Asrama Raya Sdn Bhd

(ARSB)

ENVIRONMENTAL

MONITORING

REPORT

2023

December 2023

ASRAMA RAYA SDN BHD

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ENVIRONMENTAL MONITORING REPORT

1. VULNERABLE SOIL AND STEEP AREA MONITORING

The vulnerable soil and steep areas in ARSB HS Petuang concession were monitored through:

i. Topography map

- Satellite image and digital topography map (**Figure 1 and Figure 2**) were used to check on the topography and land condition of the areas.
  - Refer Monitoring of Protected Area through Satellite Image File.

- Forest manager checked the forest areas on the topography map and ensure the sensitive and steep areas of elevation 1,000 m above sea level (a.s.l.) are avoided for any forest road construction and harvesting activities.

ii. Field examination

- Forest manager and forest supervisor monitored the forest road construction and harvesting activities (Figure 3).
  Observation and monitoring record
  - All of the forest operation activities were not conducted at the steep areas especially areas at elevations greater than 1,000 m a.s.l.
  - All the forest operation activities were conducted and compliance with the Garis Panduan Jalan Hutan 2010 (Pindaan 2013) and Guidelines for Reduced Impact Logging in Peninsular Malaysia (Revised 2018) from Forestry Department Peninsular Malaysia (FDPM).

- ARSB also cooperate with Terengganu State Forestry Department (TSFD) in conducting field examination and ground observations of the vulnerable soil and steep areas.

iii. Remote sensing applications

- ARSB cooperate with TSFD to monitor the condition of these areas using remote sensing application such as Forest Monitoring Using Remote Sensing.

