Initial Environmental Examination

Project Number: 47937
May 2014
Document Stage: Draft

Proposed Administration of Loan
PT Supreme Energy Rantau Dedap
Rantau Dedap Geothermal Development Project – Phase 1
(Republic of Indonesia)

supremeenergy

PT. SERD

Rantau Dedap Geothermal Power Project

Phase 1 - Exploration

Initial Environmental Examination

May, 2014

Rantau Dedap

Issued in May 2014

RD-RSH-RPT-IEE Rev 0-May 2014

Confidential

P.T. Supreme Energy [ML/RD/RB]
Equity Tower – 18th Floor, Sudirman Central Business District (SCBD), Lot 9
Jl. Jend. Sudirman Kav. 52-53, Jakarta 12190, Indonesia
P +62-21-5155 222
F +62-21-5155 333
W www.supreme-energy.com

The Supreme Energy project companies - SERD Muara Laboh, SERD Rajabasa and SERD Rantau Dedap are independent companies developing geothermal projects in Sumatra, Indonesia. Based on the agreement of the shareholders of the individual project companies, the Supreme Energy companies are managed in an integrated way in order to maximize the synergies in terms of use of resources and organization of their core and supporting processes. Consequently, important portions of the documentation body developed and applied within each company (manuals, procedures, description of processes, guidelines etc.) are common to all project companies. The applicability of each document to one or several project companies is reflected in the reference of each document.

Any document applicable to SERD Muara Laboh contains the characters “ML” in the document reference.

Any document applicable to the SERD Rajabasa project company contains the characters “RB” in the document reference.

Any document applicable to the SERD Rantau Dedap project company contains the characters “RD” in the document reference.

If a document applies to all three Supreme Energy companies, the term “Supreme Energy” may refer to any and all of these companies.

Table of Contents

Table of Figures

Table List

Abbreviations

ADB	Asia Development Bank
AMDAL	Analisis Mengenai Dampak Lingkungan
ANDAL	Analisis Dampak Lingkungan
BAPPENAS	Badan Perencanaan Pembangunan Nasional
CDM	Clean Development Mechanism
CSMS	Contractor Safety Management System
CSR	Corporate Social Responsibility
EIA	Environmental Impact Assessment
EIR	Extractive Industry Review
EMP	Environmental Management Plan
ESMP	Environmental and Social Management Plan
EPC	Engineering, Procurement and Construction
ESIA	Environmental and Social Impact Assessment
GHG	Greenhouse Gas
HSE	Health, Safety, and Environmental
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ILO	International Labour Organization
IPPs	Independent Power Producers
IPP	Indigenous Peoples Plan
IPs	Indigenous Peoples
ISDP	Integrated Social Development Program
LPC	Land Procurement Committee
MSDS	Material Safety Data Sheet
NGO	Non Governmental Organization
PDD	Project Design Document
PLN	Perusahaan Listrik Negara
PTSE	PT Supreme Energy
RKL	Rencana Pengelolaan Lingkungan
RPL	Rencana Pemantauan Lingkungan
SD	Sekolah Dasar
SERD	Supreme Energy Rantau Dedap
SMP	Sekolah Menengah Pertama
SMU	Sekolah Menengah Umum
SPS	Safeguard Policy Statement
SR	Safeguard Requirements
UKL	Upaya Pengelolaan Lingkungan
UNFCCC	United Nations Framework Convention on Climate Change
UPL	Upaya Pemantauan Lingkungan
VU	Vulnerable
WCD	World Commission on Dams
WHO	World Health Organization

Executive Summary

ES 1.1 Introduction

This executive summary explains the need for the geothermal power plant; describe its location and main components as well as summarizing the EIA process and findings.

The recent interest in renewable energy in Indonesia, particularly geothermal, has been attributed to several factors. **First**, a general, international, and scientific consensus of the climate-altering effects of greenhouse gas emissions has renewed interest in development of low-and zero-emission, renewable sources of energy, such as geothermal, this view is supported by the government of Indonesia as one of the supporters of Kyoto Protocol. **Second**, Indonesia GDP grew at an average rate of 5.7% per year between 2005 and 2010 and to support this growth Indonesia needs additional electricity generation to overcome this shortage, especially in the South Sumatra region. **Third**, Indonesia government formulated the National Energy Policy (KEN) in 2006 in Presidential Decree No. 5, one of the key points is to reduce oil's share, which currently accounts for a dominant share in primary energy demand, and to increase shares for coal and renewable energy. **Fourth**, Indonesia has a significant advantage in the generation of geothermal energy because of its excellent volcanic regime. The project aims to optimize the use of geothermal energy that has a high economic, sustainable and environment potential from the country's available resources. **Fifth**, the subsidies for the energy sector impose a great burden on Indonesia, and subsidized energy prices - lower than the true cost - negate Indonesia's efforts in energy efficiency improvement. Geothermal power plant provides alternative and support to the government effort to move away from fossil fuel power generation dependency.

The Indonesian government is committed to achieve a reduction in "greenhouse" gas emissions to address global warming and to move away from fossil fuel power generation dependency. One of the government initiatives was a two-phase "fast-track" generating program. In the first phase, the Perusahaan Listrik Negara (PLN), a state-owned electricity company mandated to provide electricity to the Indonesian public, was authorized to build a total of 9,551 MW of new coal-fired generation capacity to become operational in 2010 and 2012. In the second phase of the program, 11,144 MW of new capacity will be built, with coal-fired power plants taking the biggest share (68%), followed by geothermal power plants (19%), combined-cycle gas-powered plants (10%), and hydropower plants (3%).

PT. Supreme Energy Rantau Dedap (**SERD**) is the operation company established by the Joint Venture of Supreme Energy, GDF Suez and Marubeni with the concession for Rantau Dedap awarded in early December 2010. SERD have got the price approval and assignment from the Minister of Energy and Mineral Resources through assignment letter No. 5834/26/MEM.L/2011 September 30, 2011, to develop the geothermal field and power plant combined capacity of 2 x 110 MW in Rantau Dedap (the "**Project**").

The Rantau Dedap geothermal prospect is located in the Muara Enim, Lahat and Pagaralam Regencies of South Sumatra, approximately 225 km from Palembang. The contract area covers approximately 35,440 ha (18.56 km x 19.63 km) and is situated at an elevation ranging from 1,000 to 2,600 meters on the Bukit Besar volcanic complex, in which the existence of the geothermal system is indicated by a wide distribution of thermal manifestations, particularly on the flank of it. Based upon the interpretation of 1D and 3D MT data and combined with geochemistry, at least 3 geothermal system upflows reside at Rantau Dedap, here named the Air Indikat Tengah, Luang Basung and Anak Gunung systems. Air Indikat Tengah system is

associated with Air Indikat Tengah (AIT) fumaroles at the center of the Rantau Dedap area and show gas geothermometer temperature of about 240°C.

ES 1.2 Initial Environmental Examination

The Indonesian Laws No. 32 Year 2009 serves as the main regulation governing the entire environmental legislation in the country. Other regulations issued such as Minister Decree, Minister Regulation, and a number of international laws ratified by the Indonesian government regulation serve as performance standards on the Environment and Social aspect relevant to the Project.

Potential impacts, mitigation measures as well as management and monitoring methods have been suggested as per activities at the Project site. For the purpose of IEE report, the scope will be limited for the exploration phase only and does not address impacts that may be incurred during the operational phase of the Project. However, it recognises that there may be impacts during the operational phase and studies are being implemented. At this stage of the Project, there had been no significant impact to have occurred. Potential issues that have been identified include Surface Water Quality, Air Quality and Noise, Soil Quality and Erosion Potential, Aquatic Biota, Flora and Fauna, and Socio-economic and Culture.

Conclusions:

The development of the Project will expand the economic activities nationally and regionally. The benefits for the nation as follows:

1. Bolster energy security through the use of domestic renewable resource;
2. Limit exposures to fossil fuel market volatility by diversifying the Indonesian power generation profile and reducing reliance on diesel / fuel oil;
3. Support government effort of producing clean energy.

The benefits for regional economy and industry as follows:

1. Providing multiplier effect to local economy, which is expected to be sustained;
2. An increase in regional incomes at provincial and regency level, through tax and non-tax income;
3. Creating job opportunities for local communities, according to Company's requirements and conditions;
4. Reduce critical energy shortages in Sumatra Interconnection System caused by very low reserve margins.

1. Introduction

1.1 Background

SERD is developing the Project which is situated approximately 225 km from Palembang, the capital city of the South Sumatera province. Geographically the area is situated between 4° 7' - 4° 15' South Latitude and 103° 29' - 103° 18' East Longitude. The Project area covers approximately 35,440 ha (18.56 km x 19.63 km) and is situated at an elevation ranging from 1,000 to 2,600 meters on the Bukit Besar volcanic complex. The prospect is located in a very remote and undeveloped area with steep terrain; most of the prospect area has only walking trails or no access ways at all.

The Project implementation is proposed in two phases. Phase 1 constitutes the geothermal resource exploration and drilling phase. Steamfield development and power plant construction will be taken up as part of Phase 2. SERD is currently undertaking exploratory drilling to investigate the geothermal resource and, if investigations are satisfactory, to subsequently undertake the development of the geothermal power project through to commercial operation of a geothermal power plant comprising two units of approximately 120MW each.

Figure 1.1: Rantau Dedap Location Map

1.2 Purpose of this Report

1.2.1 Initial Environmental Examination

This Initial Environmental Examination (IEE) addresses impacts and mitigation actions associated with Phase I, the exploration phase only. Where appropriate, this IEE also makes recommendations for considerations of actions that will benefit the development of the environmental impact assessment of Phase 2, the production phase.

The exploration phase of the Project is already underway. As required under Indonesian law, an approved UKL-UPL and an approved Forest Management Plan were prepared prior to commencement of the exploration phase. This IEE includes the relevant elements of the UKL-UPL and the Forest Management Plan and builds on them to meet the requirements of the Asian Development Bank's 2009 Safeguard Policy Statement.

1.3 Project Objectives and Benefits

The primary objective of the development of the Project is to increase the capacity of electricity generation in Indonesia. In addition, the use of a renewable energy source will reduce the reliance on fossil fuel that would have occurred if the increased capacity in electricity generation came from a fossil-fuel fired powered electricity generation facility, the most likely candidate for additional grid-connected electricity in Indonesia.

The Project will exploit a potential geothermal field in Rantau Dedap, Indonesia. The concession of 353 km^2 is located in South Sumatra, 100km SE of Bengkulu. While initial exploration results suggested that the Rantau Dedap geothermal field could support around 400 MWe of electricity generation. It is expected that the Project will support the sustainable development of Indonesia in the following respects:

Economic: The Project will supply the growing economy with an increase in the amount of reliable electricity supply from a domestic primary energy source.

Social: The Project will create local employment opportunities for both construction and operation offering Indonesian people new experience and skill in a sector that is growing internationally and with great growth potential in Indonesia.

Environmental: The Project is fuelled by renewable geothermal heat that has very few greenhouse gas emissions compared to other thermal power projects and will have an Environmental Impact Assessment (EIA) carried out before construction of facilities for production phase to identify any changes that need to be made in order to mitigate or minimise environmental impacts.

Growth: Geothermal energy will therefore diversify the sources of electricity generation in the country and is an indigenous resource which enables sustainable energy production.

1.4 Project Development History

The concession for the Rantau Dedap was awarded to the Supreme Energy - GDF Suez - Consortium in early December 2010, with Marubeni joining in June 2011. The Mining Area License was granted to the project

company, i.e. SERD. SERD have got the price approval and assignment from the Minister of Energy and Mineral Resources through assignment letter No. 5834/26/MEM.L/2011 dated September 30, 2011.

The exploration program has started since 2011. It has completed the Airborne topographic survey and civil engineering study. Heat loss survey, report and the geoscientific interpretation were completed in February 2012.

On November 12, 2012 the Project entered into the Power Purchase Agreement (PPA) with Indonesian state-owned electricity utility company Perusahaan Listrik Negara (PT PLN). The signing was done by President & CEO of SERD, Mr. Supramu Santosa and President Director of PT PLN, Mr. Nur Pamudji, witnessed by Minister of Energy and Mineral Resources, Jero Wacik. Signing of PPA marks a key milestone as it defines the contractual rights and obligations of the parties during the exploration phase, construction phase and operation phase - conditions which are necessary to start exploration drilling activities. At the same time socialization effort with the communities and land acquisition process had started to secure approximately 45 ha land outside forestry area and 91 ha land inside forestry area.

PT. Leighton Contractors Indonesia (LCI), as SERD's civil contractor has started the site civil and infrastructure works on 1 January 2013. The Protection Forestry Area Permit document was obtained in November 2012 and was issued by Mr. Zulkifli Hasan, the Minister of Forestry.

The first stage of the Project involves the drilling of a number of exploration wells to confirm the existence, nature and size of the geothermal resource. On February 3, 2014, the exploratory drilling programme commenced with the 'spudding' and drilling of the first exploratory well. Prior to the commencement of exploratory drilling program, series of stakeholder engagement efforts were made, which included apart from village consultations, group discussions and individual interviews, a benchmarking site visit to Kamojang in Jawa with the local community as one of SERD major initiatives. A number of permits were also acquired from the government agencies with (covered in details in Appendix B). Access road were also built within the protected areas after the completion of land acquisition process.

Following, and depending on the results of, the exploration drilling programme, engineering design work will be undertaken to define the surface facilities (steamfield and power plant) in sufficient detail to allow the establishment of an Engineering, Procurement and Construction (EPC) contract for the construction of these facilities. Additional production and injection drilling may or may not be required during this period in order to provide sufficient confirmed steam under the wellhead to achieve financial closure with a lender consortium. Once financial closure has been achieved, the second stage of the Project will be the full development to commercial operation, including additional production and injection drilling and construction of the steamfield and power plant.

2. Project Description

This Chapter discusses Project details of exploratory drilling to investigate the geothermal resource and, if investigations are satisfactory, to subsequently undertake the development of the Project through to commercial operation of a geothermal power plant comprising two units of approximately 110MW each.

2.1 Project Justification

Geothermal energy offers the compelling prospect of power generation that operates continuously - regardless of weather conditions, and with negligible fuel costs and greenhouse gas (GHG) emissions. It also has the potential to help insulate energy consumers from future rises in the oil price and in the cost of emitting GHGs, for Indonesia itself it could also have strategic value, providing a secure source of energy to sustain economic growth. Indonesia continues to import a major portion of fossil fuels and, these fuel supplies will run out eventually, hence dependence on these fossil fuel sources makes our energy supply vulnerable.

The GHG emission that can be avoided as a result of the Project moving to production phase indicates 1,099,745 TCO2-e per year or approximately 30 million TCO2-e during the whole Project life, as per validated greenhouse gas calculations made in accordance with UNFCCC CDM methodologies.[ref the validated CDM PDD]

The Project itself is also in line with Government initiatives in reference to the new Electricity Law (Law No. 30/2009), enacted in September 2009, which fully deregulates the power market by allowing independent power producers to generate and sell electricity to end users. To meet the country's increasing energy needs, the Government of Indonesia initiated a two-phase "fast-track" generating program. SERD was one of the pioneers to capitalize the opportunity under the new regulations.

2.2 Analysis of Alternatives

The alternatives to this geothermal Exploration Phase are:

1. Do nothing
2. Choose an alternate site.

The do nothing alternative means that the opportunity to reduce reliance on greenhouse gas intensive thermal energy is lost and the Indonesian Government's initiative is not achieved. The choice of an alternate site alternative is impractical given current access to particular geothermal resources in Indonesia. Therefore the project is the best choice of the three alternatives.

2.3 Project Site

The Rantau Dedap geothermal prospect is located in the Muara Enim, Lahat Regencies and Pagaralam City of South Sumatra, approximately 225 km from Palembang, the capital city of the South Sumatera province. Geographically, the area is situated between 4° 7' - 4° 15' South Latitude and 103° 29' - 103° 18' East Longitude. The contract area covers approximately 35,440 ha (18.56 km x 19.63 km) and is situated at an elevation ranging from 1,000 to 2,600 meters on the Bukit Besar volcanic complex, in which the existence of

the geothermal system is indicated by a wide distribution of thermal manifestations, particularly on the flank of it. **Figure 1.1** shows the Project site locations.

2.4 Summary of Project Components

The key Project components and their current status of implementation is summarized in Figure and Table below:

Figure 2.1: Rantau Dedap Project Map (Protection Forest area indicated by Yellow shades)

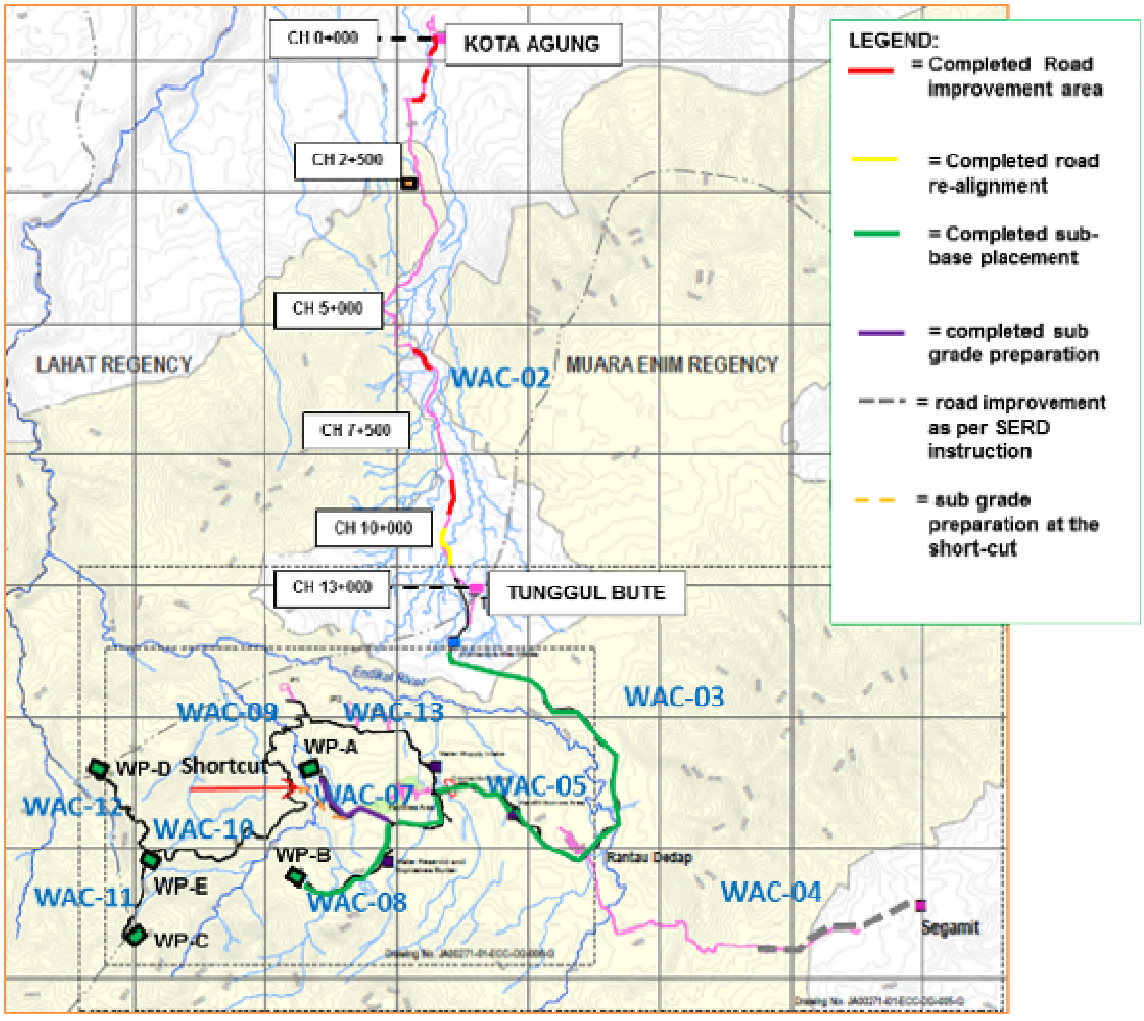


Table 2.1: Rantau Dedap Project Milestone

No.	Activity	Remarks
	Civil works	
1	Lahat - Kota Agung Road Improvement	Completed
2	Kota Agung - Tunggul Bute Road Improvement	Completed
3	Tunggul Bute - Rantau Dedap Road Construction	Completed
4	Rantau Dedap to Facilities Area Road Construction	Completed
5	Pad B Access Road Construction	Completed
6	Pad A Access Road Construction	Suspended
7	Water Supply System #1	Completed
8	Pad E Access Road Construction	In progress
9	Pad C Access Road Construction	In progress
10	Pad D Access Road Construction	Suspended
11	Well Pad RD B Construction	Completed
12	Well Pad RD E Construction	In progress
13	Water Supply System #2	In progress
14	Water Supply System #3	In progress
15	Well Pad RD A Construction	Suspended
16	Well Pad RD C Construction	In progress
17	Well Pad RD D Construction	Suspended
18	Well Pad RD G Construction	Suspended
	Drilling	
19	Spud in Well RD B-1	Completed
20	Spud in Well RD B-2	Planned
21	Spud in Well RD E-1	Planned
22	Spud in Well RD C-1	Planned
23	Spud in Well RD E-2	Planned
24	Spud in Well RD C-2	Planned
	Well Testing	
25	Short term flow test Well RD B1	Planned
26	Long term flow test Well RD B1	Planned
27	Long term flow test Well RD B2	Planned
28	Long term flow test Well RD E1	Planned
29	Long term flow test Well RD C1	Planned
30	Long term flow test Well RD E2	Planned
33	Long term flow test Well RD C2	Planned

2.4.1 Access roads

Civil works for access road can be divided into 4 level of works:

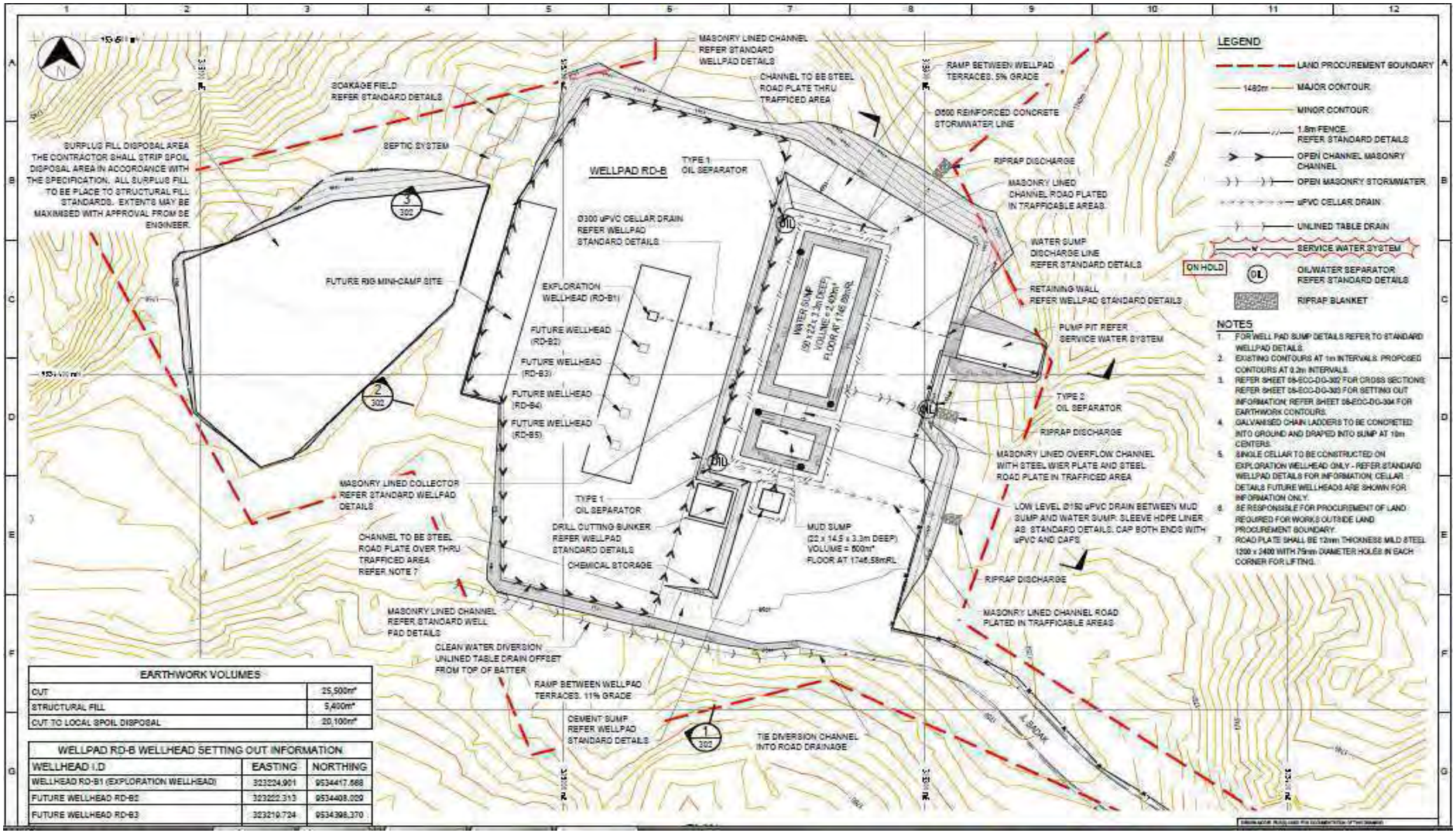
- Access Road between Lahat - Kota Agung which represents existing road improvement in previously non-forest areas.
- Access Road between Kota Agung Tunggul Bute which represents existing road improvement (2.4 km) in previously non-forest areas.
- Tunggul Bute - Rantau Dedap Road which represents road construction activity (7.8 km)
- Rantau Dedap Road - facilities area which represents road construction activity (4.0 km)

Current crop compensations status related to access roads have reached 100% progress. With the completion of access road to wellpad B, the current major implementation status is the completion of short cut access to Wellpad C and Wellpad E.

2.4.2 Well pads

Below is the typical wellpad schematic:

Figure 2.2: Pad B Layout



2.4.3 Management of Water Supply and Produced Water

The following water supply and produced water system is designed following this Project assumption:

1) River water is the primary water source for use during drilling. The main water source is from the Cawang Tengah River which has an estimated flow of 1,200 l/s and smaller water supplies are also available near Pad B and Pad C.
2) That an average flow of about 35 l/s is required during the exploration phase for single rig drilling operations, with a peak flow of up to 80 l/s, although SERD has a permit to consume up to 100 l/s.
3) A produced water system shall also be capable of conveying hot brine from one well pad to another at a nominal flow of around 80 l/s and a temperature of 80-90 deg C.
4) Movable, skid mounted, diesel-driven pumps will be used to transfer water and brine between well pads.

Current crop compensations status related to water system have reached 100% progress. The current major implementation status is the completion of water system in Pad E.

Figure 2.3: Water Intake Locations

At the exploration stage, water is mainly used for drilling activities. Water for drilling is obtained from near Well Pad B (water intake #1), near Well Pad C (water intake #2) and from Shortcut area (water intake #3). Discharge of water from each of the water intake is around the 80 - 90 liters/sec or 288 - 324 m^3/h.

Water from water intake will be stored in water pond and mud pond to be used as drilling fluid. Sufficient quantity of water will be stored in the ponds ready to be used for loss circulation or to control the well in case of well kick. Drilling program showed an estimation of 80 liters/sec is required to control the well during loss circulation or well kick.

In normal operations water will be used as drilling fluid and will be inserted into the wellbore during drilling operation to bring drilling cuttings of the well to the surface.

The mixtures of mud and drilling cutting from well is then separated in shakers where water (mud) is then sent to mud tanks to be used again as drilling fluid whereas drilling cutting is sent to a drilling cutting storage.

Upon completion of drilling of the well, water will be kept in the ponds and can be transferred to similar ponds in other wellpad for another drilling activity to help minimize water use. Upon completion the whole exploratory drilling program, water in the ponds will be injected to the wells and not released to the environment.

The size and design of the ponds have already take into account maximum water supply from the intake as well as additional input from rainfall. By design, water run off from the surrounding will not enter the ponds. Pond is made of compacted soil covered with thick HDPE liner.

The capacity of each pond is listed as follows:

Table 2.2: Capacity of Water Ponds and Mud Ponds

	Water Pond (m^3)	Mud Pond (m^3)
Well Pad B	2,400	600
Well Pad C	5,000	600
Well Pad E	2,400	600

2.4.4 Construction base camp and soil disposal sites

The logistics area represents a warehouse, pipe racks and open storage area. There are 2 soil disposal areas between Kota Agung and Tunggul Bute. For the exploration phase, one disposal area is used for explosive bunker and temporary rock crushing while the other one is not yet used. Soil disposal within the Project site has been done within the road corridors and wellpad boundaries. Most of the soil disposal area was originally disturbed land or coffee plantation and only soil disposal in wellpad-B was undisturbed. Land and/or crop compensations have reached 100% progress and the implementation is 100%.

Figure 2.4: Construction of Base Camp and Temporary Drilling Cutting Storage

2.4.5 Contractor Camps and Temporarily Occupied Areas

The LCI base camp is a temporary camp consisting mostly of "portacabins" and other temporary buildings, as well equipment such as generators, sewage treatment plant, and communications mast. Land acquisition has reached 100% progress and implementation is 100%.

2.4.6 Bridge Construction

On the existing road from Kota Agung to Talang Pisang, if necessary, SERD will repair the road and refurbish the existing bridges to ensure it can support the intended load.

On the new road, there are several new bridge constructions in SERD that may use either concrete construction (e.g Endikat river crossing) or steel culvert (Mechanically Stabilized Earth MSE) which then backfilled with compacted soil and strengthened by gabion. During construction, for safety reason and to maintain river water condition, if necessary the river is diverted and sufficient protection and strict supervision are given. Soil stability and erosion protection are also parts of the design consideration. Current land and/or crop compensations status related to bridge construction have reached 100%.

Figure 2.5: Construction of Bridge at Cawang Tengah River and Endikat River

2.4.7 Hazardous Material Management

The chemicals used in the drilling activities of PT SERD are mostly composed of Bio-Degradable or environmentally friendly material. All the chemicals used have MSDS (Material Safety Data Sheet) so as to know the content of these chemicals and how to handle when things happen that are not desirable.

Chemicals are contained in weather proof containers and mainly stored in storages located in open yard.

As part of the contract, contractor is required to be properly managed the hazardous material to fulfil GOI regulatory and Company requirements.

For drilling emergency purpose, SERD maintains a low quantity of explosive stock (oil well cartridge / OWC type). Explosive will be used by a certified blaster to release stuck drillpipe from the formation, after all other options to release it are exhausted. The explosive is stored in a government approved explosive bunker in 2 separate storage containers. One container contains approximately 23.5kg detonator while the other container contains the OWC (approximately 59,7kg safe charge and 15.8kg primacord). The fenced explosive bunker is located in the soil disposal area in between Karang Agung and Tunggul Bute and guarded 24 hours by Security and Policemen.

