CHAPTER 2: PROJECT DESCRIPTION

2.1 INTRODUCTION

This chapter describes the components of the proposed Project and outlines the key elements and Project activities involved in the planned construction and operation phases. This is to provide an overall view of the Project components and to give an indication of the magnitude of the Project.

2.2 PROJECT LOCATION AND OVERVIEW

The proposed Project is one of the 12 individual packages under the 1285 MW Baleh HEP. The Baleh HEP is located on Btg. Baleh approximately 105 km upstream of Kapit Town at Pala Bayong, and about 3 km upstream of its confluence with the Sungai (Sg.) Putai. Administratively, it is located within the Kapit Division.

The proposed 177 km transmission line connects Baleh 500 kV Substation at Baleh HEP (1°48'34.59"N, 113°46 5.66"E) to Mapai 500 kV Substation (2°07'8.66"N, 112°16'24.65"E). The transmission line will be constructed along the northern banks of Btg. Baleh and Btg. Rajang, traversing mostly hilly to mountainous terrains. There will be 35 angle towers (AT) erected along the proposed transmission line alignment.

Refer to **Figure 2.2.1** for project locality and transmission line alignment.

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112° 00' 112° 30' 113° 00' 113° 30'

02° 00'

01° 30'

BAHAGIAN BINTULU

BAHAGIAN SIBU

BAHAGIAN KAPIT

BAHAGIAN SARIKEI

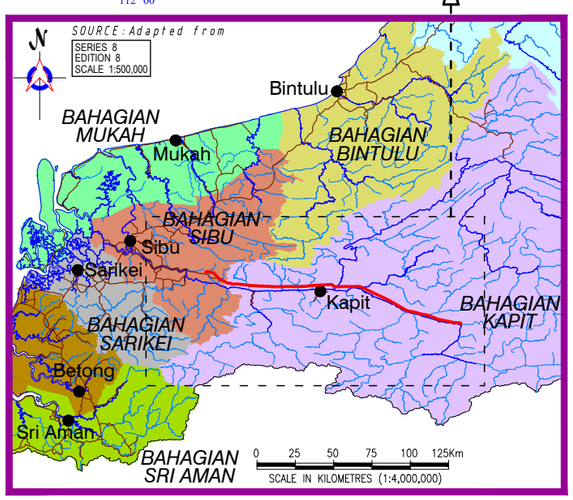
KALIMANTAN
(INDONESIA)

Sibintek
KERANJI
DURIN
Seberai Nibong
KANOWIT
Mapai
Sengayan
Dap
Ngemah
SONG
KAPIT
NANGA MERIT
Baleh HEP
NG. GAAT

BATANG OYA
BATANG RAJANG
BATANG BALUI
MUJONG
SUNGAI KATIBAS
BATANG BALEH
SUNGAI

NAT34 AT33 AT35 AT32 NAT31 NAT29 NAT28 AT27 AT26 NAT25 AT24 NAT23 AT22 NAT20 AT21 NAT18 NAT19 AT17 NAT15 AT16 NAT14 AT13 AT12 AT11 NAT9 NAT10 NAT8 AT7 NAT6 NAT5 AT4 NAT3 AT2 AT1

Sg. Siung Sg. Tamin Sg. Kokok Sg. Selangau Sg. Ayam Sg. Supan Sg. Engkoyau Sg. Tokan Sg. Ba Sg. Pemdan Sg. Besuar Sg. Kerumo Sg. Bendalui
Sg. Pasai Sg. Bua Sg. Tisok Sg. Blong Sg. Arau Sg. Anap Sg. Metah Sg. Pila Sg. Lemai Sg. Sepulau
Hulu Sg. Kamiau Sg. Termulan Bedegom Sg. Merit Sg. Ebon Sg. Taman
Hulu Mukah Sg. Julau Sg. Bangan Sg. Bukau
Sg. Paku Sg. Iran Sg. Soma
Bunau Sg. Sengkaia Sg. Sanideng Sg. Salim Sg. Sengan
Hulu Sg. Anap Sg. Amau Sg. Jawan
Sg. Dap Sg. Pukat Sg. Betalong
Sg. Cermin Sg. Kapit Hulu Sg. Meta Sg. Suan Oyan Sungai Tiau Hulu Sg. Melinau
Sg. Menuan Sg. Bangi Sg. Song Sg. Entangai Sg. Iran Sg. Ibau Sg. Belawai Sg. Bakum Sg. Tunoh Sg. Betun
Sg. Melinau Sg. Pakar
Sg. Kanowit Sg. Ranan Sg. Melipis Sg. Poi Sg. Dap Sg. Ngemah Sg. Sebatu Sg. Kapit Sg. Sebuneng Sg. Sut Sg. Suai Sg. Majau Sg. Paku Sg. Entulu
Sg. Machan Sg. Menanggoh Sg. Menuan Sg. Baleh Sg. Tekalit Sg. Yong Sg. Engkeramoh Sg. Pureh Sg. Sut Sg. Sebatu Sg. Meririai
Sg. Lijan Sg. Meluan Sg. Poi Kanan Sg. Poi Kiri Sg. Kojah Sg. Musah Sg. Mukeh Sg. Setapang Sg. Taang Sg. Sepinying
Sg. Igan Sg. Junan Sg. Pang Sg. Sepoli Sg. Mukoh Sg. Senentang Sg. Gaat Sg. Pelak Sg. Pulang Sg. Sekajang Sg. Entunau
Sg. Kanowit Sg. Mujok Sg. Igan Hulu Sg. Ngemah Sg. Mujon Sg. Nging Sg. Anan Sg. Balang Hulu Sg. Balang Sg. Piat Sg. Selalang
Sg. Selepong Katibas Sungai Sg. Meluan Sg. Rerang Bangkit Sg. Bela Ujan Sg. Sepulau Sebilu Sg. Sekawi Sg. Tekalit
Sg. Bekatan Sg. Bangkit Sg. Itik Sg. Gaat Sg. Sebatu Sg. Mengiong Sg. Tangkuan
Sg. Nyungan Sg. Beloh Sg. Pocan Sg. Santu Sg. Ayat Sg. Ranai Sg. Ririang Sg. Ramong Sg. Sekawa
Hulu Sg. Katibas Sg. Nyawang Sudok Sg. Entulu Sg. Segentu Sg. Entuloh Sg. Serau Sg. Goci
Sg. Engakroman Sg. Telanyai Sg. Latang Hulu Sg. Mengiong Sg. Belanjang Sg. Melatai Sg. Langei



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY FOR THE PROPOSED BALEH-MAPAI 500 KV TRANSMISSION LINE PROJECT

LEGEND:

- PROPOSED TRANSMISSION LINE ROUTE
- PROPOSED ANGLE TOWER (AT1 - AT35)
- INTERNATIONAL BOUNDARY
- DIVISIONAL BOUNDARY
- BALEH DAM
- BALEH DAM RESERVOIR
- RIVERS / STREAMS
- ROADS / MOTORABLE TRACK

N

0 10 20 30 40Km

SCALE IN KILOMETRES (1:600,000) – A3 MEDIUM

GRID
–The outer ticks indicate the Latitude and Longitude

SOURCE : Adapted from
SERIES 8
EDITION 8
SCALE 1:500,000

PROJECT LOCATION AND TRANSMISSION LINE ROUTE

FIGURE: 2.2.1

D:\ACAD\DRAWINGS\EV103\792\FIG-221.DWG

2.3 PROJECT STATUS AND SCHEDULE

Construction of the Project is anticipated to take approximately 36 months from securing the ROW, design and engineering works, and construction to operation / commissioning of the transmission line, demobilisation of construction team to handover by October 2024. Refer to **Figure 2.3.1** for Project Implementation Schedule.

The proposed BMTLP is divided into two packages:

- Package A: Baleh – Kapit 500 kV TLP (81 km).
- Package B: Kapit – Mapai 500 kV TLP (96 km).

AT16 will be the interface point between Package A and Package B. Both packages are further divided into sections (A, B, C, D and E) and will commence concurrently. Details of the packages are summarised in **Table 2.3.1** and shown in **Figure 2.3.2**.

Table 2.3.1: Proposed Transmission Line Packages Construction Schedule

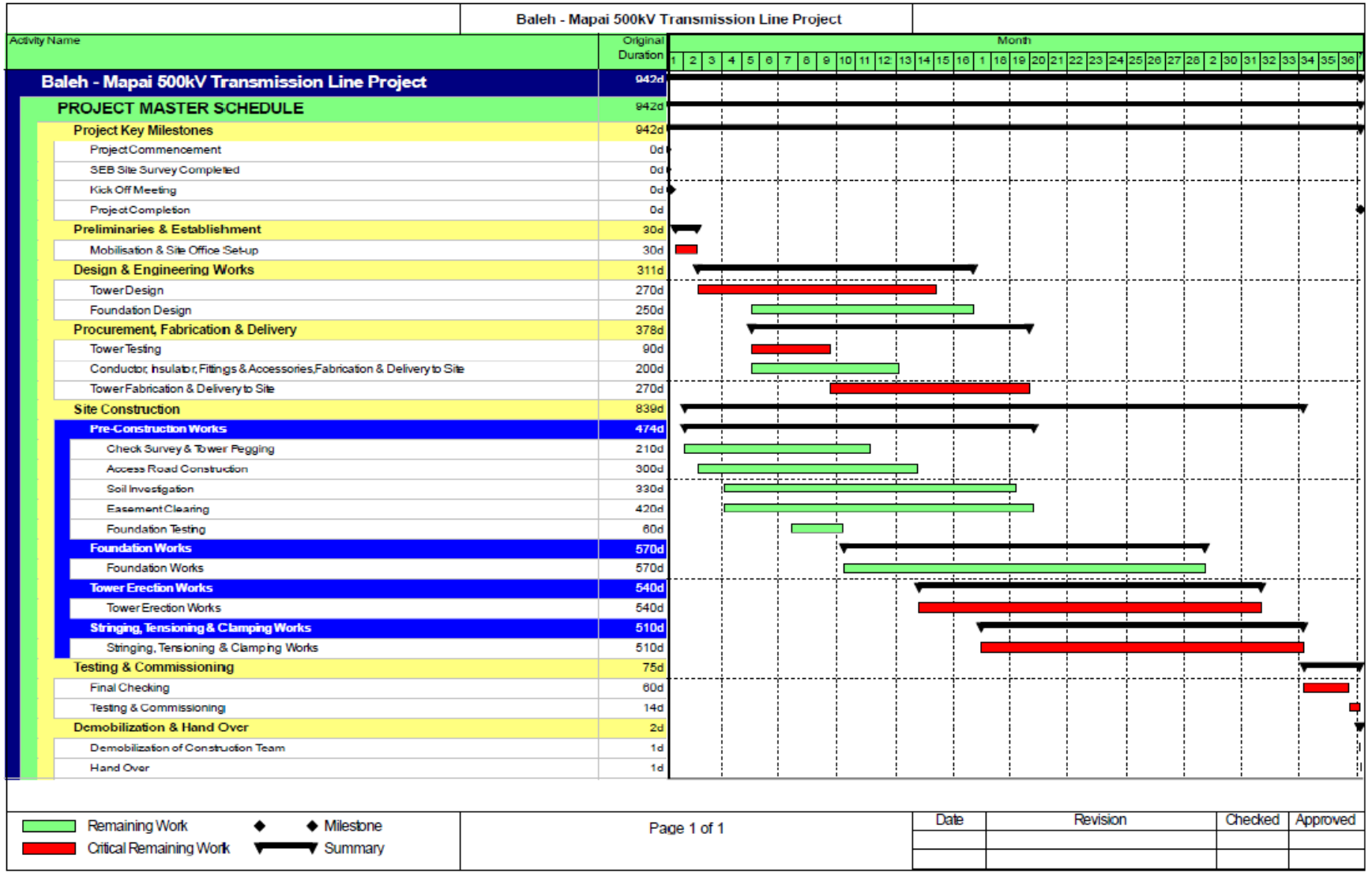
Packages	Line Length	Commencement Date	Completion Date	Contract Duration
A	81 km	1 November 2021	30 September 2024	35 months
B	96 km	1 December 2021	30 September 2024	34 months

