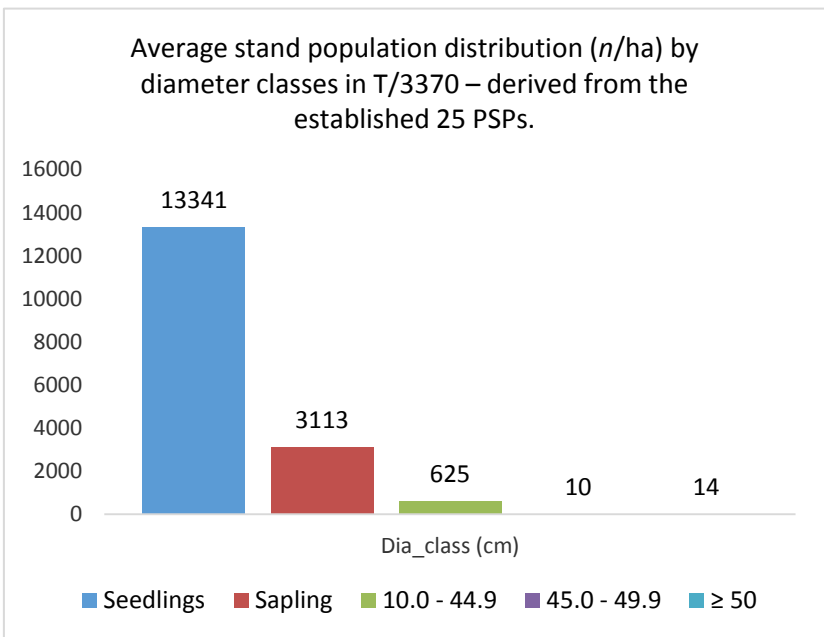
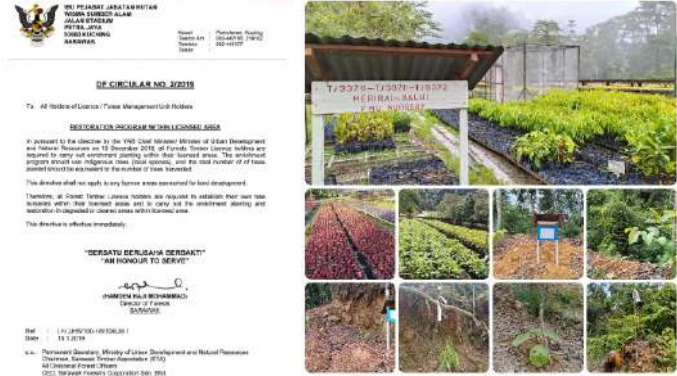


Penuan-Lebuwai FMU (T/3370)