Figure 2.6: Explosive Bunker

2.4.8 Drilling

For the exploratory drilling activities, SERD Drilling Program utilizes one (1) unit of drilling rig to drill exploration wells. The methodology for drilling typical wells in exploration wells as follow:

- The 20" casing shoe will be set at depth around 400 meters MD which determined by SERD's Drilling Department within hard rock formations, such as less altered andesite lava, if possible. Shoe depth is designed to protect steam broaching to surface through fractured earth due to high pressure and incompetent formation.
- The 13 ⅜" casing shoe will be set in the depth range of 593-825 meters MD, depending on the appearance of illite and epidote minerals, Methylene Blue analysis, ΔTemperature in-out and SFTT. The casing depth is designed to be set above top of reservoir
- 10 ¾" Casing Perforated Liner will be set at the total depth of the section and is planned at the total depth of 1593-1825 mMD
- 8 ⅝"Casing Perforated Liner will be set to achieve the objective TD of the well at 2,400 mMD.

It is estimated that one well will take 47 days to drill. Rig moves between wellpad will take between 2 – 3 weeks

2.4.9 Well Testing

For the well testing activities, SERD follow typical well testing procedures consist of:

- During drilling, Static Formation Temperature Test (SFTT) is mandatory to obtain a first estimation of real reservoir temperature (without waiting the well to heat-up for weeks) and to set the production casing at the optimized depth. Injectivity Index (II) test can also be required at some point to check if the injectivity target of the well has been reached or if it is preferable to drill deeper.
- Once the well is completed, Completion test consisting of Pressure-Temperature-Spinner (PTS) under injection and Multi-rate injection test followed by pressure fall-off monitoring is conducted to

characterize the Injectivity of the well and assess the different feed zones (location and contribution to flow).

- This is then followed by Heat-up survey when several (typically 5) Pressure-Temperature surveys are run while the well is shut-in and the heating-up process occurs. The first four surveys are usually performed during rig mobilization to next well pad (typically 1, 3, 5 and 7 days after well is completed) to observe the transient part of the temperature build-up (and thus obtain information on feed zones behaviour), and the last one once the rig has been completely demobilized (typically 21 days after well is completed). Multi-finger caliper survey is also run at this time (once) to check the well conditions.
- Once the stabilization of the temperature build-up is observed, short-term and/or long-term discharge tests (depending on injection wells availability, in green in the schedule above) will be conducted to finely characterize the well potential (temperature profile and contribution of the different feed zones). For example, in RD-B1, short-term discharge test will be conducted first using the drilling water pond (3,000 m^3) and an extra 3,000 m^3 pond, allowing to perform a discharge test of around 24 hours (assuming 80 l/s water production) to deliver a preliminary qualitative assessment of well potential. Then, once other well is completed and available for injection, RD-B1 long-term discharge test will be performed for about 1 month in order to carry out the final quantitative assessment. Ponds and piping between wellpads for water disposal have already been installed to handle the produced brine and re-inject it back to the reservoir.
- These discharge tests will also involve 1 PTS survey each under flowing conditions, as well as Tracer Flow Test (typically 3 tests under different operating conditions) to double-check the calculations of produced fluid enthalpy, and fluid chemistry sampling to have a precise characterization of steam and brine composition.

3. Policy, Legal and Administrative Framework

This Chapter discusses the policy, legal and administrative framework as well as institutional positions relevant to the environmental and social assessment of the Project. In this Chapter, environmental and social guidelines from the national agencies as well as international donors and other organizations are also included.

The statutory Indonesian environmental and socio-economic processes must be applied for the Project. The existing laws and regulation also serves as justification for the composition of the UKL-UPL document during the exploration phase. The UKL-UPL is explained as a less detailed version of the Environmental Impact Assessment (EIA). The UKL-UPL document is composed to accomodate all the environmental and socio-economic concerns regarding the Project for the exploration phase. This document will be part of a larger scope of management and monitoring effort tackled in the production phase, namely the AMDAL / EIA (*Analisis Mengenai Dampak Lingkungan /* Environmental Impact Assessment). The Indonesian Law No. 32 Year 2009 states that every proposed project that is categorized as having no significant impact is required to have a UKL-UPL document. It is also referenced in the Minister of Environment Regulation No. 5 Year 2012 that geothermal projects in the exploration phase do not need to prepare AMDAL/ EIA.

3.1 Existing Laws and Regulations

Indonesia's statute books contain a number of laws concerned with the regulation and control of the environmental and social aspects. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new phenomenon. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context-specific. The laws relevant to the developmental projects are briefly reviewed below.

3.1.1 Indonesian Law No. 32 Year 2009

Environmental Protection and Management

The Indonesian Act UU No. 32, 2009 is the basic tool and framework of the government to regulate protection and management of the environment.

The Environment, as described in the act is unity with all things space, power, state, and living creatures, including human beings and their behaviour, which affect the nature itself, the continuity of livelihood, and welfare of humans and other living organisms. While the protection and management of environment is defined as a systematic and integrated effort are being made to preserve function and prevent environmental pollution and / or damage to the environment that includes planning, utilization, control, maintenance, monitoring and enforcement. Included in this act is a broad range of issues and extends not only to aspects of environment but also social and economical aspects.

Also laid out in the regulation are tools used to evaluate and guide the process such as: Strategic Environmental Assessment, Spatial Planning, Environmental Quality Standards, Environmental Damage Standard and Criteria, Environmental Impact Assessment, Environmental Management and Monitoring as well as relevant Permits.

3.1.2 Indonesian Law No. 1 Year 1970

Safety

This act provides regulations regarding Basic Work Safety and Health (K3). The regulation provides an understanding of the definition of workplace as well as basic rules or general provisions on occupational safety in different workplaces. Also included in the act is the terms of safety, supervision methods, guidance and violation sanctions of safety. Explained in the act is the The purpose of the safety, understanding the safety, Basic Principles of Accident Prevention, Accident Prevention Methods, and Accident Analysis.

3.1.3 Minister of Environment Regulation No. 16 Year 2012

Guidelines to Develop Environmental Documents

As required under Indonesian law i.e. Minister of Environment Regulation no 5 year 2012, geothermal's exploration phase requires an approved Environmental Management and Monitoring Plans (UKL-UPL) prior to commencement of the exploration phase, while the development and production phase requires a more detailed study called Environmental Impact Assessment / EIA (Analisis Mengenai Dampak Lingkungan / AMDAL).

The Minister of Environment Regulation no 16 year 2012 aims to serve as a general guideline in preparing any environmental documents. The documents referred to include:

a. Environmental Impact Assessment (EIA) document;
b. Environmental Monitoring and Reporting document UKL-UPL form, and
c. Environmental Monitoring and Reporting Statement of SPPL.

UKL-UPL document of SERD has been approved in 2011 and currently SERD is preparing the infrastructure to enable to drill the exploratory wells. After exploratory program, a feasibility study will be conducted and EIA document will be prepared

Stages of UKL-UPL:

The UKL-UPL process will consist of a public announcement and public consultation which will be attended by stakeholders including local community and technical team. After the hearing, attended by the stakeholder and company, the document is finalized.

1. Public Announcement

2. UKL-UPL Presentation
3. UKL-UPL Approval

Stages of AMDAL / EIA for the Production Phase:

The AMDAL / EIA study document consists of Terms of Reference of ANDAL, ANDAL (Environmental Impact Analysis) and the RKL-RPL (the Environmental Management and Monitoring Plan for Production phase).

The stages in AMDAL process are:

1. Public announcement

2. Public consultation

3. TOR ANDAL approval

4. ANDAL and RKL-RPL approval

For SERD, because the Project area lies within a protection forest, the approval of AMDAL shall be obtained from the Minister of Environment. Upon the approval of AMDAL, SERD shall obtain environmental permit from the Minister of Environment.

Currently SERD's AMDAL progresses, is at TOR ANDAL composition.

3.1.4 Minister of Environment Decree No. 86 Year 2002

Guidelines for UKL and UPL Implementation

This regulation provides a guide for the Implementation and reporting of the Environmental Monitoring and Reporting document (UKL-UPL). Explained in the decree is the Justification for producing document, Content identification as well as Reporting program and reporting agents in relation to the document.

3.1.5 Indonesian Government Regulation No. 59 Year 2007

Geothermal Business Activity

This legislation provides a description of geothermal business activities in general as well as policies and procedures that have to be followed during the implementation of the Project.

3.1.6 Minister of Mines and and Energy Decree No. 555K/26/M.PE/1995

Occupational Health and Safety in Mining

This regulation governs the safety requirements in the field of mining. At this time, Geothermal activities are still classified as mining activities, therefore SERD are required to meet all the requirements of this regulation.

3.1.7 State Minister for Agrarian Affairs / Head of BPN Regulation No. 3 Year 2007

Guidance on the land acquisition process for developments in the public interest"

This regulation governs the procedures for the measurement, map plotting, establishment and installation of signs, land registration activities, maintenance and repairation of maps, measuring of images, aerial photography, certificate issuance, transfer of rights and land administration.

3.1.8 Forestry Minister Regulation No. P18/Menhut-II/2011

Forestry Land Borrow Permit (IPPKH)

This regulation serves as guideline in the areas of forestry use. The permit to use forestry areas can only be used for certain activities. The proponent in possession of forestry use license is required to meet certain requirements in this regulation, among others, security and management of forestry area.

3.1.9 Indonesian Government Regulation No. 47 Year 2012

Environmental and Social Responsibility for Companies

In accordance with this regulation, a company (Perseroan Terbatas / PT) has to fulfill social and environmental responsibilites. These responsibilities state that every company has the legal obligation to social and environmental responsibility within and outside the company.

3.1.10 Government Regulation No. 82 Year 2001 regarding

Water Quality Management and Water Pollution Control

This government regulation sets up the classification and water quality criterias, water utilization, wastewater disposal retribution, as well as emergency countermeasures. Also included in this regulation is reporting proceedures, rights and obligations of water users, terms of use and wastewater disposal, waste water utilization and administrative sanctions.

3.1.11 Indonesian Law No. 36 Year 2009

Health

This law governs the rights and obligations of each person for health, regulating the government's responsibility, the resources in the fields of health, health care facilities, health debriefing, technology and product technology. This law also regulates health measures, health care, maternal health, infant, child, adolescent, elderly, and mentally disabled, infectious and noninfectious diseases, environmental health, occupational health, health management, health information, health financing, as well as community participation. Health institutions such as the Agency for health considerations, guidance and supervision, investigation and criminal provisions also set on this legislation.

3.2 Obligations Under International Treaties

3.2.1 Indonesian Law No. 19 Year 1999

The Ratification of International Labor Organization (ILO) Convention No. 105 Concerning the Abolition of Forced Labor

This regulation stresses the implementation of anti-forced labor. The convention is intended to suppress forced labor in any form such as: political suppression or education or as a punishment for comprehension or expression of views ideologically opposed to the system of political, social, economic and legal; as a way of mobilizing and using labor for purposes of economic development; as a way to foster the discipline of labor; as a punishment for having participated in strikes or protests; for the implementation of racial discrimination, social and religios nation.

3.2.2 Indonesian Law No. 20 Year 1999

The Ratification of *ILO Convention No. 138* Concerning *Minimum Age for Admission to Employment*

This convention is set to to eliminate child labor practices and increase the minimum age for admission to employment. For jobs that are classified dangerous to health, safety or morals of children must be pursued by no less than 18 (eighteen) years of age, except for light work which should not be less than 16 (sixteen) years of age. The regulation also sets the rules regarding working hours and sanctions for violation.

3.2.3 Indonesian Law No. 21 Year 1999

The Ratification of *ILO Convention No. 111 Concerning Discrimination in Respect of Employment and Occupation*

This convention prohibits any form of discrimination in employment and occupation. Any form of discrimination such as: skin, race, sex, religion, political views, descent or origin is prohibited.

3.2.4 Indonesian Law No. 5 Year 1998

The Ratification of *ILO Convention Against Torture and Other Cruel, Inhuman Degrading Punishment*

This convention ratifies the suppressing of torture or cruelty within an organization.

4. Description of the Environment

This Chapter describes the environmental conditions of the Project area before the commencement of the Project activities. The environmental baseline in this Chapter addresses the physical and biological aspects of the Project area.

4.1 Climate

The Rantau Dedap field is located in Muara Enim District, Lahat District and Pagaralam city, South Sumatera Province. Based on the climate type in South Sumatera in general and around study area especially is classified into tropical climate. This tropical climate is described by a number of experts by several terms as follows:

1) Afa Climate (tropical rain climate), by Koppen.
2) A Climate (very wet area), by Schmidt-Ferguson 1950.
3) B1 climate (region, which from 7 to 9 wet and 2 months dry, by Oldeman 1979).

The climate data are obtained from Meteorology and Geophysical Agency of Climatology Station Class I Kenten Palembang at Muara Enim Station. The data covers rainfall, rainy days, and air temperature and air relative humidity.

Air Temperature

Average daily air temperature in the area is about 22.6°C to 26.5°C. The maximum air temperature is about 31.1°C to 34.0°C and the minimum temperature is about 21.9°C to 23.8°C.

Relative Air Humidity

Based on the climatology data composition obtained from Climatology Station of South Sumatera for the period of 10 years shows that the relative air humidity is approximately is about 74% - 92%. The highest air humidity occurs on March.

Rainfall

Data of rainfall within the range of 10 years (2011 - 2010) are presented in the Table below. The highest rainfall is 3,808 mm in 2010 and the lowest is 1,571 mm in 2003. The highest monthly rainfall is 610 mm in January 2009 and the lowest is 2 mm in November 2003.

Table 4.1: Monthly Rainfall around Study Area

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Agt	Sep	Oct	NoV	Dec	Total
2001	192	265	146	331	90	397	104	154	32	215	242	145	2413
2002	166	230	196	150	33	82	39	37	50	152	396	254	1786
2003	192	116	84	326	291	15	12	42	2	26	140	325	1571
2004	299	227	590	555	190	215	36 0	236	99	184	240	444	3639
2005	248	205	314	206	73	189	163	69	43	410	503	462	2885
2006	444	233	93	240	297	177	77	56	150	250	442	249	2713
2007	454	256	323	328	87	237	74	259	171	368	284	195	3036
2008	159	94	390	198	284	135	44	191	235	253	304	526	2813
2009	610	204	233	335	113	54	101	42	137	276	146	399	2650
2010	484	446	484	165	241	132	317	291	367	253	261	367	3808

Source: Meteorology and Geophysics Agency of Climatology Station Class II Kenten, 2010

Table 4.2: Total Monthly Rainy Days around Study Area

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Agt	Sep	Oct	Nov	Dec	Total
2001	9	15	5	12	5	7	7	5	4	9	16	9	103
2002	13	15	14	13	3	7	4	7	10	6	9	7	108
2003	6	4	4	16	13	1	1	4	1	2	12	19	83
2004	19	16	10	12	6	5	6	22	22	11	18	12	159
2005	20	16	15	10	8	24	9	8	8	21	20	12	171
2006	10	12	6	13	9	11	6	8	12	20	15	16	138
2007	18	15	13	17	13	9	3	5	11	20	19	29	172
2008	15	17	22	11	10	8	5	12	11	20	17	17	165
2009	19	16	13	15	10	8	6	6	7	9	10	21	140
210	22	14	23	10	10	7	10	18	14	15	9	14	166

Source: Meteorology and Geophysics Agency of Climatology Stasion Class II Kenten, 2010

The table above shows that total annual rainy days are about 83 to 172 days with the total lowest rainy days occur in June, July and September 2003, i.e only for 1 day and the highest total rainy days took place in December 2007 i.e. 29 days. Other climate elements covering air temperature, evaporation and speed as well as wind blow direction are shown in the table below.

Table 4.3 Climate Elements in Study Area

Element of Climate		Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Agt	Sep	Oct	Nov	Dec
Rainfall (mm)		362	423	157	431	147	105	58	87	79	225	174	584
Rainy Day (Day)		16	15	12	22	13	9	8	12	8	12	12	17
Temperature (oC)	Ave	26,3	27,0	27,3	27,5	26,5	26,9	27,3	27,5	27,2	27,1	26,4	26,8
	Max	31,1	32,0	32,4	32,2	31,7	31,5	32,4	32,8	33,0	31,9	30,5	31,8
	Min	23,7	23,9	24,3	24,8	24,3	24,3	24,0	24,2	24	24,3	23,6	22,8
Humidity (%)		86	79	85	86	86	84	84	79	78	82	84	87
Wind Speed (Knot)		5	3	3	3	3	3	4	4	5	3	3	3
Direction of Wind		NW	N	E	SE	SE	SE	SE	SE	SE	E	NE	W

Source: Meteorology and Geophysics Agency of Climatology Station Class II Kenten, 2008

4.2 Air Quality and Noise Level

The initial air quality and ambient noise setting is found by direct field measurement and sampling. The air quality analysis refers to the Governor Ordinance of South Sumatera Number 17 Year 2005 regarding Ambient Air quality Standard and Noise Level Standard.

Table 4.4: Ambient Air Quality Analysis Result and Noise Level

No	Parameter	LOCATION			
		Segamit Village Housing	Well Site	Around Drilling Site	Threshold Limit (BML*)
1	Temperature °C	28.2	28.1	28.5	-
2	SO_2 (µg/Nm^3/h)	38.31	39.90	40.15	400
3	NO_2 (µg/Nm^3/h)	14,14	12.69	13.70	900
4	CO (µg/Nm^3/h)	480.73	209.18	230.84	30,000
5	O_3 (µg/Nm^3/h)	40.19	37.75	38.79	235
6	HC (µg/Nm^3/h)	45.0	45.0	45.2	160
7	TSPS (µg/Nm^3/24 hours)	90.741	29.167	45.647	230
8	Noise	43.4	38.4	40.7	55 / 70

Source: Primary Data, April 2011

4.3 Physiographic and Geology

On a physiographic basis, the study location is covered in highland area of South Sumatera region, at elevation between 1,000m to 2,600m. This unit is characterized by hilly area with the area form is mostly classified as wavy land (may have high degree slope).

The field structure is called Ibul Tenggara and geologically is situated in the west part of South Sumatera Concavity. The formation history of South Sumatera has been started since the Eocene Rifting phase occurrence that formed valleys with the pattern toward the northeast-southwest. The next phase is the regional subsidence occurrence during Oligosen time, Miosen to the beginning of Pliosen, then during the period of Plio-Pletosen du to the compression from southwest that causes the lift and folding of northwest-southeast pattern and reactivation of faults on base rocks.

4.4 Hydrology and Water Quality

River Characteristic

The activity location of geothermal exploration well development is passed by rivers, namely Cawang River, Asahan River, Endikat River and Ampar River. These Rivers water are used for drinking water sources and for bathing and other household purposes for the local community.

Surface Water Body Quality

Water spread out in nature has never been in pure form, but it does not mean that all waters are polluted. For example, though in isolated mountainous and forest area with clean air free from pollution, the rain water always contains soluble materials such as CO_2, O_2 and N_2, and suspended materials like dust and other particles are taken from the atmosphere. The surface water and well water usually contain soluble metal materials such as Na, Mg, Ca and Fe.

1) Physical Characteristic

(a) Temperature

Water body situated around this geothermal exploration well development activity plan location is still used by the locals mainly for domestic needs and fishing. The change of water body temperature will affect the chemical reaction speed and water life cycle. Change of water body temperature in the study area is more mainly caused by chemical biology activity on solid and gas object in the water. Decomposition occurring in high temperature and organic substance oxidation level is much bigger in high temperature. High temperature may lead to the solubility of oxygen in surface water (water body) is lessened, so the aeration process needed to degrade organic substance will be impeded. It will then impose fatal impact on water biota in the water body. The

measurement of temperature in the water body around the study location is about 24.3 - 24.8°C, this means it still within normal category.

Table 4.5: Analysis Result of Surface Water Analysis

No	Parameter	Unit	Analysis Result				BML*)
			Asahan	Endikat	Ampar	Cawang	
	Physical						
1	Temperature	°C	24,3	24,8	24,5	24,6	Deviation +3
2	Soluble Solid Substance	mg/l	11.6	12,3	11,8	11,2	1000
	Chemical						
1	Mercury (Hg)	mg/l	Ttd	Ttd	Ttd	Ttd	0,01
2	Free Ammoniac (NH3-N)	mg/l	0,15	0,12	0,17	0,10	0,5
3	Arsenic (As)	mg/l	Ttd	Ttd	Ttd	Ttd	0,05
4	Barium (Ba)	mg/l	Ttd	Ttd	Ttd	Ttd	1,0
5	Iron (Fe)	mg/l	0,059	0,061	0,220	0,052	0,3
6	BOD_5	mg/l	0,24	0,19	0,21	0,15	2
7	COD	mg/l	1,6	1,3	1,2	1,2	10
8	Fluoride (F)	mg/l	Ttd	Ttd	Ttd	Ttd	0,5
9	Cadmium (Cd)	mg/l	Ttd	Ttd	Ttd	Ttd	0,01
10	Chloride (Cl)	mg/l	14,64	17,73	34,52	13,76	600
11	Chromium (Cr)	mg/l	Ttd	Ttd	Ttd	Ttd	0,05
12	Manganese (Mn)	mg/l	Ttd	Ttd	Ttd	Ttd	0,1
13	Nitrate as N (NO3)	mg/l	1,14	1,25	1,10	1,08	10
14	Nitrite as N (NO2)	mg/l	0,03	0,05	0,03	0,02	0,06
15	Soluble Oxygen	mg/l	7,02	7,35	7,26	7,38	>6
16	pH	Unit	7,53	7,25	7,34	7,14	6 – 9
17	Selenium (Se)	mg/l	Ttd	Ttd	Ttd	Ttd	0,01
18	Zinc (Zn)	mg/l	Ttd	Ttd	Ttd	Ttd	0,05
19	Cyanide (CN)	mg/l	Ttd	Ttd	Ttd	Ttd	0,02
20	Sulfate (SO4)	mg/l	3,10	3,08	3,42	2,93	400
21	Sulfide (H2s)	mg/l	Ttd	Ttd	Ttd	Ttd	0,02
22	Copper (Cu)	mg/l	Ttd	Ttd	Ttd	Ttd	0,02
23	Lead (Pb)	mg/l	Ttd	Ttd	Ttd	Ttd	0,03
24	Oil and Grease	mg/l	0,04	0,06	0,07	0,03	1
25	Phenol	mg/l	Ttd	Ttd	Ttd	Ttd	0,001

Source: Primary Data, April 2011

*) Governor Ordinance of South Sumatera Province No. 16 year 2005 (Appendix II on Class I Quality Standard)

ttd = undetected

(b) Soluble Solid Substance

Solidity consists of soluble, deposited or suspended organic and an-organic solid material. These materials will precipitate on the bottom of water, which will step by step cause

being shallow especially on receiver surface water body. Other consequences of this solidity produce certain water plant growth and can be poisonous for other creatures. Total solidity indicates mud quantity contained in the water. The analysis result of soluble solid substance in the water body around the study location shows that the soluble solid substance content is about 11.2 - 12.3 mg/l and still fulfils the specified quality standard (1,000 mg/l).

2) Chemical Characteristic

(a) Acidity Level (pH)

Normal water pH value is about neutral, namely between pH 6 to 9, and polluted water pH, for example, water disposal is varied depending on the disposal types. The acidity change to the water disposal, either toward alkali (pH rises) or to the direction of origin (pH drops) can disturb fishes and water animals life around. Further the water characteristic can have an impact on the water biota and even to the equipment used. The measurement result to the study location shows that the pH value is between 7.14 - 7.53 so it still fulfils the range of specified pH quality standard (6-9).

(b) Oil and Grease

Oil and grease in the water will form oil film on the surface (oil / grease type specific gravity is smaller than that of water). This oil film will impede air solution (mainly oxygen) into the water body (impeded re-oxygen). The soluble oxygen in the water is needed by water biota. Apart from that, the existence of oil film in the water body will hamper the sunray entry into the water so that the photosynthesis process in the water body will also be hampered. If photosynthesis process in the water body increases, so does the soluble oxygen content in the water. The analysis result of oil and grease at 4 (four) sampling locations shows that oil and grease content is about between 0.03 - 0.07mg/l and still fulfils the quality standard (1 mg/l).

(c) Phenol

Phenol is classified as hazardous and poisonous compound. This compound is grouped as a hardly-degraded compound or refractory substance by microorganism, even it is classified as a disinfectant. Phenol may impede water biota life and cause liquid waste to become colorful and odorous. The analysis result of phenol content at 4 (four) river water samples shows an undetected phenol content.

(d) Heavy and Toxic Metal

Water is frequently polluted by an-organic components, among other things are heavy metals. Heavy metal in general like mixed Iron (Fe), Copper (Cu), Chrome Hexavalence (Cr^{6+}), Zinc (Zn), Lead (Pb), Mercury (Hg), Manganese (Mn). Oxidized Manganese (Mn) and Iron (Fe) have brownish-water color and are insoluble and can cause the use of water will be restricted. In the study area, this heavy metal is mainly originated from heavy equipments and water pipes corrosion process (electrochemical reaction) occurs on the surface. The analysis result shows the content is very low (undetected) so that it still meets the specified environmental quality standard.

(e) Sulfate

Sulfate in big quantity will raise water acidity. Sulfate ion may occur on natural process. Sulfate ion by bacteria is reduced to be sulfide on an-aerobic condition and further the sulfide is turned out to be hydrogen sulfide. In aerobic situation, hydrogen sulfide is oxidized on bacteriology basis to become sulfate. In the form of H_2S, it is poisonous and has terrible smell characteristic. The analysis result at the sampling location shows that the sulfate content is between 2.93 - 3.42 and still below the specified environmental quality standard.

(f) Free Ammonia

Ammonia in the surface water (water body) may resulted from degradation either on aerobically or an-aerobically of materials containing nitrogen element such as protein. Ammonia in surface water may produce odor. The analysis result shows the free ammonia content at all locations is between 0.10 - 0.17 mg/l and still below the specified environmental quality standard.

(g) Nitrite

Low and high nitrite compound in the water is determined by nitrogen and oxygen compound decomposed by the bacteria. Nitrite in big quantity will bind oxygen in the water that will lead to lack of oxygen in the water so the soluble oxygen content becomes low. Nitrite content in the water body at all sampling locations is still below the specied quality standard (0.06 mg/l).

(h) Soluble Oxygen

Soluble oxygen is a basic need for water biota life in the water. The living creature's life in the water depends on the water capability to maintain the minimum oxygen concentration required for their life. Fishes are water biota requiring the most oxygen, followed by

invertebrate and the least is bacteria. Warm water biota requires minimum 5 ppm soluble oxygen, and cold water biota needs close to the saturated soluble oxygen.

The soluble oxygen in the water is mainly come from water plants photosynthetic process and from atmosphere (air) that enters into the water with limited speed. The soluble oxygen concentration in saturated condition depends on the atmosphere temperature and pressure. At 20°C and one atmosphere, the soluble oxygen concentration in saturated condition is 9.2 ppm, and under 50°C with the same atmosphere pressure the saturation concentration is 5.6 ppm. Higher water temperature will have lower the soluble oxygen concentration.

Too low soluble oxygen concentration will cause nekton and other water biota that needs oxygen to die. On the contrary, too high soluble oxygen concentration will cause faster rusting process because oxygen will bind with the hydrogen that layers metal surface. Measurement result of soluble oxygen to the sample in the water body at study area shows the soluble oxygen content is between 7.02 - 7.38 mg/l, this means it still supports the water biota life existing in the water bodies (>6 mg/l).

(i) Biological Oxygen Demand (BOD_5)

Organic substance in the water body consists of elements of carbon, hydrogen, oxygen and other additional element such as nitrogen, sulfur and so on that is inclined to absorb oxygen. The oxygen is used to loosen organic compound.

BOD_5 value indicates degradable organic material content, stated in oxygen quantity needed for the degradation process. The higher BOD_5 value of a surface water, the worse the surface water quality is. The permissible maximum limit is 2 mg/l. The analysis result of surface water quality at all locations shows BOD value is between 0.15 - 0.24 mg/l and still meets the quality standard (2 mg/l).

(j) Chemical Oxygen Demand (COD)

COD value indicates organic compound in the water and stated as mass of oxygen consume per liter solution to degrade biodegradable and to oxidized everything in the water that can be oxidized. The higher COD value of a surface water, the worse the surface water quality is. The analysis result of surface water quality shows COD content at all locations still meets the quality standard, that is less than 10 mg/l.

Groundwater

Investigations for shallow groundwater in the areas around pads C & E found no evidence of groundwater. The region is characterized by groundwater resources at depth which in the case of geothermal activities comprise the resource for energy, in the form of steam. As part of the Phase 1

investigations, groundwater geochemistry is analyzed in the context of suitability for geothermal energy production.

4.5 Space, Land and Soil

Based on the Layout Plan of Muara Enim District of 2004, the activity plan area is a mining development area that the oil and natural gas production operational has been in conformity with the allocation.

Based on the field study, it can be concluded that the dominant soil in the monitoring study area is Ultisol type. This soil is classified as cluster of developed soils with weathering process and advanced pedogenesis. Advanced weathering and pedogenesis process that forms this soil is triggered by rainfall and high soil temperature so that the climate destructing process becomes faster.

Study on landscape at study location covered in Pagaralam region shows the land is classified into wavy and hilly physiographic. The land condition when clearing will be sensitive to erosion and landslide. This condition occurs for the soil characteristic is texture crumb containing sand and some of them is graveled that the soil structure is loose, and inter-soil particle binding agent is very weak for lack of organic material. In addition the solum is shallow, even the soil contains pebbles and rocks, clear condition impedes root growth. Based on several soil physical parameters, the soil needs particular treatment when opened for an activity so that the loss of upper part solum impact can be minimized.

Based on the field study on soil condition covered in Pagaralam city region is concluded that the dominant soil is Brown Andosol and Brown-reddish Latosol. The Andosol soil is coined from ando, known as volcanic soil. The soil is black, from remaining volcanic ashes, has deep solum. This soil has crumbs structure, light texture, loose and fertile. Physically this soil has good characteristic as it has high porosity, good aeration and thus plant roots penetration will be easier. It is vastly suitable for vegetation and horticulture. However, soil binding power becomes very weak that the soil is sensitive to erosion and landslide.

Based on the explanation above, the soil type is suitable with the region condition, where Pagaralam City is affected by Mount Dempo activity. Andosol soil is situated in the slopes of volcano. The soils are generally black in color (epipedon mollik or umbrik) and has kambic horizon; bulk density is less than 0.85 g/cm^3, most of them contains amorf or more than 60% consist of vitric volcanic dust, cinders or other pyroclastic materials. Andosol is soil having volcanic dust main material, relative young soil than latosol and podsolik, which the characteristics are highly determined by clayey mineral contained in it, namely alofan with amorf characteristic. This soil has A1 black thick horizon for it is rich of organic materials, but does not have A2 horizon, with yellow horizon B, brown-yellowish or brown followed with decayed volcanic dust sediment to the horizon C in general has saturated relative low alkali but it has relative high exchangeable A1. By its dominant clayey mineral characteristic, then the andosol has ticsotrophic nature, has big water binding power, high porosity, low content weight, loose, non-plastic and not sticky, as well as has high phosphate fixation capacity.

4.6 Biologial Components / Flora and Fauna

4.6.1 Flora

Mixed Plantation Vegetation, Rubber and Coffee Plantation

Vegetation quality in one habitat can be seen from the variety of types, habitués and the growth, which shows plants environment condition in a region in closely respect with the vegetation function in the ecosystem. The variety of plant types will describe the stability of an ecosystem that supports wild animal life either as their habitat, protected area, proliferation or feeding area. Habitat and plant growth condition may give roles to improve environmental quality both as protection spot, hydrology regulator, soil protector and sound-damper and aesthetic value. Improvement of environmental quality by plants is due to their capability of making photosynthetic process that absorbs exhaust gas (CO_2 gas) and produces oxygen (O_2) that human and animal will use them for respiration process. In addition, vegetation may function as sound-damper and soil protector based on the plant condition and the habitat and layers as well as the crown density of plants. Beside, variety of plant types in a location will support the variety of wild animal types.

