

Environmental Management Plan

September 2018

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

Mekong River Embankment Subproject

Prepared by the Provincial Department of Public Works and Transport, Savannakhet Province, Lao PDR for the Asian Development Bank.

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CURRENCY EQUIVALENTS

(as of 25 July 2018)

Currency Unit	–	kip (KN)
KN1.00	=	\$0.00012
\$1.00	=	KN8,406

ABBREVIATIONS

ADB	–	Asian Development Bank
BOD	–	biological oxygen demand
CEMP	–	Contractor's EMP
COD	–	Chemical Oxygen Demand
CSCS	–	Construction Supervision Consultant Support
DED	–	detailed engineering design
DMF	–	Design and monitoring framework
DONRE	–	Department of Natural Resources and Environment
DPH	–	Department of Public Health
DPWT	–	District Public Works and Transport Office
EA	–	Executing Agency
ECC	–	Environmental Compliance Certificate
ECO	–	Environmental Control Officer
EERT	–	External Emergency Response Team
EHS	–	Environmental, Health, and Safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
ER	–	Environmental Representative
ERT	–	Emergency Response Team
ERTL	–	Emergency Response Team Leader
ESIA	–	Environment and Social Impact Assessment
ESO	–	environmental site officer
EWEC	–	East-West Economic Corridor
GMS	–	Greater Mekong Subregion
GoL	–	Government of Lao PDR
GRM	–	Grievance Redress Mechanism
IA	–	implementing agency
IEE	–	initial environmental examination
Lao PDR	–	Lao People's Democratic Republic
LAK	–	Lao Currency
MONRE	–	Ministry of Natural Resources and Environment
MPWT	–	Ministry of Public Works and Transport
MRF	–	materials recovery facilities
MRC	–	Mekong River Commission
O&M	–	operation and maintenance
PDPWT	–	Provincial Department of Public Works and Transport
PIT	–	Project Implement Team (of District)
PMU	–	project management unit
TSS	–	total suspended solids

UDAA	–	Urban Development and Administration Authority
USD	–	United States Dollar
UXO	–	unexploded ordnance
WREA	–	Water Resources and Environment Agency

WEIGHTS AND MEASURES

Km	–	kilometer
Kg	–	kilogram
Ha	–	hectare
mm	–	millimeter

I. BACKGROUND

1. 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 one of several subprojects prepared during the Project Preparatory Technical Assistance (PPTA) for the Lao PDR: GMS Corridor Towns Development Project.
2. The 2012 FS proposes a 50 m wide reclamation along the embankment with a length of 985 m. This section of the embankment runs along the central part of Kaysone Phomvihane. A new feasibility study was conducted in 2016. The 2016 FS assessed different options for implementation of the Mekong Embankment Sub-project.
3. This draft Environmental Management Plan (EMP) for the Kaysone Phomvihane Embankment subproject component has been prepared as part of the environmental assessment. The subproject will be included in the updated IEE.
4. According to the TOR for the 2016 FS (dated December 2015 and revised March 2016), the objectives of the Embankment Sub-project are:
 - (i) To provide flood protection, reduce riverbank erosion and secure the site with river embankment infrastructure of 980 m length. It will also support climate resilience adaptation measures (flooding horizon of 30 year return period) and
 - (ii) To create land for development along the river for recreational and economic opportunities for private and public sector investment, as well as to enhance the urban landscape for tourism and cultural heritage.
5. The 2016 FS concludes that the existing riverbank adequately protects against flooding in the township, and even has an elevation higher than required for this objective. On the other hand, erosion has occurred at a slow rate over the years for approximately 200 m long section of the riverbank, and therefore, there is limited justification for bank protection. The 2016 FS rephrased the subproject objectives as:
 - (i) Create land for development along the river for recreational and economic opportunities for private and public sector investment, and
 - (ii) Enhance the urban landscape for tourism and cultural heritage.

