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SFG3951

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR NATIONAL ROAD 13 NORTH (NR13 NORTH) IMPROVEMENT AND MAINTENANCE

DRAFT REPORT

December, 2017

Revision 2.0

Lao People's Democratic Republic

MINISTRY OF PUBLIC WORKS AND TRANSPORT

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR NATIONAL ROAD 13 NORTH (NR13 NORTH)

DRAFT REPORT

MINISTRY OF PUBLIC WORKS AND TRANSPORT

Project Proponent	Ministry of Public Works and Transport
Project	National Road 13 North Improvement and Maintenance
Title	Environmental & Social Impact Assessment (ESIA) for National Road 13 North Improvement and Maintenance

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ACRONYMS & ABBREVIATIONS

AADT	Average Annual Daily Traffic
ASEAN	Association of Southeast Asian Nations
BAP	Borrow Pit Action Plan
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
CITES	Convention on International Trade in the Endangered Species of Fauna and Flora
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CO_2	Carbon Dioxide
CR	Critical
dB(A)	Decibels
DEQP	Department of Environmental Quality Promotion
DFRM	Department of Forest Resources Management
DD	Detailed Design
DoR	Department of Roads
DoT	Department of Transport
DPWT	Provincial Department of Public Works and Transport
EA	Environmental Assessment
ESIA	Environmental and Social Impact Assessment
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
ELV	Emissions Limits Values
ESMP	Environmental and Social Management Plan
EN	Endangered
EPL	Environmental Protection Law
ERP	Emergency Response Plan
ESMMP	environmental and social management and mitigation plan

ESOM	Environmental and Social Operational Manual
ESD-PTRI	Environmental and Social Division of the Public Works and Transport Research Institute
EU	European Union
FAO	Food and Agriculture Organization
FS	Feasibility Study
GDP	Gross Domestic Product
GOL	Government of Laos
g/l	Grams per liter
GRM	Grievance Redress Mechanism
HC	Hydrocarbons
IBA	Important Bird Area
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature and Natural Resources
KM	Kilometer
KM/H	Kilometers per Hour
LCF	Local Consulting Firm
LHS	Left Hand Side
m	Meter
MAC	Maximum Allowable Concentrations
MAF	Ministry of Agriculture and Forestry
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and the Environment
MPI	Ministry of Planning and Investment
Mg/l	Milligrams per liter
mg/m^3	Milligrams per cubic meter
MPWT	Ministry of Public Works and Transport
MSDS	Material Safety Data Sheet
M/s	Meters per second
M^3/s	Cubic meters per second

NBCA	National Biodiversity Conservation Areas
NEC	National Environmental Committee
NES	National Environmental Specialist
NGO	Non-governmental Organization
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NSCC	National Strategy on Climate Change
NR13 North	National Road 13 North
NR13 South	National Road 13 South
OHS	Occupational Health and Safety
OP	Operational Policy
O&M	Operation and Maintenance
PCR	Physical Cultural Resources
PDR	Peoples Democratic Republic
PIU	Project Implementation Unit
PM	Particulate Matter
PM_{10}	Particulate Matter less than 10 Microns
PKK	Phou Khao Khoay
PONRE	Provincial Department of Natural Resources and Environment
PPE	Personal Protective Equipment
PPM	Parts Per Million
PPN	Phou Phanang
PPIAF	Public Private Infrastructure Advisory Facility
PPP	Public-private Partnership
PTRI	Public Works and Transport Research Institute
RAP	Resettlement Action Plan
RHS	Right Hand Side
ROW	Right of Way
SSESMP	Site Specific Environmental and Social Management Plan
SO_2	Sulphur Dioxide

STD	Sexually Transmitted Disease
TMP	Traffic Management Plan
UN	United Nations
VU	Vulnerable
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States Dollar
TMP	Traffic Management Plan
ToR	Terms of Reference
TSP	Total Suspended Particulate
VUDAA	Vientiane Urban Development and Administration Authority
WB	World Bank
WHO	World Health Organization
WMP	Waste Management Plan
USAID	United States Environmental Protection Agency
UXO	Unexploded Ordnance
$\mu g/m^3$	Micrograms per cubic meter

1. INTRODUCTION

1.1 Purpose of the report

1. This Environmental and Social Impact Assessment (ESIA) is part of the process of compliance with the World Bank Safeguard Policies in relation to the Project.

2. The ESIA provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental and social effects associated with the project. More specifically, the ESIA:

- Describes the existing socio-environmental conditions within the Project area;
- Describes the extent, duration and severity of potential impacts;
- Analyzes all significant impacts; and
- Formulates the mitigation actions and presents it all in the form of an Environmental and Social Management Plan (ESMP).

1.2 Identification of the Project and Project Proponent

3. The Government of Lao PDR (GoL) has a program to improve National Road 13 North (NR13 North) on an Output and Performance-Based Road Contract (OPBRC) basis. The Project is designed to improve transport connectivity by rehabilitating and upgrading the road forming the main road network of Lao PDR, thereby improving connectivity and fostering inclusive economic growth. The Project is to be implemented by the Ministry of Public Works and Transport (MPWT) through its Department of Roads (DoR).

1.3 The Nature, Size, Location and Importance of the Project

4. Being a land-locked country with growing economic development in the region Lao PDR is facing an increasing demand for road transportation. Originally, the GoL wished to increase private participation in the road sector through the instrument of a PPP. With the support from the Public Private Infrastructure Advisory Facility (PPIAF), the preliminary assessments of PPP pilot projects in roads in Lao PDR was completed, and originally suggested improvement of two sections of national road 13 with PPP mode:

- **National Road 13 North (NR13 North)** – NR13 North starts near Sikeut Junction. at Km.12 and ends at Km. 70 near Phonhong Junction. The total length of the project road is 57.775Kms. The existing carriageway configuration is two lanes with 0.5m shoulders having the width of carriageway varying between 7.5.m and 8.m. The existing pavement condition is generally fair. There are two major bridges, five minor bridges and 112 culverts along the project road.
- **National Road 13 South (NR13 South) -** Project road NR13 South starts near Don Noun at Km.13 and ends at Km 63 near Ban Hai. The total length of the project road is 50.530 Kms.

5. However, the focus has now been turned away from PPP and to an Output and Performance-Based Road Contract (OPBRC). NR13 South has been removed, for the time being, from the Project. As such, this ESIA focuses only on NR13 North.

1.4 ESIA Boundaries

6. For purposes of establishing the environmental conditions, an overview of regional data is followed by the description at the project level. This ESIA covers the entire length of the Project Road funded by the World Bank (WB) (57.775 km).

7. For purposes of this impact assessment, an envelope of 200 meters wide on each side of the project road over its entire length is identified as the primary impact area ("Project Area" or "Project Corridor"). This distance takes into account the common impacts associated with road works such as noise, dust and emissions. However, the project impact area is widened with regard to specific construction sites outside of the right of way (RoW), e.g. borrow pits and quarries.

8. The road sections where sensitive receptors are present, such as schools, hospitals or other places where people congregate are given particular attention so that ample mitigation is formulated. For road sections that cross-rivers, the impact assessment is expanded to cover the identified continuous extent of any ecologically important habitats / features along the Project Corridor. **Table 1-2** indicates the assessment boundaries adopted for the ESIA.

Table 1-2: Assessment Boundaries adopted for this ESIA

Terrestrial Environment	Aquatic Environment	Air Shed	Acoustic Environment
200 m on either side of the road.	50 m upstream and 100m downstream of any project road crossing a river (not including irrigation or drainage channel)	200 m from center line of road (and rising 100 m from the road centerline), and 500 meters from rock crushing plant, batching plants, borrow pits, etc.	200 m from centerline of road and extended on sensitive areas such as settlements.

1.5 Scope of the study

9. The scope of this ESIA was based upon four aspects:

a) The Safeguard policy requirements of the WB and the Terms of Reference (ToR) for the ESIA;

b) The findings of initial consultations and focus group discussions (FGDs);

c) The legal requirements of the Lao PDR, including environmental standards and laws; and

d) Other best practice guidelines, e.g. The World Bank Group (WBG) Environmental Health and Safety (EHS) Guidelines, Environmental and Social Operational Manual (ESOM) of the MPWT.

Appendix A provides further details of each of these aspects.

10. Based on the above four aspects the following scope of work for the ESIA was followed:

A) Overview of the Legal and Institutional Framework

Prepare an overview of the legal and institutional framework.

B) Collection of Baseline Data

Collect baseline data describing the existing biophysical environment in the area likely to be affected by the proposed project including:

- **Physical**: geology; topography; soils; climate; air quality; noise; surface water; groundwater; seismicity and natural hazards.
- **Biological**: flora and fauna; rare and/or endangered species (Red List species); critical and non-critical habitats and ecosystems; protected areas.
- **Human**: population; communities; demographics; employment and socio-economics; land use; infrastructure (including local access roads); transport; public health; cultural heritage; archaeology; waste management.

Environmental and social baseline data presented in the Feasibility Study (FS) of Pilot PPP (NR 13 N and NR 13 S) had been reviewed. Surveys conducted to address important gaps in the existing data and to collect up-to-date information on topics and areas where significant negative impacts are expected, specifically, flora, fauna, noise, air quality and water quality.

C). Impacts and Mitigation

Internationally accepted best practice will be used throughout the ESIA study, including in the process of identifying impacts and assessing their significance. All of the key issues identified above in by stakeholders in the scoping phase will be assessed in detail. Ensure that the design team is informed in a timely manner of mitigation measures that need to be included in construction contracts. For each identified risk a set of mitigation measures explaining how these impacts will be mitigated or/and avoided will be provided. In the case of legal/institutional weaknesses, recommendations of ways for closing the gaps will be made.

D) Analysis of Alternatives

The ESIA will include a systematic comparison of the feasible project alternatives including the "no project" scenario.

E) Environmental and Social Management Plan

The ESIA report will include an environmental and social management plan comprising of an Environmental and Social Mitigation Plan and an Environmental and Social Monitoring Plan. The Environmental and Social Mitigation Plan will:

- Clearly identify what specific potential impacts may various types of works have on the sensitive receptors;
- Provide concrete actions prescribed for managing these impacts, including location and timing of these actions;

- Provide cost estimates for the main discrete mitigation measures (those that are unlikely to be part of a construction company' corporate policy and will not necessarily be included into general pricing of the contract);
- Specify responsibility for the implementation of each mitigation activity;
- Provide selected criteria of monitoring implementation of mitigation measures;
- Identify location and timing/frequency of monitoring mitigation measures by the prescribed criteria; and
- Specify responsibility for tracking each monitoring criterion.

The Environmental and Social Monitoring Plan will:

- Specify methods for instrumental monitoring;
- Specify parameters, locations and schedule for monitoring;
- Indicate responsibilities and costs for the monitoring activities.

F). Cost Estimates

The ESIA report will include an estimated cost according to the ESMP which should be considered in Bill of Quantities (BOQ).

G) Grievance Redress Mechanism (GRM)

A section describing the grievance redress framework (both informal and formal channels), setting out the time frame and mechanisms for resolving complaints about environmental and social performance will be provided in accordance with the Law on Handling of Petitions (2015).

H) Disclosure, Stakeholder Consultation and Participation

Disclosure and stakeholder consultation on the draft ESIA report will be conducted according to national legislation and the WB policies.

1.6 Methodology Applied

11. The methodology is based on the World Bank Safeguard Policies and the joint experience of the International and National environmental consultants involved in the ESIA. Background data and information was obtained from published and unpublished sources, e.g., on: climate, topography, geology and soils, natural resources, flora and fauna, agriculture, and socio-economic data.

12. Several site inspections were conducted by the International Environmental Specialist during 2016 and 2017. The existing roads were driven and areas of potential environmental significance assessed carefully.

13. In addition, several surveys were undertaken to collect additional baseline data by a Local Consulting Firm (Lao Consulating Group, or the "LCF") specializing in environmental and social studies. They include:

- Instrumental Noise Monitoring.
- Instrumental Air Quality Monitoring.

- Flora and Fauna Surveys (based on existing data).
- Instrumental Water Quality Surveys.
- Physical and Cultural Resources Surveys.
- Socio-economic Surveys.

14. The scope of works for each of these surveys is included as **Appendix C**.

15. Formal discussions were held with a number of stakeholders (see **Section 7**) in order to determine their perceptions of the level of impact from road works. Data and information obtained have been included where appropriate in the ESIA Report, and also as Appendices to this report.

1.7 Structure of the Report

16. The report is organized as follows:

Section 1: Introduction – The section in hand provides the introductory information.

Section 2: Legal, Policy and Administrative Framework - This section presents an overview of the policy/legislative framework as well as the environmental standards of Lao PDR that apply to the proposed project. The section also identifies relevant World Bank safeguard policies that will apply.

Section 3: Description of the Project – Section 3 describes the Category of the Project, the Project need and its environmental setting. A limited scope of works is also provided indicating the type of engineering works required.

Section 4: Description of Environmental and Social Conditions – This section of the report discusses the regional and local environmental baseline conditions. This section is divided into subsections relating to physical environment, biological environment and socio-economic conditions.

Section 5: Environmental and Social Impacts and Mitigation Measures – Section 5 outlines the potential environmental impacts and proposes mitigation measures to manage the impacts.

Section 6: Environmental and Social Management Plan – This section provides the ESMP for the design, construction and operational phases of the Project.

Section 7: Public Consultations – Section 7 provides a summary of all of the stakeholder consultation activities undertaken.

Section 8: Conclusions and Recommendations – The final section of the report provides the report conclusions and recommendations.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 General

17. The Project will conform to the legal and administrative requirements of Lao PDR. The Project will also conform to international treaties to which the Lao PDR is signatory, and to standards and safeguard policies of the World Bank.

18. This chapter presents descriptions of:

- National Environmental Laws and Decrees;
- Institutional Framework for Environmental Management in Lao PDR;
- National Environmental Standards;
- World Bank Group (WBG) Environmental, Health and Safety Guidelines;
- International Environmental Agreements; and
- World Bank Safeguard Policies.

2.2 National Environmental Laws and Social Safeguard Related Laws & Legislation

2.2.1 General

19. In Lao PDR, there are many laws and regulations govern the utilization and management of natural resources management (land, forest, water, aquatic and wildlife, etc.) established in late 1990's and many have been updated and/or revised. On environment, the Environmental Protection Law (EPL) firstly established in 1999 and then it had been revised in 2012 to cope with a need for socio-economic development. This law was the key law governs environmental protection and management describing the principles, regulations and measures for managing, monitoring, restoring, and protecting the environment especially those related to protection of human health, natural resources and the richness of nature as well as reduction of global warming.

20. The inclusion of environmental considerations in road projects has been mandated since 1999. The Road Law requires road construction to be undertaken in accordance with public safety and environmental protection considerations, while the Environmental Protection Law (EPL-1999, 2012), supported by its Implementing Decree (2002), as the country's principal environmental legislation. An Environmental Impact Assessment (EIA) has been required for roads and other development projects under the Environmental Protection Law.

21. The key laws and legislations relevant to environment and social impact assessment and mitigation for NR13 North are described below.

2.2.2 Environmental Protection Law (2012).

22. The Environmental Protection Law (National Law 29/NA) (EPL) dated December 18, 2012. The revised Environmental Protection Law has includes 13 parts and 99 article. This Environmental Protection law defines principles, regulations and measures related to environmental management, monitoring of protection, control, preservation and rehabilitation, in order to ensure environmental quality, reduction of impacts and pollution created by human activities or by nature, aiming to provide balance between social and natural environment, to sustain and to protect natural resources and public health; and contribution to the national socio-economic development and reduction of global warming.

2.2.3 Law on Water and Water Resources (2017)

23. The Law on Water and Water Resources (No.23/NA) dates May 11, 2017. This Law on Water and Water Resources defines principles, regulations, and measures relating to the protection, administration, exploitation, use and development of water and water resources, protection damage to water or water resources, rehabilitation of the effect areas to assure the quality, quantity of water and sustainable water resources, to respond for the people's living requirements, to promote agriculture and industry, to ensure that natural environment, social environment are protection, to develop the nation sustainable and to the socio-economic development.

2.2.4 Forestry Law (2007)

24. The Amended Forestry Law, No. 06/NA (Dec. 2007) stipulates the basic principles, regulations and measures concerning forest conservation, management, and use. It aims to make the forests and forestland a stable source of livelihood and use for the people, by ensuring sustainable preservation of water sources, preventing soil erosion and maintaining soil quality, conserving plant and tree species and wildlife species, preserving the environment, and contributing to national socio-economic development.

25. The Amended Forestry Law (2007) confirms that natural forests and forestlands are the property of the national community and that these are centrally managed by the State (GoL). The State can grant individuals or organizations the right to plant and own trees. Forests are classified into three general categories: Protection Forest, Conservation Forest (or National Biodiversity Conservation Areas), and Production Forest. Each category of forest is designated a different and distinct zone and area, within which there can be rich or dense forest, degraded forest, bare forestland and village use forest according to each zoning plan.

26. Conversion of public forestland to another land use type is only possible, when allowed, if it is to bring maximum benefits to the nation and to the wellbeing of people and is included in the national socio-economic development plan. Such conversion is only allowed in designated areas. Entities given approval for forestland conversion are responsible for paying fees for technical service, royalties and conversion fees. For temporary conversion such as mining exploitation and other production activities, the land must be restored and trees must be replanted. If the State converts the forestland, which is allocated to individuals or organizations for agreed upon and determined purposes, the State will compensate according to laws and regulations. For permanent forestland conversion into another land use type for long-term purposes, such as for roads or hydropower construction, the State

owns the timber and forest resources that are cut or harvested in those forests or forestlands.

Box 1: Classification of Forest Areas

- The Forest Law provides for three classes of forest: Conservation Forest, Protection Forest, and Production Forest. The first two are relevant to biodiversity conservation and watershed protection although individual regeneration forests could presumably, in time, be reclassified as protection or conservation forests. It is estimated that conservation and protection forests cover over 80,000 km^2 or about 76 % of forest area.
- The conservation forest is defined as: 'forest and forest land classified for the purpose of protecting and conserving animal species, nature and various other things which have historical, cultural, tourism, environmental, educational and scientific research value.' The protection forest is defined as: 'forest and forest land classified for the protection of watershed areas and the prevention of soil erosion. It also includes areas of forest land significant for national security, areas for protection against natural disaster and protection of the environment and other areas.' The conservation forests aim to maintaining biodiversity and natural forest and landscapes, 'for the development of national parks appropriate for tourism and scientific research.' It also provides for zoning into total protection zones, controlled use zones and corridor zones. The former would be closed to entry or harvesting of NTFP—plant or animal.
- The protected areas are classified as national (area more than 50,000 ha), provincial (5,000-50,000 ha), district (up to 5,000 ha). Three zones are: Totally Protected Zones; Controlled Use Zones; and Corridor Zones.

27. The law stipulates which administrative authorities have the right to approve conversion of degraded forestland that cannot naturally regenerate or of barren forestland. While district, municipal, or provincial authorities can approve conversion of smaller areas of forestland, the conversion of between 100 ha and 1,000 ha of degraded forestland per activity, or between 200 ha and 10,000 ha of barren forestland per activity, must be approved by the government, through proposals by the National Land Management Authority and agreement by the Ministry of Agriculture and Forestry and the Provincial Agriculture and Forestry Office. The National Assembly Standing Committee must endorse the conversion of forestland greater than those amounts (1,000 ha of degraded forestland or 10,000 ha of barren forestland).

2.2.5 Wildlife and Aquatic Law (2008)

28. The Wildlife and Aquatic Law restricts and regulates the management, monitoring, conservation, and protection of wildlife and aquatic species in their natural habitats to promote the sustainable regeneration and utilization of wildlife and aquatic life, without any harmful impact on natural resources or habitats and decreasing species and the extinction of wildlife and aquatic life. Wildlife and aquatic species living within the territory of the Lao PDR are considered property of the national community, with the State representing the national community in managing those species throughout the country. If an individual or

organization has permission to raise and reproduce any of these species, it is then considered their own property so long as they abide by the laws and regulations.

29. Wildlife includes both terrestrial and aquatic life, and all forms of animal life, whether mammals, birds, reptiles, amphibians, or insects. Wildlife are classified into three categories for protection: 1) prohibition, 2) management, and 3) common or general. Whether any species are classified as prohibition or management depends upon the level of threat to them (endangered, threatened, rare), the condition of their habitat, and the condition of their regeneration and reproduction. The Ministry of Agriculture and Forestry recommends to the government for consideration and approval the list of species under the prohibition and management categories. The Ministry of Agriculture and Forestry has authority to include or remove species itself from the list of animals in the common or general category.

2.2.6 Land Law (2003)

30. The Land Law was enacted on October 23, 2003. The law determines the management, protection and use of land to ensure its efficient use and to conform with land-use objectives**,** with other laws and regulations**,** to contribute to national socio-economic development, and to contribute to the protection of the environment**.**

2.2.7 Road Law (2016)

31. The Road Law (2016) states that any national road construction projects either use public or private funds to be implemented when the projects have completed Environmental and Social Impact Assessment and such projects have already been included in government's development plan from the National or Provincial Assembly's approval.

32. Under the Road Law, the Ministry of Communication, Transport, Post and Construction (MCTPC) is the main agency to be responsible for management works of the Road and corporation with other concern sectors and local administrations in order to manage works relation to the roads.

Box 2: Road Types

- **Construction of new roads**: entirely new projects proposing the building/construction of a road on a new alignment (including major realignments of existing roads and bypasses). This type of project necessitates major land acquisition (for the corridor and associated work sites) and can also involve the removal of wide tracts of vegetation and habitats, and create a range of impacts on rivers and streams within the project area.
- **Road upgrading:** changing an existing road to either upgrade its classification (under the Road Law) or to improve its alignment and traffic ability, e.g., changing a seasonal road to an all-weather road. This type of project can include alteration of the surface (from gravel to paved), widening the road (e.g., from two lanes to four lanes), widening intersections, minor realignments to improve general alignment or remove hazards (e.g., sharp corners or to improve sight distance). As most of the work or activities will likely take place outside of the existing right-of-way or road platform, land acquisition will be likely and environmental and social impacts will be associated with a narrower corridor of impact than for new roads.
- **Road improvement:** this type of project generally involves improving road specifications with most of the work being done within the existing platform or right-of-way. Works include widening shoulders, adding passing lanes in steep areas, improving curves, and strengthening bridges. Additional land may be required, necessitating some land acquisition, and environmental and social impacts are likely to be limited.
- **Road rehabilitation:** this type of project aims to bring existing but deteriorated roads up to a better standard or to their previous condition. Works include improving drainage, slopes, embankments and/or other structures; strengthening pavements; or resurfacing. As all or most of the work can be done on the existing platform, no additional land will be required (making land acquisition unlikely), and environmental and social impacts are likely to be limited.
- **Road maintenance:** this type of project includes routine or periodic works and emergency road works aiming to maintain a road in working condition and includes patching potholes; clearing drains; and periodic works such as resurfacing, line marking, and bridge maintenance.
- **Emergency road works:** this type of project is carried out after an emergency such as landslide or flooding has cut off the road and posed danger to traffic and aiming to restore the passability and safety of the emergency affected road.

2.2.8 Regulations on ESIA and IEE (2013)

33. This instruction is for implementation and extending the provisions prescribed under Article 21 of the Law on Environmental Protection (Amended) No. 29/NA, dated December 18, 2012. This instruction aims to ensure the uniformity in the conductance of the Initial Environmental Examination by every investment Project and Activities of a public and private both domestic and foreign enterprises which operate business in Lao PDR that cause or are

likely to cause environmental and social impacts. Those Investment Projects and Activities will conduct the efficient Initial Environmental Examination Process, contribute to the sustainable socio-economic development of the country and will mitigate and enhance the global warming adaptation.

The regulations are following below:

1. Ministerial Agreement on the Endorsement and Promulgation of List of Investment Projects and Activities Requiring for Conducting the Initial Environmental Examination or Environmental and Social Impact Assessment – According to this regulation the Project is "Rehabilitation of national, provincial, district, rural and special roads" and as such it is a Group 1 project which only requires an IEE.
2. Ministerial Instruction for: Investment Projects and Activities that are anticipated to cause the significant or major environmental and social impact (Group II); therefore, are required to conduct an Environmental and Social Impact Assessment Process (ESIA).
3. Ministerial Instruction on the Process of Environmental and Social Impact Assessment of the Investment Projects and Activities – This instruction follows the same format and general requirements as the IEE, but with the following additions:
    a. A distinct scoping stage is required
    b. More detailed public consultations are required
    c. Cumulative impacts should be assessed
    d. Transboundary issues and impacts should be accounted for
    e. In case of Transference a project should be incorporated condition into contract of new project owners
    f. During 6 months prior to the end of the investment period should be monitored and assessed
    g. Expand the project should be conducted the ESIA or IEE before

2.2.9 Labour Law (2013)

34. The Labour Law (National Law 43/NA) dated December 24, 2013. This law defines the principles, regulations and measures on administration, monitoring, labor skills development, recruitment, and labor protection in order to enhance the quality and productivity of work in society, so as to ensure the transformation to modernization and industrialization aimed at safeguarding the rights of employees and employers, as well as the legitimate interests and the continual improvement of their livelihoods, while contributing to the promotion of investment, national socio-economic development, and regional and international links.

35. This decree clarifies the Hours of work and hours of rest for the employee as part of its responsibilities in accordance with the location of labor units and the actual conditions of employment set out in Article 51 of all labor units will not exceed six days per week or one week not exceeding forty eight hours and rest time for noon to no less than 1 hour per day**.**

2.2.10 Decree #84 on Compensation and Resettlement Of People Affected by Development Projects (2016)

36. Decree on Compensation and Resettlement of People Affected by Development Projects No.84/gov, dated April 5, 2016. This Decree provides principles, regulations and standards on the management, monitoring of compensation of losses and the management of resettlement activities in order to properly and effectively implement development projects with the aims to ensure that the affected people are compensated, resettled and are assisted with permanent livelihood alternatives leading to improving of living conditions to be better off or to be at the same level as they were before as well as to ensure that the projects can contribute to the socio-economic development of the nation in sustainable manners.

37. This decree requires that in order to protection of the rights, legitimate benefits, compensate for the affected households, have a consultation between the project owner, state agencies and people, who are directly affected from project activities by selecting the right and appropriate options based on prices applied by the state for land, constructed facilities, crop products.

2.2.11 Technical Guidelines on Compensation and Resettlement Of People Affected By Development Project (2005)

38. Pursuant to Prime Ministerial Decree No. 192/PM, GoL endorsed the Technical Guidelines on Compensation and Resettlement of People Affected by Development Projects, first issued in November 2005. These guidelines adopted under the Decree 192 are currently under review and revision to be in line with the new Decree 84 and expected to be approved in June 2018. In the meantime, the guidelines prepared under the Decree 192 remian applicable. Any descipiancies and gaps identified between the GoL legislation and the World Bank's policy on Involuntary Resettlement (OP/BP4.12), the later will overwrite. This legislation provides procedure for the assessment, planning, and mitigation of environmental as well as social impacts from development projects.

39. These guidelines include detailed procedures for the conduct of public consultation and other participatory processes, to inform affected people of the environmental and social impacts, and to assure their involvement in all aspects of the mitigation and compensation process, from planning to implementation.

2.2.12 Regulation on EIA of Road Project In Lao PDR (2004)

40. This regulation clarifies the principles and methodologies for environmental impact assessment of road projects, including setting out necessary and appropriate mitigation measures to avoid or reduce negative environmental impacts on the natural environment and society resulting from the implementation of road projects in the Lao PDR.

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

41. This decree outlines the regulations and measures for the management, conservation and use of the national heritage, including for upgrading of movable and immovable assets with historical or cultural or natural value into national heritage with the view of raising the

spirit of patriotism, people's democracy, awareness and ownership of the fine national and ethnic cultures.

42. This decree requires that in order to prevent exploitation of relics and antiquities, any person who discovers archaeological relics or a cultural site must inform the provincial and district offices within three days.

2.2.14 Law on Handling of Pitetions (2015)

43. The Law on Handling of Pititions revised and approved in 2015 provides objectives, principles and process of applying and handling different types of grievance, petition and complaints that may be raised PAPs by or those who believe they are PAPs. The Law on Handling of Petitions divides grievances into three categories as follows:

1. Proposals is to be applied to and resolved by concerned authorities.
2. Grievance is to be applied to and resolved by judicial institutions and court
3. Petition is to be applied to and resolved by Provincial and National Assembly

44. The Law on Handling of Petitions, which has superseded the old version of Law on Grievance dated November 5, 2005 applies and protects rights and interest of all citizens and entities, state organizations, community and individuals with the aim to ensure justice, social security and order. Detailed process of grievance redress mechnasim is provided in Section 7.5.

2.2.15 Public Involvement Guideline (2013)

45. The Public Involvement Guideline approved by Minister of MONRE in 2013 provide principles and process of engaging and consuling with project stakeholders and PAPs in project preparation and design and implementation. The public involvement aims to ensure that the stakeholders and PAPs are adequatedly consulted and provided with opportunity to artiultae their feedback and suggestions on project design and implememttaion to avoid or mitigate potential impacts on their livelihood and environment.

2.2.16 Guidline on Consultation with Ethnic Groups (2013)

46. The guideline on Consultation with Ethnic Group launched by the LFNC in 2013 aims to a) ensure that the implementation of consultation with ethnic groups follows an effective principles and process in line with the relevant national Laws and regulations, b) ensure that the right and lost assets of the ethnic people affected by development projects are fairly compensated by development projects, and c) to prevent or mitigate the potential environmental and social impacts on ethnic groups generated by development project and ensure that the project is properly designed for the sustainability.

2.2.17 Environmental and Social Operation Manual

47. The overall purpose of the Environmental and Social Operations Manual (ESOM) is to present the procedures, instruments, and responsibilities for environmental and social management to be applied by the Ministry of Public Works and Transport (MPWT) throughout the planning and implementation of transport investments.

48. The ESOM provides the basis for compliance with national environmental and social decrees and regulations, as well as with the safeguard requirements of international donors such as World Bank (WB), Asian Development Bank (ADB), United Nations Development Program (UNDP), and Swedish International Development Cooperation Agency (SIDA). The main objectives of the ESOM are to:

- Present, as context, an overview of the legal and institutional framework related to environmental and social management in the transport sector; and, additionally, present some of the important environmental and social characteristics of Lao PDR;
- Establish an environmental and social due diligence process, in order to establish procedures, instruments, and responsibilities for environmental and social management in transport development projects; and
- Develop environmental and social guidelines to assure the inclusion of environmental and social considerations at various stages of the project cycle and to comply with relevant environmental/social decrees and regulations as well as the safeguard policies of international donors.

49. The ESOM takes into account the following safeguard policies commonly triggered in road projects: Environmental Assessment; Natural Habitats; Forestry; Indigenous People[1]; Involuntary Resettlement; and Cultural Property.

Table 2-1: Summary of Relevant Legislation and Guidelines

Law / Decree	Article	Relating to	Content
EPL (2012)	7	Commitment in Environmental Protection (revised)	All are responsible for protection, improving, rehabilitation, controlling, monitoring and inspecting
	14	Environmental Protection (revised)	Safeguarding and preventing environment from any natural or manmade events
	22	Environmental Impact Assessment (revised)	Process of addressing an issue in order to anticipate impacts that may affect the environment, society and nature, derived from investment project
	25	Limitation of Impacts Derived from Construction Activities and Others (revised)	Any construction of road which emit pollutants shall take measures environmental impacts as being stipulated by NEQS
	41	Environmental Certification	The Natural resources and environmental sector shall be the person, who provides environmental certification under its scopes of authority, by referring to impacts from invested

[1] In the context of Lao PDR, "indigenous people" as defined by both World Bank and Asian Development Bank includes ethnic communities, which is the preferred term.

Law / Decree	Article	Relating to	Content
			construction projects.
	48	Public Participation (new)	Shall be participation by organization, local authorities and people, who are directly or indirectly affected from project activities.
Water and Water Resources Law (2017)	26	Water and water resource protection	All are obligation to protected water and water resources without damaged to water, restores forests and land in reservoirs according to management plans for allocation of water sources, forests and soils, especially in areas of water source or surrounding water sources.
	38	Permission for use	Stipulates that medium and large scale uses require feasibility studies, EIAs, and mitigation plans, before permission is granted for use of the resource
	57	Responsible for rehabilitation water and water resources (new)	Conducted the investment project or any constructions causes damage to water or water resources, should be improvement, rehabilitation, inspecting and monitoring by state agencies or line sectors.
Forestry Law (2007)	5	Policy of forest and forest land	The GoL has the policy to preserve, regenerate, and develop forests and forest land to help preserve the environment, water resources, biodiversity, and people's livelihoods.
	26	Preservation of water resources in forest zones	Stipulates the preservation of water resources in forest zones for those areas where waterways originate and flow, including strict management and regulations to control logging, shifting cultivation, and destructive forest uses
	70	Conversion of forest land	Stipulates that forestland can be converted to other land type if it brings a high level of benefits to the nation and to livelihoods of the people, and is included in the national development plan
	71	Types of converted forest land	Stipulates that for the timber and forest resources to be harvested in those areas are property of the State
Wildlife and aquatic law (2007)	52	Prohibitions	Prohibits taking of wildlife, including parts of the animals, from their habitats; tormenting wildlife and aquatic species; illegal catching, hunting, trading and possession; catching aquatic species and hunting in conservation

Law / Decree	Article	Relating to	Content
			zones, in breeding season, or when pregnant; devastation of habitats and feeding zones.
Land Law (2003)	6	Protection of land and the environment	Declares that all individuals and organizations are obliged to protect the land from degradation,
	14	Changes in land category	Land use can be changed if it does not cause social or environmental harm and if prior approval is obtained from the authorities.
Road Law (1999)	15	Public road construction	Construction of public roads must include protection of the environment
Law on handling of Pititiona (2015)		Porject related grievance	Possible project related feedback and grievances raised by PAPs shall be addressed and incorporated into the project design and improved implementation.
Public Involvement Guideline (2013		Stakeholder and community engagement	Involvement of stakeholders and PAPs in the project preparation, design , implementation and monitoring to enhance transparency and accountavility
Guideline on ethnic group consultation (2013)		Ethnic groups affected by development	Ensure that ethnic groups defiend as IPs under Bank's policy are meaningfully consulted in a free, prior informed manner and engaged in project preparation, planning and impelemntation
Environmental and Social Management Operations Manual (ESOM) updated in 2015		Lao Road Sector	ESOM is regulatory requirement and guideline for all investment projects under the transport sector which have potential impact on the environment and people. It is a regulatory tool to be used to classify the impact and level of environmental and social assessment, identify the impact that may be caused to the environment and society, provide measurement to mitigate negative impacts as well as the monitoring and evaluation of the implementation of measures to reduce impacts during the construction, per- operation and after completion of the project.

2.3 Institutional Framework for Environmental Management

50. The National Environmental Committee (NEC) established by the EPL is the highest decision-making body for environmental management. The NEC is chaired by the Deputy

Prime Minister responsible for natural resources and environment and comprises representatives of key agencies as the member and the Department of Environmental Quality Promotion (DEQP) of MONRE is the secretariat. As of the end of 2013, key institutions related to the Project are highlighted as follows:

51. **MoNRE:** Since mid 2012, MoNRE is the lead agency responsible for effective management of natural resources and environment including water resources, forest/biodiversity, land, minerals, and environmental quality including EIA process. It is a new ministry and comprises 17 agencies including DNEP, PCD, DEQP, Department of Natural Resources and Environment (DoNRE) Policy (DNEP), Department of NRE Inspection (DNEI), Department of Water Resources (DWR), Department of Meteorology and Hydrology (DMH), Department of Disaster Management and Climate Change (DDMCC), Department of Forest Resources Management (DFRM), Department of Land Management (DoLM), Department of Land (DoL), and Department of Geology and Minerals (DGM). The technical and management capacity of these agencies remains weak due to limited number of qualified staff and budget. Most activities will be carried out with technical assistance and operational supports by international financing and/or donor agencies. The role and responsibilities of MONRE are clearly defined by the Environment Protection Law (revised in 2013).

52. **Ministry of Agriculture and Forestry (MAF):** MAF is responsible for ensuring effective management of agriculture, forests, and fisheries/aquaculture and it also went through a major reorganization during 2011-2012. It comprises many departments including the Department of Irrigation, the Department of Agriculture, the Department of Forest, the Department of Inspection, the Department of Fisheries, etc.

53. **MPWT:** Ministry of Public Works and Transport is responsible for management of public works, urban development, and land and water transport including management of domestic water supply and sanitation in urban areas. It is relatively large and stable ministry and key agencies including the Department of Road (DoR), the Department of Waterways Transport, the Department of Urban Development, and the Public Works and Transport Research Institute (PTRI). DoR is responsible for road development and maintenance and technical divisions comprise the Project Management Division, 4 Regional Road Maintenance Projects, and the Technical Division which is also responsible for planning and supervision of safeguards for road related activities. At provincial level, the provincial Department of Public Works and Transport (DPWT) is responsible for planning and implementation at provincial and local level including road maintenance. The Environment and Social Division of PTRI is responsible for establishment of safeguard procedures and guideline namely Environmental and Social Operations Manual (ESOM) for the Lao road sector, supervision, and training of safeguard for MPWT.

54. **The Provinces:** In addition to the central agencies, provincial departments of MoNRE (PoNRE), MEM (PDEM), MAF (PAFO), and MPWT (DPWT) exist in each of the 17 provinces. A Provincial Environmental Committee (PEC) is also established for each province. According to the GoL policy on decentralization as instructed by the National Assembly, the provincial and district authorities have begun to play a key role in planning, decision making, and monitoring of investment activities. For the energy sector, provincial departments are responsible for approval and monitoring of energy generation projects equality or less than 15 megawatts while the central agencies remain responsible for approval and management of large-scale investments. For the mining sector, the provincial departments are responsible

for approval and monitoring of investments of less than US$2 million. For natural resources and environment, PoNRE plays a key role in management of water, land, and forest resources as well as on environmental management including conducting review and monitoring of the IEE process and ECC issuance.

55. Provincial Resettlement Committee - The further planning and implementation of the Project will be undertaken through consultation with, and advice from, provincial and district government agencies, through the Resettlement Committee (RC). The main function of the RC is to represent the interest of the APs and stakeholders in dealing with project impacts and mitigation measures. The details of the roles and responsibilities of the RC are provided in Decree 84, Articles 19-20. The RC will appoint a management and an operational unit to be responsible for the overall process of resettlement and compensation. The RC will meet regularly, and will have an inaugural meeting at least one month before the start of the Project and will operate during the construction of the subprojects and for up to two years after completion of construction activities (to monitor impacts and take action where necessary). The minutes of meetings and activities of RC will be incorporated into overall Project internal and external monitoring. The responsibilities of RC will be as follows:

- Coordination of relevant Government organizations with ESMU to ensure that RP is properly implemented;
- Review and provide comments on valuation of land and assets (crops, production, market values, etc.) for compensation for APs
- Organization of provincial and district level meetings and consultations as required;
- Monitoring and auditing funds that are earmarked for RP implementation; and
- Participation in resolution of, and follow through, of claims or complaints lodged via the established grievance redress procedure.

2.4 National Environmental standards

56. National environmental standards have been adopted based on the Environmental Protection Law No.29/NA, dated December 18, 2012 and the Decree on National Environment Standard dated 81/GV, dated 21 Feb. 2017 and 0832/MONRE. Date 7 Feb. 2017. The following section outlines standards for water quality, noise and air quality.

2.4.1 National Water Quality Standards

57. **Table 2-2** to **Table 2-4** tabulates the national water standards for:

- Drinking water quality (groundwater);
- Surface Water Quality; and
- Wastewater effluent discharge from industrial activities.

Table 2-2: National Drinking Water Quality Standards - Groundwater[2]

Parameter	Symbol	Standard Value	Unit
Color	No defined	15	No defined
Turbidity	No defined	20	NTU
Potential of Hydrogen	pH	6.5-9.0	No defined
Iron	Fe	1.0	mg/L
Manganese	Mn	0.5	mg/L
Copper	Cu	1.5	mg/L
Chromium Hexavalent	Cr^{6+}	0.05	mg/L
Zinc	Zn	15.0	mg/L
Sulphate	SO_4^{2-}	250	mg/L
Chloride	Cl^-	600	mg/L
Fluoride	F	1.0	mg/L
Nitrate	NO_3^-	45	mg/L
Total Hardness	as $CaCO_3$	500	mg/L
Hardness	Non-carbonate as $CaCO_3$	250	mg/L
Total Suspended Solid	TSS	1,200	mg/L
Arsenic	As	0.01	mg/L
Cyanide	CN^-	0.07	mg/L
Lead	Pb	0.01	mg/L
Mercury	Hg	0.001	mg/L
Cadmium	Cd	0.003	mg/L
Selenium	Se	0.01	mg/L
Bacteria (Standard Plate Count Method)	No defined	500	Colonies/cm^3
Coliform Bacteria	No defined	2.2	MPN/$100cm^3$
E. coli Bacteria	No defined	No	No defined

Table 2-3: National Surface Water Quality Standards[3]

Parameter	Symbol	Standard value					Unit	Analysis Method
		1	2	3	4	5		
Color, Order and Taste	None	n	n′	n′	n′	None	No defined	No defined
Temperature	t ^oC	n	n′	n′	n′	No defined	^oC	Thermometer
Potential of Hydrogen	pH	6-8	6-8	5-9	5-9	No defined	No defined	Electrometric
Dissolved Oxygen	DO	>7.0	6.0	4.0	2.0	<2.0	mg/L	Azide Modification
Electro conductivity	Ec	<500	≤1000	≤2000	≤4000	>4000	µS/cm	Ec meter

[2] Decree on National Environment Standard dated 81/GV, dated 21 Feb. 2017

[3] Decree on National Environment Standard dated 81/GV, dated 21 Feb. 2017

Parameter	Symbol	Standard value					Unit	Analysis Method
		1	2	3	4	5		
Chemical Oxygen demand	COD	<5	5-7	7-10	10-12	>12	mg/L	Potassium Dichromate Digestion; Open Reflux or Closed Reflux
Total Coliform bacteria	No defined	n	5,000	20,000	No defined	No defined	MPN/ 100ml	Multiple Tube Fermentation Technique
Fecal coliform bacteria	No defined	n	1,000	4,000	No defined	No defined	MPN/ 100ml	Multiple Tube Fermentation Technique
Total Suspended Solid	TSS	<10	≤25	≤40	≤60	>60	mg/L	Glass Fiber Filter Disc
Phosphate	PO_4	<0.1	0.5	1	2	>2	mg/L	Ascorbic acid
Ammonium ion	NH_4^+	<0.5	≤1.5	≤3	≤4	4	mg/L	Kjeldahl
Nitrate-Nitrogen	NO_3-N	n	5.0	5.0	5.0	No defined	mg/L	Cadmium Reduction
Ammonia Nitrogen	NH_3-N	n	0.5	0.5	0.5	No defined	mg/L	Distillation Nesslerization
Phenol	C_6H_5OH	n	0.005	0.005	0.005	No defined	mg/L	Distillation Amino antipyrine
Copper	Cu	n	1.5	1.5	1.5	No defined	mg/L	AA-Direct Aspiration
Nickel	Ni	n	0.1	0.1	0.1	No defined	mg/L	AA-Direct Aspiration
Manganese	Mn	n	1.0	1.0	1.0	No defined	mg/L	AA-Direct Aspiration
Zinc	Zn	n	1.0	1.0	1.0	No defined	mg/L	AA-Direct Aspiration
Cadmium	Cd	n	0.003	0.03	0.03	No defined	mg/L	AA-Direct Aspiration
Chromium 6	Cr^{+6}	n	0.05	0.05	0.05	No defined	mg/L	AA-Direct Aspiration
Lead	Pb	n	0.01	0.01	0.01	No defined	mg/L	AA-Direct Aspiration
Mercury	Hg	n	0.001	0.001	0.001	No defined	mg/L	AA-Cold Vapor Technique
Arsenic	As	n	0.01	0.01	0.01	No defined	mg/L	AA- Direct Aspiration, ICP
Cyanide	CN^-	n	0.01	0.01	0.01	No defined	mg/L	Pyridine Barbituric Acid

Parameter	Symbol	Standard value					Unit	Analysis Method
		1	2	3	4	5		
Radioactive -α -β	 -α -β	n	0.07	0.07	0.07	No defined	Becq. urel/L	GC
Organochlorine pesticide		n	0.05	0.05	0.05	No defined	mg/L	GC
Dichlorodiphenyltrichloroethane	DDT	n	1.0	1.0	1.0	No defined	µg/L	GC
Alpha Benzene hexachloride	α-BHC ($C_6H_6Cl_6$)	n	0.02	0.02	0.02	No defined	µg/L	GC
Dieldrin	$C_{12}H_8Cl_6O$	n	0.02	0.02	0.02	No defined	µg/L	GC
Heptachlor and Heptachlor epoxide	$C_{10}H_5Cl_7$ And $C_{10}H_5Cl_7O$	n	0.2	0.2	0.2	No defined	µg/L	GC
Endrin	$C_{12}H_8Cl_6O$	n	None	None	None	No defined	µg/L	GC

Remark:

Class 01: water sources is from natural, no any production or dilution

Class 02: water sources for consumption but need to be disinfected, this water sources aquatic conservation, fishery, water sport and other.

Class 03: water sources for consumption but need to be disinfected, this water sources agriculture, livestock and other

Class04: water resource for consumption, but need to be disinfected, this water sources for industry, colleting the effluent from urban area or community and other.

Class05: water resource for transportation, collecting the effluent from urban area or community and other.

n: natural water

n': natural water, but the temperature change is not more than ±3^{O}C

Table 2-4: Waste Water Effluent (General Industrial Wastewater Discharge)[4]

Parameter	Symbol	Standard Value	Unit	Analysis Method
Potential of Hydrogen	pH	6-8.5	No defined	pH Meter
Total Dissolved Solid	TDS	<2,500 mg/l depending on industrial activities and water body, but <5,000 mg/l	mg/L	Dry evaporation at temperature 103-105^{O}C, 1 hour
Total Suspended	TSS	<50 mg/l depending on industrial activities	mg/L	Glass Fiber Filter Disc

[4] Decree on National Environment Standard dated 81/GV, dated 21 Feb. 2017

Parameter	Symbol	Standard Value	Unit	Analysis Method
		and water body, but <150 mg/l		
Temperature	t	<40	^{O}C	Temperature Meter
Color and Odor	No defined	No	No defined	General
Hydrogen Sulfide	H_2S	<1.0	mg/L	Titration
Cyanide	CN^-	<0.2	mg/L	Distillation and Pyridine Barbituric Acid
Fat, Oil and Grease	FOG	<5.0 mg/l depending on industrial activities and water body, but <15.0 mg/l	mg/L	Solvent Extraction by Weight
Formaldehyde	CH_2O	<1.0	mg/L	Spectrophotometry
Phenol	C_6H_5OH	<1.0	mg/L	Distillation and Aminoantipyrine Method 4
Chlorine	Cl^-	<1.0	mg/L	Lodometric Method
Pesticide	-	No	mg/L	GC
Biological Oxygen Demand 5 Days	BOD_5	<30 mg/l depending on industrial activities and water body, but <60 mg/l	mg/L	Azide Modification at $20^{O}C$, 5days
Total Nitrogen	TKN	<100 mg/l depending on industrial activities and water body, but <200 mg/l	mg/L	Kjeldahl
Chemical Oxygen Demand	COD	<120 mg/l depending on industrial activities and water body, but <400 mg/l	mg/L	Potassium Dichromate Digestion; Open Reflux or Closed Reflux
(Heavy metals)				
Zinc	Zn	<5.0	mg/L	AA/AES; ICP
Chromium Hexavalent	Cr^{+6}	<0.25	mg/L	AA/AES; ICP
Chromium Trivalent	Cr^{+3}	<0.75	mg/L	AA/AES; ICP
Copper	Cu	<2.0	mg/L	AA/AES; ICP
Cadmium	Cd	<0.03	mg/L	AA/AES; ICP
Barium	Ba	<1.0	mg/L	AA/AES; ICP
Lead	Pb	<0.2	mg/L	AA/AES; ICP
Nickel	Ni	<1.0	mg/L	AA/AES; ICP
Manganese	Mn	<5.0	mg/L	AA/AES; ICP
Arsenic	As	<0.25	mg/L	AA-Hydride Generation or ICP
Selenium	Se	<0.02	mg/L	AA-Hydride Generation or ICP
Mercury	Hg	<0.005	mg/L	AA-Cold Vapour Technique

2.4.2 National Air Quality Standards

58. **Table 2-5** tabulates the Lao PDR ambient air quality standards. Note that some of the standards are expressed in parts per million (ppm) and some are expressed in mg/m^3.

Table 2-5: National Ambient Air Quality Standards [5]

Parameter	Symbol	1 hour (mg/m^3)	8hour (mg/m^3)	24 hour (mg/m^3)	1 month (mg/m^3)	1 year (mg/m^3)
Carbon Monoxide	CO	30	10.26	-	-	-
Nitrogen Dioxide	NO_2	0.32	-	-	-	-
Sulphur Dioxide	SO_2	0.78	-	0.30	-	0.10
Total Suspended Particulate	TSP	-	-	0.33	-	0.10
Particulate Matter less than 10 microns	PM-10	-	-	0.12	-	0.05
Ozone	0_3	0.20	-	-	-	-
Lead	Pb	-	-	-	1.5	-

2.4.3 National Noise Standards

59. **Table 2-6** provides the national noise standards for Lao PDR. It can be noted that nighttime noise limits are particularly stringent with regards to sensitive receptors such as hospitals and schools.

Table 2-6: Noise Standards for Other Places (Leq 24-hrs)

Area	dB(A): 06.00 – 18.00	dB(A): 18.00 – 22.00	dB(A): 22.00 – 06.00
Hospitals, libraries, kindergarten, schools	50	45	40

[5] Decree on National Environment Standard dated 81/GV, dated 21 Feb. 2017

Residential areas	55	55	45
Commercial areas	70	70	50

2.5 WBG Environmental, Health and Safety (EHS) Guidelines

60. The WBG has developed a range of environmental, health and safety (EHS) guidelines. Part of these guidelines include specific standards for ambient air quality and noise.

2.5.1 WBG Air Quality Guidelines

61. The WBG use the ambient air quality guidelines proposed by the World Health Organization (WHO). **Table 2-7** provided these standards.

Table 2-7: WHO Air Quality Guidelines

Parameter	Averaging Period	Guideline Value ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	24 hour	20
	10 minute	500
Nitrogen Dioxide (NO_2)	1 year	40
	1 hour	200
Particulate Matter PM_{10}	1 year	20
	24 hour	50
Particulate Matter $PM_{2.5}$	1 year	10
	24 hour	25
Ozone	8 hour daily maximum	100

2.5.2 WBG Noise Guidelines

62. According to the WBG EHS Guidelines, noise impacts should not exceed the levels presented in **Table 2-8**, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 2-8: WBG Noise Level Guidelines, One Hour Laeq (dBA)

Receptor	Daytime (07.00 – 22.00)	Night-time (22.00 – 07.00)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

2.5.3 General WBG EHS Guidelines

63. In addition to the above, the WBG EHS guidelines also provide extensive guidance on a range of other EHS issues, such as occupational health and safety, community health and safety, etc. The mitigation measures that have been adopted for this Project have included all of the relevant WBG EHS guidelines.

2.6 International Environmental Agreements

64. Lao PDR is a signatory to most international agreements and conventions relating to the environment, the most relevant are listed below. **Appendix D** Provides a list of all international agreements ratified by Lao PDR.

- ASEAN Agreement on the Conservation of Nature and Natural Resources (1985). Lao PDR as Party to this agreement has agreed on development planning, the sustainable use of species, conservation of genetic diversity, endangered species, forest resources, soil, water, air and address environmental degradation and pollution.
- United Nations Convention on Biodiversity (CBD 1996). Under this convention, Lao PDR has agreed to conduct an Environmental Assessment of proposed development projects to minimize harmful effects.
- Convention on International Trade in the Endangered Species of Fauna and Flora (CITES 2004). Provides an international umbrella for management and control of trade in endangered fauna and flora.
- United Nations Framework Convention on Climate Change (UNFCCC 1995). The Government of Lao PDR joined the global community to combat climate change by ratifying this Convention. As a developing country (non-Annex I), there is no requirement for Lao PDR to reduce its greenhouse gas emissions. The country also ratified the Kyoto Protocol in 2003 and thus may be eligible for involvement in carbon trading through a compliance market of the Clean Development Mechanism as well as the international voluntary greenhouse gas emission trading.
- Ramsar Convention (1982). The GoL officially joined the Convention in 2010. Two wetlands of international importance have been designed as Ramsar sites as part of the accession process which are the XeChamphone Wetlands in Savannakhet Province, and the BeungKiatNgong Wetlands in Champasak Province.

2.7 World Bank Safeguards Policies Applicable to the Project

2.7.1 General

65. The World Bank's environmental and social safeguard policies are regarded as a cornerstone of its support to sustainable poverty reduction. The objective of these policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for the World Bank and borrowers in the identification, preparation and implementation of programs and projects. The project triggers the following environmental and social safeguard policies: Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), and Physical Cultural Resources (OP/BP 4.11), Indigenous Peoples (OP/BP 4.10) and Involuntary Resettlement (OP/BP 4.12).

2.7.2 Environmental Assessment

66. Environmental Assessment is one of the 10 environmental, social, and legal Safeguard Policies of the World Bank. Environmental Assessment is used in the World Bank to identify, avoid, and mitigate the potential negative environmental impacts associated with Bank lending operations. In World Bank operations, the purpose of Environmental Assessment is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted. The World Bank's environmental assessment policy and recommended processing are described in **Operational Policy (OP) 4.01: Environmental Assessment**. This policy is considered to be the umbrella policy for the Bank's environmental 'safeguard policies'.

67. Initially the Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA. The Bank 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.

(a) *Category A*: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an EIA. The Project has been classified as a Category A project due to the resettlement of affected peoples, not specifically due to its anticipated impacts on the environment.

(b) *Category B*: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document). The Project herewith has been classified as a Category B Project.

(c) *Category C*: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

(d) *Category FI*: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

2.7.3 Other World Bank Safeguard Policies

68. **Table 2-9** lists other World Bank Safeguard policies and rationales for policies triggering or not triggering by the Project.

Table 2-9: Other World Bank Safeguard Policies

Safeguard Policies	Triggered?	Explanation
Natural Habitats OP/BP 4.04	Yes	This policy is triggered since landscape of the areas along the proposed NR13 N project is typical of a marshy area (with flood plains and riverine forest vegetation along both sides) combined with small hilly zones. The project road improvements activities will involve expansion of three bridges to accommodate 4 lanes and improvements of 4 bridges on the 2 lanes section.
Forests OP/BP 4.36	No	This policy is not triggered because the project does not pass through national parks or protected areas. It will pass through semi-urbanized areas. It is not anticipated that the project will affect the health and quality of forests or the rights and welfare of people and their level of dependence upon or interaction with forests.
Pest Management OP 4.09	No	The project will not lead to purchase or increase use of pesticides.
Physical Cultural Resources OP/BP 4.11	Yes	This policy is triggered due to the presence of village temples and graves observed near the road. Impacts assessment on physical cultural resources and measures, including chance finding procedure, necessary to minimize/mitigate impacts, have been included in the ESIA.
Indigenous Peoples OP/BP 4.10	Yes	This policy is triggered due to the presence of a Hmong Ethnic Community in the project area that will be impacted by labor influx, dust, noise, gas emission and other forms of pollution from construction, drainage blockage, traffic interruption, removal of vegetation and impacts to temples or graves during construction, increased traffic flow and speed during operation. No household resettlement is anticipated in the ethnic community.
Involuntary Resettlement OP/BP	Yes	This policy is triggered as the works to be financed will result in land acquisition, the disruption of

4.12		agricultural and livelihood activities, and the displacement of residential and commercial structure. This is primarily because the section of NR13 from Vientiane to Ban Dong (km 12 to km 31) will be upgraded from 2 to 4-lanes requiring the acquisition of 1.5m of land on each side.
Safety of Dams OP/BP 4.37	No	The project will not finance any activities related to the construction of dams nor affect operations of existing dams or affiliated reservoirs.
Projects on International Waterways OP/BP 7.50	No	The project will not affect international waterways.
Projects in Disputed Areas OP/BP 7.60	No	No activities are planned in any disputed areas.

3. PROJECT DESCRIPTION & ALTERNATIVES

3.1 General

69. This section of the report will describe the proposed project including its location, scope, and activities associated with its design, construction and operation. This section will also consider alternatives associated with the Project. Accordingly, this chapter is arranged as follows:

- Project Summary, including category of project and project need and location;
- Environmental Setting, providing an overview of the socio-environmental conditions within the Project Corridor; and
- Scope of Works, summarizing the works activities to be undertaken as part of the Project.
- Assessment of Alternatives, including the 'no project' scenario.

3.2 Project Background

70. **Country Context** - The Lao economy continues its strong expansion and overall poverty has declined. However, poverty levels remain relatively high, with development benefits not equitably shared among the population. With the gross national income per capita reaching US$1,740 in 2015, Lao PDR is a lower-middle income country. The poverty rate – based on the national poverty line – has declined from 33.5 to 23.2 percent (around 1.5 million people) between 2003-2013. Despite these gains, inequality has increased, with the Gini coefficient rising from 32 to 36 during the same period.

71. With a total population of 6.7 million, Lao PDR's annual economic growth rate averaged 8 percent between 2000 and 2015 and is projected to sustain 7 percent annual growth over the period 2017-2019, driven by growth in electricity exports and services (i.e., retail, tourism, and transport), construction, and manufacturing, and a favorable regional economic outlook with closer integration under the ASEAN Economic Community. These gains have been supported by significant public investments, and as a result, the fiscal deficit grew to 6 percent of GDP during 2015-2016, and public debt increased to 68 percent of GDP in 2016. The Government of Lao PDR (GoL) has taken steps to consolidate its fiscal position over the medium term by removing exemptions, expanding the tax base, and strengthening tax administration. However, ambitious public investment plans, including the Lao PDR section of the Kunming – Singapore rail line, are projected to keep deficit and debt levels elevated, which may constrain future investment unless economic growth can keep pace.

72. Lao PDR is highly vulnerable to climate and disaster risks. Historical damage data indicate that annual expected losses from climatic events range between 3 and 4 percent of GDP, with the associated average annual fiscal cost close to 2 percent of government expenditures. Three of the five costliest natural disasters have taken place since 2009, including two floods in 2013. The 2015-16 El Niño phenomenon was one of the strongest on record and impacted Lao PDR through lower agriculture yields, reduced hydropower

production, and infrastructure damages from storms. Climate change projections indicate further increases in temperature and increased intensity and frequency of extreme events, including increased rainfall and flooding risks during the wet season. These conditions can severely impact economic activity, such as hydropower, transport, and agricultural production, and affect poverty reduction efforts. Vulnerability and losses may rise further if infrastructure planning does not consider disaster risks.

73. **Sectoral and Institutinal Context** - New opportunities for economic expansion prompted by regional integration will further support the economy but will require improved transport connectivity. Lao PDR's membership in ASEAN and the WTO has lowered barriers and increased the potential market; however, making the most of this opportunity requires the ability to efficiently move goods and provide services across borders. The Government has invested in the construction and upgrading of new roads and bridges, but this has resulted in growing public debt, including a significant increase in arrears to contractors. The focus on new investment has also led to a comparatively lower budget allocation to maintenance and operations. Therefore, internal connectivity continues to suffer, with a significant part of the network impassable during the rainy season, particularly secondary roads. The growing impacts of natural disasters and climate change on the road network have increased the need for emergency repair, which accounts for approximately 30 percent of the overall annual road maintenance budget.

74. Funding for the road sector has been increasing, but higher efficiency is needed to serve the growing road maintenance needs. The road sector is financed through Government budget, overseas development assistance (ODA), and the Road Maintenance Fund (RMF). The RMF, capitalized mainly through a fuel levy, is the key mechanism to ensure predictable and sustained allocations of funds for road maintenance. RMF receipts have been growing by more than 10 percent per annum in recent years and received more than US$80 million in 2016, from US$2 million in 2002 (when it became operational). The Ministry of Public Works and Transport (MPWT) conservative projection is for sustained future growth rates at around 10 percent in the medium term. The RMF supports routine, periodic and emergency maintenance, as well as rehabilitation and upgrading of existing roads, with 80 percent allocated to national roads.

75. Including national budget and RMF, the road sector received a total allocation of US$107 million for fiscal year 2017, which is a 37 percent increase compared to the fiscal year 2014-15 budget. However, a large portion of the allocation has been used to pay outstanding debt for road construction and upgrading, emergency repair, and road maintenance and disaster recovery implemented over the last five years, rather than road maintenance activities implemented during the year. As such, managing the road sector debt and the outstanding liabilities and enhancing the efficiency of the RMF allocation are critical. The IDA-financed Lao Road Sector Project 2 (LRSP2), effective since March 23, 2017, is supporting sector institutional development through the preparation of financing and policy frameworks, the sector strategic plan, improved governance systems, and development of technical capacity to maximize the effectiveness of public expenditure in the sector. The proposed National Road 13 project would complement this work by demonstrating ways to achieve improved efficiency in the use of the RMF through performance-based approaches.

76. National Road 13 (NR13) is the most important corridor in Lao PDR and its upgrade, rehabilitation, and maintenance may result in significant benefits for the country. NR13 is a North-South corridor (1,500 km) and the backbone of the country that connects Lao with China in the north and with Cambodia in the south. The road comprises NR13 South from Vientiane Capital to the Cambodian border (829 km) and NR13 North (671 km) from Vientiane Capital to Boten on the Chinese border. The main sections of the road were completed in 1997 and have not been rehabilitated since, receiving only periodic and emergency maintenance.

77. Strong economic growth and trade expansion have been accompanied by a rapid increase in traffic volume and transit traffic on NR13, particularly in stretches near Vientiane Capital, some of which are expected to reach full capacity in the next 5 years. A detailed feasibility study financed by the World Bank in 2015 identified several critical sections on both NR13 North and NR13 South. The study indicated that improvements in these sections would result in reduced vehicle operating costs and travel time, increased accessibility of enterprises, increased labor productivity, and reduced road fatality rates. MPWT will use a phased approach to the improvement of NR13. To start, MPWT has prioritized the section from km 12 to km 70 on NR13 North, because this stretch serves the highest traffic volume, about 22,100 Annual Average Daily Traffic (AADT) in 2015, and is periodically damaged by severe flooding, including extensively by Typhoon Haima in 2011. The improvement of other critical sections will follow as financing becomes available.

78. For the past three years, Lao PDR has been exploring financing options to rehabilitate and make NR13 climate resilient, including private sector financing. The Government of Lao PDR (GoL) has decided that an output and performance-based approach would be the most appropriate as the application of this option builds on previous experience with performance-based contracts for the road sector in the country and can help to further develop the public-private partnership model going forward. With this option, financing for development is maximized by leveraging the private sector and optimizing the use of scarce public resources, and efficiency gains result from the incentive structure in the contract to ensure high quality road improvement and effective maintenance.

79. Reported road fatalities at the national level more than doubled between 2000 and 2010 (from 358 to 790) and increased to 1,054 in 2014. Nearly three-quarters of these fatalities were motorcyclists. Regionally, the World Health Organization places Lao PDR third behind Thailand and Vietnam – countries with significantly higher motorization rates – in terms of the share of GDP lost (2.7 percent in 2010) because of road crash related fatalities. LRSP2 is supporting the Government to operationalize road safety management and safety improvements on local roads, but this remains an important aspect on national corridors as well, including NR13. The feasibility study conducted in 2015 indicates that a "with project" option could help reduce the fatality rate by about 20 percent and the serious accident rate by 15 percent on NR13 project sections.

80. Truck overloading, from national and international freight, is increasing rapidly and affecting the rate of deterioration of the network. Most of the main roads in Lao PDR, including NR13, were designed and built for 8.2-ton standard axle loads while the current ASEAN standard is 11 tons. MPWT has identified truck overloading as a significant contributor to pavement damage on roads that serve the bulk of transit transport, including

NR13. The Government, with assistance from IDA through the LRSP2, the Asian Development (ADB), and the Japan International Cooperation Agency (JICA), is in the process of strengthening the institutional framework in this regard through the re-introduction of overloading controls and regulation. The proposed project will further support this effort through the assignment of appropriate risks and responsibilities between government and the contractor for overloading control under the output and performance-based contract. In addition, the project will install a weigh station on the project road, and rehabilitation will be carried out to ASEAN standard.