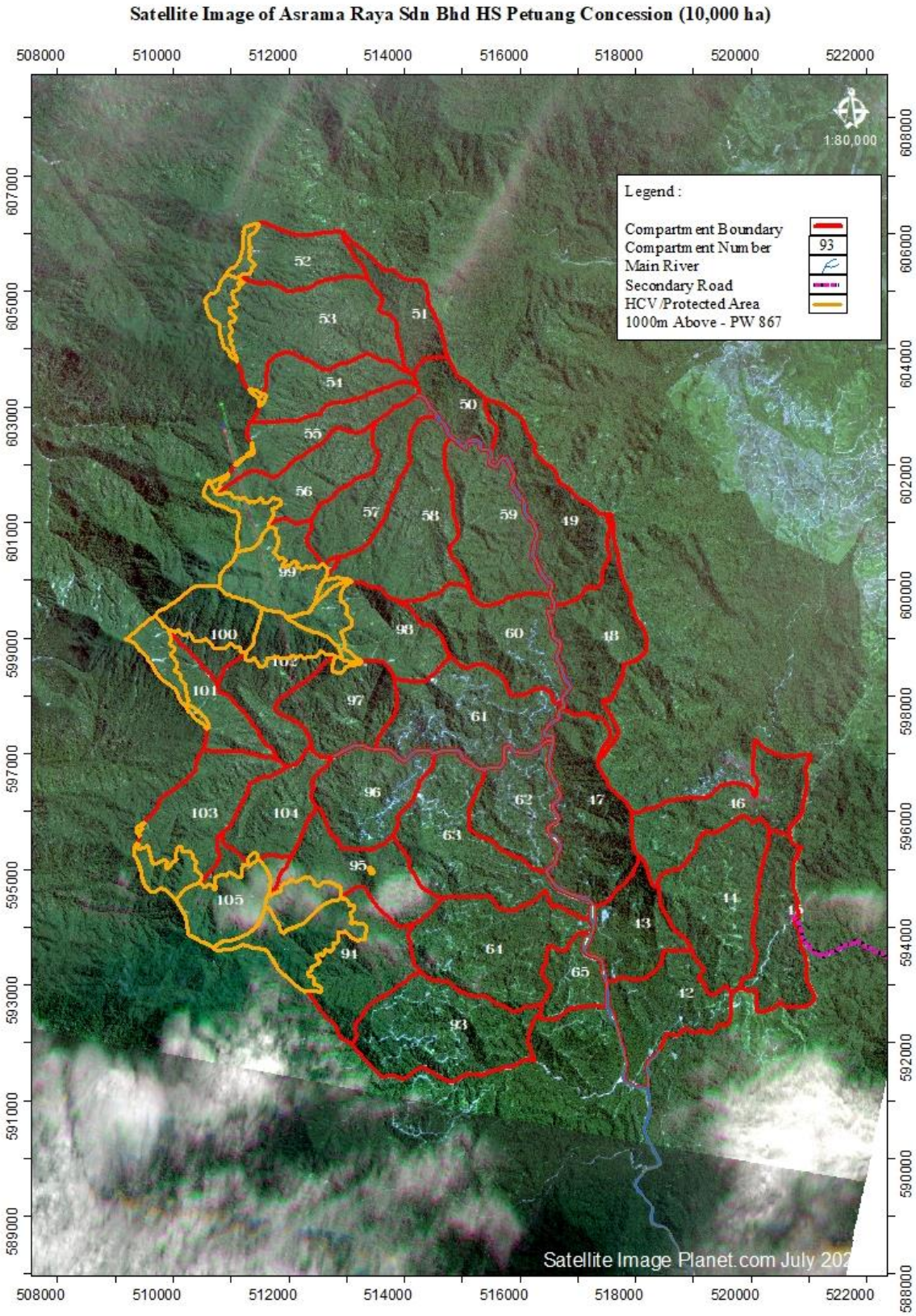

Figure 1. The satellite image of the 10,000 ha of ARSB HS Petuang concession in July 2023. The protected area boundary (orange colour boundary) is mountainous area which is greater than 1,000 m above sea level (a.s.l) covering 1,087.74 ha. *Note: Map is not to scale.

