

Initial Environmental Examination

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Nam Ngiep 1 Hydropower Project (Lao People's Democratic Republic)

Prepared by Earth Systems on behalf of the Nam Ngiep 1 Power Company for the Asian Development Bank

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NAM NGIEP 1 HYDROPOWER PROJECT

Initial Environmental Examination of the 22 kV Transmission Line (Sections 2, 3 & 4) and Ban Houay Soup Distribution Line

FINAL

Prepared for

Nam Ngiep 1 Power Company

By



EARTH SYSTEMS
Environment | Water | Sustainability

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Copy No.	Company / Position	Name
1	Manager, Environmental Management Office, NN1PC	Mr. Apirat Iamsiri
2	Senior Adviser, Environmental Management Office, NN1PC	Mr. Cliff Massey
3	Assistant Manager, Environmental Management Office, NN1PC	Ms Souksakhone Sihalath

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EXECUTIVE SUMMARY

This Initial Environmental Examination (IEE) has been prepared by Earth Systems on behalf of the Nam Ngiep 1 Power Company (NN1PC) to identify and assess the potential environmental and social impacts of the proposed Nam Ngiep 1 Hydropower Project (NN1 HP) 22 kV Project (Sections 2,3 and 4) and Ban Houay Soup Power Supply Project (the PS Project).

This IEE has been conducted at the request of the Asian Development Bank (ADB) as a supplement to the existing NN1 HP Environmental Impact Assessment (EIA).

Current GOL legislation and guidelines regarding environmental and social assessment and management of transmission lines are focused on high voltage (i.e. 230 kV and 115 kV) projects and do not outline specific requirements for 22 kV transmission line projects. The Rural Electrification Programme 2 implemented by Electricite du Lao (EDL) and financed by the World Bank has been operating for more than 10 years. The programme is viewed as a benchmark for best practice environmental and social standards for 22 kV transmission line projects in Lao PDR. As such, Rural Electrification Programme 2 standards have been adopted as de facto standards for this transmission line upgrade and extension Project.

Project Description

NN1PC requires an enhanced electrical power supply and an extension of the existing transmission line to provide adequate power for activities associated with construction of the NN1 HPP and to provide electricity to the proposed Ban Houay Soup resettlement village.

The Power Supply Project entails the conduct of the following works during the construction phase of the NN1 HPP:

1. Upgrade of the existing Electricite du Lao (EDL) 22 kV line from Paksan Substation to Ban Nonsomboun (20.8 km) (Section 1) and from Nonsomboun to Ban Hatsaykham (27.8 km)– through the Houay Nguva Provincial Protection Area (PPA) (Section 2);
2. Construction of NN1 HPP 22 kV lines from Ban Hatsaykham to the RCC plant yard and Re-regulation Dam (4.9 km) (Section 3) and from the RCC plant yard to the Main Dam and Quarry Sites (3.1 km) (Section 4);
3. Construction of a 22 kV distribution line (2.8 km) from the NN1 HPP Re-Regulation Dam to Ban Houay Soup resettlement village; and
4. Construction and operation of a temporary sub-contractor's camp to accommodate approximately 50 personnel from ASA Power Engineering Co (ASA) at a site located approximately 400 m north-east of Ban Nonsomboun.

Development of the Power Supply Project will not require expansion of the current road network (or the planned road network for the greater NN1 HPP).

Project Legal / Ownership Status

The existing 22 kV transmission line (Sections 1 and 2), extending from Paksan to Ban Nonsomboun and from Ban Nonsomboun to Ban Hatsaykham, is owned and operated by EDL and will remain under EDL jurisdiction during transmission line upgrade to this section and after completion of the proposed Power Supply Project.

The transmission line extension from Ban Hatsaykham to NN1 HPP Project facilities (Sections 3 &4) and to Ban Houay Soup will be owned by NN1PC until the Commercial Operation Date (COD) for the

hydropower project. Ownership of these sections of the Power Supply Project, post-COD, is currently under discussion.

Scope and Objectives of the IEE

This IEE assesses sections 2, 3 and 4 of the PSP including the upgrade of the EDL line from Ban Nonsomboun to Ban Hatsaykham; the construction of the Project transmission line to NN1 HPP; and the construction of the village distribution line to the Ban Houay Soup resettlement village. The upgrade of the EDL transmission line from Paksan to Ban Nonsomboun is not included in the scope of this study.

The main objectives of the IEE are to:

- Characterise physical and biological characteristics of the Project Footprint including a 'pre EDL construction' baseline of the EDL transmission line right-of-way (ROW) through the PPA;
- Assess the potential environmental and social impacts of the Power Supply Project during construction and operation;
- Propose management measures to control and mitigate the identified impacts; and
- Introduce the public and other stakeholders to the Project and the environmental and social impact assessment process, through various consultations.

Schedule of Implementation

Upgrade and extension of the Power Supply Project is expected to require approximately six (6) months to complete with the majority of right-of-way clearing, tower upgrade / construction and cable installation work being completed in the first three (3) months. It is proposed that works will be initiated in July 2014 and concluded by approximately January 2015.

Physical Impacts

Land Area

The Power Supply Project will occupy approximately 30.9 ha of land (38.6 km length x eight (8) metre right-of-way) upon its completion. Twenty-three (23.0) ha of this land is already occupied by the current EDL REP2 Project transmission line right-of-way, therefore Power Supply Project implementation will add 15 ha of land to the transmission line footprint.

Approximately 262 towers will be constructed for the transmission line extension sections (Ban Hatsaykham to Main Dam, Re-regulation Dam, and Ban Houay Soup). The foundations require 1² m of concrete foundation, occupying ~0.26 ha of ground within the ROW (permanently un-vegetated land).

Clearance Area

The Power Supply Project will require an eight (8) metre right-of-way (as per Electricite du Lao, Rural Electrification Project standards) for the length of the transmission line, with vegetation clearance required for a portion of the Power Supply Project Area and ongoing maintenance (vegetation pruning / clearing) for the length of the span.

A 25 metre right-of-way (approximately 15.5 ha of primarily Mixed Deciduous Forest) has already been cleared for the 27.8 km section from Ban Nonsomboun to Ban Hatsaykham (the current EDL REP2 transmission line). Further clearing is not required for this section (though ongoing vegetation maintenance will be required).

For the remaining 10.8 km (Power Supply Project transmission line extension from Ban Hatsaykham to Main Dam, Re-regulation Dam, and Ban Houay Soup), a maximum of 8.6 ha of vegetated area would be cleared to provide the eight (8) m right-of-way.

Assuming the eight (8) m right-of-way is fully vegetated, the following ha of vegetation would be cleared during Project construction:

- Mixed Deciduous Forest – 3.68 ha;
- Regeneration Forest (1 – 8 years old) – 3.38 ha;
- Regeneration Forest (> 8 years old) – 0.33 ha;
- Grassland / Savannah – 0.38 ha; and
- Shifting Cultivation (cleared land) – 0.66 ha; and
- Plantation (rubber) – 0.08 ha.

A significant portion of the proposed Power Supply Project transmission line extension right-of-way has already been cleared of vegetation during construction of the NN1 HPP road network and additional NN1 HPP facilities (and a small area of the ROW is water), therefore significantly less vegetation will be removed than that estimated above.

Impacts to agricultural / plantation vegetation are not anticipated, as shifting agricultural areas (indicated above) are currently devoid of vegetation (and will be planted with species that are not expected to require maintenance clearing) and the preliminary alignment to Ban Houay Soup is expected to be shifted slightly to avoid potential impacts to a small area of agriculture. The NN1PC Social Management Office will be consulted regarding potential impacts (and applicable compensation) the rubber plantation and shifting cultivation that may intersect the preliminary alignment.

Roads

Development of the Power Supply Project will not require expansion of the current road network (or the planned road network for the greater NN1 HPP). Therefore this project will not open new areas to exploitation.

Hydrology

Power Supply Project design requirements specifically avoid locating towers in natural drainages. Power Supply Project related impacts to surface water or groundwater hydrology are not anticipated.

Erosion and Sedimentation

Removal of vegetation in the Power Supply Project extension right-of-way will increase the potential for erosion and sediment runoff and associated turbidity / siltation of downstream watercourses during and for a handful of years following construction. Management and mitigation measures will be incorporated into Power Supply Project design to minimise impacts. Sediment input from the Power Supply Project is expected to be fairly minimal, but will be a component of the cumulative impact associated with concurrent NN1 HPP road construction, NN1 HPP facilities construction (e.g. Temporary Bridge) and mine exploration / hydropower plant construction activities conducted upstream of the Power Supply Project.

Water Quality

Workforce accommodation camps are a potential source of nutrients and pathogens from inadvertent discharge of grey or black water from septic tanks, kitchen, showers, etc. into drainage channels and eventually the Nam Ngiep River. Vehicle stockyards, maintenance workshops, and workforce accommodation areas are also a potential source of hazardous and non-hazardous waste that may be discharged to the downstream environment during the rainy season or may infiltrate surface soils and contaminate groundwater aquifers. Workforce camps and stockyards are expected to be designed, constructed and maintained to prevent discharge of nutrients, pathogens, hazardous and non-hazardous waste (as per the NN1 HPP ESMMP-CP), avoiding potential impacts to water quality from these parameters.

Social Impacts

Villages and People

The Power Supply Project will intersect land holdings of four (4) current villages (Ban Nonsomboun, Ban Thaheau, Ban Gniun, and Ban Hatsaykham) and will terminate at the Ban Houay Soup resettlement

village. The Power Supply Project will be constructed within the 25 metre access road right-of-way, defined as 'non-exclusive project lands' in the NN1 HPP Concession Agreement, Annex D.

Land and assets are not expected to be impacted as a result of Power Supply Project construction or operations of the transmission line from Ban Nonsomboun to the Main Dam and Re-regulation Dam. If required, compensation for the EDL right-of-way (Ban Nonsomboun to Ban Hatsaykham) is the responsibility of EDL. From Ban Hatsaykham to the Main Dam and Re-regulation Dam, all poles will be located within NN1 HPP compensated lands (within the compensated road construction corridor), avoiding requirements for further compensation.

Potential impacts to land and assets associated with the power supply extension to Ban Houay Soup will be assessed and considered by the NN1PC Social Management Office, and would be compensated by NN1PC as per the Nam Ngiep Project Resettlement and Ethnic Development Plan.

Resettlement

No local residents will be relocated as a result of Power Supply Project construction or operations. Relocation requirements and the compensation framework for the greater NN1 HPP are addressed separately from the Power Supply Project.

Ethnic Minorities and Indigenous Peoples

The Power Supply Project complies with Lao PDR rights for ethnic minorities and indigenous peoples, as impacts on culture and lifestyle of all respective people living in proximity to the Project will not be impacted by Project implementation.

Agricultural Land

No agricultural land is expected to be impacted by Power Supply Project implementation for Sections 1 – 4. The proposed preliminary alignment for the extension to Ban Houay Soup may impact 0.1 ha of rubber plantation and 0.2 ha of shifting cultivation. As only slight adjustment is required to avoid agricultural land, it is anticipated that the final design will avoid impacts to any agricultural land. The issue will be referred to the NN1PC Social Management Office for further consideration.

Archaeological and Cultural Heritage

No known archaeological sites exist within the proposed Power Supply Project right-of-way. However, the general region is known to be rich in archaeological, historical and cultural sites and artefacts. It is possible that artefacts or significant sites could be discovered during vegetation clearance. Implementation of a *Chance Find Procedure*, with notification of findings to appropriate government institutions (i.e. Ministry of Information and Culture, National Committee for the protection of national cultural heritage) and training of construction personnel in handling and communication requirements following identification of an artefact / site will facilitate avoiding impacts to sites / artefacts of significant archaeological, cultural or historical significance.

Electrical Hazards

Transmission line construction / upgrade present a significant safety risk for construction personnel and for local residents, particularly those with houses near the transmission line right-of-way. The potential for electrocution will be minimised through disruption of power during key phases of construction. Warning signs will be placed on each power pole. It is anticipated that no personnel or residents will be allowed within a specified distance of live wires during construction of the Power Supply Project or during maintenance activities.

Short-Term Disruption of Electricity

Ban Nonsomboun, Ban Thaheau, Ban Hat Gniun, Ban Hatsaykham, PKC Construction Camp, MV.DC Construction Camp and additional households/service providers currently linked to the electricity grid will have their electricity supply periodically disrupted during construction of the transmission line. Potential impacts include: loss of food requiring refrigeration; short-term closure of restaurants or other service providers during power outages; and general short-term inability to utilise electrically powered appliances including electrically powered water pumps.

It is anticipated that the more significant impacts (i.e. loss of food or revenue) will be avoided through provision of ice boxes and ice or an alternate source of energy (gas powered generator). However, pending the duration of power outages, service providers may have short-term impacts to revenue generation. Compensation should be provided to households and service providers where loss of goods requiring refrigeration cannot be avoided or where loss of revenue is expected. The issue will be referred to the NN1PC Social Management Office for further consideration.

Short Term Workforce Impacts

The presence of the migrant workforce during the construction (~50 people) presents a number of potential temporary impacts for surrounding communities including: increased pressure on non-timber forest products, timber forest products, terrestrial species (hunting) and aquatic species (fishing / collection); increased risk of traffic related safety issues (vehicle strikes); increased risk of introduced diseases including sexually transmitted diseases; and increased risk of conflict due to insensitivity of workforce to local culture and environmental values. The NN1 HPP Training and Awareness programme (refer to the ESMMP-CP) should minimise these impacts during the approximate six (6) month period of Power Supply Project activity, avoiding or reducing impacts to less than significant.

Unexploded Ordnances

Bolikhambxay Province is considered one of the 10 heaviest UXO contaminated provinces in Lao, however the Project area was reportedly not as heavily bombed as in neighbouring Districts. Unexploded ordnances still pose a risk to construction personnel clearing currently vegetated areas and inhabitants of the region that may find UXO in recently cleared areas. NN1PC has developed a detailed plan for addressing UXO survey and disposal in its ESMMP-CP, sub plan *SP13: Unexploded Ordnance Survey and Disposal* that will protect construction personnel and local residents from the danger posed by UXO, if appropriately implemented.

The clearance of UXO is an important component of the construction of the Power Supply Project and will provide some lasting benefit and from the Project. If appropriate management of UXO is incorporated into Power Supply Project planning and vegetative clearing, the risks associated with UXO are considered low and the benefit to local communities is considered significant. NN1PC has completed all access road construction where new poles will be installed in Section 3 and 4; therefore UXO clearance will not be required for these areas.

Dust

Clearing of vegetation for the transmission line ROW and for Power Supply Project pole placement will provide bare surfaces susceptible to wind erosion (temporary impact), potentially elevating airborne particulate matter (dust) on windy days. Trucks and other vehicles travelling on unsealed road surfaces also elevate the volume of airborne dust in proximity to the roads. As much of the Power Supply Project is expected to be constructed during the wet season, the generation of associated dust is expected to be low. However, on dry days, nuisance level impacts to sensitive receptors may occur, particularly when construction occurs near village centres.

During dry days, contractors will spray roads with water in proximity to villages, reducing potential nuisance level dust. NN1PC will continue monthly consultation with NN1 HPP affected villages, providing affected residents the opportunity to request more frequent road watering to minimise impacts from airborne particulate.

Noise

Some nuisance level noise may be generated during Power Supply Project construction in proximity to villages and as a result of vehicular traffic associated with the Project. Noise emission from Power Supply Project construction are expected to be significantly less than that from other NN1 HPP construction activities (e.g. blasting in quarries and road construction) and is therefore not considered a significant potential impact to sensitive receptors.

Biological Impacts

Nationally or Internationally Protected Areas

No internationally protected areas, such as Ramsar Wetlands or World Heritage Areas, or nationally protected areas are located in proximity to the Power Supply Project (i.e. the closest, Phou Khao Khouay National Biodiversity Conservation Area is 15 km away).

Houay Ngua Provincial Protection Area

The current EDL REP2 transmission line passes through the Houay Ngua Provincial Protection Area. The Power Supply Project will upgrade this current line to meet NN1 Project power requirements.

Power Supply Project upgrade to this section of the transmission line is not expected to impact the Houay Ngua PPA as EDL REP2 construction of the current line cleared a 25 metre right-of-way (exceeding the 8 m EDL REP2 standard for 22 kV projects). Power Supply Project activity will be entirely conducted within the existing EDL right-of-way.

Analysis of the pre-EDL transmission line baseline indicates that EDL REP2 Project right-of-way was comprised of approximately 17.75 ha of moderately disturbed Mixed Deciduous Forest. However, the EDL transmission line was constructed next to the access road to Ban Hatsaykham, with the right-of-way sometimes overlapping. Therefore the EDL REP2 Project cleared approximately 15.5 ha of Mixed Deciduous Forest.

Ecological Value

Though the majority of vegetation that will be removed for Power Supply Project transmission line extension has been subjected to some level of human disturbance, much of the forest provides adequate native canopy cover to be considered moderately high value habitat and some pristine habitat will be impacted on the right bank of the Nam Ngiep toward the terminal end of Section 4 (Main Quarry and Main Dam sites). Construction of the transmission line on the south bank of the Nam Ngiep for the last 1.8 km of Section 4 will require removal of approximately 1.4 ha of fairly pristine habitat.

Threatened Vegetation Species

Two tree species (*Vatica cinerea* and *Anisoptera costata*) known to occur in the Power Supply Project Area are considered Endangered (IUCN, 2014) and are commonly harvested in the region for timber. The Power Supply Project is not expected to impact threatened vegetation. As per the NN1 HPP Environmental and Social Management and Mitigation Plan – Construction Phase (ESMMP-CP), it is anticipated that a botanical survey of the final Power Supply Project alignment will be conducted to ensure endangered species are identified, marked and avoided. This provision will be required for inclusion in the Site-Specific Environmental and Social Management and Mitigation Plans (SS-ESMMP).

As the Power Supply Project will not open-up new areas to potential harvest (i.e. no associated road construction), the potential for timber felling is not expected to increase as a result of Power Supply Project implementation.

Threatened Terrestrial and Aquatic Fauna

A handful of nationally or internationally listed (threatened) terrestrial and aquatic fauna are known to occur in the greater Power Supply Project Area. No direct impacts to terrestrial or aquatic fauna are anticipated from Power Supply Project construction or maintenance. Indirect impacts to habitat for this project are considered minor and are not expected to contribute to the decline of any such species.

The influx of migrant construction personnel has the potential to increase hunting and fishing activities, which has the potential contribute to a decline in threatened species' populations. However, the workforce camp facility is located well away from sensitive areas and hunting / fishing by Power Supply Project personnel are expected to be prohibited - therefore impacts should be avoided.

Cumulative Impacts

The construction of major development infrastructure and associated land clearing, especially for planned hydroelectric projects within the Nam Ngiep catchment, will cause significant impacts to physical, biological and social components in the region. Upstream development on the Nam Ngiep is already causing considerable changes to downstream quality in addition to terrestrial and aquatic biodiversity in the catchment.

As the environmental and social impacts from the Power Supply Project are expected to be minor in extent (and short in duration, e.g. 1-2 years), the contribution to cumulative impacts from Power Supply Project development will be comparatively small in the regional context. However, the Power Supply Project will incrementally increase impacts to water quality (via sediment input) and vegetation removal in the Nam Ngiep catchment.

Conclusion

The environmental and social impacts resulting from Power Supply Project construction and maintenance are expected to be minimal and in most cases, temporary.

From a social perspective, the benefits (e.g. power to Ban Houay Soup) appear to outweigh the potential impacts (e.g. short-term power outages, noise, and dust during construction). No village land or assets will be impacted and no people will be relocated as a result of Power Supply Project implementation. However, migrant worker influx (and accommodation near Ban Hatsaykham) has some potential to impact communities in the region. The NN1 HPP Training and Awareness programme (refer to ESMMP-CP) should minimise these impacts during the approximate six (6) month period of Power Supply Project activity. ESMMP-CP requirements for the Training and Awareness programme will be included in the Contractor's SS-ESMMP.

Short-term impacts from power disruption will affect villagers in each of the four affected villages as well as service providers in the region. NN1PC should consult with villagers, restaurant owners, resort owners, etc. regarding current electricity use and to determine the potential impacts to livelihoods resulting from intermittent power outages planned for the construction phase of Power Supply Project implementation (and calculate the financial consequences to determine suitable compensation in consultation with relevant government authorities and Project Affected Peoples).

From an environmental perspective, the majority of impacts will occur for the transmission line extension ROW (28% of the alignment, ~ 8.6 ha). The remainder of works will be conducted in previously cleared and otherwise impacted area (the current EDL transmission line – 72% of the alignment (~22.2 ha)). Management and mitigation measures provided in the NN1 HPP ESMMP-CP and additional measures recommended in Section 5 and below are expected to minimise potential impacts to less than significant.

The NN1PC Environmental and Social Division (ESD), responsible for environmental and social management during the construction phase of the NN1 HPP, will oversee the implementation of the ESMMP-CP, which includes management and monitoring of the Power Supply Project construction and ongoing maintenance and monitoring requirements for NN1 HPP construction. Specific and appropriate management and monitoring plans, including: frequency of monitoring, monitoring responsibilities, format and frequency of reporting, and the funding mechanism are provided the NN1 HPP ESMMP-CP.

1 INTRODUCTION

This Initial Environmental Examination (IEE) has been prepared by Earth Systems on behalf of the Nam Ngiep 1 Power Company (NN1PC) to identify and assess the potential environmental and social impacts of the proposed Nam Ngiep 1 Hydropower Project (NN1 HP) 22 kV Project (Sections 2,3 and 4) and Ban Houay Soup Power Supply Project (the PS Project).

This IEE has been conducted at the request of the Asian Development Bank (ADB) as a supplement to the existing NN1 HP Environmental Impact Assessment (EIA).

1.1 Brief Description of the Project

1.1.1 NN1 HPP Power Supply Project

Nam Ngiep 1 Power Company Limited (NN1PC) requires an enhanced electrical power supply and an extension of the existing transmission line to provide adequate power for activities associated with construction of the Nam Ngiep 1 Hydropower Project (NN1 HPP) and to provide electricity to the proposed Ban Houay Soup resettlement village. In February 2014 NN1PC obtained permission from EDL to upgrade and extend an existing EDL 22 kV transmission line to the NN1 HPP (EDL 2014).

The PS Project entails the conduct of the following works during the construction phase of the NN1 HPP:

1. Upgrade of the existing Electricite du Lao (EDL) 22 kV line from Paksan Substation to Ban Nonsomboun (20.8 km) (Section 1) and from Nonsomboun to Ban Hatsaykham (27.8 km)– through the Houay Nguia Provincial Protection Area (PPA) (Section 2);
2. Construction of NN1 HPP 22 kV lines from Ban Hatsaykham to the RCC plant yard and Re-regulation Dam (4.9 km) (Section 3) and from the RCC plant yard to the Main Dam and Quarry Sites (3.1 km) (Section 4);
3. Construction of a 22 kV distribution line (2.8 km) from the NN1 HPP Re-Regulation Dam to Ban Houay Soup resettlement village; and
4. Construction and operation of a temporary sub-contractor's camp to accommodate approximately 50 personnel from ASA Power Engineering Co (ASA) at a site located approximately 400 m north-east of Ban Nonsomboun.

The PS Project will remain in place following NN1 HPP Commercial Operating Date (COD), providing power to Ban Nonsomboun, Ban Thaheau, Ban Hatsaykham and the Ban Houay Soup resettlement village (via connection of a distribution line from the 22 kV facilities).

Further information on the PS Project is provided in Section 2 of this report.

1.1.2 Nam Ngiep 1 Hydropower Project Background

NN1PC has received a Concession Agreement (CA) from the Government of the Lao PDR (GOL) to build and operate the NN1 HPP in Bolikhamsay, Xaysomboun, Xieng Khouang and Vientiane Provinces, Central Lao PDR.

The project will have a total generating capacity of 290 megawatts (MW) and annual power generation of 1651 gigawatt hours (GWh). Key project components will include a 148 metre high concrete gravity dam

on the Nam Ngiep River (Main Dam); 66.9 km² Reservoir; Main Power Station (272 MW); Re-regulation Dam; and Re-regulation Power Station (18 MW).

The Project is currently in pre-construction phase. This includes the construction of access roads and / or upgrading pre-existing access roads and main site preparation. The main construction phase of the Project is due to commence in July, 2014. Initial impoundment of the Reservoir is planned for July 2018 with COD expected to commence in January 2019 (NN1PC EIA 2014).

The original environmental and social assessment for the NN1 HPP was completed by the Environmental Research Institute, Chulalongkorn University in March 2012. Revised environmental and social assessment and management documentation was completed by ERM-Siam Co., Ltd between November 2013 and May 2014.

1.2 Objectives and Scope of the IEE

This IEE assesses sections 2, 3 and 4 of the PSP including the upgrade of the EDL line from Ban Nonsomboun to Ban Hatsaykham; the construction of the Project transmission line to NN1 HPP; the construction of the village distribution line to the Ban Houay Soup resettlement village; and the sub-contractors camp. The upgrade of the EDL transmission line from Paksan to Ban Nonsomboun is not included in the scope of this study.

The main objectives of the IEE are to:

- Characterise physical and biological characteristics of the Project Footprint including a 'pre EDL construction' baseline of the EDL transmission line right-of-way (ROW) through the PPA;
- Assess the potential environmental and social impacts of the Power Supply Project during construction and operation;
- Propose management measures to control and mitigate the identified impacts; and
- Introduce the public and other stakeholders to the Project and the environmental and social impact assessment process, through various consultations.

1.3 Project Developer and IEE Consultant

1.3.1 Nam Ngiep 1 Power Company

NN1PC is owned by Kansai Electric Power Co. Inc. (Kansai Electric), the Electricity Generating Authority of Thailand (EGAT) International Co. Ltd and Lao Holding State Enterprise. The Company is headquartered in Vientiane, Lao PDR. The owners of NN1PC have extensive experience in the design, construction and operation of large-scale hydroelectric power projects.

The contact details for NN1PC are as follows:

Mr Apirat Iamsiri

Nam Ngiep Power Company Limited

House No. 236, Unit 16, Ban Phonesinumam

Sisattanak District

Vientiane, Lao PDR

T: (856-21) 261251

[E: 539929@egat.co.th](mailto:539929@egat.co.th)

[W: www.namngiep1.com](http://www.namngiep1.com)

1.3.2 Contractors

Obayashi Corporation (OC) is the Head Contractor for the NN1 HPP. OC will sub-contract ASA Power Engineering Co (ASA) to construct the PS Project. EDL will be sub-contracted to upgrade the transmission line cable throughout the current EDL alignment.

1.3.3 Earth Systems

The Earth Systems Group is a multidisciplinary environmental and social consulting firm which develops and implements innovative and effective environment, water and sustainability solutions throughout the world.

Earth Systems has been operating in Lao PDR for more than 15 years completing a range of environmental and social consultancy projects including EIAs for some of the country's most significant mining and hydropower projects. Earth Systems' impact assessment expertise includes managing multi-disciplinary teams composed of a range of international and local experts in preparing international standard environmental and social impact assessments that meet national regulatory and, if required, investment bank requirements for project permitting.

The contact details for Earth Systems are as follows:

Mr Tom Callander

Earth Systems

Suite 502, 23 Singha Road

Ban Nongbone

Vientiane, Lao PDR

P: +856 (0) 21 454-434

E: enviro@earthsystems.com.au

W: www.earthsystems.com.au

1.4 Methodology

The Initial Environmental Examination was undertaken through the conduct of the following activities:

Kick-off meeting and Data Collection

Earth Systems met with NN1PC managers and engineers to discuss PS Project details, development options and key design / redesign features. During these meetings PS Project and EDL information and satellite imagery (dated January 2014) was sourced.

Desktop Studies

- **Land and vegetation analysis** - Spatial Geospatial Information Systems (GIS) mapping software was utilised to prepare an initial 'pre-EDL construction' and current baseline conditions of the ROW, with an emphasis on the Houay Nguang Provincial Protection Area. Key assets and vegetative communities were digitised based on visual interpretation of the satellite imagery, with key assets (structures) and other areas of interest included in land use and vegetative community maps developed prior to site surveys;
- **Review and analysis of relevant NN1PC and EDL information** - Earth Systems reviewed available NN1PC and EDL documentation regarding transmission line construction and maintenance, proposed construction and maintenance activities, and environmental and social aspects related to the Project Area; and
- **Additional Literature** - Earth Systems reviewed the NN1 HPP EIA and other available environmental and social literature for the Project Area. Available documentation regarding physical

(topography, geologic features, water resources, soil types) and biological aspects (vegetative communities, habitat connectivity, terrestrial and aquatic biodiversity) relative to the ROW and downstream environments was assessed prior to field surveys.

Field Surveys and Ground-Truthing

Field based ground-truthing was conducted to verify vegetation and land use classifications and record changes in land use following the date of imagery capture.

Surveys within the EDL and additional PS Project ROW were conducted to describe the physical and biological components of the transmission line corridor, including key aquatic and terrestrial habitat and additional resources within and downstream of the ROW. These observations (and geospatially referenced photographs) were used to supplement and refine the land use and vegetative mapping within the ROW.

Stakeholder Engagement and Consultations

Village level consultations and focus group discussions were conducted in June, 2014 in Ban Nonsomboun, Ban Hat Gniun, Ban Hatsaykham and Ban Thaheua. Each consultation involved approximately 30 participants including village committee members and a selection of women and men villagers. Representatives of EDL and the Environmental Management Office (EMO) NN1PC were also present during these consultations.

Other stakeholder engagement included meetings with:

- Provincial Protection Area (PPA) Managers to discuss PPA management planning, the definition of the PPA according to Lao law, and current legal and illegal resource extraction common for the protection area;
- Electricite du Laos (Bolikhamsay) to clarify previous REP2 transmission line project works, discuss standard Environmental Management Planning for REP2 22 kV projects, discuss maintenance plans and vegetation clearance requirements for the EDL ROW, and EDL participation in implementing power cables for the PS Project. This consultation was attended by staff from EDL, the NN1PC Technical Department, and Earth Systems;
- Technical Department - NN1PC and Head Contractor met to obtain and confirm technical design, construction implementation and operations information for the 22 kV PS Project; and
- World Bank REP 2 Team and EDL Environment Office to obtain environmental and social assessment and management information for the existing EDL / REP 2 transmission line.

A record of stakeholder consultations is provided in Section 9 and Appendix B.

IEE analysis and reporting

Analysis and reporting was conducted by assessing baseline conditions, identifying risks during site visit and risk assessment, evaluating potential project impacts and benefits, and assessment of the proposed project relative to the NN1 HPP EIA and ESMMP-CP as well as national / international statutory requirements.

The report considers both current and pre-EDL baseline conditions and projected construction and maintenance phase works for the Project. The impact assessment has been conducted according to the existing baseline conditions, as EDL construction (and clearing of vegetation for the transmission line right-of-way) occurred prior to PS Project planning.

Potential impacts have been evaluated to identify and recommend suitable management and mitigation measures that will facilitate Project compliance with GOL and applicable international standards and best practices.

2 DESCRIPTION OF THE PROJECT

2.1 Project Location

The proposed PS Project is located in Bolikhan District, Bolikhamsay Province approximately 130 km North East of Vientiane. The proposed works will be conducted in the ‘Downstream Area’ (Zone 4¹) of the main NN1 HPP. The total length of the proposed PS Project transmission line network is 59.4 km and consists of five sections (refer to Table 2-1).

Table 2-1 Project Power Supply Network

Section #	Section Name	Location	Distance (km)
1	Paksan to Nonsomboun [^]	Provincial Road No. 3	20.8
2	Nonsomboun to Hatsaykham	Project Access Road – A1. Ban Nonsomboun, Ban Hat Gniun, Ban Thaheua and Ban Hatsaykham. Provincial Protection Area.	27.8
3	Hatsaykham to RCC Plant Yard and Re-regulation Dam	Project Area - Project Road -P1*	4.9
4	RCC Plant Yard to Main Dam Quarry Site	Project Area - Project Roads - P1, P2 and T9*	3.1
5	RCC Plant Yard to Ban Houay Soup Resettlement Area [^]	Ban Houay Soup Resettlement Area	2.8
Total			59.4

[^] Section 1 is not within the scope of this IEE

2.1.1 Project Power Supply

Sections 1-4 will supply power to NN1 HPP facilities during the construction phase of the project (refer to Appendix D):

- Section 1 is an existing 22 kV transmission line constructed under the REP2. It extends approximately 20.8 km from the existing EDL Paksan substation to Nonsomboun. The upgrade of this Section is still under consideration and as such, is not covered in the scope of this IEE.
- Section 2 is an existing 22 kV transmission line constructed under the REP2. It extends approximately 27.8 km from Ban Nonsomboun to Ban Hatsaykham, passing through Ban Hat Gniun and Ban Thaheua. This section also passes through the Houay Ngua Provincial Protection Area. The PS Project (Section 2) will be conducted within the existing EDL ROW.
- Section 3 will traverse approximately 4.9 km, from Ban Hatsaykham to the proposed RCC Plant Yard and to the proposed Re-regulation Dam. The line will be installed along Project Road P1 within the existing NN1 HPP road network ROW.
- Section 4 will extend approximately 3.1 km from the proposed RCC Plant, culminating at the proposed Main Quarry site and Main Dam. The alignment will follow Roads P1, P2 and T9 from the RCC Plant Yard to the Main Quarry site and Main Dam (refer to Figure 2-1). Three (3)

¹ The EIA (May 2014) divides the NN1 HPP into five (5) zones: 1) upstream area; 2) reservoir area; 3) construction area; 4) downstream area; 5) main resettlement areas.

alternative routes have been considered for a portion of this alignment (refer to Section 2.5) all along existing / planned Project roads. A section of this line (from the Main Quarry site to the Main Dam) will also impact GOL land.

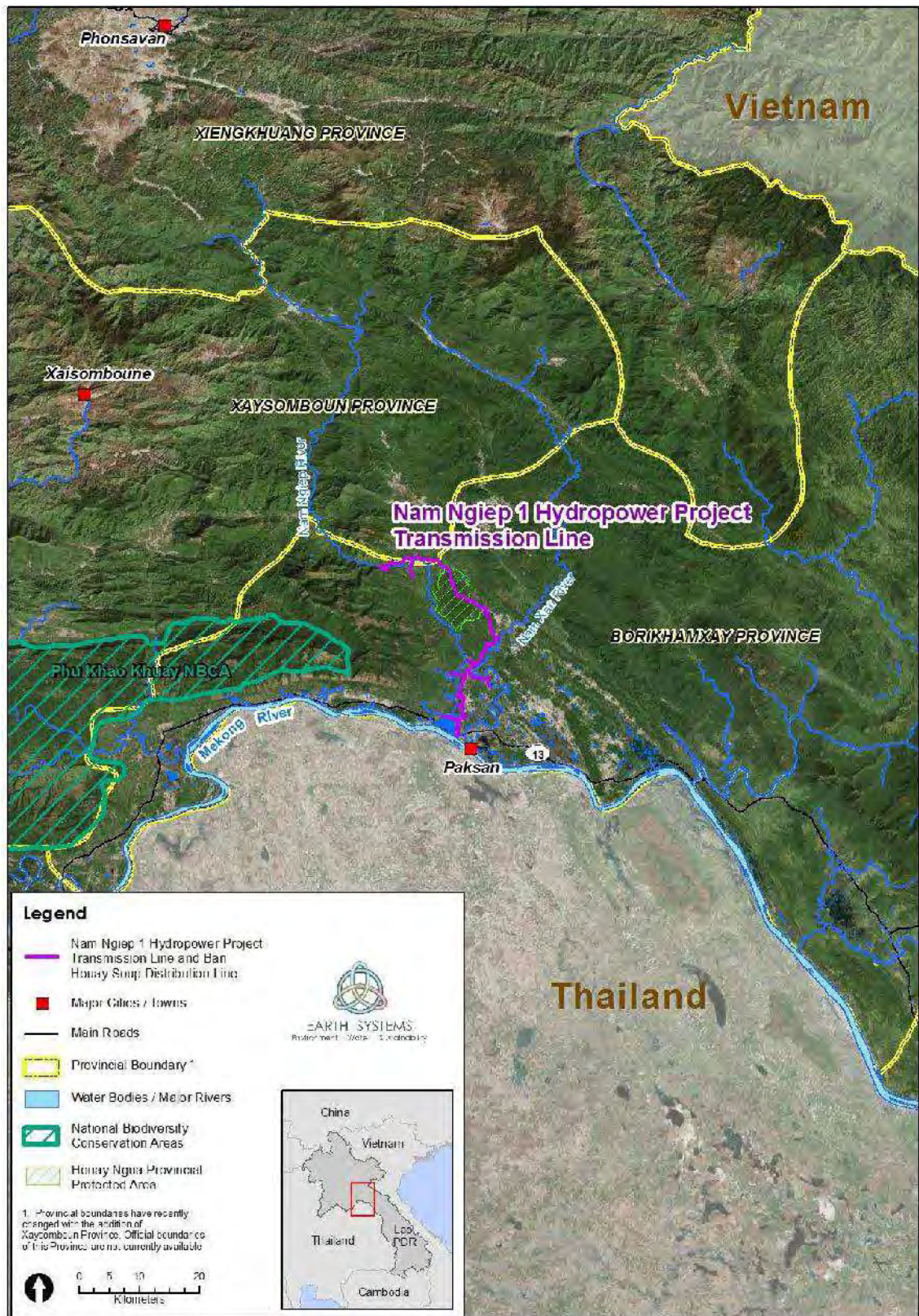


Figure 2-1 Project Location

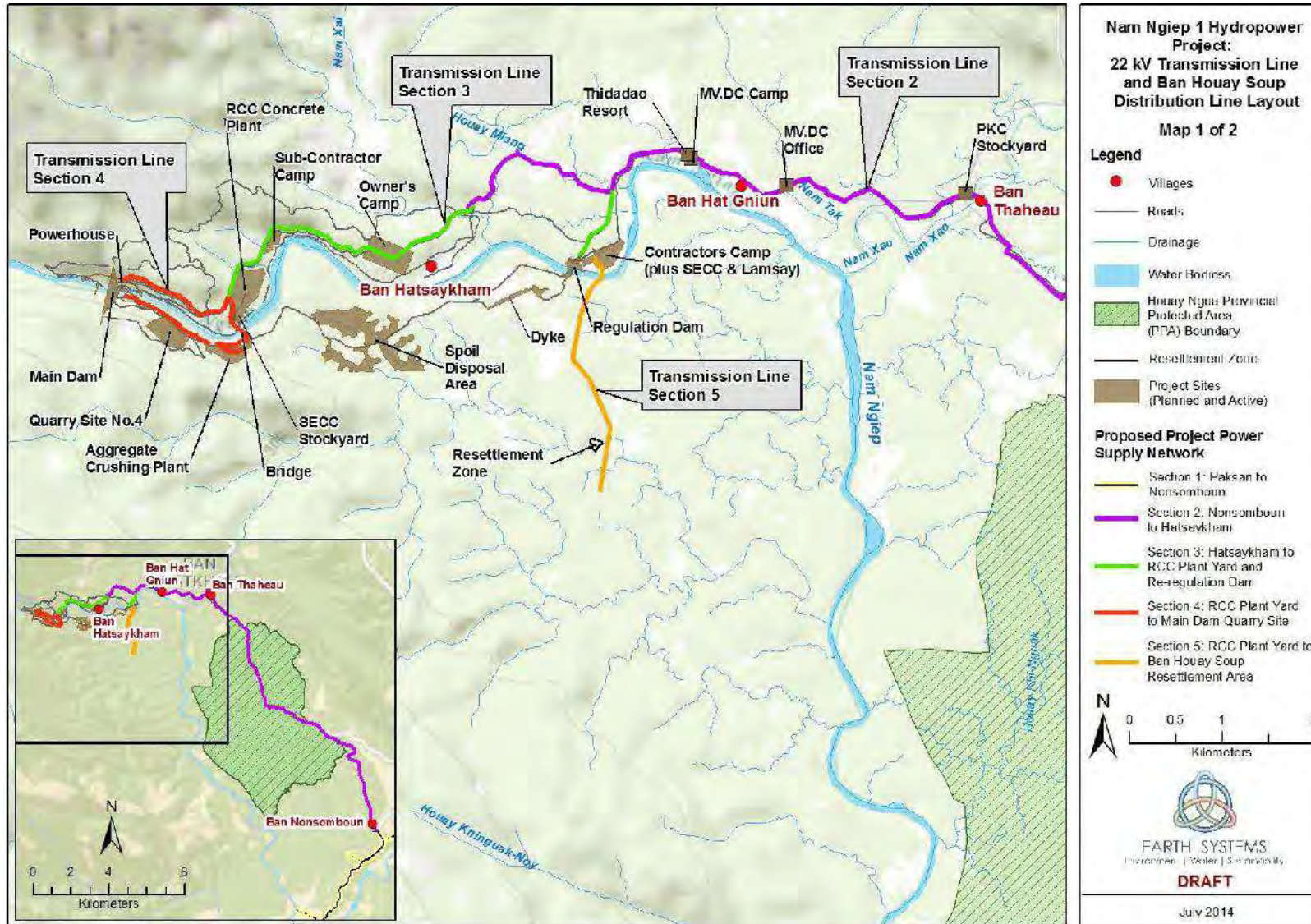


Figure 2-2 Project Arrangement

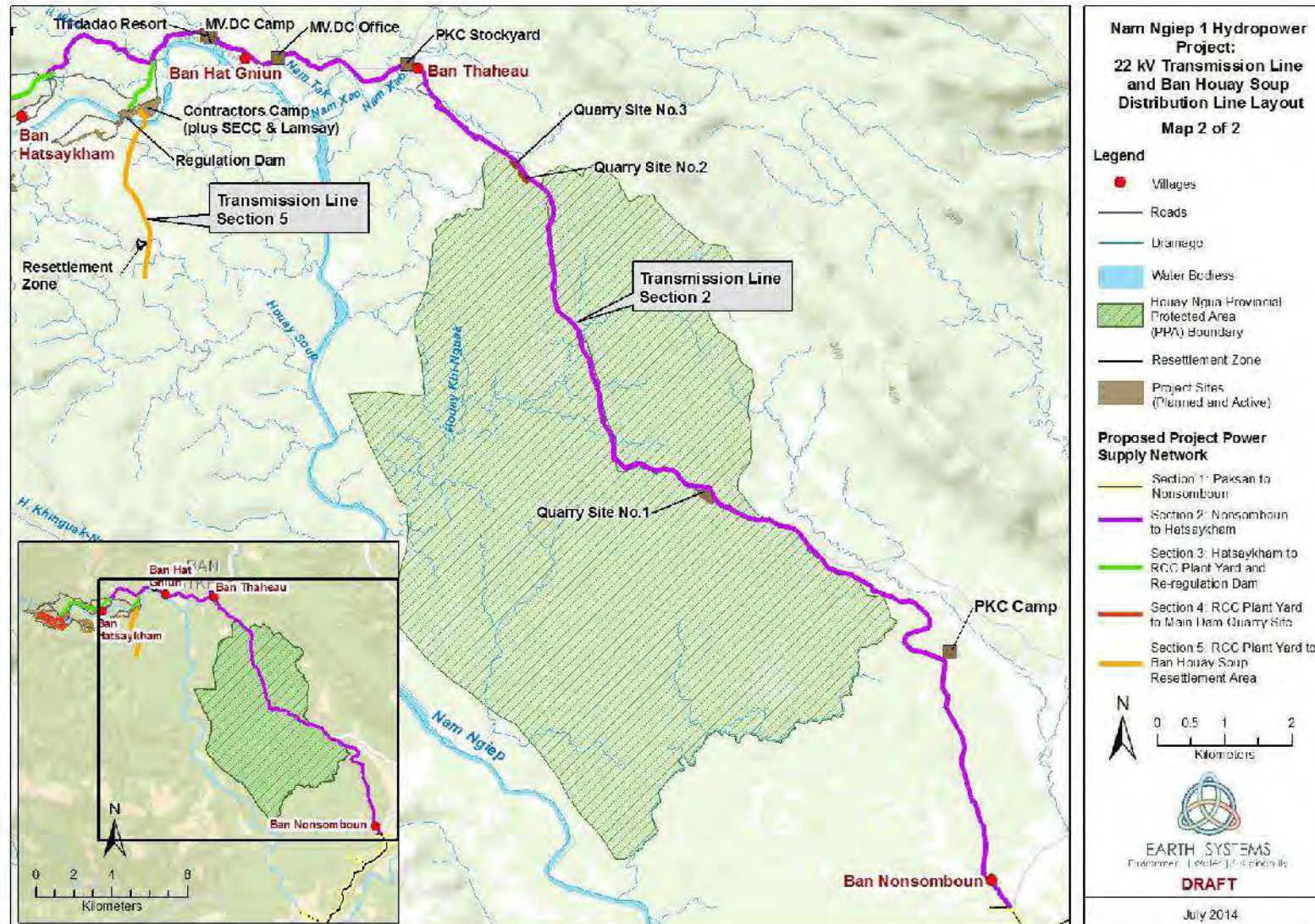


Figure 2-3 Project Arrangement

2.1.2 Ban Houay Soup Power Supply

NN1PC will also construct a 22 kV village distribution line from the main 22 kV line at the Re-Regulation Dam to the Ban Houay Soup resettlement village. The proposed Ban Houay Soup resettlement area is located on the right (south) bank of the Nam Ngiep River near the Re-regulating Dam (refer to Figure 2-4). The proposed village distribution line will cross the Nam Ngiep River and is expected to be re-aligned to either side of the paddy field area.

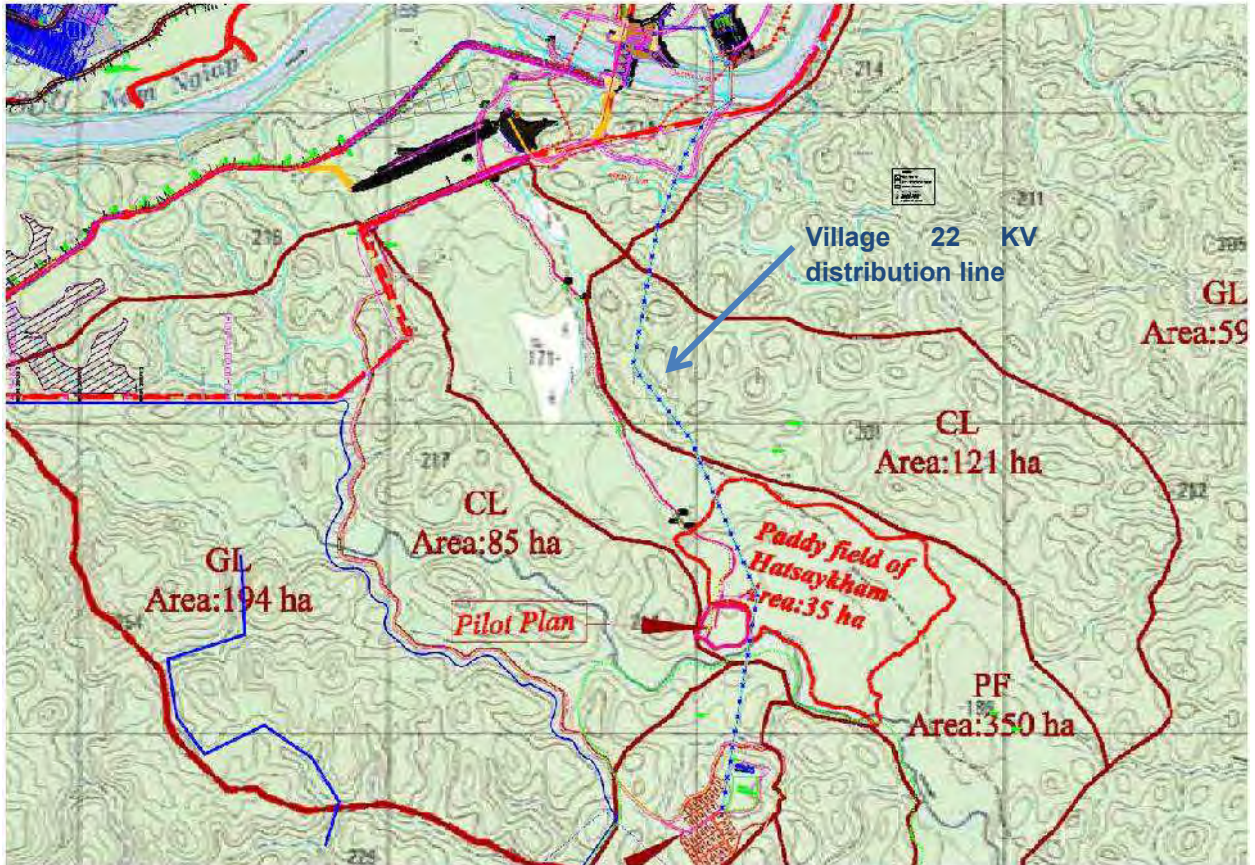


Figure 2-4 Overview of facilities planned for the Ban Houay Soup Resettlement Area (ERIC 2012)

2.2 Project - Legal / Ownership Status

The existing 22 kV transmission line, extending from Ban Nonsomboun to Ban Hatsaykham, is owned and operated by EDL and will remain under EDL jurisdiction after completion of the proposed upgrade.

The transmission line extension from Ban Hatsaykham to the Project facilities and the village distribution line to Ban Houay Soup will be owned by NN1PC until the commencement of NN1 HPP COD when this infrastructure will be transferred to EDL.

2.3 Project Design

2.3.1 Key design features

Figure 2-5 provides an overview of the Project Supply Network. Key information regarding the transmission line design is presented in Table 2-2. More detailed information is subsequently provided in Sections 2.3.2 to 2.3.4.

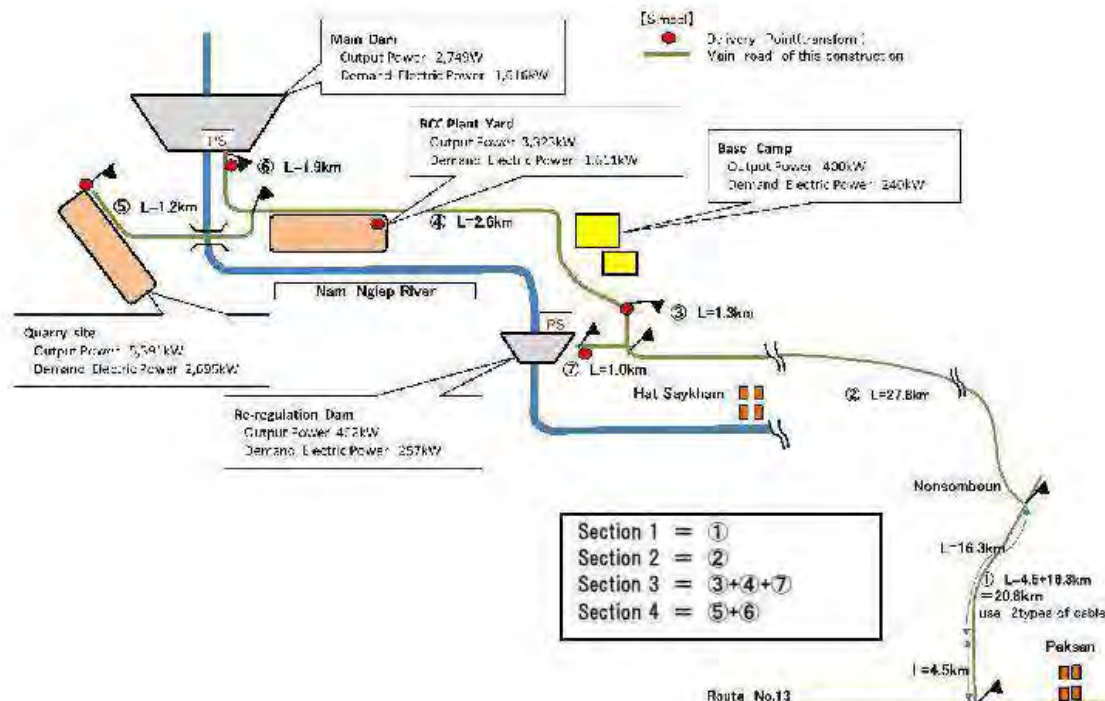


Figure 2-5 Project Power Supply Network (source NN1PC)

Table 2-2 Transmission Line Project Design (Sections 2-5)*

Line Design Features	Section 2	Sections 3 and 4	Section 5
Line voltage	22 kV	22 kV	22 kV
Type	Towers: Pole structures with concrete foundations Cable: ACSR 150 sq.mm aluminium / steel cable	Towers: Pole structures with concrete foundations Cable: ACSR 150 sq.mm aluminium / steel cable	Towers: Pole structures with concrete foundations Cable: ACSR 150 sq.mm aluminium / steel cable
Cable length	3 x 27.8 = 83.4 km	3 x 8 = 24 km	3 x 2.8 = 8.4 km
Transformers	n/a	22 kV/0.4,0.2 x 15 units	22 kV/0.4,0.2 x 3 units
Number of poles	~23 reinforced / replaced	~200	62 [^]
Average span between towers	70 metres (average)	45 metres (average)	45 metres (average)
Tower height	10 metres (12 metre length with 2 metre burial depth)	10 metres (12 metre length with 2 metre burial depth)	10 metres (12 metre length with 2 metre burial depth)
Tower land area	0.3m ² pole; 1.0 m ² foundations per pole	0.3m ² pole; 1.0 m ² foundations per pole	0.3m ² pole; 1.0 m ² foundations per pole
Right-of-way (Row) #	8 metres	8 metres	8 metres
Transformer sub-stations	n/a	5 substations (each with 3 x 22 kV 0.4 / 0.2 transformers)	1 substation (with 3 x kV 0.4 transformers)

* Section 1 not includes in the scope of this IEE. Design details are not available for the Ban Houay Soup distribution line.
 # EDL REP2 standard for 22 kV lines is 8 metres. Note - wider ROW has been cleared within the PPA for the existing EDL line.
 ^ Assumes 45 m spacing for 2.8 km section

2.3.2 Tower design

Section 2 EDL TL Upgrade

There are currently 425 tower structures supporting the existing transmission line from Ban Nonsomboun to Ban Hatsaykham. Average span between structures is 70 metres. Approximately 24 of these existing structures will be reinforced to support the new cable design. Reinforcement will include the addition of poles and cross beams as shown in Figure 2-6.

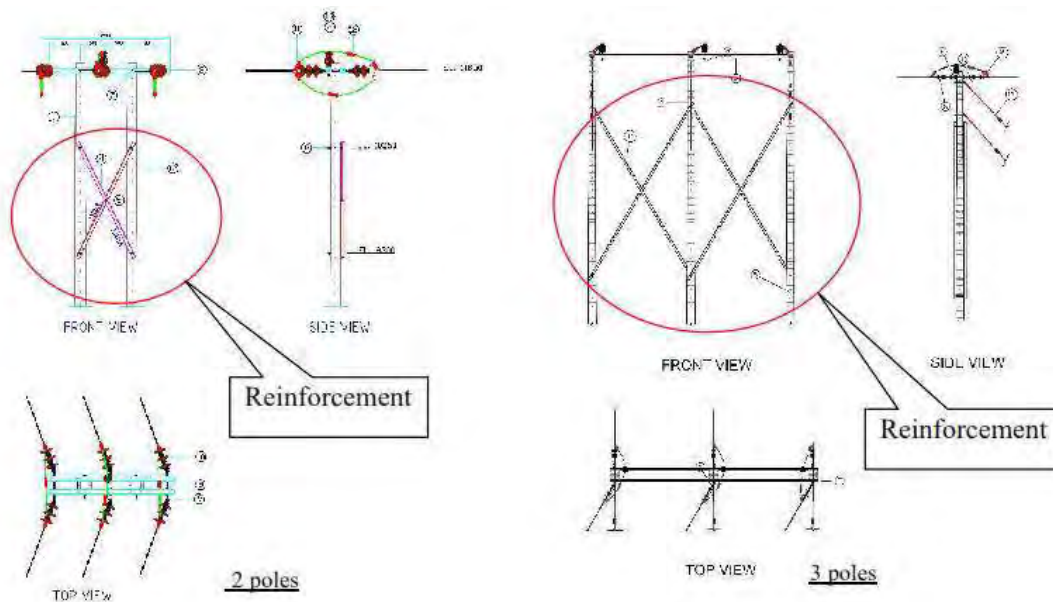


Figure 2-6 Tower reinforcement (source NN1PC 2014)

Section 3-4 PS Project Construction

The construction of the new transmission line from Ban Hatsaykham to the Project facilities (Sections 3 and 4) will require implementation of 200 poles. The majority of structures will be double pole towers. Average span between towers will be 45 metres. The reduced span will allow for more flexible alignment (i.e. following the curved road network). It will also accommodate the more hilly and mountainous terrain in this area.

Section 5 PS Project Construction

Approximately 62 poles will be required for the 22 kV Houay Soup village distribution line. New tower / pole infrastructure and new cable will be installed for the length of the proposed section and electricity will be distributed via a multiple circuit to more than 400 proposed dwellings. Transmission line specification, including procurement, will be confirmed through EDL.

2.3.3 Transmission line right-of-way

The PS Project will utilise existing EDL and Project road ROWs. The standard ROW required for 22 kV lines in Lao PDR is eight (8) metres (World Bank 2009).

According to the Lao Electrical Power Technical Standards (MIH 2004), for safe clearance to a live conductor for 22 kV transmission lines, the following clearances will be maintained:

- Common place ground clearance: 5.5 m;
- Mountainous area: 5.0 m;
- Navigable river: 2.0 m (above mast height);

- Unnavigable river: 5.0 m;
- Road crossing: 6.0 m; and
- Built-up Area: permitted when:
 - » Stranded wire has a tensile strength of no less than 30 kN;
 - » Span is no longer than 75 metres;
 - » Towers height is 10 metres (8 metres when insulated conductors are used); and
 - » Appropriate signage indicating potential danger is used.

As stipulated by the Lao Electric Power Technical Standards, trees should be pruned to ensure that overhead transmission lines are not damaged by falling trees. Similarly, the positioning of electrical conductors should be of sufficient height to avoid damage by falling trees. A clearance of 2.0 m is required for 22 kV lines.

For the Transmission Line, EDL clearance practice will be followed. On government land, trees that have the potential to grow above 3 m will be cleared. On private land, trees that can survive at less than 3 m will be pruned and maintained below this height.

2.3.4 Transformer sub-station design

Transformer sub-stations will be established at each receiving facility and the Ban Houay Soup resettlement area. Each sub-station is expected to consist of three (3) 22 kV 0.4 / 0.2 transformers. Two transformer setting methods may be used – either attached to the pole or on a concrete foundation. Detailed location and specifications of each transformer are still under consideration and subject to change.

A Metering Station with Capacitor Bank (C-Bank) will be constructed on a pole between the Project and Ban Hatsaykham. The exact location of this Metering Station is yet to be determined.

2.3.5 Contractors camps

A temporary sub-contractor's camp will be constructed to accommodate approximately 50 construction personnel from ASA Power Engineering Co. The proposed camp would be located approximately 400 m north-east of Ban Nonsomboun on a 0.9 ha land parcel (refer to Figure 2-7). A rental agreement for the property was signed on June 10th, 2014. The area has been cleared of vegetation and will include a stockyard for equipment storage and maintenance and construction materials in addition to accommodation. Facilities are currently being constructed and some materials (e.g. cable) are currently stored on-site in advance of construction.



Figure 2-7 Construction Camp Location

2.3.6 Quantity and Quality of Raw Material

Key materials required for upgrade and construction of the PS Project will include transformers, conductor wires, insulators, concrete poles and concrete for tower base (refer to Table 2-3).

Total volume of concrete for tower foundations is estimated at 100 m³ (0.45 m³ for each pole foundation).

Table 2-3 List of Materials

No.	Description	Specifications	Quantity
1	Electric cable	ACSR 150 mm ²	107.4 km
2	Concrete pole	With accessory	223 units
3	Transformers	22 kV / 0.4,0.2	15 sets
4	Capacitor pack	1.2 Mvar	1 set
5	EDL KW hour metre	EDL standard	1 set
6	Concrete (foundation)	2m ³ per pole	446 m ³

2.3.7 Waste Products Generated by the Transmission Line

The major waste created by the PS Project will be vegetation from the ROW clearance. Prior to disposal, local residents will be given access to this waste so that they can utilise it for firewood, raw materials and charcoal production (etc.).

In the case where the alignment passes through the natural forests (where commercial timber is present), commercial timber will be harvested in coordination with the relevant District Government. In addition to vegetation waste, it is anticipated that 2 m³ of soil will be excavated from each tower base, resulting in approximately 446 m³ of total spoil. Soil will be backfilled where possible and the remaining soil will be spread around the tower bases to facilitate natural re-vegetation and / or used as fill in depressions nearby so as to minimise destruction to the tower bases. No soil is expected to be removed from the construction areas.

2.3.8 Project Costing

The total cost of the 59.4 km PS Project transmission line, including sub-station equipment and infrastructure, and line conductors, towers, assembly and right-of-way compensation is estimated at \$2.1 million USD capital expenditure.

2.4 Schedule of Implementation

Figure 2-8 provides an indicative schedule for the PS Project. It is expected to be implemented over a six (6) month period with the majority of ROW clearing, tower upgrade / construction and cable installation work being completed in the first three (3) months. It is proposed that works will be initiated in July 2014 and concluded by approximately December 2014.

No.	Work Item	Month					
		1	2	3	4	5	6
0	Planning and documentation						
	EDL Agreement						
	Other permitting						
1	Cable Line Installation Work (NSB - HSK)						
	Design & Drawing						
	Mobilisation						
	Material transportation						
	Installation of new conductor						
	Additional pole setting						
	Test and commissioning						
2	Cable line installation work (HSK to Project)						
	Survey work						
	Mobilisation						
	Material transportation						
	ROW clearing						
	Pole setting and hardware installation						
	Stringing conductor						
	Test and commissioning						
3	Installation of EDL Metering Station						
	Procurement						
	Mobilisation						
	Material transportation						
	Foundation work						
	Installation						
	Test and commissioning						
4	Installation of Sub-Stations						
	Procurement						
	Mobilisation						
	Material transportation						
	Installation						
	Test and commissioning						

Figure 2-8 Indicative Project Schedule

2.5 Project Alternatives

2.5.1 Transmission Cables

Two cable options were considered during project design:

- Dual 50 mm² cable system (current); and
- Triple 150 mm² cable system (selected).

Originally the existing 50 mm² cable system was considered adequate. However upon further consideration regarding the energy requirements of the NN1 HPP during construction and the surrounding villages the 150 mm² cable system was deemed necessary.

2.5.2 Transmission Line Alignments

Three routes are currently being considered for Section 4 (RCC Plant Yard to Main Dam and Main Quarry) of the transmission line alignment:

Option 1: 3.1 km line from the RCC Plant Yard, following existing Roads P1, P2, and T9 (refer to

- Figure 2-3);
- Option 2: 3.1 km line from the RCC Plant Yard, with the final alignment to the Main Dam site following existing / proposed Road T1; or
- Option 3: 3.1 km line from the RCC Plant Yard, with the final alignment to the Main Dam site following existing / proposed Road T2.

Of the alternatives, Option 1 is the preferred route. The difference in impacts during construction is considered minimal, as construction of each road requires vegetation removal that will likely include part of the transmission line ROW (thus minimising combined vegetation removal for the road and transmission line corridors). However, Roads P1 and P2 will be actively maintained throughout the life of the greater Nam Ngiep 1 Hydropower Project, thereby reducing the magnitude of maintenance cutting of vegetation in the transmission line corridor following completion of the greater NN1PC Project construction.

2.5.3 No Project Alternative

The Project Power Supply Network is part of the NN1 HPP and therefore the no-project alternative is considered in relation to the project as a whole. The NN1 HPP EIA (ERM-Siam May 2014) no-project alternative analysis focuses on EGAT's Power Development Plan (2010) which proposes a total installed capacity of 21,500 MW throughout the Greater Mekong Sub-region. The EIA concluded that if the NN1 HPP was not to proceed, it would likely be replaced by another power generating (and most likely hydropower project) alternative with similar power supply requirements during construction.

3 POLICY, LEGAL AND INSTITUTIONAL GUIDELINES

3.1 Corporate Environmental and Social Policies

NN1PC acknowledges the potential for the Project to impact upon the community and the environment, including impacts associated with land clearing and disturbance, resettlement, air and water quality and waste. Accordingly, NN1PC has committed to avoiding and minimising environmental and social impacts, complying with the following policies:

- Responsibly minimise and manage environmental and social impacts including nuisance to local community and affected people;
- Comprehensively implement occupational health and safety to protect community health and safety;
- Equally respect the rights of indigenous people and ensure fair compensation;
- Provide training and education with respect to managing impacts to the environment and local communities on a regular basis; and
- Proactively encourage transparent communication and engagement among stakeholders to achieve mutual benefits.

NN1PC senior management are responsible for evaluating environmental and social policies on an annual basis to ensure it remains relevant and effective. This policy will be communicated to all employees to ensure that it is respected and adhered to. The policy will be made publicly available and accessible to all interested parties.

3.2 Policy and Legal Framework in Lao PDR

3.2.1 Policy

The National Socio-economic Development Plan 2011-2015 outlines the country's aims to achieve sustainable economic growth and reduce poverty. Hydropower is recognised as a strategic economic sector for growth and development. Additional strategies relevant to this Project include:

- Renewable Energy Development Strategy in Lao PDR (2011);
- Forestry Strategy to the year 2020 (2005);
- National Biodiversity Strategy 2020 and Action Plan 2010 (2004);
- Policy on Water and Water Resources (2000);
- Water Sector Strategy and Action Plan (1998); and
- National Policy on Environmental and Social Sustainability in the Hydropower Sector (2007).

3.2.2 National Laws

Relevant national laws include:

- Constitution of the Lao People's Democratic Republic 2003;
- Environment Protection Law 2012;
- Law on Investment Promotion 2009;

- Electricity Law 2012;
- Fisheries Law 2009;
- Forestry Law 2008;
- Land Law 2003;
- Law on Labour 2006;
- Law on Hygiene, Disease Prevention and Health Promotion 2001;
- Law on National Heritage 2005;
- Law on the Protection of Human Rights of Children 2006;
- Law on Property 2002;
- Law on the Development and Protection of Women 2004;
- Law on Water and Water Resources 1996; and
- Wildlife and Aquatic Animals Law 2008.

3.2.3 Statutory Environmental and Social Permitting

In addition to the above national laws, the statutory environmental and social permitting requirements for Lao PDR are outlined in a number of relevant laws, decrees and guidelines including:

- Environment Protection Law 2012;
- Decree on the Agreement to Promulgate the Environmental Protection Law 2013;
- Decree on Environmental Impact Assessment 2010;
- Procedure on Environmental, Social and Natural Impact Assessment 2013;
- Environmental Impact Assessment Guidelines 2012;
- Decree on Compensation and Resettlement of People Affected by Development Projects (2005);
- Regulations for Implementing Decree of the Prime Minister on Compensation and Resettlement of People Affected by Development Projects No. 192/PM 2005;
- Technical Guidelines for Resettlement and Compensation 2010;
- Decree on the Preservation of Cultural, Historical and Natural Heritage 1997;
- Public Involvement Guidelines 2013;
- Agreement on the National Environmental Standards 2010; and
- Regulation on the Management of the National Biodiversity Conservation Areas, Aquatic and Wild Animals 2001.

3.2.4 Electrical Power Technical Standards

The Lao Electric Power Technical Standards (MIH 2004) prescribe the fundamental technical requirements for the development of all electrical power facilities (hydropower stations, sub-stations, transmission lines, distribution lines etc.) in Lao PDR.

3.3 International Conventions, Treaties and Agreements

Lao PDR is a signatory to several international conventions and treaties. Those potentially relevant to the PS Project are listed below:

- UN Framework Convention on Climate Change (1992) and Kyoto Protocol (2003);
- Convention on the Protection of the Ozone Layer (1985) and The Montreal Protocol on Substances that Deplete the Ozone Layer (1987);
- Convention on Biological Diversity (1996) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (2004);
- Convention Concerning the Protection of World Cultural Heritage and Natural Heritage (1987);
- Mekong River Commission Agreement on the Cooperation for the Sustainable Development of the Basin (1995);
- ASEAN Agreement on the Conservation of Nature and Natural Resources (1985);
- International Plant Protection Convention (1955);
- International Convention on the Elimination of All Forms of Racial Discrimination (1974); and
- International Covenant on Economic, Social and Cultural Rights (2000).

3.4 International Environmental and Social Standards

3.4.1 ADB Environmental and Social Safeguards

The NN1 HPP is seeking finance from the Asian Development Bank (ADB). As such the PS Project is required to meet ADB's environmental and social safeguard requirements.