Field survey result shows that vegetation growth around the geothermal exploration area at Segamit village is relatively good as characterized by the plant good growth of mixed plantation vegetation and rubber plantation of the locals.

Based on the habitat, plant types that compose the plants community at this location consist of trees, clump and herbal. In general, dominant plant types other than rubber are low plant types dominated by edible fern (Gleichenia linearis) and teki grass (Cyperus monocephala). Kind of dominant clump types are bating angin (Mallotus paniculatus) and seduduk (Melastoma malabothricum). In the meantime kind of trees are varied from cehu (Litsea sp), simper (Dillenia excelsa) to sungkai (Peronema canescens). Composition of plant types round in the study area is classified as medium variety as human intervention to the land for plantation activity mainly rubber plantation.

Table 4.6: Types of Flora around Study Area

No	Local Name	Latin Name	Location	Estimated Population *)	
				2011 1)	2013 2)
1	Cehu	*Litsea sp*	Drilling Camp, Water Reservoir, Wellpad B, Contractor Camp	++	++
2	Waru	*Hibiscus tiliaceus*	Wellpad B	+	+
3	Simper	*Dilenia excelsa*	Contractor Camp, Water Reservoir, Wellpad B	+	+
4	Sungkai	*Peronema canescens*	Contractor Camp, Wellpad B	-	-
5	Sere	*Schima bancano*	Drilling Camp	+++	+++
6	Bungur	*Lagerstroemia speciosa*	Wellpad B	++	++

7	Ketepeng	*Casia alata*	Wellpad B, Drilling Camp	+	+
8	Mahang	*Macaranga sp*	Water Reservoir, Wellpad B, Contractor Camp	+	+
9	Terap	*Artocarpus elastica*	Wellpad B, Drilling Camp	+	+
10	Antanan	*Lantana camara*	Wellpad B	+	+
11	Bambu	*Bambusa* sp	Contractor Camp	+	+
12	Rumput segitiga	*Cyperus* sp	Wellpad B, Drilling camp, Water Reservoir	++	++
13	Jambe mawar	*Eugenia jambos*	Wellpad B	+	+
14	Pulai	*Alstonia scholaris*	Drilling Camp	++	++
15	Bating angin	*Mallotus paniculatus*	Wellpad B	++	++
16	Rumput teki	*Cyperus monocephala*	Wellpad B, Water reservoir, Drilling Camp	++	++
17	Sikejut	*Mimosa pudica*	Wellpad B, Water reservoir	+	+
18	Paku resam	*Gleichenia linearis*	Wellpad B, Water Reservoir, Drilling Camp	++	++
19	Seduduk	*Melastoma malabothricum*	Contractor Camp, Water Reservoir, Wellpad B	++	++
20	Medang perawas	*Actinodaphne sp*	Wellpad B	+	+
21	Merbau	*Intsia sp*	Wellpad B	+	+
22	Merawan	*Hopea globosa*	Wellpad B	+	+
23	Sepat	*Vatica maingayi*	Drilling Camp, Wellpad B	+	+
24	Leban	*Vitex pubescens*	Wellpad B	+	+
25	Sirih hutan	*Piper sp*	Drilling Camp, Wellpad B	+++	+++
26	Temalun batu	*Hopea sangal*	Wellpad B	++	++

Remark: - = rare ; + = few ; ++ = many ; +++ = abundant

Source:

1. Observation and interview data, Baseline Survey for UKL - UPL document, 2011
2. Observation and interview data by PPLH Unsri, 2013 for UKL - UPL Monitoring

Cultivation Vegetation

Cultivation plant types found around the study area have high variety. High variety of plant types is caused by locals' custom to plant variety plants despite of the total individual of each of plant types is few. This variety of cultivation plants is based on their needs of the plants, for instance vegetables, fruits, protective plants and decorative plants.

Table 4.7: Cultivation Vegetation Types at Segamit Village

No	Local Name	Latin Name	Estimated Abundance
1	Jengkol	*Pithecellobium jiringa*	+
2	Petai	*Parkia peciosa*	++
3	Kopi (coffee)	*Cofea Arabica*	+++
4	Pepaya (papaya)	*Carica papaya*	+
5	Kelapa (coconut)	*Cocos nucifera*	+++
6	Pisang (banana)	*Musa paradisiaca*	++
7	Rambutan	*Nephellium lappaceum*	+
8	Mangga (mango)	*Mangifera indica*	+
9	Jambu bol	*Eigenia malacencis*	+
10	Ganyong	*Canna edulls*	++
11	Belimbing (starfruit)	*Averrhoa carambola*	+
12	Embacang	*Mangifera foetida*	+
13	Nangka (jackfruit)	*Arlocatpus integra*	++
14	Pinang	*Areca cathecu*	+
15	Sukun	*Artocarpus communis*	+
16	Alpukat (avocado)	*Persea gratissima*	+++
17	Kuini	*Mangifera odorata*	+
18	Jeruk (orange)	*Citrus aurontifolia*	+

Source: Primary data, April 2011
Remark: + = few ; ++ = many ; +++ = abundant

4.6.2 Fauna

A preliminary desktop habitat assessment has been undertaken for the project site area. The assessment was based on a review of key global and national biodiversity datasets and spatial mapping provided through the Integrated Biodiversity Assessment Tool (iBAT). In addition, a field survey and interviews were held in the project area. Key findings are summarized below.

Tiger Conservation Landscapes

The project area is within or adjacent to a tiger conservation landscape (TCL) considered to be of "regional priority" landscape for Sumatran tigers, a critically endangered species. A regional priority landscape is considered to have a moderate probability of supporting the persistence of Sumatran tiger populations in the long-term.

This TCL forms part of a wider landscape corridor situated between a TCL of "global priority" to the northwest and a TCL of "long-term priority" to the south east of the project area (WWF, 2005). Based on the available mapping, there is a reasonable possibility the tigers may periodically utilize the project areas as part of a home range within the landscape. The Sumatran tiger is listed as Critically Endangered (CR) by the IUCN Red List of Threatened Species. The regular occurrence of at least one individual of a CR species in the project area would be a potential trigger for considering the area as critical habitat (IFC, 2012).

Assessment for other species of conservation significance

The project area is within or adjacent to the Gunung Patah Protection Forest. Data from the World Database on Protected Areas lists 165 species recorded within the IUCN Red List of Threatened Species whose ranges overlap with the protected area boundaries. Given suitable habitat, these species may potentially be found close to the area. This includes eight endangered mammal species (see list below).

Table 4.8: Types of Fauna Identified in the Preliminary Desktop Assessment

No	Latin Name	Local Name	Species type	IUCN Red List Classification
1	*Cuon alpinus*	Dhole	Mammal	EN
2	*Elephas maximus*	Asian Elephant	Mammal	EN
3	*Hylobates agilis*	Agile Gibbon	Mammal	EN
4	*Manis javanica*	Sunda Pangolin	Mammal	EN
5	*Panthera tigris*	Tiger	Mammal	EN
6	*Presbytis melalophos*	Sumatran Surili	Mammal	EN
7	*Pteromyscus pulverulentus*	Smoky Flying Squirrel	Mammal	EN
8	*Symphalangus syndactylus*	Siamang	Mammal	EN

Note:
EN = endangered species

Results of Surveys and Interviews

The following information was obtained through site surveys and interviews. Field survey and interview results with number of local persons living around the study location found that kind of wild animals that frequently are found around the study location can be classified into 4 (four) groups namely Amphibian, Reptile, Aves and Mammal. The medium variety of wild animal around the location is due to the location is close to the society housing and part of lands is cleared for plantation by locals mainly for rubber, coffee and mixed plants plantation.

Apart from that some part of local society has animal hunting hobby mainly economic-value animal and edible animal such as deer, napu and antelope. Thus, those hunted animal population is getting lessened in the habitat.

Amphibian type frequently found is swampy frog and rice field frog mainly at location near the swampy areas. Kind of reptile frequently found is newt, monitor lizard, rice field snake, cobra and welling snake. Kind of aves (bird) that frequently found is large turtledove, swift, and sparrow. Kind of mammals frequently found is pig, monkey and long-tail monkey.

Kind of wild animals found around the location among other things are protected animals such as partridge, deer and scaly anteater.

The types of fauna in the study area were observed through direct observation in the field as well as through information from the local population. Data is presented in Table below.

Table 4.9: Types of Fauna

No	Latin Name	Local Name	Location	Population Status	Estimated Population *)	
					2011 1)	2013 2)
	Amphibian Class					
1	*Rana pipiens*	Swamp frog	Water reservoir	TDL	++	++
2	*Rana cancrivora*	Rice field frogs	Access Road	TDL	++	++
3	*Bufo melanopticus*	Bangkong	Wellpad B	TDL	+	+
	Reptilia Class					
4	*Mabouya sp**	Lizard	Semak belukar	TDL	+	+
5	*Varanus salvator*	Monitor Lizard	Lake Deduhuk	TDL	+	+
6	*Calotus* sp*	Bengkarung	Lake Deduhuk	TDL	+	+
7	*Trionyx* sp*	Labi-labi	Lake Deduhuk	TDL	+	+
8	*Naja naja**	Cobra	Wellpad B	TDL	++	++
9	*Angkistrodon* sp*	Ground snakes	Lake Deduhuk	TDL	+	+
10	*Tritneresurus* sp*	Tree viper	Lake Deduhuk	TDL	++	++
11	*Bungarus* sp*	Weling snake	Lake Deduhuk	TDL	++	++
	Aves Class					
12	*Geopelia striata*	Turtledove	Wellpad B	TDL	+	+
13	*Pycnonotus aurigaster*	Finch	Access Road to Site Location	TDL	+	+
14	*Streptopelia chinensis*	Cuckoo	Access Road to Site Location	TDL	++	++
15	*Hirundo* sp	Layang-layang	Water reservoir	TDL	++	++
16	*Centropus sinensis*	But-but	Bushes	TDL	+	+
17	*Corivnia* sp	Berbah	Plantations dan Bushes	TDL	++	++
18	*Lonchura* sp	Sparrow	Plantations dan Bushes	TDL	+++	+++
19	*Streptopelia* sp*	Titiran	Bushes	TDL	-	-
20	*Ducula* sp*	Balam	Access Road to Site Location	TDL	-	-
21	*Copsycus* sp	Ground magpie	Bushes	TDL	+	+
22	*Gallus gallus**	Partridge	-	DL	+	+
23	*Turnix* sp	Quail	Bushes	TDL	++	++
	Mammals Class					
24	*Sus scrova**	Boar	Various locations	TDL	++	++
25	*Macaca* sp	Monkey	Wellpad B	TDL	++	++
26	*Manis javanica**	Trenggiling/ Anteaters	-	DL	+	+
27	*Hystrx* sp*	Hedgehog	-	TDL	+	+
28	*Pteropus* sp	Bat		TDL	+	+
29	*Tragulus napu**	Napu	-	DL	+	+
30	*Cervus* sp*	Deer	-	DL	+	+

31	*Presbyter* sp*	Hoop	-	TDL	++	++
32	*Paradoxurus* sp	Weasel	Lake Deduhuk	TDL	+	+
33	*Macacus* sp*	Cingkuk	-	TDL	+	++

Source :
1). Observation and interview data, Survey for UKL - UPL document, April 2011
2. Observation and interview data by PPLH Unsri Biology Team, December 2013
Note:
**) Interview Results :*
-: information from local community
Population Status : TDL (Tidak Dilindungi) = Not Protected ; DL (Dilindungi) = Protected
Estimated Population : Many (+++) ; Moderate (++) ; Few (+)

4.6.3 Water Biota

Plankton

Plankton is heterogenic microorganism consisting of phytoplankton and zooplankton with very small size and microscopic in nature, flying in the water, move passively and the movement is highly affected by water movement or wave. Getting more the plankton species living in the water body, getting better the waters quality are. To study the initial setting of plankton community, the plankton samples around the activity plan location are taken from Asahan River, Endikat River, Ampar River and Cawang River.

Composition and abundance of plankton community in the waters around the activity location is between 23 - 31 types with abundance of 130.6 - 328.6 individual/liter. In general the abundance of individuals of each type is almost average in quantity and no dominant species is found. This describes the water condition is very good to support all plankton types living in it and no extreme nature to one plankton type. The computation result of index value of variety type is about 2.926 - 3.301, including the variety of medium-high category.

Based on the variety index value criteria of Shanon - Wiener, the plankton variety of Endikat River, Cawang River and Ampar River is classified as high variety category for the index value of variety type is more than 3. Low and high value of plankton variety is highly depended on the quantity of species and total individual of each species. The variety value will be high if the total species is in bulk and total individual is commonly available. High variety of this plankton type is useable as one of indicators that the waters quality is very good to support the biota life. Visually the water quality around the location is categorized as clean water.

Table 4.10: Composition, Abundance and Variety of Plankton in Waters around the Activity Plan Location

No	Taxonomy	Sampling Location			
		Endikat	Cawang	Asahan	Ampar
	PHYTOPLANKTON				
	Bacillariophyceae				
1	Amphora sp	6,2	4.0	7.6	-
2	Diatoma sp	10.8	16	-	5.2
3	Navicula sp	28.4	26.6	2.6	-
4	Nitzschia sp	18.6	14.8	10.8	-
5	Pinnularia sp	10.2	9.6	-	7.4
6	Frustlia sp	9.6	10.2	8.4	4.4
7	Eunotia sp	7.2	6.8	-	2.0
8	Stauroneis sp	6.6	7.6	3.4	-
9	Coscinodisus sp	4.6	4.2	-	-
10	Gyrosigma sp	-	4.6	12.4	2.0
	Chiorophyceae				
11	Cosmarium sp	16.2	14.6	7.6	4.0
12	Scenedesmus sp	18.8	12.8	3.4	6.6
13	Pediastrm sp	10.2	6.6	7.0	10.2
14	Ulothrix sp	-	10.2	-	6.2
15	Zygnema sp	9.8	7.6	6.8	11.4
16	Penium sp	6.4	5.6	4.6	4.6
17	Crucigenia sp	4.2		12.0	-
18	Angkistrodesmus sp	12.4	3.4	-	4.2
19	Spirogyra sp	6.8	3.4	-	2.6
20	Oscillatoria sp	16.4	26.6	3.2	8.6
21	Phormidium sp	7.6	8.8	6.2	11.2
22	Microcystis sp	6.4	12.0	4.2	
23	Calothrix sp	-	4.2	-	3.8
24	Colesosphaerium sp	4.6	-	3.0	-
25	Sprirulina sp	10.6	8.6	-	9.6
	Desmidiacea				
26	Closterium sp	12.2	9.6	7.4	7.0
27	Desmidium sp	6.8	6.0		4.0
28	Staurastrum sp	7.4	4.6	3.6	-
29	Euastrum sp	3.6	2.4	-	3.0
	ZOOPLANKTON				
30	Euglena sp	14.6	12.4	-	7.0
31	Phacus sp	18.2	16.2	6.0	6.8
32	Diaptomus sp	6.8	30.6	-	-
33	Asplanchna sp	7.4	-	7.4	-
34	Tranchelomonas sp		6.4	5.2	2.4
35	Nauplil sp	12.8	-	2.0	3.6
	Total Type	31	31	23	23
	Abundance (individual/liter)	328.6	317.2	136.0	130.6
	Variety index (H')	3.301	3.171	2.926	3.051
	Variety Criteria	High	High	Medium	High

Source: Analysis result of Biology Team, April 2011

Benthos

Benthos, either of pythobenthos or zoobenthos, is waters organism living at the bottom and over the sediment in the bottom of waters or stuck to the rocks, vegetation or dead wood. The existence of benthos in waters is highly affected by water physical condition such as substrate, turbidity, flow, depth and temperature. In addition, it is also influenced by chemical factor such as pH, soluble oxygen and toxic materials as well as biological factor such as competitors and predators. Thus, the composition, abundance and variety of zoo-benthos type in the waters are highly depended on the waters quality and quantity. In polluted waters either organic or non-organic, the composition of zoobenthos type and the variety will be low, on the contrary in the unpolluted waters the composition and variety of type will be high.

The presence of zoo-benthos in the waters are important in term or the food-chain for benthos has the function as food sources of other animals living in the bottom of waters and also functions in the organic substance decomposing process such as leaves and small branch either from vegetation around the waters or from domestic waste of household waste. Thus, the composition of zoo-benthos type and the abundance and the variety may also be a quality indicator of water.

Table 4.11: Composition, Abundance and Variety of Benthos in Waters around the Activity Plan Location

No	Taxonomy	Sampling Location			
		Endikat	Cawang	Asahan	Ampar
	Olighochaeta				
1	Limnodrillus sp	10	1	-	7
	Annelida				
2	Nephelopsis sp	-	-	5	-
	Insecta				
3	Baetis sp	6	2	-	2
4	Polipedilum sp	16	-	3	9
5	Aphylla sp	-	4	2	-
6	Ephoron sp	2	6	-	2
7	Paragomphus sp	1	6	1	7
8	Chimarra sp	2	13	6	1
9	Dicranota sp	4	-	6	-
10	Stenelmis sp	2	-	-	9
Total of Types		8	6	6	7
Abudance (Individu/400 cm^2)		45	32	23	37
Index of Diversity (H')		1.606	1.529	1.645	1.725
Criteria of Diversity		Medium	Medium	Medium	Medium

Source: Analysis result of Biology Team, April 2011

Nekton

Abundance and variety of fish types (nekton) in the waters around the activity location is low. The low variety of fishes in the waters is due to the waters are situated in the mountainous area having steeply sloping side so fishes are washed away to the lower river flow. Based on the interview with the local persons that fishing activity by the society is not much done for the fishes habitats are out of reach.

Table 4.12: Fishes (Nekton) Type In the Waters

No	Local Name	Latin Name	Location			
			Endikat	Cawang	Asahan	Ampar
1	Timah	Aphocheis panchax	+	+	++	++
2	Shrimp	Crustacea spp	+++	-	+	+
3	Tilan	Mastacembelus armatus	+	-	+	+
4	Seluang	Rasbora aegyrotaenia	++	-	-	+
5	Freshwater catfish	Clarias batrachus	++	-	+	++
6	Cingkak	Cyprinus sp	+	-	+	++
7	Julung Sungai	Tylosurus annulatus	+	-	-	++
8	Tempalo	Betta taeniata	+	-	+	+

Remark: + = few ; ++ = many ; +++ = abundance

5. Environmental Assessment

5.1 General

This section of the report deals with following parts of the UKL-UPL report:

- Categorization of environmental threats.
- Collective impacts on the environment of the area.
- Most likely impacts of the project on the area.

This section of the report has been prepared in conformity of the guidelines for UKL-UPL. This process is described here to ensure that:

- Most likely impacts can be identified and properly assessed.
- The interaction between the Project components and environment are adequately described.
- Possible Project activities that can lead to an environmental disturbance are identified separately and described along with the level of intensity.

5.1.1 Methodology of Environmental Assessment

This environmental assessment was carried out using a standard methodology, in line with the national regulations. This environmental assessment was performed to determine the Project's prospective environmental effects, so as to ensure that these are given consideration in minimizing the effect of the Project's activities on the physical, ecological and socioeconomic environments. These activities have been summarized for the exploration phase of the Project. These activities are to identify any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural value or scientific concern.

5.1.2 Findings of Environmental Assessment

After a detailed and extensive environmental study it is observed that none of the Project intervention can be of the magnitude that can cause potential environmental degradation in the Project area. Though there are some of the Project components that involve low to moderate environmental degradation, but these can be minimized or gradually can be avoided and mitigated in due course of time. These are discussed in detail in the following section.

5.2 Environmental Issues Identified

Environmental issues associated with the Project are evaluated separately. The key environmental issues during the exploration phase relevant to the proposal that were identified for detailed evaluation in this report are:

- Surface Water Quality
- Ground Water Quality
- Air Quality and Noise
- Soil Quality and Erosion Potential
- Aquatic Biota
- Biodiversity, Conservation and Sustainable Natural Resource Management
- Socio-economic and Culture

5.2.1 Surface Water Quality

Type of Impact

Impacts that may arise in relation to surface water include the decline in water quality (ie. Increase in turbidity, pollution, etc.) due to the creation of access roads and wellpads as well as increasing discharge runoffs and dissolved solids that go into the receiving water bodies.

Source of Impact

- Construction of access roads to the wellpads.
- Construction of the cellar and foundation of the rig.
- Construction of the waterpond and mudpond.
- Construction of storage yard, accommodation and other supporting facilites

The severity of this issue can be categorized as low.

5.2.2 Ground Water Quality

Type of Impact

Impacts that may arise in relation to shallow ground water include potential leakage of drilling mud and cuttings from the well into the groundwater. However, for geothermal wells the primary drilling compound is a mix of water and bentonite which is a natural and low hazard material. Furthermore, once the drill casings are in place the risk of egress of drilling mud into shallow groundwater aquifers is effectively mitigated.

Source of Impact

Inadequate casing construction resulting in egress of drilling mud (bentonite).

The severity of this issue can be categorized as low.

5.2.3 Air Quality and Noise

Type of Impact

Decrease in air quality due to the construction and production activities (ie. the mobilization of heavy equipments and materials, etc.).

The project will have no negative transboundary issues. Should the project proceed to Phase 2, Phase 2 will have a positive transboundary impact by reducing greenhouse gas emissions.

Source of Impact

Sources impacts comes from the operation of transport vehicles for the mobilization of heavy equipment, mobilization of manpower, equipment, and drilling materials, as well as the operation of the generator set.

The severity of this issue can be categorized as low.

5.2.4 Soil Quality

Type of Impact

Land clearing activities during construction of roads and wellpads will have an impact, particularly in soil quality and erosion potential.

Source of Impact

Sources impact comes from the changes in physical-chemical properties of soil and soil erosion.

Soil Erosion Potential

Soil erosion is one of the key indicators that can reflect the condition of some physical and chemical properties of the soil other than the direct impact of activities. The severity of this issue can be categorized as low to medium.

5.2.5 Quality of Aquatic Biota

Type of Impact

Type of impact may come in the form of change in composition and abundance in aquatic biota.

Source of Impact

Source of Impact during the Construction phase is derived from:

- Construction of Access Roads to Drilling Site.
- Cut and Fill activities at wellpad locations.

The severity of this issue can be categorized as low.

5.2.6 Biodiversity, Conservation and Sustainable Natural Resource Management

Type of Impact

Impacts that may arise from issues regarding flora and fauna include change in the composition and abundance of flora and fauna around location of Project activities.

Source of Impact

Source of impact comes from land clearing for:

- Access Road for Project activities.
- Wellpads.
- Facilities and infrastructure to support activities.

The severity of this issue is currently categorized as low, however further assessment will be undertaken should fauna monitoring indicate potential threats to endangered species habitat as set out in the Environmental Management Plan in Section 5.5 below.

5.2.7 Socio-economic and Culture

Type of Impact

Changes in the socio-economic and cultural aspect of the community in the Project area includes: employment opportunities, business opportunities, and public perception.

Source of Impact

The main source of impact in terms of socio-economic and cultural issues is the number of nearby residents who are given employment during SERD's activity as well as the perception of the

communities during land acquisition and recruitment process. The severity of this issue can be categorized as medium.

5.2.8 Occupational Health and Safety

Type of Impact

Activities that involve manual labour or mechanized equipment during mobilization, landclearing, construction of access road, wellpads and exploratory drilling will have impacts to person, material, equipment and environment.

Source of Impact

Source of impact may come from :

- Vehicle accident
- Contact between equipment and a person
- Obnoxious / poisonous (H_2S) gas release
- Fall form height
- Landslide
- Flood
- Wild animal interference
- Fatigue
- Food poison

The severity of this issue is ranging from low to high. A comprehensive Safety Health Environment (SHE) system has been established to address foreseen issues and compliance is audited by the Site Management, Corporate and relevant regulatory bodies.

5.2.9 Community Health and Safety

Type of Impact

- Injury or fatality from site based energy hazards.

Source of Impact

- Trespassing leading to exposure to construction and operational machinery.
- Risks to the community are addressed in SHE Program and Forest management Plan.

5.3 Information Disclosure, Consultation and Participation

Consultations began in 2011 and involved local government and related agencies, affected communities and groups, local non-government organizations (NGOs), and other related stakeholders. The consultations were conducted in a culturally appropriate manner (using both Bahasa Indonesia and the Semendo dialect) with facilitators from the leaders of Semendo community. In 2011, the borrower carried out an initial socialization with the communities, informing them of the project, the land acquisition process through negotiated settlements, the role of the village institutions, and potential opportunities and benefits to the project area. Using topographic maps, pictures, and presentation materials with information on project impacts and mitigation measures, persons directly affected by the project activities were further informed and consulted through focus group discussions and in-depth interviews. In an effort to raise community and stakeholder awareness, the borrower organized a field trip for the communities, local leaders, and government representatives to Kamojang Geothermal Power Plant in West Java. Based on the field visits and subsequent consultations with the borrower, the communities provided a statement of support notification.

The proposed project will offer limited employment opportunities for the local people, primarily during the civil works construction phase. In the First Phase around 314 persons were employed. This is in line with the community request to prioritize local worker over outsiders.

This project will have a relatively short construction period, and will require a relatively small number of skilled and semi-skilled workers, including general labor, construction workers, procurement clerk, camp clerk, driver, trafficman, foreman, surveyor, welder, foreman, operator crusher, storeman, mechanic and time keeper. The project developer should accommodate as much local labor as possible from the local area so that Short-term positive economic impacts to area businesses may result from increased income and worker's expenditures for meals, lodging, etc.

5.4 Grievance Redress Mechanism

A Grievance Resolution Mechanism has been established for the project. The project will utilize various ways to socialize this Grievance Resolution Mechanism and to create community-level awareness of the grievance procedure. Specifically information will be provided through direct communication during consultation and community meetings. More specifically, upon request, each complainant will receive a written copy of this document once the complaint is logged.

The Project's activities are based on the concept of partnership. However, the Project recognizes that complaints during the Project development may arise. The Project also recognizes the need to acknowledge such complaints or claims and to have an established grievance tracking and resolution mechanism to efficiently and transparently address issues as they arise. Accordingly community members in the Project area, in particular villagers in the primary impact areas will have access to the grievance tracking and resolution mechanism as described below. The Project commits to ensuring that complainants can lodge and resolve complaints without cost and with the assurance of a timely response to the claim.

While the Project aims to resolve the majority of individual, group and community grievances by direct resolution at individual or group level, a hierarchal grievance resolution mechanism has been developed as follows:

1. Direct resolution at the individual or group level;
2. Community-level resolution through public meetings;
3. Resolution through a stakeholder group comprising Project representatives, government representatives, religious and village leaders, and the complainants; and finally
4. Recourse to legal counsel if the grievance cannot be resolved.

The Project will establish a centralized grievance log and tracking system. This database will be utilized to allow all registered grievances to be tracked and recalled as and when necessary. The Project's performance in managing and closing out grievances will be reviewed as part of internal and external monitoring.

5.5 Environmental Management Plan

This chapter outlines the environmental management and monitoring plan (UKL-UPL) and defines the institutional arrangements required for the implementation of the plan during the exploration phase. The Environmental Management Plan consolidates the environmental as well as socioeconomic mitigation measures identified. The Chapter also presents the environmental and social monitoring requirements for the Project during the exploration phase.

Should monitoring indicate impacts that result in exceeding of Indonesian environmental criteria or potentially significant impacts on flora and fauna, mitigation measures detailed above will be reviewed and appropriate actions will be taken to ensure those impacts are avoided. Specific action plans may also be developed and implemented depending on the nature of the impact. Changes to planned exploration activities may be implemented, if necessary, to avoid unacceptable impacts. The Environmental Management Plan will be updated to reflect any significant changes.

5.5.1 Surface Water Quality

Management Measures

- Perform sufficient compaction at Project location as to not allow rain water to erode.
- Revegetate unused areas using ground cover (cover crop).
- Construct drainage system along the road, at drilling pads and at other facilities.
- Construct silt / sediment traps at low point of drainage system to protect watershed.
- Re-use and recycle water where practicable.
- Isolate construction near / on a river bank by providing a divider or installation of sheet pile.
- Avoid release of contaminated water to the environment.
- Manage water as outlined in Section 2.4.3 above.

Management Period

Managing and monitoring takes place during the construction phase and onwards.

5.5.2 Air Quality and Noise

Management Measures

- Vehicles used for mobilization activities must meet the standards set by the company's operations (still feasible to operate and ensure exhaust emissions and noise generated does not exceed the quality standards that have been set).
- Limit vehicle speed mobilization and demobilization up to 20 km/h when passing through residential areas and wellpads so as not to spread dust to the environment and causing traffic accidents, as well as the installation of signs limiting the maximum speed on roads.
- Conduct watering with water trucks along the transport path and around wellpad activities, as well as construction lines, especially during the dry season during the day to avoid the scattering of dust into the surrounding air.
- Install silencers on equipment that produce high levels of noise.
- Provide a mask and ear plugs for the workforce.
- Plant trees and meeting that serves as a filter for pollutants in the surrounding area of activity.
- Equipment such as generators that produce high levels of noise should be equipped with enclosure (placed in a soundproof chamber).

Management Period

Managing and monitoring takes place during the construction phase and onwards.

5.5.3 Soil Quality and Erosion Control

Management Measures

- Conduct geotechnical study.
- Conduct land clearing in accordance with the needs of the construction activities.
- Construct proper sloping and benching.
- Maintain vegetation land cover along the drilling location to maintain the quality of the top soil.
- Conduct Land Cover Crop (LCC) planting along the location of activities.
- Construct proper drainage system.
- Implement proper soil compaction standard.

Management Period

Managing and monitoring takes place during the construction phase and onwards.

5.5.4 Aquatic Biota

Management Measures

Realization of aquatic biota quality management is done through the management of river water quality that comes from clearing of access roads and wellpads.

Management Period

Managing and monitoring takes place during the construction phase and onwards.

5.5.5 Waste Management

SERD has already established policy and procedures on waste management that shall be implemented by SERD and contractors working in the Project area.

5.5.6 Emergency Response

Emergency Response Procedures and Emergency Response Team have been established to ensure the company will properly react to an emergency. Emergency drills are conducted regularly with different possible scenarios, such as H_2S release, well kick, medical incidents, vehicle incidents, and fire. If deemed necessary for the affected people, company will ensure that the affected people are aware and informed of the proper procedures.

5.5.7 Flora and Fauna

Management Measures

- Land clearing in accordance with the Project needs only.
- Maintain tree vegetation.
- Avoid introduction of invasive alien species
- Revegetate unused land with local plant species.
- Prohibit the hunting of wild animals around Project area.
- Prohibit taking of plant from around the Project area.
- Install warning signs around Project area.
- Carry out inventory of Flora and Fauna species and monitor the changes over time (see specific details set out in the Habitat Assessment section below).

- Prevention of introducing invasive species by educating employees and visitors the hazards of introducing invasive species.
- In the case that Critically Endangered / Endangered species are identified to regularly occur within the project area, further expert assessment would be needed to assess the conservation significance of the project area. The presence of the above species may be potential triggers for the habitat around the project area to be considered "critical habitat" for the endangered species based on the IFC Performance Standard 6 Guidance Note on Biodiversity Conservation.

Management Period

Managing and monitoring takes place during the land clearing phase and onwards.