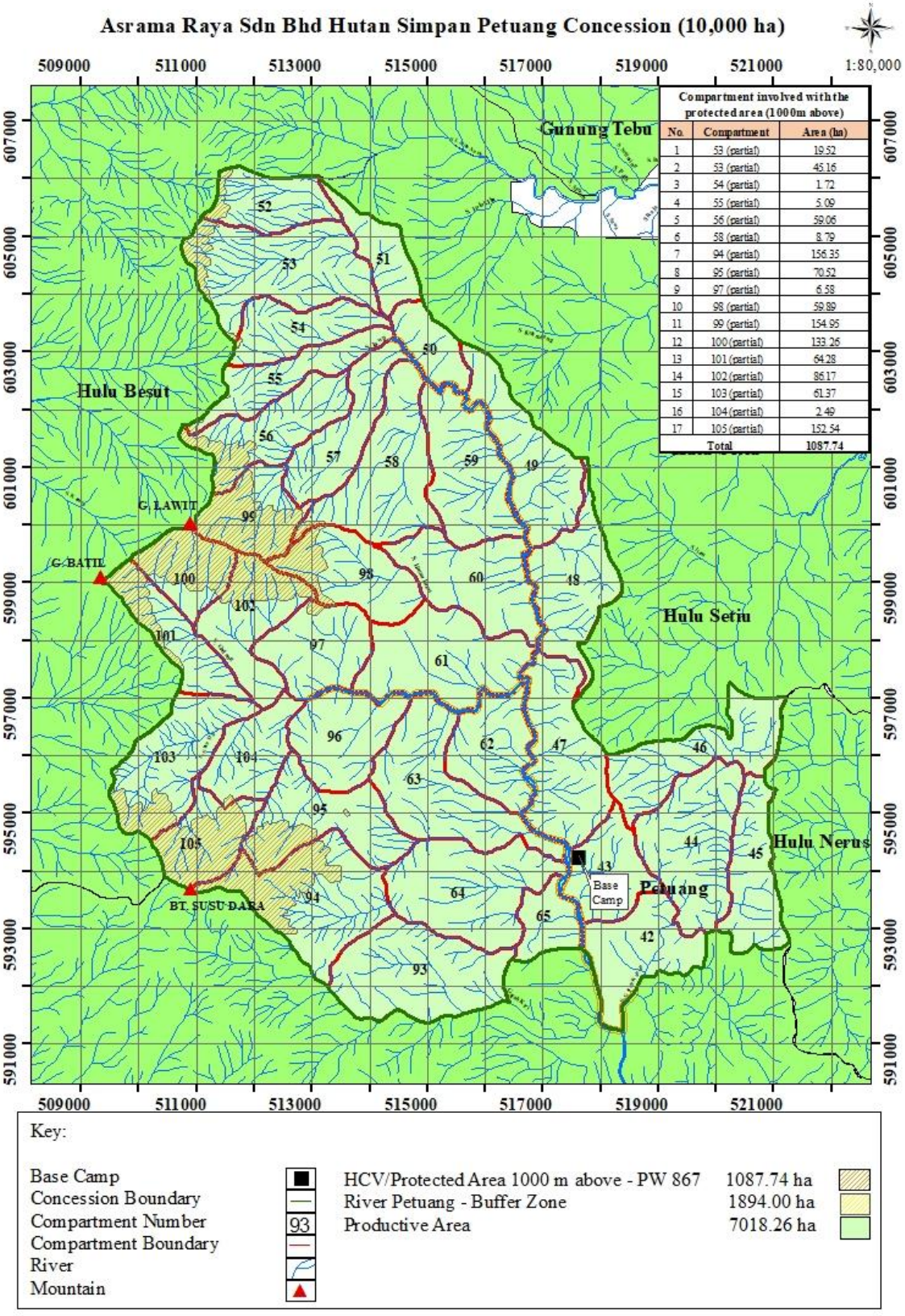

Figure 2. Map of ARSB HS Petuang concession (10,000 ha). *Note: Map is not to scale.

Figure 3. Forest manager is monitoring the forest harvesting activities.

2. LOGGING BASE CAMP AND LOGGING WORKSHOP MONITORING

- Forest manager and forest supervisor monitored the cleanness and conditions of the logging base camp and logging workshop to ensure they are well maintained.

  Observation and monitoring record

  - The logging base camp and logging workshop were clean and well maintained (Figure 4 and 5).
  - All the hazardous substances for forest harvesting operations were handled, stored and disposed based on the standard of procedure (SOP).
  - The conditions and usage of fuel tank and lubricant oil were recorded and under controlled condition.
  - All the wastes and scheduled wastes were taken out from ARSB HS Petuang concession / forest for disposing.

Figure 4. Logging camp of ARSB HS Petuang concession is clean and well maintained.

Figure 5. Notice board and rest areas are provided at logging camp of ARSB HS Petuang concession for forest workers.

3. WATERCOURSE AND WATER QUALITY MONITORING

- Forest manager monitored the buffer zones of watercourse and identified watercourses which needed for protection.
  Observation and monitoring record
  - The trees located along the border of buffer zones are not harvested.
  - The trees located along the are painted with one (1) yellow ring at not more than 10-meter intervals.
- Forest manager and forest supervisor always monitor and ensure all the buffer zones of watercourse are established in accordance with the FDPM standard and Garis Panduan Jalan Hutan 2010 (Pindaan 2013).

- ARSB also monitored water quality of river in ARSB HS Petuang concession once per year.
  Observation and monitoring record
  - Most of the rivers in ARSB HS Petuang concession are clean and river shows greenish-blue colours (Figure 6).

Figure 6. River at compartment 60A, ARSB HS Petuang concession shows greenish colours.

Water Quality Monitoring Record

In August 2023, water sampling was conducted to determine water quality status at Sg. Petuang, ARSB HS Petuang concession. Water samples were collected at two sections, which are upstream and downstream. Two stations at compartment 63 block A and another two stations at compartment 59 block A were selected as sampling site. Compartment 63 block A is the harvested compartment, whereas compartment 59 block A is the unharvested compartment.

Table 1. GPS coordinates of water sampling stations

Station	Compartment	GPS Coordinates	Stream
S1	63A	N: 595580, E: 515507	Downstream
S2	63A	N: 595451, E: 514897	Upstream
S3	59A	N: 599761, E: 516117	Downstream
S4	59A	N: 600116, E: 515583	Upstream

In situ measurement was conducted for temperature, pH and dissolved oxygen (DO) and turbidity. Temperature and pH were measured using Horiba LAQUA pH210 pH/ temperature meter, dissolved oxygen (DO) was measured using YSI 550A dissolved oxygen instrument and turbidity was measured using Eutech Tn100 turbidity meter. Water for total suspended solid (TSS), chemical oxygen demand (COD) and ammoniacal-nitrogen (NH_3-N) analysis was collected using plastic bottle. All samples were preserved using ice (<4 °C) before being taken to the laboratory for analysis.

Figure 7. Horiba LAQUA pH210 pH/ temperature meter was used for measuring pH and temperature directly at site.