ADB Safeguards Policy Statement (SPS)

The Safeguard Policy Statement (SPS) combines policies on the environment, involuntary resettlement and indigenous peoples. The aim of the SPS is to promote sustainability by protecting the environment and people from any potential adverse impacts of projects, by minimising, mitigating, and/or compensating for these impacts. The SPS requires environmental considerations to be integrated into ADB supported projects, including:

1. Environment – outlines the requirements for undertaking the environmental assessment process. These requirements include assessing impacts, planning and managing impact mitigations, preparing environmental assessment reports, disclosing information and undertaking consultation, establishing a grievance mechanism of natural resources, pollution prevention and abatement, occupational and community health and safety, and conservation of physical and cultural resources.
2. Involuntary resettlement – the ADB seeks to avoid involuntary resettlement, where possible, by exploring project and design alternatives; enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and improve standards of living of the affected poor and other vulnerable groups. The policy discusses objectives, scope of application, and underscores the requirements for undertaking the social impact assessment and resettlement planning process, preparing social impact assessment reports and resettlement planning documents exploring negotiated land acquisition, disclosing information and engaging in consultations, establishing a grievance mechanism, and resettlement monitoring and reporting.
3. Indigenous Peoples – The ADB recognises the rights of Indigenous Peoples to direct the course of their own development. This set of policy requirements will safeguard Indigenous People's rights to maintain, sustain, and preserve their cultural identities, practises, and habitats and to ensure that projects affecting them will take the necessary measure to protect these rights. The SPS outlines the requirements pertaining to (i) undertaking the social impact assessment and

planning process, (ii) preparing social impact assessment reports and planning documents; (iii) disclosing information and undertaking consultation, including ascertaining consent of affected Indigenous Peoples community to selected project activities; (iv) establishing a grievance mechanism; and (v) monitoring and reporting.

3.4.2 Equator Principles

The Equator Principles are a voluntary framework for the assessment and management of environmental and social issues associated with project financing. They provide a means for financial institutions to ensure that the projects they finance are developed in a manner that is socially responsible and consistent with sound environmental management practices. The Principles underwent an update process in 2012 with Equator Principles III in effect as of June 2013.

Financial institutions that have adopted the Equator Principles will first categorise the risk of a project based on existing IFC environmental and social impact criteria. Before a financial agreement is secured, all high (Category A) to medium (Category B) risk projects are required to complete an Environmental Assessment, which identifies and addresses key environmental and social impacts associated with the project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.

The Principles are summarised in Table 3-1.

Table 3-1 Summary of the Equator Principles (www.equator-principles.com)

Equator Principle	Summary
Principle 1: Review and Categorisation	<p>Categorisation of the project by the Equator Principle Financial Institution (EPFI) based on existing IFC environmental and social impact criteria. Project categories include:</p> <ul style="list-style-type: none"> • Category A – Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented; • Category B – Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and • Category C – Projects with minimal or no social or environmental impacts.
Principle 2: Social and Environmental Assessment	<p>For Category A and B projects, the borrower will conduct a Social and Environmental Assessment ('Assessment') appropriate to the scale of the proposed project to determine the social and environmental impacts and risks as well as appropriate management and mitigation measures.</p>
Principle 3: Applicable Social and Environmental Standards	<p>For projects located in non-OECD countries, the Assessment will comply with, or establish justified deviation from, the IFC Performance Standards and EHS guidelines. The Assessment should also comply with relevant host country social and environmental legislation.</p>
Principle 4: Action Plan and Management System	<p>For Category A and B projects in non-OECD countries, the borrower will prepare an Action Plan which details actions needed to implement monitoring and management measures. The Action Plan may include a resettlement action plan, indigenous peoples plan, emergency preparedness and response plan, decommissioning plan, etc.</p> <p>The borrower will also build on, maintain or establish a Social and Environmental Management System to manage the impacts and risks. This system will comply with IFC Performance Standards and EHS guidelines as well as relevant host country social and environmental legislation.</p>
Principle 5: Consultation and	<p>For all Category A, and as appropriate, Category B projects located in non-OECD countries, the government, borrower or third party expert will consult with project</p>

Equator Principle	Summary
Disclosure	affected communities in a manner commensurate with the risks to and impacts on these communities. This may require the preparation of a Public Consultation and Disclosure Plan (PCDP). Community engagement is one that involves 'free', 'prior', and 'informed' consultation. Consultation with Indigenous Peoples must conform to IFC Performance Standard 7 as well as relevant host country social legislation.
Principle 6: Grievance Mechanism	For all Category A, and as appropriate, Category B projects located in non-OECD countries, the borrower will establish a grievance mechanism as part of the management system to ensure consultation, disclosure and community engagement continue throughout the life of the project.
Principle 7: Independent Review	For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower will review the Assessment, Action Plan and consultation process documentation in order to assist EPFI's due diligence, and assess Equator Principles compliance.
Principle 8: Covenants	For Category A and B projects, the borrower will covenant in financing documentation to comply with all relevant host country social and environmental legislation, comply with the Action Plan, provide periodic compliance reports, and carry out mine decommissioning in accordance with an agreed decommissioning plan. EPFIs reserve the right to exercise remedies, as they consider appropriate if the borrower fails to establish or re-establish compliance.
Principle 9: Independent Monitoring and Reporting	To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.
Principle 10: EPFI Reporting	The EPFI's will commit to reporting at least annually about its Equator Principle implementation processes and experience.

3.5 Environmental and Social Management of 22 kV Transmission Line Projects

3.5.1 REP 2 Standards

Current GOL legislation and guidelines regarding environmental and social assessment and management of transmission lines are focused on high voltage (i.e. 230 kV and 115 kV) projects and do not outline specific requirements 22 kV the transmission line projects.

The Rural Electrification Programme 2 (REP 2) implemented by EDL and financed by the World Bank has been operating for more than 10 years. The programme is viewed as a benchmark for best practice environmental and social standards for 22 kV transmission line projects in Lao PDR. Key policies include:

- REP2 Environmental and Social Safeguard Frameworks 2009; and
- REP2 Environmental and Social Operations Manual 2009.

Environmental Considerations

As significant adverse environmental impacts are generally not expected with the development of 22 kV transmission lines and associated infrastructure, a streamlined environmental assessment and management process has been developed by EDL / WB. This includes:

- A standard 'Site Sensitivity Analysis' check list is used to rapidly assess the potential environmental issues associated with the project;

- If deemed necessary, (if 'high' or 'moderate' impacts are identified) - use of a standard Environment Management Plan (EMP) template to develop a project specific EMP for the given project. This includes:
 - a. A description of potential environmental impacts and management measures;
 - b. An implementation schedule coordinated with project design, bidding, construction and operation phases;
 - c. Institutional responsibilities;
 - d. A description of monitoring programs; and
 - e. Cost estimates and sources of funds.

Compensation and Resettlement

Likewise, as significant land acquisition and/or resettlement are not expected to result from 22 kV projects, a streamlined RAP process has been developed by EDL / WB for the development of 22 kV transmission lines and associated infrastructure, including:

- Completion of a standard RAP datasheet including potential impacts and list of affected individuals;
- If deemed necessary (over 200 people affected or significant loss of farmland), the completion of a full RAP; and
- Provision of compensation to affected peoples.

Note, in the event of minor household impacts, it is general practice for EDL to request affected households to waive compensation.

Consultation, Disclosure and Grievance Mechanisms

Appropriate consultation and information disclosure is required as part of the environmental and social assessment of a 22 kV project. This includes sharing initial information on potential impacts and REP2 compensation standards and/or rehabilitation measures.

3.6 E&S Compliance for the PS Project

The upgrade and construction in the PS Project was included in the scope of works for the NN1 HPP EIA, thus GOL approval for the PS Project is considered part of the EIA process and does not require further GOL approval. This IEE serves an addendum to the EIA for provision to Project lenders, providing a more detailed description of PS Project construction and implementation as well as potential impacts and proposed management and mitigation measures.

In absence of GOL legislation and guidelines regarding environmental and social assessment and management for 22 kV the transmission line projects, and considering EDL REP2 environmental and social management planning is accepted as Best Practice in Lao PDR, the environmental management planning framework for this IEE incorporated REP2 methodology (e.g. rapid assessment, impact assessment, environmental management and monitoring requirements).

The PS Project environmental and social compliance with REP2 guidelines will be ensured through incorporation of management, mitigation, and monitoring measures of the REP2 *Environmental and Social Safeguard Frameworks* 2009 (refer to Appendix C).

In addition, NN1PC will incorporate management, mitigation, monitoring and reporting procedures from the NN1 HPP Environmental and Social Management and Mitigation Plan – Construction Phase (ESMMP-CP). The ESMMP-CP specifies the Contractor's responsibilities for developing a Site-Specific Environmental and Social Management and Monitoring Plan (SS-ESMMP) that is inclusive of ESMMP-CP requirements and that considers the site-specific conditions throughout the PS Project alignment. The

contractor is not to proceed until NN1PC Environmental Management Office (EMO) and/or Social Management Office (SMO) have accepted the SS-ESMMP.

The Environmental and Social Management Plan for the PS Project is further detailed in Section 8 of this IEE (PS Project management and monitoring requirements, responsibility for implementation and monitoring, frequency of monitoring and reporting, and reference to applicable sub-plans for key compliance parameters).

4 ENVIRONMENT AND SOCIAL SETTING

Information for this section has been sourced from a variety of publications, government documents and scientific literature. Much of the information has been sourced from the *NN1 HPP EIA* and specifically *NN1 HPP EIA, (Environmental Assessment for NN1 HPP Access Road from Ban Nonsomboun to the Main Dam)*. When no specific reference has been included, please refer to the *NN1 HPP EIA Report*.

4.1 Project Area and Study Limits

4.1.1 Project Area

Project Area

The Project Area is defined as the greater Nam Ngiep 1 HPP road construction area, including the 25 m access road right-of-way (ROW), defined as 'non-exclusive project lands' in the NN1 HPP CA, Annex D. In addition, downstream watercourses (e.g. Nam Ngiep, Nam Xao and perennial and seasonal streams) are included as they are potential receiving bodies for discharge from PS Project activity. The Project Area includes (as defined in *NN1 HPP EIA*):

- Nam Ngiep River and NN1 HPP Zone 4 Downstream Area
- NN1 HPP Zone 2 – Construction Area;
- NN1 HPP Ban Houay Soup Resettlement Area;
- NN1 HPP main access road (A1);
- Houay Nguua Provincial Protection Area; and
- Four (4) villages – Ban Nonsomboun, Ban Thaheua, Ban Hat Gniun and Ban Hatsaykham.

Project Footprint

The proposed Project Footprint is defined as the eight (8) m ROW required for the 22 kV transmission line alignment and areas required for the metering and transfer sub-stations. This includes:

- Section 2: Eight (8) m of the existing Nonsomboun to Hatsaykham EDL ROW (which ranges between eight (8) and 30 m);
Section 2 intersects the land of four (4) villages – Ban Nonsomboun, Ban Thaheua, Ban Hat Gniun and Ban Hatsaykham;
- Section 3 & 4: The eight (8) m ROW for the PS Project within the 25 m NN1 HPP Access Road ROW, defined in CA Annex D as 'non-exclusive project lands'; and
- Section 5: The eight (8) m ROW between the NN1 HPP Regulation Dam (end of Section 3) and the terminal end of the line at the proposed Ban Houay Soup resettlement area.

Study Limits

The PS Project baseline and impact assessments consider the current environmental and social setting in the NN1 HPP Project Area and the potential environmental and social impacts from implementation (and maintenance) of the PS Project, which is physically delineated by the eight (8) m ROW, the four (4) affected villages, and the downstream environment.

NN1PC and ADB requested provision of information regarding the previous impacts of the EDL REP2 Project implementation, particularly for the Houay Nguua Provincial Protection Area (PPA). While this information is provided to the extent possible (given data limitations) throughout the report, these impacts

are separate from the PS Project as they occurred prior to the current project and are outside of the scope of PS Project impacts.

The environmental and social setting (i.e. current baseline) and the impact assessment (Section 5) consider the current environmental and social baseline, post-implementation of the EDL REP2 Project.

4.2 Physical Resources

4.2.1 Atmosphere and Climate

The PS Project will traverse through the Provinces of Bolikhamxay and Xaysomboun. The region is typified by a south-western monsoon climate of pronounced wet and dry seasons. The wet season occurs between May and October with rainfall ranging from 3.7 to 67.5 mm per month. Average daily maximum temperatures occur most often in April (37°C), with the heat usually abating by mid-May. The northeast monsoon brings overall cooler and drier conditions from early November to March, with the driest and coldest months generally in December and January. Maximum temperatures during the dry season range from 25 to 36°C from November to April. Overnight temperatures can drop to 11°C. Historic meteorological data for the area near to the proposed PS Project (Nam Ngiep Basin) from 1971 to 2000 indicates an average annual rainfall of 1,870 mm (NNP1PC Technical Report 2007).

4.2.2 Geology / Seismology

The PS Project occurs predominantly within the Khorat Plateau and the Indochina (Khontum) Block. The geology of the region is characterised by Cenozoic (mostly Quaternary) alluvial plain deposits, alluvial fans, terrace alluvial and floodplains. Underlying geology and other outcropping rock formations are from the Palaeozoic and Mesozoic. Fractured and weathered late Palaeozoic granites have intruded into other Palaeozoic layers, such as shales, mudstones, sandstones and schists. These formations have folded and formed separate blocks during faulting events in the late Palaeozoic. Younger and overlying Mesozoic sandstones, conglomerates, mudstones and shales have been partly fractured and exposed rock have extensive weathering.

The region is relatively stable and seismic events have been infrequent. However, fracturing of rock formations and geologic structures suggest there was seismic activity in the region in the past.

4.2.3 Topography and Soils

The current EDL transmission line (Section 2) area is flat with a few undulating hills until approximately 5 km south-east of Ban Hatsaykham. Here the transmission line passes through valleys between steeper hills, ranging from 200 to 235 m above sea level (ASL). PS Project Sections 3 and 4 will traverse through steeper hills and valleys, terminating at the base of steeper terrain to the north. This terrain ranges from 200 m ASL along the Nam Ngiep to 310 m ASL in the hills to the north of the Main Dam.

Surface soils along the PS Project corridor are chiefly from the Prateah Lang soil group and are typified by a sandy surface layer with loam or clay sub-surface layer. Soils types include Alisols, Acrisols, Luvisols, Lixisols and Cambisols.

4.2.4 Surface Water

The Nam Ngiep River originates from a mountainous region over 50 km north (upstream) of the proposed terminal end of the PS Project (Main Dam site). The river downstream of the Main Dam site gently meanders through shallow valleys and opens to a large floodplain at its confluence with the Mekong River. The PS Project will pass over tributaries of the Nam Ngiep and occurs primarily within the larger Nam Ngiep catchment.

Assessments undertaken for the *NN1 HPP EIA* indicated that surface water in the region is generally of good quality. However nutrient and pathogen concentrations are moderately high, particularly in proximity to human settlements and human-associated activities (e.g. elevated coliforms). Samples collected near Ban Hat Gniun indicated that conductivity, salinity and hardness were generally within acceptable limits. Dissolved oxygen concentrations were high, ranging from 7 to 10 mg/L. Turbidity is elevated during the wet season, as high rainfall events (and likely upstream construction) increase erosion and sediment loading in the river. Average suspended sediment concentration was 17 NTU in the dry season and 83 NTU in the wet season. Similarly, nitrate concentrations were higher during the wet season than the dry season. The increase in nitrates during the wet season is likely caused by surface particulates (e.g. faecal matter) that have built up during the dry season and are flushed into the system after high rainfall events.

4.3 Ecological Resources

4.3.1 Regional Biodiversity Setting

Lao PDR is species rich and many forests still have good coverage compared to other countries of Southeast Asia. Fauna species richness includes over 200 reported species of reptiles and amphibians, no less than 700 species of birds, over 90 known species of bats and over 100 species of large mammals (WREA, 2010).

The PS Project is within the very broad physiographic region of the Indo-Malay Tropical and Subtropical Moist Broadleaf Forests of the central highlands of Lao PDR (Duckworth et al. 1999). The PS Project crosses three eco-regions (Wikramanayake et al., 2002). The PS Project EDL transmission line (Section 2) is within the Northern Khorat Plateau Moist Deciduous Forests, it then travels through the western edge of the Northern Annamites Rainforests. The PS Project transmission line extension (Sections 3-5) is within the Luang Prabang Montane Rainforests. All three eco-regions are known for their diversity of animal and plant life. Principal threats to biodiversity include illegal trade of wildlife and habitat loss due to conversion of land for shifting cultivation and logging. However, the eco-regions still support a wide variety of flora and fauna, including threatened mammal species such as the red-shanked douc langur (*Pygathrix nemaeus*), tiger (*Panthera tigris*) and Asian elephant (*Elephas maximus*). These eco-regions remain critical to large mammal conservation in Indochina (Wikramanayake et al., 2002).

4.3.2 Protected Areas

International and National Protected Areas

No internationally protected areas, such as Ramsar Wetlands or World Heritage Areas, or nationally protected areas are located within 15 km of the PS Project (i.e. Phou Khao Khouay National Biodiversity Conservation Area (NBCA)¹ is the closest).

Provincial and Watershed Reserves

Section 2 of the PS Project (the current EDL transmission line) passes through the Houay Ngua Provincial Protection Area (PPA) and is aligned adjacent to an existing road (NN1 HPP Road A). Surveys undertaken for the *NN1 HPP EIA* identified mostly Lower and Upper Mixed Deciduous Forest, with sporadic patches of Mixed Evergreen Forest and regenerating Mixed Deciduous Forest within the Houay Ngua PPA. Previous surveys recorded 114 trees of the Critically Endangered *Dipterocarpus turbinatus* (IUCN 2014, *NN1 HPP*

¹ Also variously referred to as National Protection Areas (NPAs) in some recent GOL and NGO reports. With the recent establishment of National Protection Forests (national level watershed reserves) as separate areas, it seems appropriate to use the term NBCA to avoid ambiguity.

EIA Report), 29 of were near the proposed PS Project. Twenty-one of the 29 were cleared during implementation of the EDL REP2 Project.

The EDL REP2 Project cleared approximately 15.5 ha of predominantly Lower Mixed Deciduous Forest in providing a 25 metre ROW for the 7.1 km of EDL transmission line crossing through the PPA. The EDL transmission line is located next to the access road to Ban Hatsaykham; therefore approximately 2.2 ha of the 17.7 ha in the corridor were already devoid of vegetation.

4.3.3 Terrestrial Biodiversity

Natural, critical and modified habitat types were assessed along the PS Project ROW using previous literature (e.g. surveys for the NN1 HPP EIA), analysis of satellite imagery, and terrestrial biodiversity and resource use field surveys conducted in June 2014. Natural habitat has been defined as ecological communities where native flora and fauna species dominate the assemblage and human disturbance has not altered the primary ecological functions of the habitat (ADB, 2012). Critical habitat provides habitat essential for the survival of (IUCN listed) Critically Endangered, Endangered, endemic, restricted-range, migratory or congregatory species and overall is of high biodiversity value. Alternatively, modified habitat is where non-native species dominate and/or the area has been cleared beyond recognition of the original habitat.

Natural (vegetation) habitat types that has been identified within the vicinity of the PS Project are Mixed Deciduous Forest, Evergreen Forest and Bamboo (dominated) Forest.

Vegetation and Flora

Examination of satellite imagery and terrestrial biodiversity resource field surveys conducted by Earth Systems and Dr Phengsintham in June 2014 revealed the extent of modified and natural habitat within and adjacent to the proposed transmission line ROW.

Much of the vegetation along the PS Project alignment has been disturbed. The only remaining pristine forest occurs on the right (south) bank of the Nam Ngiep (riparian corridor) at the end of the Section 4 alignment. Due to the varied levels of human disturbance along the proposed PS Project alignment, the vegetation was comprised of a mix of modified forest types (Young and Old Regeneration Forest) and natural forest types (Mixed Deciduous Forest and Disturbed Mixed Deciduous Forest). Although the two types of Regeneration Forest are highly modified, they are included in this section because they still retain many native species and provide habitat for wildlife. Disturbed Mixed Deciduous Forest has been incorporated into the Mixed Deciduous Forest category for the purpose of vegetation coverage calculations (ha; e.g. Table 4-1), but remains separate for discussion of flora.

Mixed Deciduous Forest has been defined by the dominance of deciduous tree species, occupying more than 50% of the canopy cover. Along the PS Project ROW, canopy cover ranged from 30 to 65%. The IUCN listed *Anisoptera costata* (Endangered) was a common upper-canopy species, while additional IUCN listed species (*Dipterocarpus alatus*, *Vatica cinerea*) were less common (refer to Appendix A). The mid-storey tended to be more densely vegetated than the canopy, with coverage of 40 to 70%. As the upper structural layers were relatively dense, the understorey was generally sparser due to low light penetration (15-60%). Non-native or invasive species were found to be common in Mixed Deciduous Forest in the PS Project Area (e.g. *Chromolaena odorata*).

Disturbed Mixed Deciduous Forest structure has been highly disturbed but has not been modified to the extent that it is unrecognisable (as Mixed Deciduous Forest). The canopy has been considerably thinned and ranged between 10 to 20 % coverage. The IUCN listed (Endangered) *Anisoptera costata* was still a common tree identified within this vegetation type, but the other Endangered species were not found. Presumably some of the trees (including non-threatened) have been selectively felled (refer to Appendix A, Table A-2). The mid-storey was similar to its undisturbed archetype, but the understorey has significantly denser coverage (50-75%).

Regeneration (Young Fallow) Forest is herein defined as land that has been left to fallow and has begun to regenerate. This forest is less than eight (8) years old and typically lacks a mid or upper-storey canopy (i.e. tree/shrub layer >5 m). The lower structural layers are typically dense as adequate light is available for ground cover establishment. The Regeneration Forest has a mid-storey (2 – 4 m) that ranged from 20 to 80% cover and was dominated by young trees and large shrub species (refer to Appendix A, Table A-3). The ground layer was similarly dense, with 30 to 80% cover. Many non-native and invasive species were present within the ground layer, including the highly invasive *Chromolaena odorata*. No internationally significant (IUCN Red List Threatened 2014) species were identified within this vegetation type.

Unstocked / Regeneration (Old Fallow) Forest was characterised by older regeneration fallow forest (>8 years old) and although may have had a dense upper-storey canopy (80%), the upper storey canopy was also absent in some areas. The mid-storey canopy was similarly sparse (20%) to dense (80%) and both the mid-storey and upper-storey canopies were dominated by tree species, including the IUCN listed (Endangered) *Anisoptera costata* (refer to Appendix A, Table A-4). The ground layer is dominated by several introduced and invasive species and ranges from sparsely covered (~30%) to relatively dense (~70%), depending on the density of above layers.

Vegetation and Flora in the existing EDL Transmission Line Corridor (PS Project, Section 2)

All four vegetation types were observed along both sides of the existing EDL transmission line ROW, but Young and Old (Unstocked) Regeneration Forest were much more common outside of the Houay Ngua PPA (Table 4-1). Regeneration Forest was the only forest type observed from Ban Nonsomboun to the southern edge of the Houay Ngua PPA. Since this transmission line is already in operation, the vegetation has been cleared from the ROW, although there was some very young regrowth of Regeneration Forest (e.g. shoots, saplings). Over a third (~40%) of the vegetation along the ROW was Young and Old Regeneration Forest (Table 4-1).

Since this section of the PS Project follows an existing road, approximately 10% was mapped as road within the 8 m and 25 m ROW.

Mixed Deciduous Forest and Disturbed Mixed Deciduous Forest, of moderate to good habitat value, occurred within and north of the PPA, and few threatened species were identified in this region (refer to Appendix A, Table A-5). Several invasive species were found in disturbed areas alongside the ROW, including the highly invasive *Chromolaena odorata*. This species was common and widespread.



Plate 4-1 Section 2 (EDL) TL ROW in Houay Ngua PPA



Plate 4-2 Section 2 (EDL) TL ROW in Houay Ngua PPA

Table 4-1 Vegetation (and other) in Section 2 Transmission Line ROW

Vegetation	Area (ha) within 8m ROW	Percentage (%) area within 8 m ROW	Area (ha) within 25 m ROW	Percentage (%) area within 25 m ROW
Mixed Deciduous Forest	3.56	17.84	11.08	17.75
Regeneration Forest - Young (1-8 years)	3.95	19.77	12.23	19.59
Unstocked / Regeneration Forest - Old (>8year)	3.76	18.85	11.88	19.03
Agriculture - Other	1.18	5.91	3.84	6.15
Agriculture - Rice Paddy	0.35	1.74	1.09	1.75
Agriculture (Cleared Land)	2.89	14.45	8.62	13.81
Plantation	0.64	3.21	2.14	3.43
Road	2.07	10.36	6.66	10.67
Settlements / Residential Land	1.56	7.79	4.83	7.74
Water	0.01	0.07	0.04	0.07
Total	19.97	100	62.40	100

Source: ES Surveying 2014



Plate 4-3 PS Project (Section 3) Road P1



Plate 4-4 PS Project (Section 4) TL Alignment

Table 4-2 Invasive and IUCN threatened species recorded within the vegetation types of the EDL transmission line

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN Status	Introduced / invasive
<i>Achyranthes aspera</i>	Yah khpouy ngou	Herb	RF	N/A	Invasive in many parts
<i>Amischotholype griffithii</i>	Yar karp yai	Herb	RF	N/A	Native to Malaya
<i>Anisoptera costata</i>	Mai bark	Tree	D MDF/MDF/OF	EN	
<i>Chromolaena odorata</i>	Yar khiw	Herb	RF/OF/D MDF/MDF	N/A	Native to North America, highly invasive
<i>Coffea arabica</i>	Ton coffee	Shrub	D MDF	N/A	Native to Ethiopia
<i>Dipterocarpus alatus</i>	Mai yang	Tree	MDF	EN	
<i>Engelhardtia spicata</i>	Mai phao	Tree	RF	LR/LC	
<i>Merremia umbellata</i>	E po mae bai houp hua jai	Climber	OF/RF	N/A	Native to North America
<i>Mimosa pudica</i>	Yar youp	Climber	RF/D MDF/MDF/OF	LC	Native to Central/South America
<i>Mucuna pruriens</i>	Ya paed	Climber	RF/OF	N/A	May be beyond original range
<i>Ormosia pinnata</i>	Mai khee mou	Tree	OF/RF/D MDF/MDF	N/A	May be beyond original range
<i>Vatica cinerea</i>	Mai sy	Tree	MDF	EN	May be beyond original range
<i>Vitex trifolia</i>	Mai sa khang	Tree	D MDF	N/A	May be beyond original range

IUCN Status Red List Categories: EN – Endangered, , LC – Least Concern, LR – Lower Risk, N/A – Not Assessed; MDF – Mixed Deciduous Forest, D MDF – Disturbed Mixed Deciduous Forest, RF – Regeneration Forest, OF – Old Unstocked / Regeneration Forest

Vegetation of Ban Hatsaykham to Main Dam Site (Section 3 & 4)

While all four of vegetation types were recorded along Section 3 and 4, Disturbed Mixed Deciduous Forest (D MDF) and Mixed Deciduous Forest (MDF) were more widespread and contributed over half (57.1%) the 6.5 ha of vegetation in the ROW (combined area in Table 4-3). Regeneration Forest was the second most common forest type, but less than a third (28.8%), while Unstocked / Regeneration Forest contributed little to overall land cover. Other modified habitat within this section included cleared land and grassland for agriculture and livestock pasture. In fact, cleared land for agriculture was more common than Unstocked / Regeneration Forest.

Table 4-3 Vegetation (and other) in Section 3 Transmission Line ROW

Vegetation	Area (ha) within 8m ROW	Percentage (%) ha within 8 m ROW
Mixed Deciduous Forest	3.68	57.1
Regeneration Forest - Young (1-8 years)	1.86	28.8
Unstocked / Regeneration Forest - Old (> 8years)	0.15	2.3
Agriculture (Cleared Land)	0.51	7.9

Vegetation	Area (ha) within 8m ROW	Percentage (%) ha within 8 m ROW
Grassland	0.15	2.3
Water	0.04	0.6
Road	0.07	1.1
Total	6.45	100

Source: ES Surveying 2014



Vegetation of the Re-Regulation Dam to Ban Houay Soup (Section 5)

No natural vegetation types were mapped within Section 5. Regeneration Forest covered more than two-thirds (67%) of the total 2.2 ha within Section 5's ROW (Table 4-4). Grassland (i.e. fields used for livestock) was the second most abundant land type, but contributed less than a quarter of a hectare. Presumably the dominance of Regeneration Forest is due to the presence of nearby settlements and the subsequent use of the area in the recent past for agriculture.

Table 4-4 Vegetation (and other) in Section 5 Transmission Line ROW

Vegetation	Area (ha) within 8m ROW	Percentage (%) ha within 8 m ROW
Grassland	0.23	10.4
Unstocked / Regeneration Forest - Old (> 8 years)	0.18	8.1
Regeneration Forest - Young (1-8 years)	1.48	67.0
Agriculture (Cleared Land)	0.15	6.8
Plantation	0.08	3.6
Water	0.07	3.2
Road	0.01	0.5
Total	2.21	100

Source: ES Surveying 2014

Flora of PS Project Transmission Line Extension (Sections 3 – 5)

Invasive species were much more common than IUCN-threatened species within the proposed transmission line extension ROW (refer to Table 4-5 and Appendix A, Table A-6). Surprisingly the

Endangered *Anisoptera costata* was only found within Old Unstocked / Regeneration Forest. During surveys for the NN1 HPP EIA four (4) species of international conservation significance were recorded within the Re-regulation Dam area and near (but outside of) the PS Project transmission line extension ROW (Section 5, refer to NN1 HPP EIA). These included *Azelia xylocarpa*, *Dalbergia oliveri*, *Dipterocarpus turbinatus* and *Hopea odorata*.

Table 4-5 Invasive and IUCN threatened recorded within the vegetation types of the PS Project TL extension

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN Status	Introduced / invasive
<i>Amischotolype griffithii</i>	Yar karp yai	Herb	MDF/RF	N/A	Native to Malaya
<i>Anisoptera costata</i>	Mai bark noi	Tree	OF	EN	
<i>Aporosa cardiosperma</i>	Mai muad khon	Shrub	MDF	N/A	Endemic of Sri Lanka
<i>Aporosa lindleyana</i>	Mai muad kieng	Shrub	MDF	N/A	Native to India and Sri Lanka
<i>Chromolaena odorata</i>	Yar khiw	Herb	MDF/RF	N/A	Native to North America, highly invasive
<i>Cyclea peltata</i>	Sar mor noi	Climber	RF/D MDF	N/A	Native to India
<i>Ormosia pinnata</i>	Mai kee mou	Tree	OF/RF/D MDF	N/A	May be beyond original range
<i>Scleria terrestris</i>	Yar khom pao	Herb	MDF/RF	LC	
<i>Tetrameles nudiflora</i>	Mai sa phoung	Tree	RF	LR/LC	
<i>Vatica cinerea</i>	Mai sy	Tree	MDF	EN	May be beyond original range

IUCN Status Red List Categories: EN – Endangered, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed; MDF – Mixed Deciduous Forest, DMDF – Disturbed Mixed Deciduous Forest, RF – Regeneration Forest, OF – Old Unstocked / Regeneration Forest

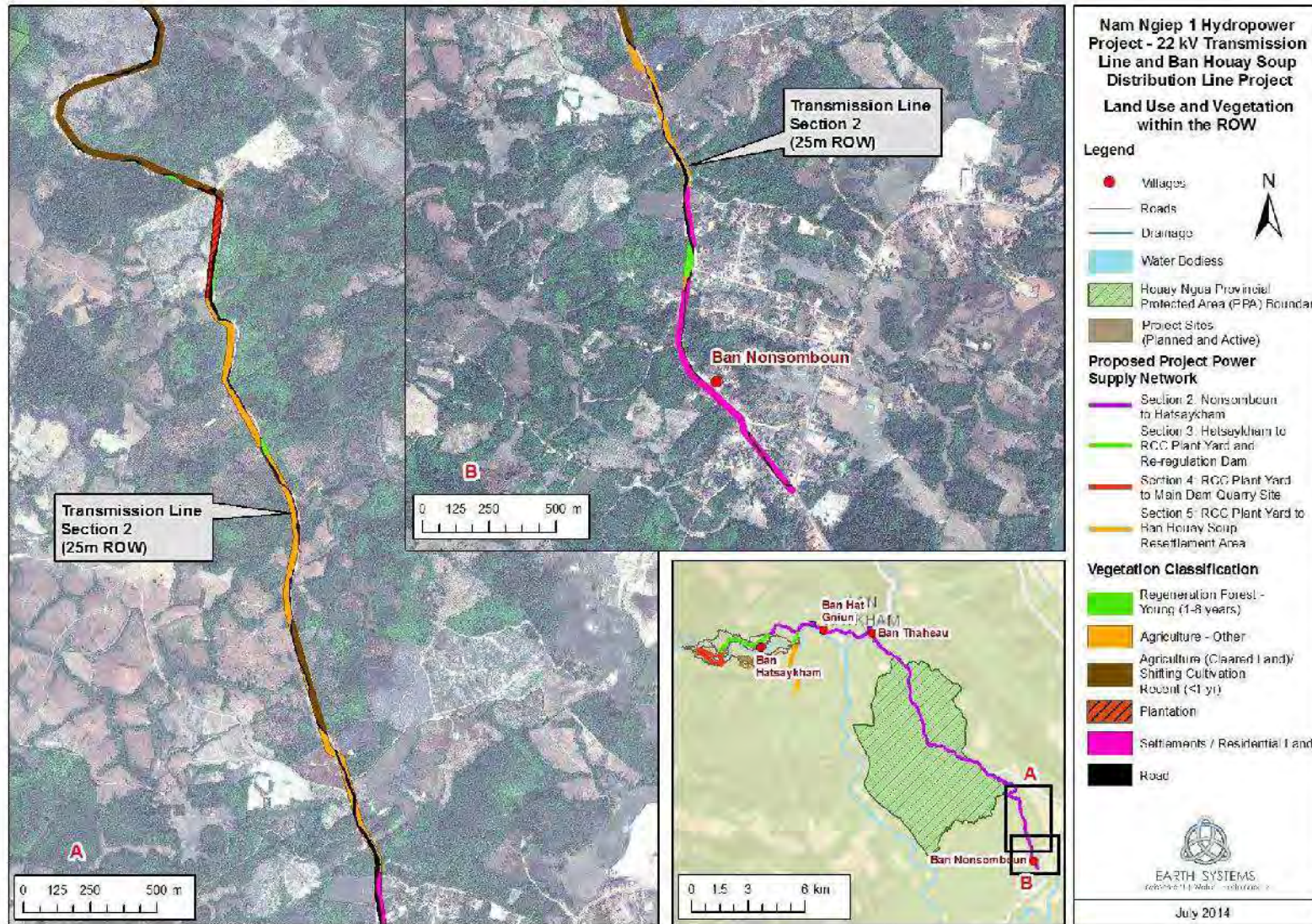


Figure 4-1 Vegetative Communities and Land Use of the Transmission Line ROW (Section 2)

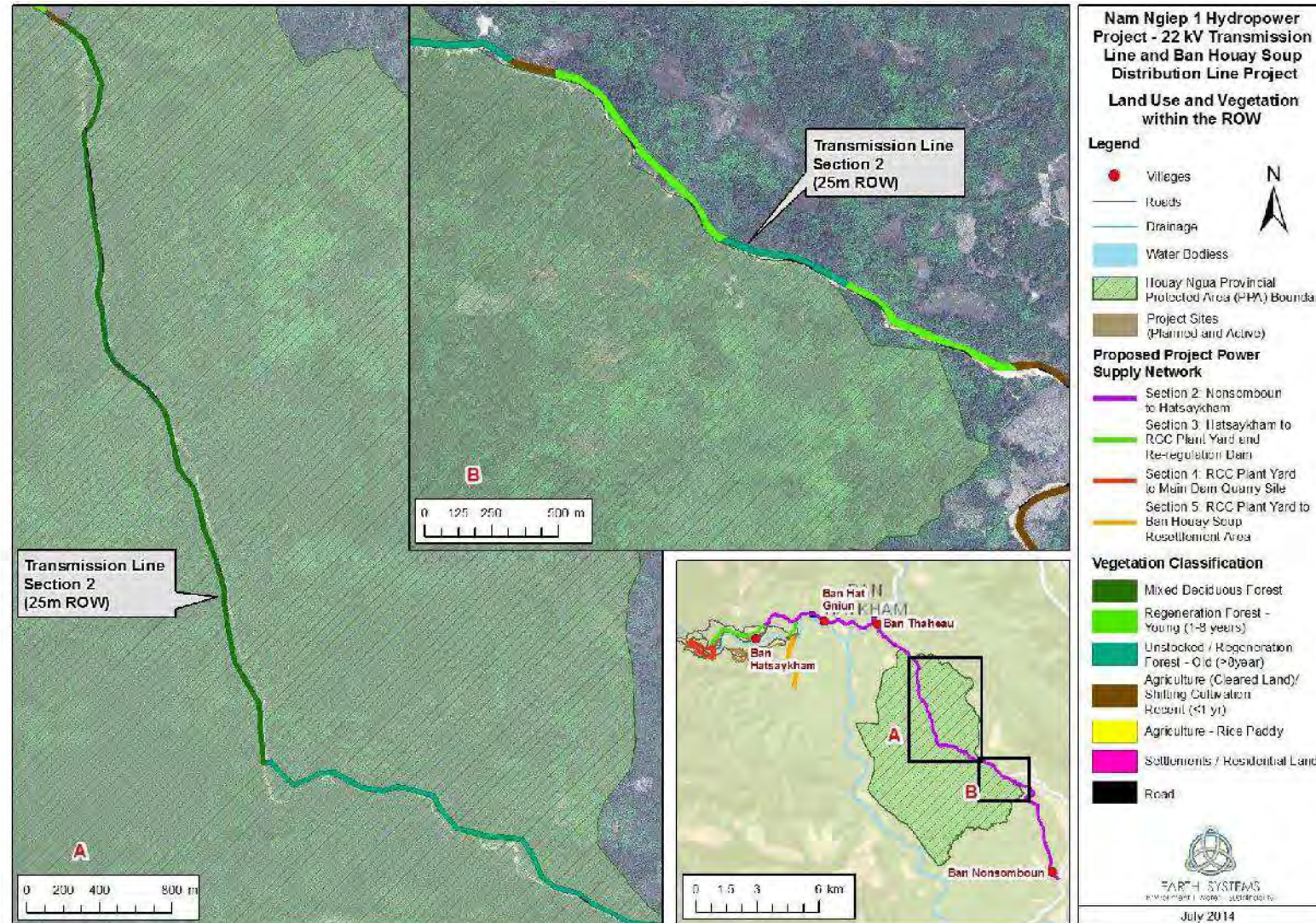


Figure 4-2 Vegetative Communities and Land Use of the Transmission Line ROW (Section 2, Cont.)

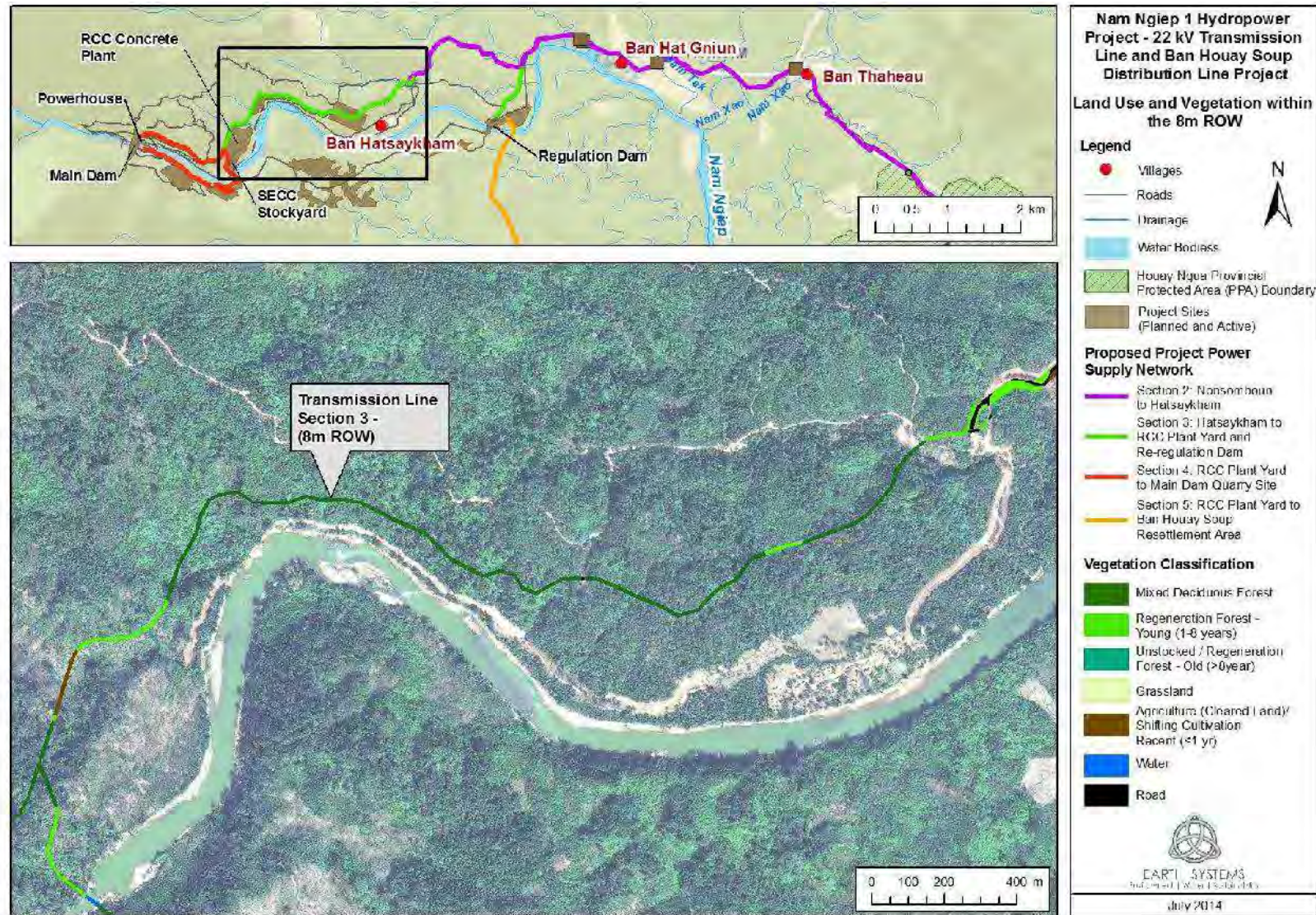


Figure 4-4 Vegetative Communities and Land Use of the Transmission Line ROW (Section 3)

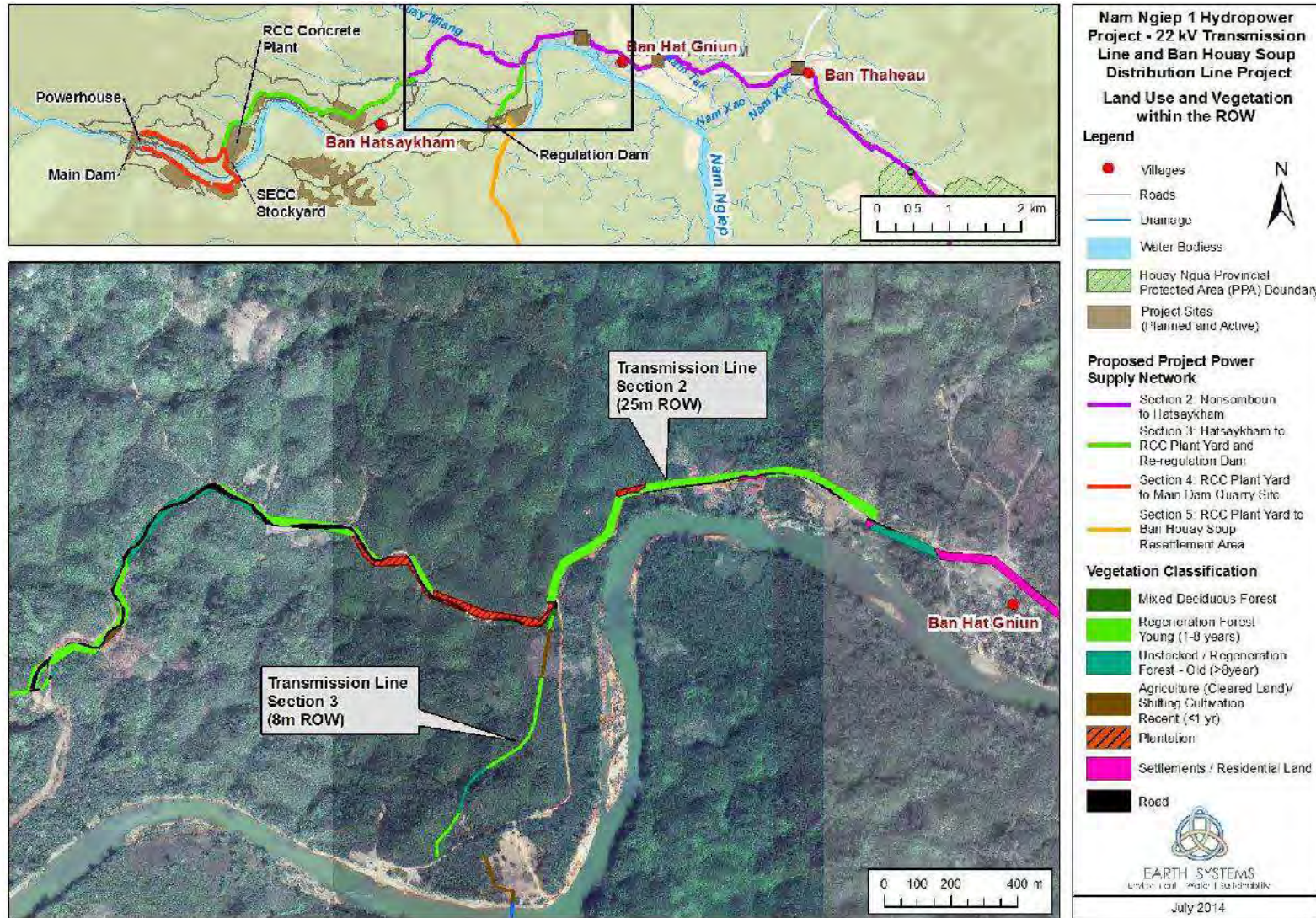


Figure 4-5 Vegetative Communities and Land Use of the Transmission Line ROW (Section 3, Cont.)

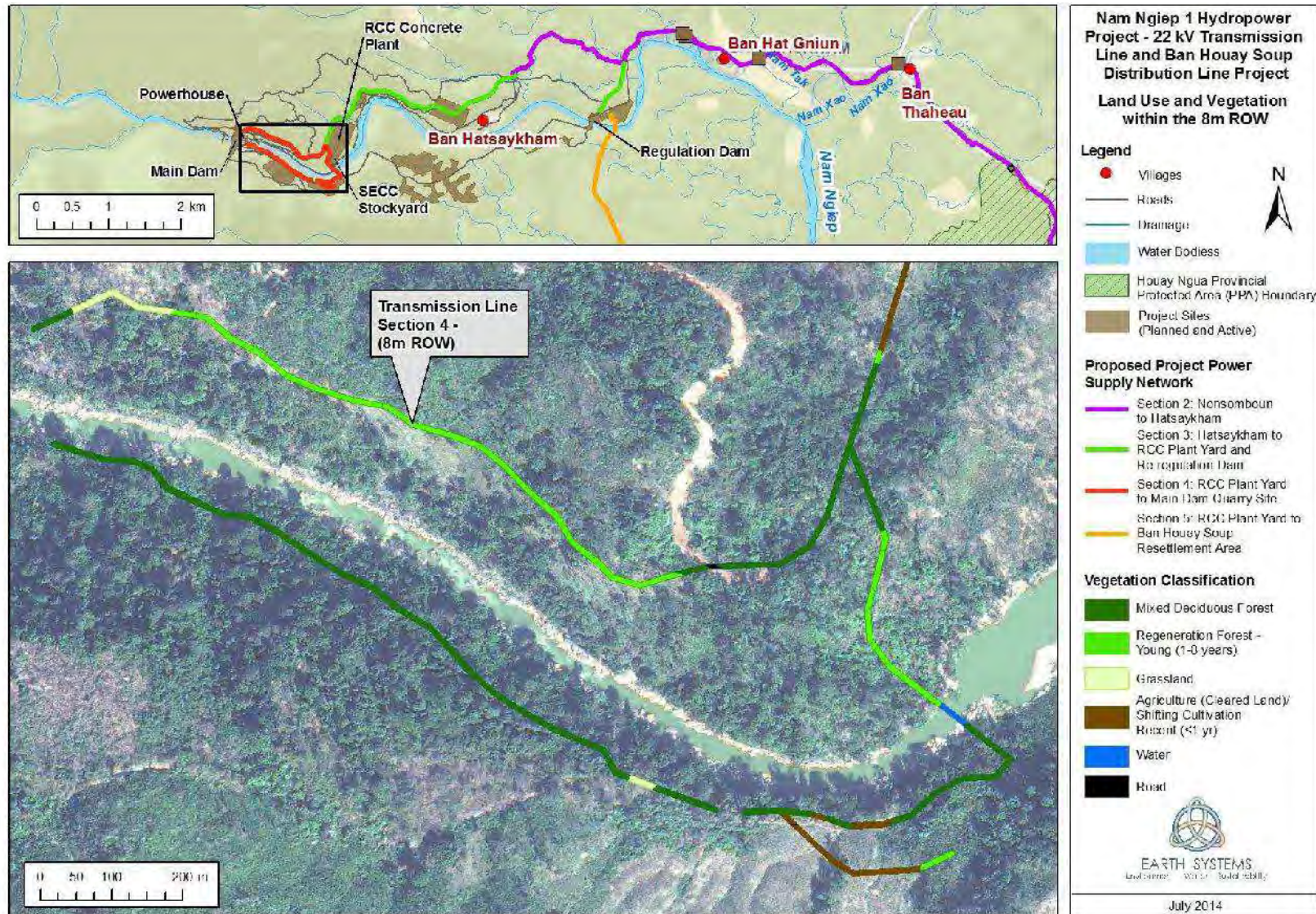


Figure 4-6 Vegetative Communities and Land Use of the Transmission Line ROW (Section 4)

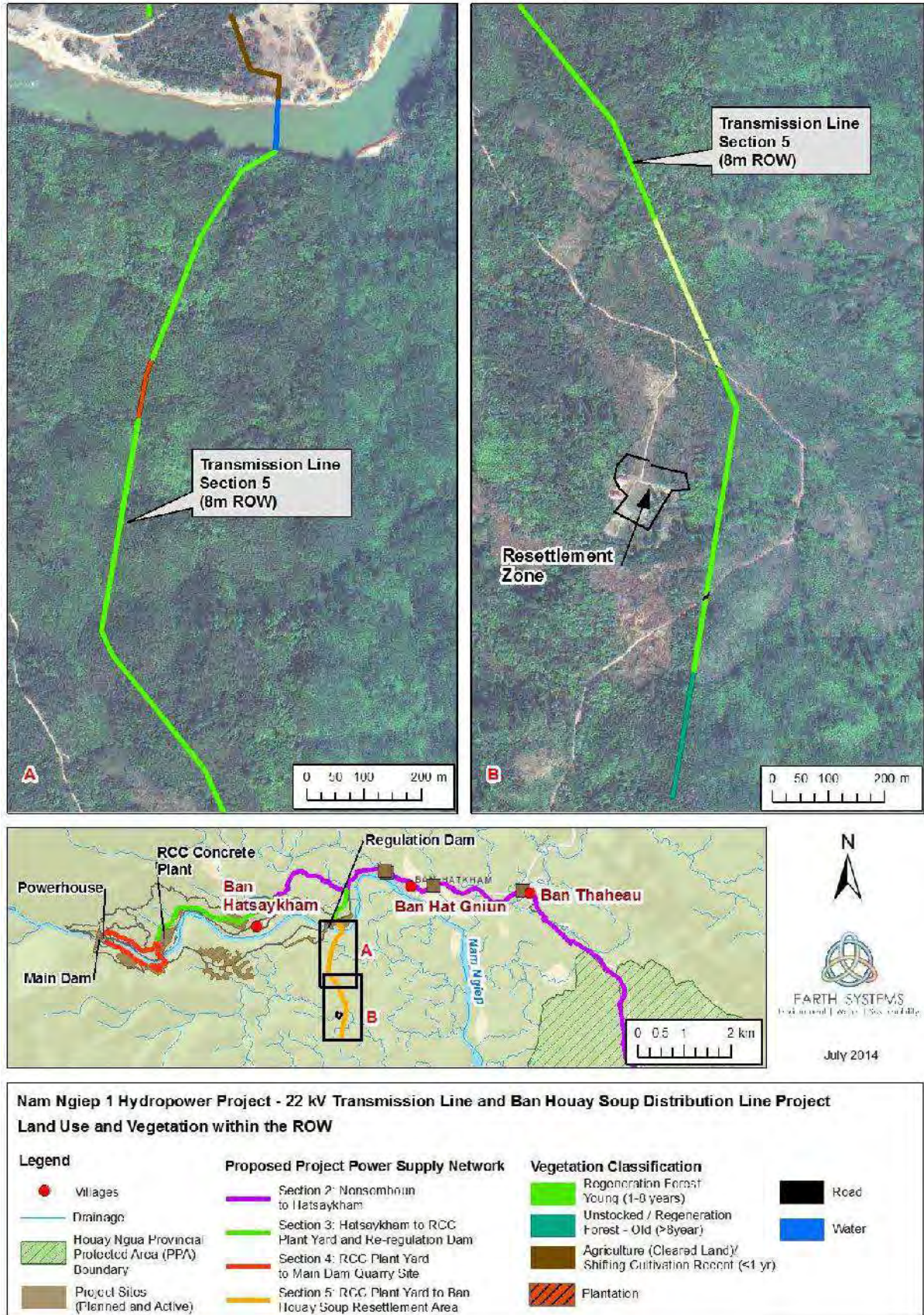


Figure 4-7 Vegetative Communities and Land Use of the Transmission Line ROW (Section 5)

Fauna

Fauna of the current EDL Transmission Line Area (PS Project, Section 2)

Previous surveys conducted within the Houay Ngua PPA identified 38 terrestrial fauna species from 19 Families and 31 Genera. Several internationally (IUCN 2014) and nationally (Lao PDR MAF Conservation Status) threatened species are known to inhabit the Houay Ngua PPA, including some that were identified within the existing EDL Transmission Line ROW (Table 4-6).

Table 4-6 Rare and/or threatened species of conservation significance identified within the Houay Ngua PPA during 2013 surveys for the NN1 HPP EIA (* species also identified within the EDL Transmission Line outside of protected area)

Common Name (Scientific Name)	IUCN (MAF) Status	Common Name (Scientific Name)	IUCN (MAF) Status
Mammals			
Northern white-cheeked gibbon (<i>Nomascus leucogenys</i>)	CR	Northern pig-tailed macaque (<i>Macaca leonina</i>)	VU
Asian wild dog (<i>Cuon alpinus</i>)	EN	Clouded leopard (<i>Neofelis nebulosa</i>)	VU
Asian elephant (<i>Elephas maximus</i>)	EN	Sambar deer (<i>Rusa unicolor</i>)	VU
Sunda pangolin (<i>Manis javanica</i>)	EN	Himalayan black bear (<i>Ursus thibetanus</i>)	VU
Fishing cat (<i>Prionailurus viverrinus</i>)	EN	Large spotted civet (<i>Viverra megaspila</i>)	VU
Phayre's leaf monkey (<i>Trachypithecus phayrei</i>)	EN	Bengal slow loris (<i>Nycticebus bengalensis</i>)	VU (Restricted)
Asian small-clawed otter (<i>Aonyx cinerea</i>)	VU	Leopard* (<i>Panthera pardus</i>)	NT (Restricted)
Gaur (<i>Bos gaurus</i>)	VU	Asiatic golden cat* (<i>Pardofelis temminckii</i>)	NT (Restricted)
Malayan sun bear* (<i>Helarctos malayanus</i>)	VU		
Birds			
White-winged duck (<i>Cairina scutulata</i>)	EN	Siamese fireback* (<i>Lophura diardi</i>)	LC (Restricted)
Green peafowl (<i>Pavo muticus</i>)	EN	Silver pheasant* (<i>Lophura nycthemera</i>)	LC (Restricted)
Imperial eagle (<i>Aquila heliaca</i>)	VU	Grey peacock-pheasant* (<i>Polyplectron bicalcaratum</i>)	LC (Restricted)
Great hornbill* (<i>Buceros bicornis</i>)	NT (Restricted)	Red-breasted parakeet* (<i>Psittacula alexandri</i>)	NT (Restricted)
Greater coucal* (<i>Centropus sinensis</i>)	LC (Restricted)		
Reptiles			
Big-headed turtle* (<i>Platysternon megacephalum</i>)	EN	Impressed tortoise (<i>Manouria impressa</i>)	VU
Southeast Asian softshell turtle (<i>Amyda cartilaginea</i>)	VU	Indo-Chinese spitting cobra (<i>Naja siamensis</i>)	VU
Snail-eating turtle (<i>Malayemys subtrijuga</i>)	VU	Reticulated python* (<i>Broghammerus reticulatus</i>)	N/A (Restricted)

Source: NN1 HPP EIA, Appendix A

MAF: Ministry of Agriculture and Forestry (Lao PDR Government); IUCN Status: CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; LC – Least Concern; N/A – Not Assessed

Fauna of the PS Project Transmission Line Extension Area (Sections 3 – 5)

One IUCN Near Threatened species, greater coucal (*Centropus sinensis*), was recorded at the Re-regulation Dam site, near the terminal end of PS Project, Section 3 (refer to *NN1 HPP EIA*). This species is also considered Restricted by the MAF. All other species recorded in this area are common and widespread. High quality fauna habitat exists just to the north of the PS Project transmission line extension and therefore it is likely that many of the species observed within the Houay Ngua PPA and during surveys for the *NN1 HPP EIA* inhabit the more pristine habitat toward the terminal ends of the PS Project transmission line extension (Section 4).

4.3.4 Fisheries and Aquatic Biology

Habitat

The Nam Ngiep River is one of the Mekong’s main tributaries and flows in a southerly direction for approximately 160 km, joining the Mekong River near Paksan. The Nam Ngiep and other nearby rivers and tributaries (Nam Xao and Nam Xan) provide ample habitat for permanent and migratory species adapted to the seasonal flows of the river. During the wet season the rivers are fast flowing and moderately deep (4-5 m), whereas during the dry, they are dominated by low water levels (2-3 m), riffle zones and dry river banks exposing some of the sand and gravel river bed. Local villagers use the Nam Ngiep and its tributaries regularly for fishing, livestock watering, swimming, washing and other activities.

Fish and Other Aquatic Species

Several fish surveys have been undertaken within the Nam Ngiep and its tributaries during the last 20 years, upstream and downstream of the greater Nam Ngiep 1 HPP area (refer to *NN1 HPP EIA*). There are over 100 species of fish within the waterways near the proposed PS Project Area. Migratory species such as Asian red-tailed catfish (*Hemibagrus wyckioides*) and mud carp (*Cirrhinus molitorella*) are common to the region. Several species have been introduced to the area, including the highly invasive common carp (*Cyprinus carpio*).

Earth Systems’ 2014 village level surveys and focus group discussions and surveys conducted for the *NN1 HPP EIA* have been used to assess the fish species assemblage in the aquatic habitats in proximity to the PS Project.

Fish and Other Aquatic Species of the Current EDL Transmission Line Area (PS Project, Section 2)

Six international (IUCN 2014) and one national (Lao PDR MAF Conservation Status) threatened fish species have been documented in waterways of Houay Ngua PPA (refer to Table 4-7). One fish found within the PPA, the giant barb (*Catlocarpio siamensis*), is considered Critically Endangered. Giant barb (also known as giant carp) was once common within the Mekong, its tributaries and surrounding floodplains of Cambodia, Lao PDR, Thailand and Vietnam (Hogan 2013).

Five migratory fish species have been identified in the PPA (Table 4-7). Migration is particularly important in the life cycle of these species and many move to and from the Mekong and its other tributaries in their annual migration patterns.

Recent (June 2014) surveys identified one Vulnerable turtle, Southeast Asian softshell turtle (*Amyda cartilaginea*), as inhabiting the Nam Ngiep and Nam Xao near Ban Thaheua (Table 4-8). This species is protected under CITES treaties due to high demand within the consumption trade (IUCN 2014). The turtle was also recorded within the PPA (Table 4-6).

Table 4-7 Threatened and/or migratory fish species identified within the waterways of Houay Ngua Provincially Protection Area during 2013 surveys conducted for the NN1 HPP EIA

Common Name	Scientific Name	MAF Status	IUCN Status	Migratory
Giant barb	<i>Catlocarpio siamensis</i>		CR	

Common Name	Scientific Name	MAF Status	IUCN Status	Migratory
Striped catfish	<i>Pangasianodon hypophthalmus</i>		EN	
Yellow tail brook barb*	<i>Poropuntius deauratus</i>		EN	
Thicklipped barb	<i>Probarbus labeamajor</i>		EN	
Bandan sharp-mouth barb	<i>Scaphognathops bandanensis</i>		VU	✓
Jaguar loach	<i>Yasuhikotakia splendida</i>		VU	
	<i>Wallago leeri*</i>	Restricted	N/A	
Horseface loach	<i>Acantopsis choirorhynchos</i>		LC	✓
Java barb	<i>Barbonymus gonionotus</i>		LC	✓
	<i>Mystacoleucus atridorsalis</i>		LC	✓
Sikuk barb	<i>Sikukia gudgeri</i>		DD	✓

Source: NN1 HPP EIA, Appendix A

* Beyond normal range, records in Laos considered misidentification

MAF: Ministry of Agriculture and Forestry (Lao PDR Government); IUCN Status: CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; LC – Least Concern; DD – Data Deficient; N/A – Not Assessed

Fish of the PS Project Transmission Line Extension Area

Fourteen fish species are known to inhabit waters of the Nam Ngiep near Ban Hatsaykham (Table 4-8, for full list refer to Appendix A, Table A-7). One of these species, *Bangana behri*, is considered internationally significant (Vulnerable IUCN 2014). All other species recorded near to the PS Project were of Least Concern, Near Threatened, and Data-Deficient or not yet evaluated.

Table 4-8 IUCN Near Threatened and more conservation significant and introduced aquatic species identified as inhabiting the rivers (Nam Xan, Ngiep and Xao) near the PS Project villages

Class	Scientific Name	Lao Name	English Common Name	IUCN Status	Family	Nam Xan	Nam Ngiep		Nam Xao		Nam Ngiep
						Nonsomboun	Thaheua	Hat Gniun	Thaheua	Hat Gniun	Hatsaykham
Reptilia	<i>Amyda cartilaginea</i>	Pa phar	Southeast Asian softshell turtle	VU	Trionychidae		✓		✓		
Actinopterygii (ray-finned fish)	<i>Balantiocheilos melanopterus*</i>	Pa boc	Silver shark	EN	Cyprinidae			✓			
	<i>Bangana behri</i>	Pa wa		VU	Cyprinidae		✓	✓	✓	✓	✓
	<i>Bagarius yarrelli*</i>	Pa khae		NT	Sisoridae		✓	✓	✓	✓	✓
	<i>Channa maruloides*</i>	Pa kuan saiy	Emperor snakehead	LC	Channidae		✓	✓			
	<i>Cirrhinus cirrhosus</i>	Pa nang	Mrigal carp	VU	Cyprinidae		✓		✓		
	<i>Hypsibarbus suvattii*</i>	Pa park		DD	Cyprinidae		✓		✓		✓
	<i>Mastacembelus armatus*</i>	Pa lard	Spiny eel	LC	Mastacembelidae	✓	✓		✓		
	<i>Mystus nemurus*</i>	Pa kod	Yellow catfish	LC	Bagridae	✓		✓		✓	
	<i>Ompok bimaculatus*</i>	Pa seuam		NT	Siluridae	✓		✓			
<i>Tor sinensis*</i>	Pa daeng		DD	Cyprinidae			✓		✓	✓	

Source: Earth Systems village level surveys, 2014

*Introduced or species beyond their normal range; IUCN Status Red List Categories: EN – Endangered, VU – Vulnerable, NT – Near Threatened, DD – Data Deficient, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed

4.4 Socio-economic Setting

Four (4) villages are located along the PS Project alignment: Ban Nonsomboun, Ban Thaheua, Ban Hat Gniun, and Ban Hatsaykham. Ban Hatsaykham is a sub-village of the larger Ban Hat Gniun to the east and is therefore administratively conjoined. Ban Hat Gniun and Ban Thaheua are near to the proposed Ban Houay Soup resettlement site for Ban Hatsaykham villagers.

All of these four villages are within Bolikhan District, Bolikhamxay Province. Ban Hatsaykham, Ban Hat Gniun and Ban Thaheua are on the northern bank of the Nam Ngiep and occur over an approximate 6 km stretch of road/track. Ban Nonsomboun is 18 km south of Ban Thaheua, along the road towards Paksan (~20 km from Paksan).

This section provides an overview of the socio-economic setting within these villages with an emphasis on providing information relevant to the PS Project. Information has been sourced from the more detailed *NN1 HPP EIA* (May 2014) and *NN1 HPP SIA* (April 2014) and is supplemented with information from village level surveying and focus group discussions conducted as part of the PS Project IEE (June, 2014).

4.4.1 Population and Communities

According to village level surveys for the PS Project, the combined population of the four villages is 2,170 (Table 4-9). Ban Hatsaykham, Ban Hat Gniun and Ban Thaheua are medium sized villages ranging in size from 252 to 620 people (Table 4-9). Ban Nonsomboun is larger, with nearly 1,022 people. Ban Hat Gniun and Hatsaykham sub-village, the communities closest to the main NN1 HPP have experienced significant population growth over the last few years.

Ban Hat Gniun, Ban Thaheua and Ban Nonsomboun residents are primarily Lao Loum. The majority of villagers in Ban Hatsaykham are Hmong. Village demographics and ethnicity is provided in Table 4-9.

Table 4-9 Demographic and ethnic parameters of villages in the PS Project Area

Village (Ban)	Demographic (2011)*					Demographic (2014)^					Ethnicity (% of people)*		
	HHs	No. of People	No. of Females	Males: Females	Population Growth (2008 to 2011)	HHs	No. of People	No. of Females	Males: Females	Population Growth (since SIA surveying 2011)	Lao Loum	Hmong	Khmu
Nonsomboun	169	956	472	1.03	n/a	179	1022	532	0.92	7%	98	2	
Thaheua	50	265	122	1.17	-3%	52	276	137	1.01	4%	Most		Few
Hat Gniun*	67	371	157	1.36	-6%	107	620	279	1.22	67%	100		
Hatsaykham (sub-village)	33	218	108	1.02	32%	37	252	161	0.57	16%	5	95	
Total	319	1810	859			375	2170	1109					

Source: *NN HPP SIA; ^ES Village Surveying

4.4.2 Housing and Local Infrastructure

Housing

The four (4) villages in the PS Project Area are typically constructed and situated within clusters and surrounded by cultivated and other agricultural land. Dwellings are built using a combination of techniques and available resources, such as wood, bamboo and tin. Lao-style residences are one or two-storey houses and are often constructed on stilts (wooden poles) with the lower storey open.

Ban Nonsomboun residents prefer to construct their homes with concrete, brick and tiles, to create a more permanent structure. Concrete, brick and tiles are much more readily available in Ban Nonsomboun due to its accessibility by paved road and proximity to Paksan. Traditional household building practices are chiefly maintained in Ban Hatsaykham, Ban Hat Gniun and Ban Thaheau. For example, Hmong houses are single-storey built on compacted soil, separate kitchen from the house, aligned from east to west and entrances do not face the mountains.



Plate 4-7 Ban Nonsomboun – Newly built concrete house under TL ROW

Plate 4-8 Ban Thaheua – Wooden houses under TL ROW

Local Infrastructure and Household Electrification

Local infrastructure in the Project Area is summarised in Table 4-10. Most relevant to this study is the increase in household electrification in the Project Area over the last six (6) months. While Ban Nonsomboun has a well-established electricity grid, with 100% of households connected, the new EDL 22 kV transmission line now provides electricity to households in Ban Hat Gniun (100%), Ban Thaheua (80%) and Ban Hatsaykham (80%).

