

# Initial Environmental Examination

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October 2017

## Lao PDR: Greater Mekong Subregion East-West Economic Corridor Towns Development Project

Prepared by the Provincial Department of Public Works and Transport, Savannakhet Province, Lao PDR for the Asian Development Bank. This is an updated version of the document originally posted in July 2012 available on <https://www.adb.org/sites/default/files/project-document/73477/43319-022-lao-iee-01.pdf>

## CURRENCY EQUIVALENTS

(as of 13 March 2017; <http://www.bol.gov.la/english/index1.php>)

Currency unit	–	kip (LAK)
LAK1.00	=	\$0.00012
\$1.00	=	LAK8,200

## ABBREVIATIONS

AH	–	Affected Household
AP	–	Affected People
CTDP	–	Corridor Towns Development Project
DBTZA	–	Dansavanh Border Trade Zone Authority
DED	–	Detailed Engineering Design
DoF	–	Department of Forestry
DPRA	–	Development Project Responsible Agency
DPWT	–	District Public Works and Transport Office
DNREO	–	District Natural Resource and Environment Office
EA	–	Environmental Assessment
EIA	–	Environmental Impact Assessment
ECA	–	Environmental Compliance Audit
ECC	–	Environmental Compliance Certificate
ECO	–	Environmental Control Officer
EMP	–	Environmental Management Plan
EMMU	–	Environment Management and Monitoring Unit
ESD	–	Environment and Social Division
ESIA	–	Environment and Social Impact Assessment
ESO	–	Environmental Site Officer
EA	–	Executing Agency
EWEC	–	East-West Economic Corridor
FDI	–	Foreign Direct Investment
FGD	–	Focus Group Discussion
FS	–	Forest Strategy
FYSEDP	–	Five Year Socio Economic Development Plan
GDP	–	Gross Domestic Product
GMS	–	Greater Mekong Subregion
GoL	–	Government of Lao PDR
IA	–	Implementing Agency
IEE	–	Initial Environmental Examination
IUCN	–	International Union for Conservation of Nature
IWRM	–	Integrated Water Resource Management
Lao PDR	–	Lao People's Democratic Republic
LFA	–	Land and Forest Allocation
LFNC	–	Lao Front for National Consolidation
LWU	–	Lao Women Union
MAF	–	Ministry of Agriculture and Forestry
MAF	–	Ministry of Agriculture and Forestry
MIC	–	Ministry of Information and Culture
MIH	–	Ministry of Industry and Handicraft
MoU	–	Memorandum of Understanding
MoF	–	Ministry of Financial

MONRE	–	Ministry of Natural Resources and Environment
MPCTC	–	Ministry of Post, Construction, Transport and Communication
MPWT	–	Ministry of Public Works and Transport
MPI	–	Ministry of Planning and Investment
MRF	–	Materials Recovery Facilities
MRC	–	Mekong River Commission
NAPA	–	National Adaptation Plan of Action
NBSAP	–	National Biodiversity Strategy and Action Plan
NGOs	–	Non-Governmental Organization
NLMA	–	National Land Management Authority
NPA	–	National Protected Area
NSEDP	–	National Socio Economic Development Plan
NTA	–	National Tourism Authority
NTFP	–	Non-Timber Forest Product
NUSS	–	National Urban Sector Strategic
O&M	–	Operation and Maintenance
PAFO	–	Provincial Agriculture and Forestry Office
PCR	–	Physical Cultural Resources
PES	–	Project Environment Specialist
PEI	–	Poverty Environment Initiative
PIC	–	Provincial Information and Cultural Office
PIU	–	Project Implementation Unit
PMU	–	Project Management Unit
PCU	–	Project Coordination Unit
PNREO	–	Provincial Natural Resource and Environment Office
PLMO	–	Provincial Land Management Office
PPI	–	Provincial Planning and Investment Office
PPH	–	Provincial Public Health Office
PPA	–	Provincial Protected Area
PPP	–	Public Private Partnership
PSA	–	Poverty and Social Assessment
PTO	–	Provincial Tourism Office
PWREO	–	Provincial Water Resources and Environment Office
RBC	–	River Basin Committee
REA	–	Rapid Environment Assessment
RoW	–	Right of Way
TSS	–	Total Suspended Solids
SEC	–	Socio-Economic and Culture
SSEZ	–	Support to Infrastructure for Special Economic Zone
UDAA	–	Urban Development and Administration Authority
UXO	–	Unexploded Ordnance
WREA	–	Water Resources and Environment Agency
WWTP	–	Wastewater Treatment Plant

## **WEIGHTS AND MEASURES**

km	–	kilometer
kg	–	kilogram
ha	–	hectare
Mm	–	millimeter

## **NOTE**

- (i) In this report, "\$" refers to US dollars.

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## **I. EXECUTIVE SUMMARY**

1. The towns of Kaysone Phomvihane, Phine, and Dansavanh are the three subproject locations for the Loan 2931-LAO, Grant 0313-LAO and Grant 0314-LAO: Greater Mekong Subregion East-West Economic Corridor Towns Development Project (the Project) in Lao People's Democratic Republic (Lao PDR). Through infrastructure developments in the three towns the goal of the Project is to develop the existing transportation corridor in Lao PDR into an economic corridor as part of the overall economic development of the Greater Mekong Sub-region.

2. This Initial Environmental Examination (IEE) updates the relevant parts of the IEE, dated July 2012 for the Project. The IEE update is prepared on the basis of the available detailed engineering design (DED) draft and final at the time of writing. This includes final DED for the four urban roads subprojects in Kaysone Phomvihane, Phine and Dansavanh as well as draft DEDs for the solid waste management and the drainage and flood mitigation subprojects in Kaysone Phomvihane<sup>1</sup>.

### **A. Project Summary**

3. The Initial Environmental Examination (IEE), 2012 considered the preliminary project design, the baseline environmental conditions, possible impacts and mitigation measures, and institutional arrangements to implement the same. Based on the findings of the IEE, the subproject was assigned Category "B" under ADB categorization. The IEE update confirms the original environmental categorization.

4. The Environmental Compliance Certificate (ECC), Certificate No. 4973/MONRE was issued July 2012 and delegated responsibility for environmental management and monitoring to DONRE at the Provincial level. DONRE extended the validity of the ECC in May 2017, subject to submission of a Lao translation of the IEE and submission of subproject-specific EMPs following completion of DED. EMP certificates for the four urban road subprojects were issued in October/November 2016.

5. The Project includes the following subprojects under the first loan.

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<sup>1</sup> The Mekong River Embankment subproject (Construction of reclamation and embankment protection with a top width for public, municipal, and tourism activities; Upgrading of the adjacent road; and Site development of a commercial area, public park and car parking) is not included in the update of the IEE. There are insufficient funds under the current loan for the Mekong River Embankment subproject, which will require additional financing to be processed. A feasibility study was conducted in 2016 with endorsement and proposals for additional financing expected during the course of 2017.

Town	Subproject
Kaysone Phomvihane,	1) Upgraded solid waste management and sanitary landfill <ul style="list-style-type: none"> <li>Establishment of a managed landfill on the existing dumpsite with modern landfill technology including leachate collection and treatment</li> <li>Procurement of additional equipment, collection trucks, and facilities</li> <li>Recycling Station (formerly a separate subproject known as Materials Recovery Facility) with modern efficient technology, incl. construction of facilities for storage, treatment, and recycling/reuse of suitable materials within the existing landfill site.</li> <li>Septage treatment facility for Kaysone Phomvihane (formerly part of the drainage and wastewater subproject).</li> </ul>
	2) Improved drainage and flood protection <ul style="list-style-type: none"> <li>700 meters of channel lining and improvement, linking the existing channel to the outfall;</li> <li>new flood gates to prevent the high water from the Mekong River from entering the drainage channel;</li> <li>a new pumping station to empty the channel during rainfall events, when the Mekong river levels are high and the flood gates closed;</li> <li>flood storage in a designated flood retention area within the existing flood plain to reduce the size and capacity of the pumping station.</li> </ul>
	3) Improved urban roads and drainage <ul style="list-style-type: none"> <li>Road widening, pavement strengthening, landscaping, lateral drainage, lighting, and signage</li> </ul>
Phine	4) Improved urban roads and drainage <ul style="list-style-type: none"> <li>Road widening, pavement strengthening, landscaping, lateral drainage, lighting, and signage</li> </ul>
Dansavanh	5) Improved urban roads and drainage <ul style="list-style-type: none"> <li>Road widening, pavement strengthening, landscaping, lateral drainage, lighting, and signage</li> </ul>

6. The solid waste management subproject will establish a modern solid waste management system for Kaysone Phomvihane with a design horizon of 2030. The subproject will establish a new cell with sanitary landfilling at the existing site and within the existing site perimeter. The landfill will receive solid waste from the municipality and improve collection rate, recycling, hazardous and medical waste management, and ensure adequate disposal. The bottom seal will be made by compacting the red-clay, giving the bottom a hard surface seal without any cracks or openings, and with the right slope for draining. The subproject will also include a Leachate Treatment facility and a Septic Sludge Treatment Plant that will receive septage collected from Kaysone Phomvihane and discharge to the Leachate Treatment Plant. A modern, materials recovery facility (MRF) will be constructed adjacent to the new sanitary landfill.

7. The current dumpsite will be assessed as part of an upcoming Environmental Compliance Audit (ECA) to determine ADB and government compliance of existing facility and possible rehabilitation or closure options. Where non-compliance is identified a corrective action plan to bring the facility into compliance will be developed before the new facility will move forward.

8. The upgrades to the urban roads and drainage in Kaysone Phomvihane, Phine and Dansavanh will occur adjacent to, and along sections of the national highway that passes through the towns. The road upgrades will consist of widened roads, strengthened pavements, installation of lights, upgraded lateral drainage, landscaping, and beautification.

## **B. Potential Impacts**

9. In general, the examination of the pre-construction, construction, and operational phases of the subprojects, which included input from community stakeholder meetings, indicates that the potential environmental impacts of the subprojects will be short-term civil construction-related which can be mitigated. The construction impacts of elevated dust, noise, traffic disruptions, erosion and sedimentation, liquid and solid waste, erosion, and public and worker safety can be mitigated and managed effectively with good construction management practices. With the updated subproject-specific EMPs, the subprojects can be implemented in an environmentally acceptable manner.

10. Potential long-term environmental impacts of the infrastructure developments concern the operation of the sanitary landfill. The sensitivity of groundwater, and downstream surface water to the operation of the new sanitary landfill as well as disposal procedures for planned treated leachate will be assessed as part of the ECA. The detailed design of the sanitary landfill depends in part on the results of the ECA.

11. Following the completion of the DED, the assessment of the presence of physical and cultural resources in the subproject areas have been updated in the EMPs and where relevant mitigation and monitoring measures proposed. Compensation for land and assets are provided for through the compensation measures of the subproject-specific Resettlement Plans.

12. UXO clearance surveys for Kaysone Phomvihane, Phine, and Dansavanh were undertaken in 2015 by Soupha Engineering Consultant (SEC). The survey of Kaysone Phomvihane concluded that there is no need for UXO clearances in this District. The surveys undertaken in 2015 did not identify UXOs in the subproject areas in Phine and Dansavanh. However, considering the greater risk associated with these subproject areas assessed on the basis of records of bombing activities and identification of UXOs, detailed UXO surveys are currently underway including the road alignments and borrow-pits. As specified in the EMPs appropriate GoL certification on UXO will be obtained prior to start of construction (certificate of UXO clearance or no UXO clearance needed).

13. The stakeholder meetings conducted in the subproject towns underscored the need for effective management of noise, dust, traffic disruptions, and traffic safety during the construction phase. The concerns of stakeholders included the increased truck and automobile traffic that is anticipated as a result of the operation of the completed subproject components.

14. Available data and information indicate an absence of critical wildlife habitat, rare or endangered species, ecological protected areas, and cultural property and values at the subproject sites.

15. Potential induced environmental impacts of the subprojects are increased natural resource consumption and environmental degradation, which could stem from the planned impact of the Project of socioeconomic development in the towns. The impacts are assessed to

be site specific, and can be mitigated through an environmental management plan and continued management and regulation by the EA and MoNRE.

### **C. Conclusions**

16. Considering the available detailed engineering design, the IEE update confirms the conclusion of the 2012 IEE that there are no significant negative environmental impacts and risks associated with the subprojects in Kaysone Phomvihane, Phine, and Dansavanh in Lao PDR that cannot be mitigated and that the subprojects with the updated subproject-specific EMPs can be implemented in an environmentally acceptable manner.

17. The 2012 IEE concluded that the description of the designs combined with available information on the affected environments was sufficient to understand the scope of potential environmental impacts of the subprojects and that further detailed environmental impact assessment (EIA) of the subprojects was not required. The IEE update confirms this conclusion.

18. The 2012 IEE assigned the project as Category “B” under ADB categorization. The IEE update confirms the original environmental categorization.

19. The information disclosure related to the project and subprojects is conducted in compliance with the ADB Public Communications Policy. The IEE update(s), the subproject specific EMPs, and the subproject specific RPs, as well as monitoring reports will be disclosed on the ADB website. Prior to onset of construction, two consultations are planned in each subproject area. One consultation that present the RP and one consultation that present the EMP and the construction program.

20. The main negative environmental impacts from the Urban Roads sub-project are temporary and short-term impacts during the construction phase associated with the road improvement and upgrade such as noise, dust, solid & liquid waste, construction traffic, and reduced community and commercial access. Construction during the wet season will be associated with additional potential impact associated with storm water runoff from the construction sites. To mitigate these impacts earthworks will not be permitted during the rainy season and should be undertaken in dry weather. Asphalt Concrete plants will be located at approved sites away from all human activity and settlements, and cultural, sensitive (e.g., schools, hospitals), and ecological receptors. The construction related impacts are of limited duration and extent and can be mitigated through standard methods and procedures of good housekeeping and good engineering practice.

21. Individual Environmental Management Plans (EMP) for the subprojects are found under separate cover. The EMPs provide detailed impacts mitigation and environmental monitoring plans. The EMPs are updated to meet the detailed designs of the subprojects.



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## **II. INTRODUCTION**

### **A. Project overview**

22. The Project is designed to facilitate the transformation of transport corridors into economic corridors that would attract further investments in economic and environmental infrastructures to spur economic growth and sustained development. The expected impact of the Project will result in the corridor towns becoming the nucleus of economic activities, thereby contributing to the emergence of economic growth centers along the transport corridors in the Greater Mekong Subregion (GMS). The outcomes of the Project will lead to provision of adequate urban and infrastructure and essential services to facilitate growth and increase urbanization.

23. The GMS countries envision that regional cooperation is essential to establish an economic link through improvements in infrastructure that would trigger increased trade and investments and spur economic growth. The cohesive efforts of the GMS countries and the committed support of the Asian Development Bank (ADB) and other financial institutions and donor agencies enhanced the establishment of regional markets, promoted cross-border movements of people, goods and services and more importantly developed a strong sense of collective action for a common economic purpose. Within a span of a decade, development investments were focused on putting in place priority transport infrastructure that forged the link between the GMS countries and stimulated the emergence of economic corridors along these key transport routes.

24. Together with the ADB, the participating national Governments recognized the need to build on the considerable benefits of increased trade and traffic flows along these transport routes. The favorable location of the corridor towns is viewed as a comparative advantage to further boost economic activity given the necessary enabling environment for strategic local economic development plan, investment programs and the strengthening of the institutional capacities at provincial and district levels. The next critical step in the GMS strategic focus demands the transformation of the transport corridors into full fledge economic corridors that would sustain the investment in essential infrastructure, and help contribute to poverty reduction in the GMS.

25. The primary objective of ADB's assistance to the GMS is the sustained increase in trade and transportation and the efficient movement of goods and services across common borders. In this regard, the transformation of transport corridors into economic growth nodes is considered essential in achieving levels of economic competitiveness of the GMS while advocating a strong sense of participation and involvement of a broad base stakeholder in the region. ADB's Regional Cooperation Strategy and Program (RSCP) is anchored on strategic thrusts towards strengthening connectivity and facilitating cross border movement, integrating national markets to promote economic efficiency and private sector development, institutional capacity strengthening as well as addressing critical social and environmental issues.

26. Lao People's Democratic Republic (Lao PDR) is a land-locked country bordering Thailand to the west, Viet Nam to the east, Peoples' Republic of China (PRC) to the north, Myanmar to the Northwest, and Cambodia to the south. In Lao PDR, the three corridor towns of Kaysone Phomvihane, Phine and Dansavanh are located in the province of Savannakhet (Figure 1). This IEE covers the proposed subprojects within the three corridor towns of Kaysone Phomvihane, Phine and Dansavanh (Table 1).

Table 1. Summary of components of subprojects

Subproject Town	Subproject
Kaysone Phomvihane	<p>Upgraded solid waste management and sanitary landfill</p> <ul style="list-style-type: none"> <li>Establishment of a managed landfill on the existing dumpsite with modern landfill technology including leachate collection and treatment</li> <li>Procurement of additional equipment, collection trucks, and facilities</li> <li>Materials Recovery Facility (formerly a separate project) with modern efficient technology, incl. construction of facilities for storage, treatment, and recycling/reuse of suitable materials within the existing landfill site.</li> <li>Septage treatment facility for Kaysone Phomvihane (formerly part of the drainage and wastewater subproject).</li> </ul>
	<p>Improved drainage and flood protection</p> <ul style="list-style-type: none"> <li>700 meters of channel lining and improvement, linking the existing channel to the outfall;</li> <li>new flood gates to prevent the high water from the Mekong River from entering the drainage channel;</li> <li>a new pumping station to empty the channel during rainfall events, when the Mekong river levels are high and the flood gates closed;</li> <li>flood storage in a designated flood retention area within the existing flood plain to reduce the size and capacity of the pumping station.</li> </ul>
	<p>Improved urban roads and drainage</p> <ul style="list-style-type: none"> <li>Road widening, pavement strengthening, lateral drainage, lighting, landscaping, and signage</li> </ul>
Phine	<p>Improved urban roads and drainage</p> <ul style="list-style-type: none"> <li>Road widening, pavement strengthening, landscaping, lateral drainage, lighting, and signage</li> </ul>
Dansavanh	<p>Improved urban roads and drainage</p> <ul style="list-style-type: none"> <li>Road widening, pavement strengthening, lateral drainage, lighting, landscaping, and signage</li> </ul>

## **B. Assessment Context**

27. The Project was assigned Environmental Category B which requires an initial environmental examination (IEE) pursuant to the ADB's safeguard policy<sup>2</sup>, and environmental assessment guidelines<sup>3</sup>. A category B project will have potential adverse impacts that are less adverse than those of category A project, are site-specific, largely reversible, and can be mitigated with an environmental management plan. The Government of Lao People's Democratic Republic (GoL) requires that an IEE be conducted for the subprojects.

28. The Environmental Compliance Certificate (ECC), Certificate No. 4973/MONRE was issued July 2012 and delegated responsibility for environmental management and monitoring to DONRE at the Provincial level. DONRE extended the validity of the ECC in May 2017, subject to submission of a Lao translation of the IEE and submission of subproject-specific EMPs following completion of DED. EMP certificates for the four urban road subprojects were issued in October/November 2016.

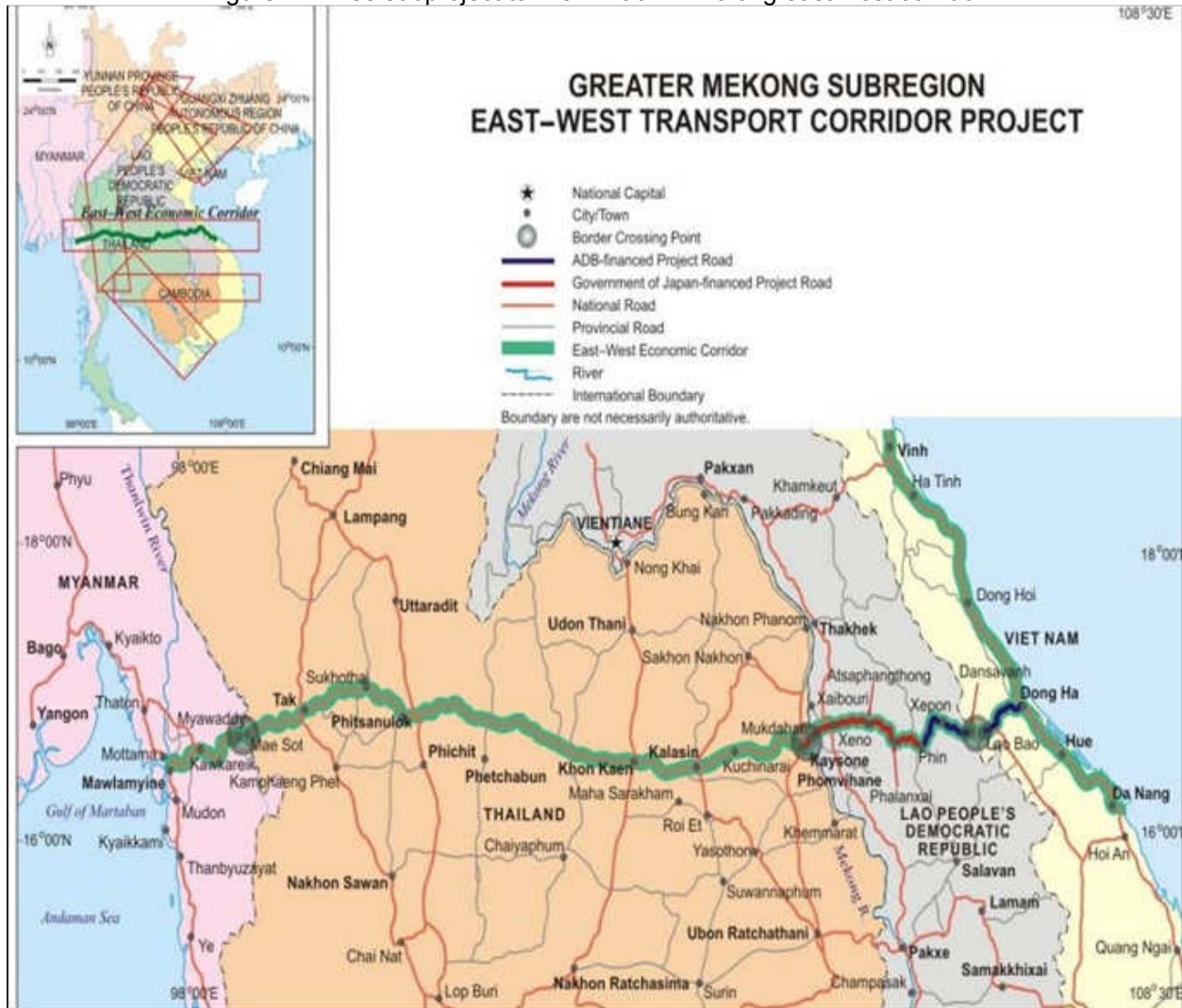
29. The detailed designs for the four urban roads subprojects have been finalized in 2016. According to the schedule detailed designs will be finalized for the remaining subprojects in 2017. The IEE and environmental management plans (EMPs) are prepared based on the available information on the construction and operational phase activities of the subprojects. Furthermore, available data and information on sensitive ecological and cultural receptors that exist at the different town sites has been carefully collected and analyzed to be included in the IEE. The EMPs will be updated in line with the detailed designs of the subprojects.

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<sup>2</sup> ADB, 2009. Safeguard Policy Statement, ADB Policy Paper

<sup>3</sup> ADB, 2003, Environmental Assessment Guidelines.

Figure 1. Three subproject towns in Lao PDR along east-west corridor



### C. IEE Update

30. The IEE updates the 2012 IEE. The stand-alone EMPs are found under separate cover.

### **III. POLICY, LEGAL AND REGULATORY FRAMEWORK**

#### **A. National Environmental Laws, Strategies, and Policies**

31. Lao PDR's national framework for the governance of environmental matters includes a comprehensive set of environmental and natural resources related laws and regulations. Several government agencies are involved in environmental management. From mid-2011 there has been change through the establishment of the new Ministry for Natural Resources and the Environment (MONRE), formerly the Water Resources and Environment Administration (WREA). The policies, laws relevant to environmental protection are listed below.

32. Detailed descriptions of the laws, policies, and regulations related to environmental protection, including the national environmental assessment procedure are found in Appendix A.

##### **1. Laws**

- Law on Environmental Protection No. 02/99/NA (1999)
- Law on Industry No. 01/99/NA (1999)
- Law on Hygiene, Prevention and Health Promotion No.01/NA (2001)
- Law on Water and Water Resources (1996)
- Law on Land (2003)
- Law on Roads (1999)
- Law on Forestry (2007)
- Law on Cultural, Historical and Natural Heritage (2005)
- Law on Fisheries (2010)

##### **2. Strategies, Plans, Policy**

- The 7th National Social and Economic Development Plan (NSED) (2011-2015)
- National Forestry Strategy to 2020 (FS2020)
- National Biodiversity Strategy to 2020 & Action Plan to 2010 (NBSAP)
- Urban Master Plan (2001) No. 58/PM
- National Water Resources Strategy and Action Plan [draft]
- Strategy on Climate Change (2010)
- National Adaptation Programme of Action to Climate Change (NAPA) (2009)
- Strategic plan on disaster risk management in Lao PDR (2020, 2010) and Action Plan (2003-2005)

33. There are national standards and criteria for drinking water quality, surface and groundwater quality, soil quality for agriculture, air quality and noise level standards, and wastewater discharge standards for DOD, NH<sub>3</sub>-N, TSS, and pH. Specific standards are also available for certain chemicals used by factories. The existing standards are found in the National Environmental Standard Order No. 2734/PMU-WREA (2009).

#### **B. National Environmental Assessment Procedure and Directives**

34. The GOL national environmental assessment procedures are briefly discussed below.

The Environmental Protection Law (No. 02-99/NA), dated 3 April 1999 and as amended No. 29/NA 18 December 2012, defines principles, regulations and measures related to environmental management, monitoring of protection, control, preservation and



rehabilitation. Article 21 defines the process of Initial Environmental Examination (IEE), while Article 22 defines the process of Environmental Impact Assessment (EIA). Article 79 specifies the rights and duties of MONRE with regards to environmental management, while Article 80 specifies the rights and duties of DONRE.

Three Ministerial Instructions and Decisions by MONRE, issued 17 December 2013, based on the Environmental Protection Law (as amended), includes:

- Ministerial Instruction No. 8029/MONRE on the Process of Initial Environmental Examination of the Investment Projects and Activities.
- Ministerial Instruction No. 8030/MONRE on Environmental and Social Impact Assessment of Investment Projects and Activities.
- Ministerial Decision No. 8056/MONRE on Approval and Declaration of the List of Investment Projects and Activities that shall conduct Initial Environmental Examination or Environmental and Social Impact Assessment. The Decision specifies the environmental assessment required for certain project types according to project scope/magnitude of work or threshold.

### **C. ADB Safeguard Policy**

35. The ADB Safeguard Policy Statement (ADB 2009) clarifies the rationale, scope and content of an EA and is supported by technical guidelines (e.g., Environmental Assessment Guidelines 2003). Projects are initially screened to determine the level of assessment that is required according to the three environmental categories: A, B, and C. Category A covers projects that normally cause significant or major environmental impacts that are irreversible, diverse or unprecedented. They may also affect a larger area than the project site, as with hydroelectric dams. For those type of projects, an Environmental Impact Assessment and an Environmental Management Plan are required. Category B projects have potential adverse impacts that are less severe than those of category A. The impacts of a category B are site-specific, largely reversible, and mitigation measures can be designed more readily than for category A projects. For these projects an Initial Environmental Examination and an Environmental Management Plan is required. Category C projects are likely to have minimal or no negative environmental impacts. An environmental assessment for Category C projects is not required but environmental implications need to be reviewed.

#### IV. DESCRIPTION OF SUBPROJECTS

36. Table 2 summarizes the different infrastructure developments in each town. In Kaysone Phomvihane the developments consist of solid waste management, drainage and flood protection as well as urban roads, while the subprojects in Phine and Dansavanh consist of only urban road and drainage improvements.

Table 2. Summary of infrastructure developments in the three towns

Infrastructure Development	Town
<p>Upgraded solid waste management facility and materials recovery facility</p> <ul style="list-style-type: none"> <li>• Establishment of a managed landfill on the existing dumpsite with modern landfill technology including leachate collection and treatment</li> <li>• procurement of additional equipment, collection trucks, and facilities</li> <li>• Materials Recovery Facility (formerly a separate project) with modern efficient technology, incl. construction of facilities for storage, treatment, and recycling/reuse of suitable materials within the existing landfill site.</li> <li>• Septage treatment facility for Kaysone Phomvihane (formerly part of the drainage and wastewater subproject).</li> </ul>	Kaysone Phomvihane
<p>Drainage and flood protection</p> <ul style="list-style-type: none"> <li>• 700 meters of channel lining and improvement, linking the existing channel to the outfall;</li> <li>• new flood gates to prevent the high water from the Mekong River from entering the drainage channel;</li> <li>• a new pumping station to empty the channel during rainfall events, when the Mekong river levels are high and the flood gates closed;</li> <li>• flood storage in a designated flood retention area within the existing flood plain, to reduce the size and capacity of the pumping station.</li> </ul>	Kaysone Phomvihane
<p>Improved urban roads and drainage</p> <ul style="list-style-type: none"> <li>• Road widening and strengthening, lateral drainage, lighting, landscaping and signage</li> </ul>	Kaysone Phomvihane, Phine, and Dansavanh

## **A. Need for Subprojects in Kaysone Phomvihane, Phine, and Dansavanh**

### **1. Kaysone Phomvihane**

37. Kaysone Phomvihane is a border town that serves as a major agricultural processing center and an emerging prime destination for manufacturing industries and business enterprises. Its strategic location across the Mekong River from the town of Mukdahan in Thailand offers considerable opportunities for increased economic activities and investments. With the increasing cross border trading and commercial exchanges, the town is emerging as a dynamic economic center for public and private sector investments.

38. The rapid growth in urban population and expansion of the town center generated complex environmental and social challenges. Given limited resources, local authorities are having difficulties addressing the growing demands for essential urban infrastructure and respond to the requirements of an urbanizing local economy.

### **2. Phine**

39. Phine is a market town located at an important road junction along the EWEC with a bypass road connecting to neighboring towns and provinces. The town center is characterized by a thriving trading and commercial activity for goods and services produced in Savannakhet and those imported from neighboring countries particularly Thailand and Viet Nam. The increasing local economic activities brought about by improved road and transport network along National Road 9 (NR9) is stimulating local opportunities for gainful employment among local residents and for establishing business enterprises among the private sector. The poor condition of the interior roads, however is adversely affecting socio-economic conditions in the town center.

40. The improvement of the road with the construction of drainage structures will provide convenient access of residents to social and economic services. It will also mitigate the adverse effects of perennial flooding of the major access road in the town center where majority of the residential houses and commercial establishments are located.

### **3. Dansavanh**

41. Dansavanh bordering Viet Nam is emerging as a trading center and a prime location for a special economic zone. The town, which is within the jurisdiction of the District of Sepone, is located along the 20 kilometer (km) stretch of the National Road No. 9 (NR9) leading to the border crossing of the Lao PDR-Viet Nam border. Within a land area of approximately 4,800 hectares (ha), Dansavanh is the site of the special economic zone managed by the Dongsavanh Border Trade Zone Authority (DBTZA).

42. The poor conditions of the interior roads parallel to both sides of NR9 are negatively affecting economic development, and overall quality of urban life and business. The improvement and upgrading of the interior roads will offer economic opportunities for the emergence of a new town centers. The provision of adequate access and mobility are considered essential measures to cope up with the requirements of increasing economic activities and a growing urban population brought about by the influx of in-migrants from neighboring provinces and countries like Viet Nam and Thailand.

## **B. Solid Waste Management in Kaysone Phomvihane<sup>4</sup>**

### **1. Existing Solid Waste Management**

43. The existing Solid Waste facility is located in the village of Ban Xok about 10 km east of Kaysone Phomvihane town. The total land area of the site is 16 ha and the site is fenced. A 6 ha concession located within the site has been given out to an operator (refer Figure 2 and Figure 3). Solid waste from households and businesses is currently collected and disposed to the dumpsite with four cells constructed in 1998 using UNDP and NORAD funds. UDAA is responsible for operating the site which is not designed nor operated as a sanitary landfill. The solid waste management system is inadequate to serve the municipality's increasing population.

44. The coverage level is only 35% with 4,300 households (out of >12,000) registered as customers by the UDAA. 25 out of 31 villages in the district are serviced. There are 368 factories (2010) and three large and two small trading markets, as well as 3226 commercial shops (2009). Hotels, restaurants and large businesses are responsible for disposal of their own wastes to the dump site.

45. An estimated 45-60 tons of solid waste are generated daily and an estimated 25-28 tons are collected daily, although there is no weighing system to measure the waste entering the site. The existing site has a fenced area of 16 ha, with 4 cells of 1.25 ha. An estimated 4 ha are currently in use. Two cells are partly excavated and partly filled with solid waste. Waste cells are not covered hence the site is continuously littered. There are frequent land fill fires at the site. No drainage was included in the works since the soils were presumed to be impermeable hence leachate was designed to be collected and flow to a treatment pond on-site. However, the system does not operate (probably due to leachate leaching into the soils). There is no system for managing hazardous wastes. The provincial hospital has a small autoclave for disposal of infectious medical wastes. Private contractors collect hazardous wastes from industries however the ultimate disposal point is not clear.

46. The existing recycling system is based on informal collection in the city of the most valuable fractions, selling them to junkyards and dealers. A materials recovery facility (MRF) is located on the dump site and is operated by a private contractor and recycles paper, plastics, and scrap metal. The recycled materials are transported to Thailand, China and Vietnam. A number of waste pickers operate at the site and there is extensive informal recycling/sorting carried out by the collection crews during collection. The "informal" sorting (waste picking) and recycling which occurs on the waste disposal site (as well as during waste collection) is extensive but has the side effect of making the waste disposal less efficient due to slowing down the collection process or disposal process. The working conditions of waste pickers are poor and workplace health and safety is an issue.

### **2. Existing Septic Tank Sludge Management**

47. Typically, wastewater from toilets is discharged to household septic tanks on-site, and the overflow discharges off-site to the road drainage system. Households are responsible for organizing septic tank sludge tankers to empty the sludge on a 6-12 monthly basis, however in reality households do not empty the contents on a regular basis. Septic tank sludge is currently collected on a private basis and sold to farmers, or disposed to the landfill or elsewhere - this is not controlled.

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<sup>4</sup> This section is prepared on the basis of the status as of May 2017 and will be updated following the completion of the ECA and the subsequent update and finalization of the DED.

48. Currently, septic tank sludge is discharged to the existing dump site (located 10km from city center). Removal is normally done via private contractors, however there is no supervision of the disposal hence there is a risk of inappropriate disposal direct to the environment. If not disposed correctly, sludge may be considered a public health risk, however if disposed appropriately it may be an opportunity for beneficial re-use as a low-grade fertilizer for adjacent agricultural use. Disposal to the dump site is not ideal because the sludge contributes to filling up the site, and the organic content drains through the dump to the leachate collection system and then must be treated again in the leachate treatment plant.

### **3. Specific Objectives of the Solid Waste Management Subproject**

49. The objective of the solid waste management subproject is to establish a modern Solid Waste Management (SWM) system with a design horizon of 2030. The system should include a high collection rate, improved recycling, improved hazardous and medical waste management, and adequate disposal.

50. The specific objectives were established in the Feasibility Study conducted during the PPTA stage and are as follows:

- To establish new cell with sanitary landfilling at or adjacent to existing site. This will include leachate collection and treatment and separate area for hazardous waste management;
- Procure additional equipment and facilities for improved solid waste collection;
- Introduce biological treatment of selected organic waste types through aerobic composting;
- Procure additional equipment for improved operations of disposal site;
- Implement public education, and motivation and awareness campaigns to support the improved solid waste management system;
- Promote public private partnership in the operation and maintenance of the new sanitary landfill and new MRF;
- Establish a modernized solid waste management system that offers high collection service coverage, improved recycling, with adequate end-disposal of waste with minimal negative impacts; and
- Achieve an immediate minimum target of 20% recycling with a long-term goal of 45% recycling.

51. Following the review of the subprojects in 2015-2016, the septic tank treatment plant was made a component of the solid waste management subproject and the following objective added:

- Establish septage management system for Kaysone Phomvihane.

52. The Environmental Compliance Audit (ECA) will assess the existing solid waste management facility to determine compliance issues as well as possible rehabilitation or closure options. Where the ECA finds that the facility is not in compliance a corrective action plan will be prepared.

### **4. Design Features of Improved Solid Waste Management System**

53. The Savannakhet Waste Treatment Centre will receive waste and recyclable materials from the municipality of Kaysone Phomvihane. Municipal solid waste from households, shops, and institutions will be collected and transported to the waste treatment center. Industrial Waste

and waste from the planned economic zone is not accepted at the waste treatment centre. Economic Entities must establish and finance their own waste collection and treatment facilities because the waste treatment center do not have the capacity or the knowledge of correct handling of industrial and hazardous waste.

54. The design of the waste treatment centre was in part based on the three Feasibility Studies for Waste Water Management, Solid Waste Management, and Material Recovery Facility prepared in 2012 for the Asian Development Bank and the Ministry of Public Works and Transport by Norconsult AS.

55. The Feasibility Studies were reviewed and the scope of design was proposed in the following Documents prepared by Grontmij A/S: Concept Note Solid Waste Management Subproject, April 2015; Concept Note Materials Recovery Facility Subproject, April 2015; Wastewater Management and Sanitation Strategy. 17 June 2015 (regarding sludge drying needs); and Conceptual Design Report Waste Treatment Centre, Kaysone Phomvihane, March 2016.

56. Compared with the originally proposed project from the scope of works, the following changes were made during the detailed engineering design:

- A Septic Sludge Treatment plant included (previously part of the wastewater subproject, but included in the solid waste subproject and to be located within the existing site perimeter covering about 875 m<sup>2</sup> plus a similar sized turning area and wheel wash).
- The Leachate Treatment plant upgraded to also treat waste water from the septic sludge treatment (plant capacity 200 m<sup>3</sup>/day).
- The Compost plant (1300 m<sup>2</sup>) upgraded to include dried sludge in the process.
- The construction of landfill cell 1 and 2 joined into one cell and included in the first phase, where cell 2 was part of a phase 2 in the Feasibility Study. This has expanded the size of the landfill cell from 1.5 ha to 2.5 ha and the capacity from 150.000 m<sup>3</sup> to 176.000 m<sup>3</sup>.
- Administration and weighbridge operation joined in one building (114 m<sup>2</sup>).
- Staff facilities joined in one building (68 m<sup>2</sup>).

#### **a. The Subproject Elements**

57. The subproject will have the following elements:

58. Reception area: All vehicles transporting material and waste to, and from, the waste treatment facility must pass the weighbridge in order to monitor and control, as well as charging a service fee<sup>5</sup>. Gates will be installed gates in the fence between the waste treatment center and the neighboring company, but these are only to be seen as emergency access. Also, vehicles to the material recovery facility and the septic sludge treatment facility uses the main entrance and the weighbridge.

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<sup>5</sup> The entrance is separated from the existing neighbouring Concession holder's entrance. However, although this company is collecting municipal solid waste as contractor for UDAA, his activity still have to be monitored and recorded, and he shall therefore use the main entrance and weighbridge as well.

59. Weighbridge: A weighbridge is essential for the everyday operation of the Waste Treatment Centre. The Weighbridge will provide the only valid data by measuring in kg – or ton – of all incoming waste and materials and all outgoing materials. All trucks entering and leaving the area will pass the weighbridge. The weighbridge is a surface mounted type of weighbridge with a length of 12 m, and with 4 or 6 weighing cells and a man-operated computerized recording system. The weighbridge and computer is operated from the weighbridge office in the administration building next to the weighbridge. The staff can inspect the vehicles entering and leaving from the administration building.

60. Parking Area for Staff Vehicles and Landfill Equipment: Parking for administrative staff and guest is established before the weighbridge next to the administration building. Staff parking for blue collar workers are in front of the staff facility building after the weighbridge. A roof structure will create shade for the staff vehicle. A landfill bulldozer is kept on the landfill site. Parking for front loaders and other waste treatment support vehicles are organized at the material recovery facility. There are no specific parking facility for waste collection vehicle, vacuum sludge tank vehicles and other vehicles.

61. Buildings: The administration building includes facilities for general management, weighbridge operation, accounting, and a laboratory. The staff facility building includes Toilet, bath and changing room for blue collar workers and working foremen. The Workshop and Storage building includes 100 m<sup>2</sup> area located under the same roof structure as for recycling activities.

62. Recycling Station: The Recycling Station is a part of the material recovery site. A 600 m<sup>2</sup> area under roof is hosting the recycling station, under the same roof as the workshop and storage. The station consists of the roof only (no walls, but wire mesh). In the open part of the Recycling Station are enclosures built like open cubicles (3x3 m) with high concrete walls (2m) on 3 sides and open on the last. There are 3 enclosures: one for scrap iron and metal, one for tires, and one for glass. The surface is concrete and the roof will be a steel framework with corrugated metal sheet roof-plates and minimum 4.5 m height. The wall for the roofed area will be galvanized iron wire mesh fences for the entire height. The entrance will be drive through for trucks for unloading materials or loading baled materials. Sorting will be performed manually on the floor. Baling of paper, cardboard, textiles, aluminum tins, etc. is performed with a baling machine. Grinding of PET bottles is performed with a grinding machine. Storing will be under the roof behind fence. Baled material will be manually handled or lifted with the front loader using the forklift accessory.