A. Subproject Investments

6. The scope of the Kaysone Phomvihane Embankment subproject is summarized below:

Reclamation	<ul style="list-style-type: none"> ▪ 50 m land reclamation on 980 m length embankment infrastructure. The project area reaches from the ferry ramp area to the South of the Viewing platform.
Upgrading of Embankment Road	<ul style="list-style-type: none"> ▪ New 980 m of embankment road with sidewalks and drainage channels.
Ferry Ramp	<ul style="list-style-type: none"> ▪ Minor works will be done to the ferry ramp e.g. cleaning of the ramp and renovation of staircases

7. The duration of project phases is presented below.

Table 1. Duration of project phases

Phase	Duration
Construction phase	2 years
Defects Liability Period	1 year

8. The Kaysone Phomvihane Embankment will be upgraded from the Ferry Ramp area (Ch. 0+280) to the platform view (Ch. 1+080, Figure 1). Reclamation level 114.00 m.

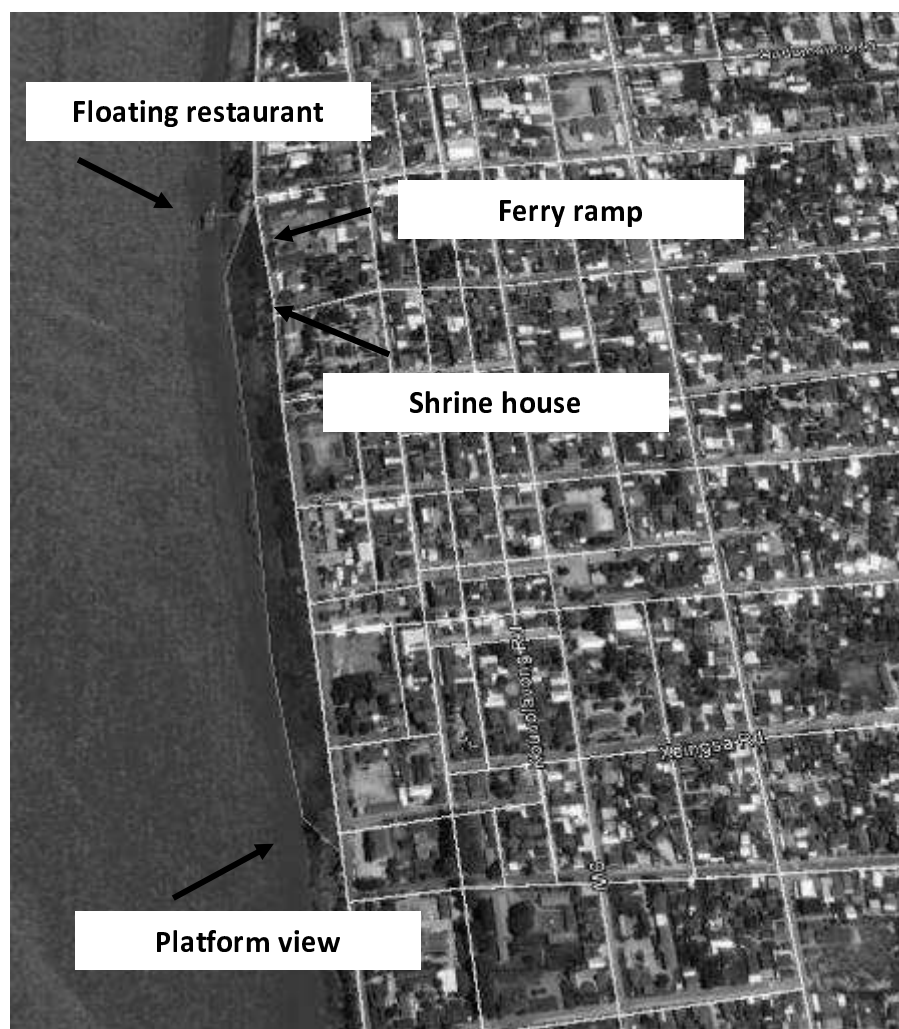


Figure 1. Kaysone Phomvihane Embankment