Table 4-10 Local Infrastructure in the Project Area

Village (Ban)	Socio-economic					Infrastructure					
	Health Centre	Primary School	Secondary School	Market	Grocery	Water Supply	Electricity*	Land-line	Mobile Phone	Temple	Cemetery
Nonsomboun	-	✓	-	-	✓	✓	✓	N/A	N/A	✓	✓
Thaheau	-	✓	-	-	✓	✓	✓	N/A	N/A	✓	✓
Hat Gniun	-	✓	-	-	✓	✓	✓	N/A	N/A	✓	✓
Hatsaykham	-	✓	-	-	✓	✓	✓	-	✓	-	✓

Source: NN1 HPP SIA (2014); *ES Surveying 2014
 N/A – Not Assessed

The availability of grid electricity has promoted a significant up-take in the use of household appliances. Refrigeration usage and other common uses of electricity are outlined in Table 4-11. Refrigeration ownership is fairly high in Ban Thaheua, Ban Hat Gniun and Ban Hatsaykham given that grid electricity was only established over the last 6 months. Other important household uses of electricity include lighting, water supply and cooking. There are also a growing number of small businesses (refer to Section 4.4.5) that rely on electricity for their operations.

Table 4-11 Refrigeration Usage and other Common Uses of Electricity

Village (Ban)	Refrigeration usage (% HHs)	Other common uses of electricity
Nonsomboun	95%	Lighting, TV, fan, water pump
Thaheau	70%	Lighting, TV, fan, cooking
Hat Gniun*	25%	Lighting, TV, fan
Hatsaykham (sub-village)	30%	Lighting, water pump, rice mill, cooking

Source: ES Surveying 2014

4.4.3 Income and Local Economies

The annual average cash income in households ranges from 8 to 17 million Kip. Income is predominantly sourced from the sale of agricultural products and livestock. Livestock, especially cattle, are a vital cash income source. Agricultural products are typically only sold if they are in surplus. Similarly, a surplus of fish, non-timber forest products (NTFPs), hunted animals and handicrafts are sold at markets, within the village or at other villages as a supplementary source of income. The largest market in the region is in Paksan, which is between 20 and 40 km from the four villages.

4.4.4 Land and Resource Use

Land Use

Much of the land surrounding the affected villages is utilised for agriculture and livestock grazing (refer to Section 4.3.4). Rice is the main crop grown in the area and is predominantly grown for household consumption, but surplus is sold within or between villages. Generally, two-thirds of villagers grow sufficient rice for 10 months of the year, while the remainder of villages suffer longer term shortages. During shortage months, villages purchase, barter or trade food. Other common crops include maize, sugar cane, cassava, pineapple and banana. Herbs, fruit trees, vegetables and spices are grown in

protected beds near village houses and vegetables are sometimes planted along river banks. Some villagers have recently planted commercial trees, such as teak and rubber and other useful (non-native) species (e.g. eucalyptus).

Forest (e.g. Young and Old Regeneration) covers much more land around Ban Hatsaykham and Ban Hat Gniun (~50%) than around Ban Thaheau. Most of this forest is managed and used by the community.

Livestock are raised around villages and include pigs, chickens, ducks, goats, buffalo and cows. The smaller livestock typically roam around the household and village areas. Larger animals tend to roam further afield during the day but are kept closer to households at night. Some villages also have fish ponds.

Forest Resources

Forest resources are important for the villagers living along the PS Project transmission line corridor. Forest products are particularly vital for the survival of the poor, particularly during the dry season when rice and fish availability is reduced. Villagers often source timber, bamboo and grasses from the surrounding local forests. Houses and fences are constructed with local timber and bamboo and firewood is collected for cooking and heat. Herbs, vegetables, mushrooms, fruit and bamboo shoots are gathered to supplement a mostly rice and fish diet. These forest resources are also frequently used in traditional medicine.

Forest Resource Collection in the current EDL Transmission Line Area

During village surveys, thirty-one (31) species of NTFPs were identified by residents of Ban Nonsomboun, Ban Thaheau and Ban Hat Gniun villagers as being collected inside or near to their respective village (refer to Appendix A, Table A-8). Most species are edible and are consumed within the household or sold within or outside of the village. Mushrooms were particularly popular consumables, and were collected by both women and men, often on a weekly basis. Many of the NTFPs, especially mushrooms, collected by villagers of Thaheau were exclusively sought from the nearby Houay Nguay PPA.

Twelve species of tree are reportedly used for timber (refer to Appendix A, Table A-9) in the villages. Of this 12, four (4) are considered of international conservation importance. All species are collected by men and women on a daily and/or weekly basis for household use. Only villagers of Hat Gniun reported selling timber.

Forest Resource Collection in the PS Project Transmission Line Extension Area

Fifteen species of NTFPs are consumed and / or sold by Hatsaykham villagers (Refer to Appendix A, Table A-8). Most species collected are edible and are consumed within the household and/or sold within or outside of the village. NTFP are typically collected daily or weekly and by both sexes. No threatened NTFPs were reported.

Seven (7) timber producing species were collected by residents of Ban Hatsaykham (Refer to Appendix A, Table A-9). Four (4) of these tree species are considered of international conservation importance, however, *Hopea ferrea* has not been confirmed as a species native to Lao PDR. All seven species were exclusively collected for use within the village by both men and women.

Water Resources

Prominent rivers near to the PS Project are the Nam Ngiep and Nam Xao. Villagers use the rivers and their tributaries for fishing, navigation, drinking, bathing, washing, livestock watering, and general household consumption (NN1 HPP EIA). Local residents also obtain drinking water from groundwater wells, springs, and gravity flow water systems (Nam Lin).

All villages have access to water from the rivers and rainfall. In addition, there is a public water supply from the Nam Tak in Ban Hat Gniun. However, Ban Thaheau residents abstract water from the Nam Xao. Ban Nonsomboun is currently being connected to the district town water system, however the centre of town is within 1 km of the Nam Xan and similar to other villages the river plays a very important role in village life. Although these rivers are vital water resources, cultivation of crops (e.g. rice) relies more on

rainfall than irrigation by the rivers. Some farmers will use river water for small vegetable plots near embankments.

Fishing

The Nam Ngiep is the most important source of fish for villagers along the PS Project transmission line corridor. Fish are a critical component of villagers' diets and provides the majority of protein in a rice-dominant diet. Catfish and carp are the most commonly caught and consumed species, but locals will catch a wide variety of species. Large and migratory species such as Asian red-tailed catfish and mud carp are common to the rivers in the Project Area.

Most villagers near the proposed PS Project regularly fish. Generally, more men fish than women, with a proportion of seven men fishing for every three women (according to focus group discussions for the PS Project for Ban Nonsomboun, Ban Thaheau and Ban Hat Gniun). Villagers use fishing nets, hooks, landing nets, winnowing baskets and bamboo fish traps to catch the wide variety of species caught.

All villagers within Ban Hatsaykham participate in fishing. Unlike nearby villages, men and women equally participate in fishing activities. Fish are caught for both consumption and for sale and the volume of dry season catches is greater than during the wet season. During focus group discussions for the PS Project, villagers reported that fish stocks have declined in recent years and it appears that fishing catches have been affected by water quality changes within the Nam Ngiep and Nam Xao.

Hunting

Hunting is a common practice for villagers in proximity to the PS Project. The practice is typically undertaken for subsistence (i.e. household consumption), but when there is surplus, villagers may sell the surplus to neighbours or neighbouring villagers. Additionally, some hunted species are specifically sought to sell. Hunters will rarely sell their catch at larger markets due to inaccessibility and lack of transport.

Villagers most frequently hunt small animals and although most villagers know that hunting of larger animals is illegal, some admit to occasionally hunting larger animals. Bamboo traps are a popular method of hunting smaller animals, such as squirrels and rats. Knives, guns and dogs are occasionally used for hunting. Hunted animals include forest rats, field rats, monkeys, mouse deer, birds and insects.

4.4.5 Small Business

Small businesses including general stores, restaurants, bars, guest houses and resorts are increasing in prominence along the main access road between Ban Hat Gniun and Ban Hatsaykham (Plate 4-9, Plate 4-). Existing businesses such as the Thidadao Resort are expanding. These businesses supply services to the growing number of workers and their families that are moving into the area. They rely on electricity to for lighting, cooking, entertainment and other electrical appliances.



Plate 4-9 Small restaurant close to Ban Hat Gniun



Plate 4-10 Larger restaurant / bar near sub-contractors temporary camp, Ban Hat Gniun

4.4.6 Transportation

Each village has an existing network of paths, tracks and roads, but many are only accessible during the dry season. The PS Project will be aligned along the current unsealed road network connecting the villages, with the main access road having been recently upgraded for the NN1 HPP.

The Nam Ngiep and Nam Xao are used by villagers for transportation between villages and to access areas on the right bank of the Nam Ngiep. During the dry season, villagers are more likely to use smaller boats with oars to better navigate rocky outcrops, rapids and other hazards in the shallower waters. In the wet season the preferred boat to be used to navigate the rivers is a long-tail boat that can be manoeuvred in the fast flowing, deeper water.

The military currently operates a small river ferry on the Nam Ngiep, providing NN1 HPP vehicles with access to the right (north to south) bank.

4.5 Cultural Heritage and Archaeology Setting

A *Preliminary Archaeology and Cultural Heritage Survey Report* was prepared for the Nam Ngiep 1 Hydropower Project EIA (refer to Appendix K of the EIA) in April, 2014. The Report indicates that the Project Area is rich in sites of archaeological, historical and cultural significance. A handful of polished stone tools have been found by inhabitants of the region (16 shown to the survey team, but many more referred to), which are key indicators of Neolithic Age activity. The objects shown to the survey team have lost their original setting, and therefore cannot in many cases be connected to a site of cultural significance. Three sites of cultural and historical significance have been identified near Ban Thaheau.

The Biodiversity Baseline Assessment Report (EIA, Appendix A) also addressed cultural resources within the greater Nam Ngiep 1 HPP Project Area. According to the report, numerous locally collected stone tools have been found in the Project Area, indicating human occupation in the area occurred between 4,000 and 12,000 years ago. However, most of the existing villages were settled in the early 1980s and 1990s. The most significant social, religious and cultural sites identified during village surveys conducted for the EIA were grave sites.

All villages have a cemetery, and Ban Nonsomboun, Ban Hat Gniun and Ban Thaheau have Buddhist temples. Temples are important for prayer, giving offerings and general religious solace, but are also important for sociality and community cohesiveness within the village. Cemeteries are culturally significant and their protection is considered important for the health of the villagers.

5 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Terrestrial Flora

5.1.1 Issues and Findings

Implementation of the PS Project will require the long term or permanent clearance of vegetation within the transmission line ROW. The total ROW is 308.8 ha, assuming an 8m buffer requirement from the centre line of the transmission line (4 metres on each side), and a total transmission line length of 38.6 km. However, a significant portion of the transmission line ROW has already been cleared of vegetation for the following facilities:

- The ROW has already been cleared for the 27.8 km segment for the current EDL transmission line (69.5 ha), including 19.8 ha previously cleared in the PPA; and
- The road alignment for the entire length of the transmission line ROW overlaps with the required vegetative clearance area in the ROW for a majority of the length of the transmission line.

The majority of vegetation has been removed for access road construction in Sections 3 – 4. However, because proposed pole locations are preliminary, impacts to some vegetation cannot be ruled-out. Therefore, impact assessments include maximum potential impacts (i.e. 8 m ROW x length of transmission line segment), but impacts will be significantly less, and will generally entail removal of disturbed vegetation from road construction.

Section 2: EDL Project Corridor - Nonsomboun to Hatsaykham (PS Project upgrades)

NN1PC Transmission Line Project Development

Project development of the transmission line for this 27.8 km section will occur entirely within the existing EDL transmission line ROW, with reinforcement work likely required for approximately 24 existing poles to support additional weight (refer to Appendix A). Very little vegetative clearance, if any, will be required in this section. Some impact to regrowth (following initial ROW clearance for the EDL line and NN1 HPP road construction work) may occur as a result of vehicle / equipment access to the 24 poles requiring reinforcement as well as during replacement of the existing power cable.

Do to the current state of vegetation in the existing EDL transmission line ROW, impacts to vegetation and habitat value from upgrade of this line are expected to be negligible (refer to Plates 4.1 and 4.2).

EDL Project Corridor (Current transmission line corridor)

Vegetative clearance for the current EDL transmission line (27.8 km) is approximately 25 m wide (though it varies considerably along its length). Vegetation has been cleared to 10 - 30 m on each side of the transmission line centre-line (refer to Plates 4.1 and 4.2).

Vegetative clearance for the original EDL transmission line development primarily occurred within 10 – 20 m of the access road to Ban Hatsaykham. Therefore, the EDL vegetation clearance requirements were less than the full ROW width, as the access road was devoid of vegetation prior to EDL construction. The access road has since been upgraded and widened for the NN1 HPP.

Previous impacts to vegetation in Section 2 (from EDL transmission line ROW clearance and NN1 HPP access road upgrade) are summarised as follows:

- Ban Nonsomboun to PPA Boundary: Approximately 16.6 ha of primarily highly disturbed Regeneration Forest with pockets of disturbed Mixed Deciduous Forest was cleared for EDL transmission line and ROW construction. The vegetation in the section was highly disturbed and provided poor habitat value. The estimates for impacts are speculative as satellite imagery pre-dates both activities (EDL construction and NN1PC road construction) and the current transmission

line varies in distance from the access road (Road A). The estimate assumes 20% of the 20.75 ha corridor had been previously cleared of vegetation for the access road;

- PPA: Approximately 15.5 ha of primarily Mixed Deciduous Forest were cleared within the PPA for EDL transmission line and ROW construction. The ROW occupies 17.8 ha, with approximately 2.3 ha (20%) of the ROW occupied by the access road. The vegetation within this section was moderately disturbed (presumably via selective harvest of timber species, firewood species and NTFP) but was moderately high value habitat as the canopy was intact; and
- PPA to Ban Hatsaykham: Approximately 24.8 of the 31.0 ha corridor was cleared of primarily Mixed Deciduous Forest EDL transmission line and ROW construction. The vegetation within this section was moderately disturbed by historic resource extraction but like the PPA, provided moderately high value habitat as the canopy was fairly intact.

Previous surveys recorded 114 trees of the Critically Endangered *Dipterocarpus turbinatus* (IUCN 2014, NN1 HPP EIA Report) in the PPA, 29 of which were near the proposed PS Project. Twenty-one of the 29 were cleared during implementation of the original EDL REP2 Project.

Section 3 & 4 PS Project extension: Hatsaykham to RCC Plant Yard and Regulating Dam

Sections 3 and 4 (8.0 km) will be constructed from the end of the current EDL line in Ban Hatsaykham to the RCC Plant yard, Main Dam site and the Re-regulation Dam site. This will be new construction and will require some vegetative clearance (maximum of 8 m ROW - 4 m on each side of the centre-line for the transmission line). However, the majority of this vegetation has been removed for construction of NN1PC access (Road P1), the NN1PC RCC Plant Yard, and additional Project components (and a small area is water). Therefore, the amount of vegetation removal will likely be significantly less than the maximum clearance area (refer to Plates 4.3 – 4.6).

The vegetation in this section is primarily Upper Mixed Deciduous Forest with some Regeneration Forest and very small areas of agriculture and grassland. A maximum of 6.45 ha of forest would be cleared for the transmission line ROW if it were entirely vegetated.

The quality of the forest varies significantly along the proposed transmission line corridor. For example, human disturbance from selective logging is evident near Ban Hatsaykham. Construction of the roads and road embankments has required clearing of buffer areas where remnant forest or regrowth is less than 1 m tall or is non-existent. However, much of the Mixed Deciduous Forest bordering the road network (and within the ROW) is moderately high value habitat with intact native forest providing significant canopy cover.

According to satellite imagery (pre-road construction), the following vegetation would require removal (at a maximum):

- Mixed Deciduous Forest – 3.7 ha;
- Regeneration Forest (1 – 8 years old) – 1.9 ha;
- Regeneration Forest (> 8 years old) – 0.15 ha;
- Agricultural area (cleared land) – 0.51 ha; and
- Grassland / Savannah – 0.15 ha.

However, as is indicated above, road and facilities have been cleared of vegetation (following satellite imagery capture); therefore the amount of vegetation removal required cannot be precisely calculated but will be significantly less than that estimated above.

The Mixed Deciduous Forest on the south side of the Nam Ngiep River (right bank) is fairly pristine near the Main Dam site (approximately 1.8 km section of proposed transmission line), and is considered the highest value forest in the PS Project Footprint with respect to its habitat value and species composition. A maximum of 1.44 ha of high value Mixed Deciduous Forest would be removed at the terminal end of PS Project Section 4 (if undisturbed by access road construction).

Section 5 NN1PC Project: Re-regulation Dam to Ban Houay Soup

This 2.8 km section of transmission line will be constructed from the Re-regulation Dam to the Ban Houay Soup resettlement village and will require vegetation clearance of eight (8) metres to accommodate the ROW.

The vegetation in this corridor is highly disturbed for the majority of the Section 5. Notably, the current alignment appears to intercept a small rubber plantation and some shifting agriculture. Approximately 2.1 ha of the ROW are vegetated, however only 1.75 ha is forested (including plantation).

According to satellite imagery, the following vegetation will require removal (at a maximum):

- Regeneration Forest (1 – 8 years old) – 1.48 ha;
- Regeneration Forest (> 8 years old) – 0.18 ha;
- Agricultural area (cleared land) – 0.15 ha;
- Grassland / Savannah – 0.23 ha; and
- Plantation – 0.08 ha.

As the alignment to Ban Houay Soup is preliminary, it is anticipated that impacts to plantation forest (rubber trees) will be avoided as only a small re-alignment (< 40 m shift for 2 – 4 poles) would avoid this impact.

However, the issue will require consideration by NN1PC SMO to ensure adequate compensation is provided, if impacts are unavoidable.

IUCN Listed Species

At least 15 IUCN listed species have been identified in the PS Project transmission line extension areas, most of which are characterised as Low Risk, Least Concern, or Not Assessed. However two IUCN listed Endangered species, Mai sy (*Vatica cinerea*) and Mai bark noi (*Anisoptera costata*) have also been identified in the area. Both species, commonly used for timber in the region, may be impacted by vegetation clearing for the PS Project ROW.

Mai bark noi (*Anisoptera costata*) is also fairly common to the current EDL transmission line alignment, however no impacts to this species should occur in the section of the PS Project (Section 2) as transmission line upgrade will not require tree removal.

Some vegetation may be impacted as a result of clearing for transmission line extension in Sections 3 – 4, though impacts to listed species are considered unlikely as most of the PS Project ROW will occur in previously cleared /disturbed vegetation from access road construction.

5.1.2 Management and Mitigation

NN1PC will implement management and mitigation measures specified in the NN1 HPP ESMMP-CP and applicable sub-plans, including:

- SP07: Vegetation Clearing;
- SP08: Landscaping and re-vegetation; and
- SP16: Training and Awareness.

These plans will form the basis for contractor development and implementation of the SS-ESMMP which will incorporate required management and mitigation measures.

Priority measures include:

- Assessment and consideration of potential impacts to the rubber tree plantation and other agricultural areas in PS Project, Section 5 to ensure compensation is provided, if required;

- Restricting vegetation removal to the smallest area required for PS Project transmission line ROW (4 m on each side of the transmission line centre-line. No clearing of vegetation outside those areas identified in plans will occur;
- The boundary of vegetation clearance areas and trees to be retained will be clearly marked, prior to PS Project related clearing;
- All staff involved in vegetation clearance shall be walked through the demarcated area and instructed on strict adherence to clearing within the boundary;
- IUCN Endangered tree species will be avoided during final design and, where possible, during construction;
- Identification and marking of IUCN listed threatened tree or other vegetative species by a qualified botanist in and near the planned clearance area;
- Each site to be cleared will be inspected by the Owner Site Environment Manager prior to the commencement of clearing. The officer shall approve vegetation clearance if the site has been clearly marked in accordance with the clearing permit; and
- The Owner Environment Officer shall inspect clearance activities at each site weekly, advising the Contractor of any non-compliance against the permit or SS-ESMMP and specifying required remedial action.

In addition, NN1PC should consider requiring inclusion of the following measures in the contractor's SS-ESMMP, and ensure compliance throughout and / or following construction:

- Larger specimens in the ROW should be pruned to the level required (3 m from ground level), where possible, to avoid felling trees where possible. Smaller trees should be transplanted to a suitable area outside the PS Project ROW;
- The transmission line ROW should be revegetated /seeded (at the onset of the following rainy season) with native grass species and / or shrub species that will not require ongoing pruning (i.e. have shorter growth habit); and
- The Training and Awareness program (as per ESMMP-CP, SP16) should inform personnel of the prohibition of harvesting TFP and NTFP as well as identifying those species that are threatened and require protection.

NN1PC should consider a slight revision to the final alignment of Section 5 to avoid a rubber plantation and an agricultural plot (shifting cultivation). The change in alignment would be minor (e.g. < 40 m shift in two areas). If impacts cannot be avoided, compensation will be required.

5.1.3 Residual Impacts

As vegetation removal is a requirement to provide an adequate buffer for the PS Project ROW, impacts to vegetation are unavoidable. Properly demarcating clearance areas, restricting vegetation removal to the smallest area required, and marking and avoiding / transplanting IUCN Endangered trees will minimise impacts to vegetation.

If the Training and Awareness Program for the PS Project workforce informs personnel of the restriction of NTFP and TFP harvesting, associated impacts should be avoided.

5.2 Invasive Vegetation

5.2.1 Issues and Findings

Areas cleared of vegetation are prone to establishment of non-native invasive species (introduction or spread). Such species are generally pioneer species (fast growing in open areas), and often prevent or delay the establishment of native vegetation or vegetative communities. By clearing vegetation, the PS

Project will provide potential for establishment of invasive species (and resulting decline in habitat value for native terrestrial species) for land that is currently comprised of (primarily) native vegetation.

Non-native and particularly invasive species have already been introduced to the Project Area and surrounds. *Chromolaena odorata* was recorded within and surrounding the Project Area and is considered as one of the world's 100 top invasive species (ISSG, 2014).

The introduction of new construction vehicles to the area may also bring seed from other areas, introducing new invasive species prone to establishment in disturbed areas.

5.2.2 Management and Mitigation

To minimise the negative impact of exotic weeds on biodiversity, the following should be included in the Contractor's SS-ESMMP and implemented:

- Vehicles entering the Project Area from outside the region should be washed prior to their utilisation to minimise the introduction of exotic species;
- Attention should be given to equipment entering the intact forest to the south bank of the Nam Ngiep, where invasive plants are not as prevalent; and
- Areas cleared of vegetation should be revegetated with native species as soon as possible following site disturbance (e.g. with native grasses to minimise maintenance requirements in the ROW).

In addition, invasive species control / suppression will be conducted during routine ROW maintenance.

5.2.3 Residual Impacts

Given the presence of invasive species in the area and the increased area of disturbance (for PS Project vegetation clearance), the spread of invasive species into the ROW is expected. Management measures can minimise impacts to higher value areas (e.g. the PPA and the more pristine south bank of the Nam Ngiep), by excluding the introduction of new invasive species and not directly spreading species.

5.3 Terrestrial Fauna

5.3.1 Issues and Findings

A number of IUCN listed fauna species are known to inhabit the Project Area (refer to Section 4 and the Project EIA, Appendix E). According to IUCN status: eight (8) mammal threatened mammal species, three (3) bird threatened bird species and two (2) threatened reptile species occur within the PS Project area (Critically Endangered, Endangered and Vulnerable) and an additional 19 species are candidates for IUCN protection.

Transmission line construction is unlikely to directly impact terrestrial fauna in the Project Area and the indirect impact of habitat removal will be minimal, as vegetative removal will occur next to pre-existing roads, where habitat value and likelihood of occurrence of species is low.

Direct impacts to terrestrial fauna resulting from PS Project implementation may occur throughout all four (4) sections of the PS Project alignment from the following:

- Transmission line strikes and subsequent electrocution of bird species (particularly raptors);
- Hunting by PS Project personnel; and
- Vehicle strikes from transport vehicles required during PS Project implementation.

5.3.2 Management and Mitigation

The potential for direct impacts to fauna can be avoided through implementation of the following management measures:

- Prohibit PS Project construction personnel from hunting in the region;
- Prohibit vehicles from excessive speeding on access roads; and
- Implement an Environmental Training and Awareness Program (refer to Project ESMMP-CP, SP16) that specifies Project prohibitions on hunting and raises awareness of the status of threatened species in the region.

5.3.3 Residual Impacts

Significant residual impacts to terrestrial fauna are not expected if recommended management measures are implemented.

5.4 Water Quality

5.4.1 Issues and Findings

Section 2: EDL Project Corridor – Ban Nonsomboun to Ban Hatsaykham

Vegetative clearance and earth moving activity will not be required for the upgrade of this section of the transmission line. Potential impacts to water quality are considered unlikely. However, some areas may be slightly more prone to erosion, resulting in sediment input to watercourses associated with construction vehicle access to transmission line poles and associated disturbance to topsoil.

The primary potential impacts in this region are associated with the construction workforce camp and vehicles stockyard / maintenance workshops, which will be located in proximity to Ban Nonsomboun. If not properly designed and maintained, these facilities have the potential to provide nutrients, pathogens, and hazardous and non-hazardous material to watercourses.

Nutrients and Pathogens

Workforce accommodation camps are a potential source of nutrients and pathogens from inadvertent discharge of grey or black water (from septic tanks, kitchen, showers, etc.) into drainage channels and ultimately the Nam Ngiep River.

Hazardous and Non-Hazardous Waste

Vehicle stockyards, maintenance workshops, and workforce accommodation areas are also a potential source of hazardous and non-hazardous waste. If not properly managed, potential impacts include discharges to downstream watercourses during the rainy season or infiltration of surface soils and contaminate groundwater aquifers.

Use of excavators and additional equipment for transmission line construction provides some potential for hydrocarbon input to watercourses from leakage or spillage.

Sections 3 – 5: NN1PC Project Corridors – Ban Hatsaykham to Main Dam, Re-regulation Dam and Ban Houay Soup

Some water quality impacts are anticipated during construction and for the first handful of years until vegetative cover has established in the ROW. Impacts from the PS Project are expected to be minimal. Contributions are considered more significant with respect to cumulative impacts (refer to Section 7) as road construction activity, workforce camps, and in-stream construction for the Nam Ngiep Project will provide for similar, though more extensive, water quality issues. The primary potential water quality impact anticipated for PS Project construction is increased erosion and sediment transport to watercourses.

Erosion and Sedimentation

Removal of vegetation in the transmission line ROW will increase potential for erosion and sediment runoff and associated turbidity / siltation of downstream watercourses during and for a handful of years following construction. Disturbance of topsoil from construction vehicles will dislodge soil particles providing material susceptible to water and wind erosion and subsequent transport to downstream watercourses.

Impacts from the PS Project are not expected to be fairly minor, as Section 3 and 4 poles are likely to be located within the disturbed areas from access road construction, thus new vegetation clearing will be limited.

5.4.2 Management and Mitigation

NN1PC had developed an ESMMP-CP for road construction and sub-plans in the ESMMP-CP that address management and mitigation for water quality during road construction activity. Measures listed in these plans are applicable to avoiding or minimising water quality impacts during PS Project construction and maintenance.

These plans will form the basis for contractor development and implementation of the SS-ESMMP which will incorporate required management and mitigation measures.

Sub-plans applicable to avoiding or minimising impacts to water quality include:

- SP01: Erosion and Sediment Control;
- SP02: Water Availability and Pollution Control;
- SP05: Waste Management;
- SP06: Hazardous Material Management;
- SP07: Vegetation Clearing;
- SP08: Landscaping and re-vegetation;
- SP11: Spoil Disposal;
- SP14: Construction of work camps; and
- SP20: Emergency Preparedness

Erosion and Sedimentation

The following management and mitigation plans should be included in the SS-ESMMP and implemented during construction and/or maintenance of the transmission line:

- Transmission line poles should not be implemented in watercourses or on steep slopes above watercourses (seasonal or perennial watercourses);
- Vegetation removal should be limited to the minimum required for the ROW and surrounding transmission line poles. Vegetation scheduled for removal should be clearly demarcated, with impacts extending no further than the intended boundary;
- Minimise the duration of soil exposure through staged clearing and subsequent covering of exposed areas following the completion of construction in that area (e.g. seeding with fast growing native grass species, cover with riprap, sand bags, erosion mats, etc.);
- Machinery should be prohibited from in-stream construction;
- Where vegetation clearing is required in riparian corridors, it will be cut to near ground level to leave root mass intact;
- Stockpile materials (soil, cement, etc.) will be located at least 30 m from steep slopes, watercourses or seasonal drainage paths; and
- Water quality for Total Suspended Sediments (TSS) and/or turbidity will be monitored regularly (as per Chapter 8 and the ESMMP-CP). If TSS volumes or turbidity values exceed applicable standards defined in the ESMMP-CP, additional erosion and sediment control measures should be implemented.

Nutrients and Pathogens

- Construction work camps, offices and construction sites will be equipped with adequate temporary sanitary facilities to avoid potential discharge of grey and black wastewaters to groundwater or nearby surface watercourses;
- The septic waste management systems will be installed at least 30 m from drainage lines or watercourses, maintained (regularly emptied), and monitored weekly;
- Solid waste management systems will be located at least 30 m from seasonal or perennial watercourse or drainage lines. Labelled watertight containers will be provided for disposal of construction debris and construction worker camp trash and will be waste will be collected / removed regularly (e.g. weekly); and
- Settling/retention ponds should be constructed with sufficient capacity to capture and treat wastewater generated from workforce camps (e.g. from kitchen, showers, bathrooms, stormwater channels).

Hazardous and Non-Hazardous Waste

- Watertight receptacles should be provided in all the equipment maintenance shops for waste oil, oily rags, spent oil filters, solvents, and oily containers. Disposal should be through an authorised waste handler and recycler;
- Hazardous materials should be stored in bunded areas designed to contain at least 110% of the waste stored on them;
- Spill prevention and emergency spill response training should be conducted for construction personnel prior to their deployment to the PS Project; and
- Spill kits (e.g. Sorbex) should be stored in adequate quantity at all hazardous waste storage and handling facilities to ensure accidental spillage is cleaned-up as quickly as possible.

5.4.3 Residual Impacts

Provided workforce camps and stockyards are constructed and maintained to prevent discharge of nutrients, pathogens, hazardous and non-hazardous waste, impacts to water quality from these parameters is expected to be minimal.

Vegetative removal associated with construction of the PS Project and the ROW will increase erosion and sedimentation of Nam Ngiep and some of its tributaries. Inputs from the PS Project are expected to be fairly minimal, but will be a component of the cumulative impact associated with con-current road construction activity (refer to Section 7).

5.5 Hydrology

5.5.1 Issues and Findings

Transmission line construction and maintenance is not expected to impact surface water or groundwater hydrology in the Project Area. It is anticipated that structures (e.g. transmission line poles, transformers) will be placed outside of seasonal drainages and other watercourses thereby avoiding the requirement for diversion of surface water.

5.5.2 Management and Mitigation

Ensure transmission line poles are located outside of surface water drainage paths.

5.5.3 Residual Impacts

No residual impacts are anticipated.

5.6 Aquatic Habitat

5.6.1 Issues and Findings

Transmission line construction will avoid direct impacts to aquatic habitat as transmission line structures will be placed outside of seasonal and perennial watercourses. Aquatic habitat may be indirectly impacted if water quality is impaired during construction. If not adequately managed, the most significant potential impact to aquatic habitat is expected to be increased sediment loading in nearby streams and rivers, although these impacts are not expected to be extensive as the majority of vegetation for Sections 2 – 4 has been removed for access road construction.

Increased sediment loading (if applicable) has the potential to decrease habitat value with respect to the following:

- Sediment may reduce water quality by making the water turbid (cloudy). Turbidity prevents sunlight from penetrating the water and thus reduces photosynthesis and underwater vegetation. Oxygen levels are reduced in turbid waters, further degrading habitat for fish and other aquatic organisms;
- Excessive turbidity may inhibit fish and macro-invertebrates from locating prey and in some cases has been shown to damage fish gills;
- Sediment may change the morphology of stream channels, altering natural pool, riffle, run sequences and stream bed textures. These changes can affect aquatic species' ability to breed, hide from predators and can alter populations of micro-invertebrates or other food sources for aquatic species.
- Fine sediments may transport adsorbed nutrients. Excess nutrients can impact water quality through eutrophication, a process whereby excess nitrogen and phosphorus causes unwanted biological growth in receiving waters; and
- Fine sediments may transport adsorbed heavy metals, which under the variable pH regimes may become toxic.

Additional potential water quality impacts that would affect aquatic habitat include potential for hydrocarbons from spillage as well as nutrient loading from workforce accommodation (refer to Section 5.4).

5.6.2 Management and Mitigation

NN1PC (and contractors) should implement the following management measures:

- Avoid placing towers / poles within drainage lines;
- Avoid in-stream construction; and
- Soil stockpiles (if required) should be located at least 30 m from natural drainages.

Specific management and mitigation measures to avoid or minimise potential impacts to water quality from erosion and sedimentation, nutrients and pathogens, and hazardous and non-hazardous materials (and therefore aquatic habitat) are provided in Section 5.4.

5.6.3 Residual Impacts

With implementation of management and mitigation measures, the most likely impact to aquatic habitat will be via increased sediment loading in watercourses following erosion of disturbed land surfaces. Implementation of management measures provided in the ESMMP-CP as well as those listed in Section 5.4.2 would minimise sediment input to watercourse. However, with the quantity of vegetative removal required for Project implementation (refer to Section 5.1), increased sediment loading is anticipated. These impacts will be exacerbated via cumulative impacts of sediment input provided by other Projects, from both upstream of the greater Nam Ngiep Hydropower Power Project and from Nam Ngiep 1 Power Project road construction activity (refer to Section 7).

5.7 Aquatic Fauna

5.7.1 Issues and Findings

Six (6) IUCN listed fish species and two (2) IUCN listed aquatic reptiles are known to occur in the Houay Ngua PPA and Re-Regulation Dam area (refer to Section 4, and EIA, Appendix E). At least 39 fish species are known to occur in the PPA, many of which are important sources of protein for villagers that live in the area.

As in-stream construction will be avoided throughout construction of the Project transmission line, direct impacts to aquatic fauna are not anticipated.

There is potential for indirect impacts to aquatic fauna, including IUCN listed species. These impacts may result from:

- Fishing or other forms of aquatic species harvest from construction personnel; and
- Impairment of aquatic habitat.

5.7.2 Management and Mitigation

Potential impacts to aquatic habitat will be managed through implementation of management and mitigation measures for water quality provided in Section 5.4.

NN1PC should provide a Training and Awareness Program (ESMMP-CP, SP16) for construction personnel prior to PS Project development. The Program should demonstrate the need to protect aquatic fauna and the importance of such species to local residents. Furthermore, the prohibition of construction personnel fishing and collection of other aquatic fauna should be reinforced during training.

5.7.3 Residual Impacts

Potential impacts to aquatic habitat from transmission line construction are expected to be minimal if management and measures are implemented. Prohibiting resource extraction (by construction personnel) from local watercourses and minimisation of erosion and sedimentation will be particularly important in minimising potential impacts.

Sediment loading is expected to increase as a result of Project implementation. The cumulative effect of increased sediment loading from upstream activity and NN1PC road construction will likely have indirect impacts on aquatic fauna via impairment of aquatic habitat (refer to Section 5.5 and 7).

5.8 Hazardous and Non-Hazardous Waste

5.8.1 Issues and Findings

Hazardous materials that may be used during Project construction, or will be associated with Project construction include:

- Petroleum products such as oils, fuels, and grease;
- Concrete curing and repair compounds; and
- Grey and black water from septic systems.

There is potential for hazardous material discharge to the environment during material storage and handling as well as during vehicle or equipment maintenance.

Non-hazardous waste will be generated at the workforce accommodation facility and from residual materials at construction sites. Non-hazardous waste includes:

- Construction materials;
- General waste at camps (e.g. plastic bottles, wrappers, etc.); and

- Food waste.

Non hazardous materials impact the environment if not properly disposed of and may be carried into watercourses, impacting downstream environments.

5.8.2 Management and Mitigation

NN1PC has developed sub-plans (ESMMP-CP) that detail management and mitigation measures for hazardous and non-hazardous waste during construction, including:

- SP05: Waste management;
- SP06: Hazardous Material Management; and
- SP02: Water Availability and Pollution Control.

NN1PC will require the Contractor to implement the measures provided in the sub-plans. The Contractor is also responsible for providing a *Site-Specific Environmental and Social Management and Mitigation Plan* for the PS Project that will apply general measures to the appropriate construction areas, maintenance areas, and the workforce camp.

Management and mitigation measures for the Project should include:

- Fuel and hazardous material storage areas will be stored in bunds that have the capacity to contain 110% of the material stored on them, to contain potential spillage;
- Whenever feasible, mobile fuelling / maintenance units will be used for construction equipment to reduce on-site fuel / hazardous material storage; and.
- Discharge of contaminated water into the environment is prohibited.

5.8.3 Residual Impacts

Provided the workforce accommodation facility, vehicle stockyard and equipment maintenance facilities are designed and constructed with management and mitigation measures documented in the NN1 HPP ESMMP-CP and personnel are provided adequate training in spill prevention and spill containment, hazardous and non-hazardous waste generated during construction of the PS Project is not expected to impact the surrounding environment.

6 SOCIAL IMPACTS AND MITIGATION MEASURES

6.1 Loss of Land, Assets and Livelihood

6.1.1 Issues and Findings

Construction of the PS Project Section 2-4 will not require further requisition of land and assets from villagers in the PS Project Area (beyond that currently being addressed for NN1 HPP development and road construction activity). A few small areas of agricultural areas and village properties exist within the PS Project ROW (refer to Tables 4-3 and 4-4) in Section 2, however it is anticipated that PS Project implementation will not impact any agricultural land or village assets as each is expected to occur an adequate distance below the transmission lines to meet clearance area requirements (refer to Section 2.2.3).

For Section 5 (extension to Ban Houay Soup), the SMO will investigate current landholdings and PS Project alignment to determine whether consultation and compensation is required as a result of PS Project implementation. According to the current alignment, approximately 0.15 ha of shifting agricultural land and 0.08 ha of plantation land may be impacted.

Minor and short term impacts to livelihoods may occur as a result of temporary power disruption during transmission line upgrade between Ban Nonsomboun and Ban Hatsaykham. This potential impact is discussed in Section 6.1.

6.1.2 Management and Mitigation

The alignment for Section 5 is preliminary, and it is possible that it may be shifted to avoid agricultural land.

If implementation of the PS Project Section 5 requires requisition of land or will impact assets, consultation and potential compensation will be addressed by the SMO as per the NN1 HPP Resettlement and Ethnic Development Plan (REDP, Chapter 14). The SMO will determine whether compensation is required and will facilitate the process, where required.

Refer to Section 6.1.2 for mitigation measures relative to livelihoods from temporary power disruption.

6.1.3 Residual Impacts

Impacts to land and assets are not expected to result from PS Project construction of Sections 2-4. Landholders will be compensation for impacts to land and/or assets in the Section 5 ROW.

Short term impacts to livelihoods from temporary disruption of power during construction are discussed in Section 6.1.3.

6.2 Disruption of Electricity during Construction

6.2.1 Issues and Findings

The supply of electricity to Ban Nonsomboun, Ban Thaheau, Ban Hat Gniun, Ban Hatsaykham, PKC Camp, MV.DC Camp and additional households/service providers currently hooked up to the electricity grid will have their electricity supply periodically disrupted during construction of the transmission line.

Small businesses including general stores, restaurants, bars, guest houses and resorts are increasing in prominence along the main access road between Ban Hat Gniun and Ban Hatsaykham. Existing businesses such as the Thidadao Resort are expanding. These businesses supply services to the growing number of workers and their families that are moving into the area. They rely on electricity to for lighting, cooking, entertainment, etc.

The availability of grid electricity has promoted a significant up-take in the use of household appliances. Refrigeration ownership is fairly high in Ban Thaheua, Ban Hat Gniun and Ban Hatsaykham given that grid electricity was only established over the last six (6) months. Other important household uses of electricity include lighting, water supply and cooking.

Potential short-term impacts include:

- Loss of food requiring refrigeration;
- Shut-down in services for restaurants or other service providers during power outages;
- Inability to use electrically powered water pumps (fairly common to the region); and
- General short-term inability to utilise electrically powered equipment / appliances.

6.2.2 Management and Mitigation

NN1PC has indicated that this disturbance will be minimised through planned disruption during weekends and only during the day time. The following measures should be considered:

- Villagers and additional affected people (restaurant/resort owners) should be notified at least 48 hours in advance of a planned power disruption;
- NN1PC should consult with those potentially affected by planned power outages to facilitate minimisation or avoidance of impacts;
- NN1PC SMO should consult with restaurant / resort owners to identify the volume of food losses and appropriate compensation;
- NN1PC should consider providing restaurants / resort owners alternate means for refrigeration if potential losses (food) are considered significant (e.g. ice boxes and adequate ice or gas powered generators); and
- Owners of restaurants, markets and the Thidadao Resort should be compensated if power outages are sustained for a long enough period of time that reduces food sales or property rental and households that refrigerate food should be compensated for spoilage.

6.2.3 Residual Impacts

Some of the impacts associated with power outages are unavoidable and likely cannot be remedied. Villagers, service providers and road construction camps will not have access to various electric powered goods (e.g. radios, clock, phone chargers, etc.).

It is anticipated that the more significant impacts to service providers (i.e. loss of food or livelihood) will be avoided through provision of ice or an alternate source of energy (gas powered generator). However, pending the duration of power outages, service providers may have short-term impacts to revenue generation.

Compensation should be provided to households and service providers where loss of goods requiring refrigeration cannot be avoided or where loss of revenue is expected.

PS Project implementation will benefit villagers relocated to Ban Houay Soup, as the current plan entails provision of electricity to each of the households.

6.3 Electrical Hazards

6.3.1 Issues and Findings

Transmission line construction / upgrade present a significant safety risk for construction personnel and for local residents, particularly those with houses near the transmission line ROW.

Construction personnel and others workers dealing with electricity directly, including working on overhead lines, electrical installation and circuit assemblies, etc. presents a direct hazard (potentially fatal) to those constructing the transmission line and maintenance providers (e.g. those that prune trees from near power lines).

Due to the recent increase in household electrification in the Project Area, many villagers in the region may be unaccustomed to the danger posed by the existence of transmission lines near their homes. While Ban Nonsomboun has well established grid electricity with 100% of households connected, the new EDL 22 kV transmission line (implemented in the last six (6) months), now provides electricity to households in Ban Hat Gniun (100%), Ban Thaheua (80%) and Ban Hatsaykham (80%).

The existence of transmission lines also increases the chance of wildfire.

6.3.2 Management and Mitigation

The potential for electrocution for construction personnel and villagers in proximity to construction will be minimised through disruption of power during key phases of construction (anticipated for weekends).

At a minimum, Lao Electrical Power Technical Standards (MIH 2004) will be adhered to for safe clearance standards to live 22 kV transmission lines (refer to Section 2.3.3), to reduce the chance for wildfire, trees knocking-over live wires, boat masts coming into contact with wires crossing the river, etc.

ASA contractors will be obligated to attend a Training and Awareness Program, which should include an occupational health and safety induction training. The Training and Awareness Program will be included in the Contractor's SS-ESMMP.

In addition, the following will be required:

- Provision of appropriate personal protective equipment to all relevant employees in accordance with international industry practices;
- Incorporation of a procedure for periodic safety audit of the PS transmission lines and implement corrective action based on the findings of the audit; and
- Reporting consolidated occupational health and safety performance to Senior Management.

Community Health and Safety Training should be conducted on at least a quarterly basis, to communicate issues to the affected villages, including:

- An awareness program on electrical safety for residents in proximity of EDL / NN1PC transmission and distribution systems; and
- Signage (Dangerous Warning Signs) shall be placed on every tower as well as on conductors where the line is crossing roads and rivers.

6.3.3 Residual Impacts

Provided the facilities are constructed and maintained to standard, maintenance of vegetation is conducted as per requirements, and robust Occupational Health and Safety Training and Community Health and Safety training are provided prior to the commencement of PS Project construction, that hazards from electricity are expected to be avoided.

6.4 Archaeology and Cultural Heritage

6.4.1 Issues and Findings

Although the *Preliminary Archaeology and Cultural Heritage Survey Report* conducted for the NN1 HPP EIA indicates that the greater Project area is rich in sites of archaeological, historical and cultural significance, surveys conducted to-date and village consultation for the NN1 HPP and PS Project have not identified any sites of archaeological or cultural significance within the proposed PS Project ROW.

Three (3) to four (4) ha of spirit forest in Ban Hat Gniun was affected by construction of the original EDL transmission line (refer to Figure 6-1). No further impacts to this forest are required for the upgrade to the transmission line in this area. The Ban Thaheua cemetery forest is fairly close to the proposed PS Project ROW, but is on the opposite side of the road from the alignment and will not be impacted.

A handful of polished stone tools have been found by inhabitants of the region (16 shown to the *Preliminary Archaeology and Cultural Heritage Survey Report* survey team, but many more referred to), which are key indicators of Neolithic Age activity. The objects shown to the survey team have lost their original setting, and therefore cannot in many cases be connected to a site of cultural significance. Three sites of cultural and historical significance have been identified near Ban Thaheau.

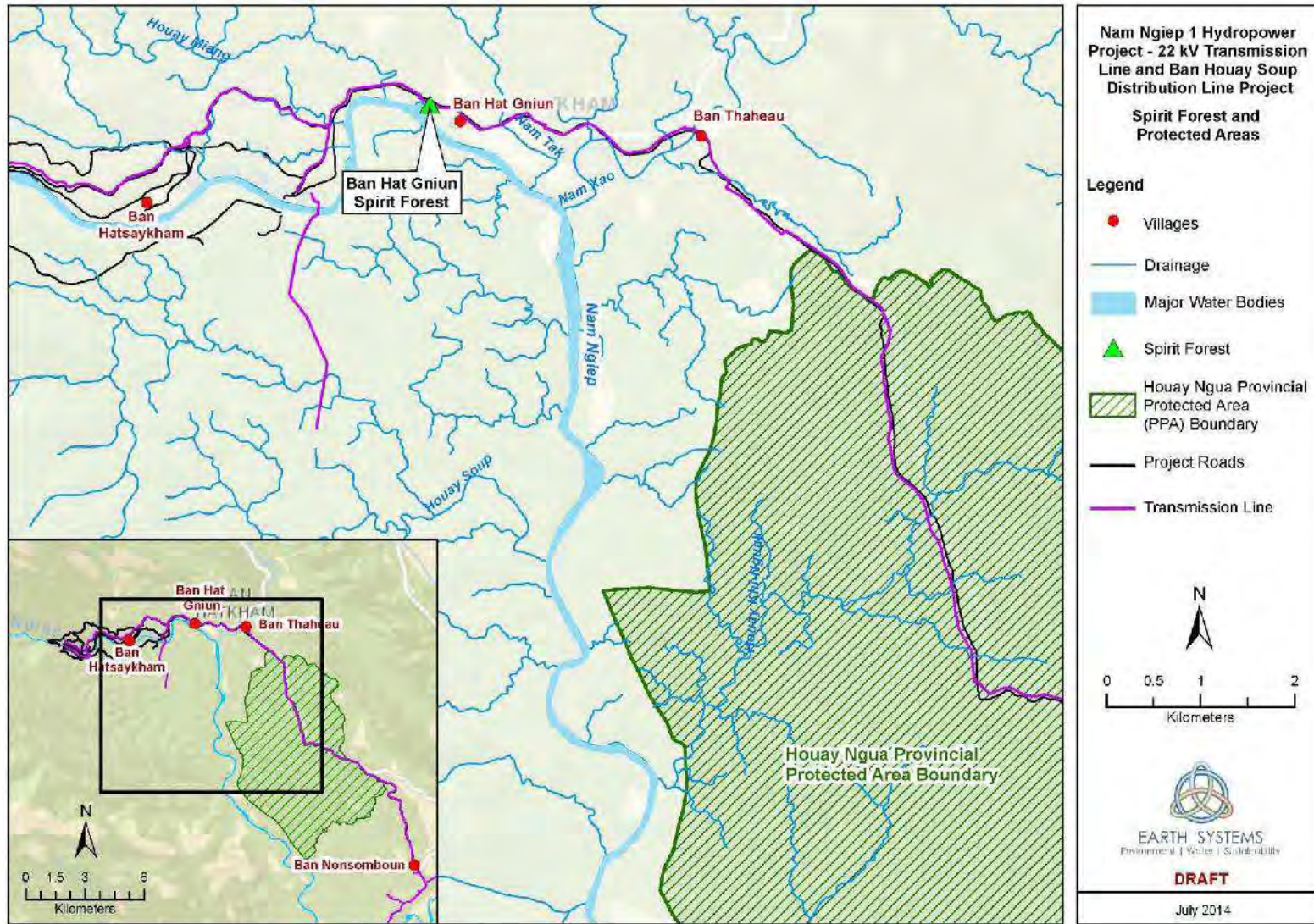


Figure 6-1 Indicative Location of Ban Hat Gniun Spirit Forest

6.4.2 Management and Mitigation

Significant cultural heritage sites in the potentially affected villages will not be impacted by PS Project implementation and therefore do not require specific management and mitigation measures. If the proposed PS Project alignment is changed and impacts are anticipated, villagers will have to be consulted regarding the scope of the impacts and required time and compensation for ceremonies often conducted in advance of disturbance to significant sites in the region.

Potentially impacted cultural sites will be identified prior to construction and appropriate appeasement aspects will be worked out with the appropriate village representatives.

Because the area is rich in archaeological and cultural heritage, chance find of artefacts during construction remains a possibility. It is recommended that a “*Chance Find Procedure*” is developed for the PS Project that identifies the steps taken following chance find of artefacts during construction.

The *Chance Find Procedure* should entail coordination with the existing system at the government level (Ministry of Information and Culture, National Committee for the protection of national cultural heritage) and training of construction personnel in handling and communication requirements following identification of an artefact.

6.4.3 Residual Impacts

With suitable development and implementation of a *Chance Find Procedure* to account for artefacts found during construction, no impacts are anticipated for PS Project construction and maintenance.

6.5 Unexploded Ordinances (UXO)

6.5.1 Issues and Findings

It is estimated that more than 80 million cluster bomblets dropped in Lao PDR during the 2nd Indochina War failed to function, resulting in significant UXO contamination of vast areas of the country (Apopo, 1014). The Bolikhamxay Province is considered one of the 10 heaviest UXO contaminated provinces (Statement by the *Delegation of Lao PDR on Victim Assistance*, Intercessional Meeting of States Parties to the Convention on Cluster Munitions, Geneva, 2013), however the Project Area was not as heavily bombed as for neighbouring Districts.

Unexploded ordinances still pose a risk to construction personnel clearing currently vegetated areas and inhabitants of the region that may find UXO in recently cleared areas.

6.5.2 Management and Mitigation

NN1PC has developed a detailed plan for addressing UXO survey and disposal in its ESMMP-CP, sub plan SP13: Unexploded Ordinance Survey and Disposal. Key management and mitigation measures include:

- An appropriately qualified organisation will be engaged to undertake survey and disposal of UXO in areas where project activities are to take place, prior to the commencement of construction works on-site;
- The first priority method for disposal of UXO should be in-situ explosion. Where this is not possible, due to potential danger to personnel or nearby population or damage to infrastructure, alternative proven methods of disposal may be implemented;
- All cleared areas will be marked and within 30 days of completion of the clearing work at a site a clearance report will be prepared, including:
 - » Description of the UXO survey, disposal and QC processes implemented on site;
 - » Description of UXO located and UXO destroyed; and

- » Certification that the area has been cleared of UXO and is suitable for its intended purpose.
- As part of the construction worker training program, construction personnel will be trained in the potential risks associated with disturbance of UXO and procedures to be followed if UXO are identified during construction; and
- A UXO notification procedure will be implemented in communities that are located in the vicinity of survey and disposal works at the time that the survey and disposal works are undertaken. The UXO notification procedure will include the following;
 - » Notification of local communities regarding the commencement and duration of UXO disposal activities in their area and precautions that should be taken; and
 - » Information to communities regarding the location of cleared areas and the meaning of the cleared area markings or signage (i.e. the delineation between cleared versus un-surveyed areas).

6.5.3 Residual Impacts

The clearance of UXO is an important component of the construction of the PS Project and will provide some lasting benefit from the Project. If appropriate management of UXO is incorporated into PS Project planning and vegetative clearing, the risks associated with UXO are considered low and the benefit to local communities is considered significant.

6.6 Noise

6.6.1 Issues and Findings

The use of excavators, additional earthmoving equipment, and transport vehicles are likely to create nuisance level noise for sensitive receptors when construction work is undertaken in close proximity. Noise monitoring undertaken during road construction work (April, 2014) determined that Project maximum noise emission standards (115 dB(A)) were not exceeded during any of the 72 consecutive hour monitoring sessions for each of the four affected villages. Noise emissions averaged 54.0, 58.7, 52.7 and 55.8 dB(A) for Ban Nonsomboun, Ban Thaheua, Ban Hatsaykham and Ban Hat Gniun, respectively and peaked at 59.0, 100.6, 90.3 and 68.0 dB(A) for the same villages, respectively.

According to data provided in Table 6-1, sound levels above 50 dB(A) start approaching nuisance level noise, depending on the individual receptor. Ambient noise levels in the affected villages appear to be quite high. More elevated noise is likely attributable to road construction, blasting or vehicles passing, though spikes in ambient noise levels may have been the result of chainsaws, tuk-tuks, livestock, children and additional noise not associated with Project activity.

Table 6-1 Reference for A-weighted Sound Levels

Sound Level (dB(A))	Environmental Conditions
140	Threshold of pain (134dB(A))*
130	
120	Loud Nightclub standing at speaker (120dB(A))
110	
100	Pneumatic drill at 5 m (100 dB(A))
90	Powered lawnmower at operators ear
80	Average traffic on street corner (74 dB(A))

Sound Level (dB(A))	Environmental Conditions
70	Telephone ringing at 2m
60	Typical business office (54 dB(A))
50	Living room in suburban area
40	Library (34 dB(A))
30	
20	
10	Threshold of hearing
0	

* A-weighted – the main way of adjusting measured sound pressure to levels which take into account human hearing and our uneven frequency response.

Source: Department of Environment. www.doen.gov.au

Noise emission from PS Project construction is expected to be significantly less than that generated for road construction and NN1 HPP blasting at quarries. Vehicle transport through villages and construction activity near villages will likely create nuisance level impacts but are expected to be significantly less than the Project maximum sound level guideline.

6.6.2 Management and Mitigation

NN1PC has committed to implementing management and mitigation measures provided in the NN1 HPP ESMMP-CP, sub-plan SP04: Noise and Vibration. NN1PC should ensure the contractor includes the following measures (from SP04) in their SS-ESMMP and that the contractor implements these measures throughout construction:

- Stationary noise sources that generate noise levels well above background levels (i.e. 45 dB(A) and above) should be set back as far as possible from dwellings, workforce camps, schools, offices, businesses and other receptor sites;
- Vehicles and equipment should be equipped with appropriate mufflers and / or other noise control equipment;
- All construction personnel working in the vicinity of noisy construction activities (defined as those activities generating noise levels greater than 80 dB(A), or any personnel who requests hearing protection, will be provided with suitable hearing protection (with adequate provision of training, if required); and
- When necessary, suitable noise control barriers will be used to reduce construction and equipment noise levels to acceptable levels in the vicinity of houses, schools, temples and other sensitive receptors.

In addition, NN1PC should consider the following:

- Limit PS Project construction activities to daylight hours; and
- Enforce driving speed limits in villages (as per SP03).

6.6.3 Residual Impacts

Nuisance level noise impacts will occur with active construction in proximity to villages. These impacts will be short-term as the majority of works will not be undertaken in villages (i.e. upgrade of the existing line through villages will not require tower foundation work / erecting).

Transport vehicles and construction vehicles will pass villages and will generate noise, however these impacts will be few (50 construction personnel), for a short duration (6 month construction period), and are expected to be less significant than noise generated from other Project activities.

6.7 Air Quality

6.7.1 Issues and Findings

Clearing of vegetation for the transmission line ROW and for PS Project pole placement will provide bare surfaces susceptible to wind erosion, potentially elevating airborne particulate matter (dust) on windy days.

Trucks and other vehicles travelling on unsealed road surfaces also elevate the volume of airborne dust in proximity to the roads. Transmission line construction will require additional truck and equipment traffic on the unsealed road network for the duration of PS Project activity. As much of the transmission line project is expected to be constructed during the wet season, the generation of associated dust is expected to be low. However, on dry days, transmission line construction vehicles and associated transport vehicles may elevate dust levels, providing nuisance level impacts to sensitive receptors (e.g. villagers, road construction personnel).

During April monitoring for PM₁₀ (particulate matter equal to or less than 10 microns in size) generation during road construction, the NN1PC EMO detected particulate matter at sensitive receptors in excess of the NN1PC Project 24-hour average guideline of 0.12 mg/m³. Twenty-four hour mass averages for Ban Nonsomboun, Ban Thaheua, Ban Hatsaykham, and Ban Hat Gniun were 0.219, 0.067, 0.166, and 0.044 mg/m³, respectively. PM₁₀ mass average volumes exceeded Project guidelines in Ban Nonsomboun and Ban Hatsaykham. Mass maximum volumes were 1.280, 0.469, 0.789, and 0.530 mg/m³ for Ban Nonsomboun, Ban Thaheua, Ban Hatsaykham, and Ban Hat Gniun, respectively – well in excess of the Project guideline for 24-hour average mass volume.

However, road construction was fairly active during the 72-hour monitoring event in Aprils, and vehicle traffic associated with road construction through each of the villages is in excess of that anticipated for transmission line work.

During village consultations for the PS Project and monthly village consultation for NN1 HPP road construction monitoring, residents of Ban Nonsomboun, Ban Thaheua and Ban Hat Gniun have expressed some concern regarding the level of dust generation during NN1 HPP road construction activity. Dust has proven to be a nuisance for residents bordering the roads (as most households do) during the dry season.

6.7.2 Management and Mitigation

NN1PC has committed to minimising dust emissions near sensitive receptors. The ESMMP-CP (Sub-plan SP03: Emission and dust control) identifies the following management and mitigation measures that contractors are to adhere to during construction and during travel on unsealed road networks (that are applicable to the PS Project):

- Dust clearing activities (particularly clearing, excavation and earth moving) will be avoided or minimised during windy conditions;
- If visible dust emissions result from a construction activity, that activity will cease until water spraying has been undertaken to prevent dust emissions in proximity to sensitive receptors (villages and construction camps);
- Speed limits (typically 25 km/hr. or less) will be imposed on all construction or transport vehicles in proximity to sensitive receptors (e.g. through villages);
- Unsealed Project roads, compounds and work areas accessible by vehicle will be regularly sprayed with water to suppress dust when a hazard exists (dry conditions); and
- Exposed surfaces will be progressively rehabilitated within one month following the completion of use to reduce the site dust and erosion hazards.

Affected villages are consulted monthly during routine monitoring to provide a forum for villager questions or complaints regarding Project activities. NN1PC has addressed dust complaints with more frequent road monitoring when the issue has been raised.

6.7.3 Residual Impacts

Particulate matter (dust) emissions during PS Project construction are expected to be low as the majority of works are planned for the rainy season. During dry days, dust emissions are likely. If the contractor sprays roads in proximity to villages during such dry spells, much of the impact will be reduced.

Wind will continue to generate dust from exposed surfaces created by PS Project construction until vegetation has established in the ROW. An incremental increase in dust emissions near cleared areas can be expected for the first one – two years following vegetative removal.

6.8 Vibration

6.8.1 Issues and Findings

The impacts from vibration are expected to be less than that generated from road construction activities and will be significantly less than that generated from blasting at Quarry sites. Vibration levels from road construction and blasting activities have not reached levels that are considered potentially damaging to structures in the region, though there is potential for nuisance level impacts (though this has not been reported by villagers during village consultations conducted for Project road construction monitoring nor through the Grievance Procedure for the road construction project).

Vibration generated from excavators for pole placement and additional equipment will not damage the closest sensitive receptors (structures) and is not expected to create nuisance level vibration impacts.

6.8.2 Management and Mitigation

The management and mitigation measures will include the following:

- Monthly consultation with affected villages (as part of the road and transmission line construction monitoring program) to identify whether impacts are occurring; and
- Ongoing use of the Project Grievance Procedure to identify impacts from vibration.

If impacts are identified, the contractor should consider using alternate equipment.

6.8.3 Residual Impacts

The PS Project is not expected to create impacts to structures in proximity to construction activity. Nuisance level impacts are possible but are not anticipated.

6.9 Short-term Workforce Impacts

6.9.1 Issues and Findings

While small (50 people), the presence of the migrant workforce during the construction period presents a number of potential impacts to the environment and surrounding communities including:

- Increased pressure on non-timber forest products, timber forest products, terrestrial species (hunting) and aquatic species (fishing / collection);
- Increased risk of traffic related safety issues (vehicle strikes);
- Increased risk of introduced diseases including sexually transmitted diseases; and
- Increased risk of conflict due to insensitivity of workforce to local culture and environmental values.

6.9.2 Management and Mitigation

Management and mitigation for potential increased pressure on non-timber forest products, timber forest products and terrestrial aquatic species are provided in Sections 5.1, 5.2 and 5.6.

The NN1PC ESMMP-CP addresses additional impacts from construction workforce in sub-plans SP16: Training and Awareness and SP18 Public safety.

Applicable measures in SP16: Training and Awareness include:

- Works will complete environmental training programs to educate them on the requirements of the environmental management plans, with particular emphasis on:
 - » Prohibition of fire-arms possession;
 - » Traffic regulations;
 - » Illegal logging and collection of non-timber forestry products;
 - » Non-disturbance of villages / resettlement communities;
 - » Hunting and fishing restrictions;
 - » Waste management; and
 - » General health.
- Health Awareness Training will be mandatory for all personnel and will cover the applicable following topics:
 - » Anti-malaria precautions;
 - » Precautions for HIV / AIDS and other venereal diseases;
 - » Recommendations regarding proper disposal of all wastes; and
 - » Use of appropriate toilets.

Applicable measures in SP18: Public safety includes:

- Speed limits will be strictly imposed for construction vehicles in residential areas;
- Drivers will be trained regarding safe driving practices to minimise accidents;
- Securing all construction vehicles and equipment during non-working hours to prevent unauthorised access or use; and
- The contractor shall immediately repair and/or compensate for damage caused by the project to properties (houses, farmlands, aquaculture ponds, irrigation canals, etc.), community facilities such as water supply, power supply, communication facilities and the like.

The following management and mitigation measures should be considered for inclusion in the contractor SS-ESMMP:

- Continual public disclosure and consultation with the local community;
- Implementation of social / cultural issues as part of the Training and Awareness Program to educate outside contractors on the cultural sensitivities of the Project location. Conversely, employees who are local residents should receive cultural awareness training to encourage understanding of incoming workers; and
- Utilise the Community Development Fund to develop and improve social services to ensure that the increased population does not detrimentally affect the quality and availability of services. Priorities for Community Development Fund disbursement will be decided in collaboration with District and Provincial Governments.

6.9.3 Residual Impacts

The duration of PS Project construction (approximately 6 months) will limit the potential for short-term impacts derived from the construction workforce. If the Training and Awareness Program is expanded to include prevention of conflict and dangers of communicable diseases (along with prohibition of resource extraction and public safety management), the risk of impacts to local residents should be minimised to the extent practicable.

7 CUMULATIVE IMPACTS

This section assesses the cumulative impacts of the PS Project, considering existing and future sources of impacts in the catchment and the extent to which the PS Project will contribute. The cumulative impact assessment includes reasonable and conceivable future actions. For the purpose of this assessment, the transmission line's impact upon the environment is considered as the residual impact, after mitigation and management measures have been implemented.

7.1 Issues and Findings

7.1.1 Current and Anticipated Development in the Region

Hydropower

A number of hydropower projects are planned or are currently being constructed in the Nam Ngiep catchment. The Nam Ngiep 2 (Xieng Khouang) hydroelectric power development and Nam Ngiep 1 HPP are the only currently active developments. Nam Ngiep 2 construction is underway upstream of the NN1 Project in the northern section of the catchment. Future developments are expected to include Nam Ngiep 3, Nam Ngiep (Mouang Mai) and Nam Phouan hydroelectric projects.

Forestry

Commercial timber operations and unregulated timber felling are widespread throughout the catchment. Forests in the middle reaches of the Nam Ngiep catchment are designated as production forest. The Nam Ngiep catchment covers 423,000 ha, with 247,104 ha of protection forest and 119,750 ha of production forest. Current estimated annual yield from the catchment is 28,740 m³. Commercial timber operations will continue in the production forests, which may expand in the area as a result of expansion of the road network for the various large scale development projects. Similarly, in-migration for these projects is expected to increase small-scale harvesting.

Mining

There are currently no active mines or mining leases in the Nam Ngiep catchment. Seven mining leases are known to be under review for future exploration partially or wholly within the Nam Ngiep catchment. At least three leases under review are upstream of the PS Project Area, including one near the middle of the catchment and two within the upper reaches of the catchment to the north of the PS Project Area.

Agriculture

Humans and human settlements have had a significant impact on the environment. Agricultural land covers much of the area surrounding the PS Project Area, including regrowth from previous shifting cultivation (i.e. old and new fallow land). Eucalyptus plantations and an increasing number of rubber plantations occur in proximity to the PS Project Area near Ban Nonsomboun.

Villages and Settlements

Four villages occur in the PS Project Area, one of which will be relocated to Ban Houay Soup. The villages are connected by an unsealed road that is currently being upgraded by the NN1 HPP.

7.2 Cumulative Impact Assessment

Construction, operations and/or the existence of the sources outlined in Section 7.1 will cumulatively impact physical, biological and / or social components of the Nam Ngiep catchment. The Cumulative

Impact Assessment for the *NN1 HPP EIA* provides a more comprehensive assessment of impacts from developments in the region as the scope of impacts from the NN1 HPP far exceed that anticipated for the PS Project. The impacts summarised below from current and anticipated future developments in the region (Sections 7.2.1 – 7.2.5), include those potential impacts that the PS Project may contribute to. The anticipated PS Project contribution to these impacts is addressed in Section 7.3.

7.2.1 Water Quality

The construction of major development infrastructure and associated land clearing is expected to significantly increase erosion and sedimentation of the Nam Ngiep and may contribute to additional water quality issues. According to the results of monthly monitoring for the NN1 HPP, upstream developments are currently contributing to turbidity and sediment loading in the Nam Ngiep.

Hydropower projects, mining projects, agriculture, and additional activities may lead to increased nutrients, pathogens, hydrocarbons and additional hazardous and non-hazardous waste in the Nam Ngiep.

Mining within the catchment may lead to acid mine drainage and discharge of other hazardous substances (e.g. cyanide) into the river.

7.2.2 Air Quality and Noise

Air emissions occur as a result of exploration, construction and operational activities during major project developments. Some impacts will be short-term, and will occur primarily during the dry season (e.g. dust).

Other possible emissions include CO, NO_x and VOCs from the exhaust of diesel and petrol powered vehicles resulting from increased traffic. It is likely there will be gas emissions from fuel combustion in stationary and mobile generators, until region-wide electrification is established. Livestock will contribute methane and additional air quality impacts.

7.2.3 Terrestrial Biodiversity

Impacts on vegetation are likely to occur due to a combination of:

- Increased fragmentation and degradation of remaining forest resources due to edge effects and exposure to weeds, pests, erosion and fire;
- Increased population pressure on land/forest resources due to in-migration associated with major projects (potentially including threatened species); and
- Increased accessibility of forest along access roads constructed or upgraded for these projects.

Regional development may result in the introduction and / or spread of non-native and invasive plant species. Non-native plants pose a threat to the biological diversity of the region by competing with native species and affecting natural processes such as plant community succession. Invasive species have already been introduced to the region. *Chromolaena odorata* appears to be widespread in the area and is considered as one of the world's 100 top invasive species (ISSG, 2014).

Current and future developments may lead to an increase in hunting and wildlife trading resulting from Project related in-migration and associated increases in demand for wildlife products as well as improved access to previously unexploited areas. .