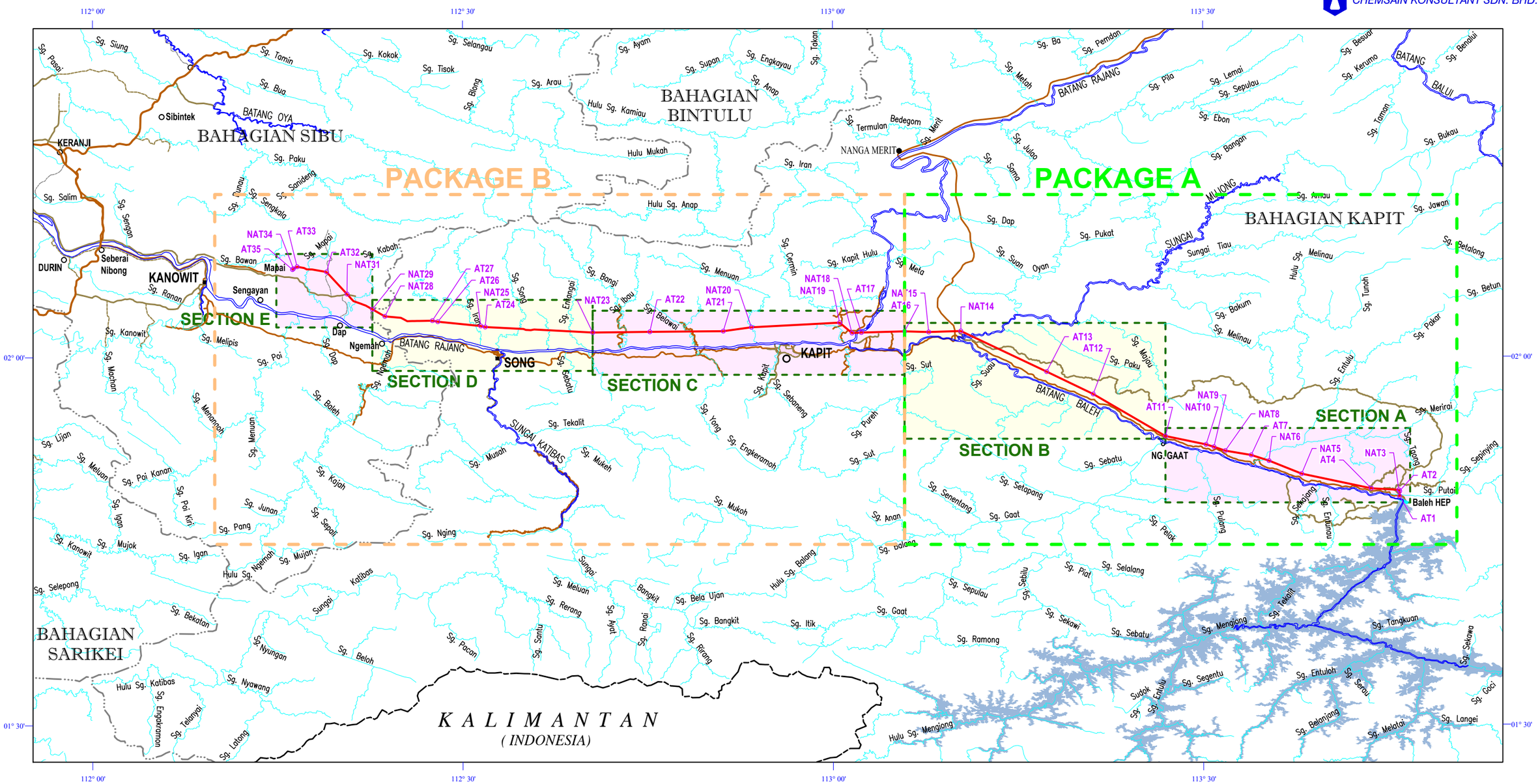
The completion of the BMTLP by October 2024 forms part of SEB's contractual obligation to Baleh Mechanical and Electrical Package (BLP6) to enable achievement of their contractual milestone as follows:

1. Start of Testing and Commissioning Works of transmission line protection and communication systems by October 2024.
2. Baleh HEP's First Generator Unit Wet Testing (Rotation, performance and reliability run) by July 2025.
3. First Power evacuation from Baleh HEP by October 2025.

This Project has received approval for the siting application by the **State Planning Authority (SPA)** on 24th January 2020 as documented in **Appendix 2.3.1**. Currently (July 2021), the appointed surveyors are still conducting the centre line survey works. The Project Proponent is also preparing the land acquisition plan for submission to Land and Survey Department (LSD). A total of 18 months is anticipated for the land acquisition process.

Figure 2.3.1: Project Implementation Schedule





LEGEND:

- PROPOSED TRANSMISSION LINE ROUTE
- PROPOSED PACKAGE A (AT1 TO AT16)
- PROPOSED PACKAGE B (AT16 TO AT35)
- INTERNATIONAL BOUNDARY
- DIVISIONAL BOUNDARY
- BALEH DAM
- BALEH DAM RESERVOIR
- RIVERS / STREAMS
- ROADS / MOTORABLE TRACK

NOTE: AT16 - INTERFACE POINT BETWEEN PACKAGE A AND PACKAGE B

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY FOR THE PROPOSED BALEH-MAPAI 500 KV TRANSMISSION LINE PROJECT

N

0 10 20 30 40Km

SCALE IN KILOMETRES (1:600,000) – A3 MEDIUM

GRID

–The outer ticks indicate the Latitude and Longitude

SOURCE : Adapted from

SERIES 8
EDITION 8
SCALE 1:500,000

PROPOSED PROJECT PACKAGES AND SECTIONS

FIGURE: 2.3.2

D:\ACAD\DRAWINGS\EV103\792\FIG-232.DWG

2.4 PROJECT CONCEPT AND COMPONENTS

The Baleh HEP project comprises of 12 individual packages. The proposed BMTLP is under Work Package 7 (BLP7):

1. BLP1 – Jetty, Road & Bridge
2. BLP2 – Explosive Magazine
3. BLP3 – Operator Village
4. BLP4 – Diversion Tunnel
5. BLP5 – Main Civil (Excl. PS Civil)
6. BLP6 – Main Electrical and Mechanical Works
7. **BLP7 – 500 kV Baleh – Mapai TLP**
8. BLP8 – Biomass Removal
9. BLP9 – Hydrometric & Seismic Station
10. BLP10 – Alternative Access Road
11. BLP11 – Kapit – Baleh 33 kV line (RES)
12. BLP12 – 500 kV Mapai Substation Extension

The main component of **BLP7** consists of the 177 km, 2 x Quad conductor Drake 500 kV transmission line from Baleh 500 kV Substation to Mapai 500 kV Substation.

2.4.1 Transmission Line

The proposed 177 km transmission line will be constructed along the northern banks of Btg. Baleh and Btg. Rajang, as shown in **Figure 2.2.1**. The basic design parameters for the proposed transmission line are shown below:

Table 2.4.1: Basic Design Parameters for the Proposed Transmission Line

Basic Transmission Line Design Parameters	Descriptions
Number of circuits	2
Line length, km	177
Line thermal rating, MVA*	2200
Line voltage rating, kV	500

Source: Project Execution Plan Document (SEB, 2020)

** MVA = Mega-Volt Amperes*

2.4.2 Towers

The type of tower that will be installed for this transmission line project is the lattice tower. The lattice-type of tower is selected due to its proven suitability to the conditions in Sarawak, low-cost operation, ease of transportation, ease of erection in hilly and remote areas with limited road access. The lattice tower is suitable for on-site manual assembly and limited space availability for installation. There are five types of lattice tower to be installed for this Project:

1. Heavy Suspension Towers (5HS)
2. Dead End-Tension Tower (5DE) / 5RA (Right Angle)
3. Light Angle-Tension Tower (5LA)
4. Medium Angle-Tension Tower (5MA)
5. 5T (Transposition Tower)

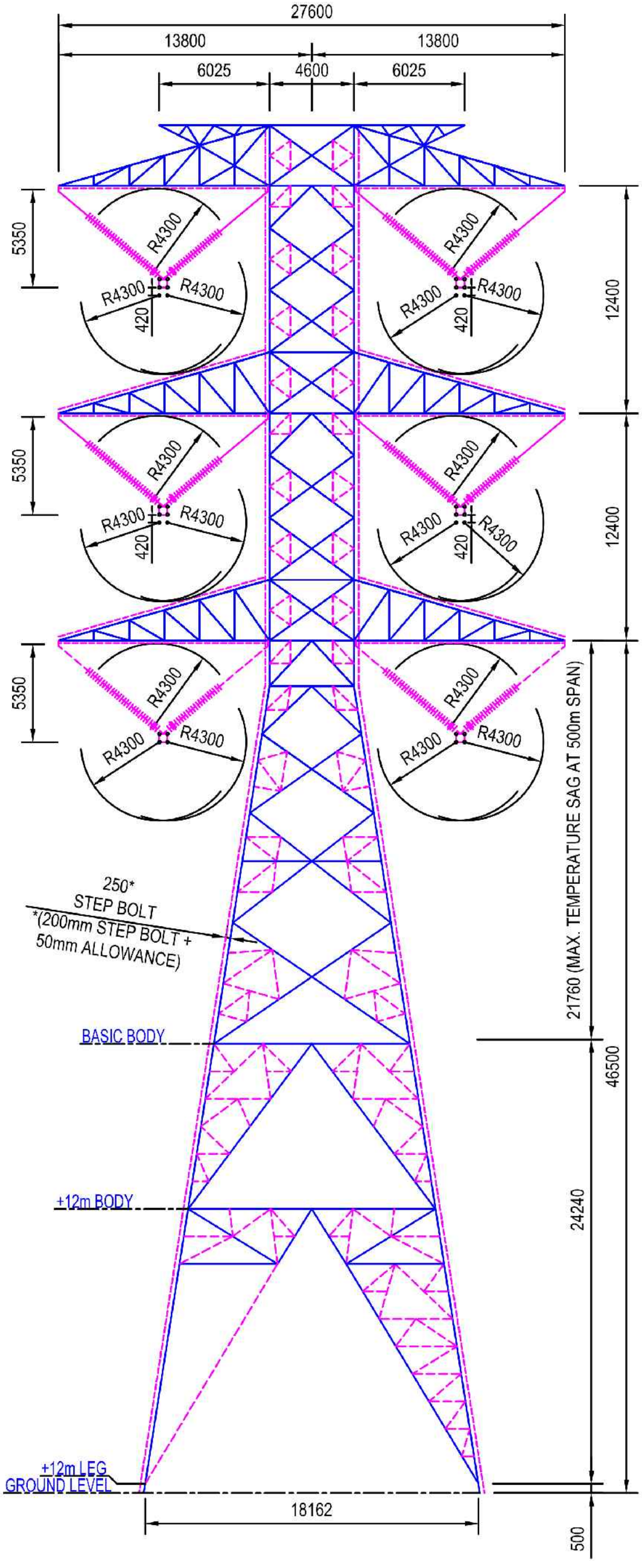
The typical design parameters for the proposed steel lattice angle towers are listed in **Table 2.4.2**. **Figure 2.4.1** and **Figure 2.4.2** show a side-profile of a typical 5HS and 5DE/5RA transmission tower respectively. Towers will be between 62 to 70 m high, depending on terrain and location. The tower platform footprint is approximated at 40 m × 40 m.