Summary of Monitoring Results on
Timber Yield and Forest Conditions

Item	Particulars	Data Source(s)	Interim Results/Remarks																																																																																																														
1	Yield of Forest Products	Royalty Volume	<ul style="list-style-type: none"> The FMU had completed timber harvesting activity in Coupe 01A & Coupe 02A and now the active coupe is Coupe 03A. The log production for Jan 2025 until Feb 2026 (Table 1) <p>Table 1: Log Production for Penuan-Lebuwai FMU (T/3370)</p> <table border="1"> <thead> <tr> <th colspan="7">Log Production for Penuan-Lebuwai FMU (T/3370) - January 2025 - February 2026</th> </tr> <tr> <th rowspan="2">Year</th> <th rowspan="2">Month</th> <th rowspan="2">Log Production Limit approved By FDS (m³)</th> <th colspan="3">Log Production (Log Royalty marked By FDS) (m³)</th> <th rowspan="2">Number of Logs (Pieces)</th> </tr> <tr> <th>M-R Series</th> <th>Others</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td rowspan="12">2025</td> <td>January</td> <td>5,383.0000</td> <td>798.6917</td> <td>1099.9398</td> <td>1898.6315</td> <td>819</td> </tr> <tr> <td>February</td> <td>5,383.0000</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td>0</td> </tr> <tr> <td>March</td> <td>5,383.0000</td> <td>859.3786</td> <td>786.2169</td> <td>1645.5955</td> <td>754</td> </tr> <tr> <td>April</td> <td>5,383.0000</td> <td>149.3020</td> <td>159.6930</td> <td>308.9950</td> <td>141</td> </tr> <tr> <td>May</td> <td>5,383.0000</td> <td>374.4343</td> <td>1519.4097</td> <td>1893.8440</td> <td>858</td> </tr> <tr> <td>June</td> <td>5,383.0000</td> <td>870.5940</td> <td>2001.6449</td> <td>2872.2389</td> <td>1594</td> </tr> <tr> <td>July</td> <td>5,383.0000</td> <td>408.5488</td> <td>124.5707</td> <td>533.1195</td> <td>310</td> </tr> <tr> <td>August</td> <td>5,383.0000</td> <td>582.9602</td> <td>484.1409</td> <td>1067.1011</td> <td>598</td> </tr> <tr> <td>September</td> <td>5,383.0000</td> <td>495.1471</td> <td>236.4385</td> <td>731.5856</td> <td>382</td> </tr> <tr> <td>October</td> <td>5,383.0000</td> <td>975.3468</td> <td>1018.1307</td> <td>1993.4775</td> <td>1036</td> </tr> <tr> <td>November</td> <td>5,383.0000</td> <td>453.9336</td> <td>1188.8555</td> <td>1642.7891</td> <td>807</td> </tr> <tr> <td>December</td> <td>5,383.0000</td> <td>169.1925</td> <td>0.0000</td> <td>169.1925</td> <td>109</td> </tr> <tr> <td rowspan="2">2026</td> <td>January</td> <td>5,383.0000</td> <td>185.0253</td> <td>1732.3878</td> <td>1917.4131</td> <td>792</td> </tr> <tr> <td>February</td> <td>5,383.0000</td> <td>0.0000</td> <td>1612.8634</td> <td>1612.8634</td> <td>511</td> </tr> <tr> <td colspan="3"></td> <td>18286.8467</td> <td></td> <td>8711</td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> Aside from timber, there will be no commercial production of other forest products. 	Log Production for Penuan-Lebuwai FMU (T/3370) - January 2025 - February 2026							Year	Month	Log Production Limit approved By FDS (m ³)	Log Production (Log Royalty marked By FDS) (m ³)			Number of Logs (Pieces)	M-R Series	Others	Total	2025	January	5,383.0000	798.6917	1099.9398	1898.6315	819	February	5,383.0000	0.0000	0.0000	0.0000	0	March	5,383.0000	859.3786	786.2169	1645.5955	754	April	5,383.0000	149.3020	159.6930	308.9950	141	May	5,383.0000	374.4343	1519.4097	1893.8440	858	June	5,383.0000	870.5940	2001.6449	2872.2389	1594	July	5,383.0000	408.5488	124.5707	533.1195	310	August	5,383.0000	582.9602	484.1409	1067.1011	598	September	5,383.0000	495.1471	236.4385	731.5856	382	October	5,383.0000	975.3468	1018.1307	1993.4775	1036	November	5,383.0000	453.9336	1188.8555	1642.7891	807	December	5,383.0000	169.1925	0.0000	169.1925	109	2026	January	5,383.0000	185.0253	1732.3878	1917.4131	792	February	5,383.0000	0.0000	1612.8634	1612.8634	511				18286.8467		8711	
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2	Forest Regeneration	<p>To-date, a total of 25 Permanent Sample Plots (PSP) has been established – as stratified by i) terrain classes; ii) timber stocking density; and iii) soil series.</p> <p>The number of PSP within the FMU is to be increased gradually.</p> <p>Reassessment, however, has not been conducted.</p>	<ul style="list-style-type: none"> Regeneration of seedlings and saplings conforms to the <i>Reverse J-curve</i> (Whitmore and Burnham, 1984) (Figure 1). <p>Figure 1: Average stand population distribution (<i>n</i>/ha) by diameter classes in T/3370 – derived from the established 25 PSPs.</p>  <table border="1"> <caption>Average stand population distribution (n/ha) by diameter classes in T/3370</caption> <thead> <tr> <th>Dia_class (cm)</th> <th>Population (n/ha)</th> </tr> </thead> <tbody> <tr> <td>Seedlings</td> <td>13341</td> </tr> <tr> <td>Sapling</td> <td>3113</td> </tr> <tr> <td>10.0 - 44.9</td> <td>625</td> </tr> <tr> <td>45.0 - 49.9</td> <td>10</td> </tr> <tr> <td>≥ 50</td> <td>14</td> </tr> </tbody> </table>	Dia_class (cm)	Population (n/ha)	Seedlings	13341	Sapling	3113	10.0 - 44.9	625	45.0 - 49.9	10	≥ 50	14																																																																																																		