63. Temporary Soil Depot: During construction there will be a need for temporary storage of soil. Excavated top-soil and red-clay from the landfill cell and other construction activities on the waste treatment center will be stored at the temporary soil depot proposed to be established on the top of the old landfill cells South – East of the landfill cell. The top soil (humus) and the red clay will be kept separated.

64. Landfill cell: The Landfill Cell will have a total area of 2.5 ha and a total estimated capacity of 176.000 m<sup>3</sup> (or 123.000 metric ton at a compaction to 700 kg/m<sup>3</sup>). The landfill cell will be operated in 3 layers: First layer 4 meter high, Second layer 3 meter high, and finally a remain filling and shaping layer of approximately 1 m. An area of approximately 1.5 ha south of the new landfill cell could be utilized for a future landfill cell, with a possible capacity of 100.000 m<sup>3</sup>. Equipment for excavation and removing soil is provided and is utilized as a part of the everyday operation and the equipment can be used for establishing the new landfill. The bottom seal will be made by compacting the red-clay, giving the bottom 0.5 m hard surface seal without any cracks or openings, and with the right slope for draining (2%). A leachate collection pipe will be installed in a trench at the bottom of the landfill. The trench will be approx. 80 cm deep. The trench with drain pipe is filled with marine gravel nut stones, washed, 16/32mm. The protection of the drain layer will be performed by adding ½ meter of non-compacted waste with a 10 cm layer of soil.

65. Gas-ventilation: Gas vents will be established of the top sealing when the landfill is closed. Once the landfill is filled and covered on the top, a lid with U-shaped plastic pipe will be placed on the top of the gas-vent making it possible to collect the gas. The project includes the construction of 10 – 15 gas-vents. The subproject does not include any connections to the vents or pipework for collecting the gas to a possible treatment facility. Gas-collection in the closed landfill cells is not part of this project, but it is possible to establish this in the future.

66. Wheel Washing Station: After the waste collection vehicles have left the landfill, the vehicles will pass a wheel washing station. The purpose is to wash the tires clean for possible sludge. The wheel wash is established in front of the Septic Sludge Treatment Facility.

67. Septic Sludge Treatment Plant: The septic sludge treatment plant consists of an 875 m<sup>2</sup> building with 8 drying beds. It is estimated that a public facility should have a capacity equal to approximately 50 m<sup>3</sup> /day (6 days/week) with a content of 5% dry matter. Sludge collected during a week will be stored in 2 sludge bed. During this first week of the process, the sludge will be drained for water just by gravity to an average dry-matter content of minimum 15% and the entire volume of sludge is 100 m<sup>3</sup>. During the second and third week of the process-cycle, the amount of sludge after drying will be reduced to maximum of 30 m<sup>3</sup> per week. During the fourth and last week of the process cycle, the drying bed will be emptied and be prepared for starting in a new process cycle. The dried sludge will be utilized in the compost process. The compost process is a sanitization process for the dried sludge which will make it suitable as soil for parks, and gardens but not suitable for vegetable or food production. The process is flexible since it is only necessary to dry the sludge to approximately 50% of dry matter because the sludge will be used in the composting plant where the moisture will enter the composting process. The water drained from the sludge is treated at the leachate treatment plant.

68. Sludge drying beds: Eight drying beds with a capacity of 100 m<sup>3</sup> sludge each. The walls are made of concrete, with an opening allowing a front-loader to enter for removing the dried sludge. The entrance will be closed with a movable gate made of hardwood. The gate may either be removed by the front-loader or manually. The bottom of the drying beds is concrete with a drain layer of marine gravel finished with a protective layer of sand. Trenches in the bottom guides the water to the treatment plant. The leachate treatment plant is optimized for impact from the raining season and is therefore able to treat the water from the sludge treatment as well for 9-10 month of the year. This requires that the septic sludge facility is not in use during the peak of the raining season – part of July, August and September.

69. Leachate Treatment Plant: Leachate treatment is performed as a simple biological treatment: Aeration -> Sedimentation -> Discharge. The entire treatment plant is designed for a maximum flow of approximately 8 m<sup>3</sup>/hour or 200 m<sup>3</sup>/day. Before the aeration pond, is a collection well, which collects the leachate and waste water from the landfill, the sludge treatment plant, the wheel wash station, and septic tank at the staff facility. The flow to the collection well is partly controlled by the regulation valve between the collection well and the aeration pond. The aeration pond has a capacity of 200 m<sup>3</sup>, equal to a retention time of one day. Aeration will be performed with a submersible, electric, aeration pump. The sedimentation pond has a capacity of 600 m<sup>3</sup>, equal to 3 days retention time. Finally, the water flows to an artificial wetland polishing pond or reed bed of 2500 m<sup>2</sup>. An overflow from the wetland will convey the water outside the plant to an open area. The plants growing in the wetland will be harvested and used as structure material in the compost plant. The water flow is running by gravity. The ponds have to be emptied for cleaning at least once a year, using a simple submersible pump. The aeration pond and the sedimentation pond are both 4 meters deep and constructed in reinforced concrete.

70. Compost Plant: The Compost plant will mainly receive waste from two sources. Collected as segregated organic waste from markets and as garden/park refuse; and 30 m<sup>3</sup>/week of dried



sludge from the septic sludge treatment plant. It is proposed to organize the compost heap as a trapezoid compost heap instead of a windrow, in order to increase the capacity. The compost plant is roofed in order to control the evaporation and moisture content during the process. The composting area will include a roof covered area of 1300 m<sup>2</sup> with a compost screening area and booths for storing structure material and final compost. Furthermore, it is possible to utilize an area at the soil depot for maturing the compost. The Roof is a steel framework with corrugated metal sheet roof-plates. The equipment for the compost plant will include a front loader with a screening bucket, a water tank trailer, a drum sieve, and a crusher.

71. Hazardous Waste Station: The landfill is designed as a category B landfill and only suitable for domestic solid waste but not hazardous waste. The hazardous waste station included in the design is for reception of small amounts of hazardous waste and Health Care Risk Waste, not reception of industrial waste volumes. The hazardous waste station area will have a size of 100 m<sup>2</sup> under the roof structure of the recycling station, next to the workshop. The station will be roofed, paved, and fenced area prevented from being flushed during rain. The roofed structure will be made of steel structure with corrugated steel roof-plates.

72. Received hazardous waste will be handled in two different ways, namely:

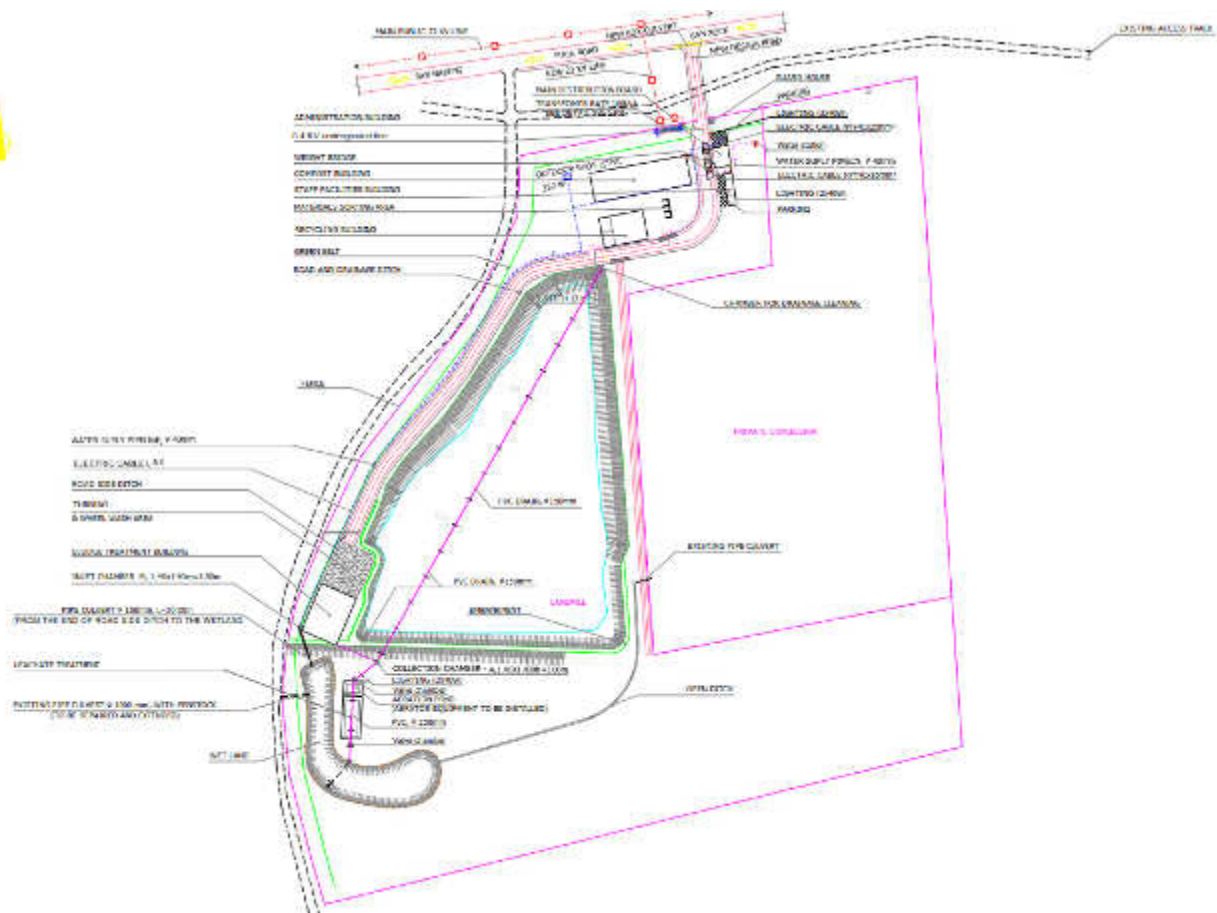
- Packing and storing of hazardous waste to be disposed at own landfill: Disposal at own landfill will be by performing trench digging in the existing waste cell, securing that disposed waste is immediately covered with waste, preventing waste pickers to get in to contact with the waste fraction. The suitable waste fractions: Health Care Waste: syringes, sharps, petri-containers, medicines, tissues; Packaging materials from obsolete pesticides; florescence lightbulbs.
- Packing and storing of hazardous waste to be sent for treatment at other waste treatment facilities, disposal, recycling or other processes. The suitable waste fractions include aerosol containers, obsolete pesticides, paint, solvents, oil, liquids, accumulators, batteries.

73. Internal Roads: All internal roads from the public road to the various treatment facilities on the site as well as parking sites will be hard surface roads paved with concrete. Existing soil roads will be used for landfill equipment. Temporary roads on landfill for unloading waste and transporting the waste on to various tipping points inside the landfill cell will be established as part of the operation of the site.

74. Fences, Gates, and Green Belt: The entire fence around the landfill will be renovated. Broken concrete fence poles will be replaced, galvanized steel wires and galvanized chain link fence installed, gates in front of the main entrance, the contractor's entrance, and close to the leachate treatment plant will be established. Manual arm barriers preventing unauthorized access to the facilities will be installed. A 10 meters wide green belt on the site next to the fence will be kept free for any activity preserving the existing vegetation.

Other infrastructure: Water will be supplied from a new water well with pump and buffer tank on the north-east corner of the site. A submersible pump will be installed which will pump directly to a water tank form where the water will be pumped to the buildings. Water for the compost facility will be taken from the ponds south west of the site by use of the water tanker. A new 100 m 22Kv line will supply power from the existing grid to a new 16 kV transformer. The transformer will supply power to the waste Plant through approximately 500 m 4Kv link. Outdoor light will be established in the reception area only. Open storm water drains are installed along the paved internal road. A septic tank will be installed for the staff building. A fuel tank for landfill equipment and vehicles will be installed at the workshop.





## 5. Environmental Compliance Audit<sup>6</sup>

77. An ECA of the dumpsite will be conducted pursuant to the requirements of the SPS (2009)<sup>7</sup>. The objective of the ECA is to determine ADB and Government of Lao PDR compliance of current waste operations as well as potential risks and impacts of the planned Solid Waste Management subproject. The ECA should identify and plan appropriate measures to address outstanding compliance issues, which could be termed as “legacy” or cause reputational risk for ADB. Where non-compliance is identified, a corrective action plan agreed on by ADB and the borrower will be prepared as part of the ECA.

78. The ECA will draw from the results of a groundwater quality study, and will be conducted to clarify the following general issues.

1. Requirements of existing regulatory framework for landfills in Lao PDR;
2. Groundwater quality above (upstream), underneath, and below (downstream) of the existing dumpsite;
3. Permeability of soils, and hydrogeology underlying dumpsite area and site of new sanitary landfill.
4. The content and toxicity of the cells of the dumpsite;
5. The influence of existing dumpsite on the environment, including risk of groundwater pollution and other risks odour, air quality, landfill fire, etc.;
6. Assess possible rehabilitation options and/or the proposed closure options including the capping design;
7. Prepare a corrective action plan (based on above findings including those from the toxicity tests and leachate sampling) define necessary remedial actions, the budget for such actions, and the time frame for resolution of noncompliance (if any);
8. Influence of existing dumpsite on design of new sanitary landfill; and
9. Evaluate existing institutional setup and capacity for operating the Solid Waste site, particularly with regard to operating as a “sanitary landfill”.

79. The detailed terms of reference for the ECA and the groundwater quality study are found in Appendix D. The results of the ECA will be used to determine any update of the detailed design of the new sanitary landfill.

Table 3. Preliminary Assessments and Procedure to decommission dumpsite in Kaysone Phomvihane

Outline of the indicative procedure to close the dumpsite based on the preliminary assessment of the environmental conditions of the dumpsite conducted in 2012. The closure process outlined indicative because the final, detailed procedure that is developed to close the dumpsite must wait for the results of an Environmental Compliance Audit (ECA) that will be conducted on existing dumpsite.

### Background

Four hectares of the 16 ha designated for landfill in Kaysone Phomvihane have been occupied by the existing dumpsite (Figure 2). The dumpsite consists of four cells of approximately 1.25 hectares (ha) which are expected to be fully utilized in the next few years as a response to increasing development in the area.

No bottom drainage system was installed with the disposal cells. A liner was not installed because initial surveys suggested the underlying soils are impermeable. A gravity-fed culvert system was installed that leads to a central outlet from which leachate is discharged to a canal. At this point a dike contains a leachate pond in which some leachate treatment occurs before being discharged

<sup>6</sup> This section will be updated following the completion of the ECA.

<sup>7</sup> SPS (2009), SR1, Appendix 1, para 10

to adjacent rice fields. However, recent groundwater sampling, and observations at the dumpsite indicate that leachate from the dumpsite is likely seeping into the ground.

A portion of the MSW is chronically on fire contributing to local air pollution. Another key condition is that in the tropical climate and with MSW being exposed to air in thin layers, most of the organic components are already aerobically biodegraded leaving plastics, metals and inert materials with limited potential for water pollution. These conditions should be considered in the future environment compliance audit (ECA), and in design of an appropriate top cover of the cells of the existing dumpsite.

The waste cells are not covered, and waste and litter is spread outside the operational area. The dumpsite operation appears unplanned and unorganised.

The following initial criteria were adopted by the subproject for the decommissioning of the dumpsite:

- a. completely cover the disposed MSW;
- b. prevent rain water and surface water to penetrate down to the MSW; and
- c. provide a solution for oxidation of methane coming from the MSW.

Based on the preliminary assessment the following indicative closure solution has been identified:

1. Level and shape the surface making it convex with a minimum slope of 2% letting rain water flow to the adjacent area.
2. Ensure open cut-off ditches capture and discharge rain water to outside the disposal site area.
3. Lay down 40 centimeters of impermeable clay excavated from authorized areas at or near the site.
4. Add a 10 cm layer of sandy material excavated from authorized areas at or near the site that provides drainage for rainwater to the sides that distributes gas emanating from MSW below.
5. Lay down a 20 cm top layer of soil suitable for grass re-vegetation, and for supporting bacteria oxidization of methane gas (local soil mixed with earth); and
6. Plant robust grass as top vegetation.

The cost for this the preliminary procedure has not been estimated in detail. The indicative closure process will be finalized with the results of the ECA.

## **C. Kaysone Phomvihane – Drainage and Flood Protection<sup>8</sup>**

### **1. Existing Situation - Houay Longkong**

80. The Houay Longkong drainage channel serves the southern catchment of the city; the catchment area is approx. 538ha and has low topography. Stormwater collected in the drainage

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<sup>8</sup> This section is prepared on the basis of the status as of May 2017 and should be updated when the DED is finalized. Compared with the 2012 Feasibility Study, the subproject has been revised substantially; the wastewater treatment components were deleted, together with the original proposal for limited combined sewerage, and replaced with a citywide septage management program. Septage treatment will now be provided at the Kaysone Phomvihane landfill as part of the solid waste management subproject and septage collection will be provided through the purchase of

system (as well as domestic wastewater from households discharged to the road drains which subsequently collect into the drainage system) discharge via the Houay Longkong drainage channel to the Mekong River. However, when the Mekong River level is high, wastewater is retained in the drainage channel. Further, during the rainy season, the drainage channel overflows, resulting in flooding in the catchment, with health risks made worse by the wastewater flowing to the drainage channel and discharging to the environment. Consequently, the objective of the drainage sub-component is to reduce the risk of flooding, improve environmental protection from pollution and to secure public health by sealing the main drainage channel, install flood gates and drainage pump station so that floodwater may be pumped out of the catchment in order to maintain a level below the maximum level in the drainage channel when the Mekong River level is high.

81. The main Houay Longkong drainage channel is sealed with concrete block, sloped walls (constructed under the ADB funded Secondary Towns Development Project, 2000-2003), except for the downstream length of approx. 500-600m which is earthen. To improve the drainage capacity, it is proposed to seal the remaining length of the drainage channel.

82. It is proposed to install flood gates near the outlet of the (sealed) drainage channel which will normally remain open. When the level of the Mekong River rises during the rainy season, it is proposed to close the flood gates and operate the drainage pump station to maintain below a maximum level in the drainage channel by pumping floodwaters from the drainage channel to the Mekong River.

83. The drainage pump station is proposed to operate automatically when the flood gates are closed and the level in the drainage channel and the Mekong River becomes high. When the river level drops, the flood gates are opened and the pump station shut down.

## **2. Design of Drainage and Flood Protection Components in Kaysone Phomvihane**

84. The Scope of Works was confirmed during the ADB Mission in August 2016 to include:

- About 700 meters of channel concrete-lining and improvement, linking the existing channel to the outfall;
- New flood gates to prevent the high water from the Mekong River from entering the drainage channel, equipped with automatic system for operating these;
- A new pumping station to empty the channel during rainfall events, when the Mekong river levels are high and the flood gates closed, incorporating natural reservoir volumes in the design of capacities by utilizing flood storage in a flood retention area within the existing flood plain, to reduce the size and capacity of the pumping station.

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new vehicles for this purpose. This subproject now focuses entirely on drainage and flood protection for Kaysone Phomvihane's southern catchment with outfall and discharge to the Mekong River.



Figure 4. Aerial view of the lower part of the Houay Longkong channel with proposed channel lining and alternative pumping station locations superimposed.



#### a. Design Basis for the Subproject Components

85. The purpose of the proposed pumping station is to alleviate Mekong-related flooding in Savannakhet and the extent and frequency of flooding in town has therefore been studied as part of the preparation of the detailed engineering design.

86. UDAA (Urban Development Administration Authority) and DPWT at both Provincial and District level has reported that rainstorms will cause floodings in central town with some 30-cm water in the streets may occur, receding after 1-2 hours. Certain low-laying areas are more flood-prone, with 40-50 cm of flood water commonly occurring, e.g. 5-6 times during the whole wet season. Such flooding are normal and expected to happen every rainy season. These flood events can happen at any times during the rainy season and are not related to high water levels in Mekong river. The level of central town is 115 m Lao Geodetic Datum<sup>9</sup> (m Lao) with certain lower-lying areas at 114.0-114.5 m Lao. This level has not been reached by the Mekong River in the monitoring data reviewed by the DED.

87. It is assessed that water level in Mekong may contribute to flooding in town when the water level is above 113 m Lao, which has happened at 2 occasions lasting a total of 9 days during the

<sup>9</sup> The offset between mean sea level (MSL) and the Lao Geodetic Datum has been established to be -23.272m, so central town is at approximately 138 m MSL, refer Houay Longkong Rehabilitation – Design Basis, PMSCD, September 2016

last 8 years. Such flooding's requires the combination of intense rainfall and extreme water level in Mekong.

88. It is reported that high water level in Mekong alone can cause flooding, as it happened in 1996 when the Mekong Water level reached 114 m Lao, and flooded areas in the downstream area of Houay Long Kong.

89. The DED design basis concluded the following concerning flooding:

- Flooding in Central town is generally caused by a combination of heavy rainfall and insufficient drainage (at least partly caused by insufficient maintenance of the drainage system).
- The flooding may be increased by a combination of very high water level in Mekong (above 113 m Lao) and heavy rainfalls happening at the same time. However, such a combination occurs very rarely.
- Flooding caused by high water level in Mekong alone occurs extremely rarely and will only cause flooding in the downstream areas of Long Kong in limited areas.

90. To assess pumping capacity and reservoir capacity, the DED design basis dimensioned rainfall events that could course flooding as daily rainfall exceeding 50 mm and assumed a duration of the main runoff of 3 hours. Such events occur on average six times per rainy season, i.e. once a month in the rainy season.

91. The DED design basis assumed a run-off coefficient of 0.6 as more conservative (above the 0.5 assumed by Norconsult in the 2012 FS). While there are large unsealed areas in the catchment area, it should be taken into consideration that during the wet season the ground will often be saturated leading to a higher direct surface runoff. It is also taken into consideration that the catchment area will be utilized for urban development in the future and that sealed areas will increase with time.

92. For the Longkong catchment with an area of 538 ha, a rainfall of 50 mm would correspond to a rain volume of 269,000 m<sup>3</sup>. By applying a run-off coefficient of 0.6, the corresponding run-off volume is 161,000 m<sup>3</sup>. The DED design basis assesses that holding this volume in the reservoir would increase the water level to 112.8 m Lao, which is below the level of the rice fields along Houay Long Kong. Utilizing this reservoir area will therefore not cause any flooding at all, not even of the adjacent rice fields. Further, as a volume of water would be pumped out during the main runoff of the rainfall, the retained volume and consequently the level would in fact be lower. With a pump capacity of 1.85 m<sup>3</sup>/s the volume would be approximately 140,000 m<sup>3</sup>. In the event of a rainstorm greater than 50 mm (occurring while Mekong water level is high and the hence the flood gates closed) the runoff would build up the level in the reservoir to a level above 113 m Lao, causing temporary flooding of the rice fields. As pumping would be ongoing, the flooding would a very short-duration of an assessed 6-12 hours.



Figure 5. Huay Longkong catchment area



93. To ensure that a volume of 140,000 m<sup>3</sup> can be emptied within 24 hours, the DED design basis, assessed that a pumping capacity of 1.85 m<sup>3</sup>/s would be required and proposed the installation of two vertical turbine pumps with a capacity of 0.9 m<sup>3</sup>/s and head of approximately 12m (actual head to be determined) with no standby needed due to the infrequent operation of the pumps.

94. The main parts of the pump station will according to the design basis include:

- Rough screen and trash rack, to prevent clogging of the pump
- Inlet channel and pump sump: to provide suitable hydraulic conditions for pumping
- Pumps with necessary valves and fittings. Water Meter will not be included. Requirement for Non-Return Valve will be considered.
- All internal piping is proposed to be stainless steel.
- Discharge pipe: The discharge pipe will go under the embankment road and discharge into a concrete chamber at the side of the downstream (outside embankment) part of Long Kong.
- The pump station will be constructed in reinforced concrete.

95. The current flood gates at the Houay Longkong culvert were installed in 2001-2004, but have never been operated. Since the Houay Longkong culvert is commonly submerged during the wet season, it will have a discharge capacity less than the upstream culvert at Phokadouath

Road being of equal dimensions. In addition, the position of the flood gates is an extraction of the flow at the outlet. According to the DED design basis, the outflow arrangement is, seen from the hydraulic point of view, inappropriate, both with respect to the dimensions of the culvert being equal to the upstream culvert and to the flood gates causing a potential flow contraction at the outlet in high flow situations.

96. With the rehabilitation of the flood gates and the installation of the pumping station, the flood gates will be closed at a certain Mekong River water level and pumping operations initiated. Setting this level at 9.75 m Zero Gauge corresponding to 111.5 m Lao the water level at the Phokadouth culvert will be about 1.0 m, with 1.5 free air to the roof slab and Mekong water level about 3-3,5 m below street level. Setting the level to 110.5 m Lao would eliminate the intrusion of Mekong water into the urban part of the Houay Longkong and in turn avoid the situations where stagnant plume of diluted wastewater in the channel creating odours during dry spells. However, the lower level for closing the flood gates and initiation of pumping operations will also imply a significant increase of the number of days with pumping operations.

97. The DED design basis, recommends that after installation and operation of the pumping station the Mekong River level for initiation of pumping stations is adjusted on the basis of experience gathered during pumping operations.

Table 4. Suggested Operation of Flood gates and Pumping Station

Season / Event	Mekong water level (m Lao Geo)	Water level inner side (m Lao Geo)	Position of flood gates	Pumping station
Dry season	< 105	< 105	Open	Not in operation
Onset of wet season	< 109	< 109	Open	Not in operation
Wet season, rising Mekong level	≈ 110.5	≈ 108, when reservoir empty	To be closed	Pumping start, until reservoir is empty, then stop pumping.
Heavy rainfall occurs	≈ 110.5 or higher	≈ 108, increasing due to runoff	Closed	Start of pumping. Reservoir will fill gradually, due to runoff.
After heavy rainfall	≈ 110.5 or higher	Becomes higher than outer side	To be opened	Stop of pumping, runoff through open flood gates
Runoff after rainfall has ceased	≈ 110.5 or higher	As on Mekong side	To be closed	Pumping start, until reservoir is empty

### a. Concrete Lining of the Houay Longkong Channel

98. Two conceptional cross sectional profiles have been prepared for the concrete-lining of the lower part of Houay Longkong, between Phokadouath Road and the Houay Longkong embankment.

99. The first cross section will be applied to the first 400 m of the alignment, where the concrete-lined channel will follow the existing, natural alignment of Houay Longkong.

100. The second cross section will be applied to the last 280 m of the alignment, where the existing natural alignment has many bends. The concrete-lined new channel will follow a new smooth alignment with a wider cross section.

101. Both cross sections include a narrow channel with width of 1.0 m, to facilitate the dry season flow. During the wet season the discharge will also mainly be the same in periods of several dry days.

102. At three positions, with spacing of about 200 m, concrete stair steps will be established on both sides of the concrete-lined channel, to facilitate safe pedestrian crossing of the channel at low flow.

103. Figure 7 shows the proposed concrete-lined cross section for the first 400 m of Houay Longkong. The profile is similar for the last part, the difference being a wider base (7.0 m).

Figure 1 is a 3D perspective view of the proposed stepped gabion structure. The structure is a rectangular prism composed of multiple layers of gabion units, with a stepped top surface. A small inset shows a cross-section of the gabion unit.

104. The Urban Roads sub-projects aims to contribute to making Kaysone Phomvihane, Phine and Dansavanh attractive and competitive towns for increased trade and investment along the East West Economic Corridor (EWEC). The specific objectives of the sub-projects are to:

- ## 1. Kaysone Phomvihane

106. The road upgrading in Kaysone Phomvihane will include road widening and pavement strengthening of; (i) 6.2 km of Kaysone Phomvihane Road and (ii) 2.2 km of Fa Ngum Road (I & II). The total length of the road upgrades is 8,323 km.

107. The scope of the Kaysone Phomvihane Road subproject is summarized below:

<b>Kaysone Phomvihane Road</b>	<ul style="list-style-type: none"> <li>▪ Widening and pavement strengthening of 6.2 km Kaysone Phomvihane Road with 2x 2 lanes of 3,5 m width</li> <li>▪ Drainage (U-Box) and footways on both sides of the road</li> <li>▪ Construction of a 1.5m motorcycle lane in both directions</li> </ul>
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	<ul style="list-style-type: none"> <li>▪ 2 m sidewalk on either side of the road</li> <li>▪ Installation of lighting facilities</li> <li>▪ Planting of trees and ornamentals</li> <li>▪ Roundabouts at junctions of Fa Ngum and Phokadhouat Roads</li> <li>▪ U-turn arrangements for easy and safe turning.</li> <li>▪ One lay-bye for temporary stopping of heavy traffic on each side of the road</li> </ul>
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108. The duration of project phases is presented below.

Table 5. Duration of project phases

Phase	Duration
Construction phase	2 years
Defects Liability Period	1 year

109. The length and width of sections are presented below.

Table 6. Length and width of the Kaysone Phomvihane Road

Road	Length in meters			Width in meters				
	Main Road	Access Road	Total	Road	Motorbike	Footway	Drainage	Total
Kaysone Phomvihane	6,182	-	6,182	2 x 2 x3.50	2 x 1.5	2 x 2.0	closed	24.1

110. The Kaysone Phomvihane Road will be upgraded from the Dinosaur Junction in the north on the 9W Road to the T-junction with the 9B Road in the south near the Samakkhixay Market.



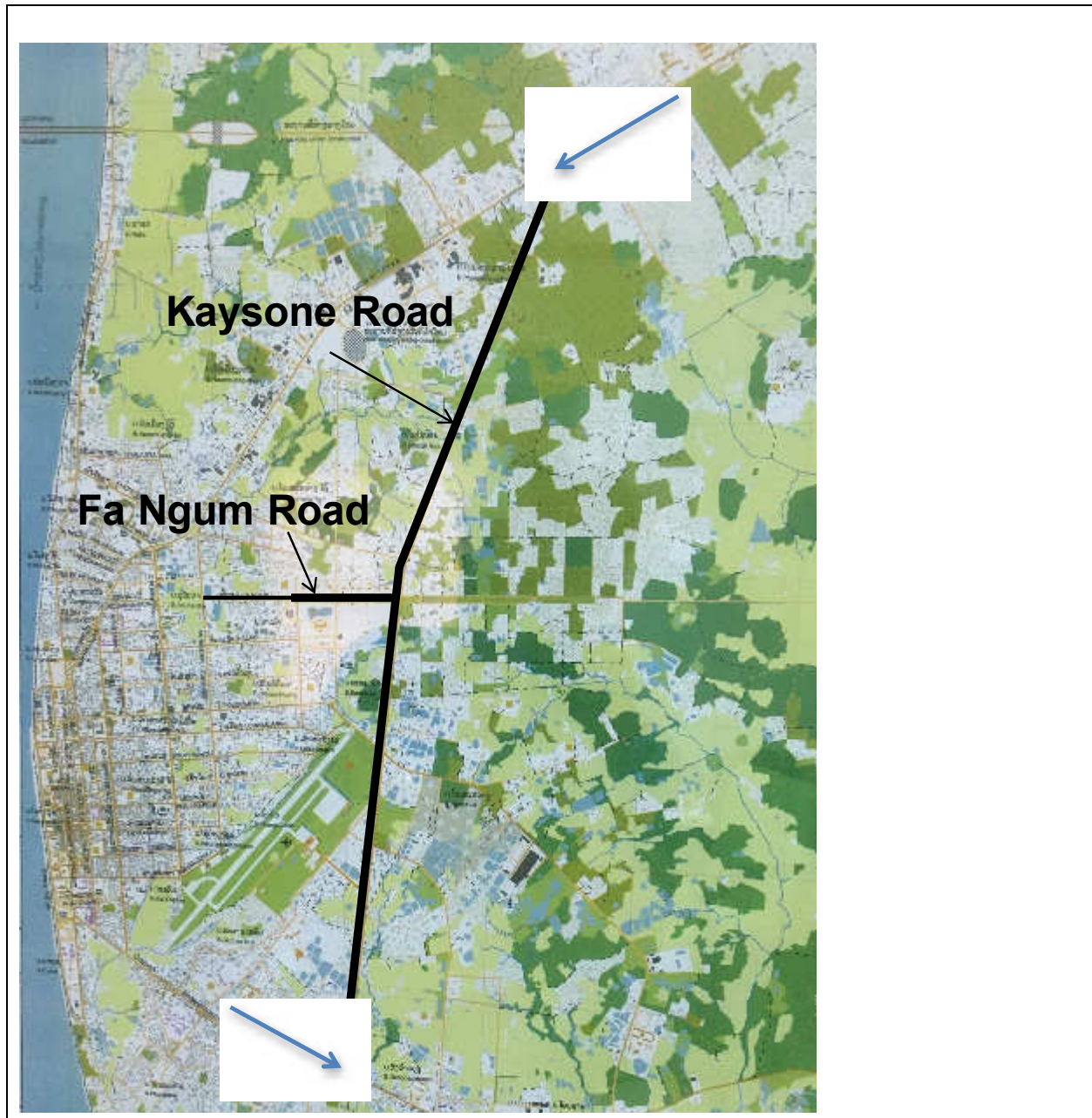
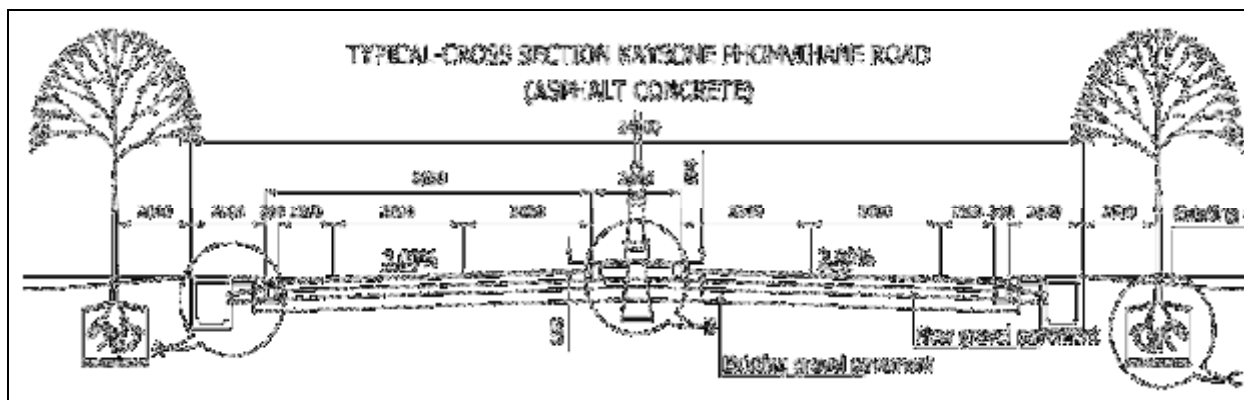
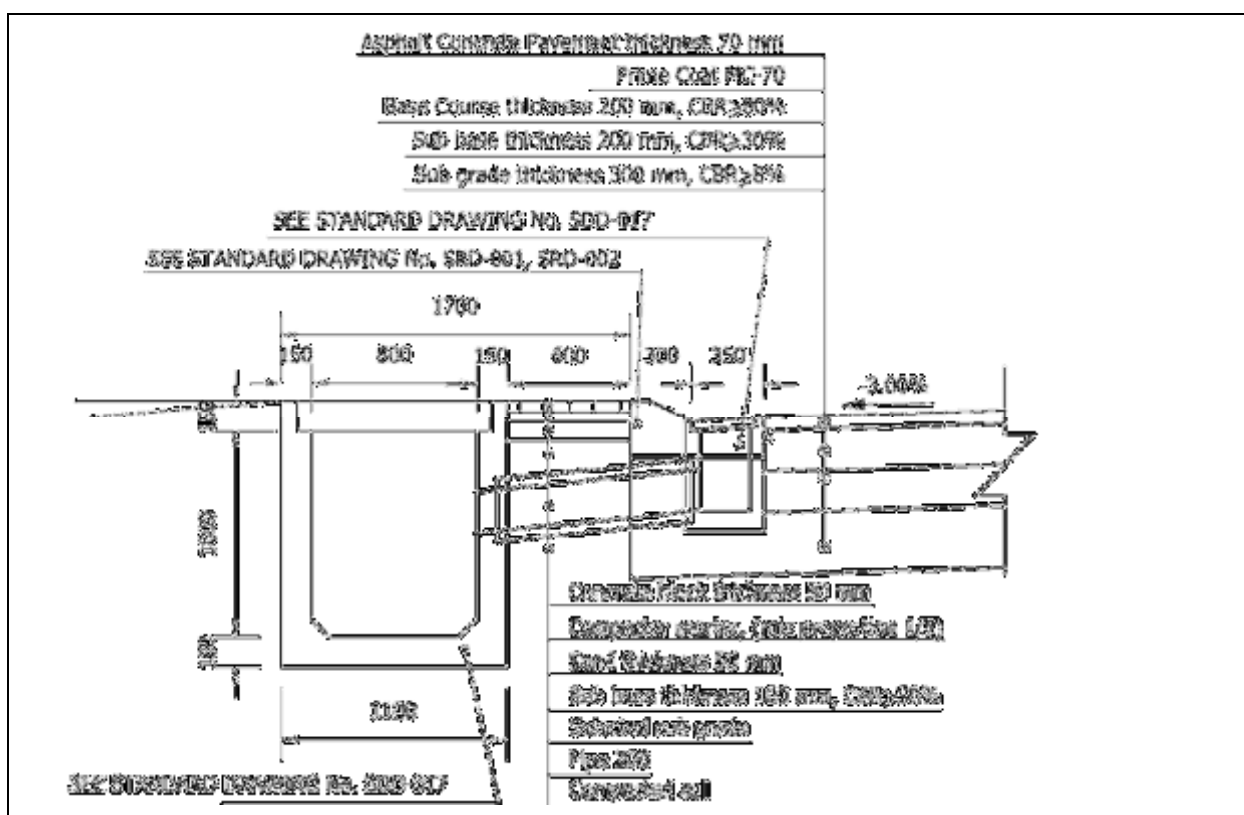


Figure 8. Kaysone Phomvihane Road

111. The typical cross section used in the design as included in the Technical Design Report is presented below.



112. The road will be constructed with gutter along the roadside, kerbs and sidewalks and will have a closed drainage system as presented below.



**b. Fa Ngum Road**

113. The scope of the Fa Ngum Road subproject is summarized below:

<b>Fa Ngum Road</b>	<ul style="list-style-type: none"> <li>Widening and pavement strengthening of 2.2 km Fa Ngum Road. The road consists of Fa Ngum Rd 1 (West) with two lanes and Fa Ngum 2A &amp; 2B (Park) with two by two lanes separated by a park.</li> </ul>
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	<ul style="list-style-type: none"> <li>▪ Drainage (U-box) and footways.</li> <li>▪ 2 m sidewalks on either side of the road.</li> <li>▪ Installation of lighting facilities and planting of trees and ornamentals</li> <li>▪ Roundabout at junction near Provincial Governor's office</li> <li>▪ Landscaped park and facilities, including shopping facility (kiosk) and public toilets.</li> </ul>
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114. The duration of project phases is presented below.

Table 7. Duration of project phases

Phase	Duration
Construction phase	2 years
Defects Liability Period	1 year

115. The length and width of sections are presented below.

Table 8. Length and width of the Fa Ngum Roads

Road	Length in meters			Width in meters				
	Main Road	Access Road	Total	Road	Motorbike	Footway	Drainage	Total
Fa Ngum West	647	-	647	2 x 3.75		2 x 2.0	closed	12.2
Fa Ngum East (Park)	1,494	-	1,494	2 x 3.75		2 x 2.0	closed	12.2

116. The Fa Ngum Rd has two overall sections. An Eastern Section with two by two lanes separated by a park and a western section with two lanes. The figure below presents an overview.