The proposed Project involves the construction of 413 towers in total, of which thirty-five (35) are angle towers (AT1 to AT35) and three hundred and seventy-eight (378) are intermediate transmission towers.

Conductor Group:
- Conductor
- Fitting
- Isolator

Tower:
- Member
- Stub & Bolt
- Plate
- Anti-climbing device
- Step bolt

Lower part:
- Foundation
- Grounding



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
(ESIA) STUDY FOR THE PROPOSED BALEH-MAPAI 500 KV
TRANSMISSION LINE PROJECT

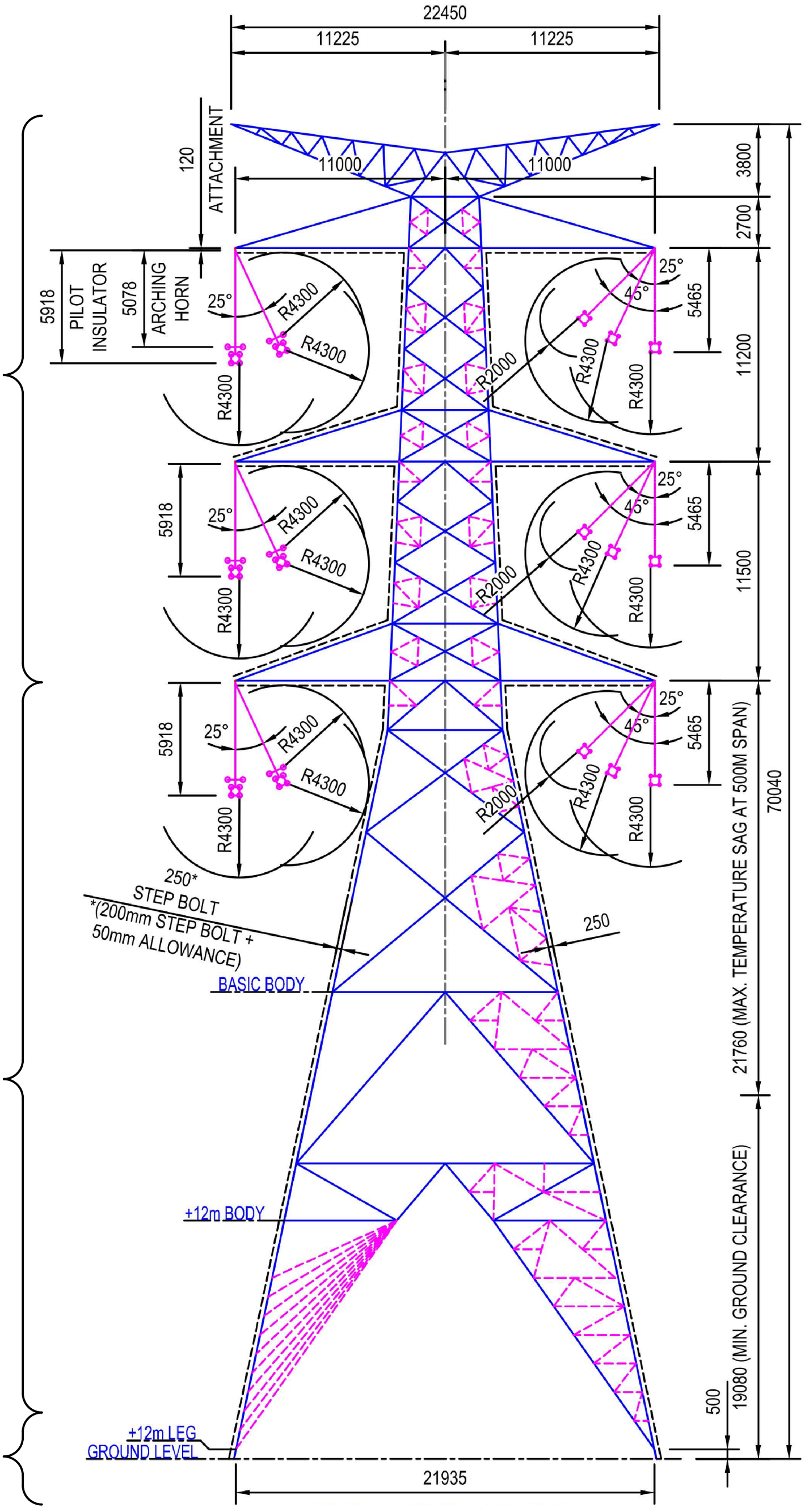
SIDE VIEW DIAGRAM OF TYPICAL 5HS TRANSMISSION TOWER

FIGURE: 2.4.1

Conductor Group:
- Conductor
- Fitting
- Isolator

Tower:
- Member
- Stub & Bolt
- Plate
- Anti-climbing device
- Step bolt

Lower part:
- Foundation
- Grounding



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY FOR THE PROPOSED BALEH-MAPAI 500 KV TRANSMISSION LINE PROJECT

SIDE VIEW DIAGRAM OF TYPICAL 5DE/5RA TRANSMISSION TOWER

FIGURE: 2.4.2

Table 2.4.2: Basic Design Parameters for the Proposed Steel Lattice Angle Towers

Tower Type	5DE / 5RA	5T	5LA	5MA	5HS
Design Span (Wind & Weight Span)	-	500 m	500 m	500 m	750 m
Minimum Weight Span (Uplift)	-	250 m	250 m	250 m	-
Maximum Line Span	500 m (5DE) 275 m (5RA)	-	-	-	-
Landing Span (Slack Tension Span)	180 m (max)	-	-	-	-
Line Deviation Angle	10° (line span) 90° (landing span) – 5DE 30° (entry angle) 60° (aux arm) – 5RA	0° - 6°	0° - 10°	10° - 30°	0° - 2°
Tower Height, m	70.040	69.090	69.090	69.405	62.100
Tower Width, m	22.450	21.390	21.390	23.450	27.600
Voltage	500 kV				
Min. Phase to Earth Clearance (Swing up to 25°)	4300 mm				
Min. Phase to Earth Clearance (Swing up to 45°)	2000 mm				-
Conductor Type	Aluminium Conductor Steel Reinforced (ACSR) DRAKE				
Number of Conductor	4				
Conductor Size	402 mm^2				
Earth Wire Type	48 CORE G655 Optical Ground Wire (OPGW)				
Conductor Slack Tension	8%UTS (EDT)	-	-	-	-
Earthwire Slack Tension	4%UTS (EDT)	-	-	-	-

Source: Sarawak Energy Berhad

The coordinates of the angle towers are tabulated in **Table 2.4.3** below. At each tower site, a structural earthing system will be installed which connects the tower structure to the ground so that, if a tower becomes energized by a lightning strike or a short circuit, the energy can flow directly to the ground.

Table 2.4.3: Proposed Angle Towers Coordinates

No.	Angle Tower No.	Longitude (E)	Latitude (N)
1.	AT1	113° 46' 05.66"	01° 48' 34.58"
2.	AT2	113° 46' 05.64"	01° 48' 59.25"
3.	NAT3	113° 46' 01.80"	01° 49' 05.50"
4.	AT4	113° 43' 47.80"	01° 49' 13.00"
5.	NAT5	113° 38' 09.50"	01° 50' 24.95"
6.	NAT6	113° 35' 31.00"	01° 51' 28.90"
7.	AT7	113° 34' 04.61"	01° 51' 57.13"
8.	NAT8	113° 31' 58.47"	01° 52' 18.25"
9.	NAT9	113° 31' 02.88"	01° 52' 37.54"
10.	NAT10	113° 30' 25.14"	01° 52' 48.95"
11.	AT11	113° 27' 08.03"	01° 53' 30.22"
12.	AT12	113° 21' 16.74"	01° 56' 56.41"
13.	AT13	113° 17' 30.76"	01° 58' 46.28"
14.	NAT14	113° 10' 33.86"	02° 02' 05.42"
15.	NAT15	113° 07' 57.49"	02° 02' 00.56"
16.	AT16	113° 06' 00.48"	02° 02' 04.03"
17.	AT17	113° 02' 30.27"	02° 01' 58.25"
18.	NAT18	113° 01' 44.68"	02° 01' 55.89"
19.	NAT19	113° 00' 44.44"	02° 02' 46.80"
20.	NAT20	112° 53' 35.71"	02° 02' 24.58"
21.	AT21	112° 51' 18.92"	02° 02' 06.04"
22.	AT22	112° 45' 21.65"	02° 02' 03.15"
23.	NAT23	112° 40' 44.06"	02° 02' 00.02"
24.	AT24	112° 32' 01.62"	02° 02' 27.36"
25.	NAT25	112° 31' 39.95"	02° 02' 32.17"
26.	AT26	112° 28' 11.01"	02° 02' 53.40"
27.	AT27	112° 27' 44.48"	02° 02' 58.60"
28.	NAT28	112° 23' 53.66"	02° 03' 19.84"
29.	NAT29	112° 22' 52.65"	02° 03' 54.77"
30.	AT29B	112° 21' 20.70"	02° 04' 34.89"
31.	NAT31	112° 20' 49.83"	02° 05' 08.62"
32.	AT32	112° 19' 10.39"	02° 06' 57.29"

No.	Angle Tower No.	Longitude (E)	Latitude (N)
33.	AT33	112° 16' 47.25"	02° 07' 22.77"
34.	NAT34	112° 16' 29.25"	02° 07' 13.21"
35.	AT35	112° 16' 24.74"	02° 07' 08.76"

Note: "N" = New. To indicate there are changes to the position (coordinate). It is still referring to Angle Tower (AT) Transmission Line Easement / Clearance

2.4.3 Right-of-Way (ROW) or Easement

A transmission line easement or ROW is a strip of land which is also referred to as the line corridor. The ROW will allow easement to build, maintain and operate electric transmission lines free from any vegetation or structure that may pose a threat in terms of safety during the construction and operation of the power line. A ROW with a width of 50 m will be established for this Project. The electrical clearance is tabulated in **Table 2.4.4**.