81. The road sector is under the overall jurisdiction of MPWT. MPWT is responsible for policy making, financing, strategic planning, oversight, and overall management of the sector. While it has progressively delegated maintenance and operational tasks for local roads to the provincial level, MPWT retains the responsibility for the maintenance and operational tasks for the national road network, including NR13. MPWT would lead and implement the proposed project. The Ministry has ample experience implementing IDA projects using country systems, which are considered appropriate and are being further strengthened through LRSP2.

3.3 Project Description

82. The overall focus of the project is the climate resilient upgrade and improvement of 58km on NR13 North from Vientiane to Phonhong, a critical stretch serving high traffic volumes.

Component 1: Road Improvement and Maintenance This component would finance: (a) improvement and maintenance, ensuring traffic capacity, quality, climate resilience, road safety aspects for (i) Section Sikeut-Songpeuay Market (km 12 to km 31), which is to be upgraded from 2 to 4-lane, with a 23m wide right-of-way; and (ii) Section Songpeuay Market-Phonhong (km 31 to km 70), to improve the existing 2-lane with a 16m wide right-of-way; and (b) land acquisition as needed for the road improvement. The improvement works and maintenance will be carried out through the implementation of an Output and Performance-Based Road Contract (OPBRC). The main features of the OPBRC approach for the project include:

a. A share of the improvement cost of the project will be reimbursed to the contractor over the initial 3-year estimated construction period through milestone payments based on completion of nominated proportions of the works, financed by IDA and NDF.
b. The rest of the contractor's financing of the improvements works and the operations and maintenance (O&M) cost over a 10-year period will be paid through performance-based quarterly payments (adjusted for inflation) based on the contractor's performance in meeting or exceeding the contracted service levels for the road. The quarterly payments over the 10-year period will come from the RMF.
c. Bidders would be assessed on their technical and financial proposals. The financial offers will include O&M costs and amortization of the capital expenditures (improvement works) that were not covered by the construction payments to the contractor during the initial construction period.
d. The IDA Guarantee will backstop the payment obligations from the Government to

the private contractor over the life of the OPBRC contract. This will improve the credit worthiness of MPWT and mitigate the risk of non-payment by MPWT to the private contractor.

Component 2: Supervision and Capacity Building This component would finance: (a) supervision of road improvement works over a 3-year construction period, including monitoring implementation of environment and social requirements, followed by supervision and monitoring of the contractor's performance for the initial two years of the post-construction operational period, including monitoring implementation of environment and social requirements, and capacity building of the MPWT on OPBRC supervision and monitoring; and (b) technical assistance to prepare environmental and social studies, and detailed design for other critical sections of NR13 that will be defined during project implementation .

Component 3: Project Management . This component would finance: (a) road safety activities; and (b) project management, including coordination, procurement, financial management (FM), technical and safeguards aspects, monitoring and evaluation (M&E), reporting, training, and incremental operating costs for both the construction period and the initial two years of the operational period.

3.4 Indicative Implementation Arrangements

83. The road sector is under the overall jurisdiction of the Ministry of Public Works and Transport (MPWT). MPWT is the Project Implementing Agency. The project will be implemented through Government structures. MPWT's Department of Roads (DoR) is responsible for the overall management and implementation of the project. DoR has appointed a Project manager for day-to-day implementation. The proposed project will use arrangements that have proved successful for previous and current IDA projects (e.g. LRSP2) implemented by MPWT. As such, MPWT departments will have implementation responsibilities as per their official mandates: (i) the Department of Finance (DoF) will have overall responsibility for financial management including procurement support to project activities; (ii) the Department of Inspection (DoI) will apply internal controls to project activities, procure independent financial auditors, and oversee the project grievance redress mechanism; (iii) the ICT Division of the Cabinet office will oversee activities related to the administration of e-procurement, disclosure of bidding documents, and public information posted in MPWT's website; and (iv) the Environmental and Social Division of the Public Works and Transport Research Institute (ESD-PTRI) will lead all aspects of safeguards preparation, supervision and reporting. MPWT's Department of Transport (DoT) will lead the activities related to traffic safety and overloading control. The Department of Planning and Cooperation (DPC) will provide coordination support to departments implementing project activities.

3.5 Project Location

84. Project works are divided into two sub-sections:

- Vientiane-Ban Dong (km 12 to km 31) - upgrade from 2 to 4-lane with 23m right-of-way.

- Ban Dong-Phonhong (km 31 to km 70) - improve 2-lane with 16m right-of-way.

85. The Project road is located within two provinces. The relevant districts and villages are listed in **Table 3-1** below.

Table 3-1: Administrative boundaries of the project impact area

Province	District	Villages
Vientiane Capital	Naxaithong	Total of 24 villages affected namely, Xaimoungkhoun, Sikeut, Phanghaeng, Donglouang, Naxaithong-tai, Naxaithong-kang, Naxaithong-nua, Houaxang, Houakhoua, Nongkhankhou, Ilai Tai, Ilai Neua, Songkhouakangsaen, Chaengsavang, Houaynamyen, Songpuay Tai, Songpuay Neua, Phonkham, Nakha, Phonmouang, Nanga, Boua, Nongsa, Nadi
Vientiane	Phonhong	Total of 20 villages affected namely, Sivilai, Mai, Phonxai-tai, Taothan, Nalao, Lak 52, Nongnak, Phonkham-tai, Phonkham-nua, Hongluay, Nabon, Vangmon, Saka, Phonngeun, Phonsavang, Houaython, Namchaeng, Phonsi-tai, Namlin, Phonhong

86. **Figure 3-1** provides a location map of the Project road within the context of Lao PDR. A schematic presentation of the road alignments is provided by **Figure 3-2**.

Figure 3-1: NR13 North Location Map

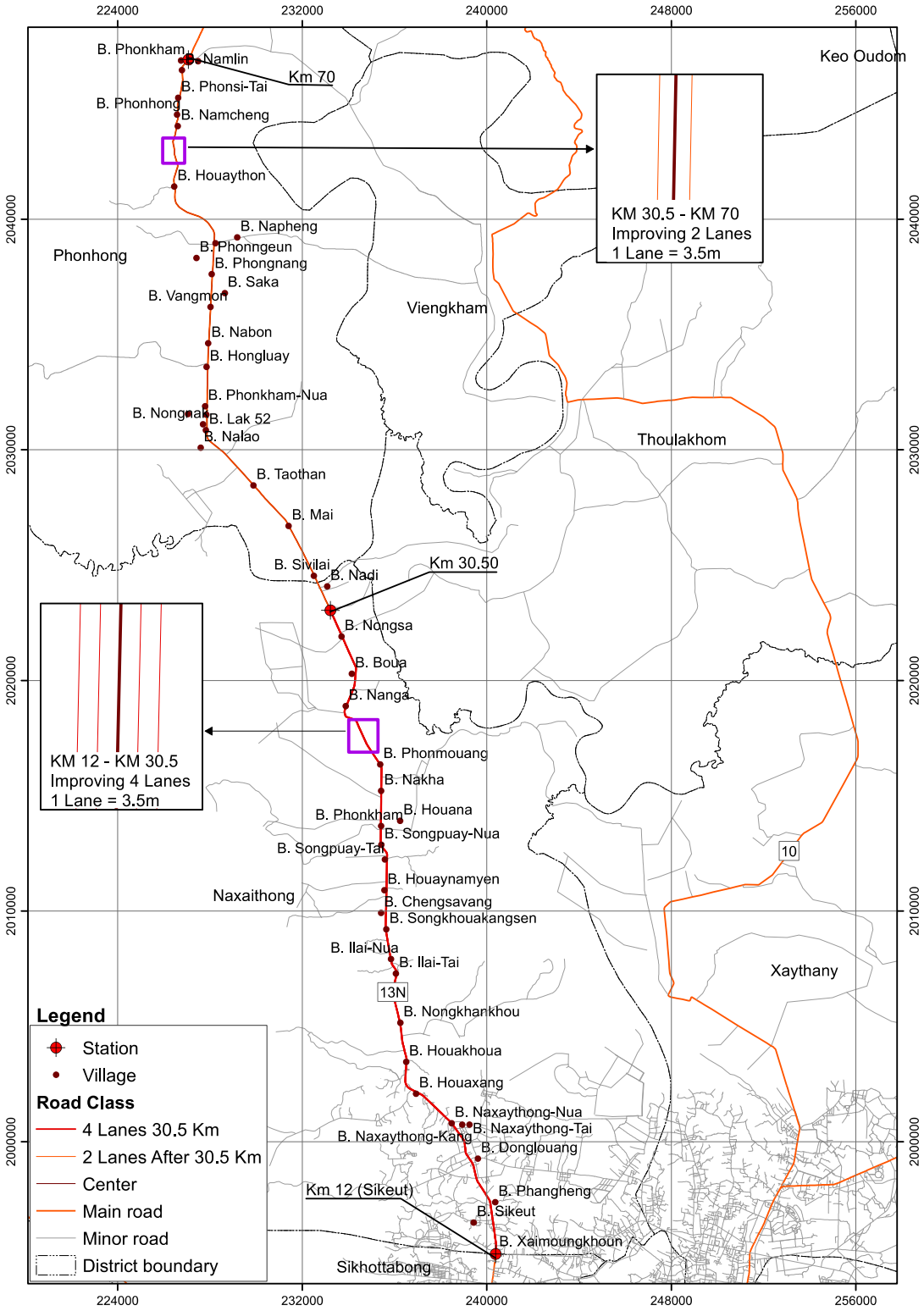


Figure 3-2: Project Road Location [6]

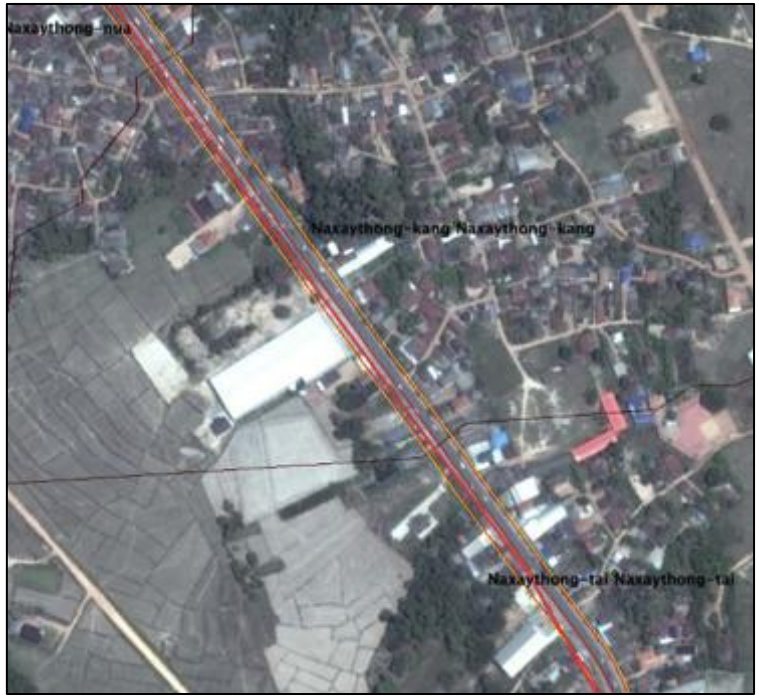
[6] KM12 – 30.5 is upgrading 2 to 4 lanes.

3.6 Environmental Setting

87. **Table 3-2** describes the general environmental and social conditions for both the roads.

Table 3-2: Environmental Setting

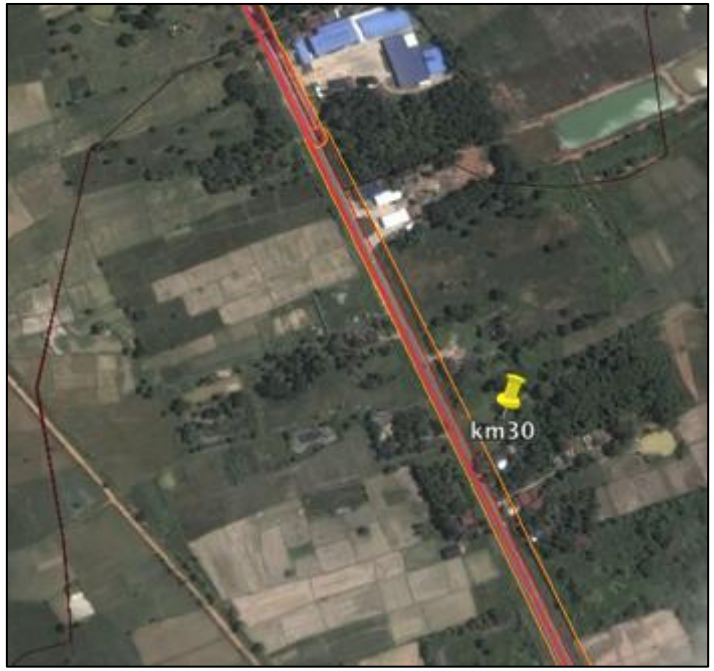
Km 0.0 - The road starts at Sikeut Junction, in the northern area of Vientiane, approximately four kilometers from Vientiane airport. The junction is busy most times of the day as traffic traverses north and south or eastwards to NR13 South. The junction is surrounded by commercial and light industrial properties which often encroach into the right of way. Low voltage electricity distribution lines crisscross the road, however, most of the utilities seem to be located outside of the right of way. The road to the left of the photo (eastwards to NR13 south) is currently unpaved, and this is leading to dirt and gravel being transported onto the roadway. This is a common effect along most of NR13 North. At this point the Phou Phanang Protected Area is more than 10 kilometers west of the Project road.



Km 5.5 - The road continues north, through a ribbon of urban development intertwined with commercial businesses and some light industrial activities, such as vehicle workshops. Some rice paddies and agricultural land break up this development ribbon periodically, but often it is hard to determine when one village ends and another starts. The road condition in this area (Naxaithong) is generally good, traffic volumes are still quite high. Roadside vegetation is more evident in these areas as shown by the photo opposite. At this point the Phou Phanang Protected Area is more than 7 kilometers west of the Project road.

Km 10.0 – The Project road continues northwards through a mix of agricultural land and villages. At around kilometer ten the road crosses bridge 2. The first three bridges in the Project road will need to be widened to accommodate the proposed four lanes. None of the water courses in these locations are particularly wide with bridge lengths generally being simple single span concrete structures of around 20 meters. Given the relatively short lengths of these structures and the low flows within the water courses construction works should be relatively straightforward to manage without significant pollution events occurring. At this point the Phou Phanang Protected Area is more than 7 kilometers west of the Project road.

Km 14 – There is little change in the road landscape as the Project road continues north. Some areas between kilometer 12 and 14 have been identified in the Project FS as areas liable to flooding (see the light colored box on the satellite image above as an example of an area identified). The photo above illustrates a typical temple located adjacent to the road. More than 30 temples have been identified along the alignment and these are classified as sensitive receptors requiring special consideration during the design and construction phase. At this point the Phou Phanang Protected Area is more than 7 kilometers west of the Project road.



Km 30 – After around kilometer 20 villages become less frequent and more vegetation, in terms of agricultural plants and road side trees can be noted. The road condition in this area is still good and speeds of up to 100 kilometers per hour are possible. After kilometer 20 the road will be a two lane construction, and as such no widening of the road will be required in this area and no changes to the alignment. Accordingly fewer environmental impacts are anticipated in this two-lane portion of the road. At this point the Phou Phanang Protected Area is more than 7 kilometers west of the Project road.

Km 37 - The Project road continues to pass through some small villages and agricultural land. More roadside trees can be observed, although this sections of the Project road will remain a two lane road. No trees will need to be cut in these areas with the possible exception of areas that require small embankments to prevent flooding. No other significant environmental issues are identified in these rural locations. At this point the Phou Phanang Protected Area is more than 5 kilometers west of the Project road.

Km 40 – The Project road passes through Lak 52 at around kilometer 40. Lak 52 is a small, bustling village with numerous commercial and residential properties very close to the roadside. The Contractor will have to take care to ensure that access is provided to all commercial and residential properties throughout the construction phase. Noise levels in Lak 52 are currently above WBG guidelines for both daytime and nighttime noise. An increase in traffic volumes during the operational phase of the project is only likely to exacerbate this issue. At this point the Phou Phanang Protected Area is more than 8 kilometers west of the Project road.

Km 50 – After kilometer 48 the Project road enters a rural section with a low population density. Woodland and spots of agricultural land dominate the rolling landscape in this area. Most of the woodland is located more than 10 meters from the edge of the existing road and as such these areas are not expected to be significantly affected by rehabilitation of the existing pavement and structures. At this point the Phou Phanang Protected Area is more than 10 kilometers west of the Project road.

Km 53 – The road continues through a rolling landscape with few residential areas. A couple of small areas in this area have been noted as flood prone. At this point the Phou Phanang Protected Area is around 4 kilometers west of the Project road, this is as close as the Phou Phanang gets to the Project road. During the public consultation meetings in Phonhong the issue of the Protected Area was raised by the ESIA team. None of the stakeholders present believed that the area would be impacted by the Project given its distance from the road. The rehabilitation works in this portion of the road will not increase accessibility to this area as access is readily available via a number of local roads connecting to the NR13 North.

Km 57 – The Project road ends at the town of Phonhong. At this point the Phou Phanang Protected Area is more than 5 kilometers west of the Project road.

3.7 Scope of Works

88. The scope of works for the Project road can typically be divided into design, pre-construction, construction and operational and maintenance (O&M) activities. The following section provides a summary of the potential activities that are anticipated to occur during each activity.

3.7.1 Design

89. **General** - During this phase of the Project detailed designs are prepared. Currently a Detailed Design (DD) Consultant is preparing the detailed engineering design for rehabilitating the road. In doing so, the DD Consultant is preparing all the documents necessary for the approval, bidding and construction of the works. These documents include, but are not necessarily limited to, detailed drawings, specifications, bill of quantities (BOQ), cost estimates and traffic management plans. The detailed engineering design will incorporate recommendations to be produced as a result of this ESIA and the BOQ will reflect all the costs associated with the implementation of the Environmental and Social Management Plan (ESMP). The DD Consultant will also ensure that all aspects of the design takes full account the historical occurrence of severe flooding and the potential for future floods to affect the roads.

90. **Design Standards** – The Design Consultant will use the design standards outlined in **Table 3-3** to guide the detailed design.

Table 3-3: Design Standards

Highway Classification		**Class 1 (4 Lane)**	**Class II (2 lane)**
Terrain Classification		Level	Level
Design Speed km/h		80-110	80-100
Width (m)	Right of Way	23	16
	Lane	3.50	3.50
	Shoulder	2.0	2.5
Min. horizontal curve radius (m)		220	200
Type of Pavement		Asphalt / cement concrete	Asphalt / cement concrete
Max. super elevation (%)		Rural: 8 Urban: 6	Rural: 10 Urban: 6

Max. vertical grade (%)	5	6
Min. vertical clearance	4.50	4.50
Structure loading (minimum)	HS20-44	HS20-44

*Design speeds in urban areas will be 40 km/h.

92. **Cross-Sections** - In road cross-section design, following aspects have been given due consideration.

- Center Median width – Though the operational effectiveness increases with increasing median width, there are factors that limit the widths that are selected. The physical constraints due to the roadside development the widths have limits and furthermore the space has to be allocate for the other cross section elements in such circumstances. A median barrier is introduced to ensure separation of opposing traffic (and divert vehicles colliding with the barriers back without having head-on collisions with traffic on the opposing stream) and the median width is reduced down to 2m as a compromise to all these environmental factors.
- Carriageway width - Taking into consideration the large sized trucks in the traffic stream and also to increase the capacity, a 3.5 m wide carriageway was adopted. This will also give a wider lateral clearance for the slow moving and vulnerable vehicle classes that will be using the hard shoulder. Besides, a similarly wider clearance is offered to the vehicles on the fast-moving lane by the 3.5m wide carriageway from the median barrier which is place on a comparatively narrower center median only 2 m wide).
- 2.0 - 2.5m Wide Hard Shoulder - To provide passage for slow moving vehicles, the hard shoulder is made a little wider than the conventional cycle lane but not wide enough for it to be mistaken as another lane.

93. **Figure 3-3, 3-4, 3-5 and 3-6** illustrate the proposed cross sections of the road. It appears from these figures that embankments will be required in all instances, however, in reality there will not be many areas where the road will be raised, except in areas identified as being flood prone.

94. **Geometry -** The Project road, from the beginning to about km 47, is predominantly flat, and the gradient is less than 2%. The section from km 47 to 70 is more rolling in nature and the gradient varies from 4% to a small section of which the gradient reaches 8%. However, the section where the gradient is high is comparatively shorter, and does not exceed half km in all and it does not affect the overall road capacity significantly. In the vertical profile design, attempts will be made to bring down these steeper gradients down to about 6% which is the specified minimum assumed.

95. **Embankments** - Roadway fill slopes will be designed as stable slopes of 1 in 1.5 which is suitable for the selected embankment material as well as for limited heights. Embankment heights do not exceed 3m as the road runs mostly on flat

terrain. Even in the rolling terrain, no high embankments are involved as the terrain is on the low rolling nature.

96. **Road safety** - Safety measures that will be taken in the detailed design can be summarized as follows:

- Cross Sectional Elements
  - More vulnerable type of traffic such as pedestrian, cycles, (both pedal cycles as well as motor cycles), farm tractors, etc. are segregated from the main traffic by providing them with a 2.5m wide hard shoulder. This hard shoulder will be demarcated by a 200 mm wide continuous pavement marking so that it can easily be distinguished from the normal 100mm wide marking.
  - Wider soft shoulders are proposed and these, while performing the function of providing better lateral support to the road pavement, can also offer useful refuge for the large trucks that require maneuvering in case of emergency.
  - Median barriers such as Double-sided Guard Rails (in rural environment) and New Jersey Barriers (in urban environment) are provided throughout the 4 lane sections of the road.
  - Median shoulders are provided to give minimum lateral clearance and space for sudden maneuvers for vehicles.

Figure 3-3: Cross Section – 2 Lane Road (Asphalt)

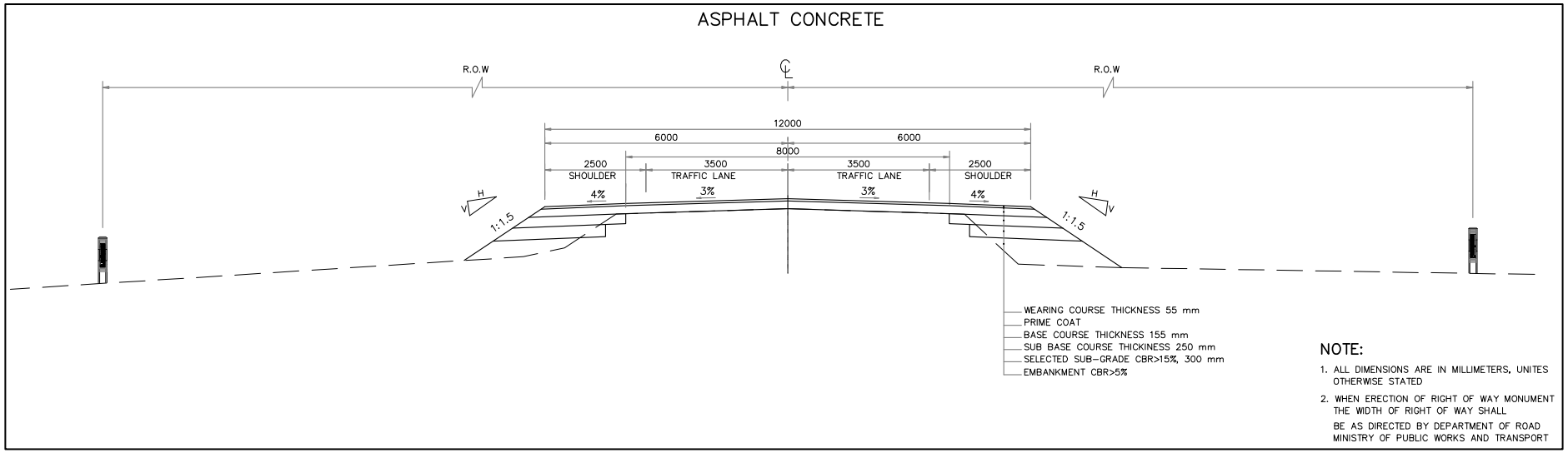


Figure 3-4: Cross Section – 2 Lane through Urban Areas (Asphalt)

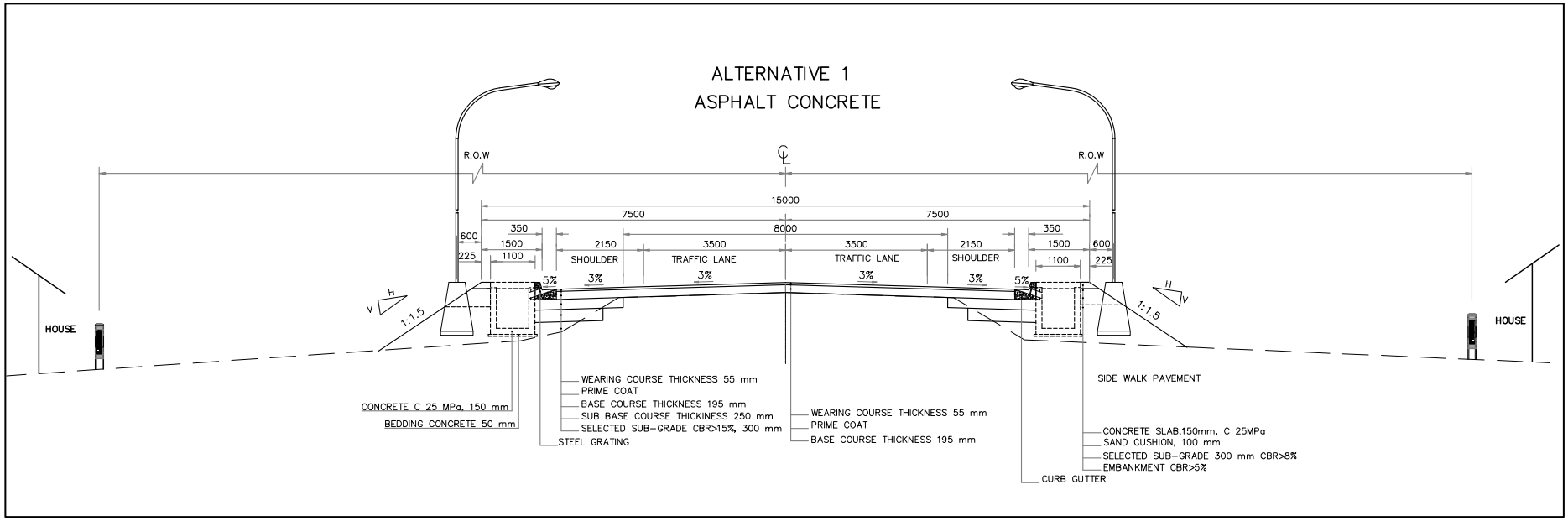


Figure 3-5: Cross Section – 4 Lane Road (Asphalt)

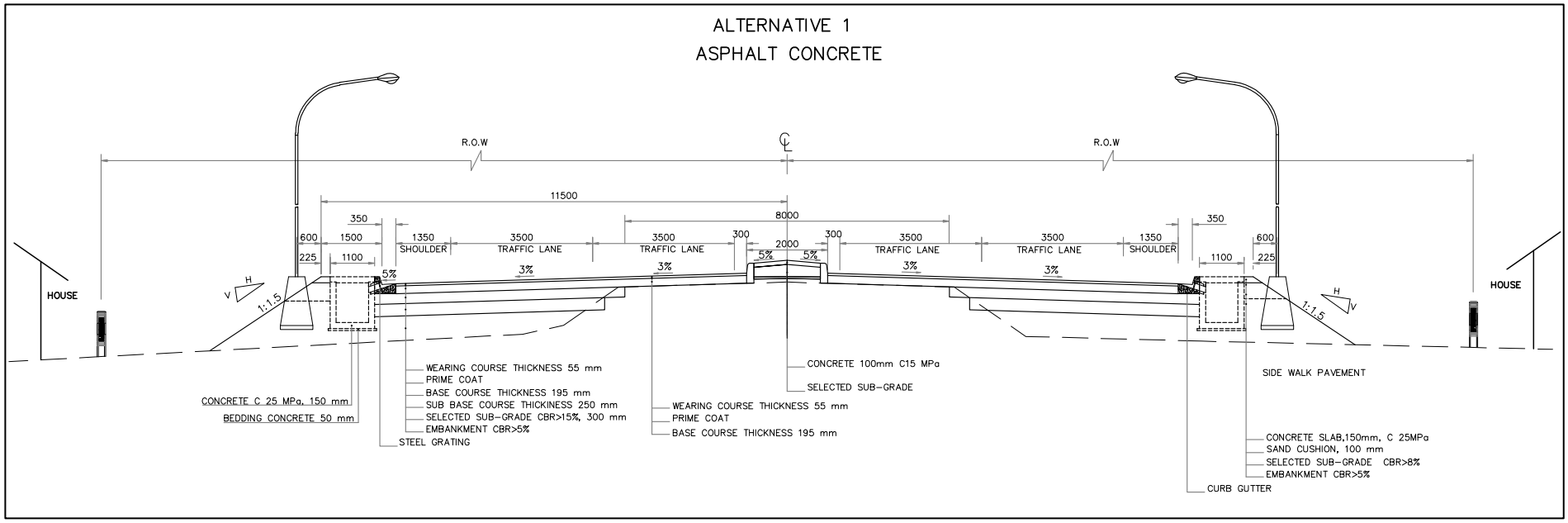
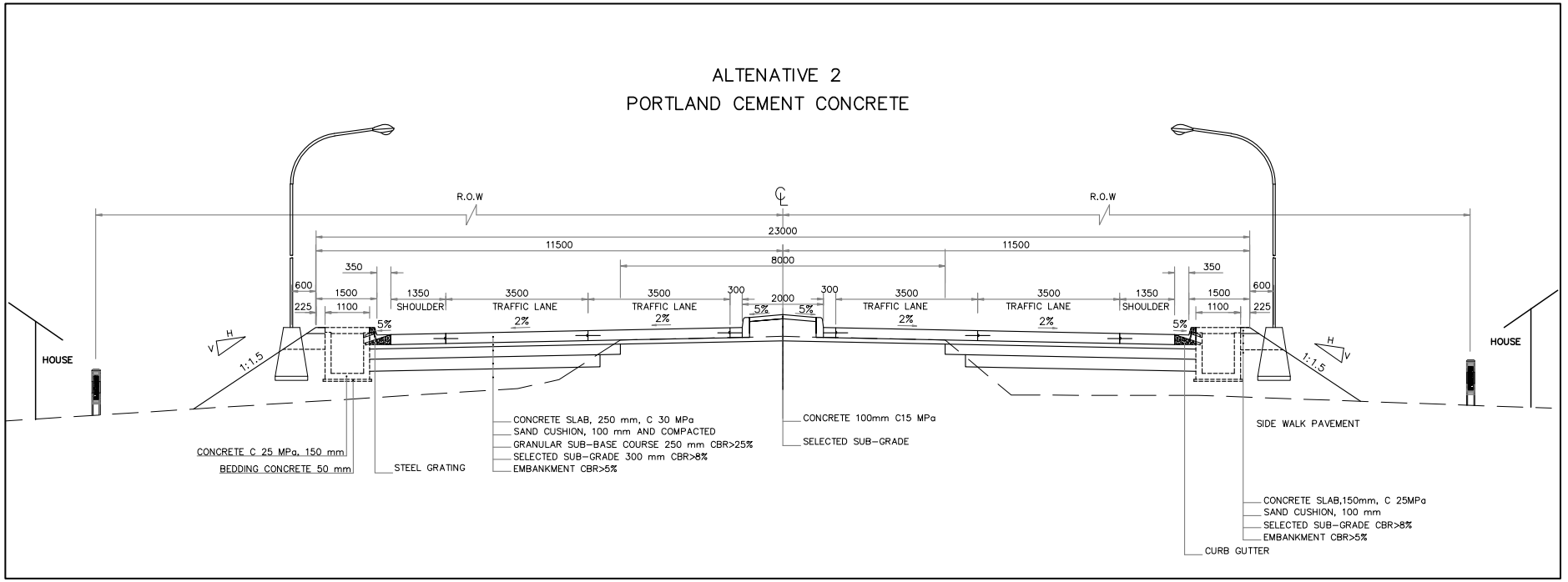


Figure 3-6: Cross Section – 4 Lane Road (Portland Cement Concrete)



- Traffic Signs and Marking
    - Entire road section is adequately signed with Traffic Signs as per MWPT Standards and advance warning signs are erected at all locations where there are changes in traffic conditions as well as hazardous conditions such as high embankment, narrowing of road etc.
    - Intersections are adequately marked indicating ghost islands, kerbed islands, transverse markings such as Give Way and STOP lines,
    - Pedestrian Crossings will be fitted with yellow road studs and be provided with Zig Zag Markings
    - Where parking needs to be banned, continuous yellow longitudinal markings are provided along the edge off setting them with the normal white pavement edge markings for easy identification and to demarcate these sections.
- Other features
    - Urban sections are adequately illuminated so that the extent of development and side friction, sudden maneuvers of parked vehicles can be detected in advance
    - Intersections in the rural sections of the road are illuminated so that the fast-moving traffic on the main road can see the intersection as well as vehicles coming on to the roads, from a distance.

97. Sight Distance is maintained as far as possible and adequate signage and pavement marking will be introduced where required sight distance cannot be achieved.

98. The main road safety benefits the project will deliver are the following:

- Reduced risk of vehicles leaving their lane to avoid potholes and surface deformations;
- Reduced risk of accidents due to road hazards, e.g. flooding;
- Improved sight distances due to improved vegetation control;
- Better separation between pedestrians and vehicles; and
- Better night driving conditions due to wider carriageway and improved pavement centerline markings.

99. Some of these advantages could be partially offset by the higher speeds, which will be possible after the road improvements.

100. A road safety audit will be undertaken upon completion of construction to determine whether the design has been properly translated and there is no inherent road safety defect has appeared in the works. Particular attention will be paid to design changes that have been made during construction.

101. During the first year of operation (This will coincide with the Defect Liability Period of the Construction Contract), a check will be kept on the number of personal injury accidents that occur, so that any serious problems can be identified and remedial work arranged quickly.

3.7.2 Pre-construction

102. During this phase of the Project typical activities will include:

- Site Clearing Works – The following works may occur:
  - Clearing and grubbing.
  - Demolition, removal and disposal of existing fences, structures/buildings or parts of structures or buildings.
  - Removal and disposal of traffic signs, signposts and their foundations.
  - Demolition, removal and disposal of existing culverts, inlet and outlet structures, headwalls, concrete drains, channel lining, and erosion protection works.
  - Removal of and any other natural or artificial objects within the ROW.
  - Backfilling and compacting cavities remaining after the removal of trees, stumps, or any other incidental works.
  - Removal and disposal of all vegetation and debris within the designated limits of the Right-of-Way.
  - Any other works incidental to demolition, tree cutting and site clearance.
- Removal of Trees.
- Relocation of Existing Services - The Works include the relocation of all services affecting the construction of the Project Road within the ROW. The services include the following:
  - Water mains.
  - Overhead electric supply lines.
  - Sewer mains.
- Site Specific Environmental and Social Management Plan (SSESMP) - During this period the Contractor should prepare his own SSESMP to conform to this ESIA and its ESMP. The SSESMP should ideally be completed with 30 days of the signing of the Contract to ensure that all ESMP measures are included within the Pre-construction phase.

3.7.3 Construction Phase

103. **Pavement –** The final decision on pavement types has yet to be determined. Two pavement types are proposed, asphalt concrete and Portland cement concrete (as shown in **Figures 3-3**, **3-4**, **3-5** and **3-6**).

104. **Bridges –** Seven bridges will be rehabilitated as part of the Project. **Table 3-4** provides a list of the bridges, their locations and lengths. **Figure 3-7** to **Figure 3-12** show the current status of the bridges.

Table 3-4: NR13 North Bridges

Serial No	Chainage	Proposed Type	Flow Direction	Name of Bridge & Proposed Length/Width	
1	6+900	1 Span	West to East	Houay Xailoun	18.7m / 8m
2	9+953	1 Span	West to East	Houay Xone	25m / 9m
3	19+205	1 Span	West to East	Nam Houm	23m / 9m
4	24+835	2 Span	West to East	Nam Souang	49.3m / 9m
5	43+841	1 Span	West to East	Nam Panai	26.9m / 9m
6	51+472	1 Span	West to East	Houay Thonh	21m / 9m
7	54+328	3 Span	West to East	Nam Cheng	72m / 9m

Figure 3-7: Bridge 1 - Houay Xailoun

Figure 3-8: Bridge 2 - Houay Xone

Figure 3-9: Bridge 4 – Nam Souang

Figure 3-10: Bridge 5 – Nam Panai

Figure 3-11: Bridge 6 – Houay Thonh

Figure 3-12: Bridge 7: Nam Cheng

105. The rehabilitation of the bridges may include the following works:

- Foundations.
- Substructure including bridge bearings.
- Superstructure, including construction of expansion and deformation joints and footpaths.
- Deck pavement including hydro isolation, drainage, hand railing, and conduits for services.
- Approach slabs.
- Slope treatments in front and around abutments.
- Construction and maintenance of traffic detours.

106. Bridges will be designed for the life expectancy of 75 years.

107. **Culverts -** Project works will include design and construction of cross drainage structures (culverts), including inlet and outlet structures and associated works. A schedule of culverts in included in **Appendix Y**. Cross drainage works may typically include:

- Replacement of existing culverts which are old, structurally deficient or undersized;
- Extension of existing culverts which are of adequate design and in good condition;
- Construction of new culverts at locations where no cross-drainage structure existed before;
- Cleaning of existing culverts which are partially or completely silted;
- Miscellaneous repair of the existing culvert joints, headwalls, wing walls, and scour and erosion protection works; and
- Construction of new scour protection and channel lining works.

108. **Other Drainage Structures -** Surface runoff from the carriageway and all other pavements, and embankment slopes should be discharged through longitudinal drains designed for adequate cross section, bed slopes, invert levels and the outfalls. The Works may include construction of the drainage system components in urban and rural areas.

109. **Earthworks –** Typical earthworks may include the following:

- Removal of topsoil.
- Construction of embankments.
- Construction of subgrade.
- Excavation and removal of the existing pavement materials and the existing road embankment.
- Removal and replacement of unsuitable materials.
- Structural excavation.
- Excavation for the construction of side drainage and cross-drainage works.
- Excavation for the removal and relocation of the existing utilities.
- All backfilling necessary for the construction of bridges, retaining walls or other earth retaining structures, cross drainage structures and associated works, side drains and erosion protection work.
- Preparation of beddings and filters for all structural, cross drainage, side drains or pavement works.
- Excavation, filling or backfilling necessary for the execution of any other incidental works.

110. **Intersections** – Ten Intersections will be constructed. **Table 3-5** provides details of the intersections and their locations.

Table 3-5: NR13 North Intersections

#	Location	Chainage	Remark
1	Ban Sikeut	0+058 R	Road to Dongdok (National University of Lao)
2	Ban Naxai	5+147 R	Road to Nakhoun noy and Thangon
3	Ban Naxai	6+615 R	Road to Thangon Bridge road No.10
4	Ban Nongkhankhou	10+950 R	Road to Ban Namkiang, Ban Nasab
5	Ban Phonmouang	22+430 R	Road to Ban Hong gnoua, Ban Sendin
6	Ban Nongsa	28+710 R	Road to Ban Tanpiao
7	Ban Nadi	31+650 R	Road to Lingxan
8	Ban Hongliuy	43+105 L	Road to Xangthong Distric
9	Ban Naphoneua	48+275 R	Road to Pakchang, Nam ngeuam bridge road No.10
10	Ban Namlin	56+685 L	Road to Phonhon education office, Ban Huay Poung

111. **Embankments** - There are no cases where high and steeper slopes have to be cut in widening the road. Even in cases where roadside slopes have to be cut, the cut slopes do not exceed 2 m and even in such cases are encountered in very short reaches only. As a safety measure, crash barriers will be installed in sections where embankment heights are higher. Advance warning signs will be posted to warn drivers of such sections. Fill slopes will also be turfed suitably to control erosion.

112. **Removal of Asphalt** – The existing pavement will be scarified, and where the material meets the required specification it will be compacted and re-used as sub-base material.

113. **Key Construction Equipment** - **Table 3-6** provides indicative lists of the key equipment required in the construction phase.

Table 3-6: Key Equipment

No.	Equipment Type and Characteristics	Minimum Number required
1	Bulldozer (>245HP)	4
2	Excavator (>100HP)	12

3	Crushing and screening plant – mobile type at least 150 m3/h including rock material washing machinery	2
4	Concrete Paving Machinery width not less than 9.0 m for 2-layer concrete placing including film-forming machinery	2
5	Small Concrete Paving Machinery width not more than 5.0 m including film-forming machinery	1
6	Front Loader (>135HP)	15
7	Concrete batching plant (>150m3/hr)	2
8	Motor grader (>135HP)	10
9	Vibratory roller (> 13T)	8
10	Tipper truck (10T)	30
11	Tipper truck (16T)	30
12	Mobile concrete carriers (>25T)	25
13	Transit mixer (>6m3)	6

114. **Permanent Ancillary Features -** The exact locations of bus stops have yet to be determined.

115. **Quarries & Borrow Pits –** Material used for road embankments and pavement layers will be procured from borrow pits. The material can be divided as soils, sands and silts, clay and gravel. Depending on the particular application in road works, the following characteristics of these materials are considered important in obtaining them in their naturally occurring form:

- Particle Size and Particle Size Distribution.
- Moisture Content.
- Consistency Limits.
- Compaction.
- Strength.

116. The Project DD Consultants have identified a number of borrow pits for NR13 North. **Figure 3-13** and **Figure 3-14** show the locations of the proposed borrow pits and **Table 3-7** provides details of the types of materials and their uses for each borrow pit list of the borrow pits including the type of material available, the borrow pit location, the estimated volume of material available in the borrow pit and the potential uses of the material, e.g. sub base, embankment material, etc.

Figure 3-13: Borrow Pit Locations

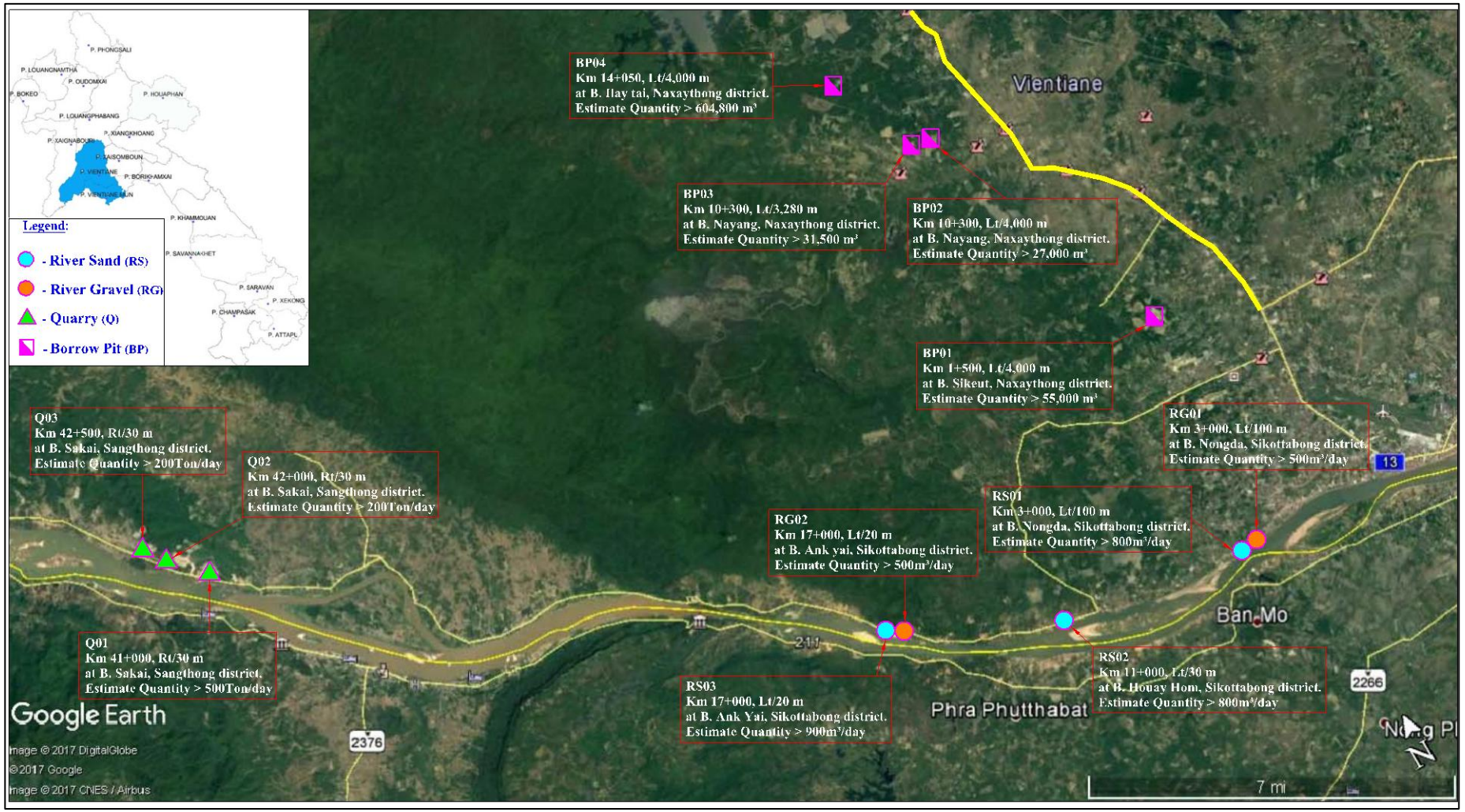


Table 3-14: Borrow Pit Locations

Table 3-7: Borrow Pit Quantities and Uses

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
BP01-S1	Clayey gravels	Km 1+500; Lt/4,000 m Sikeut junction to Phonhong Ban Sikeut	>55,000	A-6(1)	GC	Embankment and Sub grade.
BP01-S2	Clayey gravels	Km 1+500; Lt/4,000 m Sikeut junction to Phonhong Ban Sikeut	>55,000	A-2-6(0)	GC	Embankment and Sub grade
BP01-S3	Clayey gravels	Km 1+500; Lt/4,000 m Sikeut junction to Phonhong Ban Sikeut	>55,000	A-2-6(0)	GC	Embankment and Sub grade
BP02-S1	Clayey gravels	Km 10+300; Lt/4,000 m Sikeut junction to Phonhong Ban Nayang	>27,000	A-2-6(0)	GC	Embankment Sub grade and sub base
BP02-S2	Clayey gravels	Km 10+300; Lt/,4000 m Sikeut junction to Phonhong Ban Nayang	>27,000	A-2-6(0)	GC	Embankment Sub grade and Sub base
BP02-S3	Clayey gravels	Km 10+300; Lt/4,000 m Sikeut junction to Phonhong	>27,000	A-2-6(0)	GC	Embankment and Sub grade

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
		Ban Nayang				
BP03-S1	Clayey gravels	Km 10+300; Lt/3,000 m Sikeut junction to Phonhong Ban Nayang	>31,000	A-2-4(0)	GC	Embankment and Sub grade
BP03-S2	Clayey gravels	Km 10+300; Lt/3,280 m Sikeut junction to Phonhong Ban Nayang	>31,000	A-2-4(0)	GC	Embankment Sub grade and Sub base
BP03-S3	Clayey gravels	Km 10+300; Lt/3,280 m Sikeut junction to Phonhong Ban Nayang	>31,000	A-2-6(0)	GC	Embankment Sub grade and Sub base
BP04-S1	Clayey gravels	Km 14+050; Lt/4,000 m Sikeut junction to Phonhong Ban Ilai tai	>600,00	A-2-6(0)	GC	Embankment and Sub grade
BP04-S2	Clayey sands some gravels	Km 14+050; Lt/4,000 m Sikeut junction to Phonhong Ban Ilai tai	>600,000	A-2-6(0)	SC	Embankment Sub grade and Sub base

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
BP04-S3	Clayey gravels	Km 14+050; Lt/4,000 m Sikeut junction to Phonhong Ban Ilai tai	>600,000	A-2-4(0)	GC	Embankment Sub grade and Sub base
BP05-S1	Silty gravels	Km 17+800; Lt/8,200 m Sikeut junction to Phonhong Ban Phonkham	>144,000	A-2-4(0)	GM	Embankment Sub grade Sub base
BP05-S2	Silty gravels	Km 17+800; Lt/8,200 m Sikeut junction to Phonhong Ban Phonkham	>144,000	A-2-4(0)	GM	Embankment Sub grade and Sub base
BP05-S3	Clayey gravels	Km 17+800; Lt/8,200 m Sikeut junction to Phonhong Ban Phonkham	>144,000	A-2-4(1)	GC	Embankment and Sub grade
BP06-S1	Silty gravels	Km 38+700; Rt/2,000 m Sikeut junction to Phonhong Ban Nalao	>67,200	A-2-4(0)	GM	Embankment Sub grade and Sub base
BP06-S2	Silty gravels	Km 38+700; Rt/2,000 m Sikeut junction to Phonhong Ban Nalao	>67,200	A-1-a(1)	GM	Embankment Sub grade ,Sub base and Base course

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
BP06-S3	Silty gravels	Km 38+700; Rt/2,000 m Sikeut junction to Phonhong Ban Nalao	>67,200	A-1-a(0)	GM	Embankment Sub grade ,Sub base and Base course
BP07-S1	Clayey gravels	Km 45+621; Lt/1,500 m Sikeut junction to Phonhong Ban Vangmon	>96,000	A-2-6(0)	GC	Embankment Sub grade and Sub base
BP07-S2	Clayey sands some gravels	Km 45+621; Lt/1,500 m Sikeut junction to Phonhong Ban Vangmon	>96,000	A-2-6(0)	SC	Embankment and Sub grade
BP07-S3	Clayey gravels	Km 45+621; Lt/1,500 m Sikeut junction to Phonhong Ban Vangmon	>96,000	A-2-6(0)	GC	Embankment Sub grade and sub base
BP08-S1	Clayey gravels	Km 49+250; Lt/500 m Sikeut junction to Phonhong Ban PhonNgunh	>105,600	A-2-7(1)	GC	Embankment and Sub grade
BP08-S2	Clayey gravels	Km 49+250; Lt/500 m Sikeut junction to Phonhong Ban PhonNgunh	>105,600	A-2-7(2)	GC	Embankment and Sub grade

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
BP08-S3	Clayey gravels	Km 49+250; Lt/500 m Sikeut junction to Phonhong Ban PhonNgunh	>105,600	A-7-6(6)	GC	Embankment Sub grade and Sub base
BP09-S1	Clayey gravels	Km 54+800; Rt/2,500 m Sikeut junction to Phonhong Ban Nam cheng	>129,600	A-2-7(0)	GC	Embankment Sub grade and sub base
BP09-S2	Clayey gravels	Km 54+800; Rt/2,500 m Sikeut junction to Phonhong Ban Nam cheng	>129,600	A-7-6(2)	GC	Embankment Sub grade and sub base
BP09-S3	Clayey gravels	Km 54+800; Rt/2,500 m Sikeut junction to Phonhong Ban Nam cheng	>129,600	A-2-6(0)	GC	Embankment Sub grade and sub base
BP10-S1	Clayey gravels	Km 55+508; Lt/1,000 m Sikeut junction to Phonhong Ban Phonsi tai	>102,600	A-2-7(0)	GC	Embankment Sub grade and sub base
BP10-S2	Clayey gravels	Km 55+508; Lt/1,000 m Sikeut junction to Phonhong Ban Phonsi tai	>102,600	A-2-6(0)	GC	Embankment and Sub grade

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
BP10-S3	Clayey gravels	Km 55+508; Lt/1,000 m Sikeut junction to Phonhong Ban Phonsi tai	>102,600	A-2-6(0)	GC	Embankment Sub grade and sub base
BP11-S1	Clayey gravels	Km 56+200; Lt/100 m Sikeut junction to Phonhong Ban Phonsi tai	>70,000	A-2-6(0)	GC	Embankment Sub grade and sub base
BP11-S2	Clayey gravels	Km 56+200; Lt/100 m Sikeut junction to Phonhong Ban Phonsi tai	>70,000	A-2-4(0)	GC	Embankment Sub grade and sub base
BP11-S3	Clayey gravels	Km 56+200; Lt/100 m Sikeut junction to Phonhong Ban Phonsi tai	>70,000	A-2-6(0)	GC	Embankment Sub grade and sub base
BP12-S1	Clayey gravels	Km 57+300; Rt /7,000 m Sikeut junction to Phonhong Ban Phonsi tai	>100,800	A-2-6(0)	GC	Embankment Sub grade and sub base
BP12-S2	Clayey gravels	Km 57+300; Rt/7,000 m Sikeut junction to Phonhong Ban Phonsi tai	>100,800	A-7-6(4)	GC	Embankment and Sub grade

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
BP12-S3	Clayey gravels	Km 57+300; Rt/7,000 m Sikeut junction to Phonhong Ban Phonsi tai	>100,800	A-7-6(4)	GC	Embankment and Sub grade
RG01-S1	Well graded gravels and gravel sands mixture.	Km 3+000; Lt/100 m Tadthong to Sangthong District	500 m^3/day	A-1-a(1)	GW	Sub base, Base course and concrete Work
RG02-S1	Well graded gravels and gravel sands mixture.	Km 17+000; Lt/20 m Tadthong to Sangthong District	500 m^3/day	A-1-a(1)	GW	Sub base, Base course and concrete Work
RG03-S1	Well graded gravels and gravel sands mixture.	Km 28+650; Rt/7,000 m (Seno to Pakse)	300 m^3/day	A-1-a(1)	GW	Sub base, Base course and concrete Work
RG04-S1	Well graded gravels and gravel sands mixture.	Km 31+625; Rt/10,000 m Sikeut juntion to Phonhong Ban Linxan	300 m^3/day	A-1-a(1)	GW	Sub base, Base course and concrete Work

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
RG05-S1	Well graded gravels and gravel sands mixture.	Km 75+000; Rt/9,000 m Phonhong to HinHeup Ban That	250 m^3/day	A-1-a(1)	GW	Sub base, Base course and concrete Work
RG06-S1	Well graded gravels and gravel sands mixture.	Km 57+300; Rt/16,000 m Phonhong to Viengkham District Ban Nanin	300 m^3/day	A-1-a(1)	GW	Sub base, Base course and concrete Work
RG07-S1	Well graded gravels and gravel sands mixture.	Km 57+300; Rt/24,000 m Phonhong to Viengkham District Ban Donekuad)	300 m^3/day	A-1-a(1)	GW	Sub base, Base course and concrete Work
RG08-S1	Well graded gravels and gravel sands mixture.	Km 57+300; Rt/27,000 m Phonhong to Viengkham district Ban Donekuad)	300 m^3	A-1-a(0)	GW	Sub base, Base course and concrete Work
RS01-S1	Poorly graded sand and gravelly sands	Km 3+00; Lt/100 m Tad thong to Sangthong District	800 m^3/day	A-1-b(1)	SP	Sub base, Base course and concrete Work

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
RS02-S1	Poorly graded sand and gravelly sands	Km 11+000; Lt/30 m Tadthong to Sangthong District(Ban houay hom)	800 m^3/day	A-3(1)	SP	Sub base, Base course and concrete Work
RS03-S1	Poorly graded sands trace gravels	Km 17+000; Lt/30 m Tadthong to Sangthong District(Ban Ang yai)	900 m^3/day	A-3(1)	SP	Sub base, Base course and concrete Work
RS04-S1	Poorly graded sands and gravelly sands.	Km 28+650; Rt/7,000 m Sikeut to Phonhong District(Ban Hatsiao)	200 m^3/day	A-1-b(1)	SP	Sub base, Base course and concrete Work
RS05-S1	Well graded sands and gravelly sands.	Km 31+625; Rt/10,000 m Sikeut juntion to Phonhong Ban Linxan	200 m^3/day	A-1-b(1)	SW	Sub base, Base course and concrete Work
RS06-S1	Poorly graded sands and gravelly sands.	Km 75+000; Rt/9,000 m Sikeut juntion to Phonhong Ban That	200 m^3/day	A-1-b(1)	SP	Sub base, Base course and concrete Work
RS07-S1	Poorly graded sands and gravelly sands.	Km 57+300; Rt/16,000 m Phonhong to Viengkham District Ban Nanin	200 m^3/day	A-2-4(1)	SP	Sub base, Base course and concrete Work

#	Type of Material	Location	Estimated Quantity (m^3)	Soil Classification		Potential Uses
				AASHTO M-145	United	
RS08-S1	Poorly graded sands and gravelly sands.	Km 57+300; Rt/24,000 m Phonhong to Viengkham District Ban Donekuad	200 m^3/day	A-2-4(1)	SP	Sub base, Base course and concrete Work
RS9-S1	Poorly graded sands and gravelly sands.	Km 57+300; Rt/27,000 m Phonhong to Viengkham District Ban Donekuad	200 m^3/day	A-3(1)	SP	Sub base, Base course and concrete Work
Q01-S1	Crushed Rhyolite	Km 41+000; Rt/30 m First Nay Company Tad thong to Sangthong District	500 ton/day	-	-	Sub base, Base course and concrete Work
Q02-S1	Crushed Rhyolite	Km 42+500; Rt/30 m Bounmy Company Tad thong to Sangthong District	200 ton/day	-	-	Sub base, Base course and concrete Work
Q03-S1	Crushed Rhyolite	Km 42+000; Rt/30 m Lao souk Company Tad thong to Sangthong District	200 ton/day	-	-	Sub base, Base course and concrete Work

117. **Asphalt Plants -** The Contractor will be responsible for ensuring the asphalt facilities comply with the ESMP and that all necessary permits to operate are obtained from the local authorities. It is assumed that the Contractor will operate his own asphalt plant with his own plant.

118. **Water -** The locations of the extraction points for non-potable water have yet to be determined, although they should be approved by the Engineer prior to the start of

extraction. Potable water will also need to be sourced for construction camps, the requirements of which are discussed as part of the Projects ESMP.

119. **Construction Camps -** Camp sites will be selected keeping in view the availability of an adequate area for establishing campsites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Final locations will be selected by the Contractor after the approval from the Engineer. Environmental impacts of construction camps and proposed mitigation measures are discussed in **Section 5**.

120. The area requirement for construction camps will depend upon the workforce deployed and the type and quantity of machinery mobilized. In view of the area required, it will not be possible to locate campsites within the ROW and the contractors will have to acquire land on lease from private landowners. The construction camp will have facilities for site offices, workshop and storage yard, and other related facilities including fuel storage. The Contractor will provide the following basic facilities in the construction camps:

- Safe and reliable water supply.
- Hygienic sanitary facilities and sewerage system.
- Treatment facilities for sewerage of toilet and domestic wastes
- Storm water drainage facilities.
- Sickbay and first aid facilities.

121. Detailed criteria for siting of construction camps and establishment of facilities are given in the ESMP.

122. **Storage Areas -** Temporary storage areas will be required for certain activities, such as the storage of sand and gravels and construction equipment. These storage areas may range in size from anything between 50 m^2 to more than a hectare. The precise locations of these temporary facilities is not known at this stage, as such mitigation measures will be prepared to ensure that these areas are sited in approved locations.

3.8 Analysis of Alternatives

3.8.1 The No Action Alternative

123. The "No Action" Alternative in this instance is defined as a decision not to undertake the proposed construction of the Project Road. The "No Action" Alternative would result in the continued deterioration of the road, bridges and drainage structures along the ROW, thereby impeding the economic development of the Project Area and the region. All positive benefits would be foregone. The relatively minor, less than significant environmental impacts (such as noise and short-term air quality impacts due to maintenance activities) and inconveniences (such as traffic diversions) would be avoided in the short-run. In the long run, however, the steadily declining state of the roadway would severely hamper economic development in the area. In light of these considerations, the "No Action" Alternative is

deemed to be neither prudent nor in the best interest of Lao PDR or those with an interest in, and attempting to assist restoration of, Lao PDR's well-being.

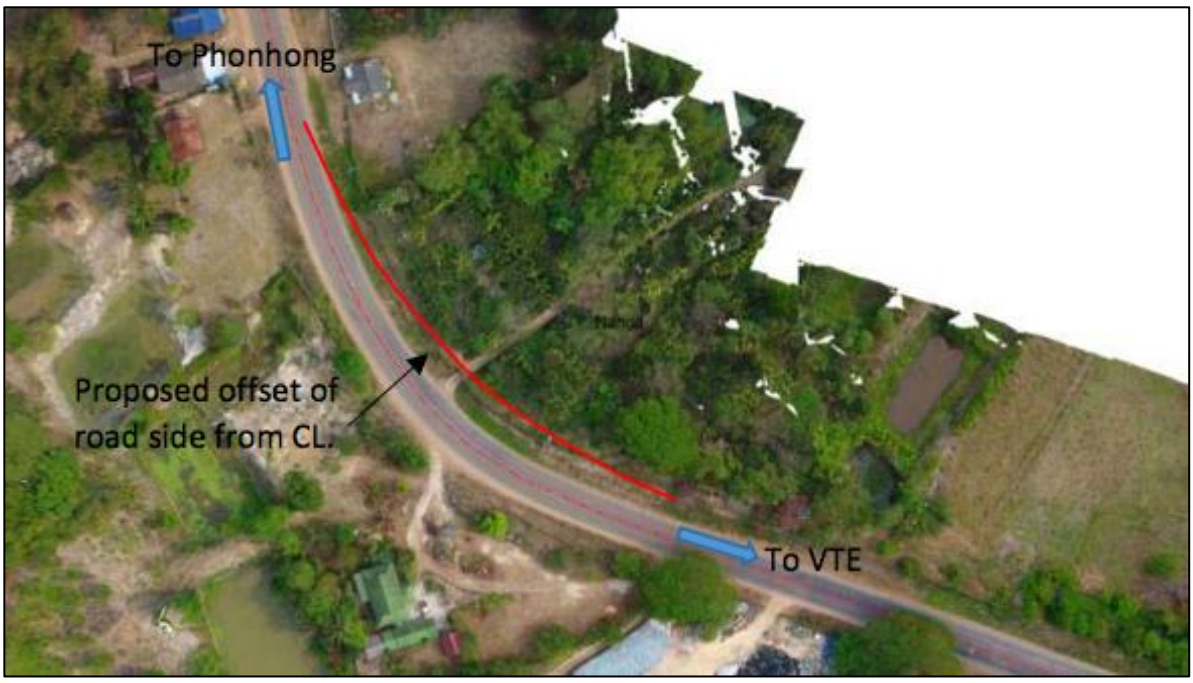
3.8.2 Alignment / Corridor Alternatives

124. All rehabilitation works will take place within the ROW and according to the Project FS the policy is to adhere to the existing alignment as much as possible. As such no alternative corridors have been proposed for the Project or are assessed in this ESIA.

125. Two bypasses were initially discussed as part of the Project FS, one is on km 52 at Ha Sip Song (4.2 km long) and the other is in Phonhong (2.4 km long). The bypasses were contemplated to avoid impact heavy roadside development. However, no further investigations on these bypasses were conducted as it was beyond the scope of ToR of the FS and as such no further investigation of these alternatives has been undertaken for the ESIA.

126. The detailed design consultant has proposed minor alignment changes during the detailed design (DD) phase, notably the re- adjustment of curve at Ban NaNga **(**km 25+570). The existing curve is very sharp (see **Figure 3-15**) and has a poor design with many accidents recorded here.