5.5.8 Occupation Health and Safety

Management Measures

SERD has established various policy and procedures on Safety, Health and Environment to protect the safety and health of employees, contractor workers and communities as well as to protect properties and the environment.

- Ensure worker competency
- Provide personal protective equipment
- Ensure appropriateness of installation and equipment. Obtain certification if necessary.
- Regulate speed limit
- Requirement of safety and traffic signs
- Conduct road maintenance
- Regulate working hours and duration
- Conduct regular medical checkup
- Use of water tank for dust control
- Conduct safety health environment inspection and audit
- Mitigate work risk through provision of standard operating procedures and job safety analysis
- Conduct tool box meeting and regular SHE meeting
- Conduct accident / incident investigation and ensure dissemination of lesson learn

In addition to the measures listed above, specific measures for hazardous materials including explosives are provided in section 2.4.7; and for emergency response procedures in section 5.5.6.

Figure 5.1 : Road Watering and Road Maintenance Activities

Management Period

Managing and monitoring takes place during the preparation phase (survey and mobilization) and onwards.

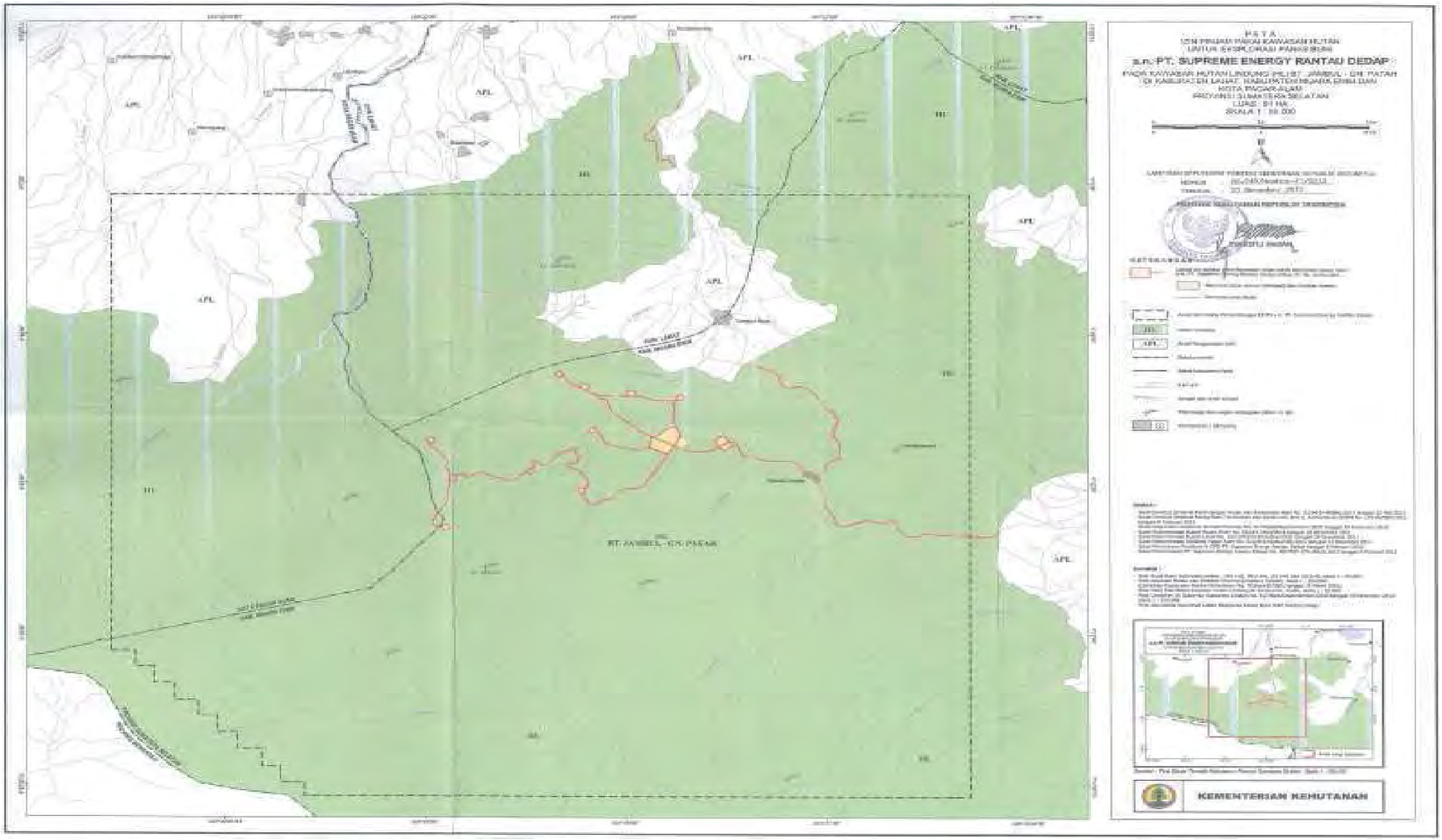
5.5.9 Forest Management Plan

Parts of the location is categorized as Protection Forest to protect water resources for the nearby cities. Although the map showed that the area is a protection forest, in actuality most parts of forest area for the Project have been cleared or used for coffee plantation.

Based on the Forest Borrow and Use Permit (IPPKH) for exploration phase, SERD and the local forestry office have inventorized the trees marked for cutting and pay compensation based on volumetric rate.

As part of the obligation under the Forest Borrow and Use Permit from the Minister of Forestry SERD has established and now is implementing a forest management plan. The Forest Management Plan is included in Appendix 1.

- **Figure 5.2: Forestry Borrow and Use Permit Map**



The Forest Management Plan is a document which constitutes the activities to protect the forest from factors which may cause damage to the trees or plants in the forest in order that the function as to protect, conserve or produce is able to be achieved optimally and sustainably according to its purpose. Meanwhile, the factors that may cause damage to the trees or plants are, among others, encroachments on land, illegal logging, fire, pests, diseases or shepherding.

In composing this document, SERD work together with the provincial and local forestry offices in selecting the necessary types of activities needed to protect the forestry area. SERD is obligated to conduct and fund the implementation of the agreed activities.

Activities under Forest Management Plan are:

No.	Type of Activities
1.	Socialization to local communities
2.	Installation of appropriate forrestry signs
3.	Data Collection and Mapping of potential Security Disturbance to the forest
4.	Form forest security task force
5.	Security Guarding / Patrol of the Forest (including forest fire control)
6.	Coordination with Relevant Agencies
7.	Establish facility and infrastructure for Forest Protection
8.	Training for Forest Fire Control
9.	Forest Protection Operation (to prevent illegal deforestation / logging)
10.	Forest Fire Fighting

5.6 Environment Monitoring Plan

Given the minimal and low impact classifications for most of activities associated with the exploration phase of this Project, a number of monitoring program is proposed. The proponent will maintain a file and respond to written concerns about environmental impacts of the Project on an ongoing basis. Upon the construction phase, the site will be inspected to ensure that any areas that require, erosion control, or other reclamation measures have been adequately addressed. As turnkey operator of the Project, the contractor will ensure that all site personnel adhere to the general environmental protection measures and specific mitigation measures are prescribed for developing this site. Although the Project is expected to have no significant long-term impact on the environment, the proponent will document environmental, social as well as cultural cases / issues throughout the exploration phase.

5.6.1 Surface Water Quality

Monitoring Location

Surface Water Quality Monitoring Locations:

No	Location	Code	Coordinates	
			S	E
1	Endikat River	AS-1	04° 12, 106’	103° 25, 691’
2	Cawang Kiri River	AS-2	04° 12, 514’	103° 25, 210’
3	Asahan River	AS-3	04° 12, 620’	103° 25, 013’
4	Ampar River	AS-4	04° 12, 785’	103° 24, 674’

Parameters Monitored

The parameters monitored for water quality follows the South Sumatera Governor Regulation No. 16 Year 2005 concerning the Designation of Water and Water Quality Standards for the Province of South Sumatera.

Monitoring Method

Surface water quality monitoring is done by taking water samples at specific sample points, and tested in a licensed laboratory in order to see the rate of change and quality according to existing standards.

Duration and Frequency of Monitoring

As a company commitment stated in the UKL-UPL document, SERD is required to perform water quality monitoring activities that include chemical testing of water properties as specified in relevant GOI regulations three times during the exploration phase, ie. one time during the construction phase, one time during the drilling phase and one time during post-operation. However to be able to monitor and detect as early as possible as to whether a change in the surrounding surface water occurs, SERD plans to conduct surface water quality monitoring every six months.

5.6.2 Air Quality and Noise

Monitoring Location

Ambient Air and Noise Level Monitoring Locations:

No	Location	Code	Coordinates	
			S	E
1	Access Road to Wellpad B	U-1	04° 12’ 055”	103° 27’ 664
2	Wellpad B Location	U-2	04° 12’ 416”	103° 24’ 328”
3	Segamit Village Dusun 3	U-3	04° 12’ 569”	103° 25’ 013”

Parameters Monitored

Air Quality and Noise Level Monitoring Parameters are based on:

- Indonesian Government Regulation No.41 Year 1999 regarding the National Ambient Air Quality Standards.
- South Sumatera Governor Regulation No. 17 Year 2005 regarding the Ambient Air Quality Standards.
- Minister of Environment Decree No. 48Year 1996 regarding the Noise Level Quality Standards.

In addition to monitor air quality, noise level measurements are also performed.

Monitoring Method

Methods for monitoring the ambient air quality is done through field sampling in accordance with the coordinates of the baseline, followed by laboratory analysis to see the difference between the data before and after presence of project activities.

Duration and Frequency of Monitoring

As a company commitment stated in the UKL-UPL document, air quality and noise monitoring activities are conducted one time during the construction phase and one time during the drilling phase. Construction and drilling phase is done in parallel.

5.6.3 Soil Quality

Monitoring Location

Soil Quality Monitoring Locations:

No	Location	Code	Coordinates	
			S	E
1	Project Access Roads	T-1		
2	Wellpad B	T-2	03° 23’ 164”	95° 34’ 310”

Parameters Monitored

Monitoring of soil quality and soil erosion rate are based on the Land Research Center (PPT, 1993) and BRLKT (1991) standards.

Soil Quality and Soil Erosion Rate Parameters:

Type of Impact	Parameter	Quality Standards	Method
Chemical Soil Fertility	pH, N-total, PBray, Kdd, Na,Ca, Mg, KTK,Al-dd,H-dd, Kej. Base.	PPT (1990),	Laboratory Analysis
Level of Soil Erosion	**Physical and Chemical** (Texture; permeability; structure; C-Organic, RPT, and Soil Color)	PPT (1990), and BRLKT (1991).	Laboratory Analysis and USLE Method

Monitoring Methods

Monitoring is done through field surveys to see the potential for erosion and soil quality around the wellpads and access roads as well as Soil Sampling and laboratory analysis.

Duration and Frequency of Monitoring

As a company commitment stated in the UKL-UPL document, soil quality monitoring activities are conducted one time during the construction phase and one time during the drilling phase. Construction and drilling phase is done in parallel.

5.6.4 Quality of Aquatic Biota

Monitoring Location

Water Biota Quality Monitoring Locations:

No	Location	Code	Coordinates	
			S	E
1	Endikat River	AS-1	04° 12, 106’	103° 25, 691’
2	Cawang Kiri River	AS-2	04° 12, 514’	103° 25, 210’
3	Asahan River	AS-3	04° 12, 620’	103° 25, 013’
4	Ampar River	AS-4	04° 12, 785’	103° 24, 674’

Parameters Monitored

The characteristics of water biota observed include: amount and types of species of plankton, the plankton species diversity, amount and types of benthic species, as well as diversity of benthos and nekton populations.

Value Diversity Index and Air Quality Classification / Criteria:

No	Diversity Index	Water Quality Criteria
1	> 2,0	not Contaminated
2	1,6 - 2,0	lightly Contaminated
3	1,0 - 1,5	insignificantly Contaminated
4	< 1,0	heavily Contaminated

Monitoring Methods

Monitoring activities to assess the changes in aquatic biota is done by obtaining samples of plankton using a plankton net and benthos using an Ekman Grab, and identification and analysis at the laboratorium.

Duration and Monitoring Frequency

As a company commitment stated in the UKL-UPL document, water biota monitoring activities are conducted one time during the construction phase and one time during the drilling phase. Construction and drilling phase is done in parallel.

5.6.5 Flora and Fauna

On the basis of the results of the preliminary desk-top assessment detailed in Section 4.6.2 the Project will undertake further assessment to determine the presence or likely occurrence of tigers and other endangered species within and adjacent to the project area.

Monitoring Location

For all species, target areas for survey work will focus on the southern forested areas of the exploration zone and adjacent forest areas.

Parameters Monitored

Specific monitoring programs will be established for the potential endangered species. In addition to monitoring for potential endangered species, parameters monitored during the exploration phase include changes in a number of terrestrial flora and fauna parameters such as critical value, abundance, species composition and economic value compared to the results of the initial study.

Monitoring Methods

Survey work would involve consultations with local communities, followed by a targeted rapid survey, prior to detailed assessment (if and where needed).

Monitoring for the potential endangered species will be done through consultation with relevant experts and authorities, consultation with local communities and a targeted field survey. As tigers have significant home ranges and low population density remote survey techniques including "camera trapping" will be implemented.

Given the potential presence of three primate species, expert advice of a primatologist will be sought where needed.

Monitoring of other flora and fauna is done by direct observation and interviews with leaders and members of the communities of the area concerned.

Duration and Monitoring Frequency

Given uncertainty as to the actual presence of endangered species, a phased approach will be taken based on advice from suitably qualified and locally experienced biodiversity experts.

5.6.6 Occupational Health and Safety

Monitoring Location

Safety health environment monitoring is conducted at camp, storage, yard, water source, rig site, affected community area and all work locations in the project area. High risk job will be monitored constantly and if necessary, a further detailed site specific procedure is established to control the risks at a specific condition and/or time e.g. during heavy rain, limited visibility, simultaneous works, national holiday, etc.

Parameters Monitored

Specific monitoring programs to protect employees, contractor workers, communities, assets and environment have been established e.g. proper use of personal protective equipment, speedcheck, worker competency, equipment license, heavy equipment license, work equipment readiness, medical fitness, hygiene, soil stability, water quality, dust emission, drop object, pinch point and others.

Monitoring Methods

Monitoring work is conducted since preparatory work through work location observation by full time Site SHE Representatives from SERD and Contractors, Corporate and Management representative from

Company and Contractors, regulatory regular inspections by Department of Mining and Energy from regency, province and national offices. Monitoring work would involve consultations with local communities, followed by a targeted rapid survey, prior to detailed assessment (if and where needed).

Regular activity and monitoring reports shall also be submitted by SERD to Department of Mining and Energy, Department of Environment and Forestry Department.

6. Conclusion

The development of the Project will expand the economic activities nationally and regionally. The benefits for the nation as follows:

1. Bolster energy security through the use of domestic renewable resource;
2. Limit exposures to fossil fuel market volatility by diversifying the Indonesian power generation profile and reducing reliance on diesel / fuel oil;
3. Support government effort of producing clean energy.

The benefits for regional economy and industry as follows:

1. Providing multiplier effect to local economy, which is expected to be sustained;
2. An increase in regional incomes at provincial and regency level, through tax and non-tax income;
3. Creating job opportunities for local communities, according to Company's requirements and conditions;
4. Reduces critical energy shortages in Sumatra Interconnection System caused by very low reserve margins.

The project is in South Sumatra at an elevation ranging from 1,000 to 2,600 meters and characterized by undulating terrain with mainly moderate slopes. The project area affects 89.1 hectares (ha) of forest, including protection forest, and 19.4 ha of private land. Protection forest is a Ministry of Forestry categorization in which development activities may be carried out provided that overall catchment integrity is maintained in accordance with the forestry permit, which has been given for this project. In addition, a Forest Management Plan (FMP) has been approved by the Forestry office.

While the project is located in a forest area, significant adverse environmental impacts that are irreversible, diverse, or unprecedented are unlikely. Further, Indonesia's Ministry of Forestry requires that exploration impacts be remediated at the conclusion of the exploration phase. Should the project move to the production phase, Phase 2 project would be categorized as category A for environment, and an environmental impact assessment (EIA) would be prepared. Baseline studies for a Phase 2 EIA are under way.

Construction of access roads, facilities, and wellpads present the primary environmental hazards. The facilities have been constructed in already disturbed farmland areas. In accordance with the FMP, (i) all trees removed must be counted and a compensation fee paid to the Ministry of Forestry; (ii) disturbed areas must be rehabilitated and revegetated at the completion of the exploration phase; and (iii) the borrower must implement various management activities such as training, prevention of illegal forestry and poaching activities, and monitoring and reporting. The project area includes four rivers that are traversed by access roads in several locations. Roads are constructed to ensure maintenance of river flows, and minimization of erosion and sediment impacts.

Operation of the drilling rig presents relatively minor and temporary environmental hazards. Noise and air impacts from drilling rig operations and vehicles are not significant because the well pads are in areas remote from human settlement. A comprehensive health, safety, and environmental management system and environmental management, monitoring, and mitigation measures are in place.

The project is designed to minimize water use and avoid the generation of wastewater from drilling. Drilling mud and drilling cuttings from the exploration wells are separated for reuse, with wastes stored for later off-site disposal or utilized as construction material. Water is ponded and can be pumped between well pads; remaining ponded water will be reinjected and not released to the environment.

A targeted species survey program will be established to ensure habitat values are protected and, should potential environmentally sensitive areas be identified, exploration activities will be modified to minimize impacts. Relevant baseline studies will be established if necessary.

FIVE-YEAR FOREST PROTECTION PLAN FOR THE PERIOD OF 2013 – 2017

PT. SUPREME ENERGY RANTAU DEDAP

JAKARTA, AUGUST 2013

PROVINCIAL GOVERNMENT OF SOUTH SUMATRA

FORESTRY DEPARTMENT

Jalan Kolonel H. Burlian Punti Kayu km 6.5, PO Box 340

Phone: 410739, 411476, 411479, Fax 411479

Palembang

==========

DECISION OF THE HEAD OF FORESTRY DEPARTMENT OF SOUTH SUMATRA PROVINCE

NUMBER: 1224/KPTS/VIII/HUT/2013

ON

VALIDATION OF FIVE-YEAR FOREST PROTECTION PLAN FOR PT. SUPREME ENERGY RANTAU DEDAP IN SOUTH SUMATRA PROVINCE

HEAD OF FORESTRY DEPARTMENT OF SOUTH SUMATRA PROVINCE

Having read : Proposal for Five-Year Protection Plan (2013-2017) for PT. Supreme Energy Rantau Dedap in the area covered by the forest area borrow-use permit for Geothermal Exploration activities Located in Lindung Jambul Gunung Patah Protected Forest, Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra covering the area of 91 Hectares.

Having considered : a. In accordance with the provisions of Law Number 41 of 1999 and Regulation of the Minister of Forestry Number P.18/Menhut-II/2011, it is stated that the parties using the forest area for the interest other than forestry

activities which cause changes of the surface are obliged to obtain the forest area borrow-use permit to be issued by the Ministry of Forestry and are obliged to conduct forest protection activities.

b. Regulation of the Government of the Republic of Indonesia Number 45 of 2004 on Forest Protection stipulating that forest protection for the forest area which has become the area for the holder of the forest area borrow-use permit shall be performed and become the responsibility of the concerned holder of such license.

c. That in connection with such matter, it is deemed necessary to establish a Decision on Validation of Five-Year Forest Protection Plan (2013-2017) for PT. Supreme Energy Rantau Dedap.

In view of : 1. Law Number 5 of 1990 on Biological Resources and Their Ecosystems,

2. Law Number 23 of 1997 on Environmental Management,

3. Law Number 41 of 1999 on Forestry,

4. Law Number 32 of 2004 on the Regional Government,

5. Law Number 33 of 2004 on Balancing of Financial Condition between Central and Regional Governments,

6. Law Number 26 of 2007 on Spatial Layout Planning,
7. Government Regulation Number 44 of 2004 on Forestry Planning,
8. Government Regulation Number 45 of 2004 on Forest Protection,
9. Government Regulation Number 6 of 2007 on Forest Arrangement and Preparation of Forest Protection as well as Utilization Plan in conjunction with Number 3 of 2008,
10. Government Regulation Number 38 of 2007 on Division of Administration amongst Central, Provincial and Regional/City Governments,
11. Government Regulation Number 58 of 2007 on Amendment to Government Regulation Number 35 of 2002 on Reforestation Funds
12. Government Regulation Number 26 of 2008 on National Regional Spatial Layout Planning (*Perencanaan Tata Ruang Wilayah Nasional* (*RTRW*)),
13. Regulation of the Minister of Forestry Number P.18/Menhut-II/2011 on Guidelines for the Forest Area Borrow-Use Permit,
14. Government Regulation Number 8 of 2008 on Organization and Work Procedure at Department of Forestry of South Sumatra Province,
15. Regulation of the Governor Number

64 of 2008 on Job Description and Functions of the Department of Forestry of South Sumatra Province.

With due Observance of : Decision of the Minister of Forestry of the Republic of Indonesia Number SK/649/Menhut-II/2012 dated 20 November 2012 on the Forest Area Borrow-Use Permit for Geothermal Exploration for PT. Supreme Energy Rantau Dedap in the Bukit Jambul Gunung Patah Protected Forest Area located in Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province covering the area of 91 (ninety) hectares.

HAS DECIDED

To determine :

FIRST : Five-Year Protection Plan for the period of 2013-2017 for PT. Supreme Energy Rantau Dedap in the area covered by the forest area borrow-use permit for Geothermal Exploration located in Bukit Jambul Gunung Patah Protected Forest Area, Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province covering the area of 91 Hectares.

SECOND : PT. Supreme Energy Rantau Dedap as the holder of the forest area borrow-use permit is obliged to perform Forest Protection activities within the designated

area by referring to the Five-Year Forest Protection Plan for the period of 2013-2017 which has been approved or validated.

THIRD : Any violation of and or deviation from the provisions as set forth herein shall be subject to the sanction pursuant to the prevailing regulations.

FOURTH : Head of Forestry Department of South Sumatra Province may assign a team to conduct monitoring and evaluation of forest protection activities performed at the site which constitutes one of the obligations of the holder of the forest area borrow-use permit.

FIFTH : Should there be a mistake found at a later date in this decision, a correction shall be made accordingly.

Issued in : Palembang

On : 22 August 2013

THE HEAD OF FORESTRY DEPARTMENT

SOUTH SUMATRA PROVINCE

Ir. SIGIT WIBOWO

Pembina Utama Madya/IV-d

Employee ID No. 1957100 198903 1 003

Copies of this Decision are delivered to:

1. The Minister of Forestry in Jakarta,
2. The Governor of South Sumatra in Palembang,
3. The Director General of Forest Protection and Natural Conservation of the Ministry of Forestry in Jakarta,
4. The Head of Forestry Department, Muara Enim Regency in Muara Enim,
5. The Head of Department of Forestry and Plantation, Lahat Regency in Lahat,
6. The Head of Department of Forestry and Plantation, Pagar Alam City in Pagar Alam,
7. The Director of PT. Supreme Energy Rantau Dedap in Jakarta

PREFACE

Praise be to God the Almighty, by whose mercy and guidance, preparation of the Five-Year Forest Protection Plan for the period of 2013-2017 for the forest area borrowed and used by PT. Supreme Energy Rantau Dedap (PT SERD) for Geothermal Exploration in the Bukit Jambul Gunung Patah Protected Forest Group has been successfully completed.

This Five-Year Forest Protection Plan is a basic guideline and reference for implementation of forest protection activities for the period of 2013-2017 in the forest area which is borrowed and used as a follow up of the Decision of the Minister of Forestry of the Republic of Indonesia Number SK.648/Menhut-II/2012 dated 20 November 2012 on the Forest Area Borrow-Use Permit for Geothermal Exploration for PT. Supreme Energy Rantau Dedap in the Bukit Jambul Gunung Patah Protected Forest Area which is located in Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province covering the area of 91 Hectares.

Thanks to all parties who had assisted the preparation of this Five-Year Forest Protection Plan until it was properly completed.

It is expected that by this Five-Year Forest Protection Plan implementation of the forest protection activities at the site will be managed and directed better so that forest protection activities are performed according to the plan and expectation.

Jakarta, August 2013

PT. SUPREME ENERGY RANTAU DEDAP

VP RELATIONS & SHE

PRIJANDARU EFFENDI

FIVE-YEAR FOREST PROTECTION PLAN IN THE AREA COVERED BY THE FOREST AREA BORROW-USE PERMIT FOR PT SUPREME ENERGY RANTAU DEDAP FOR THE PERIOD OF 2013 – 2017

Company Name	:	**PT. SUPREME ENERGY RANTAU DEDAP**
Address	:	Equity Tower, Lt. 18 Sudirman Central Business District (SCBD) Lot 9 Jalan Jend. Sudirman Kav 52-53 Jakarta 12190
Approval for Forest Area Borrow-Use Permit	:	Decision of the Minister of Forestry Number SK.648/Menhut-II/2012 20 November 2012, covering the Area of ± 91 Hectares

Location covered by Borrow-Use Permit

Forest Group	:	Bukit Jambung Gunung Patah Protected Forest
Sub-district	:	- Semende Darat Ulu and Semende Darat Tengah, Muara Enim Regency; - Kota Agung, Lahat Regency - Dempo Selatan, Pagar Alam City
Province	:	South Sumatra

Validated in : Palembang

On : 22 August 2013

Validation Number : 122/KPTS/VIII/HUT/2013

THE HEAD OF FORESTRY DEPARTMENT
SOUTH SUMATRA PROVINCE

Ir. SIGIT WIBOWO
Pembina Utama Madya
NIP. 195710061989031003

PT. SUPREME ENERGY RANTAU
DEDAP
VP RELATIONS & SHE

PRIJANDARU EFFENDI

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

Activities at the Location of PT. SERD for the period of 2013-2017

LIST OF FIGURES

LIST OF MAPS

CHAPTER I INTRODUCTION

1.1. BACKGROUND

A forest is a natural resource that has a function, whether ecological, economic, social or cultural, required to support the livings of human beings and the other living creatures. Therefore, it is necessary to control the damage to the forest by forest protection activities, so that in general forest protection constitutes the activities to protect the forest from factors which may cause damage to the trees or plants in the forest in order that the function as to protect, conserve or produce is able to be achieved optimally and sustainably according to its purpose. Meanwhile, the factors that may cause damage to the trees or plants are, among others, encroachments on land, illegal logging, fire, pests, diseases and shepherding.

Forest protection nowadays becomes no longer a regional (national) problem but it becomes a global problem. This is related to the function of the forests in maintaining ecological balance that affects the global climate such as 'global warming' effect which threats the security of living creatures. However, the fact

that the economic function of the forests as a source of income for a group of people, as a way to accumulate capital by capitalists, and as a source of income to the country is prioritized over its function as to maintain the ecological balance (including the global climate). The population pressure which is increasing continuously becomes one of the factors that contributes to the acceleration of damage to the forests. This could happen because more land and more building materials are required both for settlements and cultivation as well as materials for new buildings.

Excessive utilization of economic function of the forest by men (forest exploitation) without considering ecological balance may result in disasters to human beings, and the social and economic costs are much bigger compared to the economic results. The community who live and have sources of incomes around the forest, on one hand are frequently blamed as one of the causes of the damage of the forest, however on the other hand they are expected to play the main role in an effort to protect the forest itself. The expectation of the community who live around the forest to play the main role in the forest protection is reasonable because in daily lives they have a direct interaction with the forest and become the first men who directly receive

the impact of the forest damage, such as natural disasters in the form of flood, erosion/land slide and forest fire. The most important thing in the forest protection activities is the effort to conduct preventive activities by both legislative method (quarantine) and *silvicultural* method (*metode silvikultur*); however, it is also necessary to immediately perform the handling by an ecological, socio-economic and legal approaches if it has experienced disturbances.

Forest protection is an effort to maintain, protect and prevent the forest from various disturbances that may disturb and damage natural resources inside it such as flora, fauna, marine biota, ecosystems, habitat, water systems and others. Forest can only be protected if it is well and properly planned by accommodating and reflecting potentials or carrying capacity of the forest resources which becomes the objects of the protection.

By the understanding that forest resources are basically one of the parts of the landscape ecosystems, the potentials as well as the carrying capacity of the forest resources cannot be considered as something that is independent, but it must be viewed in the context of

its relations with the other ecosystems that may affect each other. Forest protection must consider forms of such interrelations, and therefore also the forest protection must be based on the principles of protection for the landscape ecosystem.

PT. Supreme Energy Rantau Dedap (PT. SERD) is a company engaged in geothermal business that owns a Geothermal Power Plant (*Pembangkit Listrik Tenaga Panas Bumi/PLTP*) with the capacity of 2 x 110 MW located in Muara Enim Regency, Lahat Regency and Pagar Alam City. Most of the location of PT. SERD is located forest area, namely Bukit Jambul Gunung Patah Protected Forest Area. The 2 x 110 MW Rantau Dedap Geothermal *IPP* is a part of the endeavor to increase the capacity of electricity supply in Sumatra Island and simultaneously improve the energy mixed ratio through development of new and renewable energy.

In connection with the location of geothermal located inside the protected area, PT. SERD has obtained the forest area borrow-use permit for geothermal exploration from the Minister of Forestry covering the area of 91 Hectares under the Decision of the Minister of Forestry of the Republic of Indonesia number SK.648/Menhut-II/2012 dated 20 November 2012 on the

Forest Area Borrow-Use Permit for Geothermal Exploration for PT. Supreme Energy Rantau Dedap in the Bukit Jambul Gunung Patah Protected Forest Area located in Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province with the area of 91 Hectares.

The action to follow up with the forest area borrow-use permit issued by the Minister of Forestry is to perform the obligations as specified in the Decision. One of the obligations is to perform forest protection for the forest area which has become the working area of the holder of the forest area borrow-use permit and become the responsibility of the holder of the said permit.

Forest protection is an effort to avoid and limit damage to the forest, forest area and forest products resulted from the acts of human beings, cattle, fire, natural forces, pests and diseases as well as to maintain and preserve the rights of the country, community and individuals on the forests, forest products, investment and the instruments related to the forest management.

In principles, forest protection activities are of a holistic integrated unit with the geothermal business;

and shall be performed as earlier as possible without waiting for the geothermal business process as a whole and must be performed sustainably until the geothermal business activities are completed.

Forest protection activities for the forest borrowed and used by PT. SERD will be performed in a coordinated manner by involving stakeholders, therefore for the forest protection for the period of 2013-2017 a direction and guidelines are required for the implementation of forest protection activities in the form of a middle-term Forest Protection Plan which is so called the Five-Year Forest Protection Plan which is, in practice, described in the short-term plan called the Annual Forest Protection Plan.

1.2. PURPOSE AND OBJECTIVES

The purpose of the preparation of documents of the Five-Year Forest Protection Plan at the location covered by the forest area borrow-use permit for PT. SERD is:

- As the basis in performing forest protection so that the implementation of the forest protection could be more systematic and effective.

- As the fulfilment of the obligation as set forth in the Decision on the Forest Area Borrow-Use Permit.
- As the basis of reference in monitoring and technical development.

Meanwhile, the objective is to have the activities of protecting the forest, forest products, forest area and the environment materialized in a directive manner so that the forest protection activities could be performed more optimally, efficiently, effectively and in accordance with the expectation.