Table 2.4.4: Electrical Clearance for Lattice Tower 500 kV Transmission Line

Minimum Vertical Clearance to be Ensured from the Line Conductors at Maximum Sag to Ground or by Various Crossings	
To ground	12.0 m
To main road crossing (highway)	18.0 m
To roads, streets, alleys, parking lots, non-residential driveways and other areas subject to truck traffic, tracks and railroads	15.0 m
To water at maximum flood level except navigable rivers, to buildings or structure upon which people may regularly stand	12.0 m
Over major navigable river crossing to water at maximum high-water level including 5 m electrical clearance	50.0 m
Over non-navigable river crossing to water at maximum high-water level	29.0 m
To metal clad or roofed buildings or other structures upon which people may occasionally stand.	6.0 m
To overhead power or telecommunication lines (to cradle)	5.0 – 8.0 m
Minimum Horizontal Clearance to be Ensured between the Line Conductors at Maximum Sag and 45 degrees Swing Angle and Object Near to the Line	
Buildings	6.0 m
Danger trees zone	4.3 m
Minimum Clearance to be Ensured between the Line Conductors at Maximum Sag and 45 degrees Swing Angle and Object Near to the Line	
Side ground clearance	12.0 m

Source: Sarawak Energy Berhad, 2020

2.4.4 Access Points and Jetties

2.4.4.1 Access Roads

Access roads to the proposed transmission line ROW are required to mobilize construction machineries, equipment and materials. The main access road for the Project will be the 120 km road linking Kapit and Song located on the southern bank of Btg. Rajang. Another 73 km road linking Kapit to Baleh HEP is still under construction but partially accessible. These roads will be utilized for mobilization work depending on the construction status.

Several existing or abandoned logging roads linking to the transmission line alignment and ATs will be utilized. Except for AP16, AP17 and AP18, all access points (AP) of these roads are located at the bank of Btg. Rajang and Btg. Baleh. As such, river transport is the only way to reach these access points. For these access points (AP9, AP10, AP11, AP12, AP13, AP14 and AP15), jetties will be constructed for loading and unloading purposes.

The identified access points/ roads and their estimated length are listed in **Table 2.4.5** and shown in **Figure 2.4.3 (a - d**). The combined length of these access roads is approximately 74.2 km.

Table 2.4.5: Proposed Access Roads to the Transmission Line and Angle Towers

Access Point	KM	Type	Use by:
AP1	0.82	Abandoned logging track	Community
AP2	1.41	Operating logging track	Timber company and community
AP3	2.35	Operating logging track	Timber company and community
AP4	0.87	Operating logging track	Timber company and community
AP5	0.48	Abandoned logging track	Community
AP6	5.43	Operating logging track	Timber company and community
AP7	1.41	Operating logging track	Timber company and community
AP8	18.35	Operating logging track	Timber company and community
AP9	3.88	Abandoned logging track	Coal mine and community
AP10	2.79	Operating logging track	Timber company and community
AP11	4.0	Abandoned logging track	Community
AP12	3.12	Abandoned logging track	Community
AP13	3.56	Operating logging track	Timber company and community

Access Point	KM	Type	Use by:
AP14	4.22	Operating logging track	Timber company and community
AP15	6.7	Abandoned logging track	Community
AP16	0.82	Community road	Community
AP17	8.64	Operating plantation road	Plantation and community
AP18	5.32	Operating plantation road	Plantation and community
Total	**74.17**		

Source: Sarawak Energy Berhad, 2021

Within the ROW, a system of new access roads/tracks to connect from one tower to another will be constructed if required. These will be earth or gravelled surface roads, fit for construction and stringing activities only. Where existing roads are available, these will be utilized, thus minimising the need to construct new ones. The estimated total length of access roads within the ROW is about 177 km or slightly more.

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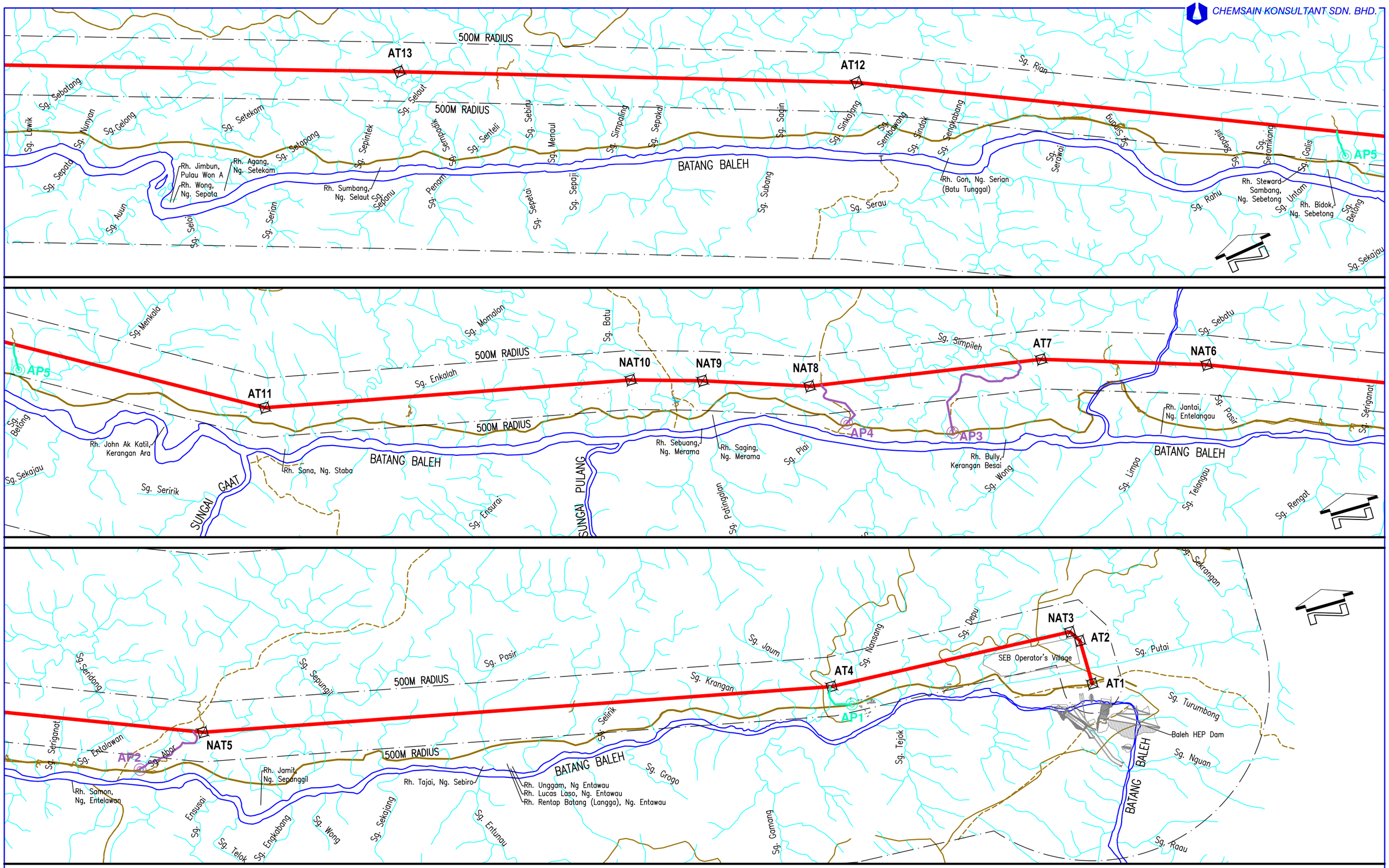

LEGEND:

- PROPOSED TRANSMISSION LINE ROUTE
- PROPOSED ANGLE TOWER (AT1 - AT35)
- RIVERS
- ROADS
- BRIDGE
- ACCESS ROADS (OPERATING LOGGING / PLANTATION ROAD)
- ACCESS ROADS (COMMUNITY ACCESS ROAD / ABANDONED LOGGING TRACK)

SOURCE : Adapted from

SERIES T738 SHEET 5914 EDITION 1-PPNM	SERIES T738 SHEET 6014 EDITION 1-PPNM	SERIES T738 SHEET 6114 EDITION 1-PPNM	SERIES T738 SHEET 6214 EDITION 1-PPNM
SERIES T738 SHEET 6314 EDITION 1-PPNM	SERIES T738 SHEET 6413 EDITION 1-PPNM	SERIES T738 SHEET 6414 EDITION 1-PPNM	SERIES T738 SHEET 6513 EDITION 1-PPNM

GRID
–The inner crosses indicate the Latitude and Longitude

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STUDY FOR THE PROPOSED BALEH MAPAI 500 KV
TRANSMISSION LINE PROJECT

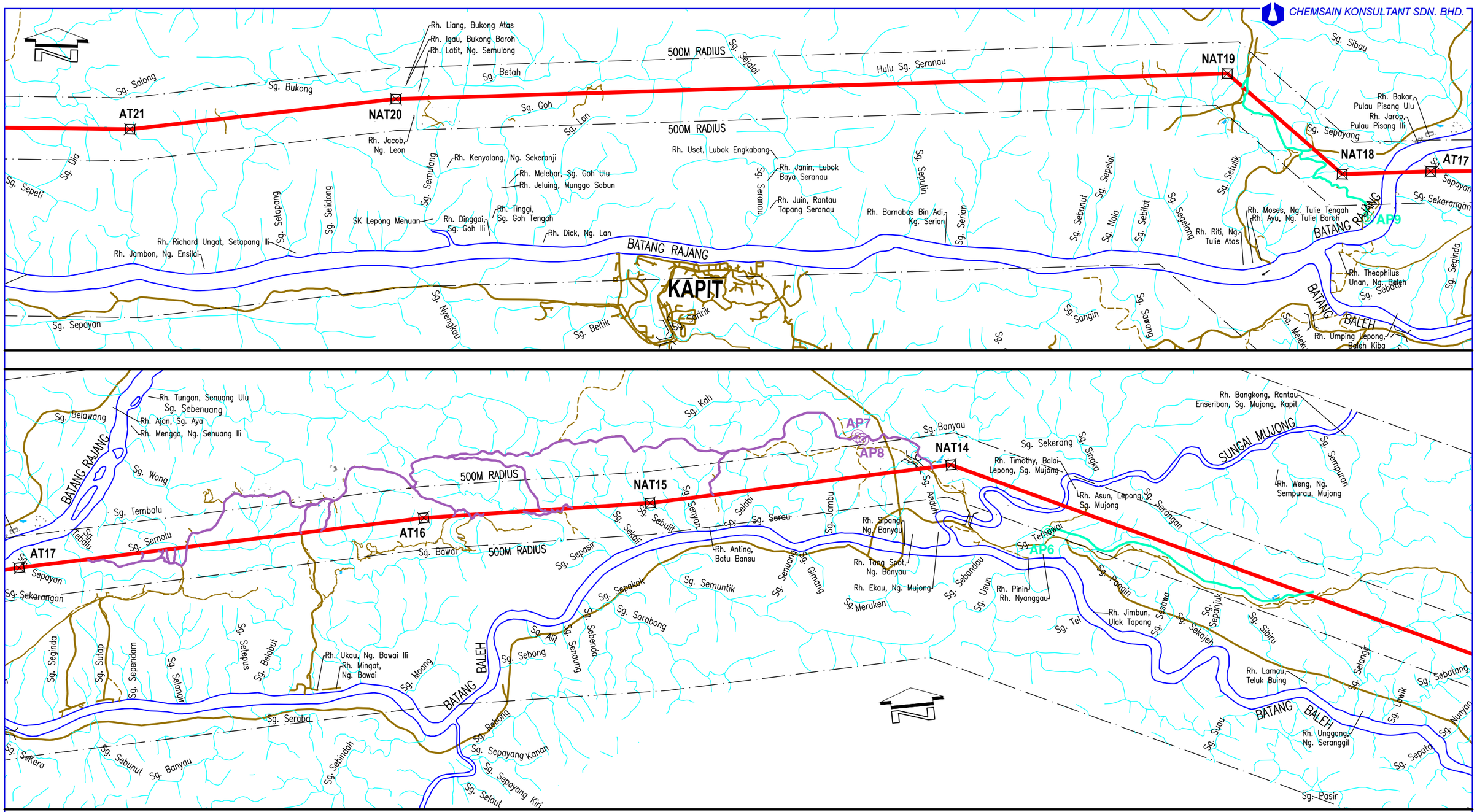
0 1 2 3 4Km
SCALE IN KILOMETRES (1:60,000) – A3 MEDIUM

IDENTIFIED EXISTING ACCESS POINTS

FIGURE: 2.4.3a

D:\ACAD\DRAWINGS\EV103\792\FIG-243a_243d.DWG

CHEMSAIN KONSULTANT SDN. BHD.