Figure 3-15: Proposed Road Re-alignment, Ban NaNga



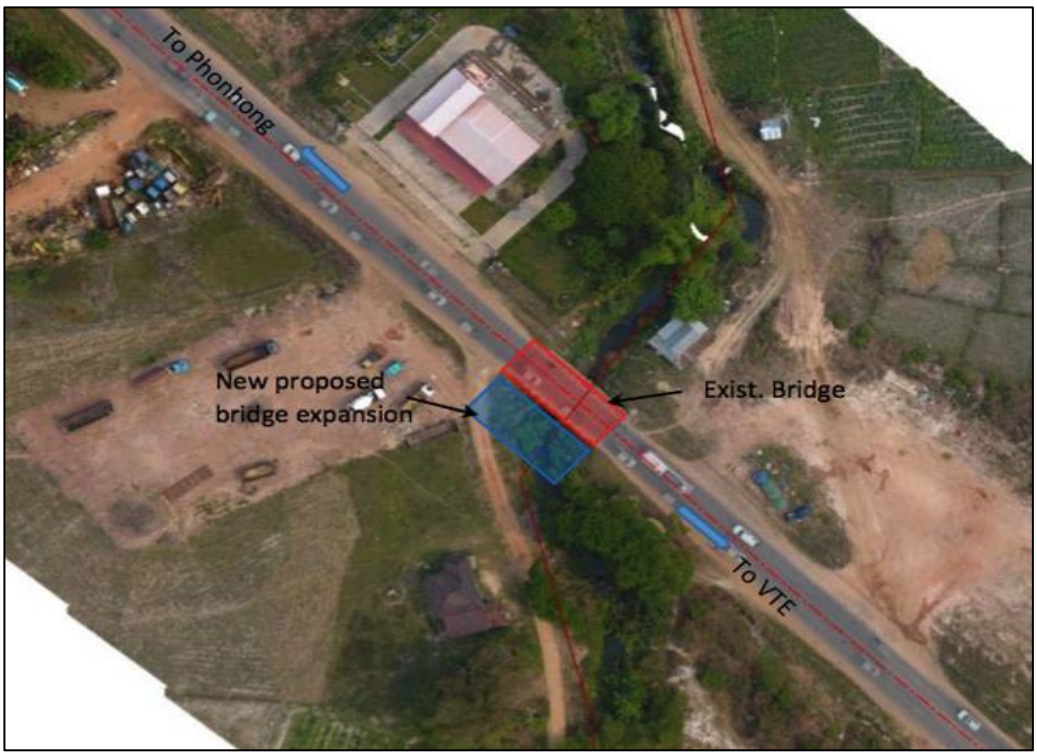
3.8.3 Alternative Bridge Locations

127. The DD Consultants, representatives of the DoR and member of ESIA team visited three bridges in August 2017. The purpose of the visit was to review the alternative locations of the bridges by the DD Consultants and to ensure that there were no significant environmental and social issues arising from these alternatives. All three bridges are located

in the section of the road that will be widened to four lanes, as such widening of the existing bridges or construction of a new parallel bridge will be required. The following summarizes the findings of the inspections.

Name	**Houay Xailoun**
Location	Naxaythong Nua village, Km 6+975
Existing Bridge	18m span concrete structure with a pedestrian lane on right side
Visual assessment	The area is sparsely built up, with empty land on the right side of the bridge with paddy field.
Recommendation	Because there is a house on the right side of the road past the bridge, it is recommended to expand the bridge on the left side to minimize the impact on the structure (**Figure 3.16**). A distance of 200m from each end of the bridge will be required to gradually and safely bring the change in alignment at the bridge location back to the existing road alignment. A shorter distance will create a deviation in the road alignment that is too sharp and that would be dangerous to traffic. The land between the existing alignment and the new alignment for 200m from each end of the bridge will have to be acquired by the Project.

Figure 3-16: Proposed Bridge Expansion Location, Houay Xailoun



Name	Houay Xone
Location	Houakhua village, Km 9+953
Bridge length	25m span concrete structure with a pedestrian lane on the right side
Visual assessment	This area has a dense population with many houses built along both sides of the road, but the right side is less dense.
Option 1	Keep the center line of the old bridge, and expand the bridge on both sides equally as shown in **Figure 3-17**. This option would require the construction of a temporary bypass road during bridge construction, because the existing bridge will be totally demolished to make way for the new bridge construction. All the traffic will have to use the bypass road during construction.
Option 2	Shift the center line to the right side as shown in **Figure 3-18**. This option will have a potential impact on houses and shops located on the right side of the road, but it will not require a bypass road during construction. The existing bridge will be used for road traffic while the right side of the new bridge is under construction; then, when first new bridge section has been completed, the old bridge will be removed and the left side section of the new bridge will be constructed. Land acquisition for a distance of 150m from each end of the new bridge will be required to gradually and safety bring the change in road alignment at the bridge back to the existing road alignment. A shorter distance would create a deviation in the road centerline that is too sharp and dangerous to traffic. The land between the existing and new road alignments extending for 150m from either end of the bridge would have to be acquired by the project.
Recommendation	Option 2 presents a more economical alternative at a cost of USD 371,680 when compared to Option 1 at a cost of USD 560,272.

Figure 3-17: Proposed Bridge Expansion Location, Option 1, Houay Xone

Figure 3-18: Proposed Bridge Expansion Location, Option 2, Houay Xone

Name	Nam Houm
Location	Songpuay-Nua village, Km 19+200
Bridge length	25m span concrete structure with a pedestrian lane on right side
Visual assessment	This section is populated with houses/shops along the road.
Recommendation	Expansion of the bridge of the left-hand side will be more economical because there are fewer built structures on this side of the road (**Figure 3-19**), within 200m from south end and 150m for North end of the bridge. These distances will be required to gradually and safely bring the change in alignment at the bridge location back to the existing road alignment. A shorter distance will create a deviation that is too sharp which will be hazardous to traffic. The land between the existing and 350m new alignment will have to be acquired by the project.

Figure 3-19: Proposed Bridge Expansion Location, Nam Houm

3.8.4 Alternative Pavement Types

128. A review of alternative pavement types is still on-going by the DD Consultants.

4. BASELINE DATA

4.1 General

130. This portion of the report will clearly identify the study area, i.e. the project area of influence, including the whole stretch of each road, and within certain radius of the road and ancillary facilities such as borrow pits, disposal sites for construction wastes, access roads; assemble the existing data, evaluate and present baseline data on the relevant environmental characteristics of the study area including the physical, biological, cultural property and socio-economic conditions.

131. Accordingly, this section of the report discusses the existing environmental and social conditions within the Project corridor of the Roads under the following headings:

- Physical Resources, including:
  - Geology
  - Topography
  - Soils
  - Climate & Climate Change
  - Air Quality
  - Hydrology
  - Natural Hazards
- Biological Resources, including:
  - Flora
  - Fauna
  - Endemic Species
  - Endangered Species
  - Protected Areas and Important Bird Areas
- Socio-Economic Resources, including:
  - Demographics
  - Vulnerable Persons
  - Economic Conditions

- Infrastructure
- Land Use
- Waste Management
- Health and Safety
- Education and Educational Facilities
- Cultural Resources
- Noise

4.2 Overview

132. Lao PDR is one of the least developed countries in Southeast Asia and lies in the Indo-Burma Biodiversity hotspot. The country has considerable natural resources in forests, water resources, and minerals and these are significant for cultural development, environment protection, and economic development. Its forests cover about 40% of the country, the highest percentage in Southeast Asia, but the total area of forest has declined dramatically from 70% of the land area of 26.5 million hectares (ha) in 1940, to 49% in 1982, and to only 40% or about 9.5 million ha in 2010. Data on changes in forest cover suggest that during the 1990s the annual loss of forest cover was around 1.4% annually, giving an average annual loss of forest cover of about 134,000ha. Efforts are being made to strengthen effectiveness of forest management including conservation of natural resources.

Figure 4-1: Physiogeographic Regions of Lao PDR

133. Lao PDR can be divided into three physiographic units with differing agro-climatic characteristics: The Northern Highlands, the Annamite Range (known as Saiphou Louang in Lao PDR) and the Mekong Plain. These physiographic units are shown in **Figure 4-1**.

134. The Mekong Plain is the river plain along the Mekong and its larger tributaries. This region has a tropical monsoon climate similar to the Annamite Range but with varying rainfall. The Mekong Plain has flat upper levees with recent alluvial deposits that are acidic

and willow. The younger alluvial soils of the floodplain are fertile but are often subject to wet season inundation. The Project road is located in this region of Lao PDR.

4.3 Physical Resources

4.3.1 Geology & Soils

135. The geological structure of the project area is under the Khorat Plateau, which is mainly a Mesozoic group to Paleogene system. NR13 North is based mainly on Vientiane formation consisting gravel, sandy Kaolinite and laterite soil types. The geology map of the project area is attached in **Appendix F**. The Project Area is generally flat with recent alluvial deposits which are acidic and willow. The younger alluvial soils are fertile but are often subject to wet season inundation.

4.3.2 Topography

136. The topography of the Project road ranges from 170 meters above mean sea level to a maximum of 205 meters above mean sea level. **Appendix G** provides a topographical map of the Project area. **Figure 4-2** indicates the road elevation at specific chainages along the corridor and **Table 4-1** indicates the road elevations at specific villages along the Project corridor.

Figure 4-2: Project Road Elevations

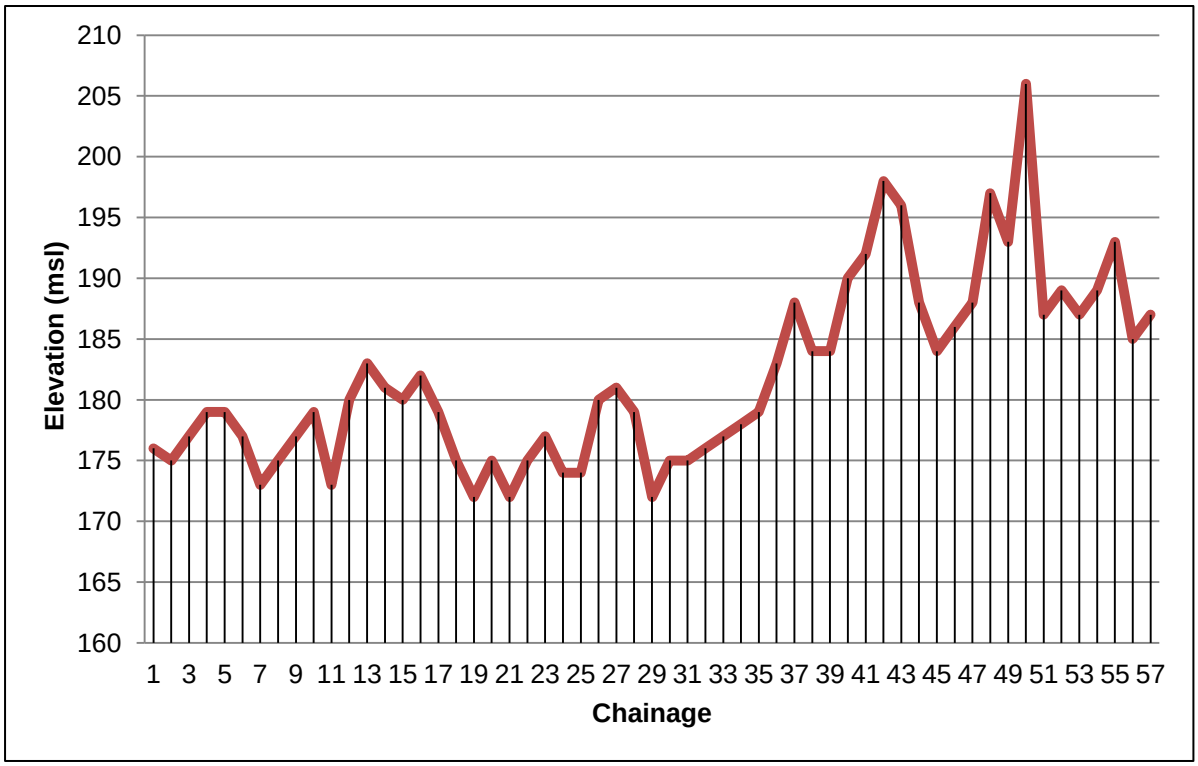


Table 4-1: Project Road Elevations

#	Location	Chainage	Elevation (meters above sea level)
1	Sikeut	Km 0	174
2	Phonmouang	Km 22	178
3	Boua	Km 28	177
4	Nadi	Km 32	175
5	Phonsavang	Km 49	193
6	Nam Cheang	Km 55	199
7	Phonhong	Km 56	179

4.3.3 Climate & Climate Change

137. Regional Climate - The climate in Lao PDR is seasonally tropical, with a pronounced wet and dry season. The lowest levels of mean annual rainfall are about 1,300 mm in the northwest, while the highest levels are well above 4,000 mm in the southern Annamite range. The majority of the lowlands experience between 1,500–2,000 mm of rainfall annually. This amounts to 90.9% of the total rainfall in the rainy season (from May to October) and 9.1% of the rainfall in the dry season (from November to April).

138. The local temperatures in Lao PDR are very different depending on the latitude and the elevation, with warmer temperatures in the south and in the lowlands and cooler temperatures in the north and in the mountains. Especially during the hot season from about March to May each year, the maximum temperatures in the lowlands can sometimes exceed 40°C, and during the cold season from about November to February each year the minimum temperatures in the northern mountains can approach 0°C.

139. Climate in the Project Area – The Project area is in the Vientiane plain, a floodplain area bordering the Mekong River, and it features a tropical savanna climate with distinct wet season and dry seasons. The dry season usually starts late in October or very early in November and runs through the end of March or later. The wet season is characterized by a bi-modal monsoon, with the first monsoon usually starting in April or May and lasting well into June, and the second monsoon starting about mid-July and lasting into October, with several weeks of low rainfall in between. However, some years the first monsoon can be very weak or virtually disappear (possibly affected by a strong El Nino), and the total rainfall during a very wet year can be nearly double the total rainfall during a very dry year. For example, Mekong River Commission records show that Vientiane received only a little more than 1.0 m of rain during a very dry year in 1991 and in excess of 2.1 m during a very wet year in 1999.

140. Laos, including the Project area, is subject to occasional tropical depressions that typically start out as tropical storms or typhoons in the western Pacific Ocean or the South China Sea, and then move westward across the coast of Vietnam and into Laos; and less frequently, tropical depressions moving northeast from the Bay of Bengal also can affect Laos. These storms frequently deliver torrential rains that can last for several days, and can

result in flash floods and lead to landslides in mountainous areas. While the rainfall can be very heavy, the winds are rarely at typhoon strength after a storm crosses the Annamite Mountains and enters Laos. During a typical year, about 1-4 of these tropical depressions may reach Vientiane, usually between June and December.

141. The Project area tends to be hot and humid throughout much of the year, with the lowest temperatures generally occurring between November and February and the hottest temperatures between March and May.

142. **Figure 4-3** and **Figure 4-4** show average precipitation levels over the last 30 years for Phonhong and Wattay International Airport in Vientiane (approximately 4km south of Sikeut Junction). Mean daily maximum and minimum temperatures are also recorded. Wind roses from Wattay International Airport are provided in **Appendix H**. The wind rose shows that the predominant winds are from the east / north east.

Figure 4-3: Precipitation and Temperature, Wattay International Airport, Vientiane

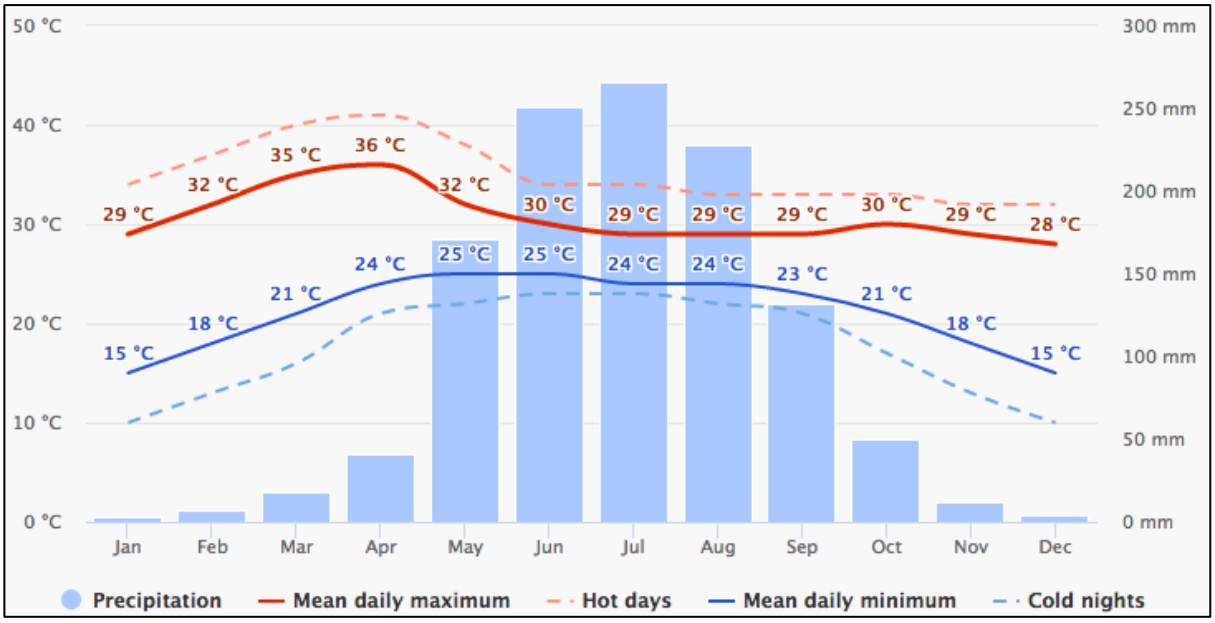
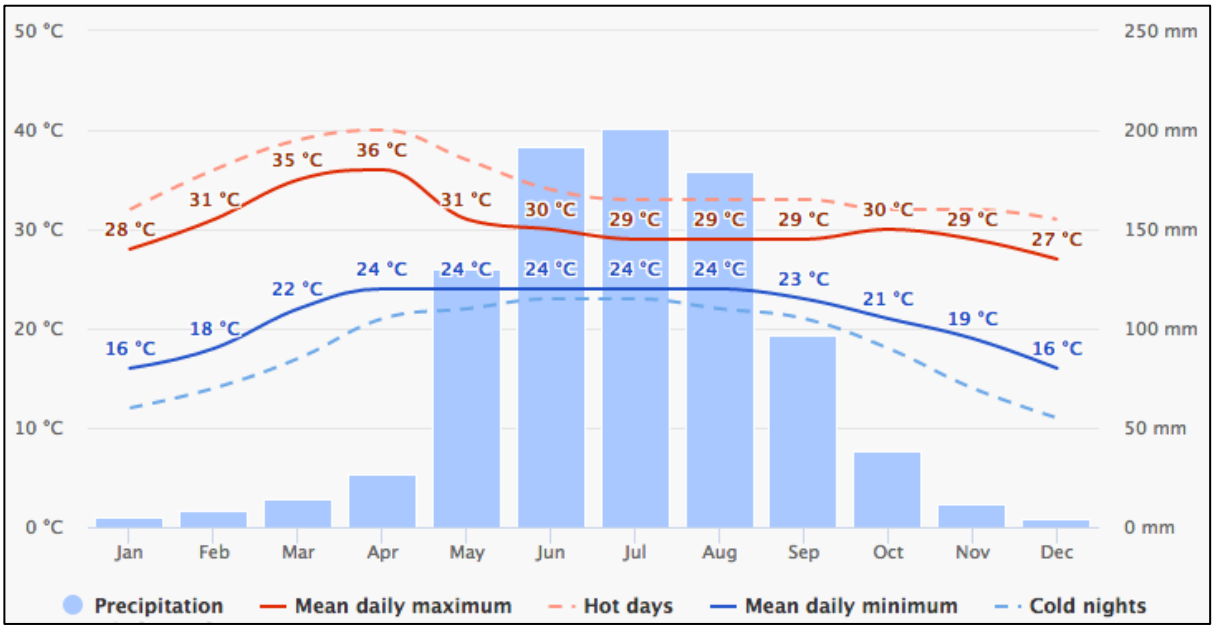


Figure 4-4: Precipitation and Temperature, Phonhong



143. Climate Change – Lao PDR is one of the world's most vulnerable countries to climate change because of high socioeconomic dependence on climate-sensitive sectors, such as agriculture and water resources. The southwest monsoon, which is a key determinant of rainfall in South and Southeast Asia, including the Lao PDR, is expected to both intensify and become more variable between years. The retreat of Tibetan glaciers and snowfields is expected to have a significant downstream effect on the Mekong River's flow regime. Recent hydrological modelling prepared by the Mekong River Commission suggests that flow may be reduced to 30% over the next 50 years. If confirmed, this will have significant implications for the transport sector, especially on design standards for new and upgraded roads to cope with changes in rainfall intensity, associated flooding, and slope stability. Urban roads and drainage infrastructure will also be affected.[7]

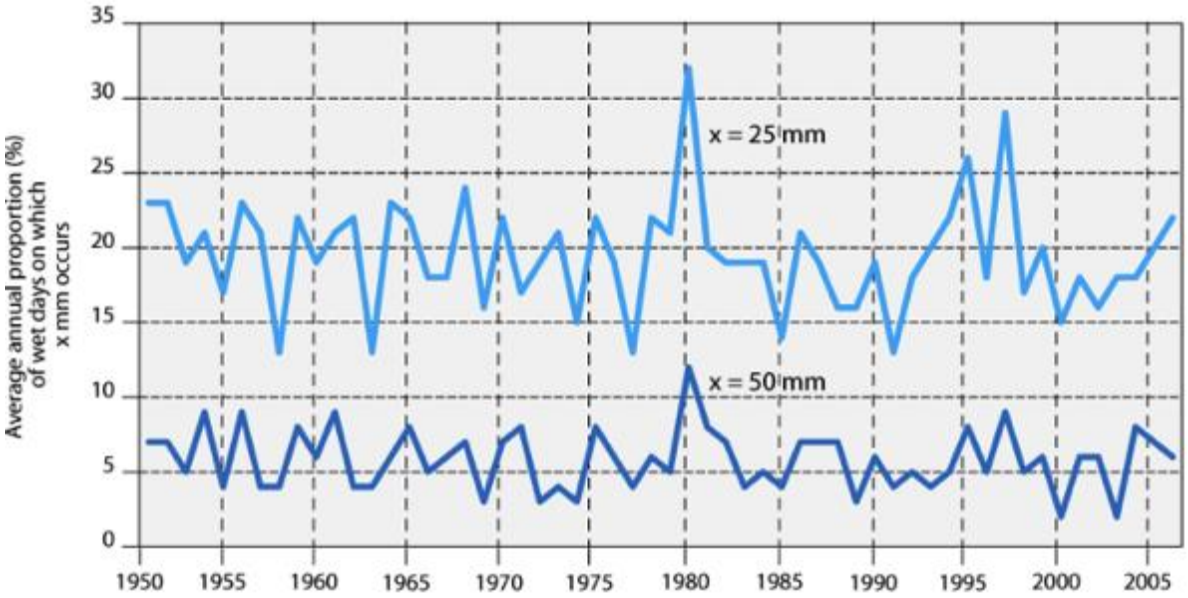
144. The Government recognizes the strong link between economic development, sustainability, and the need to mainstream environmental considerations including incorporating action on climate change into its development plans and efforts are being made to raise additional financing both from the public and private sectors. A Climate Change and Disaster Law is currently being developed with expected approval in 2017. The National Strategy on Climate Change (NSCC) was approved in early 2010, and climate change action plans for the period 2013-2020 have been prepared for key sectors, including transport. It is expected that the financial needs for implementing the mitigation and adaptation policies and actions identified in the NSCC would be about US$ 2.4 billion.

145. According to the recent (USAID)-funded Mekong Adaptation and Resilience to Climate Change Project, precipitation levels around Vientiane could increase as much as

[7] Lao Peoples Democratic Republic - Transport Sector Assessment, Strategy and Road Map. ADB, 2011

10%. Figures in **Appendix I** illustrates this point with projections to 2050. However, data from 1951-2006 prepared by the Mekong River Commission stated that 'There is no evidence to suggest that the incidence of intense storm days is increasing in line with some of the projected impacts of global warming, as the representative regional plot for the data at Vientiane confirms' (see **Figure 4-5**).

Figure 4-5: Vientiane (1951 – 2006) – percentage of wet days on which more than 25 and 50 mm of rain were observed [8]



146. Another report funded by the World Bank indicated that the mean annual temperatures in Lao PDR are projected to increase by 1.4°C to 4.3°C by 2100, with similar projected rates of warming for all seasons. This report also stated that other studies indicate similar warming is likely to occur across all regions, while others suggest that the country's southern climatic zone will experience smaller warming than the northern and north central zones. [9] The report also states that there may be an increased incidence of flooding within the Mekong Basin.

4.3.4 Air Quality

147. General - No large industrial facilities were noted within the Project corridor that may be a source of significant air emissions. Numerous light industrial properties line the corridor and may produce low levels of localized emissions, such as vehicle repair works shops. In addition, there large number of road side restaurants within the corridor that use wood and

[8] Annual Mekong Flood Report. Mekong River Commission, 2010

[9] Vulnerability, Risk Reduction, and Adaptation to Climate Change – Lao PDR. World Bank, GFDRR, Climate Investment Fund. 2011.

charcoal as cooking fuel, thereby producing an element of air pollution. Dust is currently the most significant air quality pollutant within the corridor, especially during the dry season. The unpaved road shoulders and access roads that feed on to NR13 North are all a source of dust as vehicle move to and from these areas. In addition, two portions of the Project road are also currently unpaved (see **Figure 4-6**). This is currently resulting in extremely high levels of dust in these areas which are coating residential and commercial properties as well as roadside vegetation.

Figure 4-6: Unpaved Section of Road – KM3, June 2017

148. Ambient Air Quality – Ambient air quality monitoring was carried out at five different locations during July 2017 to characterize the current air quality within the Project corridor.[10] Weather data was collected using a portable weather meter during the duration of particulate matter sampling. A description of sampling locations and the rationale of selection is given in **Table 4-2** and **Appendix J** provides the results in full along with photographs of the monitoring activity and the monitoring dates, times and climatic conditions. **Figure 4-7** provides a map indicating the approximate sampling locations. The

[10] The unpaved dusty road section shown in **Figure 4-5** was only identified after the monitoring had been completed and as such no results were available from these areas. Needless to say, the current levels of particulate matter in this section are assumed to be much higher than national or international standards.

ambient air quality data was compared against applicable Lao PDR Standards and WHO Ambient Air Quality guidelines or other internationally recognized sources

Table 4-2: Ambient Air Quality Monitoring Locations

Sample ID	Coordinates	Location	Rationale for Site Selection
A1	18° 2'21.53"N 102°32'49.48"E	Sikeut, Naxaithong District	Urban location, including sensitive receptors.
A2	18° 4'22.52"N 102°32'3.12"E	Naxaithong-Tai, Naxaithong District	Urban location, including sensitive receptors.
A3	18° 9'27.26"N 102°30'4.00"E	Karngsan, Naxaithong District	Urban location, including sensitive receptors.
A4	18°21'13.97"N 102°25'29.16"E	Lak 52, Phonhong District	Urban location, including sensitive receptors.
A5	18°29'35.88"N 102°24'48.13"E	Namlin Village, Phonhong District	Urban location, including sensitive receptors.

149. Carbon Monoxide (CO) – **Table 4-3** shows that ambient carbon monoxide is well below Lao and WBG standards.

Table 4-3: Ambient CO Results

Time	Sample ID Level (ppm)					Lao PDR Standard / USEPA Standard (ppm)	Compliance
	A1	A2	A3	A4	A5		
14.00 – 15.00	0.6	0.6	0.5	0.5	0.5	30.0 / 35.0	Yes
15.00 – 16.00	0.6	0.5	0.5	0.5	0.6	30.0 / 35.0	Yes
16.00 – 17.00	0.6	0.5	0.5	0.5	0.6	30.0 / 35.0	Yes
17.00 – 18.00	0.6	0.5	0.5	0.5	0.7	30.0 / 35.0	Yes
18.00 – 19.00	0.7	0.6	0.5	0.6	0.7	30.0 / 35.0	Yes
20.00 – 21.00	0.7	0.6	0.5	0.6	0.7	30.0 / 35.0	Yes
21.00 – 22.00	0.7	0.6	0.6	0.6	0.7	30.0 / 35.0	Yes

150. Particulate Matter (PM_{10}) – **Table 4-4** shows that ambient PM_{10} complies with both Lao PDR standards and United States Environmental Protection Agency (USEPA) standards. However, sample locations A1 and A4 both have ambient PM_{10} levels higher than WBG standards.

Table 4-4: Ambient PM_{10} Results

Sample ID	24-hour Average Result ($\mu g/m^3$)	Lao PDR Standard / USEPA Standard / WHO Standard ($\mu g/m^3$)	Compliance

A1	70	120 / 150 / 50	Yes / Yes / **No**
A2	30	120 / 150 / 50	Yes / Yes / Yes
A3	30	120 / 150 / 50	Yes / Yes / Yes
A4	120	120 / 150 / 50	Yes / Yes / **No**
A5	10	120 / 150 / 50	Yes / Yes / Yes

151. Sulfur Dioxide (SO_2) – **Table 4-5** shows that ambient SO_2 levels are within Lao PDR and European Union (EU) standard limits.

Table 4-5: Ambient SO_2 Results

Sample ID	1-hour Average Result (ppm)	Lao PDR Standard (ppm) / EU Standard (ppm)*	Compliance
A1	0.08	0.13 / 0.13	Yes / Yes
A2	0.08	0.13 / 0.13	Yes / Yes
A3	0.01	0.13 / 0.13	Yes / Yes
A4	0.03	0.13 / 0.13	Yes / Yes
A5	0.01	0.13 / 0.13	Yes / Yes

EU standard = 350 $\mu g/m^3$, the equivalent of 0.13 ppm of SO_2.

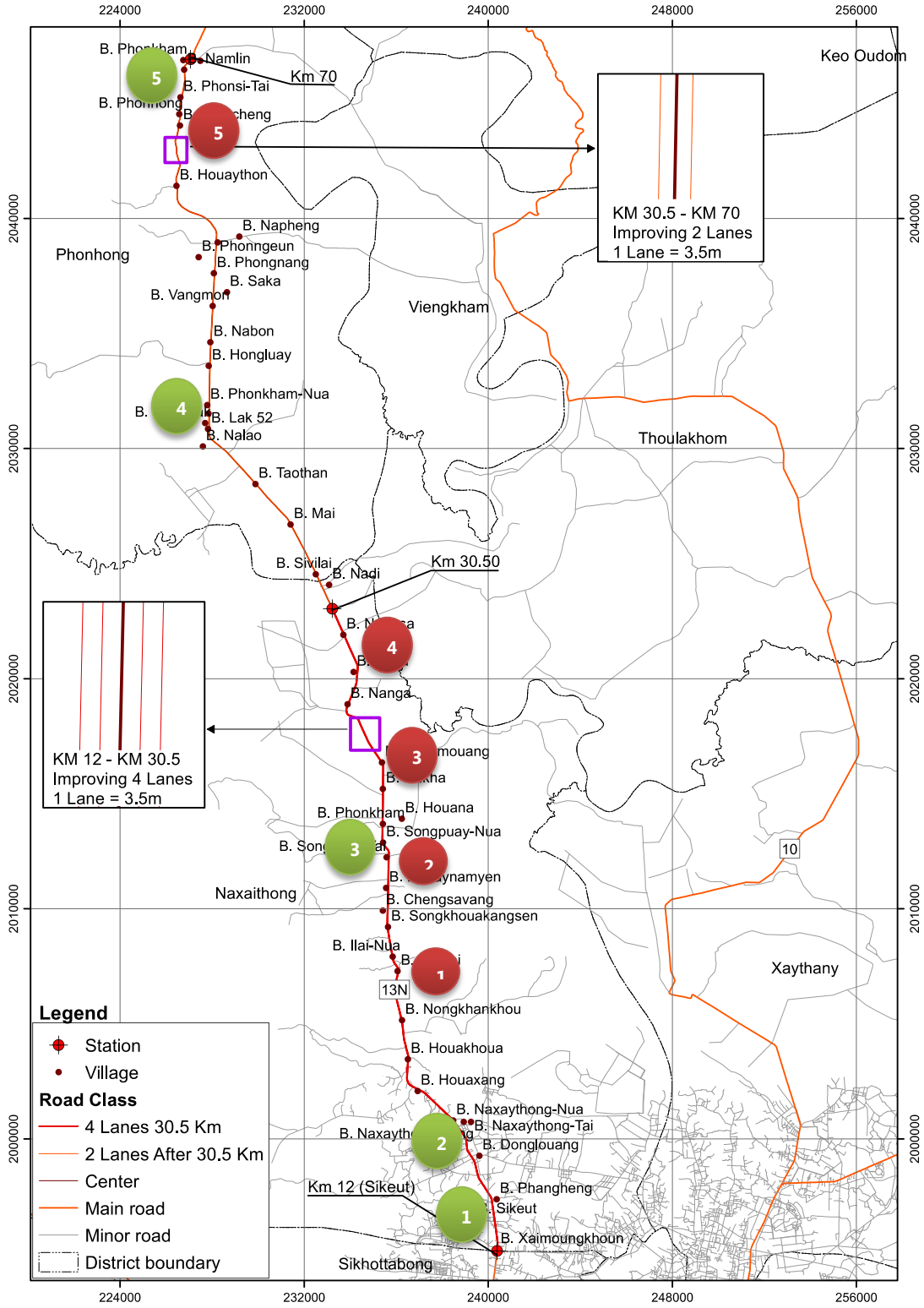
152. Nitrogen Dioxide (NO_2) – **Table 4-6** shows that ambient levels of NO_2 are within the limits set by Lao PDR standards and WHO guidelines.

Table 4-6: Ambient NO_2 Results

Sample ID	1-hour Average Result (ppm)	Lao PDR Standard (ppm) / WHO Guidelines	Compliance
A1	0.007	0.11 / 0.11	Yes / Yes
A2	0.021	0.11 / 0.11	Yes / Yes
A3	0.003	0.11 / 0.11	Yes / Yes
A4	0.007	0.11 / 0.11	Yes / Yes
A5	0.020	0.11 / 0.11	Yes / Yes

WHO standard = 200 $\mu g/m^3$, the equivalent of 0.11 ppm of NO_2.

Figure 4-7: Monitoring Locations



Key: Noise and Air in Green / Surface and Groundwater in Red.

153. Total Suspended Particulate (TSP) – **Table 4-7** shows that ambient levels of TSP are within the limits set by Lao PDR standards.

Table 4-7: Ambient TSP Results

Sample ID	24-hour Result (mg/m^3)	Lao Standard (mg/m^3)	Compliance
A1	0.18	0.33	Yes
A2	0.07	0.33	Yes
A3	0.07	0.33	Yes
A4	0.33	0.33	Yes
A5	0.05	0.33	Yes

4.3.5 Hydrology

154. Surface Water - The project area of NR13 North is located in the plain of Vientiane which is situated on the lower reaches of the Nam Ngum and Nam Lik Rivers. This area physiographically is part of the Mekong River floodplain that includes the floodplains of its larger tributaries. Existing surface water bodies crossing the Project road are listed in **Table 4-8** below.

Table 4-8: Surface Water Courses in the Project Area

#	Chainage	Flow Direction	Name of River
1	6+900	East to West	Houay Xailoun
2	9+953	East to West	Houay Xone
3	19+205	East to West	Nam Houm
4	24+835	East to West	Nam Souang
5	43+841	East to West	Nam Panai
6	51+472	East to West	Houay Thonh
7	54+328	East to West	Nam Cheng

Figure 4-7: Nam Cheng, June 2017

155. Surface Water Quality – According to a recent report by JICA, in general, the water quality of the rivers within Lao PDR and the Mekong is considered good relative to international standards. The oxygen level is high and the nutrient concentration is low. Sediment is the primary pollutant affecting rivers. Sedimentation loads in tributaries vary considerably from 41 tons/km^2/year to 345 tons/km^2/year. Tributaries and river reaches with high sedimentation are Nam Sebanghieng, Nam Sedone, Nam Ou, and the upper and lower stretches of the Mekong. However, water quality is deteriorating due to the pressures of rapid demographic growth, socio-economic development and urbanization.[11]

156. To confirm the status of water quality in the Project area monitoring was undertaken in July 2017. A total of five surface water samples were collected and analyzed to determine the baseline water quality levels. **Table 4-9** describes the sample locations and rationale for their selection. **Appendix K** provides the results in full along with photographs of the monitoring activity and the monitoring dates, times and climatic conditions. **Figure 4-7** provides a map indicating the approximate sampling locations.

Table 4-9: Surface Water Quality Monitoring Locations

[11] Profile on Environmental and Social Considerations in Lao PDR. JICA, 2013.

Sample ID	Coordinates	Rationale for Site Selection
SW01	18° 8'36.24"N 102°30'12.98"E	Irrigation channel
SW02	18°11'13.79"N 102°29'59.99"E	Location of Bridge #3
SW03	18°14'5.82"N 102°29'19.86"E	Location of Bridge #4
SW04	18°15'30.55"N 102°29'16.11"E	Major irrigation channel
SW05	18°28'4.78"N 102°24'38.14"E	Location of Bridge #7

157. Monitoring results (**Table 4-10**) indicate that surface water quality in the Project corridor is degraded by high levels of phosphate, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Dissolved Oxygen (DO).

Table 4-10: Surface Water Quality Monitoring Results

Parameter	Unit	SW01	SW02	SW03	SW04	SWO5	Lao Standard
Cadmium	mg/l	ND	ND	ND	ND	ND	0.003
Calcium	mg/l	1.68	7.45	3.57	5.94	6.14	-
Nitrate	mg/l as NO_3	1.30	<0.44	<0.44	ND	4.32	5
Phosphate	mg/l	**1.99**	**2.67**	<0.46	**3.82**	**0.70**	0.5
Turbidity	NTU	2.47	22.70	3.59	21.90	11.70	-
BOD	mg/l	**4.5**	**9.30**	1.20	**21.6**	**5.7**	<1.5
COD	mg/l	**<40**	**47.2**	**<40**	**77.0**	**<40**	5-7
Dissolved Oxygen	mg/l	**4.10**	**2.30**	8.50	**2.50**	**4.90**	6.0
Oil and Grease	mg/l	<2.0	<2.0	<2.0	2.8	<2.0	-
pH	-	6.3	6.7	6.8	6.9	6.8	6-8
Total Dissolved Solids	mg/l	68	74	30	74	93	-

158. Given the location of the monitoring locations within an area dominated by light industrial / residential and agricultural activities, the high levels of phosphate could be a result of a number of sources. Non-point sources of phosphates include: natural decomposition of rocks and minerals, storm water runoff, agricultural runoff, erosion and sedimentation, atmospheric deposition, and direct input by animals/wildlife; whereas: point sources may include: wastewater treatment plants and permitted industrial discharges. High levels of phosphate can also contribute to high BOD levels as can high levels of organic pollution.

159. Flooding – Several areas were identified by the Project FS that are prone to flooding. The flooding sections identified as of 2010 data, in the project area are summarized in **Table 4-11** below and illustrated by **Appendix L**. As noted in the table, measures to combat flooding include increasing culvert capacity size and raising the road elevation by 0.2 – 0.5m. As noted above, climate change may also increase precipitation in Lao PDR over the next 30-50 years, thereby increasing the potential for flood events in the Project area.

Table 4-11: Road Sections Subjected to Inundation

Approximate Chainage Range	Approximate Road Inundation Depth	Cause for Inundation	Proposed Remedial Measure*
19 600km- 19+ 900km	0.5m	Inadequacy of the height of culvert at 7+548km on Bridge Houay Xaimoun approaches	Raise the inundated segment by 0.5m increase the capacity of culvert by increasing its height.
22+000km to- 22+200km	0.2m	Low profile on Houay Xone bridge approaches	Raise by 0.2m
22+275km to 22+400km	0.5m		Raise by 0.5m
58+200-58+500 km	0.3m	Exceptionally Low road profile	Raise by 0.3m

* according to Project FS, 2014

160. Groundwater – Lao PDR has abundant groundwater resources, which are used for various purposes, especially in rural areas. Communities in the Vientiane Plain depend heavily on groundwater mainly for domestic uses, drinking and household garden irrigation. Groundwater is accessed through private boreholes and open wells fitted with electric pumps or hand pumps. Groundwater is also the source for industries that produce and trade packaged drinking water for the public. Due to the willow depth of the groundwater on the Plain, activities such as the application of fertilizers or the willow installation of septic tanks can leach through the soil and potentially pollute the groundwater. [12]

161. A total of five groundwater samples were collected (in the same locations as the surface water monitoring locations) and analyzed to determine the baseline groundwater quality levels in the Project area. **Table 4-12** provides a summary of the results. **Appendix M** provides the results in full along with photographs of the monitoring activity and the

[12] Groundwater Quality in the Vientiane Plain. International Water Management Institute (IWMI). May, 2016

monitoring dates, times and climatic conditions as well as the monitoring locations on a map.

Table 4-12: Groundwater Quality Monitoring Results

Parameter	Unit	GW01	GW02	GW03	GW04	GWO5	Lao Standard*	Lao Standard**
Acidity	mg/l as $CaCO_3$	9.7	38.9	19.5	9.7	19.5	-	-
Arsenic	mg/l	ND	<0.002	ND	ND	ND	≤ 0.05	≤ 0.01
Calcium Hardness	mg/l as $CaCO_3$	30.0	40.0	10.0	ND	ND	-	-
Conductivity	10^{-6} S/am	184.8	295	62.4	16.2	184.7	-	-
Iron	mg/l	0.33	ND	ND	0.56	0.27	≤ 1.0	≤ 1.0
Lead	mg/l	ND	ND	<0.01	ND	ND	≤ 0.05	≤ 0.01
Magnesium	mg/l	1.82	4.65	<1.00	ND	1.87	-	-
Nitrate	mg/l as NO_3	29.9	31.5	8.89	ND	10.8	≤ 45	≤ 45
Potassium	mg/l	8.13	18.6	1.22	0.54	2.27	-	-
Sodium	mg/l	15.6	22.9	5.29	1.52	11.2	-	-
Sulfate	mg/l as SO_4	18.0	28.5	<5.00	ND	9.9	≤ 250	≤ 250
Chloride	mg/l as Cl	15.7	30.8	6.4	ND	19.6	≤ 600	≤ 600
Dissolved Oxygen	mg/l	3.30	2.80	3.00	2.20	2.90	-	-
Hardness	mg/l as $CaCO_3$	34	54	<20.0	<20.0	70	≤ 500	≤ 500
M-Alkalinity	mg/l as $CaCO_3$	10.9	33.9	ND	<10.0	43.6	-	-
pH	-	5.2	5.6	4.7	5.2	5.5	7.0 – 8.5	6.5 – 9.0
Temperature	°C	29.00	30.10	30.2	29.6	29.8	-	-
Total Dissolved Solids	mg/l	153.00	223.00	64	<25	168	≤ 1,200	-
Total Suspended Solids	mg/l	<2.5	<2.5	<2.5	2.76	<2.5	-	≤ 1,200

* Drinking water from deep well quality standard, Notification of the Ministry of Industry No. 12, B.E. 2542 (1999)

** Lao Environmental Standards, MONRE, No. 0832, Date 03/03/2017

ND = Not detected.

MDL of Arsenic = 0.0005 mg/l, MDL of Lead = 0.005 mg/l, MDL of Calcium Hardness = 0.87 mg/l, MDL of Magnesium = 0.50 mg/l, MDL of Nitrate = 0.09 mg/l, MDL of Sulfate = 1.50 mg/l as SO_4

162. The results show that groundwater quality in the Project area does not exceed any of the Lao PDR standards for drinking water and Lao Environmental Standards.

4.3.6 Natural Hazards

163. According to the Project FS, the most prominent disaster risks associated with the proposed project impact area are earthquake, landslides and floods.

164. Earthquakes - Data from the Laos National Assessment Report (2012) on Disaster Risk Reduction, indicates that Vientiane province where the NR13 North is located is associated with moderate earthquake risk while Vientiane capital is identified as a low risk area. A map indicating earthquakes in the project area is given in **Appendix N**.

165. Landslides - In general, landslides or slope stability is mainly related to weather conditions. Rainfall is the main cause for landslide occurrences therefore most landslides occur during the wet season. However, factors such as soil condition and land use affect the occurrence of landslides as well. A large part of the country is located in low to medium landslide susceptibility zones. Only around 5% of the country is prone to very high landslide susceptibility. These high susceptibility zones are localized in the southeast and central part of Lao PDR and there is not any significant risk related to landslides in the proposed project impact areas as the area is generally located in a flat terrain. However, soil erosion is a significant issue associated with the area due to the loose silty clay loams with some clay content.

166. Floods - Floods and potential for flooding in the Project area is discussed above under **Section 4.3.5 - Hydrology**.

4.4 Biological Resources

167. Lao PDR is characterized by a rich biological diversity, with many species' populations and habitats probably being less depleted compared to other countries of the Southeast Asian region. However, the fact that Lao PDR's biodiversity remains rich—most notably its wildlife—has less to do with conservation efforts than with the country's low population density and consequent extensive forest cover.

4.4.1 Flora

168. General - Most flora resources are scattered all over the country and are found in different forests, land use types and agricultural ecosystems. There are an estimated 8,000–11,000 species of flowering plants in the country. However, compared to neighboring countries, there is very little botanical documentation in Lao PDR. This is because very few studies have been conducted on plant taxonomy in the country since 1975.

169. Forests and Trees - According to the FAO (2010), the total forest area in Lao PDR in 2010 was estimated at 15,751,000 hectares (ha), which covers 68% of the total and area. However, the extent of forest areas in Lao PDR has generally been on the decline.

Approximately 78,000 ha of forest area were converted to other uses or lost through natural causes every year during the period between 2005 and 2010; the annual deforestation rate in this period was approximately 0.49%. As part of the ESIA an inventory of trees (with a breast height diameter of more than 15cm) within the RoW has been prepared (**Table 4-13**). The individual trees are listed in the order that they appear when moving from south to north along NR13 North.

Table 4-13: Trees within the RoW

No	Distance from edge of existing roadside	LHS/ RHS (south to north)	Common Name/ Local Name	Scientific Name	Height (m)	Stem Diameter	Life Stage	Village	District
1	8	LHS	Sarm sa	Samania saman (Jacq.) Merr	4	74cm	15	Phangheng	Naxaithong
2	9	LHS	Sarm sa	Samania saman (Jacq.) Merr	6	41cm	12	Phangheng	Naxaithong
3	7	RHS	Hoo kwarng	Terminalia catappa L.	3	47cm	26	Dongluang	Naxaithong
4	6	RHS	Fang daeng	Caesalpinia sappan L.	6	39cm	17	Dongluang	Naxaithong
5	8	LSH	Vik	Eucalyptus camandulensis	2,50	31cm	35	Dongluang	Naxaithong
6	5	RSH	Mak deua	Ficus fistulosa	4,20	38cm	20	Naxay-Nuea	Naxaithong
7	11	LSH	Mak muang	Mangifera indica L.	6	37cm	18	Huaxang	Naxaithong
8	7	LSH	Phao	Cocos nucifera L.	13	30cm	15	Huaxang	Naxaithong
9	8	LSH	Phao	Cocos nucifera L.	13	30cm	15	Huaxang	Naxaithong
10	9	LSH	War	Syzigium & Eugenia wild species generally	7	38cm	20	Huaxang	Naxaithong
11	7	LSH	War	Syzigium & Eugenia wild species generally	8	31cm	20	Huaxang	Naxaithong
12	11	LSH	Ngien		4	25cm	10	Huakhua	Naxaithong
13	10	RHS	Ka dao	Azadirachta indica A.	5	70cm	30	Huakhua	Naxaithong
14	5	LSH	Hai	Ficus spp.-especially strangling figs	10	3,18m	40	Nongkhankhou	Naxaithong
15	6	LSH	Ta baeng		15	63cm	20	Nongkhankhou	Naxaithong
16	6	LSH	Ta baeng		6	50cm	15	Nongkhankhou	Naxaithong

No	Distance from edge of existing roadside	LHS/ RHS (south to north)	Common Name/ Local Name	Scientific Name	Height (m)	Stem Diameter	Life Stage	Village	District
17	6	LHS	Vik	Eucalyptus camandulensis	6	50cm	18	Ilai-Tai	Naxaithong
18	6	LHS	Vik	Eucalyptus camandulensis	5	57cm	18	Ilai-Tai	Naxaithong
19	6	LHS	Vik	Eucalyptus camandulensis	6.5	50cm	18	Ilai-Tai	Naxaithong
20	5	LHS	Yang	Dipterocarpus spp.	25	1,11m	30	Ilai-Tai	Naxaithong
21	10	LHS	Sar leng	Syzygium cumini L.	3	60cm	20	Ilai-Tai	Naxaithong
22	5	LHS	Mak muang	Mangifera indica L.	3	28cm	10	Ilai-Tai	Naxaithong
23	10	LHS	Phoh	Ficus religiosa L.	10	2,54m	40	Ilai-Tai	Naxaithong
24	8	LHS	Mak muang	Mangifera indica L.	10	50cm	10	Ilai-Tai	Naxaithong
25	6	LHS	Sarm sa	Samania saman (Jacq.) Merr	5	38cm	10	Ilai-Tai	Naxaithong
26	15	LHS	Sarm sa	Samania saman (Jacq.) Merr	4	63cm	18	Ilai-Tai	Naxaithong
27	7	LHS	Mak muang	Mangifera indica L.	6	38cm	10	Ilai-Tai	Naxaithong
28	8	LHS	Kharm	Tammarindus indicus L.	6	41cm	10	Kangsaen	Naxaithong
29	10	LHS	Sarm sa	Samania saman (Jacq.) Merr	7	63cm	30	Kangsaen	Naxaithong
30	5	LHS	Sarm sa	Samania saman (Jacq.) Merr	3	47cm	15	Chengsavang	Naxaithong
31	5	LHS	Sarm sa	Samania saman (Jacq.) Merr	2	63cm	30	Huaynamyen	Naxaithong
32	7	LHS	Sarm sa	Samania saman (Jacq.) Merr	6	1,84m	40	Songpeuay	Naxaithong
33	8	LHS	Phoh	Ficus religiosa L.	7	3,18m	40	Songpeuay	Naxaithong
34	7	LHS	Sarm sa	Samania saman (Jacq.) Merr	3	50cm	16	Songpeuay	Naxaithong
35	6	LHS	Sarm sa	Samania saman (Jacq.) Merr	3	57cm	16	Songpeuay	Naxaithong
36	6	LHS	Sarm sa	Samania saman (Jacq.) Merr	4	44cm	10	Phonkham	Naxaithong
37	5	LHS	Sarm sa	Samania saman (Jacq.) Merr	3	38cm	10	Phonkham	Naxaithong
38	6	LHS	Mak muang	Mangifera indica L.	4	38cm	10	Nakha	Naxaithong

No	Distance from edge of existing roadside	LHS/ RHS (south to north)	Common Name/ Local Name	Scientific Name	Height (m)	Stem Diameter	Life Stage	Village	District
39	7	LHS	Phao	Cocos nucifera L.	8	19cm	7	Phonmuang	Naxaithong
40	7	LHS	Phao	Cocos nucifera L.	8	19cm	7	Phonmuang	Naxaithong
41	7	LHS	Phao	Cocos nucifera L.	9	19cm	7	Phonmuang	Naxaithong
42	8	LHS	Phao	Cocos nucifera L.	8	19cm	7	Phonmuang	Naxaithong
43	12	LHS	Sat	Dipterocarpus obtusifolius Teijsm. ex Miq	8	66cm	16	Phonmuang	Naxaithong
44	9	LHS	Tin pet	Alstonia scholaris L.	6	31cm	10	Phonmuang	Naxaithong
45	8	LHS	Kathin dong	Leucaena leucocephala (Lamk.) de Wit	9	63cm	20	Phonmuang	Naxaithong
46	7	LHS	Sarm sa	Samania saman (Jacq.) Merr	7	50cm	20	Phonmuang	Naxaithong
47	8	LHS	Ta baeng		16	38cm		Na nga	Naxaithong
48	6	LHS	Sarm sa	Samania saman (Jacq.) Merr	7	50cm		Na nga	Naxaithong
49	9	LHS	Sarm sa	Samania saman (Jacq.) Merr	6	50cm		Na nga	Naxaithong
50	8	LHS	Sarm sa	Samania saman (Jacq.) Merr	3	44cm		Na nga	Naxaithong
51	8	LHS	Sarm sa	Samania saman (Jacq.) Merr	4	63cm		Na nga	Naxaithong
52	7	LHS	Mak muang	Mangifera indica L.	3	25cm		Bua	Naxaithong
53	7	LHS	Sarm sa	Samania saman (Jacq.) Merr	2	28cm		Bua	Naxaithong
54	7	RHS	Pang deng		4	31cm		Nady	Naxaithong
55	7	RHS	Pang deng		3	25cm		Nady	Naxaithong
56	8	RHS	Kathin dong	Leucaena leucocephala (Lamk.) de Wit	4	31cm		Nady	Naxaithong
57	7	RHS	Pang deng		5	33cm		Nady	Naxaithong

No	Distance from edge of existing roadside	LHS/ RHS (south to north)	Common Name/ Local Name	Scientific Name	Height (m)	Stem Diameter	Life Stage	Village	District
58	7	LHS	Mak muang	Mangifera indica L.	4	25cm		Nady	Naxaithong
59	6	RHS	Kathin dong	Leucaena leucocephala (Lamk.) de Wit	2	50cm		Nady	Naxaithong
60	7	LHS	Mak muang	Mangifera indica L.	3	47cm		Nady	Naxaithong
61	7	LHS	Mak muang	Mangifera indica L.	3	38cm		Nady	Naxaithong
62	7	RHS	Mak muang	Mangifera indica L.	4	41cm		Nady	Naxaithong
63	6	LHS	Mak Torng	Sandoricum indicum Cav.	3	38cm		Phonxay	Phonhong
64	6	LHS	Sa fang	Peltophorum dasyrachis (Miq.) Kurz	5	38cm		Phonxay	Phonhong
65	6	LHS	Sa fang	Peltophorum dasyrachis (Miq.) Kurz	7	41cm		Phonxay	Phonhong
66	7	RHS	Sarm sa	Samania saman (Jacq.) Merr	5	47cm		Phonxay	Phonhong
67	6	LHS	Pang deng		6	47cm		Taow tharn	Phonhong
68	6	RHS	Sarm sa	Samania saman (Jacq.) Merr	5	60cm		Taow tharn	Phonhong
69	6	RHS	Kathin dong	Leucaena leucocephala (Lamk.) de Wit	6	63cm		Taow tharn	Phonhong
70	8	RHS	Sarm sa	Samania saman (Jacq.) Merr	5	95cm		Nalaow	Phonhong
71	8	LHS	Sarm sa	Samania saman (Jacq.) Merr	5	79cm		Nalaow	Phonhong
72	6	LHS	Sarm sa	Samania saman (Jacq.) Merr	3	63cm		Nalaow	Phonhong
73	5	RHS	Sarm sa	Samania saman (Jacq.) Merr	3	63cm		Hongleuay	Phonhong
74	6	LHS	Sarm sa	Samania saman (Jacq.) Merr	4	70cm		Hongleuay	Phonhong
75	6	LHS	Sarm sa	Samania saman (Jacq.) Merr	5	1,10m		Hongleuay	Phonhong

No	Distance from edge of existing roadside	LHS/ RHS (south to north)	Common Name/ Local Name	Scientific Name	Height (m)	Stem Diameter	Life Stage	Village	District
76	7	RHS	Sarm sa	Samania saman (Jacq.) Merr	4	95cm		Hongleuay	Phonhong
77	6	LHS	Sarm sa	Samania saman (Jacq.) Merr	2	79cm		Hongleuay	Phonhong
78	6	LHS	Yang	Dipterocarpus spp.	15	73cm		Nabone	Phonhong
79	7	RHS	Kang par	Securinega virosa (Willdenow) Pax&Hoffm	10	31cm		Namcheng	Phonhong
80	6	RHS	Sak	Tectona grandis L.f.	8	38cm		Namcheng	Phonhong
81	8	RHS	Peuay	Lagerstroemia calyculata Kurz	8	63cm		Namcheng	Phonhong
82	8	RHS	Sak	Tectona grandis L.f.	10	47cm		Namcheng	Phonhong
83	6	RHS	Peuay	Lagerstroemia calyculata Kurz	8	41cm		Namcheng	Phonhong
84	7	RHS	Peuay	Lagerstroemia calyculata Kurz	8	63cm		Namcheng	Phonhong
85	7	RHS	Peuay	Lagerstroemia calyculata Kurz	10	63cm		Namcheng	Phonhong
86	6	LHS	Mak kharm	Tammarindus indicus L.	4	41cm		Namcheng	Phonhong
87	6	LHS	Mak muang	Mangifera indica L.	3	38cm		Namcheng	Phonhong
88	6	LHS	Mak Tong	Sandoricum indicum Cav.	6	31cm		Namcheng	Phonhong
89	5	LHS	Tin pet	Alstonia scholaris L.	10	57cm		Namcheng	Phonhong
90	8	RHS	Phoh	Ficus religiosa L.	4	25cm		Namlin	Phonhong

4.4.2 Fauna

170. Fauna in Lao PDR is relatively well documented and monitored, thereby making the assessment of its richness more accurate. The population and habitats of many species have been found to be less depleted compared to other countries in the region. Fauna resources in the country include at least 150 to more than 200 reported species of reptiles and amphibians, no less than 700 species of birds, over 90 known species of bats, over 100 species of large mammals, and approximately 500 species of fish.

171. A total of 319 species from among the 1,140 species reviewed by Duckworth et al. (1999) are significant for national or global conservation. These species comprise 67%, 53%, 6%, 14%, 22%, 25%, and 2% of the total populations of large mammals, bats, insectivores, murid rodents, birds, reptiles, and amphibians, respectively. Information on local distribution, habitat uses and population status is most complete for birds and large mammals. Even within these groups, several new species have been discovered within the country in recent years. Bats have also been surveyed extensively since 1995, but coverage remains uneven. Reptiles, insectivores and rodents are still relatively poorly documented on a national scale.

172. There are 178 mammal species in Laos, of which 4 are critically endangered, 8 are endangered, 23 are vulnerable, and 2 are near-threatened. [13]

173. A wildlife survey conducted during July and August 2014 as part of the Project FS included direct observations, village interviews, visits to roadside markets and sampling at 15 sites along NR13 North.[14] The survey focused on large mammals, mammals, birds, amphibians and reptiles; and the 15 survey sites included streams, an irrigation canal, flood plains and marshes, agricultural lands, home gardens, planted forests and abandoned lands (note that there are no natural habitat areas to sample within 50 m of the roadway). The survey species list includes 2 mammals, 13 birds, 2 reptiles, 5 amphibians, and 9 fish (see **Table 4-14**). Of the 31 species, 30 are categorized as *Least Concern* or in the lowest risk category on the IUCN Red List, and only the falcon is listed as *Vulnerable* or at high risk of extinction in the wild, but falcons range over wide areas to hunt.

174. A second wildlife survey conducted by telephone during September 2017 asked residents along NR13 North to identify what wildlife they had observed or knew of in the local area, including the NR13 North roadway and nearby areas (see **Table 4-15)**. The survey methodology included: (i) identifying various land use types along NR13 North within 100 m of the road; (ii) putting the villages along NR13 North in groups of 3, and selecting 1 village from each group for the interview; (iii) interviewing 13 village heads by telephone, 8 in Naxaithong District and 5 in Phonhong District, who are located near the selected land use areas; (iv) asking the respondents to name or describe wildlife species that they knew were

[13] https://en.wikipedia.org/wiki/List_of_mammals_of_Laos

[14] A more detailed description of the survey methodology is provided in the Feasibility Study, Chapter 14, Annex 6, Section 1.2.1.

still present or seasonally migrated through their area; and (v) using the species names and descriptions to generate the species list.

Table 4-14: Fauna Species List (from the June 2015 *Feasibility Study of Two Pilot PPP Road Projects in Lao PDR*, Chapter 14, Annex 6, Section 1.2.1.)

	Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
Mammal										
1	Pteropodidae	*Cynopterus sphinx*	Short-nosed fruit bat		BrR	LC	x			
2	Sciuridae	*Callosciurus erythraeus*	Pallas's Squirrel or belly-banded Squirrel		BrR	LC	x			
Bird										
1	Apodidae	*Aerodramus rogersi*	Indochinese Swiftlet	ນົກແອ່ນນ້ອຍ / *Nok el*	BrR	LC		x		
2	Ardeidae	*Ardeola bacchus*	Chinese-pond Heron	ນົກເຈົ້າ / *Nok Chao*	WV	LC			x	
3	Dicruridae	*Dicrurus aeneus*	Bronzed Drongo	ນົກແຊວ / *Nok Sel*	BrR	LC	x			
4	Dicruridae	*Dicrurus paradiseus*	Greater Racket-Tailedrongo	ນົກແຊວຫາງຍາວ / *Nok Selhang nhao*	BrR	LC	x			
5	Falconidae	*Falco subbuteo*	Eurasian Hobby	ແຫ່ວບີ້ / *Leo Bi*	BrR	**VU**	x			
6	Megalaimidae	*Megalaima franklinii*	Golden-Throated Barbet	ນົກຫົວໂຂກ, ນົກຕ້ຶ່ງລ ໍ / *Nok Kondok Kangluaeng, Nok Tanglo*	BrR	LC	x	x		
7	Muscicapidae	*Copsychus saularis*	Oriental Magpie-Robin	ນົກແຕ້ມປູ່ນ / *Nok tem poun*	BrR	LC		x		
8	Nectariniidae	*Arachnothera longirostra*	Little SpiderHunter	ນົກໄກສອນ, ນົກກິນແມ່ງໄມ້ / *Nok Kaisone, Nok kin meng*	BrR	LC		x		
9	Passeridae	*Passer domesticus*	Common Sparrow	ນົກຈິບບ້ານ / *Nok Jeep Ban*	BrR	LC				x
10	Pycnonotidae	*Hemixos flavala*	Ashy Bulbul	ນົກຂອກສີຂີ້ເຖົ່າ / *Nok khoaksi khi thao*	BrR	LC		x	x	
11	Pycnonotidae	*Alohoixus pallidus*	Puff-Throated Bulbul	ນົກຂອກຫົວຈຸກ / *Nok houa*	BrR	LC				x

	Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
				chook						
12	Sturnidae	*Lanius collurioides*	Bumese Shrike	ນົກແຕ້ວແຕ້ວ / *Nok tanvane*	BrR	LC		x		x
13	Sturnidae	Acridotheres tristis	Common Myna	ນົກຂໍ້ເຫຍົ້າ/ *Nok eak na*	BrR	LC			x	x
Reptile										
1	Agamidae	*Calotes emma*	Forest Crested Lizard	Kaporm	BrR	LC	x		x	
2	Scincidae	*Mabuya macularia*	Bronze grass Skink	Chiko	BrR	LC	x		x	
Amphibian										
1	Bufonidae	*Bufo melanostictus*	Common Asiatic toad	Khankhak	BrR	LC			x	x
2	Ranidae	*Rana rugulosa*	Common lowland Frog	Kopna	BrR	LC			x	x
3	Ranidae	*Rana limnocharis*	Paddy frog	Khiat mo	BrR	LC			x	x
4	Microhyliidae	*Kaloula mediolineeata*	Narrow-mouthed frog	Eung	BrR	LC	x		x	
5	Microhyliidae	*Microhyla pulchra*	Narrow-mouthed frog	Khiat Khakham	BrR	LC			x	x
Fish										
1	Osphronemidae	*Trichogaster trichopterus*	3-Spot Gourami	Pa kadeut	BrR	LC			x	
2	Belonidae	*Xenentodon canciloides*	Needlefish	Pa kathong	BrR	LC			x	
3	Cyprinidae	*Esomus metallicus*	Striped flying barb	Pa xiou	BrR	LC			x	
4	Clariidae	*Clarias batrachus*	Walking catfish	Pa douk	BrR	LC			x	
5	Channidae	*Channa gachua*	Dwarf snakehead	Pa kang	BrR	LC			x	
6	Channidae	*Channa melasoma*	Black snakehead	Pa khor	BrR	LC			x	
7	Gobidae	*Rhinogobius ocellatus*	Freshwater goby	Pa bou	BrR	LC			x	
8	Notopteridae	*Notopterus notopterus*	Bronze featherback	Pa tongna	BrR	LC			x	
9	Synbrachidae	*Monopterus albus*	Swamp eel or rice eel	Ian	BrR	LC			x	

TS – Taxonomic Status, BrR – Breeding Resident, WV – Winter Visitor, SU – Status Unknown etc.