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3a	Condition of the Forest	The analyzed data to-date has been derived from the established 25 PSP.	<ul style="list-style-type: none"> The stand density in the harvestable range was lower than the primary forest; but comparable with other logged-over forest in Peninsular Malaysia (Heng, 2000) and Sarawak (Heng, 2013). Non-Dipterocarps were significantly more than Dipterocarps in the lower diameter classes. The adoption of SFM and continuous good RIL practice are vital to timber resource sustainability. 																																								
3b	Condition of the Forest	Ten (10) Post-harvest Diagnostic Sampling Plots (DSP) have been established and enumerated.	<ul style="list-style-type: none"> The analysis is on-going; and thus, the status of post-harvest forest stocking is unknown. 																																								
3c	Condition of the Forest	Representative Conservation and Protection Area (RCPA)	<ul style="list-style-type: none"> RCPA (Control Plot) has been initiated and served as a benchmark for long-term ecological monitoring. These areas are designated for biodiversity conservation, soil and water protection, and the study of natural ecosystem processes. 																																								
3d	Condition of the Forest	Forest Landscape Restoration (FLR)	<ul style="list-style-type: none"> FLR have been started in 2021 by planted with indigenous tree species (<i>e.g. Shorea</i> spp. at 5 m x 5 m planting distance) to augment forest stocking (due to insufficient natural regeneration) in the Post-F blocks; <i>i.e.</i> along skid trails; degraded area and forest gaps (see DF Circular No. 2/2019 on Restoration Program within Licensed Area (Figure 2)). DF Circular No. 2/2019. <p>Figure 2: DF Circular No. 2/2019, pictures of type of trees species of planted.</p>  <p>Table 2 : Summary of FLR in T/3370</p> <p>Table 2: Post-harvest Enrichment Planting in Peninsular Malaysia FMU (T/3370) (January 2021 - February 2026)</p> <table border="1" data-bbox="683 1435 1493 1603"> <thead> <tr> <th>Year</th> <th>Coupe</th> <th>Number of Planted Seedlings</th> <th>Area [ha.]</th> <th>Tree Species Planted</th> </tr> </thead> <tbody> <tr> <td>2021</td> <td>01A</td> <td>4,783</td> <td>22.0</td> <td>Kelampayan</td> </tr> <tr> <td>2022</td> <td>01A</td> <td>13,007</td> <td>32.5</td> <td>Kelampayan</td> </tr> <tr> <td>2023</td> <td>01A</td> <td>13,962</td> <td>34.9</td> <td>Kelampayan</td> </tr> <tr> <td>2024</td> <td>01A</td> <td>12,166</td> <td>29.9</td> <td>Aderssaur (41%); Engkabang Langgai (41%); Lun (8%); Kelampayan (4%); Durian (3%) and Selangan Batu (1%)</td> </tr> <tr> <td>2025</td> <td>02A</td> <td>15,595</td> <td>39.0</td> <td>Kapur (55.4%); Kelampayan (25.2%); Durian (16%); Lun (2.4%); Luis (0.6%); Cempedak (0.4%)</td> </tr> <tr> <td>2026</td> <td>02A</td> <td>3,650</td> <td>9.1</td> <td>Kelampayan</td> </tr> <tr> <td></td> <td></td> <td>68,163</td> <td>157.4</td> <td></td> </tr> </tbody> </table>	Year	Coupe	Number of Planted Seedlings	Area [ha.]	Tree Species Planted	2021	01A	4,783	22.0	Kelampayan	2022	01A	13,007	32.5	Kelampayan	2023	01A	13,962	34.9	Kelampayan	2024	01A	12,166	29.9	Aderssaur (41%); Engkabang Langgai (41%); Lun (8%); Kelampayan (4%); Durian (3%) and Selangan Batu (1%)	2025	02A	15,595	39.0	Kapur (55.4%); Kelampayan (25.2%); Durian (16%); Lun (2.4%); Luis (0.6%); Cempedak (0.4%)	2026	02A	3,650	9.1	Kelampayan			68,163	157.4	
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4	Growth Rate	To-date, re-assessment of PSP has not been done, due to the fact that those 25 PSP have been established recently.	<ul style="list-style-type: none"> The MAI was determined based on cross comparison with the stand condition of Bahau-Kahei FMU (T/3236), which is adjacent to FMU T/3370 and shared similar ecological environment. It is reasonably presumed that there is no substantial difference in the environmental factors; therefore, FMU T/3370 shall adopt the MAI of 1.0 m³/ha/year to project growth and yield, until more PSP are established progressively and re-assessment is carried out in the future. 																																								
5	Composition and Observed Changes of Flora and	Flora: Sourced from 25 PSP; Chapters 2, 8 and 10 of <i>FMP for FMU T/3370</i> .	<ul style="list-style-type: none"> Information on the composition of flora and fauna shall form the baseline at this stage paving way for future monitoring. <p>Flora:</p> <ul style="list-style-type: none"> The total number of enumerated flora species (<i>i.e.</i> trees) was 380; which was further segregated into timber groups and growing conditions (Table 1). 																																								