7.2.4 Aquatic Biodiversity

Significant hydrology and water quality changes have the potential to impact aquatic biota. The most significant water quality issue is expected to be from erosion and sedimentation from construction activities. Since both mining and hydroelectricity projects require vegetation removal and generally construction of infrastructure within aquatic habitats, there is potential for species to be lost and downstream environments to be altered.

7.3 Contribution of the NN1PC Transmission Line to Cumulative Impacts

If regularly and appropriately maintained, the transmission line is a relatively permanent feature within the landscape. Maintenance should require little disturbance to the environment, simply curtailing vegetation growth in the ROW. Post construction and once in operation, the PS Project's contribution to cumulative impacts in the region will be almost negligible (i.e. vegetation pruning). Therefore a reasonable timeframe to assess cumulative impacts includes the PS Project construction phase and one to two years post construction, until vegetation has re-established and erosion-related impacts have stabilised.

It is expected that the NN1PC Transmission Line Extension will contribute little to the overall cumulative impacts on the regional environment for the following reasons:

- The PS Project will not impact hydrology in the region;
- PS Project impacts to terrestrial and aquatic species (including listed species) is expected to be negligible;
- Very little vegetation will be removed for the installation of the PS Project and the majority of vegetation that will be removed is disturbed or modified;
- Establishment of vegetation (~1-3 years following clearance) will prevent ongoing erosion and subsequent sediment loading of waterways;
- As the PS Project will be primarily constructed along an active road network, habitat in the proposed ROW is not high value; and
- PS Project impacts are expected to be minimal and short-term, and will provide for a very small proportion of any cumulative impacts.

However, the PS Project is expected to increase erosion and sediment transport to the Nam Ngiep during construction and likely for a few years following construction. Though its contribution will be comparatively small, it will be a contributor to an existing problem for the Nam Ngiep (rainy season sediment transport).

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING

Whilst most impacts of transmission line development will occur during the construction phase, some impacts are anticipated to occur through general maintenance activities undertaken on an ongoing basis. Further, monitoring activities will be required to manage anticipated impacts and continually implement adaptive management.

In accordance with current land use rights, the following environmental and social management measures for the NN1 HPP Project covers the PS Project ROW. Environmental and social management measures for the EDL REP 2 Project are incorporated into the management of the PS Project and are will cover components under EDL jurisdiction (refer Appendix C).

8.1 Institutional Structure for Management

Senior Management at NN1PC is responsible for the ongoing implementation of management and monitoring activities throughout the life of the Project.

8.1.1 Environmental and Social Division (ESD)

NN1PC has established an Environmental and Social Division, responsible for environmental and social management during the construction phase. An Environmental Monitoring Office (EMO) and Social Monitoring Office (SMO) have been established under the ESD to carry out the ongoing monitoring requirements of the overarching NN1 HPP. Environmental and Social Division Manager have been appointed to oversee the implementation of the ESMMP-CP.

Responsibilities of the ESD include:

- Establishment of the ESMMP-CP and Environmental and Social Policy;
- Communication of the Environment and Social Policy, Rules and Standards to concerned parties (i.e. Owner and Construction Contractors);
- Management of the environmental, social, economic and resettlement components, using consultant inputs as required;
- Monitoring and reporting on the effectiveness of implementation of the mitigation measures, social development activities, and resettlement program;
- Reporting of the implementation status, performance and compliance to senior management of the Project; and
- Coordination of activities during construction with relevant government agencies. The Head Contractor (Obayashi) is responsible for abiding by the mitigation measures of this ESMMP-CP and the site specific ESMMP-CP during the construction phase. The Head Contractor must appoint a qualified Environmental Officer prior to commencement of construction.

NN1PC shall establish a grievance redress mechanism that addresses communication with local residents regarding EDL / NN1PC responsibilities and compliance.

8.1.2 Environmental Monitoring Office (EMO)

During the construction phase, the EMO is comprised of an Environmental Manager (EM) and Environmental Officers (EOs). The EM/EO is responsible for the implementation of the ESMMP-CP during

the construction phase and liaison between the Owner, Head Contractor and the authorities. The EMO is responsible for a number of activities, including:

- Having a working knowledge of the environmental impacts, mitigation measures and recommendations of the ESMMP-CP;
- NN1PC EMO will monitor construction and maintenance of the transmission line as part of its routine compliance monitoring for pre-construction activities (e.g. roads and ancillary facilities) and through application of measures identified in the SS-ESMMP;
- Reviewing and approving the contractor' Site Specific ESMMP-CP;
- Acting as a primary point of contact between the GOL authorities and the Project on environmental issues;
- Reviewing and improving method statements for environmental aspects prior to work starting;
- Verifying that tender documents and civil works contracts include the Project ESMMP-CP and specify requirement for preparation and implementation of contractor Site-Specific ESMMP-CP;
- Monitoring construction performance to verify that appropriate control measures are implemented to comply with the ESMMP-CP;
- Recommending corrective action for any environmental or social non-compliance incidents on the construction site, and provide advice and liaison with the construction teams to ensure that environmental risks are identified and appropriate controls are developed;
- Compiling regular reports addressing environmental performance progress and any non-compliance issues to relevant parties, including submitting bi-annual monitoring reports to ADB through the ESD;
- Providing data and information to the lenders' environment specialist tasked to audit the environmental performance of the completed transmission lines. This data and information include the approved ESMMP-CP, SS- ESMMP-CPs, proof of delivery of training program, environmental monitoring reports, engineer's logbook, records of compliance check, contractor's report on environmental performance and incidents, environmental register of all incidents that occurred on the site during construction;
- Informing affected parties of any changes to the construction program. The contact numbers of the EOs shall be made available to the affected parties. This will ensure open channels of communication and prompt response to queries and claims; and
- Liaising and cooperating with responsible GOL authorities in arranging for adequate meeting and reporting to GOL on a regular basis.

8.1.3 Social Monitoring Office (SMO)

The Social Monitoring Office (SMO) has been established to implement and co-ordinate the social activities of the Project. The SMO is led by a Senior Social Manager, who reports to the Deputy Manager of the ESD. Key responsibilities include:

- Implementation of social obligations as per the Concession Agreement, Resettlement and Development Plan and Action Plans;
- Co-ordination and interaction with Project Stakeholders;
- Implementation of social programs including:
 - » Resettlement Infrastructure;
 - » Resettlement and Livelihood Restoration;
 - » Social Development; and

- » Monitoring and Documentation.

The SMO may be supported by specialist national and international consultants where required.

8.2 Key Documentation

8.2.1 Environmental and Social Management and Monitoring Plan-Construction Phase (ESMMP-CP)

An Environmental and Social Management and Monitoring Plan-Construction (ESMMP-CP) was prepared for the Nam Ngiep 1 HPP by ERM-Siam in December 2013. Nam Ngiep1 Power Company (NN1PC) will incorporate applicable management and mitigation requirements of the ESMMP-CP for PS Project construction and maintenance.

The ESMMP-CP was prepared to address environmental and social compliance of NN1PC during the construction phase. The ESMMP will continually be revised during the construction phase, as a result of Project scope change, significant environmental incidents or identification of insufficient or ineffective impact management through the environmental and social monitoring program.

Under the ESMMP-CP, a number of sub-plans were developed to provide management and mitigation strategies across the breadth of environmental and social impacts. These include:

- Erosion and Sediment Control;
- Water Availability and Pollution Control;
- Emissions and Dust Control;
- Noise and Vibration;
- Waste Management;
- Vegetation Clearing;
- Landscaping and Re-Vegetation;
- Protected Area Management;
- Biodiversity Management;
- Unexploded Ordinance (UXO) Survey and Disposal;
- Traffic and Access;
- Public Safety;
- Damage to Properties and Facilities; and
- Cultural Resources.

Management and mitigation measures detailed in these sub plans are expected to be incorporated into the Contractor SS-ESMMP and implemented where relevant for the construction and upgrade of the PS Project transmission lines.

8.3 Management and Monitoring Program

A management and monitoring program has been developed, based on existing structures of environmental and social management for the NN1 HPP. A summary of relevant management and monitoring measures are detailed in Table 8-1 below.

Table 8-1 Environmental and Social Management and Monitoring Plan

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
DESIGN AND CONSTRUCTION						
Terrestrial Biodiversity	Impact on terrestrial vegetation, terrestrial fauna, forest resources and protected areas	Minor – Moderate	Avoid clearance of primary and mixed deciduous forest wherever possible.	Biodiversity Management, Vegetation Clearing	ESD	EMO
			Layout plan (minimising size of access routes and tower sites) will be prepared to minimise vegetation clearing	Biodiversity Management, Vegetation Clearing	ESD, Contractor	EMO
			Avoid use of herbicides to control vegetation along the ROW. If required, select appropriate herbicides and carefully follow the MSDS.	Biodiversity Management, Vegetation Clearing	ESD	EMO
			Avoid burning where possible. If needed, fires should be carefully controlled to ensure they do not impact areas outside of the ROW.	Biodiversity Management, Vegetation Clearing	ESD	EMO
			Identify sensitive habitats and important NTFP areas close to access road / transmission line construction areas and designate these as ‘no go’ areas	Biodiversity Management; Vegetation Clearing	ESD	EMO
			Maintain forest cover as close as possible to the edge of the Transmission Line components.	Biodiversity Management; Vegetation Clearing	ESD, Contractor	EMO
			Only use native, non-invasive plant species in re-vegetation work.	Biodiversity Management; Landscaping and Re-vegetation	ESD	EMO
			Closely monitor land clearance activities throughout the construction phase to ensure that vegetation is not cleared beyond pre-defined Project boundaries. Measures should include clear demarcation of ROW boundaries clearance prior to vegetation	Biodiversity Management, Vegetation Clearing	ESD, Contractor	EMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			clearance.			
			Where residual land clearing cannot be avoided, implement the recommended offset package outlined in the Biodiversity Offset Design Report (ERM 2013)	Biodiversity Management, Vegetation Clearing, Landscaping and Re-vegetation	ESD	EMO
			Ensure that the final alignment minimises potential impacts on protected areas and other environmentally sensitive sites where possible.	Protection Area Management, Biodiversity Management.	EDL	
			Establish camps in locations that will minimise erosion and potential disturbance to drainage lines; during clearing for camps and depts. Areas; stockpile surface soils to enable rehabilitation of these areas on Project completion.	Biodiversity Management, Erosion and Sediment Control, Landscaping and Re-vegetation, Construction of Work Camps	ESD, Contractor	EMO
			Progressively rehabilitate and re-vegetate disturbed areas outside the ROW. Temporary access roads should be re-vegetated unless required for community use. Use local species and if naturalised species are required for quick establishment – ensure non-invasive species for re-vegetation and rehabilitation work.	Biodiversity Management, Vegetation Clearing, Landscaping and Re-vegetation	ESD / Contractor	EMO
			Consider the implementation of measures to minimise impacts on birds and mammals due to electrocution and wire strikes.	Biodiversity Management	EDL, ESD	
			Construction workers should be restricted from fishing, hunting and trading wild animals and ensure that adequate alternative sources of food are available.	Biodiversity Management	Contractor	EMO
			Supply alternative fuel for cooking and heating in the labour camp or ensure fuel wood supplies are	Biodiversity Management	Contractor	EMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			purchased from village sources. Collection of firewood and other forest products should be prohibited.			
Erosion and Sediment Control	Erosion and sediment control during project construction	Minor	Schedule construction activities during the dry season (low rainfall), where possible.	Vegetation Clearing, Erosion and Sediment Control, Landscaping and Re-vegetation	ESD, Contractor	EMO
			Minimise the area of land cleared for Project construction work, and retain vegetation in riparian and other suitable locations to maximise filtration of sediment from turbid runoff, during and post construction.	Vegetation Clearing, Erosion and Sediment Control, Landscaping and Re-vegetation	ESD, Contractor	EMO
			Closely monitor land clearance activities throughout the construction phase to ensure that vegetation is not cleared beyond pre-defined Project boundaries.	Vegetation Clearing, Erosion and Sediment Control, Landscaping and Re-vegetation	ESD, Contractor	EMO
			Install drainage control structures at suitable locations to divert clean runoff away from disturbed land surfaces, and to allow for frequent and safe discharge where runoff is concentrated, but without creating deeply incised scour paths.	Vegetation Clearing, Erosion and Sediment Control	ESD, EMU, Contractor	EMO
			Stockpile materials (excavated soil, quarry materials etc.) will be located at least 30m away from steep slopes, watercourses or drainage paths.	Erosion and Sediment Control	ESD, Contractor	EMO
			Install erosion and sediment control structures such as silt fences and sediment ponds at suitable locations to filter or collect eroded sediments from turbid runoff, where necessary.	Erosion and Sediment Control	ESD, Contractor	EMO
			Progressively re-vegetate disturbed land surfaces	Landscaping and Re-	ESD, Contractor	EMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			at the Transmission Line site as soon as practicable, to facilitate long term stabilisation.	vegetation, Erosion and Sediment Control		
			Once construction activities are complete, progressively re-vegetate disturbed land surfaces at the sub-station and tower as soon as practicable, to facilitate long term stabilisation.	Landscaping and Re-vegetation, Erosion and Sediment Control	ESD, Contractor	EMO
			Compensate villagers for any lost land, assets and livelihood, associated with sediment deposition. <i>Note: Compensation (associated with land assets) is currently under negotiation under the EIA for the overall NN1 HPP Project, and does not need to be considered for this IEE.</i>	Resettlement and Development Plan, Erosion and Sediment Control	ESD	SMO
			Conduct regular water quality monitoring to ensure mitigation measures are working effectively.	Erosion and Sediment Control, Water Availability and Pollution	EDS	EMO
Noise	Nuisance noise impacts	Minor	Limit the hours of operation to daylight hours. Consult local residents if some evening work is required.	Noise and Vibration	ESD, Contractor	
			Use of sound dampening equipment with machinery.	Noise and Vibration	ESD, Contractor	EMO
			Regular noise and vibration inspections will be undertaken.	Noise and Vibration	ESD, Contractor	EMO
			Personal Protective Equipment (PPE) will be available for all construction personnel working in areas with noise above 80dB	Noise and Vibration, Project Personnel Health Program	ESD, Contractor	EMO
			The distance between the stationary equipment and sensitive receptors (i.e. village settlements) should be maximised where possible to reduce noise	Noise and Vibration, Resettlement and Development Plan	ESD, Contractor	EMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			impacts associated with construction activities.			
Air quality	Dust emissions	Minor	Vegetation removal and disturbance should be minimised, where practicable.	Emissions and Dust Control, Vegetation Clearing	Contractor	EMO
			Water roads and / or construction areas to minimise generation of wind-blown dust.	Emissions and Dust Control, Noise and Vibration	Contractor	EMO
			PPE for emission protection to workers will be provided where they are exposed to emission generation, or if it is requested.	Emissions and Dust Control, Project Personnel Health Program	Contractor	EMO
			Sites available for regeneration should be planted during the first planting season following their availability.	Emissions and Dust Control, Landscaping and Re-vegetation	Contractor	EMO
	Vehicle exhaust	Negligible	Use low emission trucks and mechanical equipment.	Emissions and Dust Control, Traffic and Access	ESD, Contractor	EMO
			Speed limits should be strictly enforced through village or settlement areas.	Emissions and Dust Control, Traffic and Access	ESD, Contractor	EMO
Surface and Ground Water	Increased total suspended solids (TSS) and turbidity downstream of construction areas.	Minor	Refer to above measures for 'Erosion and sediment control'	Water Availability and Pollution Control, Erosion and Sediment Control	Contractor	EMO
	Changes to pH downstream of project areas.	Negligible	Install sedimentation ponds to collect runoff from concrete preparation and construction sites.	Water Availability and Pollution Control, Erosion and Sediment Control	ESD, Contractor	EMO
			Treat (neutralise) runoff from concrete preparation and construction sites, if necessary, prior to off-site discharge.	Water Availability and Pollution Control, Erosion and Sediment Control	ESD, Contractor	EMO
			Prevent washing of excess concrete/ cement from	Water Availability and Pollution Control, Erosion and	Contractor	EMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			vehicles or equipment adjacent to or in streams.	Sediment Control		
			Avoid use of herbicides to control vegetation along the ROW. If required, select appropriate herbicides and carefully follow the MSDS.	Water Availability and Pollution Control, Erosion and Sediment Control, Vegetation Clearing	ESD, Contractor	EMO
	Accidental release of oil or hydrocarbons	Minor	Store liquid hydrocarbons (fuels, oils and lubricants) in leak-proof containers within suitably designed bunded areas with appropriate capacity (>110% of contained fuel).	Water Availability and Pollution Control, Hazardous Material Management	EMO/Contractor	EMO
Provide temporary shelters to prevent rainfall entering bunded areas.			Water Availability and Pollution Control, Hazardous Material Management	Contractor	EMO	
Store absorbent material in hydrocarbon storage areas.			Water Availability and Pollution Control, Hazardous Material Management	Contractor	EMO	
Store spill response kits at suitable locations, in case of spills outside bunded areas.			Water Availability and Pollution Control, Hazardous Material Management	Contractor	EMO	
Conduct regular maintenance of vehicles and equipment to prevent hydrocarbon leaks.			Water Availability and Pollution Control, Hazardous Material Management	Contractor	EMO	
Conduct vehicle / equipment maintenance in designated areas where contaminated runoff can be contained.			Water Availability and Pollution Control, Hazardous Material Management	Contractor	EMO	
Park vehicles and equipment on sealed surfaces where contaminated runoff can be contained.			Water Availability and Pollution Control, Hazardous Material Management	Contractor	EMO	

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
	Hydrology	Minor	Drainage in cleared areas will be designed and constructed to retain surface runoff and facilitate infiltration.	Water Availability and Pollution Control,	Contractor	EMO
General Waste and Hazardous Material	Potential health and safety impacts	Minor	Minimise the production of waste.	Waste Management	Contractor	EMO
			Store sewage and solid waste in septic tanks or treatment ponds.	Waste Management	Contractor	EMO
			Maximise waste recycling and reuse.	Waste Management	Contractor	EMO
			Properly dispose of waste and regularly clean-up the areas affected.	Waste Management	Contractor	EMO
			Store any oils and hydrocarbons (including oily waste) at the construction site in a fully bunded area with appropriate drainage installed to prevent the runoff of oil-contaminated water.	Waste Management, Hazardous Material Management	Contractor	EMO
			Clearly label hazardous materials and waste storage sites with appropriate signage in both English and Lao.	Waste Management, Hazardous Material Management	Contractor	EMO
			Maintain an inventory of all hazardous materials on site and update regularly.	Waste Management, Hazardous Material Management	Contractor	EMO
			Remove hazardous waste from site following the completion of construction, and disposed of properly off-site or sold for reuse	Waste Management, Hazardous Material Management	Contractor	EMO
Construction Waste	Health, safety and nuisance impacts of improperly disposed waste.	Minor	Provide vegetation debris from the ROW to residents for firewood, making charcoal or other uses (e.g. making fences).	Waste Management, Vegetation Clearing	Contractor	EMO
			Recycled or dispose of packaging waste in the local landfill.	Waste Management	Contractor	EMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
Social Management	Temporary loss of electricity supply	Moderate-High	Ensure adequate forewarning of works to residents and business owners	Public Safety; Damage to Properties and Facilities	Contractor	SMO
Land use	Impact on land use	Moderate	Fair compensation paid for acquired land based on current market rates, taking into account land capability. <i>Compensation (associated with land assets) is currently under negotiation under the EIA for the overall NN1 HPP Project, and does not need to be considered for this IEE.</i>	Resettlement and Development Plan	RMU/SMO, ESD	SMO
			Replace or re-install utilities and facilities (such as ground water pumps, fishing ponds, access tracks) disturbed by the PS Project. <i>Compensation (associated with land assets) is currently under negotiation under the EIA for the overall NN1 HPP, and does not need to be considered for this IEE.</i>	Resettlement and Development Plan	RMU/SMO, ESD	SMO
			The distance between the transmission line corridor and village settlements should be maximised where possible to reduce impacts associated with construction activities and visual amenity.	Resettlement and Development Plan	NN1PC	
			Adequate compensation should be provided to local villagers for loss of access to timber and NTFPs within their village land. <i>Compensation (associated with land assets) is currently under negotiation under the EIA for the overall NN1 HPP, and does not need to be considered for this IEE.</i>	Resettlement and Development Plan	RMU/SMO, ESD	SMO
			Vegetation and trees to be cleared should be marked before clearance to ensure that minimal	Vegetation Clearing	Contractor,	

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			clearance occurs.		NN1PC	
			Felled trees and other cleared or pruned vegetation should be made available to the owner.	Vegetation Clearing, Resettlement and Development Plan	Contractor, NN1PC	EMO
			Harvesting of commercial timber to be coordinated with the GOL. Other felled trees and other cleared or pruned vegetation to be made available to the owner (individual or village), or removed if requested by the owner.	Vegetation Clearing, Resettlement and Development Plan	Contractor, NN1PC	EMO
			Trees that can survive pruning to less than 3 m should be pruned – not cleared, to provide the required line of clearance.	Vegetation Clearing, Resettlement and Development Plan	NN1PC, Contractor	EMO
			Compensation for removed or pruned trees should be based on the variety, age, productivity and the on-farm cost of production (including hire labour and processing, where relevant). <i>Compensation is currently under negotiation under the EIA for the overall NN1 HPP, and does not need to be considered for this IEE.</i>	Vegetation Clearing, Resettlement and Development Plan	EMU, ESD	EMO
			A one-off payment to be made to affected land owners to offset the devaluation of land within the ROW due to reduced land capability.	Resettlement and Development Plan	RMU/SMO, ESD	SMO
			Village use and spirit forest land should be avoided. If unavoidable, the commercial, livelihood and cultural value of these resources should be assessed, villages consulted and suitable compensation / mitigation actions agreed to.	Resettlement and Development Plan, Cultural Resources	ESD	SMO
			Construction activities to be timed to avoid	Resettlement and	Contractor	SMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			disturbance of field crops where possible.	Development Plan		
			Where crop disturbance is unavoidable, compensation to be paid prior to harvest based on market or agreed price.	Resettlement and Development Plan	RMU/SMO, ESD	SMO
			Access track construction to be minimised. Established roads to be used for construction and maintenance where possible. Where construction of access routes is required, they should be restricted to a single carriage way within the ROW.	Resettlement and Development Plan, Traffic and Access	Contractor	EMO
			Temporary concrete batching plants to be located on disturbed sites or areas of low production value (e.g. grass land where possible).	Resettlement and Development Plan,	Contractor	EMO
			Spoil disposal areas to be identified prior to beginning construction. Productive land areas and areas important for biodiversity to be avoided.	Resettlement and Development Plan, Spoil Disposal	ESD	EMO
Cultural Heritage and Archaeology	Loss of physical cultural resources	Minor	Establish and implement a NN1PC Chance Find Procedure for all construction work.	Cultural Resources	ESD	ESD
			Develop and implement an Archaeological and Cultural Heritage Chance Find Procedure for all construction and operation works. If any archaeological or cultural heritage site/artefacts encountered during vegetation clearance or excavation, the work to be stopped and the Ministry of Information and Culture to be informed. Postponed construction work to be resumed after inspection and approval by the authorities.	Cultural Resources, Vegetation Clearing, Landscaping and Re-vegetation	Contractor	EMO / SMO
			Training should be provided to the nominated Project official to ensure that there is suitable expertise available on site to recognise any	Cultural Resources	ESD, EMO/Contractor	EMO / SMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			archaeological or cultural heritage finds.			
			In general, do not disturb burial sites and other cultural heritage sites if the land is not required by the PS Project components.	Cultural Resources	ESD, Contractor	EMO / SMO
			Where the Transmission Line will directly or indirectly impact cemetery/gravesite areas, consult with affected villages regarding potential impact on cemetery areas and ensure that a consensus regarding the potential impacts and mitigation measures is obtained.	Cultural Resources	ESD	EMO / SMO
			If any specific cultural heritage sites (e.g. cemeteries) will be directly impacted, engage a Lao cultural anthropologist (or other appropriately qualified expert) to carry out the consultation process, supervise any site relocation, and oversee appeasement ceremonies where required.	Cultural Resources	ESD, Contractor	EMO / SMO
			Villagers should be given primary responsibility for the relocation of any cemeteries or other sites of cultural significance (if required), with support from NN1PC.	Cultural Resources	ESD	EMO / SMO
			Where appropriate ceremonies may also be required for nearby spirit huts if the amenity of these sites will be impacted by Project activities.	Cultural Resources	ESD	EMO / SMO
Health and Safety	Increased spread of diseases, including	Minor	Where possible, local labour to be used.	Project Personnel Health Program, Public Safety	ESD, Contractor	SMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring	
	sexually transmitted infections		Public health information to be provided to the construction workforce and community before commencement of works – including information on STIs.	Project Personnel Health Program, Public Safety	NN1PC, Contractor	SMO	
			Construction contractor to prepare an Occupation Health and Safety Plan and provide related training and instructions to staff and sub-contractors during induction.	Project Personnel Health Program, Public Safety	NN1PC	EMO / SMO	
	Construction hazards	Minor	Construction sites to be well marked and access well controlled. Warning signs to be presented where necessary.	Project Personnel Health Program, Public Safety	ESD, Contractor	EMO	
	UXO	Minor	Areas of high likelihood of UXO contamination to be surveyed prior to engaging in construction activities. Surveyed and cleared areas to be marked.	Unexploded Ordinance Survey and Disposal, Project Personnel Health Program, Public Safety	NN1PC	EMO /SMO	
	Electrocution risk and effects of electro-magnetic radiation	Minor	Adhere to EDL standards for operational safety around live conductors.	Project Personnel Health Program, Public Safety	Contractor	EMO / SMO	
			Danger and Warning Signs to be erected on every tower as well as on conductors where the line is crossing a road or river.	Project Personnel Health Program, Public Safety	Contractor	EMO	
			Appropriate conductor materials to be used to minimise health and safety risks.	Project Personnel Health Program, Public Safety	ESD, Contractor	EMO	
	Local infrastructure: Roads	Temporary loss of road use and access routes	Minor	Post warning signs to indicate slowing traffic, merging lanes and change of route.	Traffic and Access, Public Safety	Contractor	EMO
				Identify alternative access routes when roads are blocked.	Traffic and Access	Contractor	EMO
				Head contractor to adopt road safety practices including posting warning signs and appropriate	Traffic and Access	Contractor	EMO

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Relevant Nam Ngiep HPP EIA Sub-Plan	Responsibility for Implementation	Responsibility for Monitoring
			management of traffic.			
OPERATIONS PHASE						
Terrestrial Biodiversity	Impact on terrestrial vegetation, terrestrial fauna, forest resources and protected areas	Moderate	Maintain forest cover as close as possible to the edge of all Project components.	Vegetation Clearing, Biodiversity Management	ESD, NN1PC	EMO
			ROW checking and maintenance of ROW should be conducted at least once or twice a year.	Vegetation Clearing, Biodiversity Management	ESD, NN1PC	EMO
			Burning to be avoided where possible. If required, fires to be carefully controlled to ensure they do not impact areas outside if the ROW.	Vegetation Clearing, Biodiversity Management	ESD, NN1PC	EMO
Water Quality	Contamination from leakage of oils from transformers	Minor	Transformers to be constructed within a concrete banded area to contain any spills or leaks.	Water Availability and Pollution Control, Waste Management	ESD, NN1PC	EMO
			Transformers to be periodically inspected.	Water Availability and Pollution Control, Waste Management	ESD, NN1PC	EMO / Supplier
	Contamination from use of herbicides	Minor	Avoid use of herbicides to control vegetation along the ROW. If required, select appropriate herbicides and carefully follow the MSDS.	Water Availability and Pollution Control	ESD, NN1PC	EMO
Health and Safety	Electrocution risk	Minor	EDL standards for safe clearance to live conductors for a 22 kV transmission line to be adhered to.	Project Personnel Health Program, Public Safety	EDL Branch Office	EMO / EDL
			Danger and Warning Signs to be placed and maintained on every tower as well as on conductors where the line is crossing a road or river.	Project Personnel Health Program, Public Safety	EDL Branch Office	EMO
	Effects of electro-magnetic field	Minor	ROW to be maintained through periodic inspections.	Project Personnel Health Program, Public Safety	ESD	EMO

9 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

9.1 Objectives of Public Consultation and Disclosure

Consistent with the greater NN1 HPP, the goal of public consultation and disclosure for the PS Project is to improve decision-making, build understanding to ensure the long-term viability of the Project and to enhance potential Project benefits.

Specific objectives of the consultation and disclosure process are to:

- Ensure that Project affected communities and other stakeholders are well informed of the Project, its environmental and social impacts, and management measures;
- Ensure stakeholder feedback on the Project and its impacts is gained through simple and effective communication processes; and
- Promote inclusive and informed decision making on the development and management of the Project.

9.2 Project Stakeholders

Stakeholders, as defined by Lao legislation, are “any person, legal entity or organisation who/which are interested in, involved in, or have interests in an investment project, an activity or a matter (related to the project) because they are involved in or (are likely to be) affected by the investment project” (MONRE 2010).

Key stakeholders identified during the IEE include:

- Project affected people (PAPs): Residents and businesses in PS Project affected villages of Ban Nonsomboun, Ban Hat Gniun, Ban Thaheua and Ban Hatsaykham):
 - Persons losing land or assets to the PS Project; and
 - Villagers that may experience impacts during construction and operation phases of the PS Project.
- Government authorities (i.e. Provincial and district Ministry of Environment and Natural Resources; Protection Area Managers);
- Project Owners (EDL and NN1PC);
- Project Contractors (i.e. Obayashi Corporation, EDL and ASA); and
- REP 2 Partners (i.e. EDL and World Bank).

As the PS Project will utilise the existing EDL and NN1 PC Roads right of ways, impacts to villager land and assets is expected to be very minor and confined to the upgrade of current EDL transmission line structures.

9.3 Consultation Activities

A series of PS Project consultations were conducted during the preparation of this IEE and are summarised in Table 9-1. The purpose of these activities was to introduce the Project, collect information on the Project Area, and seek feedback from key stakeholders.

At each consultation, a brief description of the Project was provided and participants were given an opportunity to provide comments, advice or information relevant to the Project. Standard forms were used to record the meeting discussions.

Table 9-1 Summary of consultations conducted during the IEE process

Date	Consultation	Stakeholders
5 th June 2014	Project Kick-off meeting with NN1PC	EMO Technical Staff
11 th June 2014	Government Meeting	Bolikhamxay Forest Resource Management Division Head; Houay Ngua Provincial Protection Area Manager
12 th June 2014	Project Design Meeting 1 (EDL)	EDL Deputy Manager and technical staff (x 3); NN1PC Technical Department Manager and technical staff (x2); Obayashi Corporation Assistant Manager and technical staff (x2).
12 th June 2014	Project Design Meeting 2 (NN1 HPP Project)	Obayashi Corporation Assistant Manager and technical staff (x2).
13 th June 2014	Field Surveying of PPA	Houay Ngua Provincial Protection Area Manager; Provincial Department of Natural Resources and Environment representatives - EMU Technical Officer, Forestry Division Technical Officer, Environment Division Technical Officer; and Bolikhan District Officer.
14 th June 2014	Field Surveying of PPA (con't) and PPA border meeting	PPA Checkpoint Guard
17 th – 18 th June 2014	Village Consultations	Village committee members, residents and business owners in Ban Nonsomboun, Ban Thaheau, Ban Hat Gniun and Hatsaykham;
23 rd June 2014	REP 2 Engagement*	World Bank REP2 team members; EDL REP2 EMO Manager

* Meeting with the World Bank and email follow up with other REP2 WB and EDL team members.

9.4 Results of Consultations

9.4.1 Village Level

Village consultations were conducted in Ban Nonsomboun, Ban Thaheua, Ban Hat Gniun and Ban Hatsaykham in June 2014. At each consultation, a brief presentation and description of the PS Project was provided. Participants were given an opportunity to provide comments, advice and information relevant to the PS Project.

The results of village level consultations regarding the PS Project are summarised in Table 9-2. A record of village consultations is provided in Appendix B.

Table 9-2 Summary of Key Comments: Village Consultation

Comment / Request	Response	Reference
If any additional impact to lands or assets fair compensation should be provided.	Existing ROW will be utilised. Minor additional impacts of additional pole structures between NSB and HSK. Consultation regarding compensation will be conducted if lands or assets are impacted.	IEE, Section 6.7.2
Will the 22 kV line upgrade impact houses underneath?	PS Project construction will not impact houses underneath. Existing ROW will be utilised. Building is permitted within the ROW	IEE, Section 6.7.2

Comment / Request	Response	Reference
	(although height restrictions apply).	
Specific request that a 22 kV TL pole in Hat Gniun be relocated from the middle of one of the small village roads.	This is under EDL jurisdiction. NN1PC will consult with EDL and consider based on conditions.	NA
Comments regarding restricted use under existing EDL line. One villager in Ban Hat Gniun noted that the alignment on his land prevents him from constructing a house in this area.	Existing ROW will be utilised. NN1PC will consult with EDL and consider based on conditions.	NA
Concerns were expressed regarding the duration of temporary power outages. Will residents, including small business owners be notified in advance?	Residents will be notified in advance of power cut offs. Additional mitigation measures (i.e. provision of ice boxes etc.) are being recommended.	IEE, Section 6.1.2
Some villagers currently own fenced plantations 5 m from the road. Will these be impacted? If so, what compensation will be provided?	Existing 25 metre Project Road ROW will be utilised. If individual assets are impacted, fair compensation will be provided.	IEE, Section 6.7.2
If cultural sites will be impacted (i.e. spirit forest in Ban Hat Gniun), villagers will require appeasement ceremony.	Any potentially impacted cultural site will be identified before construction begins and appropriate appeasement aspects will be worked out with the relevant village.	IEE, Section 6.2.2
Concerns were expressed regarding the lack of dust management on roads used by Project vehicles – villagers have had to request Head Contractor to undertake road watering during the dry season.	Issue will be referred to NN1PC EMO. Dust suppression measures will be recommended, however most activity will be conducted in the wet-season.	Sections 6.6.2
Concerns were raised about potential vehicle speeding – requests were made to undertake speed reduction measures (e.g. speed bumps)	Current traffic safety measures will apply to PS Project vehicles.	ESMMP-CP, SP18

Source: Village Consultations (ES 2014)

In each village, focus group discussions with men and women were conducted to collect additional information on issues of particular importance to each group.



Plate 9-1 Public Consultation at B. Hat Gniun



Plate 9-2 Public Consultation at B. Hatsaykham



Plate 9-3 Public Consultation at B. Thaheua

Plate 9-4 Public Consultation at B. Nonsomboun

9.4.2 Other Consultations

A summary of key points raised during meetings and discussions with other PS Project stakeholders is provided in Table 9-3 below.

Table 9-3 Summary of Key Points: Other Consultations

Consultation	Key Points
Provincial PPA Managers	Key points of discussion included PPA management planning, the definition of the PPA (according to Lao law), and current legal and illegal resource extraction practices in the protected area. New PPA boundary information sourced. PPA officials were of the view that direct and indirect impacts from the PS Project would be limited, given that impacts were confined and not likely to affect more sensitive areas of the PPA.
Project Design Meeting 1 (EDL)	Clarification of previous REP2 transmission line Project works, discussion of standard Environmental Management Planning for REP2 22 kV projects, maintenance plans and vegetation clearance requirements for the EDL ROW, and EDL participation in implementing power cables for the PS Project.
Project Design Meeting 2 (NN1 HPP Project)	Confirmation of technical design, project scheduling and clarification on land ownership arrangements associated with the TL ROW.
PPA Border Meeting	Review of PPA illegal activity log. Discussion of illegal logging issues including unauthorised logging trucks (i.e. 4 recorded in May); outside buyers purchasing wood from villages; small illegal operations (i.e. small logging camp found in PPA).
REP 2 Engagement	Updated REP2 WB and EDL managers on the proposed Project; sought EMP for the NSB to HSK transmission line (yet to be provided).

9.4.3 Further Consultations

NN1PC and EDL should undertake ongoing open and transparent information disclosure and consultation with the identified Project affected villages in accordance with its obligations under Lao PDR Law, Concession Agreement, and the recently released Lao Public Involvement Guidelines 2013 (No 707/MONRE, Government Lao PDR 2013).

10 CONCLUSIONS AND RECOMMENDATIONS

The Nam Ngiep 1 Power Supply Project is required to provide adequate power to meet requirements for NN1 HPP construction and to supply power to residents of the Ban Houay Soup resettlement village. It is anticipated that environmental and social impacts resulting from PS Project construction and ongoing maintenance will be minimal.

Current EDL alignment (PS Project Upgrade)

For the current EDL alignment from Ban Nonsomboun to Ban Hatsaykham, potential physical and biological impacts are expected to be negligible, as the ROW for the current facility exceeds the 8 m ROW (buffer) requirements for NN1PC Project works. No further vegetative clearance is required in this section, no additional transmission line towers will be added, surface water hydrology will be avoided, and upgrade of electrical cables will not impact physical or biological components of this region. This is particularly significant for the Houay Nguia Provincial Protection Area. Previous EDL implementation of the current transmission line entailed clearance of approximately 15 ha of vegetation (primarily Mixed Deciduous Forest) – no further impacts are anticipated as a result of PS Project implementation.

Some potential physical and biological impacts could result from construction and operations of the temporary construction camp near Ban Nonsomboun. Workforce camps, vehicle stockyards, maintenance and storage facilities are a potential source of surface or groundwater contamination from nutrients, pathogens, hazardous and non-hazardous waste. Adherence to the NN1 HPP ESMMP-CP and associated sub-plans are expected to reduce impacts to less than significant.

Potential social impacts are considered more likely within and near (temporary construction camp) the current EDL alignment. Short term disruption to power in Ban Nonsomboun, Ban Thaheua, Ban Hat Gniun and Ban Hatsaykham during transmission line upgrade activities may be a nuisance to some and may more significantly impact others that depend on electricity for their livelihoods (e.g. restaurant or resort owners). Management, mitigation or compensation measures can avoid or minimise the extent of this short term impact. Additional dust and noise impacts are anticipated during upgrades of the current EDL transmission, however these impacts are not expected to be significant, as the majority of construction will occur during the rainy season (minimising impacts from dust), most activity will not be conducted in close proximity to villages, and upgrades will be conducted during the daylight hours (minimising nuisance noise impacts).

Migrant worker influx (and accommodation near Ban Hatsaykham) has some potential to impact the region in the following respects:

- Increased pressure on non-timber forest products, timber forest products, terrestrial species (hunting) and aquatic species (fishing / collection);
- Increased risk of traffic related safety issues (vehicle strikes);
- Increased risk of introduced diseases including sexually transmitted diseases; and
- Increased risk of conflict due to insensitivity of workforce to local culture and environmental values.

The NN1 HPP Training and Awareness programme (refer to ESMMP-CP) should minimise these impacts during the approximate six (6) month period of PS Project activity.

PS Project Transmission Line Extension Area

Physical and biological impacts will be more significant for Section 3 – 5 of the PS Project, where transmission line construction will require vegetation removal, tower construction, concrete batching, etc. The primary physical impact is expected to be siltation of watercourses (including the Nam Ngiep) from increased erosion and sediment transport following vegetation removal. PS Project sediment input is expected to be much less than that from NN1 HPP road and facilities construction as well as upstream

activities, but PS Project input will contribute to the cumulative impacts of sediment input from construction in the catchment. Implementation of recommended management and mitigation measures and rehabilitation and planting of the ROW will minimise impacts.

Additional potential impacts to water quality (as well as hydrology) are expected to be avoided via ensuring tower placement outside of natural drainages, stockpiling soil and other material at least 30 m from natural drainages, and avoiding any in-stream construction.

Vegetation removal is expected to be the most significant biological impact for the PS Project Area (transmission line extension). Mixed Deciduous Forest, Bamboo Forest, Fallow Forest and Savannah (and potentially a small area of agricultural plantation) will be cleared for the ROW. The current ecological value of these forests varies across the PS Project alignment. The vegetation on the left bank of the Nam Ngiep has been modified by human disturbance, though is generally of moderately good habitat value. The vegetation on the right bank of the Nam Ngiep near the Main Dam is more pristine. Removal of this vegetation is not expected to considerably reduce the habitat value of the forests, as the proposed transmission line corridor largely borders current NN1 HPP roads, and terrestrial wildlife is expected to have moved from these areas of active construction and vehicle traffic.

The maximum area of vegetative clearance for the following vegetative communities or PS Project construction (considering an 8 m buffer for the length of the transmission line) is as follows:

- Mixed Deciduous Forest – 3.68 ha;
- Regeneration Forest (1 – 8 years old) – 3.38 ha;
- Regeneration Forest (> 8 years old) – 0.33 ha;
- Grassland / Savannah – 0.38 ha; and
- Shifting Cultivation (cleared land) – 0.66 ha; and
- Plantation (rubber) – 0.08 ha.

However, because the transmission line ROW will overlap areas already cleared of vegetation (roads and additional facilities); the actual clearance area for the natural vegetative communities will be substantially less than the above estimates (~20%).

Impacts to terrestrial and aquatic fauna and NTFP/TFP will be negligible if construction personnel are prohibited from hunting, fishing and NTFP/TFP collection in the Project Area.

Potential social impacts in the NN1PC transmission line extension areas are expected to be minor. Dust and noise will be generated near Ban Hatsaykham, but levels are expected to be below Project standards. Project development is not expected to impact areas of archaeological or cultural significance. However given the area is rich in sites of archaeological, historical and cultural significance, the potential for chance find of a significant site or artefacts during vegetation clearing is very possible. With development of a *Chance Find Procedure*, the Project should avoid disturbance of significant sites and ensure artefacts are handed over to the appropriate people.

The PS Project will provide significant social benefit in the NN1PC transmission line extension areas, for the following reasons:

- Each household in the Ban Houay Soup (400+ houses) will be supplied with electricity as a result of transmission line extension to the resettlement village; and
- UXO clearance will be required for PS Project implementation. The clearance of UXO is an important component of the construction of the PS Project and will provide some lasting benefit from the Project. If appropriate management of UXO is incorporated into PS Project planning and vegetative clearing, the risks associated with UXO are considered low and the benefit to local communities is considered significant.

Recommendations

1. Consult with villagers, restaurant owners, resort owners, etc. regarding the current electricity use and determine the impact to livelihoods resulting from intermittent power outages planned for the construction phase of PS Project implementation. Calculate the financial consequences of power outages (i.e. loss of food and revenue for restaurant / resort owners) and determine suitable compensation in consultation with relevant government authorities and Project Affected Peoples. Consider providing an alternate source of refrigeration for food and / or medicine, as applies (e.g. ice boxes and ice) or an alternate source of power (e.g. petrol powered generators) to minimise associated impacts and reduce compensation requirements.
2. Ensure key management and mitigation measures specified in **SP13: Unexploded Ordinance Survey and Disposal** (ESMMP-CP) are implemented prior to vegetative clearance and ground disturbing activities, including:
 - Engagement of a qualified organisation to undertake survey and disposal of UXO in areas where project activity are to take place, prior to the commencement of construction works on-site;
 - Marking cleared areas and within 30 days of completion of the clearing work and describe the UXO survey, disposal and QC processes implemented on site; UXO located and destroyed; and certification that the area has been cleared of UXO and is suitable for its intended purpose.
 - Training construction personnel in the potential risks associated with disturbance of UXO and procedures to be followed if UXO are identified during construction; and
 - Implementing a UXO notification procedure in communities located in the vicinity of survey and disposal works. Notify local communities regarding the commencement and duration of UXO disposal activities and precautions that should be taken and inform communities of the location of cleared areas and the meaning of the cleared area markings or signage (i.e. the delineation between cleared versus un-surveyed areas).
3. Consider seeding the ROW with native grass species following vegetative clearance to reduce erosion and sedimentation and to reduce future maintenance costs by attempting to achieve vegetative cover with plants that will not require ongoing pruning / cutting (height reduction) in the ROW.
4. Require contractor development of a Site-Specific Environmental and Social Management and Monitoring Plan (SS-ESMMP) as per the NN1 HPP ESMMP-CP that prioritises the following:
 - Development of erosion and sediment control facilities that focus on the character / topography of the terrain for each component of construction (e.g. proximity to natural drainages, slope angle, etc.);
 - Demarcation of vegetation clearance areas, minimising clearance to the area required, and considering UXO protocol;
 - Development of specifications for storage, handling and disposal of hazardous and non-hazardous waste (including adequate sewage storage and treatment); and
 - Development of a suitable septic system and general waste disposal area in the temporary construction workforce camp.
5. Develop a *Chance Find Procedure* to account for potential finding of archaeological sites or artefacts during vegetation clearance. The *Chance Find Procedure* should entail coordination with the existing system at the government level (Ministry of Information and Culture, National Committee for the protection of national cultural heritage) and training of construction personnel in handling and communication requirements following identification of an artefact and train staff during Training and Awareness.
6. Implement a Training and Awareness program (as per ESMMP-CP, SP16: Training and Awareness) that emphasises:

-
- Prohibition of hunting, fishing, and collection / harvest of NTFP, TFP and artefacts of cultural significance;
 - Non-disturbance of villages / resettlement communities. Educate outside contractors on the cultural sensitivities of the Project location. Conversely, employees who are local residents should receive cultural awareness training to encourage understanding of incoming workers;
 - Health Awareness Training for all personnel covering: anti-malaria precautions; precautions for HIV / AIDS and other venereal diseases; recommendations regarding proper disposal of all wastes; and use of appropriate toilets;
 - Public safety measures (as per ESMMP-CP, SP18: Public safety) including: speed limits for vehicles in residential areas; safe driving practices to minimise accidents; securing all construction vehicles and equipment during non-working hours to prevent unauthorised access or use; and the requirement to repair and/or compensate for damage caused by the project to properties (houses, farmlands, aquaculture ponds, irrigation canals, etc.), community facilities such as water supply, power supply, and communication facilities;
 - Continual public disclosure and consultation with the local community; and
 - Proper waste management procedures.

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APPENDICES

APPENDIX A: EARTH SYSTEMS SURVEY RESULTS

Table A-1 Characteristic species within the structural layers of Mixed Deciduous Forest

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
Canopy (5-20 m)	<i>Anisoptera costata</i>	Tree	EN	
	<i>Aphanamixis polystachya</i>	Tree	LR/LC	
	<i>Bombax anceps</i>	Tree	N/A	
	<i>Cratoxylum formosum</i>	Tree	LR/LC	
	<i>Cratoxylum formosum var. prunifolium</i>	Tree	LR/LC	
	<i>Dialium cochinchinense</i>	Tree	LR/NT	
	<i>Diospyros spp.</i>	Tree	N/A	
	<i>Dipterocarpus alatus</i>	Tree	EN	
	<i>Garcinia oliveri</i>	Tree	N/A	
	<i>Grewia paniculata</i>	Tree	N/A	
	<i>Irvingia malayana</i>	Tree	LR/LC	
	<i>Lagerstroemia calyculata</i>	Tree	N/A	
	<i>Markhamia stipulata</i>	Tree	N/A	
	<i>Memecylon fruticosum</i>	Shrub	N/A	
	<i>Mesua ferrea</i>	Tree	N/A	
	<i>Ormosia pinnata</i>	Tree	N/A	May be beyond original range
	<i>Parkia sumatrana</i>	Tree	N/A	
	<i>Peltophorum dasyrrhachis</i>	Tree	N/A	
	<i>Radermanchera ignea</i>	Tree	N/A	
	<i>Sapium discolor</i>	Tree	N/A	
	<i>Sapium discolor</i>	Tree	N/A	
	<i>Schima wallichii</i>	Tree	N/A	
	<i>Sindora siamensis var. siamensis</i>	Tree	LC	
<i>Syzygium cumini</i>	Tree	N/A		
<i>Vatica cinerea</i>	Tree	EN	Not native. May be beyond original range	
<i>Vitex pinnata</i>	Tree	N/A		
<i>Xanthophyllum flavescens</i>	Tree	N/A		
Mid-storey (2-4 m)	<i>Aphanamixis polystachya</i>	Shrub	LR/LC	
	<i>Aporosa cardiosperma</i>	Shrub	N/A	Endemic of Sri Lanka
	<i>Aporosa lindleyana</i>	Shrub	N/A	Native to India and Sri Lanka

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
	<i>Aporosa spp</i>	Shrub	N/A	
	<i>Aralia armata</i>	Shrub	N/A	
	<i>Ardisia elliptica</i>	Shrub	N/A	
	<i>Capparis micrantha</i>	Shrub	N/A	
	<i>Casearia grewiaefolia</i>	Shrub	N/A	
	<i>Cinnamomum iners</i>	Tree	N/A	
	<i>Cratoxylum formosum var. prunifolium</i>	Tree	LR/LC	
	<i>Croton argyratus</i>	Shrub	N/A	
	<i>Croton laevigatus</i>	Shrub	N/A	
	<i>Gardenia spp</i>	Shrub	N/A	
	<i>Glochidion eriocarpum</i>	Shrub	N/A	
	<i>Gonocaryum lobbianum</i>	Shrub	N/A	
	<i>Grewia paniculata</i>	Tree	N/A	
	<i>Lepisanthes tetraphylla</i>	Shrub	N/A	
	<i>Maesa ramentacea</i>	Shrub	N/A	
	<i>Mallotus barbatus</i>	Shrub	N/A	
	<i>Mallotus paniculatus</i>	Shrub	N/A	
	<i>Memecylon fruticosum</i>	Shrub	N/A	
	<i>Musa acuminata</i>	Herb	N/A	
	<i>Oxytenanthera albociliata</i>	Herb	N/A	
	<i>Phoebe lanceolata</i>	Shrub	N/A	
	<i>Pterospermum obliquum</i>	Tree	N/A	
	<i>Sauropus androgynus</i>	Shrub	N/A	
	<i>Syzygium cumini</i>	Tree	N/A	
	<i>Trevesia palmata</i>	Shrub	N/A	
	<i>Wrightia arborea</i>	Tree	N/A	
Ground cover / understorey (0 - 1 m)	<i>Amischotolype griffithii</i>	Herb	N/A	Native to Malaya
	<i>Amomum avoideum</i>	Herb	N/A	
	<i>Ardisia crispa</i>	Shrub	N/A	
	<i>Ardisia elliptica</i>	Shrub	N/A	
	<i>Aspidistra typica</i>	Herb	N/A	
	<i>Calamus javensis</i>	Climber	N/A	
	<i>Calycopteris floribunda</i>	Shrub	N/A	
	<i>Casearia grewiaefolia</i>	Shrub	N/A	
	<i>Catimbum bracteatum</i>	Herb	N/A	

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
	<i>Chromolaena odorata</i>	Herb	N/A	Native to North America, highly invasive
	<i>Cissus assamica</i>	Climber	N/A	
	<i>Costus speciosus</i>	Herb	N/A	
	<i>Drynaria quercifolia</i>	Fern	N/A	
	<i>Epipremnum giganteum</i>	Climber	N/A	
	<i>Eurycoma longifolia</i>	Shrub	N/A	
	<i>Halopegia blumei</i>	Herb	N/A	
	<i>Hedyotis spp</i>	Herb	N/A	
	<i>Helicteres viscida</i>	Herb	N/A	
	<i>Ixora chinensis</i>	Shrub	N/A	
	<i>Leea rubra</i>	Herb	N/A	
	<i>Melastoma normale</i>	Shrub	N/A	
	<i>Mimosa pudica</i>	Herb	LC	Native to Central and South America
	<i>Oxytenanthera albociliata</i>	Herb	N/A	
	<i>Rhapis micrantha</i>	Herb	N/A	
	<i>Scleria terrestris</i>	Herb	LC	
	<i>Tabernaemontana spp</i>	Shrub	N/A	
	<i>Tinospora crispa</i>	Climber	N/A	
	<i>Urena lobata</i>	Herb	N/A	
	<i>Uvaria littoralis</i>	Climber	N/A	
	<i>Ventilago denticulata</i>	Climber	N/A	

IUCN Status Red List Categories: EN – Endangered, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed

Table A-2 Characteristic species within the structural layers of Disturbed Mixed Deciduous Forest

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
Canopy (5-20 m)	<i>Alangium kurzii</i>	Tree	N/A	
	<i>Anisoptera costata</i>	Tree	EN	
	<i>Aphanamixis polystachya</i>	Tree	LR/LC	
	<i>Cratoxylum formosum</i>	Tree	LR/LC	
	<i>Cratoxylum formosum var. prunifolium</i>	Tree	LR/LC	
	<i>Grewia paniculata</i>	Tree	N/A	
	<i>Iringia malayana</i>	Tree	LR/LC	
	<i>Lagerstroemia calyculata</i>	Tree	N/A	
	<i>Lithocarpus polystachyus</i>	Tree	N/A	
	<i>Mallotus paniculatus</i>	Shrub	N/A	
	<i>Mesua ferrea</i>	Tree	N/A	
	<i>Nauclea orientalis</i>	Tree	N/A	
	<i>Ormosia pinnata</i>	Tree	N/A	May be beyond original range
	<i>Parkia sumatrana</i>	Tree	N/A	
	<i>Peltophorum dasyrrhachis</i>	Tree	N/A	
	<i>Sapium discolor</i>	Tree	N/A	
	<i>Schima wallichii</i>	Tree	N/A	
<i>Sindora siamensis var. siamensis</i>	Tree	LC		
<i>Syzygium cumini</i>	Tree	N/A		
Mid-storey (2-4 m)	<i>Ailanthus fauveliana</i>	Tree	N/A	
	<i>Aporosa polystachya</i>	Shrub	N/A	
	<i>Aporosa spp</i>	Shrub	N/A	
	<i>Ardisia crispa</i>	Shrub	N/A	
	<i>Artocarpus chaplasha</i>	Tree	N/A	
	<i>Casearia grewiaefolia</i>	Shrub	N/A	
	<i>Coffea arabica</i>	Shrub	N/A	Native to Ethiopia
	<i>Cratoxylum formosum var. prunifolium</i>	Tree	LR/LC	
	<i>Croton argyratus</i>	Shrub	N/A	
	<i>Croton laevigatus</i>	Shrub	N/A	
	<i>Croton oblongifolia</i>	Shrub	N/A	
	<i>Duabanga grandiflora</i>	Tree	N/A	
	<i>Eurycoma longifolia</i>	Shrub	N/A	
	<i>Ficus hispida</i>	Shrub	N/A	
	<i>Gonocaryum lobbianum</i>	Shrub	N/A	

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
	<i>Grewia paniculata</i>	Tree	N/A	
	<i>Lepisanthes tetraphylla</i>	Shrub	N/A	
	<i>Mallotus barbatus</i>	Shrub	N/A	
	<i>Mallotus paniculatus</i>	Shrub	N/A	
	<i>Mesua ferrea</i>	Tree	N/A	
	<i>Morinda spp</i>	Shrub	N/A	
	<i>Ormosia pinnata</i>	Tree	N/A	May be beyond original range
	<i>Oxytenanthera albociliata</i>	Herb	N/A	
	<i>Sapium discolor</i>	Tree	N/A	
	<i>Vitex trifolia</i>	Shrub	N/A	May be beyond original range
	<i>Wrightia arborea</i>	Tree	N/A	
Ground cover / understory (0 - 1 m)	<i>Aralia armata</i>	Shrub	N/A	
	<i>Ardisia crispa</i>	Shrub	N/A	
	<i>Ardisia elliptica</i>	Shrub	N/A	
	<i>Blumea balsamifera</i>	Herb	N/A	
	<i>Calamus javensis</i>	Climber	N/A	
	<i>Cassia tora</i>	Herb	N/A	
	<i>Catimbum bracteatum</i>	Herb	N/A	
	<i>Chromolaena odorata</i>	Herb	N/A	Native to North America, highly invasive
	<i>Clausena anisata</i>	Shrub	N/A	
	<i>Cnestis palala</i>	Climber	N/A	
	<i>Cyclea barbata</i>	Climber	N/A	
	<i>Cyclea peltata</i>	Climber	N/A	Native to India
	<i>Dioscorea alata</i>	Climber	N/A	
	<i>Dioscorea triphylla</i>	Climber	N/A	
	<i>Erechtites valerianifolia</i>	Herb	N/A	
	<i>Eurycoma longifolia</i>	Shrub	N/A	
	<i>Helicteres viscida</i>	Herb	N/A	
	<i>Melastoma normale</i>	Herb	N/A	
	<i>Melicope pteleifolia</i>	Herb	N/A	
	<i>Mimosa pudica</i>	Herb	LC	Native to Central and South America
<i>Oxytenanthera albociliata</i>	Herb	N/A		
<i>Panicum spp</i>	Herb	N/A		
<i>Rhapis micrantha</i>	Herb	N/A		

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
	<i>Scleria terrestris</i>	Herb	LC	
	<i>Smilax glabra</i>	Climber	N/A	
	<i>Torenia fourmieri</i>	Herb	N/A	
	<i>Uncaria macrophylla</i>	Climber	N/A	
	<i>Urena lobata</i>	Herb	N/A	
	<i>Uvaria littoralis</i>	Climber	N/A	

IUCN Status Red List Categories: EN – Endangered, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed

Table A-3 Abundant species within the two lower structural layers of Regeneration Forest

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
Mid-storey (2- 4 m)	<i>Adenantha pavonina</i>	Tree	N/A	
	<i>Aphanamixis polystachya</i>	Tree	LR/LC	
	<i>Aporosa ficifolia</i>	Shrub	N/A	
	<i>Aporosa macrostachyus</i>	Shrub	N/A	
	<i>Aporosa polystachya</i>	Shrub	N/A	
	<i>Artocarpus chaplasha</i>	Tree	N/A	
	<i>Bombax anceps</i>	Tree	N/A	
	<i>Casearia grewiaefolia</i>	Shrub	N/A	
	<i>Cratoxylum formosum var. prunifolium</i>	Tree	LR/LC	
	<i>Croton argyratus</i>	Shrub	N/A	
	<i>Croton laevigatus</i>	Shrub	N/A	
	<i>Engelhardtia spicata</i>	Tree	LR/LC	
	<i>Glochidion eriocarpum</i>	Shrub	N/A	
	<i>Gonocaryum lobbianum</i>	Shrub	N/A	
	<i>Macaranga denticulata</i>	Shrub	N/A	
	<i>Maesa ramentacea</i>	Shrub	N/A	
	<i>Mallotus barbatus</i>	Shrub	N/A	
	<i>Mallotus paniculatus</i>	Shrub	N/A	
	<i>Mesua ferrea</i>	Tree	N/A	
	<i>Musa acuminata</i>	Herb	N/A	
	<i>Nauclea orientalis</i>	Tree	N/A	
	<i>Ormosia pinnata</i>	Tree	N/A	May be beyond original range
	<i>Oxytenanthera albociliata</i>	Herb	N/A	
	<i>Peltophorum dasyrrhachis</i>	Tree	N/A	
	<i>Sapium discolor</i>	Tree	N/A	
	<i>Schima wallichii</i>	Tree	N/A	
<i>Tetrameles nudiflora</i>	Tree	LR/LC		
<i>Trema orientalis</i>	Shrub	N/A		
<i>Wrightia arborea</i>	Tree	N/A		
Ground cover / understorey (0 - 1 m)	<i>Acacia pennata</i>	Climber	N/A	
	<i>Achyranthes aspera</i>	Herb	N/A	Invasive in many parts
	<i>Amischotolype griffithii</i>	Herb	N/A	Native to Malaya
	<i>Buttneria andamensis</i>	Climber	N/A	
	<i>Calamus javensis</i>	Climber	N/A	

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
	<i>Calycopteris floribunda</i>	Shrub	N/A	
	<i>Catimbum bracteatum</i>	Herb	N/A	
	<i>Chromolaena odorata</i>	Herb	N/A	Native to North America, highly invasive
	<i>Cissus astrotricha</i>	Climber	N/A	
	<i>Clausena anisata</i>	Shrub	N/A	
	<i>Clerodendrum colebrookianum</i>	Herb	N/A	
	<i>Cnestis palala</i>	Climber	N/A	
	<i>Coscinium fenestratum</i>	Climber	N/A	
	<i>Costus speciosus</i>	Herb	N/A	
	<i>Cyclea peltata</i>	Climber	N/A	Native to India
	<i>Dioscorea alata</i>	Climber	N/A	
	<i>Dioscorea triphylla</i>	Climber	N/A	
	<i>Embelia libers</i>	Climber	N/A	
	<i>Erechtites valerianifolia</i>	Herb	N/A	
	<i>Eurycoma longifolia</i>	Shrub	N/A	
	<i>Helicteres viscida</i>	Herb	N/A	
	<i>Lepisanthes tetraphylla</i>	Shrub	N/A	
	<i>Lygodium dimorphum</i>	Fern	N/A	
	<i>Mallotus thorelii</i>	Shrub	N/A	
	<i>Melastoma normale</i>	Herb	N/A	
	<i>Merremia umbellata</i>	Climber	N/A	Native to North America
	<i>Mimosa pudica</i>	Herb	LC	Native to Central and South America
	<i>Mucuna pruriens</i>	Climber	N/A	May be beyond original range
	<i>Musa acuminata</i>	Herb	N/A	
	<i>Oxytenanthera albociliata</i>	Herb	N/A	
	<i>Oxytenanthera parvifolia</i>	Herb	N/A	
	<i>Sauropus androgynus</i>	Herb	N/A	
	<i>Scleria terrestris</i>	Herb	LC	
	<i>Tetracera indica</i>	Climber	N/A	
	<i>Trevesia palmata</i>	Shrub	N/A	
	<i>Urena lobata</i>	Herb	N/A	
	<i>Ziziphus oenopolia</i>	Shrub	N/A	

IUCN Status Red List Categories: LC – Least Concern, LR – Lower Risk, N/A – Not Assessed

Table A-4 Characteristic species within the structural layers of Unstocked / Regeneration Forest

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
Canopy (5-20 m)	<i>Alstonia scholaris</i>	Tree	LR/LC	
	<i>Anisoptera costata</i>	Tree	EN	
	<i>Bombax anceps</i>	Tree	N/A	
	<i>Cratoxylum formosum</i>	Tree	LR/LC	
	<i>Crypteronia paniculata</i>	Tree	N/A	
	<i>Dillenia parviflora</i>	Tree	N/A	
	<i>Grewia paniculata</i>	Tree	N/A	
	<i>Irvingia malayana</i>	Tree	LR/LC	
	<i>Lagerstroemia calyculata</i>	Tree	N/A	
	<i>Mesua ferrea</i>	Tree	N/A	
	<i>Ormosia pinnata</i>	Tree	N/A	May be beyond original range
	<i>Peltophorum dasyrrhachis</i>	Tree	N/A	
	<i>Pterocarpus macrocarpus</i>	Tree	N/A	
	<i>Sapium discolor</i>	Tree	N/A	
	<i>Schima wallichii</i>	Tree	N/A	
	<i>Sindora siamensis var. siamensis</i>	Tree	LC	
	<i>Spondias pinnata</i>	Tree	N/A	
	<i>Stereospermum semisagittatum</i>	Tree	N/A	
<i>Syzygium cumini</i>	Tree	N/A		
<i>Syzygium zeylanicum</i>	Tree	N/A		
Mid-storey (2-4 m)	<i>Ailanthus fauveliana</i>	Tree	N/A	
	<i>Alangium kurzii</i>	Tree	N/A	
	<i>Anisoptera costata</i>	Tree	EN	
	<i>Antidesma acidum</i>	Shrub	N/A	
	<i>Aporosa ficifolia</i>	Shrub	N/A	
	<i>Aporosa polystachya</i>	Shrub	N/A	
	<i>Casearia grewiaefolia</i>	Shrub	N/A	
	<i>Cratoxylum formosum</i>	Tree	LR/LC	
	<i>Croton oblongifolia</i>	Shrub	N/A	
	<i>Eurycoma longifolia</i>	Shrub	N/A	
	<i>Ficus perfulva</i>	Shrub	N/A	
	<i>Glochidion eriocarpum</i>	Shrub	N/A	
	<i>Gonocaryum lobbianum</i>	Shrub	N/A	
	<i>Irvingia malayana</i>	Tree	LR/LC	
	<i>Lagerstroemia calyculata</i>	Tree	N/A	

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
	<i>Mallotus barbatus</i>	Shrub	N/A	
	<i>Mallotus paniculatus</i>	Shrub	N/A	
	<i>Melicope pteleifolia</i>	Shrub	N/A	
	<i>Mesua ferrea</i>	Tree	N/A	
	<i>Ormosia pinnata</i>	Tree	N/A	May be beyond original range
	<i>Oroxylum indicum</i>	Shrub	N/A	
	<i>Oxytenanthera albociliata</i>	Herb	N/A	
	<i>Peltophorum dasyrrhachis</i>	Tree	N/A	
	<i>Phoebe lanceolata</i>	Shrub	N/A	
	<i>Sauropus androgynus</i>	Shrub	N/A	
	<i>Tetrameles nudiflora</i>	Tree	LR/LC	
	<i>Trema orientalis</i>	Shrub	N/A	
Ground cover / understorey (0 - 1 m)	<i>Acacia pennata</i>	Climber	N/A	
	<i>Ancistrocladus tectorius</i>	Climber	N/A	
	<i>Asystasia gangetica</i>	Herb	N/A	
	<i>Calycopteris floribunda</i>	Shrub	N/A	
	<i>Catimbum bracteatum</i>	Herb	N/A	
	<i>Chromolaena odorata</i>	Herb	N/A	Native to North America, highly invasive
	<i>Cnestis palala</i>	Climber	N/A	
	<i>Dracaena angustifolia</i>	Herb	N/A	
	<i>Entada phaseoloides</i>	Climber	N/A	
	<i>Eurycoma longifolia</i>	Shrub	N/A	
	<i>Globba reflexa</i>	Herb	LC	
	<i>Lepisanthes tetraphylla</i>	Shrub	N/A	
	<i>Lygodium dimorphum</i>	Fern	N/A	
	<i>Melastoma normale</i>	Shrub	N/A	
	<i>Merremia umbellata</i>	Climber	N/A	Native to North America
	<i>Mimosa pudica</i>	Herb	LC	Native to Central and South America
	<i>Mucuna pruriens</i>	Climber	N/A	May be beyond original range
	<i>Musa acuminata</i>	Herb	N/A	
	<i>Oxytenanthera albociliata</i>	Herb	N/A	
	<i>Sauropus androgynus</i>	Shrub	N/A	
<i>Scleria terrestris</i>	Herb	LC		
<i>Scoparia dulcis</i>	Herb	N/A		
<i>Smilax glabra</i>	Climber	N/A		

Structural Layer	Dominant Species	Habit	IUCN Status	Invasive / introduced
	<i>Streptocaulon griffithii</i>	Climber	N/A	
	<i>Tetracera indica</i>	Climber	N/A	
	<i>Tiliacora triandra</i>	Climber	N/A	
	<i>Urena lobata</i>	Herb	N/A	
	<i>Ziziphus oenopolia</i>	Climber	N/A	

IUCN Status Red List Categories: EN – Endangered, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed

Table A-5 Species recorded within the vegetation types of the EDL transmission line (Section 2)

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN	Introduced / invasive
<i>Acacia pennata</i>	Kheua num hun	Climber	OF	N/A	
<i>Achyranthes aspera</i>	Yah khpouy ngou	Herb	RF	N/A	Invasive in many parts
<i>Adenanthera pavonina</i>	Mai mak lum	Tree	RF	N/A	
<i>Ailanthus fauveliana</i>	Mai yom	Tree	OF/D MDF	N/A	
<i>Alangium kurzii</i>	Alangium	Tree	OF	N/A	
<i>Alstonia scholaris</i>	Mai teun pet	Tree	OF	LR/LC	
<i>Amischotolype griffithii</i>	Yar karp yai	Herb	RF	N/A	Native to Malaya
<i>Ancistrocladus tectorius</i>	Khua hang kouang	Climber	OF	N/A	
<i>Anisoptera costata</i>	Mai bark	Tree	D MDF/MDF/OF	EN	
<i>Antidesma acidum</i>	Mai mao som	Shrub	OF	N/A	
<i>Aporosa ficifolia</i>	Mai meuad kieng	Shrub	RF/OF	N/A	
<i>Aporosa macrostachyus</i>	Mai meuad khon	Shrub	RF	N/A	
<i>Aporosa polystachya</i>	Mai muad	Shrub	RF/OF/D MDF	N/A	
<i>Aporosa spp</i>	Mai muad khon	Shrub	MDF/D MDF/OF	N/A	
<i>Ardisia crispa</i>	Tin cham noi	Shrub	MDF/D MDF	N/A	
<i>Ardisia elliptica</i>	Tin cham bai yai	Shrub	MDF/D MDF	N/A	
<i>Artocarpus chaplasha</i>	Mai mee pah	Tree	RF/D MDF	N/A	
<i>Asystasia gangetica</i>	Ya chi loh	Herb	OF	N/A	
<i>Blumea balsamifera</i>	Ton nad	Herb	D MDF	N/A	
<i>Bombax anceps</i>	Mai ngioe pah	Shrub	OF	N/A	
<i>Calamus javensis</i>	Wai hang nou	Palm	MDF/D MDF	N/A	
<i>Calycopteris floribunda</i>	kheua ka daeng	Shrub	OF	N/A	
<i>Capparis micrantha</i>	to sa sou	Shrub	MDF	N/A	
<i>Casearia grewiaefolia</i>	Mai ka douk	Tree	D MDF/RF/MDF/OF	N/A	
<i>Cassia tora</i>	Yar lum meun	Herb	D MDF	N/A	
<i>Catimbum bracteatum</i>	Man kha	Herb	RF/OF/D MDF/MDF	N/A	
<i>Chromolaena odorata</i>	Yar khiw	Herb	RF/OF/D MDF/MDF	N/A	Native to North America, highly invasive
<i>Cinnamomum iners</i>	Mai chuang	Tree	MDF	N/A	
<i>Clausena anisata</i>	Ka bee khon	Shrub	RF/D MDF	N/A	
<i>Clerodendrum colebrookianum</i>	Phoung phing	Herb	RF	N/A	
<i>Cnestis palala</i>	Kham khua	Climber	RF/D MDF/OF	N/A	
<i>Coffea arabica</i>	Ton coffee	Shrub	D MDF	N/A	Native to