CS – Conservation Status, species are classified by the IUCN Red List into nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation.

EX = Extinct, no known individuals remaining.

EW = Extinct in the wild, known only to survive in captivity, or as a naturalized population outside its historic range.

CR = Critically endangered, extremely high risk of extinction in the wild.

EN = Endangered, high risk of extinction in the wild.

VU = Vulnerable, high risk of endangerment in the wild.

NT = Near threatened, likely to become endangered in the near future.

LC = Least concern, lowest risk, does not qualify for a more at risk category; widespread and abundant taxa are included in this category.

DD = Data deficient, not enough data to make an assessment of its risk of extinction.

NE = Not evaluated, has not yet been evaluated against the criteria.

Habitat: A - Forest, B - stream or river, C - rice field, and D - house or building.

Table 4-15: List of fauna that occur in the general area of NR13 North, including Phou Phanang, according to telephone interviews with local residents conducted during September 2017.

	Order and Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
Mammal										
1	Primates Lorisidae	*Nycticebus spp*	Slow loris	ລ ົ ງ ລ ົ ມ		**VU***				
2	Primates Hylobatidae	*Hylobates Leucogenys*	White-cheeked gibbon	ທະ ນ ິ ດ ກ ້ ມ ຂ າ ວ		**CR**				
3	Primates Hylobatidae	*Hylobates gabriellae*	Red-cheeked gibbon	ທະ ນ ິ ດ ກ ້ ມ ດ ຳ		**EN**				

	Order and Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
4	Carnivora Canidae	*Cuon alpinus*	Asiatic wild dog, dhole	ໝາໄນ		**EN**				
5	Carnivora Canidae	*Canis aureus*	Golden Jackal, Asiatic jackal	ໝາຈອກ		LC				
6	Carnivora Herpestidae	*Herpestes javanicus*	Javan mongoose	ຈອນຟອນ		LC				
7	Carnivora Viverridae	*Paradoxurus hermaphroditus*	Common palm civet	ເຫງັນ		LC				
8	Rodenta Hystricidae	*Hystrix brachyura*	Malayan porcupine			LC				
9	Rodentia Sciuridae	*Callosciurus erythraeus*	Pallas's squirrel	ກະຮອກ		LC				
10	Rodentia Sciuridae	*Callosciurus pygerythrus*	Irrawaddy squirrel	ກະລອນ		LC				
11	Cetartiodactyla Suidae	*Sus scrofa*	Wild Boar	ໝູປ່າ		LC				
12	Lagomorpha Leporidae	*Lepus peguensis*	Siamese Hare	ກະຕ່າຍ		LC				
13	Cetartiodactyla Cervidae	*Muntiacus muntjak*	Barking deer, Indian muntjac	ຟານ		LC				
14	Scandentia Tupaiidae	*Tupaia belangeri*	Northern treeshrew	ກະແຕ		LC				
Bird										
1	Accipitriformes	*Aquila heliaca*	Imperial eagle	ແຫ ົ່ວ		VU				

	Order and Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
	Accipitridae									
2	Anseriformes Anatidae	*Tadorna tadorna*	Common shelduck	ນົກເປັດ		LC				
3	Columbiformes Columbidae	*Columba punicea*	Pale-capped pigeon	ນົກເຂົ້າ		**VU**				
4	Columbiformes Columbidae	*Streptopelia tranquebarica*	Red turtle dove	ນົກເຂົ້າດົ່ງ		LC				
5	Cuculiformes Cuculidae	*Centropus sinensis*	Greater coucal	ນົກກົດ		LC				
6	Galliformes Phasianidae	*Gallus gallus*	Red jungle fowl	ໄກ່ປ່າ		LC				
7	Passeriformes Artamidae	*Artamus fuscus*	Ashy woodswallow	ນົກແອ່ນ		LC				
8	Passeriformes Cisticolidae	*Orthotomus sutorius*	Common tailorbird	ນົກກະຈິບ		LC				
9	Passeriformes Corvidae	*Corvus macrorhynchos*	Large-billed crow	ກາດຳ		LC				
10	Passeriformes Laniidae	*Lanius collurioides*	Burmese shrike	ນົກແຕ້ວແຂວນ		LC				
11	Passeriformes Pycnonotidae	*Pycnonotus Jocosus*	Red-whiskered bulbul	ນົກຫົວຈຸກ		LC				
12	Passeriformes Sturnidae	*Acridotheres tristis*	Common myna	ນົກຮ້ອງ		LC				
13	Pelicaniformes	*Ardea intermedia*	Intermediate egret	ນົກຍາງ		LC				

	Order and Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
	Ardeidae	*(Mesophoyx intermedia)*								
14	Pelicaniformes Ardeidae	*Botaurus stellaris*	Common bittern	ນົກເຈົ່າ		LC				
15	Psittaciformes Psittacidae	*Psittacula eupatria*	Alexandrine parakeet	ນົກແກ້ວ		**NT**				
16	Strigiformes Strigidae	*Bubo nipalensis*	Spot-bellied eagle-owl	ນົກເຄົ້າ		LC				
17	Gruiformes Rallidae	*Amaurornis phoenicurus*	White breasted waterhen	ນົກໄກ່ນາ		LC				
Reptile										
1	Squamata Varanidae	Varanus bengalensis	Bengal monitor lizard	ແລນ		LC				
2	Squamata Scincidae	Eutropis multifasciata	Sun skink	ຈິ້ໂກະ						
3	Squamata Psammophiidae	Psammophis condanarus	Sand snake	ງູດິນ		LC				
4	Squamata Pythonidae	Python molurus	Burmese or rock python	ງູຫຼາມ		**VU**				
5	Squamata Pythonidae	Python reticulates	Reticulated python	ງູເຫຼືອມ						
6	Squamata Colubridae	Ptyas mucosus	Common ratsnake	ງູສີງ		LC				
7	Squamata	Naja sp.	Cobra	ງູເຫົ່າ						

	Order and Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
	Elapidae									
8	Squamata Viperidae	Trimeresurus sp.	Green snake	ງູຂຽວ		LC				
9	Squamata Elapidae	Ophiophagus hannah	King cobra	ງູຈົງອາງ		**VU**				
10	Squamata Colubridae	Elaphe radiata	Radiated ratsnake	ງູສາ		LC				
11			Ngou Kan Pong	ງູກ້ານປ່ອງ						
12			Ngou Sam Than	ງູສຳພັນ						
13			Ngou Dang Hae	ງູດາງແຫ						
14	Testudines Geoemydidae	Malayemys subtrijuga	Mekong snail eating turtle	ເຕົ້າສາມສັນ		VU				
15	Testudines Testudinidae	Testudo spp.	Tortoise	ເຕົ່າ						
16	Testudines Trionychidae	*Amyda cartilaginea*	Asiatic softshell turtle	ປາຜາ		**VU**				
Amphibian										
1	Anura Dicroglossidae	*Hoplobatrachus rugulosa (Rana rugulosa)*	Common lowland frog	ກົບ-ຂຽດ		LC				
Fish										
1	Cypriniformes Cyprinidae	*Cyprinus carpio*	Common carp	ປາໄນ		**VU****				
2	Cypriniformes Cyprinidae	*Barbonymus goniotus*	Silver barb	ປາປາກ		LC				

	Order and Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
3	Cypriniformes Cyprinidae	*Cirrhinus molitorella*	Chinese mud carp	ปาแกง		NT				
4	Cypriniformes Cyprinidae	*Hampala dispar*	Eye-spot barb	ปาสูด		LC				
5	Cypriniformes Cyprinidae	*Hypophthalmichthys molitrix*	Silver carp	ปาเภ้ดแลบ		**NT****				
6	Cypriniformes Cyprinidae	*Labeo chrysophekadion*	Black sharkminnow	ปาท่า		LC				
7	Cypriniformes Cyprinidae	*Labeo sp. (Morulius sp.)*	Barb	ปาขาอ / Pa Khao						
8	Cypriniformes Cyprinidae	*Osteochilus vittatus (O. hasselti)*	Carp variety	ปาฮ่ีไท / Pa Ethai		LC				
9	Cypriniformes Cyprinidae	*Poropuntius sp.*	Catfish variety	ปาจาด / Pa Chat						
10	Cypriniformes Cyprinidae	*Rosbora atridorsalis*	Rasbora	ปาฉ่ือ		LC				
11	Perciformes Ambassidae	*Parambassis siamensis*	Glass fish	ปาคาบของ / Pa Khup Khong		LC				
12	Perciformes Anabantidae	*Anabas testudinens*	Climbing Perch	ปาแข้ง		LC				
13	Perciformes Channidae	*Channa gachua*	Dwarf snakehead	ปาก้้ง		LC				
14	Perciformes Channidae	*Channa striata*	Striped snakehead	ปาอ่ำ		LC				

	Order and Family	*Genus and species*	English Name	Local Lao Name	TS	CS	Recorded Habitat			
							A	B	C	D
15	Perciformes Cichlidae	*Oreochromis niloticus*	Nile tilapia	ປາ ນ ິ ນ		LC				
16	Perciformes Eleotridae	*Oxyeleotris marmorata*	Marbled goby	ປາ ບ ູ		LC				
17	Perciformes Osphronemidae	*Trichogaster trichopterus*	Three spot gourami	ປາ ກ ະ ດ ິ ດ		LC				
18	Osteoglossiformes Notopteridae	*Chitala ornata*	Clown featherback	ປາ ຕ ອ ງ		LC				
19	Siluriformes Bagridae	*Hemibagrus sp*	Catfish	ປາ ກ ົ ດ / Pa Kod						
20	Siluriformes Bagridae	*Mystus nigriceps*	Twospot catfish	ປາ ຂ ະ ແ ຍ ງ						
21	Siluriformes Clariidae	*Clarias batrachus*	Walking catfishes	ປາ ດ ຸ ກ		LC				
22	Siluriformes Siluridae	*Ompok bimaculatus*	Butter catfish	ປາ ເ ຊ ິ ຍ ມ / Pa Seuam		**NT**				
23	Siluriformes Sisoridae	*Bagarius yarrelli*	Gooch	ປາ ແ ຂ ้		**NT**				

* Various species of slow loris have different conservation status ratings from Vulnerable (several species) to Critically Endangered (N. javanicus)

** The common carp and silver carp are not native to Lao PDR; they are introduced species that are commonly cultured in cages and ponds.

TS – Taxonomic Status, BrR – Breeding Resident, WV – Winter Visitor, SU – Status Unknown etc.

CS – Conservation Status, species are classified by the IUCN Red List into nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation.

EX = Extinct, no known individuals remaining.

EW = Extinct in the wild, known only to survive in captivity, or as a naturalized population outside its historic range.

CR = Critically endangered, extremely high risk of extinction in the wild.

EN = Endangered, high risk of extinction in the wild.

VU = Vulnerable, high risk of endangerment in the wild.

NT = Near threatened, likely to become endangered in the near future.

LC = Least concern, lowest risk, does not qualify for a more at risk category; widespread and abundant taxa are included in this category.

4.4.3 Endemic Species

175. While the diversity of flora and fauna in Lao PDR is relatively high, the total number of species endemic to Lao PDR is extremely low, as shown in **Table 4-16**. It must be noted that these numbers are very likely to change as a full inventory of species in Lao PDR has yet to be completed, especially for fish.

Table 4-16: Endemic Species in Lao PDR[15]

Family	Number
Mammals	6
Birds	1
Amphibians	6
Fish	Undetermined
Fresh Water Crabs	13
Reef-forming Corals	0
Conifers	0
Cycads	0

4.4.4 Endangered Species

176. The world's most comprehensive inventory of the global conservation status of biological species has been compiled by the International Union for Conservation of Nature and Natural Resources (IUCN). The IUCN Red List of Threatened Species is regularly revised. The latest report published in February 2012 categorizes 165 species of animals and 30 species of plants in Lao PDR as critically endangered (CR), endangered (EN) or vulnerable (VU). For details of each species, see **Table 4-17** and **Table 4-18**.

Table 4-17: Conservation Status of Flora and Fauna in Lao PDR

	EW	CR	EN	VU	Total
Animal	0	23	50	91	165
Plant	0	7	9	14	30

Note: EW: Extinct in the Wild; CR: Critically Endangered; EN: Endangered; VU: Vulnerable.

[15] IUCN, 2013

Table 4-18: Threatened Species in Lao PDR (by taxonomic group)

Mammals	Birds	Reptiles	Amphibians	Fish	Mollusc	Other Inverts	Plants	Total
45	24	16	5	4	16	5	3	195

4.4.5 Protected Areas & Important Bird Areas (IBA)

177. Protected Areas - There has been a substantial improvement in Lao PDR's protected area system since the Environment Action Plan was established in 1993 (Prime Ministerial Decree No. 164/1993). In the same year, 18 National Biodiversity Conservation Areas (NBCAs) were designated as protected areas covering approximately 10% of the land area of the country. Subsequently, five additional new areas were added, raising the total number of NBCAs to 23. These 23 NBCAs cover approximately 36,079 km^2, which is over 15% of the country's land area. It must be noted that NBCAs are the only national-level areas designated for nature conservation.

178. The NBCAs in Lao PDR were established under the 1993 Decree on Establishment of National Conservation Forest. The management of these areas is divided among three tiers of government—central, provincial and district and village. The central government is represented by the Department of Forestry (DoF) of the Ministry of Agriculture and Forestry (MAF). The above decree prohibits the following actions in NCBAs:

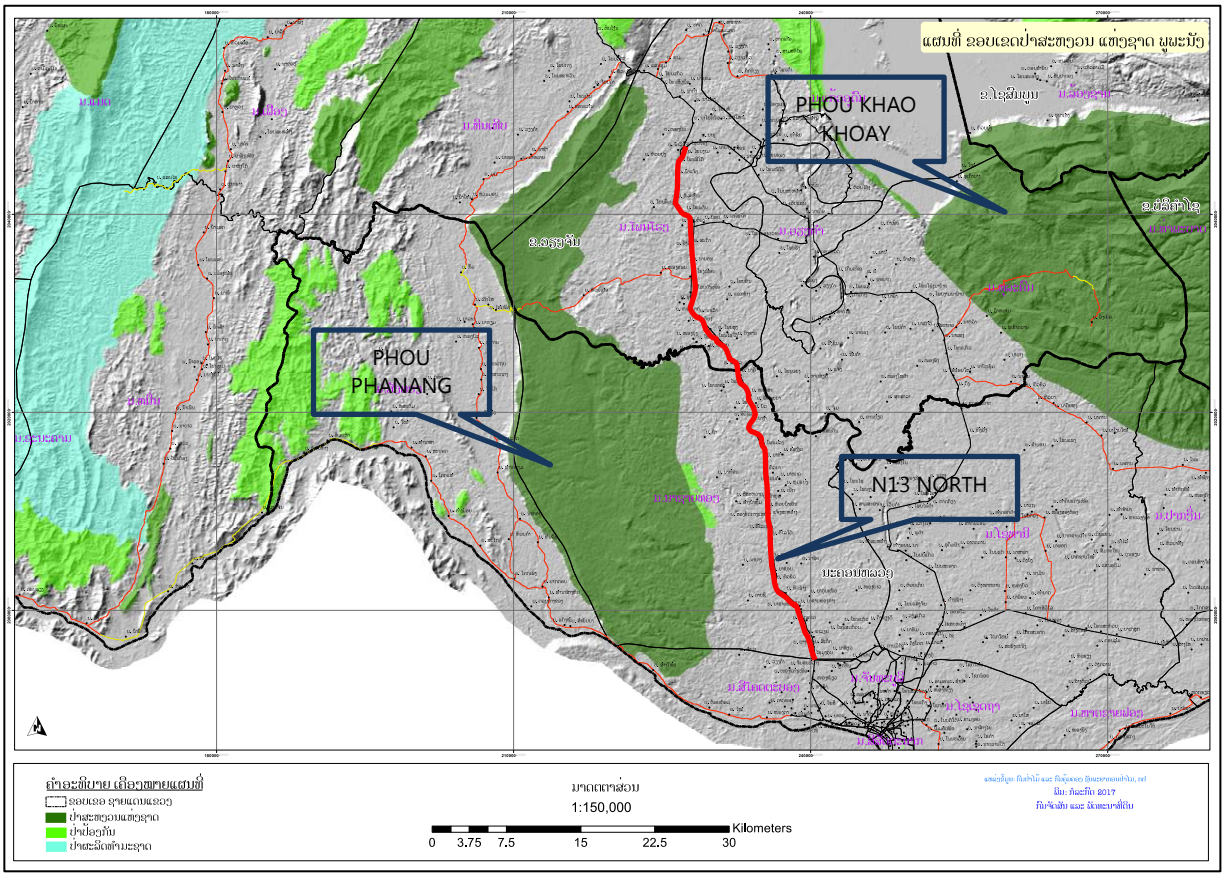
- Cutting and removal of any timber except for research purposes.
- Hunting, fishing or collecting non-timber forest products without specific authorization each time from MAF/DoF.
- Mining and construction of reservoirs or roads without the permission of the GoL.

179. In addition to NBCAs, some 276 areas of locally significant conservation or watershed value have been designated as conservation or protection forests at the provincial or district level. These areas have no national legal framework, and are instead governed under the variable provincial frameworks.

180. In 2015, a new Decree on protected areas was established. The Department of Forest Resources Management (DFRM) of MoNRE is the lead agency responsible for ensuring effective management of these areas.

181. In addition to the NBCAs there are two Ramsar sites in Lao PDR, neither of which are located in the Project Provinces. However, two protected areas are however located within the region; Phou Khao Khoay (PKK) and Phou Phanang (PPN) (see **Figure 4-8**).

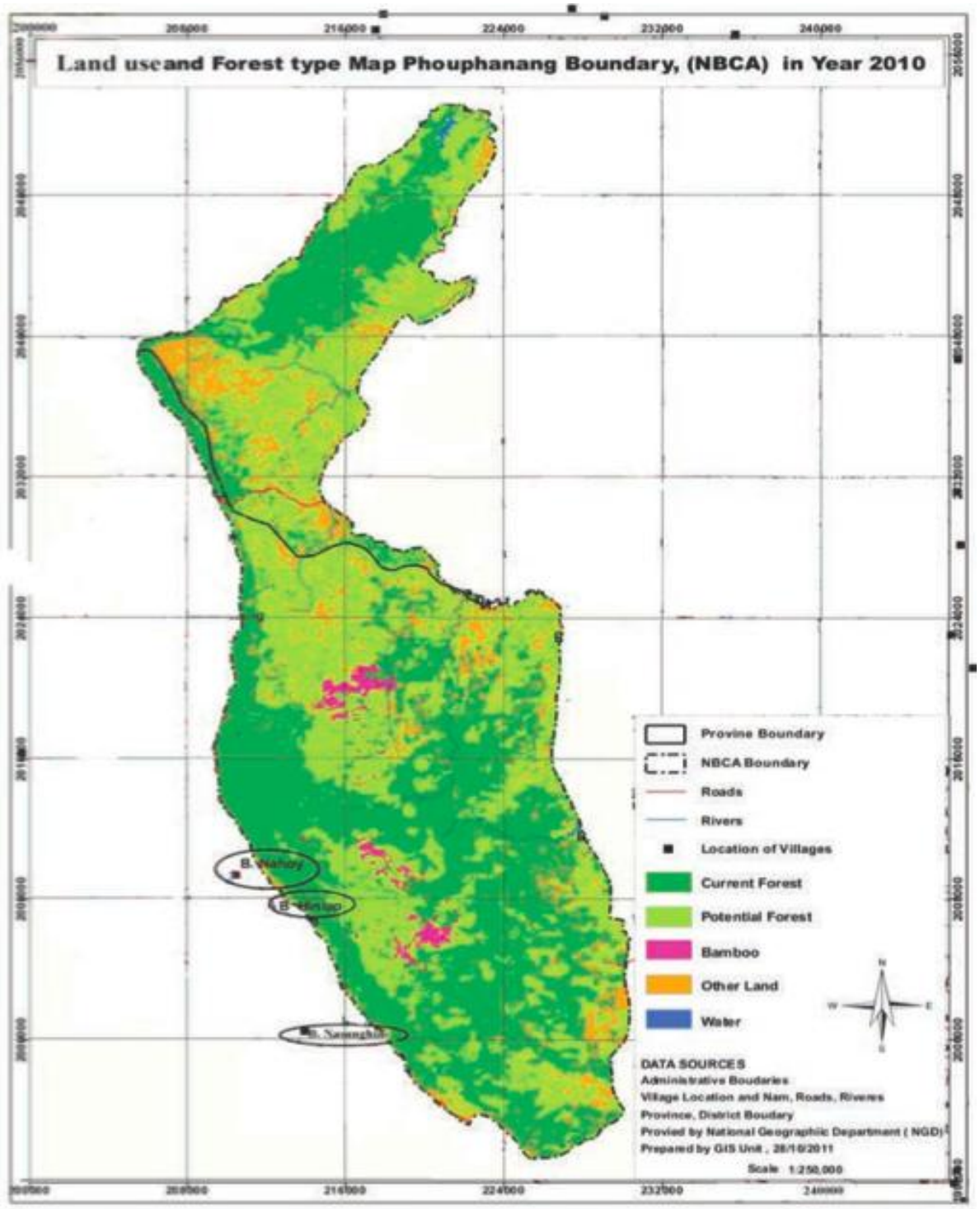
Figure 4-8: Location of Phou Khao Khoay and Phou Phanang Protected Areas



182. At its closest point of approach to NR13 North, Phou Khao Khouay is more than 20 km to the east, and the Nam Ngum River also lies between NR13 North and PKK. While PKK includes large areas of natural habitat, and a number of IUCN Red List species are considered to occur in the area, it is far enough from NR13 North that the Project is expected to have no discernible impact on the protected area or its flora and fauna.

183. Phou Phanang's main axis runs generally north-south and is roughly parallel to NR13 North for the entire length of the project area. The closest point of approach from the road to Phou Phanang occurs near the middle of the project area and is nearly 3 km distant. On average the PA is more than 10 kilometers from the road. Land use mapping undertaken in 2010 shows that the forests cover less than 50% of PPN (see **Figure 4-18**); and a review of the area using Google Earth backed up by visits made along the eastern boundary show that much of eastern portions of Phou Phanang are degraded by human activity, including agricultural developments, various small settlements and several reservoirs.

Figure 4-9: Land use and forest type Map of Phou Phanang National Protected Area in 2010



Source: National Geographic Department (NGD), GIS Unit, Lao, PDR.

184. Phou Phanang, established in 1993, is the closest protected area to Vientiane and covers a total area of about 70,000 ha or 700 km^2, of which about 52,000 ha is in Vientiane Capital and 18,000 ha is in Vientiane Province. Geologically the area is a single N-S scarp

system facing to the west and sloping more gently down to the east, with elevations ranging from about 200-698 masl.

185. The habitat is described as mostly degraded forest with a small area of semi-evergreen forest. Various published sources say that the wildlife includes species such as gibbons, civet cats, elephants and possibly gaur, although in an interview on 29 May 2017 the head of the Protection Forest Section of Vientiane Capital said that elephants hadn't been seen in the area for the past 10 years. PPN's eastern margin runs roughly parallel to NR13N and includes various residential and agricultural areas, and there are several reservoirs. There are some public hiking trails, but there is little or no road or trail access to the interior sections where most wildlife are found.

186. Important Bird Areas (IBAs) – IBAs are recognized as globally important habitats, particularly for the conservation of birds. According to BirdLife International, Laos has 699 species of birds, including 597 landbirds and 102 waterbirds, of which 265 are migratory species and 6 are seabirds. In addition, 25 species are globally threatened and one is endemic (found only in Laos). There are 27 IBAs in Laos, and the closest one to NR13 North project area is about 30 km east of the road near PKK's southwestern boundary. Given its distance from NR13 North, the Project is expected to have no discernable impact on the IBA.

187. The IBA is situated in the foothills of the Phou Khaokhouay massif, close to Ban Nakhay. The topography of the IBA is dominated by gently sloping sandstone shelves, with patches of thin, sandy soil, supporting stunted dry dipterocarp forest and bamboo scrub. Along streams and by pools, there are also patches of mixed deciduous forest. The eastern portion is especially important for wildlife, including species such as gibbons, green pea fowl and elephants. The IBA is the only site in northern Lao PDR confirmed to support a significant population of Green Peafowl *Pavo muticus*. The IBA differs from most other IBAs in Lao PDR in that it was identified for a single species in a very localized area.

4.5 Socio-Economic Resources

4.5.1 Demographics

188. Lao PDR is an ethnically diverse country, the country's population of approximately 6.8 million people (Census 2015) can be categorized into four broad ethno-linguistic families: The Lao-Tai (67%), the Mon-Khmer (21%), the Hmong-Iew Mien (8%), and the Sino-Tibetan (3%). These groups encompass 49 distinct ethnicities and over 200 ethnic sub-groups. Specifically, the Lao-Tai is comprised of eight ethnic groups, the Mon-Khmer thirty-two, the Hmong-Lu Mien two, and the Sino Tibet seven.

189. Naxaithong - The Naxaithong district is one of 9 districts in the Vientiane Capital. It is located in the northern part of the Capital and covers an area of 90,800ha. The district has 54 villages, and a population of 75,228, with a sex ratio of 1.01. The majority of them belong to Lao-Tai ethnic group. The 24 villages that lie along Road 13 North have a total population is 33,766, in 6,665 households. Of these, 2,187 households, businesses, restaurants and blocks of unimproved land lie directly along the road. Ethnic groups other than Lao/Tai constitute only 1% of the households in the 24 villages, and own only 2 blocks of land and 4 houses of the 2,187 houses, businesses, pieces of land along the road.

190. Phonhong - The Phonhong district is one of the 13 districts of the Vientiane province, and is located to the north of Naxaithong district. It borders with Naxaithong in the south and with Vangvieng district in the north. The district has 59 villages with 12,465 households and a population of 65,181 inhabitants. There are 20 Phonhong villages lying along Road 13 North, with a total population of 32,608 in 5,901 households, and a sex ratio of 0.96. The main ethnic group is the Lao-Tai (64.5%). The Mon-Khmer ethnic group (Khmu) have about 1,030 people (3.2%), and the Hmong ethnic group about 10,500 (32.3%). Of the population living along the road in Phonhong District Hmong and Khmu own or rent 35 houses, 29 shops, 2 restaurants, 2 hotels and 8 pieces of land.

191. Relatively undocumented business settlers (including foreign nationals - Vietnamese, Chinese and Thai) add about 940 people to this mix along the road (both districts). This figure does not include itinerant sellers who sell lottery tickets, bread, fruit and so on along the road.

192. **Figure 4-10** illustrates the ethnic make-up of the Project area and **Figure 4-11** illustrates population density.

193. Project Corridor – **Table 4-19** shows the ethnic composition within the Project corridor itself. The different ethnic groups showed very different household sizes – 7.2 for Hmong, 5.7 for Khmu and 5.0 for Lao Loum. The sex ratio of Khmu households was 1.28 (M:F), compared with close to 1 for Hmong and Laoloum. Data for Tai Daeng was based on a small number of households and sex ratio and household size are outside the expected range.

Table 4-19: Ethnicity and Population, Household size and Sex ratios in the Project Corridor

Ethnicity	Total No. HHs	Total Population	Sex ratio	HH size
Lao-Tai	10,494	52,642	0.98	5.02
Hmong	1,496	10,736	1.01	7.18
Tai Dam	293	901	0.96	3.08
Khmu	224	1,280	1.28	5.71
Tai Daeng	74	166	0.73	2.24
Totals	**12,581**	**65,725**	**0.99**	**5.22**

Figure 4-10: Ethnicity in the Project Area

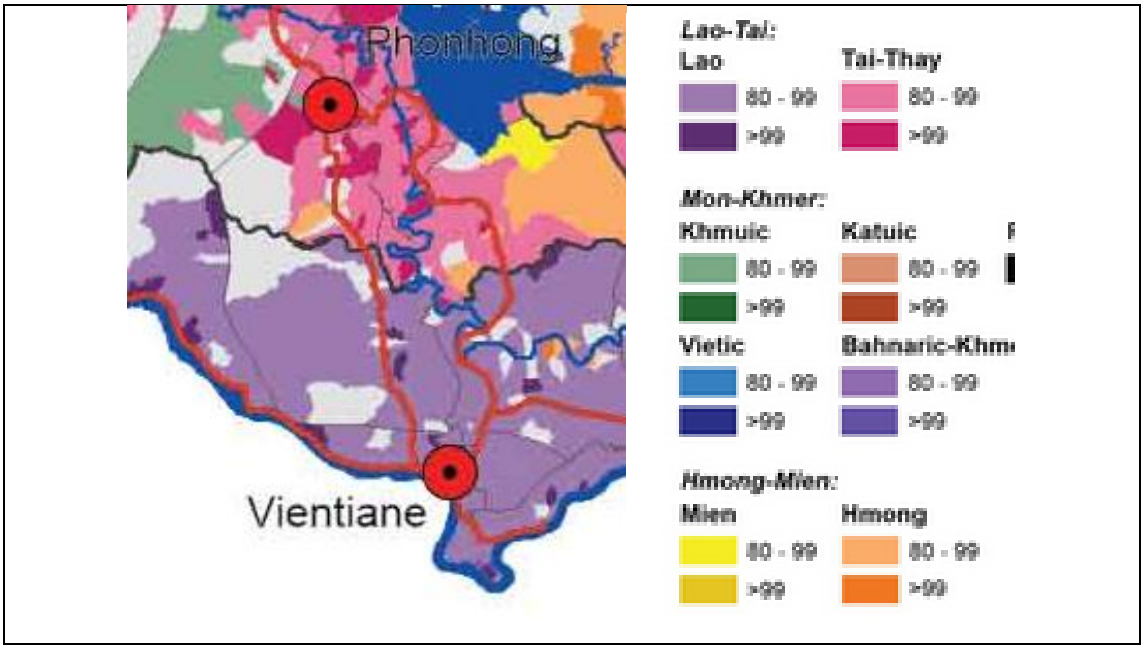
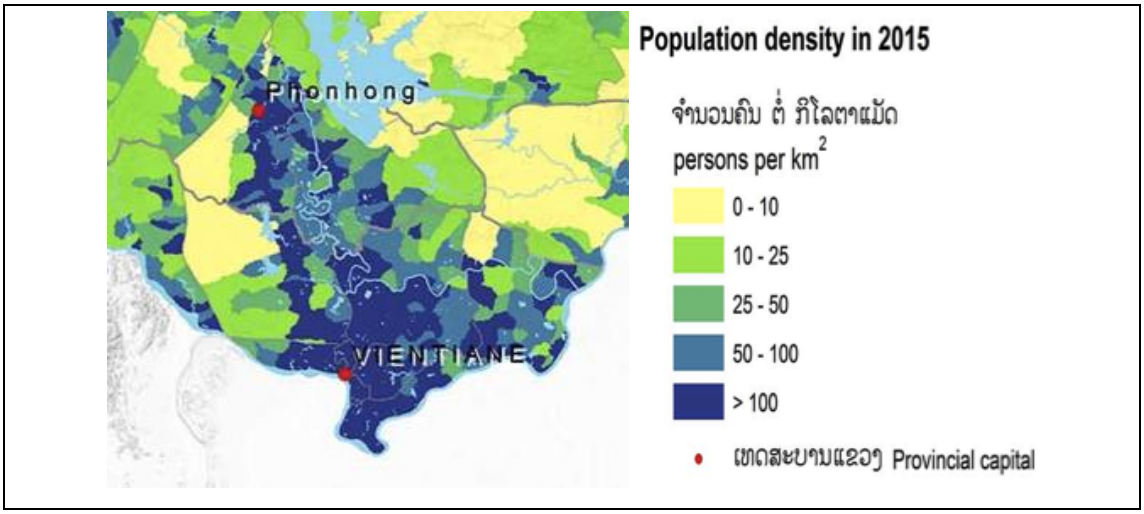


Figure 4-11: Population Density in the Project Area



4.5.2 Ethnic Groups Development Plan (EGDP)

194. The proposed project is likely to result in a number of adverse socio-economic impacts for the ethnic groups present in the project area, particularly the Hmong at Lak 52 and Phonkham-nua villages. Following the consultation with the relevant stakeholders, the project will trigger the World Bank Indigenous Peoples Policy OP.4.10. Accordingly, an EGDP and social assessment has been prepared as part of the Project. The findings of the EGDP show that there are no additional concerns of the Hmong that are different to other stakeholders living and working along the road, with the exception of the needs to respect New Year celebrations. The findings of the social assessment are discussed below and any mitigation measures have been included in the ESMP.

4.5.3 Gender & Children

195. General - Problems that women in rural areas of Lao PDR face include a lack of awareness about maternal health and malnutrition. Gender gaps are also seen in education, and even though these gaps are narrowing, girls are more likely to be left behind and challenges still persist in education completion. Low-quality education and consistent dropout rates among girls in rural areas have ranked Lao PDR as one of the lowest performers in the East Asia Pacific region for girls' education. Women are also subjected to human trafficking to neighboring countries, often ending up in forced prostitution and domestic labor. In addition, violence against women is widespread. This has been attributed to weak or absent definitions and distinctions of violence in legislation (for example, the Penal Code only recently addressed domestic violence or marital rape), a culture of silence and impunity, poor access to justice for women in rural ethnic communities, and an absence of data and information on the rate of violence and the availability of services for survivors.

196. Besides women, children are the most vulnerable to poverty. As about 50% of the population is under the age of 18, a significant number of children are likely to experience poverty either directly or indirectly. The child labor issues do not seem to have gained much attention from policy makers, nor is there sufficient understanding of this matter. About 15% of the total population of children 5 to 17 years of age are considered to be employed. Children in Lao PDR are also vulnerable to sexual abuse and exploitation. Although official reports of child abuse are rare, anecdotal evidence suggests that the problem exists. [16]

197. Project Area – In Naxaithong and Phonhong it was found that land ownership was usually held jointly by husband and wife. Naxaithong in particular is a relatively wealthy and well-educated district. There are many small businesses along the road in both districts, and a majority of these are effectively controlled by women.

[16] Profile on Environmental and Social Considerations in Lao P.D.R. JICA, December, 2013.

198. In Naxaithong almost all children graduate from both primary school and lower secondary school, as both these levels are compulsory. A large number (66%) of 3-5 age group also attend kindergarten.

4.5.4 Vulnerable People

199. Vulnerable households, as defined by Decree 84 by GoL, dated 05/04/2016 on Compensation and Resettlement Management in Development Project, include those who might suffer disproportionately from the loss of fixed and movable assets, other assets and production base, or face the risk of being marginalized from the effects of resettlement, and specifically include:

- Households with persons falling under the generally accepted indicator for poverty as defined by the Ministry of Labor and Social Welfare (already discussed above), or the landless;
- Divorced or widowed female headed households with dependents and low income;
- Households with disabled or invalid persons; and
- Elderly households with no means of support.

200. Approximately 23 households (less than 1%) fall below the official poverty line of per capita monthly income of 240,000 Kip. Most of these were women-headed households, as well as farmers and daily labourers.

201. Excluding those already included in the "poor", 34 of the female headed households are in the 2nd income group (low income with monthly income per capita between 240,000 and 500,000 Kip) and have dependents.

202. There are 5 households that are headed by the elderly, with monthly income per capita between 240,000 and 500,000 Kip and comprise only one or two persons and therefore have little labor to sell or other means of support.

203. About 10 AHs with monthly income per capita between 240,000 and 500,000 Kip recorded having members with a disability. These households are in the 2nd income quartile and considered vulnerable.

204. In total there are 81households (3%) that are considered vulnerable by virtue of the foregoing definition. **Table 4-20** shows the number of households falling into each classification of vulnerability.

Table 4-20: Vulnerability of Affected Households

Category of vulnerability	Affected Households	
	Male-headed	Female-headed
Households falling below poverty line	14	18
Low income, single female-headed AHs (excluding households below poverty line) Per capita income of 500,000 Kip/month or less	0	34
Households with disabled members (excluding households below poverty line)	6	4
Elderly with no means of support (household head >65 years and household size less than 3)	5	0
Total	**25**	**56**
	81	

Source: Socio-Economic Survey (August 2017)

4.5.5 Economic Conditions

205. The Lao economy grew 7% in 2016 (WB estimate, Economic Monitor), slightly down from 7.4% the previous year. Investments in hydropower brought installed capacity to over 6,000MW, and agricultural production improved slightly from the year before. The government revenue shortfall deepened during the year, reaching 6.2% of GDP.

206. Naxaithong District – Economic growth in Naxaithong was reported at 9.5% for 2016[17]. The average income per head was $1,989. The district government has forecasted an increase to $2,100 per head by the end of 2017.

207. Phonhong District - Growth in GDP was reported by the district government at 8,97%, with an average annual income per person of $2,220.[18]

4.5.6 Infrastructure

208. Lao Road Network – Considerable development of the road network in the Lao PDR has occurred over the last 2 decades. The length of the road network has risen from 14,000 km in 1990 to 20,000 km in 1997 and to 35,600 km in 2008. While the Lao PDR's road network is extensive, only 14% of the current road network is paved, including 56% of the national roads and 3% of the total of urban, rural, and special roads. Gravel and earth roads account for 34% and 52%, respectively, of the length of the network. Seasonal closures are frequent due to poor pavement and

[17] Naxaythong District Party Congress Report, No 12, Congress No. 6, June 2017

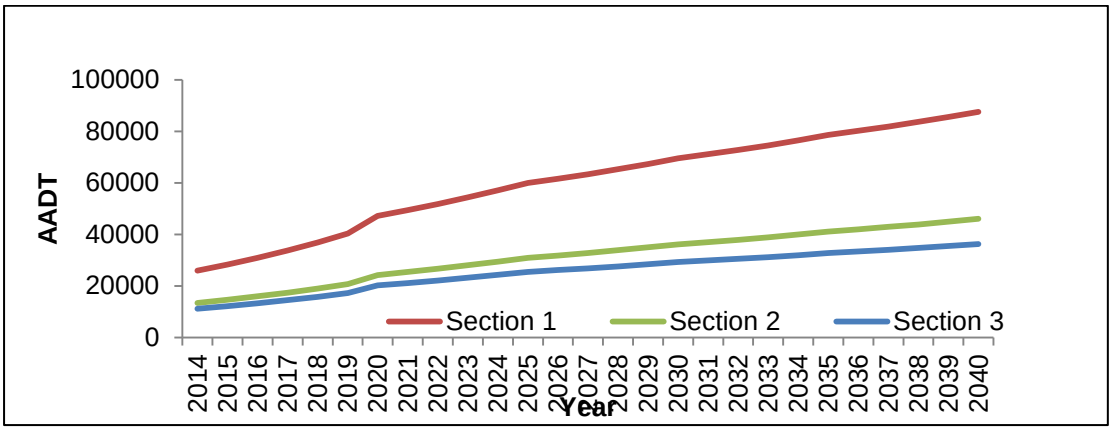
[18] Summary Report of Implementation of Social and Economic Development Plan Aug 2017.

deficient cross-drainage. Nineteen out of 139 district centres and one-third of all villages (3,500 out of 10,500) do not have year-round all-weather road access. [19]

209. The main national roads, such as Road 13, 9, 3, 8, 7, and 12, which also serve transit transport, are heavily affected by overloading trucks. After neglecting overload control for some years and with the rapid deterioration of the road condition, the government realizes the need to reinstate and reinforce overloading control and is in the process to reinstall modern permanent weighing stations on national road 3, 9 and 13 and plans to scale it up to other roads later on. Road safety is another challenge and efforts are being made to address the issues sector wide.[20]

210. Traffic Forecasts - The traffic forecasting for the Project road has been carried out during the FS using forecast growth rates considering different homogeneous sections depending on the traffic levels at present on NR13 North. The base year traffic has been given by vehicle categories based on the comprehensive traffic surveys carried out in 2014 in the FS.

Figure 4-12: Forecasted AADT Over 25 years, NR13 North



Section 1	Section 2	Section 3
Sikeut - Ban Naxaithong	Ban Naxaithong - (Junc to Lingxan)	(Junc to Lingxan) – Phonhong

211. Road Tolls – The Project FS analyzed 1,098 road users surveys to determine the willingness to pay toll fees for both NR13 North and NR13 South. The average willingness to pay for each categories of vehicles were obtained by considering the amount expressed to pay for the tolls and their travel distances for the journey of concerned. The average willingness to pay by all vehicle categories are given in **Table 4-21.** It is observed that 4 wheelers were willing to pay on average of 416kips/km. The 2 wheelers were willing to pay 465 kips/km which is the highest among all users. This indicates again that majority of the two wheelers are not in an income group

[19] Lao PDR - Transport Sector Assessment, Strategy and Road Map. ADB, 2011

[20] Draft Environmental and Social Management Framework (ESMF) - Second Lao Road Sector Project (LRSP-II). MPWT / DOR, 2016

whose income is less than 4 wheel users. The average values observed for willingness to pay from truck users are the lowest and not consistent and not related with their freight income.

Table 4-21: Willingness to Pay for Road Tolls

No	Vehicle Type	# Respondents	Amount Willing to Pay (kips/km)	Average by Type (kips/km)
Private Passenger Vehicles				
1	Car/ Jeep	114	507	416
2	Van	111	342	
3	Pickups	101	424	
4	Taxi	38	389	
5	M Bike	53	465	374
6	Tuk-Tuk	10	283	
Goods Vehicle (Freight Vehicles)				
7	Light Truck	113	194	209
8	Medium Truck	63	286	
9	Heavy Truck (3&4Axle)	80	241	
10	Heavy Truck (5 & More Axle)	32	114	
Public Transport				
11	Bus (14 Seater Truck Type)	82	359	256
12	Full Body Small Bus	88	159	
13	Full Body Large Bus	213	251	
	Total	1,098		

212. FGD participants were also canvassed on their feelings towards making NR13 North a toll road. Some suggested that if the fee is implemented, it should be capped at about 3000 kip per trip. Others suggested that tolls should only be levied on new roads, not upgraded ones like NR13 North. It is understandable that the government needs to raise a lot of funds for a new road, but for an upgrade it should use the currently available budget. Yet some others said that a toll was acceptable, but the government needed to build a separate road alongside it for local traffic, without a toll. An alternative needed to be provided for those who are not going long distances.

213. People who travelled frequently or daily to Vientiane for education or business were most opposed to the idea of a toll, unless local residents were exempt. Residents could be paying the toll fee several times per day. The solution suggested was that all residents should be issued a vehicle pass.

214. Many respondents argued that, as a national road, it should be free of tolls for all. Some suggested that a toll on commercial vehicles, especially heavy trucks, would be acceptable, but not on ordinary road users.

215. There was a suggestion from some respondents that if the government needed to increase revenue for construction and maintenance, it should do so via the vehicle registration fees. However most disagreed with this too, saying that they already paid vehicle registration fees. Others suggested an increase in the price of fuel could cover maintenance and construction costs.

216. Types of Vehicles and Trip Purpose – An Origin Destination survey undertaken for the Project in July 2017 assessed the types of vehicle used on the NR13 North and the trip purpose. **Figure 4-13** illustrates that the majority of vehicles using the road are cars (50%), followed by 2-axle rigid trucks (20%) and motorcycles (20%). The purpose of travel is illustrated by **Figure 4-14**. The main purpose of travel was business (32%) followed by going to work (24%) and going home (23%). Less than 2% used the road for travel to school.

Figure 4-13: Types of Vehicle, NR13 North

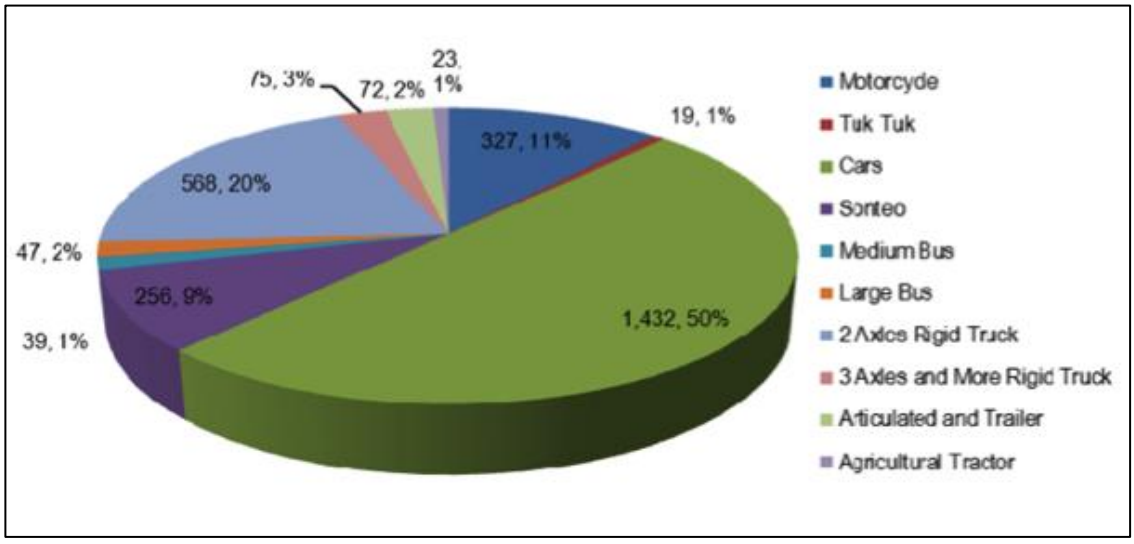
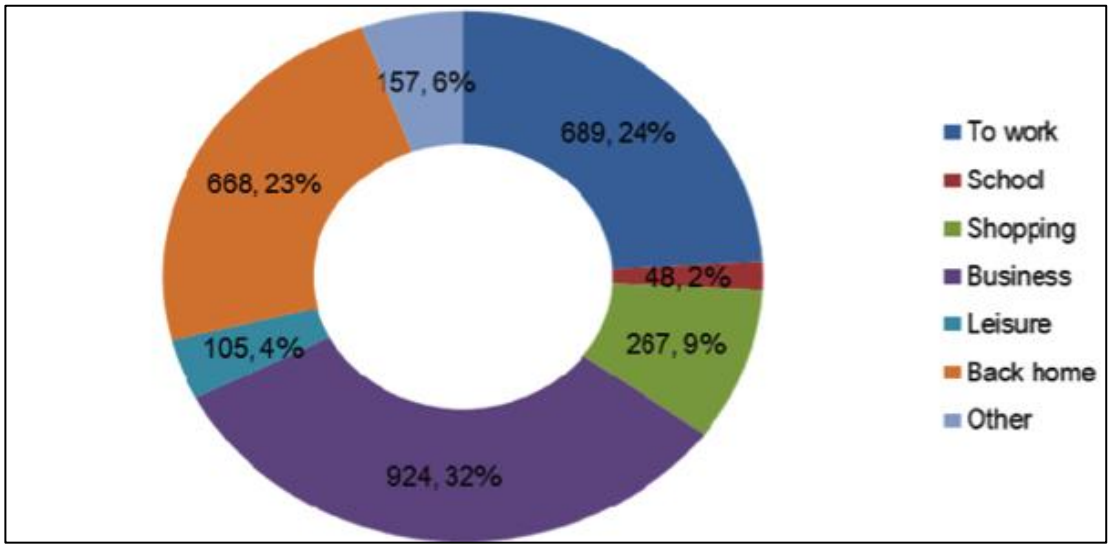


Figure 4-14: Main Purpose of Travel, NR13 North



217. Air transport - In the civil aviation subsector, the Lao PDR operates the Wattay Airport at Vientiane and two regional airports at Louangphrabang and Pakxe. In addition, there are 10 minor airports in the provincial capitals and 39 other airstrips.

218. Inland waterways - The Lao PDR's topography has traditionally facilitated inland waterway transport. However, this form of transport is insufficiently used and lacks integration with the other forms of transport, especially roads. The country has over 2,000 km of rivers, comprising the Mekong and its tributaries. Twenty-one river port facilities, constructed by the government, have typically been employed for domestic trade only. However, recent years have witnessed a growth in cross-border trade with the China, Myanmar, and Thailand.

4.5.7 Land Use

219. Land use within the Project corridor is dominated by a ribbon of residential / commercial / light industrial properties and patches of agricultural land between each village and town. Often it is difficult to determine when one village ends and another starts due to continuous development along the road. As the road continues further north to Phonhong, areas of natural vegetation can be noted (km 49 – 55), although within the ROW most portions are degraded by human activity. **Table 4-22** provides an overview of the population of villages along the road and the types of property present and **Figure 4-24** provides a land use map of the Project corridor.

Table 4-22: Population of Villages, Number of Establishments along NR13 North

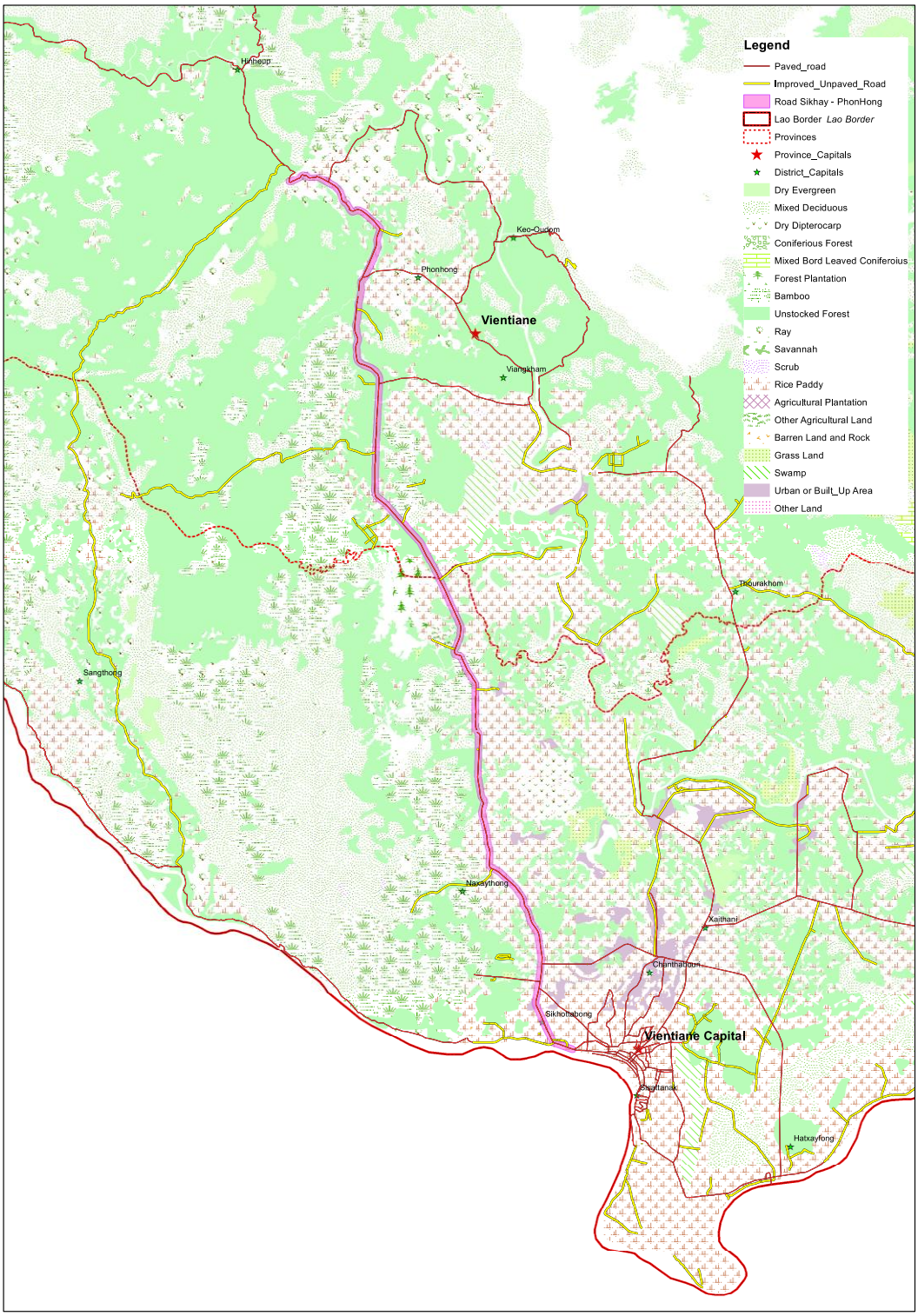
Village	Total Population	Households	Total possibly impacted	HHs along 13 N	Shops	Hotels	Restaurants	Vacant land
Xaimoungkhoun	830	165	38	3	26	0	3	5

Village	Total Population	Households	Total possibly impacted	HHs along 13 N	Shops	Hotels	Restaurants	Vacant land
Sikeut	3018	585	61	26	27	0	4	4
Phanghaeng	2335	432	101	43	36	0	11	11
Donglouang	1782	387	68	23	35	4	6	0
Naxaythong-Tai	1274	244	92	31	48	0	10	3
Naxaythong-kang	1095	205	26	7	14	0	2	3
Naxaythong-nua	1342	331	96	52	32	0	4	10
Houaxang	1193	227	114	50	40	0	6	18
Houakhoua	1795	330	165	77	54	0	6	33
Nongkhankhou	713	179	95	32	32	0	2	29
Ilai -Tai	1448	263	103	59	29	0	3	12
Ilai-nua	2036	381	98	49	37	0	3	9
Songkhouakang saen	627	117	70	51	3	0	14	2
Chaengsavang	466	96	12	4	7	1	0	0
Houaynamyen	2648	477	132	42	49	0	5	36
Songpuay-tai	1313	250	65	23	38		2	2
Songpuay-nua	1159	220	77	44	24	1	6	2
Phonkham	1457	310	85	50	25	2	5	3
Nakha	1025	211	88	59	8	0	0	21
Phonmouang	1495	295	130	33	55	0	7	35
Nanga	1373	359	121	87	3	0	6	25
Boua	793	153	76	47	3	1	4	21
Nongsa	1803	304	181	91	47		6	37
Nadi	746	144	93	41	27		1	24
Sivilay	751	138	99	45	25	1	4	24
Mai	2499	460	178	94	52	2	16	14

Village	Total Population	Households	Total possibly impacted	HHs along 13 N	Shops	Hotels	Restaurants	Vacant land
Phonxay Tai	1315	300	109	67	26	1	3	12
Taothan	834	161	83	52	19	0	7	15
Nalao	3202	531	140	65	53	1	10	11
Lak 52	2498	404	114	8	102	2	2	0
Nongnak	3276	425	13	0	6	6	0	1
Phonkham-tai	1940	284	41	8	28	1	2	2
Phonkham-nua	2421	282	68	37	21	1	3	6
Hongluay	1362	217	61	27	21	0	3	10
Nabon	1274	235	89	52	24	0	2	11
Vangmon	1359	256	119	72	14	1	4	28
Saka	2229	423	124	62	39	0	5	18
Phonngeun	783	164	66	36	12	0	1	17
Phonsavang	1441	315	121	53	35	2	7	24
Houaython	884	195	94	57	15	0	5	17
Namchaeng	1094	230	138	66	26	0	5	41
Phonsi-tai	714	150	113	76	17	3	3	14
Namlin	1024	202	42	19	18	0	3	2
Phonhong	1657	391	59	22	31	0	3	2
Totals	65,725	12,581	4,058	1942	1283	29	205	618

Source: interviews with village authorities, June-July 2017, data from 2016

Figure 4-15: Land Use within the Project Corridor



220. The Project will require a considerable amount of land take within the Project corridor which will necessitate resettlement and compentation payments. A resettlement action plan (RAP) has been prepared as part of the Project to account for this issue.

4.5.8 Waste Management

221. General - Urban populations in Lao PDR are expanding, and as a result, there are poor waste collection and insufficient disposal facilities. Solid wastes in urban areas degrade the quality of surface and ground water. The improper handling of wastes also results in health risks for people living in the area. The capital city of Vientiane, municipalities and secondary towns have landfill sites, whereas small towns have open and uncontrolled dump sites. Recycling systems for most forms of waste are based on the informal collection and selling of valuable waste to junkshops and dealers. On the other hand, there is no system for dealing with hazardous waste. [21]

222. Project Area – Waste generated per capita in Vientiane Capital Province is around 0.65kg per day, generating around 500 tons of waste per day, of which around 300 tons are collected, transported and disposed of at a landfill site located at Km32 of NR13 South (operated by Vientiane Urban Development and Administration Authority (VUDAA)). All types of waste are sent to this landfill including residential, commercial and industrial waste (assumed to include hazardous waste). According to reports the landfill is uncontrolled meaning that waste is simply dumped without consideration of the types of waste or the potential for pollution of soils and groundwater, or indeed potential health and safety impacts to those living around the site. However, there is a healthcare waste incinerator at the site (funded by JICA), but its limited capacity (20kg/h) is not sufficient for the requirements of the Province. There are also facilities for collecting and bulking recycled materials at the site. It is estimated that as much as 10% of waste if recycled (metal, plastic, glass, cardboard, etc) at the site and sent to China, Vietnam and Thailand for processing. [22]

Figure 4-16: Uncontrolled Landfill, Km32, N13 South

223. Other waste management facilities and landfills in the Project area are listed in the following tables.

[21] Profile on Environmental and Social Considerations in Lao P.D.R. JICA, December, 2013.

[22] Municipal Solid Waste Management Assessment Report, Vietntiane Capital Province Climate and Clean Air Coalition. 2014

Table 4-23: Waste Management Facilities in Naxaithong

No	Village	Landfill	Company	Km from road 13 N	Price/Month	Waste
1	Xaymongkhoun	Lak 32	VCOMS	32	20,000-35,000 kip	General
2	Sikeut					
3	Phangheng					
4	Donglouang					
5	Naxaitai					
6	Naxaikang					
7	Naxaineua					
8	Houaxang					
9	Houakhua					
10	Nongkhunkhou					
11	Ilai tai	Phontong Village	Thilakhoun	4	20,000-35,000 kip	General
12	Ilai nuea					
13	Songkhuakangsaen					
14	Chengsavan					
15	Huaynamyen					
16	Songpeuaytai					
17	Songpeuaynuea					
18	Phonkham					
19	Nakha					
20	Phonmuang					
21	Nanga	Village's Area				
22	Boua	Phontong Village	Thilakhoun	4	20,000-35,000 kip	General
23	Nongsa					
24	Nadi					

Table 4-23: Waste Management Facilities in Phonhong

No	Village	Landfill	Company	Km from road 13 N	Price/Month	Waste
1	Sivilay	Phontong Village	Waste Management Unit	4	20,000-35,000 kip	General
2	Mai					
3	Phonxay tai					
4	Taothan					
5	Nalao					
6	Lak 52					
7	Nongnat					
8	Phonkham tai					
9	Phonkham neua					
10	Hongleuay					
11	Nabone					
12	Vangmonkhat		Thilakhoun			
13	Saka/Phonyang					
14	Phonngeun					
15	Phonsavang					
16	Houaythou					
17	Namchaeng					
18	Phosi Tai					
19	Namlin					
20	Phonhong					

4.5.9 Health & Safety

224. Regional Health Issues – Common afflictions in Phonhong were reported as Hepatitis A, malaria, dengue fever, diarrheal disease, measles. 95% of the population use piped water, and 92% use a toilet. Only 79 births were reported at hospitals in the first 6 months of 2017. A total of 401 families have joined the community health insurance funds.

225. In Naxaithong common diseases were reported as dengue fever, diarrheal disease, malaria. About 144 mothers gave birth in hospitals, and 442 used hospital provided ante-natal, but most gave birth elsewhere. 95% were connected to a piped water supply, and 98% used a toilet.

226. Road Traffic Accidents – The Project FS tabulated accidents between 2004 and 2013 on the Project road. **Table 4-24** shows that nearly all accidents recorded during this period were in Phonhong district. **Table 4-25** shows the variation of total recorded accidents over the period 2004 – 2013. It seems somewhat difficult to believe that there were no recorded accidents in Naxaithong between 2004 and 2011, so this data should be ignored. It does appear that there is an upward trend in the number of accidents recorded in Phonhong district perhaps due to increased traffic levels. **Table 4-26** shows that around 160 fatalities were recorded on the Project road between 2004 and 2013.

Table 4-24: Total Accidents Recorded during 2004 -2013

District	Number of All Accidents by Road Geometric Locality				
	Junction	Curve	Straight	Bridge	Total
Naxaithong	21	0	43	0	64
Phonhong	1,136	927	1,409	26	3,498

Source: Feasibility Study, 2014

Table 4-25: Variation of Total Accidents Recorded during 2004 -2013

District	Total Number of Accidents 2004 - 2013										
	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	Total
Naxaithong	18	46	0	0	0	0	0	0	0	0	**64**
Phonhong	444	459	523	518	408	242	269	170	357	108	**3,498**

Source: Feasibility Study, 2014

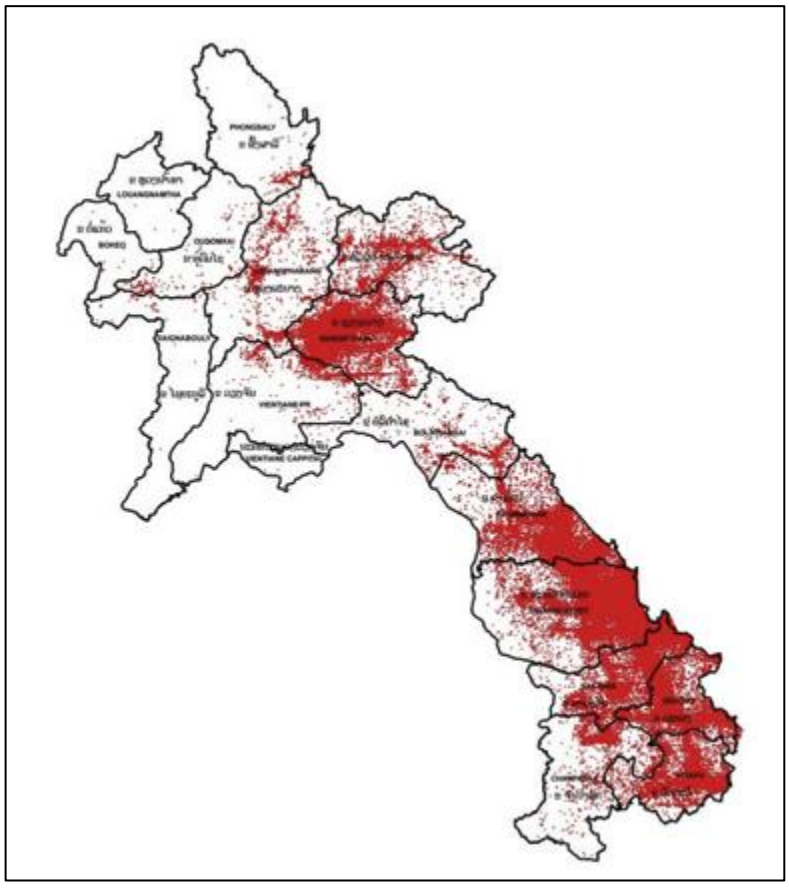
Table 4-26: Accidents by Type during 2004 -2013

District	Accident Types				Total
	Fatal	Grievous	Light Injuries	Property Damage only	
Naxaithong	7	15	10	32	64
Phonhong	153	661	959	1,725	3,498

Source: Feasibility Study, 2014

227. Unexploded Ordnance - Lao PDR has the unwanted distinction of being per capita the most heavily bombed nation in the world. Between the years 1964 and 1973, the United States flew more than half a million bombing missions, delivering more than two million tons of explosive ordnance, in an attempt to block the flow of North Vietnamese arms and troops through Laotian territory. The ordnance dropped include more than 266 million submunitions (known as "bombies" in Laos) released from cluster bombs. Significant land battles, including those during the war for independence during the French colonial era and between the Pathet Lao and the Royal Lao forces, also contributed vast quantities of unexploded heavy bombs, rockets, grenades, artillery munitions, mortars, anti-personnel landmines, and improvised explosive devices. It is estimated that up to 30% of all ordnance did not explode. Such unexploded ordnance (UXO) continues to remain in the ground, maiming and killing people, and hindering social-economic development and food security.[23] **Figure 4-17** illustrates the bombing data used to predict UXO contamination in Lao PDR.