1.3. TARGET OF ACTIVITY LOCATION

In accordance with the Decision of the Minister of Forestry of the Republic of Indonesia Number SK.648/Menhut-II/2012 dated 20 November 2012, the target of the activity location of the forest protection is the forest area borrowed and used by PT. SERD for Geothermal Exploration covering the area of 91 Hectares. However, the forest protection is not limited to be performed by PT. SERD only in such location, but also in the forest area surrounding the location of borrow-use permit which may be developed under the

forest protection borrow-use permit for geothermal exploration activities.

Based on the forest administration, the borrow-use location of PT. SERD lays in the Bukit Jambul Gunung Patah Protected Forest Area.

Based on the administration such location belongs to the area of Muara Enim Regency (Semende Darat Ulu Sub-district, Semende Darat Tengah Sub-district), Lahat Regency (Kota Agung Sub-district) and Pagar Alam City (Dempo Selatan Sub-district), South Sumatra Province.

1.4. SCOPE OF ACTIVITIES

Forest protection is not only aimed to consider how to overcome the damage when it occurs but also intended to identify and evaluate any sources of potential damage in order that big damage can be avoided, so that the potential causes of the damage to the forest can be reduced as maximum as possible.

An important principle in forest protection activities is that the early prevention from the causes of the damage is much more effective than destroying the destroyers after the attacks. In recent years, the

opinion that prevention is more important in forest protection has been widely accepted.

The forest protection plan at the location of forest area borrow-use permit for geothermal exploration for PT. SERD is covered in the Five-Year Forest Protection Plan for the period of 2013-2017, which constitutes a middle-term plan for forest protection which contains:

(1) Introduction
(2) General Conditions of the Location
(3) Forest Protection Plan
(4) Budgetary Plan and Implementation Schedule
(5) Monitoring, Evaluation and Reporting

Meanwhile, the targets of the forest protection among others comprise:

- Protection for the forest area

  The protection and security measures for the forest are necessary to prevent and minimize damage to the forest as well as maintain the country's rights on the forest, forest products; and it also has a strategic value in the lives of the community and the country where the forest has the functions as the biological resources, life support and one of the region's assets which has ecological and economic benefits.

The forest management is any efforts to utilize and stabilize the functions of forest natural resources and its ecosystem, whether as the protector of the life support and biological diversity preservation or as the resource for economic development.

The utilization of the forest area must be in line with its functions and purpose. The deviation of the use of the forest area must first obtain approval from the Minister. In order to obtain the legal certainty at the field, any area appointed as the forest area shall be subject to boundary arrangement. With the forest boundary having been arranged, any person is prohibited to cut, move, damage or eliminate the forest boundary markers.

Exploration and exploitation activities which are aimed to collect mines in the forest area or forst reserve shall be granted by the authorized agency after obtaining approval from the Minister. In the event that the concerned area is determined as the forest area after the granting of the forest area borrow-use permit for the purpose of exploration and exploitation, further implementation of such

exploration and exploitation activities shall be in accordance with the guidelines from the Minister. In the forest area and forest reserve it is prohibited to collect forest products by using equipment which is not suitable with the soil and site conditions, or perform any act which may result in damage to the soil and plants. Any person is prohibited to cut down trees within a certain radius/distance from the spring, the edge of the precipice, dam, river, and creek located in the forest area, forest reserve and other forests.

Any person is prohibited to cut down trees in the forest without consent from the authorized official except for the forest officers or any person whose duties or interests cause him or her to be in the forest area. Any person is prohibited to bring equipment which is commonly used to cut, cut down and split the trees in the forest area. Any person is prohibited to burn the forest except as legally authorized. The community around the forest area have the obligation to participate in an effort to prevent from and extinguish forest fire. Shepherding inside the forest area may only be conducted in certain places specifically

designated for such purpose by the authorized officer.

- Protection for forest products

  Forest products are any goods produced by the forest in the form of vegetables, animals, non-biological objects, services, products obtained directly from the results of processing of the raw materials in the forest.

  Forest protection for the forest products is performed with the objective to avoid excessive or unlawful utilization of the forest; and the protection activities are performed by development, supervision as well as enforcement. Forest protection for forest products may be performed inside or outside the area.

  According to the Government Regulation No. 60 of 2009, protection for the forest products shall be provided by submitting the forest product validity affirmation letter (*surat keterangan sahnya hasil hutan*). A forest product shall be deemed invalid if its physical conditions, either type or quantity collected, controlled and owned, whether as a part or a whole, are not in accordance with

the content of the forest product validity affirmation letter.

Considering the very wide area of the forest with the proneness to crimes to the forest and forest products in the form of cutting down/illegal logging, collection of logs without valid documents, smuggling of logs and other forest products, as well as encroachment on forest being at the level of anxiety, it is necessary to carry out the protection and security measures for the forest through various kinds of approach which are sufficient and effective in order to overcome breach/crimes in the field of forestry.

- Protection for flora and fauna

  Utilization of biological resources for commercial purpose, particularly wild animals has been done for a long time in a physically extractive manner such as in the form of meats, leathers, and other parts therefrom that have economic and aesthetical values such as wild animal show and maintenance that demonstrates physical beauty, sounds and characters of wild animal species.

The tendency to utilize natural resource (wild animals and plants) shows that whether the direct utilization or indirect utilization, by reason of economy and pleasure has put a pressure which affects quality and quantity of the wild animal population in the habitat. Excessive exploitation that has prolonged for quite a long time simultaneously has threatened the existence of several species of wild animals in the habitat.

Forest protection is a part of the forest management activities, including protection for forest products in the form of plants and wild animals. Utilization of the plants and animals which are currently protected has actually created big problems to the existence of such animals, which is the decrease of the awareness of preserving the population, for instance illegal trading of animals to foreign countries and illegal ownership of animals. If these cannot be prevented, it will potentially result in not only the drastic decrease of the animal population but also the extinction of a species of animal, particularly a wild animal which is protected by the law. Exploitation of natural resources which is excessive and contrary to the principles of

natural resources preservation is very detrimental.

The progress towards the damage and shrinkage of the natural resources are not tolerable, so that it must be prevented. Any natural resources which are renewable or recoverable must be saved and preserved for the sake of development of the country and the nation.

- Protection for the environment

  A forest has an important role in supporting the survival and sustainability of living creatures, especially human beings. The forest does not only provide a direct benefit (tangible use) as the source of the forest products in the form of wood and non-wood products, but it also provides indirect benefit (intangible use) as the water system regulator, soil fertility, micro climate, erosion and landslide prevention, so that its existence must be maintained by managing the functions of the forest.

  In accordance with Article 1 paragraph 1 of Law No. 5 of 1990, biological resources means biological elements in the nature which consist of

vegetable resources and animal resources which together with the non-biological resources in the vicinity of the area as a whole form the ecosystem. From the abovementioned definition, the forest can be considered as a biological resources, so that it requires protection and conservation. In Article 4, it is stated that conservation of biological resources and the ecosystem shall be the responsibility of the government and the community. Besides, the holder of the land title and business license must undertake protection for the biological resources, as referred to in article 9 paragraph 1.

Conservation shall be performed jointly with the objective as to maintain the ecological process between ecosystem components so that it is able to support the sustainability of the lives and improve welfare of the people which is in accordance with Article 7.

Conservation of biological resources shall be performed by the following activities:

- Protection of life support system,
- Diversity preservation of varieties of plants and animals along with their ecosystem,

- Sustainable utilization of biological resources and the ecosystem.

1.5. LEGAL BASIS

1. Law of the Republic of Indonesia No. 41 of 1999 on Forestry, article 48 paragraph 48

   "Holder of the forest area use permit is obliged to protect the forest of its working area"

2. Regulation of the Government of the Republic of Indonesia Number 45 of 2004 on Forest Protection, Article 8, paragraph (2) and (4)

   "Forest protection for the forest area which becomes the working area of the holder of the forest area borrow-use permit shall be performed and become the responsibility of the holder of such permit:,

   with the forest protection activities covering:

   - To secure its working area related to forest, forest area and forest products including plants and animals,
   - To prevent damage to the forest from the acts of human beings and cattle, forest fire, pests and diseases as well as natural forces,

- To take the first action required against forest security disturbance in its working area,
- To report any breach of law in its working area to the nearest forestry institution,
- To provide facilities and infrastructure as well as the workforce for the forest security measure in line with the demand.

3. Regulation of the Minister of Forestry No. P/18/Menhut-II/2011 on Guidelines for Forest Area Borrow-Use

   Article 26 paragraph (1)

   "Holder of the forest area borrow-use permit is obliged to:

   - Provide forest protection in accordance with the laws and regulations,
   - Secure the forest conservation and protected forest areas in the event that the area covered by the forest area borrow-use is bordering forest conservation and protected forest areas."

   Article 27 paragraph (1)

   "Holder of the forest area borrow-use permit for the survey activities is obliged to provide forest

protection in accordance with the laws and regulations."

4. Decision of the Minister of Forestry of the Republic of Indonesia number SK.648/Menhut-II/2012 dated 20 November 2012.

   "PT. Supreme Energy Rantau Dedap as the holder of the forest area borrow-use permit is obliged to perform the activities related to the forest protection which include:

   - Maintaining security of the forest area borrowed and used and the surrounding forest area.
   - Assisting to maintain security of the forest area up to the outer boundary of the borrow-use area, particularly reporting to the authorized agencies regarding illegal activities in such area.
   - Avoiding and preventing damage to the forest area, erosion, landslide and forest fire in performing the activities at the site
   - Assisting to provide forest protection up to the outer boundary of the forest borrow-use area

- Preparing the regular report to the Minister of Forestry one copy of which is addressed to the Head of Forestry Department, South Sumatra Province”.

CHAPTER II GENERAL CONDITIONS OF THE LOCATION

Protected forest is the forest area which has been determined by the government or certain group of community to be protected in order that its ecological functions in particular those related to the water system and soil fertility are able to be maintained and the benefit from which is able to be enjoyed by the surrounding community. The law of the Republic of Indonesia No. 41 of 1999 on Forestry states that the protected forest is the forest area which has a main function as a support system protection for the water system, preventing from flood, controlling erosion, preventing from intrusion of sea water and maintaining soil fertility.

From the above definition, it is implied that the area that may be designated as the protected forest are the areas of river upstream (including the mountain around it) as the rain catchment area, along the river flow whenever deemed necessary, at the beach (for instance, in the mangrove) and other places in line with the expected functions.

In accordance with the Decision of the Minister of Forestry of the Republic of Indonesia Number SK.648/Menhut-II/2012 dated

20 November 2012 the geothermal exploration activities by PT. Supreme Energy Rantau Dedap (PT. SERD) are located in the Bukit Jambul Gunung Patah Protected Forest Area situated in Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province covering the area of 91 Hectares, with the detailed utilization plan as follows:

- Well pad plan with the supporting facilities
- Access road plan

2.1. CONDITIONS OF FLORA AND FAUNA

2.1.1. Flora

Diversity of the variety of plants may describe the environmental conditions in an area in connection with the function of vegetation in the ecosystem. The type of ecosystem found around the planned location of the geothermal business is a primary and secondary forest with the function as the protected forest area. Based on the habitat, the types of plants composing the community in this location consist of trees, shrubs and herbs.

The canopy of the protected forest is very tightly closed so that the understory of the forest tends to be humid and types of plants such as ferns and liana are frequently found. Many types of the trees found in the

protected forest have high economic value, including the plants that produce wood and drugs such as among others: Timber (*Kayu Tanam*), *Shorea Sp*, *Dipterocarpus sp*, *Peronema canescens*, *Bridelia monoica*, *Glutha renghas*, *Lanne grandis* and many others.

Meanwhile, a type of herbs and liana such as rattan and ferns are found as the plants at the understory of the protected forest. Judging from the composition of the plants forming the protected forest community, the diversity of the plants is categorized as high, particularly the type of trees. This is because the forest is a protected forest, so that human intervention and activities of the local community in exploiting wood and other types of plants are relatively limited.

Table 2.1. Types of Plants Composing Secondary Forest Community

Around the Location of PT. SERD

No.	**Local Name**	**Binomial Nomenclature**	**Estimated Abundance**
1	*Sirih Hutan* (betel found in the forest)	*Pipper sp*	+++
2	*Paku-pakuan* (ferns)	*Licopodium spp*	+++

No.	Local Name	Binomial Nomenclature	Estimated Abundance
3	*Rengas* (a kind of trees that yield timber and a sap which produes lacquer/varnish)	*Gluta Renghas*	++
4	*Rumput Segitiga* (a kind of grass)	*Cyperus sp*	+++
5	*Pisang Hutan* (a kind of banana)	*Musa sp*	++
6	*Seduduk* (known also as Malabar Melastome, Indian Rhododendron, Singapore Rhododendron)	*Melastoma malabathricum*	+++
7	*Waru* (hibiscus tree, whose bark fibres are used for making rope and sacking material)	*Hibiscus tiliaceus*	+
8	*Jelutung* (is a type of tropical trees up to 80 m in height in family Apocynaceae occurring in southeast Asia)	*Dyera sp*	++
9	*Manggis Hutan* (a king of magnosteen)	*Garcinia mangostana*	+
10	*Rotan* (Rattan)	*Calamus sp*	+++
11	*Nyamplung* (a large evergreen,	*Callophylum*	++

No.	Local Name	Binomial Nomenclature	Estimated Abundance
	commonly called Alexandrian laurel balltree)	*inaphylum*	
12	*Jamblang* (a kind of tree with edible fruit)	*Eugina cumini*	++
13	*Sungkai* (a kind of small tree used for hedges)	*Peroma canescens*	++
14	*Pulai* (devil's tree, stool wood)	*Alstonia scholaris*	++
15	*Pelangas* (a plant type of the family *Phyllanthaceae*)	*Bridelia monoica*	++
16	*Meranti* (a kind of large tree with timber used for boards, etc.)	*Shorea sp*	++
17	*Mahang* (various species of soft-wood trees)	*Macaranga sp*	++
18	*Keruing* (a generic name for a number of trees yielding a kind of wood-oil)	*Dipterocarpus sp*	+++
19	*Kayu Kuda*	*Lannea grandis*	++
20	*Durian*	*Durio zibethinus*	+
21	*Pandan Hutan* (a plant with long weet-smelling leaves	*Pandanus sp*	++

No.	Local Name	Binomial Nomenclature	Estimated Abundance
	whose thorns are used for weaving hats/mats, etc. screw pine)		
22	*Keladi Hutan* (a species of caladium)	*Caladium sp*	+++
23	*Bambu* (Bamboo)	*Bambussa sp*	++
24	*Betung* (a large bamboo species)	*Dendrocalamus*	+
25	*Telekan* (a species of flowering plant in the verbena family)	*Lantana camara*	+
26	*Sage* (a tree whose fruit resembles *petai* (*Parkia speciosa*);	*Adenantera sp*	+++
27	*Cehu/Medang* (laurel-like trees with commercial timber used for furniture and planks)	*Litsea sp*	++
28	*Simpur Kubung* (a kind of small trees with hard wood and showy yellow flowers)	*Dillenia exelsa*	++
29	*Leban* (a kind of trees which provide wood for construction; leaves and bark are used as	*Vitex pubescens*	+

No.	Local Name	Binomial Nomenclature	Estimated Abundance
	medicines)		
30	*Jelatang* (various specied of nettles)	*Laportea sp*	++

Remarks: + = small quantity, ++ = medium quantity; +++ = large quantity

Types of cultivated crops planted by the community tend to vary although abundance of the each individual type is low. This condition is shown in the cropping pattern of the community who tend to plant several types of cultivated crops each type of which is planted in 2 to 4 pieces. In general, types of crops planted are fruits and vegetables used for family consumption. Besides, ornamental plants and cover crops are frequently found planted in the houses' front yards.

The various cropping patterns of the cultivated crops are aimed to make the limited area of the land able to be planted with various types of plants having several benefits.

Types of cultivated crops planted by the community are described in the following table:

Table 2.2. Types of Cultivated Crops of the Community

Around the Location of PT. SERD

No.	**Local Name**	**Binomial Nomenclature**	**Abundance Estimate**
1	*Ceremai* (a tree with small, yellowish, sour fruits with a hard seed, preserved and eaten as a side dish)	*Phylanthus emblica*	+
2	*Kapuk Randu* (cotton tree)	*Ceiba petandra*	+
3	*Jambu Bol* (rose apple)	*Eugenia jambos*	++
4	*Embacang* (horse mango)	*Magnifera foetida*	+
5	*Jeruk Manis* (sweet orange)	*Citrus aurantifolia*	+++
6	*Kelapa* (coconut)	*Cocos nucifera*	+++
7	*Pisang* (banana)	*Musa paradisiaca*	+++
8	*Rambutan* (rambutan, fruit with a hairy usually reddish integument)	*Nephelium lappaceum*	++
9	*Pepaya* (papaya)	*Carica papaya*	++
10	*Jambu Biji* (apple guava or common guava)	*Psidium guajava*	+

No.	Local Name	Binomial Nomenclature	Abundance Estimate
11	*Kweni* (mango with a strong odor)	*Mangifera odorata*	+
12	*Pinang* (arena nut)	*Areca cathecu*	+
13	*Mangga* (mango)	*Mangifera indica*	+
14	*Ubi Kayu* (cassava)	*Manihot utilisima*	+++
15	*Ubi Kayu Gajah* (a kind of cassava)	*Manihot esculenta*	++
16	*Durian* (durian)	*Durio zibethinus*	+
17	*Jambu Air* (rose apple)	*Syziqium guajava*	+
18	*Tebu* (sugarcane)	*Saccarum oficinarum*	+
19	*Kembang Sepatu* (rose mallow, Chinese hibiscus)	*Hibiscus rosasinensis*	+
20	*Belimbing* (carambola)	*Averoha carambola*	+
21	*Kayu Manis* (cinnamon)	*Cinnamomum sp*	+
22	*Nanas* (pineapple)	*Ananas comasus*	+++
23	*Dadap* (tiger's claw)	*Erythrina*	+

No.	Local Name	Binomial Nomenclature	Abundance Estimate
		veriageta	
24	*Waru* (hibiscus tree whose bark fibers are used for making rope and sacking material)	*Hibiscus tilliaceus*	+
25	*Duku* (a kind of tree in Mahogany family, bearing edible fruit also known as *langsat, buahluku* or lanzones. It is the provincial flower for the Indonesian province of South Sumatra)	*Lancium sp*	+
26	*Bougenvil* (bougainvillea)	*Bougenvillea spectabilis*	+
27	*Bambu* (bamboo)	*Bambusa sp*	++
28	*Empelam* (tropical tree native to Asia, bearing edible, fleshy fuit)	*Mangifera sp*	+
30	*Petai Cina* (white leadtree)	*Leucaena glauca*	+
31	*Alpukat* (Avocado)	*Persea gratissima*	+
32	*Cengkeh* (Clove)	*Eugenia aromatica*	++

No.	Local Name	Binomial Nomenclature	Abundance Estimate
33	*Jarak Jepang* (a genus of flowering plants in the spurge family, Euphorbiaceae; future best candidate for biodiesel production)	*Jathropa sp*	+
34	*Kopi* (Coffee)	*Coffea arabica*	+++

Remarks: + = small quantity; ++ = Medium quantity; +++ = Large quantity

This high level of diversity of cultivated crops is because most of the community in the villages are farmers whose hobby is farming. Besides, the soil is very fertile that it supports the growth of the crops, so that various types of crops can grow well. Types of crops planted are coffee, cinnamon, banana, orange and areca nut.

2.1.2. Fauna

The types of fauna which are frequently found around the planned location of the geothermal business activities largely vary from the one included in the class *amphibian*, *reptilian*, *aves* and mammals. The high variety of wild

animals around this location is because in this location there is a protected forest which is a primary forest dominated by a type of trees with closely tight canopy. This primary forest is a habitat for the wild animals to interact each other and between populations to breed, reproduce, foraging, take care of the young and other life activities. Besides, the local community do not hunt the wild animals living in the protected forest.

Several types of wild animals living in the primary forest including the types of animals categorized as rare animals and protected by the Law are among others: Cobra (*Naja naja*), Hawk (*Haliastus sp*), Jungle Fowl/*Ayam Hutan* (*Gallus gallus*), Mouse Deer/*Kancil* (*Manis javanica*), Deer (*Cervus sp*), Tapir (*Tapirus indicus*), Greater Mouse Deer/*Napo* (*Tragulus Napu*), Tiger (*Panthera sumatrensis*), *Macan akar* (*Neofelis sp*), Cloud Leopard/*Macan Dahan* (*Neofelis nebulosa*) and Barking Deer/*Kijang*

(*Cervulus sp*), and many others. Therefore, the protected forest area must be seriously managed and protected by PT. SERD because not only is poaching subject to a legal sanction but it also makes wild animals protected by the law extinct.

Table 2.3. Types of Wild Animals Living Around the Location of PT. SERD

No.	**LOCAL NAME**	**BINOMIAL NOMENCLATURE**	**ABUNDANCE ESTIMATE**	**STATUS**
	CLASS *AMPHIBIA*			
1	*Katak Sawah* (a species of frog in the Ranidae family)	*Rana cancrivora*	+++	Unprotected
2	*Bangkong* (a kind of frog)	*Bufo melanopticus*	+++	Unprotected
	CLASS *REPTILIA*			
3	*Kadal* (lizard)	*Mabouya sp*	++	Unprotected
4	*Biawak* (a kind of large lizard)	*Varanus salvator*	++	Unprotected
5	*Bunglon* (a various specied of	*Draco volans*	+++	Unprotected

No.	LOCAL NAME	BINOMIAL NOMENCLATURE	ABUNDANCE ESTIMATE	STATUS
	chamellion)			
6	*Bengkarung* (skink)	*Calotus sp*	++	Unprotected
7	*Kura-kura* (turtle)	*Testudo elegans*	++	Unprotected
8	*Labi-labi* (various species of soft-shell turtles)	*Trionyx sp*	++	Unprotected
9	*Ular Sawah* (Phyton)	*Phyton reticulatus*	+++	Unprotected
10	*Ular Kobra* (Cobra)	*Naja naja*	+++	Protected
11	*Ular Tanah* (a genus of venomous snake)	*Angkistrodon sp*	++	Unprotected
12	*Ular Weling* (a genus of venomous elapid snake found in South and Southeast Asia)	*Bungarus sp*	++	Unprotected
	CLASS *AVES*			
15	*Elang* (Hawk)	*Haliastur sp*	++	Protected
16	*Perkutut* (turtledove)	*Geopelia striata*	++	Unprotected
17	*Tiung Batu* (whistling thrushes)	*Myophonus sp*	+	Unprotected

No.	LOCAL NAME	BINOMIAL NOMENCLATURE	ABUNDANCE ESTIMATE	STATUS
18	*Kutilang* (sooty-headed bulbul)	*Pycnonotus aurigaster*	++	Unprotected
19	*Tekukur* (Malay spotted dove)	*Streptopelia chinensis*	+++	Unprotected
20	*Punai* (various species of green pigeons and doves)	*Treron sp*	++	Unprotected
21	*Layang-layang* (swallow)	*Hirundo sp*	+++	Unprotected
22	*But-but* (crow-pheasant, short-toed coucal)	*Centropus sinensi*	++	Unprotected
23	*Berbah*	*Corivnia sp*	+++	Unprotected
24	*Pipit* (various specied of small birds)	*Lonchura sp*	+++	Unprotected
25	*Titiran* (Streptopelia, a genus of birds in dove family)	*Streptopelia sp*	++	Unprotected
26	*Bakan* (Imperial pigeon)	*Ducula sp*	++	Unprotected
27	*Murai Tanah* (magpie-	*Copsycus sp*	++	Unprotected

No.	LOCAL NAME	BINOMIAL NOMENCLATURE	ABUNDANCE ESTIMATE	STATUS
	robins)			
28	*Puyuh* (various species of quail)	*Turnix sp*	++	Unprotected
30	*Ayam-ayaman* (Common Flameback or Common Goldenback)	*Dinopium javanensis*	++	Unprotected
31	*Kepodang* (various species of orioles, shrikes, cicada birds)	*Oriolus Chinensis*	++	Unprotected
32	*Pergam* (various species of pigeons)	*Ducula sp*	++	Unprotected
33	*Tiung* (various species of birds that imitate human words)	*Gracula gallus*	++	Unprotected
34	*Ayam Hutan* (Red Junglefowl)	*Gallus gallus*	+++	Protected
35	*Enggang* (Rhyticeros, a genus of medium to large hornbill)	*Phyticeros sp*	++	Protected
36	*Srindit* (Blue-crowned hanging	*Lorichulus galgulus*	+++	Unprotected

No.	LOCAL NAME	BINOMIAL NOMENCLATURE	ABUNDANCE ESTIMATE	STATUS
	parrot)			
37	*Prencak* (prinias)	*Prinia sp*	+++	Unprotected
	CLASS *MAMALIA*			
38	*Babi Hutan* (wild boar or wild pig)	*Sus scrova*	+++	Unprotected
39	*Monyet* (a group of Old World monkey species)	*Macaca sp*	+++	Unprotected
40	*Trenggiling* (Sunda pangolin)	*Manis javanica*	++	Unprotected
41	*Kancil* (Mouse deer)	*Tragulus javanicus*	++	Protected
42	*Landak* (porcupine)	*Hystrix sp*	+++	Unprotected
43	*Cingkuk* (black monkey species)	*Macacus sp*	++	Unprotected
44	*Kelelawar*	*Pteropus sp*	+++	Unprotected
45	*Kera Ekor Panjang* (Crab-eating macaque, also known as long-tailed macaque/monkey)	*Macaca fascicularis*	+++	Unprotected
46	*Rusa* (Cervus, a	*Cervus sp*	++	Protected

No.	LOCAL NAME	BINOMIAL NOMENCLATURE	ABUNDANCE ESTIMATE	STATUS
	genus of deer)			
47	*Tapir* (Tapir)	*Tapirus indicus*	++	Protected
48	*Napo* (Greater mouse-deer)	*Tragulus napu*	++	Protected
49	*Simpai* (a kind of leaf monkey)	*Presbytes sp*	+++	Unprotected
50	*Bajing* (plantain squirrel)	*Callosciurus notatus*	++	Unprotected
51	*Harimau* (Tiger)	*Panthera Sumatrensis*	+	Protected
52	*Macan Akar* (a kind of Neofelis)	*Neofelis sp*	+++	Protected
53	*Macan Dahan* (clouded leopard)	*Neofelis nebulosa*	+++	Protected
54	*Beruk* (pig-tailed monkey)	*Macaca sp*	++	Unprotected
55	*Beruang* (bear)	*Helarctos sp*	++	Protected
56	*Kijang* (deer)	*Cervulus sp*	++	Protected
57	*Siamang* (long-armed black (tailless) gibbon)	*Cignagalle beneti*	+++	Unprotected

Remarks: + = small quantity; ++ = Medium Quantity, +++ = Large

Quantity

2.1.3. Impact of Development on Conditions of Flora and Fauna

Geothermal business activities of PT. SERD in the form of construction of well pads with their supporting facilities and planned access roads covering several stages of activities as described above, both directly and indirectly may create impact on the conditions of flora and fauna.

The activities of opening the land in the form of land clearing will demolish the existence and diversity of the existing types of vegetation. After the opening of the forest area, automatically there will be no biomass remained which is able to regenerate. Succession of the vegetation in the forest area which has been naturally opened may take place, however it needs a very long time, where in the early years the forest will be filled with a type of grass and bush, and after several years later the land will be filled with a type of pioneering plants, and finally within the period of hundreds of years such forest area will be full of several types of trees that will form another secondary forest.

The disappearance of the covering vegetation will indirectly damage several types of flora which is in the habitats of the fauna, disturbing the existing ecological balance, changing the local climate, and altering the biological diversity, both flora and fauna in the area.

The land opening activities at the location will cause the disappearance of various kinds of flora and further will affect the sustainability of the fauna living in it due to the disappearance of the habitat, the source of living, the shelters and nests.

2.2. PHYSICAL CONDITIONS OF THE SITE

2.2.1. Climate

The conditions of the climate are studied through secondary data obtained from the Climatology station, Meteorology and Geophysics Agency, Climatology Station Class II, Kenten, Palembang within the latest period of 10 years.

The geothermal business location of PT. SERD is administratively located in Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province.

Based on the type of climate in South Sumatra in general and at the location in particular, the geothermal business location of PT. SERD belongs to the tropical area which is marked with dry season and rainy season.

Generally, the rainy season takes place from October to April and the dry season takes place from May to September. Based on such condition, it is determined that the type of the climate of Muara Enim according to the classification by Schmidt and Ferguson is Climate Type A, in which the pattern of the rainfalls is affected by circulation of the Monsoon from Asia and Australia continents.

2.2.2. Rainfalls

According to the rainfall data within the period of 10 years and the analysis of rainfall data by Schmidt and Ferguson (1951), the activity area is included in the climate type A (according to Kopen) and included in the zone of agroclimate B2 (according to Oldeman, Darwis and Las, 1979, quoted from *Geografi Indonesia*, Sunarto, S., Erlangga, 1999). The wet season takes place for 8 (eight) months, from September to April, with the rainfalls around 249-514 mm/month. The peak is in November, which is 514 mm.

Table 2.4. Climate Elements around the Location of PT. SERD

Unsur Iklim	Bulan											
	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agt	Sep	Okt	Nop	Des
Curah Hujan (mm)	275,5	363,6	254,1	420,3	242,9	171,4	156,8	193,8	411,2	336,3	514,2	249,1
Hari Hujan (mm)	23	26	23	21	17	15	12	16	19	20	21	16
Suhu Min	23,1	24,2	24,5	23,4	25,3	23,6	24,5	24,2	23	24,2	23,7	23,6
Suhu Maks	31,6	32,03	32,78	32,5	33,7	31,7	32,4	32,5	31,6	32,9	32,7	31,5
Suhu Rata-Rata	26,5	27,11	27,5	27,2	28,4	26,5	27,3	27,1	26,1	27,6	27,3	26,7
Kelembaban Udara (%)	86,19	88,46	86,94	83,03	85,68	83,61	85,52	84,97	84,81	81,16	86,1	86,4
Penyinaran Matahari	40,2	47,01	45,3	50,1	54,5	52,13	53,7	57,58	53,06	52,7	56,6	37,5

Source: Meteorology and Geophysics Agency, Climatology Station Class II, Kenten, 2012

Translator’s Notes on the above table:

Bulan = Month

Curah Hujan = Rainfalls

Hari Hujan = Number of Rainy Days

Suhu Min = Minimum Temperature

Suhu Maks = Maximum Temperature

Suhu Rata-Rata = Average Temperature

Kelembaban Udara = Humidity

Penyinaran Matahari = Solar Irradiance

The average number of rainy days from September to April which form the wet season is 16 to 26 days/month.

The largest number of rainy days is in February, which is 26 days/month. For the dry season, the number of rainy days lies between 12 and 17 days/month, which take place from May to August.