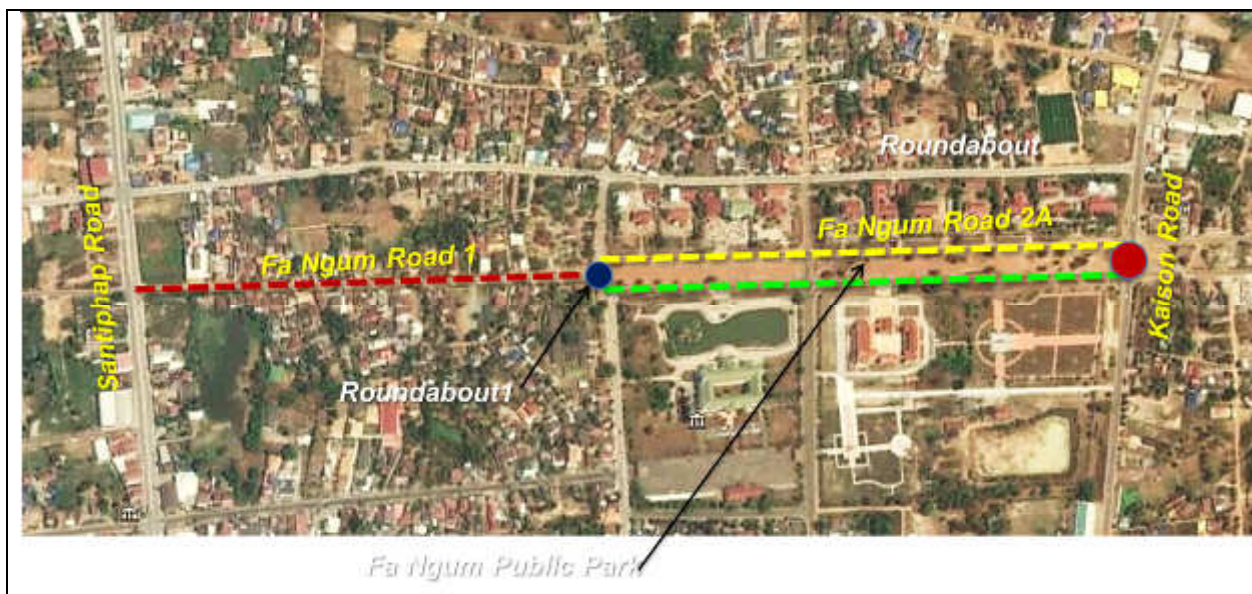




Figure 11. Fa Ngum Road

117. The typical cross sections used in the design as included in the Technical Design Report are presented below.

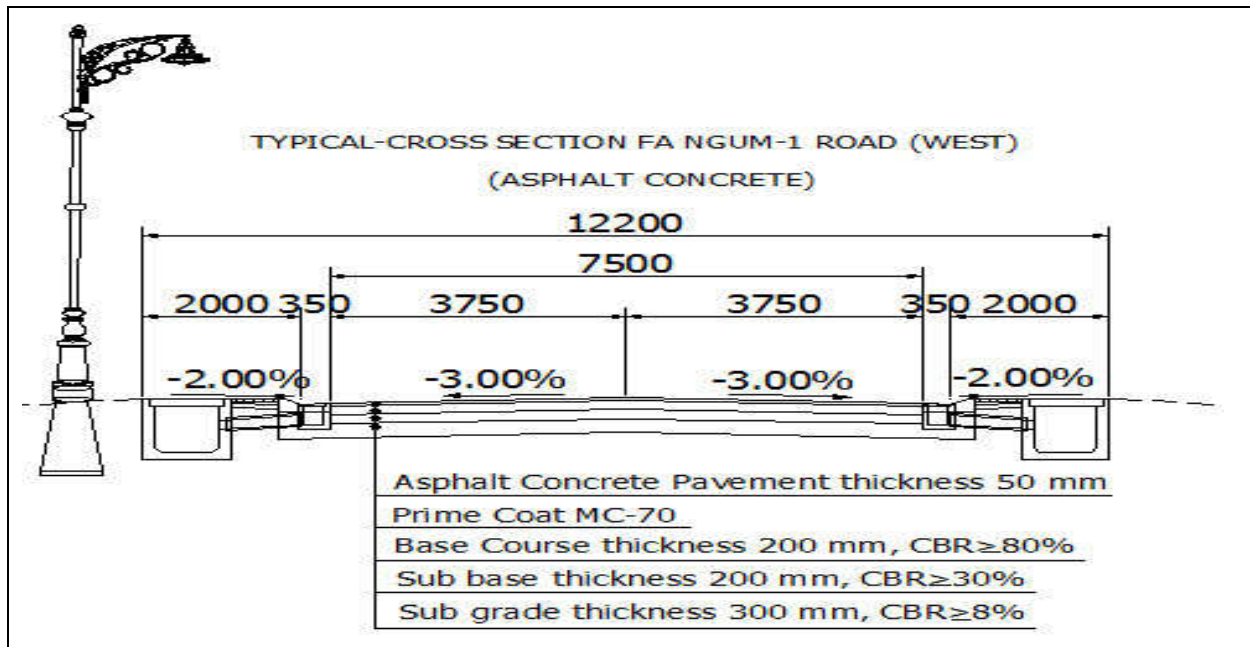


Figure 12. Typical cross-section of Fa Ngum-1 Road (West)

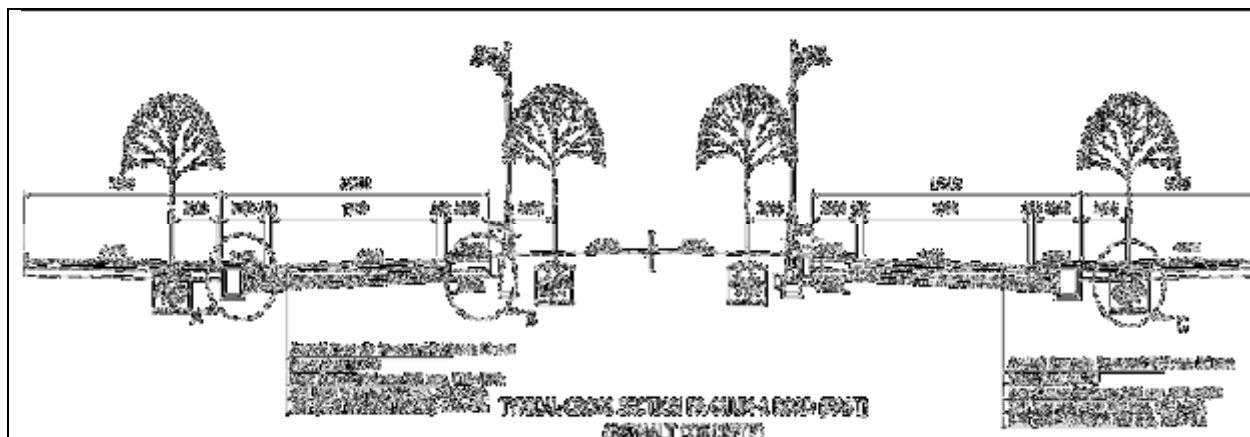


Figure 13. Typical cross-section of Fa Ngum Road (East, Park)

118. The roads will be constructed with gutter along the roadside, kerbs and sidewalks and will have a closed drainage system as presented below.

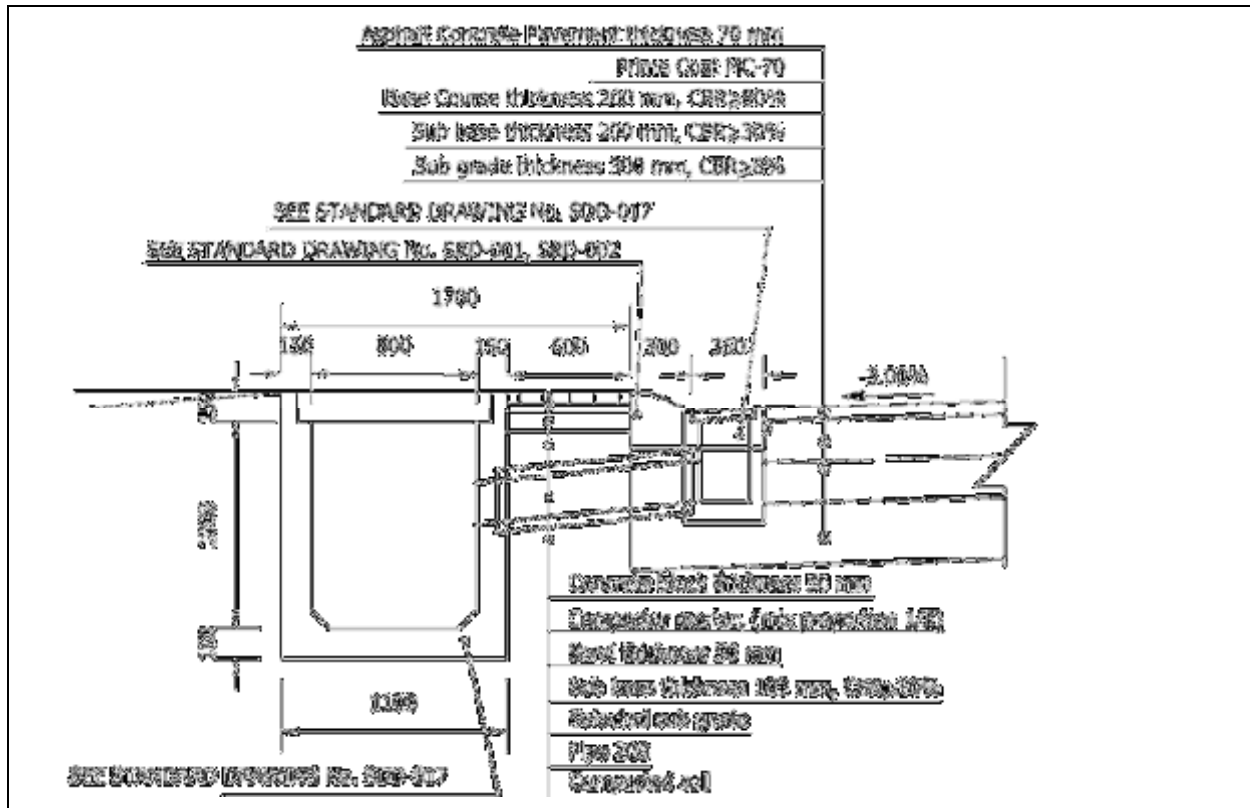
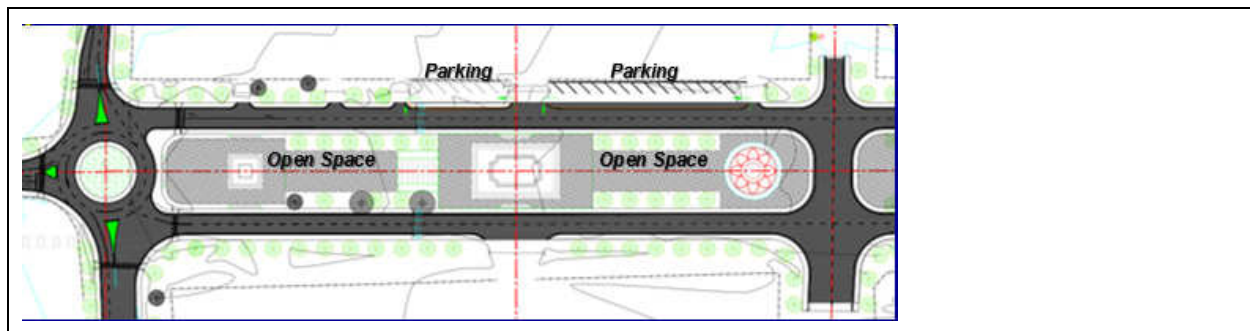


Figure 14. Principle for closed drainage system

119. The Fa Ngum public park will be located between the Fa Ngum 2A and Fa Ngum 2B. Design concepts have been developed, while the final design will be decided upon by the PMU in the construction phase, including tree and plant species, landscaping, and final layout. A provisional sum for the construction of the park has been set aside in the construction budget. The design concept for the park includes different sections with varying themes. Designs for public toilets with septic tank and a small shopping area with a kiosk have been prepared.



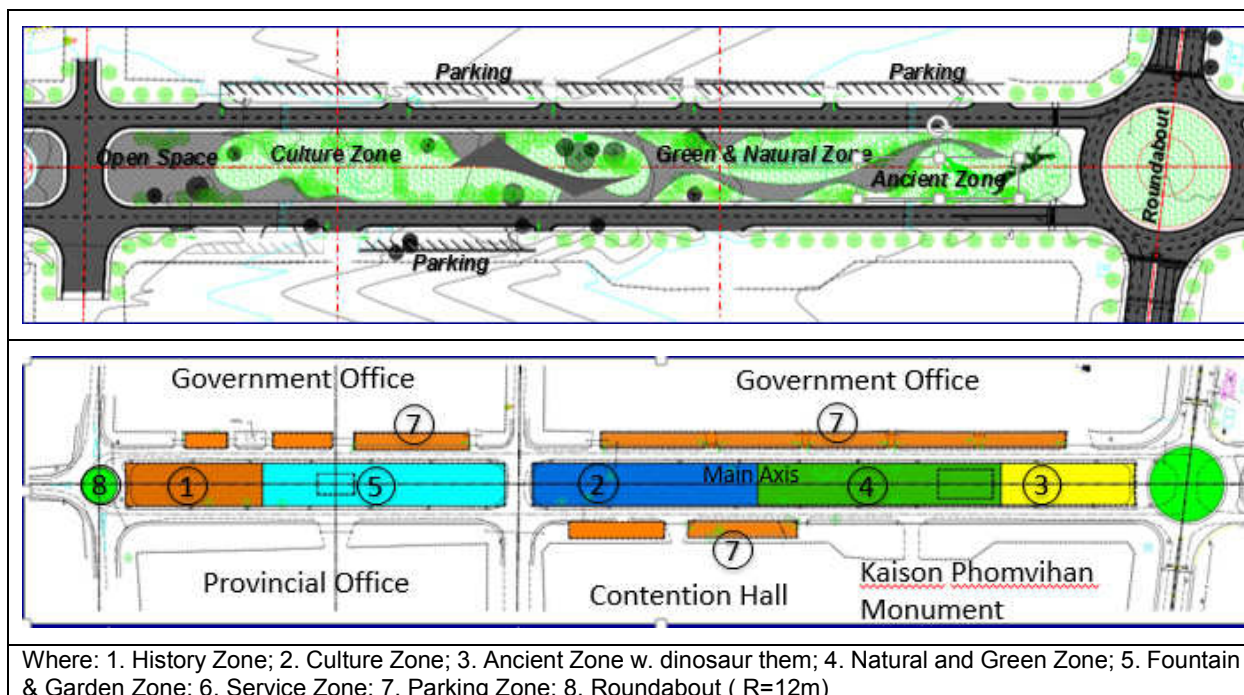


Figure 15. Design concept for the Fa Ngum Public Park

## 2. Phine

120. The scope of the Phine Road subproject is summarized below:

<b>Phine Road</b>	<ul style="list-style-type: none"> <li>Improvement, widening, and construction of about 9.978 km interior urban roads, including 6.838 km main road and 3.140 km access road with double bituminous surface treatment (DBST) pavements and including two new sections of road (Main A and Main Q) totaling approximately 4 km. Existing road sections have laterite/gravel surfaces.</li> <li>Drainage (U-Box) and footways.</li> <li>One roundabout.</li> </ul>
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121. The roads will be constructed with sidewalks and open drains along main roads and closed drainage along access roads.

122. The duration of project phases is presented below.

Table 9. Duration of project phases

Phase	Duration
Construction phase	2 years
Defects Liability Period	1 year

123. The length and width of sections are presented below.

Table 10. Length and width of the Phine Roads

Road	Length in meters		Width in meters				
	Length	Total	Road	Motorbike	Footway	Drainage	Total
Main Road	6,838	9,978	2 x 3.5	-	2 x 1.15	open	14.2
Access Road	3,140		2 x 2.5	-	2 x 1.065	closed	7.85

124. The Phine Rd subproject consists of a number of subsections of access road and main road. The sections are presented in the figure below.

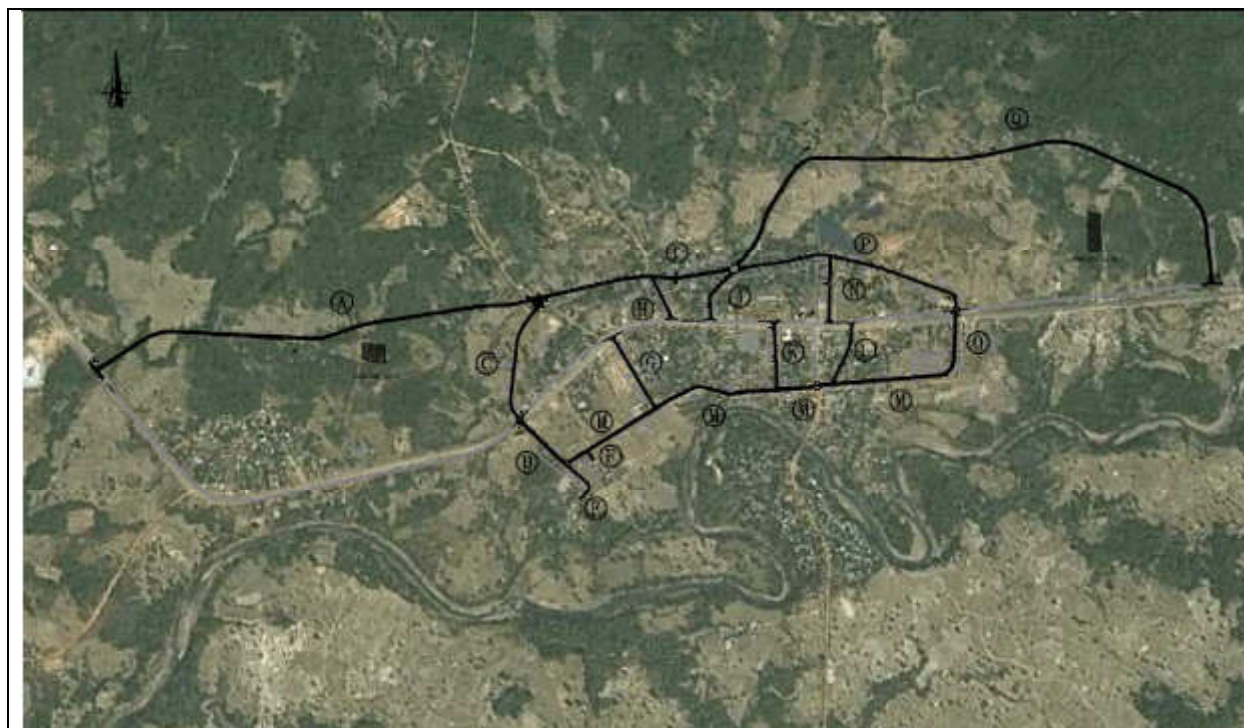


Figure 16. Phine Road

125. The typical cross sections used in the design as included in the Technical Design Report are presented below.

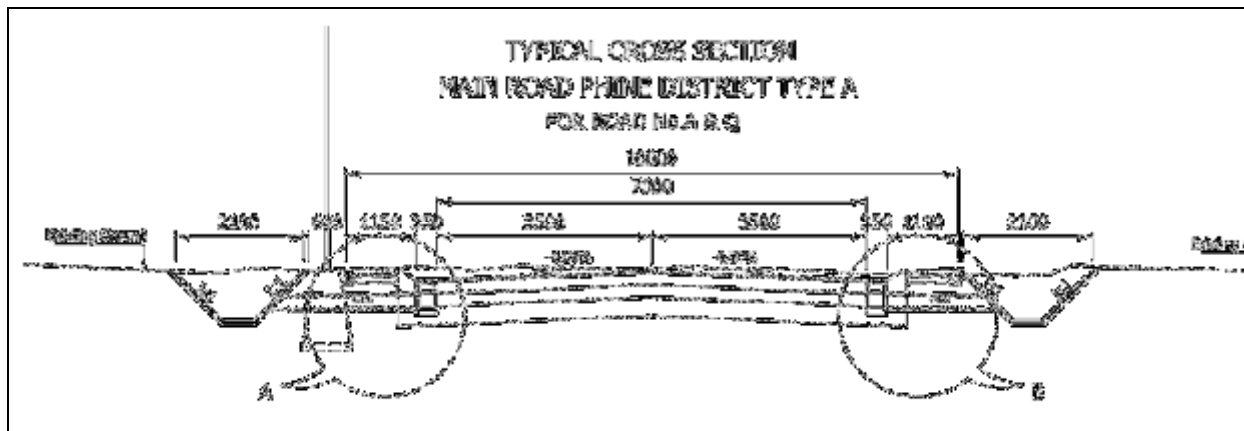




Figure 17. Typical cross-section of Main Road Phine Type A

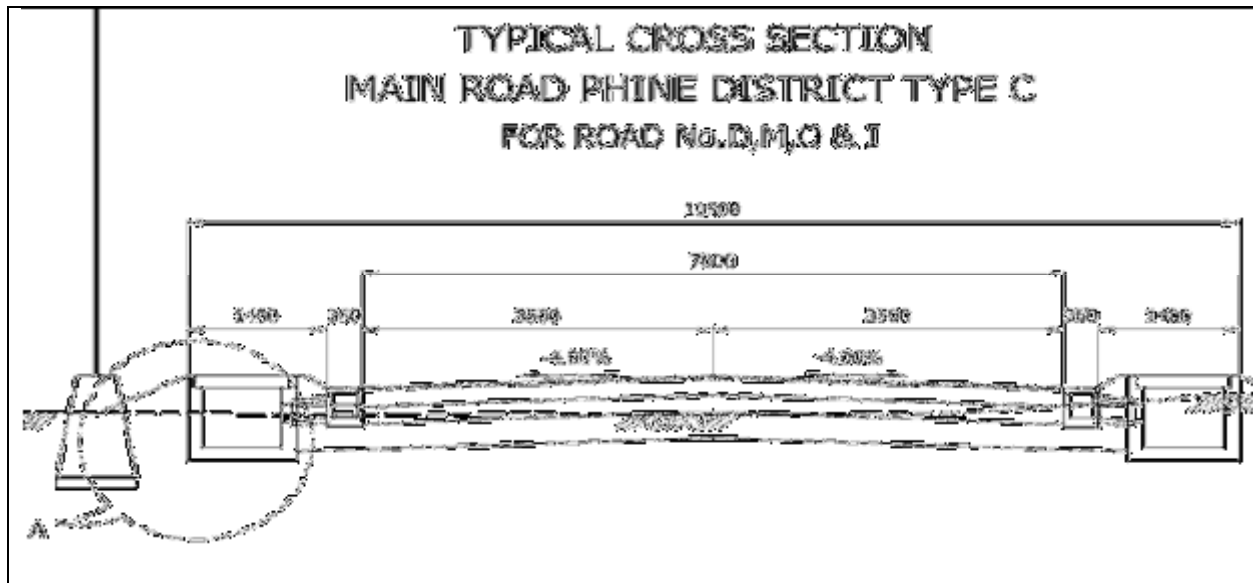


Figure 18. Typical cross-section of Phine Main Road Type C

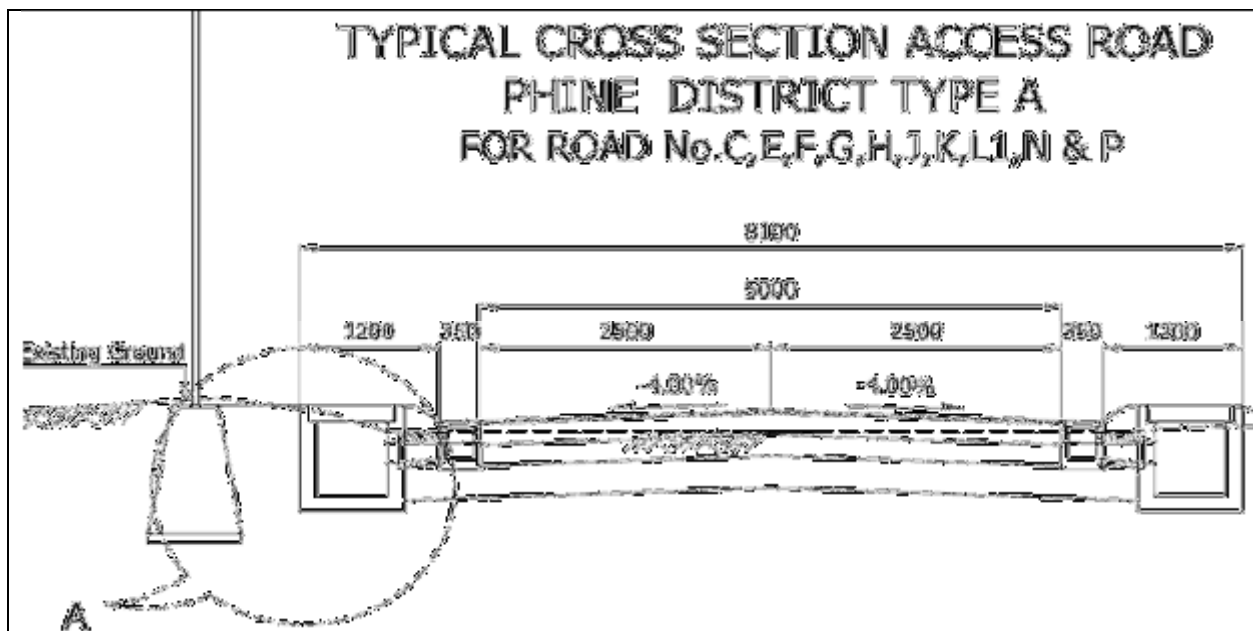


Figure 19. Typical cross-section of Phine Access Road

### 3. Dansavanh

126. The scope of the Dansavanh Road subproject is summarized below:

Dansavanh Road	<ul style="list-style-type: none"> <li>Construction, improvement and widening of about 3.884 km interior urban roads, including 1.739 km of Main Rd and 2.145 km of Access Road to double bituminous surface treatment (DBST) pavements, including a section of the proposed future by-pass to the 9E road that</li> </ul>
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	<p>intersects the town. Existing road sections have laterite/gravel surfaces and three road sections are currently footpaths.</p> <ul style="list-style-type: none"> <li>▪ Drainage, closed U-box along access roads and open drains along main roads and footways.</li> </ul>
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127. The roads will be constructed with sidewalks and open drains along main roads and closed drainage along access roads.

128. The duration of project phases is presented below.

Table 11. Duration of project phases

Phase	Duration
Construction phase	2 years
Defects Liability Period	1 year

129. The length and width of sections are presented below.

Table 12. Length and width of the Dansavanh Roads

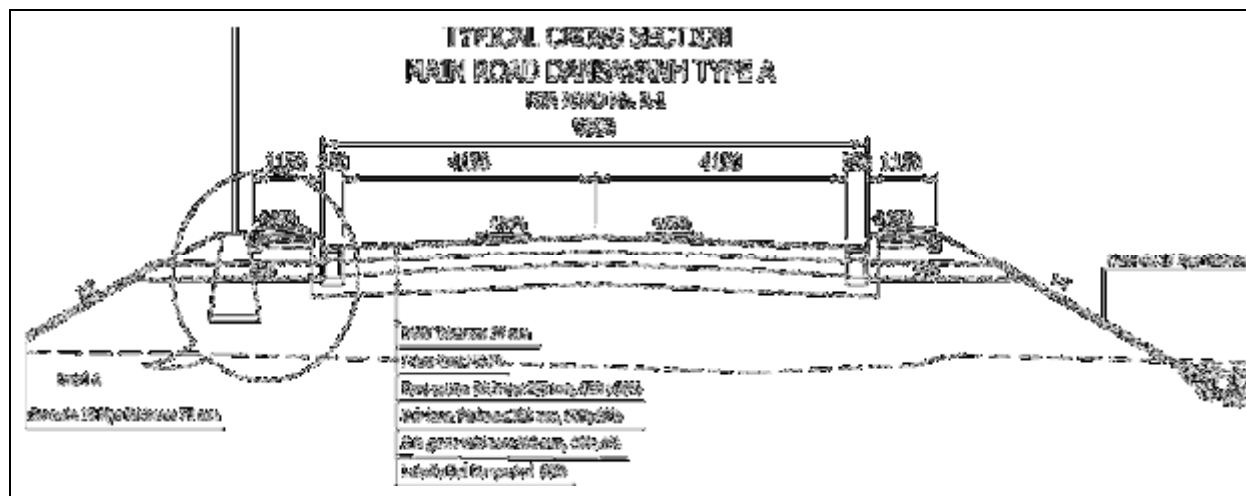
Road	Length in meters		Width in meters				
	Length	Total	Road	Motorbike	Footway	Drainage	Total
Main Road	1,739	3,884	2 x 3.5	-	2 x 1.15	open	14.2
Access Road	2,145		2 x 2.5	-	2 x 1.065	closed	7.85

130. The Dansavanh Rd subproject consists of a number of subsections of access road and main road. The sections are presented in the figure below.



Figure 20. Dansavanh Road

131. The typical cross sections used in the design as included in the Technical Design Report are presented below.



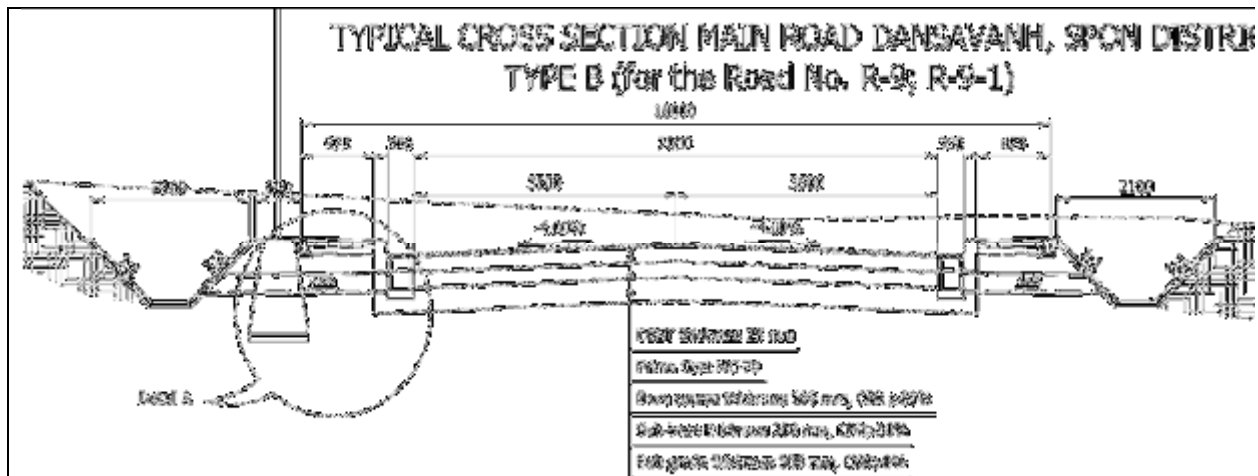


Figure 22. Typical cross-section of Dansavanh Main Road Type B

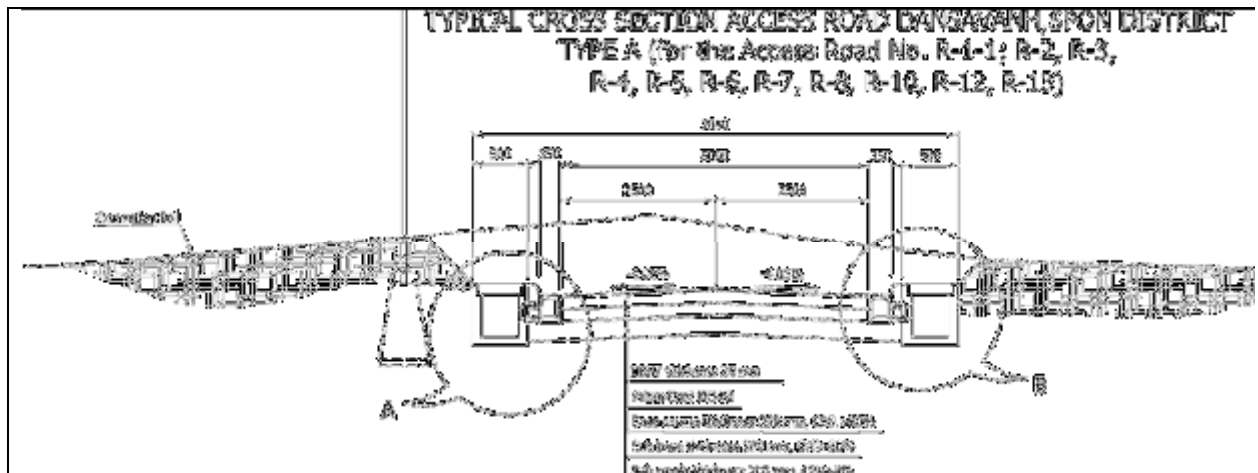


Figure 23. Typical cross-section of Dansavanh Access Road

132. To reduce the resettlement impacts, the road sections Road 6, Road 8, and Road 12 have been redesigned to reduce the width and hence the limit of construction and impacts along these road sections. The following designs have been prepared for these road sections.

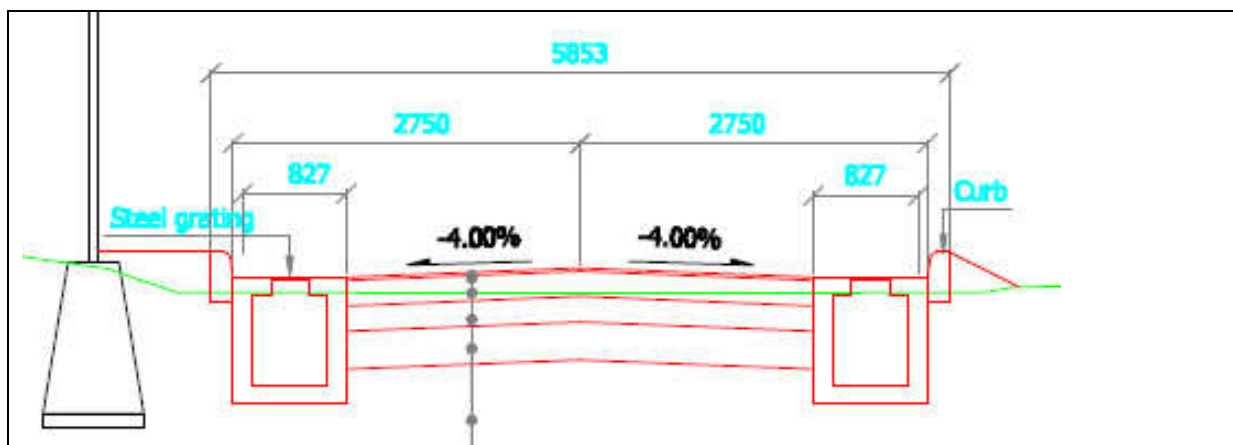


Figure 24. Updated design for cross-section of access road, Road 6 and Road 12



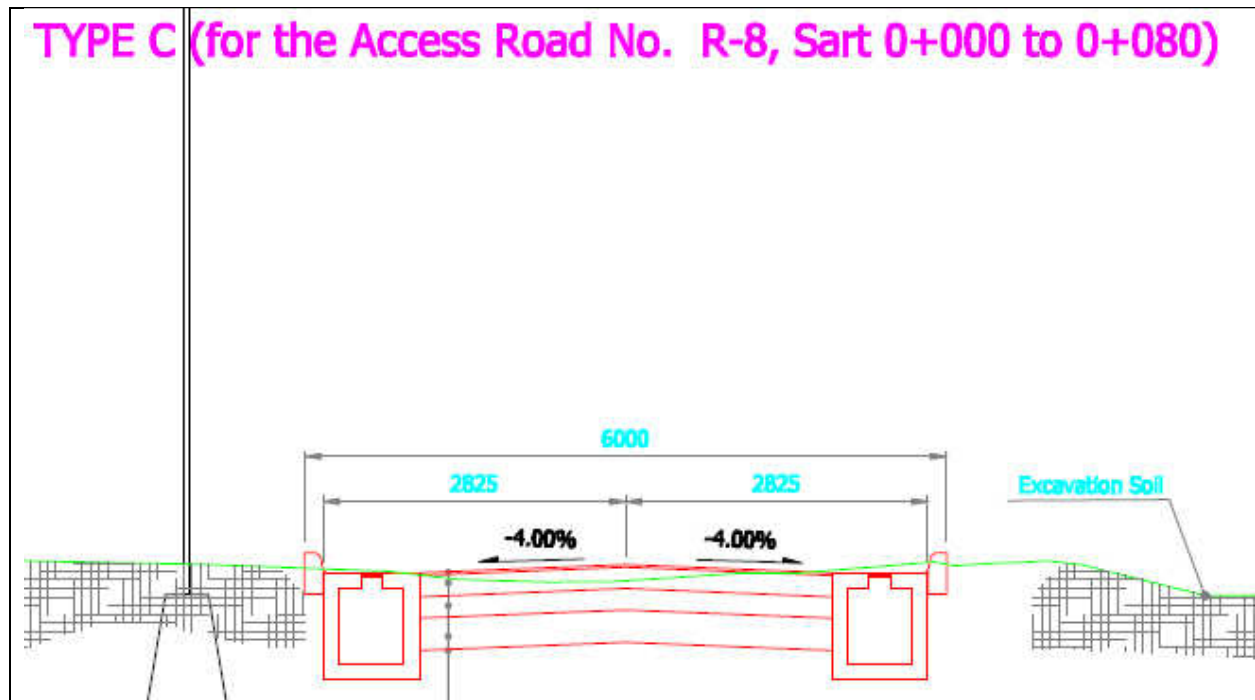


Figure 25. Updated design for cross-section of access road, Road 8

## V. DESCRIPTION OF ENVIRONMENT<sup>10</sup>

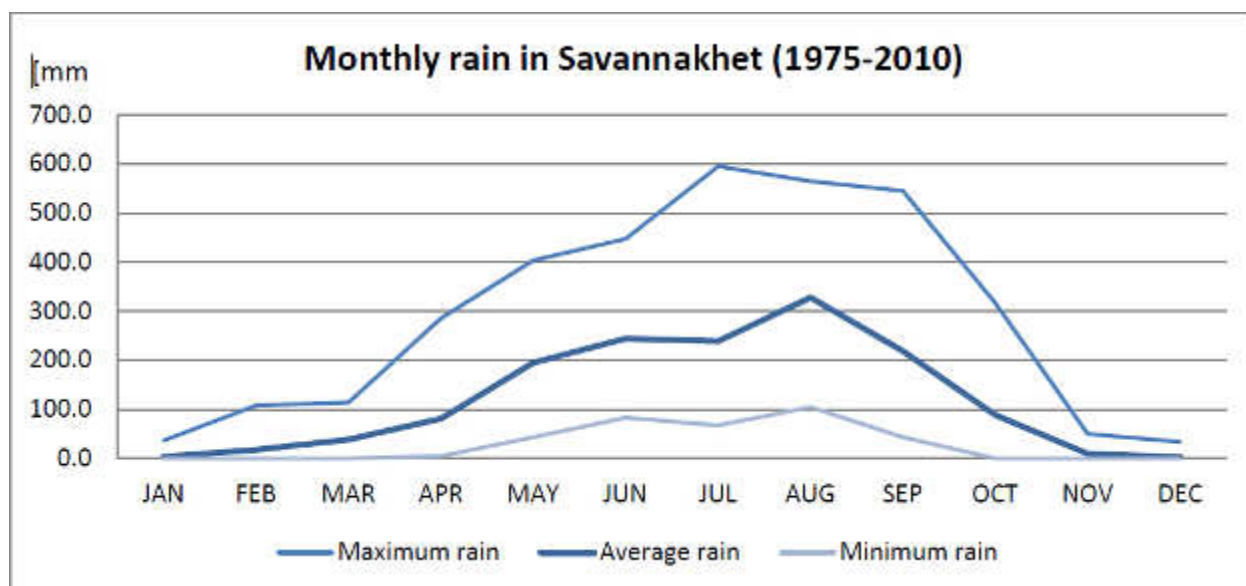
### A. Features Common to Kaysone Phomvihane, Phine, and Dansavanh

#### 1. Climate and Climate Change

133. Savannakhet has the typical tropical monsoon (wet-dry) climate of the region. During the rainy season (June to October), the winds of the southwest monsoon is responsible for an average monthly rainfall of >200 mm, occasionally reaching >500 mm (Figure 26). The dry season (November to April) is dominated by the northeast monsoon. The average rainfall in Savannakhet is 1,600 mm per year, which is about 175 mm less than the average for the country as a whole.

134. According to the Mekong River Commission (MRC), temperatures can range in Savannakhet from a minimum low of 13°C in January to a maximum high of around 39°C in April. Climate change may be considered an issue in the province due to observations of increased rainfall intensity and frequency in certain months as well as high precipitation in the upper part of the Annamite Mountain Range.

Figure 26. Seasonal rainfall in subproject areas

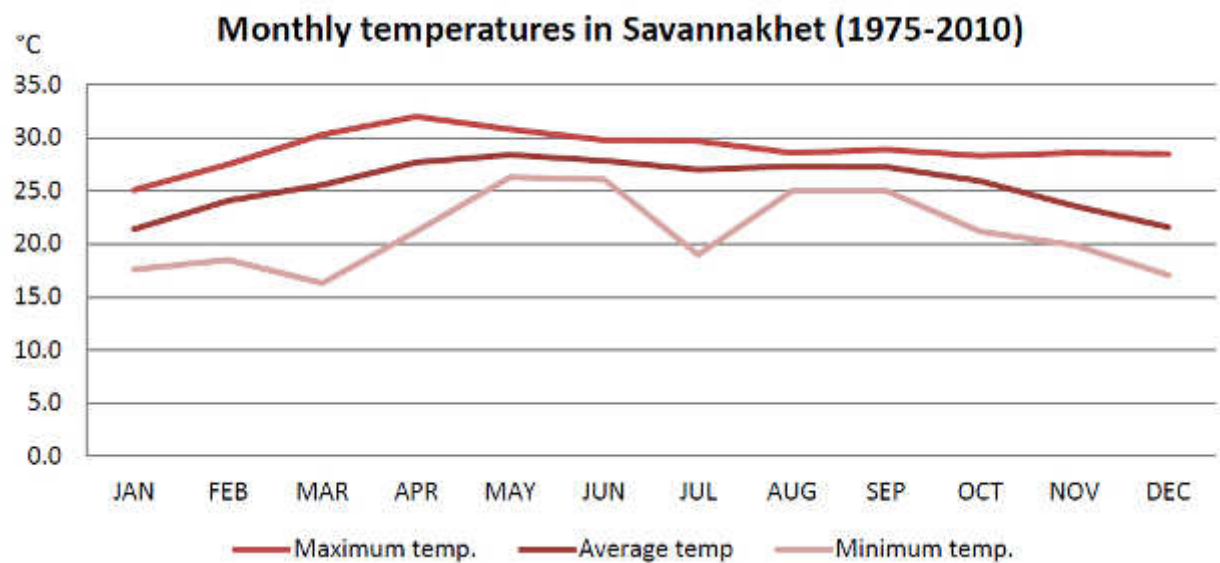


135. Savannakhet is the hottest and driest province of Lao PDR: the average temperature is estimated to be 26.1 degrees centigrade, which is about 2 degrees higher than the national average (Figure 27). The average number of hours of sunlight per year is estimated to be 2,280, which is about 257 hours longer than the national average<sup>11</sup>.