Figure 4-17: US bombing data map used to predict UXO contamination



Source: National Regulatory Authority for UXO/Mine Action Sector Lao PDR (http://www.nra.gov.la/uxomap.html)

[23] Lao National Unexploded Ordnance Programme. http://www.uxolao.org/index.php/en/the-uxo-problem

228. Although this is considered an incomplete picture and is only used to illustrate where significant quantities of UXO could be found it does indicate that the Project area is not one of the areas of significant contamination. However, it is still possible that UXO could be present within the Project corridor.

229. Health Facilities – A number of health facilities have been identified within the Project corridor that maybe impacted by the Project. **Table 4-27** tabulates these health facilities and their distance from the edge of the existing road. **Figure 4-18 to Figure 4-25** illustrates their locations. **Appendix Q** also provides an inventory of the health facilities.

230. Note that this is the distance to the boundary of the sites and that the buildings used by patients and staff are set further back than the boundary, in some cases more than 50 meters, for example Phonhong Hospital.

Table 4-27: Health Facilities Identified in the Project Corridor

#	Name	Village	District	Locations (GPS)	Distance from edge of existing road to site boundary
1	Naxaythong Hospital	Donglouang	Naxaithong	18° 3'52.76"N 102°32'15.25"E	10m
2	Ilai Health Center	Ilai-Nua	Naxaithong	18° 8'39.00"N 102°30'12.11"E	10m
3	Nakha Health Center	Nakha	Naxaithong	18°12'36.23"N 102°29'54.52"E	15m
4	Lak 52 Health Center	Nalao	Phonhong	18°20'42.86"N 102°25'37.56"E	10m
5	Phonhong Hospital	Namlin	Phonhong	18°29'20.19"N 102°24'45.85"E	5m

Figure 4-18: Location of Health Facilities, Educational Facilities and Temples

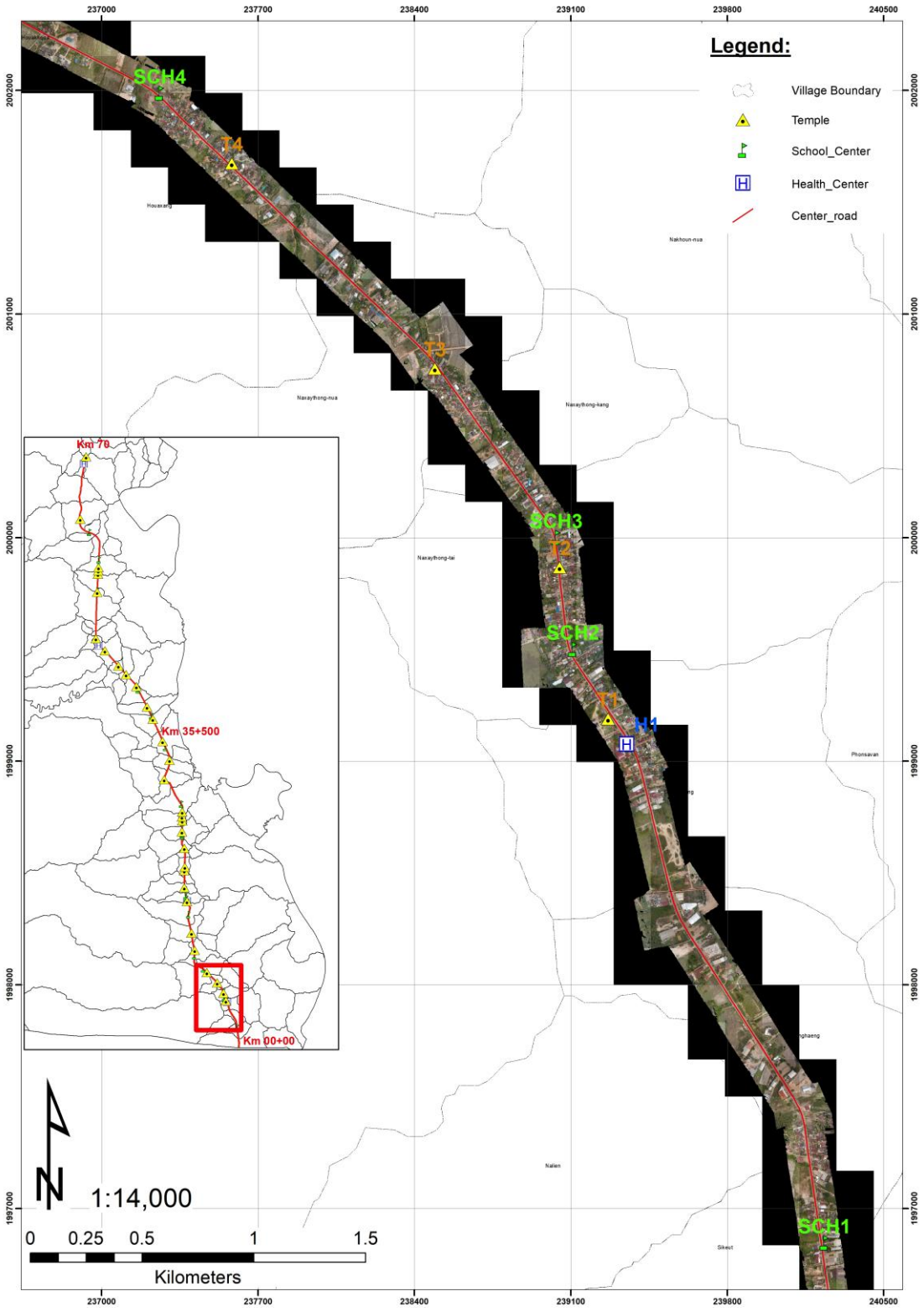


Figure 4-19: Location of Health Facilities, Educational Facilities and Temples

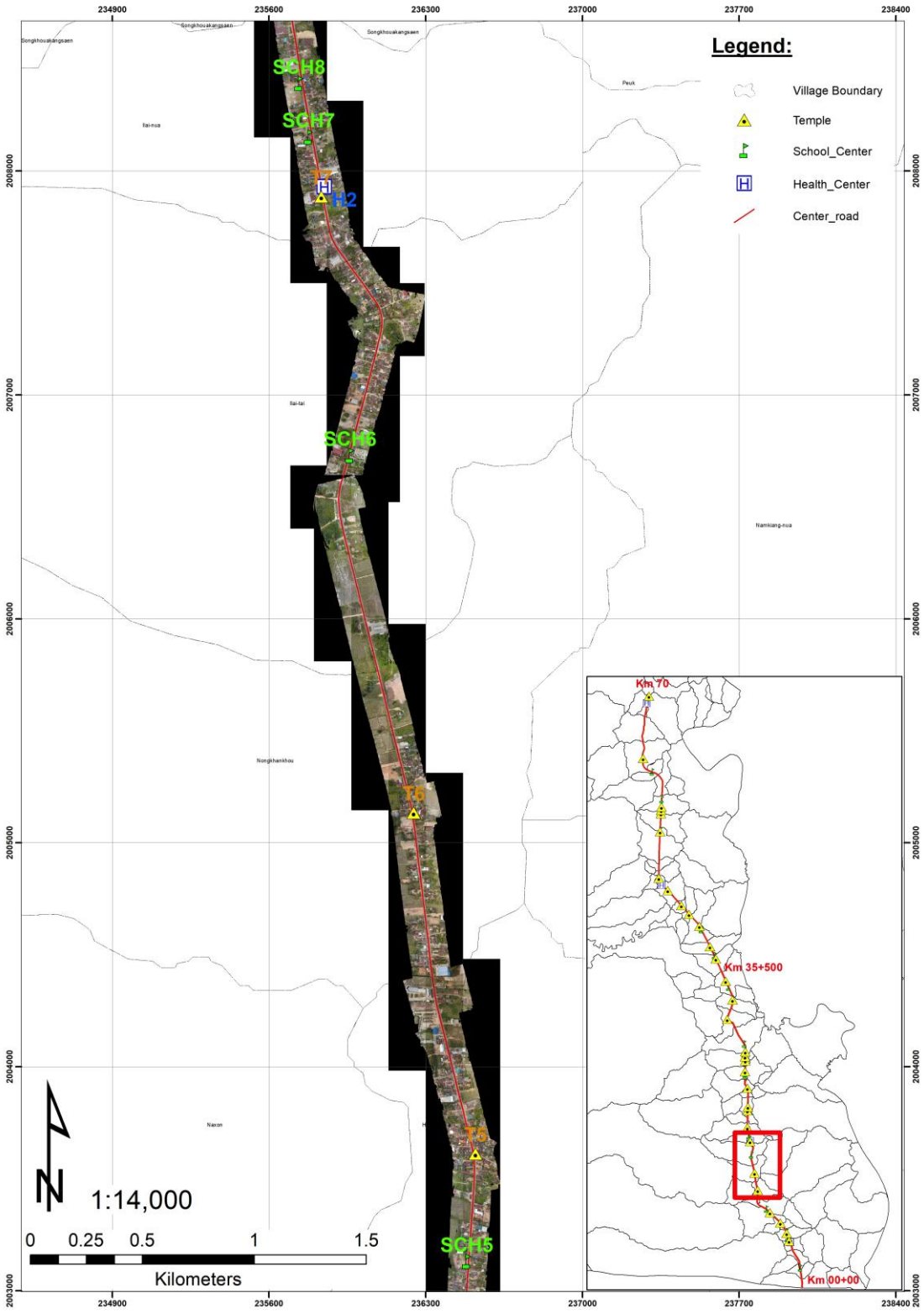


Figure 4-20: Location of Health Facilities, Educational Facilities and Temples

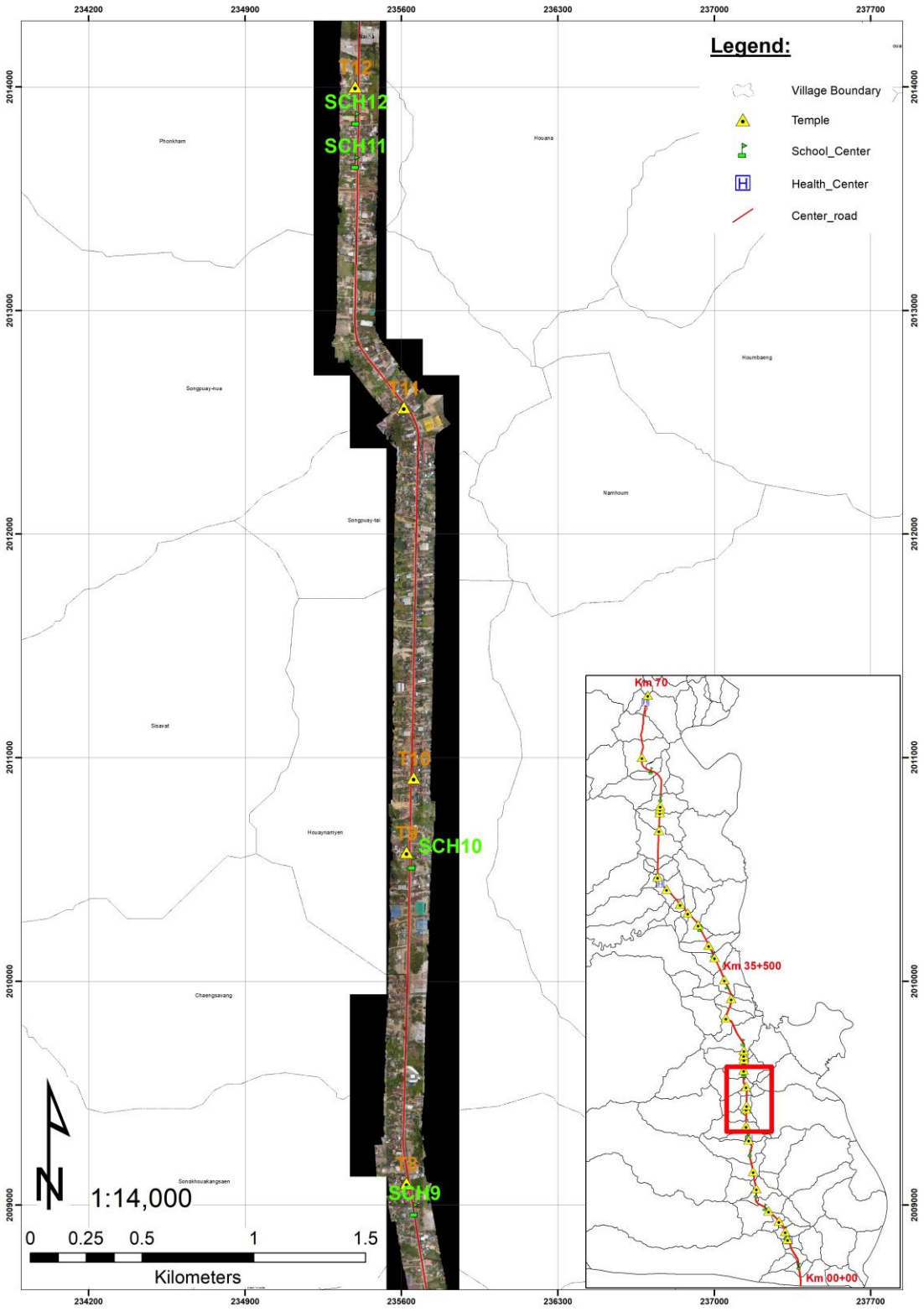


Figure 4-21: Location of Health Facilities, Educational Facilities and Temples

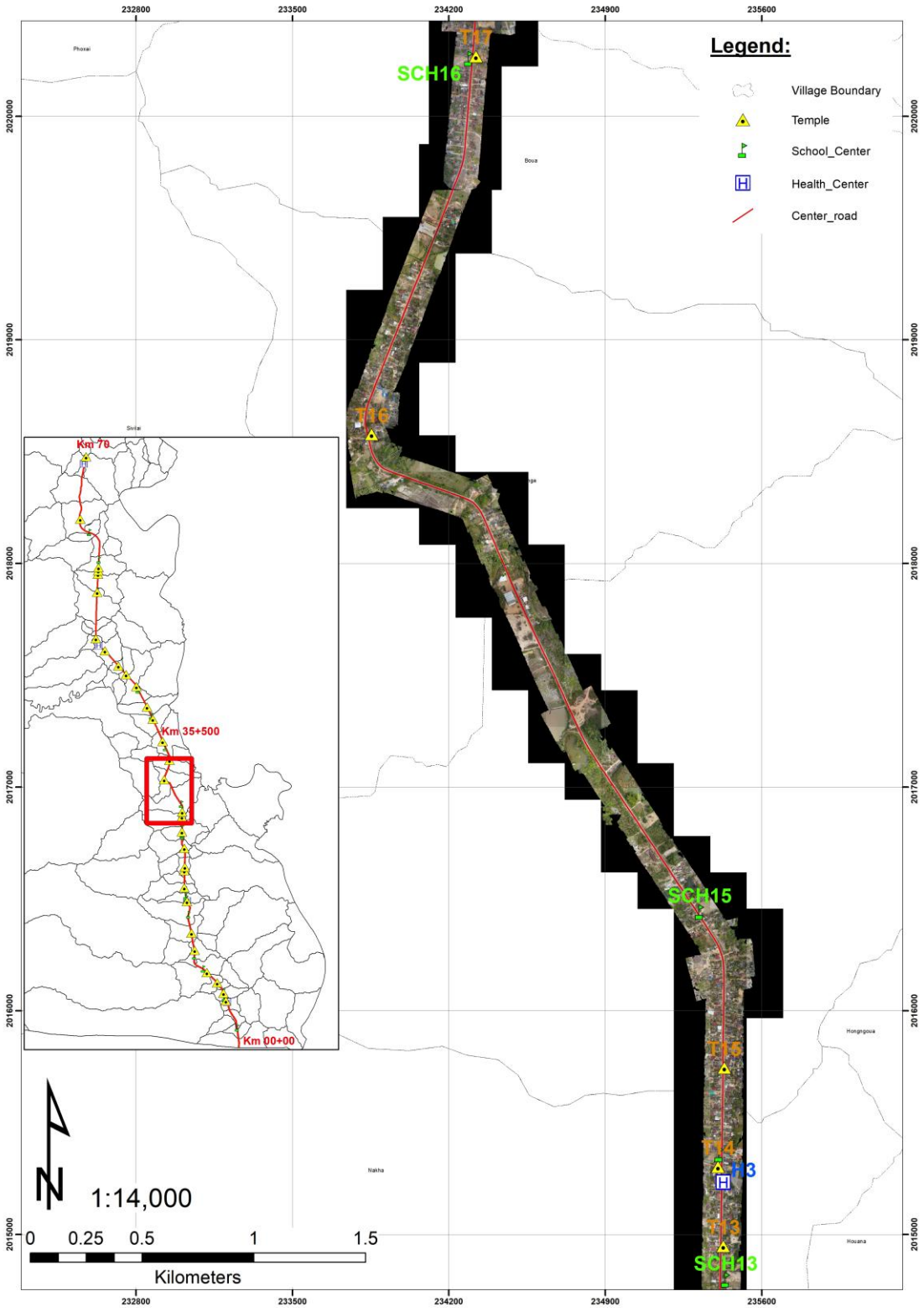


Figure 4-22: Location of Health Facilities, Educational Facilities and Temples

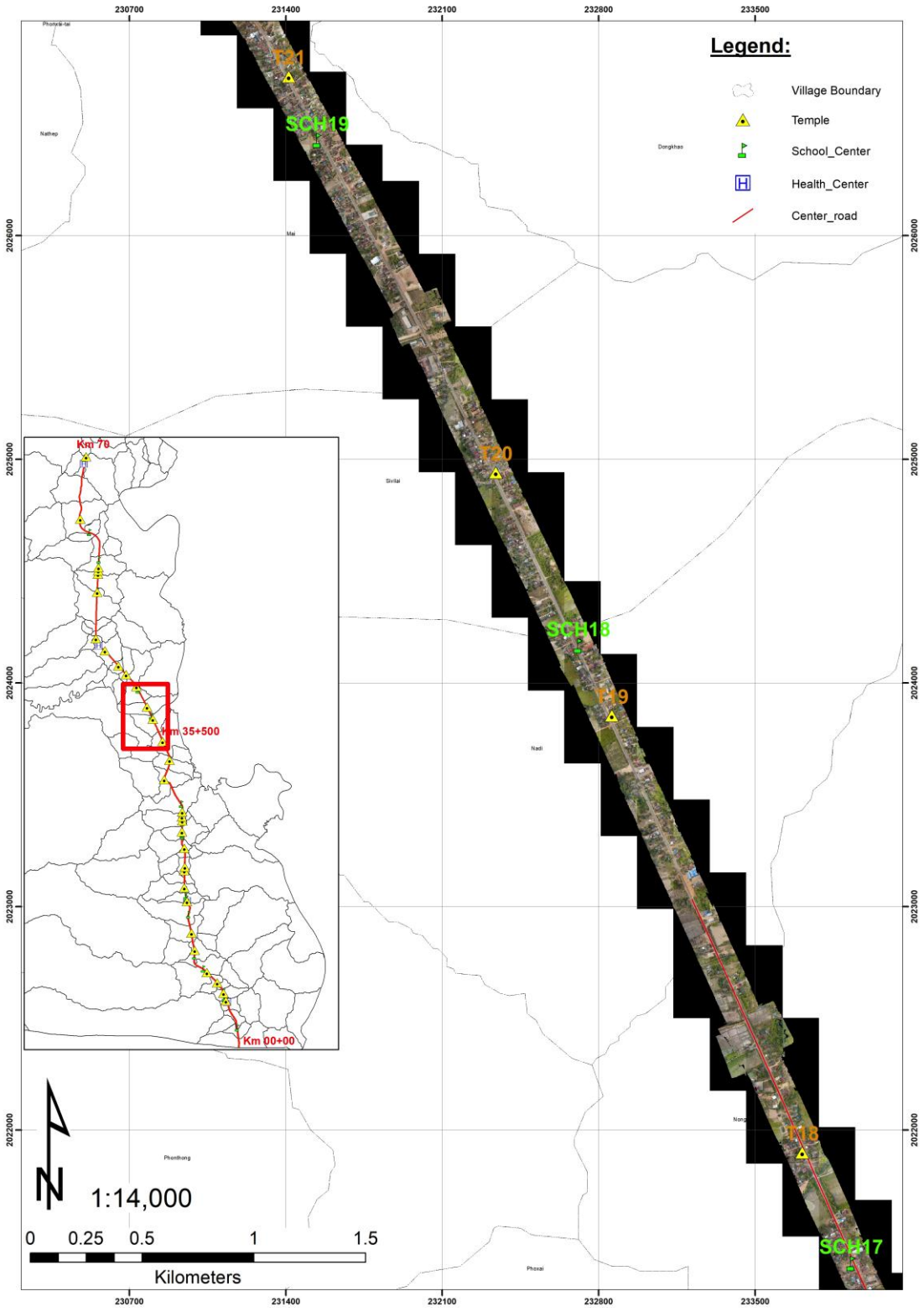


Figure 4-23: Location of Health Facilities, Educational Facilities and Temples

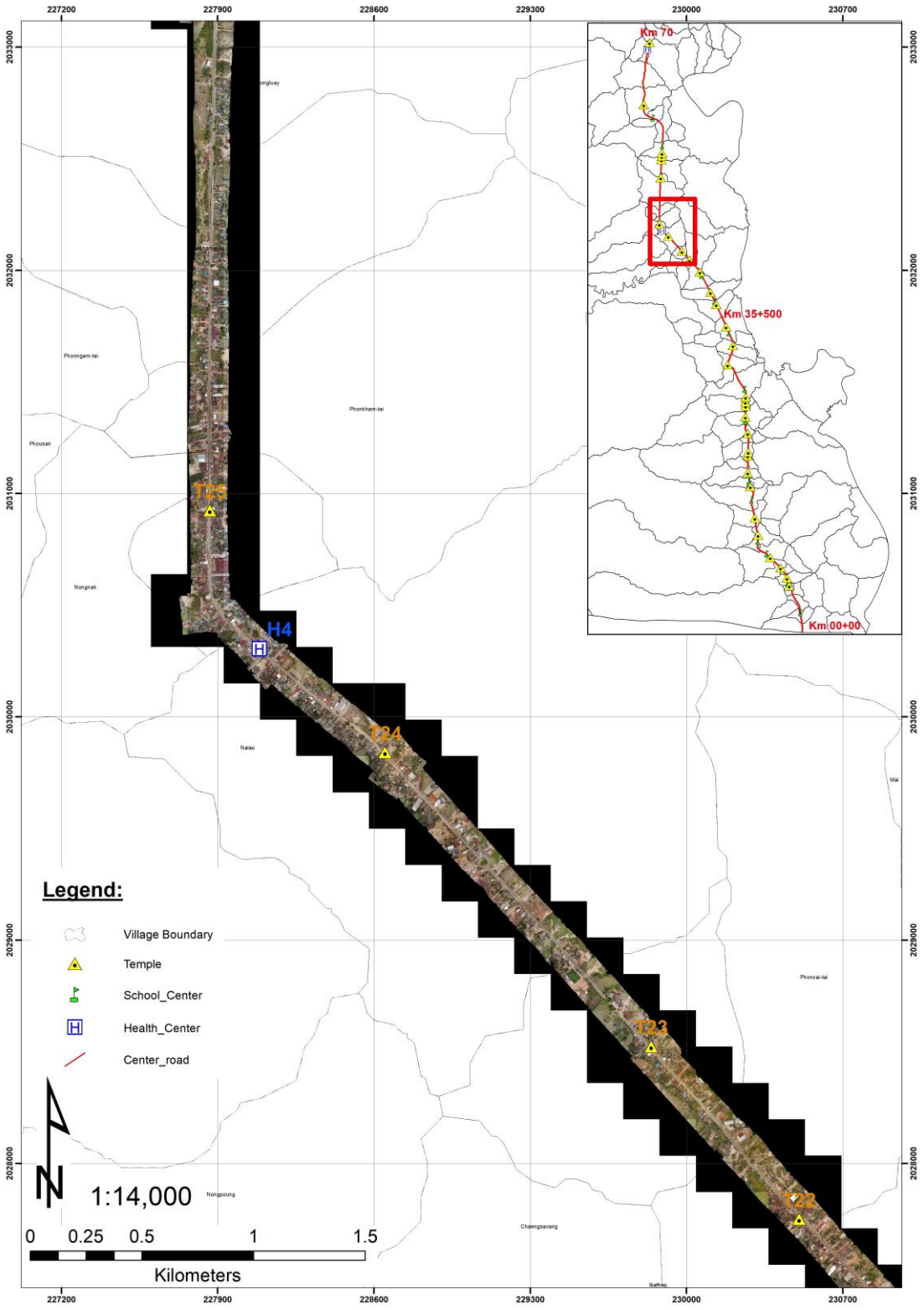
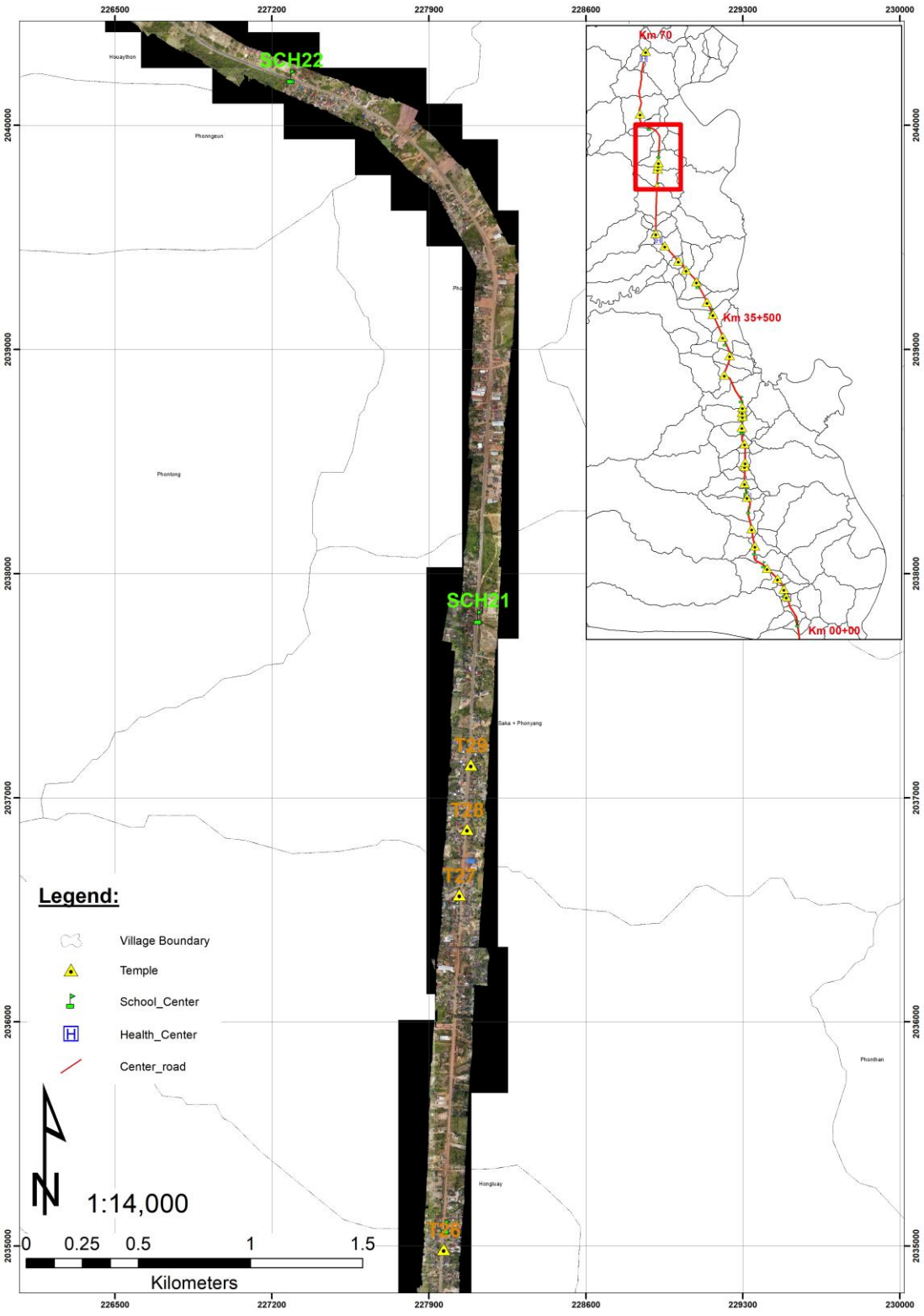


Figure 4-24: Location of Health Facilities, Educational Facilities and Temples


226500
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SCH22
SCH21
T29
T28
T27
T26
Km 70
Km 35+500
Km 00+00
Legend:
Village Boundary
Temple
School_Center
Health_Center
Center_road
1:14,000
0 0.25 0.5 1 1.5
Kilometers

Figure 4-25: Location of Health Facilities, Educational Facilities and Temples

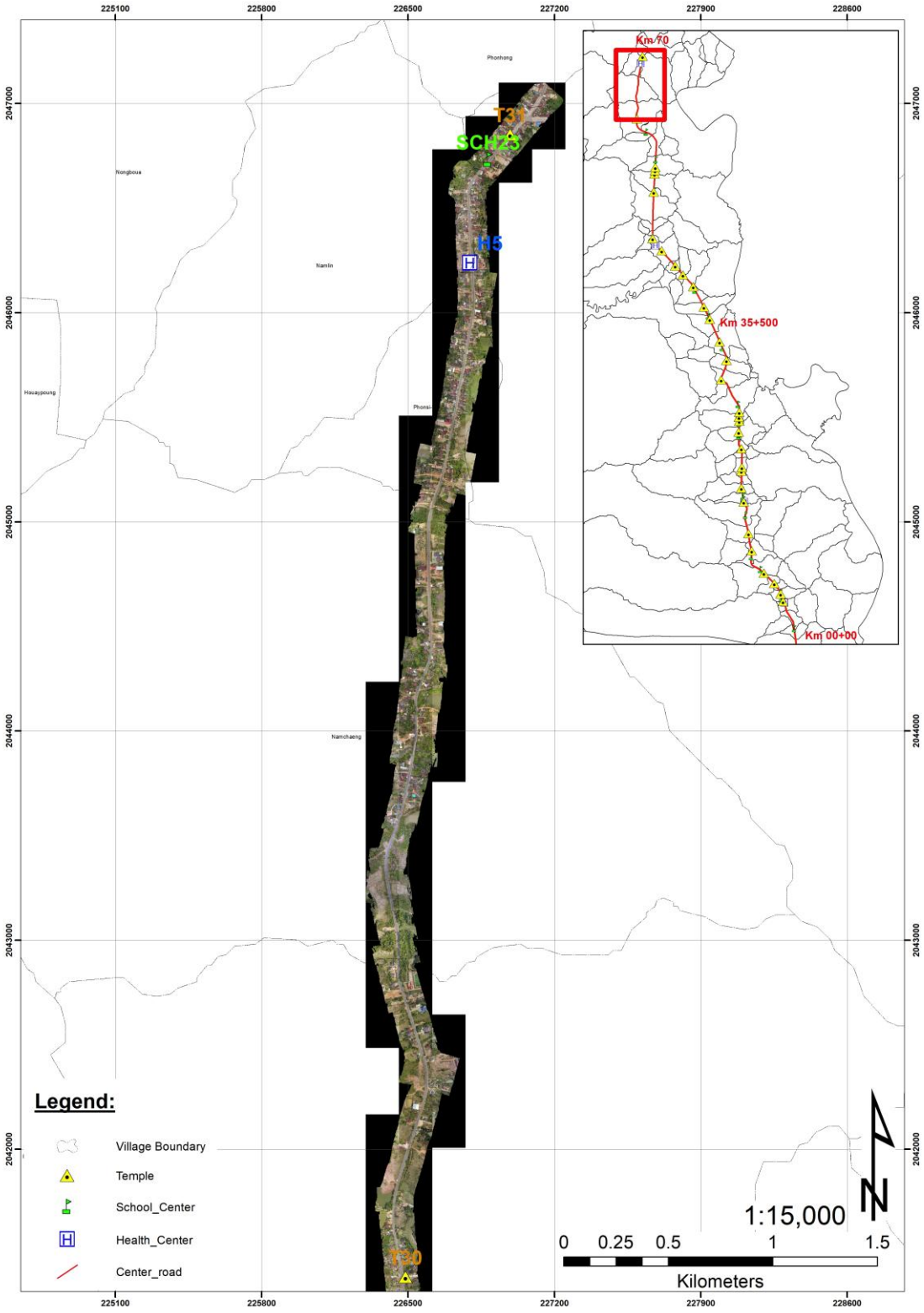


Figure 4-18: Naxaithong Hospital

Figure 4-19: Phonhong Hospital

4.5.9 Education and Educational Facilities

231. Education – In Naxaithong almost all children graduate from both primary school and lower secondary school, as both these levels are compulsory. A large number (66%) of 3-5 age group also attend kindergarten. The FGDs revealed that a lot of people travel daily to Vientiane for university or technical education.

232. Educational Facilities in the Project Corridor - A survey of educational facilities within the Project corridor has been undertaken by the National Survey Firm as part of this ESIA. **Table 4-28** lists the educational facilities and their locations along with their distances from the edge of the Project road.

233. **Figure 4-20** and **Figure 4-21** illustrates two typical schools within the Project corridor. As can be seen, often the school buildings are actually set well back (between 30 and 100 meters) from the boundary wall of the facility even though the boundary walls are often very close to the Project road (see **Table 4-28** below). Photos of all educational facilities listed have been included as **Appendix P.**

Table 4-28: Educational Facilities Identified within the Project Corridor

#	Name	Village	District	Locations (GPS)	Distance of School boundary from edge of existing road
1	Thipaksone English centre	Phangheng	Naxaithong	18° 2'40.64"N 102°32'46.34"E	7m
2	Naxaythong Secondary School	Naxaithong-Tai	Naxaithong	18° 4'6.38"N 102°32'6.63"E	12m
3	Sangpaserd Kindergarten, Primary, Secondary School	Naxaithong-Tai	Naxaithong	18° 4'22.65"N 102°32'4.11"E	8m

#	Name	Village	District	Locations (GPS)	Distance of School boundary from edge of existing road
4	Namkieng Secondary School	Houaxang	Naxaithong	18° 5'26.49"N 102°31'2.88"E	5m
5	Houakhua Primary School	Houakhua	Naxaithong	18° 6'3.30"N 102°30'35.95"E	10m
6	Ratana Business Administration College	Ilai-Tai	Naxaithong	18° 8'0.06"N 102°30'16.57"E	10m
7	Ilai Primary School	Ilai-Nuea	Naxaithong	18° 8'46.21"N 102°30'9.62"E	15m
8	Ilai Scondary School	Ilai-Nuea	Naxaithong	18° 8'53.96"N 102°30'8.09"E	7m
9	Ilai High School	Ilai-Nuea	Naxaithong	18° 9'13.06"N 102°30'5.22"E	15m
10	Houinamyen Primary School	Houaynamyen	Naxaithong	18°10'3.50"N 102°30'4.19"E	7m
11	Phommasaly Kindergarten School	Phonkham	Naxaithong	18°11'45.19"N 102°29'54.10"E	5m
12	Phonkham Primary School	Phonkham	Naxaithong	18°11'51.58"N 102°29'54.10"E	5m
13	Nakha Secondary School	Nakha	Naxaithong	18°12'22.06"N 102°29'55.06"E	20m
14	Nakha Primary School	Nakha	Naxaithong	18°12'40.28"N 102°29'53.82"E	10m
15	Phonmuang Primary School	Phonmouang	Naxaithong	18°13'15.48"N 102°29'50.34"E	7m
16	Ban Boua Primary School	Boua	Naxaithong	18°15'19.09"N 102°29'13.39"E	10m
17	Nongsa Primary School&Phonthong Secondary School	Nongsa	Naxaithong	18°15'56.19"N 102°29'0.67"E	8m
18	Nady Primary School	Nadi	Naxaithong	18°17'25.44"N 102°28'17.83"E	10m
19	Ban Mai Primary School	Mai	Phonhong	18°18'38.38"N 102°27'37.00"E	7m
20	Nabon Primary School	Nabon	Phonhong	18°23'18.25"N 102°25'31.47"E	8m
21	Saka Primary, Scondary School	Saka	Phonhong	18°24'46.73"N 102°25'35.13"E	15m
22	Phonngeun Primary School	Phonngeun	Phonhong	18°26'4.72"N 102°25'5.54"E	10m

#	Name	Village	District	Locations (GPS)	Distance of School boundary from edge of existing road
23	AHHA Education	Phonhong	Phonhong	18°29'36.33"N 102°24'48.58"E	10m

Figure 4-20: Naxaithong Secondary School

Figure 4-21: Nakha Secondary School

4.5.10 Physical Cultural Resources (PCR)

234. PCR are important as sources of valuable historical and scientific information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. PCR can be defined as:

- Sites, structures or objects having archaeological, paleontological, historical, religious, or other cultural significance.
- Natural environmental features that have cultural significance (e.g. sacred graves, sacred sites).

235. The management of the cultural heritage of Lao PDR is divided into four main levels: the Ministry of Information and Culture at the central level, the Division of the Information and Culture at the provincial level, the District Information and Culture Office at the district level, and the village authorities at the fourth level.

236. A PCR survey was undertaken within the Project corridor by the National Survey Firm as part of this ESIA. A number of religious temples were identified within the corridor along with several cemeteries. **Table 4-29** and **Table 4-30** lists the temples and cemeteries and their locations **Figure 4-18** to **Figure 4-25** provide the

locations of the temples. Photos of the temples and cemeteries have been included as **Appendix O**. **Figure 4-22** illustrates a typical cemetery and **Figure 4-23** shows one of the more ornate temples within the Project corridor.

Table 4-20: Religious Temples within the Project Corridor

#	Temple Name	Village	District	Locations (GPS)
1	Vatsoukkhalarm	Dongluang	Naxaithong	18° 3'56.37"N 102°32'12.36"E
2	Vatsysaward	Naxaithong-Tai	Naxaithong	18° 4'18.30"N 102°32'4.70"E
3	Vatsythammalarm	Naxaithong -Nuea	Naxaithong	18° 4'46.97"N 102°31'45.32"E
4	Vatsythammalardvanalarm	Houaxang	Naxaithong	18° 5'16.40"N 102°31'14.00"E
5	Vatanongkhalarm	Houakhua	Naxaithong	18° 6'18.94"N 102°30'37.09"E
6	Sethhalarm	Nongkhankhou	Naxaithong	18° 7'8.32"N1 02°30'26.97"E
7	Vatsysawardxaykhao	Ilai-Nuea	Naxaithong	18° 8'37.55"N 102°30'11.71"E
8	Vatpaxayyalarm	Karngsan	Naxaithong	18° 9'16.88"N 102°30'3.95"E
9	Vatmahaoudomamphavan	Houaynamyen-Tai	Naxaithong	18°10'4.97"N 102°30'3.27"E
10	Vatoudomchalernxayyalarm	Houaynamyen	Naxaithong	18°10'15.82"N 102°30'4.19"E
11	Vatsongpuayphoxayyalarm	Songpuay	Naxaithong	18°11'9.65"N 102°30'1.96"E
12	Vatsavangxayyalarmphonkham	Phonkham	Naxaithong	18°11'56.19"N 102°29'53.88"E
13	Vatphoutthavongsansoukchalern	Nakha	Naxaithong	18°12'26.94"N 102°29'54.65"E
14	Vatphabartphonkhong	Nakha	Naxaithong	18°12'38.47"N 102°29'53.65"E
15	Vatamphavansoukyalarm	Phonmouang	Naxaithong	18°12'52.87"N 102°29'54.45"E
16	Vatnonsavarngphothilalarm	Nanga	Naxaithong	18°14'24.25"N 102°28'59.41"E
17	Vatbanbuasavanxayyalarm	Boua	Naxaithong	18°15'19.43"N 102°29'14.50"E
18	Vatnongsa	Nongsa	Naxaithong	18°16'12.19"N 102°28'52.98"E
19	Vatsouvanpaditmungkhalalarm	Nadi	Naxaithong	18°17'15.32"N 102°28'23.05"E
20	Vatmoungkhounxayyalarm	Sivilai	Phonhong	18°17'50.41"N 102°28'4.89"E
2	Vatsyanontha alarm	Mai	Phonhong	18°18'47.58"N

1				102°27'32.47"E
22	Vatnakxaymoungkhounxayyalarm	Phonxay	Phonhong	18°19'20.92"N 102°27'1.07"E
23	Vatnontha alarm	Taothan	Phonhong	18°19'45.76"N 102°26'38.16"E
24	Vatsyxomxuenphothixayyalarm	Nalao	Phonhong	18°20'28.03"N 102°25'56.96"E
25	Vatsymoungkhounxayyalarm	Lak 52	Phonhong	18°21'2.92"N 102°25'29.73"E
26	Vatsoukhativiharn	Nabon	Phonhong	18°23'14.99"N 102°25'31.20"E
27	Vatsoukhativala alarm	Vangmon	Phonhong	18°24'6.41"N 102°25'32.82"E
28	Vatbansakasysombounphothilard	Saka	Phonhong	18°24'15.95"N 102°25'33.84"E
29	Vatvisoutthibavalalarm	Phonngeun	Phonhong	18°24'25.30"N 102°25'34.26"E
30	Vatbanhouithon	Houaython	Phonhong	18°26'42.43"N 102°24'37.77"E
31	Vatsouvannakhilyphonhong	Phonhong	Phonhong	18°29'40.23"N 102°24'52.12"E

Table 4-30: Cemeteries Identified within the Project Corridor

#	Cemetery	Village	District	Locations (GPS)	Distance from road edge
1	Ilai-Tai Cemetery	Ilai-Tai	Naxaithong	18° 8'2.42"N 102°30'16.30"E	15m
2	Phonngeun Cemetery	Phonngeun	Phonhong	18°26'5.20"N 102°25'1.62"E	5m

Figure 4-22: Phonngeun Cemetery

Figure 4-23: Vatsoukkhalarm Temple


237. Ethnic PCR - Unlike other ethnic groups in Laos, Hmong ethnic group do not have any specific spirit of the village or town territory (Phi Muang). They only practice some spiritual activities when they would like to request some protection for certain situation: moving into their new houses, going to the war, traveling to a new place, and etc. With this particular situation, they organise a *Basi* or specific ceremony to ask for the blessing and protection from the spirit of their ancestors and/or houses.

238. In the project area, Hmong people still follow this practice, and the size of the event depends on the capacity of the households, ranging from offering chicken to pigs or to cows. During the focus group discussions with the affected people, they did not show a great deal of concern about this arrangement. They said that if they receive appropriate compensation for their assets before the actual construction, they will be able to to take care of their customary traditional requirements relevant to their resettlement.

239. Nevertheless, they do have the well-known and important ceremony that they have to follow annually, that is Hmong New Year *(Boun Kin Chieng)*, which is between December and January of every year for a maximum of 7 days. The purpose of the ceremony is to celebrate the harvest. The main activities arranged during the Hmong new year are as follows:

- Day 1: The head of families prepares and conducts the necessary spiritual prayers and offerings to thank the ancestor and spirit of the house. Only chicken is offered on day 1.
- Day 2-7: Full celebration: eating and playing some traditional games: (i) spinning MakKhang and (ii) throwing MakKhone (for men and women who are looking for partners).

4.5.11 Noise

240. Baseline noise monitoring was undertaken in July 2017 at five locations over a period of 24 hours. **Table 4-32** describes the sample locations and rationale for their selection. **Appendix R** provides the results in full along with photographs of the monitoring activity and the monitoring dates, times and climatic conditions. The results are presented in **Figure 4-24** to **Figure 4-29**.

Table 4-32: Noise Monitoring Locations

Sample ID	Coordinates	Rationale for Site Selection
N01	18° 8'30.97"N, 102°30'13.98"E	Sikeut, Naxaythong District, start point of the Project road and major junction.
N02	18°11'13.74"N, 102°30'0.21"E	Naxaythong-Tai, main urban area.
N03	18°14'7.41"N, 102°29'17.35"E	Lak 52, main urban area
N04	18°15'28.94"N, 102°29'15.57"E	Namlin Village, main urban area
N05	18°28'1.57"N, 102°24'38.39"E	Nongsa Village, main urban area

241. The results of the noise monitoring undertaken in July 2017, clearly show that noise levels at all of the monitored locations exceeded the WBG daytime and nighttime noise limits for residential, institutional and educational areas in almost all instances, and in some cases by more than 15 dBA. However, all noise levels are below WBG daytime and nighttime noise limits for commercial and industrial areas. Leq 24 hrs in all locations, range from 56.3 dBA – 63.2 dBA, and are classified as "Moderate" noise level according to Laos Noise Standards.

242. Land use mapping shows that the project corridor is dominated by commercial and residential properties (often single properties serve both commercial and residential purposes). Many properties are within 10-20 meters of the Project road. In addition, surveys have identified more than 30 temples, 20 schools and 5 hospitals/health clinics within the Project corridor many of which are already exposed to elevated noise levels due to their proximity to the Project road. However, often school/health facility/temple buildings are set further back from the boundary wall of the facility even though the boundary walls are often very close to the Project road.

Figure 4-24: 24 Hour Noise Levels (dBA) – Sikeut, Naxaythong District

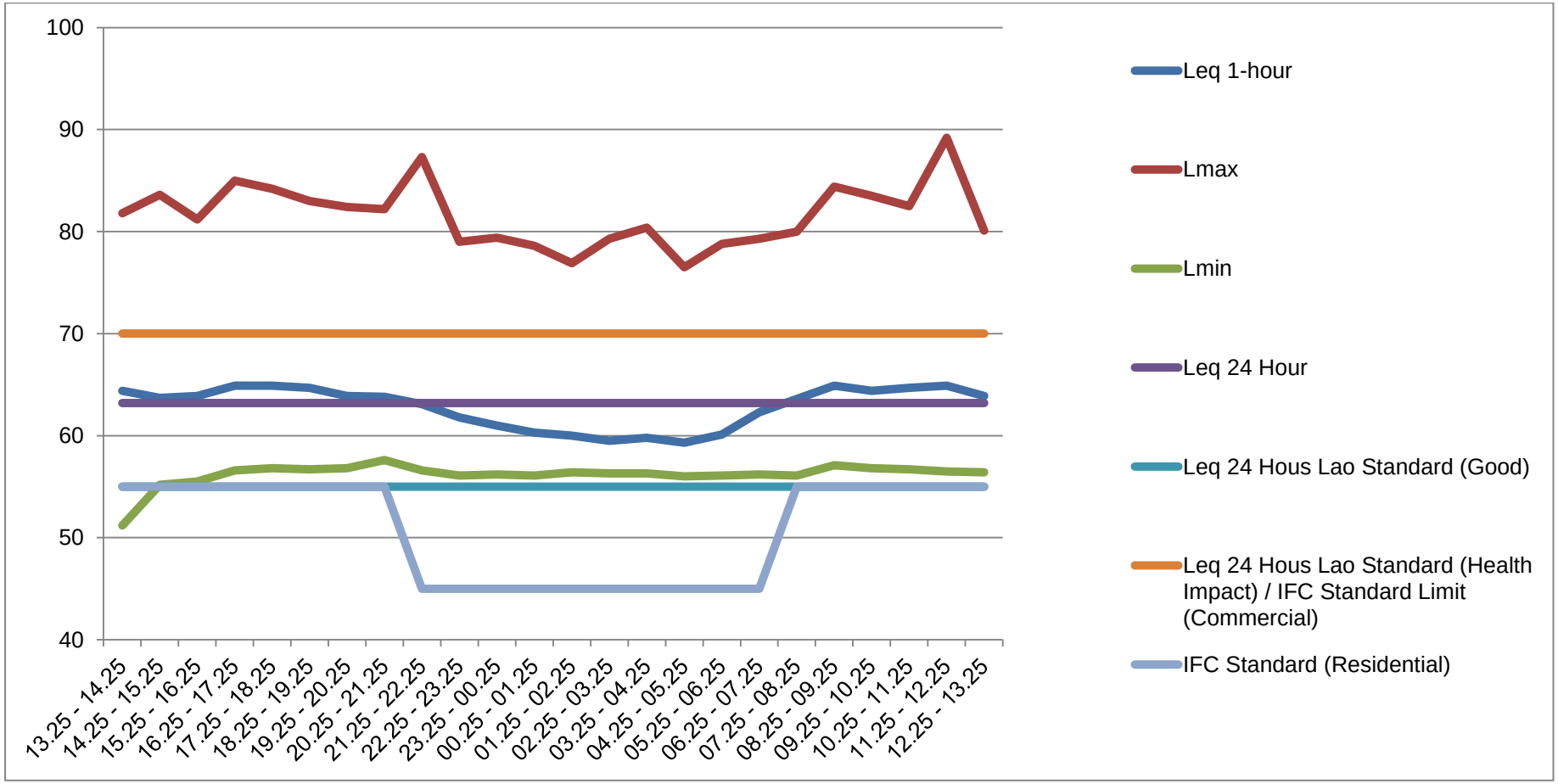


Figure 4-25: 24 Hour Noise Levels (dBA) – Naxaythong-Tai, Naxaythong District

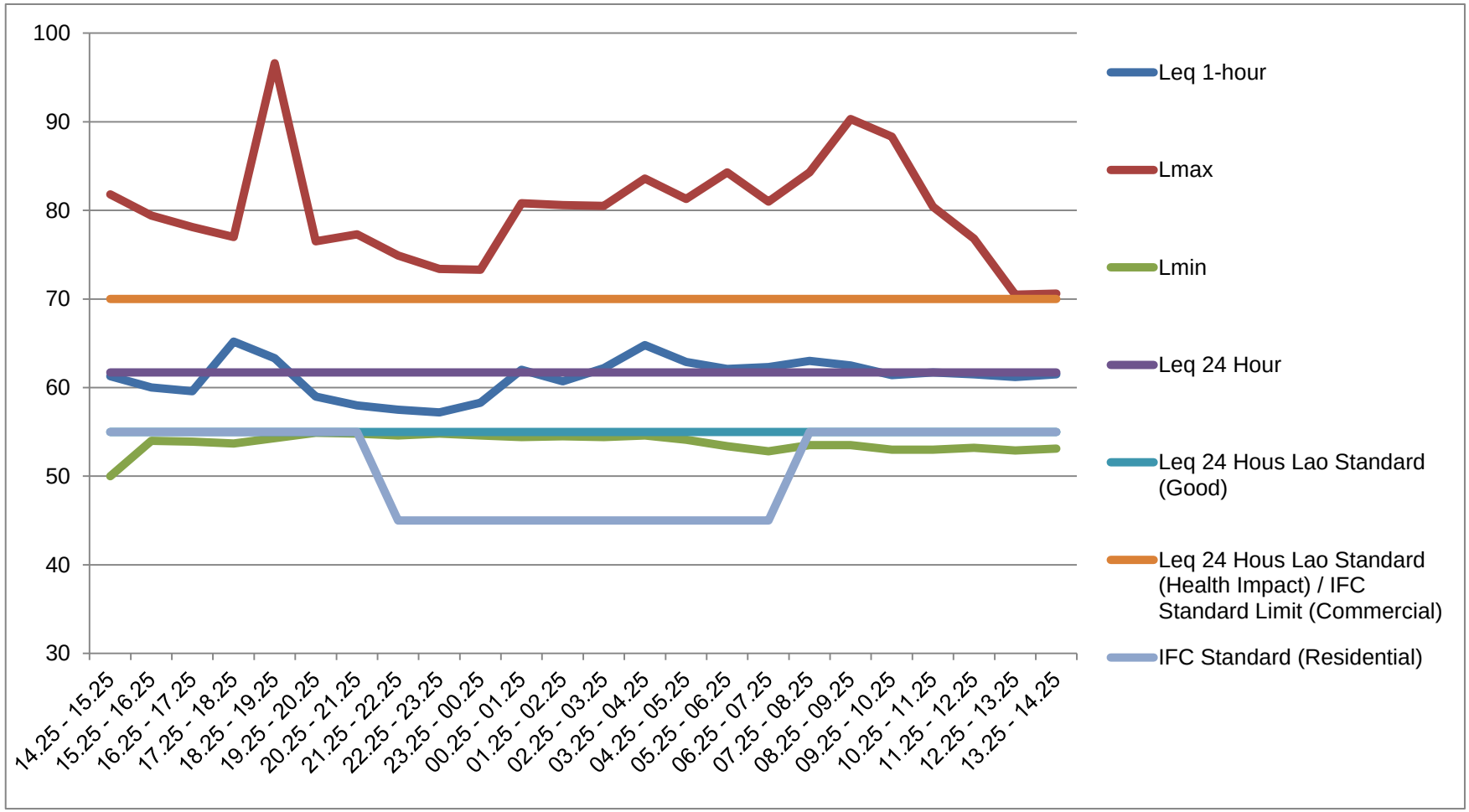


Figure 4-26: 24 Hour Noise Levels (dBA) – Karngsan, Naxaythong District

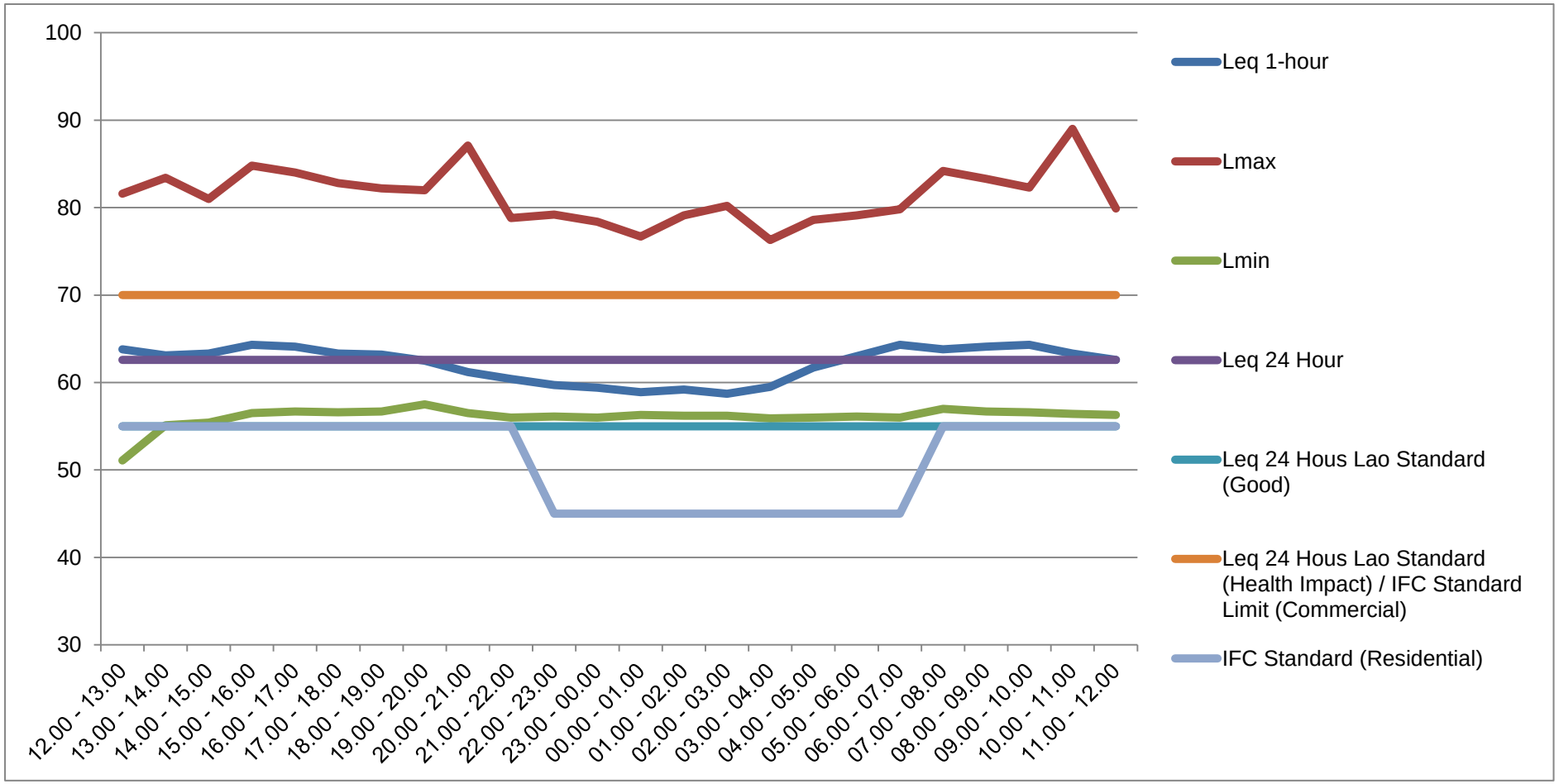


Figure 4-27: 24 Hour Noise Levels (dBA) – Lak 52, Phonhong District

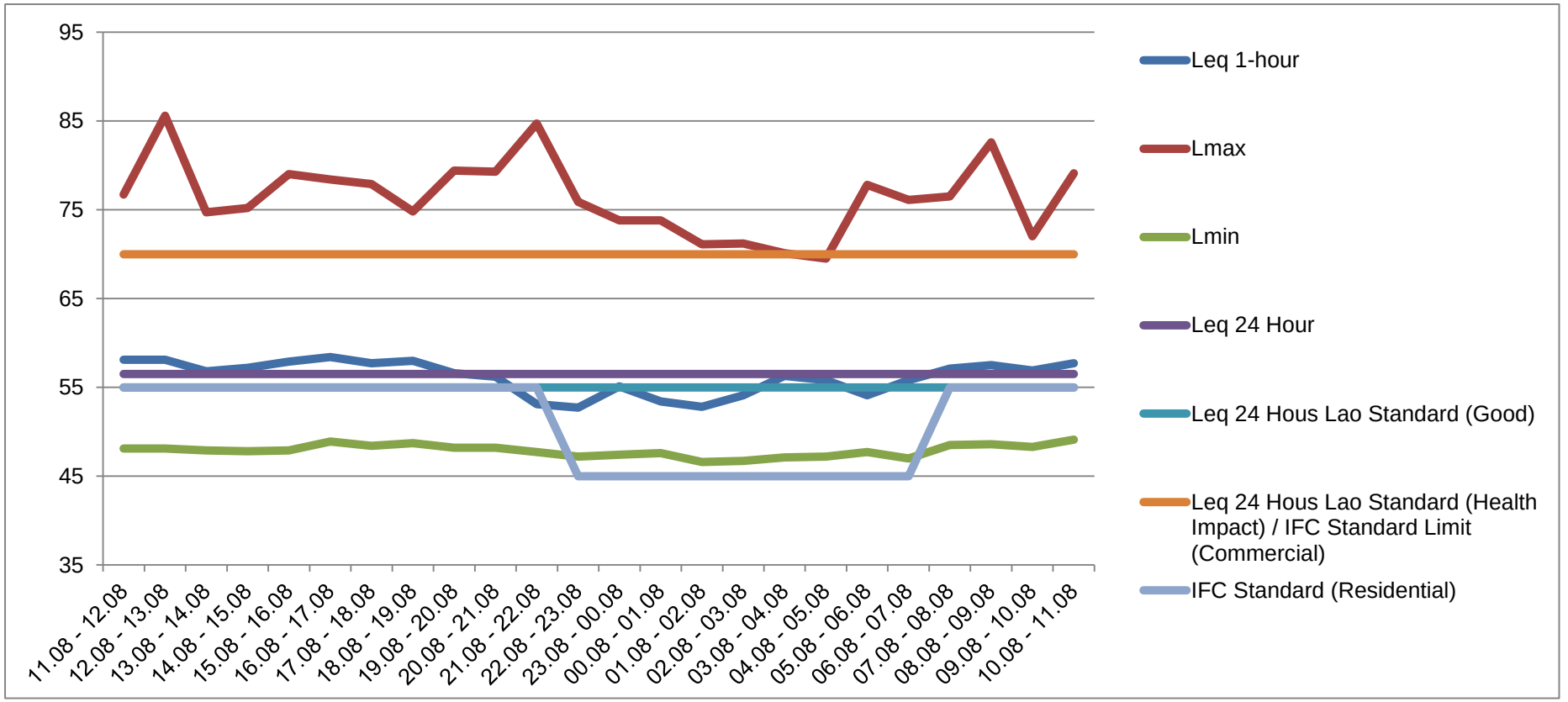


Figure 4-28: 24 Hour Noise Levels (dBA) – Namlin Village, Phonhong District

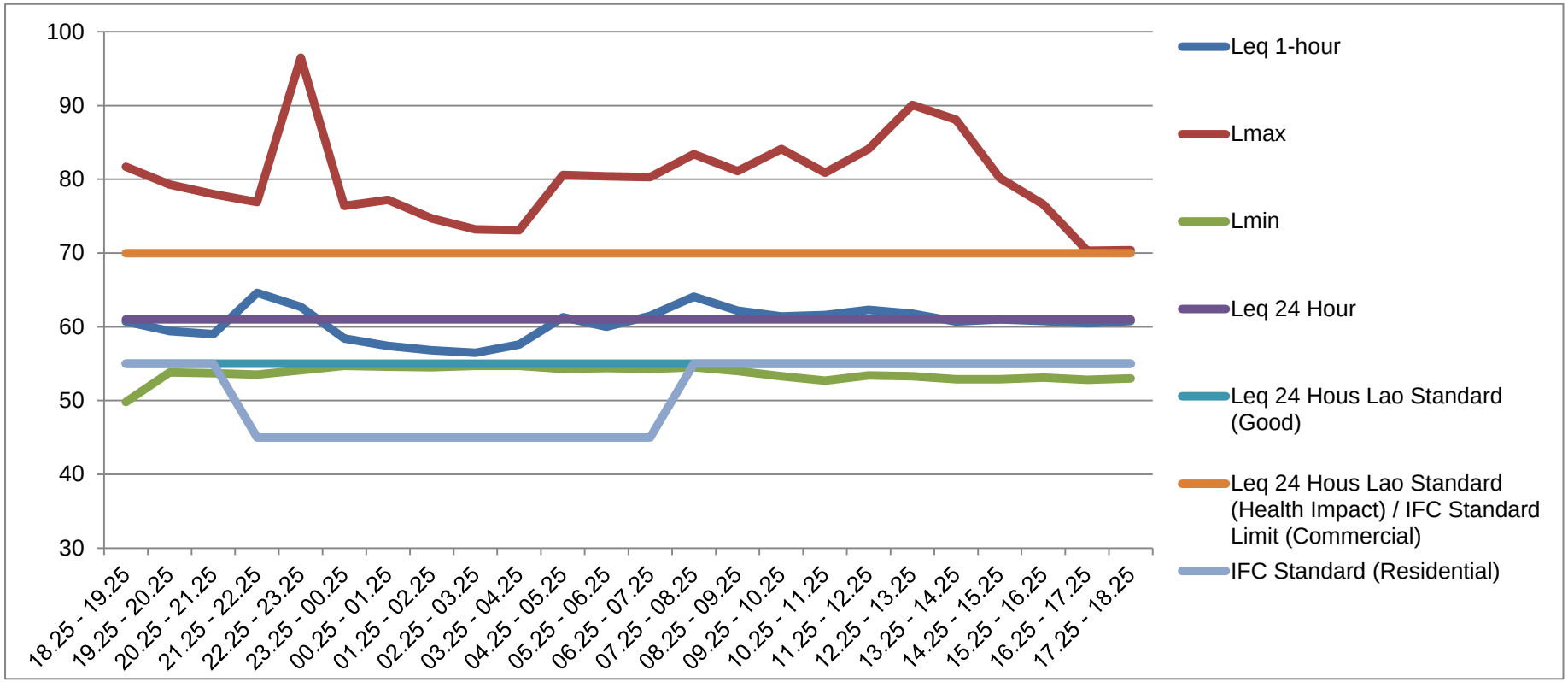
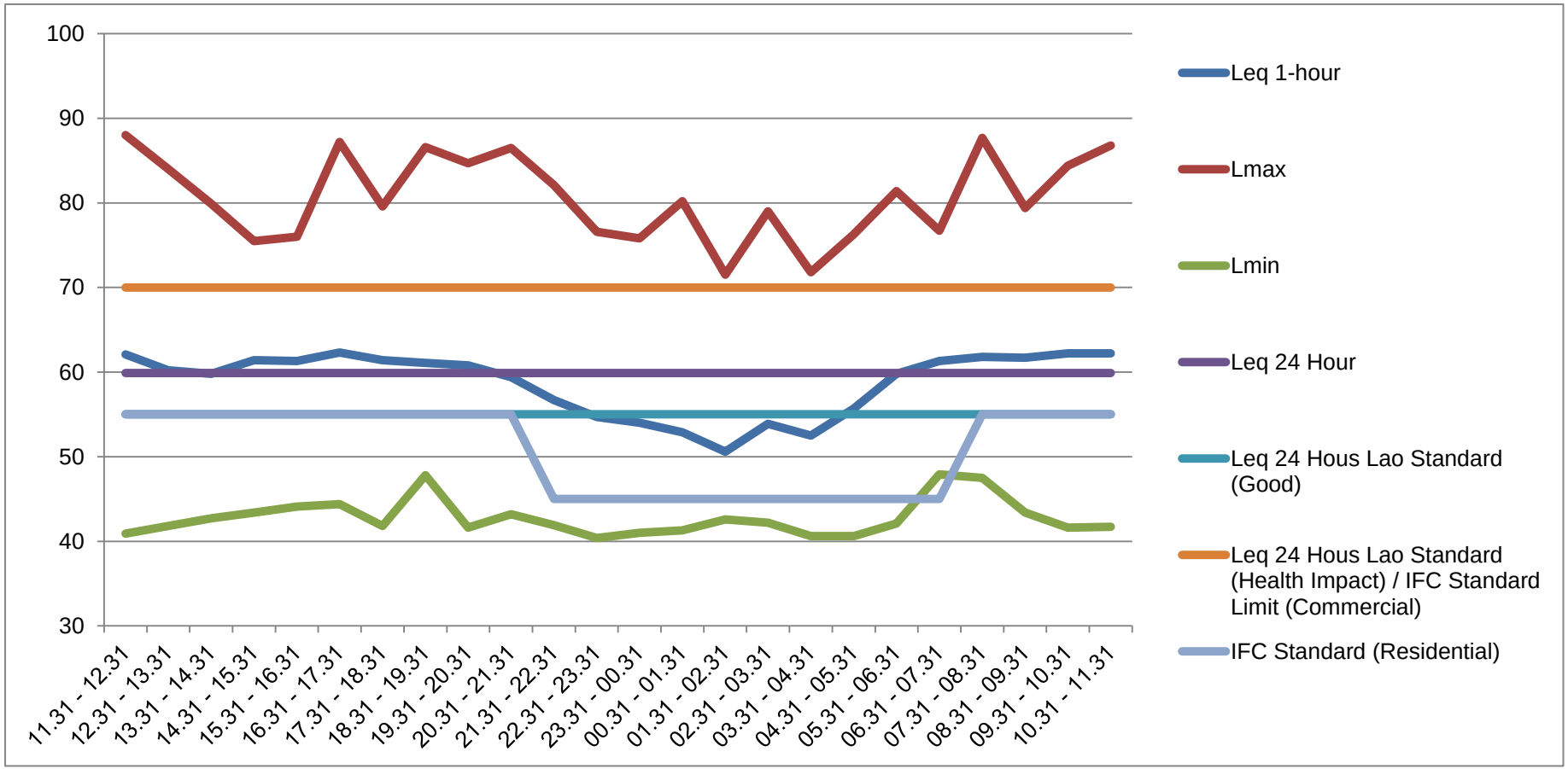


Figure 4-29: 24 Hour Noise Levels (dBA) – Nongsa Village, Phonhong District



5. ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

5.1 General

243. This section of the ESIA details the Projects potential impacts and proposes mitigation measures to limit any negative impacts identified. The first items discuss the types and phases of the impacts. The report then presents the impacts and mitigation in detail for the Project in the subsections as follows:

- Physical Resources, including:
  - Topography
  - Soils & Geology
  - Air Quality & Climate Change
  - Hydrology
  - Natural Hazards
- Biological Resources, including:
  - Flora
  - Fauna
  - Protected Areas and Important Bird Areas
- Socio-Economic Resources, including:
  - Economic Development
  - Social Sector
  - Land use
  - Infrastructure & Transportation Facilities
  - Waste Management
  - Construction Camps and Batching Plants
  - Borrow Pits
  - Community Health and safety
  - Occupational Health and Safety
  - Physical and Cultural Resources
  - Noise

- Cumulative Impacts
- Compliance Impacts

5.2 Impact Phases

244. This impact assessment and mitigating measures cover the entire cycle of the project activities, from design, pre-construction, construction and operation and maintenance. The coverage of each of this sub-project phases is defined as follows:

- Design – This is the period of the detailed design.
- Pre-construction Phase – this period is the time that the 'Notice to Proceed' is given to the Contractor until commencement of construction.
- Construction Phase - the period from the completion of the Pre-construction activities time until the issuing of the 'Certificate of Completion'.
- Operation and Maintenance Phase – This final period is the time from completion of works.