LEGEND:

- PROPOSED TRANSMISSION LINE ROUTE
- PROPOSED ANGLE TOWER (AT1 - AT35)
- RIVERS
- ROADS
- BRIDGE
- ACCESS ROADS (OPERATING LOGGING / PLANTATION ROAD)
- ACCESS ROADS (COMMUNITY ACCESS ROAD / ABANDONED LOGGING TRACK)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)
STUDY FOR THE PROPOSED BALEH MAPAI 500 KV
TRANSMISSION LINE PROJECT

0 1 2 3 4Km

SCALE IN KILOMETRES (1:60,000) – A3 MEDIUM

SOURCE: Adapted from

SERIES T738 SHEET 5914 EDITION 1-PPNM	SERIES T738 SHEET 6014 EDITION 1-PPNM	SERIES T738 SHEET 6114 EDITION 1-PPNM	SERIES T738 SHEET 6214 EDITION 1-PPNM
SERIES T738 SHEET 6314 EDITION 1-PPNM	SERIES T738 SHEET 6413 EDITION 1-PPNM	SERIES T738 SHEET 6414 EDITION 1-PPNM	SERIES T738 SHEET 6513 EDITION 1-PPNM

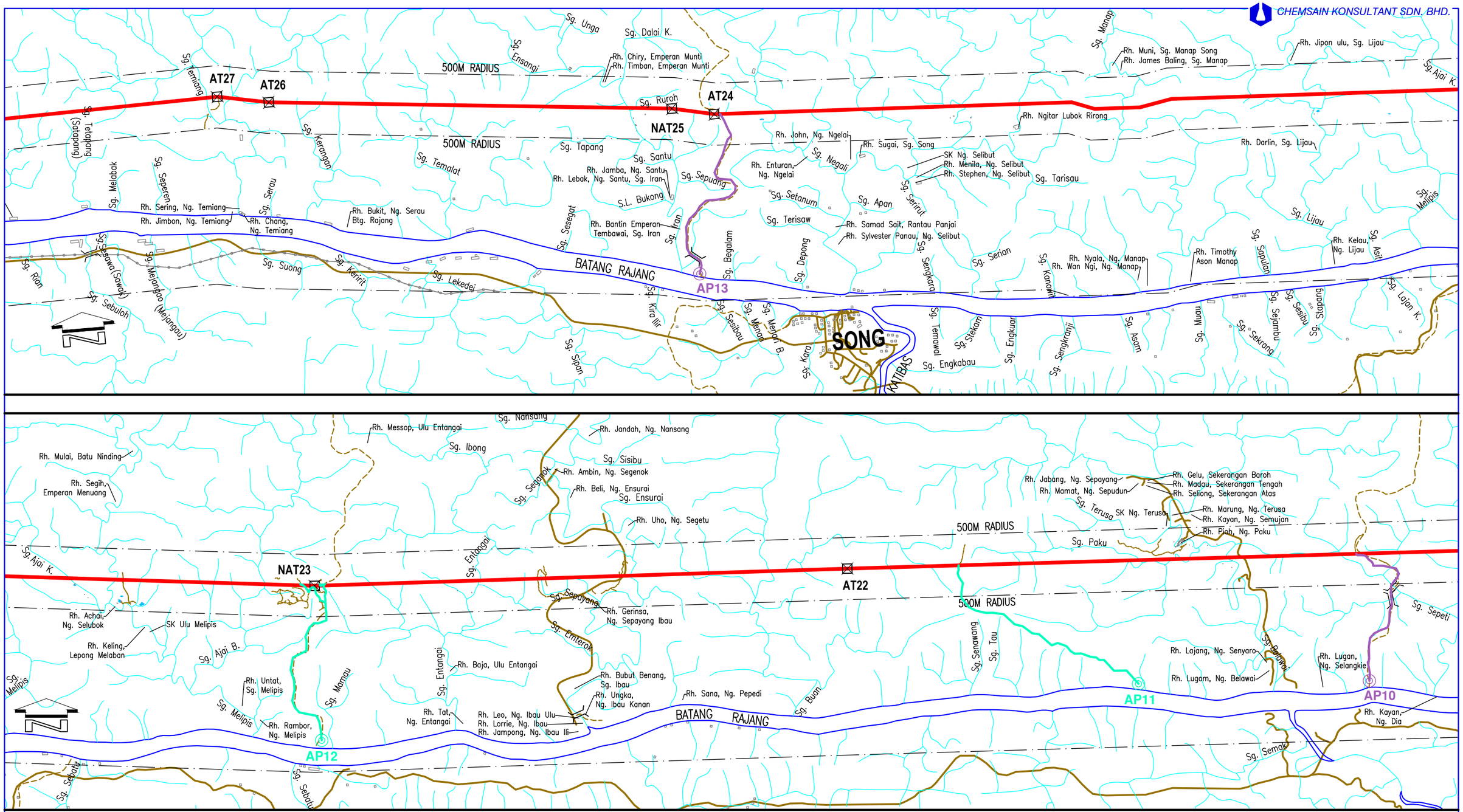
GRID
–The inner crosses indicate the Latitude and Longitude

IDENTIFIED EXISTING ACCESS POINTS

FIGURE: 2.4.3b

D:\ACAD\DRAWINGS\EV103\792\FIG-243a_243d.DWG

CHEMSAIN KONSULTANT SDN. BHD.



LEGEND:

- PROPOSED TRANSMISSION LINE ROUTE
- PROPOSED ANGLE TOWER (AT1 - AT35)
- RIVERS
- ROADS
- EXISTING TRANSMISSION LINE
- BRIDGE
- ACCESS ROADS (OPERATING LOGGING / PLANTATION ROAD)
- ACCESS ROADS (COMMUNITY ACCESS ROAD / ABANDONED LOGGING TRACK)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)
STUDY FOR THE PROPOSED BALEH MAPAI 500 KV
TRANSMISSION LINE PROJECT

0 1 2 3 4Km

SCALE IN KILOMETRES (1:60,000) – A3 MEDIUM

SOURCE : Adapted from

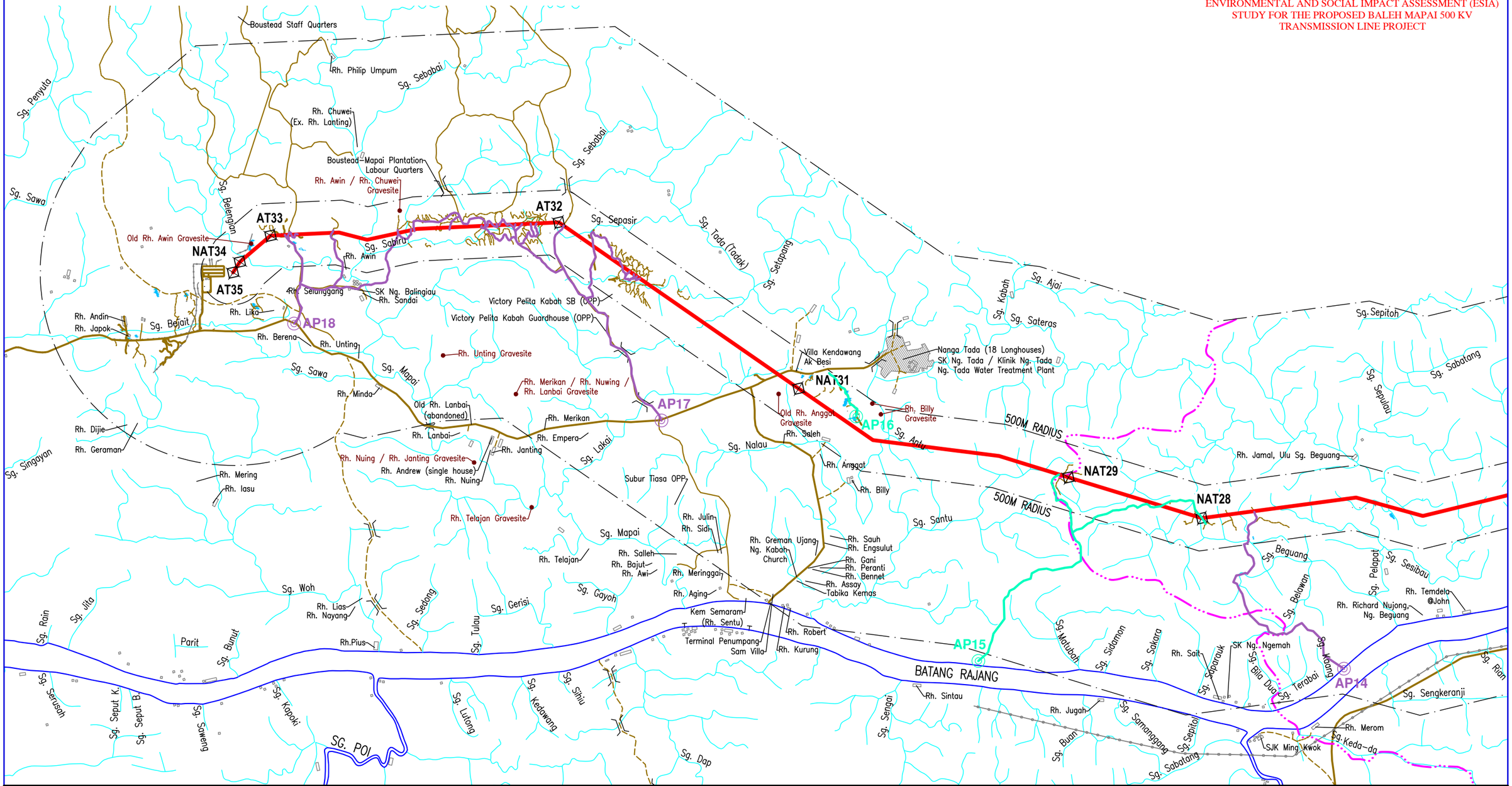
SERIES T738 SHEET 5914 EDITION 1-PPNM	SERIES T738 SHEET 6014 EDITION 1-PPNM	SERIES T738 SHEET 6114 EDITION 1-PPNM	SERIES T738 SHEET 6214 EDITION 1-PPNM
SERIES T738 SHEET 6314 EDITION 1-PPNM	SERIES T738 SHEET 6413 EDITION 1-PPNM	SERIES T738 SHEET 6414 EDITION 1-PPNM	SERIES T738 SHEET 6513 EDITION 1-PPNM