Table 2.5. Rainfalls within the Period of the Last 10 Years (2002-2011) around the Location of PT. SERD (Muara Enim Regency)

Tahun	Bulan											
	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agt	Sep	Okt	Nop	Des
2002	166	230	196	150	33	82	39	37	50	152	396	254
2003	192	116	84	326	291	15	12	42	2	26	140	325
2004	299	227	590	555	190	215	360	236	99	184	240	444
2005	248	205	314	206	73	189	163	69	43	410	503	462
2006	444	238	93	240	297	177	77	56	150	250	442	249
2007	454	256	323	328	87	237	74	259	171	368	284	195
2008	159	94	390	198	284	135	44	191	235	253	304	526
2009	610	204	233	335	113	54	101	42	137	276	146	399
2010	484	446	484	165	241	132	317	291	367	253	261	367
2011	293	191	161	245	171	157	39	15	0	201	353	299

Source: Meteorology and Geophysics Agency, Climatology Station Class II, Kenten, 2012

Translator's Note on the above table:

Tahun = Year

Bulan = Month

2.2.3. Temperature

The average daily temperature at the activity location and the surrounding area reaches its minimum figure in

September which is 23°C, while the maximum figure is reached in May with 28.4°C. The highest air temperature lies between 31.5°C and 33.7°C and the lowest temperature is around 23°C up to 25.3°C.

2.2.4. Physiology and Geology

The planned area of geothermal exploration has a morphological type of *andisol* highland. This area has premature soil with the topography 30-40%. The relief of the most area is relatively flat land with the height varies from 400 to 1000 meters above sea level, and it is located in the plain geomorphological unit. Regional morphology of the location of activities is hilly and wavy in general and the slope is higher than 8%.

From the result of observation on the geological conditions based on the rocks disclosed and the appearance of the landscape viewed from the site survey combined with the study on literature and interpretation of maps available, it has been described that the geothermal exploration site of PT. SERD is located in the area of *regosol, latosol and andisol*.

Geologically, the location of geothermal business activities is formed by quarter-aged rocks with

stratigraphic order as follows: (1) Alluvial Sediment/Qa; (2) Limestone/*Terumbu Karang* (Coral Reefs)/Q1; (3) Volcanic Rocks/Qpvg; (4) Intruded Igneous Rocks (*Batuan Beku Intrusi*)

2.2.5. Land Cover

The land used for the planned geothermal business location is included in the Bukit Jambul Gunung Patah Protected Forest Area.

The land cover at the location of activities based on the result of the Inventory Team for forest area borrow-use in the geothermal business area of PT. SERD shall be in the form of vegetation of primary and secondary natural forests by understorey vegetation which does not seem to have been intervened by human beings and local activities in exploiting woods and other types of plants.

2.2.6. Impact of Development on the Physical Conditions of the Site

Geothermal business activities of PT. SERD may directly or indirectly create impact on the physical conditions

of the site. The activities of land opening and maturation have resulted in the clearing of the land and eliminated the land cover, so that it has demolished the existence of vegetation in the forest area being opened.

The nonexistence of such vegetation results in a surface run off, so that it accelerates the erosion, affects upstream water quality, changes the land fertility, morphology, climate, air quality and causes environmental changes to the land components. Physical conditions of the location in the form of hilly high land with the high slope (steep) may potentially cause erosion and landslides.

Based on the result of data collection and site survey already conducted, it was found that most of the location was still in the process of construction of infrastructure. In such locations, there were open lands which are overgrown by the pioneering vegetation which does not function optimally to withstand the erosion rate and surface run off. Such conditions of the forest land which is open and only overgrown by understory pioneering plants and bush, if continuously allowed, may potentially decrease the fertility of the land.

Meanwhile, in another location at the borrowed and used forest area, the infrastructure construction activities are still continuing. The forest area which generally has the high slope (>8%) are mostly open and not vegetated with pioneering plants so that it is critical of erosion and landslides.

2.3. SOCIO-ECONOMIC CONDITIONS

2.3.1. Location

The geothermal business area of PT. SERD is located in 3 (three) regencies of the South Sumatra Province, namely Muara Enim Regency (Semende Darat Ulu Sub-district and Semende Darat Tengah Sub-district), Lahat Regency (Kota Agung Sub-district) and Pagar Alam (Dempo Selatan Sub-district).

The settlements close to the business location are Tunggul Bute Village, Kota Agung Sub-district and Segamit Village, Semende Darat Ulu Sub-district. Although the location of PT. SERD is included in the area of Semende Darat Tengah Sub-district and Dempo Selatan Sub-district, the settlements in both sub-districts are far from the location of exploration.

The the location of Borrow-Use area is accessible by the following inland transportation:

- Trip from Jakarta to Palembang by airplane in approx. 1 hour,
- Trip from Palembang by four-wheeled vehicle through public roads to Muara Enim (capital of Muara Enim Regency) in approx. 4 hours, then continued with the route Pulau Panggung – Segamit – Rantau Dedap to the location in 6 hours, or from Muara Enim through Lahat-Kota Agung-Tunggul Bute to the location in approx. 6 hours.

The location of the geothermal exploration activities of PT. SERD was previously quite isolated because of the inadequate access road. To market the farming products the community has no other way than to bring them by using ropes tied around their heads. However, the roads have been and will continue to be constructed by PT. SERD with the distance of approx. 40 km so that cars as a mean of transportation can enter the village and it makes the mobility of the community easier.

2.3.2. Profile of Population

The population around the working area of PT. SERD are generally native peoples, although there are some of

them who come from Java. The increase of number of population is relatively low, and even it has experienced decrease because the people who have moved are now financially successful and they take their relatives to follow them to move.

The data on population affairs especially those related to the number of population are of another complexity; this is because of, amongst other things, mobilization of people between administration areas, spaces and time is extremely high. Besides, the increase and decrease of number of population in one area due to the cases such as maternity and mortality as well as mutation of people by various reasons such as looking for jobs and other things make collection of data is relatively difficult.

Table 2.7. Number of Population around the Location of PT. SERD

No	KECAMATAN	PRIA	WANITA	JUMLAH	RASIO
1	Semende Darat Ulu	8.057	8.073	16.130	99,80
2	Semende Darat Tengah	4.870	5.014	9.884	97,13
3	Kota Agung	6.304	5.844	12.148	107,87
4	Dempo Selatan	6.153	5.458	11.611	112,73
	Jumlah	25.384	24.389	49.773	104,08

Translator's Note:

Kecamatan = Sub-district

Pria = Male

Wanita = Female

Jumlah = Total

Rasio = Ratio

The ratio of gender is the ratio of the number of male population to the number of female population. In general, it is stated that the number of male population in every 100 female population is 104.08. The higher the Ratio of Gender is the more the number of male population is.

The Ratio of Population Gender in the geothermal working area of PT. SERD in 2011 shows the average number of 104.08 which means the area covering the four sub-districts has more number of male population than the number of female population as mentioned in Table 2.7.

Table 2.8. Population Density around the Location of PT. SERD

No	KECAMATAN	POPULASI (jiwa)	LUAS WILAYAH (km^2)	KEPADATAN PENDUDUK (per km^2)
1	Semende Darat Ulu	16.130	466,60	34
2	Semende Darat Tengah	9.884	419,93	23
3	Kota Agung	12.148	165,59	73
4	Dempo Selatan	11.611	217,95	53

Translator's Note:

Kecamatan = Sub-district

Populasi = Population

Luas Wilayah = Area

Kepadatan Penduduk= Population Density

The population growth rate of Muara Enim Regency in 2011 is 2.01 percent referring to the previous year (2010), which was 14,743 people. In Lahat Regency, the population growth only reaches 0.15 percent, which becomes 4.531 people.

2.3.3. Livelihood

The main livelihood of the people around the activity location of PT. SERD is farming, which is in the form of coffee plantation. Besides such farming works, other commodities managed by the community are fruits, secondary crops (*palawija*), vegetables and cattle. Nevertheless, there are some people who have livelihoods such as trading, becoming labors, employees of private companies, members of armed forces, government employees and others.

As a plantation commodity, coffee has a fluctuating production cost value and it tends to be low-priced. With the harvesting time once a year, the community who rely on coffee products suffer a famine (*paceklik*). In

the period of famine some of the community go to the town to look for jobs or looking for forest products for additional income.

As farmers, except for coffee plantation, to fulfill their daily basic necessity, the community cultivate rice crops and vegetables such as tomato, cabbage, long beans, chives, chilly and other vegetables that are going to be developed intensively.

2.3.4. Education

The education being considered important nowadays is one of the reflection of the level of advancement and welfare of a nation. With the education, it is expected that the quality of human resources can be improved. The improvement in education is an important instrument which may lead to the realization of the people's welfare.

For the government, the benefit obtained from the investment in the field of education is one of the way to fight against poverty, to eradicate the unbalanced of income and to improve productivity of employees. Meanwhile for the community, better education means a capital to win the job opportunity, so that at the end the income can be increased.

Level of education of the community around the location of geothermal business activities of PT. SERD in general is still relatively low, which are *SD* (elementary school graduates); however, there are some people who have graduated from *SLTP* (Junior High School), *SLTA* (Senior High School), diploma, and bachelor degree. This low level of education is because the formal education facilities available are only *SD* and *Ibtidaiyah* (Islamic elementary school). Children who have graduated from *SD* must leave their villages to continue the education.

The conditions and quality of education of the human resources around the location of geothermal business activity of PT. SERD, particularly in Muara Enim, if associated with formal education, are relatively low. The result of the *Susenas* (National Economic Sensus) 2009 shows that amongst the population having the age of 15 and above, 20.91% of them have no certificates, 33.69% of them have certificates equal to *SLTP*, 15.70% of them have certificates equal to *SLTA* (Senior High School) and 2.61% have high education, i.e. Diploma I, II, III, *Strata 1* (Bachelor Degree), *Strata 2* (Master Degree) and *Strata 3* (Doctoral Degree).

In Segamit Village, Semende Darat Ulu Sub-district, Muara Enim Regency, there are 2 State's Elementary School (*SD Negeri*), 2 Islamic schools (*Madrasah*) and 1 *SLTP*, meanwhile in Tunggul Bute Village, Sub-district Kota Agung, Lahat Regency, there are 1 *SDN* and 1 State's *SLTP*; in Bandar Jaya Village, Dempo Selatan Sub-district, Pagar Alam City, there is 1 *SD Negeri*.

2.3.5. Religion

Most of the villagers around the geothermal development area of PT. SERD are Moslems; it has affected the life style of the community at the time of maternity, circumcision, marriage, mortality and community relationship.

2.3.6. Perception of the Community

Most of the community have been informed about the geothermal exploration activities in their area. The perception of the community about the geothermal exploration is positive (showing agreement), where they expect that they could work and that the Company's activities could bring benefits to the local community.

Geothermal exploration activities of PT. SERD is expected not to reduce income of the local community,

but they are expected to increase the welfare of the people due to geothermal exploration activities.

The geothermal exploration activities will bring positive impact in the form of the increase of the people's income. The large number of workers who come both from the location around the activities as well as from outside the location will lead to the growth of economic activities because the workers will cause the economic activities of the community to grow as the workers need consumable products, lodging, as well as basic necessity. Therefore, the existing businesses, especially those which provides daily basic necessity will increase and it is not impossible that new businesses will emerge in order to meet the workers' needs.

Further, electricity which will be produced later is expected to create a positive impact on the people's welfare especially in the area of Muara Enim Regency, Lhat Regency and Pagar Alam City. By the fulfilment of electricity need, the economic activities of the community will increase.

Besides, the public service works for the local community will increase, where PT. SERD has launched

CSR (Corporate Social Responsibility) programs. CSR activities performed by PT. SERD in the nearest villages in the form of provision of bags for *SDN* students, assistance for the teachers' uniform, assistance for *Posyandu* future activists, assistance for *Karang Taruna* (Youth's Local Organization), pipe assistance and clean water as well as spring to the villages, assistance in the form of incentives for the teacher, assistance by providing computers, laptops, printers and scholarship for outstanding students.

However, the indirect negative impact of the geothermal business activities of PT. SERD on the forest area is the increase of accessibility to the forest area which will cause potential illegal lodging, the encroachment on forest and forest as well as forest and land fire.

Besides, if it is associated with the decrease of water quality, the public health will also be affected, considering at present the villagers around the location of activities largely depend upon the rivers for drinking, bathing and washing. In the current conditions, for the supply of water for drinking and cooking, the community pays less attention to the health requirements. If the water quality is not considered, it may bring diseases.

2.4. CRITICAL CONDITIONS OF THE FOREST AND FOREST AREA

Before the geothermal exploration activities by PT. SERD Started, around the location of activities in Bukit Jambul Gunung Patah Protected Forest there were disturbances threatening the existence of the forest and forest area which amongst others consists of:

2.4.1. Encroachment of Forest Area

Encroachment on forest has been conducted at a part of PT. SERD's location by the Community living around the forest area for farming by planting coffee and other agricultural plants.

The location where the encroachment on the forest area for coffee cultivation could be found outside the borrow-use area of PT. SERD, that is around the access roads. Although the encroachment on forest area around the location of PT. SERD is still limited, if an anticipation is not taken in an effort to protect the forest, it is feared to expand to other areas.

2.4.2. Cutting Down of Trees and Collection of Other Forest Products without Consent

Forest products mean any goods yielded from the forest in the form of vegetables, animals, non-biological objects, services, results of the production directly obtained from the processing of raw materials in the forest.

In the Bukit Jambul Gunung Patah Protected Forest area, trees that have high selling values are still found. With the exploration activities, road accessibility to the location of exploration is also opened. In the location of this Protected Forest, footpaths are found which according to the information from the site the community used them to transport wood resulted from illegal logging. Such conventional theft is conducted by cutting down trees in the forest and open the land by burning continuously. These activities have been conducted by the community to meet their daily needs and demand for the wood itself.

Therefore, forest protection activities are required to anticipate illegal logging, timber theft and collection of other forest products. Forest protection for forest products shall be provided with the objective as to

avoid excessive or illegal utilization of the forest and such protection activities are performed by means of development, supervision and enforcement. Implementation of forest protection for forest products can be provided within the forest area covered by the borrow-use or within the forest area around the borrow-use area.

2.4.2. Forest Fire

Forest fire was previously considered as having occurred naturally, however it is possible that human beings play a role in starting the fire in recent years, firstly for the purpose of making the hunting easy and further for opening farming areas inside the forest.

So far the activities of opening the land are usually done by combining mechanical method and the method of burning the remains of cut trees. The method of burning the remains of cut trees surely gives advantage that it is quicker and cheaper, however if considered from the environmental aspects, this is very detrimental. Opening of the land by burning causes several things, which amongst others are (1) Disturbance of smoke, which is harmful to the health and aviation; (2) Soil becoming dry and the microorganism elements inside the

soil will be killed; (3) waste of natural resources, in this case is wood; (4) For certain conditions if not carefully done may cause uncontrollable and expanding fire.

Fire will reduce quality of the forest and therefore supporting the efforts to have a permanent forest area (such as production forest) in a legal manner to be reclassified as the forest areas available for conversion into the plantation. By the limited availability of the unclassified land as forests which is suitable for developing oil palm plantation, burning the forest further becomes one of a beneficial way to increase availability of the land.

By the encroachment on forest area for cultivation of crops where the opening of land is done by burning, it is feared that this will become the new modus by the community who live in other areas around the Bukit Jambul Gunung Patah Protected Forest.

2.4.4. Hunting of Flora and Fauna and Possibility of Pests

Biological resources are biological elements in the nature which consist of plant natural resources and

animal natural resources that together with the surrounding non-biological elements as whole form an ecosystem. From such above definition, the forest may be considered as biological resources, so that the forest needs protection and conservation. Conservation of biological resources and their ecosystems become the responsibility of the government and the citizens. Besides, the holder of the title of the land for business is obliged to provide protection of biological resources.

Conservation shall be performed jointly with the objective as to maintain the ecological processes between components of the ecosystem so that they are able to support the sustainability of life and increase welfare of the community around the forest.

The forest being attacked by the pests, if occurred, is caused by unbalanced ecological conditions between the population of the pests and the area of the forest, meanwhile the pests grow more rapidly than the forest, and that the pests do not have predators or things that disturbe them. The pests mentioned here is a kind of insects.

Attacks by a group of pests is more destructive than individual attacks. Further, the type of disturbances are damaging the form of the object, making the object weaker, reducing the level of growth of the plant and killing.

Diseases of the forest plants are developed because of a determining factor such as plant sensitivity which results in susceptibility or the ease of being infected by the diseases, immunity of the plant from the disease, which is an absolute resistance which means it cannot be infected by the disease. Usually the disease spreads by several stages, amongst others are: Pathogenic, which is the forming of inoculum of inoculation spread, penetration and infection, meanwhile the Survival is to determine whether or not the tree is infected. There are several factors which cause the disease to emerge in the forest plants which amongst other are fungus, bacteria, virus and weeds.

So far, at the location of the protected forest which becomes the location of PT. SERD, pests and diseases which attacks the forest plants are not found. Meanwhile, the hunting of the protected fauna, based on the information from the community, still happen and in

general it is done by the surrounding community and new comers.

2.4.5. Availability of Facilities and Infrastructure for

Forest Protection

Protection and security maintenance of the forest are required with the objective as to prevent and minimize damage to the forest as well as maintain the rights of the country over the forest and forest products, and to have a strategic value in the lives of the community and the country in which the functions of the forest as the biological resources, life support and regional assets have ecological and economic benefits.

Considering the forest area which is very large with the criticalness to the crime to the forest and forest products in the form of illegal logging, transportation of timbers without valid documents, smuggling of timbers and other forest products as well as encroachment on forest has reached the level of concern, that it is necessary to conduct an arrangement of forest protection and security measures by various types of approach, being adequate and effective in overcoming the crimes in the field of forestry.

To implement the above concept, forest protection and security measures are necessary to be provided by various types of activities in addition to the support by the laws and regulations as well as human resources; it is important to take note of the availability of the facilities and infrastructure for forest protection.

Facilities and infrastructure for forest protection shall be procured in order to improve the performance and mobility of security officers. Output from this activity is the increase of performance of the forest security guard in the effort to protect the forest.

CHAPTER III FOREST PROTECTION WORK PLAN

Forest protection and security measures are quite complex and dynamic. With the development in various fields and the dynamic change at the field, the problems of forest protection and security measures also develop, starting from the nomadic cultivation and illegal plantation/encroachment done by the community ranging from the simple one to the illegal logging and big-scale smuggling of animals supported by strong capitalists.

At the geothermal business location of PT. SERD, the main problems of forest protection and security measures found at the site are encroachment by the local community and illegal logging which tend to increase and widely spread out.

There are several factors which cause the community around the forest to conduct encroachment; amongst other things are the closeness and dependency of the community living around the forest area with and on the forest, which creates interaction between the community and the forest. Although at the earlier stage, the interaction between the community and the forest still maintained the aspect of natural preservation; however, due to the developing civilization and needs, such

interactions between the community and the forest has started to change.

The surrounding community usually only rely their source of living on agriculture sector. Limitation of land owned by each family as well as the increase of needs cause some of the community who cannot afford to buy conduct encroachment on the forest to expand their area and agricultural production. Besides, the level of welfare of the community around the location of PT. SERD is relatively low. The low level of welfare of the community around the forest causing the low level of fulfilment of economic needs which tends to increase which is marked with the number of family members and changes of the era makes the community taking a shortcut by conducting encroachment. The low level of welfare also becomes the background of their activities in utilizing natural resources without considering the aspect of preservation. This leads to the short-term interest that is detrimental without taking into account the long-range aspects.

Furthermore, it is predicted that the limitation of the forest security guards, limitation of forest security facilities, the high level of accessibility to the forest area, and unfirmed law enforcement may become the other factors that lead to the encroachment being spread out in this location.

The forest protection and security problems in the form of illegal logging at the location of PT. SERD is predicted to have been done by the local and/or immigrant community because there are parties who support them, by both providing facilities and infrastructure as well as purchasing the product of illegal logging. It is suspected that there are some parties who become the sponsors as the community often receive money in advance before their conducting the illegal logging.

Illegal logging taking place in this area is the same as in the other areas in Indonesia, is included in organized crimes, in which there are think tanks and executors. The executors could be the woodcutting labors (local and or immigrant community) who are paid, the party who owns the capital (sponsor), the purchaser, the seller and frequently there are parties who back up so that the practice of illegal logging is difficult to eradicate.

Forest protection does not only face the situation of how to overcome the damage when it occurs but also it is more directed to identify and evaluate all the potential causes of damage, in order that the serious damage can be avoided, so that the damage to the forest can be minimized to the lowest level and avoided from the potential causes.

An important principle in forest protection activities is the early prevention of the cause of the damage is much more effective than to demolish the destroyer after the attack. In recent years, the opinion that prevention is a more important system in forest protection has been widely accepted. However, it is still doubtful whether or not development of this idea by the silvicultural method and forest management within the long run is considered quite beneficial. Prevention through the application of management and silviculture takes a long time, however the result will be more permanent and cheaper compared to the direct eradication method.

So, the principle of forest protection is to give priority to the early prevention or development of a damage to the forest by good silviculture planning and management. This will be more effective than the direct control after the occurrence of the serious damage. In the principle of forest protection, proactive actions must be put forward and reactive action should as maximum as possible be avoided.

For the law enforcement in the field of forestry in the form of forest protection and handing of the disturbances to the forest area and forest products by preemptive, preventive and repressive actions.

3.1. PREEMPTIVE ACTION

3.1.1. Introduction to the Community

Development of the community is performed by coordinating with the relevant agencies both in the provincial and regency levels. Counselling on forestry to the community by PT. SERD individually or accompanied by the Department of Forestry of the Province and the Regency shall be provided by giving explanation to them on the benefits and functions of the forest so that the community realize the importance of taking good care of the existence of the forest so that it could bring benefits to the current generation and the coming generation; the followings are the things to perform (amongst others):

- Introduction to and explanation on (*Sosialisasi*) the laws and regulations on forestry, forest protection, protection from forest fire and conservation of biological diversity.
- Conducting interviews with the community and discussing about how to solve the problems in forest protection, so that the surrounding community will actively take part in the protection and security maintenance of the forest in such location.
- Community welfare approach. The activities that can be performed is by granting the assistance to

the farming business to the community through the Corporate Social Responsibility (CSR) Programs, so that the community can develop the agriculture by intensification pattern in order to improve productivity of agricultural products.

- Establishing relationship with the relevant agencies to support the programs to be carried out by PT. SERD.

3.1.2. Installation of Prohibiting/Warning Signboards

To prevent the damage to the forest due to the encroachment on the forest area, illegal logging, collection of forest products without consent, it is necessary to install signboards containing prohibition and warning which are made in the readable and understandable language.

The prohibiting/warning signboards will be installed in a scattered manner in several locations which include roads, well pad locations and forest area boundaries with the following details:

Table 3.1. Locations and Number of Prohibition/Warning Signboards

NO.	LOCATION	NUMBER OF PROHIBITION SINGBOARDS

		ROAD	WELL PAD/FACILITIES & INFRASTRUCTURE	TOTAL
I	**ROADS**			
1	Jalan Anoa	2	1	3
2	Jalan Badak	2	1	3
4	Jalan Cendrawasih	2	1	3
5	Jalan Domba	2	1	3
6	Jalan Gajah	2	1	3
7	Jalan Arabika	3		3
8	Jalan Endikat	3		3
9	Jalan Segamit – Rantau Dedap	4		4
10	Jalan Tunggul Bute – Rantau Dedap	2		2
11	Jalan Kota Agung – Tunggul Bute	2		2
II	**FACILITIES//INFRASTRUCTURE**			
1	Contractor Camp Area		1	1
2	Helipad		1	1
3	Admin		1	1
4	SE Camp		1	1
5	SE Laydown		1	1

NO.	LOCATION	NUMBER OF PROHIBITION SINGBOARDS		
		ROAD	WELL PAD/FACILITIES & INFRASTRUCTURE	TOTAL
6	Contractor Laydown		1	1
7	Power Plant		1	1
8	Water Reservoir & Explosive Bunker		1	1
9	Water Supply Intake		1	1
10	Borrow Area		1	1
11	IP 1		1	1
12	IP 2		1	1
13	IP 3		1	1
14	Disposal Area 1		1	1
15	Disposal Area 2			
16	Contractor Site Office			
III	**OUTER BOUNDARY OF FOREST AREA**			
	Border with Segamit Village	2		2
	Border with Tunggul Bute Village	4		4

NO.	LOCATION	NUMBER OF PROHIBITION SINGBOARDS		
		ROAD	WELL PAD/FACILITIES & INFRASTRUCTURE	TOTAL
	Border with Kota Agung	1		1
	TOTAL	33	20	53

Installation of the warning/prohibition signboards in the first year is prioritized to the main roads that were constructed in 2013 meanwhile the remaining were installed at the locations of the facilities and infrastructure and roads constructed in the following year.

Meanwhile, in the third and fourth years there will be no activities related to the prohibition/warning signboards, and in the fifth year, improvement and correction activities are performed again.

3.2. PREVENTIVE ACTIVITIES

Preventive activities are any activities performed to prevent security disturbances to the forest area, forest products and biological diversity.

In implementing the preventive efforts, forest protection activities are performed by PT. SERD itself or jointly with the community or in cooperation with the forest rangers; this effort is performed to minimize the breach of law done by the community. With the objective that the community have the awareness to reduce or stop the disturbances that threaten the existence of forest area, forest products and biological diversity. The preventive activities are in the form of:

3.2.1. Data Collection and Mapping of Forest Security Disturbances

Data collection and mapping of forest security disturbances are the implementation of the forest functional security measure activities which becomes a part of the detecting activities, that is to make prediction on the conditions of the possibility of the occurrence of disturbances to the forest and forest products completed with the data of the person who conducts such crime, community leaders around the

forest, plotting of crime-prone map and planned and continuous mobilization.

In the forest area in the area of PT. SERD or the surrounding forest areas, data collection and mapping of security disturbances necessary to be performed are amongst others:

a. Collection of data concerning encroachment on forest

   In the activities of collection of data on disturbances of encroachment on forest the community who conducts the encroachment to open the land for cultivation and farming become the target of the data collection.

   The basic data are produced in the first year, that is in 2013, meanwhile in the following years, the collection activities are in the form of data updating.

   The data of the person who encroaches on the forest include: name, village of origin, number of family members, width of the area opened; commodity; nature of settlement (permanent or nomadic only as a working camp); possibility of willingness to plant vegetables and woods; possibility to expand the farming area; encroacher’s perception on the forest biological

resources; possibility that the community will expand the farming or plantation area; and others.

b. Collection of data of disturbances due to illegal logging and collection of forest products without consent

Target of the activities of collection of data due to illegal logging and collection of forest products without consent is the community who live around the forest location who has wood business and or other forest products. Included in this case are the protected flora and fauna in the protected forest.

The basic data are made in the first year, which is in 2013, meanwhile in the following years the activities of data collection are in the form of data updating.

The required data related to illegal logging include the data of number of sawmills in the village, sales of sawmill products; possibility of willingness to change the business to another one; information about which flora and fauna are searched by the people; the locations where rare animals are found; information about network of marketing of the forest products taken from the protected forest.

c. Collection of data of possibility of landslides

Topography of the geothermal business location of PT. SERD is hilly. At the time of construction, both for roads, well drilling or offices, land cutting and landfilling are frequently done. These land cutting and landfilling will make the cliffs almost perpendicular that it is critical for landslides.

The target of the data collection of this landslide is the areas in which land cutting and landfilling are conducted.

The data related to landslides required include the data of locations; prediction of width of the area and others.

d. Collection of data of protected flora and fauna

The purpose of this activity is to study, collect, compile and analyze the data of potentiality, number of population and distribution of the flora and fauna.

The objective is to develop the result of the analysis into a kind of recommendation expected to

become a consideration for the development of the management of natural resources optimally and sustainably.

e. Mapping of the Location Critical to the Forest Fire

The mapping of forest fire location is the mapping of the forest area around the location of PT. SERD which is critical to the forest fire. Based on the result of data collection on the disturbances to the existence of forest, forest products and biological diversity, a study and mapping of the criticalness are conducted, especially forest fire and landslides. The places being prioritized for its criticalness to the forest fire are the place of encroachment, open area locations for access roads, locations which are possible to be opened and converted into plantations.

The mapping of the location to identity the areas critical to the forest fire is the activity to collect the data and information about the hot spots and handling of forest fire if case if occurs. Output of the activity is the data of the areas being critical to forest fire and the landslides that functions as the tool to identify the critical areas to the forest fire and landslides, so that the incidents can be anticipated.

3.2.2. Establishment of Forest Security Guard Units

Forest security maintenance is any activities, efforts and endeavor performed by the forestry officers with the support from the relevant agencies in order to secure the forest and forest products in a systematically planned manner, continuously with the principles of efficient and effective.

Forest security maintenance in the forest area, is functionally performed by the security guards of PT. SERD. This is in accordance with the functional rights and obligations of the holder of the borrow-use permit. By coordinating with the relevant agencies (Forestry Deparment of South Sumatra Province, Department of Forestry and Plantation of Lahat Regency, Department of Forestry and Plantation of Pagar Alam City, and Department of Plantation and Forestry of Muara Enim and Manggala Agni Regency), the security guards are trained to conduct security measures in the forest by PT. SERD separately or jointly with the forest rangers.

In performing their duties in the security maintenance eof the forest in the geothermal business location of PT. SERD, a Standard Operating Procedure shall be made

to be used as the guidelines for implementation of forest security maintenance. Such SOP contains the job description, routine scheduling of work, patrol and inspection mechanism as well as reporting system and others.

3.2.2. Security Maintenance of the Forest

a. Security Guarding of the Forest

Security guarding is performed in the designated security guardhouses the placement of which can safeguard the interest of the Company and protect critical points from the disturbances to the forest and forest products.

The main objective of the security guarding is to reduce the possibility of the breach in forestry to take place. Checking the people who are entering and leaving the locations of PT. SERD inside the forest area, the security guarding are conducted on shift by the Security Head of PT. SERD.

b. Forest Security Patrol

The patrol is the activity in supervising security of the forest which is carried out by moving from one place to another by two persons or more in the forest area which becomes their responsibility where breach or

crime in the field of forestry frequently happens. The patrol is conducted regularly and selectively depending upon the situation and conditions of forest security with the objective as to avoid the disturbances to the forest and forest products, being aware of the situation of the site and taking action to the breach or crime found during the patrol.

c. Forest fire control

In general, the handling of forest and land fire is still reactive and uncomprehensive. It can be made sure that this temporary handling cannot resolve the main problem which causes and simultaneously triggers forest and land fire that have occurred so far. The impression is that the government is only busy after the forest fire takes place and unfortunately the reaction comes after the strong protests from the neighboring countries. Learning from the experience of 1997, economy, ecology and good relationship between countries were disturbed.

The effects of the forest fire is not only the economic loss and damage to the ecosystem, we are also claimed as a nation and community that cannot and do not want too maintain natural resources. Whereas, forest areas in Indonesia covers 10 percent of the tropical forest

area in the world or the third biggest after Zaire and Brazil. In addition to this, the smoke disturbing the neighboring countries make a number of countries claim that we are not a good neighbor. Not only are the health and community activities disturbed, but also navigation of aviation and sailing are disturbed.

Forest fire in Indonesia occurs every year almost during the dry season. Effects of the forest fire are the complaints from the neighboring countries especially Malaysia and Singapore which are also affected by the haze produced.

In the country the forest fire has disturbed aviation activities, traffic of vehicles, and disturbance to health in the form of irritation to the eyes, and Acute Respiratory Infection (ARI) as well as other environmental damage.

Forest fire almost takes place during the whole dry season and the handling has not demonstrated a maximum result. The width of the area and limitation of the personnel as well as the equipment become some of the reasons. Besides, the climate condition and moreover the factor of human error become the main cause of the forest fire.

Activities of the community in the forest area are actually the main root cause of the forest fire. In addition to that, the plantation companies are only seeking the practical and cheaper ways to open the land. To prevent and limit the damage to the forest due to the forest fire, a controlling activity shall be carried out which includes prevention, extinguishing and handling after the fire.