245. The key feature of the three Project activities that mitigate the overall adverse impact is the fact that all Projects will be confined within the existing road alignment.

5.3 Type of Impacts

246. Potential impacts from projects such as road improvement projects may be classified as:

- Direct Impacts - i.e., those directly due to the project itself such as the conversion of land previously used for agricultural purposes to transport use. Direct impacts also include the impact of construction expenditures in the local economy.
- Indirect Impacts – i.e., those resulting from activities prompted by the project, but not directly attributable to it. The use of rock for the improved roadbeds, for example, has an indirect impact of increasing the demand for crushed rock and increased borrow operations.
- Cumulative Impacts – i.e., impacts in conjunction with other activities. A single road improvement may not exert a significant environmental impact, but if several roads comprising a network are developed in the same area, or are combined with agricultural reform programs in the same general area, the cumulative or additive effect could be large.

247. Impacts in all three categories may be either:

- Short-term – i.e., impacts which occur during road construction and affect land use, air quality and other factors. Many of these impacts, however, will be short- lived and without long-lasting effects. Even the effects of some relatively significant impacts such as borrow pits, for example, may be eventually erased if appropriate mitigation actions are taken. Many potential short-term negative impacts can be avoided or otherwise mitigated through proper engineering designs and by requiring contractors to apply environmentally appropriate construction methods. Or;

- Long-term – i.e., road impacts that could, for example, affect regional land use and development patterns and regional hydrology and flooding if roads are poorly designed. Long-term negative impacts can also result from the loss of agricultural land to other land uses; air and water pollution; problems associated with scattered borrow pits; and haphazard growth.

248. Both short-term and long-term impacts may be either beneficial or adverse. Short-term positive impacts will include, for example, the generation of employment opportunities during construction period. Long-term benefits will include enhanced development opportunities, improved transport services, easier access to commercial and service facilities; faster communications and commodity transport; improved access to markets and growth centers and increased services and commercial facilities.

5.4 Mitigation Aspects

249. Mitigation is recommended through strategic avoidance combined with construction and monitoring. Bid and contract documents are recommended to specify that a Site Specific ESMP (SSESMP) will be required. The Contractor will ensure that the SSESMP is submitted to the Engineer for review at least 10 days before taking possession of any work site. No access to the site will be allowed until the SSESMP is reviewed and approved by the Engineer.

5.5 Summary of Impacts

250. **Table 5-1** provides a summary of the potential Project impacts that are discussed in detail under **Sections 5-4** to **5-7**.

5.6 Impacts to Physical Resources

5.6.1 Topography

5.6.1.1 Potential Impacts

251. All Phases - The Project road alignment in this instance has been determined by the existing ROW to be rehabilitated and widened. No significant alteration in realignment is included in the Project with the exception of the minor alterations to curves due to the requirements of safety specifications (and temporary changes in alignment to accommodate bridge works). Due to the relatively flat nature of the Project road no cut and fill activities will occur and no blasting will be required. Accordingly, potential impacts to topography will be limited to borrow pits and quarries, which are discussed in more detail below under **Section 5.8.7** – Borrow Pits.

5.6.1.2 Mitigation Measures

252. None warranted.

Table 5-1: Summary Impact Table

	Physical Characteristic					Biological Characteristic			Socio-economic Characteristic							
	Geology	Topography	Soils	Climate and Air Quality	Hydrology	Flora	Fauna	Protected Areas	Infrastructure	Land Use	Waste Management	Socio-economic	Health & Safety	Educational Facilities	PCR	Noise
Land Acquisition										D/L		D\L				
Borrow Pits / Quarries		D/L	D/S	D/S	D/S	D/S			D/S	D/S			D/L			D/S
Asphalt Plants / Batching Plants			D/S	D/S	D/S	D/S			D/S	D/S	D/S		D/S			D/S
Construction Camp			D/S	D/S	D/S	D/S			D/S	D/S	D/S	D/S	D/S			D/S
Storage / Laydown Areas			D/S		D/S	D/S			D/S	D/S	D/S		D/S			D/S
Haul Routes				D/S					D/S				D/S	D/S		D/S
Site Clearance			D/L		D/S	D/L	D/L			D/L	D/S				D/L	D/S

D = Direct Impact	S = Short-term Impact	L= Long term Impact		Potential Positive Impact		Potential Low/Medium Impact		Potential High Impact

	Physical Characteristic					Biological Characteristic			Socio-economic Characteristic							
	Geology	Topography	Soils	Climate and Air Quality	Hydrology	Flora	Fauna	Protected Areas	Infrastructure	Land Use	Waste Management	Socio-economic	Health & Safety	Educational Facilities	PCR	Noise
Pavement construction			D/L	D/S	D/S	D/L			D/S	D/L	D/S		D/S	D/S		D/S
Bridge construction			D/S	D/S	D/S	D/S	D/S			D/L	D/S		D/S			D/S
Culverts & Side drains			D/S	D/S	D/S	D/S					D/S		D/S			D/S
Earthworks		D/L	D/L	D/S	D/S	D/L	D/S		D/S	D/S	D/S		D/S			D/S
Removal of Trees			D/L		D/L	D/L	D/L			D/L		D/S				D/S
Relocation of Services									D/S	D/S		D/S				
Increased traffic				D/L								D/L	D/L	D/L		D/L
Road Maintenance			D/S	D/S	D/S						D/S		D/S			D/S

D = Direct Impact	S = Short-term Impact	L= Long term Impact		Potential Positive Impact		Potential Low/Medium Impact		Potential High Impact

5.6.2 Geology & Soils

5.6.2.1 Potential Impacts

253. The decision to restrict the Project works to within the existing ROW, will keep soils related construction impacts to a minimum. Potential impacts to this component may however include:

- Loss of Soil for Agricultural Production – As the project involves reconstruction and rehabilitation of an established road, the Project impact on the land acquisition is reduced to a minimum. As part of this ESIA process the DD Consultant and the ESIA team have worked together to prepare the geometric design of the road in such a way that no land acquisition in addition to that included in the Resettlement Action Plan (RAP) is required in consequence of the design.
- Loss of Topsoil - Several impacts to topsoil may occur during the construction phase, including; removal of top soil for construction outside the ROW; compaction of topsoil; loss of top soil by wind and water erosion and covering of top soil by project works.
- Erosion - It is possible, that without adequate protection measures soil erosion could occur on road embankments and bridge embankments. It is also possible, that stockpiles of soil located close to surface waters could infiltrate the water courses during heavy rainfall and cause siltation of the rivers.
- Borrow Pits – Potential impacts relating to borrow pits are discussed under **Section 5.8.7 –** Borrow Pits.
- Induced Changes - Induced changes in the Project Area leading to industrial and commercial development are conceivable, thereby decreasing soil availability for agricultural purposes.
- Contamination Due to Spills or Hazardous Materials - Potential soil contamination is a possibility resulting from poorly managed fuels, oils and other hazardous liquids used during the project works.

5.6.2.2 Mitigation Measures

254. Mitigation related to the potential soil-related impacts is recommended as follows:

<u>Pre-construction Phase</u>

- Loss of Soil for Agricultural Production - The DoR have, as aprt of the Project, prepared a resettlement action plan (RAP). **Section 5.8.4** – Land Use, discusses this issue in more detail.
- Borrow Pits – Mitigation relating to borrow pits is discussed under **Section 5.8.7** – Borrow Pits.

255. Emergency Response Planning - The Contractor will be responsible for preparation of an Emergency Response Plan (ERP), which will cover containment of hazardous materials, oil spills, and work-site accidents. The plan will detail the process for handling, and subsequently reporting, emergencies, and specify the organizational structure (including responsibilities of nominated personnel). The plan will be submitted to the Engineer for approval. Implementation of the plan will be monitored by the Engineer. Any emergencies, and how they were handled, will be reported in monthly progress reports by the Contractor to the Engineer and the DoR.

Construction Phase

256. Potential adverse impacts will be avoided or otherwise mitigated by ensuring the Contractor complies with the following:

- Erosion - During construction, the Contractor will be responsible for ensuing material that is less susceptible to erosion will be selected for placement around bridges and culverts. In addition, he will ensure re-vegetation of exposed areas including; (i) selection of fast growing and grazing resistant species of local grasses and shrubs; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth. The Engineer and the Contractor will both be responsible for ensuring that embankments are monitored continuously during construction for signs of erosion.
- Topsoil – To reduce impacts to topsoil the following measures will be employed by the Contractor; locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion; construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil; rip ground surface prior to the spreading of topsoil; and remove unwanted materials from topsoil such as roots of trees, rubble and waste etc. Specifically regarding soil compaction, the Contractor will confine operation of heavy equipment within the ROW, as much as possible, to avoid soil compaction and damage to privately owned land. If in case private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation.
- Borrow Pits – Mitigation relating to borrow pits is discussed under **Item 5.8.7 – Borrow Pits**.
- Conversion of Agricultural Soils Due to Indirect/Induced Impacts - Although the ESMP contains provisions controlling direct impacts of land takings for both the road and ancillary functions (asphalt plants, construction camps, etc.), control of the induced impacts is largely beyond the scope of the Project.
- Contamination Due to Spills or Hazardous Materials. The Contractor, with oversight from the Engineer, will ensure that:
    - All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tank (or one tank if more than one tank is located in the bund).

- The construction camp maintenance yard will be constructed on impervious hardstanding with adequate drainage to collect spills, there will be no vehicle maintenance activities on open ground.
- Filling and refueling will be strictly controlled and subject to formal procedures. Drip pans will be placed under all filling and fueling areas. Waste oils will be stored and disposed of in compliance with Lao PDR regulartory requirements, international best practices or by a licensed contractor.
- All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
- The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any soils.
- No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hardstanding.
- Areas using bitumen will be constructed on impervious hardstanding to prevent seepage of oils into the soils.
- No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hard standing.

5.6.3 Air Quality & Climate Change

5.6.3.1 Potential Air Quality Impacts

257. The potential impacts of the Project to air quality are described as follows:

Design and Pre-construction Phase

258. The road rehabilitation works are generally intermittent and not permanent in a specific site, the works move along the Project road as work progresses and as such air quality impacts will be short term in specific locations. However, fugitive emissions will be emitted on a longer-term basis from stationary sources such as quarries, borrow pits and asphalt plants. These sites can however be selected prior to construction and be placed in an area where it can cause the least impact on human and ecologic receptors.

Construction Phase

259. During construction, air quality may be degraded by a range of operational activities including:

- Exhaust emissions from the operation of construction machinery (e.g. Nitrogen Oxides (NO_X), Sulfur Oxides (SO_X) and Carbon Monoxide (CO));
- Open burning of waste materials; and
- Dust generated from quarries, borrow pits, haul roads, unpaved roads, exposed soils and material stock-piles. The dust may settle on productive crops, and may cause some degree of respiratory stress for nearby residents.

260. Dust is the major air quality problem from construction sites. Dust is a problem for a variety of reasons, as outlined below:

- Inconvenience to local people. For example, people may have to re-wash laundry that has been put outdoors to dry, and wash windows, curtains and vehicles. Dust can contaminate meat hanging up in open-air butchers and other food that is exposed to it in homes, shops and open-air restaurants, giving food a gritty texture.
- Health and safety problems. Dust may affect health by irritating eyes and worsening the health of people with asthma. Dust can reduce visibility for drivers on roads. It can also be blown for long distances by the wind.
- Crop damage. Even low concentrations of dust can affect plant and fruit growth as far away as one kilometer from a construction site. Plant growth is particularly susceptible to dusts that are highly alkaline, for example limestone and cement dust. Dust deposited during light rainfall can cause the soil surface to form a crust increasing run-off.
- Impact on ecology. Dust blowing onto watercourses may damage ecology by increasing sedimentation, reducing sunlight and suffocating fish. It may also affect plant growth and change the species of plants growing in an area. Dust may also damage trees and other vegetation planted as part of the construction contract.
- Damage to plant and equipment. Within the construction site, dust can cause mechanical or electrical problems in sensitive equipment such as computers. It can also increase abrasion of moving parts in equipment and clogging of air filters.

Box 3: Construction Phase Air Quality Issues Identified by Stakeholders

- The project should consider paving access roads connecting to the Project road in order to reduce transfer of dust and mud from the access road to the Project road.
- Water the road daily. The water should be clean because if using wastewater, the road will smell bad for months.
- Provide dust mask to people.

Operational Phase

261. The main source of air pollution during the operational phase will be vehicles moving on the highway. The main pollutants are: CO; NO_X; hydrocarbons (HC); SO_2; carbon dioxide (CO_2); and particulate matter (PM). These compounds can damage health and/or the environment. The concentration of pollutants generated by vehicles depends on factors such as the number, type and speed of vehicles. The effect of air pollution on local people depends on the distance between them and the road, wind direction, topography and other factors. The main direct effects are in the

area closest to the road as the rapid dispersion and dilution of exhaust gases quickly reduces their concentrations to levels at which risks are minimal.

262. Baseline air quality monitoring in the Project corridor shows that levels of NO_2 and CO are well within national and international standards and that all parameters measured were within the limits set by Lao PDR standards. However, some levels of SO_2 and PM_{10} were noted above USEPA and WBG standards.

263. It is safe to say that as the traffic volumes increase on the Project road, so will the levels of air emissions, such as NO_2, CO and CO_2. However, given the existing low levels of NO_2 and CO in the Project corridor, it is considered unlikely that they will rise above the national standards in the future. It could also be suggested that within the next ten to fifteen years electric cars will start to play a major role in the transport sector and as such this would serve to limit the potential increases in vehicle emissions such as NO_2, CO and CO_2.

264. The elevated levels of PM_{10} recorded in the baseline monitoring at locations A1 and A4 (and also higher levels of TSP, although within the Lao PDR limits) are a result of the movement of dust as vehicles travel along the road. As noted in **Section 4.2.5 – Air Quality**, in some sections of the road high levels of dust can be observed, resulting from a number of sources, including:

- Transport of mud and dirt from access roads;
- Vehicles traveling within the unpaved areas outside of the pavement; and
- Unpaved sections of the road.

5.6.3.2 Potential Climate Change Impacts

265. Higher average temperatures could lead to an increased maximum pavement temperature which increases the potential for rutting and shoving, requiring more rut resistant asphalt mixtures (if asphalt is chosen as pavement material). A change in precipitation levels and more extreme rainfall events could lead to a number of potential issues including:

- Increased need for surface friction meaning potentially more focus on surface texture and maintaining adequate skid resistance.
- Increased need for surface drainage to prevent flooding.
- Increased need for functioning sub-drainage.
- Need to improve visibility and pavement marking demarcation.
- High levels of precipitation may threaten embankment stability.
- Reduction in structural capacity of unbound bases and subgrade when pavements are submerged.
- Potential damage to roads and drainage systems due to flooding.

- Increase in scouring of roads, bridges, and support structures. [24]

266. An analysis of greenhouse gas emissions (GHG) was undertaken by the World Bank based on fuel consumption rate at different speed under with- and without-project scenarios. Without project, the road's deteriorated condition limits vehicle speed and leads to higher fuel consumption per vehicle-km compared to the with-project scenario. With project, improved road condition leads to improved speed, and hence lower fuel consumption. The total emission of CO^2 under the project scenario over the evaluation period (13 years) is estimated to be 891,742 tCO2e and the estimated GHG reduction is 188,137 tCO2e. The social benefit from GHG reduction is estimated to be US$5.64 million.[25]

5.6.3.3 Air Quality Mitigation

Design and Pre-construction Phase

267. Locations for borrow pits, rock crushing facilities, concrete batching yards and asphalt plants will require approval from the Engineer, PONRES and DoR during the Pre-construction phase. Efforts will be made to ensure that these facilities are as near to the Project road as practical to avoid unnecessary journeys and potential dust issues from vehicle movements during construction works on unpaved roads in urban areas. Locating these facilities to the east of NR13N wherever possible also will maximize the distance from and minimize the impacts on the Phou Phanang protected area to the west of the road. Haul routes will be prepared and submitted to the Engineer as part of his Traffic Management Plan (TMP).

268. To prevent impacts arising from asphalt plants, construction camps, batching plants and rock crushing plants, they will be prohibited within 500 meters of any urban area or sensitive receptor (school, hospital, etc) and to the east of the Project road, where possible, to avoid impacts to protected areas. The locations of these facilities will be indicated within the Contractors SSESMP.

269. To adequately manage air quality impacts the Contractor will be responsible for the preparation of an Air Quality Plan, submitted to the Engineer as part of the SSESMP. The plan will detail the actions to be taken to minimize dust generation (e.g. spraying un-surfaced roads with water (including the types of equipment, sources of water, locations for watering and schedule), covering stock-piles, etc) and will identify the type, age and standard of equipment to be used and will also provide details of the air quality monitoring program for baseline and routine monitoring. The Plan will also include contingencies for the accidental release of toxic air pollutants.

Construction Phase

270. The Contractor will be responsible, through compliance with this ESMP and his SSESMP, for the following;

[24] Climate Proofing ADB Investment in the Transport Sector. ADB, 2014.

[25] Draft Project Appraisal Document - Report No: PAD2512. World Bank, 2017

- Exhaust emissions - No furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the Engineer. Construction equipment will be maintained to a good standard and fitted with pollution control devices regularly monitored by the Contractor and Engineer.
- Open burning of waste materials - No burning of debris or other materials will occur on the Site.
- Dust generated from haul roads, unpaved roads, material stock piles, etc - The Contractor will ensure and that material stockpiles will be located in sheltered areas and be covered with tarpaulins or other such suitable covering to prevent material becoming airborne. All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins, or other acceptable type cover (which will be properly secured) to prevent debris and/or materials from falling from or being blown off the vehicle(s). Hard surfaces will be required in construction areas with regular movements of vehicles. Effective use of water sprays will be implemented (e.g., Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25°C, or in windy weather. Avoid overwatering as this may make the surrounding muddy). All water used for controlling dust will be free of odor and pollution.

271. In addition, any new borrow pits, concrete batching plant, rock crushing facility and asphalt mixing plant will be the subject of separate environmental application under the responsibility of the Contractor. The Engineer will ensure that no such facility becomes operational without the required permits.

272. The Contractor is also responsible for the preparation of a Health and Safety Plan. The Plan, required as part of the SSESMP, will include contingencies for the accidental release of toxic air pollutants.

Operational Phase Mitigation

273. As noted above, the higher levels of PM10 and TSP are largely a result of the deteriorating pavement and the poor quality of access roads. Improvements to the pavement, including widening of the pavement and inclusion of a paved shoulder are likely to reduce the levels of dust generated during the operational phase of the Project. Main access roads will also be linked to intersections that will further reduce the amount of mud and debris being spread onto the road from access roads. Accordingly, no operational phase mitigation is required relating to air quality.

5.6.3.4 Climate Change Mitigation

274. Detailed pavement implications for climate change are scarce but growing in number and include work on the effect of rising average temperatures, changes in precipitation patterns, and increasing freeze-thaw cycling on pavement performance. The focus of these efforts is to integrate climate change into pavement design and predict pavement performance based on future climate scenarios. Most work has

offered general advice or predictions but has stopped short of recommending immediate changes in practice. [26]

275. Most climate change impacts are projected to occur slowly over a long period of time and as such providing mitigation measure for topics such climate change impacts on pavement design need to be taken over time and cannot be determined in a study like this, nor was this suggested in the ESIA ToR. Notwithstanding the above a number of simple measures can be taken to ensure that in the short term that extreme precipitation events do not result in significant impacts to the Project, they include:

- Increase ditch and culvert capacity;
- Maintain positive cross slope to facilitate flow of water from surface;
- Increase resistance to rutting;
- Reduce splashing/spray through porous surface mixtures;
- More frequent use of elevated pavement section especially in flood prone areas;
- Improve visibility and pavement marking demarcation; and
- Ensure that all embankments are seeded to help increase stability.

5.6.4 Hydrology

5.6.4.1 Potential Hydrological Impacts

Design Phase Impacts

276. The following potential impacts to hydrological conditions exist within the Project corridor:

- Drainage & Flooding - Inadequate assessment of the hydrological conditions in the Project Area and poor design could result in the failure of some of the Project structures, including bridges and culverts. This in turn would result in several impacts including cost to rebuild the structures, potential flooding of valuable agricultural lands and impacts to surface water quality. Bridges and culverts should be designed to accommodate the stream and drainage channel flows during heavy rains from a tropical depression that may last several days; tropical depressions typically affect the project area between 2 and 4 times per year during the typhoon season from June to December.
- Construction Camps – Improper siting and design of construction camps can have negative impacts to hydrology, both surface (wetlands) and groundwater, through improper disposal of liquid waste and spills of hazardous liquids.

[26] Climate Change Adaptation for Pavements. US Department of Transport, Federal Highways Administration, 2015

- Borrow Pits – It is possible that the Contractor could use river bed materials as identified in **Section 3** – Project Description. Hydraulic impacts resulting from extraction of river bed materials may include; channel modifications such as widening or deepening the channel, creation of deep pools, loss of riffles, alteration of bedload, alteration of channel flow, and degraded aesthetics; and
- Upstream and downstream erosion, and related impacts to bridges and other infrastructure whose foundations may be undermined by the lowering of the riverbed.

Construction Phase Impacts

277. The following potential impacts to hydrological conditions exist:

- Bridge Construction - Bridge construction activities may increase silt load in the river during construction at bridge sites and may result in accidental spillage of concrete and liquid waste into the river. This may impact upon the ecology of rivers including fish species.
- Construction Camps and Storage Areas – Impacts during the construction phase can result from the discharge of wastes to surface water from construction camps, the poor management of sanitary waste and accidental spills of hazardous liquids.
- Drainage and Flooding – Temporary drainage structures may fail, or get clogged with construction debris during the construction phase of the Project. This could lead to flooding of properties adjacent to these areas and construction sites.

Operational Phase Impacts

278. Run-off from re-habilitated bridge decks could flow directly to surface water courses if correct drainage is not installed on the bridges. This could be a problem if the bridges have accumulated oils and grease during dry periods and they are suddenly washed out during heavy rainfall.

279. With correct design, the drainage of the road will be improved compared to the existing situation allowing for peak flows to be contained in the storm water drains and allowing for possible higher flows due to more erratic climate patterns. In addition, some embankments will be raised slightly to eliminate flooding of the road. In these areas, suitable cross drainage structures will also be constructed to ensure that the raised embankments do not induce flooding of properties. Thus, the hydrological situation will be improved providing benefit to the community.

Box 4: Hydrology Issues Identified by Stakeholders

- Engineering of the new road should ensure adequate flood/drainage canals and leveling of driveways into the houses so that runoff does not flow into the houses/properties.
- Ensure that building material is not left in the drains causing blockages and then flooding.
- Large drainage canals during peak flows needed. Some villages suffer from

flooding so improving this situation is a high priority for them.

- Effluent/drainage from work sites potentially draining to their houses.

5.6.4.2 Hydrological Mitigation

280. Potential adverse impacts in the Project Area will be avoided or otherwise mitigated by ensuring the Contractors comply with the following:

Design Phase

- Drainage and Flooding - Consideration in the design phase has be given to the issue of drainage and culverts to ensure that drainage patterns are improved from the existing conditions and that increased run-off does not occur or result in flooding of areas previously undisturbed or in those areas identified as flood prone by the Project FS. During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges. If, during the operational phase of the Project, the rehabilitated road does result in increased run-off and flooding, the DoR will be responsible for rectifying this issue.
- Construction Camps – no construction camp, permanent or temporary, will be located within 200 meters of any river, or irrigation channel (not including drainage channels) identified in **Table 3-5** of this report.
- Bridges - All new bridges will be designed for the life expectancy of 75 years. Bridge rehabilitation and strengthening works will be designed for the life expectancy of 50 years. The design loading and design of all structural components must conform to the bridge design standards provided in the Employer's Special Requirements. Bridge designs will ensure that drainage from bridge decks over 50 meters does not discharge directly to the watercourses beneath the bridges. The bridge run-off waters will lead to an interceptor tank, or filter pond adjacent to the bridge in order to trap oil and grease run-off. The bridge design and layout must also be aesthetically pleasing and in harmony with the existing environment. Finally, the Contractor, through his Environmental Manager, will be responsible for consulting with PONRES to establish the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period.

Pre-construction Phase

- Construction Camps – The Contractor will be responsible for the preparation of a Construction Camp Site Plan which will form part of the SSESMP. The Plan will indicate the system proposed and the locations of related facilities in the site, including latrines, holding areas, septic tanks, etc. The Contractor will ensure the following conditions are met within the Plan:
    - Wastewater arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and

disposed of at a location and in a way that will cause neither pollution nor nuisance.

- There will be no direct discharge of sanitary or wash water to surface water, including the surface water courses identified in **Table 3-5** of this report. Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited.
- Liquid material storage containment areas will not drain directly to surface water (including wetlands).
- Lubricating and fuel oil spills will be cleaned up immediately and spill clean-up materials will be maintained (including spill kits) across the Contractors construction camp and ancillary facilities, e.g. asphalt plant.
- Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters.
- Discharge of sediment-laden construction water directly into surface watercourses or wetlands will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge.
- Spill clean-up equipment will be maintained on site. The following conditions to avoid adverse impacts due to improper fuel and chemical storage:
- Fueling operations will occur only within containment areas.
- All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks.
- Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids.
- All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
- The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses.
- Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.
- Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal. Disposal of such was will be undertaken by a waste management company contracted by the Contractor. The waste management company must have the

required licenses to transport and dispose of hazardous waste before any such waste is removed from the site. The Contractor will keep copies of the company's licenses and provide waste transfer manifests at his camp site for routine inspection by the Engineer.

- Site plans will be devised to ensure that, insofar as possible, all temporary construction facilities are located at least 100 meters away from any surface water course. If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the Contractors camp sites (see **Appendix S** for proposed designs). If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site.

Construction Phase

- Construction Camps and Storage Areas – The Engineer will undertake regular monitoring of the Contractors construction camp and storage areas to ensure compliance with the SSESMP and the Contractors Construction Camp Site Plan.
- Water supply – Two sources of potable water exist for the Contractors staff; bottled water or groundwater. If groundwater is to be used for drinking it will be tested to ensure that the water quality meets the Lao PDR drinking water standards specified in **Section 2**. Approximately 200 m^3 of technical water will be needed per day during the construction phase and around 15 m^3 of potable water per day. Consultations with the DD Consultant were undertaken to determine where the technical water will be sourced from, but to date the DD Consultant has not been able to confirm exactly where technical water will be sourced from. However, the Contractor shall obtain all necessary abstraction permits for both technical and potable water supplies.
- Bridge Construction - Concerning bridge construction works, the Contractor will:
  - Divert the water flow near the bridge piers.
  - Provide coffer dams, silt fences, sediment barriers or other devices to prevent migration of silt during construction within streams.
  - Perform dewatering and cleaning of cofferdams to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.
  - Carry out bridge construction works without interrupting the traffic on the Project Road with the provision of suitable diversions.
  - Ensure no waste materials are dumped in the river, including re-enforced concrete debris.
  - Place generators more than 20 meters from the river.
  - Ensure that no concrete sludge waste is dumped in the river.

  - Carefully collect all polystyrene (from expansion joints) so that it does not litter the local environment.
  - Ensure that no hazardous liquids are placed within 10 meters of the river.
  - Provide portable toilets at bridge construction sites to prevent defecation by workers into the river.
  - Ensure that workers are provided with correct PPE including harnesses (at Nam Cheng).
  - During piling works ensure that pumped water is filtered through a silt trap before being discharged to the river.

- Drainage and Flooding - During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to properties and land by flooding and silt washed down from the works. The Contractor will arrange with the village representatives those works which might interfere with the flow of irrigation waters to be carried out at such times as will cause the least disturbance to irrigation operations. Should any operation being performed by the Contractor interrupt existing irrigation facilities, the Contractors will restore the irrigation appurtenances to their original working conditions within 24 hours of being notified of the interruption. The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor. The Engineer will be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris.

Operation Phase

281. During the operation of the new road, the hydrology is likely to be improved as compared to the old road due to improved designs of storm water drainage. Peak flows will be contained within the storm water drains preventing flood water from flowing to houses and businesses as used to be the case according to accounts provided during Focus Group Discussions (FGD). Likewise, flora and fauna is likely to be better protected from foul polluted storm water flowing to natural areas. Health of populations will thus benefit as will their safety due to increased space from the edge of the road to the houses and businesses. These benefits are contingent on proper design and construction of the road and ultimately on its proper maintenance.

5.6.5 Natural Hazards

282. Apart from the issue of potential flood events (discussed above under Hydrology) and increased precipitation (discussed above under Climate Change), no other impacts to the Project are anticipated as a result of natural hazard events.

5.7 Impacts to Biological Resources

283. In Lao PDR, the standard ROW for a national road such as NR13 North is 25 m, while the standard width of a paved road lane is 3.5 m, that of the shoulder

area beside the paved road is 2.0 m, and that of the drainage beside the shoulder is another 1 m. If it is assumed that NR13 North all along the Project area from Sikeut to Phonhong is currently a standard paved road 2 lanes wide, without a median but with the standard shoulder and drainage areas on each side, then the actual built road width would average about 13 m.

- The full NR13 North legal ROW from Sikeut to Phonhong covers an area of 25 m x 58,000 m = 1,450,000 m^2 or 145 ha.
- The current built road is estimated at 13 m x 58,000 m = 754,000 m^2 or 75.4 ha, that covers 52.0% of the ROW.
- If the 19 km of road from Sikeut to the Songpeuay Market is upgraded to 4 traffic lanes with a median, shoulders and drainage that together are 23 m wide, then the additional built area along that section of the roadway will cover about 10 m x 19,000 m = 190,000 m^2 or 19.0 ha, that is an additional 13.1% of the ROW.
- If the 39 km of road from Songpeuay Market to Phonhong is improved but still comprises 2 standard traffic lanes and the standard shoulders and drainage, then it will add no additional built area to the road.
- In accordance with these assumptions, the NR13 North project would increase the area of the built roadway from about 75.4 ha to 94.4 ha, and that additional 19.0 ha would be permanently removed from providing habitat for flora and fauna.
- If an additional temporarily cleared area 2 m wide is required on either side of the built roadway to facilitate construction, then another 23.2 ha.

284. The amounts of land that the NR13 North project would permanently and temporarily remove as habitat for flora and fauna along the roadway, about 19 ha and 23 ha respectively, are inconsequential, especially as the areas already are heavily impacted by human development, and only wildlife that has adapted to developed areas normally would be found there.

285. The strips of land up to 50 m on either side of NR13 North (not including the built road) also have been stripped of their original forest cover and heavily impacted by human development, and do not contain any areas of critical wildlife habitat. Each strip covers an area of about 290 ha, so together they cover about 580 ha.

5.7.1 Flora

286. The Project primary impacts on flora during the construction phase stem from the minor loss of land area to widen the road surface, the roadside areas that are cleared to facilitate construction activities, and the clearance of land to establish construction camps, staging areas and borrow pits. The project area extends along NR13 North for approximately 58 km from the Sikeut junction to Phonhong, of which the first 19 km section will be expanded from 2 lanes to 4 lanes with a 23 m wide right of way, and the second 39 km section will be kept at 2 lanes, but improved with a 16 m wide ROW. The total amount of land that will actually be incorporated into the renovated roadway is relatively small as discussed above. The main impacts

during the road operation phase are essentially the same as during construction, except that roadside areas, camps, staging areas and borrow pits cleared temporarily to facilitate construction activities should be rehabilitated and/or allowed to naturally re-vegetate.

287. The inventory of trees along the roadway that will need to be removed to allow construction activities is presented in **Section 4.3** of this report. The tree removals will include trees in the road alignment where it is being widened from 2 to 4 lanes, and trees in the additional strips of land about 2 m wide on either side of the road that must be cleared to allow construction equipment to operate. Because the locations of the construction camps, staging areas and borrow pits have yet to be determined, it is not yet possible to inventory the trees that may have to be removed there. To minimize the impact on flora to the greatest extent possible, all of the temporary construction facilities should be located on already heavily disturbed ground where secondary forest growth has not yet become well-established.

288. If it is required by Lao law or applicable international guidelines, the Project could support compensatory tree planting activities, for example, in degraded areas of the Phou Phanang protected area. However, such compensatory activities should not cause any new access road or trail suitable for vehicles or motorcycles to be opened inside Phou Phanang, and the activities must be led or coordinated by the Vientiane Capital or Vientiane Province authority that is responsible for the target area inside Phou Phanang. The tree species to be planted must be suited to the planting site, and should include as many as possible of the species that were removed for project construction.

5.7.2 Fauna

289. A wildlife survey conducted during July and August 2014 as part of the FS included direct observations, village interviews, visits to roadside markets and sampling at 15 sites along NR13 North.[27] The survey focused on large mammals, mammals, birds, amphibians and reptiles; and the 15 survey sites included streams, an irrigation canal, flood plains and marshes, agricultural lands, home gardens, planted forests and abandoned lands (note that there are no natural habitat areas to sample within 50 m of the roadway). The survey species list includes 2 mammals, 13 birds, 2 reptiles, 5 amphibians, and 9 fish (see **Table 4-14**). Of the 31 species, 30 are categorized as *Least Concern* or in the lowest risk category on the IUCN Red List, and only the falcon is listed as *Vulnerable* or at high risk of extinction in the wild, but falcons range over wide areas to hunt and its nesting area likely was far from the road, and possibly inside Phou Phanang.

290. While it is quite likely that additional wildlife surveys of the areas along the roadway would document additional wildlife species, it is considered highly unlikely that any ground-dwelling species with a conservation status of other than *least*

[27] A more detailed description of the survey methodology is provided in the Feasibility Study, Chapter 14, Annex 6, Section 1.2.1.

concern would be encountered. In this case, no special mitigation measures are required for wildlife species with a conservation status of *near threatened* or higher.

291. A second wildlife survey conducted by telephone during September 2017 asked residents along NR13 North to identify what wildlife they had observed or knew of in the local area, including the NR13 North roadway and nearby areas. This survey identified many more species than did the one from the Feasibility Study, including 14 mammals, 17 birds, 16 reptiles, 1 amphibian, and 23 fishes, for a total of 71 species (see **Table 4-15**). Of those species, 11 appear on the IUCN Red List: 1 mammal is critically endangered; 2 mammals are endangered; 1 mammal, 1 bird, 3 reptiles and 1 fish are vulnerable; and 1 bird and 1 fish are near threatened. Any of the listed species could be resident in Phou Phanang, except for the two carp species and the Nile tilapia that would be resident in the reservoirs only if introduced for aquaculture; and it is doubtful that IUCN Red List species such as the slow loris or gibbons would be observed outside of Phou Phanang unless they were poached and either kept as pets or sold into the illegal trade in wildlife.

5.7.2.1 Loss of Wildlife Habitat along NR13 North

292. Project impacts on fauna are expected to be minimal along the roadway, as the loss of habitat due to additional land areas taken to permanently widen the road and to facilitate construction are so small as to be inconsequential (see **Section 5.7**), and those areas already are heavily impacted by human development. Any species of wildlife commonly found along the roadway will be species with widespread distributions that have generally adapted to living in developed areas.

293. The potential Project impacts on fauna will depend on the locations of various project facilities, including worker camps, equipment staging areas, borrow pits, etc., and on whether or not provisions are made to restore the areas to a natural state once the construction phase has been completed. As previously mentioned, it is recommended that project facilities be located to the east of NR13 North wherever possible, to minimize their potential impacts on the flora and fauna of PPN to the west of the road. This is especially important for the worker camps in order to limit worker access to PPN, and thereby limit the possibilities that the workers would engage in hunting and collecting wildlife inside the protected area. In addition, project facilities should be located on land that already is heavily impacted by human activities, and avoid clearing land where good vegetative ground cover or secondary forest has been established.

5.7.2.2 The Threat from Animal Crossings along NR13 North

294. The threat of being hit by a vehicle while crossing the roadway is a more significant long-term threat to wildlife than the temporary or permanent loss of habitat associated with Project construction. During an interview on 29 May 2017, the head of the Section of Forest Protection of the Vientiane Capital Administration said that they have not received notices of road kills along NR13 North, and they do not consider it a problem. However, the roadway will continue to be a dangerous place for animals (and people), especially as the traffic volume is expected to continually increase over time, vehicle speeds all along the improved road are expected to

increase, and the road section widened from 2 to 4 lanes will be more difficult to cross safely, especially with the 2 meter median.

295. The bridges that will be replaced or renovated along NR13 North can be designed with dry paths under the bridge on either side of the streams to facilitate movements of people, livestock and wildlife, the latter primarily at night when people are not around. Culverts under the road also can be designed to serve as safe passageways for wildlife; for example, where there are multiple culverts, the intake for one could be raised somewhat above the intakes of the others to provide a dry passage when water flow rates are low.

296. Because NR13 North passes through extensive agricultural areas, and animal husbandry is one of the main agricultural activities, providing underpasses through which farmers may safely move their livestock, especially cattle and buffalo, from one side of the road to the other should be considered by the DD Consultants. Such underpasses also could provide safe passage for wildlife.

297. In areas where livestock occasionally must be moved from one side of the road to the other, and where underpasses are not provided, warning signs should be posted to alert drivers to the possibility of encountering livestock on the roadway, and lower speed limits also may be posted.

5.7.3 Protected Areas

298. The closest point of approach from NR13 North to PPN is about 3 km, and the closest point of approach to PKK is about 25 km. There is no known wildlife migration route between the two protected areas, largely due to the barrier presented by the Nam Ngum River that flows between them to the east of NR13 North. As discussed below, neither the proposed construction activities nor the normal traffic use along NR13 North after project completion should have any significant impact on either PPN or PPK, largely due to the distances separating the road and the protected areas, and also the even greater distances to their core areas.

299. An issue of concern for NR13 North is the risk that wildlife from the protected areas may regularly migrate or occasionally move across the road, as this potentially would put both the animals and vehicular traffic on the road at risk from a collision. This issue was discussed with the head of the Section of Protection Forest for Vientiane Capital on 29 May 2017.[28] First, he stated that there are no known wildlife migration routes between PPN and PKK, largely because the Nam Ngum River presents an obstacle that few wildlife species could cross. Historically, elephants had been found in PPN, but there haven't been any sightings during the past decade; and other large mammals that might make seasonal migrations (and pose a danger to traffic on the road) such as tigers, kouprey and banteng also are not found there. Wildlife that are found in the protected area include species such as deer, wild boar, and civet cats, but they generally stay in the remote hilly or mountainous section on the western side that is farthest away from the road.

[28] Vientiane Capital manages the southern 52,000 ha of the protected area while Vientiane Province manages the northern 18,000

300. When asked if there is a problem with smaller wildlife from PPN crossing the road, he stated that no problems have been reported regarding wild animals on the road. The reasons that wild animals generally are not found on or along the road include: (a) most wild animals stay in the higher elevation core areas of PPN that are on the western side and away from the road and the farming, residential and commercial areas that border the road; (b) there are enough permanent streams and reservoirs inside the protected area that the wildlife residing there do not need to leave to find water during the dry season or a drought; and (c) while hunting and shooting are not allowed inside the protected area, some trapping is done around the farms that are inside PPN along its eastern border.

301. Although there are some agricultural and residential developments inside PPN's eastern boundary, the core areas of the protected area where the wildlife are concentrated are accessible only on foot. There is some tourism development inside the protected area in the form of hiking trails that lead to waterfalls and vistas, but they do not reach into the core areas.

302. The IUCN and WWF offices in Vientiane also were contacted by email regarding the wildlife inside PPN, but they did not respond to the request for interviews.

303. The following series of six annotated Google Earth images (**Figure 5-1** to **Figure 5-6**) explains why the NR13 North project is expected to have no discernible impact on PPN and PKK, including the Important Bird Area, and the wildlife they contain. The primary reason for the lack of impacts is the distance from the road to the protected areas, and especially to the less disturbed core areas of PPN; and this will be reinforced if the project borrow pits, worker camps and equipment staging areas are located to the east of the road and away from PPN as recommended. PPN stands alone and is not connected to any other national protected area, and there are no known wildlife migration routes that originate in or pass through PPN. Nearly the whole of PPN, with the possible exception of some areas with steep terrain, has been logged over or otherwise degraded at some point in recent decades, and the core areas at higher elevations are so small that they do not provide sufficient habitat to maintain populations of large mammals such as elephants, tigers, gaur, banteng, etc. Therefore, there is minimal danger that wildlife from PPN will pose any danger to traffic along NR13 North.

Figure 5-1: This Google Earth image shows the alignment of NR13 North (the yellow lines are major roads) from Sikeut Junction in the south to Phonhong Junction in the north, with the Phou Phanang national protected area to the west, the Phou Khao Khouay national protected area to the northeast, and the Important Bird Area on the margin of Phou Khao Khouay.

The Phou Phanang boundary is about 3 km west of NR13 North at its closest point of approach, the Phou Khao Khouay boundary is nearly 25 km east of the northern section of NR13 North, and the Important Bird Area is about 30 km east

of NR13 North.	

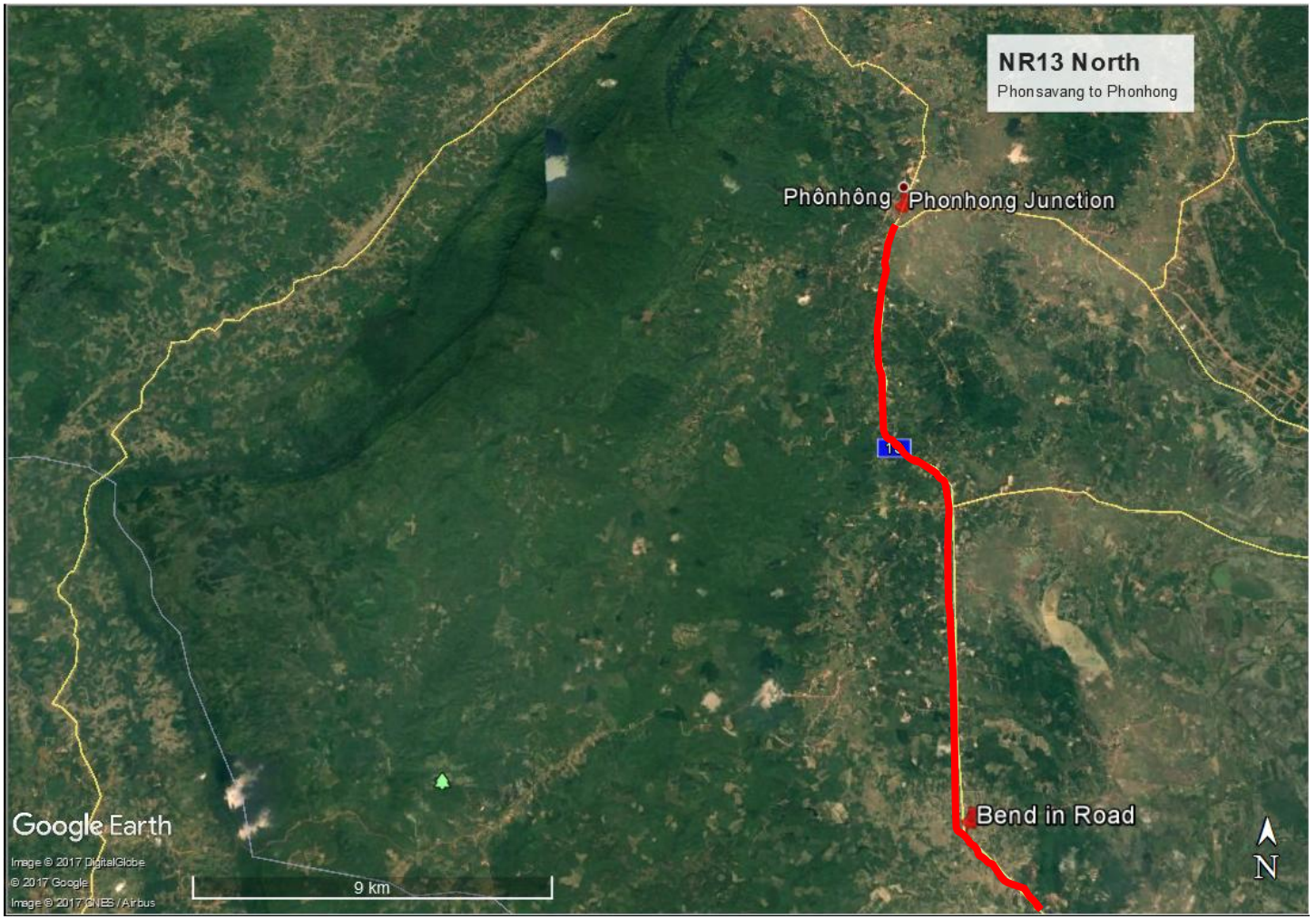


Figure 5-2: The dark green area in the upper section of the enlargement is the remaining relatively remote and undisturbed core of Phou Phanag in Vientiane Province, where the mountainous terrain helps to restrict public access. The closest point of approach of the NR13 North project area to the edge this core area is about 3 km west from Phonhong Junction.

Figure 5-3: The dark green area in the center of the image is the relatively remote and undisturbed core of Phou Phanang in Vientiane Capital District, where the mountainous terrain helps to restrict public access. The closest point of approach of the NR13 North project area to the edge of this core area is about 5 km west, across the reservoirs. This is the largest relatively undisturbed section of Phou Phanang, yet its extent is less than 20 km north to south, and perhaps 15 km east to west, giving an area of less than 200 km^2. This area is not large enough to sustain populations of large wildlife species such as elephants, tigers and gaur, but it is suitable for smaller animals like deer, civet cats,

porcupines, squirrels, and many birds, reptiles, amphibians, etc.	

Figure 5-4: This image of the southern section of the NR13 North project area shows the fairly heavily impacted area between the road and Phou Phanang, as evidence by the light patches of cleared land used for agriculture that are interspersed with lines showing access routes along minor roads and dirt tracks. Note the lack of light patches and lines in the relatively intact forest area at the upper left of the image (see Figure 5-3).

Figure 5-5: This image of the central section of the NR13 North project area shows the heavily impacted area between the road and the two large reservoirs, as evidence by the light patches of cleared land used for agriculture that are interspersed with lines showing access routes along minor roads and dirt tracks. Again, note the lack of light patches and lines in the relatively intact forest area at the lower left of the photo (the same area shown in the upper left of Figure 5-4).

The light blue line winding horizontally across the image is the boundary between Vientiane Capital to the south and Vientiane

Province to the north.	

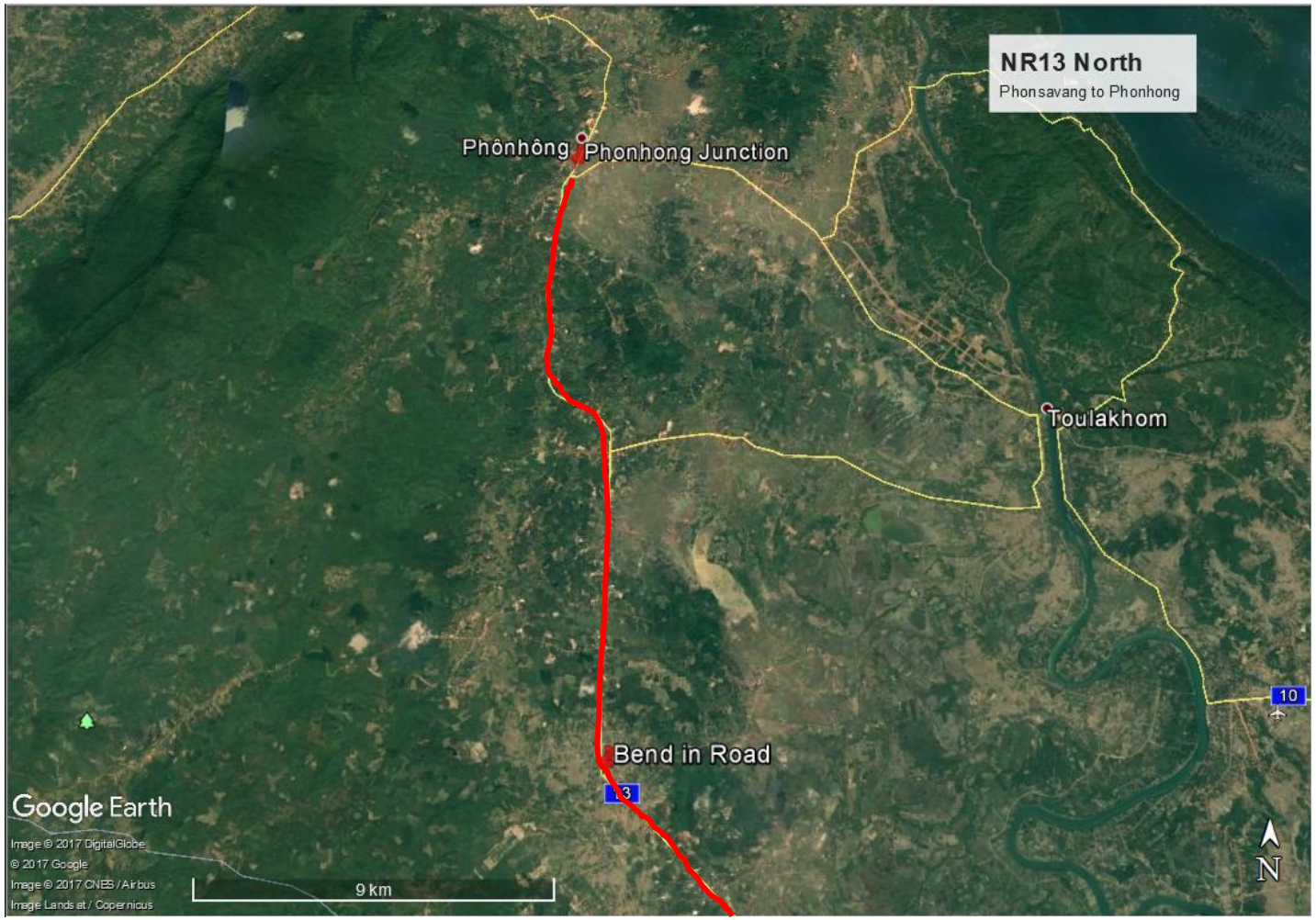


Figure 5-6: This image of the northern section of the NR13N project area shows the heavily impacted area extending from the road well into Phou Phanang, limited only by the mountainous terrain at the upper left of the photo, again as evidence by the light patches of cleared land used for agriculture that are interspersed with lines showing access routes along minor roads and dirt tracks. Note the lack of light patches and lines in the relatively intact forest area along the mountain ridges at the upper left of the image.

5.8 Impacts to Socio-Economic Resources

304. In as much as the project is rehabilitation of the existing road only, it does not have the social, economic and community life concerns that are associated with new road construction, this road improvement project is generally aimed at bringing benefits to surrounding communities through lower transport costs and better access to market places, jobs, and services such as health and education. Road construction and rehabilitation projects can lead to changes in the community or social environment around the road, influencing various aspects of lifestyles, travel patterns, social and economic activities.

5.8.1 Economic Development

5.8.1.1 Potential Economic Impacts

305. The Project is expected to have significant beneficial impacts to the economy of the Project area. The key benefits include:

- Improved access to markets – The road will improve access to markets for farmers along the entire Project Road alignment;
- Reduction in travel times – Journey times from Vientiane and between villages along the road will reduce; there will be less congestion on the road;
- The new road is perceived to improve safety for communities alongside the road. There will be more street signs and lightning and formal crossings, better enforcement of vehicle speeds, more space between houses and businesses and traffic and better animal management;
- The new road is perceived to improve health. The existing road is dusty with solid waste and mud in wet season, some of which enters houses due to their current proximity to the road and due to the engineering design of the road. Blocked drainage is common in the existing road also. Villagers expect these problems will be resolved with the new road and for this reason they typically welcome the new development.
- Reduction of maintenance costs – Increased maintenance of vehicles due to poor road condition drives up the costs of agricultural products;
- Increased Reconstruction effort in remote areas - improved access to these areas may also allow a more intense level of reconstruction effort in the remote areas including facilities such as schools and clinics;
- Improved access to health and education facilities – Improved road conditions will most likely result in increased traffic on the roads including mini-bus and taxi services, this will enable people to access health care and educational facilities more easily; and
- Creation of Jobs - The community along the alignment of sub-project will have opportunities for temporary employment during construction. Albeit, this opportunity is temporary in nature, this will be beneficial.
- The communities also perceive on going economic benefits due to additional space between shops and the new road allowing shoppers to park easily, avail of goods and

services and move on safely. The existing road was more cramped and busy causing many shoppers to seek goods and services elsewhere.

Box 5: Benefits Perceived by Stakeholders

- Travel will be more convenient, less crowded.
- Safety will be improved by improved signage, lighting and more space between traffic and houses.
- Health will be improved due to lower dust concentration, improved drainage, less incidence of dengue due to improved flow of stormwater.
- Business will be improved due to better parking arrangements for shoppers.
- Tourism will be improved.

306. Notwithstanding the above, the Project will have some negative impacts on the economy of the Project area, including:

- Temporary disruption to house and businesses access exacerbated by possible construction delays;
- Dust generated during construction impacting upon commercial areas and households;
- Impacts to commercial properties, road vendors and markets;
- Impacts to agricultural areas;
- Impacts to housing;
- Limited space available for roadside commercial activities during constructions;
- Inadequate replacement land;
- Utilities and supply interruptions;
- Possible issues with land titles changes;
- Income impacts due to construction and possible delays; and
- Possible safety issues during construction, workers management.

Box 6: Economic Issues Identified by Stakeholders – not including resettlement and compensation issues.

- Income may decline due to access and dust and preventing customers from coming to the shop. If construction is delayed, income losses may be extended.
- Driveways to houses maybe cluttered by construction materials and waste.
- Delay in construction is a big concern. People want the contractor to follow planned schedule.

- Impacts on markets access which may lower trading volumes.
- Erratic and unplanned scheduling of construction stages may cause several sections of road to be disturbed simultaneously.

5.8.1.2 Economic Mitigation

307. Employment - The Contractor will employ local labor to benefit local communities and to promote the overall acceptance of the project. A budget will be made available to pay for training of locals and a minimum target for local labor will be set in contracts and enforced. As part of the maintenance of the road the DoR should also look into the possibility of employing the local people for the maintenance of roadside drains upon completion of rehabilitation works.

308. Road Vendors – To avoid disruption to vendors the Contractor, in coordination with the DoR and the Provincial government, shall set aside a specific area for road vendors to continue to operate throughout the construction phase. The area should be located within at least 50 meters of the project road and should be sized to accommodate all road vendors. The site should be clearly signposted for traffic and an all weather track provided to the site with parking space.

309. Scheduling of civil works – The scheduling of the construction is a key aspect to mitigating disturbances to incomes and impacts on health. It is recommended that the schedule for civil works be divided into sections comprising a number of work sites each with specific arrangements custom designed for the affected community. The works schedule will be a key document in the contracts of the Contractor and advancement of works will need to be very carefully monitored by the Engineer. Contingencies for unaccounted disturbances to scheduling will be included in the works schedule.

310. Accessibility – Access to businesses must be maintained at all times throughout the construction period. This means that the contractor must prepare dedicated temporary pathways to all businesses that might otherwise be cut off from the road during the construction phase. The pathways must be wide enough to allow access to the business and must be kept free of mud and construction debris and should not be liable to flooding.

311. Dust / Mud Mitigation - FGDs revealed that people are quite concerned about dust and mud and how it affects their livelihoods as well as health. Mitigation measures relating to dust and mud are discussed above under **Section 5.6.3** – Air Quality.

312. Flooding Management - Engineering of the new road will ensure adequate flood/drainage canals and leveling of driveways into the houses so that runoff does not flow into the houses/properties. This issue us discussed under **Section 5.6.4** – Hydrology, above.

313. Public communication - Stakeholders will be able to communicate issues through the grievance redress mechanism (GRM) as and when they occur. The GRM can be found in **Section 7.5**. In addition, the Contractor will provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions. This will be achieved by undertaking a rolling program of community meetings along the Project corridor as work progresses. Four weeks prior to the Contractor starting

works in any village or town he will be responsible for holding a works orientation meeting within the village / town and will invite members of the public and village officials. The purpose of the meeting is to summaries the scope of works, the schedule and to provide copies of the GRM. The Contractor will also hold monthly community meetings in each village / town where construction works are on-going.

5.8.2 Social Sector

5.8.2.1 Potential Social Impacts

314. Based on accounts collected from FGDs, many households and businesses belong to families headed by single women and many of those belong to single aged women without families. Typically, their shops are rented from land owners and paid for either monthly to local authorities based on their takings, or day by day as a fixed daily rate. For example, a stall-holder in Lak 52 reported she paid 60,000 per day to the owner of the land her stall occupied (the local government). These women or their children access local markets, buy goods and resell them at their shops where shoppers can pull over conveniently, purchase quickly and move on. A key aspect of their viability is their location along the road and access for parking, the shop's access to local markets for goods supply and the ability to pay the land owner on a day by day basis.

315. The FGDs reveal that any disturbance due to road construction to these comparative advantages may cause some businesses to suffer financially and potentially cause their failure. Loss of income for single women headed business/families could exacerbate their already marginal status and inflict hardship.

316. Fortunately, many households along the road recognize the positive impacts the new road can have on their lives in terms of improving business viability. However, the engineering and loss compensation process, amount and timing are critical to ensure a smooth transition to the new road situation. The critical aspects of this transition are also well recognized based on accounts of the FGDs and mostly very reasonable.

317. Communities interviewed during the preparation of the ESIA acknowledge benefits of the new road on travel time, safety, health and business bottom line. These are good positives and tangible views of what a new road can do for communities. Details of these positive impacts have been described in **Box 5.** With these benefits in mind, people are generally in agreement to "put up with" some disturbances during construction but it is the job of mitigation processes to reduce the disturbances to community expectations and in line with World Bank and GoL standards at a minimum.

318. Communities have highlighted impacts to temples, gates, cemeteries and importantly sacred Buddha trees, which they want moved and not cut down if they are to be affected by Project works. In many cases, villagers will contribute their labor where possible if funds are provided to finance reconstruction and movement of these village assets.

319. Communities have also asked to record possible impacts on village offices, water supply, and schools.

320. Communities worry most about house and businesses demolition and their impacts on day to day living. Timely compensation and in cases such as women-headed and poor households, reconstruction by the company is paramount to successful mitigation. Some

villagers have noted bad experiences with previous construction and alleged the Government not paying compensation to re-build houses. Women headed households have requested not cash compensation but land for land and reconstruction of their homes and businesses where they own them. Villagers would like compensation prior to demolishing houses. The compensation should be available at the time expenses will be incurred as reconstruction needs to happen very quickly. The faster this process, the more resilient businesses will be. This is very important as noted earlier, many businesses pay rent on a day to day basis with very small cash flows. Small disturbances due to trading volumes for example caused by lower access to their shops or higher dust levels in the vicinity can translate to loss of incomes and indebtedness and possible bankruptcy.

321. With regards to replacement land, existing larger plots can afford to lose a section to the road, but small plots will often need complete acquisition requiring a replacement block of land somewhere else. Houses and businesses on larger plots will be able to remain in-situ, perhaps with some modifications but houses and businesses on small plots of land will need to be moved completely. The extent to which this will occur is detailed in the Resettlement Action Plan (RAP). Thus, particular attention is required to small plots whose owners and renters are more vulnerable to the transition.