GRID
–The inner crosses indicate the Latitude and Longitude

IDENTIFIED EXISTING ACCESS POINTS

FIGURE: 2.4.3c

D:\ACAD\DRAWINGS\EV103\792\FIG-243a_243d.DWG



LEGEND:

- PROPOSED TRANSMISSION LINE ROUTE
- PROPOSED ANGLE TOWER (AT1 - AT35)
- RIVERS
- ROADS
- DIVISIONAL BOUNDARY
- EXISTING TRANSMISSION LINE
- BRIDGE
- ACCESS ROADS (OPERATING LOGGING / PLANTATION ROAD)
- ACCESS ROADS (COMMUNITY ACCESS ROAD / ABANDONED LOGGING TRACK)

0 1 2 3 4Km

SCALE IN KILOMETRES (1:60,000) – A3 MEDIUM

SOURCE : Adapted from

SERIES T738 SHEET 5914 EDITION 1-PPNM	SERIES T738 SHEET 6014 EDITION 1-PPNM	SERIES T738 SHEET 6114 EDITION 1-PPNM	SERIES T738 SHEET 6214 EDITION 1-PPNM
SERIES T738 SHEET 6314 EDITION 1-PPNM	SERIES T738 SHEET 6413 EDITION 1-PPNM	SERIES T738 SHEET 6414 EDITION 1-PPNM	SERIES T738 SHEET 6513 EDITION 1-PPNM

GRID
–The inner crosses indicate the Latitude and Longitude

IDENTIFIED EXISTING ACCESS POINTS

FIGURE: 2.4.3d

2.5 PROJECT ACTIVITIES

The implementation of the Project shall be undertaken in three different phases:

- Site Preparation Phase
- Construction Phase
- Operation and Maintenance Phase

2.5.1 Preparation Phase

2.5.1.1 Engineering Survey

The detailed design will necessarily be preceded by a linear survey along the full length of the proposed transmission line alignment, to establish accurately the topography within the proposed ROW, and to identify features that will require special consideration, e.g., houses, stream crossings, vegetation height, gravesites, culturally sensitive sites, etc. This information will be important for the design and spacing of the towers so that the minimum ground line clearance and vegetation clearance can be achieved. These activities will provide opportunities to ensure that the routing of the transmission line avoids environmentally or socially sensitive sites while still being technically sound.

2.5.1.2 Land Requirement

2.5.1.2.1 Permanent Land Acquisition

The proposed transmission line is approximately 177 km in length with a required 50 m easement (25 m on either side), i.e., the total land area to be permanently acquired for the transmission line is approximately 885 ha.

Land acquisition is under the jurisdiction of Land and Survey Department (LSD) of Sarawak involving siting, survey, valuation, land acquisition and alienation.

Siting is the process by which government agencies obtain sites or land for a project development. Sites are identified jointly with applicants (client agencies) and recommended for the decision of the SPA. This Project has received approval for the siting application from SPA on 24th January 2020 (see **Appendix 2.3.1**). Currently, the Project Proponent is preparing the land acquisition plan and will proceed with the submission to LSD. The land acquisition process is managed by Valuation Branch within the LSD.

2.5.1.2.2 Temporary Land Requirement

There will be temporary use of some land for the work areas of the contractors, their camps, and other facilities. These will be identified by the respective contractor for Package A and Package B. The area will be allocated according to:

1. Proximity to the project site.
2. Minimal impact on local livelihoods.
3. Minimal forest clearance required.
4. Accessibility to the roads as well as drinking water and electricity.

Total land area required for onsite base camps and offices will be approximately 0.8 ha.

Table 2.5.1: Anticipated Land Requirement by the Proposed BMTLP

Component	Unit Size	Land Required
Permanent		
Transmission line ROW including Tower footprint (50 m)	177 km	885 ha.
Total (Permanent)		**885 ha.**
Temporary		
Construction access roads	74.2 km x 2 m wide	14.8 ha
Site Offices, onsite base camps, warehouse/ store, material stock yard and machine parking	0.4 ha x 2 sites	0.8 ha
Total (Temporary)		**15.64 ha.**

Source: Sarawak Energy Berhad, 2021

2.5.1.3 Recruitment of Labour

Labour recruitment is essential prior to the commencement of the construction works to secure sufficient manpower comprising of professionals, technical, semi-skilled and general workers for work implementation and to ensure progress of work as planned.

SEB will appoint at least two main contractors for the construction of the transmission line. Contractors will be required to recruit local workers from the district first, especially from villages around the project site, then from other parts

of the State. Some specialized labour will need to be recruited from outside the area, including civil and electrical engineers.

For this Project, an estimated total number of 817 workers are required for the Project implementation during peak periods. **Table 2.5.2** below shows the breakdown of the estimated total number of workers based on categories of work. The Proponent may hire additional workers if needed or reallocate manpower during the course of the Project.

Table 2.5.2: Estimated Total Number of Workers and Categories of Work

No	Description	Team	Number of personnel
1	Project Manager	Contractor	2
2	Site/Construction Manager	Contractor	2
3	Engineering Manager	Contractor	2
4	Safety and Health Manager	Contractor	2
5	Safety and Health Officer	Contractor	2
	Environmental Officer (EO)	Contractor	2
6	Site Safety Supervisor	Contractor	6
7	Project Engineer	Contractor	2
8	QA/QC Manager/Engineer	Contractor	2
9	Site Engineer	Contractor	2
10	Supervisors	Contractor	20
11	Store officer	Contractor	2
12	Drivers	Contractor	20
		SUB-TOTAL	66
1	Foundation subcontractor	Sub-Contractor	150
		SUB-TOTAL	150
1	Slope protection subcontractor	Subcontractor	40
		SUB-TOTAL	40
1	Tower Erection team	Contractor	150
		SUB-TOTAL	150

No	Description	Team	Number of personnel
1	Stringing Team	Contractor	320
		SUB-TOTAL	320
1	Store workers	Contractor	36
		SUB-TOTAL	36
1	Scaffolding	Sub-Contractor	20
		SUB-TOTAL	20
1	Security	Contactor	20
		SUB-TOTAL	20
1	Sarawak Energy Personnel	SEB	15
		SUB-TOTAL	15
		TOTAL MANPOWER	**817**

Source: Sarawak Energy Berhad, 2020

2.5.1.4 Mobilization of Machineries and Equipment

Equipment and machinery will be mobilized to the site over the course of the Project via the access points as mentioned in **Section 2.4.4**. It is expected that the mobilization of machinery and equipment will temporarily contribute to an increase in traffic, dust pollution and noise levels in the area. The estimated list of vehicles, heavy machineries and fuel burning equipment are provided in **Table 2.5.3**, **Table 2.5.4** and **Table 2.5.5** respectively. Similar to labour recruitment, the number of equipment and machineries on site is expected to change depending on the different phases of the proposed Project.

Table 2.5.3: List of Vehicles for Proposed Project

Vehicles	Estimated Quantity
4WD Vehicle (Pick-up)	22
4WD Vehicle (SUV)	4
Material Transport Lorries	6
Boat	2
TOTAL	**34**

Table 2.5.4: List of Heavy Machinery for Proposed Project

Heavy Machinery	Estimated Quantity
Excavator	8
Soil Investigation Machines	4
Piling Machines	8
Cement Mixer Truck	6
TOTAL	**26**

Table 2.5.5: List of Fuel Burning Equipment for Proposed Project

Equipment	Estimated Quantity
Generator for Camps / Living Facilities	10
Generator for Tower Erection Works	6
Conductor Payout Machine	4
TOTAL	**20**

Source: SEB, 2020

2.5.1.5 Access Point Establishment

Referring to **Section 2.4.4.1**, access roads will be constructed to facilitate the construction of proposed transmission line towers. Construction of new access roads will be carried out whenever the work sites are not accessible via existing access roads. Existing access roads which are too narrow or unsafe to travel will be improved to ensure the safety of the road users and smooth traffic flow. The access roads will mainly be used during construction phase, as well as for maintenance work during Operation and Maintenance Phase.

Jetties will also be constructed to access areas of the proposed Project site which are not easily accessible by land.

2.5.2 Construction Phase

2.5.2.1 Onsite Support Facilities

Temporary facilities and onsite support facilities shall be established before the construction phase of the Project to accommodate site workers, for the storage of construction material and for the placement of various material, vehicles, machineries and equipment required for the Project. These facilities will be of temporary nature designed for relocation as the construction continues along the line route.

Local building may be rented for site office or residence for workers where available, to minimize the need for new building construction.

An area of approximately 50 by 50 meters on each site will be demarcated as a temporary tower laydown and assembly area, in order to allow for the 413 towers to be installed.

2.5.2.1.1 Offices and Onsite Base Camps

Offices and onsite base camps will be established to facilitate the construction activities. There will be two (2) main camps, one each for Package A and Package B of the development. Each camp shall be able to accommodate about 400 workers. The base camps may include living quarters and accommodation, kitchen, workshop, laydown area, temporary storage area, fuel stations, and so on. It will be demolished at the end of the construction period (36 months).

There will be several fly camps (2 or 3 for each Package) set up en-route the transmission line. These camps are mainly migratory in nature and to be located within the ROW. These camps will work in one place for 3 to 4 weeks before moving on to the next place as work on the transmission line progresses.

To minimise any potential environmental and social impacts from these onsite facilities, contract provisions specifying minimum setback requirements for construction camps from water bodies, local settlements, reserved areas, environmental sensitive areas, etc., shall be provided by SEB (see **Section 2.5.1.2.2**). Provision of adequate washing and sanitary facilities by the contractor to the workers should be made obligatory.

2.5.2.1.2 Water Supply (Sources)

The major requirement of water is in the workers base camps for domestic purposes. Depending on the location of the construction sites and base camps, the sources of water supply will differ. JBALB is responsible for providing water supply to the areas near major towns and bazaars such as Kanowit, Song, Kapit and Nanga Entawau. In the rural areas, domestic water usage is supplied by village-managed gravity-feed water supply systems. Some of the rivers and their tributaries are sources to these gravity-feed systems.

For this project, in places where there is no piped water supply system, water will be sourced from rivers and streams either via direct extraction or gravity feed. This will also be supported by rainwater harvesting since Sarawak has high rainfall intensity throughout the year.

Plate 2.5.1: Rainwater harvesting is very common in the area.

The average Sarawakian uses 165 litres of water a day for household purposes such as drinking, cooking, washing and showering (MWA, 2000). With a total staff of 817 workers during construction phase, the estimated daily domestic water requirement is 135,105 litres per day or 4,053 m^3 per month.