<sup>10</sup> This section is a repetition of the Description of the Environment provided in the 2012 IEE. Minor edits have been made.

<sup>11</sup> PEI, Poverty-Environment Initiative (PEI) (2011). Report on Economic, Social and Environmental Costs and Benefits of Investments in Savannakhet Province. Prepared by International Union for Conservation of Nature (IUCN), Lao PDR and The National Economic Research Institute (NERI), Ministry of Planning and Investment of Lao PDR

Figure 27. Seasonal temperature in subproject areas



136. Average daily temperatures in Southeast Asia increased by 0.5 to 1.5°C between 1951 and 2000, and mean temperatures across the Mekong River Basin will most likely increase further over the next 20 years. Similarly, climate change is expected to modify temperatures, rainfall and wind in the Lower Mekong Basin, affecting natural ecosystems as well as agriculture and food production, of serious concern in countries that rely strongly on natural resources. In Lao PDR agricultural and infrastructure losses due to increased storm intensity and frequency, land degradation and soil erosion from increased precipitation and a higher prevalence of infectious diseases are predicted.

137. A case study for climate change resilience in Kaysone Phomvihane was conducted in 2015 supported by the ADB<sup>12</sup>. The case study drew on climate change and hydrological modelling with the Mekong River Commission and other partners to prepare the climate change profiles for Kaysone Phomvihane for the year 2050. The key projected climate change impacts are presented in the table below.

Table 13. Summary of key projected climate change impacts (2050), Kaysone Phomvihane

Climate change parameter	Baseline	With CC	% Change
Annual precipitation	1570 mm	1758 mm	+12 %
Precipitation in wet season	1370 mm	1507 mm	+10 %
Precipitation in dry season	230 mm	260 mm	+13 %
T max	32.2 °C	34.3 °C	+2.1 °C
T max in wet season	32 °C	34.2 °C	+2.2 °C
T max in dry season	32.5 °C	34.5 °C	+2 °C

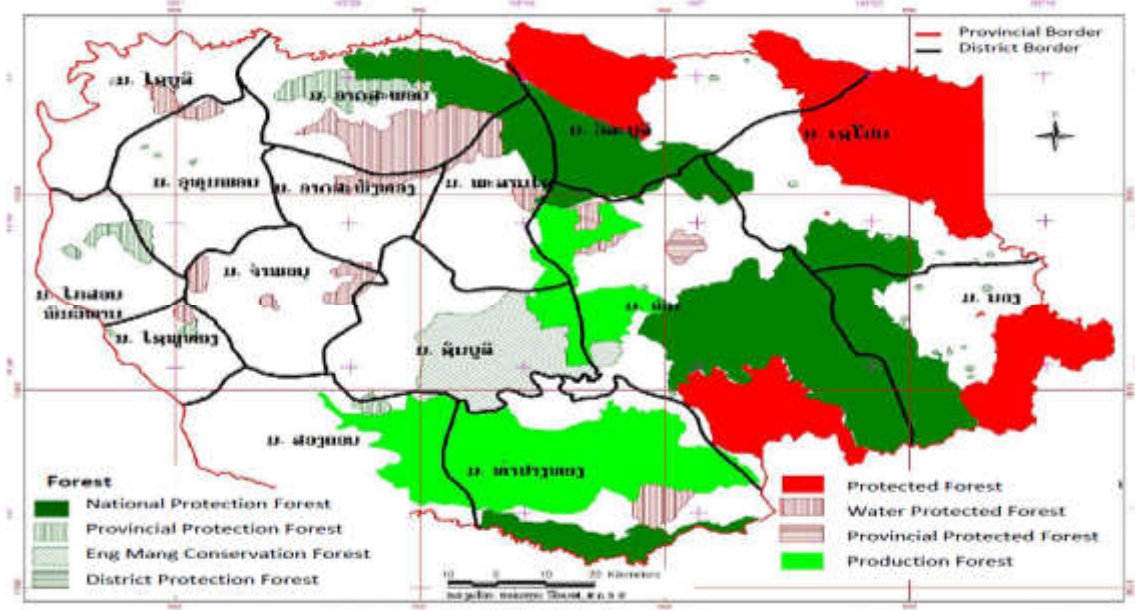
138. The projected climate change impacts include an increase of rainfall in the wet season by 10% and by 13% in the dry season. Also expected are increases in temperatures with average maximum temperatures to increase by 2 °C in the dry season and 2.2 °C in the wet season.

<sup>12</sup> ADB. 2015. Building Resilience in Kaysone Pomvihane, Lao PDR, Volume 7 of the Resource Kit for Building Resilience and Sustainability in Mekong Towns, Prepared by ICEM – International Centre for Environmental Management for the Asian Development Bank and Nordic Development Fund. Manila (TA 8186).

## 2. Terrestrial Characteristics

139. Savannakhet Province has a total forest area of about 1.1 million ha, representing about 52% of the total provincial area (PEI Report (2011)). Of that forest area, about 46% is conservation forest, 40% is protection forest and about 14% is production forest. The main types of forest in the Savannakhet Province are dry dipterocarp, lower and upper mixed deciduous, upper dry evergreen, bamboo, and poorly stocked forests (Figure 28).

Figure 28. Forest types of Savannakhet province



140. Kaysone Phomvihane is located where lowland forest habitats and wetlands determine the terrestrial ecosystems. The terrestrial ecosystem characteristics are considered fairly poor compared to other parts of the Province, only dry dipterocarp and mixed deciduous forests which support better biodiversity in wet season are more highly valued. The most important tree species still found in the project area is Mai Dou (*Dipterocarpus macrocarpus*).

141. Phine District is located where lowland forest habitats determine the terrestrial ecosystem. The terrestrial ecosystem characteristics are considered good compared to other parts of Savannakhet province. Most of the project area has dry dipterocarp, partly savannah and some mixed deciduous forests but the mixed deciduous forest is found mostly in upper areas. The most important tree species still found in the project area is Mai Dou (*Dipterocarpus macrocarpus*).

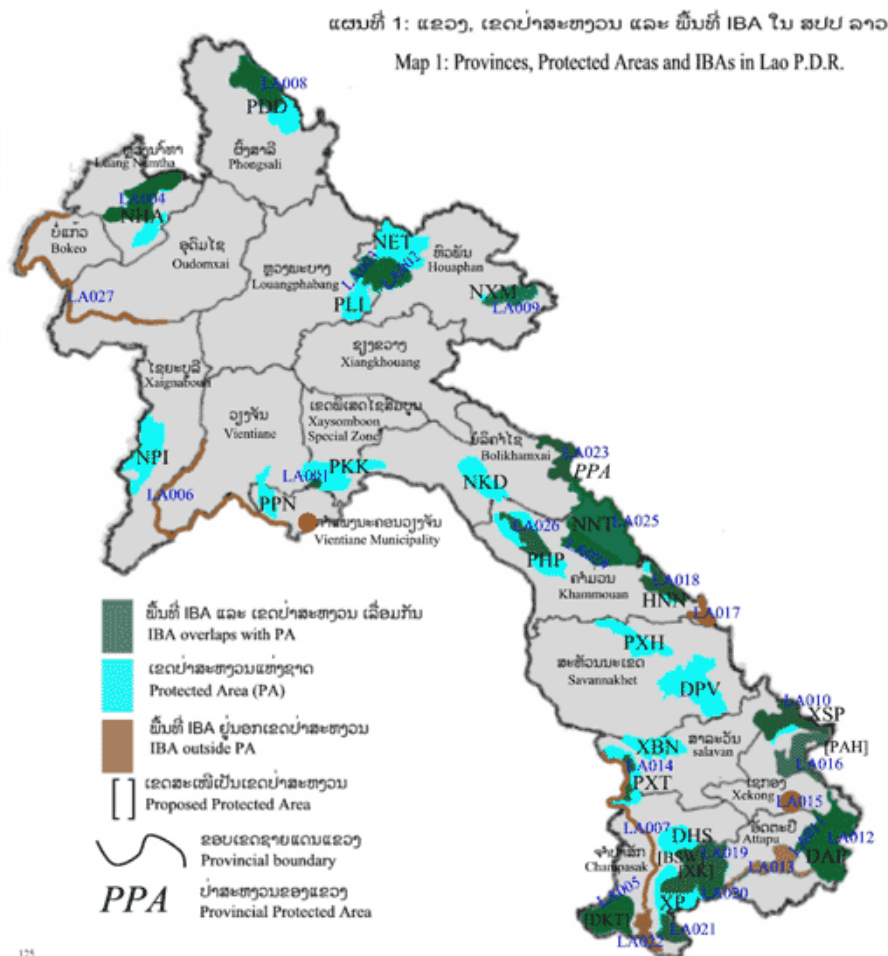
142. Forest cover in some part of Phine District has been converted to rubber tree plantation as the province allowed land concession permits in over 7,500 ha for industrial tree plantation. A number of small and medium sizes of plots, up to approximately 30 ha are found in the east of the district. However, most of the subproject area is not part of the forest habitat nor is it a refuge for wildlife given its urban characteristics. The western and eastern roads will, however, cut through a mixture of farmland and forest land.

143. Dansavanh is surrounded by forested area which includes some degraded forests. However, the terrestrial ecosystem characteristics are considered good. Forest cover and quality around Dansavanh has decreased because most villagers engage in hill rice cultivation and gardening such as bananas and aquilaria (Bong bark). The subproject area is located in the urban area and will not affect forest land.

### 3. Protected Areas and Rare and Endangered Species

144. Lao PDR is relatively wealthy in terms of protected areas (Figure 29). The province also has three National Biodiversity Conservation Areas (Phou Xang He, Dong Phou Vieng and Xe Bang Nouane as well as a number of provincial protected areas. The subproject sites of Kaysone Phomvihane and Dansavanh are not near any of these protected areas. The Dong Nata provincial protected area is located approximately 15 km east of Kaysone Phomvihane. However, the protected area of Dong Phou Vieng is located south of Phine and south of the Xe Chon River. Dong Phou Vieng was established in 1995 and extended in 1998 to a total of 1,970 km<sup>2</sup>. With the northern boundary of the site running along the southern bank of the Xe Chon, the integrity of the site will not be disturbed by the implementation of the project. There are no natural or critical habitats directly affected by the subprojects. No rare or endangered species or critical wildlife habitat are located in subproject areas.

Figure 29. Protected areas and IBAs in Lao PDR



145. The site of the sanitary landfill in Kaysone Phomvihane District is an existing site and only supports secondary re-growth of trees. Although some number of bird species are present in Kaysone Phomvihane there are no IBAs in or immediately around the subproject area.

146. There are no protected areas or sensitive habitats in the Phine subproject area. Although many bird species are present in Phine area there are no IBAs in the subproject area. No rare or endangered terrestrial or aquatic species of flora or fauna are recorded in the subproject area.

147. Many bird species are present in Dansavanh district, however, there are no IBAs in or immediately around the subproject area. Mixed deciduous and evergreen forests are important habitat for some mammals including sambar, barking deer, civets, wild pigs, a number of reptiles etc. Most wildlife found is quite far to the north of the town. No sensitive habitats or rare or endangered terrestrial species of flora or fauna are recorded in subproject.

148. The complete species lists compiled for each subproject area are listed in the Appendices.

#### **4. Natural Hazards**

149. Natural hazards applicable to Savannakhet Province include flooding and extreme weather. Kaysone Phomvihane is prone to flooding during heavy rain and due to insufficient drainage capacity of the town's drainage system. For a more detailed description of the flooding issues refer section IV.C & V.B.5. Phine is also prone to flooding during heavy rainfall, due to an insufficient drainage system. For a description refer section V.C.7.

#### **5. Unexploded Ordnances**

150. UXO clearance surveys for Kaysone Phomvihane, Phine, and Dansavanh were undertaken in 2015 by Soupha Engineering Consultant (SEC). The survey of Kaysone Phomvihane concluded that there is no need for UXO clearances in this District.

151. Data on bombs dropped by US forces between 1965 and 1973 is available from the National Regulatory Authority for UXO/Mine Action and has been reviewed. While Savannakhet Province was intensively bombed in the eastern part of the province, the available maps do not indicate bombing activity in the Kaysone Phomvihane District and there are no records showing bombing activity in the subproject areas in the Kaysone Phomvihane District.

152. Based on the abovementioned survey and the records, it is assessed that there are no risk of encountering UXOs in connection with the construction work in Kaysone Phomvihane District.

153. The surveys undertaken in 2015 did not identify UXOs in the subproject areas in Phine and Dansavanh either. However, considering the greater risk associated with these subproject areas assessed on the basis of records of bombing activities and identification of UXOs, detailed UXO surveys are currently underway including the road alignments and borrow-pits.

154. As specified in the EMPs, appropriate GoL certification on UXO will be obtained prior to start of construction (certificate of UXO clearance or no UXO clearance needed).

### **B. Kaysone Phomvihane**

#### **1. Water Environment and Surface Water**

155. The dominant surface water body is the Mekong River to which all other rivers/streams in Kaysone Phomvihane drain. The Mekong River flows almost 1,900 km through Laos. Five kilometers of this length passes by Kaysone Phomvihane, where its width varies between 1.25 km and 1.6 km.

156. The Mekong River Commission (MRC) conducts water quality monitoring at stations along the Mekong on a monthly basis. The most recent published results available at their website are



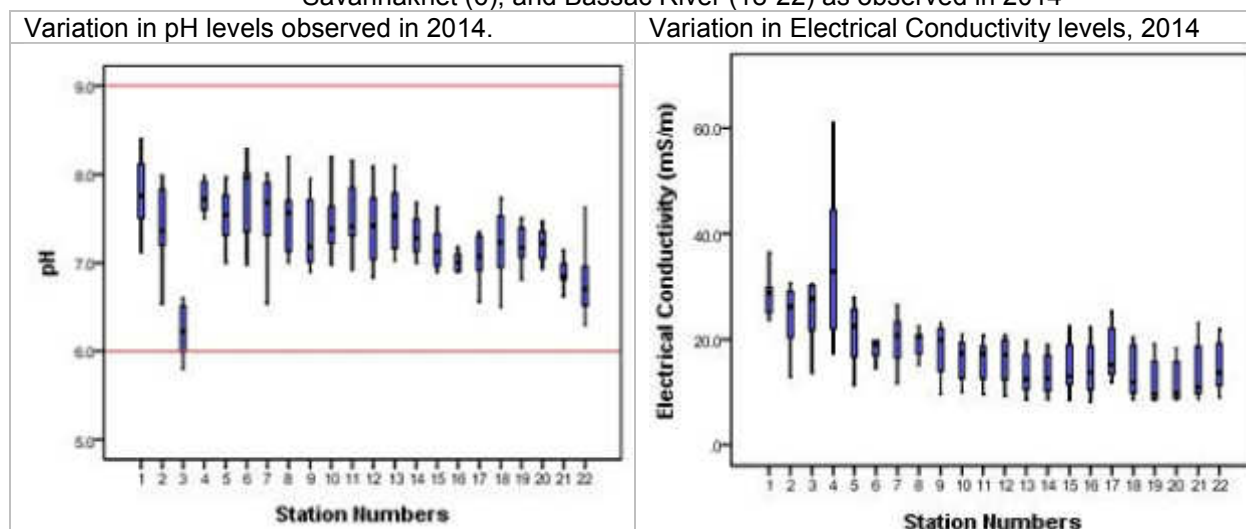
from 2014 and published in 2016<sup>13</sup>. Station No. 6 Savannakhet with ID H013401 is located in Kaysone Phomvihane. The report includes summary results in three water quality classes for the protection of aquatic life, human health, and for agricultural use. The water quality indices at the Savannakhet monitoring station are presented in the table below.

Table 14. Water quality class of the Mekong River at monitoring station 6: Savannakhet, 2009-2014.

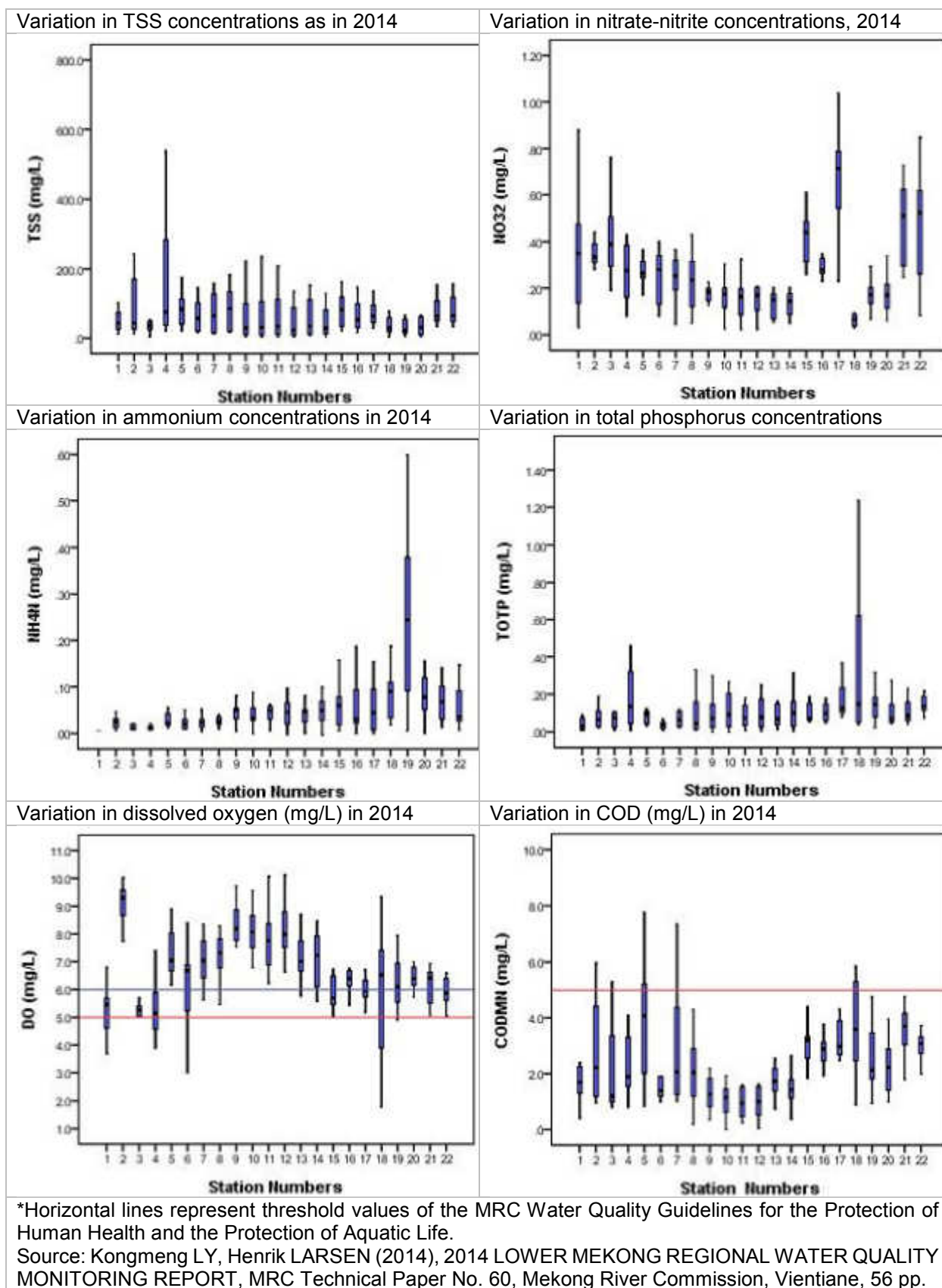
Water quality class	2009	2010	2011	2012	2013	2014
For the protection of aquatic life*	A	A	A	A	B	B
For the protection of human health*	A	A	A	B	B	C
For agricultural use**	A	A	A	A	A	A
*A: High; B: Good; C: Moderate; D: Poor; E: Very Poor						
**A: No Restrictions; B: Some Restrictions; C: Severe Restrictions						

157. At Savannakhet, the water quality class for protection of aquatic life has declined from high in 2009-2012 to good in 2013 and 2014, attributed to a slight increase in total phosphorous concentration above the threshold. The water quality class for protection of human health has declined from high in 2011 to moderate in 2014. This decline is a result of elevated chemical oxygen demand levels as well as low dissolved oxygen levels. The water quality class for agricultural use remains high with no restrictions on use. The results of the water quality monitoring on the selected parameters in 2014 are presented in the figure below.

Figure 30. Variation in water quality parameters along the Mekong River (1-17), where Savannakhet (6), and Bassac River (18-22) as observed in 2014



<sup>13</sup><http://www.mrcmekong.org/assets/Publications/technical/Annual-Water-Quality-Report-2014-final-lowres.pdf>





## **2. Aquatic Ecology Characteristics**

158. The main aquatic ecosystems around Kaysone Phomvihane are found in the Mekong River, its tributaries and various streams as part of the larger catchment area of Mekong. The most extensive knowledge of aquatic resources is related to fish while other aquatic resources such as amphibians, reptiles, molluscs, crustaceans, and water insects have not been well researched.

159. Fish species found in the area of Kaysone Phomvihane are mostly Panin (*Tilapia*), Panai (Nile *Tilapia*), Pakheng (*Cirrhinus* sp.). Occasionally, they are more fish species found in the area, migrating up the streams and canals in wet season including Pakhao (*Akysis bantamensis*), Padouk (*Clarias batrachus*), Pakho (*Channa striata*), Pakha yang (*Cirrhinus* sp), Pakadeut, Pakhao, Pasiew etc. None of the fish species are rare or endemic.

160. Aquatic animals and amphibians are also found in the area and many associated with paddy fields. No sensitive habitats or rare or endangered aquatic species of flora or fauna are recorded from the project area.

## **3. Socio-Economic and Cultural Setting**

### **a. Demographic Characteristics**

161. Based on the 2015 Population and Housing Census (National Statistics Center), the population of the town was 125,622 and the total number of households was 21,132 with an average household size of 5.9.

Table 15. Population figures and projections in Kaysone Phomvihane Town and District

<b>Year</b>	<b>Population in town</b>	<b>Total Population</b>
2015	79,339	125,622
2016	80,608	127,632
2017 (projection)	81,898	129,674
2020 (projection)	85,892	135,999
2025 (projection)	92,987	147,233
2030 (projection)	100,668	159,396

162. It is projected that the population would increase to 159,396 by 2030.

## **4. Poverty Incidence and Vulnerable Groups**

163. The Prime Minister's Decree No.285/PM (13 October 2009) established the most current poverty lines, based on average per capita monthly income as derived from data analyzed in the Fourth Lao Expenditure and Consumption Survey (LECS-4). The poverty lines are given as follows: (i) national poverty line - per capita income below 192,000 kip/month; (ii) urban poverty line - per capita income below 240,000 kip/month; and rural poverty line - per capita income below 180,000 kip/month.

164. Based on the thresholds given above, the poverty rate of Savannakhet province is recorded at 43% which is higher than the national rate of 34%. There are three districts in the province that are classified as among the poorest districts in the country but Kaysone Phomvihane is not one of the three due to its favorable conditions.

165. Based on Decree 192, vulnerable people are classified in Kaysone Phomvihane as marginalized and vulnerable include the poor, those engaged in the informal sector including: casual and seasonal laborers; landless farmers; small vendors and street sellers and those who have limited access to, or are unable to take advantage of, urban economic opportunities. In the town, there are also a number of people who make livelihoods from picking through the rubbish at the landfill and selling plastic, cardboard/paper and aluminum cans to a private recycling operator.

## 5. Economic Activities and Employment

166. Given its strategic presence along the transport corridor, Kaysone Phomvihane Phomvihane has emerged as the focal point for development of secondary and tertiary industries that are established in the province of Savannakhet. The service sector and the industry and commercial sectors are the major source of employment and income for local inhabitants who work in both private business establishments and government institutions.

167. Local employment and job opportunities are expected to increase over the next two decades with the anticipated increase in the number of industry locators in the SSEZ which is approximately 2 km from the town center.

168. Based on gross domestic product (GDP), over the three-year period 2007 to 2010, the economy of Kaysone Phomvihane grew from 9.4% to 9.8%. Per capita GDP increased from \$712 in 2006 to \$1,027 in 2010 and is expected to be as high as \$1,464 by 2014. There has been a gradual shift away from the agriculture sector (with a share of 20.9% of GDP in 2006 to 20.3% in 2010) and services sector (GDP share reducing from 48.2% in 2006 to 46.6% in 2010) to the industrial/commercial sector (increasing its share of GDP from 30.8% to 32.9%). It is the industrial/commercial sector which is expected to continue to grow.

Table 16. GDP over 2006-2009 and estimates for 2010-2014 in Kaysone Phomvihane

Sector	Year							
	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14
GPD growth rate (%)		9.41	9.68	9.75	9.82	9.97	10.85	10.89
Agriculture-Forestry (%)	20.9	20.9	20.7	20.5	20.3	20.0	19.6	19.1
Industry-Commerce-Handicraft (%)	30.8	31.2	31.8	32.3	32.9	33.4	34.3	35.1
Service (%)	48.2	47.8	47.4	47.0	46.6	46.7	46.1	45.6
GDP per capita (US\$)	712	870	945	1,027	1,116	1,215	1,333	1,464

Source: 2009 Statistic Survey, Planning Office, Kaysone Phomvihane

169. In 2010, the town had 368 factories (food processing, garment making, wood processing and furniture making, concrete products and aggregates) with a total production output valued at 450.3 billion kip.

170. Although the agriculture sector is declining, rice is still the predominant agricultural product in Kaysone Phomvihane, with volume produced accounting for about 20% of national production since 1990s. Rice production is undertaken over an area of 14,681 ha. In addition to rice production, the area is becoming known as a rubber and eucalypt growing area; there are 180 ha planted with rubber trees and 105 ha planted with eucalypts.

171. The number of hotels, lodging houses and restaurants are increasing to accommodate the growing number of visitors and tourists in Kaysone Phomvihane. These establishments which are mostly in the town center are providing local employment to residents.

172. About 60% of households in the town are engaged in activities in the commercial and services sector and reflects the increasing number of medium and large trading and commercial enterprises in the town. Over a third (38%) of households are still engaged in agriculture including small-holder farming, rice production, livestock and poultry raising and fish farming.

Table 17. Main sector of economic activity in Kaysone Phomvihane

Sector	% of HHs
Agriculture and forestry	38.5
Handicraft	1.5
Commerce and service	60.0

Source: 2009 Statistics Survey, Planning Office, Kaysone Phomvihane

173. The 14 to 60 year age group constitutes more than two-thirds (68%) of the labor force. In general, it has been noted by the Planning Office that the labor-force overall has low levels of skills and education. However, funds available through provincial government programs to support vocational skills training and upgrading of human resources are inadequate.

#### Service and Infrastructure

174. In the town, there are 40 kindergartens, 71 primary schools, 21 secondary schools and one university. In terms of access to health care services and facilities, there are 1 hospital, 13 health centers, 34 pharmacies and 39 private clinics.

175. There are three large markets/trading centers and two small markets operating in the town. These markets are outlets for locally produced vegetables, fruit, meat and processed goods. In the town center there are 3,226 commercial and shops registered generating earnings in the order of 9.7 billion kip.

#### Transportation Services and Facilities

176. Kaysone Phomvihane is accessible by land, air and waterways. The completion of the Second Mekong River Friendship Bridge is providing easier access for freight forwarder, passenger bus, and tour buses to Mukdahan, Thailand or from Thailand to Savanakhet. The Friendship Bridge also provides easy links to Viet Nam via NR9, there are shuttle buses travelling to Mukdahan (Thailand) and Quang Tri (Viet Nam). The bus terminal in the town center provides national (Vientiane, Pakse, Thakek as well as to other provinces in southern Lao PDR) and international services for trips to other parts of Lao PDR and to Thailand and Viet Nam (Quang Tri, Da Nang, Thua Tien Hue and Ha Noi). There are 12 shuttle buses per day from Mukdahan to Savanavegas Casino.

177. Kaysone Phomvihane has an international airport located in the southern part of the town with total area of 104 ha, and a 1,650 m long runway. The domestic flights through Savannakhet between Vientiane and Pakse operate three times per week, and international flights to Bangkok (Thailand) also operate three times per week.

#### Water Supply System

178. The state-owned water supply enterprise - Nam Papa - operates and manages the water supply and sanitation system in the town. Of the district population of 118,748 in 2010, Nam Papa supplied potable water to about 75,000 people, covering 63% of the population. The area served by the town supply includes the six village development clusters under the jurisdiction of the UDAA. The existing water supply system was established in 1974 and completed in 1977. The facility includes a water treatment plant with a capacity of 15,000 m<sup>3</sup>/day and a main transmission and distribution pipeline network of 54 km. The water treatment and supply facilities have deteriorated due to limited financial capacity and resources for O&M.

Table 18. Population served by municipal water supply system

Item	Year			
	2010	2014	2015	2016
Population in district (no.)	124,541	125,292	125,622	127,632
Population in service area (no.)	76,905	78,595	79,339	80,608
Serviced area (ha)	1,340	1,340	1,340	1,340
Household connections (no.)	12,402	12,468	12,896	13,170
HH service rate (%)	62	63	63	63

Source: Nam Papa, Province of Savannakhet

179. In 2003, a grant from Japan provided technical and financial assistance to Nam Papa for the rehabilitation of the water intake and water treatment plant facilities. As a result, the system managed to restore its original daily capacity. In its efforts to meet the water supply requirements of the increasing number of households in the town center and adjacent areas, in 2010 Nam Papa agreed a Memorandum of Understanding (MOU) with a Malaysian private sector group for expansion of the water supply system to provide an additional capacity of 7,000 m<sup>3</sup>/day.

#### Sewer and Sanitation

180. Wastewater from households and businesses is currently treated via: i) septic tanks and latrines for sewage (black water) with overflow to roadside stormwater drains, and ii) direct discharge to stormwater drains for household sullage (grey water). Roadside drains discharge to main drainage channels.

181. There are no grease/sediment traps installed for pre-treatment of grease and oil from either households or small commercial enterprises. Small industries usually discharge waste directly to the drainage system following simple treatment via storage tank. The inadequate installation of effluent pipes from septic tanks is causing leakage of sewage and thus risk of pollution of soil and ground water.

182. The 2012 Feasibility Study estimated that the wastewater generated in Kaysone Phomvihane was 14,000-15,000m<sup>3</sup>/day from three sub-catchments assuming a per capita domestic water consumption of 180L/capita-day and 80% return rate to the sewer (i.e. per capita wastewater rate of 144L/day), pollution load of 45g/capita-day (hence a BOD concentration of 320mg/L). The operation of household septic tanks will reduce the BOD discharged to the road drains (typically up to 50% of BOD).

#### Solid Waste Management

183. The solid waste management system in Kaysone Phomvihane involves the collection of garbage from residential areas, hauling it to the designated dumpsite (16 ha with four cells) which is about 12 km away from the town center. Waste from households and businesses is currently collected by UDAA (and private contractors) and disposed at a dump site designed and constructed in 1998 using UNDP and NORAD funds.

184. UDAA is responsible for operating the site which is not designed nor operated as a sanitary landfill. The solid waste management system is inadequate to serve the municipality's increasing population.

185. The coverage level is only 35% with 4,300 households (out of >12,000) registered as customers by the UDAA. 25 out of 31 villages in the district are serviced. There are 368 factories (2010) and three large and two small trading markets, as well as 3226 commercial shops (2009). Hotels, restaurants and large businesses are responsible for disposal of their own wastes to the dump site.

186. An estimated 45-60 tons of solid waste are generated daily and an estimated 25-28 tons are collected daily, although there is no weighing system to measure the waste entering the site. The existing dump site has a fenced area of 16 ha, with 4 cells of 1.25 ha. Two cells are partly excavated and partly filled with solid waste. Waste cells are not covered hence the site is continuously littered. There are frequent land fill fires at the site. No drainage was included in the works since the soils were presumed to be impermeable hence leachate was designed to be collected and flow to a treatment pond on-site. However, the system does not operate (probably due to leachate leaching into the soils). There is no system for managing hazardous wastes. The provincial hospital has a small autoclave for disposal of infectious medical wastes. Private contractors collect hazardous wastes from industries however the ultimate disposal point is not clear.

187. The existing recycling system is based on informal collection in the city of the most valuable fractions, selling them to junkyards and dealers. A materials recovery facility (MRF) is located on the dump site and is operated by a private contractor and recycles paper, plastics, and scrap metal. The recycled materials are transported to Thailand, China and Vietnam. A number of waste pickers operate at the site and there is extensive informal recycling/sorting carried out by the collection crews during collection. The "informal" sorting (waste picking) and recycling which occurs on the waste disposal site (as well as during waste collection) is extensive but has the side effect of making the waste disposal less efficient due to slowing down the collection process or disposal process. The working conditions of waste pickers are poor and workplace health and safety is an issue.

#### Flood Control and Drainage

188. The existing drainage system in the town center area consists of roadside drains and open channels where flood water flows through natural streams and creeks before finally discharging to the Mekong River. Flooding often occurs in the old town after heavy rain when flood waters cannot be drained away.

189. UDAA (Urban Development Administration Authority) and DPWT at both Provincial and District level has reported that rainstorms will cause flooding in central town with some 30 cm water in the streets may occur, receding after 1-2 hours. Certain low-laying areas are more flood-prone, with 40-50 cm of flood water commonly occurring, e.g. 5-6 times during the whole wet season.

190. Such flood events are normal and are expected to happen every rainy season. These flood events can happen at all times during the rainy season and are not related to high water levels in Mekong river.

191. A main cause of flooding in Savannakhet is insufficient capacity of the drain channels, probably caused by a combination of design deficiencies and insufficient maintenance. The actual capacity of the drainage system in Savannakhet is not known, it is evaluated that flooding can be reduced by proper maintenance of the drains. A fully functional drainage system may require redesign and reconstruction.

192. The drainage network and flood mitigation system is an old system that was improved during 2000 - 2003 under the ADB-assisted Secondary Towns Development Project (covering Savannakhet and four other areas). At that time, the primary, secondary and tertiary drainage channels in the town area were rehabilitated, and flood gates were installed at the outfall to the Mekong River.

193. At present, there are three large discharge points from the town to the natural canals that eventually flow to the Mekong River. However, only two of these locations have flood gates to prevent water from the Mekong River flowing back to the urban area. These gates have never been operational due to mechanical defects. As a result, flooding occurs during heavy rains and would be exacerbated if the Mekong River is at high water level.

### Urban Roads

194. The PDWT is also the agency responsible for the road network and transport planning. The JICA study indicated that there is a total road network of 192.5 km within the Kaysone Phomvihane Town. The total main roads have 55 km of paved roads and 10.5 km of unpaved. The minor paved roads are 46.6 kilometers and unpaved is 77.4 kilometers. In addition, nearly 3 km of access road and footpath was constructed under a Japanese grant between the intersection located on National Road 9 and the Second Friendship Bridge.

195. Sections of the road network have also been improved and constructed under the ADB-assisted Secondary Towns Development Project. A number of narrow interior urban roads traverse the old town center, running parallel to and perpendicular with the main road along the Mekong River.

196. Good road conditions (15 - 20 m width) provide easy access for traffic to and from the Second Friendship Bridge. While the lateral roads in the interior of the town are constructed with bitumen surfaces, the majority of these interior roads have been constructed without drainage structures while other road sections are not properly connected to natural drainage canals, and therefore are frequently flooded.

### Support Infrastructure to Special Economic Zones

197. The SSEZ is a thriving hub of trade and services within the GMS consists of support infrastructure including: i) the EWEC linking Thailand, Lao PDR and Viet Nam along NR 9 and also along the north-south axis with NR 13 linking Cambodia, Lao PDR and the People's Republic of China; ii) the Second Friendship Bridge across the Mekong River; iii) Savannakhet International Airport; iv) the 115kV power grid and supply; and v) the Government fully supports the development and has invested \$7.3 million to establish the office facilities in Site A in addition to the funds for resettlement and compensation.

198. On the 18th of May 2007, SSEZ signed agreement with Malaysian developer-Pacifica Streams Development Company to develop a commercial and Industry Park in Site C to attract foreign investment along the EWEC. Development is divided into 4 phases. On 16 June 2010, Company started work on phase 1 by developing industrial lots including provision of basic infrastructure. By end of June 2011, 24 investors (including eight national) had received permission to establish in Site C.

Table 19. Industries locating in SSEZ in Kaysone Phomvihane

<b>Investor nationality</b>	<b>Industry/enterprise</b>	<b>No. of</b>
Lao PDR	Vehicle assembly; concrete; freight	8
Malaysian	Motorcycle assembly	3

Hong Kong	Garment	2
Japan	Vehicles; tin smelting	2
Holland	Small parts manufacture (Boeing)	2
South Korean	Vehicle assembly	1
Thailand	Import-export goods	1
Belgium	Diamond cutting	1
France	Concrete processing	1
Australia	Import equipment/material for gold mining	1
JV Lao PDR - Malaysia	Import second-hand vehicles	1

Source: Pacifica Streams Development Company (July 2011)

## 6. Physical and Cultural Resources

199. The presence of physical and cultural resources in the subproject areas are assessed in more details in the EMPs and where relevant mitigation and monitoring measures proposed.

200. Key cultural resources and sensitive receptors in the area affected by the Fa Ngum subproject includes the Kaysone Phomvihane Memorial Park, the Kaysone Phomvihane Cultural Hall, the Wat Phonesavang Tai, and the Hospital of Kaysone Phomvihane District and vocational training centre for disabled.

201. The Kaysone Phomvihane Road functions as a ring road connecting the Road 9W and the Road 9B in the south. Along the road are a mix of residential houses, businesses and commercial infrastructure such as the market in the south. The road is also the main access to the Savannakhet International Airport.

202. Key sensitive recipients along the Kaysone Phomvihane road includes the Thippanya Kindergarten and Elementary School, the Xaysombath Technology College, Kindergarten, and Primary and Secondary School. Key social resources in the project area includes the Savannakhet International Airport with the main access road to the airport. Also of significance is the Samakkhixay Market located at the southern end of the road. The market is one of the biggest in Savannakhet with access via the Kaysone Phomvihane Road. Alternative access to the market is possible. Key cultural resources in the area affected by the project includes the Kaysone Phomvihane Memorial Park located at the junction with Fa Ngum Road.

## 7. Land Use

203. The land use of Kaysone Phomvihane District is mainly residential and industrial, paddy fields, woodland and grassland. The forest is found to the east of the town - basically around Dong Nata provincial protected area located about 15 km east of town.

204. The emergence of Kaysone Phomvihane as a town started with the movement of people from the area adjacent to the Mekong River, to the eastern and northern areas of what is now the town center. The completion of the Second Friendship Bridge, linking Kaysone Phomvihane to Mukdahan in Thailand has encouraged the spread of residential and commercial establishments along NR 9 requiring further conversion of previously unused lands and agricultural areas. With the increased trade and traffic volume, the land use pattern has changed to accommodate the use for residential and commercial purposes. At present, residential and commercial mixed uses account for 64% of urban land use. The mixed use policy is provided for in the Master Plan of the town.