Fauna

Fauna:
Sourced from HCVRNS (2017).

Table 1: Total number of enumerated flora species (*i.e.* trees) in T/3370 and segregated into timber groups and growing conditions.

Total Number of Trees Species Enumerated			
380			
Dipterocarp		Non-dipterocarp	
75		305	
Light-demanding	Shade-tolerant	Light-demanding	Shade-tolerant
51	24	274	31

- Across all DBH classes (≥ 10.0 cm), Non-Dipterocarp is dominant than Dipterocarp (Table 2).

Table 2: Average stand density, basal area and gross volume by DBH classes and timber groups based on enumerated 25 PSPs.

Timber Group	Parameters		
	stems (n/ha)	Basal Area (m ² /ha)	Volume (m ³ /ha)
Dipterocarps	168	8.42	140.93
Non-Dipterocarps	482	17.96	257.69
Total	650	26.38	398.62

Fauna:

- Mammals, avifauna and herpetofauna were enumerated using four indices at the highest level (Table 3).

Table 3: Population dynamics of mammals and avifauna in T/3370

Method	Shannon-Weiner Diversity Index (H')	Shannon's Equitability Index (Evenness, EH)	Simpson's Diversity Index (DS)	Margalef Species Richness Index
Mammals (Camera Trapping)	1.34	0.69	0.65	1.24
Avifauna (Line Transect)	1.52	0.85	0.75	1.52

- Based on the findings by monitoring, the current forest condition is still providing a reasonable habitat for the well diverse and rich fauna species present in the FMU (Table 4).

Table 4: The recorded number of families and species of fauna in T/3370

Fauna Type	Number of Families	Number of Species
Mammals	5	9
Avifauna	5	6

The abundance of fauna in FMU T/3370 could be due to the availability of food sources in the still intact forest landscape and less pressure from hunting.

6

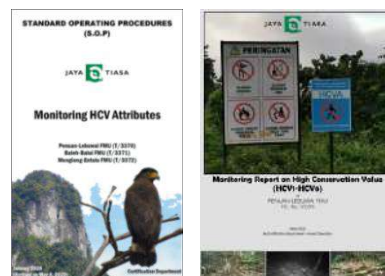
Environmental Impacts of Forest Operations



At FMU level → *HCVF Assessment Report*.

At operational level → *Environmental Compliance Audit (ECA) Report*, made under the NRE (Audit) Rules, 2008 covering on:
 a. Biodiversity conservation;
 b. Forest harvesting operations;
 c. Control of soil erosion and

- HCV attributes 1 – 6 identify the environmental aspects complete with appropriate mitigation measures (Figure 2) and their levels of implementation are been described in the HCV monitoring report. It also follows *Guideline 5 of The Green Book* (FDS, 2019a).