For construction works, water will be used only for concreting. The volume of concrete used shall be about 45,000 m^3 which shall consume about 8,020 litres/day. However, concreting shall be done only for laying foundation for the tower and the duration shall be at the most 570 days. **Table 2.5.6** gives the estimated daily and monthly water requirements of the Project.

Table 2.5.6: Water Requirements for Drinking and Other Purposes

Purpose	No of Workers	Amount Used L/Day	Water Required L/Day	Water Required L/Month
Project Staff Requirement	15	165	2,475	74,250
Contractor facility and workers	802	165	132,330	3,969,900
Construction works (concreting)	-	-	8020	240,602
TOTAL WATER REQUIRED			**142,825**	**4,284,752**

2.5.2.1.3 Power Supply (Source)

Similar to water supply, the power supply differs depending on the location of the construction sites and base camps. For areas near major towns, 24-hour electricity supply is provided by Syarikat SESCO Berhad (SESCO)/SEB. In the interior areas, most settlements have yet to connect to the main grid; thus, they have to rely on private or communal generator sets, solar panels and micro-hydroelectric systems as sources of electricity. For this project, where SESCO electricity supply is available, it will be tapped from there. Otherwise, alternative power supply would be from fuel powered generator sets (see **Table 2.5.5**).

2.5.2.1.4 Requirements for Raw Materials/Construction Materials

The construction of the BMTLP will require large quantities of materials. These materials include concrete, cement, coarse aggregates, sand, rebar steel scaffolding and steel. The details are provided in **Table 2.5.7**.

Table 2.5.7: Requirements for Construction Materials (SEB to provide)

Purpose	Concrete Volume m^3	Cement m^3	Sand m^3	Gravel/ Aggregate m^3	Timber m^3	Steel Bars Tonnes
Reinforced Cement Concrete for foundation and pillars	45,000	8,000	8,000	22,250	NA	3,000
Formwork	NA	NA	NA	NA	220,000	NA

Source: Sarawak Energy Berhad, 2021
NA – Not Applicable

In instances where materials and equipment are made available by local vendors, the Contractor shall utilize and procure related items from them. Sand and gravel will only be sourced from licensed aggregate suppliers.

2.5.2.1.5 Sanitary Facilities

Sanitary facilities shall be installed at proposed base camps. No direct discharge of sewage is allowed. Sewage will be treated in septic tanks at site offices and / or workers camps. High-density polyethylene (HDPE) septic tanks will be used to treat the sewage generated.

The number of septic tanks required for the project depends on the size of the septic tank that will be sourced by the Contractors. However, an estimate is given here based on the sizing of typical system shown in **Table 2.5.8**. At the peak of construction phase, the maximum workers on site will be 817 and the population equivalent (PE) is calculated to be 245 PE. Assuming that the largest septic tank is chosen, the number of septic tanks required to be installed will be four (4).

Table 2.5.8: Typical Septic Tank Sizing

PE for black water only	5-9	9-16	9-20	16-25	25-60
Effective volume, L	>2200	>2700	>3400	>5800	>8800
Inlet/outlet diameter, mm	100	100	100	100	100/150
Detention time, hr	45	33	40	36	55

For fly camps, simple pit latrine will be used. This will ensure the effluent is not discharged directly into any nearby streams. It should be minimum 30 m downstream from any source of drinking water.

2.5.2.1.6 Waste Handling and Disposal Facilities

Disposal of wastes during and after construction forms an essential part of the project activities. Wastes need to be carefully disposed of for safety and health concerns, aesthetics and pollution prevention.

Four main categories of wastes will be generated at the project site i.e., biomass wastes, construction wastes, domestic wastes and sewage, and scheduled wastes.

a) Biomass Wastes

Biomass or vegetative wastes in the form of trees, stumps, roots, snags, logs, bush, undergrowth, grass, crops, and vegetative debris are foreseen as a result

of tower base and ROW clearing. It is estimated that up to 249,821 tonnes dry matter (d.m) of biomass will be removed. The general practice of managing biomass wastes is to spread the wastes within the ROW to allow for natural decomposition. Open burning of such wastes is prohibited by NREB unless with written permission being granted by the Board.

Since there are no commercial forestry interests per se in the strip to be acquired and subsequently cleared for the transmission line, the Project Proponent will take this opportunity to provide some services to local communities by stacking timbers, that may be useful for the communities for them to take freely for their non-commercial domestic use. Other vegetation will in a separate clearing process be cut down and crushed in situ for more effective natural decomposition. A particular concern is felled oil palms, which must be roughly chipped in order to avoid attracting harmful insects and other pests.

b) Construction Wastes

Construction wastes such as discarded construction materials, cement bags, wood, and steel are anticipated. The wastes, for instance cut excess soil and concrete materials, where suitable, shall be reused and recycled to greatest extent. Other non-recyclable wastes shall be collected at designated areas and disposed of at the local authorities' landfills / dumpsites at Kanowit, Song or Kapit, whichever is nearer to the sources of wastes. No waste other than soil and felled vegetation may be left at the project site or discarded outside designated waste deposit sites.

c) Domestic Wastes and Sewage

Such wastes are mostly generated at the site office, base camps and at the stretch of the ROW where human activities are abundant. Domestic wastes are generally disposed into rubbish bins, which will be disposed of at the local authority's landfill or dumpsite. When it is too far from any local authority's landfill, alternative disposal site or spot will be considered. Appropriate spots within the ROW can be identified to use as wastes dump. The wastes shall be compacted and covered with soils regularly.

Wastewater and sewage will also be generated as detailed in **Table 2.5.9**.

Table 2.5.9: Example of Wastewater and Sewage Generated

Category	Example Types
Sanitary wastewater	Wastewater generated by kitchen and canteen as a results of food preparation and washing
Grey water	Liquid waste discharged from toilets, office and domestic residences other than sewage
Sewage	Toilets

Work sites shall be provided with toilets which are desludged regularly as per requirements. Provision of adequately-sized septic tanks is mandatory to treat sewage and grey/sanitary wastewater before discharge to nearby water bodies (see **Section 2.5.2.1.5** above). Desludging is also required to ensure effective treatment. The desludging frequency for residential category is once in 4 years (Sewerage Services Department, Sarawak, 2021. https://ssd.sarawak.gov.my/page-0-469-226-Data-Statistics-Septic-Sludge-Collection.html).

Oil and grease traps are to be installed at kitchen and canteen. Grease and solids that are trapped are to be disposed as non-scheduled waste.

d) Scheduled Wastes

Key example scheduled waste streams from construction activities are detailed on **Table 2.5.10**.

Table 2.5.10: Example of Potential Scheduled Wastes from Construction Activities

Category	Example Types	SW Code
Batteries (large lead acid)	Vehicle batteries	SW102
Used batteries container	Cd, Ni, Hg, Li	SW 103
Dust, slag, dross or ash containing arsenic, mercury, lead, cadmium, chromium, nickel, copper, vanadium, beryllium, antimony, tellurium, thallium or selenium excluding slag from iron and steel factory	Residues from construction	SW 104
Used fluorescent tube / bulbs, e-waste	Wastes from electrical and electronic assemblies	SW110
Spent acids	Cleaning or work-over acids	SW 301
Spent lubricating oil		SW 305

Category	Example Types	SW Code
Spent hydraulic oil		SW 306
Spent mineral oil-water emulsion		SW 307
Waste of oil or oily sludge		SW 311
Oily residue from automotive workshop, service station oil or grease interceptor	Oil residual from workshops	SW 312
Contaminated used containers	Empty drums, empty chemical containers, paint contaminated containers	SW 409
Oily solid waste	Rags, filter, gloves, used filters	SW 410
Mixture of scheduled wastes		SW 421
Mixture of scheduled and non-scheduled wastes		SW 422

Note: SW= Scheduled Waste

Whilst most of these are likely to be non-hazardous, some of these may be hazardous including used paint, engine oils, hydraulic fluids, spent batteries, spent insulating oil, etc.

Scheduled wastes (if any) shall be stored as per the requirements of the Environmental Quality (Scheduled Wastes) Regulations, 2005. Such wastes should be contained, labelled, and disposed of by DOE-approved contractors to DOE-approved facilities. Designated scheduled wastes storage area will be allocated at the proposed Project site. Repair work is to be carried out at designated workshop only.

2.5.2.2 Clearing of ROW

At the tower sites, all vegetation within the footprint of the tower base and for a distance of approximately 2 m beyond the base in all directions will be cleared to ground level using hand tools such as chainsaws, *parang*, grass cutter, bush cleaner, etc. No chemical herbicides will be used. The material to be cleared will include, but not be limited to trees, stumps, roots, snags, logs, bush, undergrowth, grass, crops, and overhanging objects such as branches occurring within the transmission towers footprint and access road.

Tall vegetation will be cut to ground level throughout the ROW. Low vegetation and roots/stumps will be left in situ. A clear path will be totally cleared and levelled as an access road between all towers. This path will be as straight as possible to

facilitate stringing operations. Roots and stumps will be left in situ and the cut vegetation stacked or cut/chipped or mulched to increase ground contact for a speedy decomposition. The decomposing biomass will simultaneously act as an erosion control measure. Local communities may be allowed to take the timbers for domestic use.

No open burning is planned to take place. Of particular importance will be the chipping of felled oil palm trunks. Decomposing palm trunks are known to attract particularly Rhinoceros beetles, who are a pest to the oil palm plantations. Such infestation may be prevented by chipping for fast decomposition. Where the establishment of the cleared ROW necessitates cut and fill the new slopes will be immediately revegetated or otherwise stabilised.

Vegetation in the ROW will during the operation and maintenance phases be kept low so as to avoid any safety issues of interference of the vegetation and the transmission conductors. The towers will be kept clear of any vegetation.

Eventual gully formations will be prevented through vegetation management or through civil works/rock filling.

2.5.2.3 Overburden Removal

There will be no major overburden removal or earthworks involved in the Project. Earthworks will mostly be carried out for the excavation of tower footings and levelling of the access road to the desired level.

The estimated earthwork cut volume for tower bases (413 nos) is approximately 140,000 m^3 (SEB, 2021). Slopes outside tower bases and access roads construction are excluded. Considering the relatively small amount of cut or excavated material, the excess earth or rocks shall be stored at the site of each foundation and used for backfilling purposes.

2.5.2.4 Temporary Drainage System and Erosion and Sediment Control

Drainage systems are essential to assist the natural gravity flow of surface runoff and prevent water ponding. Temporary drainage systems will be constructed along the perimeter of the work area at the towers to intercept surface runoff. For steep-slope areas, where perimeter drainage is not possible to be constructed, erosion control blankets may be utilised to provide cover for bare soil. Earth drains are expected to be constructed rather than reinforced concrete drain. All denuded areas will be revegetated (leguminous cover crops / grasses / local ground-creepers / bushes) without delay.

Specific erosion and sedimentation best management practices (BMPs) will be implemented in order to prevent uncontrollable erosion and gully formation. The risk of erosion is greatest during clearing and establishment of the tower foundations. Erosion control measures will therefore be considered early in the process. This can be done through a proper and systematic planning in implementing the mitigation measures of soil erosion and silt runoff from the project area. These mitigation measures, however, are subject to change depending on the actual site condition and it is expected that as the work progresses, more mitigation measures may be applied where or when necessary.