322. FGDs record mostly very good awareness of possible impacts to businesses and homes. In some villages, the groups were less aware. Villagers impacted by the 4 lane sections were more worried about impacts than hose living in the 2 lane sections.

323. The Focus Group Discussions (FGD) and socio-economic survey provided much information on the anticipated loss of income due to small businesses being affected by the road widening project. The consultant interviewed 1,808 businesses, situated along the section of road to be widened/improved. These businesses vary in scale from one-person stalls to medium sized enterprises employing 50 or more staff. Apart from physical impacts resulting from the requirement to pull back from the ROW, many small business owners anticipated negative effects on their income due to restrictions on access during construction, and a median strip preventing access from vehicles on the other side of the road after construction. The contractor will be required to provide access to these businesses during construction. About 65% of the businesses were in Naxaythong District, and 35% in Phonhong District.

324. Villagers were also concerned about delays in construction which extend the period of disturbance to people's livelihoods due to prolonged impacts. This concern came out of almost all FGDs with villagers requesting the company to advise a clear schedule and stick to it. Small sections of road should be completely upgraded at a time. This approach should be reflected in the construction schedule.

325. Drainage and flooding of the new road was often a concern drawing from their experience with the old road. Proper and adequate drain design was high on the priority list of concerns. This is because flooding of the road often means flooding of houses and businesses also and loss of incomes in the case of shops along the road due to lack of access until the flood waters recede. Floods also bring mud and solid waste in the vicinity of homes and businesses and also smell bad. All these impacts combine to lower business and so impact incomes.

326. Many households were concerned about dust during construction and during operation of the road. They requested adequate watering with clean water and a road finish on arterial roads and driveways similar to that of the main road. This will prevent dust from side streets from being dragged onto the main road transferring it to other parts of the communities along the road. While the main road is a PPP project, side streets could be financed by community work as could driveways. Such complementary projects could ensure long term viability of the main road project.

327. Some concerns were expressed about land titles changes which is an expensive and lengthy process. Some households and businesses have informal titles despite having been on site for 20 years or more. In many villagers' experience, with previous projects involving surrendering their land, the cost of changes to land titles have been passed on to villagers.

328. Vulnerable People – Only three households (of the total of 1,942), comprising 16 people, were listed as poor by the local governments. All three were women-headed households. If they are identified as affected, special measures will be put into place for their compensation and resettlement (if applicable).

329. Separate to this report, an EGDP has been prepared which discusses potential impacts to ethnic groups within the Project corridor and mitigation measures to ensure that they are not disadvantaged by the Project.

Box 7: Social Issues Identified by Stakeholders

- Major concerns regarding delays in construction, dust, safety, air pollution, flooding of their houses (water, mud). Excavation is often fast then re-construction is slow.
- Inform village authorities about workers staying overnight in the villages.
- Night workers to be identified to village authorities.
- Concerns about lack communication during construction.
- PAPs should be able to communicate with project responsible persons any time so need contact details of project in public place in the village like village office.
- Construction company to meet with village committee at regular intervals to updater on progress of construction.

5.8.2.2 Mitigation Measures

330. Utilities – Impacts to utilities are discussed below under **Section 5.8.3** – Infrastructure and Transportation Facilities.

331. Physical Cultural Resources – Impacts to PCR, including cemeteries and Buddha trees are discussed below under Item – Physical Cultural Resources.

332. Workers behavior in villages - The Contractor will be obliged to keep a record of all workers staying overnight in a village, including within construction camps in that village, this information will be relayed to village authorities on a weekly basis. The Contractor will be responsible for the behavior of all his staff.

333. Accessibility - Access to residential properties must be maintained at all times throughout the construction period. This means that the contractor must prepare dedicated temporary pathways to all properties that might otherwise be cut off from the road during the construction phase. The pathways must be wide enough to allow access to the properties and must be kept free of mud and construction debris and should not be liable to flooding.

334. Safety – Health and safety issues are discussed below under **Section 5.8.8** – Community Health and Safety.

5.8.3 Infrastructure & Transportation Facilities

5.8.3.1 Potential Impacts to Infrastructure

335. Drainage Infrastructure - construction activities will include the demolition or rehabilitation of existing drainage structures and construction of new drainage structures (culverts and side drains) along the alignment. Design errors could lead to portions of the drainage network operating below the required standard (e.g. culverts are not long enough, or poorly sized wing walls) and lead to erosion of embankments, road washout, flooding, inadequate flow of water to and from agricultural land and dangerous driving conditions.

336. Roads - During the construction phase, it may be inevitable that disruption of existing traffic and local accessibility are impaired which may cause problems with the local community. Within the Project Corridor the operations of a number of retail shops, mechanic shops and some restaurants, etc., may also be affected during construction in terms of access.

337. Utilities - Medium and low voltage power lines and water pipes are located within the Project corridor. The medium voltage transmission lines are mostly located outside of the ROW. However, it is possible that low voltage distribution lines and below ground water pipes within the ROW maybe impacted during construction, especially in the proposed four lane section of the road (up to Km 19.2).

338. Irrigation – Several irrigation channels cross beneath the Project road. Project works will require temporary diversions of these channels.

Box 8: Infrastructure and Transport Issues Raised by Stakeholders

- How will utilities, e.g. water supply be affected?
- If damage occurs to water pipes and electrical cables, the Contractor must fix it.

5.8.3.2 Infrastructure Mitigation

339. Drainage - As mentioned above under the Item relating to Hydrology (**Section 5.6.4**) detailed designs will ensure that all drainage structures are sized and located correctly and will account for all of the flood prone areas identified in the Project FS, and. During the construction phase the Engineer will ensure that the Contractor follows the detailed design with respect to the required infrastructure facilities. However, the Contractor may propose changes to locations and specifications of the drainage structures to account for any errors

in the detailed design. The Engineer will be responsible for reviewing and approving any changes to the design before the Contractor can implement the proposed changes.

340. Roads - To mitigate the potential impacts to existing roads the Contractor will:

- Submit a Traffic Management Plan to local traffic authorities and the Engineer prior to mobilization and include the plan as part of his SSESMP;
- Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions, as discussed above under **Item 5.8.1.2**.
- Allow for adequate traffic flow around construction areas;
- Provide adequate signalization, appropriate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control;
- Provide temporary access where accessibility is temporarily restricted due to civil works; and
- Ensure that access routes, via diversions, remain open at all times to businesses, residential properties, schools, medical facilities, etc.

341. Prior to the commencement of works a road condition survey will be undertaken by the Engineer to record the condition of access roads to borrow pits, asphalt plants, camps, etc. These access roads will be maintained during the construction phase and repaired to their original state at the end of construction by the Contractor to the satisfaction of the Engineer, local authorities and in compliance with the contract.

342. Utilities - During construction all power lines (transmission and distribution) and water pipes in the Project Corridor will be kept operational, this will include temporary transmission lines while existing poles and lines are moved. If any temporary disruption to water or power supplies is absolutely necessary the Contractor must warn the affected population, and receive approval from the Engineer for the disruption at least 24 hours in advance and no disruption will last longer than 4 hours.

343. Irrigation – **Section 5.6.4** - Hydrology outlines the process for temporary disruptions to irrigation systems. A Grievance Mechanism has also been prepared (**Section 7.5**) in case of any disputes between farmers, landowners and the Contractor regarding this, and other matters. In addition, monthly community meetings will be scheduled by the Contractor in each village / town where construction works are ongoing to ensure that regular information exchange is made between both parties during the construction period.

5.8.4 Land Use

5.8.4.1 Potential Impacts to Land Use

Design Phase

344. To ensure land acquisition issues are addressed appropriately a RAP has been prepared by the LCF as part of the Projects detailed design. The RAP for the Project complies with the World Bank's OP 4.12, Decree 84 of the Lao Government, and the Ministry of Natural Resources and Environment's (MONRE) 2013 Ministerial Instruction No.

8030/MONRE on Environmental and Social Impact Assessment Process of the Investment Projects and Activities. The summary findings of the RAP are as follows:

- Altogether the Project will affect 2,613 plots of land covering about 135,557 square meters, of which 95% is in Naxaythong with the 4 lane road section. The most affected land areas are residential land (48.80%), followed by commercial land (31.70%), agricultural land (12%), empty land (6.5%) whose owners cannot be identified or reached, and government land (1%).
- Approximately 184 affected plots of land (7.6%) will lose more than 10% of their total land area and almost all of them (183) are located in Naxaythong District. Amongst the more than 10% affected plots of land, 54.9% are residential land, 38.6% are commercial land, 6% are agricultural land and empty land.
- The Project will affect 3,281 structures of 2,155 households and amongst the affected structures 30% are houses, 13% are fences, 25% are cement slabs in front of commercial buildings, and 32% are house entrances.
- There were approximately 246 restaurants and food stalls which were felt to be at risk from construction dust and noise.

Construction Phase

345. Potential impacts to land uses outside of the ROW during the construction stage are limited to the creation of construction camps and other ancillary facilities such as borrow pits, batching plants, etc.; and are discussed under headings relating to those items below.

5.8.4.2 Land Use Mitigation Measures

346. The RAP has included a number of compensation measures in the form of an entitlement matrix which outlines in detail measures to compensate for:

- Loss of land or use of land;
- Loss of crops and trees;
- Loss of structures and fixed assests;
- Livelihood impacts;
- Allowances, assistance and livelihood restoration; and
- Temporary impact during construction.

347. As with this ESIA, the RAP will be reviewed and approved by the DoR and World Bank before it cam be implemented prior to the start of the construction phase.

5.8.5 Waste Management

5.8.5.1 Potential Impacts from Waste

348. Road construction will inevitably generate solid and liquid waste products potentially including:

- Inert waste – for example, concrete, metal, wood and plastics.

- Hazardous waste – acids and alkaline solutions, waste oils and oily sludge, batteries, and bitumen.

349. In addition, uncontrolled discharges of sewage and 'grey water' (e.g. from washrooms and canteens) from construction sites and worker's camps may also cause odors and pollute local water resources. As well as being a cause of complaints by the local population, this may lead to contravention of local regulations and fines being imposed on the Contractor.

350. The main construction waste produced will waste concrete (solid and sludge) and possible asphalt, depending upon how much can be re-used as sub-base material. **Table 5-2** indicates the main types of waste and an estimate of volumes (based on similar road construction projects).

Table 5-2: Waste Types and Estimated Volumes

#	Waste Type	Hazardous	Estimated Volume
1	Concrete	No	200 m^3
2	Asphalt	No	Currently unknown
3	Bituminous Mixtures	Yes	1 t
4	Wood	No	1 t
5	Uncontaminated Metal	No	5 t
6	Uncontaminated Plastic	No	1 t
7	Contaminated metal (paint tins, etc.)	Yes	2 t
8	Contaminated plastic (oil containers)	Yes	3 t
9	Domestic waste (food stuffs)	No	5 t
10	Domestic Waste (non-foodstuff)	No	40 t
11	Sewage Water	Yes	150 m^3
12	Tyres	Yes	150 t
13	Hazardous liquid waste	Yes	20 m^3
14	Hazardous solid waste	Yes	10 t

351. It is noted that the waste management situation in Lao PDR is far from perfect, and that the waste management facilities in Vientiane Capital Province are poor quality and do not comply with international best practice, i.e. controlled landfills for hazardous waste, suitable capacity for medical waste, etc. The waste generated by the Project should not simply be dumped in this exiting landfill (even if it is a licensed facility) if it adds to existing pollution.

5.8.5.2 Waste Mitigation

352. To ensure waste management is adequately controlled, given the constraints mentioned above, the Contractor will be responsible for a range of measures including:

1. Waste Management Plan - The Plan will include items relating to the safe handling and management, including storage, collection and disposal of the following wastes on site:

- Domestic waste
- Food waste
- Recycled Waste (including Asphalt)
- Plastic
- Metals
- Wood
- Construction Waste
- Hazardous Waste
- Liquid Waste

353. Oversight of the implementation of the Plan is the responsibility of the Contractor as outlined in the ESMP.

A. Recycling and Reuse - Where possible, surplus materials will be reused or sent for recycling at the landfill at NR13 South – this will include wood, plastic, metal and glass. A plan for the recycling of materials will be included in the Contractors waste management plan. In addition, where practical, the Contractor will explore opportunities to recycle concrete and reuse asphalt especially as base material.

B. Storage of Hazardous Wastes - Oils, fuels and chemicals (including bitumen, bridge deck waterproofing agents and concrete) are substances which are hazardous to human health. They need to be stored properly in correctly labeled containers, both within the construction camp and also at construction sites (e.g. bridges, culverts, etc.). Bitumen, oil and fuel will be stored in tanks with lined bunds to contain spillage (the bund will be able to contain at least 110% of the volume of the largest storage tank within the bund).

C. Waste Disposal – Collection and Disposal of waste materials shall be properly undertaken inline with national regulatory requirements. The Contractor will keep a record of the waste volumes and types removed from the site. Prior to the start of the works the Contractor will provide copies of the waste management contractors licenses to the Engineer for review. The Engineer shall then perform a due diligence review of the waste management conractors facilities to ensure that they are in compliance with Lao PDR regulatory requirements.

D. Concrete - Waste concrete and reinforced concrete will also require disposal. Waste concrete should be crushed and re-used as fill material, or base material where possible. Under no circumstances will concrete mixers be washed out onto open ground at construction sites, such as bridges – this issue is discussed further under **Section 5.6.4** - Hydrology.

E. Liquid Waste -The issue of liquid waste, including concrete sludge, camp run-off water, vehicle washing water, batching plant wastewater, etc., is discussed above under **Section 5.6.4** – Hydrology and **Section 5.8.6** - Construction Camps. Under no circumstances will liquid waste be used in water bowsers from water spraying.

5.8.6 Construction Camps, Concrete Batching and Asphalt Plants

5.8.6.1 Potential Impacts

354. Construction camps constitute a temporary land use change and raise issues related to activities such as impacts to air quality; poor sanitation arrangement and improper methods used for disposal of solid wastes and effluent; and transmission of communicable diseases to the local people by the construction workers due to inappropriate health monitoring facilities. Specific issues may arise as a result of the following:

355. Design and Siting - Improper siting and design of construction camps can have negative impacts to hydrology through inappropriate disposal of liquid waste and spills of hazardous liquids. Poor management of sanitary waste and accidental spills of hazardous liquids from construction camps can also have negative impacts on ground and surface water. Rock crushing plants and concrete batching plants can also have impacts on sensitive receptors located downwind of the sites if the plants are too close to the urban areas.

356. Concrete Batching Plants - Potential pollutants in batching plant wastewater include cement, sand, aggregates and petroleum products. The main sources of wastewater at batching plants are; contaminated storm water runoff, dust control sprinklers, the agitator washout station, the agitator charging station, the slumping station, and cleaning and washing areas. These substances can adversely affect the environment by:

- Increasing water pH.
- Increasing the turbidity of waterways (turbidity is a measure of the cloudiness of a suspension).

357. Asphalt Plants – Several impacts are associated with asphalt plants:

- Emissions – including dust from the transport and handling of aggregates and emissions from the combustion process in the dryer.
- Noise - Noise occurs at different places in the process for examples in the conveyor belts, dryer and mixer drum, internal and external traffic. The noise is estimated to be in the range of 90 to 100 dBA (Leq) at a few metres from the equipment.
- Storage of Bitumen – Drums of bitumen will be stored safely and securely to prevent accidents and pollution.
- Storage and Use of Hazardous Materials – Some materials used during asphalt production, such as Kraton, can be explosive or a fire hazard. These materials need to be stored and managed appropriately.
- Health and Safety - Asphalt Plants can be very dangerous, accidents may occur at any time. Hence it is important to have a proper policy for the Health and Safety Issues.

- Vehicle Movement – a large number of trucks will be required to transport the hot asphalt from the plant to the work site, this may be a distance of up to 25 kilometers.

5.8.6.2 Mitigation

358. Construction Camps – In the first instance, no construction camp will be permitted within 500 meters of any sensitive receptor or within 2 kilometers of a protected area and at least 200 m from any surface water course. In addition, if possible construction camps should be located on the eastern side of the Project road. This will help reduce noise, water and air quality impacts and impacts to the protected areas.

359. The Engineer will approve the locations of the Contractors camps prior to the establishment of the camp. In addition, the Contractor will be responsible for the preparation of a Construction Camp Site Plan which will form part of the SSESMP. The Plan will indicate the system proposed and the locations of related facilities in the site, including latrines, holding areas, etc. The Contractor will ensure the following conditions are met within the Plan:

- Rain-water run-off arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that will cause neither pollution nor nuisance. The drainage system will be fitted with oil and grease interceptors.
- There will be no direct discharge of sanitary or wash water to surface water.
- In the absence of functioning sewerage and sewage treatment facilities it is recommended that the Contractor provides his own on-site wastewater treatment facilities. For sites servicing a small number of employees (less than 150), septic tanks may be used. For larger sites, liquid wastes will as a minimum receive primary treatment in anaerobic tank or pond preceded by a bar screen to remove large solid objects (e.g. sticks, rags). Primary treatment (also referred to as clarification, sedimentation or settling) is the process where wastewater is allowed to settle for a period (around 2 hours) in a settling tank. This leads to separation of a liquid effluent which includes oils and grease and a liquid-solid sludge. Primary treatment leads to reduction in suspended solids, biological oxygen demand and removal of floating material (e.g. faeces). There will be no direct discharge of untreated sanitary or oily wastewater to surface water bodies.
- Licensed contractors will be required to collect and disposal of liquid waste from the septic tanks on regular basis.
- Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited.
- Liquid material storage containment areas will not drain directly to surface water.
- Waste water from vehicle washing bays will be free of pollutants if the wash bay has been constructed correctly. **Appendix S** provides a schematic of a vehicle washing bay that should be considered by the Contractor.
- Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained at the storage area.

- Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters and are connected to septic tanks, or waste water treatment facilities.
- Discharge of sediment-laden construction water directly into surface watercourses will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge.
- Washing out concrete trucks at construction sites will be prohibited unless specific concrete washout areas are provided for this purpose at the construction site (e.g. a bridge site). The washouts will be impermeable and emptied when 75% full.
- Spill cleanup equipment will be maintained on site (including at the site maintenance yard and vehicle fueling areas). The following conditions to avoid adverse impacts due to improper fuel and chemical storage:
    - Fueling operations will occur only within containment areas.
    - All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks.
    - Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids.
    - All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
    - The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses.
    - Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.
    - Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal to a site authorized to dispose of hazardous waste.

360. If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the sites. If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site. The Engineer will undertake regular monitoring of the construction camps to ensure compliance with the SSESMP and the Construction Camp Site Plan.

361. The Contractor will also be responsible to maintain and cleanup campsites and respect the rights of local landowners. If located outside the ROW, written agreements with local landowners for temporary use of the property will be required and sites must be restored to a level acceptable to the owner within a predetermined time period.

362. Concrete Batching Plants – The following measures will be followed to limit the potential for pollution from batching plants:

- To limit impacts from dust, the following conditions will apply:
  - Batching plants will be located downwind of urban areas and not within 500 meters of any sensitive receptor or within 2 kilometers of a protected area and at least 200 m from any surface water course.
  - The entire batching area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material.
  - Sand and aggregates will be delivered in a dampened state, using covered trucks. If the materials have dried out during transit they will be re-wetted before being dumped into the storage bunker.
  - Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one metre above the height of the maximum quantity of raw material kept on site, and extend two metres beyond the front of the stockpile.
  - The hopper or bunker will be fitted with water sprays, which keep the stored material damp at all times. Monitor the water content of the stockpile to ensure it is maintained in a damp condition.
  - Overhead storage bins will be totally enclosed. The swivel chute area and transfer point from the conveyor will also be enclosed.
  - Rubber curtain seals may be needed to protect the opening of the overhead bin from winds.
  - Conveyor belts which are exposed to the wind and used for raw material transfer will be effectively enclosed, to ensure dust is not blown off the conveyor during transit. Conveyor transfer points and hopper discharge areas will be fully enclosed.
  - Conveyor belts will be fitted with belt cleaners on the return side of the belt.
  - Weigh hoppers at front-end loader plants will be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind. The raw materials transferred by the front end loader should be damp, as they are taken from a dampened stockpile.
  - Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work will be dust-tight.
  - Silos will be equipped with a high-level sensor alarm and an automatic delivery shut-down switch to prevent overfilling.
  - Cement dust emissions from the silo during filling operations must be minimised. The minimum acceptable performance is obtained using a fabric filter dust collector.

  - Totally enclose the cement weigh hopper, to ensure that dust cannot escape to the atmosphere.
  - An inspection of all dust control components will be performed routinely – for example, at least weekly.

- All contaminated storm water and process wastewater will be collected and retained on site.
- All sources of wastewater will be paved and bunded. The specific areas that will be paved and bunded include; the agitator washout area, the truck washing area, the concrete batching area, and any other area that may generate storm water contaminated with cement dust or residues.
- Contaminated storm water and process wastewater will be captured and recycled by a system with the following specifications:
  - The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain.
  - Water captured by the bunds will be diverted to a collection pit and then pumped to a storage tank for recycling.
  - An outlet (overflow drain) in the bund, one metre upstream of the collection pit, will divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours).
  - Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments.
  - Wastewater will be pumped from the collection pit to a recycling tank. The pit will have a primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails.
  - Wastewater stored in the recycling tank needs to be reused at the earliest possible opportunity. This will restore the system's storage capacity, ready to deal with wastewater generated by the next rainfall event. Uses for recycling tank water include concrete batching, spraying over stockpiles for dust control and washing out agitators.

363. Asphalt Plants – the following measures will be applied by the Contractor:

- Emissions & Noise:
  - Asphalt plants will be located downwind of urban areas and not within 500 meters of any sensitive receptor or within 2 kilometers of a protected area and at least 200 m from any surface water course.
  - Adequate Personal Protective Equipment (PPE) will be provided to staff working in areas of high noise and emissions.
- Storage and Use of Hazardous Materials (including bitumen):

  - Ensure all hazardous materials are stored (including within suitable sized bunds for liquids), handled and disposed of according to their Material Safety Data Sheet (MSDS).
  - Copies of MSDS will be kept on site with all hazardous materials.
  - The Contractor will keep a log of the type and volume of all hazardous wastes on site.
  - The Contractor will keep a plan of site indicating where all hazardous materials are stored.

- Vehicle Movement:
  - The Contractor will include the asphalt plant in his Traffic Management Plan, including haul routes from the plant.

- Health and Safety:
  - All transportation, handling and storage of bitumen will be handled safely by experienced personnel.
  - The dust from the manufacturing process may pose respiratory hazards, hence protective air mask will be provided to the operators for the loading and unloading of aggregates
  - Ear-muffs will be provided those working on the plant
  - First Aid kit will be available on site for the workers in case of emergency
  - The MSDS for each chemical product will be made accessible onsite and displayed.

5.8.7 Borrow Pits

5.8.7.1 Potential Borrow Pit Impacts

364. Opening and operating of borrow pits can result in multiple environmental and social impacts, including degradation of productive soils, elevated levels of noise, degradation of air quality, etc. Borrow pits can also fill with water that can then become a hazard to the local community.

365. The DD Consultant has identified numerous potential borrow pits which can provide the necessary quantity of materials for the Project (see **Section 3**). However, several of these borrow pits were located within close proximity to, protected areas. The Contractor will make the final decisions on the borrow pits that he wishes to use, however, a borrow pit located within 2 km radius , or within a protected area is not considered good international best practice, and will be prohibited under this Project. In addition, Borrow pits BP01, BP02, BP03, BP04, BP05, BP07, BP08, BP10, BP11, RG01, RG02, RS01, RS02 and RS03 (for river sand and river gravels) should be avoided. .

5.8.7.2 Borrow Pit Mitigation Measures

366. In the first instance, no Project borrow pits will be utilized that are located within protected areas. Borrow pits will only be selected that are at least two kilometers from the Project road and should not include those borrow pits listed above.

367. If the Contractor intends to utilise materials from any of the other existing borrow pits listed in this ESIA a due diligence review will be carried out by the Engineer to confirm that these sites identified for use by the Contractor are indeed operating or operable in an appropriate manner. This will include review of the borrow pits operational license and a site visit to the borrow pit to ensure that no sensitive receptors are located within 500 meters of the borrow pit. A copy of the agreement between the operator and the Contractor will also be provided to the Engineer for review.

368. If the Contractor intends to open and operate his own borrow pits, the Contractor will prepare a Borrow Pit Action Plan (BAP) that will be submitted to the Engineer prior to the start of construction. The plan will identify the locations of all proposed borrow pits taking into account the recommendations of this report and will not be located within two kilometers of a protected area.

369. The locations of the borrow pits will be approved by both the Engineer, DoR and PONRE. The plan will ensure that:

- Pit restoration will follow the completion of works in full compliance all applicable standards and specifications.
- Arrangements for opening and using material borrow pits will contain enforceable provisions.
- The excavation and restoration of the borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the Engineer will be required before final acceptance and payment under the terms of contracts.
- Additional borrow pits will not be opened without the restoration of those areas no longer in use.

370. While operational, the Contractor will ensure that the following conditions are met at his borrow pits:

- Loss of top soil - Before the materials extraction the layer of top soil (about 20 cm) will be removed to the side of excavation area and kept until the area works will be finalized. Top soil stockpiles will be located at least 50 meters distance from any watercourses to avoid water siltation and obstruction. The height of stockpiles will not exceed three meters to avoid wind erosion and dust emissions.
- Fencing – if the Engineer deems the site to be hazardous to the local community (for example a pit could fill with water and people and animals could drown in it) he will request the Contractor to fence the site to prevent access and provide warning signs on the fencing.
- Soil compaction and disturbance to local flora and fauna species at access roads - The Contractor will take responsibility to provide an access road to the borrow site and all

drivers will be instructed to use only this officially designated road. This will help to avoid additional soil compaction and disturbance to the local fauna species.

- Reinstatement - Full site reinstatement will be undertaken by the Contractor to avoid landscape damage and habitat loss. Rehabilitation measures will include: removing of all types of equipment from the site; removing of all types of waste or/and polluted soil and materials if any exist; slops grade reduction with use of unsuitable stockpiles and uncrushed rocks and; slope stabilization measure such as re-covering with top soil, and further seeding, grassing and planting of appropriate bushes or/and trees if reasonable.
- Haul Routes - Due to the sensitivity of the borrow pit locations, the Borrow haul routes will follow established transport corridors/rights-of-way, to the extent that is practicable. The routes will be indicated in the Contractors TMP. Haul routes will not pass within protected areas.

5.8.8 Community Health and Safety

5.8.8.1 Potential Health and Safety Impacts

371. Potential impacts due to the proposed construction can be identified as follows:

372. Easier access to health care facilities - Positive health impacts may result due to quicker response time in emergency situations;

373. Air quality - The amount of particulate matter, or dust, generated by vehicle movement may increase slightly during construction works (mitigation for this issue is provided under **Section 5.6.3** – Air Quality), but will decrease the operational phase of the Project. This will have positive impacts to the health of the population living and working adjacent to the road.

374. Contamination of local water supplies during construction - Potential impacts to local water supplies include the possibility of temporary labor camps and the water supply and wastewater disposal associated with them during the construction period.

375. Noise levels with health consequences - Potential noise issues are discussed in **Section 5.8.12** – Noise below;

376. Public Safety During Construction - Construction activities may result in an increase in the total number of road traffic accidents between vehicles, pedestrians and vehicles and livestock and vehicles. Other accidents could occur if work sites are not appropriately signed and secured, for example borrow pits, excavation for culverts, etc.;

377. Public Safety During Operational Phase – Increases in the number of vehicles using the Project road and their speeds may result in an increase in the number of road accidents suring the operational phase of the Project. It is relatively easy for pedestrians to cross the road in its current two-lane form. However, when the first section of the road is increase to four lanes with a concrete median, crossing will only become possible at dedicated crossing points otherwise accidents will occur as people attempt to cross the four lanes and a median which will, over time, see an increase in traffic levels.

378. Vector Borne Disease – Given the location of the Project road it is likely that workers will be at risk of certain vector borne diseases, such as malaria.

379. Labour Influx - Labor influx for construction works can lead to a variety of adverse social and environmental risks and impacts, they include:

- Risk of social conflict: Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources.
- Increased risk of illicit behavior and crime: The influx of workers and service providers into communities may increase the rate of crimes and/or a perception of insecurity by the local community. Such illicit behavior or crimes can include theft, physical assaults, substance abuse, prostitution and human trafficking.
- Influx of additional population ("followers"): Especially in projects with large footprints and/or a longer timeframe, people can migrate to the project area in addition to the labor force, thereby exacerbating the problems of labor influx. These can be people who expect to get a job with the project, family members of workers, as well as traders, suppliers and other service providers (including sex workers). However, this issue cannot be mitigated by this ESIA.
- Increased burden on and competition for public service provision: The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services. However, workers will be housed in construction camps with independent services, so this issue will not be significant.
- Increased risk of communicable diseases and burden on local health services: The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance.
- Gender-based violence: Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of social control. This can lead to inappropriate and criminal behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the local community. A large influx of male labor may also lead to an increase in exploitative sexual relationships and human trafficking whereby women and girls are forced into sex work.
- Child labor and school dropout. Increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.
- Local inflation of prices: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and/or crowding out of community consumers. However, this issue cannot be mitigated by this ESIA.
- Increased pressure on accommodations and rents: Depending on project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of local

residents. Contractors staff will be located within camps and as such this issue is unlikely to occur during the construction phase.

Box 9: Health and Safety Issues Identified by Stakeholders

- Concerns about safety of the work sites for pedestrians, drivers, etc.
- Manage construction site to ensure safety and continued access for people's businesses and houses. If damage to property occurs, the Contractor must take responsibility and repair.
- If an accident occurs in unsigned areas, Contractor must be responsible.
- New road to include street lights and pedestrian path.
- Sections for safe crossing (sky bridge or zebra crossing) at schools, temples etc.
- Speed control.
- Safety signs to be placed at sections not completed to alert drivers of changed conditions.
- Construction safety: signs, warnings, construction material to be kept on sites, fenced etc.

5.8.8.2 Health and Safety Mitigation Measures

380. Safe Access - It will be the responsibility of the Contractor to provide safe access at all times through the construction site to people whose residences/shelters and routes are temporarily severed by road construction.

381. Water Supply – Potential impacts resulting from construction works to water supply are discussed above under **Section 5.6.4** – Hydrology.

382. Public Safety – The Contractor will be responsible for preparation of a TMP that will outline how he will manage issues relating to transport of materials and staff, road closures, diversions, safety signs, etc. The plan will be reviewed and approved by the Engineer. The Contractor will not be allowed to commence works until the plan has been approved. In addition, the Contractor will be responsible for fencing and sign posting any borrow pits that are identified by the Engineer as a potential hazard to public safety.

383. Public Safety During Operational Phase – On the physical side, the detailed design incorporates findings from a traffic safety audit, International Road Assessment Program (iRAP) inspections, and public feedback provided by residents during project preparation consultations. Physical features include enhanced measures to safeguard pedestrians' safety, including: pedestrian bridges; traffic calming options; street lighting in populated areas; road furniture; reflectors; improvements in driving vision facilities; motorcycle lanes; and sidewalks. Traffic safety aspects will be embedded in the service levels under the OPBRC. To complement the physical measures, the project will implement a program of public education and communication on road safety, targeting motorists and pedestrians throughout project implementation, as well as innovative solutions such as geospatial data

gathering, Safety signs should also be erected warning people not to attempt to cross the four-lane section. With these measures, the project will provide a model for traffic safety on national roads in the country.

384. Labour Influx Management Plan – Prior to the start of construction the Contractor will be responsible for the preparation of a Labour Influx Managament Plan as part of his SSESMP.

385. Worker Orientation Program - The Laboiur Influx Management Plan will include the a worker orientation program as part of worker induction to discuss religious, cultural or ethnic differences within the Project area and sexual behavior and Gender based violence. As part of the worker orientation program, Contractors staff shall sign a Code of Conduct relating to his personal behavior on site. Violations of the code of conduct may lead to dismissals.

386. Sexually Transmitted Diseases – It will be a requirement of the Contract that the Contractor sub-contracts with a Service Provider to provide an HIV Awareness Program to the Contractor's Personnel and the Local Community as soon as practicable after the Contractor's Personnel arrive at the Site but in any case, within two weeks after the Contractor's Personnel arrive at Site and to repeat the HIV Awareness Program at intervals not exceeding four months.

387. Child Labour – The Contractor will ensure that no persons under the age of 18 are employed on the Project.

388. Vector Bourne Disease - Workers will also be given awareness training relating to vector born disease and posters will be located around work sites warning workers of the potential health risks. The Contractor will also ensure that medicines for the treatment of vector borne diseases are provided at his camp medical facility. In addition, Water and drainage facilities at construction camps and work sites will be maintained to avoid breeding of mosquitoes. Effective measures will be used to ensure that water stagnant is not present around the camp site. Use of pesticides for vegetation control is prohibited.

389. Educational Facilities – During the construction phase specific attention will be given to the many schools that are located adjacent to the Project road. The Contractor will place warning signs outside of each school to alert construction vehicles of their locations and to be aware of children crossing the road in these areas. In addition, at least two weeks before construction starts within the vicinity of any of the schools listed in **Table 4-28**, the Contractor will be responsible for informing the School of the works program and schedule so that the school can inform pupils of the impending works and to be vigilant throughout the construction program. If warranted, the Engineer may recommend that the Contractor places protective barriers in-front of school entrances to prevent children rushing out from the school gates into the path of construction vehicles or works. When working in the immediate vicinity of a school, the Contractor will cease works for at least 30 minutes before school starts and after it closes to allow children to leave the area safely and to allow parents safe access to collect their children.

390. Operational Phase - To ensure public safety the DD consultants are preparing a road safety report with recommendations relating to road safety aspects during the operational phase of the Project.

5.8.9 Occupational Health and Safety (OHS) and Workers Rights

5.8.9.1 Potential OHS Impacts

391. Worker Health and Safety - Accidents are common during a project of this size and scale. Accidents can occur if workers are not adequately trained or qualified for the job or if they have incorrect safety equipment and clothing.

392. Sexually Transmitted Diseases – See **Section 5.8.8** above for impacts and mitigation relating to STDs.

5.8.9.2 Workers Rights

393. Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labor abuses and to ensure fair treatment, remuneration and working and living conditions. These issues need to be considered not only for workers who are directly employed by the Project but also sub-contractors.

5.8.9.3 OHS and Workers Rights Mitigation Measures

394. Worker Health and Safety – An OHS Plan will be prepared by the Contractor to manage worker safety. The Plan will include the following items:

- Safety Training Program. A Safety Training Program is required and will consist of:
  - Initial Safety Induction Course: All workmen will be required to attend a safety induction course before they are allowed access to the Site.
  - Periodic Safety Training Courses: Period safety course will be conducted not less than once every six months. All Contractor (and any sub-contractor) employees will be required to participate in relevant training courses appropriate to the nature, scale and duration of the subcontract works. Training courses for all workmen on the Site and at all levels of supervision and management. A list of training participants names and time-stamped photographic evidence of the training will be provided by the Contractor to the Engineer for his records.
  - Safety Meetings. Regular safety meetings will be conducted on a monthly basis. The Engineer will be notified of all safety meetings in advance. The Engineer may attend in person or by representative at his discretion. The minutes of all safety meetings will be taken and sent to the Engineer within seven (7) days of the meeting and will include a list of participants names and time-stamped photographic evidence of the training.
  - Safety Inspections. The Contractor will regularly inspect, test and maintain all safety equipment (including firefighting equipment), scaffolds, guardrails, working platforms, hoists, ladders and other means of access, lifting, lighting, signing and guarding equipment. Lights and signs will be kept clear of obstructions and legible to read. Equipment, which is damaged, dirty, incorrectly positioned or not in working order, will be repaired or replaced immediately by the Contractor.

  - PPE – Workers will be provided (before they commence works) with of appropriate PPE suitable for electrical work such as safety boots, helmets, gloves, protective clothes, goggles, and ear protection at no cost to the workers.

- All construction plant and equipment used on or around the Site will be fitted with appropriate safety devices. These will include but not be limited to:
  - Effective safety catches for crane hooks and other lifting devices, and
  - Functioning automatic warning devices and, where applicable, an up-to-date test certificate, for cranes and hoists.

395. In addition, all Project sub-contractors will be supplied with copies of the SSESMP. Provisions will be incorporated into all sub-contracts to ensure the compliance with the SSESMP at all tiers of the sub-contracting. All subcontractors will be required to appoint a safety representative who will be available on the Site throughout the operational period of the respective sub-contract unless the Engineers approval to the contrary is given in writing. In the event of the Engineers approval being given, the Engineer, without prejudice to their other duties and responsibilities, will ensure, as far as is practically possible, that employees of sub-contractors of all tiers are conversant with appropriate parts of the SSESMP. To implement the above items the Contractor will designate a qualified environmental, health and safety personnel.

396. Any gaps and descripiencies in guidelines for environment, health, safety, gender-base violence, child abuse labor influx management will be governed by the World Bank Guidelines for a Code of Conduct and Action Plan on Gender-Based Violence (GBV) and Violence Against Children. The guideline provide guidance and procedures to identify, address and mitigate the above decribed issues to be complied by contractors, sub-contractors and concerned agencies. The key provisions of the guideline will be incoporatred into package of bidding docments to be submitted by the bidders.

5.8.10 Educational facilities

397. Impacts to educational facilities relate predominantly to noise and health and safety issues. Both of these topics are discussed under separate sections (**5.8.8 – Community Health and Safety** and **5.8.12 – Noise**).

5.8.11 Physical Cultural Resources (PCR)

5.8.11.1 Potential Impacts to PCR

398. Land Acquisition - A number of cemeteries and temples have been identified within the Project area (see **Tables 5-3**). However, according to the MPWT none of these will need to have any portion of their properties removed, e.g. walls, gates, etc.

399. Noise - Most of the temples identified within the Project corridor will be subject to elevated noise levels above national and WBG standards during the operational phase of the Project. In addition, they may be subject to short term elevated noise levels during the construction phase of the Project. The issue of construction and operational noise and its impacts on sensitive receptors, such as temples is discussed below in **Section 5.8.12** – Noise.

400. Buddha Trees – A Buddha tree was noted close to the road at a temple in Songeuay-Neua in Naxaithong District. **Figure 5-7** illustrates it location and proximity to the Project road. However, the DD Consultants have move the road alignment slightly to the east to prevent the Buddha tree from being cut. Some trimming of the trees branches may however be required.

401. Chance Finds - Given Lao PDRs rich cultural heritage it is possible that chance finds could occur, although this is considered remote due to the fact that the works are confined to the already heavily disturbed right of way.

Box 10: Physical Cultural Resource Issues Identified by Stakeholders

- If the project will have an impact on cemeteries, it should be treated according to the tradition of ethnic groups.
- Buddha trees maybe affected. If the tree is very old it should be moved, not cut down.
- If graves are to be removed a spiritual ceremony is needed.

Figure 5-7: Buddha Tree, Songeuay-Neua, Naxaithong

5.8.11.2 PCR Mitigation

402. Buddha Trees – Only one Buddha tree has been identified that maybe directly impacted by the Project. Trimming of the trees braches maybe required. This activity will be coordinated between the Contractor and the temple. No cutting of the tree will be allowed without the permission of the Engineer.

403. Any other Buddha trees that are within 10 meters of a construction zone will be clearly marked and fenced prior to the start of construction works in the vicinity of the tree (within 50 meters). Under no circumstances will any Buddha tree be trimmed, or cut without consultation between the Temple, the Engineer and the Contractor.

404. Chance Finds – The Contractor will prepare a chance find procedure. The procedure will incorporate all of the requirements of the GoL regarding chance finds. A template for the chance finds procedure, adapted from the ESOM, is included as **Appendix B**.

5.8.12 Noise

5.8.12.1 Potential Noise Impacts

Construction Phase

405. Noise during the construction phase will mostly come from the operation of construction equipment. Typical noise signatures of the different equipment for different construction activities are enumerated below.

Table 5-3: Construction Equipment Noise Levels

Site Clearing		**Excavation and Earth Moving**		**Structure Construction**	
Equipment	**Noise Level**	**Equipment**	**Noise Level**	**Equipment**	**Noise Level**
Bulldozer	80	Bulldozer	80	Pneumatic drill	81-98
Front end loader	72-80	Backhoe	72-93	Crane	75-77
Dump Truck	83-94	Dump Truck	83-94	Welding Machine	71-82
Grading and compacting		Jack Hammer	80-93	Concrete Mixer	74-88
Grader	80-93	**Landscaping and Clean Up**		Concrete Pump	81-84
Roller	73-75	Bulldozer	80	Concrete Vibrator	76
Paving		Excavator	72	Air Compressor	74-87
Paver	86-88	Truck	83-94	Bulldozer	80
Truck	83-94	Paver	86-88	Cement and Dump trucks	83-94
Tamper	74-77				

406. If we assume three pieces of equipment maybe working at the same time, taking a random sample of equipment, bulldozer, front end loader and dump truck and combining their maximum noise levels a figure of around 94.3 decibels. Considering that many properties within the Project corridor are less than 20 meters from the edge of the existing pavement this would give a figure of around 67 decibels, which is considerably higher than WBG daytime and nighttime standards. This impact would be temporary in nature. Construction activities would be carried out during daytime.

Operational Phase

407. Baseline noise monitoring has shown that noise levels in the Project corridor are considered moderate noise level according to national Leq 24 hrs limit (55 -70 dBA). Daytime and nighttime noise is elevated well above national and WBG standards for residential areas and sensitive receptors (but not for commercial / industrial areas). Given the fact the traffic volumes are anticipated to more than double over the next twenty years traffic noise is anticipated to increase further. In general doubling of traffic will lead to a three dB increase in noise levels. [29] If we apply this assumption to the baseline noise levels monitored as part of this ESIA then noise levels would generally increase around by around 4.5 dBA by 2034. This would result in the following approximate Leq-24 hour levels:

- Sikeut Junction: 67.7 dBA
- Naxaithong Tai: 66.2 dBA
- Karngsan: 67.1 dBA
- Lak 52: 61.0 dBA
- Namlin Village: 65.5 dBA
- Nongsa: 65.4 dBA

408. Stakeholder consultations in Naxaithong and Phonhong (September, 2017) included specific questions about the issue of noise impacts. The majority of stakeholders (50% in Naxaithong and 90% in Phonhong) indicated that road noise was not currently a concern for them and they were not concerned about future noise levels.

409. It should be noted that the road can be quite bumpy in some locations and this results in elevated noise levels as trucks and busses jolt over these bumps. Improving the road surface will eliminate these sources of noise which may reduce noise levels by a few decibels in these locations.

5.8.12.2 Noise Mitigation

Construction Phase

410. Given the proximity of many properties to the construction site exposure to elevated noise levels will be unavoidable during the construction phase in the daytime. However, number of mitigation and management measures can be provided to reduce noise levels during daytime and nighttime periods:

[29] Traffic Noise. Vic Roads, 2013.

411. During the construction phase the Contractor will be responsible for ensuring the use of:

- Source Controls, i.e., requirements that all exhaust systems will be maintained in good working order; properly designed engine enclosures and intake silencers will be employed; and regular equipment maintenance will be undertaken; and
- Site Controls, i.e., requirements that stationary equipment will be placed as far from sensitive land uses as practical; selected to minimize objectionable noise impacts; and provided with shielding mechanisms where possible. No asphalt plants, rock crushing plants or any long term generators of significant noise will be allowed within 500 meters of sensitive receptors;
- Time and Activity Constraints, i.e., operations will be scheduled to coincide with periods when people would least likely be affected; work hours and work days will be limited to less noise-sensitive times. Hours-of-work will be approved by the Engineer having due regard for possible noise disturbance to the local residents or other activities. Construction activities will be strictly prohibited between 10 PM and 6 AM in the residential areas. When operating close to sensitive areas such as residential areas, medical facilities, educational facilities and religious temples. The Contractor's hours of working will be limited to 8 AM to 6 PM. During religious holidays the Contractor will not work within 250 meters of any temple;
- Community Awareness, i.e., public notification of construction operations, as outlined in Item 5.8.3.2 will incorporate noise considerations.

Operational Phase

412. Noise levels in commercial areas are unlikely to increase above WBG and national standards. However, it is difficult to define exactly what areas are commercial and what are residential within the Project corridor as many people both live and work in properties along the road.

413. Consultations with stakeholders indicate that road noise is not a significant issue for them. However, for residential and sensitive receptors a number of mitigation measures could be applied to reduce noise levels, they include:

- Reduction of speed from 120kmph to 70kmph - reduces noise levels by approximately 5 dBA.
- Reduction of speed from 70kmph to 50kmph - reduces noise levels by approximately 4 dBA.
- Noise barriers (3 meter high) - reduces noise levels by as much as 10 dBA 25 meters from the road.
- Plantation of shrubs with thick canopy in 1-2 m width (two rows) - reduces noise levels by about 5 dBA.
- Noise Reducing Road Surfaces - double course drain asphalt – reduces noise levels at 50 km/h by 3 dBA.

- Noise Reducing Surfaces – thin layer surfaces – reduces noise levels at 50 km/h by 1.5 dBA.
- Façade Insulation – can reduce noise levels inside by 10 dBA.

414. According to the Project FS, average road speeds are around 40 km/h which are still producing very high noise levels. As such there is no scope to reduce noise through speed limit restrictions.

415. Noise barriers are a potential option. During ESIA consultations more than 400 stakeholders were canvassed on their thoughts about the use of noise barriers. In Naxaithong less than 10% thought noise barriers were a good option to reduce noise levels. In Phonhong that figure dropped to 2%. One of the main impacts of noise barriers would be restriction of access to properties and to movement across the road. In addition, the barriers might be considered unsightly, or block views.

416. Noise reducing road surfaces will only have a small impact on noise levels. These types of surfaces also need to be considered carefully from a financial (they are more expensive than conventional pavements) and technical point of view (e.g. maintenance is more frequent).

417. Plantation of shrubs is considered a viable option if space is available, but it may impede access to properties and movement.

418. Façade insulation is a good option, but will be expensive and only applies to indoor areas. In addition, it only works when windows are shut, which would mean that properties would require air conditioning. However, even façade insulation would be unlikely to reduce noise levels to below WBG standards on their own.

419. Given the above, the following recommendations are made:

1. DoR undertakes a program of consultation with stakeholders within the Project corridor to determine:
    a. If noise is a significant issue? Does it affect sleep or work? Does it have any health impacts?
    b. Are stakeholders concerned about an increase in noise levels?
    c. Would stakeholders like noise to be reduced?
    d. If so, what measures would they consider?
2. If stakeholders do not think noise is a significant issue and they are not concerned about increases in noise levels no further actions should be considered during this stage of the Project. However, routine monitoring of noise levels along the road should be undertaken annually to assess how noise levels are changing year or year. The noise monitoring should also include surveys with stakeholders to continue assessing their thoughts on noise levels. If noise levels rise more than 3 dBA over the next ten years, and if stakeholders become more sensitive to the noise issue the DoR should investigate concrete methods to reduce noise levels through the mitigation measures outlined above.

3. If stakeholders feel that noise is a significant issue and that they are concerned about increases in noise levels the DoR should prepare a noise model to determine the exact nature and extent of any noise levels increase over the next 25 years. The model should be part of a report that recommends precise mitigation measures, or a combination of measures, to reduce noise levels. The model should clearly define what areas of the corridor are commercial and which are residential / sensitive locations so that mitigation measures can be applied accordingly. The DoR would then have to consult with the stakeholders to confirm that they are willing to accept the proposed mitigation measures and then implement the noise mitigation measures.

5.8.13 Emergency Response Planning

5.8.13.1 Emergency Issues

420. Emergency situations may arise during the construction phase, for example, fires and explosions at construction camps (through poor management and storage of fuels and chemicals), or impacts caused by earthquakes.

5.8.13.2 Emergency Measures

421. The Contractor will be responsible for preparation of an Emergency Response Plan (ERP) which will include sections relating to:

- Containment of hazardous materials;
- Oil and fuel spills;
- Fire and explosions;
- Work-site accidents; and
- Earthquake hazards.

422. The plan will detail the process for handling, and subsequently reporting, emergencies, and specify the organizational structure (including responsibilities of nominated personnel). The plan will be submitted to the Engineer for approval. Implementation of the plan will be monitored by the Engineer. Any emergencies, and how they were handled, will be reported in monthly progress reports by the Contractor to the Engineer. The Engineer will also provide periodic monitoring of the Contractors works throughout construction to ensure the ERP is implemented effectively.

5.9 Cumulative & Induced Impacts

423. A cumulative impact can be described as: "The combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/or beneficial impacts that cannot be expected in the case of a stand-alone project." Induced impacts can be described as: "Adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project, which may occur at later or at a different location.

424. No other existing, proposed and anticipated future road projects have been identified that may result in cumulative impacts to the Project area. In addition, construction and

operation of the road has not been identified as a key factor for the future development of projects that may have significant environmental and social impacts, e.g. construction of a new industrial park. The project is a rehabilitation project which intends only to upgrade the existing road.

425. However, the Project may lead to induced impacts, including, for example:

- Conversion of agricultural land to commercial, industrial and residential property, this in turn may lead to:
  - Increased population living within the corridor which may lead to stress on social services, such as schools, hospitals, etc.
  - Required upgrading or expansion of utilities, such as electricity supply.
  - Stresses on water availability, specifically groundwater.
- Expansion of development towards the Phou Phanang Protected area.

426. Although the ESMP contains provisions controlling direct impacts of land takings for both the road and ancillary functions (asphalt plants, construction camps, etc.), control of the induced impacts is largely beyond the scope of the Project.

5.10 Compliance Impacts

427. In addition to the impacts associated with the construction and operation phases of the Project several compliance impacts have also been identified as follows:

- Lack of Environmental Clauses in Contracts -The ESIA is an environmental statement by the DoR. While it is prepared by the ESIA consultant the ESIA defines the commitment by the GoL through the proponent and its contractors and consultants, to implement the mitigation and monitoring actions listed in the ESIA. For the measures proposed in the ESIA's ESMP to be taken seriously, they must become legally binding through inclusion as environmental clauses in the loan agreement between the GoL and the WB as well as the specifications in the contract-bid documents. This will be achieved by integrating the ESMP into the contract specifications as a clause and using the ESMP to prepare SSESMPs defining specific steps to be taken by the contractors and the government during the project construction phase. References to the ESMP will be made in the loan agreement between the GoL and WB. It will be the Engineers responsibility to review the environmental mitigation and monitoring activities undertaken by the Contractor, with payments made only after verification that each work component has been completed as prescribed.
- Lack of Construction Compliance Inspection Services and Environmental Training - While the ESMP and the environmental covenants can be very clear and specific, if there is no one knowledgeable to undertake compliance monitoring, inspection and regular reporting, little of the ESMP will be implemented or completed. The Engineer, through his Environmental Manager or International/Regional Environmental Specialist, will ensure that compliance inspections are undertaken on a regular basis. In addition, the Engineers International/Regional Environmental Specialist will also provide training to the Contractor and his HSE team in the correct implementation of the SSESMPs prior to the commencement of works.

6. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

6.1 General

428. The ESMP provided herewith documents the impacts identified in this ESIA report, the actions required to mitigate those impacts to acceptable levels in accordance with the laws of Lao PDR and the World Banks Operational Policies, and the monitoring activities that are to be undertaken as part of the project to confirm that the mitigation actions have been effective in achieving their objectives or to initiate changes in the actions required.

429. The ESMP also details the institutional arrangements and capacities that currently exist, or that will be put in place as part of the project implementation, to ensure that the environmental due diligence (including the ESMP) has comprehensively considered both Lao PDR and World Bank requirements for environmental protection, has identified all likely environmental impacts and proposed appropriate mitigation measures, and has the systems in place to ensure that effective procedures for environmental monitoring and control of the project impacts and mitigation measures are implemented throughout the life of the project. Finally, this section of the report provides the required implementation schedule and costs for the proposed mitigation and monitoring.

6.2 Mitigation and Monitoring

430. The environmental impacts associated with the Project activities, have been detailed above in the relevant sections of this ESIA. Mitigation measures required to address the impacts identified in the ESIA have been summarized in each of the relevant sections covering the physical, biological and socio-economic environment affected by the project. The impacts identified and the specific mitigation measures proposed to address them have been consolidated into the **Environmental and Social Mitigation Plan (ESMP)** presented in **Tables 6-1** to **6-3**, which includes time frames and responsibilities.

431. An Additional **Environmental Monitoring Plan** is presented in **Table 6-4** which outlines the activities and responsibilities associated with instrumental monitoring, i.e. Air Quality and Noise Monitoring.

6.3 Implementation Arrangements and Responsibilities

432. The main institutions that will be involved in implementation of the ESMP are the DD Consultants, the Implementation Support and Work Supervision Consultants (the Engineer), the Contractor and to a lesser extent the DoR / PTRI through their Project Implementation Unit (PIU).

6.3.1 Detailed Design Consultant Responsibilities

433. The DD Consultant has already started to coordinate with the ESIA Team on issues such as impacts from bridge rehabilitation / construction. Moving forward, the DD Consultant will ensure that he reads and understands all of the identified environmental

impacts highlighted by this ESIA. He will also ensure that all recommendations made for the design phase of the ESMP are considered and incorporated in the final detailed designs, or that justifications are made for the exclusion of any recommended mitigation measure.

Table 6-1: Environmental and Social Management Plan - Detailed Design / Pre-construction Phase

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Air Quality	Construction impacts	• Preparation of an Air Quality Plan (AQP) including the location of haul routes and the items specified under Item 5.6.3.3 of this ESIA.	• Contractor to prepare AQP • Engineer to review and approve AQP.	• N/A	• N/A
	Air quality impacts from stationary sources	• Locations for quarry sites, borrow pits and concrete batching plants will require approval from the Engineer and PONRES. • No quarry, borrow pit or batching plant will be located within 500 meters of any urban area or sensitive receptor.	• Contractor to select sites. • Engineer and PONRE to approve sites.	• N/A	• N/A
Land Use	Road Vendors	• The Contractor, in coordination with the DoR and the Provincial government, will set aside a specific area for road vendors to continue to operate throughout the construction phase. • The area will be located within at least 50 meters of the project road and should be sized to accommodate all road vendors. • The site will be clearly signposted for traffic and an all weather track	• Contractor, DoR and Provincial government to select site. • Contractor to implement mitigation.	• N/A	• N/A

		provided to the site with parking space. This should inline with measures proposed in the RAP.			
Climate Change	Damage to roads and drainage systems due to increased flooding and more intense rainfall.	As part of the detailed design, the following measures will be considered: • Increase ditch and culvert capacity; • Maintain positive cross slope to facilitate flow of water from surface; • Increase pavement resistance to rutting; • Reduce splashing/spray through porous surface mixtures; • More frequent use of elevated pavement section; • Improve visibility and pavement marking demarcation; and • Ensure that all embankments are	• DD Consultants • Engineer to review design documents prior to the start of construction.	• N/A	• N/A

		seeded to help increase stability.			
Borrow Pits and Quarry's	Suitability of borrow pits	• No Project borrow pits will be utilized that are located within protected areas. • Use of the following borrow locations listed in **Table 3-6** should be avoided: o BP01, BP02, BP03, BP04, BP05, BP07, BP08, BP10 and BP11, RG01, RG02, RS01, RS02 and RS03. • The Contractor will not use borrow pits located within 2km of protected areas.	• Contractor to select sites. • Engineer and PONRE to approve sites.	• N/A	• N/A
	New Quarry Sites	• Any new quarries must obtain the required permits prior to commencement of works at these sites, this will include approval from PONRE and the Engineer. • No quarry will be located within 500 meters of any urban area, sensitive receptor or within 2 kilometers of a protected area.	• Contractor to select quarry sites and apply for approval from PONRE and any other regulatory agencies as necessary. • Engineer to review quarry locations, licenses and approvals from PONRES.	• N/A	• N/A

	Existing Borrow Pits	• For existing borrow pits a due diligence review will be carried out by the Engineer to determine their suitability. • The due diligence review will be undertaken before the Contractor signs any contract with the existing borrow pit owner.	• Engineer to undertake due diligence review. • Results of the due diligence review will be presented to PIUand Contractor clearly stating the reasons for any rejection of the site.	• N/A	• N/A
	New Borrow Pits	• Obtain all necessary permits from the regulatory authorities. • Prepare a Borrow Pit Action Plan (BAP) according to the requirements of Section 5.8.7.2 of the ESIA. • No borrow pit will be located within 2 kilometers of a protected area. • Arrangements for opening and using material borrow pits will contain enforceable provisions.	• Contractor to select borrow sites and apply for approval from PONRES and any other regulatory agencies as necessary. • Engineer to review borrow locations, licenses and approvals from PONRE.	• N/A	• N/A
Hydrology	Bridge Construction	• All new bridges will be designed for the life expectancy of 75 years. • A design discharge of 100 years return period is considered for bridges. • The bridge rehabilitation and strengthening works will be designed for the life expectancy of 50 years.	• DD Consultants • Engineer to review design documents prior to the start of construction.	• N/A	• N/A

		• Bridge designs should ensure that drainage from bridge decks over 50 meters does not discharge directly to the watercourses beneath the bridges. • The bridge design and layout must be aesthetically pleasing and in harmony with the existing environment. • Provide dry paths under the bridge on either side of the river to facilitate movements of people, livestock and wildlife.			
		• Consult with PONRES to establish the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period.	• Contractor to consult with PONREs regarding fish spawning periods.	• N/A	• N/A
	Culverts	• A design discharge of 50 years return period is considered for culverts	• DD Consultants • Engineer to review design documents prior to the start of construction.	• N/A	• N/A
	Siting of facilities	• No construction camp, permanent or temporary, will be located within 200 meters of any river, or irrigation channel (not including drainage channels) identified in **Table 3-4** of	• Contractor to select sites. • Engineer and PONRE to approve sites.	• N/A	• N/A

		this report			
	Water Use	• The Contractor will be responsible for obtaining all necessary permits for the abstraction of water for technical and potable uses prior to the start of construction, or abstraction.	• Contractor to obtain licenses / permits. • Engineer to review permits.	• N/A	• N/A
Flora & Fauna	Tree cutting	• Tree cutting will be undertaken according to the law of the GoL.	• Contractor to undertake tree cutting. • Relevant regulatory Authority to monitor tree cutting.	• N/A	• N/A
	Animal Crossing	• Awareness raising program to be initiated by PTRI/DOR/traffic safety division of DOT. • Provide warning signs and speed restrictions in locations where cattle frequently cross the road.	• DD Consultant to consult with villagers to determine appropriate crossing locations. • DD Consultant include safety signs in design documents.	• N/A	• N/A
	Land clearance	• The Contractor will prepare a Clearance, Re-vegetation and Restoration Management Plan for prior approval by the Engineer. The Clearance Plan will be followed strictly by the contractor. Areas to be cleared should be minimized as much as	• Contractor to prepare and implement Plan • Engineer to review and approve plan.	• N/A	• N/A

		possible. • All temporary construction facilities should be located on already heavily disturbed ground where secondary forest growth has not yet become well-established.			
	Impacts to Protected Areas	• No construction camp, or construction facility, such as a concrete batching plant, will be constructed within 2 km of a Protected Area.	• Contractor to implement mitigation. • Engineer to approve final locations.	• N/A	• N/A
Construction Camps	Selection of Construction Camp Site	• Preparation of a Construction Camp Site Plan. • Preparation of a Spills Response Plan. • Construction camps will not be located within 500 meters of an urban area and at least 200 meters from any surface water course and not within 2 kilometers of a protected area. • Coordinate all construction camp activities with neighboring land uses.	• Engineer to review & approve Plans. • Engineer and PIU to approve camp locations.	• N/A	• N/A
Transportation and Utilities	Damage to roads	• Prior to the commencement of works a road condition survey will be undertaken by the Engineer to record the condition of access roads to borrow pits, asphalt plants, camps, etc.	• Engineer to complete road condition survey.	• N/A	• N/A

Occupational Health and Safety	Worker Health and Safety	• Prepare an Occupational Health and Safety Plan (OHS Plan), including the items specified by Item 5.8.9.3 of this ESIA. • Ensure that sub-contractors are provided with copies of the SSESMP.	• Contractor to prepare OHS Plan. • Contractor to provide copies of the SSESMP to sub-contractors prior to their access to the site. • Engineer to review and approve OHS Plan.	• N/A	• N/A
	Traffic Safety	• Submit a Traffic Management Plan (TMP) to PIU and local traffic authorities prior to mobilization.	• Contractor to prepare TMP. • Engineer to approve TMP.	• N/A	• N/A
	UXO	• Prior to the start of any works the Contractor will consult with the relevant regulatory authorities to confirm that the construction area is clear of any UXO. If this cannot be confirmed the Contractor (through an approved sub-contractor) will be responsible for surveying the construction areas (including ancillary facilities, such as borrow pits and access roads) and confirming that the work sites are free of UXO. The Contractor will provide, in writing, the	• Contractor to consult with relevant regulatory authorities. • Sub-contractor to survey the site, if required. • Contractor to provide the results of the survey to the Engineer.	• N/A	• N/A

		findings of the survey to the Engineer. If any UXO is found on site the Contractor, through his approved sub-contractor, will be responsible for removing any UXO.			
Community Health and Safety	Health and Safety	• Traffic safety issues will be accounted for during the design phase of the Project. • Safety signs will be included in the design warning people not to attempt to cross the four-lane section of the road without using dedicated crossing areas. • Consider additional traffic safety measures close to schools, including reduced speed limits (maximum 50 kilometers per hour) and traffic calming measures such as speed bumps. • Construct pedestrian walkways in urban areas, specifically in the four lane section of the road. • Project sticker with contact information of site supervisor should put on all contractor's, sub-contractor's vehicles and equipment and all projects vehicles and equipment.	• DD Consultants to prepare designs incorporating traffic safety measures. • Engineer to review design documents prior to the start of construction.	• N/A	• N/A

	Migrant Workers	• Preparation of an Labor Influx Management Plan in line with WBG ESHS standards. • The Labour Influx Management Plan will include the a worker orientation program as part of worker induction to discuss religious, cultural or ethnic differences within the Project area and sexual behavior and Gender based violence. As part of the worker orientation program, Contractors staff shall sign a Code of Conduct relating to his personal behavior on site. Violations of the code of conduct may lead to dismissals.	• Contractor to prepare plan. • Engineer to review and approve plan	• N/A	• N/A
	Communications	• Four weeks prior to the Contractor starting works in any village or town he will be responsible for holding a works orientation meeting within the village / town and will invite members of the public and village officials.	• Contractor to hold meeting. • Engineer to be present at all meetings.	• N/A	• N/A
Emergency Response	Fires, explosions, traffic accident, earthquakes, etc.	• Preparation of an Emergency Response Plan (ERP). Including measures to handle traffic accidents.	• Contractor to prepare ERP • Engineer to review and approve ERP.	• N/A	• N/A

Waste Management	Management of waste materials	• Preparation of a waste management plan, including measures to re-use and recycle wastes. • Preparation of a construction camp management plan to manage liquid wastes. • Prior to the start of the works provide copies of the waste management contractors licenses to the Engineer for review. • Perform a due diligence review of the waste management conractors facilities to ensure that they are in compliance with Lao PDR regulatory requirements.	• Contractor to prepare Plans • Engineer to review and approve Plans. • Contractor to give copies of the waste management contractors licenses to the Engineer. • Engineer to undertake due diligence review.	• N/A	• N/A
PCR	Chance Finds	• The Contractor will prepare a chance find procedure in line with the requirements of the GOL and **Appendix B** of this report.	• Contractor to prepare Plans • Engineer to review and approve Plans.	• N/A	• N/A
ESMP Requirement	Preparation of SSESMPs	• Prepare SSESMPs including alignment sheets.	• Contractor to prepare SSESMPs including alignment sheets. • Engineer to review and approve SSEMPs	• N/A	• N/A
	Incorporation of Items into Bid Documents	• A specific environmental and social section will be included within the main Bid Documents indicating that the Contractor will be responsible for conforming with the requirements of	• RFF to ensure ESMP is included within Bid Documents.	• N/A	• N/A

		the ESMP.			