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN	Introduced / invasive
					Ethiopia
<i>Cratoxylum formosum</i>	Mai tiee som	Tree	D MDF/MDF/OF/RF	LR/LC	
<i>Cratoxylum formosum var. prunifolium</i>	Mai tiee khon	Tree	D MDF/MDF/RF/OF	LR/LC	
<i>Croton argyratus</i>	Mai sa long khong	Shrub	D MDF/RF/MDF	N/A	
<i>Croton laevigatus</i>	Mai tong thong	Shrub	RF/D MDF/MDF	N/A	
<i>Croton oblongifolia</i>	Mai pau yai	Shrub	D MDF/OF	N/A	
<i>Crypteronia paniculata</i>	Mai ka arm	Tree	OF	N/A	
<i>Dialium cochinchinense</i>	Mai mak kheng	Tree	MDF	LR/NT	
<i>Dillenia parviflora</i>	Sa kheng	Tree	OF	N/A	
<i>Dioscorea alata</i>	Man keen	Climber	RF	N/A	
<i>Dioscorea triphylla</i>	Koy	Climber	RF	N/A	
<i>Dipterocarpus alatus</i>	Mai yang	Tree	MDF	EN	
<i>Dracaena angustifolia</i>	Khon khaen	Herb	OF	N/A	
<i>Engelhardtia spicata</i>	Mai phao	Tree	RF	LR/LC	
<i>Eurycoma longifolia</i>	Yik bor thong	Shrub	D MDF/MDF/OF	N/A	
<i>Ficus perfulva</i>	Mai harm pou	Shrub	OF	N/A	
<i>Garcinia oliveri</i>	Mai som mong	Tree	MDF	N/A	
<i>Globba reflexa</i>	Ya globba	Herb	OF	LC	
<i>Glochidion eriocarpum</i>	Mai kee mod	Tree	RF	N/A	
<i>Gonocaryum lobbianum</i>	Seng meuang	Shrub	OF/MDF/D MDF/RF	N/A	
<i>Grewia paniculata</i>	Mai khom som	Shrub	OF/MDF/D MDF	N/A	
<i>Halopegia blumei</i>	To ching	Herb	MDF	N/A	
<i>Helicteres viscida</i>	Po kee kai	Herb	D MDF/MDF/RF	N/A	
<i>Irvingia malayana</i>	Mai ka bok	Tree	OF/MDF/D MDF	LR/LC	
<i>Lagerstroemia calyculata</i>	Mai peuy	Tree	MDF/D MDF/OF	N/A	
<i>Lepisanthes tetraphylla</i>	Ton huad	Shrub	RF/OF	N/A	
<i>Lithocarpus polystachyus</i>	Mai ko ta mou	Tree	D MDF	N/A	
<i>Lygodium dimorphum</i>	Phak kood kheua	Fern	RF	N/A	
<i>Maesa ramentacea</i>	Ton khup	Shrub	RF	N/A	
<i>Mallotus barbatus</i>	Ton ta vaen	Shrub	RF/OF/D MDF/MDF	N/A	
<i>Mallotus paniculatus</i>	Mai tong tao	Shrub	RF/OF/D MDF/MDF	N/A	
<i>Mallotus thorelii</i>	Mai sae	Shrub	RF	N/A	
<i>Melastoma normale</i>	Ben a	Herb	D MDF/RF	N/A	
<i>Melicope pteleifolia</i>	Ka bee khon	Herb	D MDF/OF	N/A	
<i>Memecylon fruticosum</i>	Muad ae	Shrub	MDF	N/A	

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN	Introduced / invasive
<i>Merremia umbellata</i>	E po mae bai houp hua jai	Climber	OF/RF	N/A	Native to North America
<i>Mesua ferrea</i>	Mai sa thang	Tree	D MDF/MDF/OF/RF	N/A	
<i>Mimosa pudica</i>	Yar youp	Climber	RF/D MDF/MDF/OF	LC	Native to Central and South America
<i>Mucuna pruriens</i>	Ya paed	Climber	RF/OF	N/A	May be beyond original range
<i>Musa acuminata</i>	Kouay pah	Herb	OF	N/A	
<i>Mussaenda spp</i>	Dok maeng ka beua	Shrub	OF	N/A	
<i>Ormosia pinnata</i>	Mai khee mou	Tree	OF/RF/D MDF/MDF	N/A	May be beyond original range
<i>Oroxylum indicum</i>	Lin mai	Tree	OF	N/A	
<i>Oxytenanthera albociliata</i>	Mai lai	Herb	RF/D MDF/MDF/OF	N/A	
<i>Panicum spp</i>	Yar young	Herb		N/A	
<i>Parkia sumatrana</i>	Mai hua lon	Tree	D MDF	N/A	
<i>Peltophorum dasyrrhachis</i>	Mai sa phang	Tree	RF/D MDF/MDF/OF	N/A	
<i>Phoebe lanceolata</i>	Pa iy ven	Shrub	OF	N/A	
<i>Pterocarpus macrocarpus</i>	Mai dou	Tree	OF	N/A	
<i>Pterospermum obliquum</i>	Ham ao	Tree	MDF	N/A	
<i>Rhapis micrantha</i>	San	Palm	MDF/D MDF	N/A	
<i>Sapium discolor</i>	Mai pang	Tree	RF/D MDF/MDF/OF	N/A	
<i>Sauropus androgynus</i>	Phak van ban	Herb	RF	N/A	
<i>Schima wallichii</i>	Mai mee	Tree	OF/D MDF/RF/MDF	N/A	
<i>Scleria terrestris</i>	Yar khom pao	Herb	RF/OF/MDF/D MDF	LC	
<i>Scoparia dulcis</i>	Khon khee thung	Herb	OF	N/A	
<i>Sindora siamensis var. siamensis</i>	Mai tae nam	Tree	D MDF/MDF/OF	LC	
<i>Smilax glabra</i>	Ya hua	Climber	OF	N/A	
<i>Spondias pinnata</i>	Ton mark kok	Tree	OF	N/A	
<i>Stereospermum semisagittatum</i>	Ham ao	Tree	OF	N/A	
<i>Streptocaulon griffithii</i>	Kheua pa song	Climber	OF	N/A	
<i>Syzygium cumini</i>	Mai ha	Tree	D MDF/MDF/OF	N/A	
<i>Syzygium zeylanicum</i>	Mai sa mek	Tree	OF	N/A	
<i>Tabernaemontana spp</i>	Pout pah	Shrub	MDF	N/A	
<i>Tetracera indica</i>	San kheua	Mushroom	RF/OF	N/A	

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN	Introduced / invasive
<i>Tetrameles nudiflora</i>	Mai pounng	Tree	OF	LR/LC	
<i>Tiliacora triandra</i>	kheua yar narng	Climber	OF	N/A	
<i>Trema orientalis</i>	Po hou	Shrub	OF/RF	N/A	
<i>Urena lobata</i>	Ya khee onh	Herb	OF/D MDF/MDF/RF	N/A	
<i>Uvaria littoralis</i>	Phi phuan	Climber	MDF/D MDF	N/A	
<i>Vatica cinerea</i>	Mai sy	Tree	MDF	EN	Not native. May be beyond original range
<i>Vitex trifolia</i>	Mai sa khang	Tree	D MDF	N/A	May be beyond original range
<i>Wrightia arborea</i>	Mai mouk	Tree	D MDF/RF	N/A	
<i>Ziziphus oenopolia</i>	Khuea narm leo meo	Climber	RF/OF	N/A	

IUCN Status Red List Categories: EN – Endangered, NT – Near Threatened, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed; MDF – Mixed Deciduous Forest, D MDF – Disturbed Mixed Deciduous Forest, RF – Regeneration Forest, OF – Old Unstocked / Regeneration Forest

Table A-6 Species recorded within the vegetation types of the NN1PC transmission line extension (Sections 3 – 5)

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN Status	Introduced / invasive
<i>Acacia pennata</i>	Kheua num hun	Climber	RF	N/A	
<i>Alangium kurzii</i>	Alangium	Tree	D MDF	N/A	
<i>Amischotolype griffithii</i>	Yar karp yai	Herb	MDF/RF	N/A	Native to Malaya
<i>Amomum avoideum</i>	Mak naeng	Herb	MDF	N/A	
<i>Anisoptera costata</i>	Mai bark noi	Tree	OF	EN	
<i>Aphanamixis polystachya</i>	Mai ta seua	Tree	D MDF/MDF/RF	LR/LC	
<i>Aporosa cardiosperma</i>	Mai muad khon	Shrub	MDF	N/A	Endemic of Sri Lanka
<i>Aporosa lindleyana</i>	Mai muad kieng	Shrub	MDF	N/A	Native to India and Sri Lanka
<i>Aporosa spp</i>	Mai muad kieng	Shrub	OF	N/A	
<i>Aralia armata</i>	Ton tarng	Shrub	MDF/D MDF	N/A	
<i>Ardisia crispa</i>	Ton teen jum	Shrub	D MDF	N/A	
<i>Aspidistra typica</i>	Kok kard diew	Herb	MDF	N/A	
<i>Asystasia gangetica</i>	Ya chi loh	Herb	OF	N/A	
<i>Bombax anceps</i>	Mai ngiw pah	Shrub	MDF	N/A	
<i>Calamus javensis</i>	Wai harnng nou	Palm	RF	N/A	
<i>Calycopteris floribunda</i>	Kheua ka deng	Shrub	OF/MDF/RF	N/A	
<i>Casearia grewiaefolia</i>	Mai ka douk	Tree	D MDF	N/A	
<i>Casearia grewiaefolia</i>	Ton ka book	Tree	MDF	N/A	
<i>Catimbum bracteatum</i>	Khar	Herb	MDF/OF	N/A	
<i>Chromolaena odorata</i>	Yar khiw	Herb	MDF/RF	N/A	Native to North America, highly invasive
<i>Cinnamomum iners</i>	Mai sa chaung	Tree	MDF	N/A	
<i>Cissus assamica</i>	kheua som poun	Climber	MDF	N/A	
<i>Cissus astrotricha</i>	khuea houn hua jai	Climber	RF	N/A	
<i>Clausena anisata</i>	Ka bee khon	Shrub	RF	N/A	
<i>Cnestis palala</i>	Kham kheua	Climber	OF	N/A	
<i>Cosciniium fenestratum</i>	Kheua haem	Climber	RF	N/A	
<i>Costus speciosus</i>	Eeuang	Tree	MDF	N/A	
<i>Costus speciosus</i>	Kok euang	Tree	RF	N/A	
<i>Cratoxylum formosum</i>	Mai tiw som	Tree	RF/OF	LR/LC	
<i>Cratoxylum formosum var. prunifolium</i>	Mai tiw khon	Tree	OF/RF/MDF	LR/LC	
<i>Croton laevigatus</i>	Mai pao thong	Shrub	RF	N/A	

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN Status	Introduced / invasive
<i>Crypteronia paniculata</i>	Mai ka arm	Tree	OF	N/A	
<i>Cyclea barbata</i>	Khuea mor noi	Climber	D MDF	N/A	
<i>Cyclea peltata</i>	Sar mor noi	Climber	RF/D MDF	N/A	Native to India
<i>Dioscorea alata</i>	khuea mun kin	Climber	D MDF	N/A	
<i>Dioscorea triphylla</i>	Koiy	Climber	D MDF	N/A	
<i>Diospyros spp.</i>	Mai nang dam	Tree	MDF	N/A	
<i>Drynaria quercifolia</i>	Phak kood hue ka hork	Epiphyte Fern	MDF	N/A	
<i>Duabanga grandiflora</i>	Kok lin ngor noi	Tree	D MDF	N/A	
<i>Embelia libers</i>	Som khee morn	Climber	RF	N/A	
<i>Entada phaseoloides</i>	Kheua mak lae	Climber	OF	N/A	
<i>Epipremnum giganteum</i>	Kheua moum	Climber	MDF	N/A	
<i>Erechtites valerianifolia</i>	Yar la mung	Herb	D MDF/RF	N/A	
<i>Eurycoma longifolia</i>	Yik bor thong	Shrub	OF/MDF/RF	N/A	
<i>Ficus hispida</i>	Mak deua pong	Shrub	D MDF	N/A	
<i>Gardenia spp</i>	Mai khai nao	Shrub	MDF	N/A	
<i>Glochidion eriocarpum</i>	Ton khee mod	Tree	OF/MDF	N/A	
<i>Hedyotis spp</i>	Ya chi loh	Herb	MDF	N/A	
<i>Irvingia malayana</i>	Mai ka bok	Tree	OF/MDF	LR/LC	
<i>Lagerstroemia calyculata</i>	Mai peuay	Tree	OF/MDF/D MDF	N/A	
<i>Leea rubra</i>	Tarng kai	Herb	MDF	N/A	
<i>Lepisanthes tetraphylla</i>	Ton huad	Shrub	MDF/RF/D MDF	N/A	
<i>Lygodium dimorphum</i>	Pha kood khua	Fern	OF	N/A	
<i>Macaranga denticulata</i>	Mai tong khop	Shrub	RF	N/A	
<i>Maesa ramentacea</i>	Ton khup	Shrub	MDF	N/A	
<i>Mallotus paniculatus</i>	Mai tong tao	Shrub	RF/D MDF/RF	N/A	
<i>Markhamia stipulata</i>	Mai khae	Tree	MDF	N/A	
<i>Melastoma normale</i>	Ben a	Herb	OF/MDF/RF	N/A	
<i>Memecylon fruticosum</i>	Mai meuad ae	Shrub	MDF	N/A	
<i>Morinda spp</i>	Yor dong	Shrub	D MDF	N/A	
<i>Musa acuminata</i>	Kouay pah	Herb	MDF/RF	N/A	
<i>Nauclea orientalis</i>	Mai karn lueang	Tree	RF/D MDF	N/A	
<i>Ormosia pinnata</i>	Mai khee mou	Tree	OF/RF/D MDF	N/A	May be beyond original range
<i>Oxytenanthera albociliata</i>	Nor mai lai	Herb	RF/D MDF/MDF	N/A	
<i>Panicum spp</i>	Yar young	Herb	D MDF	N/A	

Scientific Name	Lao Name	Habit	Vegetation Types	IUCN Status	Introduced / invasive
<i>Parkia sumatrana</i>	Mai hua lon	Tree	MDF	N/A	
<i>Peltophorum dasyrrhachis</i>	Mai sa phang	Tree	RF/OF/MDF	N/A	
<i>Phoebe lanceolata</i>	Phai ven	Shrub	MDF	N/A	
<i>Radermanchera ignea</i>	Mai dork pip	Tree	MDF	N/A	
<i>Sapium discolor</i>	Mai pang	Tree	MDF/RF/D MDF	N/A	
<i>Sauropus androgynus</i>	Pha van pah	Herb	OF	N/A	
<i>Sauropus androgynus</i>	Ton phak van	Herb	MDF	N/A	
<i>Schima wallichii</i>	Mai mee	Tree	OF/MDF	N/A	
<i>Scleria terrestris</i>	Yar khom pao	Herb	MDF/RF	LC	
<i>Sindora siamensis</i> var. <i>siamensis</i>	Mai tae narm	Tree	MDF	LC	
<i>Smilax glabra</i>	kheua yar hua	Climber	D MDF	N/A	
<i>Tetrameles nudiflora</i>	Mai sa phoung	Tree	RF	LR/LC	
<i>Tinospora crispa</i>	kheua khao hor	Climber	MDF	N/A	
<i>Torenia fourmieri</i>	Dork lung hin	Herb	D MDF	N/A	
<i>Trevesia palmata</i>	Tong tarng yai	Shrub	MDF/RF	N/A	
<i>Uncaria macrophylla</i>	Kheua narm khor	Climber	D MDF	N/A	
<i>Vatica cinerea</i>	Mai sy	Tree	MDF	EN	Not native. May be beyond original range
<i>Ventilago denticulata</i>	Khuea ngou hao	Climber	MDF	N/A	
<i>Vitex pinnata</i>	Mai sa kharng	Tree	MDF	N/A	
<i>Wrightia arborea</i>	Mai mouk noi	Tree	MDF	N/A	
<i>Xanthophyllum flavescens</i>	Mai saeng dong	Tree	MDF	N/A	

IUCN Status Red List Categories: EN – Endangered, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed; MDF – Mixed Deciduous Forest, D MDF – Disturbed Mixed Deciduous Forest, RF –Regeneration Forest, OF – Old Unstocked / Regeneration Forest

Table A-7 Aquatic species identified as inhabiting the rivers (Nam San, Ngiep and Xao) near the transmission line (TL) villages, including international conservation significance of species (IUCN 2014)

Class	Scientific Name	Lao Name	English Common Name	IUCN Status	Family	Nam Xan	Nam Ngiep		Nam Xao		Nam Ngiep
						Nonsomboun	Thaheau	Hat Gniun	Thaheau	Hat Gniun	Hatsaykham
Reptilia	<i>Amyda cartilaginea</i>	Pa phar	Southeast Asian softshell turtle	VU	Trionychidae		✓		✓		
Actinopterygii (ray-finned fish)	<i>Anabas testudineus</i>	Pa kheng		DD	Anabantidae	✓			✓		
	<i>Anguilla marmorata</i>	Pa lard meo	Giant long-finned eel	LC	Anguillidae				✓		
	<i>Balantiocheilos melanopterus*</i>	Pa boc	Silver shark	EN	Cyprinidae			✓			
	<i>Bangana behri</i>	Pa wa		VU	Cyprinidae		✓	✓	✓	✓	✓
	<i>Bagarius yarrelli*</i>	Pa khae		NT	Sisoridae		✓	✓	✓	✓	✓
	<i>Channa gachua</i>	Pa khor kung	Dwarf snakehead	LC	Channidae	✓		✓		✓	✓
	<i>Channa maruloides*</i>	Pa kuan saiy	Emperor snakehead	LC	Channidae		✓	✓			
	<i>Channa striata</i>	Pa khor		LC	Channidae	✓		✓		✓	✓
	<i>Cirrhinus cirrhosus</i>	Pa nang	Mrigal carp	VU	Cyprinidae		✓		✓		
	<i>Clarias batrachus</i>	Pa douk		LC	Clariidae		✓	✓	✓	✓	
	<i>Cyclocheilichthys repasson</i>	Pa e thai		LC	Cyprinidae			✓		✓	
	<i>Discherodontus ashmeadi</i>	Pa dork ngiw	Redtail barb	LC	Cyprinidae	✓					
	<i>Hampala dispar</i>	Pa soud		LC	Cyprinidae			✓		✓	✓
	<i>Hemibagrus wyckioides</i>	Pa kherng	Asian red tailed catfish	LC	Bagridae		✓	✓	✓	✓	✓
<i>Hypsibarbus suvattii*</i>	Pa park		DD	Cyprinidae		✓		✓		✓	
<i>Labeo sp.</i>	Pa song		N/A	Cyprinidae		✓		✓			

Class	Scientific Name	Lao Name	English Common Name	IUCN Status	Family	Nam Xan	Nam Ngiep		Nam Xao		Nam Ngiep
						Nonsomboun	Thaheau	Hat Gniun	Thaheau	Hat Gniun	Hatsaykham
	<i>Lobocheilos melanotaenia</i>	Pa khing		LC	Cyprinidae		✓		✓		
	<i>Macrogathus siamensis</i>	Pa lod	Spotfin spiny eel	LC	Mastacembelidae	✓	✓		✓		
	<i>Mastacembelus armatus*</i>	Pa lard	Spiny eel	LC	Mastacembelidae	✓	✓		✓		
	<i>Monopterus albus</i>	Len	Asian swamp eel	LC	Synbranchidae		✓	✓	✓		
	<i>Morulius chrysophekadion</i>	Pa peer	Black sharkminnow	LC	Cyprinidae		✓		✓		
	<i>Mystus albolineatus*</i>	Pa yorn		LC	Bagridae			✓		✓	
	<i>Mystus nemurus*</i>	Pa kod	Yellow catfish	LC	Bagridae	✓		✓		✓	
	<i>Notopterus notopterus</i>	Pa tong na		LC	Notopteridae		✓		✓		✓
	<i>Ompok bimaculatus*</i>	Pa seuam		NT	Siluridae	✓		✓			
	<i>Osteochilus lini</i>	Pa khee khom	Dusky face carp	LC	Cyprinidae	✓		✓		✓	
	<i>Parambassis siamensis</i>	Pa kharp khong		LC	Ambassidae			✓			
	<i>Poropuntius laoensis</i>	Pa jard		LC	Cyprinidae	✓	✓		✓		✓
	<i>Pristolepis fasciata</i>	Pa kar	Malayan leaf fish	LC	Nandidae			✓			
	<i>Puntius brevis</i>	Pa khao	Swamp barb	LC	Cyprinidae		✓		✓		
	<i>Rasbora rubrodorsalis</i>	Pa kha yaeng		LC	Cyprinidae			✓			
	<i>Rasbora sp.</i>	Pa siw		N/A	Cyprinidae			✓			

Class	Scientific Name	Lao Name	English Common Name	IUCN Status	Family	Nam Xan	Nam Ngiep		Nam Xao		Nam Ngiep
						Nonsomboun	Thaheau	Hat Gniun	Thaheau	Hat Gniun	Hatsaykham
	<i>Scaphiodonichthys acanthopterus</i>	Pa morm		LC	Cyprinidae		✓		✓		✓
	<i>Schistura sp.</i>	Pa id		N/A	Nemacheilidae						✓
	<i>Monotrete suvattii</i>	Pa pao		LC	Tetraodontidae						✓
	<i>Tor sinensis*</i>	Pa daeng		DD	Cyprinidae			✓		✓	✓
	<i>Xenentodon sp.</i>	Pa thon		N/A	Belonidae			✓		✓	✓

*Introduced or species beyond their normal range; IUCN Status Red List Categories: EN – Endangered, VU – Vulnerable, NT – Near Threatened, DD – Data Deficient, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed

Table A-8 Non-timber forest products (NTFPs) commonly collected by local residents

Scientific Name	Lao Name	Habit	IUCN Status	General Uses	Ban Nonsomboun			Ban Thaheua			Ban Hat Gniun			Ban Hatsaykham			
					Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collected in PPA?	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)
<i>Alpinia galanga</i>	Nor khar	Herb	N/A	Edible young shoot								W	B	C/S			
<i>Amanita vaginata var. alba</i>	Hed la ngok	Mush.	N/A	Edible	W		C/S	W	✓	B	C/S						
<i>Amomum aculeatum</i>	Mark naeng	Herb	N/A	Aromatic spice/herb											B	B	C/S
<i>Bambusa arundinacea</i>	Nor phai pa	Bamboo	N/A	Edible young shoot, furniture				W		B	C/S	W	B	C/S	W		C/S
<i>Bauhinia spp</i>	Kheua john nao	Climber	N/A	Ornamental, legumes				B		B	C						
<i>Calamus spp.</i>	Wai	Liana	N/A	Edible young shoot, furniture	B		C/S	B		B	C/S						
<i>Centella asiatica</i>	Phak nork	Herb	LC	Medicine	B		C/S	B		B	C/S						
<i>Cephalostachyum virgatum</i>	Nor mai heer	Bamboo	N/A	Young shoot eaten				W		B	C/S	W	B	C/S	W		C/S
<i>Chromolaena odorata*</i>	Yar khiw	Herb	N/A	Medicine								B	B	C/S			
<i>Colocasia antiquorum</i>	Bone	Herb	N/A	Edible											B	B	C/S
<i>Coscinium fenestratum</i>	Kheua haem	Climber	N/A	Edible fruit				B		B	S				B		S
<i>Cratoxylum formosum</i>	Phak tie som	Tree	LR/LC	Edible young leaves, timber	W	B	C										
<i>Daemonorops jenkinsiana</i>	Nor voun	Palm	N/A	Furniture, resin				B		B	C/S	B	B	C/S			
<i>Diplazium esculentum</i>	Phak kood	Fern	LC	Edible	B	B	C/S	B		B	C/S	B	B	C/S	B		C/S

Scientific Name	Lao Name	Habit	IUCN Status	General Uses	Ban Nonsomboun			Ban Thaheua			Ban Hat Gniun			Ban Hatsaykham			
					Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collected in PPA?	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)
<i>Eleusine indica</i>	Yar khay	Herb	LC	Tuber can be eaten cooked								B	B	C/S			
<i>Entada phaseoloides</i>	Mark bar	Climber	N/A	Fruit, seeds											B	B	C/S
<i>Irvingia malayana</i>	Mark ka bok	Tree	LR/LC	Edible roasted seeds, timber				B	✓	B	C/S						
<i>Lasia spinosa</i>	Bone narm	Aq.Herb	LC	Edible											B	B	C/S
<i>Lentinus polychrous</i>	Hed bot	Mush.	N/A	Edible	W		C/S	W	✓	B	C/S	W	B	C/S	W		C/S
<i>Lentinus squarrosulus</i>	hed khao	Mush.	N/A	Edible	W		C/S	W	✓	B	C/S	W	B	C/S	W		C/S
<i>Limnocharis flava*</i>	Phak karn jong	Herb	N/A	Edible				B		B	C/S						
<i>Marsilea crenata</i>	Phak vaen	Fern	LC	Edible				B		B	C/S						
<i>Melientha suavis</i>	Phak warn	Herb	N/A	Edible young shoots				B		B	C/S	B	B	C/S	B		C/S
<i>Oxytenanthera albociliata</i>	Nor mai lai	Bamboo	N/A	Edible shoots, furniture, tools	W	F	C/S	W		B	C/S	W	B	C/S	W		C/S
<i>Oxytenanthera parvifolia</i>	Nor Sord	Bamboo	N/A	Edible shoots, furniture, tools	W	F	C/S					W	B	C/S			
<i>Pentace burmanica</i>	Sy sied	Shrub	N/A	Bark for medicine & tanning				B		B	C/S	B	B	C/S			
<i>Dipterocarpaceae spp</i>	Khee sy			Edible raisons				B	✓	B	S	B	B	S	B		S
<i>Rhapis micrantha</i>	San	Palm	N/A	Leaves used for handcrafts	B		C/S										
<i>Sagittaria sagittifolia</i>	Phak hin	Aq.herb	LC	Edible tuber				B		B	C/S						
<i>Schizophyllum commune</i>	Hed bee	Mush.	N/A	Edible				W	✓	B	C/S				W		C/S

Scientific Name	Lao Name	Habit	IUCN Status	General Uses	Ban Nonsomboun			Ban Thaheua			Ban Hat Gniun			Ban Hatsaykham			
					Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collected in PPA?	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)
<i>Smilax sp.</i>	Yar hua	Climber	N/A	Roots/shoots, medicine				B		B	C/S	B	B	C/S			
<i>Syzygium zeylanicum</i>	Phak sa mek	Tree	N/A	Sweet aromatic edible fruit	W		C/S	W		B	C/S						
<i>Termitomyces spp</i>	Hed puak	Mush.	N/A	Edible	W		C/S	W	✓	B	C/S	W	B	C/S	W		C/S
<i>Volvariella esculenta*</i>	Hed fueang	Mush.	N/A	Edible				W	✓	B	C/S						

* Introduced or beyond known range; IUCN Status Red List Categories: EN – Endangered, NT – Near Threatened, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed; D – Daily, W – Weekly, B – Both, C – Consumed, S – Sold, M - Male, F - Female

Table A-9 Timber forest products (TFPs) commonly collected by local residents

Scientific Name	Lao Name	Habit	IUCN Status	General Uses	Ban Nonsomboun			Ban Thaheua			Ban Hat Gniun			Ban Hatsaykham		
					Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)
<i>Adenanthera pavonina</i>	Mai Mark lum	Tree	N/A	Food, medicine and timber				B	B	C						
<i>Anisoptera costata</i>	Mai bark	Tree	EN	Timber, fragrant oily resin	B	B	C	B	B	C	B	B	C/S	B	B	C
<i>Cephalostachyum virgatum</i>	Mai Heer	Bamboo	N/A	Young shoot eaten, NTFP							B	B	C/S			
<i>Cratoxylum formosum (var. prunifolium)</i>	Mai tieo deng (khon)	Tree	LR/LC	Timber, NTFP	B	B	C									
<i>Dipterocarpus alatus</i>	Mai yang	Tree	EN	Timber	B	B	C	B	B	C	B	B	C/S	B	B	C
<i>Hopea ferrea*</i>	Mai Khaen hin	Tree	EN	Timber										B	B	C
<i>Hopea odorata</i>	Mai khaen hua	Tree	VU	Timber				B	B	C	B	B	C/S	B	B	C
<i>Irvingia malayana</i>	Mai ka bok	Tree	LR/LC	Timber	B	B	C									
<i>Lagerstroemia calyculata</i>	Mai Peauy	Tree	N/A	Decoration, timber				B	B	C	B	B	C/S			
<i>Pometia pinnata</i>	Mai kuang daeng	Tree	N/A	Fruit, timber				B	B	C						
<i>Pterocarpus macrocarpus</i>	Mai dou	Tree	N/A	Timber										B	B	C
<i>Schima wallichii</i>	Mai mee	Tree	N/A	Timber	B	B	C									
<i>Sindora siamensis var. siamensis</i>	Tae Narm	Tree	LC	Timber										B	B	C
<i>Trema orientalis</i>	Por Hou	Shrub	N/A	Hemp, timber, firewood										B	B	C

Scientific Name	Lao Name	Habit	IUCN Status	General Uses	Ban Nonsomboun			Ban Thaheua			Ban Hat Gniun			Ban Hatsaykham		
					Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)	Frequency (D/W/B)	Collectors (M/F/B)	Use (C/S)
<i>Vatica cinerea</i> *	Mai sy	Tree	EN	Timber	B	B	C	B	B	C	B	B	C/S			

* Introduced or beyond known range; IUCN Status Red List Categories: EN – Endangered, NT – Near Threatened, LC – Least Concern, LR – Lower Risk, N/A – Not Assessed; D – Daily, W – Weekly, B – Both, C – Consumed, S – Sold, M - Male, F - Female

APPENDIX B: RECORDS OF CONSULTATION

ບົດບັນທຶກກອງປະຊຸມປຶກສາຫາລືຂັ້ນບ້ານ
(Meeting Notes of village consultation)

1. ວັນເດືອນປີ (Date):	17-6-14
2. ບ້ານ (Village)	ບ້ານ ທ່າເຮືອງ Tha Hua.
3. ຜູ້ເຂົ້າຮ່ວມ (Participants)-(refer to the attendance sheet)	
4. (ຂໍ້ສະເໜີຕ່າງໆ) Notes: (Try to note under different topics/issues)	
ຫົວຂໍ້ (Topics)	ຄໍາເຫັນ-ຂໍ້ສະເໜີຕ່າງໆ ແລະ ວິຖໍາຕອບ (comments and actions)
	<ul style="list-style-type: none"> - ກຳລັງ ໗໒ຕາມ ແລະ ໝູ ເທົ່າ ກໍ່ ບໍ່ ມີ ບັນຫາ. - ແຕ່ ກຳລັງ ໗໒ ມີ ການ ບຸກ ເບີກ ກວັງ ຈອກ ໄປ ຕື້ມ ແລະ ກະທົບ ຕໍ່ ດິນ ທີ່ ຕື້ມ ໄວ້ ຂອງ ປູ/ຊຸ ກໍ່ ອາດ ຈະ ຈາກ ສ່ອງ ໃຫ້ ມີ ການ ຊຶກ ເຊີຍ. - ເຮັດ ປູ ກ່ອງ ລາຍ ໄຟ ຈະ ໄດ້ ບົກ ບັດ ບໍ່ ອ່ອ ? - ປ້າມ ເພີ່ມ ມອດ ໄຟ ດິນ. - ກ່ອນ ກໍ່ ມອດ ຕັ້ງ ແຊ່ ກ່ອນ.
	<ul style="list-style-type: none"> - ມີ ຂໍ້ ສະ ເໜີ ຕ່າງ ໆ ແຕ່ ບໍ່ ສາ ມາດ ຈາກ ສາ ພັນ ປໍາ ໄດ້. ເວົ້າ ເໝາ ທີ່ ຄວນ ມີ ການ ຄຸ້ມ ຄອງ ຕື້ມ. - ກຳລັງ ທຶນ ມີ ວ່ອມ ກໍ່ ຂໍ ປົກ ລຽງ ປາ ໃຫ້ ປູ/ຊຸ ເມື່ອງ ຈາກ ວ່າ ສັດ ມີ ໄດ້ ສາ ມາດ ພ້ອມ ສິ່ງ. - ກໍ່ ເປັນ ໄປ ໄດ້ ປົກ ຮໍ່ ໃຫ້ ວິ ຊາ ການ ເພີ່ມ ສ່ອງ ມາ ເຝິກ ຈົບ ວິ ມ ໃນ ການ ລຽງ ເປັດ ລຽງ ໃກ້. - ສ່ອງ ກອງ ທຶນ ສາ ມາດ ການ ຕໍ່ ເຫງກ.

ເຊັນ ແລະ ປະທັບກາ ນາຍບ້ານ
(Sign and stamp)



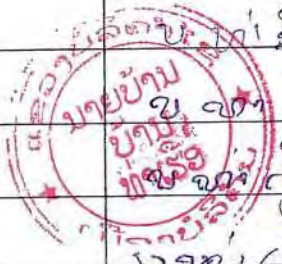
ບຸນຮຽງ ໄຊຍະສິງ
Bounhieng XAYALAT

17-6-14

B. Tha Heva

Registration Form (ຟອມລົງທະບຽນ)

No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	ທ. ສິທອງ ທອງວິຈິດ	ບ.ທ່າເຮັງ	54399470	
2	ທ. ບຸນຍາ ໄທພະລາດ	ບ.ທ່າເຮັງ	55491810	
3	ຊິງ ຈິນິດ	ບ.ທ່າເຮັງ	90967892	
4	ທ. ພິ ພິ	ບ.ທ່າເຮັງ	59404763	
5	ທ. ບຸນຍາ	ບ.ທ່າເຮັງ		
6	ບ. ອິນທາ	ບ.ທ່າເຮັງ		
7	ບ. ຂັນທອນ	ບ.ທ່າເຮັງ	91906875	
8	ບ. ສິນ	ບ.ທ່າເຮັງ		
9	ບ. ສິນ	ບ.ທ່າເຮັງ		
10	ບ. ສິນ	ບ.ທ່າເຮັງ		
11	ບ. ສິນ	ບ.ທ່າເຮັງ		
12	ບ. ສິນ	ບ.ທ່າເຮັງ		
13	ບ. ສິນ	ບ.ທ່າເຮັງ		
14	ບ. ສິນ	ບ.ທ່າເຮັງ		
15	ບ. ສິນ	ບ.ທ່າເຮັງ		
16	ບ. ພິມພາ	ບ.ທ່າເຮັງ		
17	ບ. ສິນ	ບ.ທ່າເຮັງ		
18	ບ. ສິນ	ບ.ທ່າເຮັງ		
19	ບ. ສິນ	ບ.ທ່າເຮັງ		
20	ບ. ສິນ	ບ.ທ່າເຮັງ		
21	ບ. ບຸນຍາ	ບ.ທ່າເຮັງ		
22	ບ. ສິນ	ບ.ທ່າເຮັງ		



17-6-14

B. Tha Heva

Registration Form (ຟອມລົງທະບຽນ)

No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	ທ. ພອມ ສິມພັນ	ປ/ຊ.	020 59200977	
2	ທ. ຄິດ ສິວ. ໂອວິທະຍາ	ປ. ກ. ສ. ປາຍ		
3	ທ. ສິມ ໂອວິທະຍາ	ຮອງ ມາຍ ທາມ	55592803	
4	ທ. ພຸວັນ ຫິມມະວິ	ປ/ຊ.	58422904	
5	ທ. ໂອວິທະຍາ	ປ/ຊ.	95708324	
6	ທ. ພຸວັນ ພິມມະວິ	ປ/ຊ.	58701933	
7	ທ. ບຸນທານ	ປ/ຊ.		
8	ທ. ອາ ສິມ	ປ/ຊ.		
9	ທ. ອິດ ສິມ	ປ. ກ. ຊ.	98263905	
10	ທ. ບຸນ	ປ/ຊ.	59847215	
11	ທ. ພຸວັນ	ປ/ຊ.	56061018	ທ. ພຸວັນ
12	ທ. ສິມ	ປ/ຊ.	54404903	
13	ທ. ສິມ ພິມມະວິ	ປ/ຊ.	59793904	
14	ທ. ວິໄນ	ປ/ຊ.	0309154556	ທ. ວິໄນ
15	ທ. ສິມ ພິມມະວິ	ປ. ກ. ສ. ປາຍ	56467302	
16	ທ. ສິມ	ປ/ຊ.		ທ. ສິມ
17	ທ. ໂອວິດ	ປ/ຊ.		ທ. ໂອວິດ
18	ທ. ພິມມະວິ	ປ/ຊ.		ທ. ພິມມະວິ
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20				
21				
22				



17-6-14

B. Tha Heva

Registration Form (ຟອມລົງທະບຽນ)

No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	ບ. ພັດ	ບ. ທ່າເຮືອ		ບ. ພັດ
2	ບ. ວິມ ດາ	ບ. ທ່າເຮືອ		ບ. ວິມ ດາ
3	ບ. ວິມ	ບ. ທ່າເຮືອ		ບ. ວິມ
4	ບ. ຄິມ	ບ. ທ່າເຮືອ	59202609	ບ. ຄິມ
5	ບ. ສິມ ວິມ	ບ. ທ່າເຮືອ	0309562726	ບ. ສິມ ວິມ
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17-6-14
B. Tha Heua

Registration Form (ຟອມລົງທະບຽນ)

No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	Katsuda Masato	NPP / PC	020-5551-5060	
2	Ryuzichi Miyamoto	OBAYASHI	020-5988215	
3	Mauonway	EMO	020-22000650	
4	Yomy Nemy	NPP SMO	020 28120405	
5		CRD		
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ບົດບັນທຶກກອງປະຊຸມປຶກສາຫາຫາລືຂັ້ນບ້ານ
(Meeting Notes of village consultation)

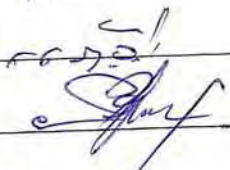
1. ວັນເດືອນປີ (Date):	17-6-14
2. ບ້ານ (Village)	B. Hot Sionk. ບຸ. ຫາດຢຸນ
3. ຜູ້ເຂົ້າຮ່ວມ (Participants)-(refer to the attendance sheet)	
4. (ຂໍ້ສະເໜີຕ່າງໆ) Notes: (Try to note under different topics/issues)	
ຫົວຂໍ້ (Topics)	ຄໍາເຫັນ-ຂໍ້ສະເໜີຕ່າງໆ ແລະ ວິຄໍາຕອບ (comments and actions)
	<ul style="list-style-type: none"> - ຖ້າເພິ່ນ ລະມາ ກາມ ອອກ ແບບ ເລີ ໄຟ. ເລີ ໄຟ ສົ່ງ ຢູ່ ໃຈ ກາງ ທາງ ເຂົ້າ ອອກ. - ຈະ ພັ ກາມ ບ້າຍ ເລີ ໄຟ ໂຕ ມີ ມີ ບໍ່ ? - ເຮືອນ ທີ່ ສົ່ງ ຢູ່ ກ້ອງ ລາຍ ໄຟ, ຈະ ມີ ຜົນ ກະ ທົບ ແນວ ໃດ ? -
	<ul style="list-style-type: none"> - ກາມ ທົດ ມັກ, ຄົມ ບອກ ທົດ ລະ ຈິ່ງ ທົດ, ບໍ່ ຫາກ ລະ ບໍ່ ທົດ. (ເປັນ ທາງ ສ່ວນ) - ຢ່າ ກາ ທົດ ວິ ທົດ ຄົມ ເພິ່ນ ທຸກ ຜ່ອນ ຄວາມ ໄວ. - ຈົ່ງ ກາມ ມາ ໃຊ້ ມາ ບໍ່ ມາ, ມາ ບໍ່ ພໍ ຢ່າ ກາ ລະ ເພິ່ນ ຈົ່ງ ໂຄງ ກາມ ລະ ເພິ່ນ ມາ ຕົ້ນ. - ທາງ ເຂົ້າ ບ້ານ ເປັນ ຊຸມ, ລັດ ໂຄງ ກາມ ທາງ ທາຍ, ຢ່າ ກາ ໃຫ້ ປັບ ປຸງ ເສັ້ນ ທາງ. (ກາ ປຸງ ລາຍ) (ເຮົາ ມາ ປະ ຊຸມ ມາ ມາ ບໍ່ ທົດ) - ສະ ພາ ບໍ່ ເຮັດ ຕາມ ແລະ ທາງ ທີ່ ຄວາມ ເປັນ ເຊິ່ງ ມັກ ເຂົ້າ ໃນ ວິ ທົດ / ມາ
	<p>ດິນ ຂອງ ຊາວ ບ້ານ, ລະ ເພິ່ນ ໃຫ້ ເພິ່ນ / ພາກ ສ່ວນ ທາງ ຂອງ ທາຍ ເລີ ອອກ ຈາກ 12 ດ ດິນ ຂອງ 1/4 1/4 ບໍ່ ສາ ມາ ປຸກ ເຮືອນ ທີ່ ເຮັດ ທາຍ ໃດ.</p>

ເຊັນ ແລະ ປະທັບກາ ນາຍບ້ານ
(Sign and stamp)

17-6-14
B. Hat Union

Registration Form (ພອມລົງທະບຽນ)

No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	ນ. ທຸມ	ປ/ຊ		ນ. ທຸມ
2	ນ. ອຸ້ງ	ປ/ຊ		ນ. ອຸ້ງ
3	ທ. ມ່າ	ປ. ງ		ມ່າ
4	ທ. ສີ	ປ. ຊ		ສີ
5	ນາງ ແສງ	ປ. ງ		ແສງ
6	ທ. ດຳລຳ ແກ້ວ ວິໄລ	ປ/ງ	54241366	
7	ນ. ມາ	ປ/ຊ		ນ. ມາ
8	ນ. ອຸ້ງ	ປ/ຊ		ນ. ອຸ້ງ
9	ນ. ມະສິກ	ປ/ຊ	56552157	ນ. ມະສິກ
10	ນ. ທາວ	ປ/ຊ		ນ. ທາວ
11	ນ. ວິ	ປ/ຊ		ນ. ວິ
12	ນ. ດຳ	ປ/ຊ		ນ. ດຳ
13	ນ. ລິມ	ປ/ຊ		ນ. ລິມ
14	ນ. ວິ	ປ/ຊ		ນ. ວິ
15	ນ. ອຸ້ງ	ປ/ຊ		ນ. ອຸ້ງ
16	ນາງ ວິ	ປ/ຊ		ນາງ ວິ
17	ນ. ດຳ	ປ/ຊ		ນ. ດຳ
18	ນ. ດຳ	ປ/ຊ	030 9192993	ນ. ດຳ
19	ນ. ວິ	ປ/ຊ		ນ. ວິ
20	ນາມ ສິມ	ປ/ຊ	9890778	ນາມ ສິມ
21	ນ. ພິມ	ປ/ຊ	54745565	ນ. ພິມ
22	ນ. ແສງ	ປ/ຊ	56284074	ນ. ແສງ



17-6-14
B. Hat Grun

Registration Form (ພອມລົງທະບຽນ)

No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	ຊິງ ສີທິພອນ	ຮອງ ການ ຂາດ	59204118	
2	ຈຸນ ວິໄລ	11 ຂອ ລິ ວິ ມ	91751042	
3	ທ. ພານ	ປ/ກ ທາດ ສີ ຂີ		
4	ທ. າວ	ທ້ ວິ ຂ ທາ ດ		
5	ທ. ງາມ ວິໄລ	ປ/ກ ທາດ ສີ ຂີ		
6	ທ. ສິມ	ປ/ກ ທາດ ສີ ຂີ		
7	ທ. ສິມ	ປ/ກ		
8	ທ. ວິໄລ	ປ/ກ ຂ	56152496	
9	ທ. ວິໄລ	ປ/ກ		
10	ທ. ວິໄລ	ປ/ກ		
11	ທ. ວິໄລ	ປ/ກ		
12	ທ. ວິໄລ	ປ/ກ		
13	ທ. ວິໄລ	ປ/ກ	96122019	
14	ທ. ວິໄລ	ປ/ກ		
15	ທ. ວິໄລ	ປ/ກ		
16	ທ. ວິໄລ	ປ/ກ		
17	ທ. ວິໄລ	ປ/ກ	58418529	
18	ທ. ວິໄລ	ປ/ກ		
19	ທ. ວິໄລ	ປ/ກ		
20	ທ. ວິໄລ	ປ/ກ		
21	ທ. ວິໄລ	ປ/ກ	59204781	
22	ທ. ວິໄລ	ປ/ກ		



Registration Form (ຟອມລົງທະບຽນ)

No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	ທ. ພູອຸງ	ປ/ຊ	59774434	ພູອຸງ
2	ທ. ຫວັດ	ປ/ຊ		ຫວັດ
3	ທ. ຫ້າ ຂົນ	ປ/ຊ	59665641	
4	ທ. ຄຳພັນ	ຮາດ ຫວັດ	59540994	ຄຳພັນ
5	ທ. ດອນ	ປ/ຊ		ດອນ
6	ທ. ພູອຸງສະວິງ	-/-	59683986	ພູອຸງ
7	ທ. ເຫຼົ້າວິໄນ	-/-	59703444	ເຫຼົ້າວິໄນ
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(Meeting Notes of village consultation)

1. ວັນເດືອນປີ (Date):	17-6-14
2. ບ້ານ (Village)	B. Hat Saykham ບ.ຫາດສາຍຄຳ
3. ຜູ້ເຂົ້າຮ່ວມ (Participants)-(refer to the attendance sheet)	
4. (ຂໍ້ສະເໜີຕ່າງໆ) Notes: (Try to note under different topics/issues)	
ຫົວຂໍ້ (Topics)	ຄຳເຫັນ-ຂໍ້ສະເໜີຕ່າງໆ ແລະ ວິຕຳຕອບ (comments and actions)
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ເຊັນ ແລະ ປະທັບກາ ນາຍບ້ານ
(Sign and stamp)



17-6-14

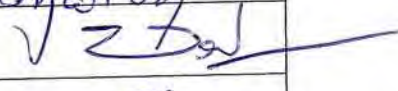

B. Hat saykham

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No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
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2	ທ. ວິຈິງ ສິວລິ	-	0305169393	ວິຈິງ ສິວລິ
3	ທ. ເຈີຊິງ	-	52912905	ເຈີຊິງ
4	ທ. ສິວລິ	-	0309007567	ສິວລິ
5	ທ. ສິວລິ	-	030575360	ສິວລິ
6	ທ. ສິວລິ	-	02059204106	ສິວລິ
7	ທ. ສິວລິ	-		ສິວລິ
8	ທ. ສິວລິ	-	0305770422	ສິວລິ
9	ທ. ສິວລິ	-	02059201891	ສິວລິ
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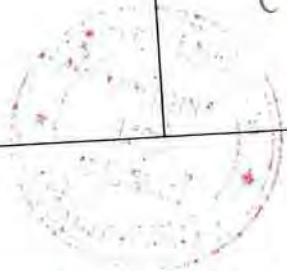
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No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	ທ. ລິວ ວິໄລ	ໜີ້ສິນໄຮງລຳ	0205920702	ລິວ ວິໄລ
2	ທ. ທິ່ງຝາວິໄລ	ໜີ້ສິນໄຮງລຳ	12	ທິ່ງຝາວິໄລ
3	ທ້ວ ບຸນພາພອນ	EDL (REP2)	2233 4430	✓ 
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1. ວັນເດືອນປີ (Date):	18-6-14
2. ບ້ານ (Village)	B. Nonsomboun ບ. ນົມສົມບູນ
3. ຜູ້ເຂົ້າຮ່ວມ (Participants)-(refer to the attendance sheet)	
4. (ຂໍ້ສະເໜີຕ່າງໆ) Notes: (Try to note under different topics/issues)	
ຫົວຂໍ້ (Topics)	ຄໍາເຫັນ-ຂໍ້ສະເໜີຕ່າງໆ ແລະ ວິຕໍາຕອບ (comments and actions)
	<ul style="list-style-type: none"> - ກຳ ທາກ ມັ ກາມ ບຸກ ລົກ ກຸ້ກ ເລື້ອ ທີ່ ດົນ ລ່ວຍ ຂອງ ປູ ແລະ ຢາກ ໃຫ້ ຮັບ ເລີດ ຊອບ . - ກຳ ທາກ ແລະ ລ່າຍ ໄຟ ທາກ ກາ ທົບ ກຸ້ກ ບັ້ນ ເລື້ອຍ ປູ ແລະ ຢາກ ໃຫ້ ຕິດ ຕໍ່ ທາ ປູ ທີ່ ກຸ້ກ . - ກຳ ທາກ ມັ ກາມ ສອກ ໄຟ ຕ້ອງ ໄດ້ ມັ ກາມ ແຈ້ງ ລ່ວຍ ແທ້, ແລະ ມັ ບາງ ຄອບ ຄົວ ທີ່ ມັ ບຸກ ກິດ ຂ: ພາດ ມັ ບຸກ, ຈຳ ເປັນ ຕ້ອງ ໄດ້ ກຸ້ກ ກຸ້ກ ກຸ້ກ .
	<p>ປີ. ມີ . ບໍ່ ຢາກ ໃຫ້ ປິດ ໄຟ ດົມ .</p> <ul style="list-style-type: none"> - ຊື່ ບໍ່ ມັ ບຸກ ກຳ ໄປ ກາມ ແລະ ໄຟ ເກົ່າ . - ຊ່ວຍ ເຄື່ອງ ຂ: ທາຍ ທາ ຄົບ ໂທລາ ໂຄງ ເພື່ອ ໃຫ້ ແຈ້ງ ກາມ ຮັບ ຊື່ ທີ່ ກຸ້ກ, ກຳ ທາກ ໂຄງ ກາມ ທາກ ຊ່ວຍ ໄດ້ . - ທາງ ຊ່ວຍ ຈາກ ທາງ ໃຫຍ່ (ທາງ ທີ່ ຕິດ.) ຊື່ ມັ ກາມ, ສະ ເພື່ອ ໃຫ້
	<p>ເລີດ ທົບ ກຸ້ກ - ຄຸນ ມັ ລົດ ກຸ້ກ ຍາກ .</p> <ul style="list-style-type: none"> - ກຳ ເປັນ ໄປ ໄດ້, ສະ ເພື່ອ ໃຫ້ ບໍລິ ສັດ ຂ: ທາຍ ທາ ທາງ ຊ່ວຍ ທີ່ ລົດ ທາງ ທາຍ, ອິດ ຊ່ວຍ ມັ ມ ແລະ ໂພດ, ລົດ ທາ ກຸ້ກ ທາຍ (ທີ່ ກຸ້ກ) sub-contract .



ເຊັນ ແລະ ປະທັບກາ ນາຍບ້ານ
(Sign and stamp)



ຫວັດ ຫຼວງສຸວັນນະວິງ

18-6-14

B. Nonsomboun.

Registration Form (ຟອມລົງທະບຽນ)

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1	ທ. ຫວັດ	ໜີ້ສະໜັບສະໜູນ	59201600	55557170
2	ທ. ສິງເກີ	CRD	281201405	
3	Masato Matsuda	WPIPC	—	
4	ທ. ໂພນ	ປ/ຊ	—	
5	ທ. ເພັດ	ປ/ຊ	22821061	
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22	ທ. ສິງ	ປ/ຊ	55181878	ທ. ສິງ



Registration Form (ຟອມລົງທະບຽນ)

No.	Name and surname (ຊື່ ແລະ ນາມສະກຸນ)	Organization (ພາກສ່ວນ)	Contact No (ເບີຕິດຕໍ່)	Signature (ລາຍເຊັນ)
1	ນ. ວອນ	ປ/ຊ		ນ. ວອນ
2	ນ. ວັດທະນະ	ປ/ຊ	56515903	ນ. ວັດທະນະ
3	ນ. ພອນສະໝາ	ປ/ຊ		ນ. ພອນສະໝາ
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APPENDIX C: EDL REP 2 ENVIRONMENTAL SAFEGUARDS OPERATION MANUAL

LAO PEOPLE'S DEMOCRATIC REPUBLIC

PEACE INDEPENDENCE DEMOCRACY UNITY PROSPERITY

Ministry of Energy and Mines



Electricite Du Laos

No...../EDL

Vientiane Capital, Date.....

Rural Electrification Project 2 (REP II)

On-grid component

Environmental Safeguards Operation Manual

March 2009

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- A** **Site Sensitivity Analysis**

- B** **Environmental Screening and EMP/IEE Decision Template**

- C** **Housekeeping Measures**

- D** **Environmental Management Plan Template**

- E** **Sample Management and Enhancement Measures**

- F** **Legal Frameworks**

List of Acronyms

ADB	Asian Development Bank
BOS	Branch Office Safeguard Staff
DOE	Department of Electricity
DECC	District Environment Coordination Committees
ESCBP	Environmental and Social Capacity Building Program
EMP	Environmental Management Plan
EDL	Electricite Du Laos
EFI	Environmental Field Inspector
EGAT	Electricity Generating Authority of Thailand
EGCO	Electricity Generating Public Company Ltd
EIA	Environmental Impact Assessment
ESOM	Environmental Safeguards Operations Manual
HQ EO	Head Quarter Environmental Office
FMECA	Failure Modes Effects and Criticality Analysis
GOL	Government of Lao PDR
IEE	Initial Environmental Examination
LV	Low Voltage Line
MEM	Ministry of Energy and Mines
MV	Medium Voltage Line
NGO	Non- Governmental Organization
NOL	No Objection Letter
PAP	Project Affected Persons
PEMU	Provincial Environmental Management Unit
PIU	Project Implementation Unit
PPAH	Pollution Prevention and Abatement Handbook (World Bank)
REP I	Rural Electrification Phase I
REP II	Rural Electrification Phase II
RFP	Request for Proposals
SIA	Social Impact Assessment
TOR	Terms of Reference
WB	World Bank
WREA	Water Resource and Environment Administration

1. Introduction and Environmental Consideration

1.1 REP II Program Level Environmental Consideration

The development of on-grid and off-grid components of the REP II would include MV and LV lines and SHS, Village Hydro, Biomass gasification, and Mini-Grid schemes. Land disturbance and environmental impacts associated with the development of both components are expected to be minimal. However, given the nature and approach of the development, environmental impacts cannot be fully defined from the start. Therefore, the development of the REP II will be designed in a manner such that environmental consideration is given at both the program and subproject levels.

At the program level, DOE and EDL has agreed to study and prepare Environmental Impact Assessment (EIA) for each scheme of the on-grid and off-grid component of the REP II. The EIA will be prepared in compliance with the country's Regulation of Environmental Assessment (2000) and draft Decree on the Assessment of Impact on Environmental and Society in Lao PDR (working draft 2008). The EIA will assess overall REP II impacts and identify whether environmental impact assessment is required at the subproject level. Based on experience from the REP I, environmental impacts for both the on-grid and off-grid components are expected to be minor and can be easily managed through good engineering designed and construction practices, as well as, simple easily performed good housekeeping measures during the implementation of subprojects.

At the subproject level, DOE and EDL has agreed to develop an Environmental and Social Safeguards Framework, including safeguard operations manuals for both components. On-Grid Environmental Management Framework

1.2 Objectives of ESOM REP II On-grid component

The objective of this Environmental Safeguards Operations Manual (ESOM) is to establish rules, processes and institutional arrangements to be utilized under this project with regard to identification, monitoring and mitigation of negative environmental and social impacts of project activities. Impacts which are common and typical for investment types under REP II on-grid component are described. Further the Manual provides an overview of the environmental legislation of Lao PDR, as well as World Bank requirements, and how they relate specifically to potential REP II impacts. The EMF establishes an approach for environmental management that meets the requirements of both Lao PDR laws and regulations, and the World Bank safeguards for a 'Category B' project.

Specifically, this ESOM provides detail procedures, documentation requirements and institutional responsibilities for:

- Project Identification;
- Environmental Screening;
- Environmental documentation;
- Review and approval;
- Consultation and disclosures;
- Monitoring and reporting;
- Project implementation; and
- Standard format of
 - Site Sensitivity Analysis
 - Environmental Screening and EMP/IEE Decision Template
 - Environmental Management Plan Template
 - Sample Mitigation and Monitoring Measures
 - Housekeeping measures

2. Subproject Descriptions and Potential Environmental Impacts

2.1 Subproject Descriptions

The development of the REP II on-grid component will consist of power supply installations with capacities of medium voltage (22kV) and low voltage (0.4kV) transmission and distribution lines respectively and/or transformers. The low voltage (LV) lines will be connected to individual households. The medium voltage (MV) lines will be designed to follow existing access road, wherever possible, and will be constructed in such a manner that local residents in villages through which the lines will pass have the potential for connections. Vegetation clearing will be conducted progressively along the medium voltage alignment as the construction proceeds. It is anticipated that vegetation and trees within 14 meters of right-of-way will be cleared. However, utilizing existing access road will mean that existing vegetation will likely be shrubs and bushed type vegetation and not dense and fertile type vegetation. Utilizing existing access road will minimize the potential negative impacts of the project on environmentally sensitive areas. Environmental management plan (EMP) will be prepared in accordance with guidelines provided in this EMF in order to minimize any potential adverse environmental impacts.

Reinforced 12 meter concrete poles will be used for the MV lines and 8 meter concrete poles for the LV lines. During installation, one sixth of the LV and MV lines pole length will be buried underground. Poles will generally be spaced at a frequency of 14 poles per kilometre along existing roads and access ways, using land available within road corridors. Step-down voltage transformers will be placed on the same type of poles. The majority of the poles will be placed on government owned land, which has previously been cleared and set aside for public access. Some will be placed on privately owned lands, for which EDL will provide appropriate compensation. Compensation measures for the on-grid component of the REP II can be found in the on-grid's Resettlement Policy Framework (RPF).

2.2 Potential Environmental Impacts

The main potential environmental impacts associated with the development of the on-grid component of the REP II are expected to occur during the construction and operation and maintenance phases. Potential environmental impacts during these phases are summarized below and detail potential impacts and management measures can be found in Annex E.

Construction Phase

The main potential environmental impacts associated with the development of on-grid component are likely to occur during construction. These impacts can include:

- Elevated dust levels due to increase vehicles movement;
- Elevated noise levels due to construction and vegetation clearing activities;
- Environmental impacts associated with the establishment of construction camps including waste management and exploitation of forest resources;
- Impacts associated with land clearing, cutting and trimming of vegetation and trees for right-of-way, including erosion and sedimentation, fragmentation of wildlife habitat, and improper disposal of vegetation debris; and
- Permanent lost of land use where along the MV line alignment and particularly where MV pole to be placed.

Where possible, the alignment of the MV lines designed and constructed along existing roads. Therefore, no construction of new access roads is likely to be necessary. As a result, the impacts of the development of the on-grid component are expected to be relatively minor and mostly temporary in nature, and can be easily managed through good engineering design and construction practices, and easily performed good housekeeping measures during construction.

Operation and Maintenance Phase

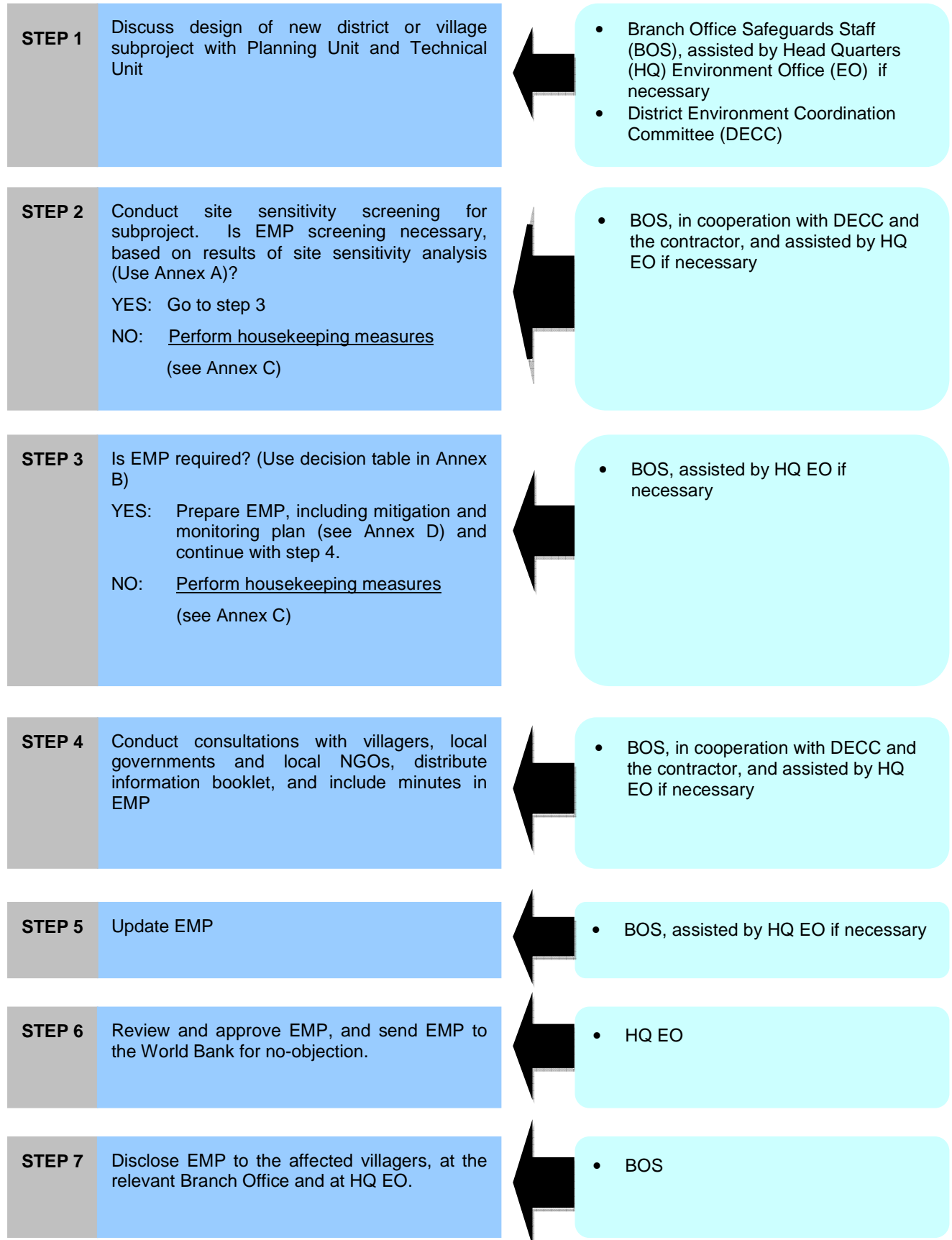
The main potential environmental impacts during the operation and maintenance phase are likely to be associated with the annual vegetation clearance. These potential impacts, however, are expected to be minor and temporary in nature, but can include the disturbance of wildlife habitat, as well as, erosion and sedimentation. Through the implementation of good housekeeping and/or management measures, impacts during the operation and maintenance phase can be easily mitigated.

3. Mechanism to Satisfy Environmental Requirements

This framework integrates relevant environmental requirements of Lao PDR, as well as, the World Bank requirements for a 'Category B' project. These requirements can be found in Annex F – Legal Frameworks – of this document. By following these legal frameworks, it is believed that the development of the on-grid subproject will be carried out in a manner that will satisfy environmental requirements of the country and the Bank. The implementation structure of the on-grid ESOM is illustrated in **Figure 4.1**.

It should be noted that the Government of Laos is currently preparing a Decree on the Assessment of the Environment and Society in Lao PDR which expected to be approved in 2009. The Decree defines rules, regulations, procedures, processes and measures for assessing environment and social impacts, ensuring that all project and development activities, whether owned by the public or private sectors, are designed and managed in a manner that negative impacts are effectively prevented, minimized or mitigated. The approval of this Decree may mean that both the on-grid and off-grid components of REP II may be required to conduct environmental and social impact assessment at the subproject levels instead of the program level. In which case, Annex A – site sensitivity assessment – can be modified to be used as an Initial Environmental Examination (IEE) screening process of the subproject.

Figure 4.1: Outlines EDL’s proposed environmental management implementation structure for on-grid subprojects under the REP II.



3.1 Subproject Designing Phases

The EDL Branch Office Safeguards Staff (BOS) and the District Environment Coordination Committee (DECC), which is composed of relevant district and village authorities, are involved in the preliminary design of subprojects and participate in meetings with the BO-PIU planning and technical staff in this phase. The objective of the participation is to avoid, mitigate or minimize environmental and social impacts as much as possible. The participation of BOS and DECC during the preliminary design stage will also allow them to develop an early understanding of potential environmental and social impacts which will be valuable during the monitoring of construction and operation activities.

3.1.1 Environmental Screenings

Environmental screening will be carried out in a “two-steps” process with an objective of eliminating unnecessary environmental screening for EMP. Site sensitivity screening will be used as a first screening step to identify whether an environmental screening for EMP is necessary for the subproject. Due to the nature and approach of the on-grid component development, it is anticipated that some subprojects may not require EMP, and that simple housekeeping measures maybe sufficient to effectively mitigate any potential environmental impacts that may occur. However, if the site sensitivity screening reveals that environmental screening for EMP is necessary, the BOS, together with DECC and the Contractor, will conduct a thorough environmental screening to identify whether an EMP is required for the subproject. Detail screening procedures, as well as, roles and responsibilities for each screening process are discussed below.

Site Sensitivity Screening

Site sensitivity screening for the on-grid component is a simple checklist developed to define the level of site sensitivity (low, moderate or high) of each subproject. Together with the DECC and the Contractor, the BOS is responsible for carrying out the site sensitivity screening. Site sensitivity screening will be carried out using available data and GIS mapping which can be carried out in each EDL Branch Office. In the event that no or little data is available, a visit to the subproject impacted area may be necessary. The BOS is required to fill out site sensitivity template (see Annex A) which has been divided into three sections based on sensitivity. The results of the screening will be used to determine whether an environmental screening for EMP is necessary. If the result of the screening reveal that the subproject impacted areas have moderate to high sensitivity, an environmental screening for EMP must be carried out (see below). On the other hand, if the result of the screening reveals that the subproject impacted areas have low sensitivity, no further screening will be required. The BOS must then carry out housekeeping measures to ensure that any potential environmental impacts are addressed (see Annex C). The BOS should request the assistance from the HQ EO during the screening if necessary.

Environmental Screening for EMP

The BOS, together with the DECC and Contractor, is responsible for the environmental screening of each subproject. The BOS, DECC and Contractor will be required to visit each subproject impacted areas, including villages, as well as, the alignment of MV and LV lines. The BOS fills out an environmental screening form, which describes potential environmental impacts of the subproject. Environmental screening for EMP template can be found in Annex B. Based on the result of the screening form, the BOS has to decide whether an Environmental Management Plan (EMP) is required. If EMP is required, The BOS must prepare EMP using template provided in Annex D. On the other hand, if EMP is not required, the BOS must carry out housekeeping measures (Annex C) to make sure that any potential environmental impacts are address.

Based on the nature of the development, it is anticipated that the majority of subprojects will not require EMP. The BOS should requests assistance from the HQ EO during the screening if necessary.