2.5.2.5 Foundation Installation

The transmission line will require the erection of 413 towers, each of which will be spaced at a distance of approximately 100-800 m (depending on the terrain and stability of the soil) along the 177 km stretch. Depending on the soil strength and tower locality, the installation of foundations may be of three types:

a) Pad and chimney

b) Cast in-situ

c) Piled

Foundation construction begins with excavations of earth or auguring of holes for footing and concreting of the tower base. Depending on the foundation type, different machineries such as excavators or drillers will be used to excavate the pit to the required depth as per designed. During the excavation, pumping may be required to remove water and dry the site.

Concrete mixing will be carried out onsite, near the tower base using mobile concrete mixers. Once the concrete has cured, crews can begin the construction of the structure itself.

2.5.2.6 Raising the Towers

Generally, structures are built from the ground up. Erection of towers is done by assembling prefabricated components of the lattice structure in sections using crane or gin poles. Towers may be erected by any suitable method in the sequence best adapted to the equipment, workers experience and site conditions.

2.5.2.7 Stringing, Tensioning and Clamping Works

Stringing or conductoring of the transmission line commences only upon completion of a minimum length of continuous stretch, which would make fullest possible use of maximum conductor lengths and minimum number of conductor joints. Insulators shall be installed at all crossed arms before the stringing work commences. During stringing, pulleys will be attached at the end of all insulators. These will be removed once the conductor line is tensioned and the line may be attached directly to the insulator. Stringing of the section between two angle towers is done in one operation.

To pull the conductors through the pulleys at the insulators, a simple rope is first pulled through the system. This rope is used to pull a slightly thicker rope or cable, which again pulls a yet stronger cable repeatedly till a cable strong enough to pull the main conductor is in place. Cable drums carrying approximately 2 km to 4 km of cable will be delivered to site. A stringing system with tower backstays, conductor pullers and tensioners shall be prepared before stringing process. Conductors from reels are pulled and wound into the tensioner before being strung on the pulleys attached to the conductor crossarms. The puller and tensioner work together during the pulling operation to ensure that the conductor maintains the proper ground clearance at all times. Once the conductor is pulled through the length of the line, the tensioner is then used to sag the conductors to the proper tension. If joints have to be installed, i.e., a new reel of conductor shall be added, these are installed before the tensioner.

After adjustment to the desired tension level, the conductors at each crossarm shall be clamped to the respective insulators. After the clampering work, jumpers are applied to connect the tranches between anchored towers. These jumpers are simple cables cut in a curve with the shape to avoid possible short-circuits between the phases during operational phase.

2.5.2.8 Stabilization and Restoration of Disturbed Areas

Stabilization and restoration are undertaken for each component of the construction phase, which include the following activities:

- Removal of spoil material and waste.
- Compaction of loose fill materials in case of cut and fill.
- Repairing any damage caused by the construction's activities.

- Rehabilitate finished working areas with suitable final ground contour and revegetating the site with suitable vegetation cover.

2.5.2.9 Decommissioning of Temporary Facilities

The targets for the decommissioning activities are:

- To improve and restore the aesthetics of the cleared and worked areas as a whole.
- To remove hazardous conditions, to protect the environment and the health of workers and public during and after the contractors' abandonment of the site.

Clean-up and rehabilitation of the area may be divided into two distinct sections:

1. Removal and rehabilitation of objects and sites that have a direct or indirect impact on air, water or soil.
2. Removal and rehabilitation of objects and sites that have a direct or indirect impact on the current or future cultural or economic use of the area.

Facilities to be taken over by the Proponent will not be dismantled. Temporary facilities or structures such as workers quarters, site offices, warehouse, store and so on will be removed. All the machinery and equipment or parts thereof shall be demobilized too. Underground structures such as concrete septic tanks (if any) may be filled with soil and left underground. HDPE tanks must be desludged, cleaned and removed from the site for reuse or disposed of at council approved landfill or dumpsite. Tanks, which protrude above ground must be removed from the project site.

2.5.2.10 Testing and Commissioning of the Transmission Line

On completion of the stringing work, physical inspection and checking of all foundation work, tower erection and stringing is carried out to ensure strict adherence to the technical requirements/specifications.

The purpose of undertaking transmission line testing is to prove system integrity after installation work is completed and before connection to the Sarawak Grid system. The commissioning test for the transmission line shall include, but not be limited to:

- Structure Earth Resistance Test
- Phase Continuity Test
- Insulation Resistance Test
- Earth Current Injection Test
- OPGW Test
- Radio Frequency Radiation Test

2.5.3 Operation and Maintenance Phase

2.5.3.1 Transmission Line Maintenance

A regular maintenance and monitoring programme for the transmission line will be undertaken which comprises of preventive measures and measure for breakdown. Activities generally undertaken during operation and maintenance are given below:

- Visual inspections of insulator, conductor, missing tower numbers, etc.
- Measurement of earth footing resistance for all towers periodically and taking necessary action by improving earthing arrangements as per site conditions.
- Checking of tower foundation, anti-climbing device, phase plate, number plate, circuit plate, danger plate.
- Checking of corrosion on tower members, tower earthing etc., and taking necessary actions.
- Checking of adequate conductor clearances at important crossings, conductor creep, etc.
- Rectification of identified faults.

2.5.3.2 ROW, Access Roads and Slopes Maintenance

Maintenance of the ROW will be important, especially in more remote areas. The maintenance activities will mainly focus on transmission line easement on the clearance of vegetation (to ensure that it is maintained below the line above trees on a regular basis), access roads maintenance and slope maintenance and stability. This will be achieved using existing vegetation management plan.

2.5.3.3 Surveillance

Surveillance of the line needs to be undertaken regularly to ensure that insulators, earthing systems, and structural components are in order. In addition to the lines structural and operational integrity surveillance is carried out to ensure the levels of safety to the public remain at the level achieved during construction and operation. Examples of this are; buildings are not being constructed under the lines without ROW consent, trees are not planted that could lead to future problems, wires or fences are not attached to towers, etc.

Normal practice is that surveillance is undertaken by personnel via the access roads to the tower sites, or, in less accessible area, by drones on an annual basis.

2.6 PROJECT ACTIVITIES AND KEY ENVIRONMENTAL RECEPTORS

ESIA scoping identified the following activities and environmental receptors to be carried forward and further assessed in this ESIA.

Phase / Activities	**Environmental / Social Receptors**		**Impacts**
Pre-Construction Phase			
• Engineering survey • Land acquisition • Recruitment of workforce • Access points establishment • Mobilisation of machineries and equipment	Physical	-	-
	Biological	-	-
	Socio-Economic and Cultural Heritage	Land and crops	• Permanent loss of land and crops leading to loss of livelihoods and household income
		Employment and economy	• Employment opportunities
		Community health and safety	• Environmental health – air and noise, wastes, water quality
	Occupational safety and health	Workforce	• Waste generation and management • Air quality • Noise level • Traffic
Construction Phase			
• Onsite support facilities • ROW clearing • Cut and fill activities and	Physical	Soil	• Loss of soil resources due to erosion • Soil erosion and slope stability
		Water resources	• Water pollution

Phase / Activities	Environmental / Social Receptors		Impacts
overburden removal • Drainage and erosion control • Foundation preparation and installation • Raising of towers • Stringing • Site stabilisation and restoration • Decommissioning of temporary facilities • Testing and commissioning		Air quality	• Exhaust emission and
		Noise level	• Noise pollution
	Biological	Terrestrial flora and fauna	• Disturbance to vegetation and habitat loss and fragmentation as a result of the ROW or degradation to environment and habitat
	Socio-Economic and Cultural Heritage	Land and crops	• Temporary loss of access to forest products from site clearing
		Cultural heritage	• Damage to gravesites considered important by the local communities
		Economy and employment	• Employment opportunities
		Community health and safety	• Environmental health – air (exhaust and dust) and noise pollutions, wastes, water quality • Traffic safety • Interaction with construction workforce
	Occupational safety and health	Workforce	• Labour camp related occupational safety and health (OSH) and hygiene issues • Effects on worker health and safety and labour rights
Operation and Maintenance Phase			
• Transmission line maintenance • ROW, access roads and slopes maintenance • Surveillance	Physical	Soil	• Soil erosion and slope stability • Water pollution
	Biological	Terrestrial flora and fauna	• Disturbance to vegetation
	Socio-Economic and Cultural Heritage	Community health and safety	• Electric and magnetic fields exposure • Waste generation

Phase / Activities	Environmental / Social Receptors		Impacts
	Occupational safety and health	Workforce	• Workers' health and safety

Appendix 2.3.1

Siting Application Approval by the State Planning Authority

IBU PEJABAT TANAH DAN SURVEI

Menara Pelita, Jalan Tun Abdul Rahman Ya'akub, Petra Jaya,
93050 Kuching, Sarawak, Malaysia.
Telefon: 082-444111 Faks: 082-446611
Laman Web: www.landsurvey.sarawak.gov.my E-mel: landsurvey@sarawaknet.gov.my

Ruj. Kami: 3/SP/3D-26/19
Ruj. Tuan:

Tarikh: 24.01.2020
Tarikh:

Vice President
Sarawak Energy Berhad,
Menara Sarawak Energy
No. 1, The Isthmus
93050 Kuching

Tuan,

Proposed Baleh - Mapai 500kV Overhead Transmission Line Project Sibu/Kapit

Dengan hormatnya, permohonan pihak tuan berhubung perkara di atas dirujuk.

2. Sukacita dimaklumkan bahawa projek di atas telahpun **diluluskan** oleh Majlis Perancangan Negeri dalam mesyuaratnya pada **17.01.2020** seperti yang ditunjukkan dalam **Pelan No. 3/SP/3D-26/19**. Sempadan sebenar juga adalah tertakluk kepada kerja-kerja ukur di lapangan.

3. Kelulusan ini hanya sah untuk tempoh **36 bulan mulai dari tarikh kelulusan.** Dalam tempoh ini, pihak tuan dikehendaki :

i) Mengemukakan pelan jajaran terperinci (*detailed alignment plan*) untuk tindakan jabatan ini ; dan

ii) Menyalurkan peruntukkan untuk kos pengambilan balik/kos survei atau kos-kos lain yang berkaitan kepada jabatan ini (jika ada). Sekiranya tiada peruntukkan diterima oleh jabatan ini dalam tempoh tersebut, maka kelulusan ini akan luput dengan sendirinya. Pihak tuan akan dikehendaki untuk mengemukakan permohonan pertapakan yang baru jika ingin meneruskan projek ini.

4. Pihak tuan akan dimaklumkan tentang kos berkaitan dengan pengambilan balik, kos survei dan kos lain yang berkaitan (jika ada). Bersama ini dilampirkan sesalinan **Pelan No. 3/SP/3D-26/19** untuk makluman dan tindakan pihak tuan.

'BERSATU BERUSAHA BERBAKTI'
"AN HONOUR TO SERVE"

(PEGGY RONIN ANAK EDIN)
b.p. Pengarah Tanah dan Survei
SARAWAK
dan Setiausaha, Majlis Perancangan Negeri