Figure 8. YSI 550A dissolved oxygen instrument was used for measuring dissolved oxygen directly at site.

Figure 9. Eutech Tn100 turbidity meter was used for measuring turbidity at site.

Water Quality Monitoring Result

Result of water quality parameters (DO, BOD, COD, NH_3-N, TSS, pH and turbidity) measured at compartment 63 block A and compartment 59 block A of Sg. Petuang, ARSB HS Petuang concession is shown in Table 1.

Dissolved oxygen (DO)
DO measures the amount of oxygen dissolved in the water. It is a vital indicator in supporting aquatic life as aquatic organisms need oxygen to survive in the river. DO recorded minimum value of 7.95 at station 1 and maximum value of 8.47 at station 3. The DO above 7 mg/l showed that the rivers are categorized as healthy river with good water flow (Ibrahim & Kutty, 2013). The DO for all stations is categorized as Class I water for the Interim National Water Quality Standards for Malaysia. The water temperature obtained recorded that the minimum value of temperature was 24°C and maximum value was 26°C. The water temperature levels for all stations are within the normal value for river water. However, the correlation analysis has indicated that temperature has a negative correlation with dissolve oxygen (r = -0.0891).

pH value
The pH value for all the stations ranged from 6.9 to 7.1 which indicated the water is neutral and categorized as Class I water for the Interim National Water Quality Standards for Malaysia. The pH in the river effect types of organisms can live in the river, pH6.5 to 8.2 is optimal for most organisms (Murdock et al. 2001).

Biochemical oxygen demand (BOD)
BOD measures the amount of oxygen used by microorganisms in decomposing organic matter in the water. The BOD values for three stations (station 1, station 2 and station 4) are 1 mg/L indicated that the water of the rivers were uncontaminated and categorized as Class I water under the Interim National Water Quality Standards for Malaysia. The highest value of BOD is 2 mg/L recorded at station 3 which are categorized as Class II water under the Interim National Water Quality Standards for Malaysia.

Chemical oxygen demand (COD)
COD uses chromate as an oxidizing agent to measures the amount of oxygen required to chemically oxidize the organic material in the water to carbon dioxide. For station 1, station 2 and station 4), the COD values are 4 mg/L which categorized as Class I water under the Interim National Water Quality Standards for Malaysia. The COD values at station 3 are 10 mg/L which are categorized as Class II water under the Interim National Water Quality Standards for Malaysia.

Total suspended solids (TSS)
TSS refer to small solid particles which remain in suspension in water as a colloid or due to the motion of the water. TSS for all four stations was 2 mg/L which meant the suspended solid is low. TSS for four rivers were categorized as Class I water under the Interim National Water Quality Standards for Malaysia.

Ammoniacal nitrogen
Ammoniacal nitrogen is a measure for the amount of ammonia in the water which associated with pollution compound of animal and human waste, domestic waste and cleaning agents (Ahmad et al. 2015). Ammoniacal nitrogen level in all rivers was at or below 0.2 mg/L. The

ammoniacal nitrogen presented in four rivers are categorized as Class II water under the Interim National Water Quality Standards for Malaysia.

Turbidity

The turbidity value obtained for Station 1 and Station 4 were 2.5 NTU and 3.4 NTU were classified as Class I water under the Interim National Water Quality Standards for Malaysia. The turbidity recorded for Station 2 (10.3 NTU) and Station 3 (11.6 NTU) were classified as Class II water under the Interim National Water Quality Standards for Malaysia.

Water Quality Index

Malaysian's water quality index (WQI) formula was used to calculate the subindex six water parameters (DO, BOD, COD, NH3-N, TSS and pH) as shown in Table 2. Subindex for DO, BOD, TSS, pH is almost same for all four stations, they are categorized as clean water based on the WQI. Subindex for COD was same at station 1, station 2, station 4 while slightly different at station 3. Subindex for ammoniacal nitrogen for four stations are same but they are categorized as slightly polluted based on the WQI. This is probably due to the pollutant discharged by animal waste, human waste and cleaning agents such as soap.

Based on Malaysian WQI formula, all the four stations showed high water quality index (WQI), ranged from 92 to 95 (Table 2). All these rivers were classified as Class I with status as clean river. Sg. Petuang is classified as very clean and can be used for conservation of natural environment. These rivers are very sensitive for aquatic species and practically no treatment is needed for the water.