3.1.2 Environmental Management Plan (EMP)

The BOS is responsible for preparing EMP for each subproject. An EMP includes

- a description of potential environmental impacts and management measures;
- an implementation schedule coordinated with project design, bidding, construction and operation phases;
- an institutional responsibilities;
- a description of monitoring programs; and
- cost estimates and sources of funds.

Environmental Management Template found in Annex D can be used to prepare EMP. The BOS should request assistance from the HQ EO during the EMP preparation if necessary.

**THE ACTIVITIES DESCRIBED BELOW ARE ONLY REQUIRED IF AN EMP IS
REQUIRED**

3.2 Subproject Preparation Phase

3.2.1 Consultation

The BOS, with help of the DECC and the contractor, announces, organizes, conducts and documents consultation meetings with affected individuals, villages, local authorities, community organization, and local NGOs in the project area. The purpose of these consultations is to obtain views of the local people, including of the vulnerable groups, concerning environmental and social issues related to the project which they feel are important, and to inform them about potential project impacts. The EMPs and grievance procedures are discussed. The BOS documents the comments and feedbacks in the minutes of the meeting. The BOS includes the minutes in the EMP. If necessary, the BOS can request assistance of the HQ EO.

The REP II safeguards booklets, which HQ EO will prepare before the start of the implementation of REP II, which include an overview of expected construction activities and impacts, compensation rights, compensation rates, and grievance procedures, will be distributed during consultations for reference to villagers.

3.2.2 Review and Approval

After consultations are completed and BOS has made revisions to the EMP, the HQ EO is responsible for the review and approval of the EMP. The HQ EO can either approve the EMP or provide comments requesting clarifications, revisions or additions from the BOS. After having approved the EMP, HQ EO will send the document to the World Bank for review and no-objection, prior to implementation of the subproject.

3.2.3 Disclosure

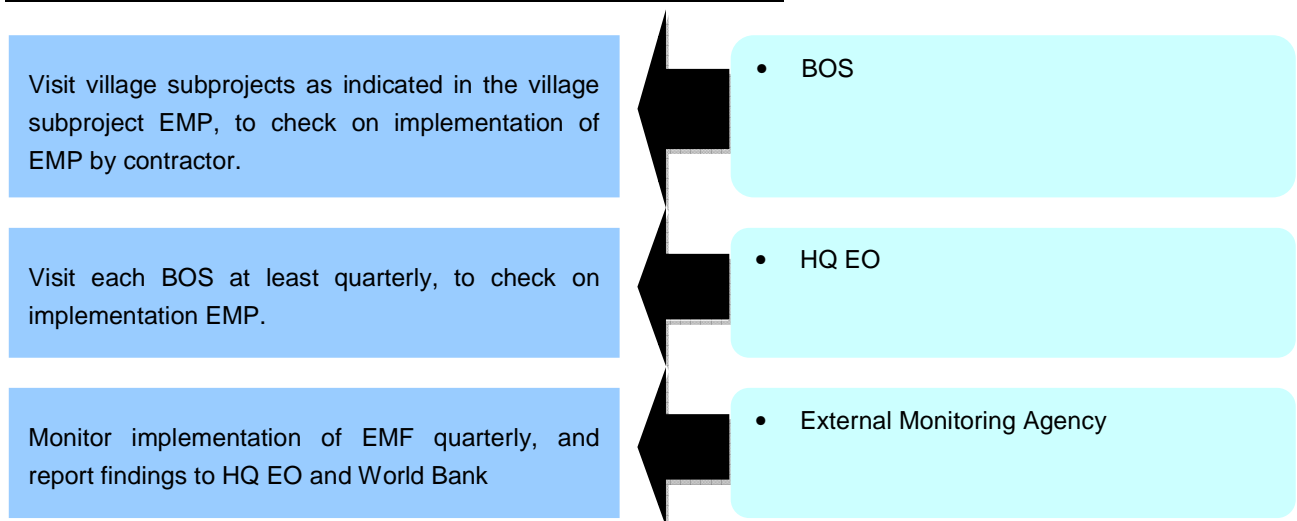
The HQ EO office is responsible for disclosing the EMF at the HQ EO office and all Branch Offices.

The BOS is responsible for disclosing the EMP to the affected villagers and both at the relevant Branch Office and the HQ EO. The approved EMP is to be placed in a public location convenient to the people living in or near the areas where the project is to be implemented or in the nearest local village.

3.3 Subproject Construction and Operation Phase

Following the requirements of the World Bank, during the project implementation, both internal and external environmental monitoring and evaluation exercises need to be carried out in order to monitor EMF and EMP implementation. The monitoring exercise will also allow the Bank to assess the adequacy of the management measures implemented to mitigate the adverse environmental impacts.

Figure 4.2: Monitoring during construction and Operation Phases



3.3.1 Internal Monitoring

The BOS is responsible for monitoring the construction work of the contractors. The BOS is required to visit project construction sites on a regularly basis, and is required to reports any findings in the Quarterly Report to the HQ EO.

The HQ EO is responsible for the monitoring and supervision of the provisions in the on-grid component EMF. The HQ EO is required to periodically review the activities undertaken by the BOS in the various Branch Offices. It is recommended that the HQ EO visits each Branch Office at least once every three month.

3.3.2 External Monitoring

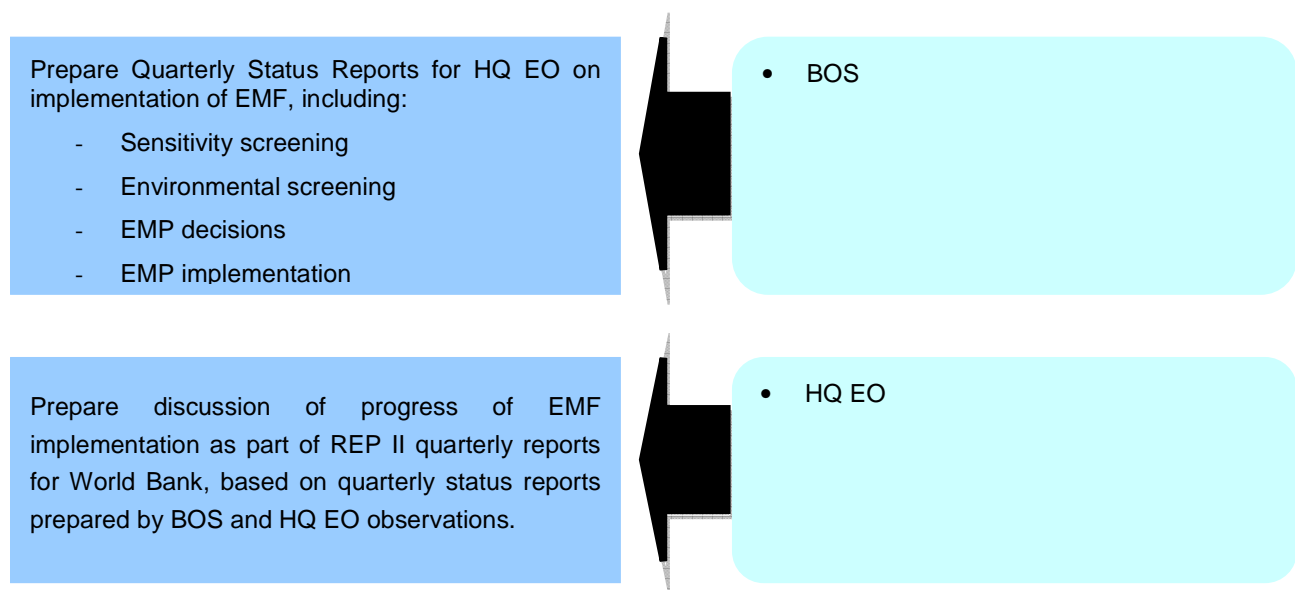
An External Monitoring Agency will be commissioned to monitor the implementation of the EMF on quarterly basis and report any findings to the HQ EO and to the World Bank. It randomly selects BOS and subprojects to visit. The External Monitoring Agency will monitor subprojects for which an EMP has been prepared more closely. The selected Agency needs to have extensive experience in environmental activities and/or monitoring of such activities.

3.4 Reporting

The BOS is responsible for preparing Quarterly Status Report on the implementation of the EMF. The Quarterly Status Report will include results of the site sensitivity and environmental screening, as well as, the results and the progress of the implementation of the EMP. The BOS is responsible for submitting the Quarterly Status Report to the HQ EO for review and approval. The HQ EO can either approve the report or provide comments requesting clarifications, revisions or additions from the BOS

Once the Quarterly Status Report has been approved, the HQ EO is responsible for preparing a REP II Quarterly Progress Report to the World Bank, detailing the results and progress of the EMF and EMP implementation. The information in the Quarterly Progress Report will be based on Quarterly Status Report and based on HQ EO observation during site inspection.

Figure 4.3: Reporting during All Phases



3.5 Grievance Mechanism

In order to address complaints and disputes in an effective and timely manner, a grievance mechanism will be set up and disclosed to project affected persons (PAP) before the commencement of the subproject development. Figure 4.4 below describes a grievance mechanism to be used for the on-grid component of the REP II Project.

According to Figure 4.4, a PAP or stakeholders can voice their complaints to the BOS directly. Once a complaint is received, the BOS, in consultation with the DECC, has the responsibility to respond to the complaint. The BOS must provide a solution to the complaints within two weeks.

However, if agreement cannot be reached between the PAP and the BOS, the PAP can submit their complaints to the HQ EO. Once a complaint is received, the HQ EO has the responsibility to address to the complaint. The HQ EO must provide a solution to the complaint within two weeks.

After HQ EO has provided a solution, if the PAP still finds the solution provided by the HQ EO to be unacceptable, then the complaint can be submitted to the District Courts where final decision will be made.

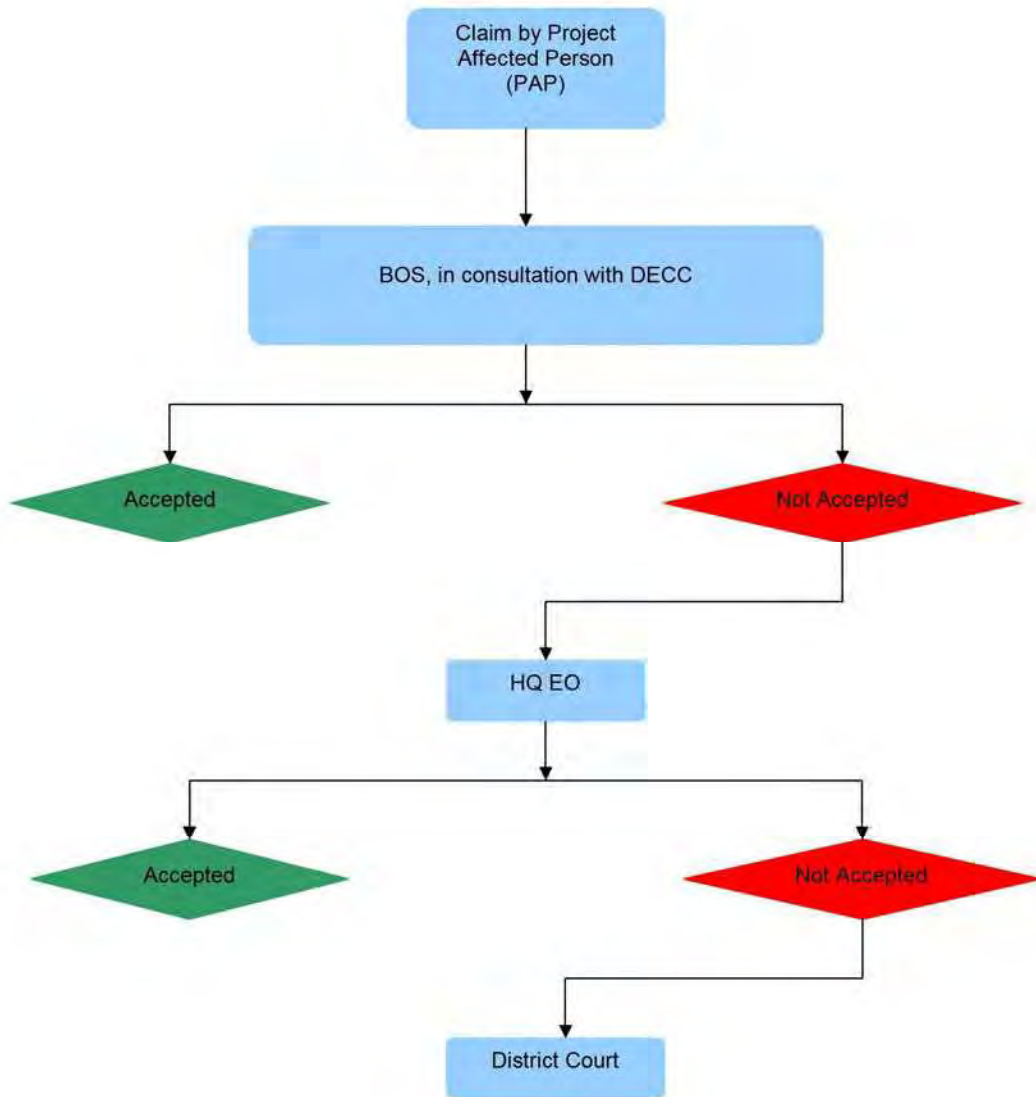


Figure 4.4: Grievance Procedure for the On-Grid Component of the REP II

4. Overview of Roles and Responsibilities for the implementation phases

EMF implementation responsibilities of each institution and unit associated with the development of Rural Electrification Phase II subprojects are outlined in Table 5.1 below. The table outlines responsibilities of EDL Head Quarter Environmental Office, EDL Branch Office, Contractors, District Environmental and Coordination Committee, District Court, World Bank and External Monitoring Agency.

Table 5.1: EDL grid component, responsibilities of institutions involved in implementation of the EMF

Institution	Unit	EMF Implementation Responsibilities
EDL Head Quarters	Environment Office (EO)	<ul style="list-style-type: none"> - <u>Monitor and supervise</u> implementation of the Environmental Safeguards Operations Manual (ESOM). - <u>Translate</u> ESOM to Lao language before the start of the REP II project. - <u>Disclose ESOM</u> at the HQ EO and all Branch Offices. - <u>Prepare safeguards information booklet</u>, before start of the REP II project. - Before implementation of ESOM, <u>provide training and assistance</u> on ESOM to the Branch Office Safeguards Staff (BOS), contractors, and District Environment Coordination Committees (DECC). During implementation, <u>assess training needs</u> and provide training. - <u>Provide advice and support to BOS and DECC</u> on taking part in project design, conducting environmental screening, deciding whether an EMP is required, in conducting consultation meetings, and in responding to complaints from villagers. - <u>Review</u> compliance with ESOM requirements of <u>bidding documents and contracts</u> with Contractors. - <u>Prepare Quarterly Status Reports</u>, based on progress reports from the BOS, as part of the quarterly reports to the World Bank. - <u>Receive complaints (second instance)</u> from PAPs or others, and respond with solution within two weeks. <p>ONLY IF EMP REQUIRED:</p> <ul style="list-style-type: none"> - Provide <u>advice and support to BOS</u> in preparing EMPs. - <u>Review and approve</u> EMPs, and obtain no-objection from the World Bank. - <u>During construction and operation of projects, check performance</u> of BOS and implementation of the ESOM periodically, and visit each Branch Office at least every three months. - <u>Prepare discussion of progress of ESOM implementation</u> as part of REP II quarterly reports for World Bank, based on quarterly status reports prepared by BOS and own observations.
	REP II Project	<ul style="list-style-type: none"> - In discussion with HQ EO, <u>include environmental requirements in bidding documents and contracts</u> with contractors.

<p>EDL Branch Offices</p>	<p>Branch Offices Safeguards Staff (BOS)</p>	<ul style="list-style-type: none"> - Together with DECC, take part in discussions about <u>district subproject design</u> with the planning and technical staff; if necessary with assistance of the HQ EO. - Together with the DECC and contractor, <u>conduct site sensitivity screening and decide whether an environmental screening for EMP is required</u>; if necessary seek assistance of the HQ EO. - Together with the DECC and contractor, <u>conduct environmental screening</u>, and decide whether an EMP is required; if necessary seek the assistance of HQ EO. - <u>Receive complaints (first instance)</u> from Project Affected Persons (PAP) or others, and respond with solution within two weeks, in consultation with the DECC. - <u>Send Quarterly Status Reports</u>, describing the progress in implementation of the ESOM, including during the design phase, and during the construction and operation phase (monitoring) to the HQ EO. <p>ONLY IF EMP REQUIRED:</p> <ul style="list-style-type: none"> - <u>Prepare and update EMP</u>; if necessary with assistance of the HQ EO. - Together with the DECC and the contractor, <u>organize and conduct consultation meetings</u> with villagers, local NGOs, and local authorities, during which the information booklet is made available. <u>Prepare minutes</u> and include these in the EMPs. - <u>Disclose</u> EMP at affected villages, at the Branch Office, and at HQ EO. - <u>Monitor construction work by Contractors</u>. Visit project sites as indicated in the EMP for each village subproject. <p>ONLY IF EMP IS NOT REQUIRED:</p> <ul style="list-style-type: none"> - <u>Prepare environmental housekeeping measure</u>; if necessary seek the assistance of the HQ EO. - <u>Monitor the implementation of environmental housekeeping measures</u> by the Contractor
	<p>Project Implementation Unit (PIU)</p>	<ul style="list-style-type: none"> - Invite BOS and DECC to discussions about <u>district subproject design</u>.
<p>Contractors</p>	<ul style="list-style-type: none"> - <u>Provide bidding documents in compliance</u> with the ESOM. - Work with the BOS and DECC on <u>environmental screening</u>. <p>ONLY IF EMP REQUIRED:</p> <ul style="list-style-type: none"> - Work with the BOS and DECC to <u>conduct consultation meetings</u> for villagers, NGOs and local authorities. - <u>Conduct construction and maintenance activities in compliance</u> with the ESOM and EMPs. <p>ONLY IF EMP IS NOT REQUIRED:</p> <ul style="list-style-type: none"> - <u>Implement environmental housekeeping measures</u> as recommended by the BOS. 	

District Environmental Coordination Committee (DECC)	<ul style="list-style-type: none"> - Together with BOS, participate in meetings with BO-PIU technical and planning staff on preliminary design of district subprojects. - Work with the BOS and the contractor to <u>conduct the environmental screening</u>. <p>ONLY IF EMP REQUIRED:</p> <ul style="list-style-type: none"> - Work with the BOS and the contractor to <u>conduct consultation meetings</u> for villagers, NGOs and local authorities. - <u>Receive complaints (first instance)</u> from PAPs or others, and respond with solution within two weeks.
District courts	<ul style="list-style-type: none"> - <u>Receive complaints (last instance)</u> from PAPs or others.
World Bank	<ul style="list-style-type: none"> - <u>Review quarterly reports</u> provided by the HQ EO. - Review and <u>provide no-objection to EMPs</u>.
External Monitoring Agency	<ul style="list-style-type: none"> - <u>Monitor implementation</u> of the ESOM and EMPs quarterly. - <u>Provide quarterly report</u> to the EDL EO and the World Bank.

5. References

Decon (2004), Evaluation of Rural Electrification, Socio-Economic Survey, Establishment of Database for Rural Electrification Planning in Lao PDR.

Ministry of Health (2003), Statistic of Electricity Consumption in the Year 2002. Vientiane, Lao PDR.

World Bank (2006), Environmental Assessment and Environmental Management Plan of the Rural Electrification (Phase I) Project in Lao PDR.

World Bank (2006), Project Appraisal Document of the Rural Electrification (Phase I) Project in Lao PDR.

ANNEX A: SITE SENSITIVITY ANALYSIS

Site No.:
 Site Name:

Site Sensitivity	Description	Yes (Please tick ✓)
High	National Biodiversity Conservation Areas (National Protected Area)	
	Sensitive or critical ecosystems (wetlands, endanger wildlife habitat, wildlife breeding area)	
	Area with high degree of environmental degradation (high degree of deforestation and hunting)	
	Area with high forest fire potential (Pine forest particularly sensitive)	
	High potential for erosion (steep slopes > 35%, instable soil, important natural drainage system)	
	High risk of flooding (large watershed, drainage problems, low lying, flooding frequency < 5 years)	
	High risk for water pollution (river stream close to site, water used downstream)	
	Cultural/Historical interest areas (objects identified within or next to site)	
	High safety risk (Area known to have UXO incident)	
Medium	Buffer areas of the National Biodiversity Conservation Areas	
	Moderate sensitive ecosystems (areas known to have wildlife)	
	Moderate degree of environmental degradation (medium degree of deforestation and hunting)	
	Moderate erosion potential (15 to 35% slope)	
	Moderate risk of flooding (flooding frequency of between 5 to 10 years)	
	Presence of cultural/historical interest areas/objects < 500 meters from the project areas	
	Moderate safety risk (areas known to have UXO, but no incident have been observed)	
Low	Intervened areas outside of National Biodiversity Conservation Areas or buffer areas	
	Low biodiversity and ecological values	
	Low degree of environmental degradation (low degree of deforestation and hunting)	
	Low risk of erosion (slope < 15%)	
	Low risk of flooding (no flooding incident)	
	Absence of cultural and historical areas or objects	
	Low safety risk (areas known to have no UXO)	

EMP Screening Decision		
<ul style="list-style-type: none"> If there is any ✓ on the high and medium sensitivity, environmental screening for EMP must be carried out. Please refer to Annex B. If the subproject has low site sensitivity, environmental screening for EMP is not necessary. Proceed to Annex C and prepare environmental housekeeping measures. 		
	YES	NO
Based on the site sensitivity analysis, does the subproject require environmental screening for EMP? (please ✓ on “YES” or “NO” to the right)		

ANNEX B: EMP SREENING FOR REP II ON-GRID COMPONENT

Name of Subproject	
Subproject Number	
Date of Assessment	
Checklist Assessed by	
Checklist approved by	
Development status. Please tick right answer (√)	<input type="checkbox"/> Feasibility and Design Phases <input type="checkbox"/> Construction Phase <input type="checkbox"/> Operation and Maintenance Phases

1. Description of Potential Impacts

1. Description of Potential Impacts			
Potential Environment Impacts	Scale of impact, chose alternative: A) no impact; B) minor impact; C) medium impact D) significant impact; Please circle correct alternative A, B, C or D.	Description of impacts: I) What could the impacts of the project be? II) Where along the alignment could the impacts happen? III) What kind of problems could this lead to?	Suggested mitigation measures: I) How can the impact be prevented or minimised? II) Who should be responsible for taking action? <i>(Refer to sample measures in ESOM)</i>
EXAMPLE OF HOW TO FILL	A) no impact	I) What impact?	I) How to minimize?

<p>IN FORM:</p> <p>Significant disturbance of nearby communities during construction (noise/vibration and dust) from on-going works and transports using heavy vehicles and machines.</p>	<p><input checked="" type="radio"/> B) minor impact</p> <p><input type="radio"/> C) medium impact</p> <p><input type="radio"/> D) significant impact</p>	<p><i>Heavy trucks driving on dusty road to supply construction materials. Will cause dust, noise and vibration.</i></p> <p>II) Where?</p> <p><i>Road between Ban Ilay and Ban Sivilay.</i></p> <p>III) What kind of problems?</p> <p><i>Villagers disturbed, dust can cause respiratory problems.</i></p>	<p><i>Watering road</i></p> <p>II) Who is responsible?</p> <p><i>Contractor</i></p>
<p>Impact on terrestrial vegetation, forest resources and protected areas, including village, district, provincial and national protected areas</p>	<p><input type="radio"/> A) no impact</p> <p><input type="radio"/> B) minor impact</p> <p><input type="radio"/> C) medium impact</p> <p><input type="radio"/> D) significant impact</p>	<p>I) What impact?</p> <p>II) Where?</p> <p>III) What kind of problems?</p>	<p>I) How to minimize?</p> <p>II) Who is responsible?</p>
<p>Increase erosion and sedimentation runoff during subproject construction</p>	<p><input type="radio"/> A) no impact</p> <p><input type="radio"/> B) minor impact</p> <p><input type="radio"/> C) medium impact</p> <p><input type="radio"/> D) significant impact</p>	<p>I) What impact?</p> <p>II) Where?</p> <p>III) What kind of problems?</p>	<p>I) How to minimize?</p> <p>II) Who is responsible?</p>

<p>Accidental release of oil or hydrocarbons into downstream waterways</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>
<p>Noise impact on adjacent villages</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>
<p>Elevated dust levels due to construction activities</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>

<p>Increase solid waste volume</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>
<p>Impact associated with leakage and spillage of hazardous waste and materials including PCBs</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>
<p>Large amount of vegetation debris</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>

<p>Potential disturbance of sites or artifacts of archaeological or cultural significance during land clearance</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>
<p>Interference with local aesthetic characteristics</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>
<p>Potential environmental impacts associated with the establishment of construction camp site</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>

<p>Possible impact to public health due to UXO clearance</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>
<p>Worker occupational health and safety during construction activities</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>
<p>Road and traffic safety</p>	<p>A) no impact B) minor impact C) medium impact D) significant impact</p>	<p>I) What impact? II) Where? III) What kind of problems?</p>	<p>I) How to minimize? II) Who is responsible?</p>

2. Decision table: Is there a need for EMP?			
<i>Are there any potential minor, medium or significant impacts?</i>	<i>Please count the number of 'Bs' in the whole of section 1 above.</i>	<i>Please count the number of 'Cs' in section 1 above.</i>	<i>Please count the number of 'Ds' in section 1 above.</i>
	No of Bs: _____	No of Cs: _____	No of Ds: _____
<p><i>Does the project require an EMP?</i></p> <ul style="list-style-type: none"> • <i>If there are any Bs, Cs or Ds in section 1, the project will require an EMP (Please refer to Annex D for EMP Template)</i> • <i>If there are only As in Section 1, EMP is not required, but housekeeping measures must be implemented (Please refer to Annex C)</i> 	<input type="checkbox"/> YES, EMP required (Mark ✓) <input type="checkbox"/> NO, EMP not required (Mark ✓)	Key issues to consider in the EMP:	

ANNEX C: HOUSEKEEPING MEASURES

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
Feasibility and Design	Impact on terrestrial vegetation, forest resources and protected areas, including village, district, provincial and national protected areas	As much as possible, MV and LV lines should follow existing rights-of-way, and avoid environmentally sensitive areas	BOS DECC	HQ EO	N/A
	Increased erosion and sediment transport during subproject construction	Schedule construction activities during the dry season (low rainfall)	BOS DECC	HQ EO	N/A
	Noise impact on adjacent villages	Avoid schedule construction activities between 8:00 PM and 6:00 AM	BOS	HQ EO	N/A
	Potential disturbance of sites or artifacts of archaeological or cultural significance during land clearance	Conduct consultations with local authorities to identify sites or artifacts of archaeological or cultural significance	BOS/DECC Contractor	HQ EO	N/A
Construction	Impact on terrestrial vegetation, forest resources and protected areas, including village, district, provincial and national protected areas	If new access road is unavoidable, tree cutting, environmentally sensitive areas and productive land should be avoided as much as possible	BOS DECC	HQ EO	At least once during construction
		Minimize the amount of land cleared for the subproject	Contractor	BOS	During clearing activities
		Avoid clearance of mixed deciduous forest wherever possible	Contractor	BOS	During clearing activities
	Increased erosion and sediment transport during subproject construction	Minimize the areas of land cleared for subproject construction work, and retain vegetation in suitable locations (e.g. riparian) to maximize filtration of sediment from turbid runoff, during and after construction	Contractor	BOS	At least one per month

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
	Accidental release of oil or hydrocarbons into downstream waterways	Store liquid hydrocarbons (fuels, oils and lubricants) in leak-proof containers within suitably designed bunded areas	Contractor	BOS	At least once during construction
		Prohibit vehicle washing and cleaning in waterways	Contractor	BOS	At least one per month
	Noise impact on adjacent villages	Limit construction hours for specific pieces of equipment to day time hours	Contractor	BOS/DECC	At least one per month
		If evening construction activities are unavoidable, local affected people should be consulted at least one week in advance of the proposed activities	Contractor	BOS/DECC	Prior to construction
		Reduce project traffic routing through community areas wherever possible	Contractor	BOS/DECC	At least one per month
	Elevated dust levels	Minimize disturbed areas	Contractor	BOS	At least one per month
		Limit vehicle speed in village areas to minimize dust disturbance on roadside villages	Contractor	BOS/DECC	At least one per week during construction
	Large amount of vegetation debris	Minimize vegetation clearance	Contractor	BOS	At least one per month
	Potential disturbance of sites or artifacts of archaeological or cultural significance during land clearance	Minimize area disturbed during land clearing activities	Contractor	BOS	At least one per month
	Interference with local aesthetic characteristics	As much as possible, MV and LV lines should follow existing rights-of-way, and avoid disturbing additional areas	Contractor	BOS	At least one per month
		Leave vegetation buffer between roads and disturbed areas	Contractor	BOS	At least one per month

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
	Possible impact to public health due to UXO clearance	Only appropriate qualified organization will be engaged to undertake search and disposal of UXO in areas where activities are to take place.	Contractor	BOS/HQ EO	Prior to construction
	Worker occupational health and safety during construction activities	Provide safety induction training to all personnel	Contractor	BOS	Prior to construction
		Provide appropriate personal protective equipment (PPE) to all relevant employees in accordance with good international industry practices	Contractor	BOS	At least one per month
		Put in place procedures for recording and reporting of all near misses, lost time incidents and major incidents including calculation of severity rate and frequency rate	Contractor	BOS	At least one per month
		Put in place standard work/operational control procedures for activities that expose workers to hazardous conditions	Contractor	BOS	Prior to construction
		Put in place a procedure for periodic safety audit of subproject sites and implementation of corrective action based on the audit findings	BOS	Technical Safety	At least one per quarter
		Reporting of consolidated occupational health and safety performance to Senior Management	BOS	Technical Safety	At least one per quarter
	Security Personnel Procedure	Screening of past records of security personnel employed	Contractor	BOS	Prior to award of contract
		Laying out clear objectives and permissible actions for security personnel	Contractor	BOS	Prior to award of contract
		Training of security personnel in use of fire arms and handling various situations with clear procedures, specific dos and don'ts are laid out to avoid human right violations	Contractor	BOS	Prior to award of contract
		Recording of security incidents, investigation and implementation of corrective action	Contractor	BOS	Prior to award of contract and at least once per month during construction
		Bonafide complaints against security personnel are investigated/disciplinary actions implemented	Contractor	BOS	Prior to award of contract and at least once per

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
					month during construction
		A grievance mechanism is in place for aggrieved members of community or employees, in the event of a violation of the code for security personnel	Contractor	BOS	Prior to award of contract and at least once per month during construction
	Labor Camp/Worker Accommodation	Ensure living quarters have basic amenities (refer to guidance on Worker Accommodation) and electricity;	Contractor	BOS	At least one per month
		Provide canteen/mess facilities for food and where labor desires self cooking, provision of LPG for cooking;	Contractor	BOS	At least one per month
		Provide drinking water which meets host country potable water norms;	Contractor	BOS	At least one per month
		Provide toilets and bath including separate toilets and baths for women family members of workmen;	Contractor	BOS	At least one per month
		Provide primary medical facilities	Contractor	BOS	At least one per month
		Put in place garbage segregation, collection and disposal/composting facilities	Contractor	BOS	At least one per month
	Road and traffic safety	Put a sewage collection and treatment system in place such that treated sewage meets WBG norms	Contractor	BOS	At least one per month
		Limit vehicle speed in village areas to minimize accidental risk on roadside villages	Contractor	BOS/DECC	At least one per month
		All drivers must be fully qualified for the class of vehicle being operated	Contractor	BOS	At least one per month
		All drivers must adhere to Lao national road safety regulations and those regulations developed specifically for the subproject.	Contractor	BOS/DECC	At least one per month
Operation and maintenance	Impact on terrestrial vegetation, forest resources and protected areas, including village, district, provincial and national protected areas	Minimize the amount of land cleared for the subproject during maintenance	Contractor	BOS	At least one per week during maintenance

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
		Avoid clearance of mixed deciduous forest wherever possible	Contractor	BOS	At least one per week during maintenance
	Large amount of vegetation debris	Minimize vegetation clearing during maintenance	Contractor	BOS	At least one per week during maintenance
	Community Health and Safety	Put in place a structured awareness program on electrical safety for communities resident in the vicinity of EDL's transmission and distribution system	BOS	Technical Safety	Quarterly
	Worker occupational health and safety during construction activities	Provide safety induction training to all personnel	Contractor	BOS	Prior to construction
		Provide appropriate personal protective equipment (PPE) to all relevant employees in accordance with good international industry practices	Contractor	BOS	At least one per month
		Put in place procedures for recording and reporting of all near misses, lost time incidents and major incidents including calculation of severity rate and frequency rate	Contractor	BOS	At least one per month
		Put in place standard work/operational control procedures for activities that expose workers to hazardous conditions	Contractor	BOS	Prior to construction
		Put in place a safety committee comprised of worker representatives and managers	BOS	Technical Safety	Committee to meet at least quarterly
		Put in place a procedure for periodic safety audit of subproject sites and implementation of corrective action based on the audit findings	BOS	Technical Safety	At least one per quarter
		Reporting of consolidated occupational health and safety performance to Senior Management	BOS	Technical Safety	At least one per quarter

ANNEX D: ENVIRONMENTAL MANAGEMENT PLAN (EMP) TEMPLATE

Date of preparation of EMP: _____

Name of BOS preparing EMP: _____

Name of village subproject: _____

Subproject No.: _____

Project description:

(Present a brief description of the village subproject. Include the number of 12 meter and 8 meter poles and total length of MV and LV lines, the location, and any characteristics of the area that are of particular interest; e.g. near a protected area, area of cultural, historical, religious interest. Also, very briefly describe land general land use characteristics (rice paddies, gardens, scrub land, small industry etc.

Map of subproject:

(Include map showing village subproject design).

Consultations with project affected persons, local NGOs and local authorities:

Date of consultation meeting: _____

BOS leading consultation meeting: _____

Other EDL staff participating: _____

DECC representative participating: _____

Contractor representative participating: _____

<u>Persons attending the consultation meetings</u>		
Name	Organization and Position	Tel. or email address

Summary of project minutes:

(Comments, question and responses by presenters; agreed actions)

MITIGATION AND MONITORING PLAN

(see Annex E for potential mitigation and monitoring measures)

Potential Environmental Impact & Phase (copy from Environmental Screening Form)	Mitigation Measure and Action Required	Implementing Schedule	Implementing Responsibility	Monitoring Schedule	
Feasibility and design phase					
Construction phase					
Operation and Maintenance phase					

Institutional arrangements EMP implementation:

(Describe how monitoring data is going to be used to maintain sound environmental performance. Include information on who will collect data, who will analyze the data, who prepares monitoring reports for the HQ EO., who has the authority to change operations or to stop constructions if violation with EMP occurs. The information in this section should be similar to the information in the Mitigation and Monitoring Plan.

ANNEX E: POTENTIAL ENVIRONMENTAL MANAGEMENT AND ENHANCEMENT MEASURES

– REFERENCE RESOURCE FOR DEVELOPING EMP

This annex outlines the proposed environmental management measures for potential impacts of the subprojects under the REP II. The objective of the table is for each potential impact, to identify key environmental management measures that could be implemented during design, construction and operation phases of each subproject. The table designates implementation and monitoring responsibilities for the proposed measures.

Annex E should be used as a reference resource for developing EMPs for sub-projects.

Table E.1: Summary of potential environmental impacts and management and enhancement measures.

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
Feasibility and Design	Impact on terrestrial vegetation, forest resources and protected areas, including village, district, provincial and national protected areas	As much as possible, MV and LV lines should follow existing rights-of-way, and avoid environmentally sensitive areas	BOS DECC	HQ EO	N/A
		Identify sensitive habitats and important NTFP areas close to construction areas and designate these as 'no go' areas	BOS DECC	HQ EO	N/A
	Increased erosion and sediment transport during subproject construction	Schedule construction activities during the dry season (low rainfall)	BOS DECC	HQ EO	N/A
	Noise impact on adjacent villages	Develop a mechanism to record and respond to noise related complaints	BOS	HQ EO	N/A
	Potential disturbance of sites or artifacts of archaeological or cultural significance during land clearance	Conduct consultations with local authorities to identify sites or artifacts of archaeological or cultural significance	BOS/DECC Constructor	HQ EO	N/A
		Prior to construction activities, sites or artifacts of archaeological or cultural significance will be identified in the Environmental Management Plan and the necessary control measures established in consultation with villagers and relevant government authorities to avoid their disturbance	BOS/DECC	HQ EO	N/A
		Develop a Chance Find Procedure for previously unidentified PCR	BOS	HQ EO	N/A

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
	Possible impact to public health due to UXO clearance	Conduct UXO safety risk assessment prior to the start of any construction; if the construction areas are known to have UXO risk, UXO surveys will be carried out prior to the commencement of construction activities.	BOS/DECC	HQ EO	N/A
Construction	Impact on terrestrial vegetation, forest resources and protected areas, including village, district, provincial and national protected areas	If new access road is unavoidable, tree cutting, environmentally sensitive areas and productive land should be avoided as much as possible	BOS DECC	HQ EO	At least once during construction
		Minimize the amount of land cleared for the subproject	Contractor	BOS	During clearing activities
		Avoid clearance of mixed deciduous forest wherever possible	Contractor	BOS	During clearing activities
		Prohibit staff and contractors from hunting or trading of wildlife as well as the collection of timber and NTFPs	Contractor	BOS	At least one per month
		Minimize project-related in-migration to the subproject area to minimize exploitation of forest resources and wildlife	Contractor	BOS	At least one per month
	Increased erosion and sediment transport during subproject construction	Minimize the areas of land cleared for subproject construction work, and retain vegetation in suitable locations (e.g. riparian) to maximize filtration of sediment from turbid runoff, during and after construction	Contractor	BOS	At least one per month
		Monitor land clearance activities throughout the construction phase to ensure that vegetation is not cleared beyond pre-defined project boundaries	BOS DECC	HQ EO	At least one per month
		Install drainage control structures at suitable locations to divert clean runoff away from disturbed land surfaces	Contractor	BOS	At least one per month
		Install erosion and sediment control structure such as silt fences and sediment ponds at suitable locations to filter or collect eroded sediments from turbid runoff, where necessary	Contractor	BOS	At least one per month

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
	Accidental release of oil or hydrocarbons into downstream waterways	Store liquid hydrocarbons (fuels, oils and lubricants) in leak-proof containers within suitably designed bunded areas	Contractor	BOS	At least once during construction
		Provide temporary shelters to prevent rainfall entering bunded areas.	Contractor	BOS	At least once during construction
		Store spill response kits at suitable locations, in case of spills outside bunded areas	Contractor	BOS	At least once during construction
		Conduct regular maintenance of vehicles and equipment to prevent hydrocarbon leaks	Contractor	BOS	At least one per month
		Conduct vehicle / equipment maintenance in designated areas where contaminated runoff can be contained.	Contractor	BOS	At least one per month
		Prohibit vehicle washing and cleaning in waterways	Contractor	BOS	At least one per month
	Noise impact on adjacent villages	Limit construction hours for specific pieces of equipment to day time hours	Contractor	BOS/DECC	At least one per month
		If evening construction activities are unavoidable, local affected people should be consulted at least one week in advance of the proposed activities	Contractor	BOS/DECC	Prior to construction
		Select equipment with lower sound power levels	Contractor	BOS/HQ EO	Prior to construction
		Install suitable mufflers on engine exhausts	Contractor	BOS	Prior to construction
		Reduce project traffic routing through community areas wherever possible	Contractor	BOS/DECC	At least one per month
	Elevated dust levels	Minimize disturbed areas	Contractor	BOS	At least one per month
		Sprinkle/spray disturbed areas with water, particularly during hot, dry and windy conditions	Contractor	BOS	At least one per week during construction

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
		Restriction of construction activities on high wind days	Contractor	BOS	At least one per week during construction
		Limit vehicle speed in village areas to minimize dust disturbance on roadside villages	Contractor	BOS/DECC	At least one per week during construction
	Increased solid waste volumes	Minimize the production of solid wastes	Contractor	BOS	At least one per month
		Segregating different waste streams to enable recovery of recyclables	Contractor	BOS	At least one per month
		Properly dispose of non-hazardous waste in designated waste pit located above the water table and at least 50 m from any water body and covered with at least 30 cm of earth every time dispose	Contractor	BOS	At least one per month
		Only combustible solid waste may be burnt within designate pits; burning of waste must be supervised at all times	Contractor	BOS	At least one per month
		No waste materials will be disposed above ground	Contractor	BOS	At least one per month
	Impact associated with leakage or spillage of hazardous materials and wastes including PCBs	Segregating hazardous waste from other waste materials	Contractor	BOS	At least one per month
		Hazardous materials storage areas must meet the following standards: 1. Located at least 50 m from any water body 2. Liquids to be stored in securely sealed containers, within a bunded area at least twice the volume of the largest container 3. Solid hazardous wastes to be stored in covered, securely sealed containers 4. Check storage containers regularly for signs of leakage or damage. 5. Label all containers clearly as "HAZARDOUS"	Contractor	BOS	At least one per month
		All hazardous waste must be removed from the subproject areas once construction activities completed	Contractor	BOS	At least one per month

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
		Any hazardous materials or chemicals involved in the operations must be declared and approved by the EDL Environmental Management Unit	Contractor	BOS/HQ EO	Prior to construction
		Forbidden the use and purchase of any equipments and materials containing PCBs	Contractor	BOS/HQ EO	Prior to construction
	Large amount of vegetation debris	Tree tops and branches will be cut into lengths that can be manually collected, and stockpiled in the logging area.	Contractor	BOS	At least one per month
		Burning of logging debris must be supervised	Contractor	BOS	At least one per month
		Vegetation debris from land clearing will be stacked and burned in designated areas. A firebreak of at least 30 m must be cleared around the stockpile. Burning will not be undertaken (i) during severe wind conditions and (ii) within 5 km of village Following completion of the burn, construction supervisor will inspect and certify that the fire has been extinguished.			
	Potential disturbance of sites or artifacts of archaeological or cultural significance during land clearance	Minimize area disturbed during land clearing activities	Contractor	BOS	At least one per month
	Interference with local aesthetic characteristics	As much as possible, MV and LV lines should follow existing rights-of-way, and avoid disturbing additional areas	Contractor	BOS	At least one per month
		Leave vegetation buffer between roads and disturbed areas	Contractor	BOS	At least one per month
	Potential environmental impacts associated with the establishment of construction camp site	Camp rules will be prominently displayed in the camp site. These rules apply to all workers	Contractor	BOS	At least one per month
		Provide environmental induction training to all camp personnel	Contractor	BOS	Prior to construction
		The camp site will be kept in a tidy and clean condition	Contractor	BOS	At least one per month

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
		There will be no hunting, possession of wildlife, fishing, harvesting of plants or trees, or harvesting of any forest product for consumption or sale. Workers are not allowed to possess any hunting or fishing equipment including firearms, snares, or traps.	Contractor	BOS	At least one per month
		Ensure living quarters have basic amenities (refer to guidance on Worker Accommodation) and electricity;	Contractor	BOS	At least one per month
		Provide canteen/mess facilities for food and where labor desires self cooking, provision of LPG for cooking;	Contractor	BOS	At least one per month
		Provide drinking water which meets host country potable water norms;	Contractor	BOS	At least one per month
		Provide toilets and bath including separate toilets and baths for women family members of workmen;	Contractor	BOS	At least one per month
		Provide primary medical facilities	Contractor	BOS	At least one per month
		Put in place garbage segregation, collection and disposal/composting facilities	Contractor	BOS	At least one per month
		Put a sewage collection and treatment system in place such that treated sewage meets WBG norms	Contractor	BOS	At least one per month
		All waste must be disposed in proper facilities in camp.	Contractor	BOS	At least one per month
	Possible impact to public health due to UXO clearance	Only appropriate qualified organization will be engaged to undertake search and disposal of UXO in areas where activities are to take place.	Contractor	BOS/HQ EO	Prior to construction
		Training will be given to construction workers regarding safety risk associated with disturbance of UXO and procedures to be followed if potential items of UXO are identified during construction activities	Contractor	BOS	Prior to construction
	Worker occupational health and safety during construction activities	Provide safety induction training to all personnel	Contractor	BOS	Prior to construction
		Provide appropriate personal protective equipment (PPE) to all relevant	Contractor	BOS	At least one per

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
		employees in accordance with good international industry practices			month
		Provide appropriate personal protective equipment (PPE) to all relevant employees in accordance with good international industry practices	Contractor	BOS	At least one per month
		Put in place procedures for recording and reporting of all near misses, lost time incidents and major incidents including calculation of severity rate and frequency rate	Contractor	BOS	At least one per month
		Put in place standard work/operational control procedures for activities that expose workers to hazardous conditions	Contractor	BOS	Prior to construction
		Put in place a procedure for periodic safety audit of subproject sites and implementation of corrective action based on the audit findings	BOS	Technical Safety	At least one per quarter
		Reporting of consolidated occupational health and safety performance to Senior Management	BOS	Technical Safety	At least one per quarter
	Road and traffic safety	Limit vehicle speed in village areas to minimize accidental risk on roadside villages	Contractor	BOS/DECC	At least one per month
		All drivers must be fully qualified for the class of vehicle being operated	Contractor	BOS	At least one per month
		All drivers must adhere to Lao national road safety regulations and those regulations developed specifically for the subproject.	Contractor	BOS/DECC	At least one per month
		All vehicle must be clearly numbered and traceable to operator	Contractor	BOS/DECC	At least one per month
Operation and Maintenance	Impact on terrestrial vegetation, forest resources and protected areas, including village, district, provincial and national protected areas	Minimize the amount of land cleared for the subproject	Contractor	BOS	At least one per week during maintenance
		Avoid clearance of mixed deciduous forest wherever possible	Contractor	BOS	At least one per week during maintenance
	Large amount of vegetation debris	Tree tops and branches will be cut into lengths that can be manually collected, and stockpiled in the logging area.	Contractor	BOS	At least one per week during maintenance

Phases	Potential Environmental Impacts	Mitigation Measures	Implementing Responsibilities	Monitoring Responsibilities	Monitoring Frequency
		<p>Burning of logging debris must be supervised</p> <p>Vegetation debris from land clearing will be stacked and burned in designated areas. A firebreak of at least 30 m must be cleared around the stockpile.</p> <p>Burning will not be undertaken (i) during severe wind conditions and (ii) within 5 km of village</p> <p>Following completion of the burn, construction supervisor will inspect and certify that the fire has been extinguished.</p>	Contractor	BOS	At least one per week during maintenance
	Community Health and Safety	Put in place a structured awareness program on electrical safety for communities resident in the vicinity of EDL's transmission and distribution system	BOS	Technical Safety	Quarterly
	Worker occupational health and safety during construction activities	Provide safety induction training to all personnel	Contractor	BOS	Prior to construction
		Provide appropriate personal protective equipment (PPE) to all relevant employees in accordance with good international industry practices	Contractor	BOS	At least one per month
		Put in place procedures for recording and reporting of all near misses, lost time incidents and major incidents including calculation of severity rate and frequency rate	Contractor	BOS	At least one per month
		Put in place standard work/operational control procedures for activities that expose workers to hazardous conditions	Contractor	BOS	Prior to construction
		Put in place a safety committee comprised of worker representatives and managers	BOS	Technical Safety	Committee to meet at least quarterly
		Put in place a procedure for periodic safety audit of subproject sites and implementation of corrective action based on the audit findings	BOS	Technical Safety	At least one per quarter
		Reporting of consolidated occupational health and safety performance to Senior Management	BOS	Technical Safety	At least one per quarter

ANNEX F: LEGAL FRAMEWORKS

F.1 Lao PDR Legal Frameworks

Lao PDR laws and regulations stipulate the protection of environmental values for land, water and air. Key regulatory requirements relevant to the development under the REPII are detailed in Table F.1 below.

Table F.1 Key relevant Lao PDR laws and regulations

Document No: 1	Environmental Protection Law (1999)
	<p>The Environmental Protection Law is the main piece of environmental legislation in Lao PDR. The law specifies principles, rules and measures to [Article 1]:</p> <ul style="list-style-type: none"> ○ Manage, monitor, restore and protect the environment, public health, natural resources and biodiversity; and ○ Ensure the sustainable socio-economic development of the nation. <p>Environment protection consists of all activities that contribute to the protection of the environment and do not cause damage to the environment, which ensure a clean and pollution-free environment and which do not cause negative impacts to human, animal, plant and ecological health [Article 3].</p> <p>Of relevance to the development under REP II Project, the basic principles of environmental protection are that [Article 5]:</p> <ul style="list-style-type: none"> ○ All persons and organizations residing in Lao PDR have an obligation to protect the environment. ○ Whoever causes damage to the environment is responsible for the impact under the law. ○ Natural resources, raw materials and energy shall be used in an economical manner, which minimizes pollution and waste and allows for sustainable development. <p>Important provisions of the Law include:</p> <ul style="list-style-type: none"> ○ Development projects and activities that have the potential to affect the environment shall require an Environmental Impact Assessment report ... for issuance of an environment compliance certificate before starting the project [Article 8] (also refer to Regulation on Environmental Assessment). ○ Obligation of all organizations to control pollution in accordance with environmental quality standards [Article 22] (also refer to Regulation on Ambient Environmental Standards).
Document No: 2	Regulation on Environmental Assessment in Lao PDR (2000)
	<p>The purpose of the Regulation is to [ref: Article 1]:</p> <ul style="list-style-type: none"> ○ To establish uniform environmental assessment requirements and procedures to ensure that environmental conservation is integrated into all socio-economic development projects in Lao PDR. ○ Within two years of the enactment of this regulation, all line ministries responsible for planning and implementing socio-economic development projects shall issue guidelines for environmental impact assessment for activities within their sector area responsibilities. <p>The Regulation outlines the general principles and requirements for Environmental Assessment [ref: Article 3] including the organizational responsibilities of the Project Owner, the Development Project Responsible Agency (DPRA) and STEA [ref: Article 4].</p> <p>The steps in the EA process described in the Regulation are as follows:</p> <ul style="list-style-type: none"> ○ Project Description; ○ Screening of Project Description; ○ Initial Environmental Examination (IEE) Procedures; ○ Review and Approval of IEEs; ○ Scoping and Terms of Reference; ○ Content and format of the EIA Report; and ○ Review and approval of the EIA Report.

The Regulation also outlines requirements for the following:

- Environmental Management Plans;
- Environmental Monitoring and Evaluation; and
- Public Involvement.

Prior to the commencement of construction the Project Owner and developer shall have received an environmental compliance certificate for the EIA and EMP [ref: Article 14].

The Project Owner shall implement the EMP during the entire duration of the project and shall include and shall include the terms and conditions of the EMP in all contracts, operation and closure of the project [ref: Article 14].

The EMP shall detail the environmental monitoring requirements of the project which shall include [ref: Article 15] submission of a monthly monitoring report to the DPRA and STEA.

Document No: 3

Electricity Law (1997)

The Electricity Law is the over-arching legislation relating to electricity production and transmission in Lao PDR. This law refers to environmental assessment and management in the following clauses:

Article 14. Environmental Impact Evaluation

1. Along with the economic-technical analysis, the investor shall submit an environmental impact evaluation, which shall consist of the following components:
2. Environmental impact evaluation shall describe all potential damages to the environment along with possible solutions or strategies in reducing such detrimental consequences to the environment, the ecological system, society, and natural habitat of wildlife.
3. The estimated costs of potential damages and relocation of local residents who may be affected as a result of such electricity production project.
4. Strategies to limit the risks of flooding in areas below the hydropower dam, which may be potentially high during the rainy season. Strategies may include the use of irrigation canals or other means in order to divert the flow of water through alternate routes when necessary.

Document No: 4

Law on Water and Water Resources (1996)

The role of the Water and Water Resource Law is to [ref: Article 1] provide principles, regulations and any mitigation measures governing the management, development, exploitation and use of water and water resources within Lao PDR; with the aim to protect and sustain water resources and water particularly with regard to the assurance of water in sufficient quantity and of sufficient quality to satisfy the national needs in terms of domestic, agricultural, industrial uses and the uses of other sectors in such manner as to protect the natural environment.

Of relevance to the development under REP II Project, the Law defines the following:

- Organisations are responsible for the protection of water and water resources in such way as not to adversely effect the environment [ref: Article 29].
- Organisations must observe the regulations concerning the control of polluted water. Activities likely to damage water resources, the environment or quality of human life are prohibited [ref: Article 42].

Document No: 5

Land Law (2003)

The purpose of the Land law is to determine the rules relating to the management, protection and use of land to make contribution to the acceleration of the national socio-economic development, protection of the environment, and national security [ref: Article 1].

Land is under the ownership of the national community in which the State is charged with management. No persons or organisations can take land as a commodity for the purpose of buying and selling [ref: Article 3].

Of relevance to the development under REP II Project, the Law defines the following:

- All individuals and organizations shall have the obligation to protect the land in order to keep it in good condition in which there is no soil erosion, land slip and soil degradation, and in a quality which is suitable to each category of land [ref: Article 6].
- Land is classified according to use [ref: Article 11]. Users of industrial land shall comply with the following [ref: Article 30]:
 - Causing no harm to the environment

<ul style="list-style-type: none"> ▪ Repairing land surface and improving the land condition in order to allow the land to be returned in its original condition after giving up the use as in the case of mining land. ○ The land user has the following obligations [ref. Article 66]: <ul style="list-style-type: none"> ▪ Not causing damage to land quality and not causing harmful impacts on the natural or social environment ▪ Not violating the rights or interests of other persons ▪ Paying the lease on the land and other fess relating to land ▪ Complying fully with land regulations 	
Document No: 6	MIH Department of Electricity – Environmental Management Standard for Electricity Projects (2003)
<p>The <i>Environmental Management Standards for Electricity Projects</i> were initially prepared in 2001 in response to the <i>Implementing Decree of the Environmental Protection Law, 2001</i>. Initially, in 2001, the Department of Electricity produced three relevant standards:</p> <ul style="list-style-type: none"> ▪ Environmental Impact Assessment for Electricity Projects ▪ Social Impact Assessment for Electricity Projects ▪ Environmental Management Plans for Electricity Projects <p>In 2003, these standards were updated and synthesised into the <i>Environmental Management Standard for Electricity Projects</i>, which is comprised of five (5) different sections:</p> <ul style="list-style-type: none"> ➤ Environmental Screening; ➤ Social Impact Assessment; ➤ Resettlement; ➤ Environmental Management Guideline from Socio-Economic and Culture; and ➤ Responsibilities. 	
Document No: 7	Regulation on the Management of the National Biodiversity Conservation Areas, Aquatic and Wild Animals (2001)
<p>The purpose of the Regulation is to [ref: Article 1]:</p> <ul style="list-style-type: none"> ○ Identify rules principles and measures on the establishment, management and utilization of all types of forest land areas located in NBCAs. ○ Protect NBCAs, aquatic and wild animals, for the benefit of sustainable development, eco-tourism and scientific research. ○ Protect locations of geographical, historical and cultural significance. ○ Implement the Regulation in accordance with other international and regional agreements on NBCA, aquatic and wild animal management, that have been signed by the Government <p>Of relevance to the development under REP II Project, the important provisions of the Regulation include:</p> <ul style="list-style-type: none"> ○ Individuals, state organisations and private sectors are obliged to protect the forest, forest land, water resources, aquatic and wild animals, and also to contribute to the protection and prevention of all forms of forest fire and destruction of forest resources in NBCAs [ref: Article 3]. ○ Prohibited activities within a NBCA including exploitation timber, mining, construction activities and road construction [ref: Article 16]. ○ Prohibited activities such as wildlife trade, hunting and breeding [ref: Article 17]. ○ Identification of protected aquatic resources and wild animals [ref: Article 18, 19]. 	
Document No: 8	Forest Law (1996, amended 2007)
<p>The Forestry Law determines the basic principles, regulations and measures on inventory survey, management planning, management, conservation, development and utilization of forest resources and forest land; promotion of regeneration; tree plantation; and increase of forest resources in Lao PDR [ref: Article 1]</p> <p>The vision of the Law is that forests in Lao PDR [ref: Article 1]:</p> <ul style="list-style-type: none"> • Maintain natural equilibrium so that forest and forest land can sustain people’s livelihoods; 	

- Ensure the protection and conservation of watersheds;
- guard against soil erosion ;
- Protect plant and wildlife species and the environment; and
- Contribute to the national socio-economic development.

Of relevance to the development under REP II Project, the Forestry Law requires organisations, households and individuals to [Article 7]:

- preserve and develop forests, forest resources and forestland, water sources, biodiversity and environment in accordance with the country's laws and regulations;
- refrain from causing forest degradation and forest depletion; and
- prevent forest fire and any form of forest and forestland destruction

Document No: 9

Law on aquatics and wildlife (2007)

This law determines the rules, regulations and measures that should be taken concerning the conservation and sustainable use of aquatic and wild animals. The purpose of the law is to inform people about their role to participate in the management and monitoring, conservation, protection and sustainable use of aquatic and wild animals [ref: Article 1].

The overall aim of the law is to ensure the conservation of aquatic and wild animals and the sustainable use of this resource to help increase livelihoods and socio-economic development [ref: Article 1].

Of relevance to the development under REP II Project, the Law on Aquatic and Wild animals requires all person and entities both domestic and international in Lao PDR must manage, conserve, protect, sustainably develop and use the aquatic and wild animals and wild life in natural and residential areas. [ref: Article 8]

Document No: 10

Law on national heritage (2005)

The Law sets out regulations for organisations and individuals in the protection and conservation of natural heritage [ref: Article 47-55] - the heritage formed by nature which is of outstanding value from the point of view of landscape scenery, biodiversity of a pure, original nature, [and] aesthetics. [ref Article 3].

Of relevance to the development under REP II Project, The law applies to Lao citizens, aliens and apatrids residing in the territory of Lao PDR and foreigners and tourists entering Lao PDR [ref: Article 5]

Document No: 11

Decree on the Preservation of Cultural, Historical and Natural Heritage (1997)

The Decree outlines the regulations and measures for the management, conservation, preservation and use of national heritage, including movable and immovable assets with historical or cultural or natural value [ref: Article 1].

Of relevance to the development under REP II Project, key provisions of the decree include:

- Persons or entities have the obligation to contribute to the management, conservation, preservation and restoration of the national heritage and the national cultural, artistic and cultural values [ref: Article 4].
- Any removal within the country or export of moveable assets constituting a national heritage shall require the approval of the Ministry of Information and Culture and any import of cultural materials and artefacts shall similarly require approval from the Ministry of Information and culture [ref: Article 13].
- Persons or entities are forbidden to damage artefacts, artistic sites, whether immovable, movable or natural, constituting the national heritage, whether by committing a wilful offence or out of negligence [ref: Article 15].
- Persons or entities are forbidden to sell, purchase or transfer artefacts of national heritage value without the approval of the Ministry of Information and Culture [re: Article 16].
- Persons or entities discovering artefacts, archaeological sites, ancient historical sites ... shall notify the relevant administrative authorities within three days from such discovery [re: Article 18].
- Persons or entities are forbidden to exploit / excavate for artefacts or objects of historical, artistic, scientific, technical or archaeological value without approval from the Ministry of Information and Culture [re: Article 19].

Document No: 12

Regulation on Industrial Waste Discharge (1994)

The purpose of the Regulation is to control hazards arising from the discharge of industrial waste water and the waste which may affect water quality, the health of the citizens and other kinds of life [Article 1].

Key provision relevant to the development under REP II Project include:

- Owners shall be responsible for providing a waste treatment system for their operations [ref: Article 7].
- The government is authorized to enter in any location to inspect, observe, measure and collect wastewater samples

[ref: Article 13]

- o The government is authorized to temporary suspend industrial wastewater discharge ... in the event of compliance failure [ref: Article 16].

Document No: 13

Guidelines on Public Involvement for Environment Assessment in Lao PDR (Draft) (2000)

The Public Involvement Guidelines were drafted and intended to be an annex to the Regulation on Environmental Assessment in Lao PDR (2000) for use by project proponents and the GoL. The Guidelines are yet to be annexed.

The Guideline provides broad considerations and generic methods for the integration of projected affected groups into project decision-making during planning, implementation and operational phases.

The Guidelines on Public Involvement for EA provide guidance under the following areas:

1. **Establish institutional arrangements** – A committee or advisory group consisting of key stakeholder groups from all levels should be convened for discussions. Key stakeholders would be reps from project management; national, provincial and regional institutions within the government as well as mass organisation and community representatives.
2. **Recruitment of Personnel** – the number of PI specialist depends on the project size although at least two positions are needed for all projects.
3. **Identify Stakeholders** – a number of surveys and preliminary consultations are required to identify surveys.
 - Discussions with various government departments, mass organisations, NGOs and local communities are required for identifying all stakeholders.
 - Surveys also need to be conducted and the guidelines outline the data that is required to formulate a proper PI strategy and plan.
 - Identified stakeholders should be grouped in terms of those of level effect from the project and in terms of their relative resources and ability to deal with potential impacts and change (see matrix provided in Section 3)
4. **Develop General Objectives** – after stakeholders have been identified, agreements on strategies and objectives should be worked out in cooperation with the general project goals.
5. **Integrated Public Involvement Plan** – an ongoing process and a plan that should form parts of many project plans with a series of mechanisms to ensure that proper information is disseminated to the general public and stakeholders and that feedback loops are created.
6. **Coordination of PI** – PI team leader is required to take responsibility and to coordinate efforts of PI; hold regular meetings; continually integrate PI into project programs and implementation strategies
7. **Training Village-based field workers** – in larger projects where field workers are required it is recommended that PI tap into existing village structures, employing headmen, assistants etc).
8. **Information briefings** – info about the project needs to be made available to the general public and all stakeholders.
9. **Workshops and public meetings** - should be regular and recorded
10. **Grievance Committees** and procedure is outlined in the guidelines
11. **Integration of PI into monitoring** – should continue for many years after project is constructed. Evaluation of all aspects of project activities is an important part of continued PI. Monitoring between authorities responsible for the implementation of the EMP and monitoring should be regular

F.2 World Bank Safeguard Policies

Environmental and social policies of the World Bank provide additional guidance for REP II projects regarding the establishment and implementation of environmental and social safeguards.

According to the World Bank's Project Appraisal Document for Rural Electrification Phase I Project (Report No.: 30961), the Bank identified the following safeguard policies as relevant to the development of the REP I Project. It is believed that the

same safeguard policies will be relevant to the management of environmental issues of the subproject under the REP II Project. These safeguard policies include:

- Environmental Assessment (OP/BP/GP 4.01)
- Natural Habitats (OP/BP 4.04)
- Pest Management (OP 4.09)
- Physical and Cultural Resources (OP 4.11)
- Involuntary Resettlement (OP/BP 4.12)
- Indigenous Peoples (OP 4.10)
- Forest (OP/BP 4.36)
- Safety of Dams (OP/BP 4.37)

These safeguard policies are summarized in Table F.2 below.

Table F.2 Description of current World Bank Safeguard Policies

Document No: 1	OP/BP/GP 4.01 Environmental Assessment (October 1998, updated 2007)
<p>The IFC requires environmental assessment of projects for IFC financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making.</p> <p>The scope of environmental assessment includes the natural environment (air, water, and land); human health and safety; and social aspects (involuntary resettlement, indigenous people and cultural property); and transboundary and global aspects.</p> <p>The project sponsor is responsible for carrying out the environmental assessment.</p> <p>The guidelines address the following aspects of environmental assessment:</p> <ul style="list-style-type: none"> ○ Environmental Screening: Determines the appropriate extent and type of environmental assessment. IFC classifies the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. ○ Public consultation: The project sponsor consults project-affected groups and local non-government organizations about the project's environmental aspects and takes their views into account. ○ Disclosure: The project sponsor provides relevant material in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted. ○ Implementation: During project implementation, the project sponsor reports on compliance with (a) measures agreed with IFC on the basis of the findings and results of the EA; (b) the status of mitigate measures; and (c) the findings of monitoring programs. <p>The guidelines provide an outline of (i) the content of an Environmental Assessment Report; and (ii) Environmental Action Plan.</p>	
Document No: 2	OP/BP 4.04 Natural Habitats (June 2001, revised August 2004)
<p>This policy contributes to the Bank's mission of poverty reduction and sustainable development by supporting the conservation of natural habitats. It applies to all borrowers and to subprojects under sectoral loans or loans to financial intermediaries.</p> <p>The Bank supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank expects borrowers to apply a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. This document outlines specific policies and requirements regarding the conservation of natural habitat in world bank funded projects.</p>	
Document No: 3	OP 4.09 Pest Management (1998)
<p>WB supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. In Bank-financed projects, the borrower addresses pest management issues in the context of the project's environmental assessment.</p>	
Document No: 4	OP 4.11 - Physical and Cultural Resources (July 2006)
<p>This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural,</p>	

religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

The objective of this OP on Physical and Cultural Resources is to assist countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances.

This Operational Policy applies to all projects financed by World Bank.

The OP 4.11 details borrower obligations in regards to physical and cultural resources. It requires the borrower to address impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process.

Document No: 5

OP/BP 4.12 Involuntary Resettlement (2002, updated 2004)

The policy describes the obligations of the borrower (proponent) in the event that the project results in involuntary resettlement.

Involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. For these reasons, the overall objectives of the World Bank's policy on involuntary resettlement are the following:

- (a) Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.
- (b) Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.
- (c) Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

The scope of the policy covers direct economic and social impacts that both result from Bank-assisted investment projects, and are caused by:

- a) The involuntary taking of land resulting in: (i) relocation or loss of shelter; (ii) lost of assets or access to assets; or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or
- b) The involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons.

Required Measures: In the event of the above the policy requires that the borrower prepares a resettlement plan or a resettlement policy framework. The scope of the resettlement plan or resettlement policy framework is described in the policy.

Eligibility for Benefits: Upon identification of the need for involuntary resettlement in a project, the borrower develops a procedure, satisfactory to the Bank, for establishing the criteria by which displaced persons will be deemed eligible for compensation and other resettlement assistance.

Resettlement Planning, Implementation and Monitoring: The borrower is responsible for preparing, implementing, and monitoring a resettlement plan, a resettlement policy framework, or a process framework (the "resettlement instruments"), as appropriate, that conform to this policy.

Document No: 6

OP 4.10 Indigenous Peoples (July 2005)

This policy contributes to the Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies, and cultures of Indigenous Peoples. For all projects that are proposed for Bank financing and affect Indigenous Peoples, the Bank requires the borrower to engage in a process of free, prior, and informed consultation. The Bank provides project financing only where free, prior, and informed consultation results in broad community support to the project by the affected Indigenous Peoples. Such Bank-financed projects include measures to (a) avoid potentially adverse effects on the Indigenous Peoples' communities; or (b) when avoidance is not feasible, minimize, mitigate, or compensate for such effects. Bank-financed projects are also designed to ensure that the Indigenous Peoples receive social and economic benefits that are culturally appropriate and gender and inter-generationally inclusive.

As described in the guidelines, a project proposed for Bank financing that affects Indigenous Peoples requires:

- screening by the Bank to identify whether Indigenous Peoples are present in, or have collective attachment to, the project area;

- a social assessment by the borrower;
- a process of free, prior, and informed consultation with the affected Indigenous Peoples' communities at each stage of the project, and particularly during project preparation, to fully identify their views and ascertain their broad community support for the project;
- the preparation of an Indigenous Peoples Plan or an Indigenous Peoples Planning Framework; and
- disclosure of the Indigenous Peoples Plan or Indigenous Peoples Planning Framework.

Document No: 7**OP/BP 4.36 Forest (November 2002, updated 2004)**

The World Bank Operational Policy for Forests outlines the requirements for the management, conservation, and sustainable development of forest ecosystems and their associated resources are essential for lasting poverty reduction and sustainable development, whether located in countries with

The objective of this policy is to assist borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.

This policy applies to the following types of Bank-financed investment projects:

- Projects that have or may have impacts on the health and quality of forests;
- Projects that affect the rights and welfare of people and their level of dependence upon or interaction with forests; and
- Projects that aim to bring about changes in the management, protection, or utilization of natural forests or plantations, whether they are publicly, privately, or communally owned.

The Operational Policy for Forests outlines World Bank Financing conditions:

- The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical natural habitats.
- The Bank does not finance projects that contravene applicable international environmental agreements.

The OP on Forests requires that In accordance with OP/BP 4.01, *Environmental Assessment*, the environmental assessment (EA) for an investment project addresses the potential impact of the project on forests and/or the rights and welfare of local communities.