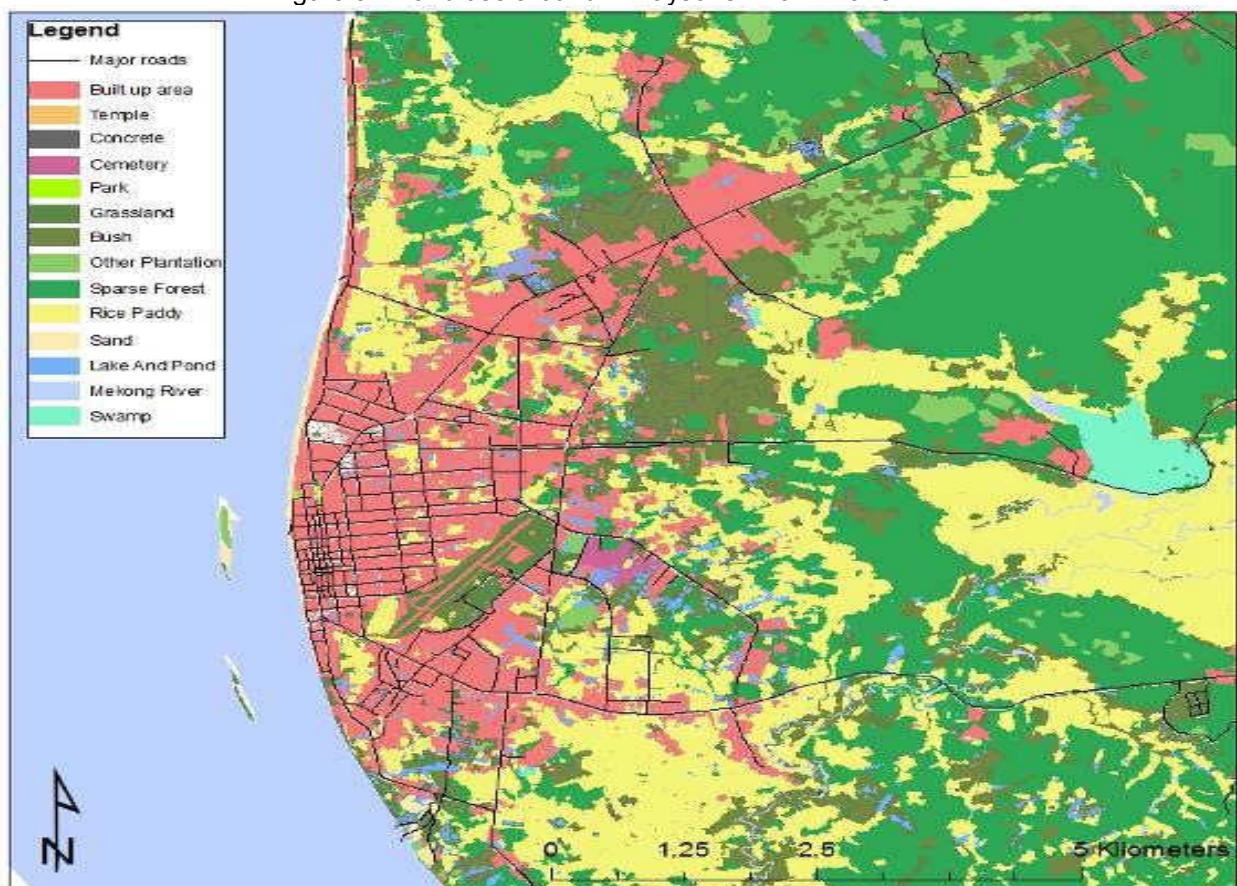
205. The centre of Kaysone Phomvihane is the old town center built during the colonial period. The town center is characterized by thriving trading and commercial activities including production of goods in Savannahket and trade of goods imported from Thailand and Viet Nam. The town center is divided into zones or areas including the old city center with heritage buildings remaining from the French period.

206. Around the old city center is the core business district including banks, shops, hotels and restaurants located along the major city thoroughfare. Along the Mekong River, facing Moukdahan, there are also a number of hotels, small restaurants and eateries, and makeshift recreational facilities that were erected during the traditional boat racing festivals.

207. The provincial and district offices of government agencies are mainly located along the Mekong River as well as a complex located on Fa Ngum Road. There are two public parks in the town, one is within the provincial government complex and features a statue of former President Kaysone Phomvihane, a small museum, and trees. The other park is located next to an old sport stadium on the bank of the Mekong River.

208. It should be noted that a new city center has been designated along the EWEC, which is envisioned to be the future center of economic activities for the district, given the presence of the SSEZ. This location is considered ideal for the expanding commercial and business establishments such as supermarkets and shopping malls, restaurants and hotels. It would also serve as a new tourist destination in the province.

Figure 31. Land use around in Kaysone Phomvihane





## C. Phine

### 1. Water Environment and Surface Water

209. Phine is located in on the northern bank of the Xe Chon River and in the Xe Chon floodplain. The town drains to the Xe Chon River via the streams Huay Ding, Huay Namxai, and Huay Xan. The protected area of Dong Phou Vieng is located south of the town and south of the Xe Chon River. The protected area of Dong Phou Vieng is located south of the town and south of the Xe Chon River. Water quality monitoring data has not been reviewed and is understood to not be available with DONRE.

### 2. Socio-Economic and Cultural Setting

210. Phine is one of the 15 districts in Savannakhet<sup>14</sup>, the district comprises 100 villages of which five villages make up the main town and urban area of the district.

#### a. Demographic Characteristics

211. Phine district is divided into 15 village development clusters comprising 13 urban villages and 87 rural villages. There were 10,183 households and a district population of 65,085 in 2015; an increase from 8,325 households (22.3%) and a population of 56,523 (15.1%) in 2010. The town of Phine consists of five villages and an area of 1,249 ha. The distribution of the population in these five villages in 2015 is presented in the table below. The total population in Phine town has increased by 21% from 5,643 to 6,828 between 2010 and 2015. The number of households has increased by 21% from 909 to 1,102 and the average household size remained 6.2.

Table 20. Population by village in Phine, 2015

Village	No. of households	Av. Household size	No. population		
			Total	Female	Male
Napho	270	5.4	1,446	718	728
Sakhueang	84	5.8	490	252	238
Pasomxay	272	7.4	2,023	984	1,039
Veunhongkham	203	6.1	1,232	588	644
Phine	273	6.0	1,637	813	824
Total	1,102	6.2	6,828	3,355	3,473

Source: Phine Annual Report, 2015

212. There are no official records on the number of people moving in and out of Phine. However, information from local authorities indicated that young people migrate out from their villages to seek economic opportunities in the other cities and provinces in Lao PDR and in the neighboring countries of Thailand and Viet Nam. There are workers from Viet Nam coming to Phine to work in rubber and cassava plantations, construction activities and a number have settled in the town and operate small businesses (restaurants and shops). There also a number of Chinese and Vietnamese nationals who are involved in commerce and trade along the main road.

### 3. Poverty Incidence and Vulnerable Groups

213. The poverty rate in the town has been reduced substantially since 2010 where 6.7% of households fell below the poverty line compared with 1.4% in 2015. While the village Sakhueang

<sup>14</sup> Savannakhet province is divided into 15 districts and comprises 1,016 villages (37% urban).

still has a larger proportion of poor than other villages, the situation has improved significantly compared with 2010 where about a third of households fell below the poverty line.

Table 21. Poverty rates of Phine 2010 and 2015

Village	2010			2015		
	No. of households	Poor households		No. of households	Poor households	
		No.	%		No.	%
Napho	213	16	7.5	270	4	1.5
Sakhueang	54	18	33.3	84	3	3.6
Pasomxay	216	5	2.3	272	2	0.7
Veunhongkham	180	6	3.3	203	4	2.0
Phine	246	16	6.5	273	2	0.7
Total	909	61	6.7	1,102	15	1.4

Source: Phine Annual Report, 2010 & 2015

#### 4. Physical and Cultural Resources

214. The presence of physical and cultural resources in the subproject areas are assessed in more details in the EMP and where relevant mitigation and monitoring measures proposed.

215. The Phine Road subproject area includes existing access and main roads in Phine town through residential areas with residential houses and small shops. The subproject also includes two sections of new road through farmland and undeveloped land that will establish a northern by-pass.

216. Compared with the original design, the alignment was changed to avoid interference with two graveyards in Phine. Following the change of alignment, the distance to the graveyards is about 150 m. There are no temples or Wats located close to the road sections included in the subproject.

217. A key sensitive receptor is the Phine Hospital which is located on road section E. Based on the design drawings the road upgrade will be constructed less than 5m from the hospital.

#### 5. Land Use and Zoning

218. The land use pattern on Phine is a mixed use of agricultural, commercial and services area. The land use plan of the district is incorporated in the Master Plan that was approved by the Provincial Government of Savannakhet in June 2010. Residential and commercial mixed use areas along the NR 9 occupy approximately 300 ha. The core urban center of the town where the majority of population resides has an area of 81 ha.

219. The municipal authorities have designated some 62 ha within the town center as green space where construction is prohibited. The other major land use is the agricultural zone which covers 265 ha, areas of which are devoted to plantation crops like rubber and cassava and small paddy fields, and vegetable plots. The rest of the area is idle flat and hilly terrain.

220. The town center of Phine is characterized by a thriving trading and commercial activity for goods and services produced in Savannakhet and those imported from neighboring countries particularly Thailand and Viet Nam. The other side of the town serves as the administrative center where Phine District Government offices are located.

221. Phine town is linked with a “sister” town of Xethamouak located 12 km west of Phine, which has a larger urban center than Phine with a larger number of commercial establishments such as restaurants, market, guesthouses, sawmills, spare part shops and motor vehicle repair shops.

## **6. Economic Activities and Employment**

222. Statistical records from the Planning Office reported in the 2012 IEE indicated that the local economy of Phine is growing at a rate of approximately 7% per year. In terms of GDP shares by economic sector, the agriculture and forestry sector has the highest share at about 71.4% in 2010 which is largely due to the dominant agricultural resource base of the municipality. The GDP shares of the services and industry sector which were reported with small increases represent 15.1% and 13.3% respectively. With the strategic location of Phine along the EWEC, the GDP shares of the industry and services sectors are expected to increase with expanding rubber and cassava cultivation along with increasing commercial and industrial establishments.

223. Information from the Planning Office recorded a total of 213 enterprises and commercial shops in 2010. These include ten enterprises in agricultural production and processing, 55 handicraft enterprises, 98 commercial stores and 50 service enterprises. In 2009, the gross domestic value of industry and handicrafts was LAK 32.2 billion, representing an increase of 16.5% from 2005. The gross domestic commercial activities were valued at LAK 37.07 billion, representing an increase of 16.2% over the previous year.

224. As has been noted, the local economy of Phine is largely influenced by its agricultural resource base. Agriculture and Forestry sectors are biggest share of GDP in Phine. The GDP for agriculture and forestry was valued at LAK 178.57 billion in 2009, registering an increase of about 14% from the year 2005. The rice production area increased to 6,213 hectares in 2009, representing an increase about 11% from the reported production area in 2005. Aside from the increasing areas cultivated for rice production, rubber plantation is becoming an important industry crop where 4,457 ha are devoted for its production. The other industrial tree plant is eucalyptus which is being grown in 59.25 ha.

225. Economic activity in the service sector is limited to engagement in trade and commerce activities and from the small number of commercial establishments such as lodging houses and eateries in Phine. In 2009, the GDP for the services sector was valued at LAK 39.9 billion. The existing market of Phine which is an important source of employment in the services sector was burned down. Local vendors and stallholders have to contend in selling and vending their products in temporary shelters and makeshift stalls. Local authorities expect increases in the service sector activities as soon as the essential urban infrastructures such as improvement of the town center roads and the construction of the new market and trading facilities are in place.

226. Nearly three-quarters (73%) of households in the town are engaged in agricultural activities and 23% are engaged in the industry and handicraft sector and reflects the increasing number of medium and large trading and commercial enterprises in the town. Only a small proportion of households are involved in commercial and services sector handicraft making and home-based activities.

Table 22. Main sectors of economic activity in Phine

<b>Sector</b>	<b>% of HHs</b>
Agriculture and forestry	72.6
Industry and handicraft	23.1
Commerce and service	2.3

Source: 2009 Statistics Survey, Planning Office, Phine

## **7. Services and Infrastructure**

227. To provide for the health and medical needs of the local population, Phine district has a district hospital with 15 bed capacity, seven health centers and eight medical clinics. The health services are constrained by the inadequacy of health facilities and equipment, medical health officers and personnel.

228. The existing public market was recently destroyed by fire and the local authorities have provided the market vendors temporary location to ply their trade. The site of a new market and trading center is being developed and the municipal government expects that market vendors and stallholders will move to the new market site which is situated about 2 km from the former site and located along the NR 9. The new market and trading center is managed and operated by the private sector.

229. The major transport system within the town and adjacent villages are the motor bikes and the Songtheo which are operated by individuals and family members. There has a reported increased in the number of motorbikes which has become the key transport facility among the local residents. There are buses registered in Phine, but there is no bus terminal facility. Inter- provincial buses and shuttle vehicles pick up passengers at any point along the main road. Cross country tour buses plying their route along the NR 9 passes through the town center of Phine and do not stop for refreshments and passenger comfort needs due to the absence of a terminal facility. These international buses travel to and from Thailand and through Dansavanh to Dong Ha, Thua Tien Hue, Da Nang and Ha Noi in Viet Nam.

230. There is an ongoing construction of rest area and service station with facilities such as bathrooms/toilets and souvenir shops in Phine. This facility is a component activity of the ADB-assisted Sustainable Tourism Project in Lao PDR.

231. The water supply system in the town center of Phine is operated and managed by Phine Nam Papa, a branch unit of Provincial Nam Papa Savannakhet, which is a State-Owned Water Supply Enterprise. Phine Nam Papa supplies clean water to the served area of about 1,249 hectares covering five villages near the town center and mostly located along NR 9. The projected population target to be served by the water supply system is 5,400 persons or 840 households in the town center.

232. In Phine town center, roadside drains for interior urban roads have not been installed and no interconnection of drainage system has been established. The waste water and sewerage collects on the roadside surface which serves as breeding grounds for mosquitoes or parasites. Flooding in urban areas occurs due to accumulation of runoff following heavy rain. However, the pressing issue is roadside drains able to take waste water and sewerage from the populated areas.

233. The solid waste management system in Phine is contracted by the local government to a private service provider whose system involves collection of the solid waste in containers and haulage to the dumpsite. About LAK 30,000 per month is collected from each household as the solid waste management fee. Under the private contract management, the service provider uses two trucks and manages a 1 ha of land fill (dump size 25x25m) which is situated some 5 km from the town center.

234. Phine District has a total of 121.2 km of road network of which 49 km are asphalted roads, of which, about 10 km are in the town center. These roads were built at low construction cost using low filled lateritic materials. The main roads in the town center along NR 9 comprise about 5 km and provide access to residential areas and commercial establishments. The access roads that are planned within the periphery of the town center is in anticipation of the growth of the urban areas in Phine. These new road networks within the town are included in the FYDP.

## D. Dansavanh

### 1. Water Environment and Surface Water

235. Dansavanh is located in on the northern bank of the Sepon River and in the Sepone floodplain. The town slopes and drains towards the Sepon River and its tributary the Alone River. The Alone River is located at the eastern end of the road section 9-1. The distance from the road section to the Sepon River is 200m and more. The Alone River has significant season flow variation and very reduced flow in the dry season. Water quality monitoring data has not been reviewed and is understood to not be available with DONRE.

### 2. Aquatic Ecology Characteristics

236. Common fish species found in the project area of Dansavanh District are Pakhao (*Akysis bantamensis*), Padouk (*Clarias batrachus*), Pakho (*Channa striata*), Pakha yang (*Cirrhinus sp*), Pakadeut, Pasiew, Panin (Tilapia), Panai (Nile Tilapia), Pakheng (*Cirrhinus sp.*) etc. Seasonally there are more fish species found in the area, that migrate up the streams in the wet season. Aquatic animals and amphibians are also found in the area and most are associated with paddy fields such as frogs, tree frogs, snails, crabs etc. No sensitive habitats or rare or endangered aquatic species of flora or fauna are recorded from the project area though.

### 3. Socio-Economic and Cultural Setting

#### a. Population, Ethnicity and Demography

237. Dansavanh Border Trade Zone comprises of 8 villages with a population of 8,493 inhabitants and 1,479 households in 2015. Dansavanh BTZ has a total land area of approximately 4,000 hectares. Based on the Five Years Socio Economic Plan of the Dansavanh BTZ, the population growth rate is projected at 2 percent.

238. There are three major ethnic groups in the Zone area, namely the Phouthai (a sub-group of Lao-Tai ethno-linguistic group) which accounts for 24% of the population, the Tri (a sub-group of Mon-Khmer ethno-linguistic group) which represents 50% and the Makong group (also part of Mon-Khmer group) which accounts for 11% of the population. In Dansavanh town the majority belongs to the Tri ethnic group. With the projected growth rate, the population in the town is expected to increase regularly to 9,400 by 2020 and to 11,400 by 2030.

Table 23. Population by village in the Dansavanh municipality / DBTZ

No.	Village	HHs	Population			Ethnic Minorities						Other	
						Phoutai		Tri		Makong			
			Total	Female	Male	Total	Female	Total	Female	Total	Female	Total	Female
1	Dansavanh	316	1,868	928	940	162	84	1,185	585	70	40	451	219
2	Kengyang	173	1,034	534	500	191	93	668	354	124	64	51	23
3	Sanoun	181	890	435	455	194	98	554	269	73	36	69	32
4	Dongsavanh	183	1,119	556	563	307	158	563	278	40	23	209	97

5	Sakiphine	173	1,019	505	514	26	11	260	136	585	295	148	63
6	Pheuang	162	917	455	462	385	192	471	232	7	3	54	28
7	Hoysan	236	1,347	681	666	777	391	508	262	3	2	59	26
8	Kadap	55	299	146	153	0	0	6	5	3	3	290	138
	<b>Total</b>	<b>1,479</b>	<b>8,493</b>	<b>4,240</b>	<b>4,253</b>	<b>2,042</b>	<b>1,027</b>	<b>4,215</b>	<b>2,121</b>	<b>905</b>	<b>466</b>	<b>1214</b>	<b>626</b>

Source: Annual Report 2015, DBTZ

239. The ethnic groups are mainly Phouthai, Tri and Makong. The population growth is mostly from migrants from other parts of the country as well as neighboring countries for running small shops and business in the area.

#### 4. Employment and Commerce

240. In order to boost trade, investment and stimulation economic growth of the GMS “East-West Economic Corridor”, Savannakhet Province of Lao PDR is in good position to make regional trade links. Dansavanh is located at the end of National Road No.9 before entering to Viet Nam through Lao Bao – the international border. In 2000-2009, GDP increased mainly due to agriculture, industry and services. In Sepone District the GDP per capita registered an increase from \$434 in 2007 to \$560 in 2010 which would be similar to that in the Dansavanh Town.

241. The largest percentage of households in Sepone are engaged in agriculture and forestry at 97.21%, with income generation based on agricultural products, while industry and handicraft is only 0.19% and commerce and services at 2.60 percent.

Table 24. Population by household sector in Dansavanh

No.	Number of Household working in	Percentage
1.	Agriculture and Forestry	97.21 %
2.	Industry and Handy craft	0.19 %
3.	Commercial and Service	2.60 %
	Total	100%

Source: 2009 Statistic Survey, Planning Office, Sepone

#### 5. Physical and Cultural Resources

242. The presence of physical and cultural resources in the subproject areas are assessed in more details in the EMP and where relevant mitigation and monitoring measures proposed.

243. The Dansavanh road subproject consists of 11 road sections, which includes upgrading of existing roads through residential areas and establishing of new roads. Sensitive receptors identified in the project area, includes the Wat Polam located near the future road section 12, the

Alone River located at the eastern end of road section 9-1 and the residential areas located along the roads. The closest school is located at a distance of 300m.

244. Key social resources in the project area includes the border crossing 605 to Vietnam. Access to the border is via the 9E National Highway. The project will not involve construction on the 9E Highway, but of access roads and main roads connecting to the highway. There is no alternative access to the border crossing. Key cultural resources in the area affected by the project includes the Wat Polam located at Rd 12.

## **6. Social Services**

245. Education is considered an important precondition in the stimulation of the growth of socio-economic development and investment. Provision of education is encouraged to support the growth of the province' economic development. However, little information is available specifically for Dansavanh Town as data is for the entire Sepone district. A total of 84 primary schools and 4 secondary schools in Sepone District with Dansavanh BTZ having complete primary schools in most 8 villages and one secondary school located in Ban Houy San. Illiteracy rate of the district as well as the town is likely higher compared to the provincial average due to high share of ethnic peoples, the rural location, and insufficient public facilities.

246. The health sector is quite poorly developed in Dansavanh with only one small health center available for basic health checks. Mostly, people who can afford to pay for treatment are using the health service in Viet Nam.

247. Dansavanh BTZ is promoted as a special economic zone to attract both local and international investors. According to records, Dansavanh BTZ has received a significant number of requests for potential investments in hotels and factories. The area received budget allocations for its investment program over 2003-2010 as support to about 30 projects which include: 14 road construction projects; 6 government office buildings; 5 water supply construction projects; 3 electricity network installation projects; 1 UXO clearance program; and a land conversion project.

## **7. Livelihoods**

248. Livelihoods are the activities, means, entitlements and assets by which people sustain their households and make a living, and they should be understood as systems, considering all of the components, as well as the relationship between, and priorities of, those components. Livelihood systems are essentially needs based and comprise production and enterprise activities integrated in such a way as to respond to the food security and cash income requirements of households.

249. The table below provides an indication of the subsistence levels of households in the Project Area. Overall a fifth of households mostly produce the food their household consumes, with a larger proportion of households headed by men (21%) than women (14%) being dependent on home produced food.

Table 25. Subsistence levels of households in Dansavanh

Sex of head of household	Food consumed by household (%)	
	Mostly home produced	Mostly purchased or traded
Female	14.3	85.7
Male	21.0	79.0
Total	19.5	80.5

Source: Dansavanh Inventory of Losses October 2011

250. The AHs receive multiple sources of income including from sales of agricultural goods and products (54%), trade or sales including small household business (31%) income from daily or casual labor (15%), wages and salary (5%) and some households also receive and a small proportion (2%) receive income from non-labor sources including remittances and pensions.

251. In terms of the relative importance of the income, 52% of AHs stated that the income from selling small goods, trade or small household business was the primary or most important sources of income while for 20% the primary household income came from either casual or daily labor or agriculture. Only a small proportion of households stated that wages form either the government (public service) or private sector was the primary source of income for the household.



## **VI. PUBLIC CONSULTATION & INFORMATION DISCLOSURE**

### **A. National Requirements**

252. Government of Lao PDR Decree 112 sets out specific requirements for consultation of communities and stakeholders in the EIA/SA process. Article 7 sets out the rights and duties of project-affected people and stakeholders which include complete information disclosure on potential adverse impacts or benefits if the project proceeds. Involvement in the EIA/SA process is required through provision of appropriate and sufficient information to people and communities affected.

253. Article 8 of Decree describes the participation process, and establishes joint responsibility between the project developer and MONRE to ensure the participation of affected people and communities and other stakeholders in the process of project feasibility study (including survey and exploration etc.), impact assessment, and review of documents prepared during that process.

254. The Guidelines on Public Involvement in Environmental and Social Impact Assessment (2009) detail requirements of proper consultation and participation in support of Decree 112 with the following objectives:

- Ensure public involvement is conducted accordingly to proper methods, regulations and Environmental Protection Law of Lao PDR;
- Ensure project affected people receive fair and just compensation from development projects;
- Prevent and mitigate environmental and social impacts that may be caused by projects;
- Ensure that development projects are designed in a sustainable manner.

255. The guidelines define public involvement as a process that disseminates information about a project while collecting opinions and suggestions from interested and/or affected parties in order to assess impacts caused by the project before making a decision. As defined in the Guidelines public involvement includes the following:

- Dissemination of information of proposed project through news boards, leaflets, newspaper and other media;
- Coordination and collaboration with relevant local authorities (including provincial and district level Department of Natural Resources and Environment [DONRE]) to organize consultation meetings in villages;
- Organization of meetings at village level to disseminate information about a proposed project, including the potential benefits and environmental/social impacts that may be generated by the project;
- Listening to opinions and comments of local people and incorporating suggestions and recommendations into project documents; and
- Updating of project documents (by the developer) based on information received from consultation meetings.

### **B. ADB Public Communication Policy**

256. The information disclosure related to the project and subprojects is also conducted in compliance with the ADB Public Communications Policy. The IEE update(s), the subproject specific EMPs, and the subproject specific RPs, as well as monitoring reports will be disclosed on the ADB website.

257. In order to ensure that relevant social and environmental safeguard information is made available to the affected people and stakeholders in the subproject areas, consultations will be held in the subproject areas. Prior to onset of construction, two consultations are planned in each subproject area. One consultation that present the RP and one consultation that present the EMP and the construction programme. Refer section VI.E below.

### **C. Information Disclosure, Consultation and Public Participation Process**

258. Information disclosure and stakeholder consultations were conducted as part of the environmental assessment process. The consultations involved in-depth key informant interviews with relevant Government agencies and focus group discussions.

259. The consultations aimed on environmental issues and concerns affecting the community. Specifically, the objectives of the consultation meetings are the following:

- To present the proposed projects to the stakeholders;
- To solicit views of the stakeholders relative to the proposed project;
- To identify the most important project components for the locals;
- To identify possible environmental issues inherent on the proposed project and
- to identify mitigation measures to address these issues in the project design.

260. Subsequent information dissemination to, consultation with and participation of affected people and involved agencies will reduce the potential for conflicts and minimize the risk of project delays.

261. Further information dissemination and consultations will be carried out before construction starts and during the construction period. Prior to the start of the construction, consultation will be carried out in all the areas where the proposed project activities are anticipated. The objective will be to provide the local population with accurate information on activities to be undertaken, on the schedule of these activities and on the potential nuisances for them during construction. This information stage, which concerns all the project sites, will be carried out jointly with the team in charge of RP preparation in those areas that will require compensation and/or resettlement.

262. During the construction stage, consultation will be carried out with local population in specific area where construction activities are expected to start within 1 month. This will be carried out through focus group discussion with residents and key stakeholders (police station, ward heads) on possible nuisances (noise, dust, traffic/access constraint, temporary suspension of public utility, etc.), on safety measures they will have to respect (regarding engines under activity, risks of fall in excavations, risks specific to children etc.) and on the detailed schedule of activities.

263. At the end of the construction activities, inspection of site to ensure cleaning and rehabilitation has been done by the Contractor will include interview of residents to possibly identify non-compliance in the rehabilitation or restoration of the site.

### **D. Summary of Consultations**

264. The consultations conducted over the course of the project include consultations conducted in connection with the preparation of the Feasibility Studies, Initial Environmental Examination, and Resettlement Plans under the PPTA in 2012. Consultation at the PPTA stage took the form of (i) interviews with village leaders, focus discussion groups (FGDs) and household

interviews/surveys; (ii) discussions about impacts and mitigation measures, and discussions about implementation of EMPs and SMPs; and, (iii) provision of opportunity to review, respond to, or comment on the IEEs and PSAs/REGPs.

265. Under the PMSCD, consultations were conducted in January to April 2015 in connection with the preparation of the Subproject Concept Notes, which reviewed the subprojects with respect to issues arising since the PPTA, options, recommendations, cost estimates, benefits, and problems. The Subproject Concept Notes constituted revisions of the scope of subprojects and the DED proceeded on the basis of the agreed Subproject Concept Notes.

266. In the preparation of Resettlement Plans (RPs), the identification of affected assets and impacts was conducted in consultations with the affected persons and the village head.

## **E. Pre-Construction Consultation and ongoing Consultation**

267. Consultations and communications with affected households and stakeholders will continue in the subproject implementation. The following consultations are planned following the finalization of the DED and prior to the onset of construction.

268. As part of the implementation of the Resettlement Plans, consultations with affected households on the following topics are carried out: Entitlement Matrix, Compensation unit rates, Presentation of identified IR impacts and compensation, Grievance Redress Mechanism dissemination.

269. The pre-construction consultation will be held in each subproject area with affected people and will include presentation of the construction program and dissemination of project level Grievance Redress Mechanism (GRM).

270. The number, location, content, and expected outcome of pre-construction consultations are presented in the table below.

**Table 26. Pre-construction consultations**

<b>No.</b>	<b>Timing</b>	<b>Location</b>	<b>Content</b>	<b>Outcome</b>
1.	Prior to construction	Subproject area	<ul style="list-style-type: none"> <li>• Resettlement Plan, including:</li> <li>• Entitlement Matrix</li> <li>• Compensation unit rates</li> <li>• Presentation of identified IR impacts and compensation</li> <li>• Grievance Redress Mechanism dissemination</li> </ul>	<ul style="list-style-type: none"> <li>• Affected people understands entitlements</li> <li>• Affected people can raise comments on compensation unit rates</li> <li>• Affected people are informed of anticipated IR impacts</li> <li>• Affected people understand the GRM and their access to it</li> </ul>
2.	Prior to construction, following contract award	Subproject area	<ul style="list-style-type: none"> <li>• Pre-construction consultation to present EMP and construction programme</li> <li>• Grievance Redress Mechanism dissemination</li> </ul>	<ul style="list-style-type: none"> <li>• Affected people and other stakeholders are informed of construction program, timing of clearances, etc.</li> <li>• Reiteration of the GRM and access to it</li> <li>• Affected people and stakeholders become familiar with the Contractor company</li> </ul>

## F. Summary of Stakeholder Views

271. The summaries of the consultations with key stakeholders in the project development phase on the subproject components are presented below. Focus group discussion (FGD) showed high levels of support for the proposed subprojects since the participants could identify specific benefits of the project. Some negative impacts were also identified, primarily in relation to the construction phase of the projects. The detailed records of the public consultations for each subproject can be found in the Appendices.

### 1. Kaysone Phomvihane: Solid Waste Management

272. The primary stakeholders are the households and commercial enterprises (including market stall holders) who will benefit from regular and reliable solid waste collection and improvement in their immediate urban environment. Waste pickers are primary stakeholders who must be afforded opportunities to participate in any formalized waste selling/recycling scheme and must not be excluded from picking through waste as a result of improving operations at the site as this would further marginalize them and deepen their poverty. The private contractors and/or municipality should be encouraged to formally employ these people as sorters when the MRF is operational.

Table 27. Summary of stakeholder's interest in the solid waste management subproject in Kaysone Phomvihane

Stakeholder	Primary	Secondary	Key Stakeholders' Interest in the subproject
Households in beneficiary area	X		Improved and regular waste collection and management reduces localized pollution from informal and illegal rubbish dumping; Improved public health status and living conditions in immediate area; Improved environment and reduced nuisance (smell and flies) for households currently adjacent to, close proximity of, existing dump-site; Opportunities to participate in recycling, environmental health and hygiene awareness raising campaign
Private contractors	X		Increased business opportunities in offering regular and reliable waste collection services
People trading in waste products; Waste pickers	X		MRF can formalize recycling and trade in waste; Exclusion from picking through waste at the future sanitary landfill; Potential employment as sorters when MRF operational; Provides opportunity for income generation through sale of waste collected from town or sorted at landfill; Opportunities to participate in recycling, environmental health and hygiene awareness raising campaign
Wider community		X	Improved public health status and living conditions (reduced nuisance - smell and flies); Opportunities to participate in recycling, environmental health and hygiene awareness raising campaign

273. Private contractors may benefit from offering collection services in an improved solid waste management system. Secondary beneficiaries are the wider town population who will benefit in less direct but no less tangible ways, for example health benefits and an improved urban environment (reduced litter, reduced waste build-up, reduced potential for flies and disease vectors).

## 2. Kaysone Phomvihane: Drainage and Flood Protection

274. The primary stakeholders are the households and commercial enterprises who currently live along the open channel.

275. This component will also contribute to addressing flooding issues along with the road improvement subproject. Secondary beneficiaries are the wider town population who will benefit in similar ways, for example health benefits and an improved urban environment (reduced potential for flies and disease vectors).

Table 28. Summary of stakeholders' interest in the drainage and flood protection subproject in Kaysone Phomvihane

Stakeholder	Primary	Secondary	Key Stakeholders' Interest in the Subproject
Households in beneficiary area	X		Improved and regular septage collection; Improved public health status and living conditions in immediate area (adjacent to open channel); Improved environment and reduced nuisance for households; Opportunities to participate in environmental health and hygiene awareness raising campaign.
Private investors and business operators		X	Induced business opportunities from incremental improvements in urban environment and improved services and infrastructure;
Municipality	X		As major stakeholder in infrastructure and service provision; Potential to levy higher fees/taxes with improved septage collection services.
Wider community		X	Improved public health status and living conditions; Opportunities to participate in environmental health and hygiene awareness raising campaign.

## 3. Urban Road and Drainage Improvements: Kaysone Phomvihane, Phine, and Dansavanh

276. The primary stakeholders are the people living or operating businesses along the roads, road users, road-side stall holders and street vendors, as well as the wider population that rely on the roads for access to facilities and services.

277. The benefits, as identified by the FGDs, were considered to include participation in construction and opportunities for local contractors, increased selling opportunities for street vendors, local cafés and food sellers during construction. Following construction, the improved roads would benefit most people, with specific benefits identified for enterprises and those engaged in marketing with it being easier to carry goods and traffic volumes increasing.

278. Transport operators (passenger transport services and cargo/freight cartage) are another primary beneficiary who can respond to improved access and increased demand for services. Secondary beneficiaries are those who will benefit in less direct ways, for example street vendors, marketers and merchants could potentially have more customers once the congestion and parking issues are resolved.

279. Concerns of stakeholders centered on traffic congestion and safety during construction and operation phases of the road improvements. Issues are identified in bold in Table 29 below.

Table 29. Stakeholder views of road improvements in Kaysone Phomvihane, Phine, and Dansavanh

Stakeholder	Primary	Secondary	Key Stakeholders' Interest in the Project
Road users, members of households in catchment of roads	X		Improved access to markets, key social services (health and education services) and urban employment opportunities; Reduced local flooding from improved drainage (household and public health); Small household retail businesses will become more profitable as traffic volumes and local incomes rise; Potentially increased incentives to produce higher value agricultural products as transport to markets improve; Increased incomes from produce and cash crop marketing will allow families to invest in better housing and healthcare which will improve wellbeing and living standards; Increased access to vocational education, training and employment opportunities among youth in district center; <b>Concerns regarding safety and accidents should be addressed</b>
Transport operators	X		Increased business opportunities to carry passengers and goods; School and tourist bus and taxi services will improve; <b>Need for awareness raising with drivers in respect of speed and safe driving</b>
Street vendors and markets along the roads	X		<b>Temporary impacts during construction will need to be addressed;</b> Improved access, increased traffic and passenger flow and reduced congestion can increase volume of sales; Access and mobility improved (convenience, comfort and ease of travel)
Health and education personnel		X	Services in schools and the health centre disrupted during rainy season flooding can resume without interruption; <b>Need to work with Police and transport operators to ensure road safety (reduced road accidents and injury)</b>
Police/traffic police	X		Improved security (including street lighting) deterrent for petty and local criminals; Civil defense capability of local area improved; <b>Need to enforce existing road rules;</b> Involved in delivery of road safety campaign
Businesses, processors and exporters		X	Assuming other constraints to the sector/industry are overcome, production in the area will increase, diversify and modernize as it becomes easier to get products to market; Improved access will encourage further investors in the special economic zones
Municipality	X		As major stakeholder in infrastructure and service provision; Potential to levy higher fees/taxes with improved services; Can encourage additional investors to area as services expanded to cover wider area
Merchants		X	Improved access and increased traffic and passenger flow can increase volume of sales to small businesses and households

## **G. Project Response to Stakeholder Concerns**

280. The overall response of the consulted stakeholders to the subprojects in Kaysone Phomvihane, Phine, and Dansavanh was positive. The negative views of the subprojects highlighted focused on traffic congestion and safety during the construction phase of the subprojects, and during operation of the completed upgraded road segments in the three subproject towns.

281. The EMP for the upgraded roads and drainage components of the subprojects include specific sub-plans that will prescribe measures to minimize traffic disruption, accidents, and public injury. These possible impacts will be addressed and mitigated by; 1) scheduling construction and activity during light traffic periods and to minimize nighttime work, 2) creating traffic detours where necessary, 3) enforcing speed limits, 4) informing communities of the location of construction areas and provide information on how to avoid it, 5) establishing pedestrian crossings away from construction areas, and 6) planning construction activities to reduce impacts on businesses.

## **VII. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

282. The assessment of potential impacts of the Project is structured by the five primary types of infrastructure developments that will be implemented in the three towns defined as follows:

- a. Solid Waste Management and Materials Recovery Facility: (Kaysone Phomvihane);
- b. Drainage and Flood Protection: (Kaysone Phomvihane);
- c. Urban Road & Drainage: (Kaysone Phomvihane, Phine, and Dansavanh).

283. The organization of the impact assessment by infrastructure investment follows the Project Description. The Kaysone Phomvihane subproject will dominate assessment of impacts because that subproject consists of all five types of infrastructure investments. The assessment of the urban road upgrades will highlight subproject-specific impacts.

## **A. Overview of Benefits of Subprojects**

284. The benefits of the completed subprojects will be registered at two spatial and temporal scales. As clearly indicated in the Introduction the planned impact of the project will be regional socioeconomic development in the vicinity of each subproject town, and cumulatively along the east-west economic corridor of the GMS.

285. On a local scale, the sub-projects, will have direct effects on the citizens' everyday life within each subproject town. Urban transportation will be significantly improved in all three towns, while community sanitation, solid waste management, and flood control will be improved in the town of Kaysone Phomvihane. The investments in Kaysone Phomvihane will reduce risk of spread of waterborne diseases from under-served septic tanks, and make the urban environment a much cleaner place to live through improvement of solid waste collection. The investments in all subproject towns will improve and develop livelihoods.

286. The different sub-projects are built upon the specific needs statement for each town in the Project Description, and the projects are designed to benefit the communities in the best possible way. The consulted community stakeholders have also identified the project benefits as reported in the previous section.

## **B. Sub-project Impacts and Mitigations**

287. The assessment of potential negative impacts of the primary infrastructure developments is structured chronologically according to subproject implementation starting with the pre-construction preparation phase, followed by the construction phase, and ending with the post-construction operation phase of the commissioned infrastructure developments. This assessment structure is carried forward and shapes the three environmental management plans for each of the three subprojects.

### **1. Pre-construction Phase**

288. Negative impacts associated with the pre-construction phases of the infrastructure developments concern land acquisition or resettlement. Following the detailed engineering design, the need for local resettlement and compensation for loss of land or structures is identified in Resettlement Plans prepared for each individual subproject and presented under separate cover.

289. The subprojects will impact land and assets of households and businesses along the upgraded roads sections in Kaysone Phomvihane, Phine, and Dansavanh, along the Houay Longkong channel in Kaysone Phomvihane. The new landfill and MRF will be located adjacent to the existing landfill within the site perimeter. The compensation is expected to include compensation for loss of income for the waste pickers working at the existing site.

290. Key impact mitigation measures of the pre-construction phase of all three subprojects are:

- 1) Completion and initiation of the resettlement plans (RPs) for each subproject;
- 2) Updating of the EMPs for each subproject.

291. The EMPs are reviewed and updated where necessary during the pre-construction phase to meet the detailed designs of the subproject components to ensure that additional or changes to impacts arising from detailed designs are addressed by the EMPs.

292. Climate change and flood risks were integrated in the designs in the following way. The design criteria for the urban roads subprojects were established in accordance with the Rainfall-Intensity-Duration curves established on the basis of historical data from the Savannakhet weather station in Kaysone Phomvihane, with allowance for more severe rainfalls caused by climate change. According to national standards, pipe culverts shall be designed for a 25-year rain storm, and box culverts for a 50-year rainstorm. Designs were conducted using the formulas specified in the Lao PDR Road Design Manual considering 10, 20 or 50 year rainfall frequency. Design of culverts for other subprojects, such as the solid waste subproject followed the same approach. The Houay Longkong drainage and flood protection subproject is designed to improve the drainage capacity of the main drainage channel in Kaysone Phomvihane, the Houay Longkong. The flood gates and the pumping station will alleviate the effect of high water level in Mekong river.

293. Following the completion of the DED, the assessment of the presence of physical and cultural resources in the subproject areas have been updated in the EMPs and where relevant mitigation and monitoring measures proposed. Siting of off-site components such as borrow pits, waste storage, and asphalt plants near cultural resources are prohibited in the EMPs and chance-find procedures are specified.

294. UXO clearance surveys for Kaysone Phomvihane, Phine, and Dansavanh were undertaken in 2015 by Soupha Engineering Consultant (SEC). The survey of Kaysone Phomvihane



concluded that there is no need for UXO clearances in this District. The surveys undertaken in 2015 did not identify UXOs in the subproject areas in Phine and Dansavanh either. However, considering the greater risk associated with these subproject areas assessed on the basis of records of bombing activities and identification of UXOs, detailed UXO surveys are currently underway including the road alignments and borrow-pits. As specified in the EMPs appropriate GoL certification on UXO will be obtained prior to start of construction (certificate of UXO clearance or no UXO clearance needed).

295. A major component of the pre-construction detailed design stage will be the finalization of the design and location for the new sanitary landfill. The influence of the existing dumpsite on the design of the new sanitary landfill requires careful assessment. The ECA and leachate and groundwater quality assessment (Appendix D) for the existing dump site will provide the information needed for the detailed design, and ultimate management of the old dumpsite and new sanitary landfill.

296. Updating the EMPs during the detailed design stage will involve finalization of subproject specific EMPs to manage potential impact areas such as erosion, sedimentation of surface waters, noise, dust & air quality, spoil disposal, traffic, and worker and public safety at the project sites. The impact mitigations of the pre-construction phase are detailed in the EMPs.

## **2. Construction Phase**

### **a. Common potential impacts of infrastructure developments**

297. The potential environmental impacts of the subprojects in Kaysone Phomvihane, Phine, and Dansavanh are dominated by the construction phase of the individual subproject components. Common potential impacts arising from civil and earthworks will consist of reduced and/or blocked public access, disrupted business and recreation, noise, dust and air pollution from NO<sub>x</sub>, SO<sub>x</sub>, & CO caused by increased truck traffic and heavy equipment use, soil and surface water pollution caused by equipment operation and maintenance, public and worker accidents, increased traffic accidents, land erosion and surface water sedimentation, drainage and flooding problems, solid waste, wastewater, and domestic pollution from worker facilities, occupational and public health and safety hazards, and risk of spread of vector-borne diseases from influx of workers. Mitigation measures are presented below and in more detail in the subproject EMPs. These short-term impacts will occur at different levels of magnitude depending on the activity at all construction areas of the infrastructure developments of the subprojects.