The preventive operation that constitutes the efforts aimed to identify the areas critical to the forest fire is the activity of collecting data and information about hot spots and handling of the forest fire if it occurs. Output from the activity is the data of areas critical to the forest fire that functions as to identify forest fire critical locations so that prevention and handling can be handled appropriately.

The efforts to prevent the forest fire is not a standalone activity but it is an integrated with the other protection activities. Implementation of the forest fire control is in the form of integration of forest fire control and other protection activities, which amongst others are:

- Conducting inventory of the locations critical to forest fire;
- Inventorying of factors of the causes of fire;
- Preparing fire fighter groups;
- Preparing a fixed procedure for forest fire extinguishing;
- Procuring the forest fire extinguishing facilites; and
- Making firebreaks.

3.2.4. Coordination with Relevant Agencies

Coordination for the implementation of forest protection is the coordination with the relevant agencies who handle forest protection so that the same vision could be established in handling the forest security operation, in handling the crime in the field of forestry, in the efforts to handle the encroacher on the forest, and in handling the forest fire. To support the smoothness and the success operation of the forest protection activities, a coordination is required between PT. SERD and the relevant agencies. In connection with the forest protection activities, the coordination is prioritized to the coordination with the forestry

agencies of the regency, province and central government.

3.2.5. Procurement of Facilities and Infrastructures of Forest Protection

Facilities and infrastructure required in supporting the implementation of forest protection in general are:

- Guardhouses

  Guardhouses will be constructed in the exit road from the location of PT. SERD to Lahat and Muara Enim directions.

- Transportation facilities

  The transportation facilities used for protection activities are motorcycles for patrolling throughout the area. Number of motorcycle shall be at minimum 1 (one).

- Communication Facilities

  To support optimum operation of the forest protection the communication facilities shall be prepared. The communication facilities are in the form of handy talky (HT).

Meanwhile, the facilities and infrastructure for forest protection to overcome forest fire are additional equipment in the form of:

- Pulaski; having a function to cut small trees, gouging, scratching and digging in making the *ilaran api* and cleaning of fuel.
- *Kapak Dua Mata* (two-edged axe); having a function to cut small up to medium-sized trees;
- Bushhook; having a function to reduce accumulation of fuels in the canopy;
- Machete; having a function to clear bush/twigs;
- Saw; having a function to cut small trees;
- Flapper
- Fire Rake; having a function to collect surface fuel.
- McLeod Rake
- Hoes; having a function to dig the soil;
- Shovel; having a function to throw soil or muds as well as hit the fire;
- Backpack Pump; having a function to spray water;
- Water Pumps

Procurement of facilities and infrastructure of forest protection will be carried out gradually

starting from 2013 or since the first year of the forest protection implementation, meanwhile for the following years, it is just as repair of the damaged facilities and infrastructure or to add/replace if such facilities or infrastructure are considered insufficient or missing.

3.2.6. Forest Protection Training

Training is aimed to improve the capacity of human resources especially in forest protection activities. The training is directed to improve the capability of the officers of PT. SERD in forest protection activities, including forest fire control.

The training of forest fire prevention and control is the activity of facilitating theories and practice in the form of prevention and control of forest fire to the officers and the community living around the forest. Output of this activity is the availability of skillful workforce in preventing and controlling forest fire and providing knowledge and awareness of the impact of the forest fire.

The training for preventing and controlling the forest fire is conducted by coordinating with the Forest Fire

Control Unit of the Department of Forestry in South Summatra Province, namely Manggala Agni.

In connection with the training activity, PT. SERD will dispatch the officer of the Company or the community around the geothermal business location of PT. SERD in case there is a kind of training related to the forest protection carried out by the forestry agency or other relevant agencies.

3.3. REPRESSIVE ACTIVITIES

The law enforcement is not only conducted preventively but also repressively. This can be performed functionally by the Forest Rangers (*Polisi Hutan*) or it can be jointly performed by the relevant legal apparatus of the relevant institutions. Repressive action is defined as an action taken to the person who is identified to conduct breach of laws and regulations on wild plants and animals.

Repressive action is the action to enforce the law where the disturbance to the security of the forest area has occurred and tends to continue or proliferate so that an action to the person who performed such breach must be taken. Based on the form of actions

taken in the field, repressive actions are categorized into (1) Tactical Operation, that is the activity or effort to prevent and take action to the breach directly in the field through patrolling program, to check documents and evidence, to examine the person who performed such breach, to confiscate the evidence, to secure the crime scene, to settle administration in the field and reporting. (2) Legal Operation (*Operasi Yustisi*), which constitutes the activity or effort to enforce the law by the Examiner from the Government Institution (*Penyidik Pegawai Negeri Sipil/PPNS*) or an examiner from Police Department in order to prevent the person who has conducted the breach from doing the same thing again, which shall begin with the examination until a sanction is imposed based on the court's decision.

3.3.1. Forest Security Operation

Repressive action or law enforcement by securing the crime scene (the suspected and evidence), making and signing of report of the incident, and further immediately report or submit the report to the Government Employee as the Examining Officer from the forestry institution or to the investigator from the Police Department.

3.3.2. Forest Fire Extinguishing

Forest Fires Extinguishing means any effort, action or activity to remove or distinguish fire that burns the forest. The effort to prevent and limit the damage to the forest due to fire is in the form of forest fire controlling activities including the extinguishing and handling after the fire.

The series of actions in extinguishing fire are as follows:

- Identification of forest fire;
- Empowerment of available resourced;
- Making firebreaks in order to localize the fire
- Mobilizing the community to accelerate the extinguishing process

Repressive activity of the forest protection which includes operation of forest security maintenance and fires fire extinguishing will only be conducted if there is a disturbance to the forest area, forest products and biological diversity. If an illegal logging or fire happen in the forest, the repressive action will be taken by the authorized agencies. PT. SERD may provide assistance for the smoothness of the repressive activities, if necessary.

CHAPTER IV BUDGETARY AND IMPLEMENTATION SCHEDULE PLAN

4.1. BUDGETARY PLAN

Budget component in the activity of forest conservation covers the entire costs, both direct and indirect cost spent in the implementation of forest protection activity.

Direct cost constitutes costs spent for the purpose of socialization, installation of restriction/warning sign board, data collection and mapping of security disturbance to the forest, formation of forest security guard, security guarding/patrol in the forest, coordination with relevant agencies, provision of facilities and infrastructures for forest protection, forest fire control drill, forest security guarding operation, forest fire extinguishing.

Meanwhile indirect cost constitutes mobilization and demobilization, forest protection plan, administration and supervision.

Socialization is conducted to the society lives in the villages around activity location of PT. SERD by giving the priority to Tunggul Bute and Segamit village twice a year. The

cost for each socialization is amounting to Rp. 6,000,000 which covers honorarium and travelling cost for the speakers, food and beverages (*konsumsi*) and accommodation, and honorarium/allowance for participants.

Installation of restriction/warning sign board as many as 53 pieces with the cost in the amount of Rp.2,300,000 per piece details the cost of restriction board set-up/provision and installation fee. While annual maintenance cost is budgeted in the amount of Rp.300,000.- per piece.

Data collection and Mapping of security Disturbance to the Forest are conducted by coordinating with Regency Department of Forestry. Data collection and mapping of security disturbance to the forest were conducted in the first year with the budget of Rp. 21,400,000 for 3 regency territories, while in the second year and afterward it constitutes data renewal activity with the budget in the amount of Rp. 15,000,000 for honorarium of data collectors and travelling expense.

The formation of Forest Security Guard is conducted by coordinating with the agencies related to forest protection both at regency and provincial level. The cost of forming forest security guard is amounting to Rp. 64,000,000 a year, which detailed travelling expense to implement coordination,

coordination meeting cost which constitutes meeting honorarium, food and beverages (*konsumsi*) and accommodation.

Security guarding/patrol of the Forest is conducted continuously along the year. Activity of security guarding/patrol of the Forest includes supervision activity on encroachments of the forest, theft of forest products and the danger of forest fire. The personnel on duty is from the company, accompanied by forest police from Forestry Department of the province and regency/city. 2 Personnel are assigned at the checkpoint at the border territory, they guard in shift periodically. The budget required for the activity of security guarding/patrol of the forest for one year is amounting to Rp. 157,150,000 per annum, which consists of daily honorarium cost for the forest police who guards in shift, round-trip transportation cost to the location, food and beverages (*konsumsi*), accommodation and operational cost for one year.

In order to support the success and ease of the implementation of forest protection activity, a coordination between PT. SERD and the relevant agencies is needed. Monitoring and evaluation on forest protection activity shall be performed in coordination with the relevant agencies. The cost required is amounting to Rp. 50,000,000 for honorarium and meeting cost, travelling expense and others.

The General facility and infrastructure required for forest protection among others are checkpoint, transportation facility, communication facility and some equipment to control fire in the forest as well as other administration facilities. The activity to provide facility and infrastructure for forest protection was conducted in the first year, while in the next year it constitutes maintenance. The cost required for the first year was Rp. 35,000,000, while the cost for facility and infrastructure maintenance in the next year is amounting to Rp. 30,000,000 annually.

In connection with the danger of forest fire, the effort to control such matter is not only performed by forestry officer and the company, but it should also involves the society. Forestry agency who handles the danger of forest fire shall provide trainings to the officers or the society periodically in order to improve technical capability in forest fire control. Although there is no information on technical training in the effort of forest protection, especially the activity to control forest fire, PT. SERD allocates budget for the activity of technical training for forest protection in the amount of Rp. 50,000,000 annually.

Some activities have been included in the forest protection plan, but it is not necessarily to be performed, because the implementation depends on the current situation and condition.

The activity of forest protection operation shall be conducted in a sudden, if based on initial identification it is estimated that there will be disturbance towards forest security which constitutes illegal logging or arson of the forest area. It is expected that through sudden implementation the culprit can be arrested and legally processed.

Similarly for the activity of forest fire extinguishing, such activity will be performed if forest fire is happening. On the contrary, if there is no illegal logging or forest fire, such activities will not be performed. However the 2 (two) repressive activities will be planned and budgeted every year in the amount of Rp. 100,000,000 for every activity of forest protection operation and forest fire extinguishing.

Table 4.1. Cost Plan of Forest Conservation Activity in the Site of PT. SERD of 2013-2017

No.	Type of Activity	Unit	Year 2013		Year 2014		Year 2015		Year 2016		Year 2017	
			Vol	Cost (Rp)	Vol	Cost (Rp)	Vol	Cost (Rp)	Vol	Cost (Rp)	Vol	Cost (Rp)
A.	**DIRECT COST**											
1.	Socialization	Activity	2	12,000,000	4	24,000,000	4	24,000,000	4	24,000,000	4	24,000,000
2.	Restriction board set-up, installation and/or repairmen	Pcs	23	69,000,000	30	90,000,000	20	6,000,000 *)	20	6,000,000 *)	20	6,000,000 *)
3.	Data Collection and Mapping of Security Disturbance to the forest and Coordination with Relevant Agencies	Package	1	21,400,000	1	15,000,000	1	15,000,000	1	15,000,000	1	15,000,000
4.	Formation and Coordination of Forest Security Guard	Package	1	64,000,000	1	64,000,000	1	64,000,000	1	64,000,000	1	64,000,000
5.	Security Guarding/Patrol of the Forest (including forest fire control)	Package	1	157,150,000	1	157,150,000	1	157,150,000	1	157,150,000	1	157,150,000
6.	Coordination with	Package	1	50,000,000	1	50,000,000	1	50,000,000	1	50,000,000	1	50,000,000

	Relevant Agencies											
7.	Facility and Infrastructure of Forest Protection	package	1	35,000,000	1	30,000,000	1	30,000,000	1	30,000,000	1	30,000,000
8.	Training for Forest Fire Control	Package	1	50,000,000	1	50,000,000	1	50,000,000	1	50,000,000	1	50,000,000
9.	Forest Protection Operation	Package	1	100,000,000	1	100,000,000	1	100,000,000	1	100,000,000	1	100,000,000
10.	Forest Fire Extinguishing	Package	1	100,000,000	1	100,000,000	1	100,000,000	1	100,000,000	1	100,000,000
	TOTAL			658,550,000		680,150,000		596,150,000		596,150,000		596,150,000
B.	**INDIRECT COST (10%)** Mobilization and Demobilization; Planning; Administration; Supervision and evaluation			65,855,000		68,015,000		59,615,000		59,615,000		59,615,000
	TOTAL			724,405,000		748,165,000		655,765,000		655,765,000		655,765,000

Notes: *) Maintenance or repairmen for damaged restriction/warning sign board

4.2. IMPLEMENTATION SCHEDULE

Geothermal operation activity of PT. SERD in the protected forest area of Bukit Jambul Gunung Patah, Muara Enim Regency, Lahan Regency and Pagar Alam City, South Sumatra Province covering the area of 91 hectares which consists of:

- Tapak sumur plan (well pad) with its supporting facilities
- Access road plan

Forest protection activity is performed to overcome some disturbances which threats the existence of forest area, forest products and biodiversity such as encroachments in forest area; illegal logging; theft of other forest products; forest fire; theft of protected flora-fauna and possibility of pests attack, as well as availability of facility and infrastructure for forest protection which covers:

1. Socialization
2. Installation of restriction/warning sign board
3. Data collection and Mapping of Security Disturbance to the Forest
4. Formation of Forest Security Guard
5. Security guarding/patrol in Forest area (including control of fire in the forest)
6. Coordination with relevant agencies in forest protection

7. Provision and maintenance of facility and infrastructure for forest protection
8. Forest protection training
9. Forest guard operation
10. Forest fire extinguishing

In general, the detail of activity of forest protection in protected forest area in Bukit Jambul Gunung patah by PT. SERD will be conducted continuously and sustainably for 5 (five) years (2013 – 2017).

Some activities of forest protection are only conducted at the beginning of five-year period or in 2013, such as activity of data collection and mapping of security disturbance to the forest, formation of forest security guard, provision of facility and infrastructure for forest protection. It is caused by such activities are used as the basic and support of other activities. In the activity of data collection and mapping of security disturbance to the forest and provision of facilities and infrastructures for forest protection, although they are conducted at the beginning of the period, they are still planned to be performed for the next year, due to its nature to renew data and maintain facilities and infrastructures provided.

Implementation schedule of forest protection activity yearly for 5 (five)-year period is as follows:

1. Year 2013

- Socialization, will be conducted in 2 sessions
- Installation of restriction/warning sign board, as many as 23 pieces
- Data collection and mapping of security disturbance to the forest, 1 package
- Formation of forest security guard, 1 package
- Security guarding/patrol of forest area, 1 package
- Coordination with relevant agencies, 1 package
- Provision of facilities and infrastructure for forest protection, 1 package
- Forest protection training, 1 package
- Forest security guarding operation, 1 package
- Forest fire extinguishing, 1 package

2. Year 2014

- Socialization, will be conducted in 4 sessions
- Installation of restriction/warning sign board, as many as 30 pieces
- Data collection and mapping of security disturbance to the forest, 1 package
- Formation of forest security guard, 1 package
- Security guarding/patrol of forest area, 1 package

- Coordination with relevant agencies, 1 package
- Maintenance of facilities and infrastructure for forest protection, 1 package
- Forest protection training, 1 package
- Forest security guarding operation, 1 package
- Forest fire extinguishing, 1 package

3. Year 2015

- Socialization, will be conducted in 4 sessions
- Installation of restriction/warning sign board, as many as 20 pieces
- Data collection and mapping of security disturbance to the forest, 1 package
- Formation of forest security guard, 1 package
- Security guarding/patrol of forest area, 1 package
- Coordination with relevant agencies, 1 package
- Maintenance of facilities and infrastructure for forest protection, 1 package
- Forest protection training, 1 package
- Forest security guarding operation, 1 package
- Forest fire extinguishing, 1 package

4. Year 2016

- Socialization, will be conducted in 4 sessions
- Installation of restriction/warning sign board, as many as 20 pieces
- Data collection and mapping of security disturbance to the forest, 1 package
- Formation of forest security guard, 1 package
- Security guarding/patrol of forest area, 1 package
- Coordination with relevant agencies, 1 package
- Maintenance of facilities and infrastructure for forest protection, 1 package
- Forest protection training, 1 package
- Forest security guarding operation, 1 package
- Forest fire extinguishing, 1 package

5. Year 2017

- Socialization, will be conducted in 4 sessions
- Installation of restriction/warning sign board, as many as 20 pieces
- Data collection and mapping of security disturbance to the forest, 1 package
- Formation of forest security guard, 1 package
- Security guarding/patrol of forest area, 1 package
- Coordination with relevant agencies, 1 package

- Maintenance of facilities and infrastructure for forest protection, 1 package
- Forest protection training, 1 package
- Forest security guarding operation, 1 package
- Forest fire extinguishing, 1 package

Table 4.2. Schedule Plan of Forest Protection Activity in the location of PT. SERD of 2013-2017

No	Activity Type/Benchmark	Unit	2013	2014	2015	2016	2017
1.	Socialization	Activity	2	4	4	4	4
2.	Installation of restriction/warning sign board	Pieces	23	30	20	20	20
3.	Data collection and mapping of security disturbance to the forest	Package	1	1	1	1	1
4.	Formation of forest security guard	Package	1	1	1	1	1
5.	Security guarding/patrol of forest area	Package	1	1	1	1	1
6.	Coordination with	Package	1	1	1	1	1

	relevant agencies						
7.	facilities and infrastructure for forest protection	Package	1	1	1	1	1
8.	Forest protection training	Package	1	1	1	1	1
9.	Forest security guarding operation	Package	1	1	1	1	1
10.	Forest fire extinguishing	Package	1	1	1	1	1

CHAPTER V MONITORING, EVALUATION AND REPORTING

5.1 MONITORING AND EVALUATION

Implementation of monitoring and evaluation for forest protection shall be performed by PT. SERD as implementer of the activity and by the element of Forestry Department as advisor and supervisor for forest protection activity.

5.1.1. Monitoring and Evaluation by PT. SERD

Monitoring & evaluation activity shall be conducted continuously by PT. SERD during implementation of forest protection. Monitoring and evaluation activity of forest protection implementation shall be conducted to observe the improvement of the implementation of forest protection activity, to identify and anticipate the problems occurred and/or will be occurred to obtain action as early as possible.

Monitoring and evaluation activity shall be conducted in order to obtain data and information related to the policy in implementing forest protection. In order to support the success of forest protection activity, it is also necessary to conduct

technical coaching activity which is aimed to give advice and input to improve the implementation of forest protection which is lacking from/not in conformity with the existing provision.
The result of monitoring and evaluation activity is used to acknowledge the development/progress of the implementation of forest protection activity, and to present data and information as a control function to the implementation of forest protection in accordance with the laws and regulations.

5.1.2 Monitoring and Evaluation by Department of Forestry

Referring to the Regulation of Minister of Forestry Number P.18/Menhut-II/2011 on Guidelines for the Forest Area Borrow-Use Permit, The Minister of Forestry monitored and evaluated forest protection activity which is an obligation of the holder of forest area borrow-use permit as stipulated in the license granted by the Ministry of Forestry. In its implementation, monitoring and evaluation are handed over to the Governor of South Sumatra which is performed by Department of Forestry of South Sumatra Province.

Monitoring shall be conducted as a coaching so that the holder of forest area borrow-use permit fulfills the obligation of forest protection, and it shall be conducted minimum 1 (once) in

a year, while for the evaluation, it shall be conducted to acknowledge the size of the difference between fulfillment of obligation status and the obligation specified in the forest area borrow-use permit. Evaluation shall be conducted once every 5 (five) years.

Monitoring result data is required to determine the success of forest protection implementation, while evaluation result data will be required to extend borrow-use permit. The implementation of monitoring and evaluation shall be performed by a joint team from Forestry Department of the Province and the relevant agencies.

5.2. REPORTING

In accordance with the Regulation of Minister of Forestry Number P.18/Menhut-II/2011 on Guidelines for the Forest Area Borrow-Use Permit, reporting of forest protection activity as implementation of obligation to holder of forest area borrow-use permit shall be performed regularly, once every 6 month. Reporting form shall be in the form of reporting, filled with data of activity plan and its realization for every 6 months.

CHAPTER VI CLOSING

Forest as an asset of national development owns real benefit for the life and livelihood of Indonesian nation, both ecological, social cultural benefit and economy equally and dynamically. Therefore forest, including a wide range of biodiversity therein, must be maintained, guarded, managed, protected and utilized sustainably and continuously for the prosperity of the people of Indonesia.

Forest protection is one way of forest preservation in accordance with its function. This forest protection holds an important role in the world of forestry in Indonesia. The commitment from the government in the effort of forest protection is declared with regulations which regulate forest protection.

In accordance with Government Regulation of the Republic of Indonesia Number 45 of 2004 on Forest Protection. Article 8, paragraph (2) and (4), PT. SERD as holder of borrow-use permit of forest area has the obligation and responsibility to perform Forest Protection of forest area which has become its working area with forest protection activities which cover:

1. Securing its working area which relates to forest, forest area and forest products including flora and fauna;
2. Preventing forest damage from the action of human and cattle, forest fire, pest and disease as well as natural forces;
3. Taking first action required for security disturbance to the forest in its working area;
4. Reporting every event of law violation in its working area to the closest forestry agency;
5. Providing facilities and infrastructures as well as forest security guard as required.

For optimum implementation of forest protection performance obligation, it is necessary to compile Forest Protection Plan which constitutes initial stage of planning from a series of procedures which is appropriate and suitable with the planning system of forest management. With the existing forest protection plan, it is intended that sources of potential damage can be possibly identified and evaluated before huge damage occurs. With such principle the cause of the damage which threats the forest can be suppressed in time with effective result.

MINISTER OF FORESTRY

OF THE REPUBLIC OF INDONESIA

DECISION OF THE MINISTER OF FORESTRY OF THE REPUBLIC OF INDONESIA

NUMBER: SK.648/Menhut-II/2012

ON

FOREST AREA BORROW-USE PERMIT FOR GEOTHERMAL EXPLORATION FOR PT. SUPREME ENERGY RANTAU DEDAP IN BUKIT JAMBUL GUNUNG PATAH PROTECTED FOREST AREA, LOCATED IN MUARA ENIM REGENCY, LAHAT REGENCY AND PAGAR ALAM CITY, SOUTH SUMATRA PROVINCE IN THE AREA OF 91 (NINETY ONE) HECTARES

THE MINISTER OF THE REPUBLIC OF INDONESIA,

Having considered	:a.	That in accordance with letter Number RD-MGT-LTR-006.II.2012 dated 9 February 2012, the President and CEO of PT. Supreme Energy Rantau Dedap submitted an application for borrow-use permit application for forest area covering 114 (one hundred fourteen) hectares for geothermal exploration activity in protected Forest Area of Bukit Jambul Gunung Patah in Muara Enim

		Regency, Lahat Regency and Pagar Alam City, South Sumatra Province;	
	:b.	That the application of the President & CEO of PT. Supreme Energy Rantau Dedap as referred to in letter a, has fulfilled the requirements in accordance with Article 9 of Government Regulation Number 24 of 2010, Article 13 paragraph (1), Article 14 paragraph (1) and paragraph (2) of Regulation of the Minister of Forestry Number P.18/Menhut-II/2011, namely:	
		1.	Working plan of forest area utilization;
		2.	Proposed location map in the scale of 1 : 50,000;
		3.	Geothermal mining business license (IUP) in accordance with the Decision of the Governor of South Sumatra Number 917/KPTS/DISPERTAMBEN/2010 dated 29 December 2010, for the period of 35 (thirty five) years;
		4.	Recommendation from the Mayor of Pagar Alam in accordance with letter Number 522/411/HUTBUN/B1/2011 dated 24 December 2011;

		5.	Recommendation from the Regent of Lahat in accordance with letter Number 522/1001/II-2/Hutbun/2011 dated 28 December 2011;	
		6.	Recommendation from the Regent of Muara Enim in accordance with letter Number 522/617/ Hut/2011 dated 30 December 2011;	
		7.	Statement Letter from the President & CEO of PT. Supreme Energy Rantau Dedap dated 8 February 2012:	
			a)	Able to fulfill all obligations and bear all costs in connection with application of forest area borrow-use permit;
			b)	All documents attached to the application are valid;
			c)	Have not yet conducted any activity at the site and will not do any activity prior to obtaining consent from the Minister of Forestry;
		8.	Technical consideration of Directorate General of New Renewable Energy and Energy Conservation in accordance with letter Number 109/30/DEP/2012 dated 9 February	

		2012;
	c.	That in accordance with letter of Directorate General of Forest Protection and Natural Conservation Number S.192/IV-KKBLH/2012 dated 22 May 2012, application of borrow-use permit for Protected Forest Area of Bukit Jambul Gunung Patah for geothermal exploration activity on behalf of PT. Supreme Energy Rantau Dedap in Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province may be considered to be processed further;
	d.	That in accordance with Article 6 paragraph (2) letter c point 2 of Government Regulation Number 24 of 2010 on Forest Area Utilization, for survey and exploration activity, borrow-use permit for forest area without land compensation or without paying Non-tax State Revenue (PNBP) of Forest Area Utilization and without planting for rehabilitation on river flow area;
	e.	That in accordance with the SECOND point letter b of President Instruction Number 10 of 2011 on Postponement of New License Granting and

		Management Improvement of Primary Natural Forest and Peatland, geothermal exploration activity on behalf of PT. Supreme Energy Rantau Dedap including activities that are vital in nature, so that the application of borrow-use permit for forest area is not included as the postponed new license issued;
	f.	That in accordance with Article 10 paragraph (4) of Government Regulation Number 24 of 2010 on Forest Area utilization, in the event that application of borrow-use permit of forest area for survey or exploration activity has fulfilled the requirements, the Minister of Forestry shall issue borrow-use permit of forest area without having to issue the principal permit;
	g.	That in accordance with the above considerations, it is necessary to issue the Decision of the Minister of Forestry on Borrow-Use Permit of Forest Area for Geothermal Exploration on behalf of PT. Supreme Energy Rantau Dedap, in Protected Forest Area of Bukit Jambul Gunung Patah, located in Muara

		Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province in the area of 91 (ninety one) hectares;
In view of	: 1.	Law Number 41 of 1999 on Forestry, as amended to Law Number 19 of 2004;
	2.	Law Number 32 of 2004 on Regional Government, as repeatedly amended and the last by Law Number 12 of 2008;
	3.	Law Number 32 of 2009 on Environmental Protection and Management;
	4.	Government Regulation Number 44 of 2004 on Forestry Planning;
	5.	Government Regulation Number 45 of 2004 on Forest Protection, as amended to Government Regulation Number 60 of 2009;
	6.	Government Regulation Number 6 of 2007 on Forest Arrangement and Preparation of Forest Management as well as Utilization Plan, as amended to Government Regulation Number 3 of 2008;
	7.	Government Regulation Number 38 of 2007 on Division of Administration amongst Central, Provincial and Regional/City Governments;

	8.	Government Regulation Number 76 of 2008 on Forest Rehabilitation and Reclamation;
	9.	Government Regulation Number 15 of 2010 on Implementation of Spatial Planning
	10.	Government Regulation Number 24 of 2010 on Forest Area Utilization, as amended to Government Regulation Number 61 of 2012;
	11.	Presidential Decree Number 84/P of 2009 on Establishment on Second United Indonesia Cabinet, as amended to Presidential Decree Number 59/P of 2011;
	12.	Presidential Regulation Number 47 of 2009 on Establishment and Organization of State Ministry;
	13.	Presidential Regulation Number 24 of 2010 on Position, Duty, and Function of State Ministry as well as Organizational Structure, Duty, and Function of Echelon I;
	14.	Presidential Regulation Number 28 of 2011 on Utilization of Protected Forest Area for Underground Mining;
	15.	Presidential Instruction Number 10 of 2011 on Postponement of New License Granting and

		Management Improvement of Primary Natural Forest and Peatland;
	16.	Regulation of the Minister of Forestry Number P.18/Menhut-II/2007 on Technical Procedure Guidelines of Imposition, Collection and Payment on Forest Resources Provision (PSDH) and Reforestation Fund (DR);
	17.	Regulation of the Minister of Forestry Number P.40/Menhut-II/2010 on Organization and Work Procedures of Ministry of Forestry;
	18.	Regulation of the Minister of Forestry Number P.18/Menhut-II/2011 on Guidelines of Forest Area Borrow-Use Permit
	19.	Decision of Directorate General of Forestry Planning on behalf of Minister of Forestry Number SK.2271/Menhut-VII/IPSDH/2012 on Stipulation of Indicative Map of New License Postponement for Forest Utilization, Forest Area Exploitation, and Designation Amendment of Forest Area and Other utilization Area (Second Revision);
With due observance	:1.	Decision of Governor of South Sumatra Number 917/KPTS/DISPERTAMBEN/2010 dated 29 December

of		2010;
	2.	Recommendation from Mayor of Pagar Alam in accordance with letter Number 522/411/HUTBUN/B1/2011 dated 24 December 2011;
	3.	Recommendation from Lahat Regent in accordance with letter Number 522/1001/II-2/Hutbun/2011 dated 28 December 2011;
	4.	Recommendation from Muara Enim Regent in accordance with letter Number 522/617/Hut/2011 dated 30 December 2011;
	5.	Statement Letter of the President & CEO of PT. Supreme Energy Rantau Dedap dated 8 February 2012;
	6.	Technical Consideration of Directorate General of Renewable New Energy and Energy Conservation in accordance with letter Number 109/30/DEP/2012 dated 9 February 2012;
	7.	Technical Consideration of Directorate General of Forest Protection and Nature Conservation in accordance with letter Number S.192/IV-KKBHL/2012 dated 22 May 2012;
HAS DECIDED:		
To	:	**DECISION OF MINISTER OF FORESTRY ON FOREST AREA**

Establish		**BORROW-USE PERMIT FOR GEOTHERMAL EXPLORATION ON BEHALF OF PT. SUPREME ENERGY RANTAU DEDAP, IN PROTECTED FOREST AREA OF BUKIT JAMBUL GUNUNG PATAH, LOCATED IN MUARA ENIM REGENCY, LAHAT REGENCY AND PAGAR ALAM CITY, SOUTH SUMATRA PROVINCE IN THE AREA OF 91 (NINETY ONE) HECTARES.**
FIRST	:	To grant forest area borrow-use permit for geothermal exploration for PT. Supreme Energy Rantau Dedap, in the protected forest area of Bukit Jambul Gunung Patah, located in Muara Enim Regency, Lahat Regency and Pagar Alam City, South Sumatra Province in the area of 91 (ninety one) hectares, as specified in the Map as attached to this Decision, with utilization plan of forest area as follows:
		a. Well pad plan with its supporting facilities;
		b. Access Road Plan.
SECOND	:	The purpose of granting forest area borrow-use permit as referred to in the FIRST point is to allow PT. Supreme Energy Rantau Dedap to perform geothermal exploration, however not for

		other activities and the status of the area is still forest area.	
THIRD	:	PT. Supreme Energy Rantau Dedap is entitled to:	
		a.	stay, occupy and manage as well as perform other activities related thereto in the forest area which is borrowed and used;
		b.	utilize the result of activities performed in connection with geothermal exploration in the forest area which is borrowed and used;
		c.	cut down trees in order to clear land by making payment of compensation of the plants (*penggantian nilai tegakan*) and Forest Resources Provision (*PSDH*) and/or Reforestation Fund (*DR*) in accordance with the provisions of the laws and regulations.
FOURTH	:	PT. Supreme Energy Rantau Dedap is obliged to:	
		a.	make payment of *PSDH*, *DR* and

			compensation of the plants (*penggantian nilai tegakan*), and other financial obligation, as well as to employ Technical Examiner for Jungle Round Timber (GANIS-PKB-R);
		b.	submit Bank Guarantee from government bank in the amount of 3/12 (three twelfth) of estimated cutting volume according to LHC recapitulation;
		c.	perform reclamation and reforestation in the forest area which are not used anymore by using local pioneer and superior plant species without waiting for the expiration of the forest area borrow-use permit;
		d.	perform maintenance of the boundary of borrow-use area;
		e.	perform the activities of forest protection and security maintenance;
		f.	facilitate the forestry officers both from central government and regional government during monitoring and evaluation at the site;

		g.	bear any costs incurred due to the borrow-use of the forest area;
		h.	empower the local community through the *Program Bina Desa Hutan* (Forest Village Development Program) and employ *Tenaga Teknis Kelola Sosial* (Social Management Technical Workforce) (GANIS-KESOS);
		i.	make coordination of activities with the local forestry agencies;
		j.	develop the public information system
		k.	Submit the work plan for fulfilment of obligations as referred to in letter a through letter j to the Director General of Forestry Planology with copies to the Governor of South Sumatra, Regent of Muara Enim, Regent of Lahat, Mayor of Pagar ALam, Head of Forestry Department of South Sumatra Province, Head of Forestry Department of Muara Enim Regency, Head of Department of Forestry and Plantation of Lahat

			Regency, Head of Department of Forestry and Plantation of Pagar ALam City and Head of Forest Area Establishment Agency Region II Palembang no later than 100 (one hundred) working days after the decision on the forest area borrow-use permit is issued;
		l.	prepare report on fulfillment of obligations as specified in the permit regularly every 6 (six) months to the Minister of Forestry;
		m.	prepare a report in the form of financial statements audited by a public accountant; particularly for the obligation of letter a through letter k every 6 (six) months attached with cost and expenditure obligatory posts to the Minister of Forestry with copy to the Secretary General of the Ministry of Forestry and Director General of Forestry Planology.