Document No: 8**OP/BP 4.37 Safety of Dams (2001)**

For the life of any dam, the owner has full responsibility for the safety of the dam. The IFC is concerned about the safety of new dams it finances.

When the Bank finances a project that includes the construction of a new dam, it requires that the dam be designed and its construction supervised by experienced and competent professionals. It also requires that the borrower adopt and implement certain dam safety measures for the design, bid tendering, construction, operation and maintenance of the dam and associated works.

The guidelines distinguish between small dams (normally less than 15 meters in height), for which generic dam safety measures designed by qualified engineers are usually adequate. For large dams, that are between 10 and 15 meters or higher, and present special design complexities – the bank requires:

- Reviews by independent panel of experts.
- Preparation and implementation of detailed plans.
- Prequalification of bidders during procurement and bid tendering.
- Periodic safety inspections of the dam after completion

APPENDIX D: PRELIMINARY DESIGN DOCUMENTS

Date: 12th May 2014
Ref: NNP1-PCL-00254



OBUYASHI CORPORATION

Ban Phonsay, Nouy-17, Pakxan district, Bolikhamxay Province, Lao P.D.R.
Tel: +856-54-790-686 Fax: +856-54-790-688

To: Mr. Takashi TADA
Deputy Managing Director
Nam Ngiep 1 Power Company Limited

Subject: Re-Submission (2nd) of Detailed Works Program for Power Supply System
Installation Works

Dear Sir,

Referring to your letter Ref, NNP1/0134-014/OBA/EPC-CE "Detailed Works Program and Site Specific ESMMP-CP for Power Supply System ", dated 8th May 2014 and Ref,,NNP1/114-014/OBA/EPC-CE, dated 23th April 2014, we would like to herewith provide the Corrected detailed Works Program for Power Supply System Installation Works (Rev.A2) in accordance with Sub-clause 2.1.6 Contractor's Documents of Schedule 12 of Civil Works Contract for your review and approval.

Your prompt approval would be highly appreciated.

Sincerely Yours,

OBUYASHI CORPORATION

Kazuhiko CHABAYASHI
Project Manager
Nam Ngiep Project Office
OC/RM


Attachment: NNP1-MS-OT001-A2 with comment reply sheet

Detailed Works Program
for
Power Supply System Installation Works
for
Nam Ngiep 1 Hydropower Project

Document No. : NNP1-MS-OT001-A2

OBAYASHI Corporation

Submitted By:



Kazuhiko CHABAYASHI
Project Manager
Nam Ngiep Project Office

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REVISION STATUS

Rev. No.	Description	Issue Date	Remarks
A1	1 st Submission for Owner review	02 nd Apr 2014	
A2	2 nd Submission for Owner review	12 th May 2014	

1. GENERAL

This Detailed Works Program is prepared for installation works for the Power Supply System. This Power Supply System is installed for construction of the main dam, re-regulation dam and other facilities for the Project. The installation works of Power Supply System are one of the temporary works.

The works can be divided into two parts. One part is installation work of main cable line and another part is that of substations including metering station. This program (Document No.NNP1-MS-OT001) focuses on these two parts.

General route of the main cable line from EDL Paksan substation to the Project site is shown in Fig.1.



Fig.1 General Route of Main Cable Line

The main cable line route and location of substation in the Project site are shown in Fig.2. Exactry location of substation shall be decided based on further study.

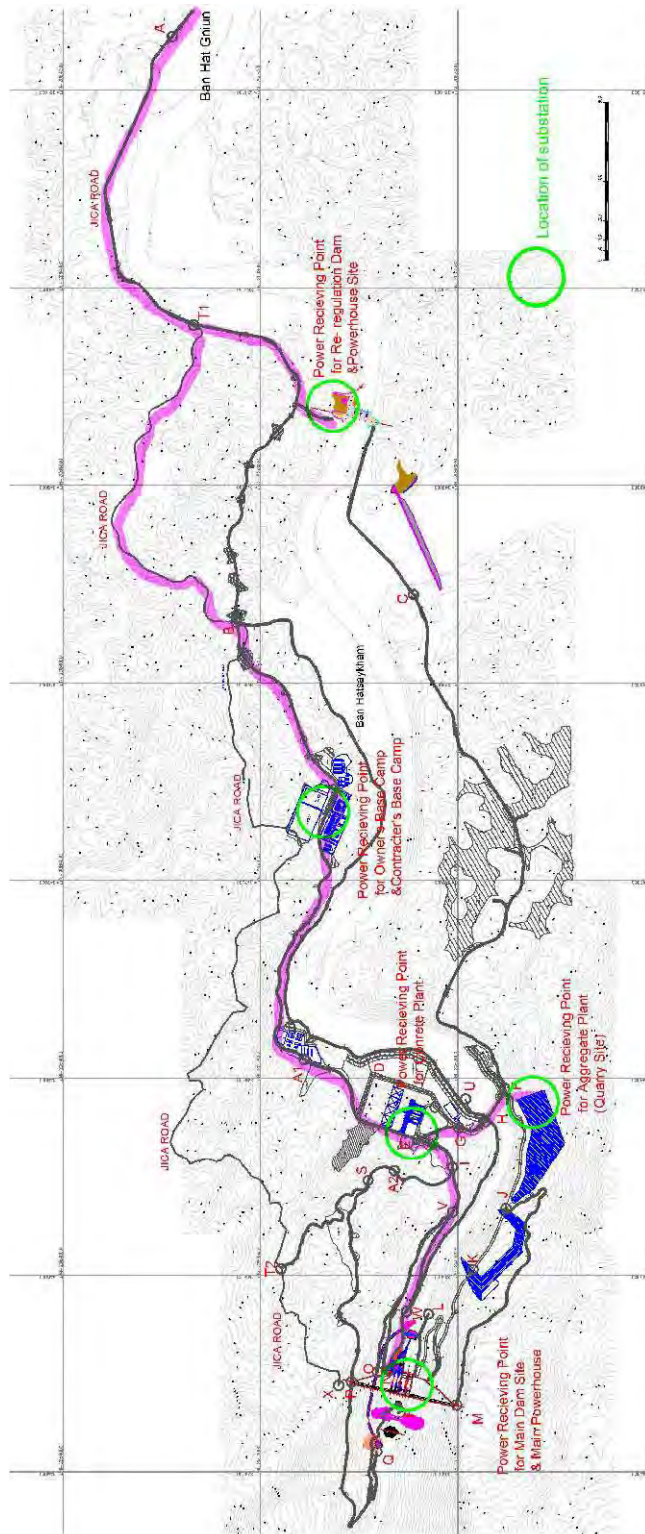


Fig.2. Main Cable Line Route and Location of Substation (Project site)

The general route of the main cable line shall be decided depending on road and existing electric line condition. The installation type of electric line will be able to be divided into four sections as follows;

Section 1: From Paksan to Nonsomboun (L=4.5km and 16.3km=20.8km)

The new cable line shall be installed in this section. In 4.5km distance of this section, existing poles will be used. This section is under studying and also it is necessary to discuss with EDL , the plan will be submitted until end of May 2014.

The design policy of this section shall be followed;

-It should be use existing poles and to avoid setting new poles as much as possible.

-If it can not to avoid setting new poles, the cable line shall be inside ROW along road and new electric poles shall be set within this area.

Section 2: From Nonsomboun to Hatsaykham(L=27.8km)

The existing cable line installed by EDL will be replaced in this section. The existing cable line of 50Sq.mm will be changed into new cable line of 150Sq.mm to accommodate necessity voltage for the construction work. However, the existing poles can be used even after the scale of the cable is changed and the weight of cable become heavy, reinforcement work is necessary such 24 locations as shown Appendix 9.3 PART 2 and how to reinforce is shown is shown Fig.4. All the cable installation work in this section will be carried out within EDL's ROW, therefore additional compensation will not be necessary.

Section 3: From Hatsaykham to RCC Plant Yard and to Re-regulation Dam(L=1.3km and 1.0km and 2.6km)

The new cable line and poles will be installed in this section. The cable line can be installed along Road P1 where compensation is already complete by the Owner. Additional compensation will not be necessary in this section.

Section 4: From RCC Plant Yard to Main Dam and Quarry site (L=1.9km and 1.2km)

The new electric line and pole will be installed in this section. The electric line can be installed along Road P1, P2, T9 and T9 where compensation is already complete by the Owner. Even if the route of cable line will have to be changed such as that along Road T1 or T2, additional compensation will not be necessary because this section is located within governmental land.

Table 1: Summary of each section

	Section 1	Section 2	Section 3	Section 4
Cable	new	replace	new	new
Electric poles	use existing and add New	use existing and reinforce	new	new
line location	Inside EDL's ROW	Inside EDL's ROW	Inside compensated area	Inside compensated area

To grasp whole works, Basic Plan of power supplying is shown in Fig.3.

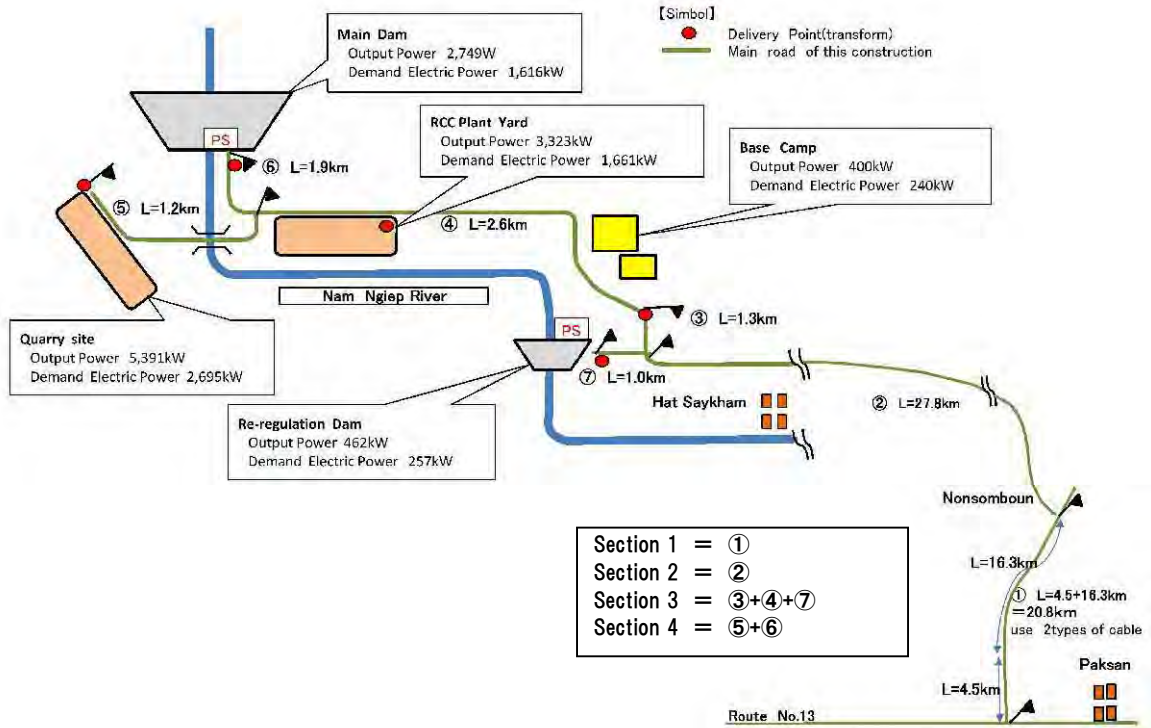


Fig.3.Basic Plan of Power Supplying System

The scope of works of the power supply system and capacity of transformer to be installed at the site are shown in Table 2.

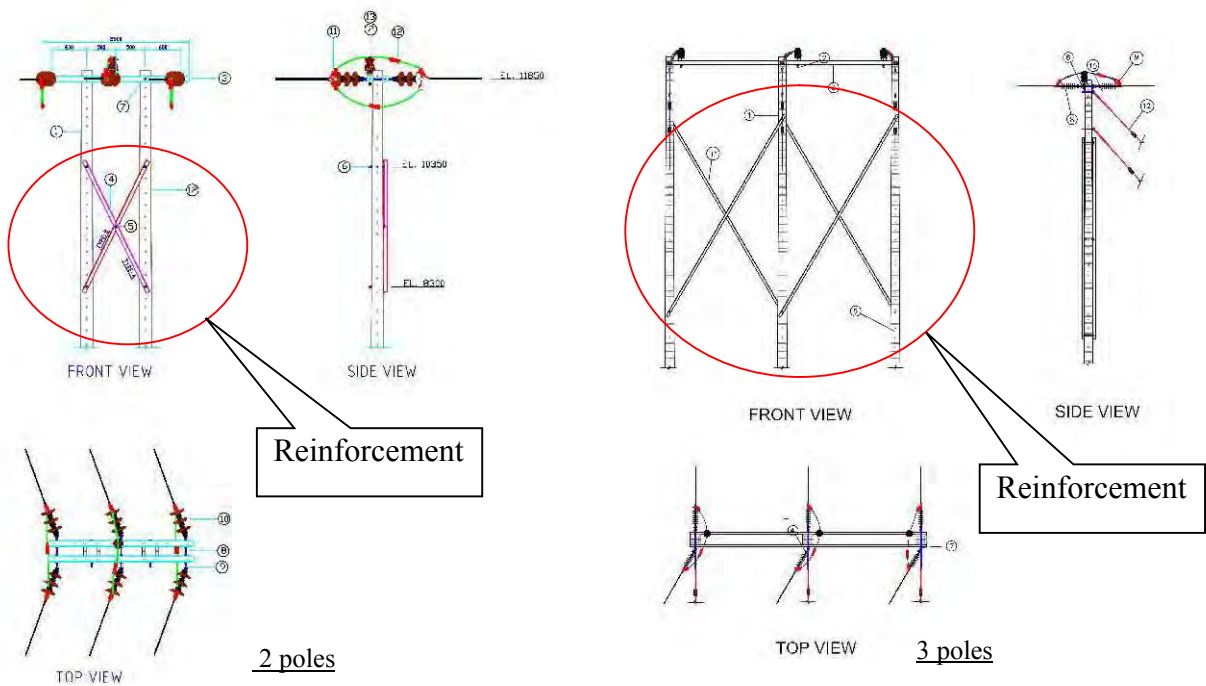


Fig.4. Reinforcement of pole (Sample)

Table 2: Scope of Work for Power Supply System and Capacity of Transformer

No.	Location	Quantity (km)	Maximum Demand Electric Power (kW)	Electric Line Voltage (V)	Required Voltage (V)	Transformer Capacity (kVA)	Remark
1. Main Power Supply Line							
①	Paksan ~ Nonsomboun	20.8	6,470	22,000			Section1
②	Nonsomboun ~ Hatsaykham	27.8	6,470	22,000			Section2
③	Hatsaykham ~ Base Camp	1.3	6,470	22,000	200	250x2	Section3
④	Base Camp ~ Plant Yard	2.6	6,230	22,000	440/220	4,000	Section3
⑤	Plant Yard ~ Quarry Site	1.2	2,695	22,000	440/220	6,000	Section4
⑥	Plant Yard ~ Main Dam	1.9	1,616	22,000	440/220	2,630	Section4
⑦	Branch(Road P1) ~ Re-regulation Dam	1.0	257	22,000	440/220	400	Section3
	Total	56.6					

In Table 3, Maximum Demand Electric Power of each number is calculated in accordance with Appendix 9.0(Calculation basis of Demand Electric Power)

Additionally, metering station (with C-BANK) will be installed between Base Camp and Ban Hat Gniun. The location of the metering station has not been decided yet. After decision of its location, necessary drawing shall be submitted for the Owner's review and approval.

When this plan will be changed, the Contractor shall resubmit revised documents and drawings.

2. REFERENCE

Referenced Specifications:

- Earthwork : TS 2.2, 2.3
- Drainage : TS 9.3
- Incidentals : TS 9.8

In addition, the works for the power supply system shall follow EDL Technical Standard.

3. MATERIAL

Major materials for the works are listed in Table 3.

Table 3: List of Major Materials

No.	Description	Specification	Q'ty	Use for
1	Electric cable	ACSR 150sq.mm	157km	Power supply line(except 4.5km section which from EDL Paksan Substation)
2	Electric cable	SAC 185sq.mm	13.5km	Power supply line(4.5km section which from Paksan Substation)
3	Concrete pole	with accessary	350 set*)	Supporting cable
4	Transformers	22KV/0.4,0.2	15 set*)	Transform voltage
5	Capacitor bank	1.2Mvar	1 set	Preventing drop down of voltage
6	EDL Kilowatt-hour meter	EDL standard	1 set	Measuring of consumption

*) It may be changed by actual site condition

The quantity of each material shall be separately informed to the Owner because it has not been fixed yet.

4. RESOURCES TO BE USED

4.1 Proposed Subcontractor for the Works

Proposed Subcontractor: **ASA POWER ENGINEERING Co., LTD**

This contractor has been approved as the subcontractor of Power Supply System by the Owner. The corresponding of subcontractor approval is listed below;

NNP1-PCL-00177 dated 22nd March 2014

NNP1-PCL-00184 dated 27th March 2014

NNP1/0081-014/OBA/EPC-CE dated 28th March 2014

4.2 Organization Chart

Organization Chart for the works is shown in APPENDIX 9.1.

4.3 Manpower

Manpower for the works is listed in Table 4.

Table 4: List of Manpower

No.	Title / Position	Quantity	Duty
1	Chief Engineer	1	Site management
2	Foreman	1	Work management
3	Skilled worker	3	Pole setting work
		3	Cable stringing work
		2	Transformer Installation
4	Common worker	50	Assist Skilled worker
5	Chief Surveyor	1	Survey chief
6	Assistant Surveyor	2	Survey assistant
	Total	63	

Note: Detailed manpower distribution plan is not decide yet. It will be submitted separately.

4.4 Equipment and Tools

Equipment and tools for the works are listed in Table 5.

Table 5: List of Equipment & Tools

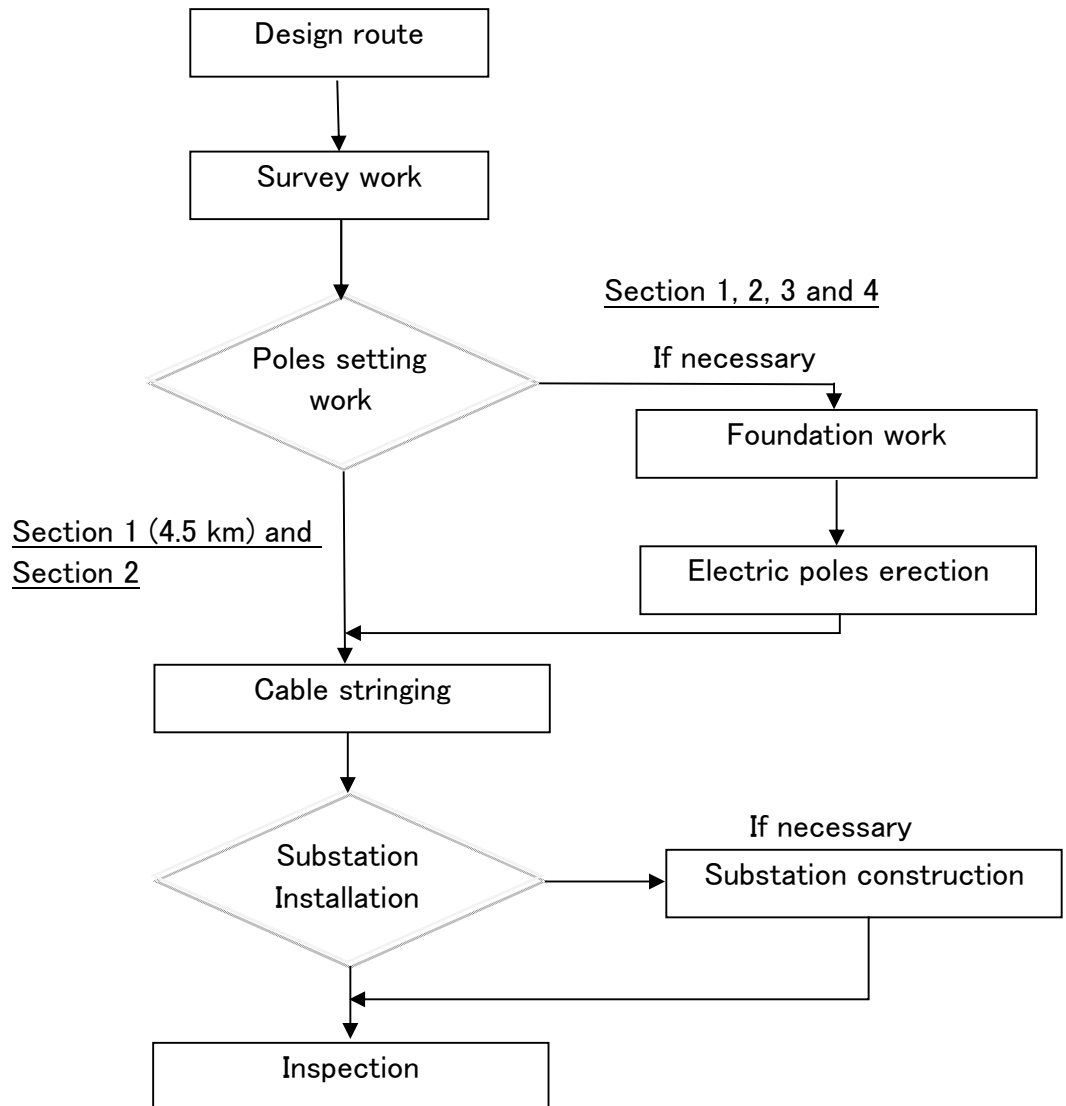
No.	Equipment / Tool	Capacity	Nos	Purpose
1	Excavator	0.7~1.0m ³	4	Clearing and levering
2	Crane mounted truck	8~22ton	8	material transport
3	Truck	3ton	8	material transport
5	4WD CAR	1ton	10	Man transport
6	Concrete mixer	6m ³	5	Foundation work
7	Concrete vibrator		5	Foundation work
8	Water pump		5	Foundation work
9	Bar bender		1	Foundation work
10	Bar cutter		1	Foundation work
11	Winch		6	Cable stringing work
12	Reel stand		6	Cable stringing work

Whole equipment shall be maintained periodically and shall be checked every day before the works.

5. CONSTRUCTION PROCEDURES

5.1 Workflow

The procedure of the construction for the power supply system is shown below.



5.2 Design Route

At first, the preliminary route investigation shall be carried out to study the geographical condition of the overall line routes.

Several alternative routes shall be considered and the best route shall be selected by technical analysis considering several factors such as line length, structure types, road or river crossing, meteorological data, accessibility during construction and maintenance after the completion. When the initial analysis has been completed, specific data shall be gathered by the field investigation for the purpose of making route on the map. Fig.5 and

Table 6 is shown the example of route examination for the section 3(between Hatsaykham and RCC Plant Yard via Base Camp).

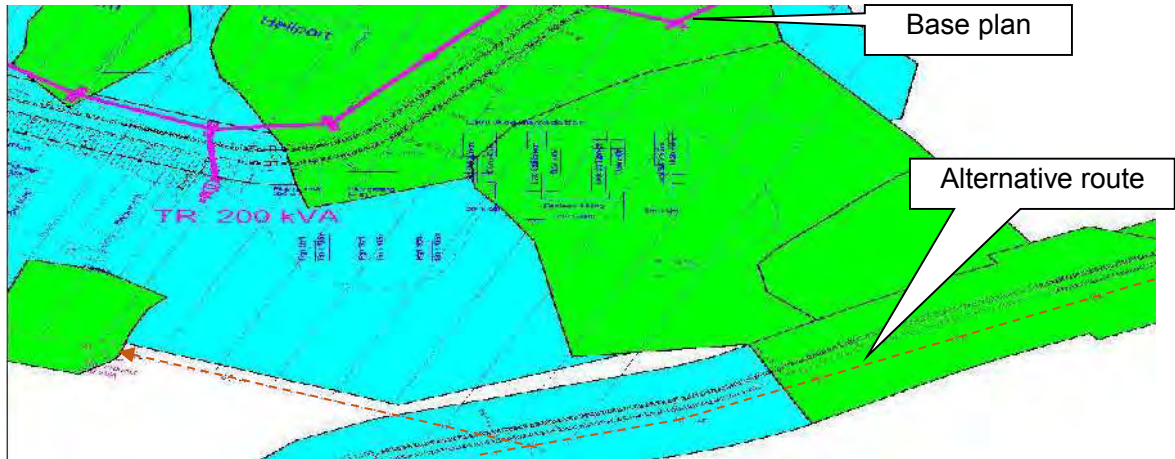


Fig.5 Sample of route examination (in case of near Base Camp)

Table 6: Sample of route Examination(evaluation table)

	item	Alternative plan	Base plan
1	Line length	Short (○)	Long (△)
2	Accessibility for the route	Difficult (△)	Easy (○)
3	Maintainance (after taking over)	Bad (×) (temporary road will be no maintained)	Good (○)
4	metrological impact	N/A	N/A
	Evaluation	△	○

As describe in Clause 1 “GENERAL”, the design route shall be decided depending on the existing road and electric line condition. The installation type of electric line will be able to be divided into four sections as follows:

Section1: From Paksan to Nonsomboun

The new cable line shall be installed in this section. In 4.5km distance of this section, existing poles will be used. The other part is now studying and the plan will be submitted separately.

Section2; From Nonsomboun to Hatsaykham

The existing cable line installed by EDL will be replaced in this section. The existing cable line of 50Sq.mm will be changed into new line of 150Sq.mm. However, the existing poles can be used even after the scale of electricity line is changed and the weight of the newly-installed cable becomes heavy, reinforcement work is necessary several locations in accordance with Appendix 9.3 PART 2.

All the cable installation work in this section will be carried out within EDL's ROW, therefore additional compensation will not be necessary.

Section3: From Hatsaykham to RCC plant yard and to Re-regulation Dam

The new electric line and pole will be installed in this section. The electric line can be installed along Road P1 where compensation is already complete by the Owner. Additional compensation will not be necessary in this section.

Section4: From RCC plant yard to Main Dam and Quarry site

The new electric line and pole will be installed in this section. The electric line can be installed along Road P1, P2, T9 and T9 where compensation is already complete by the Owner. Even if the route of electric line will have to be changed such as that along Road T1 or T2, additional compensation will not be necessary because this section is located within governmental land.

5.3 Survey Work

The field survey should be carried out at all the Sections mentioned above except Section 2, after the final route alignment has been determined. Following the drawings of the final profile and plan, center line of pole locations, right of way and access to the line shall be marked by this survey work. In the route survey, the most careful attention should be paid to how to finalize the line route technically.

In each Section, if the original design alignment is not suitable in consideration of actual site conditions, the alignment will be modified and corrected. The modification of the alignment is subject to the Owner's approval.

At all the Sections mentioned above except Section 2, special attention should be paid to the ROW and existing underground and aboveground obstacles.

5.4 Clearing Work

Clearing works shall be implemented at Section 3 and Section 4. Before commencement of the clearing work, the clearing area shall be marked by wooden peg clearly. The clearing area shall be confirmed and approved by the Owner prior to the works at the site. Once the route of electric line is fixed, the drawing of the clearing area shall be submitted to the Owner.

Removed trees and shrubs shall be stored at designated area along the alignment. Drawings of the designated area shall be submitted to the Owner prior to the work.

5.5 Foundation Work

Soil investigation may be carried out at the specified or typical locations to study the type and physical condition of soil for the decision of the foundation type, referring to the available soil test data by authorities, if necessary.

After the route is finalized, type of foundation applied to each pole location will be designed in accordance with the soil conditions and design requirements as shown below:

- Burial depth of electric pole is decided by overall length of the electric pole in accordance with EDL technical standard. In this installation work, 12m length of poles will be used. The burial depth shall be 2000mm.
- Dimension (Length x width); approximately 1.0m x 1.0m
- Concrete strength shall be 21N/mm²

Any concreting materials such as cement, sand, coarse aggregate, water and reinforcing steel bars shall be carefully studied and selected in accordance with "Owner's Requirement PART II TECHNICAL SPECIFICATION OF CIVIL WORKS Clause 6[Ordinary Concrete]". Concrete should be cast to the foundation pit by means of chutes or any other implements. Suitable vibrators shall be used with appropriate intervals and proper time during the concrete placing, each dimension of the foundation shall be checked carefully.

Soil back filling should be carried out in layers in General by means of suitable mechanical compactors and replace the soil if necessary to ensure the sufficient strength against the maximum design uplift load of the pole.

5.6 Erection of Electric Poles

All necessary materials for erection of electric poles will be transported by truck trailers or 4 wheel drive Vehicles to each concrete pole location.

For the erection works, crane, excavator or other suitable lifting equipment shall be used. Special consideration should be taken to select type and number of the implements for the pole erection in the technical point of view.

In case a crane is employed, the working angle and radius of the crane shall be kept within the allowable limit.

5.7 Cable Stringing Work

Prior to stringing of conductors, insulator strings shall be installed on each pole. The insulators shall be cleaned up to remove mud, grease, dirt and other foreign materials before the installation and any bending or straining on the insulator ball pins shall be avoided during the installation.

The stringing equipment and the operation method shall be selected to avoid any overstressing to the poles and foundations.

Conductors shall be carefully strung to avoid kinking, loosening of strand, scraping, nicking or any damage.

Appropriate stringing sheaves or travelers shall be employed not to damage conductors and earth wires.

Compressed length and diameter of all compression joints shall be carefully checked to certify the permissible limits instructed by the manufacturer. In addition, the photographs of all joints should be taken and kept in the work reports to justify the actual works.

Conductors and earth wires shall be sagged in accordance with the practical sag table.

(supplementation)

Regarding section 2, cable replacement work shall be done. In this section, the procedure is described as below;

1. Confirmation of electricity suspended
2. Removal of existing cable (the procedure is reversed in stringing)
3. Stringing new cable and connecting
4. Resumption of power supply
5. Roll old cable around reel

When this cable stringing work will be done in section 2, power supplying for this section 2 will have to be stopped because it is necessary to replace existing cable. To start this replacement work fluently and to minimize social impact for relative villagers, daily working schedule shall be made in advance and inform to all relatives then obtain consensus from them before start working which needs a power cut.

Section 1, 3 and 4 are only new cable line will be installed. However, when this new cable line connect existing line to supply electricity, it is necessary to stop power supplying. At this moment, we shall provide such outage information in advance and obtain consensus from relatives before start working which needs a power cut.

5.8 Installation of Substation (including Metering Station with C-BANK)

Transformer substations shown in Table 1 are distributed each construction area. The detailed location and specification of each transformer are under consideration and subject to change. The relevant information shall be submitted to the Owner for review and approval by Owner.

The Voltage will be transformed from 22KV to applicable volts (e.g. 0.4KV, 0.2KV, etc.) by transformer.

The capacity of each transformer depends on amount of load which is connected.

There are two transformer setting methods. One is attached with pole and another is on the concrete foundation. It depends on the transformer capacity/weight. In case a transformer is set on the ground, it shall be surrounded by the fence to prevent electric shock. And DANGER sign is posted on the fence. The location of substations shall be determined by the Inspection with the Owner.

Metering Station with Capacitor Bank (C-BANK) will be installed before Transformer substations. This facility is installed for measuring power consumption of the construction area and compensate power factor to prevent drop of voltage. This Metering Station will be mounted pole. The location shall be determined by the inspection with the Owner.

Because the location of this facility is not finalized yet. The finalized information will be provided by end of May 2014.

5.9 Interruption and Resumption of Power Supply to the Villages

During the installation of Power Supply System, it is necessary to interrupt the power supply to the villages such as Nonsomboun, Tafua, Hatgniun and Hatsaykham in order to replace the existing cable with new one or to connect substations/metering station.

Before commencement of the works, explanatory meeting shall be held at each village. In order to minimize the influence to the villagers, the period of interruption shall be determined and informed to relevant villages in advance.

For section 2, power supplying will have to be stopped because it is necessary to replace existing cable. To start this replacement work fluently and to minimize social impact for relative villagers, daily working schedule shall be made in advance and inform to all relatives then obtain consensus from them before start working which needs a power cut.

Section 1, 3 and 4 are only new cable line will be installed. However, when this new cable line connect existing line to supply electricity, it is necessary to stop power supplying. At this moment, we shall provide such outage information in advance and obtain consensus from relatives before start working which needs a power cut.

5.10 Inspection & Test

It is essential to record all data at each working stage so that the quality of the works may be controlled and assured as well as the conditions and trend of all the processes may be clarified.

All the check sheets shall be standardized. Inspection items are shown Appendix 9.5.

6. SAFETY MANAGEMENT

Safety management for site works shall be followed to the Safety and Security Program (Document No. NNP1-PRG-SSP-A3) in the Contractor letter NNP1-PCL-00044, dated 10th December 2013.

Especially, during this installation work, the following issues shall be concerned.

- 1) Electric Shock
 - Whenever commencement of the works, check, then double check, to be sure there is no source of electricity flowing.
 - Do not, under any circumstances, assume that someone else would have cut off the power source. You must check things for yourself.
 - Work by qualified persons

- 2) High place work
 - To avoid simultaneous works at the top and bottom place, each works shall be adjusted in advance.
 - Safety belts/harness shall be wear worn. The conditions of safety equipment must be checked every day.
 - The area under high place work shall be limited to enter.

- 3) Accident to third party
 - For all staffs and worker, the safety training shall be carried out.
 - Warning sign board will be arranged.

- 4) Striking heavy equipment
 - Watch man shall be arranged.
 - When equipment parks on site, stopper shall be set.

Before the commencement of work, safety training shall be carried out to relevant staffs and workers. And the emergency action plan is attached in Appendix 9-4.

The safety control on site will be changed, revised and added time by time in accordance with the occurrence of a dangerous situation and the Owner's comments.

7. ENVIRONMENTAL MANAGEMENT

Environmental mitigation plan shall be followed to the SSES MMP for Power Supply System which will be later submitted.

The Environmental mitigation plan will be changed, revised and added time by time in accordance with the occurrence of adverse impact to the surrounding environment and social environment and the Owner's comments.

8. QUALITY MANAGEMENT

Quality Assurance shall be followed to the Quality Assurance Program (Document No. NNP1-PRG-DrQAP-A3) in the NNP1-PCL-00086, dated 16th Jan. 2014.

Because these works are one of the temporary works, the inspection and test on site shall be held by the Contractor, basically.(see appendix 9.5)

9. APPENDICES

- 9.0 Calculation basis of Demand Electric Power
- 9.1 Organization Chart
- 9.2 Construction Schedule
- 9.3 Working Drawing
- 9.4 Emergency Action Plan
- 9.5 Inspection and Test Plan

APPENDIX 9.0

Calculation basis of Demand Electric Power

**Calculation Sheet of Main Operation Equipments Used in
Main Dam site**

No.	Names and Specifications	Unit	Q' ty	Power (KW)	out put (KW)	utilization rate(%)	output x rate (demand)	Remarks	sub-total of output	sub-total of demand
Equipment of Concrete Placing(Main Dam)										
1	(1) Transportation - Tower Belcon	set	1	961.00	961.00	60.00	576.60	MD2200	1130.4	661.3
2	(1) Transportation - Tower Crane	set	1	169.40	169.40	50.00	84.70	MD1100		
3	(2)Concrete Placing-Cyclechanger for vibrator	set	2	27.30	54.60	60.00	32.76		355.6	157.7
4	(2)Concrete Placing-Water pump	set	10	1.50	15.00	70.00	10.50			
5	(2)Concrete Placing-Welding machine	set	10	11.00	110.00	40.00	44.00			
6	(2)Concrete Placing-High-washer	set	8	22.00	176.00	40.00	70.40		803.0	546.2
7	(3)Temporary facilities - Water supply pump	set	2	22.00	44.00	70.00	30.80			
8	(3)Temporary facilities - Water supply pump	set	4	75.00	300.00	70.00	210.00			
9	(3)Temporary facilities -Drainage pump	set	2	55.00	110.00	60.00	66.00			
10	(3)Temporary facilities -Drainage pump	set	10	15.00	150.00	60.00	90.00			
11	(3)Temporary facilities -Drainage pump	set	1	22.00	22.00	60.00	13.20			
12	(3)Temporary facilities -Drainage pump	set	2	22.00	44.00	60.00	26.40			
13	(3)Temporary facilities -Drainage pump	set	3	11.00	33.00	60.00	19.80			
14	(3)Temporary facilities -Lighting	set	100	1.00	100.00	90.00	90.00			
					2,289.00		1,365.16		2289.0	1,365.2

Calculation Sheet of Grout Facility

No.	Names and Specifications	Unit	Q' ty	Power (KW)	out put (KW)	utilization rate(%)	output x rate (demand)	Remarks	sub-total of output	sub-total of demand
Equipment of Grouting										
1	(1)Center plant - center plant	set	2	60.00	120.00	50.00	60.00		127.4	63.7
2	(1)Center plant - Screw conveyor	set	2	3.70	7.40	50.00	3.70			
3	(2)Boring &Pouring - Boring machine	set	18	5.50	99.00	50.00	49.50		216.7	108.3
4	(2)Boring &Pouring - propulsive pump	set	18	2.00	36.00	50.00	18.00			
5	(2)Boring &Pouring - grout pump	set	9	8.00	72.00	50.00	36.00			
6	(2)Boring &Pouring - propulsive pump	set	9	0.35	3.15	50.00	1.58			
7	(2)Boring &Pouring - grout flow pressure measu	set	10	0.20	2.00	50.00	1.00			
8	(2)Boring &Pouring - data dealing equipment	set	9	0.50	4.50	50.00	2.25			
					344.05		172.03			

**Calculation Sheet of Main Operation Equipments Used in
Aggregate Processing System**

No.	Names and Specifications	unit	Q' ty	Power (KW)	out put (KW)	utilization rate(%)	output x rate (demand)	Remarks
	Equipment of aggregate system							
1	Jaw crusher C125	set	2	160.00	320.0	50	160	
2	Feeder GZZ1660	set	2	37.00	74.0	50	37	
3	Feeder GZG110-150	set	5	2.20	11.0	50	5.5	
4	Vibrating screen 3YKR2460	set	4	37.00	148.0	50	74	
5	Straight screen ZKR1233	set	1	7.50	7.5	50	3.75	
6	Cone crusher GP300SEC	set	2	250.00	500.0	50	250	
7	Feeder GZG110-150	set	2	2.20	4.4	50	2.2	
8	Iron remover B800	set	1	5.00	5.0	50	2.5	
9	Cone crusher GP300	set	2	250.00	500.0	50	250	
10	Feeder GZG110-150	set	2	2.20	4.4	50	2.2	
11	Iron remover B650	set	1	5.00	5.0	50	2.5	
12	Feeder GZG90-110	set	6	2.20	13.2	50	6.6	
13	High-frenquency screen 3618VM	set	4	30.00	120.0	50	60	
14	Impact crusher B9100	set	3	500.00	1,500.0	50	750	
15	Manual arc door	set	3		0.0	50	0	
16	Manual arc door	set	25		0.0	50	0	
17	Electric belt scale B1000	set	1	0.50	0.5	50	0.25	
18	Dirt catcher SZMG-4/5/15	set	3	45.00	135.0	50	67.5	
19	1# belt conveyor B=1200mm, L=162.87m	set	1	360.00	360.0	50	180	
20	2# belt conveyor B=1000mm, L=129.5m	set	1	90.00	90.0	50	45	
21	3# belt conveyor B=500mm, L=55m	set	1	11.00	11.0	50	5.5	
22	4# belt conveyor B=500mm, L=53.5m	set	1	11.00	11.0	50	5.5	
23	5# belt conveyor B=500mm, L=52m	set	1	11.00	11.0	50	5.5	
24	6# belt conveyor B=800mm, L=57.5m	set	1	55.00	55.0	50	27.5	
25	7# belt conveyor B=1000mm, L=43.32m	set	1	55.00	55.0	50	27.5	
26	8# belt conveyor B=500mm, L=35.54m	set	1	7.50	7.5	50	3.75	
27	9# belt conveyor B=650mm, L=42.04m	set	1	11.00	11.0	50	5.5	
28	10# belt conveyor B=800mm, L=48.29m	set	1	18.50	18.5	50	9.25	
29	11# belt conveyor B=650mm, L=33.62m	set	1	15.00	15.0	50	7.5	
30	12# belt conveyor B=650mm, L=41.68m	set	1	30.00	30.0	50	15	
31	13# belt conveyor B=500mm, L=70.64m	set	1	11.00	11.0	50	5.5	
32	14# belt conveyor B=650mm, L=58.95m	set	1	22.00	22.0	50	11	
33	15# belt conveyor B=500mm, L=76.71m	set	1	11.00	11.0	50	5.5	
34	16# belt conveyor B=1000mm, L=51.13m	set	1	45.00	45.0	50	22.5	
35	17# belt conveyor B=1200mm, L=91.38m	set	1	90.00	90.0	50	45	
36	18# belt conveyor B=1000mm, L=43.06m	set	1	45.00	45.0	50	22.5	
37	19# belt conveyor B=1000mm, L=43.06m	set	1	45.00	45.0	50	22.5	

No.	Names and Specifications	unit	Q' ty	Power (KW)	out put (KW)	utilization rate(%)	output x rate (demand)	Remarks
39	21# belt conveyor B=650mm, L=68.35m	set	1	30.00	30.0	50	15	
40	22# belt conveyor B=650mm, L=21.64m	set	1	15.00	15.0	50	7.5	
41	23# belt conveyor B=800mm, L=68.35m	set	1	55.00	55.0	50	27.5	
42	24# belt conveyor B=500mm, L=65.90m	set	1	15.00	15.0	50	7.5	
43	25# belt conveyor B=650mm, L=64.49m	set	1	18.50	18.5	50	9.25	
44	26# belt conveyor B=650mm, L=59m	set	1	15.00	15.0	50	7.5	
45	27# belt conveyor B=1000mm, L=230m	set	1	110.00	110.0	50	55	
46	D1# belt conveyor B=1000mm, L=93.5m	set	1	75.00	75.0	50	37.5	
47	D2# belt conveyor B=1000mm, L=91.9m	set	1	55.00	55.0	50	27.5	
48	D3# belt conveyor B=1000mm, L=66.2m	set	1	75.00	75.0	50	37.5	
49	D4# belt conveyor B=1000mm, L=80.3m	set	1	90.00	90.0	50	45	
50	D5# belt conveyor B=1000mm, L=191m	set	1	220.00	220.0	50	110	
51	D6# belt conveyor B=1000mm, L=191m	set	1	220.00	220.0	50	110	
52	D7# belt conveyor B=1000mm, L=154m	set	1	45.00	45.0	50	22.5	
53	D8# belt conveyor B=1000mm, L=142m	set	1	45.00	45.0	50	22.5	
					5,375.5		2687.75	

**Calculation Sheet of Main Operation Equipments Used in
RCC Plant**

No.	Names and Specifications	unit	Q' ty	Power (KW)	output (kw)	utilization rate(%)	output x rate (demand)	Remarks
	Equipment of RCC Plant							
1	double shaft mixer 4.5m ³	set	4	150.00	600.00	50.00	300.00	75*2
2	belt conveyer w=1000mm 1.68m/s	set	4	44.00	176.00	50.00	88.00	22*2
3	ground feed hopper	set	4	2.20	8.80	50.00	4.40	1.1*2
4	#1conveyor w1000	set	1	22.00	22.00	50.00	11.00	
5	#2conveyor w1600	set	1	22.00	22.00	50.00	11.00	11*2
6	#3conveyor w1600	set	1	22.00	22.00	50.00	11.00	11*2
7	#4conveyor w1600	set	1	22.00	22.00	50.00	11.00	11*2
8	dewatering screen w1610	set	3	14.00	42.00	50.00	21.00	7*2
9	banker discharge(vibrator)	set	8	2.20	17.60	50.00	8.80	1.1*2
10	rotary distributor belt	set	2	5.50	11.00	50.00	5.50	
11	banker discharge(vibrator)	set	6	2.20	13.20	50.00	6.60	1.1*2
12	aggregate silo 4*40m ³ *8gates	set	1			50.00	-	
13	weighing system for aggregate	set	3			50.00	-	
14	weighing system for cement/flyash/sp	set	4			50.00	-	
15	weighing system for water	set	4			50.00	-	
16	weighing system for ice	set	2			50.00	-	
17	ice conveyor (screw conveyor) 45deg	set	1	15.00	15.00	50.00	7.50	
18	ice conveyor (screw conveyor) 0deg	set	1	9.20	9.20	50.00	4.60	
19	belt conveyor for ice	set	1	11.00	11.00	50.00	5.50	
20	weighing system for admixture	set	4			50.00	-	
21	compressor 0.34m ³ /min	set	4	2.20	8.80	50.00	4.40	
22	belt conveyor w1200	set	2	30.00	60.00	50.00	30.00	
23	belt conveyor w1200	set	2	60.00	120.00	50.00	60.00	30*2
24	belt conveyor w1200	set	2	11.00	22.00	50.00	11.00	
25	discharge hopper	set	4			50.00	-	
26	iceplant	set	3	450.00	1,350.00	50.00	675.00	
27	chiller 30kw+4kw	set	1	34.00	34.00	50.00	17.00	
28	flake ice generator	set	1	120.00	120.00	50.00	60.00	
29	concrete belt w1200	set	1	55.00	55.00	50.00	27.50	
30	concrete belt w1200	set	1	55.00	55.00	50.00	27.50	
31	control room (air conditioner)	set	3	3.31	9.94	50.00	4.97	
32	screw conveyor for silo	set	12	22.00	264.00	50.00	132.00	
33	vibrator for silo	set	12	0.18	2.16	50.00	1.08	
34		set				50.00	-	
				total	3,092.70		1,546.35	
				for concrete plant	1,564.50		782.25	
				for ice plant	1528.2		764.1	

**Calculation Sheet of Main Operation Equipments Used in
Re-regulation Dam site**

No.	Names and Specifications	Unit	Q' ty	Power (KW)	out put (KW)	utilization rate(%)	output x rate (demand)	Remarks	sub-total of output	sub-total of demand
Equipment of Concrete Placing(Re-reg.Dam)										
1	(1)Concrete Placing- Cyclechanger for vibrator	set	1	27.30	27.30	60.00	16.38		125.8	57.9
2	(1)Concrete Placing-Water pump	set	7	1.50	10.50	60.00	6.30			
3	(1)Concrete Placing-Welding machine	set	4	11.00	44.00	40.00	17.60			
4	(1)Concrete Placing-High-washer	set	2	22.00	44.00	40.00	17.60			
5	(2)Temporary facilities - Water supply pump	set	2	11.00	22.00	60.00	13.20		235.5	148.8
6	(2)Temporary facilities - Water supply pump	set	2	5.50	11.00	60.00	6.60			
7	(2)Temporary facilities -Drainage pump	set	10	15.00	150.00	60.00	90.00	D=200		
8	(2)Temporary facilities -Drainage pump	set	5	5.50	27.50	60.00	16.50	D=100		
14	(3)Temporary facilities -Lighting	set	25	1.00	25.00	90.00	22.50			
					361.30		206.68		361.3	206.7

**Calculation Sheet of Waste Water treatment Facility
and Base Camp(Owner's & Contractor's)**

No.	Names and Specifications	Unit	Q' ty	Power (KW)	out put (KW)	utilization rate(%)	output x rate (demand)	Remarks	sub-total of output	sub-total of demand
Equipments of Waste water treatment equipment										
1	(1)For concrete plant -treatment machine	set	1	22.00	22.00	50.00	11.00		27.5	13.75
2	(1)For concrete plant -water sand-pump	set	1	5.50	5.50	50.00	2.75			
3	(2)For grouting-treatment machine	set	1	37.00	37.00	50.00	18.50		42.5	21.25
4	(2)For grouting -water sand-pump	set	1	5.50	5.50	50.00	2.75			
5	(3)For Main Dam-treatment machine	set	2	47.00	94.00	50.00	47.00		116.0	58.00
6	(3)ForMain Dam -water sand-pump	set	4	5.50	22.00	50.00	11.00			
7	(3)For Re-regulation Dam-treatment machine	set	1	47.00	47.00	50.00	23.50		100.5	50.25
8	(3)For Re-regulation Dam-treatment machine	set	1	37.00	37.00	50.00	18.50			
9	(3)For Re-regulation Dam -water sand-pump	set	3	5.50	16.50	50.00	8.25			
10	(4)For Diversion Tunnel-treatment machine	set	1	37.00	37.00	50.00	18.50		42.5	21.25
11	(4)For Diversion Tunnel -water sand-pump	set	1	5.50	5.50	50.00	2.75			
Equipments of Base Camp										
1	For Owner's Base Camp (lighting)	LS	1	100.00	100.00	60.00	60.00		200.0	120.00
2	For Owner's Base Camp (Other)	LS	1	100.00	100.00	60.00	60.00			
3	For Contractor's Base Camp (lighting)	LS	1	100.00	100.00	60.00	60.00		200.0	120.00
4	(2)For grouting -water sand-pump	LS	1	100.00	100.00	60.00	60.00			

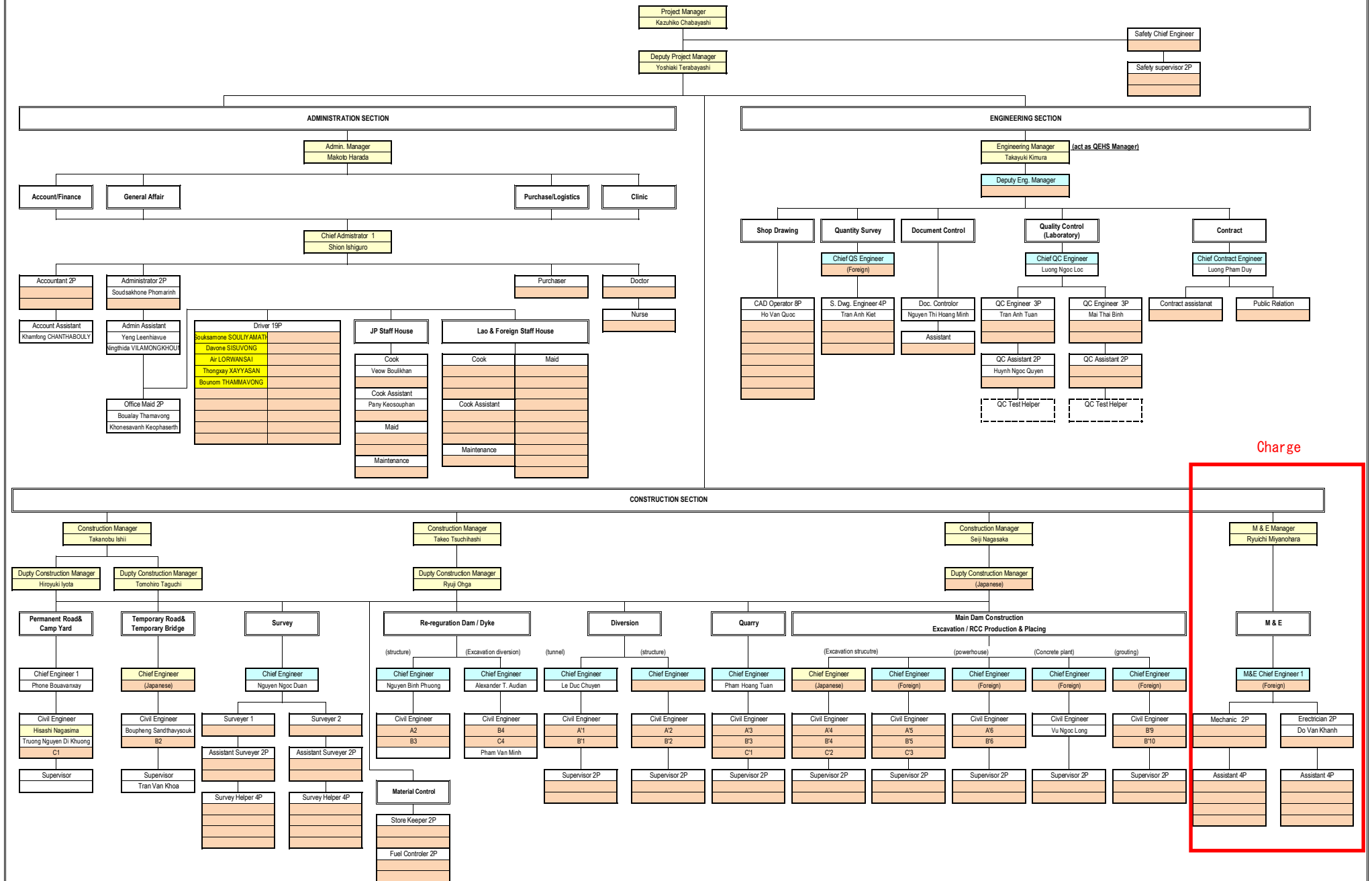
APPENDIX 9.1

Organization Chart for the Works

APPENDIX 9.1

Organization Chart for the Works

ORGANIZATION CHART

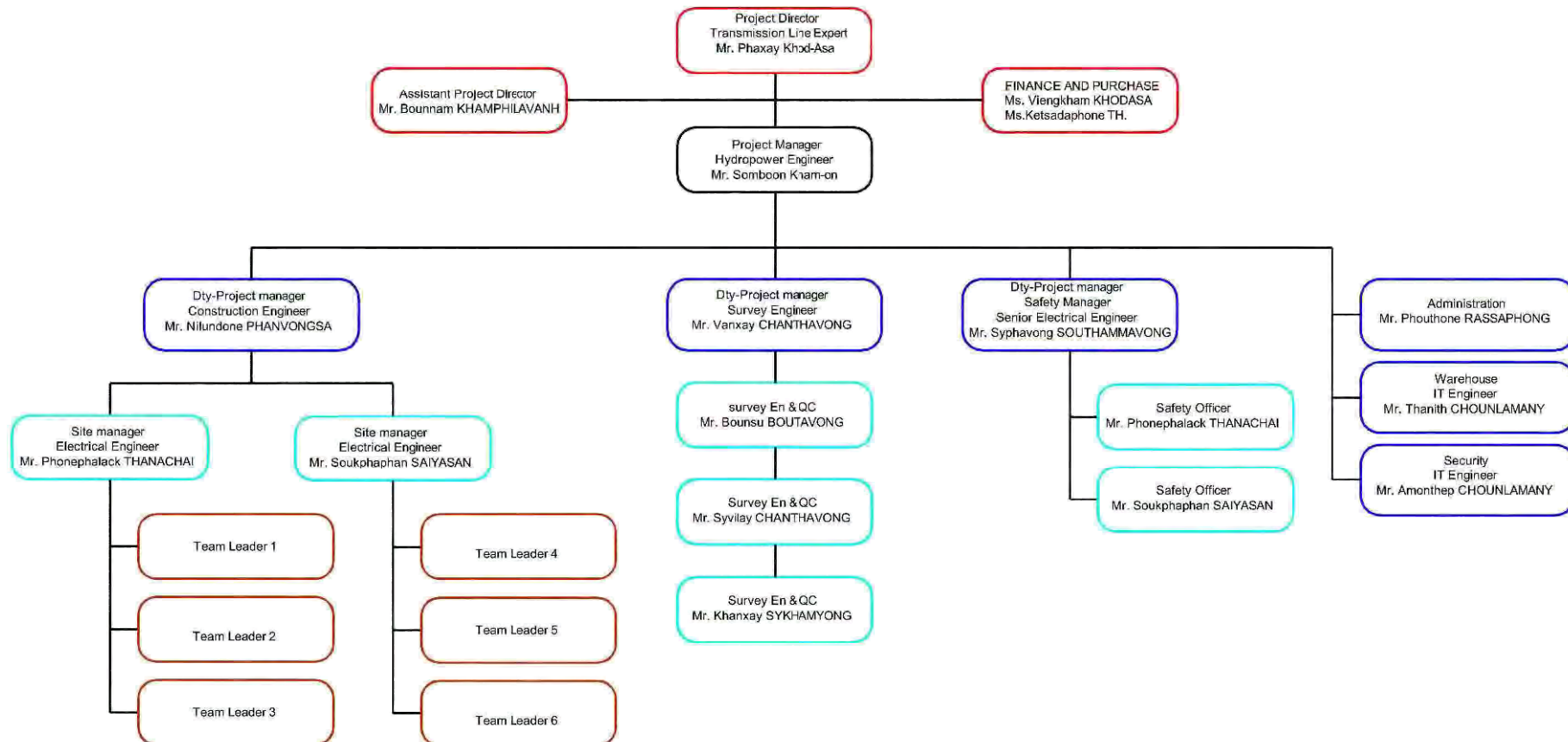


Charge



ASA POWER ENGINEERING CO., LTD
Samkay Road, 118 Ban Vangsai, Vientian Lao PDR.
Tel: (856-21) 412 201, Fax: (856-21) 451 295
Website: www.asa-power.com

ASA Organization Chart for Installation of Power Supply System of NNG1 Project

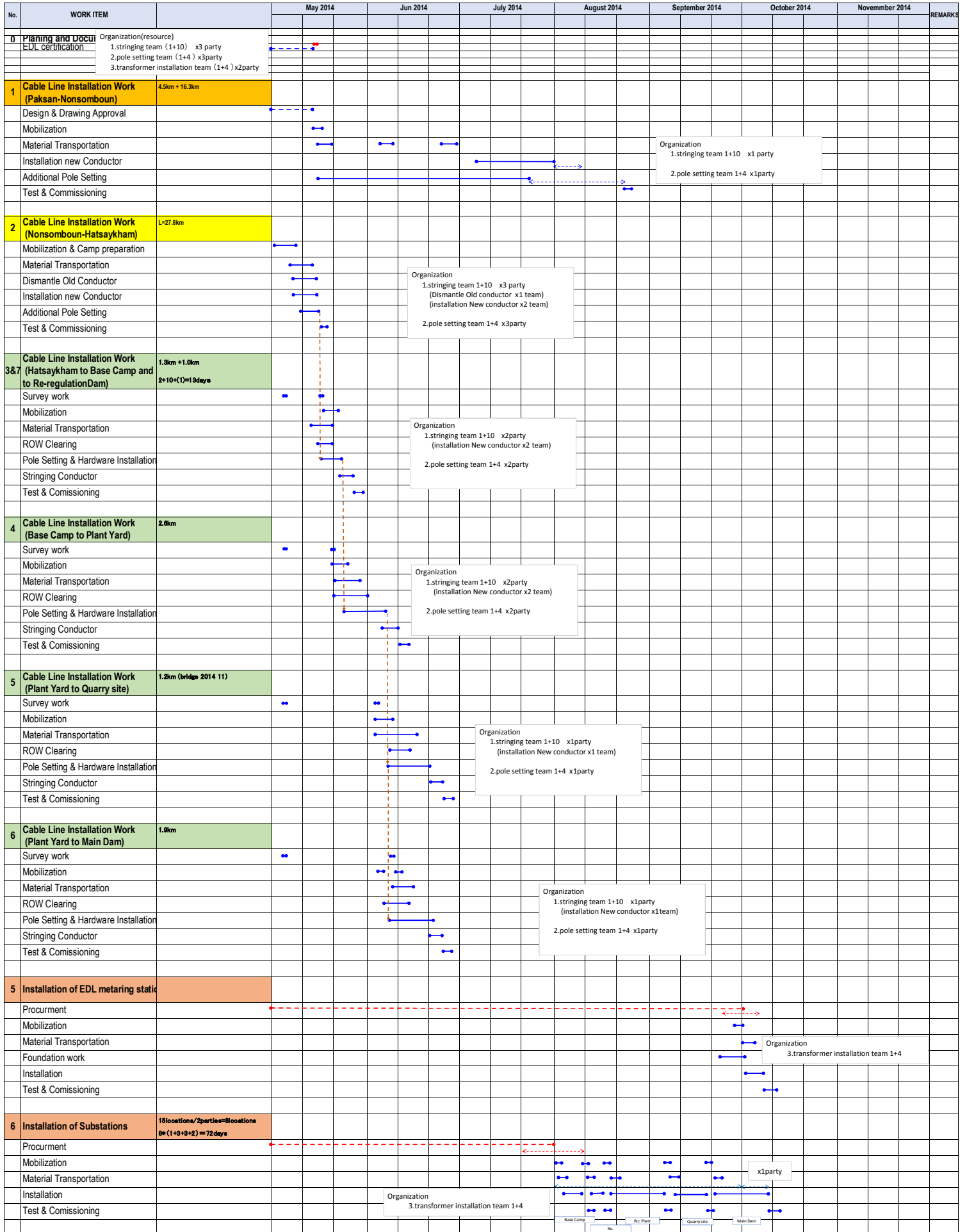


APPENDIX 9.2

Construction Schedule

APPENDIX 9.2

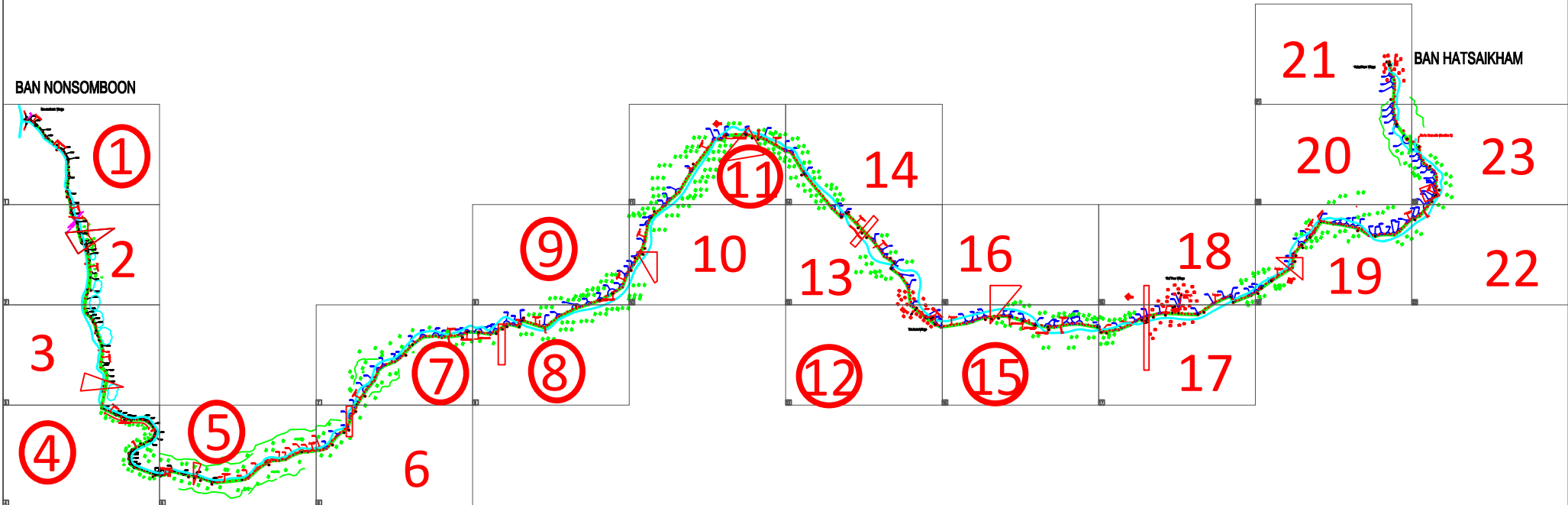
Construction Schedule



APPENDIX 9.3

Working Drawing

LINE ROUTE OVER VIEW & JOINING SHEET

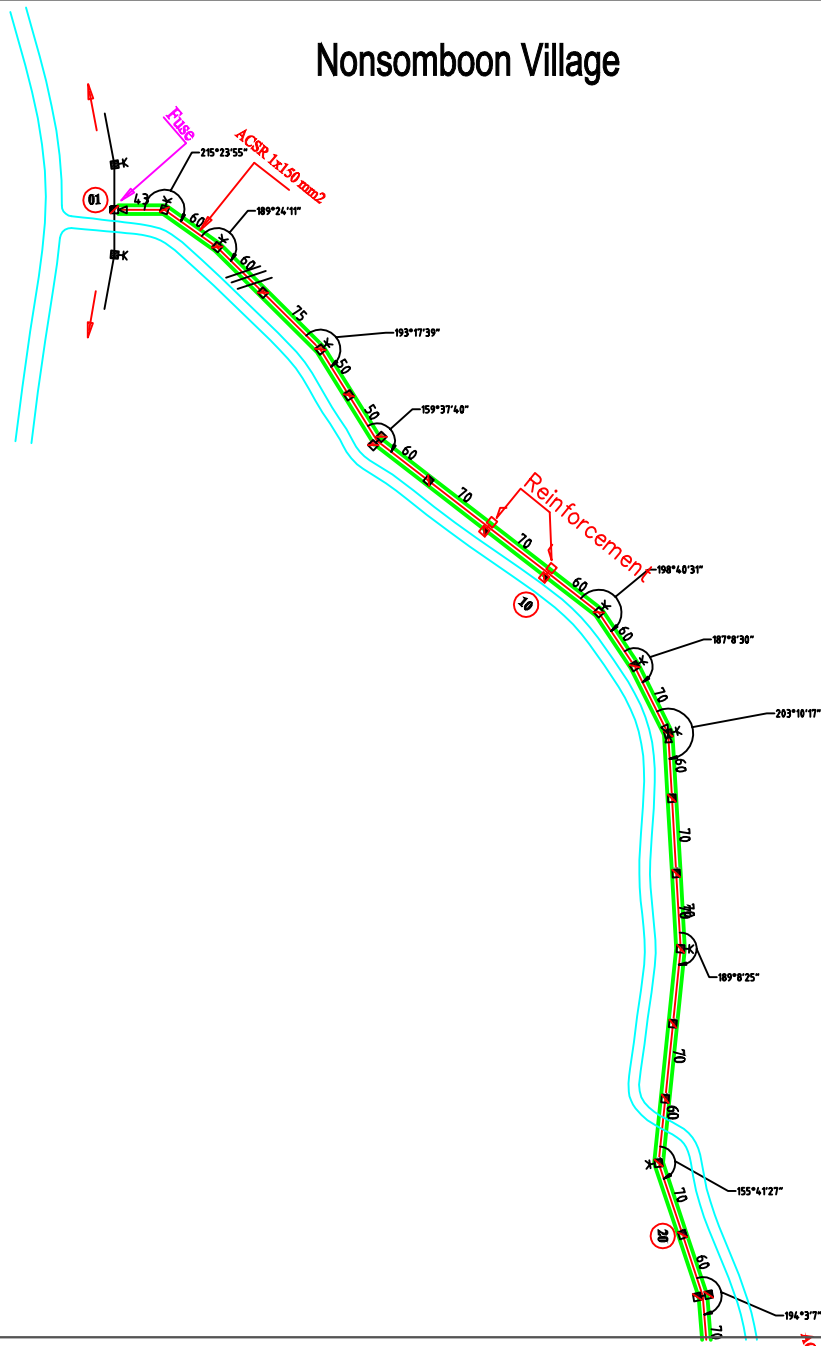


 reinforcement work exist

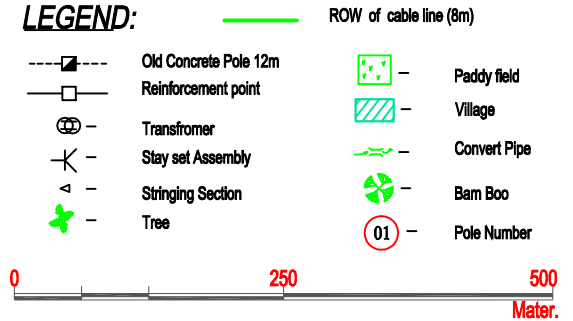


OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT		
					TITLE	NAME	DATE	TITLE		
CONTRACTOR:	OBAYASHI CORPORATION				DESIGNED	Soukphaphanh	10/3/14	23KV TRANSMISSION LINE		
					DRAWN	Soukphaphanh	10/3/14	GENERAL OF LINE ROUTE		
					CHECKED	Bounnam	14/3/14	SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
					APPROVED	Phaxay	14/3/14	SCALE:	SUBMISSION NO.	Rev. 01
								Non Scale	DRAWING NO.	NN1-TL-NB-HK-00
									SHEET NO.	1 OF 1