### **i. Common mitigation measures**

298. Management measures to mitigate potential common impacts associated with the construction phase of the infrastructure developments are presented below. The mitigation measures are detailed further in the EMPs.

- 1) Care must be taken to ensure that sites for earthworks (e.g., excavations, trenches) that are suspected to have unexploded ordnance should be surveyed by the GoL prior to construction. If such ordnance is detected clearing work will need to be commissioned prior to undertaking civil works.
- 2) Open excavations should be fenced, and trenches covered where public walkways or vehicles must cross.
- 3) Final disposal/management of construction spoils (especially from excavation): where possible spoils should be used for backfilling. Topsoil should be temporarily stored for reapplication. Disposal of spoils should be at designated disposal sites approved by the

Project Manager, which must never be in or adjacent surface waters. Designated sites must be clearly marked and identified. Spoil must not be disposed of on sloped land, near cultural property or values, ecologically important areas, surface waters, or on/near any other culturally or ecologically sensitive feature. Where possible, spoil should be disposed of at spent quarries or borrow pits. A record of type, estimated volume, and source of disposed spoil must be recorded.

- 4) A chance find management plan must be in place for cultural artifacts and property.
- 5) Regular watering should be employed at construction sites to minimize dust.
- 6) All construction vehicles and equipment should be maintained in proper working order, and not operated at night if possible to minimize noise.
- 7) Speed limits should be posted and adhered to by all construction vehicles.
- 8) Where possible construction vehicles should use different roads or dedicated lanes of roads shared by the public.
- 9) Disruptions of access/other disturbances: As specified in the EMP, the Contractor is required to establish agreement with Electricite' Du Lao (EDL) to execute the removal or relocation of electricity works. Develop carefully a plan of days and locations where outages in utilities and services will occur, or are expected. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages. Contact affected community to inform them of planned outages. Try to schedule all outages during low use time.
- 10) Trees and other vegetation at all construction sites should be protected.
- 11) Present and past land use should be reviewed to assess whether excavated soils are contaminated. Contaminated spoil should be disposed at a landfill or a location approved by MoNRE.
- 12) Berms and/or silt traps should be constructed around all excavation/trench sites and along all surface waters to prevent soil erosion and surface water sedimentation.
- 13) Local workers should be used as much as possible to prevent or minimize influx of migrant workers, and incidence of spread of vector-borne diseases.
- 14) Worker facilities must have adequate domestic waste collection facilities and sufficient sanitation that are located away from public areas and surface waters. The Contractor is required to ensure access to adequate sanitary facilities during the construction phase, including toilet facilities and collection and disposal of wastewater in line with GoL regulations. Domestic solid waste from workers should be disposed of in accordance with GoL regulations and at designated disposal sites as approved by the Project Manager.
- 15) Dedicated fuel storage areas must be established away from public areas and marked clearly.
- 16) To minimize the impact of construction the World Bank Environment, Health, and Safety Guidelines (2007) should be followed.
- 17) Occupational Health and Safety: The Contractor will, as specified in the EMP and the Basic Specifications, be required to establish, elaborate and manage the Plan for Occupational Health and Safety (OHS). Worker safety guidelines of GoL or IFC EHS Guidelines should be followed, whichever is more stringent. Appropriate safety clothing and footwear should be mandatory for all construction workers. Adequate medical services must be on site or near all construction sites. Drinking water must be provided at all construction sites. Adequate worker facilities, including toilets, rest room, and washing facilities to be provided. All construction sites should be examined daily to ensure unsafe conditions are removed.
- 18) Public Health and Safety: As specified in the EMP, the Contractor is required to plan and implement public safety measures, including: Proper fencing, signage, protective barriers, and buffer zones should be provided around all construction sites. Use site supervisors

and night guards. Follow public safety guidelines of the GoL. Speed limits should be imposed on all roads used by construction vehicles.

- 19) Aggregates (e.g., sand, gravel, rock) that are transported by truck should be covered.
- 20) Prolonged use of temporary storage piles should be avoided, or covered, or wetted regularly to prevent dust and erosion.
- 21) Sand extraction in rivers for road embankment fill should be done at licensed areas only.
- 22) Storage of bulk fuel should be on covered concrete pads away from the public and worker camp. Fuel storage areas and tanks must be clearly marked, protected and lighted. Contractors should be required to have an emergency plan to handle fuel and oil spillage.

## **b. Infrastructure-specific Construction Impacts and Mitigations**

299. Potential construction impacts specific to an infrastructure type of a subproject are identified below. The potential impacts elaborate some common impacts identified above.

### **i. Solid Waste Management and Materials Recovery Facility<sup>15</sup>**

#### Groundwater and surface water

300. Based on available information, the excavations for the cell for the sanitary landfill will not penetrate or become too close to the local groundwater table. The bottom seal will be made by compacting the red-clay, giving the bottom a hard surface seal without any cracks or openings, and with the right slope for draining and a geotextile will be installed to prevent the washing out of sand and gravel.

301. The hydrogeology in the area of the landfill site will be documented in the ECA. The ECA on the existing dumpsite will determine the permeability of the soils, and will improve understanding of the sensitivity of groundwater and surface water to the new sanitary landfill. The ECA will also determine the present and future exposure to groundwater and soil contamination from the existing dumpsite.

302. Surface water is not anticipated to be at risk from contamination from the landfill. However, as part of the groundwater assessment of the ECA, a review of the sensitivity of local surface waters downstream of the proposed site to runoff from the landfill during rainy season conditions will be conducted.

### **ii. Drainage and Flood Protection**

303. The construction work will take place in and along the Houay Longkong channel. The channel will be straightened and vegetation will be removed and covered by lining of the channel. The channel will lose its natural meanders and the removal of vegetation will reduce the value of the area along the channel as a habitat. The impacted environment is considered a modified habitat of low biodiversity value, due to the diluted wastewater discharged to the Houay Longkong channel, the upstream lining of the channel, and the function as a drainage channel for the southern catchment.

304. During construction work there is risk of contamination of surface water from construction waste, degradation of water quality, loss of drainage, and land erosion. Measures to mitigate these impacts are included in the EMP.

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<sup>15</sup> This section will be updated following the completion of the ECA and the subsequent update and finalization of the DED.

305. To mitigate loss of drainage the measures include: Provide adequate short-term drainage away from construction sites to prevent ponding and flooding. Install temporary storm drains or ditches for construction sites. Ensure connections among existing drainage infrastructure and surface waters are maintained or enhanced to sustain existing stormwater storage and drainage capacity.

306. To prevent degradation of water quality and erosion the measures include: Protective coffer dams, berms, plastic sheet fencing, or silt traps should be placed between all earthworks and surface waters. Protect surface waters from silt and eroded soil. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. Earthworks should not be permitted during the rainy season and should be conducted during dry weather. Maintain a stockpile of topsoil for immediate site restoration following backfilling. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready. Re-vegetate all soil exposure areas as soon as possible. Construction fluids such as oils, and fuels should be stored and handled well away from surface waters. Washing and repair of machinery should not be permitted near surface waters. Waste and materials should be stored and handled away from surface water.

### **iii. Urban Roads in Kaysone Phomvihane, Phine, and Dansavanh**

307. The improvement of urban road and drainage structures are undertaken in an urban area. The alignments for drainage and roads already exist and are functioning. No vulnerable ecosystems will be disrupted by this project as the entire implementation will be in an urban setting.

308. The main negative environmental impacts are temporary and short-term impacts during the construction phase associated with the road improvement and upgrade such as noise, dust, solid & liquid waste, construction traffic, and reduced community and commercial access. Construction during the wet season will be associated with additional potential impact associated with storm water runoff from the construction sites. To mitigate these impacts earthworks will not be permitted during the rainy season and should be undertaken in dry weather. Asphalt/Concrete plants will be located at approved sites away from all human activity and settlements, and cultural, sensitive (e.g., schools, hospitals), and ecological receptors. The ready-made mix will arrive at the road construction site. Borrow pits will be located at approved sites or existing borrow pits will be used. The Contractor will establish an agreement with the Electricite' Du Lao (EDL) of Savannakhet Branch to execute the removal or relocation of electricity works. The construction related impacts are of limited duration and extent and can be mitigated through standard methods and procedures of good housekeeping and good engineering practice.

309. A number of sub-plans have been created in order to mitigate the negative impacts of the Urban Roads project. For example, there are plans for dust, noise, power distribution, worker and public safety, as well as plans to mitigate air pollution, land and water contamination, traffic and access problems, construction waste management, and spoil management. Please see the separate EMPs for more detailed information about how the issues will be addressed.

#### **Increased traffic accidents**

310. There are several mitigation efforts in place to ensure road safety during construction. Examples of these can be seen below:

- Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights.
- Enforce speed limits, and create dedicated construction vehicle roads or lanes.
- Inform community of location of construction traffic areas, and provide them with directions on how to best co- exist with construction vehicles on their roads.

- Establish pedestrian crossings away from construction areas and ensure adequate lighting.
- Plan construction-related activities to reduce impacts on businesses to the extent possible. For example, construction machinery and site works related equipment to avoid blocking access to the Samakkhixay Market as well as shops and kiosks.

#### Increased air pollution

311. During the operational phase, the near surrounding area will be affected by air pollution from the traffic. This will be addressed through the following efforts:

- Submit plan for asphalt plant including location for pre-approval.
- Dust control measures needs to be implemented.
- Locate asphalt plant at approved sites and well away from all human activity and settlements, and cultural, sensitive (e.g., schools, hospitals), and ecological receptors. Bitumen production and handling areas should be isolated.
- Contractors must be well trained in handling and application of bitumen.
- All spills should be cleaned immediately and handled as per hazardous waste management plan, and according to GoL regulations.
- Bitumen should only be spread on designated road beds.

#### **iv. All infrastructure components**

#### Terrestrial and Aquatic Resources, and Cultural Property and Values

312. There are no reported rare or endangered animals and plants in the affected subproject areas, or cultural property and values that will be affected by the infrastructure developments.

313. The proximity and sensitivity of valued ecological and cultural resources to the subproject areas considering finalized infrastructure development locations has been assessed with the conclusion that none are negatively affected.

### **3. Operation Phase**

#### **a. Solid Waste Management and Materials Recovery Facility<sup>16</sup>**

#### Operations procedures, including occupational and public health and safety

314. A Solid Waste Management Operation Manual for the Waste Treatment Centre has been drafted under the DED. The manual is to be adapted to the actual constructed site and the actual delivered equipment. The objective as established in the manual is to handle the incoming waste and recyclable materials in order to minimize the impact on occupational health and the environment. The manual also establishes procedures for establishing of a data collection system suitable for continues improvement of the ambitions, the operation, and the environmental impact.

315. An Occupational Health and Safety (OHS) manual for the Waste Treatment Centre is established as a subsection of the Operation Manual. Following the manual, no worker is allowed to perform any task before a proper training and instruction and no worker is carrying out a task without having the right equipment. The OHS manual establishes the procedures for the OHS

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<sup>16</sup> This section will be updated following the completion of the ECA and the subsequent update and finalization of the DED.

training program, work clothes and personal protective equipment (PPE), tools, equipment, and vehicles. The manual also establishes the procedures with respect to incidents and accidents investigations, registration, corrective measures development and implementation, and reporting.

316. The Waste Treatment Centre will rehabilitate the fence around the site and regulate access to prevent unauthorized access by the public. The managed landfill will reduce the risk of landfill fires, which are a significant source of air pollution.

#### Contamination of groundwater, surface waters, and land

317. The landfill and leachate treatment facility could contaminate groundwater and possibly downstream surface waters depending on natural surface drainage and subsurface flow. The sensitivity of groundwater and surface waters downstream of the finalized sites for the sanitary landfill and leachate treatment facility will be assessed as part of the ECA.

318. The ECA will also assess the integrity of the current and proposed substrate integrity in order to recommend the use of liners versus current/compact clay lining to prevent seepage from the cell, assess options for leachate management and monitoring, and requirements for groundwater and surface water monitoring.

319. With respect to the future of the existing dumpsite, the ECA will assess possible rehabilitation options and/or the proposed closure options including capping design of active cells for adequacy of environment safety and compliance with environment safeguards. Prepare rehabilitation plan (including the possibility of an excavation plan), closure plan and monitoring plan as applicable. This will be based on an assessment of present impacts of the dumpsite on the environment and long-term impacts of dumpsite.

#### Negative Aesthetics and Community Health

320. A landfill can create conditions for odor, disease vector habitat, vermin, and risk of injury to local community from unrestricted access to landfill site. Mitigations for the potential impacts of the operation of a landfill on the community are included in standard operations guidelines (e.g., O&M) for landfills. Example key mitigations for potential community impacts are as follows:

1. Establish landfill away from residential and urban areas and ensure that development occurs at appropriate distance from the landfill;
2. Install perimeter fence and embankment with trees and vegetation around the entire landfill site;
3. Install sufficient signage along perimeter warning the public to stay away from landfill;
4. Post a fulltime guard at landfill who monitors the perimeter by vehicle;
5. Grade and cover solid waste with appropriate thickness of soil/aggregate to minimize exposure of waste to open air, disease vectors, and vermin;
6. All loaded solid waste trucks on route to landfill must be covered, and solid waste trucks should be rinsed and kept clean daily.

#### Traffic disruption and road accidents

321. Speed limits along road to the solid waste facility should be clearly posted and enforced. Roads should be well lighted at night. Signage for road conditions should be well placed.

#### Increased air pollution

322. As much as possible all vehicles and trucks that travel to the solid waste facility must be kept in good working order, and inspected regularly by authorities.

## **b. Drainage and Flood Protection**

323. During the operation phase of the drainage and flood protection subprojects it is assessed that most impacts will be positive as the subproject will lead to improved drainage of the southern catchment area through lining of the Houay Longkong channel and reduce the risk of flooding of the area along the Houay Longkong channel currently utilized for rice fields.

324. During rising water stages Mekong water flows at a very moderate speed through the box culvert in the embankment, and the water on the inner side of the embankment is expected to rise with the same speed as in Mekong River. Hereby the whole area along Houay Longkong is subject to Mekong flooding.

325. In the catchment, there are some lower-lying rice fields, assessed to be at a level of about 113 m Lao. In years of very high Mekong level, i.e. above 113 m Lao these rice fields will be flooded with Mekong water. This is assessed to occur once per 3-5 years (last 3 events in 2005, 2008 and 2011), when the rice fields have been flooded with Mekong water for some 4-7 days, before Mekong water has receded.

326. With the implementation of the pumping station and rehabilitation of the flood gates, Mekong water will not intrude into the catchment, when the Mekong River stage exceeds the level chosen for closing the flood gates and initiation of pumping operations. The impact is that the rice fields along the Houay Longkong no longer are subject to Mekong flooding.

327. A secondary impact of the drainage and flood control measures is reduction of stagnant diluted wastewater in the Houay Longkong during dry spells in the wet season. In the current situation during high Mekong water levels the Mekong water intrudes into the Houay Longkong. The wet season commonly brings one to two periods of dry spells with no rainfall. Such dry periods may have a duration of 6-10 days. When such dry spells occur at high Mekong water level, large volumes of diluted wastewater may accumulate in the Houay Longkong, and with little outflow into Mekong due to the absence of rains. It is assessed that in case of rising Mekong water level such plumes of polluted water may become stagnant or maybe even be pushed backwards into Houay Longkong. Stagnant diluted wastewater creates foul odor that pollutes the air, causing inconvenience to the local residents.

## **c. Urban roads in Kaysone Phomvihane, Phine, and Dansavanh**

328. During the operation phase of the roads it is assessed that most impacts will be positive as the project will lead to improved access, reduction in traffic induced dust emissions as the road surface will be sealed, improved road safety as a result of improved pavements, pedestrian crossings, and improved signage and speed limit enforcement. However, the roads project will also lead to increased traffic, subsequently leading to increased air pollution.

## **4. Induced and Cumulative Impacts**

329. Complementing the planned impact of the Project of socioeconomic development at each subproject town and along the EWEC are the potential negative impacts of increased urban development which would occur at different spatial scales. An immediate potential impact of urban development is air pollution.

330. At the town level, the new and upgraded infrastructure may create immigration to the towns. Potential induced impacts will be increased land development and pressure on existing infrastructure not developed by the Project. New zones for housing and commercial development could follow to support and be supported by the expanding populations of the towns.



331. Socioeconomic development from the Project could cause increased consumption of natural resources, and pollution along and adjacent to the EWEC. Regional economic development commonly is linked to environmental degradation and natural resource consumption. Socioeconomic development of a region is normally manifest by population growth and the increase in living standards which lead directly to increased individual and family consumption leading directly and indirectly to increased natural resource consumption, and waste production, and environmental pollution.

332. The potential induced and cumulative impacts of the subprojects are largely managed by the scale of the infrastructure investments. While economic growth is the decided impact, the outcome/outputs of the investments are meant to increase the quality of life of only the existing local communities. Further, the EAs are expected to work with the community and the MoNRE to manage the growth in an environmentally sustainable manner.

## VIII. ANALYSIS OF ALTERNATIVES

### A. Solid Waste Management and Materials Recovery Facility

333. The suitability of the existing site and solid waste treatment methods were assessed at the PPTA stage and are presented below. Changes in scope and design during the DED are presented at the end of this section.

#### 1. Assessment of Site

334. There has been a previous site identification, screening and selection process to arrive at a suitable site for a disposal site. According to the local authorities, several sites were assessed in 1995 and the existing one was recommended. A review at the PPTA stage concluded that the site is in accordance with national and professional requirements as presented in the following table and thus could be utilized in the future SWM system. The compliance with various criteria has been assessed as good, medium or poor, and no criteria should be assessed as poor.

335. The site has been assessed as suitable for continued use as landfill site (

336. Table 30). An Options analysis was also carried out for the method to be selected for solid waste management (SWM). The general objectives and selection criteria for treatment and disposal were:

- Select the least cost solutions compatible with what is considered appropriate technology under current economic and development conditions in Lao PDR.
- Collect and dispose of solid waste through solutions creating a minimum of damage and inconvenience for humans and the environment, while at the same time causing a minimum of demand on natural resources.
- Plan all technical facilities at the same environmental standard; small treatment and disposal facilities with less stringent environmental and operating requirements should be discouraged.
- All solutions must take into consideration the particular local conditions.
- All existing national environmental standards should be applied.

Table 30. Existing Site Compliance with Disposal Site Location Criteria

Criteria	Compliance with criteria	Comments
Minimal distance from town center. (Reduced transport costs)	Good	Currently 8 km from the town center. This is as close as realistically possible when following the master plan development in the next 15-20 years. The site also has a good location adjacent to the main road.
Minimum volume requirement: minimum 20 years of operation, preferably more.	Good/medium	Available area/capacity allow for min. 20 years of operation. Adjacent land is available and currently idle, and can be used as expansion for operation beyond 20 years.
Little or no visual impact (sheltering topography or vegetation)	Good	Surrounded by dense vegetation with very limited visual impact.
No inhabitants at the area and no neighbors within min. 300 m	Good	Nearest houses 0.5 km away

Favorable Soil/ground conditions. (highly recommended; impermeable soils) and no underlying or adjacent potential or existing groundwater or surface water sources	Good/medium	Soils: Alluvial/colluvial silty sand and sand with sections of finer materials. Although the available soil survey indicates impermeable soils, the leachate survey and observations indicate that the soil permits the water to seep down. Consequently, the use of additional liner has been included (local suitable clay) in the feasibility assessment. No stability problems are expected under the local soil conditions and landfill design. No groundwater interests or wells in the downstream neighborhood. Existing hydrogeological and soil study from 1998 concludes that there is a low risk of deep seepage of leachate to the underlying groundwater.
Good and adjacent availability of cover material.	Good	Most of the cover material may be provided through initial 1-3 m excavation of the site.
Suitable recipient for leachate.	Medium	The leachate will be treated before discharge to the wetland.
No flooding at the site	Good	The flood situation is important, and consultations with the local EA and the elevated location indicates that the site is not a flood prone area.
Uncomplicated ownership of area.	Good	The site of 16 ha is readily available.
Limited or no ambient area use and interests.	Good	The existing site with adjacent area has no land use except for agriculture within a wide distance from the site.
Available existing infrastructure.	Good	Since the site has a beneficial location and electricity lines, water supply well and access road are available.
No other environmental constraints (protected natural areas etc.)	Good	The site is not in wetlands or in an area with valuable fauna/flora importance. It is an elevated dry land with no critical vegetation.
None (or limited) other political constraints	Good	No other plans in the adjacent area. Site readily available.
No other natural conditions Concerns	Good	Not subject to earthquakes or similar concerns.

Source: IEE 2012

## 2. Assessment of Solid Waste Treatment Methods

337. The following treatment and disposal methods were assessed at the PPTA stage on the basis that they are internationally recognized as pertinent for municipal solid waste (MSW) and potentially applicable in a Lao PDR context:

- Sanitary landfilling with possibility of bio-gas collection and utilization.
- Incineration of most of the waste stream, or alternatively incinerate selected, high calorific waste categories.
- Composting of waste with high organic content.
- Centralized sorting of mixed MSW or selected waste streams.

338. It is an important condition that MSW treatment plants have a clear economy-of-scale. Typically, the unit treatment cost (USD/ton) for a large treatment facility may be less than a third of a small facility.

339. Sanitary landfilling is still the most common treatment and disposal method in most industrialized countries. Properly designed and operated landfills have limited environmental impacts.

340. A sanitary landfill provides the possibility of extracting and utilizing the energy-rich landfill gas (LFG).

Table 31. Sanitary Landfill Issues

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• very flexible with regard to change in quantities and characteristics of MSW</li> <li>• Landfill gas (LFG) extraction and utilization may provide a profitable resource recovery method</li> <li>• low requirements for skilled/specialized workers</li> <li>• low costs, both in investments and annual costs</li> <li>• very flexible in combination with RRR activities and other treatment methods</li> </ul>	<ul style="list-style-type: none"> <li>• potential major negative environmental impacts if improperly designed and/or operated</li> <li>• difficult to completely eliminate all environmental or social impacts</li> <li>• very low resource recovery if LFG utilization is not introduced</li> <li>• occupies and limits the use of large areas</li> <li>• with a limited and dense populated area sites may be difficult to find and establish</li> <li>• a larger portion of the country is on limestone and soil aquifer, requiring extra precautions against groundwater contamination</li> </ul>

341. Incineration is a widespread treatment method in many western countries. Normally it is combined with utilization of the generated energy, preferably with the utilization of both electricity and surplus heat. Also, worldwide, this method is becoming more and more recognized; although the experience to date in many countries outside the most industrialized is not very encouraging, mostly because of very wet MSW and lack of operational and financial capacities. The costs per treated ton are very high and the net income of sale of (only) electricity is low. In addition, the required operational skills are high, and the method may not be appropriate for the current conditions in Lao PDR.

342. In Lao PDR with a relatively low percentage of combustible components like paper, cardboard, plastics, textiles etc., the waste composition will normally not make incineration an acceptable nor sustainable solution. However, the method has been described and analyzed as an option, in order not to exclude any available method.

Table 32. Incineration issues

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• volume reduction</li> <li>• detoxification of hazardous waste</li> <li>• reduced leachate and landfill gas production at the landfills</li> <li>• energy recovery</li> <li>• landfill stabilization</li> </ul>	<ul style="list-style-type: none"> <li>• very high costs, both investment and operation</li> <li>• technically sophisticated</li> <li>• require highly skilled operators</li> <li>• secondary pollution impacts, particularly air pollution</li> <li>• adverse public sector reactions</li> </ul>

343. The warm and humid climate as well as the high proportion of biodegradable, organic material is favorable conditions for composting. However, some sort of pre-treatment or separation schemes could preferably be included.

344. Based on an assessment of available composting technologies, it is recommended to base the composting solution on low-technology aerobic windrow composting with frequent mechanical mixing.

345. Composting is considered suitable only for waste with a high content of organic material, like market and yard waste, etc. For mixed MSW, the reject percentage could be high (40-50 percent) for production of compost of sufficiently high quality. In most developed countries, modern composting is mainly based on source-separated organic fractions of MSW.

346. Without quite extensive post-treatment, like sieving etc., compost based on MSW has a limited use. It is internationally accepted to see this compost as soil conditioner, not a fertilizer. In most western countries the compost is used by the municipality in parks, at road side slopes, as vegetation cover at landfills, etc.

347. Based on experience from elsewhere it is considered economic feasible to compost only about 20% of the total MSW stream. This percentage of the MSW may be achieved through rather low-cost and simple pre-sorting separation schemes. A higher percentage of composting may require extensive and expensive additional source separation schemes.

348. Small scale, manual back yard composting of garden waste and possibly vegetable waste from households should be strongly encouraged and stimulated in medium and high income areas, with large plot sizes, and in rural communities.

Table 33. Composting issues

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• low-tech solution (the proposed solution)</li> <li>• reduces the quantities that need to be landfilled, and particular of components with potential environmental impacts</li> <li>• properly prepared end-product is environmentally friendly and provide a high quality soil conditioner for municipal or agricultural use</li> </ul>	<ul style="list-style-type: none"> <li>• only suitable for a portion of the MSW, unless a large percentage of reject for disposal is accepted</li> <li>• insufficient demand for compost at unsubsidized production cost. For Lao PDR soil conditioners may be available</li> <li>• rather high unit cost of production</li> <li>• limited resource utilization of the total MSW stream</li> <li>• may cause negative environmental impacts if not properly operated</li> </ul>

349. Central sorting of mixed MSW may be done in plants with different complexities, from very simple plants with mechanical sorting of more bulky components (cardboard, plastics, metals, etc.) to more complex plants with mechanical pre-sorting, conditioner and a main sorting line where these components of items that have an economic value are manually picked and sorted.

Table 34. Central sorting issues

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• high yield resource recovery (material recycling)</li> <li>• limited impact on the environment (enclosed plants)</li> </ul>	<ul style="list-style-type: none"> <li>• can only receive a portion of the MSW (normally not mixed/wet household waste)</li> <li>• can be complex and expensive to operate</li> <li>• sophisticated facilities: high initial investment and operating costs</li> <li>• very limited domestic market for the potential materials and varying international markets with large price fluctuations</li> </ul>

350. The above assessment of the solid waste management methods are summarized in the following table, which in addition includes assessment of costs and efficiency.

Table 35. Summary comparison of SWM methods

Aspects	Sanitary Landfilling	Incineration	Composting	Low-tech Central Sorting
Environmental impact	Acceptable (proper operation)	Good to very good	Acceptable to good	Good to very good (high % rejects)

Resource recovery		Acceptable (LFG)	Good to very good	Very good (soil conditioner)	Good
Local operation and maintenance capability (appropriateness)		Good to very good (appropriate technology)	Not Acceptable	Good (low-tech solutions)	Acceptable
Need/market for end-product		Good to very good (LFG electricity + reclaimed land)	Very good (electricity)	Acceptable to good (compost as soil conditioner)	Good to very good (but difficult market for some recycled materials)
Efficiency (% of total MSW stream handled)		Very good (~ 100%)	Good (~ 70-80%)	Acceptable (10-30%)	Good (30-40%)
Treatment (O&M) Costs Unit Price USD/ton	Small size plant 50 t/d	20	142	32	32
	Medium size plant 100 t/d	13	108	25	22

Source: IEE 2012

### 3. Scope and Design Changes in the DED Phase<sup>17</sup>

351. During the DED phase various changes to scope of the solid waste management subproject were made. The Material Recovery Facility (MRF) was included as a component of the subproject and following the revision of the Wastewater subproject to focus on drainage in the southern catchment of Kaysone Phomvihane, the septage collection and septic sludge treatment facility were included under this subproject as well.

352. Changes to the landfill cell design compared with the 2012 Feasibility Study included that the phase 2 landfill cell was merged with the phase 1 landfill cell thereby increasing the size from 1.5 to 2.5 ha and expanding the capacity from 150,000 m<sup>3</sup> to 176,000 m<sup>3</sup>. Compared with the Feasibility Study, no changes were made to the proposed phase 3 landfill cell, while the proposed phase 4 landfill cell is located at the site, which will be occupied by the leachate treatment plant and therefore not possible to construct. The changes to the landfill cell design simplifies the construction and makes it possible to reach the phase 2 capacity already after completion of phase 1.

353. The septic sludge treatment plant is an addition to the solid waste management subproject following the revision of the wastewater subproject. The land availability at the solid waste facility and the possibility of operating the collection vehicles and the plant in conjunction with the solid waste facility rather than as a separate stand-alone facility were part of basis for this decision.

354. The leachate treatment plant has been modified compared with the original concept as included in the Feasibility Study. The plant will receive the effluent from the septic sludge treatment plant. The retention pond has been replaced with a collection well. The floating aerator operating on diesel as proposed in the 2012 Feasibility Study has been replaced with a

<sup>17</sup> This section will be updated following the completion of the ECA and the subsequent update and finalization of the DED.



submersible electric aerator, which is a more reliable and efficient solution. The depth of the ponds have been increased.

355. The compost plant has been increased in size compared with the 2012 concept with a larger roofed area due to the additional treatment of dried septic sludge from the septic sludge treatment plant.

## **B. Drainage and Flood Protection<sup>18</sup>**

356. Compared with the 2012 Feasibility Study, the subproject has been revised substantially; the wastewater treatment components have been deleted, together with the original proposal for limited combined sewerage, and replaced with a citywide septage management program. Septage treatment will now be provided at the Kaysone Phomvihane landfill as part of the solid waste management subproject and septage collection will be provided through the purchase of new vehicles for this purpose.

357. In the revision of the subproject, it was decided to prioritize the implementation of the drainage project as specified in the Feasibility study (services the South catchment), incl. sealing the existing drainage channel, install flood gates and construct stormwater pump station. Thus, the subproject now focuses entirely on drainage and flood protection for Kaysone Phomvihane's southern catchment with outfall and discharge to the Mekong River.

### **1. Scope Changes Compared with PPTA Stage**

358. During the review of subprojects and preparation of Concept Notes in 2015, the subproject was the subject of an extensive review. The subproject scope as proposed in the PPTA, included:

- Construction of three WWTPs in the northern, central and southern catchments areas of Kaysone Phomvihane using aerated lagoons, all three located in urban areas, and part of urban development zones in the Savannakhet Urban Master Plan.
- Installation of interceptor sewers at the base of the existing main drainage channels to collect wastewater, transport and treat in a new mechanical WWTP installed within each catchment (total of 3 WWTPs).
- Improvement of drainage and installation of a drainage pump station to pump storm flows from the south drainage system to the Mekong River to prevent flooding.

359. The following issues were identified with the subproject scope as identified at the PPTA stage:

- Construction costs of US\$5.0 million have been under-estimated (low unit rates not reflecting market prices; absence of essential works, e.g. site access roads, auxiliary buildings and facilities, standby generator, etc.). The revised budget with necessary items included reach US\$13million.
- High land compensation cost not considered for purchase and income compensation for the three centrally located urban areas. The area required for the three WWTPs is 8.54 ha.
- 500m buffer zone normally required for aerated lagoons has was not considered.
- The use of aerated lagoons requires maintenance and power costs, and the location in populated areas requires to minimize the spread of aerosol to secure public health.
- Problem of regular collection and management of septic tank sludge is not addressed. Sludge and sullage is discharged to the road drains and exacerbate public health risks, especially during flood periods.

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<sup>18</sup> This section is prepared on the basis of the status as of May 2017 and should be updated when the DED is finalized.

360. The following alternative options were considered:

1. Sewage collection and treatment in a single WWTP using waste stabilization ponds located at the periphery of the city is also far beyond the scope of the budget (\$12-13M).
2. Provide wastewater collection and treatment for limited part of the catchment (e.g. South catchment), using either aerated lagoons or waste stabilization pond treatment options, however costs remain above budget (\$7-9M).
3. Focus on improved drainage with septic tank sludge management (and treatment) serving the whole city which is within \$5M budget.

361. It was recommended that a strategic and phased plan for the wastewater management and related drainage issues in Kaysone Phomvihane should be prepared. The phased approach consisted of three phases with only the first phase financed under the current project.

Table 36. Phased Implementation of the Sanitation Strategy for Kaysone Phomvihane

Phase	Strategy	Construction Works
<b>Short-term</b> 2015-2020	1.1 Septage sludge collection and treatment	Septic sludge tankers. Sludge treatment plant. DEWATS for market area.
	1.2 Drainage component	Renovate/seal drainage channel. Install sluice gate. Drainage pump station.
<b>Medium</b> 2020-2030	<b>2.0 Wastewater transported to WWTP</b>	Pump stations at catchments. Pressure mains to new WWTP. New WWTP at periphery of city.
<b>Long-term</b> 2030 onwards	<b>3.0 Separate sewerage</b>	Household connections. Sewage collection system.

Source: Wastewater Management and Sanitation Strategy, 2015

## 2. The Drainage and Flood Protection of the Southern Catchment

362. For the improvement of the southern portion of Kaysone Phomvihane drainage system the options considered in the Detailed Engineering Design phase included the need for a pumping station and flood gates, the type of pumping station, and the location of the pumping station.

363. An assessment of the types of flooding that occurs in Kaysone Phomvihane was conducted as part of the design basis for the Houay Longkong drainage and flood protection subproject. The conclusion was that flooding in central town is caused by a combination of heavy rainfall and insufficient drainage (at least partly caused by insufficient maintenance of the drainage system). The flood level of the central town is 114-115 meter Lao is not reached by the Mekong river. Flood risk will increase if the water level in the Mekong is high when the heavy rainfall occurs, but that this combination of events occurs rarely. Flooding by the Mekong River alone occurs extremely rarely and will cause flooding in the downstream area of the Houay Longkong when the water level reaches 114 meter Lao.

364. On that basis, it was concluded that the rehabilitation of the flood gates and the pumping station would have little (or no) influence on the flooding in central town. However, the alternative of not installing a pumping station and removing the flood gates was considered not acceptable by the DPWT due to the potential impact of a flooding by the Mekong on the area along the Houay Longkong.

365. Thus, the subproject was defined to include new flood gates to prevent the high water from the Mekong River from entering the drainage channel, equipped with automatic system for

operating these and a new pumping station to empty the channel during rainfall events, when the Mekong river levels are high and the flood gates closed, incorporating natural reservoir volumes in the design of capacities.

366. To assess pumping capacity and reservoir capacity, the DED design basis dimensioned rainfall events that could cause flooding as daily rainfall exceeding 50 mm and assumed a duration of the main runoff of 3 hours. Such events occur on average six times per rainy season, i.e. once a month in the rainy season.

367. The run-off quantity for the Longkong catchment with a catchment area of 538 ha, a rainfall of 50 mm corresponds to a rain volume of 269,000 m<sup>3</sup>. By applying a runoff coefficient of 0.6, the corresponding runoff volume is 161,000 m<sup>3</sup>. The DED design basis assesses that holding this volume in the reservoir would increase the water level to 112.8 m Lao, which is below the level of the rice fields along the Houay Longkong. To empty the reservoir within 24 hours would require a pump capacity of 1.85 m<sup>3</sup>/s. As the volume of water would be pumped out during the main runoff of the rainfall, the retained volume and consequently the level would in fact be lower. With a pump capacity of 1.85 m<sup>3</sup>/s the volume would be approximately 140,000 m<sup>3</sup>. In the event of a rainstorm greater than 50 mm (occurring while Mekong water level is high and the hence the flood gates closed) the runoff would build up the level in the reservoir to a level above 113 m Lao, causing temporary flooding of the rice fields. As pumping would be ongoing, the flooding would a very short-duration of an assessed 6-12 hours.

368. With the design basis requiring the 140,000 m<sup>3</sup> reservoir emptied within a 24-hour period, the required pumping capacity is 1.85 m<sup>3</sup>/s. To deliver this the design basis proposed to install two vertical turbine pumps with a capacity of 0.9 m<sup>3</sup>/s and head of approximately 12 meters, with no standby pump needed due to the infrequent operation of the pumps.

369. The pumps are of substantial size and consequently needs substantial power supply. The capacity of the existing electricity system will be investigated during the detailed design. The pumping station is intended as an emergency facility to avoid flooding and therefore back-up power supply is included to ensure continued operation in the event of power cut. It is therefore proposed to install a diesel generation to provide back-up power.

370. Automatic operation rather than manual was selected with start and stop of the pumps controlled by the water level in the pump sump (or inlet channel) through simple mechanical means (floats) or ultrasonic measurements. The same control will be used to control the floodgate to close when the Mekong rises to above a certain level.

371. Two options for location of the pumping station has been considered. Either on the outside of the embankment culvert or on the inside of the embankment at an area, alongside Houay Longkong. The design basis has recommended to locate the pumping station inside of the embankment area.

### **C. Urban Roads**

372. The location of the urban roads sub-project were determined by the planning priorities of the EA in terms of necessary road upgrading. The changes to road sections made during the detailed design stage, included: No bridge across the Alone river in Dansavanh, change in the alignment of two new road sections in Phine, and Santhipap Road in Kaysone Phomvihane was financed through other means.

## 1. Kaysone Phomvihane Urban Roads

### a. Feasibility Study, 2012

373. The location of the urban roads sub-projects were determined at the PPTA stage by the planning priorities of the EA in terms of necessary road upgrading. The changes to road sections made following the PPTA stage and during the detailed design stage, included to cancel the Santhipap Road Section, which was financed through other means.

374. The Feasibility Study (November 2012), prepared as an output of the PPTA, assumed that the proposed roads will be upgraded to 2x2 lanes, with a median divider, and with 2.0-meter-wide sidewalks and drainage on each side of the road. For the Kaysone Phomvihane Road, an additional 1.5-meter-wide lane for motorcycles was proposed in each direction. Three different options were considered in respect of the detailed geometric standard and the standard of the drainage. The three options partially differed on the width of the lanes and median with the drainage being the main difference.

Table 37: Comparison of options, Design Standard Options

Road	Overall width [m]	Lane widths (one side) [m]	Median width [m]	Side drain
<b>Kaysone Phomvihane Road</b>				
Option 1	25.0	3.8 + 3.5 + 1.5	2.4	2 x RCPC Ø1.0m+gully
Option 2	24.4	3.5 + 3.5 + 1.5	2.4	2 x RCPC Ø0.8m
Option 3	23.2 x)	3.5 + 3.5 + 1.5	1.2	1 x RCPC Ø0.8m + Open side ditch
<b>Fa Ngum Road (Lot 1)</b>				
Option 1	20.2	3.5 + 3.5	1.2	2 x RCPC Ø1.0m+gully
Option 2	20.2	3.5 + 3.5	1.2	2 x RCPC Ø0.8m
Option 3	20.2 x)	3.5 + 3.5	1.2	1 x RCPC Ø0.8m + Open side ditch

m = meter, RCPC = Reinforced Concrete Pipe culvert.

x) = Not including the open side ditch on one side of the road

Source: Feasibility Study, 2012, GMS Corridor Towns Development Project. (TA7644-REG)

375. Both Options 1 and 2 had a closed drainage system under the sidewalk on each side of the road, with a pipe culvert of different size. In addition, Option 1 has a “gully” (also called “catch basin” or “sand trap”) under the curb and gutter, while for Option 2 the surface water from the pavement goes directly to the manholes from the gutter via a pipe. This solution is less costly, but also less favorable when it comes to maintenance. Option 3 included an open side ditch along the roads, which the PPTA Consultant advised against because construction of accesses to properties along the road tend to block the drainage and may complicate maintenance, it would also require additional land acquisition, and/or demolition of buildings along the roads.

Table 38. Comparison of Options for the Kaysone Phomvihane Urban Roads Subproject

Option	Technical and Engineering Aspect	Social and Environmental Impact	Cost Efficiency
Option 1	Closed drainage system under the sidewalk on each side of the road, with a pipe culvert of different size	No adverse impact on land acquisition and resettlement impact since no houses or significant structures will be adversely affected with the	This solution is less costly, but also less favorable when it comes to maintenance.

	Has a “gully” (also called “catch basin” or “sand trap”) under the curb and gutter.	improvement and widening of the urban roads	
Option 2	Closed drainage system under the sidewalk on each side of the road, with a pipe culvert of different size; Surface water from the pavement goes directly to the manholes from the gutter via a pipe.	No adverse impact on land acquisition and resettlement impact since no houses or significant structures will be adversely affected by the improvement and widening of the urban roads	This solution is less costly, but not favorable when it comes to maintenance.
Option 3	Open side ditch, which is not recommended for reasons demonstrated by the roads, i.e., construction of accesses to properties along the road tend to block the drainage and may complicate maintenance.	The urban roads improvement and widening will require acquisition and demolition of existing buildings and structures along the urban roads.	While construction is lower compared to Options 1 and 2, additional cost will be required for the cost of land acquisition and resettlement.

Source: Feasibility Study, 2012: GMS Corridor Towns Development Project. (TA 7644-REG)

107. The PPTA Consultant concluded that based on an overall assessment of quality and cost, Option 2 was recommended.

#### **b. Concept Review and Detailed Engineering Design**

376. In a review of the Kaysone Phomvihane urban roads subproject proposed at the Feasibility Study stage, it was found that the traffic count surveys did not justify the proposed design standards. At the same time, the unit rates for the major work items used in the cost estimate were lower than the standard unit rates used by the MPWT. The design standards as well as unit rates were reviewed and modified resulting in different volumes and quantities for major work items and revised estimated costs.