FIFTH	:	PT. Supreme Energy Rantau Dedap is prohibited to:	
		a.	transfer the forest area borrow-use permit to another party or change the Company name without consent from the Minister of Forestry;
		b.	make the borrow-use area as the security or collateral to another party;
		c.	Cut down trees in the forest area with the radius or distance up to: 1. 200 (two hundred) meters from the edges of the spring and at the left and right side of the river in the bushy areas; 2. 100 (one hundred) meters from the left and right of the river bank; 3. 50 (fifty) meters from the right and left sides of the creek
SIXTH	:	Prior to performing geothermal exploration at the site, PT. Supreme Energy Rantau Dedap must contact the Forestry Department	

		of the South Sumatra Province no later than 1 (one) month after the date of issuance of this forest area borrow-use permit for coordination of activities at the site.
SEVENTH	:	If in the forest area which is borrowed and used there are rights of a third party, the settlement shall become the responsibility of PT. Supreme Energy Rantau Dedap under coordination with the local government.
EIGTH	:	If the holder of the borrow-use permit breach the regulations as specified in this permit, the permit shall be revoked and the holder of the permit shall be imposed with a sanction in accordance with the laws and regulations after being given maximum 3 (three) times of warning by the Director General of Forestry Planology with the time interval of 30 (thirty) working days after receipt of the previous warning letter and the holder of the permit fails to make any correction within 30 (thirty) days after the receipt of the third warning letter.
NINTH	:	The forest area borrow-use permit as

		referred to in the FIRST point may be extended based on the application for extension which shall be submitted by the holder of the permit no later than 3 (three) months prior to the expiration of this permit by referring to the validity of the mining license after an evaluation is conducted:	
		a.	Forest area which is borrowed and used may only be utilized for the geothermal exploration by the holder of the permit or its affiliation or by the party which is allowed under the laws and regulations;
		b.	The activities of using the forest area and fulfilment of the obligations under coordination with the provincial agency engaging in forestry affairs; and
		c.	There must be no violation of the provisions of this forest area borrow-use permit by the holder of the permit;

TENTH	:	This decision shall come into force as from the date of its issuance for the period of 2 (two) years and shall automatically expire unless it is extended.	
			Issued in: Jakarta On : 20 November 2012
Copy certified as having the same content as the original **HEAD OF BUREAU OF LAW AND ORGANIZATION** **KRISNA RAYA**			**THE MINISTER OF FORESTRY OF THE REPUBLIC OF INDONESIA** **sgd.** **ZULKIFLI HASAN**

Copies of this Decision are delivered to:

1. The Minister of Energy and Mineral Resources;
2. Secretary General of the Ministry of Forestry;
3. Director General of Forestry Planology;
4. Director General of Forestry Business Development;
5. Director General of Management of River Water Flow Area and Social Forestry Affairs;
6. Director General of New, Renewable Energy and Energy Conservation;

7. The Governor of South Sumatra;
8. Regent of Muara Enim;
9. Regent of Lahat;
10. Mayor of Pagar Alam;
11. Head of Forestry Department of Lampung Province;
12. Head of Forestry Department of Muara Enim Regency;
13. Head of Department of Forestry and Plantation of Lahat Regency;
14. Head of Department of Forestry and Plantation of Pagar Alam City;
15. Head of Forest Area Establishment Agency Region II Palembang;
16. The President & CEO of PT. Supreme Energy Rantau Dedap

PERMIT LIST FOR RANTAU DEDAP GEOTHERMAL PROJECT

Updated	:	March 17, 2014
Target	:	Exploration activity
Permits/License Indicator	:	Done/ Completed Done, need to update periodically To be applied/or not yet required On going/ being processed Alert and critical to obtain. Show stopper.

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
A.	***General Licenses***								
1.	BKPM Approval regarding a change of status to become a foreign investment company	Head of BKPM	This BKPM approval is required for the change of the status of PT SERD into a foreign investment company ("**PMA Company**") under the framework of the Capital Investment Law. Upon conversion of status as a PMA Company, PTSERD will be subject to the requirements of the Capital Investment Law, including obtaining approval from BKPM for the quarterly capital increase.	Issued within no later than 10 (ten) working days as of the receipt of true and complete application.	No expiry date 3 months	Done, BKPM Approval No. 0584/1/PPM/PMA/2011 dated 28 Februari 2011 Quarterly, need recommendation from IUP issuer for submission to BKPM.	Before Joint Venture signatory Quarterly capital increase	High medium	Owner - (Legal Department)
2.	Limited Import License for Importation of Goods or *Angka Pengenal Importir Produsen* ("**API-P**")	Director General of Foreign Trade, Ministry of Trade	An API-P is required for imports of any capital goods, material or equipment for the project. This license is required before we apply for NIK, IP-iron, and NPI-K	Issued within no later than 21 (twenty one) working days as of the receipt of copies to API application and filling form in accordance with Minister of Industry and Trade Regulation No. 550/MPP/Kep/10/1999 regarding Importer Identification Number.	5 years	Done No. 090500106-D dated Dec. 26, 2012	Before importing activities	High	Owner- (SCM Department)
3.	Registration with the Director General of Customs and Excise ("**NIK**")	Director General of Customs and Excise	The registration is required for imports of any capital goods, material or equipment for the project.	Issued within no later than 30 (thirty) working days as of receipt of true and complete filling form in accordance with Minister of Finance Regulation No. 124/PMK.04/2007 regarding Importer Registration and Director General of Customs and Excise Regulation No. P-34/BC/2007 regarding Procedures of Importer Registration.	No expiry date	Done No. 01.026135 dated Jan. 31 2013	Before importing activities	High	Owner-(SCM Department)

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
4.	Acknowledgment of Status as a Producer Importer of Iron or Steel (IP-Iron or Steel), if relevant	Director General of Foreign Trade, Ministry of Trade	IP-Iron/steel is required for imports of any steel or iron materials, probably for the construction of a geothermal power plant, casing, pipeline, etc	Ref. to Peraturan Menteri Perdagangan No. 54/M-DAG/PER/12/2010 superseded by No. 08/M-DAG/PER/2/2012 dated 14 February 2012 regarding provisions of iron or steel imports, company must apply IP-Besi/Baja as the regulation regulates the importation of iron or steel products (including casing and tubing) for company use to support its operation. Company shall submit application letter for IP-Besi/Baja to Director General of Foreign Trade by attaching API-P, TDP, NPWP, NIK, and technical recommendation from Directorate General of Geothermal.	Refer to the validity of respective Minister Trade's regulation	Done No. 01.09.01224-P dated March 22, 2013	Before importing activities	High	Owner –(SCM Department)
5.	Special identification number for importer (NPI-K)	Directorate General of Foreign Trade, Ministry of Trade	This license should be used for importing any electricity material	30 days	3 years 9 months (valid until 1 September 2015)	Done No. 2. 09.05.07.97547 dated Jan. 28, 2013	Before importing activities	High	Owner-(SCM Department)
6.	Approval for Exemption of Import Duties	Ministry of Finance	The approval is required in order to obtain the import duty facilities for the imports of any capital goods, material or equipment for the project.	Issued within 30 working days as of complete application.	1 years	Approval from MoF is not required. Only need to submit the Master List to Customs Department attaching recommendation from DJEBTKE to be eligible for the exemption under the PMK No. 21/PMK.011/2010.	Before material importation plan and realization	High, for casing delivery from Batam to Jakarta/site	Owner - (SCM & Finance Department)
7.	Certificate of Company's Domicile or *Surat Keterangan Domisili Perusahaan* ("**SKDP**")	Head of Sub-District, Regional Government	Commonly, These certificate is required for applying other permits/licenses	-	28 November 2014	Done		High	Owner – (Legal Department)
8.	Company Registration Number or *Tanda Daftar Perusahaan* ("**TDP**")	Department of Trade	Commonly, These certificate is required for applying other permits/licenses	-	5 years, extensible will be expired on 5 June 2014	Done		High	Owner- (Legal Department)
9.	Taxable Entrepreneur Confirmation Letter or *Surat Pengukuhan Pengusaha Kena Pajak* ("**SPPKP**")	Directorate General of Tax, Ministry of Finance		-	No expiry date	PTSERD has obtained the SPPKP		Medium	Owner- (Finance Department)
10.	Tax Payer Identification Number or *Nomor Pokok Wajib Pajak* ("**NPWP**")	Directorate General of Tax, Ministry of Finance	Commonly, These certificate is required for applying other permits/licenses	-	No expiry date	Done,		High	Owner – (Finance Department)
11.	VAT Registration	Directorate General of Tax, Ministry of Finance		2 - 3 days		VAT Registration is not require since electricity is non VAT-able, therefore no benefit to be registered as VAT company.		None	Owner – (Finance Department)
12.	Approval to keep books in English Language and foreign currency, if necessary	Ministry of Finance	This is required if the company intends to arrange the bookkeeping in English language and US Dollar currency, which will be the case if the company is converted into PMA company.	Should be applied within 3 months prior to commencement of the USD bookeeping.	No expiry date	Done, Minister of Finance Decision No. KEP-2408/WPJ.04/2010 dated 11 October 2010.		Medium	Owner – (Finance Department)

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
13.	Offshore Commercial Loan "**PKLN**"	Central Bank of Indonesia	Reporting obligation to government thru Central Bank	Central Bank of Indonesia Regulation No.: 2/ 22 /PBI/2000		PKLN for shareholder loan: We have reported the Shareholders Loan Agreement to BI on October 2013	Before financing Close	Medium	Owner - (Finance Department and Legal Department)
14.	Importation documents: RKBI, RIB, SKEP	RKBI : EBTKE RIB : EBTKE SKEP : Customs	Those documents should be available before importation conducted	Minister of Finance Regulation No. 177/2007. Minister of Finance Regulation No. 70/2013	RKBI & RIB : 1 years SKEP : during exploration	a. RKBI 2013: PTSERD obtained approval from EBTKE b. RIB for master valves, all imported casings, and explosives are obtained c. SKEP (duty and taxes – VAT & PPH) for master valves and all imported casings are obtained from Customs office, except explosives (waiting for P2 permit) Please be noted that we need to have SKB (Surat Keterangan Bebas) for PPH year 2014 for 2nd shipment of various casings size from Batam. This SKB is being processed.	Before explorations, December 2013	High	Owner – (SCM & Finance Department)
B.	***Operational Licenses***								
1.	Mining Business License (*Izin Usaha Pertambangan*/IUP)	Regional Government	PTSERD has obtained the IUP These license is required for applying other operational and environmental permits/licenses	2 months after awarded	35 years	Done, but exploration phase need to be extended before 29 Desember 2013. PTSERD has send the application letter for extending the exploration period to the Governor of South Sumatera. There will be a presentation and clarification toward the progress of PTSERD's exploration activity up to December 2013. This presentation is planned to be conducted in the first week of December 2013.	Done, 1 year extension for exploration period has been approved by Governor of South Sumatera, issued on December 27, 2013	High	Owner – (Relations & SHE Department)

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
2.	Exploration permit, Exploitation Permit, and Borrow-Use permit on protected forest area	Minister of Forestry	It is regulated under Law no. 41/1999, Government Regulation No. 2/2008 and Minister of forestry regulation No. P.18/2011. All activities in the protected forest should have a permission from Minister of Forest. Exploration permit need requirements i.a. recommendation from Bupati & Governor, Technical recommendation from Directorate General of New Renewable Energy (EBTKE) & UKL/UPL. Exploitation permit need requirements i.a. recommendation from Bupati & Governor, Technical recommendation from Directorate General of New Renewable Energy (EBTKE), AMDAL, satellite maps. This permit will be upgraded to Borrow-Use Permit in before production stage with additional requirement i.e. clean & clear land compensation 1:2 (java lampung) or Non-tax income payment to GOI (sumatera except Lampung).	Exploration permit 4 - 6 months after application to Ministry of Forestry submitted. Explotation permit 12-15 months to obtain.	2 years, extensible Refer to B.1.	Done , obtained on November 20, 2012 Currently being proposed for extension, starting May 2014	Before entering protected forest	High	Owner – (Relations & SHE Department)
3.	Head of Technical Geothermal (KTT)	Regional Government & Directorate General of New Renewable Energy and Energy Conservation	PTSERD is preparing appointed permanent employee to get POP (First Operational Supervisior), POM (Middle Operational Supervisor) & POU (Mayor Operational Supervisor) certifications to be entitled and obtaining the KTT – Field Manager will be Head of Technical Mining/Geothermal This should be available before applying the explosive permit and conducting exploration activities	Based on Minister of ERM regulation No. 555.K/26/M.PE/1995, Entitled persons must have POP, POM & POU competency certification. 1 month after application letter submission and program presentation	6 months for temporary	Currently, temporary KTT license has been issued by Regional Government. Required some training series and competency tests before a permanent KTT license is issued Erwin Guminda has been appointed and valid until 29 December 2013. Need to be extended.	Done, extension letter has been issued on January, 8 2014, valid for 6 months	High	Owner - (Relations & SHE Department)
4.	Electric Power Supply Business License (*Izin Usaha Penyediaan Tenaga Listrik/* ***IUPTL****)*	Director General of Electricity, Ministry of Energy and Mineral Resources	The IUPTL will be required to conduct the activities as electric power producer. This should be available before signing the PPA Permanent IUPTL should be applied once all it's requirement are available.	Issued within 30 (thirty) days as of receiving complete application in accordance with MoEMR Regulation No. 0010/2005 regarding Procedure of Obtaining Licenses for Electricity Business Between Provinces or Connected with National Transmission Network.	2 years	Done, on 02 January 2012 PT. SERD has obtained the Temporary General Electricity Business License or IUPTLS. In accordance with MoEMR Regulation No. 010/2005 regarding Procedure of Obtaining Licenses for Electricity Business Between Provinces or Connected with National Transmission Network, which will be valid during exploration and/or exploitation. if all requirements are available, this IUPTLs must be replaced by IUPTL (permanent license).	2 January 2014 (extension), Done.	High	Owner – (Relations & SHE Department)
5.	Approval of Power Purchase Agreement	State Minister of State-Owned Enterprises	The approval from the State Minister of State-Owned Enterprises is required prior to the Power Purchase Agreement signing with PLN.	-	Refer to PPA	Done	Before PPA sigining	High	Owner – (Relations & SHE Department)

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
6.	Permit to construct road, If applicable	the Communication Agency / Regional Government	This license is required for construction of roads to support geothermal activities	Issued within 30 working days as of complete application.		Done, based on Location Determination Permit (Ijin Penetapan Lokasi) from Lahat. See C.1		Medium	Owner – (Relations & SHE Department)
7.	Dispensation Permit for heavy equipment mobilization and road constructions	Regional Government & Balai Besar Pelaksana Jalan Nasional (BBPJN/Road Conductor Agency)	There is load limitation of using South Sumatera Provincial highway as well as the national roads, those permits are required when we mobilize heavy equipment with load heavier than 10 tons (Lahat – Kota Agung)	Province road permit is issued after recomendation from BBJN Recommendation complete. National road permit is issued by Balai Pelaksana Jalan Nasional (BBPJN)	1 years, extensible	On going process. Provincial Permit road from Simpang Air Dingin – Kota Agung National permit road from Lahat – Simpang Air Dingin	Done and issued on 3 December 2013.	High	Owner – (SCM Department and Relation & SHE Department)
8.	Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**") for power plant*	Director General of Electricity	The SLO is required to operate the geothermal power plant	Under Decree of Directorate General of Electricity and Utilization of Energy No. 200-12/44/600.4 /2003 regarding Procedure of Issuance of SLO of Electricity Instalation the application of SLO can be submitted 1 month before the test. No timeframe for the issuance of SLO.		Certificate must be obtained before starting construction of power plant.	May 2016	High	Owner – (Operation Department asissted by Relations & SHE Department)
9.	Worthiness Certificate or *Sertifikat Kelayakan Penggunaan Instalasi ("**SKPI**"), for drilling rig*	Director General of New Renewable Energy & Energy Conservation	The SKPI is required for the drilling rig, inspections will be conducted for validating whether the drilling rig and its supporting equipment appropriate and comply with the Safety & Health regulation or not. This certificate covers all safety aspects i.e: lifting equipment, crane, etc This certificate should be available before drilling rig inspection conducted.	Minister of ERM decree No. 555.K/ 26/M.PE/1995. All minig equipment should be comply with this regulation. Direcorate General of New Renewable Energy and Energy Conservation No. 387/2012	3 years	Contractor's responsibility to obtain the SKPI certicate for the drilling rig. Being processed at EBTKE.	Before spud in, tentative to be issued on 25 January 2014	High	Drilling Contractor
9.1.	Pre spud-in inspections	Director General of New Renewable Energy & Energy Conservation	inspections will be conducted for validating whether the drilling rig and its supporting equipment appropriate and comply with the Safety & Health regulation or not. This inspection covers all safety aspects i.e: lifting equipment, crane, etc	Minister of ERM decree No. 555.K/ 26/M.PE/1995. All minig equipment should be comply with this regulation. Directorate General of New Renewable Energy and Energy Conservation No. 387/2012	Each well	The inspections will be performed after Rig up which will be conducted before spud in. EBTKE and local ERM office will issue the approval.	Before spud in each well (3 February 2014) Being coordinated with EBTKE and SERD. Plan to be conducted on 31 Jan – 2 Feb 2014	High	Owner – (Drilling Department, and Relations & SHE Department)
10.	Certificate for Specialist Technician for power plant construction, as applicable	Directorate General of Electricity	The certificate is required for the construction of geothermal power plant (as necessary)	Issued within 30 working days as of complete application.		EPC contractor's responsibility to ensure their Special Technician pass the test conducted by Directorate General of Electricity to obtain certificate.		Medium	EPC Contractor
11.	Certificate for Specialist Technician for O&M	Directorate General of Electricity and Energy Utilization	The certificate is required for the operation of geothermal power plant	Issued within 30 working days as of complete application.		When applicable, an application will be made before start of construction of power plant.		None	Owner – (Operation Department assisted by Relations & SHE Department)
12.	Permits to use of surface water or underground water (SIPA)	Regional Government	This permit is required for the use of surface or underground water for drilling operations or electric power plant activities	Will be issued within 30 working days as of complete application.	2 years	Done. PTSERD has obtained from Bupati Muara Enim based on the letter no. no. 629/KPTS/Tamben/2013.	October 2013	High	Owner – (Relations & SHE Department)

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
13.	Explosive Permit	DJEBTKE & Police Department	Minister of ERM Regulation No. 555.K/26/M.PE/1995. Permit will require recomendation from DJEBTKE and will be issued by Police Department.	3-4 months	Purchase : 6 months Transportation : 3 months Storage : 1 years Ownership : 1 years	On going, assisting with PT. Dahana as consultant. Including to build the explosive bunker. This permit is required to be in place before tranfering the explosive material from where we purchase. SERD Obtained Bunker permit already. From this, SERD applies P3 and P2. SERD has attained the P3 and P2 Permit;. Next action is the transportation of explosives from MOMOY to SERD site (ETA 3rd week Jan 2014)	December 2013 Done, except transportation permit.	High	Owner – (SCM Department, assisted by Relations & SHE Department)
14.	Tariff Approval from Minister of ERM	Minister of Energy Resource Mineral	Tariff Approval is one of the CP for PPA validation. PLN will accept the tariff based on the tender result provided that the tariff has been approved by the Minister of ERM and assigned to PLN. This should be available before signing the PPA	No timeframe available	30 years	Done.	Before PPA signing	High	Owner – (Relations & SHE)
C.	***Licenses related to Land Titles***								
1.	Location Determination Permit *(Ijin Penetapan Lokasi)* covering the areas required for the road construction of the project outside protected forest	Regional Government	This permit is required to secure that our project has been included in its master plan by Regional Government This permit is required for construction/updgrade the road from Kota Agung to Tunggul Bute	Issued within 2 weeks of complete application.	3 years	Done	Januari 2013	High	Owner – (Relations & SHE Department)
2.	Building Construction Permit or *Izin Mendirikan Bangunan* ("**IMB**")	Regional Government	This permit is required for construction of any buildings	Issued within 30 working days as of complete application.	Refer to B.1.	IMB application will be made after land acquisition, and applied for permanent building only.	Before commence to build permanent office	Medium	Owner – (Relations & SHE Department)
3.	Land Title Certificate (depending on types of land title, such as Right to Build (Hak Guna Bangunan/HGB or Hak Guna Usaha/HGU, etc.)	Regional Land Office /National Land Office	This certificate is to be obtained as evidence of land ownership	Issued within 6 months.	20 - 30 years, extensible	Application will be made for the land outside the protected forest and exclude the land for widening the road.	Before financing close	Medium	Owner – (Relations & SHE Department and Legal department)

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
D.	***Environmental Licenses***								
1.	Environment Impact Assessment (or *Analisis Mengenai Dampak Lingkungan* ("**AMDAL**")) Terms of Reference Approval.	AMDAL Commission ("**BPLHD**")	The AMDAL must be obtained prior to commencement of the exploitation stage. There some documents need to provide: ANDAL and RKL-RPL documents.	Issued within 30 working days as of complete application.	Refer to B.1.	AMDAL will be prepared during the exploration phase and submitted upon completion of exploration phase. It takes almost a year in preparing the completeness of application.		High	Owner – (Relations & SHE Department)
2.	AMDAL Approval	Regional Government	This approval must be obtained prior to commencement of the exploitation stage.	Issued within 30 working days as of complete application.	Refer to B.1.	Application will be made after AMDAL documents ready.	Before financing close	High	Owner – (Relations & SHE Department)
3.	Environmental Management Efforts and Environmental Monitoring Efforts ("**UKL-UPL**") for drilling activities prior to the exploitation stage.	Regional Government	PTSERD has obtained the approval of the UKL-UPL for exploration activities	-	Exploration phase only	Done	Desember 2012	High	Owner – (Relations & SHE Department)
4.	Nuisance Permit or "**HO**"	Regional Government	This permit is required to conduct the activities in the work area. This permit is basicly as a non-objections statement from the neigbour in regard with our activity. This permit is governed by a legal product (Perda) made by the Local House of Legislative	Issued within 30 working days as of complete application.	Refer to B.1.	Application will be made after finishing land acquisition, securing UKL/UPL and paying retribution. In the absent of Perda of this matter, a serial of discussions are being held to understand the application and mechanism. What we believe currently, Ijin Penetapan Lokasi and UKL/UPL should be sufficient.	-	Medium	Owner – (Relations & SHE Department)
5.	Environment permit "Ijin Lingkungan"	Regional Government	Environment permit wiil be issued after UKL/UPL or AMDAL document been approved. This permit will covers all permits related with the environment.	Issued after UKL/UPL or AMDAL document been approved. This permit is regulated in Government Regulation No. 27/ 2012. Based on this regulation, Government Regulation No. 27/1999 has been revoked	Refer to B.1.	Application will be made after UKL/UPL or AMDAL document approved	Before financing close	High	Owner – (Relations & SHE Department)
6.	Drilling Cutting Bunker permit	Muara Enim Local Environment Office (BLH Muara Enim)	Before we got the drilling bunker permit, generally, we need to obtain some requirements as follows: IMB, HO.	2 – 3 months		Due to the location of drilling cutting bunker is inside the protected forest, then the IMB and HO will NOT be required, Exploration permit from The Minister of Forestry has already complied. DC bunker Inspection has been done. SERD required to fulfill some requirements before permit issuance (finish the contructions)	December 2013, on going process, construction to be completed in end of January 2014.	High	Owner – Relations & SHE Construction – Project

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
E.	***Manpower Licenses***								
1.	Temporary Permission Card, Limited Stay Permit Card (KITAP), if relevant	Directorate General of Immigration, Minister of Law and Human Rights	This permit is required for expatriates employed by the company. The current plan is that PTSERD will be the employer of all staff.	3-4 weeks	1 years	Application for expatriates will be made by PTSERD as required.	December 2013	High	Owner – (HR Department)
2.	Approval for Foreign Personnel Utilization Plan (**RPTKA**), if relevant	Minister of Manpower	The RPTKA will be required for utilization of expatriates	Under Manpower and Transmigration Minister Regulation Number Per.02/MEN/III/2008.	3 years maximum SERD: valid November 2013 - 30 November 2014	Application will be made by PTSERD as necessary for new expatriates	December 2013	High	Owner – (HR Department)
3.	Work Permit (IMTA / IKTA), if relevant	Minister of Manpower	This permit is required for expatriates working in Indonesia	IMTA will be issued within 3 days after the submission of complete requirements.	12 months, extensible maximum 2 x 12 months	Application will be made by PTSERD as necessary for new expatriates.	December 2013	High	Owner – (HR Department)
4.	Manpower Report or *Wajib Lapor Tenaga Kerja* ("**WLTK**")	Receipt by the regional office of the Ministry of Manpower	This report must be submitted annually by the company for employees in the head office and the site (as relevant))	Pursuant to Law No. 7 of 1981 the Company must submit written report within 30 days after establish, recommence or relocate/transfer of ownership of the Company.	Valid 16/02/2013 – 16/02/2014	The report should be submitted annualy.	Every December	Medium	Owner – (HR Department)
5.	Ratification for the Company Regulation	Head of Manpower Service Office of DKI Jakarta	If the company has ten or more employees, a Company Regulation must be made by the company and must be ratified by the Head of the Manpower Office.	About 30 working days	Valid : 29/06/2012 – 8/06/2014	Done	December 2013	Medium	Owner – (HR Department)
6.	Manpower Social Security Program ("**Jamsostek**")	PT Jamsostek (Persero)	The company must register its employees with the Jamsostek if the company has at least ten employees or pays total wages in excess of Rp 1,000,000 per month	Jamsostek issued within 7 days after the application form and first payment received by the Execution Body of Jamsostek.		Done for 26 employees as per October 2013	December 2013	High	Owner – (HR Department)
F.	***Safety***								
1.	Pressure Vessel license	Directorate General of New Renewable Energy Director General of Electricity	This license is required for the operation of the geothermal power plant This license is required for applying the Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**") for power plant*	Issued within 30 working days as of complete application.	3 – 5 years	Application will be made before or during plant construction.	April 2016	High	Owner – (Relations & SHE Department)

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
2.	Steam Vessel license	Directorate General of New Renewable Energy Director General of Electricity	This license is required for the operation of the geothermal power plant This license is required for applying the Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**") for power plant*	Issued within 30 working days as of complete application.	3 – 5 years	Application will be made before or during plant construction.	April 2016	High	Owner – (Relations & SHE Department)
3.	Fire Extinguishers system	Directorate General of New Renewable Energy Director General of Electricity	This license is required for the operation of the geothermal power plant This license is required for applying the Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**") for power plant*	Issued within 30 working days as of complete application.	3 – 5 years	Application will be made before or during plant construction.	April 2016	High	Owner – (Relations & SHE Department)
4.	Lightning Protection system	Directorate General of New Renewable Energy Director General of Electricity	This license is required for the operation of the geothermal power plant This license is required for applying the Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**") for power plant*	Issued within 30 working days as of complete application.	3 – 5 years	Application will be made before or during plant construction.	April 2016	High	Owner – (Relations & SHE Department)
5.	Elevator to Carry People and Goods	Directorate General of New Renewable Energy Director General of Electricity	This license is required if the company uses elevator to carry people and goods. This license is required for applying the Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**")*	Issued within 30 working days as of complete application.	3 – 5 years	Application will be made before power plant construction, if required.	April 2016	High	Owner – (Relations & SHE Department)
6.	Power Production Machinery/ Engine	Directorate General of New Renewable Energy Director General of Electricity	This license is required for the operation of the geothermal power plant This license is required for applying the Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**") for power plant*	Issued within 30 working days as of complete application.	3 – 5 years	Application will be made before or during plant construction.	April 2016	High	Owner – (Relations & SHE Department)
7.	Lifting Equipment and Transportation	Directorate General of New Renewable Energy Director General of Electricity	This license is required if the company uses such equipment in the construction and operation of the geothermal power plant This license is required for applying the Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**")*	Issued within 30 working days as of complete application.	3 – 5 years	Application will be made before power plant construction, if required.	April 2016	High	Owner – (Relations & SHE Department)
8.	Electrical Installation in Work Environment in work place	Directorate General of New Renewable Energy Director General of Electricity	This license is required for the operation of the geothermal power plant This license is required for applying the Worthiness Certificate or *Sertifikat Layak Operasi ("**SLO**") for power plant*	Issued within 30 working days as of complete application.	3 – 5 years	Application will be made before or during plant construction.	April 2016	High	Owner – (Relations & SHE Department)
9.	50 K litre Fuel Tank license	EBTKE	Based on the regulation this license should be applied for liquid fuel tank above 40 K litre		1 year	Application letter has been send to EBTKE, planned to conduct inspections by BKI and EBTKE on 16 – 19 January 2014	End of January 2014	Medium	Project, Engineering, and Relations & SHE

No.	Documents	Issued By	Remarks	Legal Timeframe	Permit Duration	Updated Status	Date Needed	Level of Critical	Responsible Party
10	Atmospheric flash tank	EBTKE	Based on the regulation this license should be applied for Atmospheric Flash Tank			already engage with BKI for the fabrication inspection (it will not affected the spud in date	February 2014	Medium	Project, Engineering
11	Earth moving and lifting equipment used by Civil contractor	EBTKE	Based on the regulation this license should be applied						
12	Earth moving and lifting equipment used by drilling contractor	EBTKE	Based on the regulation this license should be applied			Already certified up to April 2015			