Nonsomboon Village

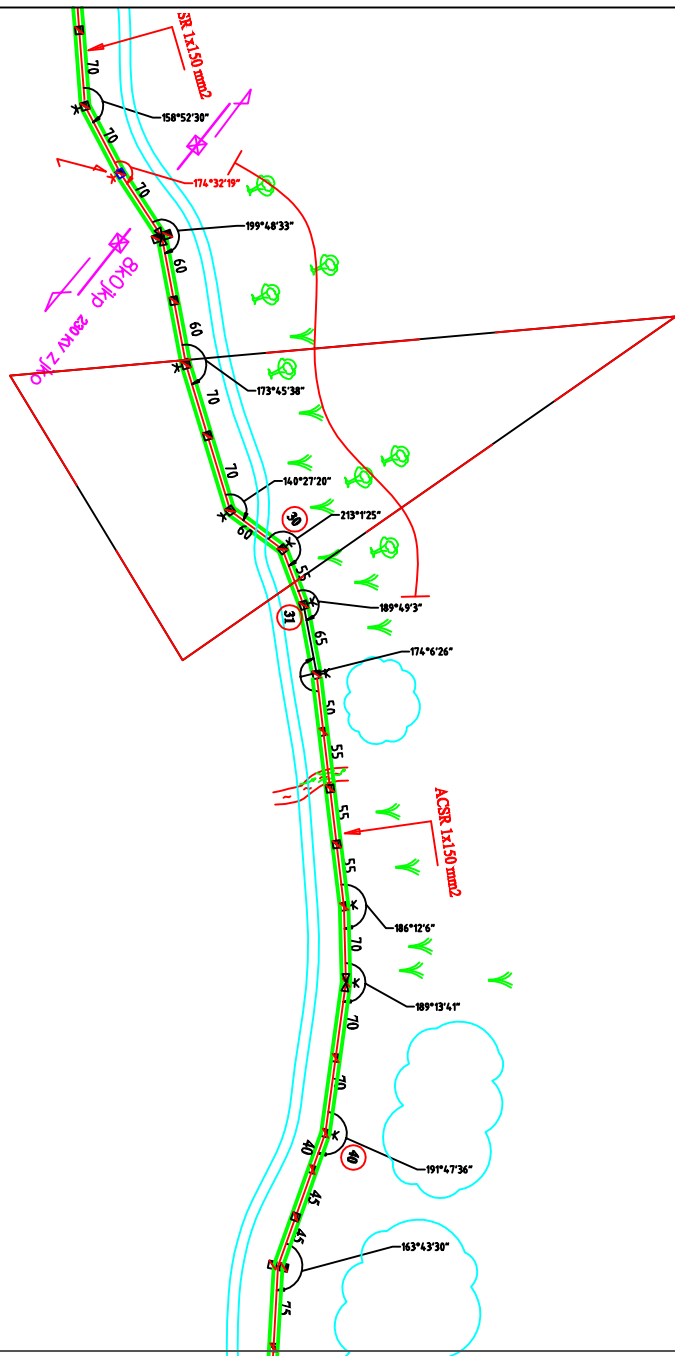


LEGEND:



1

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT		
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	TITLE		
						DESIGNED	Soukphaphanh	10/3/14	22kV TRANSMISSION LINE		
						DRAWN	Soukphaphanh	10/3/14	GENERAL OF LINE ROUTE		
						CHECKED	Bounnam	14/3/14	SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
						APPROVED	Phaxay	14/3/14	SCALE:	SUBMISSION NO.	Rev. 01
									Non Scale	DRAWING NO.	NN1-TL-NB-HK-01
										SHEET NO.	1 OF 23



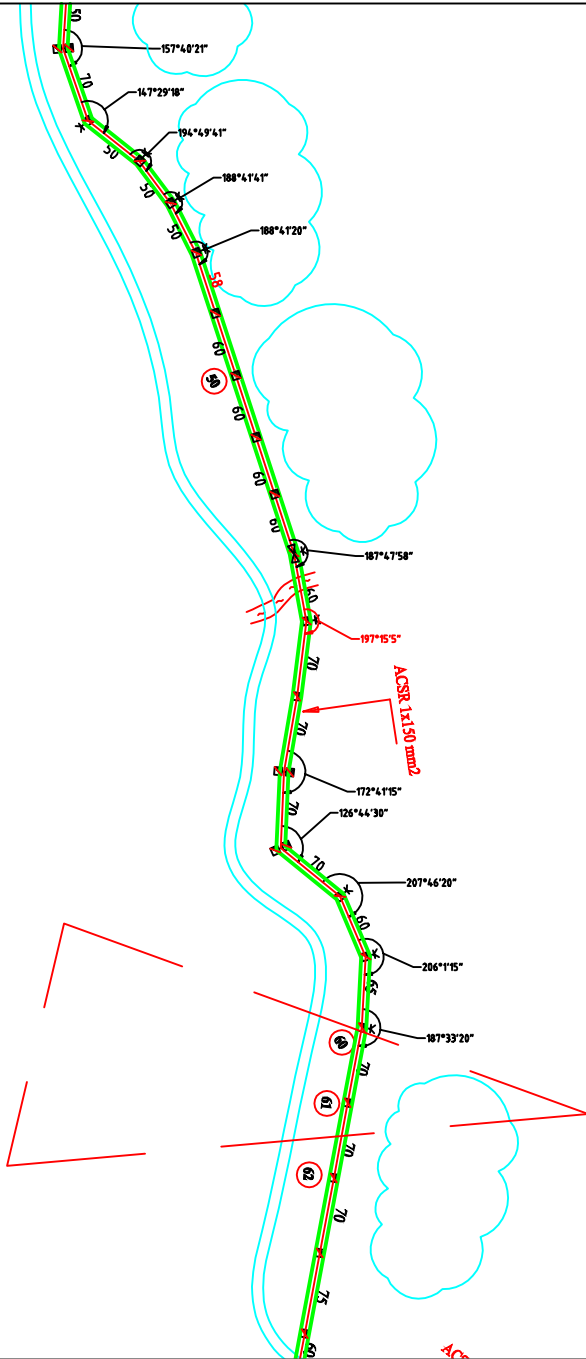
LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convent Pipe
- Bam Boo
- Pole Number



2

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT		
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE			
						DESIGNED	Soukphaphanh	10/3/14	SCALE:	SUBMISSION NO.	Rev. 01
						DRAWN	Soukphaphanh	10/3/14	Non Scale	DRAWING NO.	NN1-TL-NB-HK-02
						CHECKED	Bounnam	14/3/14		SHEET NO.	2 OF 23
						APPROVED	Phaxay	14/3/14			

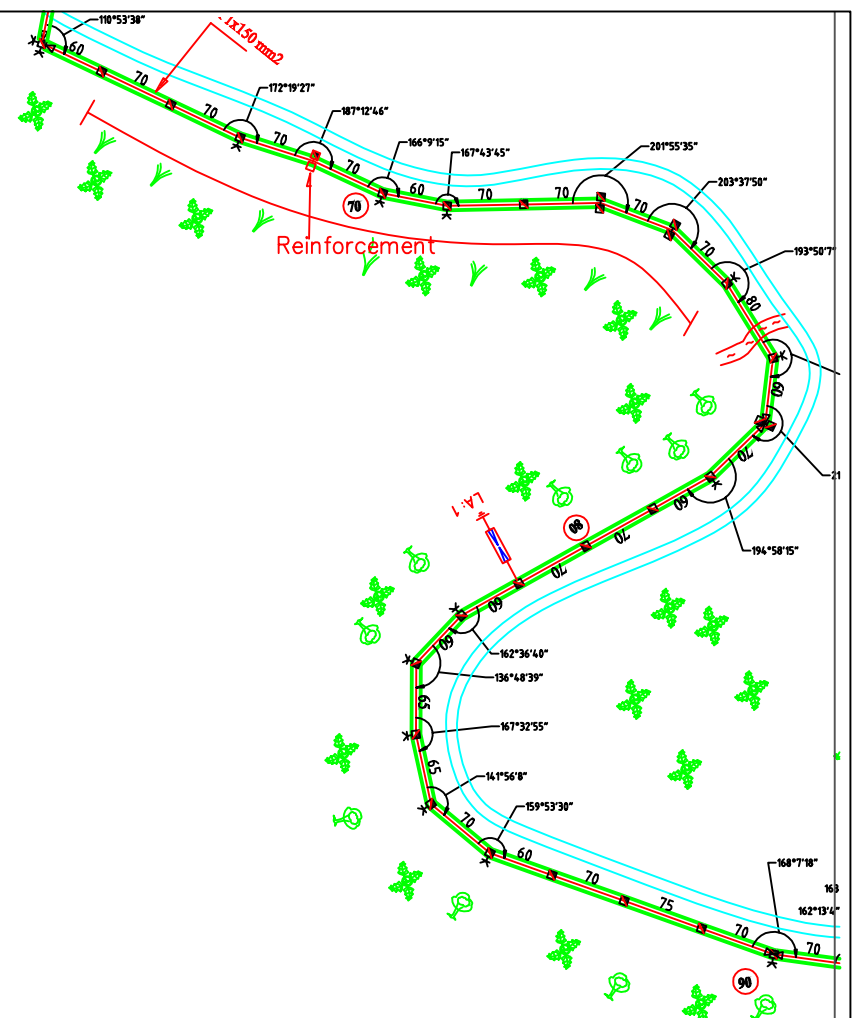


- LEGEND:**
- ROW of cable line (8m)
 - Old Concrete Pole 12m
 - Reinforcement point
 - Transformer
 - Stay set Assembly
 - Stringing Section
 - ▲ Tree
 - ▲ Paddy field
 - ▨ Village
 - Convert Pipe
 - Bam Boo
 - 01 Pole Number



3

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT <small>TITLE: 23kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)</small> <small>SCALE: Non Scale</small> <small>SUBMISSION NO. Rev. 01</small> <small>DRAWING NO. NNL-TL-NB-HK-03</small> <small>SHEET NO. 3 OF 23</small>
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	
						DESIGNED	Soukphaphanh	10/3/14	
						DRAWN	Soukphaphanh	10/3/14	
						CHECKED	Bounnam	14/3/14	
						APPROVED	Phaxay	14/3/14	

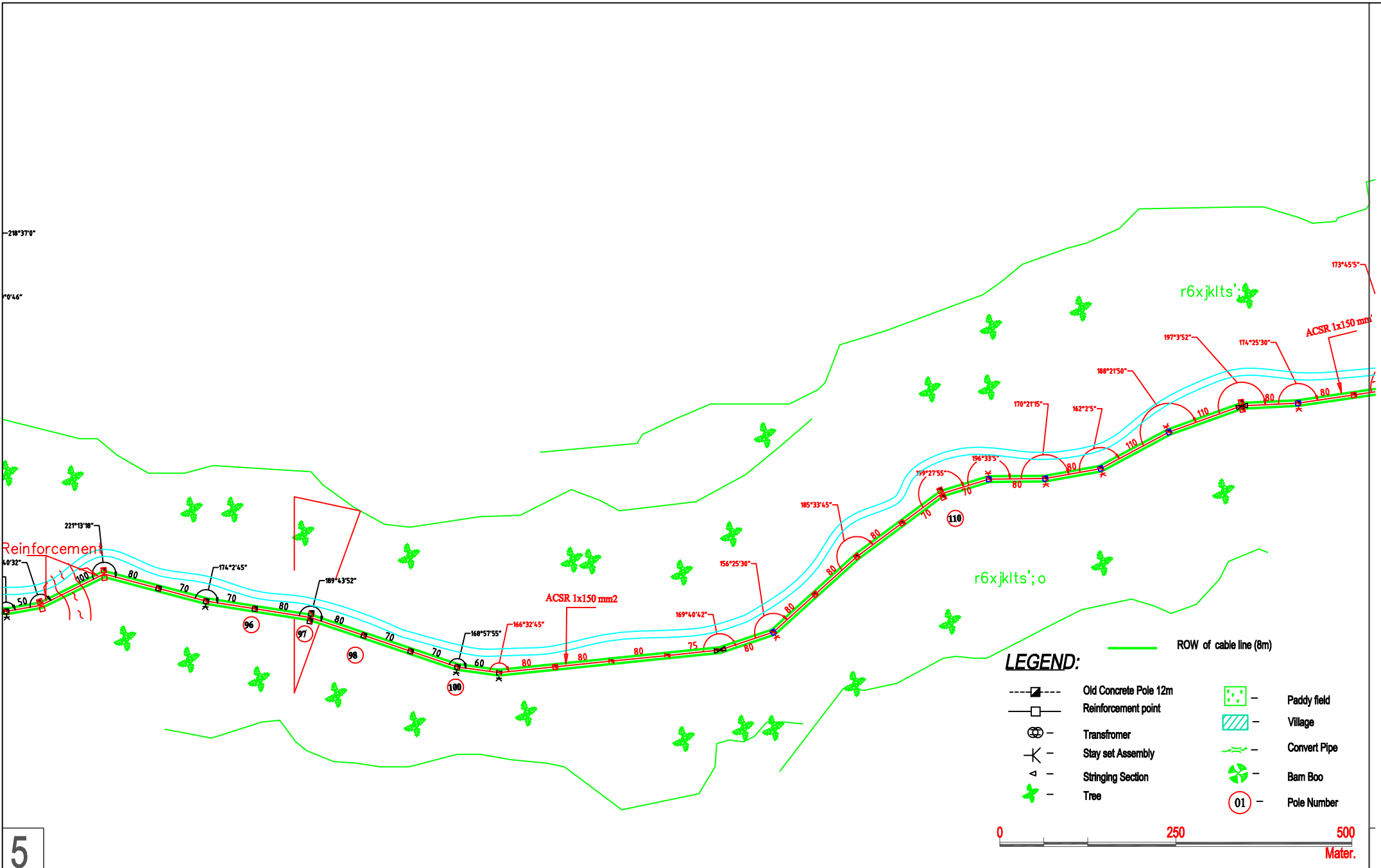


- LEGEND:**
- ROW of cable line (8m)
 - Old Concrete Pole 12m
 - Reinforcement point
 - Transformer
 - Stay set Assembly
 - Stringing Section
 - Tree
 - Paddy field
 - Village
 - Convert Pipe
 - Bam Boo
 - 01 Pole Number

4



OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			TITLE	
	CONTRACTOR:		OBAYASHI CORPORATION		TITLE	NAME	DATE		NAM NGIEP 1 HYDRO POWER PROJECT
						DESIGNED	Soukphaphanh	10/3/14	SECTION (BAN NONSOMBOON - BAN HATSAIKHAM) SCALE: Non Scale SUBMISSION NO. Rev. 01 DRAWING NO. NNL-TL-NB-HK-04 SHEET NO. 4 OF 23
						DRAWN	Soukphaphanh	10/3/14	
						CHECKED	Bounnam	14/3/14	
						APPROVED	Phaxay	14/3/14	



5



OWNER:	NAM NGIEP 1 POWER COMPANY
CONTRACTOR:	OBAYASHI CORPORATION

REVISION No.	DESCRIPTION	DATE	ENGINEER:		
			TITLE	NAME	DATE
			DESIGNED	Soukphaphanh	10/3/14
			DRAWN	Soukphaphanh	10/3/14
			CHECKED	Bounnam	14/3/14
			APPROVED	Phaxay	14/3/14

TITLE		
22KV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
SCALE:	SUBMISSION NO.	Rev. 01
Non Scale	DRAWING NO.	NN1-TL-NB-HK-05
	SHEET NO.	5 OF 23



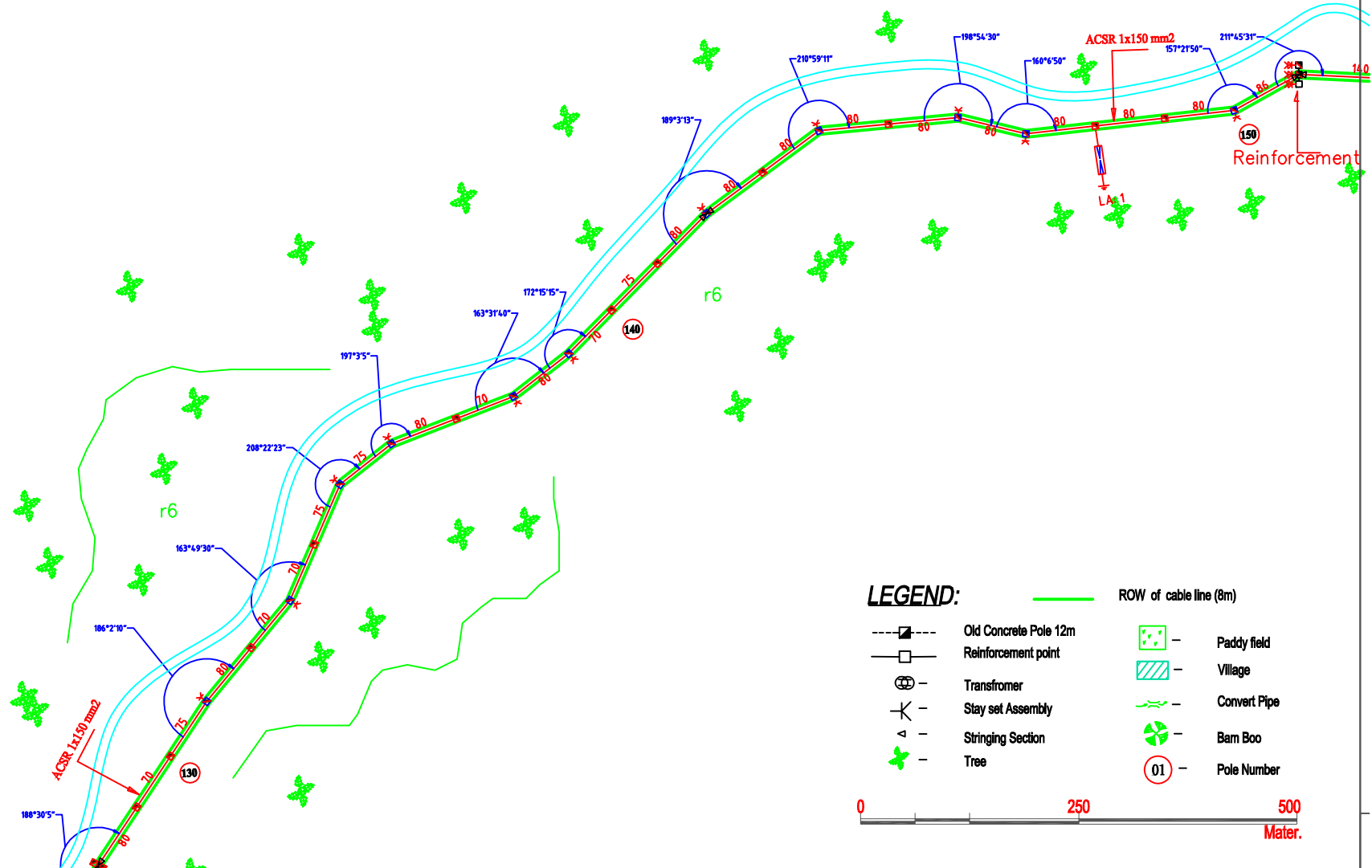
LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convent Pipe
- Bam Boo
- Pole Number



6

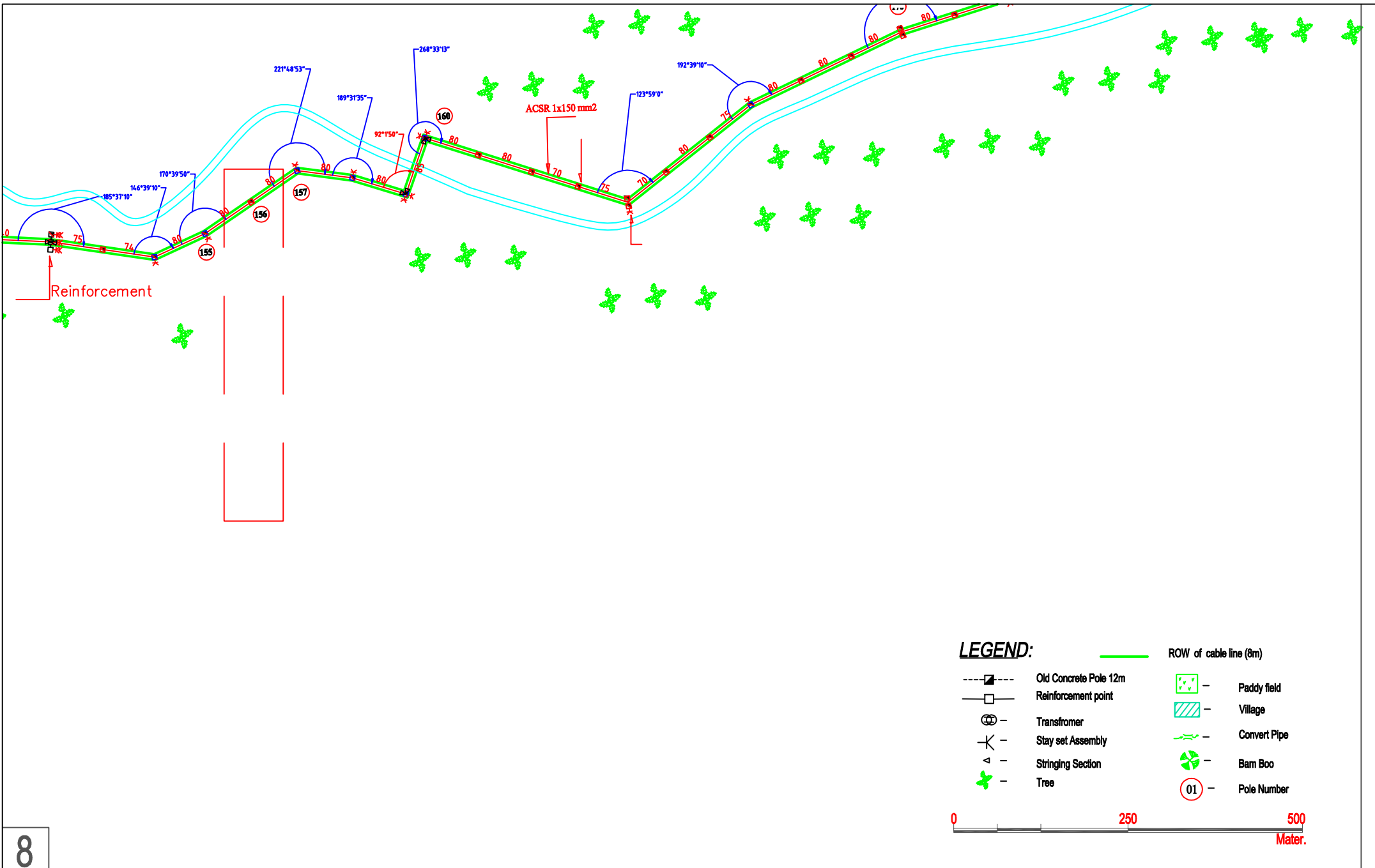
	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT <small>TITLE: 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)</small>		
						TITLE	NAME	DATE			
	CONTRACTOR:	OBAYASHI CORPORATION				DESIGNED	Soukphaphanh	10/3/14	SCALE: Non Scale SUBMISSION NO. Rev. 01 DRAWING NO. NNL-TL-NB-HK-06 SHEET NO. 6 OF 23		
						DRAWN	Soukphaphanh	10/3/14			
					CHECKED	Bounnam	14/3/14				
					APPROVED	Phaxay	14/3/14				



- LEGEND:**
- (thick green line) — ROW of cable line (8m)
 - (dashed line with square) --- Old Concrete Pole 12m
 - (square with cross) — Reinforcement point
 - ⊕ — Transformer
 - (cross symbol) — Stay set Assembly
 - △ — Stringing Section
 - ✕ — Tree
 - ✕ (with dots) — Paddy field
 - ▨ (hatched) — Village
 - (dashed line) — Convert Pipe
 - ✕ (with dots) — Bam Boo
 - ⊙ (with number) — Pole Number



OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			TITLE	NAM NGIEP 1 HYDRO POWER PROJECT		
					TITLE	22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)					
CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	SCALE:	SUBMISSION NO.	Rev. 01	
					DESIGNED	Soukphaphanh	10/3/14		Non Scale	DRAWING NO.	NNL-TL-NB-HK-07
					DRAWN	Soukphaphanh	10/3/14				
					CHECKED	Bounnam	14/3/14				
					APPROVED	Phaxay	14/3/14	SHEET NO. 7 OF 23			



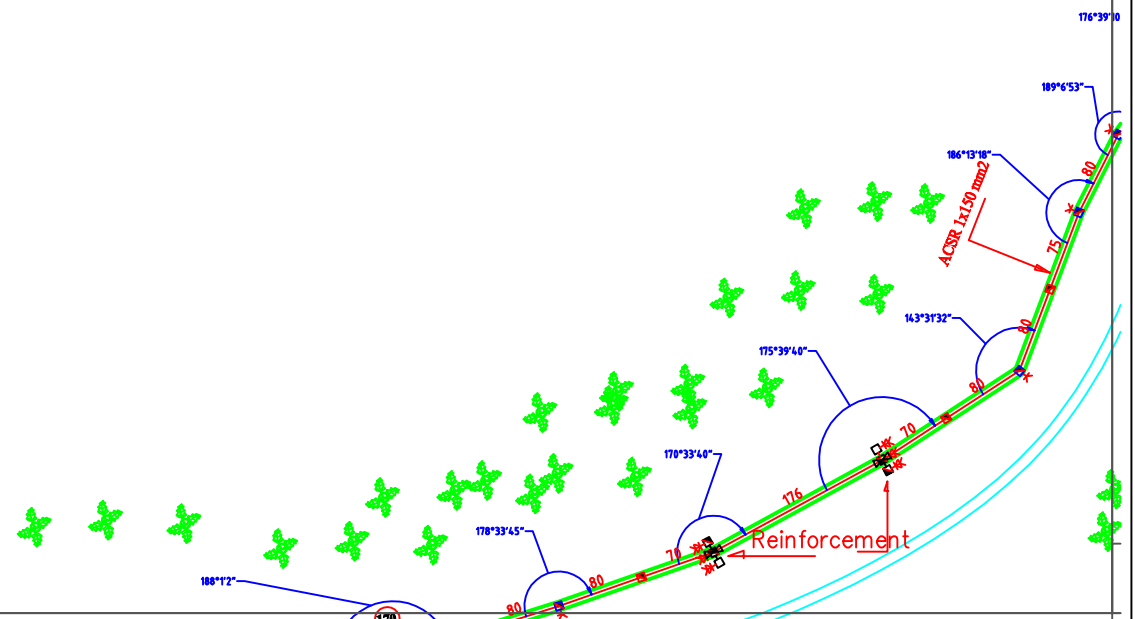
- LEGEND:**
- ROW of cable line (8m)
 - Old Concrete Pole 12m
 - Reinforcement point
 - Transformer
 - Stay set Assembly
 - Stringing Section
 - Tree
 - Paddy field
 - Village
 - Convert Pipe
 - Bam Boo
 - Pole Number

8

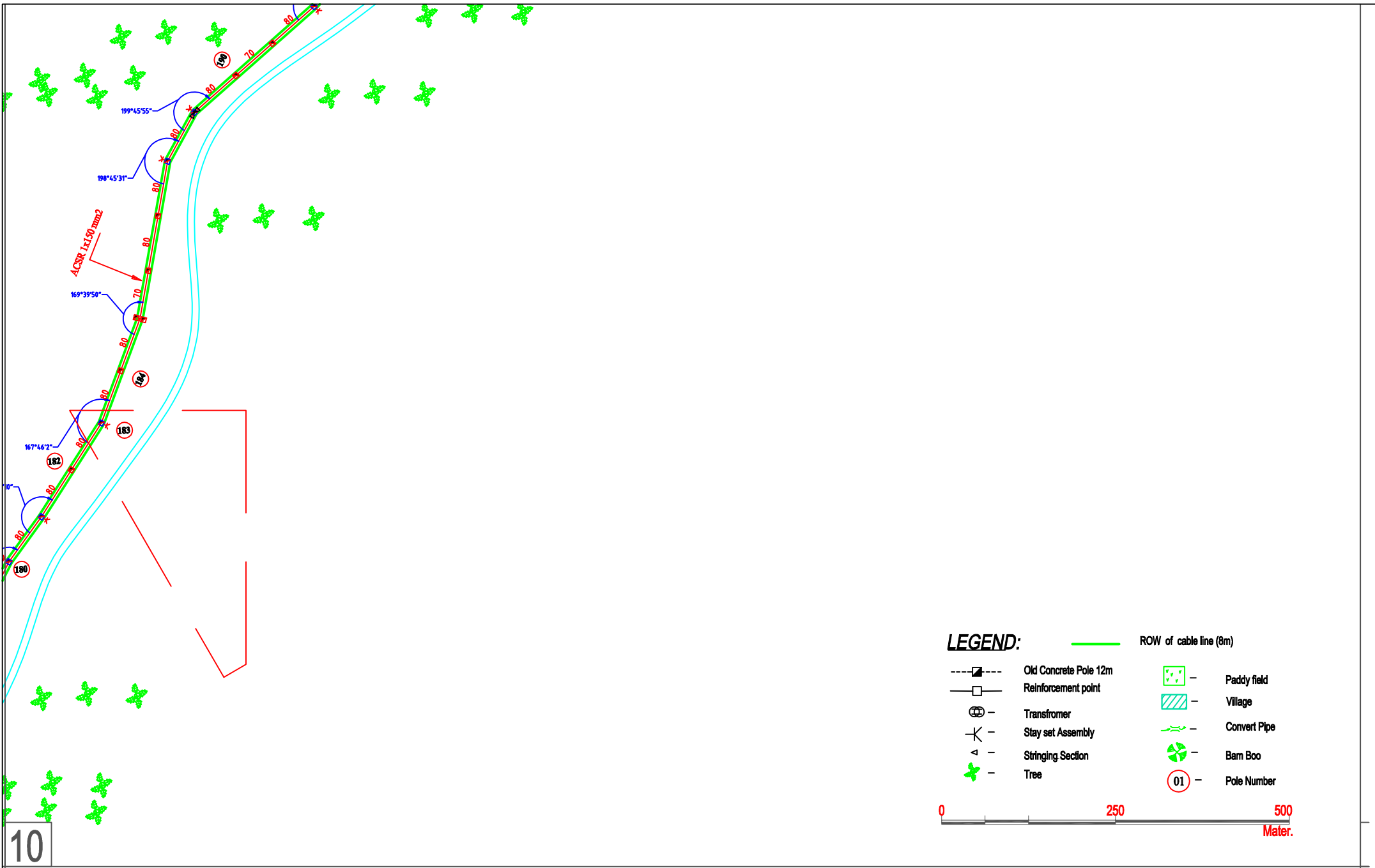
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						TITLE	NAME	DATE				
							DESIGNED	Soukphaphanh	10/3/14	22KV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
							DRAWN	Soukphaphanh	10/3/14			
CONTRACTOR:	OBAYASHI CORPORATION					CHECKED	Bounnam	14/3/14	SCALE:	SUBMISSION NO.	Rev. 01	
						APPROVED	Phaxay	14/3/14	Non Scale	DRAWING NO.	NN1-TL-NB-HK-08	
										SHEET NO.	8 OF 23	

LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- Pole Number



	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT		
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	TITLE 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
						DESIGNED	Soukphaphanh	10/3/14	SCALE:	SUBMISSION NO.	Rev. 01
						DRAWN	Soukphaphanh	10/3/14	Non Scale	DRAWING NO.	NNL-TL-NB-HK-09
						CHECKED	Bounnam	14/3/14		SHEET NO.	9 OF 23
						APPROVED	Phaxay	14/3/14			

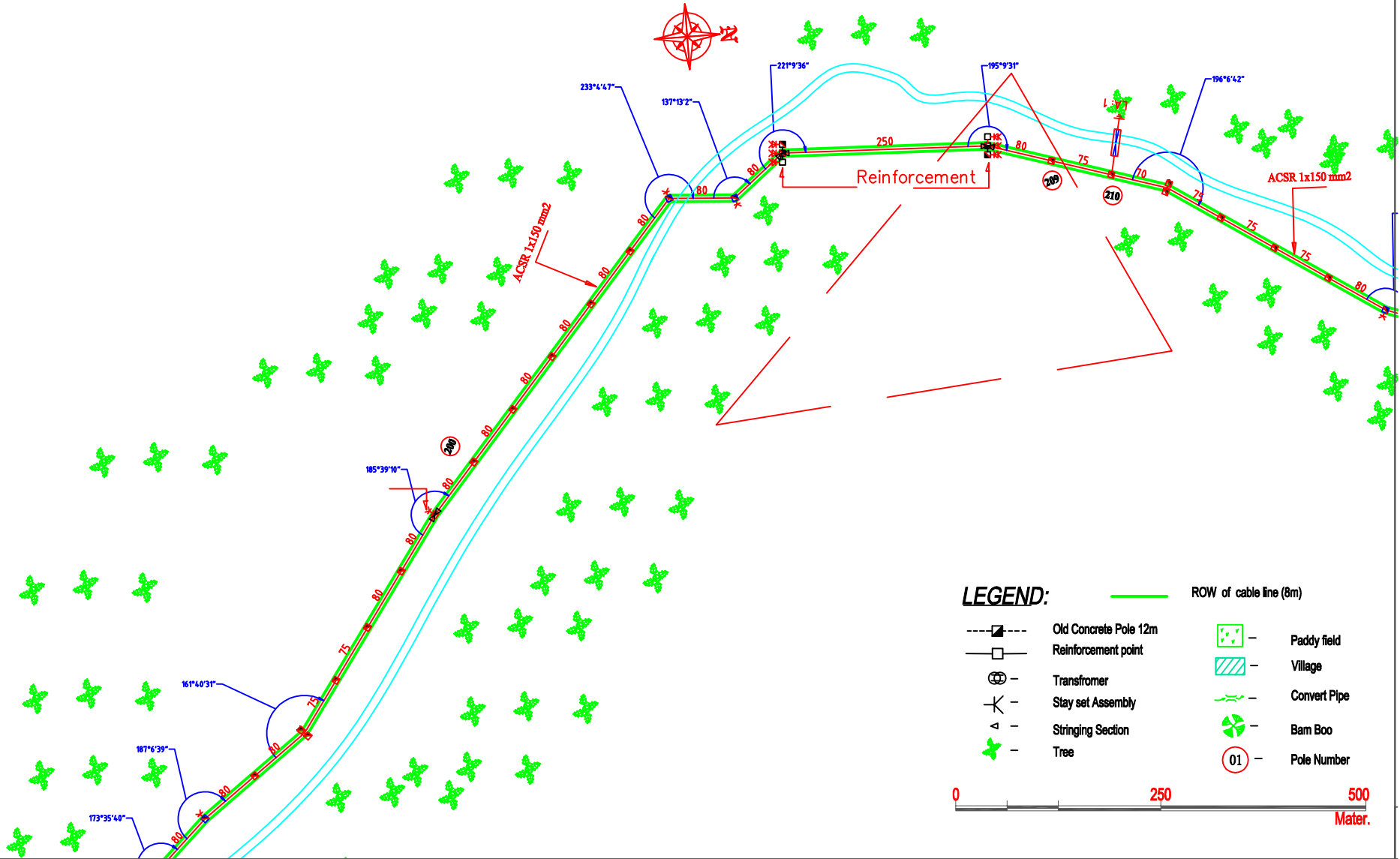


LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- Pole Number

10

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT TITLE: 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)				
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE					
						DESIGNED	Soukphaphanh	10/3/14			SCALE:	SUBMISSION NO.	Rev. 01
						DRAWN	Soukphaphanh	10/3/14			Non Scale	DRAWING NO.	NNL-TL-NB-HK-10
						CHECKED	Bounnam	14/3/14				SHEET NO.	10 OF 23
						APPROVED	Phaxay	14/3/14					



LEGEND:

- ROW of cable line (6m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- Pole Number



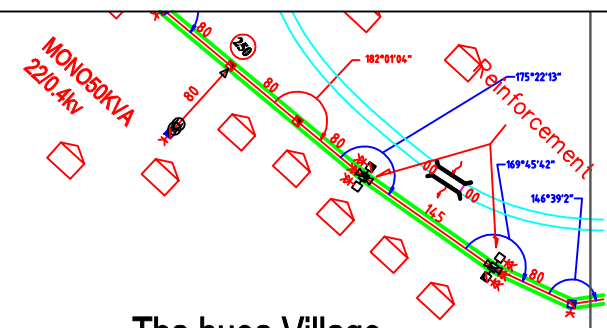
OWNER:	NAM NGIEP 1 POWER COMPANY
CONTRACTOR:	OBAYASHI CORPORATION

REVISION No.	DESCRIPTION	DATE	ENGINEER:		
			TITLE	NAME	DATE
	DESIGNED		Soukphaphanh		10/3/14
	DRAWN		Soukphaphanh		10/3/14
	CHECKED		Bounnam		14/3/14
	APPROVED		Phaxay		14/3/14

TITLE			NAM NGIEP 1 HYDRO POWER PROJECT		
SUBMISSION NO.			Rev. 01		
DRAWING NO.			NNL-TL-NB-HK-11		
SHEET NO.			11 OF 23		

SCALE: Non Scale

TITLE: 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)



Tha huea Village

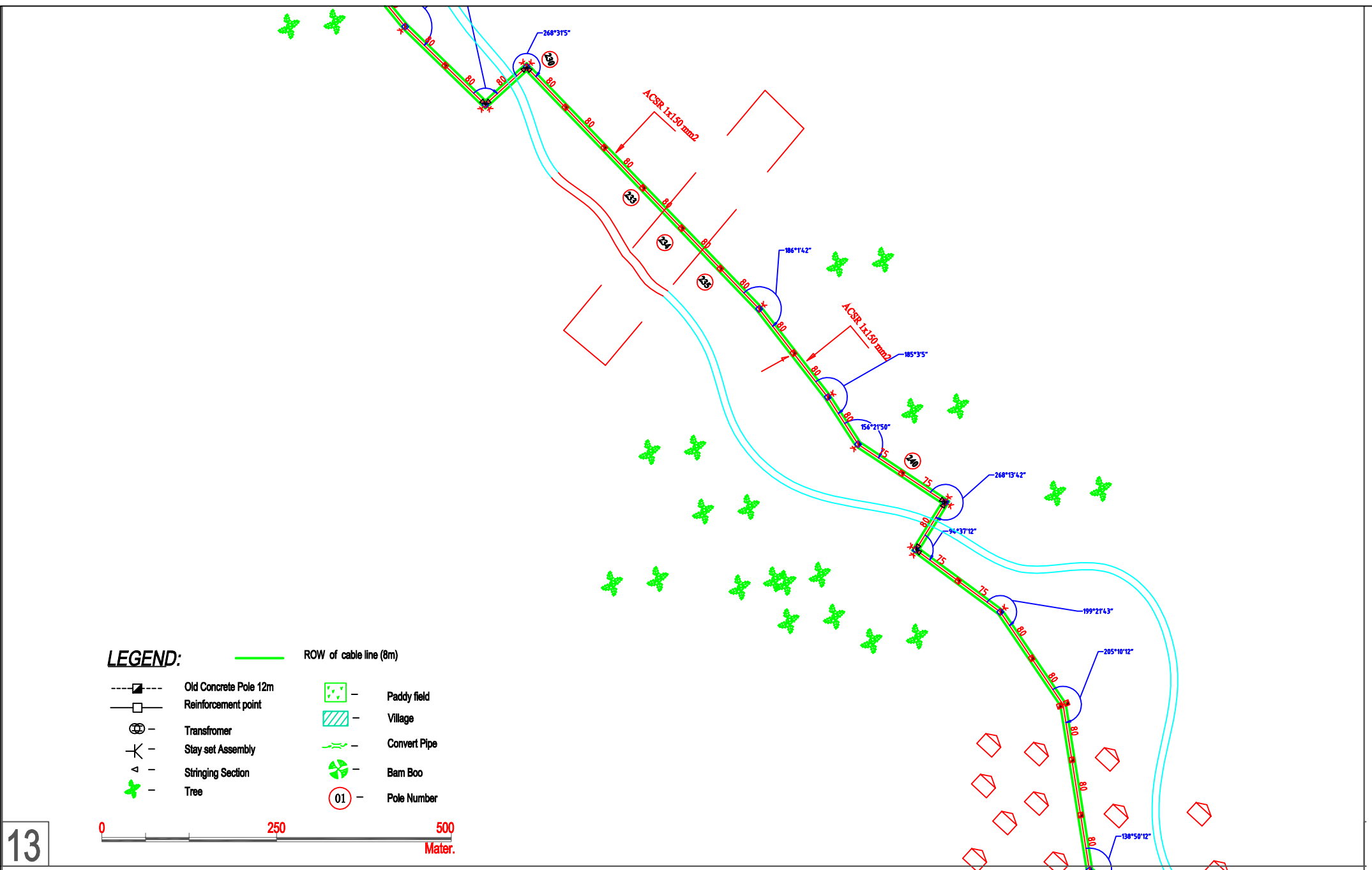
LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transfomer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- Pole Number



12

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT			
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	GENERAL OF LINE ROUTE			
						DESIGNED	Soukphaphanh	10/3/14	SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)			
						DRAWN	Soukphaphanh	10/3/14	SCALE:	SUBMISSION NO.	Rev. 01	
						CHECKED	Bounnam	14/3/14	Non Scale	DRAWING NO.	NNTL-NB-HK-12	
						APPROVED	Phaxay	14/3/14		SHEET NO.	12 OF 23	



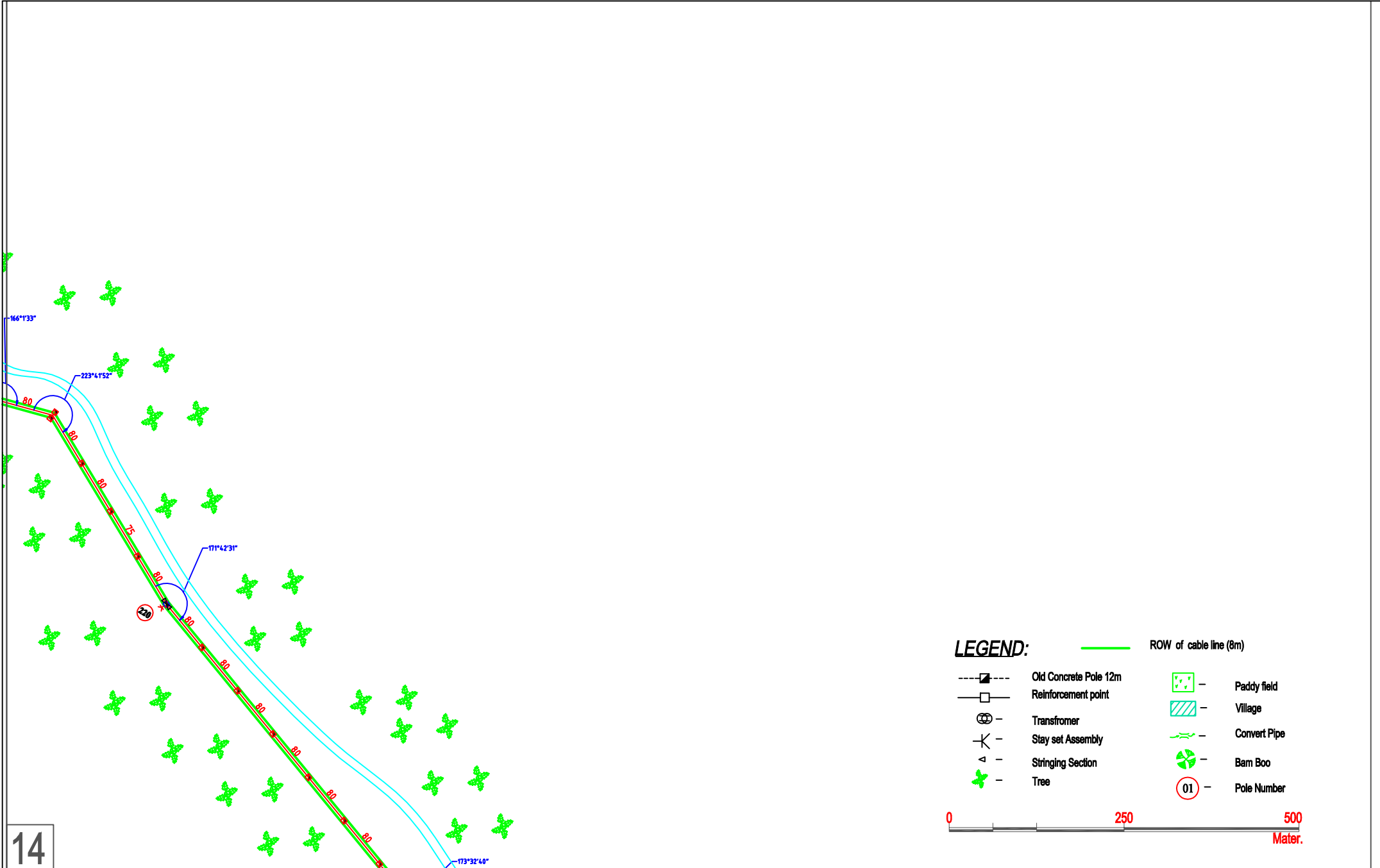
LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- ✱ Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- Pole Number



13

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT		
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	TITLE 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
						DESIGNED	Soukphaphanh	10/3/14	SCALE:	SUBMISSION NO.	Rev. 01
						DRAWN	Soukphaphanh	10/3/14	Non Scale	DRAWING NO.	NNTL-TL-NB-HK-13
						CHECKED	Bounnam	14/3/14		SHEET NO.	13 OF 23
						APPROVED	Phaxay	14/3/14			



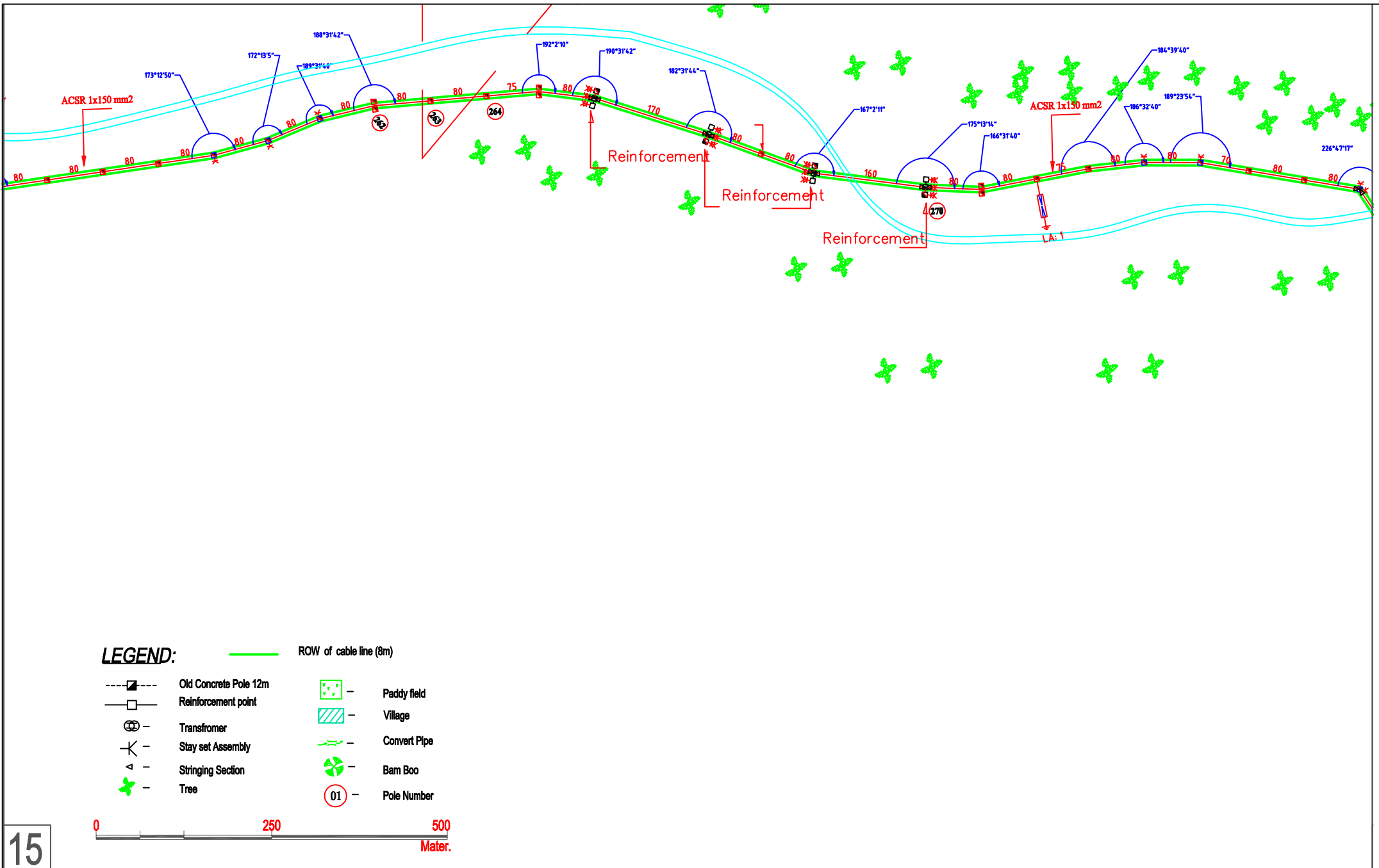
14



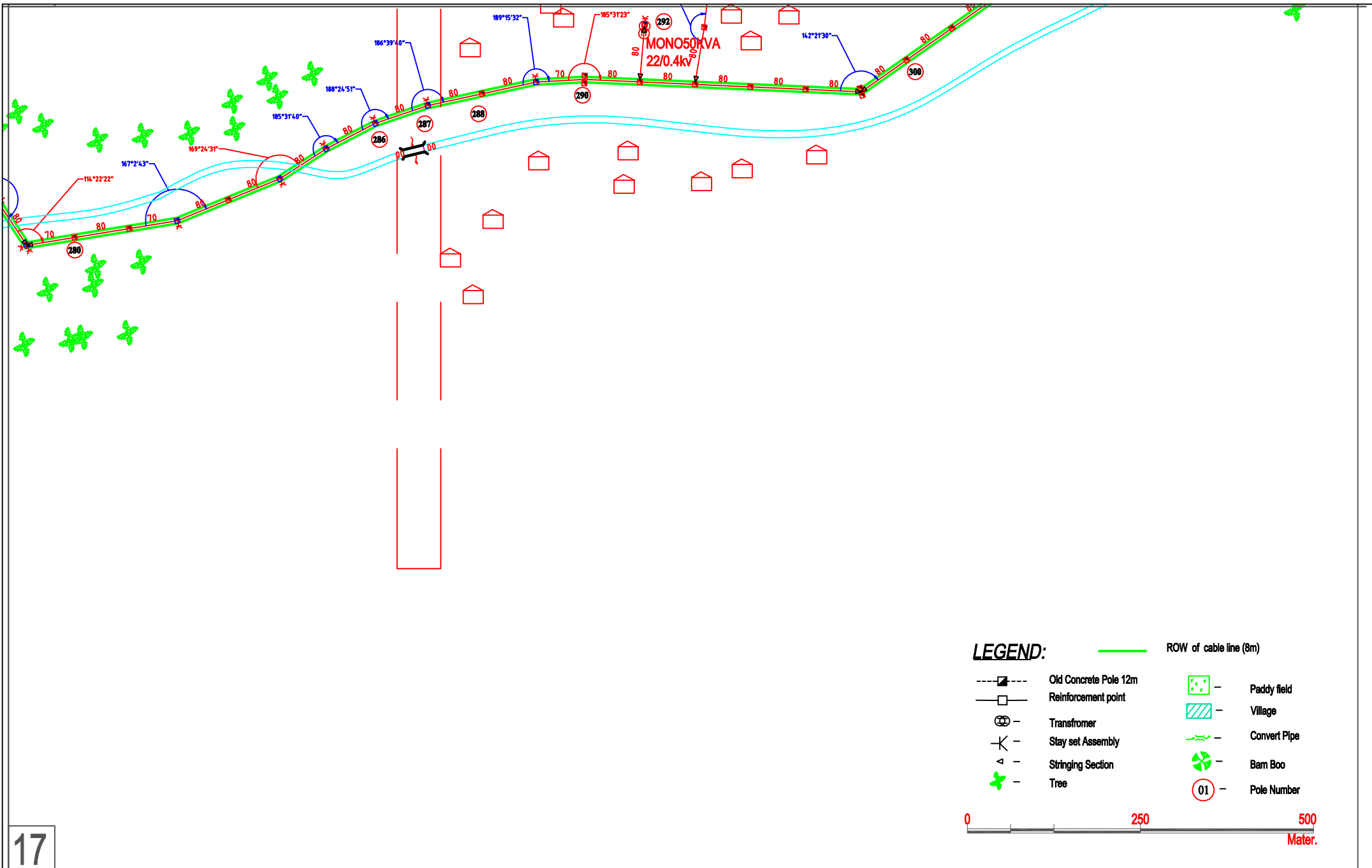
OWNER:	NAM NGIEP 1 POWER COMPANY
CONTRACTOR:	OBAYASHI CORPORATION

REVISION No.	DESCRIPTION	DATE	ENGINEER:		
			TITLE	NAME	DATE
	DESIGNED		Soukphaphanh		10/3/14
	DRAWN		Soukphaphanh		10/3/14
	CHECKED		Bounnam		14/3/14
	APPROVED		Phaxay		14/3/14

NAM NGIEP 1 HYDRO POWER PROJECT		
TITLE 22KV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
SCALE: Non Scale	SUBMISSION NO. DRAWING NO. SHEET NO.	Rev. 01 NNL-TL-NB-HK-14 14 OF 23



	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT		
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	TITLE		
						DESIGNED	Soukphaphanh	10/3/14	22kV TRANSMISSION LINE		
						DRAWN	Soukphaphanh	10/3/14	GENERAL OF LINE ROUTE		
			CHECKED	Bounnam	14/3/14	SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)					
			APPROVED	Phaxay	14/3/14	SCALE:	SUBMISSION NO.	Rev. 01	SCALE:		
						Non Scale	DRAWING NO.	NN1-TL-NB-HK-15	Non Scale		
							SHEET NO.	15 OF 23			



LEGEND:

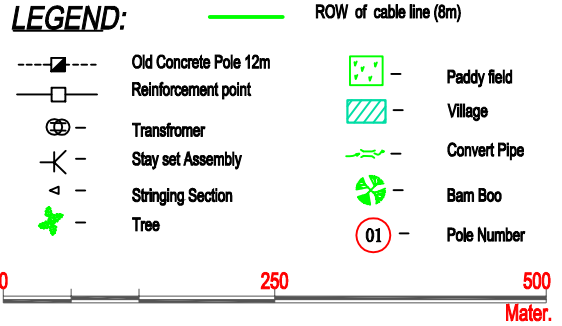
- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- Pole Number

0 250 500
Meter.

17

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT TITLE 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM) SCALE: Non Scale SUBMISSION NO. Rev. 01 DRAWING NO. NNL-TL-NB-HK-17 SHEET NO. 17 OF 23
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	
						DESIGNED	Soukphaphanh	10/3/14	
						DRAWN	Soukphaphanh	10/3/14	
						CHECKED	Bounnam	14/3/14	
					APPROVED	Phaxay	14/3/14		

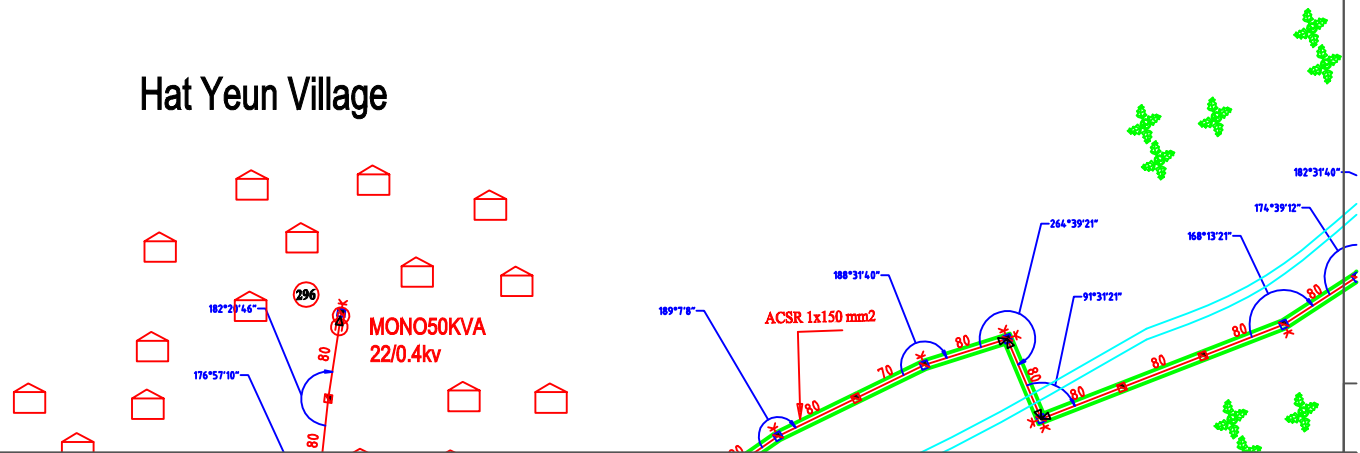
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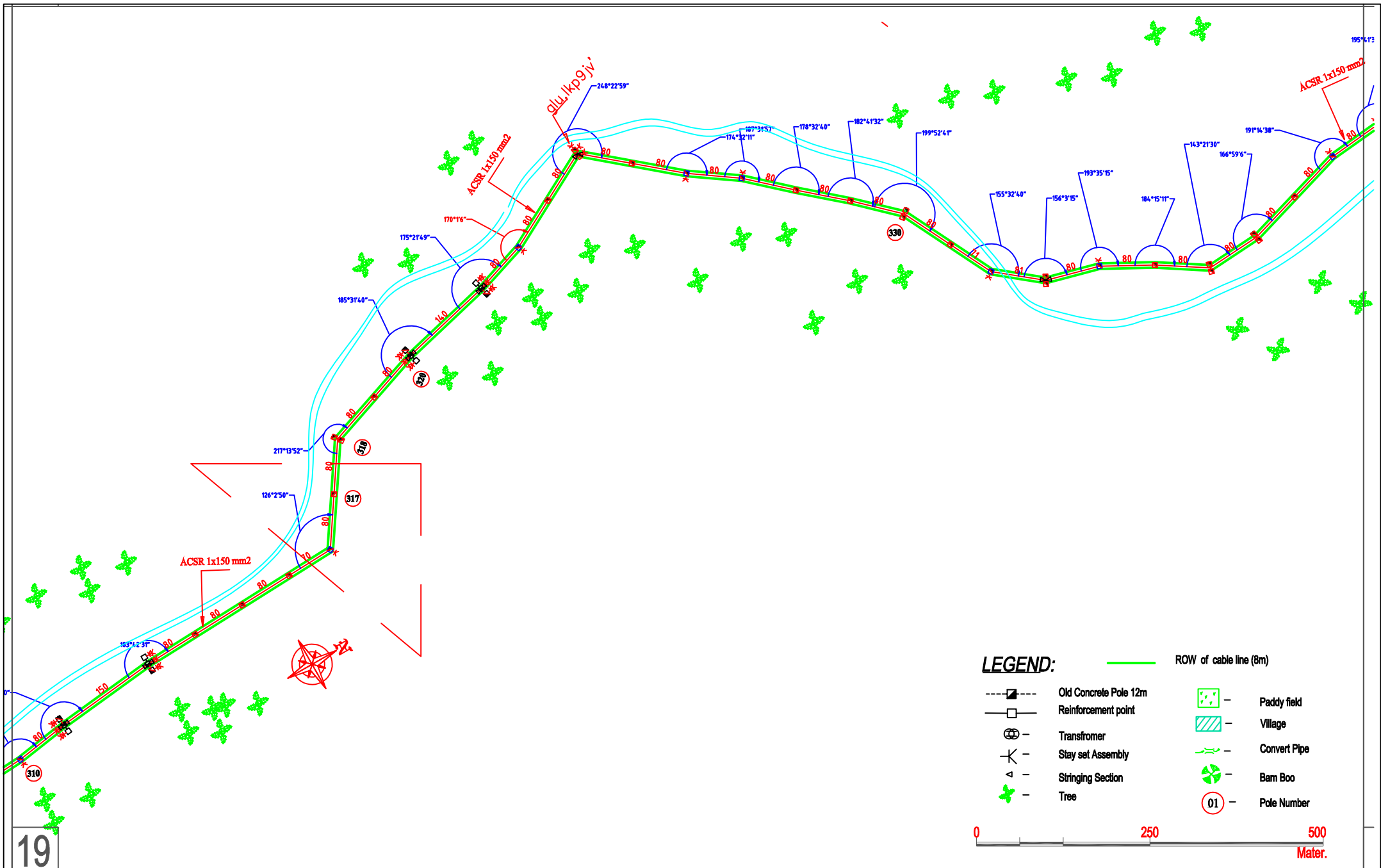
Hat Yeun Village



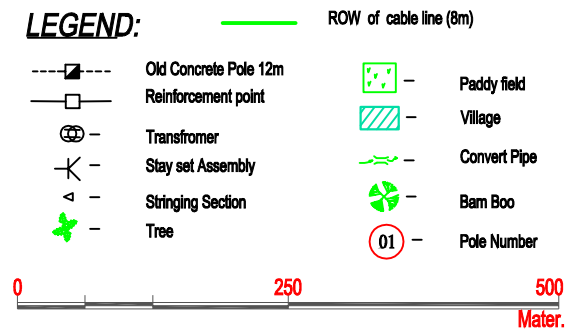
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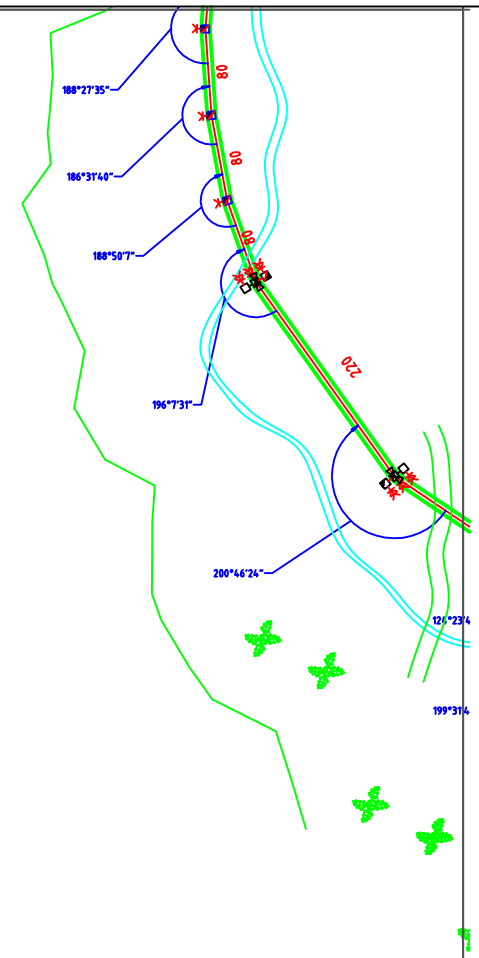
	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			TITLE NAM NGIEP 1 HYDRO POWER PROJECT		
						TITLE	NAME	DATE			
	CONTRACTOR:	OBAYASHI CORPORATION				DESIGNED	Soukphaphanh	10/3/14	SECTION (BAN NONSOMBOON - BAN HATSAIKHAM) SCALE: Non Scale SUBMISSION NO. Rev. 01 DRAWING NO. NNL-TL-NB-HK-18 SHEET NO. 18 OF 23		
						DRAWN	Soukphaphanh	10/3/14			
					CHECKED	Bounnam	14/3/14				
					APPROVED	Phaxay	14/3/14				



19



	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT TITLE: 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE			
						DESIGNED	Soukphaphanh	10/3/14	SCALE:	SUBMISSION NO.	Rev. 01
						DRAWN	Soukphaphanh	10/3/14	Non Scale	DRAWING NO.	NNL-TL-NB-HK-19
						CHECKED	Bounnam	14/3/14		SHEET NO.	19 OF 23
						APPROVED	Phaxay	14/3/14			



LEGEND:

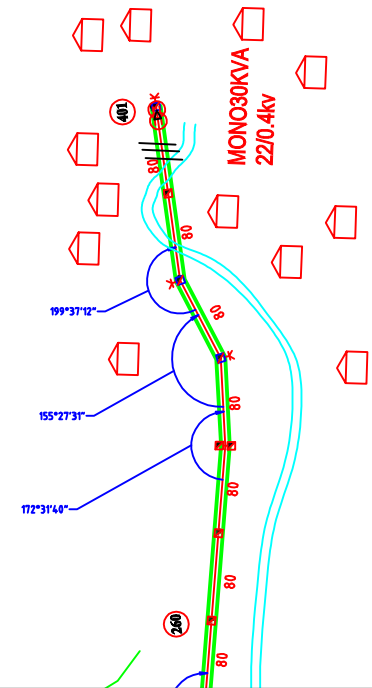
- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- Pole Number



20

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT			
						TITLE	NAME	DATE				
							DESIGNED	Soukphaphanh	10/3/14	TITLE 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
	CONTRACTOR:	OBAYASHI CORPORATION				DRAWN	Soukphaphanh	10/3/14				
						CHECKED	Bounnam	14/3/14	SCALE:	SUBMISSION NO.	Rev. 01	
						APPROVED	Phaxay	14/3/14	Non Scale	DRAWING NO.	NN1-TL-NB-HK-20	
										SHEET NO.	20 OF 23	

Hatsaikham Village



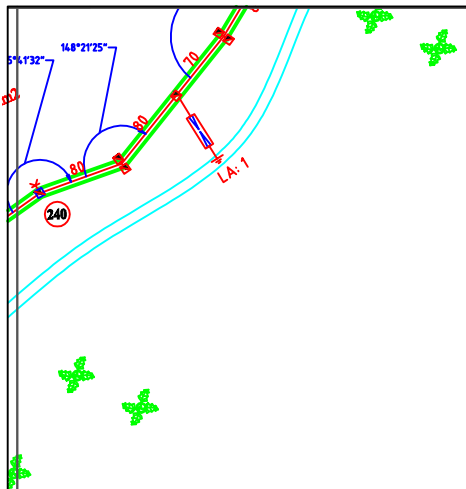
LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transfomer
- Stay set Assembly
- Stringing Section
- ▲ Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- 01 Pole Number



21

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT TITLE 22kV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	
						DESIGNED	Soukphaphanh	10/3/14	
						DRAWN	Soukphaphanh	10/3/14	
						CHECKED	Bounnam	14/3/14	
						APPROVED	Phaxay	14/3/14	SCALE: Non Scale SUBMISSION NO. NNI-TL-NB-HK-21 SHEET NO. 21 OF 23



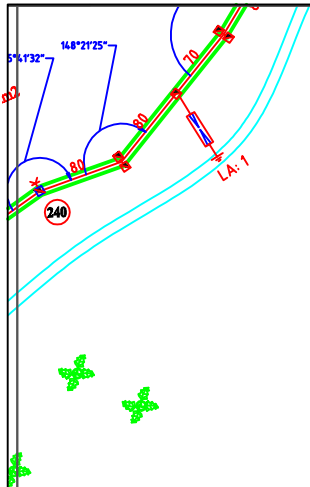
LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convent Pipe
- Bam Boo
- Pole Number



22

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT		
						TITLE	NAME	DATE			
	CONTRACTOR:	OBAYASHI CORPORATION				DESIGNED	Soukphaphanh	10/3/14	22KV TRANSMISSION LINE GENERAL OF LINE ROUTE SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)		
						DRAWN	Soukphaphanh	10/3/14			
					CHECKED	Bounnam	14/3/14	SCALE:	SUBMISSION NO.	Rev. 01	
					APPROVED	Phaxay	14/3/14	Non Scale	DRAWING NO.	NN1-TL-NB-HK-22	
									SHEET NO.	22 OF 23	



LEGEND:

- ROW of cable line (8m)
- Old Concrete Pole 12m
- Reinforcement point
- Transformer
- Stay set Assembly
- Stringing Section
- Tree
- Paddy field
- Village
- Convert Pipe
- Bam Boo
- Pole Number



22

	OWNER:	NAM NGIEP 1 POWER COMPANY	REVISION No.	DESCRIPTION	DATE	ENGINEER:			NAM NGIEP 1 HYDRO POWER PROJECT		
	CONTRACTOR:	OBAYASHI CORPORATION				TITLE	NAME	DATE	TITLE		
						DESIGNED	Soukphaphanh	10/3/14	22KV TRANSMISSION LINE		
						DRAWN	Soukphaphanh	10/3/14	GENERAL OF LINE ROUTE		
					CHECKED	Bounnam	14/3/14	SECTION (BAN NONSOMBOON - BAN HATSAIKHAM)			
					APPROVED	Phaxay	14/3/14	SCALE:	SUBMISSION NO.	Rev. 01	
								Non Scale	DRAWING NO.	NN1-TL-NB-HK-23	
									SHEET NO.	23 OF 23	