377. The main recommendations of the concept review were:

- Set sub-base at level appropriate for present and forecast traffic volumes;
- Use “U-shaped” drainage design on the road side under the side walk, instead of pipes and manholes in the center of the road to reduce costs and to simplify the design and maintenance;
- Include two roundabouts at appropriate locations on the Fa Ngum Road to provide improve traffic safety;
- Cost reductions to be utilized in part for beautification through planting of trees and street lighting.

378. In the establishment of the design criteria for the DED in 2016, the Fa Ngum Road 1 (West) was reduced to a two-lane carriageway each with a width of 3.75m. Compared with the proposal at the PPTA stage this reduced the total width significantly from about 25m to 12.2m. This reduction has largely removed the need for resettlement compensation along the Fa Ngum Road.

379. An option with concrete pavement on the Kaysone Phomvihane Road and Fa Ngum Road was assessed, which would have required additional funding or reallocation between subprojects. In the DED, asphalt concrete pavement for both roads was selected.

## **2. Phine Urban Roads**

### **a. Feasibility Study, 2012**

380. The location of the urban roads sub-project were determined by the planning priorities of the EA in terms of necessary road upgrading. Therefore, all options considered under the Feasibility Study (November 2012), prepared as an output of the PPTA, considered the same road alignments.

381. The Feasibility Study considered three cross section options with respect to technical and cost implications. The PPTA Consultant proposed that the full cross section would only apply when there was sufficient space and that in existing narrow streets the width was reduced to a minimum of 6 meters as applicable and that consequently, the resettlement for the options would be almost similar.

382. For Option 1 the existing interior urban road would follow the existing horizontal alignment and gradient longitudinal profile, requiring some filling of the road embankment. The road would be extended and widened with asphalt pavement and surface carriageway that would allow two-lane measuring 7.5 meters and have 2 meters wide sidewalks on each side. The roads would have a width of 12.5 meters excluding open drains at new alignments. The inlet drain sump from the curbs channel would be designed with reinforced concrete gully with covering. Cast iron gratings and frames would directly connect the drainage to the main drain. The main drain will be designed with closed pipes culvert for the full-length along both roadsides. The subproject was also proposed to include a reinforced concrete chamber to collect sullage/wastewater from residential houses and commercial establishments located adjacent to the road.

383. The Option 2 was similar to Option 1 with the exclusion of reinforced concrete gully with covering, cast iron gratings, and curbs channel drains connected to the manhole. The design for main drains was for open drainage structures.

384. The Option 3 was generally similar to Option 2 with the exception that there would only be one drainage pipeline in the middle of the street and open drains with stone masonry or approach slabs along certain road sections.

Table 39. Comparison of options for Phine Urban Roads Subproject

Option no.	1	2	3
Technical aspects	Road improved and widened with 2 lane asphalt pavement of two-lane road, sidewalks, drains crossing with pipes culvert and manholes. Installation of reinforced concrete gully with covering, cast iron gratings and frames connected to culverts or manholes.	Technical design generally similar with Option 1 but without the reinforced concrete gully and cast iron gratings. The design is for open drainage structures.	Design is similar with Option 2 but will only have one drainage pipeline. Many road sections will have open drains made of stone masonry and approach slabs.
Functional aspects	Reinforced concrete gully will control the flow of storm drains and will mitigate flooding of the roads and adjacent residential and commercial establishments. The road is designed with maintenance costs.	Open drains with stone masonry and approach slab will cause the overflow of storm water during rainy months that will result in flooding of the roads and adjacent residential and commercial areas.	Drainage pipes in the middle of the road will results in frequent damages on the road and therefore tedious maintenance works and higher maintenance costs.
Resettlement aspects	Road improvement and widening is designed for minimum impact on land acquisition and resettlement	Change in road alignment <sup>1</sup> will adversely affect residential houses and commercial establishments adjacent to the road.	Similar to Option 2.
Environmental aspects	Insignificant negative impacts on the environment	Same as Option 1	Same as Option 1
Rank	1	2	3

<sup>1</sup>As there was no difference in the road alignment between the three option, this assessment is unclear.

Source: Feasibility Study, 2012: GMS Corridor Towns Development Project. (TA 7644-REG)

385. Based on these assessments and technical discussions with PDPWT and the District Authorities, the Option 1 was selected. The PPTA Consultant noted that the cost analysis showed that the drainage component would carry 40% of the total cost for the construction.

#### **b. Concept Review and Detailed Engineering Design**

386. In a review of the Phine urban roads subproject proposed at the Feasibility Study stage, it was found that the traffic count surveys did not justify the proposed design standards. At the same time, the unit rates for the major work items used in the cost estimate were lower than the standard unit rates used by the MPWT. The design standards as well as unit rates were reviewed and modified resulting in different volumes and quantities for major work items and revised estimated costs.

387. The main recommendations of the concept review were:



- Reduce the thickness of the road pavement sub-base on the Main Road from 25cm to 20cm and on the Access Roads from 25cm to 15cm. This is more appropriate for the existing and forecast volumes of traffic.
- Use “U-shaped” drainage design on the road side under the side walk, instead of the closed drainage system to reduce costs and to simplify the design and maintenance;
- Move streetlights from the inside to the outside of the sidewalk for road safety, and easier access for maintenance.
- Reduce width of sidewalks to 0.9m.
- Cost reductions to be utilized in part for beautification through planting of trees and street lighting.

388. The location of the urban roads sub-project were determined by the planning priorities of the EA in terms of necessary road upgrading. However, during the detailed design phase it was decided to change the alignment of the new road sections A and Q to avoid interference with two graveyards.

389. The road surfacing was reassessed with respect to cost effectiveness and it was decided to change the surfacing from asphalt concrete to DBST.

390. The road width was reviewed and optimized with respect to needs and three typical cross sections were prepared for Main Road Type A with a total width of 15.2 meters including open side drains, Main Road Type C with a total width of 10.5 meters including closed side drains, and Access Roads with widths of 8.1 meters including closed side drains. This was a modification from the Design Criteria Report, which had only operated with one type of Main Road with a total width of 14.2 meters, including open side drains and an Access Road with a total width of 7.6 meters.

### **3. Dansavanh Urban Roads**

#### **a. Feasibility Study 2012**

391. The location of the urban roads sub-project were determined by the planning priorities of the EA in terms of necessary road upgrading. The alignments were selected on the basis of the Sepone District Development Master Plan. Based on discussions with the Savannakhet Provincial Department of Public Work and Transport (PDPWT) and the local authorities, it was agreed that the subproject should include the core (1. phase) roads, to support a stepwise development of the town. Specifically, for the bridge over the Alone River and associated road section alignment two options were considered.

392. Therefore, with the exception of the bridge and associated road section, the Feasibility Study (November 2012), prepared as an output of the PPTA, considered the same road alignments. The Feasibility Study considered three options with respect to technical and cost implications.

393. For Option 1 the existing interior urban road would follow the existing horizontal alignment and gradient longitudinal profile, requiring some filling of the road embankment. Carriageways would allow two-lane traffic measuring 7.5 meters and have 2 meters wide sidewalks on each side. The roads would have a width of 12.5 meters excluding open drains at new alignments. The inlet drain sump from the curbs channel would be designed with reinforced concrete gully with covering. Cast iron gratings and frames would directly connect the drainage to the main drain. The main drain will be designed with closed pipes culvert for the full-length along both roadsides. The subproject was also proposed to include a reinforced concrete chamber to

collect sullage/wastewater from residential houses and commercial establishments located adjacent to the road.

394. The alignment of the new bridge crossing the Houay Alone was at a location that would avoid land acquisition and resettlement and impact to productive land. The alignment was based on the proposed by-pass road included in the Sepone District Development Master Plan.

395. The Option 2 was similar to Option 1 with the exclusion of reinforced concrete gully with covering, cast iron gratings, and curbs channel drains connected to the manhole. The design for main drains was for open drainage structures. The alignment of the new bridge across Houay Alone stream was designed at site further south and would require land acquisition and resettlement of 20 households. The road section would impact on the existing public facilities such as market, community hospital, school and commercial establishments.

396. The Option 3 was generally similar to Option 2 with the exception that the road side drains at the new alignment connecting to the new bridge across Houay Alone would be open drains with stones masonry, approach slab or grass sodding. Embankment fill at bridge abutment would maintain existing and new proposed alignment. As in the case of Option 2, the road section would impact on residential houses, public facilities such as market, community hospital, school and commercial establishments.

Table 40. Comparison of options for Dansavanh Urban Roads Subproject

Option no.	1	2	3
Technical aspects	Design with widened asphalt pavement surfaces, closed pipes culvert for the full-length along both roadsides, reinforced concrete chamber to collect sullage and of wastewater. Main drains are closed pipe culverts	Generally similar to Option 1, but without the reinforced concrete gully with covering and cast iron gratings. Open drains made of stone masonry and grass sodding.	Similar to Option 2 with changes in road side drains at new alignment.
Functional aspects	Reinforced concrete gully with covering will control the flow of storm water and will mitigate flooding of the road and adjacent areas. Low maintenance of the drainage structures.	With open drains, the tendency for storm water to overflow and will cause flooding. Maintenance would be tedious and costly	Similar to Option 2
Resettlement aspects	Road and bridge alignments are designed to minimize significant land acquisition and resettlement issues	Road and bridge alignment will adversely affect 20 households and will impact on public facilities like market, community hospital and school.	Similar to Option 2
Environmental aspects	Insignificant negative impacts on the environment	Same as opt. 1	Same as opt. 1
Rank	1	2	3

Source: Feasibility Study, 2012: GMS Corridor Towns Development Project. (TA 7644-REG)

397. The 3 road options were subjected to further field validation and technical discussions with the UDAA and the Provincial and District Public Works and Transport. Based on these assessments and subsequent discussions with the EA, the Option 1 was selected. The PPTA Consultant noted that the cost analysis showed that the drainage component would carry 40% of the total cost for the construction.

#### **b. Concept Review and Detailed Engineering Design**

398. In a review of the Dansavanh urban roads subproject proposed at the Feasibility Study stage, it was found that the traffic count surveys did not justify the proposed design standards. At the same time the unit rates for the major work items used in the cost estimate were lower than the standard unit rates used by the MPWT. The design standards as well as unit rates were reviewed and modified resulting in different volumes and quantities for major work items and revised estimated costs.

399. The main recommendations of the concept review were:

- Reduce the thickness of the road pavement sub-base on the Main Road from 25cm to 20cm and on the Access Roads from 25cm to 15cm. This is more appropriate for the existing and forecast volumes of traffic.
- Use “U-shaped” drainage design on the road side under the side walk, instead of the closed drainage system to reduce costs and to simplify the design and maintenance;
- Move streetlights from the inside to the outside of the sidewalk for road safety, and easier access for maintenance.
- Reduce width of sidewalks to 0.9m.
- Location of the Alone River Bridge on the north side of the NR9 was deemed too close to the Vietnamese border by the DPWT and the District authorities and it was thus decided to survey an alternative route passing outside the urban areas on the south.
- Cost reductions to be utilized in part for beautification through planting of trees and street lighting.

400. The location of the urban roads sub-project were determined by the planning priorities of the EA in terms of necessary road upgrading. However, during the detailed design phase various changes to the road subsections were made, which mainly consisted of reductions of the scope of the subproject by excluding various minor road sections. Various options for the bridge over the Alone River was considered and it was proposed to include a simple Irish Crossing at Dansavanh crossing the Alone River North of Road no. 9 ensuring access across the river during the dry season. The final decision was to take the bridge over the Alone River out of the subproject with only surveying of an alternative route conducted under in this phase.

401. The road surfacing was reassessed with respect to cost effectiveness and it was decided to change the surfacing from asphalt concrete to DBST.

402. The road width was reviewed and optimized with respect to needs and three typical cross sections were prepared for Main Road Type A with a total width of 11.9 meters, Main Road Type B with a total width of 15.2 meters including open side drains, and Access Road Type A with widths of 7.85 meters including closed side drains. This was a modification from the Design Criteria Report, which had only operated with one type of Main Road with a total width of 14.2 meters, including open side drains and an Access Road with a total width of 7.6 meters.

403. In the preparation of the Resettlement Plan for the Dansavanh subproject, significant resettlement impacts were identified along the northern sections of Road 6 (R6) and to a lesser extent Road 8 (R8) and the southern section of Road 12 (R12). The road widening according to the DED would require demolition of residential houses along the roads. Options for carriageway

and road reservations were considered. On that basis the PMU decided to opt for a design variation for R6, R8, and R12 reducing the total road width and shifting the alignment of R12 eastwards to avoid impact to a residential house on the corner of the National Highway. The shift in alignment of the R12 has in addition reduced the impact to fishponds significantly. The design variation was presented at the pre-bid meeting and will be formally issued following contracting.

## **IX. GRIEVANCE REDRESS MECHANISM**

404. The purpose of the grievance redress mechanism (or, the mechanism) is meant for persons seeking satisfactory resolution to their complaints on the environmental performance of the Subproject. Grievances raised on environmental impacts may be critical to the health and wellness of affected persons (APs) and, hence, prompt responses/actions are critical. The mechanism will ensure that: i) the basic rights and interests of every person affected by poor environmental performance of a Subproject are protected; and ii) their concerns arising from the poor environmental performance of a Subproject during the conduct of pre-construction, construction and operation activities are effectively and timely addressed.

405. Any person who has complaint regarding the environmental performance of the Subproject during pre-construction, construction and operation phases shall have access to the mechanism free of charge.

406. The PMU has appointed a Grievance Point Person (GPP) to handle environmental grievances lodged prior to construction, during construction and during operation. The PMU will provide sufficient support system, i.e., communication facilities, recording, and reporting system and funds, among others, shall have been set up to sustain the effective implementation of the mechanism.

407. The PMU through its GPP shall ensure that the mechanism, including names and contact details of responsible persons in the affected villages, PMU, UDAA and DPWT, is publicly disclosed, and posted in the offices of the affected villages and in strategic places of the Project's area of influence, so that the mechanism is accessible to all segments of the affected villages. During operation, the GPP will liaise with the Kaysone Phomvihane UDAA and the DPWT (the operators) for the management of the mechanism until loan closure.

408. The affected person lodge complaints to any of the following: i) village officers; ii) Contractor, during construction; iii) DPWT or UDAA; iv) PMU, through its GPP, or v) third parties, e.g., NGO, religious groups. The AP may also lodge complaint through ADB's accountability mechanism. Complaints may be acted on immediately by the responsible party. However, it shall be made a policy that all informally lodged and acted on complaints shall have to be registered with the PMU as soon as possible for record purposes.

409. The Contractor is required to establish grievance management procedures in line with the project level GRM and signpost contact information (phone number and website) on the construction site. The Contractor's Environmental Representative is required to conduct ongoing consultations with the affected persons in the project area through random site walks and consultations.

410. The CSCS and the GPP will conduct site visits and site walks and conduct consultations with affected persons and village heads to obtain information on grievances.

### **A. The Grievance Redress Process**

411. Informally, an AP can approach or call the village heads, Contractor, the PMU, UDAA or DPWT to raise his/her complaints/concerns. Complaints may be acted on immediately by the responsible party. However, it shall be made a policy that all informally lodged and acted on complaints shall have to be registered with the PMU as soon as possible for record purposes. If informally lodged complaint is not acted on promptly, or if AP is not satisfied with the resolution undertaken, he/she can then avail of the formal mechanism, as follows.

#### Step 1: Lodging complaint

It is possible that APs lodge complaints to any of the following: i) village officers; ii) Contractor, during construction; iii) DPWT or UDAA; iv) PMU, through its GPP, or v) third parties, e.g., NGO, religious groups. The AP may also lodge complaint through ADB's accountability mechanism<sup>19</sup>.

#### Step 2: Grievance Documentation/Registration

The GPP as appointed by the PMU will be responsible for documenting and registering complaints received during construction. During operation, the responsibility will be assumed by the DPWT or/and UDAA depending on the asset. Other potential complaint recipients shall make sure that the received complaints are directed to, documented by, and registered with the GPP as soon as possible. The GPP shall make sure that documented/registered complaints are acknowledged, duly referenced.

#### Step 3: Screening of complaint

The AP shall immediately be informed if the grievance is within, or outside, the purview of the mechanism. If it is outside the scope, AP shall be directed to the proper institution and/or proper mechanism for the complaint.

#### Step 4: Reviews, Investigation and Discussion

If it is covered by the mechanism, the AP shall be informed/reminded of the expected action timelines as set forth in the established mechanism. If both the AP and the other party, Contractor or PMU, are available, the complaint shall be immediately reviewed, investigated and discussed. If not, the review, investigation and discussion should immediately take place on the next day. The discussion will center on the measures to implement based on the review and investigation.

#### Step 5: Action/Resolution

If complaint is minor, the Contractor/DPWT/UDAA shall immediately act on the complaint. Minor complaint will be those impacts/issues that would not require thorough review and investigation and will be easy to resolve. If impact/issue will need thorough review and investigation, more work to be done, and/or supplies/parts to be procured, to resolve, the Contractor/DPWT/UDAA shall immediately provide the most suitable interim measure to reduce the magnitude of the impact; and to start work on the final measure not later than 5 days from the day discussion meeting is held.

#### Step 6: Acceptance of Resolution

If, according to the AP, the impact has been resolved satisfactorily, the GPP shall obtain a written confirmation of satisfaction from the AP, which will form part of the grievance documentation.

#### Step 7: Monitoring and Evaluation

For at least a week after closure of grievance (that is, when action implemented has been satisfactorily confirmed in writing by the complainant), the GPP shall monitor the effectiveness of the resolution. Monitoring and evaluation shall be properly documented and included in the Project Environmental Monitoring Report of the PMU.

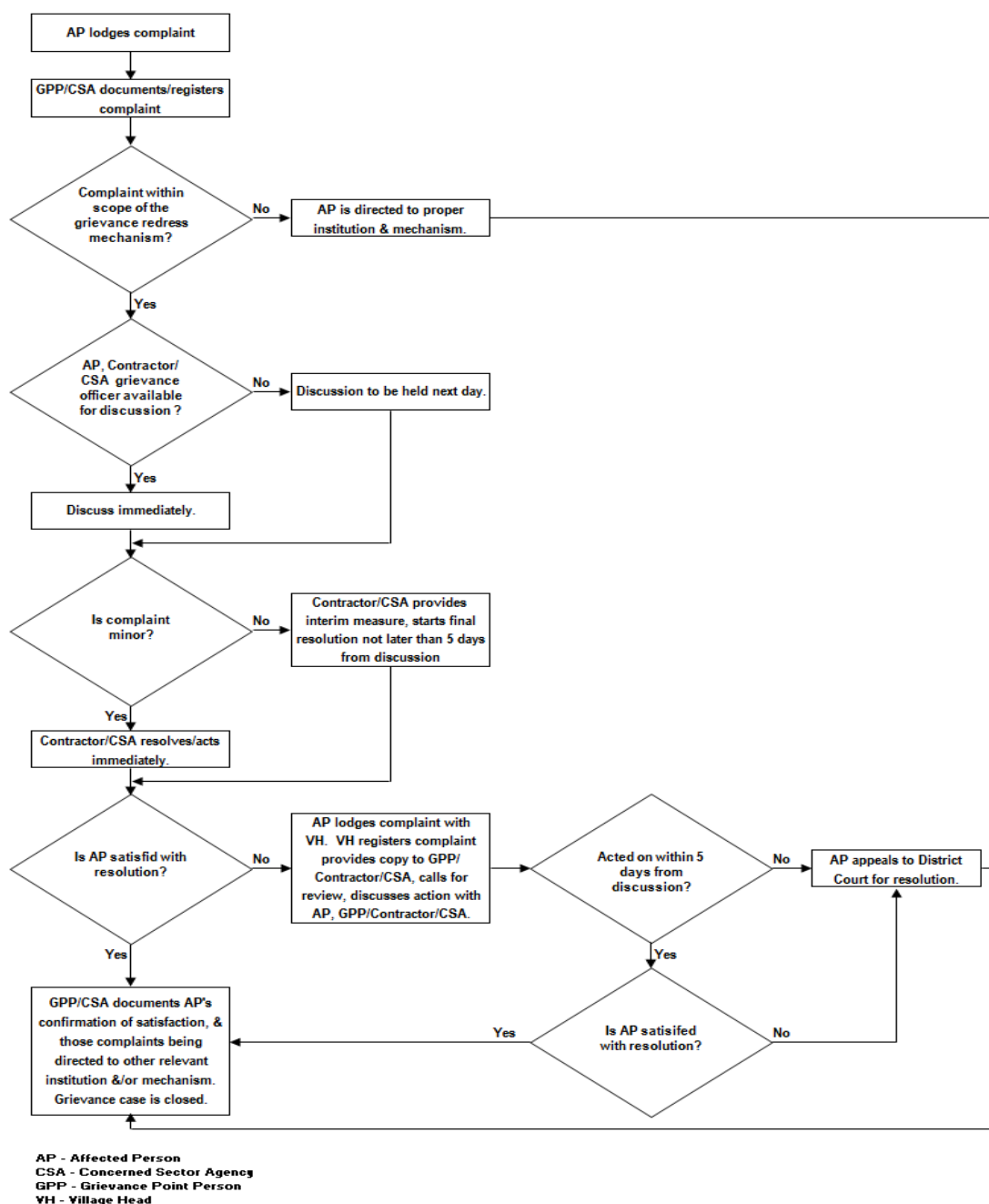
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<sup>19</sup> *ADB's accountability mechanism provides a forum where people adversely affected by ADB-assisted projects can voice and seek solutions to their problems and report alleged noncompliance of ADB's operational policies and procedures. It consists of two separate but complementary functions: problem solving and compliance review function. Complaints must be in writing and addressed to the Complaints Receiving Officer. More information can be found at: (<http://www.adb.org/site/accountability-mechanism/main>).*

### Step 8: Lodging of Appeal by Dissatisfied APs

In the event the issue/impact persists, AP can lodge an appeal to his/her village head. The village head shall immediately: (i) record the appeal; (ii) contact the GPP, Contractor/DPWT/UDAA and provide them with copy of the appeal; and (iii) call for a meeting to review the history of the grievance and discuss the appeal and quick resolution of the issue. If the agreed on action/measure has not started within 5 days from the time of formal lodging of the appeal, or if the issue still persists despite the second action, AP can seek assistance from village head to raise the grievance to the District Court.

Figure 32. Flow-chart over the Grievance Redress Procedure



## **X. ENVIRONMENTAL MANAGEMENT PLANS**

412. Environmental management plans have been updated at completion of the detailed engineering design, and are found under separate cover.



## **XI. CONCLUSIONS AND RECOMMENDATIONS**

413. Considering the detailed engineering design as available, the IEE update confirms the conclusion of the 2012 IEE that there are no significant negative environmental impacts and risks associated with the subprojects in Kaysone Phomvihane, Phine, and Dansavanh in Lao PDR that cannot be mitigated and that the subprojects with the updated subproject-specific EMPs can be implemented in an environmentally acceptable manner.

414. The final design of the sanitary landfill depends in part on the results of the ongoing environmental compliance audit (ECA). The ECA will assess compliance of the existing operation, the present and future impact of the existing dumpsite on the environment, and the potential risks and impacts for the solid waste components designed under the current project. An output under the ECA will include an Action Plan to bring the existing facility in compliance.

415. The public consultation meetings underscored the need for effective management of noise, dust, traffic disruptions, and safety during the construction phase of the project. Follow-up meetings with the consulted stakeholders to address any construction-related issues are required prior to construction and are identified as actions in the EMPs and RPs. The pre-construction consultations will include introduction of the grievance redress mechanism, which has been developed based on cultural norms and GoL requirements.

416. The civil construction impacts of elevated dust, noise, traffic disruptions, erosion and sedimentation, and public and worker safety can be managed effectively with standard construction practices (e.g., World Bank 2007).

417. The IEE 2012 concluded that there are no critical habitats, rare or endangered species, significant biodiversity values, ecological protected areas, cultural or heritage structures affected by the subprojects. The IEE update on the basis of available detailed design confirms this conclusion.

418. The 2012 IEE concluded that the description of the designs combined with available information on the affected environments was sufficient to understand the scope of potential environmental impacts of the subprojects and that further detailed environmental impact assessment (EIA) of the subprojects was not required. The IEE update confirms this conclusion.

419. The 2012 IEE assigned the project as Category “B” under ADB categorization. The IEE update confirms the original environmental categorization.

420. The EMPs for the subprojects provide impacts mitigation plans, environmental monitoring plans. The EMPs are reviewed and updated at the detailed design phase to ensure that the EMPs address the final subproject designs. The EMPs for the Urban Roads sub-project have been updated and include mitigation plans for assessed impacts, which are mostly construction related.

## **XII. REFERENCES**

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### **XIII. APPENDIX A: DESCRIPTION OF POLICY, LEGAL, & EIA FRAMEWORK**

#### **Laws**

421. Law on Environmental Protection No. 02/99/NA (1999): sets out the basic principles of environmental protection at Article 5, stating that all persons and organizations residing in the Lao PDR have an obligation to protect the environment. It does stipulate that those who generate an environmental impact are responsible for the resulting damage caused. Directs that environmental management and monitoring units be established at all levels of government, with responsibilities to include such things as: establishing and enforcing sector environmental plans; taking action to mitigate environmental damage; issuing orders to adjust, suspend, remove or close down activities that cause negative impacts. It states at Article 8(3) that development projects and operations that have or will have the potential to affect the environment shall submit an Environmental Impact Assessment (EIA) report in accordance with the regulations of WREA. WREA is responsible for environmental management and monitoring, and the issuance of an Environmental Compliance Certificate (ECC).

422. Law on Industry No. 01/99/NA (1999): indicates all businesses shall ensure the protection of the environment in accordance with the Environment Protection Law. Solid and liquid wastes shall be treated in accordance with the relevant MIH waste discharge regulations (Article 19).

423. Law on Hygiene, Prevention and Health Promotion No.01/NA (2001): focuses on controlling the elements of the environment which are dangerous or may be dangerous to the body, to mental health and social status of human (Article 2); promoting the investment in hygiene, prevention and health promotion (Article 5); community hygiene to be in place (Article 11); to ensure the building access to hygiene principles (Article 14); the care of working conditions for workers (Article 18); to ensure the cleanness of goods exposed, be far away from dirty sources, cemetery and rearing animal places (Article 22). All facilities to be in place particularly wastewater management, solid waste management systems and anti-fire management system.

424. Law on Water and Water Resources (1996): currently under revision specifies that the GoL is responsible for the prevention of adverse impacts from water and all acts that cause the depletion of water; water resources must be managed and used according to centralized, comprehensive and integrated management principles and according to the 'allocation plan' which gives individuals and organizations the right to use water. The law includes several key points about regulating use and environmental impacts: Medium and large-scale use of water requires approval, registration and/or a contract. Large-scale use must be accompanied by a feasibility study, an ESIA and detailed measures to deal with the impact. The Law regulates 'Water Source Development activities', stating that these activities require approval from the relevant authorized agency and must comply with 'socio-economic and environmental development plans, the master plan, periodic development plans of each sector, and the construction plan for each approved project'. These must also ensure the preservation of water and prevent adverse impacts on the environment.

425. Law on Land (2003): is relevant to environmental and wetland management, as well as the management of the country's land resources. The Land Management Authorities are responsible for, among other things, coordinating with concerned sectors and local administrations to plan the use of land, to protect and develop land, and to define land areas for certain uses; they can allocate land use rights to lease or grant concessions, and withdraw the right to land use. Various articles allow for the lease or concession of land from the State. In terms of environmental protection, Article 6 obliges individuals and organizations to 'protect the land to ensure that it is in a good condition'. It also states that land use shall not have a negative impact in the natural or social environment.

426. Law on Roads (1999): provides directives for transportation of hazardous materials via Lao PDR roads. Also designates weight limits on vehicles traveling on Lao PDR roads. It states that construction activities that the road contractor shall perform includes protection of the environment (Article 15); Ministry of Communications, Transport, Post and Construction (MCTPC) is authorized to manage and use material from borrow pits, quarries, gravel, sand etc, from authorized locations (Article 18); Reasonable compensation must be paid to individuals whose land is expropriated for roads, relocation of replacement structures, and loss of trees and crops (Article 19); and it states that it is prohibited to construct within the road reserve (Article 21).

427. Law on Forestry (2007): while under revision defines distinct uses of forest or forest products (e.g. tourism, recreational sites, logging) and specifies which 'Forest Category' each 'use' may be conducted within. Those wishing to engage in 'business operations in the forest' must seek approval from the Forest and Forest Land Management Authority. Utilizing forests for business purposes 'shall avoid causing any negative impacts to forest and forest production areas, nature, the environment and society'. Degraded forestland and barren forestland can be used for other activities; the level of degradation is vaguely defined at Article 3 as forestland areas where forest has been heavily and continually damaged and degraded, causing a loss in the balance in organic matter, which means that the forest may not be able to regenerate naturally. The Law also defines buffer zones as the forest and forestlands from 100m to 500m in width surrounding protected areas.

428. Law on Cultural, Historical and Natural Heritage (2005): addresses a number of environmental protection issues. It states that socio-economic development shall proceed side by side with protection and conservation of the national heritage. It defines cultural, historical and natural heritage, noting that natural heritage may have scenic or ecological value. The Law also sets out zoning and measures for protection of heritage sites. Areas of national natural heritage shall be registered, especially those containing heritage of high value, such as biodiversity areas, conservation forests, wetlands, caves, and so on . Although it states that sources of biodiversity which have national natural heritage, e.g. wetlands, ponds and marshes, shall be administered by inspection and registration, as proposed by the concerned sectors. It also sets out regulations for protection of national heritage, such as the need to obtain prior approval for development in any national natural heritage area from the Ministry of Information and Culture (MIC) and other concerned sectors.

429. Law on Fisheries (2010): was developed specifically for the fisheries and aquaculture sector. The Food and Agriculture Organization (FAO) and other organizations carried out a "Legislative Review of Fisheries and Aquaculture in the Lao PDR" to provide guidance to this process. The review noted that (in 2008) unlike in most countries, Lao PDR had not enacted a separate fisheries and aquaculture legislation and that the sector was regulated under the Forestry Law.

### **Strategies & Policies**

430. The 7th National Social and Economic Development Plan (NSED) (2011-2015): seeks to define future directions for the development of Lao PDR. It includes mainly agriculture and forest, energy, mining and environmental protection and natural resource management. It provides the basis for sectoral and provincial plans, some framework for environmental protection/sustainability efforts; its stated aim is to "Ensure the sustainability of development by emphasizing economic development with, cultural and social progress, preserving natural resources and protecting the environment"<sup>20</sup>.

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<sup>20</sup> Ministry of Planning and Investment. 2010. *7th National Social and Economic Development Plan (2011-2015): Executive Summary* [Draft & unofficial translation].

431. National Forestry Strategy to 2020 (FS2020): analyzes the status of the Lao PDR forest sector and provides targets and recommendations for its development. Importantly, it sets out the categories of forests: production forests; conservation forests; protection forests; regeneration forests; and degraded forests. Targets for the sector include: stabilization of shifting cultivation by 2005 and its eradication by 2010; improvement of forest cover and quality. It also notes the establishment of NPAs in order to protect natural areas and species of fauna and flora to ensure the balance of nature, and for protecting watersheds<sup>21</sup>.

432. National Biodiversity Strategy to 2020 & Action Plan to 2010 (NBSAP): aims to protect biodiversity resources and to ensure their sustainable use. It notes that implementation requires cooperation and coordination from all levels of government and society. Water resources are one of many issues addressed in NBSAP document. It states that “water resources such as ground water, lakes, rivers, streams and wetlands should remain clean and abundant, and where necessary, be improved, through their protection, conservation and sustainable use”.

433. Urban Master Plan (2001) No. 58/PM: includes the land use plan, road network planning, drainage system planning, solid waste management system and building regulation. Most of the current urban development activities such as road network improvements, drainage structure rehabilitation and solid waste management.

434. National Water Resources Strategy and Action Plan [draft]: addresses water needs, and governance of basic subsistence water use. Developed in 2010, it provides the Government’s direction and decision making for water resources management, summarized in nine major policy statements which address the major issues which face the water sector. It notes that increasing scarcity/competition is a driving need for development of the policy and that water is a valuable national asset, with economic as well as social and environmental values. Further, decision-making should be based on consultation and local involvement. The most relevant of the nine policy statements are: the development of IWRM plans for priority (sub) basins; allocation of water resources is to prioritize human and ecosystem needs where scarcity exists; the need for water quality protection; and efforts to reduce the impacts of flood, drought and climate change. The policy also forms the basis for drafting a five year strategy & action plan (2011-2015). In the action plan, 22 activities are identified under the nine policy statement areas<sup>22</sup>. There is no specific mention of wetlands in either document, although wetlands can be tied to other water issues, such as groundwater, water quality, and so on. The impact of prioritization of human needs in water allocation requires further discussion.

435. Strategy on Climate Change (2010): discusses global climate change, as well as the expected climate change and development situation for Lao PDR. This strategy sets out objectives and strategic directions for addressing climate change, with goals including reinforcing sustainable development, increasing the resilience of economy and natural resources, enhancing cooperation, and improving public awareness. This is followed by adaption and mitigation options in key strategic areas, such as agriculture, energy, water resources, health, and so on.

436. National Adaptation Programme of Action to Climate Change (NAPA) (2009): references regional predictions of the potential impacts of climate change. It identifies urgent needs for adaptation, priority activities and potential barriers to implementation. Urgent needs for the water sector include: Awareness rising on water resource management; flood mapping and early warning systems; strengthening institutional capacity; surveying of underground water sources in drought-prone areas; multi-use reservoirs in drought-prone areas; conservation and development of major watersheds; flood protection barriers; improved navigation; and repairing infrastructure

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<sup>21</sup> Prime Minister’s Office. 2005. Forestry Strategy to the Year 2020 of the Lao PDR.

<sup>22</sup> WREA. July 2010. National Water Resources Strategy and Action Plan for the Years 2011 to 2015 [Draft].

damaged in floods. The NAPA's emphasis for this sector is thus on flood, drought and disaster preparedness, with only broad mention of watershed conservation.

437. Strategic plan on disaster risk management in Lao PDR (2020, 2010) and Action Plan (2003-2005): sets out lessons learned from disaster experiences, a strategy and approach on disaster management, goals for 2005, 2010 and 2020, and implementation methods and budget. The natural disasters listed include flood, drought, landslides, fire, as well as disease. However, the role of environmental degradation & changing climate is also noted. There is recognition of previous emphasis on relief and mitigation, rather than prevention. The Strategy aims to: safeguard sustainable development; shift more to preparedness; build community capacity; and promote environmental protection.

<b>Law or Decree</b>	<b>Article</b>	<b>Relating To</b>	<b>Content</b>
<i>Constitution of the Lao People's Democratic Republic (1991, amended 2003)</i>	17	Environment in general	"All organizations and citizens must protect the environment and natural resources: land, underground, forests, fauna, water sources and atmosphere."
<i>Environmental Protection Law (1999)</i>	5	Environment in general	Conservation takes priority over mitigation and restoration. Socio-economic development planning must include planning for environmental protection
<i>Environmental Protection Law (1999)</i>	8	EIA Process	MONRE is main agency to issue regulations for EIA. People affected by projects, mass organizations, and local administrations are to be involved in the EIA process
	10	Responsibility of those engaged in development works	Those engaged in development works must adhere to safeguards, and to standards and regulations issued by GOL agencies
	14	Responsibility of those engaged in development works	Those engaged in development works must abide by laws on land, forests, water, etc.
	16	Responsibility toward cultural, historical, natural heritage sites	Those engaged in development works must abide by laws and regulations to protect such heritage sites
	22	Pollution control	All are responsible for control of pollution, and applying technologies appropriate to control such pollution
	23	Hazardous wastes / emissions	Restrictions to hazardous wastes and means to control such wastes and emissions
	28	Damage to environment	Those causing damage to environment are responsible for repair through appropriate GOL agencies
	38, 39	Local environmental management and monitoring	Stipulates responsibilities of local administrations (provinces, municipalities, special districts, districts) to establish environmental management and monitoring units

<b>Law or Decree</b>	<b>Article</b>	<b>Relating To</b>	<b>Content</b>
	40	Local environmental responsibilities	Stipulates responsibilities of village administrations to follow environmental regulations
<i>Water and Water Resources Law (1996)</i>	4	Rights to use water resources	Defines rights, obligations, and procedures to gain approval for use of water resources
	18	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
	22	Principles in water resource development management	Stipulates that water resource development must be consistent with national and sector plans, must ensure preservation of the natural beauty of the resources, and must protect against harmful effects of water
	25	Promotion of Watershed and Water Resource Protection for Hydropower Development	Stipulates that 'hydropower projects must be developed with due concern for environmental protection, flood protection, water supply, irrigation, navigation, fisheries and others.'
	29	Water and water resource protection	Requires that water resources be protected from becoming spoilt, polluted, or drying up, and that forest and land resources be protected to help protect the water resources
<i>Lao Forestry Law (amended 2007)</i>	5	Policy on 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.
	9 to 13	Forest types	Classify the various types of forests according to use, including forests for village use
	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 forestland	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


<b>Law or Decree</b>	<b>Article</b>	<b>Relating To</b>	<b>Content</b>
	71	Types of converted forestland	Stipulates that for uses such as dam construction, the timber and forest resources to be harvested in those areas are property of the State
<i>Wildlife and Aquatic Law (2007)</i>	31	Use for Household purposes	Allows use by village households of wildlife and aquatic species in the common and general category list in particular seasons or permitted areas, using tools or equipment that do not adversely affect habitats or compromise the species population.
	32	Customary Use	Allows use of wildlife or aquatic species in the common and general category list by village households for “necessary cultural beliefs.”
	52	Prohibitions	Prohibits taking of wildlife, including parts of the animals, from their habitats; tormenting wildlife and aquatics; illegal catching, hunting, trading and possession; catching aquatic and hunting in conservation zones, in breeding season, or when pregnant; devastation of habitats and feeding zones.
<i>Land Law (2003)</i>	6	Protection of Land and 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.
<i>Decree on Land Lease or Concession (2009)</i>	39	Obligation of Person or Legal Entity Who Leases or Obtains Concession	The person or legal entity who leases land or obtains a concession is obligated, among other things, “not to cause any damage to the quality of land and negative impact to the natural environment and the society.”
<i>Road Law (1999)</i>	15	Public Road Construction	Construction of public roads must include protection of the environment
<i>Prime Ministerial Decree No. 112/PM on Environmental Impact Assessment (2010)</i>		Stipulates the need for Environmental Impact Assessment	Stipulates rights of those affected by projects, and need for participation. Outlines the process of conducting the EIA, preparing environmental management and monitoring plans, social management and monitoring plans, issuing environmental compliance certificates, monitoring compliance with the various plans, establishing the institutional framework including grievance procedures.