Figure 2: The 'SOP on Monitoring HCV Attributes' at FMU level the Monitoring Report of HCV for Year 2025.



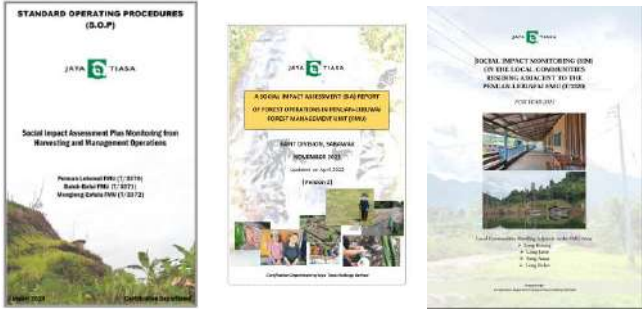
		<p>d. sedimentation; Protection of water quality;</p> <p>e. Waste disposal management; and</p> <p>f. Abandonment plan.</p>	<ul style="list-style-type: none"> Internal Audit for FMU T/3370 – against <i>MC&I SFM</i> – has been conducted on 13th – 16th July 2020; followed by Verification Audit on 9th – 11th December 2020 and follow by report for 2023, 2024 & 2025 (Figure 3). <p>Figure 3: A combo picture showing cover pages of Internal Audit and Verification Audit findings that were made available in 2020, 2023, 2024 & 2025.</p>  <ul style="list-style-type: none"> The first Internal ECA for FMU T/3370 was conducted for Penuan-Lebuwai FMU (Figure 4). No major pollution has been detected and the water quality was found to be good. <p>Figure 4: The Report of IECA for Year 2024 & 2026 & EECA for Year 2025.</p>  <ul style="list-style-type: none"> In the active coupe, road density at 3.8 m/ha and skid trail density at 64.7 m/ha are within the permissible limits, <i>i.e.</i> below the 10 m/ha – 13 m/ha (road density) and 80 m/ha – 90 m/ha (skid trail density), respectively. In addition, the 20-m width of Stream Buffer Reserve (SBR) has also been demarcated on both banks of permanent waterways (<i>Guideline 10A of The Green Book</i> (FDS, 2019b)).
7	Social Impacts of Forest Operations	<p>At the FMU level:</p> <ul style="list-style-type: none"> HCVF Assessment Report; and Social Impact Assessment (SIA) Report <p>At the operational level:</p> <ul style="list-style-type: none"> Environmental Compliance Audit (ECA) report under NRE (Audit) Rules, 2008; covering locals and forest workers on: <ul style="list-style-type: none"> Occupational Safety and Health (OSH); Road and 	<ul style="list-style-type: none"> HCV attributes 5 – 6 identifying the basic needs and cultural values of the local communities in Long Busang, Long Jawe and Sang Anau-Long Bulan. These settlements, however, are situated outside of the FMU with mere presence of SA – been established by Long Busang and Long Jawe at this stage. Sang Anau-Long Bulan has been engaged after a separate dialogue held on 22nd March 2022, establishing itself as the origin of Long Bulan that has been inundated under Bakun HEP (<i>Item #3 in HCV 5 of ‘Public Summary (for) Penuan-Lebuwai FMU (T/3370): Summary of Identified High Conservation Value (HCV) Attributes’</i>). In SIA (previously conducted in Long Busang and Long Jawe), four key impacts comprising water supply and qualities, livelihood, air and noise pollution and social cultural life were studied: <ul style="list-style-type: none"> Out of the 4 key impacts, water supply and qualities and livelihood (forest resources) were identified as major impacts; Despite the negative impact on river quality from previous harvesting, the locals are less dependent on water supply from river for daily usages. Instead, they rely on gravity feed water supply; Some degree of siltation has also occurred from previous harvesting activities, but it has not caused disruption to the river transportation by locals for conducting farming mostly along the river; A higher degree of difficulty in obtaining some of the forest resources nearby the village, such as rattan, fish, wild fruits and construction material; and

River Traffic Safety; and

- Socio-Economic Consideration.
- Internal audit.