Water Quality Index (WQI) result indicated that no differences between water quality of upstream and downstream. There are also no differences between water quality of harvested compartment (compartment 63 block A) and unharvested compartment (compartment 59 block A).

Table 2. Result of water quality parameter measured at four sampling stationsof Sg. Petuang, ARSB HS Petuang concession.

Station	Compt.	Stream	Temp (°C)	DO (mg/L)	DO (%)	BOD (mg/L)	COD (mg/L)	NH_3-N (mg/L)	TSS (NTU)	pH	Turbidity
S1	63A	Downstream	26	7.95	96.95	1	4	0.2	2	6.9	2.5
S2	63A	Upstream	25	8.18	99.76	1	4	0.2	2	7.1	10.3
S3	59A	Downstream	26	8.47	103.29	2	10	0.2	2	7.1	11.6
S4	59A	Upstream	24	8.26	96.05	1	4	0.2	2	7	3.4

Table 3. Subindex and water quality index (WQI) at four stations in Sg. Petuang.

Station	siDO	siBOD	siCOD	siNH3-N	siTSS	sipH	WQI	Class
S1	100	96	94	80	96	99	95	I
S2	100	96	94	80	96	99	94	I
S3	100	92	86	80	96	99	92	I
S4	100	96	94	80	96	99	94	I

4. PLANT MONITORING

- Forest manager conducted the plants / trees monitoring and make sure all the protected tree species, rare and endangered tree species, mother trees are not harvested.

Permanent Sample Plot (PSP)

ARSB had set up two PSP areas in compartment 42 and compartment 63 in ARSB HS Petuang concession (Figure 11). Each PSP area is about 1 ha. The PSP in compartment 42 was set up in 2020 and the tree diameter was remeasured after three years in 2023. Another new PSP in compartment 63 was set up in 2023. ARSB is expected to set up ten PSPs in the FMU in the coming years.

ARSB set up the PSP with 100 m x 100 m plot size (Figure 12). Those mature trees which were larger than 15 cm diameter were measured in all 20 m x 20 m plot. The small trees, saplings and seedlings were only measured in plot 1, 7, 13, 19 and 25. In these plots, only those seedlings with 0.15 m - 1.5 m height were measured in 2 m x 2 m plot. Small trees with 1.5 m height and less than 5 cm diameter were measured in 5 m x 5 m plot. Those trees with 5 cm –15 cm diameter were measured in 10 m x 10 m plot.

All of the PSP trees were properly tagged with species names and tree diameter (Figure 13). The PSP trees were painted with one (1) red ring and labelled with the numbering and plot number. All of the tree diameter are recorded for analysis. In addition, the dipterocarp and non-dipterocarp composition also are recorded. The data are collected every three years to measure growth rate of the trees and to determine the mean annual increment (MAI).

PSP monitoring record

- The tree DBH and stand volume were recorded and calculated.
- The PSP were monitored annually and the measurement of tree growth will be conducted after 3 years.
- **Refer permanent sample plot (PSP) data for PSP monitoring records.**