Table 6-2: Environmental and Social Management Plan - Construction Phase

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Air Quality	Open burning of waste materials	• No burning of debris or other materials will occur on the at any camp or construction site.	• Contractor to implement mitigation.	• Engineers NESS	• Daily site inspections, throughout construction period.
	Fuel Emissions	• No furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the Engineer.	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.	• Engineers NESS	• Daily site inspections, throughout construction period.
	Rock-crushing plant	• Rock crushing plant equipment will be fitted with water sprinklers that will run continuously while the plant is operational.	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.	• Engineers NESS	• Daily site inspections, throughout construction period.
	Exhaust emissions from the operation of	• No furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the	• Contractor to implement mitigation. • Engineer to	• Engineers NESS	• Daily site inspections, throughout construction

	construction machinery	Engineer. • Construction equipment will be maintained to a good standard and fitted with pollution control devices regularly monitored by the Contractor and Engineer.	routinely monitor Contractors activities.		period.
	Fugitive emissions.	• Conveyor belts (e.g. at batching plants and rock crushing plants) will be fitted with wind-boards, and conveyor transfer points and hopper discharge areas will be enclosed to minimize dust emission. • All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins. • Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25C, or in windy weather. Avoid overwatering as this may make the surrounding muddy.	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.	• Engineers NESS	• Daily site inspections, throughout construction period.
Borrow Pits and Quarry's	New Quarry Sites	• Any new quarries must obtain the required permits prior to commencement of works at these sites, this will include approval from PONRES and the Engineer. • No quarry will be located within 500 m of any urban area or sensitive receptor and not within two kilometers of a protected area.	• Contractor to select quarry sites and apply for approval from PONRES and any other regulatory agencies. • Engineer to review quarry locations, licenses and	• N/A	• N/A

			approvals from PONRES.		
	New Borrow Pits	• The Contractor will: – Prior to the start of excavation works, ensure that the borrow area, and its access roads are free of any UXO. – Before the materials extraction the layer of top-soil (about 20 cm) will be removed to the side of excavation area and kept until the area works will be finalized. – Top-soil stockpiles will be located at least 50 meters distance from any watercourses to avoid water siltation and obstruction. The height of stockpiles will not exceed three meters to avoid wind erosion and dust emissions. – Provide an access road to the borrow site. All drivers will be instructed to use only this officially designated road. • If the Engineer deems the site to be hazardous to the local community he will	• Contractor to select borrow sites and apply for approval from PONRES and any other regulatory agencies. • Engineer to review borrow locations, licenses and approvals from PONRES. • Engineer to determine if the site requires fencing.	• Engineers NES • Engineers NES and IES to ensure reinstatement of borrow pits are completed satisfactorily.	• Monthly inspections of borrow pits. • Final inspection of reinstatement activities.

		request the Contractor to fence the site to prevent access and provide warning signs on the fencing. • Due to the sensitivity of the borrow pit locations, borrow haul routes will follow established transport corridors/rights-of-way, to the extent that is practicable. • Full site reinstatement will be undertaken by the Contractor to avoid landscape damage and habitat loss. Rehabilitation measures will include: – Removing of all types of equipment from the site; – Removing of all types of waste or/and polluted soil and materials if any exist; – Slope stabilization measure such as re-covering with top soil, and further seeding, grassing and planting of appropriate bushes or/and trees if reasonable. • The excavation and restoration of the borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the Engineer will be required before final acceptance and payment under the terms of contracts.			

		• Additional borrow pits will not be opened without the restoration of those areas no longer in use.			
Bridge Construction	Bridge Construction	• Consult with PONRES to establish the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period. • Divert the water flow near the bridge piers. • Provide coffer dams, silt fences, sediment barriers or other devices to prevent migration of silt during construction within streams. • Perform dewatering and cleaning of cofferdams to prevent siltation by pumping from cofferdams to a settling basin or a containment unit. • Carry out bridge construction works without interrupting the traffic on the Project Road with the provision of suitable diversions. • Ensure no waste materials are dumped in the river, including re-enforced concrete debris. • Place generators more than 20 meters from the river.	• Contractor to consult with PONRES regarding fish spawning periods. • Contractor to implement mitigation.	• Engineers NESS	• Daily site inspections, throughout construction period.

		• Ensure that no concrete waste is dumped in the river. • Carefully collect all polystyrene (from expansion joints) so that it does not litter the local environment. • Ensure that no hazardous liquids are placed within 10 meters of the river. • Provide portable toilets at bridge construction sites to prevent defecation by workers into the river. • Ensure that workers are provided with correct PPE including harnesses (at Nam Cheng). • During piling works ensure that pumped water is filtered through a silt trap before being discharged to the river.			
Flora and Fauna	Vegetation clearance	• No chemicals will be used to clear vegetation.	• Contractor to implement mitigation.	• Engineers NESS	• Daily site inspections, throughout construction period.
Soils Erosion and Soil Contaminati	Contamination of Soils	• All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and	• Contractor to implement mitigation. • Engineer to review and approve	• Engineers NESS	• Daily site inspections, throughout construction period.

on		bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tank (or one tank if more than one tank is located in the bund). • The construction camp maintenance yard will be constructed on impervious hardstanding with adequate drainage to collect spills, there will be no vehicle maintenance activities on open ground. • Filling and refueling will be strictly controlled and subject to formal procedures. Drip pans will be placed under all filling and fueling areas. Waste oils will be stored and disposed of by a licensed contractor. • All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. • The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any soils. • No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hardstanding. • Areas using bitumen will be constructed on	bunding prior to the start of construction. • Engineer to review and approve vehicle fueling area prior to the start of construction.		

		impervious hardstanding to prevent seepage of oils into the soils. • No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hard standing. • Areas using bitumen will be constructed on impervious hard standing to prevent seepage of oils into the soils.			
	Loss of topsoil	• Locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Rip ground surface prior to the spreading of topsoil. • Remove unwanted materials from topsoil such as roots of trees, rubble and waste etc. • Specifically regarding soil compaction, the Contractor will confine operation of heavy equipment within the RoW, as much as possible, to avoid soil compaction and damage to privately owned land. • If in case private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation.	• Contractor to implement mitigation.	• Engineers NESS	• Daily site inspections, throughout construction period.

	Soil Erosion	• Material that is less susceptible to erosion will be selected for placement around bridges and culverts. • Re-vegetation of exposed areas including; (i) selection of fast growing and grazing resistant species of local flora; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth. • The Engineer and the Contractor will both be responsible for ensuring that embankments are monitored continuously during construction for signs of erosion.	• Contractor to implement mitigation.	• Engineers NESS	• Daily site inspections, throughout construction period.
Hydrology	Drainage and Flooding	• During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to properties and land by flooding and silt washed down from the works. • Arrange with the village representatives those works which might interfere with the flow of irrigation waters to be carried out at such times as will cause the least disturbance to irrigation operations. • Should any operation being performed by the Contractor interrupt existing irrigation facilities, the Contractors will restore the irrigation appurtenances to their original	• Contractor to implement mitigation.	• Engineers NESS	• Monitor drainage channels on a weekly basis.

		working conditions within 24 hours of being notified of the interruption. • The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor. • The Engineer will be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris.			
	Ground and surface water pollution.	• Implementation of the specific mitigation measures outlined under **Construction Camps**, below. • Provide portable toilet facilities for workers at road work sites.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections, throughout construction period.
	Water Supply	• Only legally permitted water resources are used for technical water supply.	• Contractor to implement mitigation.	• Engineers NES	• Weekly inspections, throughout construction period.
Employment	Use of Local Labour	• The Contractor will employ local labor to benefit local communities and to promote the overall acceptance of the project. • A budget will be made available to pay for training of locals.	• Contractor to ensure local labor employment rates are maintained.	• Engineer to routinely monitor contracts to ensure levels are maintained.	• Monthly.
	Migrant	• The Contractor will be obliged to keep a	• Contractor	• Engineers NES	• Monthly review

	workers	record of all workers staying overnight in a village, including within construction camps in that village, this information will be relayed to village authorities on a weekly basis. The Contractor will be responsible for the behavior of all his staff.			of records.
Waste and Spoil	Recycling and re-use	• Where possible, surplus materials will be reused or recycled. • Used oil and grease will be removed from site and sold to an approved used oil recycling company.	• Contractor to implement mitigation.	• Engineers NES	• Monthly review of waste manifests to determine if wastes are being recycled.
	Spoil	• Under no circumstances will the Contractor dump excess materials on private lands. • Excess spoil will not be dumped or pushed into any river at any location.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections, throughout construction period.
	Inert Solid & Liquid waste	• Provide refuse containers at each worksite. • Maintain all construction sites in a cleaner, tidy and safe condition. • Waste storage containers will be covered, tip-proof, weatherproof and scavenger proof. • Train and instruct all personnel in waste management practices and procedures. • Collect and transport non-hazardous wastes to all approved disposal sites.	• Contractor to implement mitigation and conduct training. • Engineer to approve any waste disposal site.	• Engineers NES	• Daily site inspections, throughout construction period. • Regular review of Contractors training sessions.
	Asphalt and	• Waste asphalt will be recycled where possible for base material and shoulder	• Contractor to implement any	• Engineers NES	• Daily site inspections,

	Concrete	material. • Unused or rejected tar or bituminous products will be returned to the supplier's production plant. • Waste concrete will be crushed and re-used as fill material, or base material where possible. • Under no circumstances should concrete mixers be washed out onto open ground at construction sites, such as bridges.	recommendations for re-use of asphalt. • Contractor to implement mitigation.		throughout construction period.
	Hazardous Waste	• Storage of hazardous waste will be in specific secure locations as identified by the waste management plan. • Hazardous liquids must be stored within impermeable bunds. • Collect and temporarily store used hazardous waste separately in specialized containers and place in safe and fire-free areas with impermeable floors roofs, at a safe distance from fire sources and according to the requirements of their MSDS. • Training and suitable PPE will be provided to all personnel handling hazardous waste. • Disposal of waste materials will be properly undertaken in-line with national regulatory	• Contractor to implement mitigation. • Engineer to approve any waste disposal site. • Engineer to review waste manifests.	• Engineers NES	• Daily site inspections, throughout construction period. • Monthly review of waste manifests.

		requirements. • Keep records of the types and volumes of waste removed from the site on a weekly basis. • A method statement for the safe handling and disposal of asbestos waste.			
Construction Camps	Soil and water pollution	• Wastewater arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a way that will cause neither pollution nor nuisance. • There will be no direct discharge of sanitary or wash water to surface water, including the surface watercourses identified in **Table 3-5** of this report. Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited. • Liquid material storage containment areas will not drain directly to surface water (including rice paddies). • Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained (including spill kits) across the Contractors construction camp.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections, throughout construction period.

		• Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters. • Discharge of sediment-laden construction water directly into surface watercourses will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge. • Spill clean-up equipment will be maintained on site. • The following conditions to avoid adverse impacts due to improper fuel and chemical storage: – Fueling operations will occur only within containment areas. – All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks. – Filling and refueling will be strictly controlled and subject to formal			

		procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids. – All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. – The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses. – Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited. – Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal. Disposal of such was will be undertaken inline with national regulatory requirements. • The Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the Contractors camp sites (see **Appendix S** for proposed			

		designs). • The Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. • Maintenance of vehicles will only occur in a covered vehicle maintenance yard with spill containment measures, e.g. bunding or drainage fitted with interceptor tanks. • The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site.			
	Water Supply	• Ensure that potable water for construction camps and workers meets the necessary water quality standards. • If groundwater is to be used for drinking it will be tested before being used to ensure that the water quality meets the Lao PDR drinking water standards specified in **Section 2**.	• Contractor to implement mitigation. • Contractor to sub-contract water testing company and provide results to the Engineer	• Engineers NES	• Daily site inspections, throughout construction period. • Monthly review of water tests, if required.
Asphalt Plants	Pollution and Emissions from Asphalt Plant	• Emissions & Noise: – Asphalt plants will be located downwind of urban areas and not within 500m of any sensitive receptor. – Adequate PPE will be provided to	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections, throughout construction period. • Monthly review of hazardous

		staff working in areas of high noise and emissions. – Storage and Use of Hazardous Materials (including bitumen): – Ensure all hazardous materials are stored (including within suitable sized bunds for liquids), handled and disposed of according to their Material Safety Data Sheet (MSDS). – Copies of MSDS will be kept on site with all hazardous materials. – The Contractor will keep a log of the type and volume of all hazardous wastes on site. – The Contractor will keep a plan of site indicating where all hazardous materials are stored. • Vehicle Movement: – The Contractor will include the asphalt plant in his Traffic Management Plan, including haul routes from the plant. • Health and Safety: – All transportation, handling and storage of bitumen will be handled			waste log.

		safely by experienced personnel. – The dust from the manufacturing process may pose respiratory hazards, hence protective air mask will be provided to the operators for the loading and unloading of aggregates. – Ear-muffs will be provided those working on the plant. – First Aid kit will be available on site for the workers in case of emergency. – The Material and Data Sheet (MSDS) for each chemical product will be made accessible onsite and displayed.			
Concrete Batching Plants	Pollution and Emissions from Concrete Batching Plants	• To limit impacts from dust, the following conditions will apply: – Batching plants will be located downwind of urban areas. – The entire batching area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material. – Sand and aggregates will be delivered in a dampened state,	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections, throughout construction period.

		using covered trucks. If the materials have dried out during transit they will be re-wetted before being dumped into the storage bunker. – Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one metre above the height of the maximum quantity of raw material kept on site, and extend two metres beyond the front of the stockpile. – The hopper or bunker will be fitted with water sprays which keep the stored material damp at all times. Monitor the water content of the stockpile to ensure it is maintained in a damp condition. – Overhead storage bins will be totally enclosed. The swivel chute area and transfer point from the conveyor will also be enclosed. – Rubber curtain seals may be needed to protect the opening of the overhead bin from winds. – Conveyor belts which are exposed			

		to the wind and used for raw material transfer will be effectively enclosed, to ensure dust is not blown off the conveyor during transit. Conveyor transfer points and hopper discharge areas will be fully enclosed. – Conveyor belts will be fitted with belt cleaners on the return side of the belt. – Weigh hoppers at front end loader plants will be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind. The raw materials transferred by the front end loader should be damp, as they are taken from a dampened stockpile. – Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work will be dust-tight. – Cement dust emissions from the silo during filling operations must be minimised. The minimum acceptable performance is obtained using a fabric filter dust collector. – Totally enclose the cement weigh			

		hopper, to ensure that dust cannot escape to the atmosphere. – An inspection of all dust control components will be performed routinely – for example, at least weekly. • All contaminated storm water and process wastewater will be collected and retained on site. • All sources of wastewater will be paved and bunded. The specific areas that will be paved and bunded include; the agitator washout area, the truck washing area, the concrete batching area, and any other area that may generate storm water contaminated with cement dust or residues. • Contaminated storm water and process wastewater will be captured and recycled by a system with the following specifications: – The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain. – Water captured by the bunds will be diverted to a collection pit and then pumped to a storage tank for			

		recycling. – An outlet (overflow drain) in the bund, one metre upstream of the collection pit, will divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours). – Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments. – Wastewater will be pumped from the collection pit to a recycling tank. The pit will have a primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails. – Wastewater stored in the recycling tank needs to be reused at the earliest possible opportunity.			
Occupational Health and Safety	HIV / AIDS	• Subcontract with a Service Provider to provide an HIV Awareness Program to the Contractor's Personnel and the Local Community. • Repeat the HIV Awareness Program at	• Contractor to implement mitigation. • Service Provider to implement training. • Engineer to review	• Engineers NES	• Annual review of awareness program activities.

		intervals not exceeding four months	program.		
	Worker Health & safety	• Develop a Safety Training Program including training to recognize and respond to workplace chemical hazards. • Safety Meetings conducted on a monthly basis. • Regularly inspect, test and maintain all safety equipment. • Equipment, which is damaged, dirty, incorrectly positioned or not in working order, will be repaired or replaced immediately. • All construction plant and equipment used on or around the Site will be fitted with appropriate safety devices. • A fully equipped first aid base will be provided. • Coordinate with local public health officials and will reach a documented understanding with regard to the use of hospitals and other community facilities. • Workers will be provided (before they commence works) with of appropriate PPE suitable for electrical work such as safety	• Contractor to implement mitigation. • Engineer to review and approve training program.	• Engineers NES	• Daily site inspections, throughout construction period. • Periodic attendance of training sessions to determine quality and numbers in attendance.

		boots, helmets, gloves, protective clothes, goggles, and ear protection at no cost to the workers.			
	Sub-contractor H&S	• All sub-contractors will be supplied with copies of the SSESMP. • Provisions to be incorporated into all sub-contracts to ensure the compliance with the SSESMP. All sub-contractors will be required to appoint a safety representative who will be available on the Site.	• Contractor to provide SSESMP. • Sub-contractors to ensure compliance with SSESMP	• Engineers NES	• Routinely monitor sub-contractors activities.
	Vector borne disease	• Effective measures will be used to ensure that water stagnant is not present around the camp site. • Use of pesticides for vegetation control is prohibited. • Workers will be given awareness training relating to vector born disease and posters will be located around work sites warning workers of the potential health risks. • Medicines for the treatment of vector borne diseases will be provided at the camp medical facility.	• Contractor to implement mitigation. • Engineer to review and approve training program. • Engineer to approve any pesticide use.	• Engineers NES	• Daily site inspections, throughout construction period. • Periodic attendance of training sessions to determine quality and numbers in attendance. • Monthly inspections of Contractors medical facilities.

	Noise	• Zones with noise level above 80 dBA must be marked with safety signs and appropriate PPE must be worn by workers.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections and monitoring (with smartphone technology) throughout construction period.
Economic Activity	Accessibility	• The Contractor must prepare dedicated temporary pathways to all businesses that might otherwise be cut off from the road during the construction phase. The pathways must be wide enough to allow access to the business and must be kept free of mud and construction debris and should not be liable to flooding.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections throughout construction period.
Community Health and Safety	Road closures, diversions and blocking of access routes	• Provision of all road diversion signs and ensure that diversion roads do not impact negatively upon private lands. • Any diversions will be agreed upon by the Engineer. • All access routes will be kept open during Project works for at least 50% of the day during construction works and 100% of the time after construction works are completed for the day.	• Contractor to implement mitigation. • Engineer to review and approve diversions.	• Engineers NES	• Daily site inspections throughout construction period.
	Access	• Provide safe access at all times through the construction site to people whose	• Contractor to implement	• Engineers NES	• Daily site inspections

		residences/shelters and routes are temporarily severed by road construction.	mitigation.		throughout construction period.
	Traffic safety	• Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions. • Allow for adequate traffic flow around construction areas. • Provide adequate signalization, appropriate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control. • Access roads for borrow pits, batching plants, etc, should be maintained during the construction phase and rehabilitated at the end of construction.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections throughout construction period.
	Educational Facilities	• Place warning signs outside of each school to alert construction vehicles of their locations and to be aware of children crossing the road in these areas. • At least two weeks before construction starts within the vicinity of one of the schools listed in **Table 4-28**, the Contractor will be responsible for informing the School of the works program and schedule so that the school can inform pupils of the impending works and to be vigilant throughout the construction program. • If warranted, the Engineer may recommend	• Contractor to implement mitigation. • Contractor to provide letters to schools to Engineer to confirm that the schools have been informed of impending works.	• Engineers NES	• Daily site inspections throughout construction period.

		that the Contractor places protective barriers in-front of school entrances to prevent children rushing out from the school gates into the path of construction vehicles or works. • When working in the immediate vicinity of a school, the Contractor will cease works for at least 30 minutes before school starts and after it closes to allow children to leave the area safely and to allow parents safe access to collect their children.			
	Child Labour	• The Contractor will ensure that no persons under the age of 18 are employed on the Project.	• Contractor to implement mitigation	• Engineers NES	• Routine review of staff contracts to determine age of staff.
	Construction Noise and Vibration	• All exhaust systems will be maintained in good working order; properly designed engine enclosures and intake silencers will be employed; and regular equipment maintenance will be undertaken. • Stationary equipment will be placed as far from sensitive land uses as practical and provided with shielding mechanisms where possible. • Work near Sensitive Receptors will be limited to short term activities. • Construction activities will be strictly prohibited between 10 PM and 6 AM in the residential areas. • When operating close to sensitive areas	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections throughout construction period.

		such as residential, nursery, or medical facilities, the Contractor's hours of working will be limited to 8 AM to 6 PM. • Public notification of construction operations. • Disposal sites and haul routes will be coordinated with local officials.			
Social Sector	Accessibility	• The Contractor must prepare dedicated temporary pathways to all properties that might otherwise be cut off from the road during the construction phase. The pathways must be wide enough to allow access to the properties and must be kept free of mud and construction debris and should not be liable to flooding.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections throughout construction period.
Infrastructure	Electrical Systems and water pipes	• During construction all power lines (transmission and distribution) and water pipes in the Project Corridor will be kept operational, this will include temporary transmission lines while existing poles and lines are moved. • If any temporary disruption to water or power supplies caused by construction activities is absolutely necessary the Contractor must warn the affected population, and receive approval from the Engineer for the disruption at least 24 hours in advance and no disruption will last longer than 4 hours.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections throughout construction period.
Physical and	Impacts to	• In the event of any chance finds during the	• Contractor to	• Engineers NES	• Daily site

Cultural Resources	Historical and archeological areas	construction works procedures will apply that are governed by GoL legislation and guidelines and as outlined in the Contractors Chance Find Procedure.	implement mitigation.		inspections throughout construction period.
	Religious Holidays	• During religious holidays the Contractor will not work within 250 meters of any temple. • No work shall be undertaken during the 7 day Hmong New Year period at Lak 52.	• Contractor to implement mitigation.	• Engineers NES	• Daily site inspections throughout construction period.

Table 6-3: Environmental and Social Management Plan - Operational Phase

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities
Employment	Use of Local Labor	• As part of the maintenance of the road the Contractor should also look into the possibility of employing the local people for the maintenance of roadside drains upon completion of rehabilitation works.	• Contractor
Hydrology	Flooding	• If the rehabilitated road does result in increased run-off and flooding the issue will be rectified during the operational phase.	• Contractor during defects liability period. DoR after this period.
Noise	Elevated noise levels in residential areas	• Consultation with stakeholders. • Take appropriate mitigation measures as agreed with local communities.	• DoR/PTRI to undertake consultation with stakeholders. • DoR/PTRI to implement mitigation measures and necessary.

Table 6-4: Construction and Operational Phase Instrumental Monitoring

Issue	Mitigation	Locations	Schedule	Responsibilities	Reporting
Air Quality	The Engineer will establish routine ambient air quality monitoring throughout the construction period. In addition, if complaints are received from stakeholders regarding air quality additional monitoring maybe undertaken. The following parameters will be monitored: Particulate Matter (PM_{10} & $PM_{2.5}$), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO). Other parameters maybe warranted as determined by the Engineer.	Five construction locations determined by the Engineer.	Monitoring to be undertaken once every 6 months during construction period (24 months), or as required in the event of complaints.	The Engineer will hire certified laboratory to perform the monitoring activities.	The certified laboratory will provide the results to the Engineer within one week of the monitoring activity.
Noise	The Engineer will establish routine noise monitoring throughout the construction period. In	Five construction locations determined by the Engineer.	Monitoring to be undertaken once every 6 months both daytime and night-time measurements	The Engineer will hire certified laboratory to perform the monitoring activities.	The certified laboratory will provide the results to the Engineer within one week of the

	addition, if complaints are received from stakeholders regarding construction noise additional monitoring maybe undertaken. Parameters to be monitored include: Laeq 1h (dBA), Laeq 24 h (dBA)		during construction period (24 months)		monitoring activity.
	DoR to undertake noise monitoring (Laeq 24h (dBA).	five locations monitored in this ESIA.	Annually during Operation	The DoR wi5ll hire certified laboratory to perform the monitoring activities.	N/A
Water Quality	The Engineer will undertake water quality monitoring during the construction period. In addition, if complaints are received from stakeholders regarding water quality additional monitoring maybe undertaken. Parameters to be monitored include: pH; Suspended Solids; BOD5; COD; Coliforms; Nitrate (NO3); Phosphate (PO4); Oil and	50 meters upstream from all bridge sites during construction; 50 meters downstream of the bridge site;	Monitoring to be undertaken twice during bridge construction works	The Engineer will hire certified laboratory to perform the monitoring activities.	The certified laboratory will provide the results to the Engineer within seven days of the monitoring activity.

	Grease Other parameters maybe warranted as and when required.				

6.3.2 Implementation Support and Supervision Consultant (Engineer) Responsibilities

434. The Engineer is tasked with specific responsibility to ensure safeguard compliance of civil works – with particular emphasis on the monitoring of implementation of ESMP through the Contractors SSESMP and related aspects of the project.

435. To achieve this, the Engineer will include a part-time International Environmental and Social Specialist (IESS) (for 3 months during the first year of construction and 2 months per year for the second and the third year) and a full time National Environmental and Social Specialist (NESS) to monitor implementation of the ESMP during construction of all Project Components. In addition, an International Team Leader of the Implementation support and supervision consultant will take overall responsibility in ensuring that the Project is implemented consistent with the provisions of the environmental management plan (ESMP). The main responsibilities of the Engineer are as follows:

- NESS to monitor the Contractor's implementation of his SSESMP via weekly inspections of the Contractors camps and work sites;
- NESS to prepare Monthly Environmental Reports summarizing the Contractors compliance with the ESMP and SSESMP for that particular month;
- IESS to prepare Quarterly Environmental Reports providing details of the Contractors activities (such as training programs, community meetings, etc) and compliance with the ESMP and SSESMP; and
- Engage external service from a certified laboratory for environmental instrumental monitoring of air quality, noise and water quality;.

436. In the event that the Engineer identifies any ESMP / SSESMP non-compliance issues by the Contractor, a Non-Compliance Notice will be issued to the contractor if the Engineer requires action to be taken. The Contractor will be required to prepare a corrective action plan which is to be implemented by a date agreed with the Engineer. Non-compliance will be ranked according to the following criteria:

437. Non-Compliance Level l: A situation that is not consistent with requirements of the ESMP/SSESMP, but not believed to represent an immediate or severe social or environmental risk. Repeated Level I concerns may become Level II concerns if left unattended.

438. Non-Compliance Level II: A situation that has not yet resulted in clearly identified damage or irreversible impact, but which demonstrates potential significance. Level II requires expeditious corrective action and site-specific attention to prevent severe effects. Repeated Level II concerns may become Level III concerns if left unattended.

439. Non-Compliance Level III: A critical situation that will result in significant social or environmental damage occurring or a reasonable expectation of very severe impending damage. Intentional disregard of Non-Compliance Notices or specific prohibitions is also classified as a Level III concern.

440. The failure to prepare a corrective action plan or to implement it within the required timeframe will result in the Employer undertaking the work at the Contractor's expense (as will be specified in the Contract).

441. A terms of reference for the Engineers IES and NES is provided below.

National Environmental and Social Specialist (NESS)

442. Scope of Services: He/she will (i) review all documents and reports regarding the integration of environmental and social including contractor's environmental and social action plan, (ii) supervise the contractors' compliance to ESMP / SSESMP, and (iii) prepare monthly compliance reports.

443. Qualification: Degree in environmental sciences, occupational health and safety or equivalent. Preferably five (5) years' experience in conducting environmental and social impact assessments and implementation of environment and social mitigation plans and/or monitoring implementation of environmental and social mitigation measures during implementation of projects including highway projects funded by developing partners.

444. Time Period–The NESS will be a full time position over the duration of the construction period.

International/Regional Environmental and Social Specialist (IESS)

445. Scope of Services: During the supervision stage the IESS will prepare a detailed action plan including environmental and social monitoring checklists to be completed by the NESS to ensure that the Environmental and Social Management System is established, implemented, maintained and will monitor its performance. He/she will also take care of all environmental and social issues during construction works. He/she will also conduct environmental and social training and briefings to provide environmental awareness on World Bank and the government environmental safeguards policies, requirements and standard operating procedures in conformity with the government's regulations and international practice; ensure baseline monitoring and reporting of Contractor's compliance with contractual environmental and social mitigation measures during the supervision stage. The IESS will also help the with the development of the Contractors SSESMPs (at least three months prior to the start of construction).

446. Qualification: Degree or diploma in environmental sciences or equivalent. Preferably twelve (12) years' experience in conducting environmental and social impact assessments and implementation of environment mitigation plans and/or monitoring implementation of environmental mitigation measures and health and safety plans during implementation of projects including highway projects funded by developing partners, including 8 years' international experience. Working knowledge in Lao Language and experience in Southeast Asian countries is preferred.

447. Time Period: The IESS will be engaged on a part-time basis for a period of four months per year spread over the duration of the construction period.

6.3.3 Contractor Responsibilities

448. The Contractor will appoint a full time Environmental and Social Manager (ESM) to be a senior member of the construction management team based on site for the duration of the contract. The ESM will have a university degree (preferably at Masters level) in Environmental Science or related discipline and have at least 10 years work experience in environmental and Social management of infrastructure projects.

449. Key responsibilities of the Contractor (through the ESM) are as follows:

- Preparing the Site Specific Environmental and Social Management Plan (SSESMP) for approval by the Engineer prior to the Contractors taking possession of the construction site (see below).
- Ensuring the SSESMP is implemented effectively throughout the construction period.
- Coordinating community relations issues through acting as the Contractor's community relations focal point (proactive community consultation, complaints investigation and grievance resolution).
- Establishing and maintaining site records of:
  - Weekly site inspections using checklists based on the SSESMP;
  - Environmental accidents/incidents including resolution activities;
  - Non-compliance notifications issued by the Engineer;
  - Corrective action plans issued to the Engineer in response to non-compliance notices;
  - Community relations activities including maintaining complaints register;
- Preparing monitoring reports (Monthly);
- Routine reporting of SSESMP compliance and community liaison activities;
- Adhoc reporting to the Engineer of environmental incidents/spillages including actions taken to resolve issues; and
- Provide daily toolbox training at the construction camp and also at construction sites. The EO will keep a record of all monthly training and toolbox training undertaken.

450. The Contractors monthly reports, which will include the weekly environmental and Social checklists, will contain sections relating to:

1. General Progress of the Project.
2. Environmental Incidents; e.g. spills of liquids, blasting issues.
3. Progress of any environmental initiatives, e.g. protection of sensitive sites.
4. Records of any environmental monitoring, both observational and instrumental.
5. Records of community relations or stakeholder meetings conducted, complaints received and actions taken.
6. Conclusions and Recommendations.

6.3.4 Project Implementation Unit (PIU) Responsibilities

451. A PIU established within the DoR will be responsible for the day to day management of the Project components including implementation of the ESMPs. The PIU Project Manager is supported by MPWT's departments as per their official mandates including the Environmental and Social Division of the Public Works and Transport Research Institute (ESD-

PTRI) to lead all technical aspects of safeguards preparation, monitoring and reporting. The ESD-PTRI has Safeguards Specialists who are responsible for management of the environmental and social aspects associated with development of all donor funded road sector projects for which MPWT is the responsible Executing Agency. The PIU /PTRIresponsibilities in respect of implementation of the ESMP will be as follows:

- Overseeing full compliance with project safeguard instruments and will conduct monitoring of safeguard policy implementation.
- Ensure that all relevant ESMP requirements (including environmental designs and mitigation measures) are duly incorporated into the project bidding documents.
- Review necessary permits and/or clearance, as required, from MONRE / PONRE and other relevant government agencies, ensuring that all necessary regulatory clearances are obtained by the Contractor before commencing any civil work on the project.
- Liaising with the Department of Environment and Social Impact Assessment of the Ministry of Natural Resources and Environment (MONRE).
- Ensure that the Contractor has access to the ESMP and ESIA report.
- Ensure that the Contractor understands his responsibilities to mitigate environmental problems associated with their construction activities and facilitate training of their staff in implementation of the ESMP.
- Approve the SSESMP, with support from the engineer, before the Contractor takes possession of construction site.
- Undertake regular site visits to assess the Contractors compliance with the ESMP / SSESMP and make recommendations to the Contractor where non-compliance issues are identified.
- Keep proper safeguards documentations.
- Lead safeguard supervision and reporting at the project level. ESD/PTRI will prepare six month and annual safeguard progress report.
- Integrating the gender dimension into safeguards documents, and consultation processes;
- Track and report on grievances received, addressed, and overall work and implementation of the grievance redress mechanism (GRM).

6.3.5 Site Specific Environmental and Social Management Plan (SSESMP)

452. Following the award of the contract and prior to construction commencing the Contractor will review the ESMP and develop this into his detailed SSESMP. The SSESMP will identify persons who will be responsible for supervising the work within the Contractor's team. This information will be presented in a series of site plans covering the whole project site showing all environmental management requirements for all activities in the construction phase. The SSESMP will also include the following plans:

- Waste Management and Recycling Plan

- Construction Camp Plan
- Borrow Pit Plan
- Emergency Response Plan
- Air Quality Plan
- Health and Safety Plan
- Traffic Management Plan
- Spill Response Procedures

453. The SSESMP will also include a monitoring plan and a reporting program corresponding to the requirements of the ESMP. The SSESMP, and all of its plans without exception, will be submitted to the Engineer, PIU and World Bank for review and approval prior to the Contractor taking possession of any work site.

454. It is recommended that the Engineers' IESS supports the Contractor's ESM through on the job training in the preparation of the SSESMP.

6.3.6 Site Induction

455. Following approval of the SSESMP the Contractor will be required to attend a site induction meeting with the Engineers IESS whereby the SSESMP is confirmed with the Contractor to ensure that all compliance conditions are clearly understood. Following confirmation of the SSESMP with the Contractor the Engineers IESS advises the Engineers Team Leader that the Contractor is now cleared to take possession of the Site and may commence moving equipment to the Site. The Contractor will be responsible for ensuring that all sub-contractors abide by the conditions of the SSESMP.

6.3.7 Reporting

456. Contractors Reporting - The Contractor will prepare two levels of environmental reports:

1. Weekly Environmental Checklists – These will be prepared weekly by the Contractors ESM and will be submitted to the Engineer on a weekly basis. A sample Checklist is provided by **Appendix T**.
2. Monthly Summary Report - (Maximum 3 pages and appendices, if required) in respect of compliance with ESMP / SSESMP requirements that will be submitted to the PIU through the Engineer. The report will contain the following sections.
    a. Details of any environmental incidents
    b. Status of all non-conformance identified during audits and inspections that are identified by non-compliance notices.
    c. Complaints from the public and proactive community relations activities
    d. Monthly Accident Report
    e. Waste volumes, types and disposal

f. Details of any contaminated areas that have been identified and rehabilitated.

g. Details of any archaeological discoveries.

h. Details of any ecological issues.

i. Other relevant environmental issues.

457. The Contractor will have a duty to immediately report to the Engineer if any serious environmental breach has occurred during construction e.g. clearing of sensitive areas, serious oil spills etc.

458. Engineer Reporting – The Engineer will prepare two levels of environmental reports as follows:

459. Monthly Environmental Report – prepared by the NESS and submitted to the PIU. This monthly report will summarize the Contractors environmental performance based on the Contractors weekly checklists and the weekly site visits by the NESS.

460. Quarterly Environmental Report – prepare by the IESS and submitted to the PIU and World Bank, this report will be more detailed that the monthly monitoring reports and will include findings of the IESS site visits to the Contractors work sites and camps.

6.3.8 World Bank responsibilities

461. In regard to implementation of environmental and social safeguards requirements for the project include: undertaking periodic monitoring of the ESMP / SSESMP implementation and due diligence as part of an overall project review mission; and if required, provide advice to the PIU in carrying out its responsibilities to implement the ESMP for the project.

6.4 PIU Capacity Building Requirements

462. The **PIU/PTRI** has experienced Safeguard Specialists with experience of oversight of these types of road rehabilitation projects. However, PIU/PTRI capacity to implement and supervise implementation of mitigation measures amd monitoring program that meet international best practices could be further strengthened. The engineer's International Environmental and Social Specialist tasks will include strengthening the capacity of DoR/PTRI to implement and monitor environmental and social mitigation measures and monitoring as specified in the project ESIA/ESMP. Study tour to other countries for DOR/PTRI safeguards specialists is also supported by the on-going LRSP2 project currently undertaking by MPWT under the World Bank and NDF supports.

6.5 ESMP Costs

463. Most costs associated with the environmental recommendations of the ESMP are a normal part of preparing the bid and contract documents and ensuring that proper environmental provisions are incorporated therein. The installation of septic systems at construction camps, for example, is an environmental necessity, but not generally considered an "environmental cost". **Table 6-5** lists the proposed mitigation measures and indicates where they would be "included in the project budget" as part of a bid document and where

additional costs are a likely "environmental cost" beyond what would normally be included in a project budget.

Table 6-5: ESMP Mitigation Costs

Activity	Item	Number of Units / Unit cost	Cost estimate / US$	Responsibility
Pre-construction				
SSESMP	SSESMP and associated plans	Included in Project Budget	-	Contractor
Approval of Camp locations	Approval	Included in Project Budget	-	PIU / Engineer
Incorporation of Environmental Items into Bid Documents	Item in Bid Document	Included in Project Budget	-	PIU
Obtain permits	Permits	Included in Project Budget	-	Contractor
UXO	UXO Surveys	Included in Project Budget	-	Contractor
Construction				
Standard site management Additional environmental measures	Septic Tanks	Included in Project Construction costs	-	Contractor
	Spill Kits	20 / US$200	4,000	Contractor
	Bunds for fuel and oil storage	Included in Project Construction costs	-	Contractor
	Waste containers	Included in Project Construction costs	-	Contractor
	Waste Storage areas	Included in Project Construction costs	-	Contractor
	Waste collection and disposal	Included in Project Construction	-	Contractor

		costs		
	Storage areas for hazardous materials	Included in Project Construction costs	-	Contractor
	Sprinklers for rock crushing plant	Included in Project Construction costs	-	Contractor
	Drainage (including oil and grease interceptors)	Included in Project Construction costs	-	Contractor
	Vehicle washing bay	Included in Project Construction costs	-	Contractor
	Fire safety	Included in Project Construction costs	-	Contractor
	PPE	Included in Project Construction costs	-	Contractor
	Impervious hardstanding (for maintenance yards, bitumen storage, etc)	Included in Project Construction costs	-	Contractor
	First aid facilities	Included in Project Construction costs	-	Contractor
	Animal Crossings	Included in Project Construction costs	-	Contractor
	Fencing around borrow pits	8 / $,2000	$16,000	Contractor
	Protective barriers at school entrances	20 s / $1,000	$1,000	Contractor

	Water bowsers	Included in Project Construction costs	-	Contractor
	Water sprinklers (rock crushing plant)	Included in Project Construction costs	-	Contractor
	Dust control measures (rock crushing and batching plants)	Included in Project Construction costs	-	Contractor
	Tarpaulins	Included in Project Construction costs	-	Contractor
Tree / Vegetation maintenance	Labour and water	Included in Project Construction costs	-	Contractor
Embankment vegetation and soil erosion measures	Vegetation, labour and maintenance	Included in Project Budget	-	Contractor
Training & Awareness Programs	Safety Training	Included in Project Budget	-	Contractor
	HIV/AIDS Training	4 / US$1,000	4,000	Independent Contractor
	Toolbox Training	Included in Project Budget	-	Contractor
	Construction orientation meetings	Included in Project Budget	-	Contractor
	Periodic meetings with stakeholders	Included in Project Budget	-	Contractor
Clean-up of construction sites.	Labor, waste disposal	Included in Project Budget	-	Contractor
Environmental Staff	ESM	36 / US$ 2,000	72,000	Contractor
	IESS	7 / US$ 12,000	84,000	Engineer

	NES	36 / US$ 1,500	54,000	Engineer
Total Cost	**US$ 235,000**			

Table 6-6: ESMP Instrumental Monitoring Costs

Activity / Item	Frequency	Unit Cost / USD	Total Cost / USD	Responsibility	Source: WB	Source: GoL
1. Air Quality Monitoring	Once every six months at locations specified by the Engineer (maximum five sites)	1,550 per site	37,200	Engineer	X	
2. Noise Monitoring	Once every six months at locations specified by the Engineer (maximum five sites)	800 per site	16,000	Engineer	X	
3, Water Quality Monitoring	Twice during construction period at the bridge sites crossing rivers (seven sites).*	385 per site	5,390	Engineer	X	
Total			**58,590**			

Table 6-7 – Operational Monitoring Costs

Activity / Item	Frequency	Unit Cost / USD	Annual Cost / USD	Responsibility	Source: WB	Source: GoL
1. Noise	Annually at five	800 per site	4,000	DoR		X

Monitoring	locations					

6.6 ESMP Implementation summary

464. The following Table (**Table 6-8**) summarizes the various institutional responsibilities for the implementation of the environmental management plan at various stages of the Project.

Table 6-8: ESMP Implementation

Project Stage	Responsible Institution	Responsibilities
Detailed Design	PIU/PTRI with the Detailed Design Consultant and ESIA Team.	• Incorporate ESMP mitigation measures into engineering design.
	PIU/PTRI	• Ensure ESMP is incorporated into the works Contracts.
	PIU/PTRI	• Review Contractors proposals to ensure that they are aware of the ESMP requirements and that line items for environmental management as per the ESMP are included in the BOQ.
Pre-construction	Contractor	• Prepare SSESMP • Obtain all necessary environmental and social related permits for construction.
	Engineer, World Bank and PIU/PTRI	• Review and approve SSESMP
	Contractor and Engineer	• Site Induction
Construction	Contractor (through its ESM)	• Daily monitoring of environmental and social issues. • Preparation of weekly environmental and social checklists. • Preparation of Monthly environmental and social reports. • Preparing Corrective action plans.
	PIU/PTRI	• Routine site visits to monitor Contractors environmental and social performance.
	Engineer	• Weekly monitoring of the Contractors

		compliance with ESMP / SSESMP by the NESS. • Issuing the Contractor with Non-compliance Notices. • Monthly reporting to PIU/PTRI of Contractors performance based on the review of Contractors weekly checklists and weekly site visits. • Quarterly Environmental and Social Reports prepared by the IESS and submitted to PIU/PTRI and World Bank. • Implement instrumental monitoring per **Table 6-6**.
Operation	PIU/PTRI	• Instrumental monitoring of noise and implementation of appropriate mitigation measures.

7. STAKEHOLDER CONSULTATIONS, INFORMATION DISCLOSURE AND GREIVANCE REDRESS MECHANISM

7.1 Public Consultations

465. According to OP 4.01 "For all Category A and B projects proposed for IBRD or IDA financing, during the EA process, the borrower consults project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. The borrower initiates such consultations as early as possible".

466. Accordingly, this section of the report provides the results of the consultations undertaken during the preparation of this ESIA report.

7.2 Public Consultations Methodology

467. Consultations with stakeholders have been undertaken in two phases, during the Project scoping and during the draft ESIA phase. In addition, the social survey team undertook a number of FGD's during the initial phase of the study.

7.2.1 Scoping Consultations Methodology

468. Consultations were undertaken in Naxaithong and Phonhong during June 2017. The meetings were arranged by the DoR/PTRI and involved more than 150 stakeholders. The consultations were undertaken with a range of stakeholders, including local government officials and local residents. PowerPoint presentations were prepared for the meetings (including handouts of the presentations) outlining:

- The need for ESIA
- Regulatory Requirements
- Need for the Project
- Project Description
- Potential Impacts
- Potential Benefits
- Scope of Work for ESIA and Schedule

469. The presentations were given in Lao by the International Environmental Specialist, the National Environmental Specialist and the DoR. A copy of the scoping presentation is provided in **Appendix U**.

470. The stakeholders were then invited to express their opinions on the Project, and to identify any issues that they felt would be potentially significant during the construction and

operational phase of the Project. These key issues would then be studied in more detail at the ESIA phase of the Project.

7.2.2 Draft ESIA Consultations Methodology

471. Consultations were undertaken in Naxaithong and Phonhong during September 2017. The meetings were arranged by the DoR and involved more than 400 stakeholders. The consultations were undertaken with a range of stakeholders, including local government officials and local residents. PowerPoint presentations were prepared for the meetings (including handouts of the presentations) outlining:

- Project Description.
- Description of Alternatives.
- Identified Impacts (positive and negative).
- Proposed Mitigation Measures.
- Grievance Redress Mechanism.

472. The presentations were given in Lao by the International Environmental Specialist and the National Environmental Specialist. A copy of the presentation used in the meeting is provided in **Appendix W**.

473. The stakeholders were then invited to express their opinions on the impacts and proposed mitigation measures, and to identify any other mitigation measures that they felt would help improve the Project. These mitigation measures, if considered appropriate, would be included within this ESIA and its ESMP.

7.3 Public Consultations

7.3.1 Scoping Consultations

474. The following section provides a summary of the two scoping consultations undertaken in Naxaithong and Phonhong on 21st June 2017. The minutes of meeting can be found in **Appendix V** along with the list of attendees.

Naxaithong:

- The Vice Governor asked during the construction phase what project owner will do to solve problems relating to water supply system, power grid and fiber optical wire under the earth that might be affected?
- One participant from village in Naxaithong questioned about compensation for the project who will be responsible? He proposed the project to consider providing a pavement extending from a junction that an access road connects to the project's road about in order to reduce dust and mud from the access road to the project's road. He also added that the project should not make road shoulders and median too large because it is not effective and wastes space. He also requested that there should be a specific lane for bicycle and motorbike and traffic lights.
- Participant from Songpeuaytai village wanted to know why power grid line along the road some area are far from the road but some are close to the road?

- The Vice Governor also requested all village authorities to dissemtinate information to their affected villagers in order to have a better understanding and contribution to the project.

Phonhong:

- One participant from village in Phonhong asked how the project will solve a problem if it affects land use of temple, school, temple's fence\gate or school's gate?
- The delegation from Phon Ngeun village said there are two ethnic groups in the village, Khmu and Lao. Traditionally, we either cremate or burry death body. If the project will have an impact on our cemetery, it should be suitable treat according to the tradition of ethnic group.
- Representatives from Hongleuay village said a construction company that will carry out the work should pay an attention on environmental issues, complete the construction as planned, watering the road to control dust problem and provide a crosswalk.
- Delegation from Natural Resource and Environment Department, Vientiane province said "the compensation has to refer to Decree no. 84/PM; the impact assessment no.8029 and 8030, etc."
- Delegation from Mai village: said "the water supply of the village may be affected by the project, how to solve this issue?"

7.3.2 Focus Group Discussion Findings

475. Sixty eight FGDs were undertaken in forty four locations within the Project corridor. The main findings of the FGDs are discussed throughout **Section 5.8** and are presented in full in **Appendix E**.

7.3.3 Draft ESIA Consultations Findings

476. The following section provides a summary of the two draft ESIA consultations undertaken in Naxaithong and Phonhong on 27th September, 2017. The minutes of meeting can be found in **Appendix X** along with the list of attendees.

Naxaithong:

1. Deputy Village Head of Phangheng:
   How does the project calculate compensation cost for affected people if their structure will be partially affected e.g. 2 m into the structure but they have to demolish the whole structure because it is not safe.
   - Answer. Provided by resettlement team.
2. Ban Sikeut:
   - Question. The project should pave the local road to Ban Nalom.
   - Answer. Paving local roads is not currently part of the Project.
3. Ban Ilai Tai:
   - Comment. Totally agree with the proposed project but compensation should be carried out before the construction.
   - Response. Provided by resettlement team.

- Question. Noise impact due to poor road condition cause a significant health impact to local people that reside along the road.
- Answer. We agree, as the presentation noted noise levels are high, therefore we would like to understand what types of noise reduction levels you would like to see as part of the Project. (after this followed some discussion about types of noise mitigation measures, see **Section 5** for full details).

4. Naxaithong retired solder association:
   - Comment. Strongly support the project.
   - Comment. The construction should have good quality because previous construction the quality was very poor. This resulted in many accidents and casualties recorded in this area.
   - Response. The DD Consultant will incorporate a range of safety measures in the Project. The road will be constructed to international standards.
5. Village Font -Ilai Neua:
   - Comment. Agree with what proposed by the project.
   - Question. Regarding to previous survey for 25m ROW that had been measured, what will we do about the impacts areas if the new ROW now is 12m.
   - Answer. Provided by resettlement team.
6. Ban Chengsavang
   - Comment. The village used to have a bad experience from the China-Vientiane Railway project as contractor for the project did not rehabilitate/properly clear lands associated with construction wastes. In some case, they invaded the lands or demolished structures without seeking permission from the owners. Hence, the proposed project should avoid such mentioned issues.
   - Response. A supervision Engineer will monitor the Project works to ensure these issues do not occur. In addition, there will be a grievance redress mechanism to allow locals to make complaints about the Project to the Engineer, PIU and Contractor.
7. Owner of Gas station at Ban Douang
   - Comment. Designing median for the project should consider providing a crossing point for vehicles on both directions in order to minimize impact for his business.
   - Response. The DD Consultant is considering the locations for pedestrian crossings.
8. Ban Nanga
   - Comment. There are 3 dangerous curves along the road in the village boundary therefore the project should improve the curves to have a safety standard.
   - Response. The DD consultant is changing the alignment of one dangerous curve. All other sections of the road will be constructed to the design specifications to ensure safety.

Phonhong:

1. Representative of villagers:
   - Comment. All villagers agree with the proposed project because they have a chance to use the road soon and reduce time for traveling to the city.
   - Comment. What the people want to know most is detail of the compensation and they should be fairly compensated by the project.

- Response. Provided by resettlement team.

2. Villager:
   - Comment. Experiences from past projects in this area, dust was a big problem due to structures along a road and existing pavement had been removed to pave way for the construction. However, after the removal of such obstructions the construction had never started. This leaded to a severe dust pollution and health impact on local people in the areas from traffic that used the road.
   - Response. In construction zones where high dust levels are occurring the roads will be watered three times per day during the dry season.

478. Of the 508 people who attended the ESIA consultations 263 were male and 245 were female. 493 participants were classified their ethnicity as Lao, 7 as Hmong and 8 as Khmu.

479. Upon completion of both ESIA consultation meetings (and the previous days EGDP Consultations (with 46 people)) participants were asked to respond if they supported the Project, or not. 427, out of a total of 554 people supported the Project and 127 people did not reply. No negative responses were received.

480. Participants were also asked to provide any written responses to the presentation findings. **Table 7-1** summarizes the comments received.

Table 7-1: Summary of Comments Received in Writing from ESIA Consultations

Comment	Ethnic				Total
	Lao	Hmong	Khmu	Foreigner	
The construction must be started as soon as possible.	13	0	0	0	13
Street lights are needed.	4	0	0	0	4
Construction must be within the time frame to avoid more impacts on the livelihoods along the road.	7	0	0	0	7
Safety sign board must be put up during the construction.	2	0	0	0	2
Regulations must be developed to manage all impacts during the construction.	2	0	0	0	2
Want to know about the RoW.	1	0	0	0	1
If the 2 meter temporary affected land reserved for the construction work can be used after project completion.	2	0	0	0	2
Need 4 to 8 lane road.	8	0	0	0	8
Concern about the drainage capacity.	4	0	0	0	4
Dust during the construction.	13	0	1	0	14
Good standard road is needed.	10	0	0	0	10
Qualified contractor is needed.	2	0	0	0	2
Noise disturbance during and after the construction.	10	0	0	0	10

Concern about increased incidence of accidents with the improved road.	3	0	0	0	3
Soil, gravels and other construction materials must be removed from the affected land when the construction is completed.	1	0	0	0	1
Sharp curve sections must be fixed.	2	0	0	0	2
Pedestrian bridge must be built in critical sections vulnerable to accidents.	3	0	0	0	3
No Comment.	426	24	12	1	463
Agree with 2 length.	1	0	0	0	1
Less accident after construction.	1	0	0	0	1
Need the concrete road.	1	0	0	0	1
Total	**516**	**24**	**13**	**1**	**554**

7.4 Planned Information Disclosure

481. The draft ESIA will be disclosed on the MPWT website and the World Bank website in December 2017. Final ESIA reports will be disclosed once finalized.7.5 Grievance Mechanism

482. Due to differing perceptions, values, objectives and responsibilities among different stakeholders, a range of conflicts may occur among and between affected people, resettled villages, district authorities, central government and others. Avoidance is preferable to resolution, but that is not always possible. While the consultative and participatory nature of the ESIA and RAP are aimed at reducing disagreements and conflicting positions, in instances where disagreements do occur, it is important that they are resolved quickly before positions harden and the conflict escalates. The earlier that discord is recognized and dealt with, the higher the chance of a successful outcome. Grievances related to environmental and social issues from directly or indirectly affected ethnic groups as a result of implementation of the project will be resolved by the Grievance Redress Committee (GRC) through the project grievance redress mechanism.

483. Article 23 and 24 of the Compensation and Resettlement Decree (No. 84/GOL, 2016) requires the project to establish an effective mechanism for grievance resolution. The decree requires that the project proponent, MPWT & DoR, are responsible for setting up the grievance redress mechanism and to take actions to resolve issues.

484. Prior to project commencement, village leaders have participated in the survey of directly affected people's land, assets and livelihoods. Prior to the construction the village leaders together with the PIU will continue to conduct free, prior and informed consultation with affected groups, including businesses and project affected persons (PAP) and project affected households (PAH) to further discuss options in the case of land acquisition and land donation. The whole process will be well documented. All complaints and grievances will be received in writing, or if given verbally then written at the same time and place, from PAP and PAH and duly recorded by each level of the grievance committee (See forms A to F in

Appendix Z). PAP and PAH will be exempted from all administrative and legal fees incurred pursuant to the grievance redress procedures.

485. Grievance committees have been set up and approved in August and July 2017 by the Mayor of Vientiane Capital and Governor of Vientiane Province respectively. The committee members in each district composed of the following parties:

- Deputy Chief of the District.
- Deputy Director of DPWT of both Vientiane Capital and Vientiane Province.
- Head of District PWTI Office.
- Head of District Office for Natural Resources and Environment (PONRE).
- Head of District Agriculture and Forestry.
- Chairman of District Lao Front for National Development.
- Chairman of District Lao Women Union.

486. The role and responsibilities identified in these directions for the establishment of the grievance committees in each district include:

- Coordination with MPWT, village authorities and other concerned parties to create awareness of the project purpose and to mobilize for cooperation with the project.
- Monitor compensation of the affected lands, structures and crops.
- Coordinate with the project officers in monitoring of compensation payment of the affected land, structures and crops approved by the government.
- Resolve grievances, problems and settle compensations according to legal frameworks and security.
- Report periodically on the compensation implementation to the higher authorities and to seek guidance.

487. Since the provincial authorities in both Vientiane Capital and Vientiane Province have already established the grievance committees in their respective provinces it is recommended that village grievance committee should also be established in every affected village that will be composed of the following parties:

- Village chief.
- Village authority member, who is responsible for the economic/tax collection issues.
- Village Lao Women's Union.
- Village Front for National Development.
- Two Representatives from the PAPs (one man and one woman).
- Two representatives from the ethnic PAPs (in the villages were there are ethnic PAPs).

488. It is also recommended that an independent civil society organization with relevant experience in resettlement issues should be involved in helping filing grievances to the

project grievance committee. A hot-line and complaint boxes in each village should also be set up for the AP to raise their grievance.

489. While every effort will be made to resolve conflicts by mutual agreement of the parties involved, in some cases, arbitration and adjudication on disagreements and conflicts by an external mediator will be required and it is under the responsibility of PIU to find the suitable independent agency. If a PAP, PAH or group is not satisfied with, or has a complaint about, an aspect of the environmental impacts, resettlement or compensation package, or if for any reason the compensation does not materialize according to the procedures set out in the RAP and as agreed between the PAP and PIU, the PAPs have the right to make a claim.

490. The various phases or stages of conflict development and appropriate interventions are summarized in **Table 7-2**.

Table 7-2: Phases of Conflict and Possible Interventions Stage Intervention

Stage	Intervention
Conflict avoidance	Consultation & participation in planning, decision making
Simple disagreements	Informal negotiation, discussion and mediation
Early conflict development	Reference to village leaders and VRC
Conflicting positions taken	Reference to district/provincial level committees
Intractable conflict	Refer conflict to Provincial or National Court

491. To ensure that the basic rights and interests of PAPs are protected, that their concerns are adequately addressed, and that entitlements are delivered in full and in a timely manner, a grievance procedure has been designed for the Project and is outlined below. There are basic steps to resolve grievances, as described below.

492. **Step One** - the first step is for the PAP or a group of households to approach the VRC which is chaired by the village chief and present the grievance. Various village leaders and members of VRC can be involved in helping resolve grievances at the village level, as shown in **Table 7-3**. In most cases, issues can be resolved through discussions and mediation at this level. At village level resolving a grievance should take between 1 to 3 days.

493. If the complaint or grievance could not be resolved at village level, or if the claimant was not satisfied with the decision, the next step can be taken, either by the claimant or the VGC on his/her behalf to the district level.

Table 7-3: Village Level Resettlement Tasks and Responsibilities

Specific Task	Responsible person
Provide information and other required data to DMS Team	Village chiefs

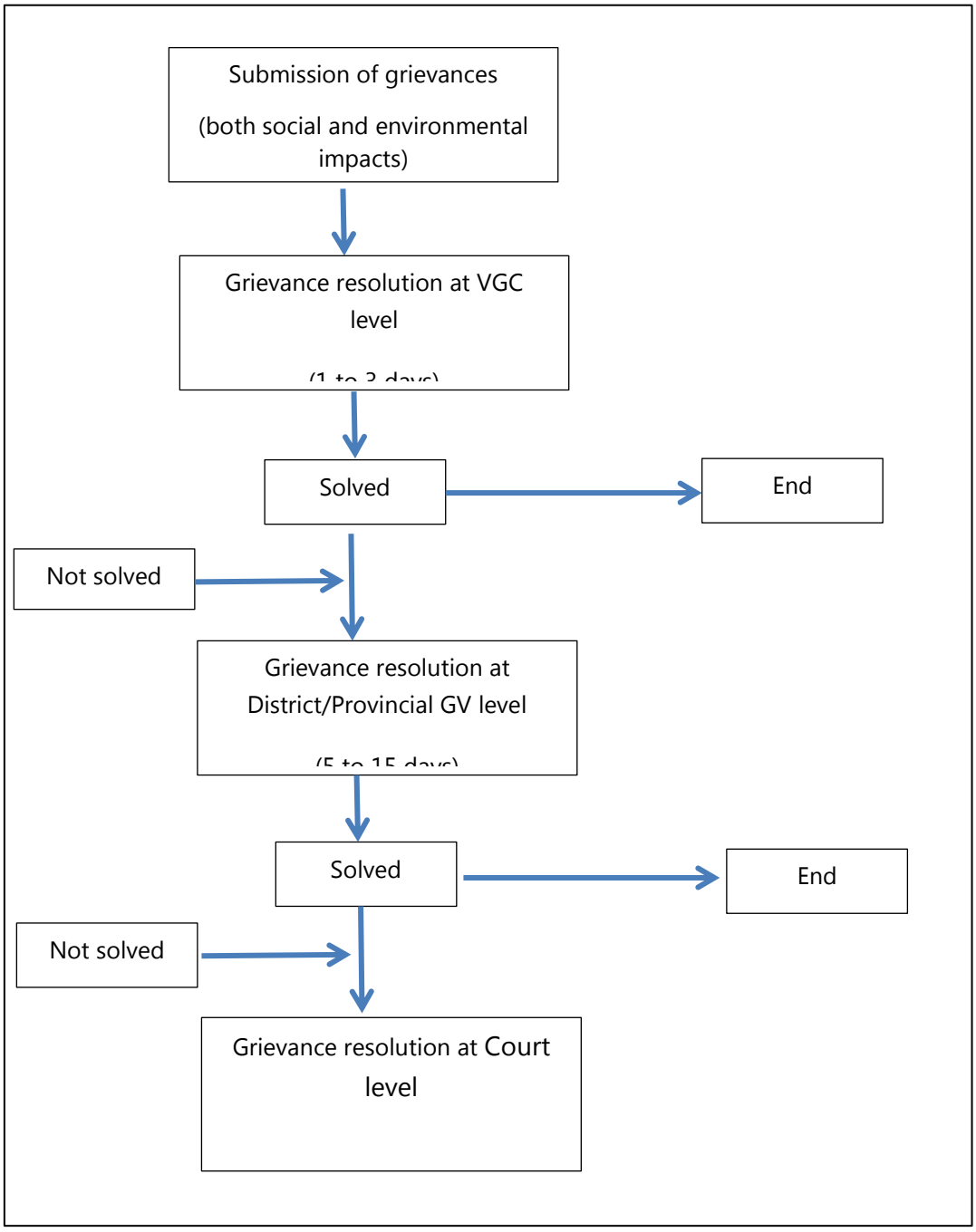
Certify PAP and PAH and submit the affected lists to DMS Team	
Assist the DMS Team in data collection from affected PAP and PAH	Deputy village chief (responsible for land tax collection) along with VGC members and the PAPs
Assist the DMS Team in identifying and entitlement of PAP and PAH	
Assist in grievance redresses and identification	
Represent PAPs and PAHs in grievance resolutions	
Mobilize assistance to PAPs and PAHs	
Participate in monitoring and evaluation	

494. **Step Two** - the next step is to present the grievance or complaint at the district level. This will be to the District/Provincial Grievance Committee (D/PGC) which is chaired by the Deputy Chief of the District. At this level the grievance should be addressed within 5 to 15 days. If the D/PGC cannot resolve the matter or the PAP is not satisfied with the proposal of the D/PGC, the PAP may take the case to the next level.

495. **Step Three** - the third step is access to the court system. In the first instance the case or grievance will be presented to District and Provincial Court. It will be in the interest of the MPWT/DoR/PIU, D/PRC, and affected parties to resolve issues before they are brought to the District and Provincial Court. If the grievance can still not be resolved, or the PAP is not yet satisfied with the findings, the second instance is for the claimant to present the case at National Court. Access to the courts is obviously a last resort. At the district level MPWT/DoR/PIU would be primary witnesses in order to both: (i) respond to the claimant's grievance in terms of prior activities undertaken, etc; and, (ii) ensure that the claim is reviewed within the context of the existing policy, regulations, procedures and entitlement limits, and that the compensation awarded does not go beyond established matter of practice. The findings of the committee will be obligatory. The D/PGC and PIU must maintain a log book showing all complaints and grievances received and the decisions made. These records will be monitored as part of both internal and external monitoring procedures. The PGC cannot award compensation in excess of what is established as a matter of practice, or not within budgets which they are operating. The D/PGC must respond to any complaint or claim between 15 and 30 days.

496. MPWT/DoR/PIU will be responsible for meeting the administrative and legal costs that will be incurred in the resolution of complaints and grievances. If the grievance relates to a dispute over the valuation of an asset to be acquired, then the MPWT/DoR/PIU will acquire of an additional independent assessor to inform the decision of the relevant grievance redress committee. The grievance redress committees will function, for the benefit of PAP and PAH, during the entire life of the project, including the defects liability period.

Figure 7-1: Grievance Resolution Flow Chart



8. CONCLUSIONS & RECOMMENDATIONS

8.1 Conclusions

497. This ESIA has established that there are no significant environmental issues that cannot be either totally prevented or adequately mitigated to levels acceptable Lao PDR and international standards for all Project activities.

498. The total estimate costs of the environmental mitigation and management to be funded by the WB has been calculated at approximately $249,590 or approximately 0.3% of the total project cost of $90m.

8.2 Recommendations

499. The ESMP, its mitigation and monitoring programs, contained herewith will be included within the Bidding documents for project works for all Project components. The Bid documents state that the Contractor will be responsible for the implementation of the requirements of the ESMP through his own SSESMP which will adopt all of the conditions of the ESMP and add site specific elements that are not currently known, such as the Contractors borrow pit locations. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

500. The ESMP and all its requirements will then be added to the Contractors Contract, thereby making implementation of the ESMP a legal requirement according to the Contract. He will then prepare his SSESMP which will be approved and monitored by the Engineer. Should the Engineer note any non-conformance with the SSESMP (and the ESMP) the Contractor can be held liable for breach of the contractual obligations of the ESMP. To ensure compliance with the SSESMP the Contractor should employ an Environmental and Social Manager to monitor and report Project activities throughout the Project Construction phase.