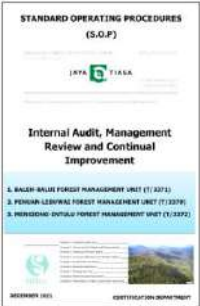
- FMU shall monitor the major impacts once in every five years, *i.e.* based on the *SOP on SIA (Figure 5)*.

Figure 5: The ‘*SOP on SIA plus Monitoring from Harvesting and Management Operations*’ at FMU level; the Report of Social Impact Assessment (SIA) for Year 2022 and Social Impact Monitoring (SIM) for Year 2025.



- In addition, the annual internal audit shall be conducted, *i.e.* based on the *SOP on Internal Audit, Management Review and Continual Improvement (Figure 6)*.

Figure 6: The ‘*SOP on Internal Audit, Management Review and Continual Improvement*’ at FMU level.



- To-date, the SA areas for both Long Busang and Long Jawe are yet to be demarcated. In addition, cultural sites and water catchment areas are located outside of the FMU area.
- To safeguard the basic needs of the local communities, the FMU has already put the RIL practices in place.
- The CRC has been established and endorsed by FDS; with the 1 – 3 meetings to-date; acting as one of the channels for FPIC process. Until now, no major issue has been encountered.
- The FMU has strived to prioritize the employment for the local communities from Long Busang, Long Jawe, Sang Anau and Long Bulan.
- On CSR to the affected communities, the FMU has made contributions in various forms. It includes the regularly maintained road leading to Long Busang and also other contributions to benefit the community.
- The FMU has met all of the OSH as stipulated under OSHA, 1994:
 - Health, Safety and Environment (HSE) Policy has been communicated to all employees through training and displayed the policy at notice board at several designated locations;
 - risk assessment has been conducted for all main and support operations in the FMU and documented in the HIRARC register;
 - Safety Operation Procedures (SOP) and training programs for all type of works have been disseminated to forest workers;
 - Safety and Health Committee (SHC) has been set up to discuss on HSE-related matters regularly;
 - Emergency Response Team (ERT) has been established to assist and prepare for any unforeseen circumstances; and
 - Hazardous areas with proper signages at the work sites have been identified and demarcated.

8	Forest Protection		<ul style="list-style-type: none"> The FMU Production Area has been encroached for farming purposes – especially by some members of the Long Busang community, due to easy access via logging road. The case has been reported to FDS and remedial actions have been drawn up and shall be implemented in stages. 								
9	Productivity and Efficiency of Forest Management		<ul style="list-style-type: none"> To-date, the FMU has started monitoring the productivity and efficiency of pre-harvest and harvest teams (Table 5). <p>Table 5: The productivity and efficiency of pre-harvest vs. harvest teams at T/3370.</p> <table border="1"> <thead> <tr> <th>Work Type</th> <th>Productivity</th> <th>Efficiency</th> </tr> </thead> <tbody> <tr> <td>Pre-harvest</td> <td>6 - 7 mandays/ha</td> <td rowspan="2">To be closely monitored for better efficiency</td> </tr> <tr> <td>Harvest</td> <td>304 m³/team/month</td> </tr> </tbody> </table> <ul style="list-style-type: none"> The FMU shall extend similar study into other areas such as PSP and DSP establishment and assessment; including boundary demarcation and/or monitoring, <i>etc.</i>; and to produce useful figures for more accurate cost control. 	Work Type	Productivity	Efficiency	Pre-harvest	6 - 7 mandays/ha	To be closely monitored for better efficiency	Harvest	304 m ³ /team/month
Work Type	Productivity	Efficiency									
Pre-harvest	6 - 7 mandays/ha	To be closely monitored for better efficiency									
Harvest	304 m ³ /team/month										
10	Cost of Forest Management		<ul style="list-style-type: none"> Production cost comprising direct and indirect costs for Financial Year 2025 has amounted to RM678.10/m³. For Financial Year 2026, the projected production cost is about RM659.50/m³. In addition to the harvesting and transport cost, the total production cost has also factored in the cost of R&D, RIL, training, protection, monitoring and other key activities. Bottom line is slim with tighter budget on more prudent spending. Measures to improve log production are pertinent, coupled with better productivity and efficiency. 								

References

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