<b>Law or Decree</b>	<b>Article</b>	<b>Relating To</b>	<b>Content</b>
<i>Decree on Compensation and Resettlement of People Affected by Development Projects (2006)</i>		Establish the procedures for compensation and resettlement for project affected people	Defines the principles, rules, and measures to mitigate adverse impacts and to compensate for damages that may result from involuntary acquisition or repossession of land and of fixed or movable assets, including changes in land use and restrictions to access of community or natural resources

#### XIV. APPENDIX B: APPROVAL BY MONRE/DONRE

Copy of Environmental Compliance Certificate for IEE and English translation, 2012:

	
<b>ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ</b>	
<b>ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ</b>	
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ກະຊວງ ຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ	ເລກທີ 497 /ກຊສ
ນະຄອນຫລວງວຽງຈັນ, 30 ກໍລະກົດ 2012	
<b>ໃບຢັ້ງຢືນ</b>	
<ul style="list-style-type: none"><li>- ອີງຕາມ ກົດໝາຍ ວ່າດ້ວຍ ການປົກປັກຮັກສາສິ່ງແວດລ້ອມ ສະບັບເລກທີ 02/99/ສພຊ, ລົງວັນທີ 03 ເມສາ 1999.</li><li>- ອີງຕາມ ດໍາລັດ ວ່າດ້ວຍການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວ ຂອງກະຊວງ ຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ສະບັບເລກທີ 435/ນຍ, ລົງວັນທີ 28 ພະຈິກ 2011.</li><li>- ອີງຕາມ ດໍາລັດ ວ່າດ້ວຍ ການທົດແທນຄ່າເສຍຫາຍ ແລະ ການຍົກຍ້າຍຈັດສັນປະຊາຊົນ ຈາກໂຄງການ ພັດທະນາ, ສະບັບເລກທີ 192/ນຍ, ລົງວັນທີ 07 ກໍລະກົດ 2005.</li><li>- ອີງຕາມ ດໍາລັດ ວ່າດ້ວຍ ການປະເມີນຜົນກະທົບ ຕໍ່ສິ່ງແວດລ້ອມ, ສະບັບເລກທີ 112/ນຍ, ລົງວັນທີ 16 ກຸມພາ 2010.</li><li>- ອີງຕາມ ການສະເໜີ ຂອງກອງປະເມີນຜົນກະທົບ ຕໍ່ສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ, ສະບັບເລກທີ 893/ກຊສ.ກປສສ, ລົງວັນທີ 23 ກໍລະກົດ 2012.</li></ul>	
ກະຊວງ ຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ (ກຊສ) ຕົກລົງ:	
<ol style="list-style-type: none"><li>1. ເຊັນດີຮັບຮອງເອົາບົດລາຍງານ ການສຶກສາສິ່ງແວດລ້ອມເບື້ອງຕົ້ນ, ໂຄງປະກອບວຽກງານທົບທວນ ແລະ ການປະເມີນສິ່ງແວດລ້ອມ, ແຜນການເວນຄືນທີ່ດິນ ແລະ ການຊົດເຊີຍຄ່າເສຍຫາຍ, ໂຄງປະກອບການເວນຄືນທີ່ດິນ ແລະ ການຊົດເຊີຍຄ່າເສຍຫາຍ ສະບັບເດືອນ ມິຖຸນາ 2012 ຂອງໂຄງການພັດທະນາຕົວເມືອງ ຕາມແວດຫາງອະນຸພາກພື້ນແມ່ນໍ້າຂອງ ທີ່ແຂວງ ສະຫວັນນະເຂດ.</li><li>2. ໃຫ້ເຈົ້າຂອງໂຄງການ (ກົມເຕຫາ ແລະ ຜັງເມືອງ, ກະຊວງໂຍທາທິການ ແລະ ຂົນສົ່ງ) ປະຕິບັດຕາມ ເງື່ອນໄຂດັ່ງນີ້:<ul style="list-style-type: none"><li>ກ.) ຮັບຜິດຊອບໂດຍກົງ ຕໍ່ການສຶກສາ ແລະ ຂໍ້ມູນ ທີ່ໄດ້ລະບຸໄວ້ ໃນບົດລາຍງານ ການສຶກສາສິ່ງແວດລ້ອມ ເບື້ອງຕົ້ນ ແລະ ແຜນການທົດແທນຄ່າເສຍຫາຍ. ໃນກໍລະນີ ມີຂັ້ນຫາທາງດ້ານສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ ເກີດຂຶ້ນ ທີ່ບໍ່ໄດ້ສຶກສາໄວ້ໃນບົດລາຍງານ ແລະ ແຜນການດັ່ງກ່າວ, ເຈົ້າຂອງໂຄງການຕ້ອງຮັບຜິດຊອບເພີ່ມເຕີມ ໃນການສ້າງແຜນການຖິ້ມຄອງສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ, ມີມາດຕະການຫຼຸດຜ່ອນ/ແກ້ໄຂ ບັນ ນ</li></ul></li></ol>	

ຫາຜົນກະທົບເຫຼົ່ານັ້ນ ພ້ອມທັງຮັບປະກັນ ໃຫ້ມີງົບປະມານພຽງພໍ ໃນການຈັດຕັ້ງປະຕິບັດ ມາດຕະການ ດັ່ງກ່າວ;

ຂ.) ຮັບປະກັນໃຫ້ມີງົບປະມານພຽງພໍ ເພື່ອເຮັດໜ້າທີ່ ຕິດຕາມກວດກາ ສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ;

ຄ.) ໃນເວລາອຸດົມເອົາດິນ, ທີນ ແລະ ຊາຍ ເພື່ອໃຊ້ໃນການກໍ່ສ້າງ ຕ້ອງໄດ້ຮັບອະນຸຍາດຈາກ ອົງການປົກຄອງ ທ້ອງຖິ່ນ ແລະ ຂະແໜງການຕ່າງໆ ທີ່ກ່ຽວຂ້ອງ;

ງ.) ທິດແທນຄ່າເສຍຫາຍ ສຳລັບເນື້ອທີ່ດິນ ແລະ ຊັບສິນອື່ນໆ ຂອງປະຊາຊົນ ທີ່ໄດ້ຮັບຜົນກະທົບ ຈາກການ ດຳເນີນໂຄງການ ໂດຍປະຕິບັດຕາມລະບຽບກົດໝາຍຢ່າງເຂັ້ມງວດ ບົນພື້ນຖານການປົກສາຫາລື ແລະ ເປັນ ເອກະສານນຳກັນ ລະຫວ່າງຜູ້ທີ່ໄດ້ຮັບຜົນກະທົບ ແລະ ເຈົ້າຂອງໂຄງການ;

ຈ.) ໃນເວລາກໍ່ສ້າງ ໃຫ້ຈຳກັດຢູ່ໃນເຂດເນື້ອທີ່ກຳນົດ ແລະ ໃຫ້ມີຜົນກະທົບໜ້ອຍທີ່ສຸດ ໂດຍເອົາໃຈໃສ່ ເປັນສິເສດ ໃນການຈັດຕັ້ງປະຕິບັດຕາມແຜນການຄຸ້ມຄອງສິ່ງແວດລ້ອມ ໃນການກຳຈັດສິ່ງເສດເຫຼືອ, ຄາບມຳມັນ, ຂີ້ຝຸນ ແລະ ການຕິດປ້າຍເຕືອນໄພຕ່າງໆ;

ສ.) ແຕ່ງຕັ້ງປະສານງານໂຄງການ ເພື່ອຈັດຕັ້ງປະຕິບັດ ແຜນການຄຸ້ມຄອງສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ, ພ້ອມທັງເອົາໃຈໃສ່ຕິດຕາມກວດກາ ຜູ້ຮັບເໝົາຢ່າງເຂັ້ມງວດ ໃນການຈັດຕັ້ງປະຕິບັດແຜນການດັ່ງກ່າວ;

ຊ.) ພາຍຫຼັງສຳເລັດການກໍ່ສ້າງ ເຈົ້າຂອງໂຄງການຕ້ອງໄດ້ປົວແປງ ແລະ ຟື້ນຟູພື້ນເຂດທີ່ຖືກຜົນ ກະທົບ ຍ້ອນການກໍ່ສ້າງ ໃຫ້ຄືນສູ່ສະພາບທີ່ສາມາດນຳໃຊ້ໄດ້ເປັນປົກກະຕິ;

ຈ.໓) ເຮັດບົດລາຍງານປະຈຳໄຕມາດ, 6 ເດືອນ ແລະ ປະຈຳປີ ກ່ຽວກັບ ການຈັດຕັ້ງປະຕິບັດວຽກງານສິ່ງ ແວດລ້ອມ ແລະ ສັງຄົມ ຂອງໂຄງການ ສົ່ງໃຫ້ ກຊສ, ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແຂວງສະຫວັນນະເຂດເພື່ອຊາບຕິດຕາມ.

3. ມອບໃຫ້ ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແຂວງສະຫວັນນະເຂດ ສົມທົບກັບບັນດາ ຂະແໜງການ ແລະ ອົງການປົກຄອງເມືອງໄກສອນ ພົມວິຫານ, ເມືອງພົນ ແລະ ເມືອງເຊໂປນ ປະຕິບັດ ໜ້າທີ່ຕິດຕາມກວດກາ ການຈັດຕັ້ງ ປະຕິບັດ ມາດຕະການຫຼຸດຜ່ອນ/ແກ້ໄຂຜົນກະທົບ ທີ່ອາດຈະເກີດຂຶ້ນ ຕໍ່ສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ ຂອງໂຄງການດັ່ງກ່າວ ແລ້ວລາຍງານໃຫ້ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ເປັນປົກກະຕິ.

ໃບຢັ້ງຢືນສະບັບນີ້ ມີຜົນນຳໃຊ້ໄດ້ ນັບແຕ່ວັນລົງລາຍເຊັນເປັນຕົ້ນໄປ. ♪

ສັດຖະມົນຕີວ່າການ  
ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ



ສີສະຫວັດ ວິຫານ

Certificate

- Reference to the Law on Environmental Protection No 02/99/NA date 03 April 1999
- Reference to MONRE's role and responsibility No 435/MN date 28/11/2011
- Reference to the Decree on compensation No192/MN Date 07 July 2005
- Reference to the Decree IEA No 112/MN date 16 Feb. 2010
- Reference to the proposal from IEA Meeting No 893/MONRE date 23 July 2012

The Ministry of Natural Resource and Environment agree:


1. To accept the report on the IEE, the Environmental Assessment Structure, Compensation Plan, Compensation structure with the cost dated Jun 2012 of EWECTD in Savannakhet Province.
2. And request the Department of Housing and Urban Planning, MPWT to proceed the following:
  - a. The Department assumes direct responsible for the studies required in the environmental assessment and as reported in the IEE, including in the event of occurrence of social and environmental issues not yet studied in the report and plan. The project owner is responsible in addition to prepare the social and environmental plan, to set up the measure to reduce the impact and ensure sufficient budgets for implementation.
  - b. To ensure sufficient budget for the implementation of those measures.
  - c. During the excavation of soil, stone and sand for the construction purpose, to obtain required permission from local authority and concerned sectors.
  - d. To compensate the loss of land and other properties of people affected by the project implementation and conduct consultation in accordance with rules and legislation and ensure completed compensation documentation is signed by the project affected persons and the Project owner.
  - e. During the construction, the construction work should be minimized and limited to the identified area and specially to implement the Environmental Management Plan to mitigate impacts from solid waste, oil, and dust and ensure proper use of required warning signals and signs.
  - f. To ensure nomination of a Project Coordinator to implement the plan and to monitor the contractor's implementation of the plan.
  - g. After completion of the construction the project management should improve the impact area from the construction to the same situation as before.
  - h. To prepare Quarterly, 6 month and annual monitoring reports concerning the implementation of social and environmental management measures for submission to MONRE and DONRE of Savannakhet Province.
3. Giving to DONRE of Savannakhet Province in cooperation with the other Department and District Authority of Kalsone Phomvihane, Phine and Sepone responsibility to monitor, reduce and solve the impacts of the project, then to report to MONRE regularly.

This certificate is going in force after the signature of the Minister.

For Minister of  
MONRE

Mr Sisavath Vithaxay





**ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ**  
**ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ**

ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມແຂວງ

049.  
ເລກທີ...../ພຊສ.ສຂ  
ແຂວງສະຫວັນນະເຂດ, ວັນທີ...**22 MAY 2017**...


**ໜັງສືຕໍ່ອາຍຸ ໃບຢັ້ງຢືນ ກ່ຽວກັບ ສິ່ງແວດລ້ອມ**


- ອີງຕາມກົດໝາຍ ວ່າດ້ວຍ ການປົກປັກຮັກສາສິ່ງແວດລ້ອມ ສະບັບປັບປຸງ ເລກທີ 29/ສພຊ, ລົງວັນທີ 18 ທັນວາ 2012;
- ອີງຕາມ ດຳລັດ ວ່າດ້ວຍ ການທົດແທນຄ່າເສຍຫາຍ ແລະ ການຍົກຍ້າຍຈັດສັນປະຊາຊົນ ຈາກໂຄງການ ພັດທະນາ ສະບັບເລກທີ 84/ລບ, ລົງວັນທີ 05 ເມສາ 2016;
- ອີງຕາມ ຂໍ້ຕົກລົງ ວ່າດ້ວຍ ການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວ ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມແຂວງ ສະບັບເລກທີ 1467/ກຊສ ລົງວັນທີ 9 ມີນາ 2012
- ອີງຕາມ ດຳແນະນຳ ຂະບວນການສຶກສາເບື້ອງຕົ້ນ ກ່ຽວກັບ ຜົນກະທົບຕໍ່ສິ່ງແວດລ້ອມ ຈາກໂຄງການລົງທຶນ ແລະ ກິດຈະການຕ່າງໆ ສະບັບເລກທີ 8029/ກຊສ, ລົງວັນທີ 17/12/2013;
- ອີງຕາມບົດບັນທຶກ ລະຫວ່າງຫົວໜ້າພະແນກ ຊສ ແຂວງ ແລະ ຫົວໜ້າພະແນກໂຍທາທິການ ແລະ ຂົນສົ່ງແຂວງ ກ່ຽວກັບການຕໍ່ໃບຢັ້ງຢືນໃຫ້ກ່ອນ ສະບັບລົງວັນທີ 05 ພຶດສະພາ 2017.

**ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແຂວງສະຫວັນນະເຂດ ຕົກລົງ:**

1. ຕໍ່ອາຍຸ ໃບຢັ້ງຢືນ ກ່ຽວກັບ ສິ່ງແວດລ້ອມ ຮັບຮອງເອົາ ແຜນການຄຸ້ມຄອງ ແລະ ຕິດຕາມກວດກາສິ່ງແວດລ້ອມ ສິ່ງຄົມ ແລະ ທຳມະຊາດ ສະບັບປັບປຸງ ເດືອນ....., ປີ..... ສຳລັບ ໂຄງການພັດທະນາດົວເມືອງ ຕາມແລວ ເສດຖະກິດ ຕາເວັນອອກ-ຕາເວັນຕົກ ອະນຸພາກພື້ນແມ່ນ້ຳຂອງ ທີ່ເປັນໂຄງການຂອງກົມເຄຫາ ແລະ ຜັງເມືອງ ກະຊວງ ໂຍທາທິການ ແລະ ຂົນສົ່ງ.
2. ເຈົ້າຂອງໂຄງການ ຕ້ອງປະຕິບັດຢ່າງເຂັ້ມງວດ ບັນດາເງື່ອນໄຂ ທີ່ໄດ້ກຳນົດໄວ້ໃນ ບົດບັນທຶກ ລະຫວ່າງຫົວໜ້າ ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມແຂວງ ແລະ ຫົວໜ້າພະແນກໂຍທາທິການ ແລະ ຂົນສົ່ງແຂວງ ກ່ຽວກັບການຕໍ່ໃບຢັ້ງຢືນໃຫ້ກ່ອນ ສະບັບລົງວັນທີ 05 ພຶດສະພາ 2017.
3. ໃບຢັ້ງຢືນ ກ່ຽວກັບ ສິ່ງແວດລ້ອມ ສະບັບນີ້ ມີຜົນໃຊ້ໄດ້ 3 ປີ ນັບຕັ້ງແຕ່ວັນລົງລາຍເຊັນເປັນຕົ້ນໄປ.

**ຫົວໜ້າພະແນກ**  
**ຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມແຂວງ**





**ພູທອນ ຄອດວຸດທະວົງ**

## XV. APPENDIX C1: SPECIES LIST IN KAYSONE SUBPROJECT AREA

The following lists record species found in the general Project area. No rare or endangered species of flora or fauna will be negatively impacted by the Project.

### Birds

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Wastewater	Sub-Project 2 Urban Road	Sub-Project 3 Landfill
							✓
1	Nok kot peu	Greater Coucal	<i>Centropus sinensis</i>	LI	✓		
2	Nok En	Asian house Martin	<i>Delichon dasypus</i>		✓		
3	Nok En	Plain Martin	<i>Riparia paludicola</i>		✓		✓
4	Nok En	House Swift	<i>Apus affinis</i>		✓	✓	✓
5	Nok En	Ban Swallow	<i>Hirundo rustica</i>		✓		✓
6	Nok hon	Red-whisker Bulbul	<i>Pycnonotus jocosus</i>				✓
7	Nok khouk	Striped throated Bulbul	<i>Pycnonotus finlaysoni</i>				✓
8	Nok kadepdoao	Richard's	<i>Anthus richardi</i>		✓	✓	
9	Nok kadepdoao	Paddy field Pipit	<i>Anthus rufulus</i>		✓		
10	Nok kadepdoao	White Wagtail	<i>Motacilla alba</i>		✓		
11	Nok kadepdoao	Mekong Wagtail	<i>Motacilla samveasnae</i>		✓		
12	Nok kadepdoao	Citrine Wagtail	<i>Motocilla citreola</i>		✓		
13	Nok pit kon khao	White-rumped Munia	<i>Lonchura striata</i>		✓	✓	✓
14	Nok pit	Eurasian tree Sparrow	<i>Passer montanus</i>		✓	✓	✓
15	Nok khao	Barn Owl	<i>Tyto alba</i>	LII	✓		✓
16	Nok khao	Brown fish Owl	<i>Ketupa xlonensis</i>	LII			✓
17	Nok kapba	Great-eared nightjar	<i>Eurotopodus macrotis</i>				✓
18	Nok khao duea	Spotted Dove	<i>Streptopelia chinensis</i>	LII	✓		✓
19	Nok khao	Red-collared Dove	<i>Streptopelia tranquebar.</i>		✓		✓
20	Nok wak	White breasted waterhen	<i>Amaurornis phoenicurus</i>		✓		✓
21	Nok khao sai	Oriental Pratincole	<i>Glareola maldivarum</i>		✓		
22	Nok khao sai	Small Pratincole	<i>Glareda lacteal</i>		✓		
23	Nok kee ka deuan	Sandpiper spp.	<i>Triga stragnatilis</i>		✓		
24	Nok Ngang khao	Cattle Egret	<i>Bubulcus ibis</i>				✓
25	Nok yang	Intermediate Egret	<i>Mesophoyx intermedia</i>				✓

26		Yellow Bittern	<i>Lyobrychus sinensis</i>			✓
27	Nok zeo	Bronzed Drongo	<i>Dicrurus aeneus</i>			✓
28	Nok Eing	Common Myna	<i>Acridotheres tristis</i>		✓	✓
29	Nok kadepdoao	Olive-backed Pipit	<i>Anthus hodgsoni</i>			
30	Nok pit dam	Black headed Bunting	<i>Emberiza melanocephala</i>		✓	✓

### Mammals

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Wastewater	Sub-Project 2 Road	Sub-Project 3 Solid waste
1	Nou	Rat sp.	<i>Rattus sps.</i>		✓	✓	✓
2	Chia dang weuk	Short-nose fruit Bat	<i>cynopterus spp.</i>	LII	✓		✓
3	Ling lom noy	Pigmy Loris	<i>Nycticebus pygmaeus</i>	VU, LI			✓
4	Ngen hangkan	Large indian Civet	<i>Viverra zibetha</i>	LI			✓
5	Chonphon	Mongoose spp.	<i>Herpestes</i>	LI			✓
6	Sua lai hin on	Marble Cat	<i>Pardofelis marmorata</i>	LI			✓
7	Ka nai	Tree squirrel	<i>Callosciurus spp.</i>				✓
8	Ka chon	Striped Squirrel	<i>Tamias mclellandii</i>				✓
9	Katai	Siamese Rabbit	<i>Lepus peguensis</i>	LII			✓

### Reptiles

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Wastewater	Sub-Project 2 Urban Road	Sub-Project 3 Landfill
1	Ngou kiao hang ham	White-lipped pit viper	<i>Trimeresurus albolabris</i>				✓
2	Ngou chong Ang	King Cobra	<i>Ophiophagus hannah</i>	LI			✓
3	Ngou pa	Striped water snake	<i>Enhydryis jagorii</i>		✓		✓
4	Ngou khodeng	Red-neck Keelback	<i>Rhaddophis subminiatus</i>		✓		✓
5	Ngou pa	Gerard's water snake	<i>Gerarda prevostiana</i>		✓		✓
6	Ngou seauk khouy	Striped Keelback	<i>Amphiesma stolata</i>				✓
7	Kap kae	Tockay	<i>Gekko gekko</i>		✓	✓	✓
8	Khee chiem	Spotted house Gecko	<i>Gekko monachus</i>				
9	Khee chiem	Sandstone Gecko	<i>Gekko petricolus</i>		✓	✓	✓
10	Khee chiem	Spiny tailed house Gecko	<i>Hemidactylus frenatus</i>		✓	✓	✓
11	Ka pom	Golden fence lizard	<i>Calotes versicolor</i>		✓	✓	✓
12	Ka pom pik	Common Gliding Lizard	<i>Draco vorans</i>		✓	✓	✓

13	Kathang	Common butterfly Lizard	<i>eiolepis belliana</i>				✓
14	Len	Bengal Monitor	<i>Varanus bengalensis</i>	LII			✓
15	Khee ko	Many-line sun skink	<i>Mabuya multifasciata</i>		✓	✓	✓

#### Amphibian

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Wastewater	Sub-Project 2 Urban Road	Sub-Project 3 Landfill
1	Kop		<i>Hoplobatrachus rugulosus</i>		✓	✓	✓
2	Kiat Kha kham		<i>Rana spp.</i>		✓	✓	✓
3	Kiat chana		<i>Rana spp.</i>		✓	✓	✓
4	Kiat lai mo		<i>Rana spp.</i>		✓	✓	✓
5	Kiat tapad		<i>Polypedates leucomystax</i>		✓	✓	✓
6	Khan khak				✓	✓	✓
7	Oung		<i>Calluella guttulata</i>				✓

#### Fish

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Wastewater	Sub-Project 2 Urban Road	Sub-Project 3 Landfill
1	Pa kho	Snake head fish	<i>Channa striata</i>		✓	✓	✓
2	Pa douk na	Catfish	<i>Clarias batrachus</i>		✓	✓	✓
3	Pa douk oui	Catfish spp.	<i>Clarias macrocephalus</i>		✓	✓	✓
4	Pa kadeut		<i>Tricopodus trichogaster</i>		✓	✓	✓
5	Pa khang lai		<i>Crossocheilus sp.</i>		✓		
6	Pa cheo		<i>Esomus metallicus</i>		✓	✓	✓
7	Pa cheo na ngen		<i>Orygaster anomaluna</i>		✓	✓	✓
8	Pa cheo ao		<i>Rasbora aurotaenia</i>		✓	✓	✓
9	Pa kang		<i>Channa gachua hamilton</i>				✓
10	Pa khao		<i>Systemus aurotaeniata</i>		✓	✓	✓
11	Pa kheng		<i>Anabas testudineus</i>				
12	Pa nin	Tilapia sp.	<i>Oreochromis niloticus</i>		✓	✓	✓
13	Pa nai	Nile tilapia	<i>Oreochromis spp.</i>		✓		
14	Pa pok		<i>Systomus orphoides</i>		✓	✓	✓
15	Pa kat		<i>Betta cf. splendens regan</i>		✓	✓	✓



16	Pa pak			✓	✓	✓
17	Pa seu			✓		
18	Pa pao		<i>Tretrapdon sp.</i>	✓		
19	Pa tong		<i>Chitala ornata</i>	✓	✓	
20	Pa tong kai		<i>Notopterus spp.</i>	✓		
21	Pa keng		<i>Cirrhinus sp.</i>	✓	✓	✓
22	Pa chat		<i>Scaphoidontichthys sp.</i>	✓		✓
23	Pa vienphai		<i>Danio sp.</i>	✓		✓
24	Pa xueam			✓		✓
25	Pa kha yang		<i>Cirrhinus sp.</i>	✓	✓	✓
26	Pa mak wai			✓		✓
27	Pa bou		<i>Oxeleotris marmorata</i>			
28	Pa ien		<i>Monopterus albus</i>	✓	✓	✓

**Remarks:** CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; CI: Appendix I of CITES; CII: Appendix II of CITES; LI: List I - prohibit species of Lao Wildlife Law; List II - management species of Lao Wildlife Law.

**List of key fish species in the Mekong River associated with the River bank with distribution in Savannakhet project area.**

No	Lao name	Common name	Scientific name	Remarks
1	Pa kot luang	Sutchai river catfish	<i>Hemibagrus filamentus</i>	
2	Pa phia	Black sharkminnow	<i>Labeo chrysophekadion</i>	
3	Pa na mu	Catfish	<i>Helicophagus waandersii</i>	
4	Pa ka	Goonch	<i>Bagarius yarrelli</i>	
5	Pa va	Two-headed carp	<i>Bangana betri</i>	
6	Pa kuang	Small scale croaker	<i>Boesemania</i>	
7	Pa mu man	Redtail leach	<i>Botia modesta</i>	
8	Pa ka ho	Giant barb	<i>Cattocarpio siamesis</i>	
9	Pa phone	Small scale river carp	<i>Cirrhimnus microlepis</i>	
10	Pa sa ee	Striped river barb	<i>Mekongina erythrospila</i>	Key stone sp.
11	Pa nang	Silver sheatfish	<i>Micronema apogon</i>	
12	Pa tong na	Bronze featherback	<i>Notopterus notopterus</i>	
14	Pa tong kai	Indochina featherback	<i>Chitala blanci</i>	
15	Pa tong kuai	Clown featherback	<i>Chitala ornata</i>	
16	Pa I thai	Nilem carp	<i>Osteochilus hasseltii</i>	
17	Pa beuk	Giant Mekong catfish	<i>Pangasianodon gigas</i>	Most important
18	Pa souy	Sutchi river catfish	<i>Pangasianodon hypophthalmus</i>	
19	Pa nyang	Bocourt's catfish	<i>Pangasius bocourti</i>	

20	Pa phob	Sharp-nosed catfish	Pangasius conchophilus	
21	P suey hang	Krempf's catfish	Pangasius krempfi	
22	Pa hua muam	Yellow-finned catfish	Pangasius mekongensis	
23	Pa peung	Black-spotted catfish	Pagasius larnaudii	
24	Pa nyon thong	Red-finned catfish	Pangasius pleurotaenia	
25	Pa nyon hang hian	Elongate catfish	Pangasius elongates	
26	Pa yawn	Long-barbel catfish	Pangasius macronema	
27	Pa leum	Giant catfish	Pangasius sanitwongsei	Most important
28	Pa taap	Pelagic river carp	Paralabuca typus	Key stone sp.
29	Pa soi	Siamese mud carp	Cirrhinus siamensis	Key stone sp.
30	Pa chok	Soldier rive barb	Cyclocheilichthys	
31	Pa sood	Eye-spot barb	Hampala dispar	
32	P sood	Barred barb	Hampala macrolepi dota	

## XVI. APPENDIX C2: SPECIES LIST IN PHINE SUBPROJECT AREA

The following lists record species found in the general Project area. No rare or endangered species of flora or fauna will be negatively impacted by the Project.

### Birds

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Water supply	Sub-Project 2 Road
1	Nok kot peu	Greater Coucal	<i>Centropus sinensis</i>	LI	✓	
2	Nok En	Asian house Martin	<i>Delichon dasympus</i>		✓	
3	Nok En	Plain Martin	<i>Riparia paludicola</i>		✓	
4	Nok En	House Swift	<i>Apus affinis</i>		✓	✓
5	Nok En	Ban Swallow	<i>Hirundo rustica</i>		✓	
6	Nok hon	Red-whisker Bulbul	<i>Pycnonotus jocosus</i>			
7	Nok khok	Striped throated Bulbul	<i>Pycnonotus finlaysoni</i>			
8	Nok kadepdoao	Richard's	<i>Anthus richardi</i>		✓	✓
9	Nok kadepdoao	Paddy field Pipit	<i>Anthus rufulus</i>		✓	
10	Nok kadepdoao	White Wagtail	<i>Motacilla alba</i>		✓	
11	Nok kadepdoao	Mekong Wagtail	<i>Motacilla samveasnae</i>		✓	
12	Nok kadepdoao	Citrine Wagtail	<i>Motocilla citreola</i>		✓	
13	Nok pit kon khao	White-rumped Munia	<i>Lonchura striata</i>		✓	✓
14	Nok pit	Eurasian tree Sparrow	<i>Passer montanus</i>		✓	✓
15	Nok khao	Barn Owl	<i>Tyto alba</i>	LII	✓	
16	Nok khao	Brown fish Owl	<i>Ketupa xlonensis</i>	LII		
17	Nok kapba	Great-eared nightjar	<i>Eurotopodus macrotis</i>			
18	Nok khao duea	Spotted Dove	<i>Streptopelia chinensis</i>	LII	✓	
19	Nok khao	Red-collared Dove	<i>Streptopelia tranquebar.</i>		✓	
20	Nok wak	White breasted waterhen	<i>Amauornis phoenicurus</i>		✓	
21	Nok khao sai	Oriental Pratincole	<i>Glareola maldivarum</i>		✓	
22	Nok khao sai	Small Pratincole	<i>Glareda lacteal</i>		✓	
23	Nok kee ka deuan	Sandpiper spp.	<i>Triga stragnatilis</i>		✓	
24	Nok Ngang khao	Cattle Egret	<i>Bubulcus ibis</i>			
25	Nok yang	Intermediate Egret	<i>Mesophoyx intermedia</i>			

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Water supply	Sub-Project 2 Road
26		Yellow Bittern	<i>Lyobrychus sinensis</i>			
27	Nok zeo	Bronzed Drongo	<i>Dicrurus aeneus</i>			
28	Nok Eing	Common Myna	<i>Acridotheres tristis</i>		✓	✓
29	Nok kadepdoao	Olive-backed Pipit	<i>Anthus hodgsoni</i>			
30	Nok pit dam	Black headed Bunting	<i>Emberiza melanocephala</i>		✓	✓

#### Mammals

No	Lao phonetic	Common name	Scientific name	Cons. Status		
1	Nou	Rat sp.	<i>Rattus sps.</i>		✓	✓
2	Chia dang weuk	Short-nose fruit Bat	<i>cynopterus spp.</i>	LII	✓	
3	Ling lom noy	Pigmy Loris	<i>Nycticebus pygmaeus</i>	VU, LI		
4	Ngen hangkan	Large indian Civet	<i>Viverra zibetha</i>	LI		
5	Chonphon	Mongoose spp.	<i>Herpestes</i>	LI		
6	Sua lai hin on	Marble Cat	<i>Pardofelis marmorata</i>	LI		
7	Ka nai	Tree squirrel	<i>Callosciurus spp.</i>			
8	Ka chon	Striped Squirrel	<i>Tamiops mclellandii</i>			
9	Katai	Siamese Rabbit	<i>Lepus peguensis</i>	LII		

#### Reptiles

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Water supply	Sub-Project 2 Road
1	Ngou kio hang ham	White-lipped pit viper	<i>Trimeresurus albolabris</i>			
2	Ngou chong Ang	King Cobra	<i>Ophiophagus hannah</i>	LI		
3	Ngou pa	Striped water snake	<i>Enhydrys jagorii</i>		✓	
4	Ngou khodeng	Red-neck Keelback	<i>Rhaddophis subminiatus</i>		✓	
5	Ngou pa	Gerard's water snake	<i>Gerarda prevostiana</i>		✓	
6	Ngou seauk khouy	Striped Keelback	<i>Amphiesma stolata</i>			
7	Kap kae	Tockay	<i>Gekko gekko</i>		✓	✓
8	Khee chiem	Spotted house Gecko	<i>Gekko monachus</i>			
9	Khee chiem	Sandstone Gecko	<i>Gekko petricolus</i>		✓	✓
10	Khee chiem	Spiny tailed house Gecko	<i>Hemidactylus frenatus</i>		✓	✓

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Water supply	Sub-Project 2 Road
11	Ka pom	Golden fence lizard	<i>Calotes versicolor</i>		✓	✓
12	Ka pom pik	Common Glidding Lizard	<i>Draco vorans</i>		✓	✓
13	Kathang	Common butterfly Lizard	<i>eiolepis belliana</i>			
14	Len	Bengal Monitor	<i>Varanus bengalensis</i>	LII		
15	Khee ko	Many-line sun skink	<i>Mabuya multifasciata</i>		✓	✓

#### Amphibian

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Water supply	Sub-Project 2 Road
1	Kop		<i>Hoplobatrachus rugulosus</i>		✓	✓
2	Kiat Kha kham		<i>Rana spp.</i>		✓	✓
3	Kiat chana		<i>Rana spp.</i>		✓	✓
4	Kiat lai mo		<i>Rana spp.</i>		✓	✓
5	Kiat tapad		<i>Polypedates leucomystax</i>		✓	✓
6	Khan khak				✓	✓
7	Oung		<i>Calluella guttulata</i>			

#### Fish

No	Lao phonetic	Common name	Scientific name	Cons. Status	Sub-Project 1 Water supply	Sub-Project 2 Road
1	Pa kho	Snake head fish	<i>Channa striata</i>		✓	✓
2	Pa douk na	Catfish	<i>Clarias batrachus</i>		✓	✓
3	Pa douk oui	Catfish spp.	<i>Clarias macrocephalus</i>		✓	✓
4	Pa kadeut		<i>Tricopodus trichogaster</i>		✓	✓
5	Pa khang lai		<i>Crossocheilus sp.</i>		✓	
6	Pa cheo		<i>Esomus metallicus</i>		✓	✓
7	Pa cheo na ngen		<i>Orygaster anomaluna</i>		✓	✓
8	Pa cheo ao		<i>Rasbora aurotaenia</i>		✓	✓
9	Pa kang		<i>Channa gachua hamilton</i>			
10	Pa khao		<i>Systemus aurotaeniata</i>		✓	✓
11	Pa kheng		<i>Anabas testudineus</i>			

12	Pa nin	Tilapia sp.	<i>Oreochromis niloticus</i>		✓	✓
13	Pa nai	Nile tilapia	<i>Oreochromis spp.</i>		✓	
14	Pa pok		<i>Systomus orphoides</i>		✓	✓
15	Pa kat		<i>Betta cf. splendens regan</i>		✓	✓
16	Pa pak				✓	✓
17	Pa seu				✓	
18	Pa pao		<i>Tretrapdon sp.</i>		✓	
19	Pa tong		<i>Chitala ornata</i>		✓	✓
20	Pa tong kai		<i>Notopterus spp.</i>		✓	
21	Pa keng		<i>Cirrhinus sp.</i>		✓	✓
22	Pa chat		<i>Scaphoidontichthys sp.</i>		✓	
23	Pa vienphai		<i>Danio sp.</i>		✓	
24	Pa xueam				✓	
25	Pa kha yang		<i>Cirrhinus sp.</i>		✓	✓
26	Pa mak wai				✓	
27	Pa bou		<i>Oxeleotris marmorata</i>			
28	Pa ien		<i>Monopterus albus</i>		✓	✓

CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; CI: Appendix I of CITES;  
 CII: Appendix II of CITES; LI: List I - prohibit species of Lao Wildlife Law; List II - management species of Lao Wildlife Law.

## XVII. APPENDIX C3: SPECIES LIST IN DANSAVANH SUBPROJECT AREA

The following lists record species found in the general Project area. No rare or endangered species of flora or fauna will be negatively impacted by the Project.

### Birds

No	Lao phonetic	Common name	Scientific name	Cons. Status	Road Project
1	Nok kot peu	Greater Coucal	<i>Centropus sinensis</i>	LI	✓
2	Nok En	Asian house Martin	<i>Delichon dasympus</i>		✓
3	Nok En	House Swift	<i>Apus affinis</i>		✓
4	Nok En	Ban Swallow	<i>Hirundo rustica</i>		✓
5	Nok hon	Red-whisker Bulbul	<i>Pycnonotus jocosus</i>		✓
6	Nok khauk	Striped throated Bulbul	<i>Pycnonotus finlaysoni</i>		✓
7	Nok kadepdoao	Paddy field Pipit	<i>Anthus rufulus</i>		✓
8	Nok pit kon khao	White-rumped Munia	<i>Lonchura striata</i>		✓
9	Nok pit	Eurasian tree Sparrow	<i>Passer montanus</i>		✓
10	Nok khao	Barn Owl	<i>Tyto alba</i>	LII	✓
11	Nok khao	Brown fish Owl	<i>Ketupa xlonensis</i>	LII	✓
12	Nok kapba	Great-eared nightjar	<i>Eurotopodus macrotis</i>		✓
13	Nok khao duea	Spotted Dove	<i>Streptopelia chinensis</i>	LII	✓
14	Nok khao	Red-collared Dove	<i>Streptopelia tranquebar.</i>		✓
15	Nok wak	White breasted waterhen	<i>Amauornis phoenicurus</i>		✓
16	Nok Ngang khao	Cattle Egret	<i>Bubulcus ibis</i>		✓
17	Nok yang	Intermediate Egret	<i>Mesophoyx intermedia</i>		✓?
18	Nok zeo	Bronzed Drongo	<i>Dicrurus aeneus</i>		✓
19	Nok Eing	Common Myna	<i>Acridotheres tristis</i>		✓
20	Nok kadepdoao	Olive-backed Pipit	<i>Anthus hodgsoni</i>		✓
21	Kai pa	Red jangle fowl	<i>Gallus gallus</i>		✓
22	Nok Khoum	Barred buttonquail	<i>Turnix Suscitator</i>		✓
23	Nok sai	Fulvous b. Woodpecker	<i>Jendrocopos macei</i>	LII	✓
24	Nok khon dok	Green-eared Barbet	<i>Megaliama fiostrica</i>		✓

Mammals					
No	Lao phonetic	Common name	Scientific name	Cons. Status	Road Project
1	Nou	Rat sp.	<i>Rattus sps.</i>		✓
2	Chia dang weuk	Short-nose fruit Bat	<i>cynopterus spp.</i>	LII	✓
3	Ling lom noy	Pigmy Loris	<i>Nycticebus pygmaeus</i>	VU, LI	✓
4	Ngen hangkan	Large Indian Civet	<i>Viverra zibetha</i>	LI	✓
5	Ngen Om	Common palm Civet	<i>Paradoxurus herma.</i>		✓
6	Chonphon	Mongoose spp.	<i>Herpestes</i>	LI	✓
7	Sua lai hin on	Marble Cat	<i>Pardofelis marmorata</i>	LI	✓
8	Ka nai	Tree squirrel	<i>Callosciurus spp.</i>		✓
9	Ka chon	Striped Squirrel	<i>Tamiops mclellandii</i>		✓
10	Mou pa	Wild pig	<i>Tamiops mclellandii</i>		✓
11	Fan	Barking deer	<i>Tamiops mclellandii</i>		✓
Reptiles					
No	Lao phonetic	Common name	Scientific name	Cons. Status	Road Project
1	Ngou kiao hang ham	White-lipped pit viper	<i>Trimeresurus albolabris</i>		✓
2	Ngou chong Ang	King Cobra	<i>Ophiophagus hannah</i>	LI	✓
3	Ngou kanpong	Kriat	<i>Bungurus candidus</i>		✓
4	Ngou Leum	Striped water snake	<i>Enhydris jagorii</i>		✓
5	Ngou pa	Striped water snake	<i>Enhydris jagorii</i>		✓
6	Ngou khodeng	Red-neck Keelback	<i>Rhaddophis subminiatus</i>		✓
7	Ngou pa	Gerard's water snake	<i>Gerarda prevostiana</i>		✓
8	Ngou seauk khouy	Striped Keelback	<i>Amphiesma stolata</i>		
9	Kap kae	Tockay	<i>Gekko gekko</i>		✓
10	Khee chiem	Spotted house Gecko	<i>Gekko monachus</i>		
11	Khee chiem	Spiny tailed house Gecko	<i>Hemidactylus frenatus</i>		✓
12	Ka pom	Golden fence lizard	<i>Calotes versicolor</i>		✓
13	Ka pom pik	Common Gliding Lizard	<i>Draco vorans</i>		✓
14	Kathang	Common butterfly Lizard	<i>eiolepis belliana</i>		✓
15	Len	Bengal Monitor	<i>Varanus bengalensis</i>	LII	✓
16	Pa fa ong?	Asiantic Soft-shell turtle	<i>Amyda cartilaginea</i>	VU	✓
17	Khee ko	Many-line sun skink	<i>Mabuya multifasciata</i>		✓



Amphibian					
No	Lao phonetic	Common name	Scientific name	Cons. Status	Road Project
1	Kop		<i>Hoplobatrachus rugulosus</i>		✓
2	Kiat Kha kham		<i>Rana spp.</i>		✓
3	Kiat chana		<i>Rana spp.</i>		✓
4	Kiat lai mo		<i>Rana spp.</i>		✓
5	Kiat tapad		<i>Polypedates leucomystax</i>		✓
6	Khan khak				✓
7	Oung		<i>Calluella guttulata</i>		✓
Fish					
No	Lao phonetic	Common name	Scientific name	Cons. Status	Road Project
1	Pa kho	Snake head fish	<i>Channa striata</i>		✓
2	Pa douk na	Catfish	<i>Clarias batrachus</i>		✓
3	Pa douk oui	Catfish spp.	<i>Clarias macrocephalus</i>		✓
4	Pa kadeut		<i>Tricopodus trichogaster</i>		✓
5	Pa khang		<i>Crossocheilus sp.</i>		✓
6	Pa sieow		<i>Esomus metallicus</i>		✓
7	Pa sieow na ngen		<i>Orygaster anomaluna</i>		✓
8	Pa sieow ao		<i>Rasbora aurotaenia</i>		✓
9	Pa kang		<i>Channa gachua hamilton</i>		✓
10	Pa khao		<i>Systemus aurotaeniata</i>		✓
11	Pa kheng		<i>Anabas testudineus</i>		✓
12	Pa nin	Tilapia sp.	<i>Oreochromis niloticus</i>		✓
13	Pa nai	Nile tilapia	<i>Oreochromis spp.</i>		✓
14	Pa pok		<i>Systomus orphoides</i>		✓
15	Pa pak				✓
16	Pa seu				✓
17	Pa pao		<i>Tetraodon sp.</i>		✓
18	Pa tong		<i>Chitala ornata</i>		✓
20	Pa keng		<i>Cirrhinus sp.</i>		✓
21	Pa chat		<i>Scaphoidontichthys sp.</i>		✓

22	Pa xueam				✓
23	Pa kha yang		<i>Cirrhinus sp.</i>		✓
24	Pa ien		<i>Monopterus albus</i>		✓

**Remarks:** CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; CI: Appendix I of CITES;  
CII: Appendix II of CITES; LI: List I - prohibit species of Lao Wildlife Law; List II - management species of Lao Wildlife Law