Figure 10. PSP setup and tree inventory

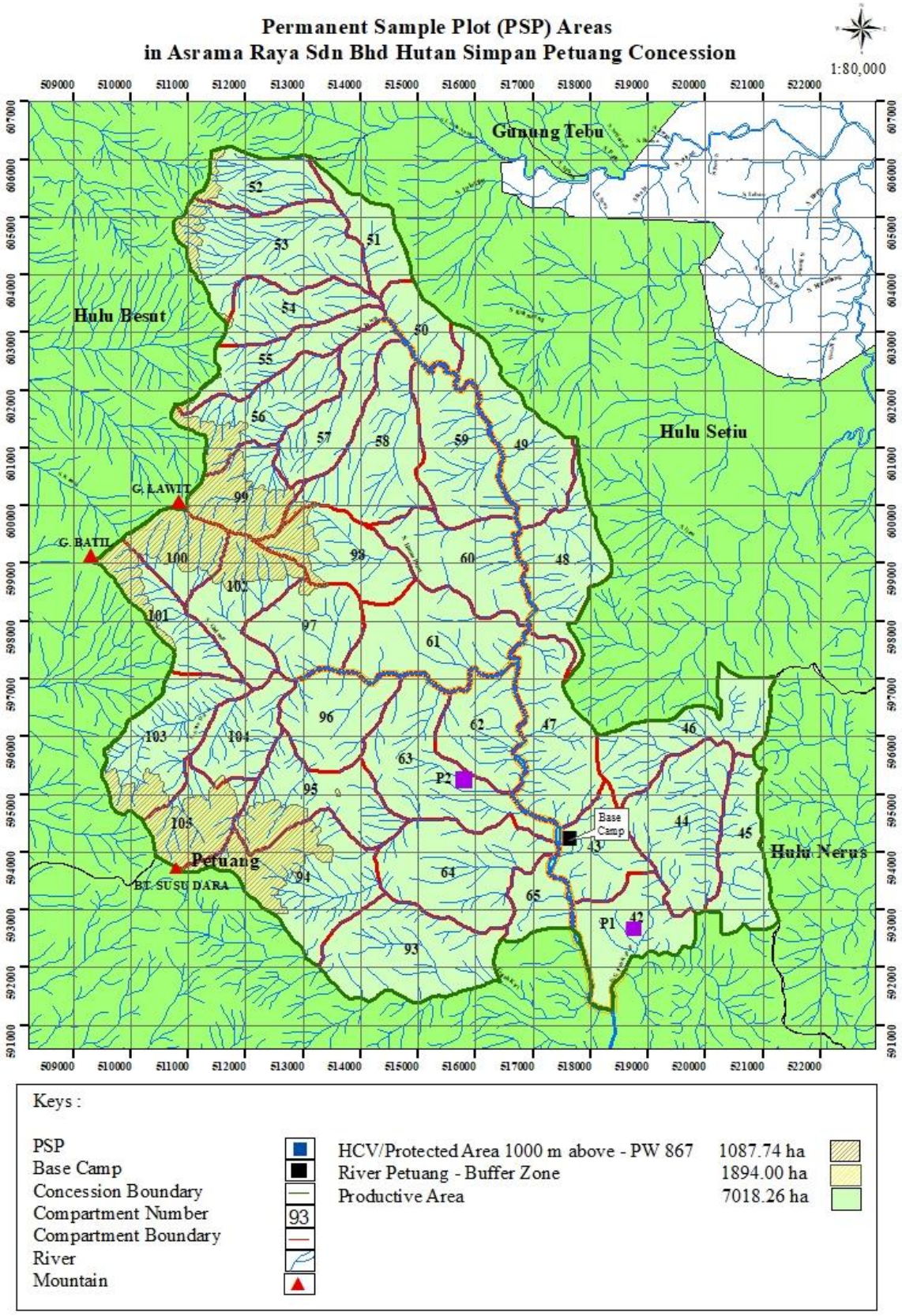

Figure 11. Map of PSP in ARSB HS Petuang concession set up in compartment 42 (2020 and 2023) and compartment 63 (2023). *Note: Map is not to scale.

Figure 12. Set up plot of PSP with 100 m x 100 m plot size.

5. WILDLIFE MONITORING

- ARSB regular monitor ARSB HS Petuang concession from encroachment, illegal activities and hunting.

- ARSB engaged with local community of Kg. Petuang and TSFD for helping in monitoring ARSB HS Petuang concession from encroachment and hunting.

- ARSB conducted periodic monitoring of wildlife.
  I. Monitored the occurrence of animals through camera trapping.
     - **Refer camera trapping data and results for monitoring results.**

  II. Monitored the occurrence of animals through opportunistic sightings.
     - **Refer opportunistic sightings data for monitoring results.**

Figure 13. Forest supervisor/ 'Kepala Hutan' set up the camera trap by mounting up the camera at the tree.

Table 4. List of wildlife found in ARSB HS Petuang concession based on camera trap result in 2023.

Common name	**Species**	**IUCN**
Sumatran serow	*Capricornis sumatraensis*	Vulnerable
Sun bear	*Helarctos malayanus*	Vulnerable
Barking deer	Muntiacus muntjak	Least Concern
Bird	Unknown sp.	Least Concern
Yellow-coloured bird	Unknown sp.	Least Concern
Squirrel	*Callosciurus* sp.	Least Concern
Grey-bellied squirrel	*Callosciurus caniceps*	Least Concern
Plantain squirrel	*Callosciurus notatus*	Least Concern
Lesser mouse-deer	*Tragulus kanchil*	Least Concern
Malaysian wood rat	*Rattus tiomanicus*	Least Concern
Wild boar	*Sus scrofa*	Least Concern

- Refer camera trapping data for more details.
- The camera trapping did not record any wildlife habitat and pattern of wildlife distribution or diversity in ARSB HS Petuang concession.

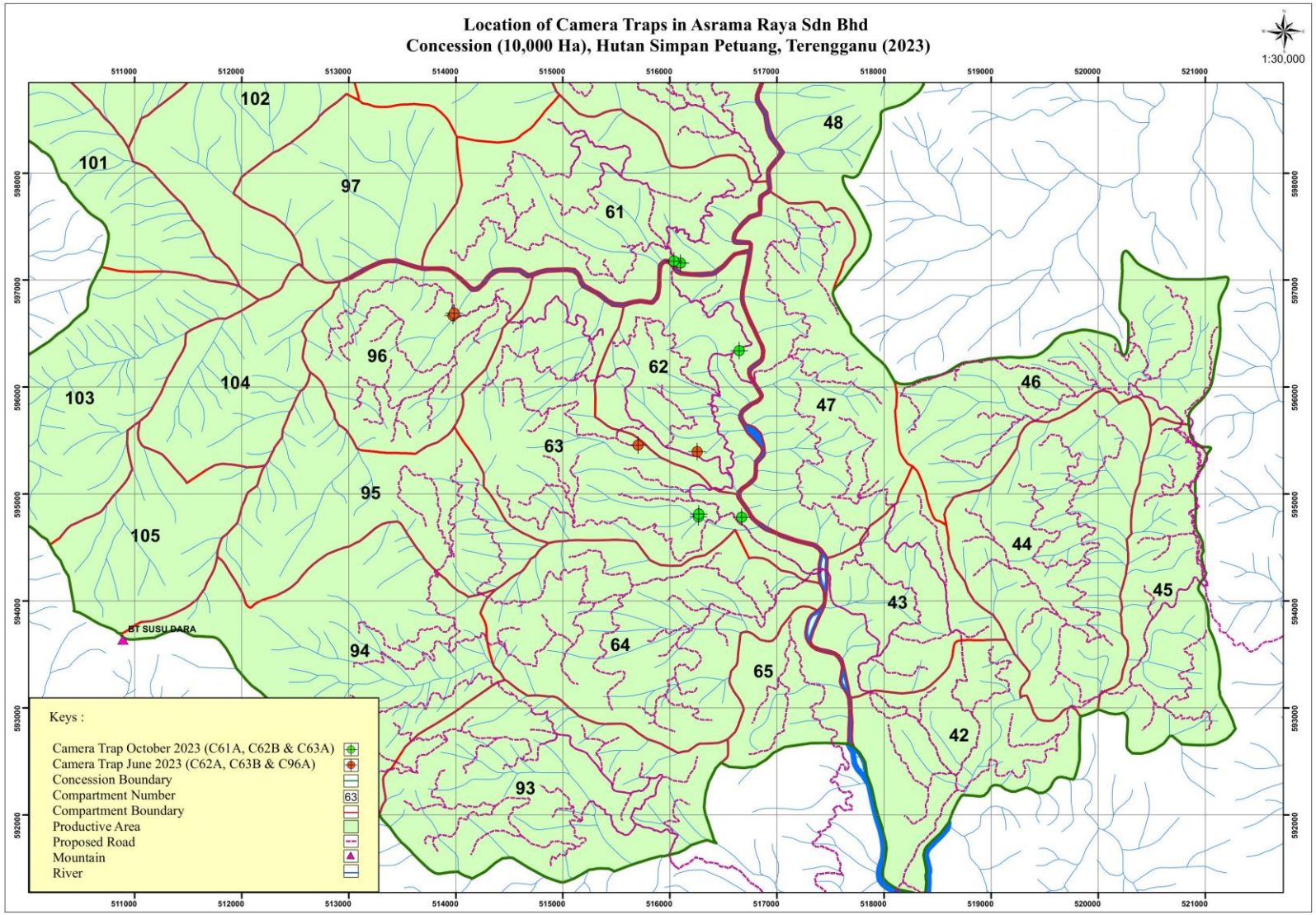

Figure 14. Location of camera traps of ARSB HS Petuang concession in 2023. *Note: Map is not to scale..