9. Drawings and cross sections for the embankment are presented below (Figure 2 to Figure 10).

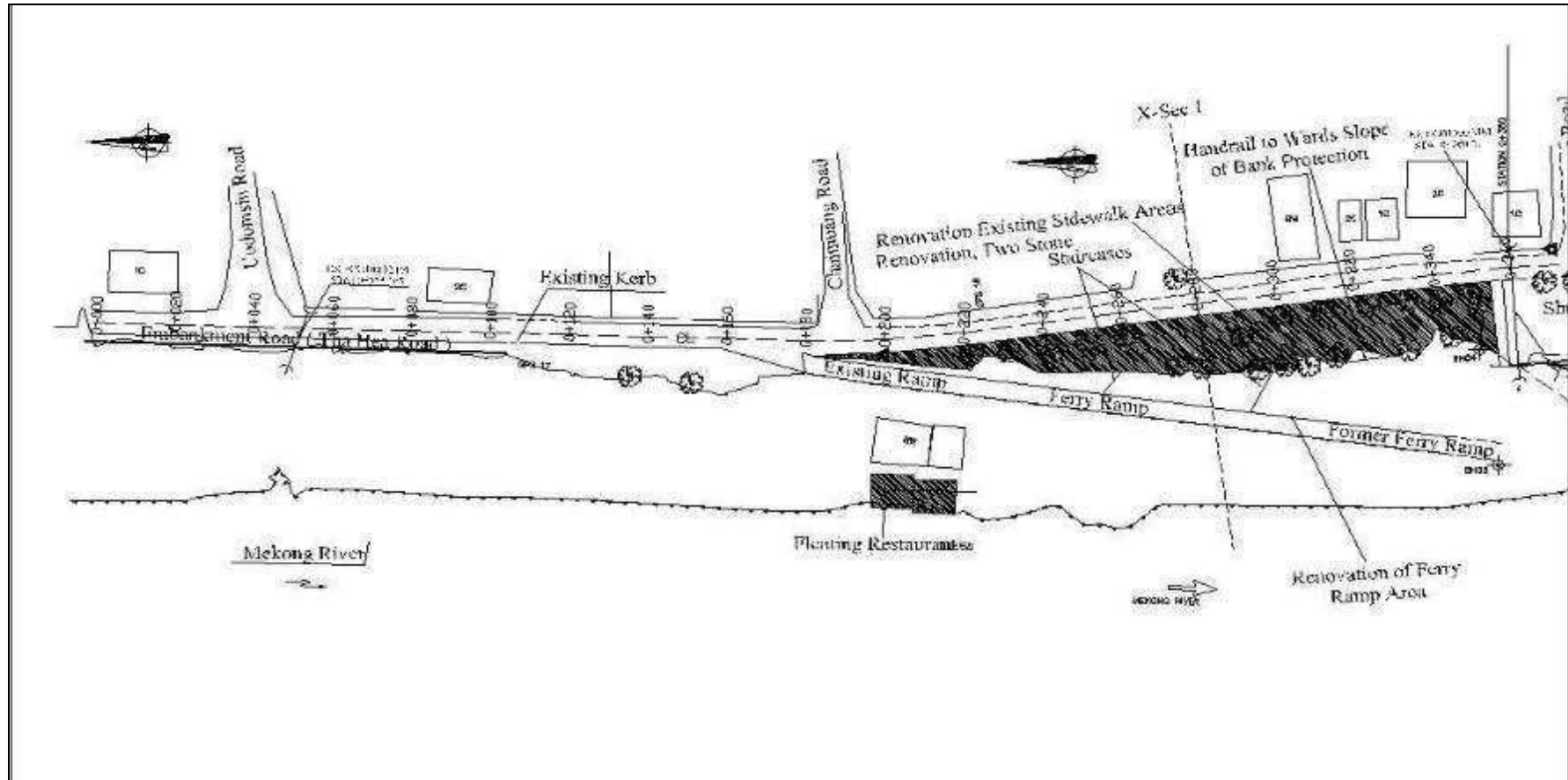


Figure 2: Embankment X-Sec 1

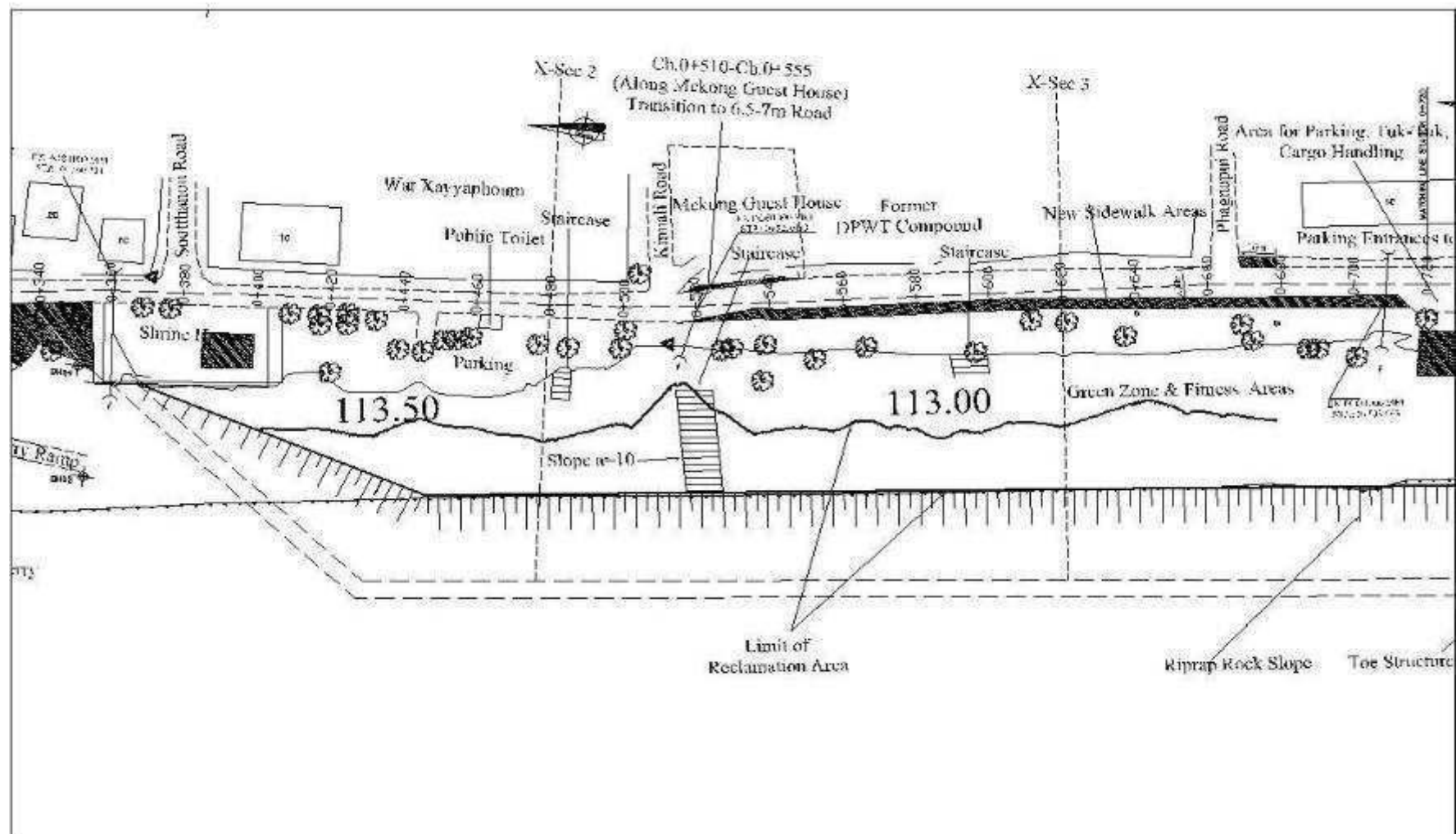


Figure 3: Embankment X-Sec 2 and X-Sec 3

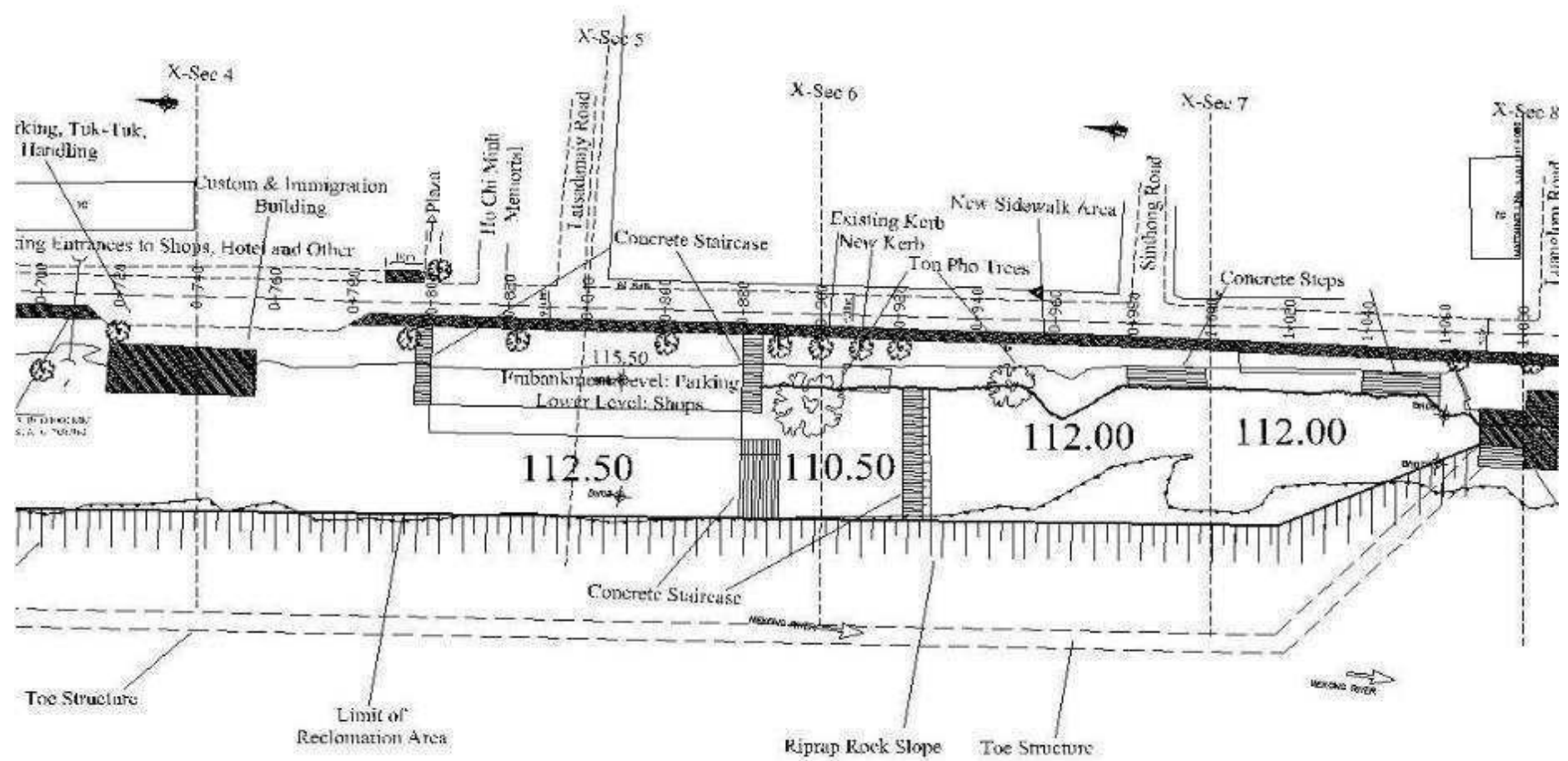


Figure 4: Embankment X-Sec 4 to X-Sec 7

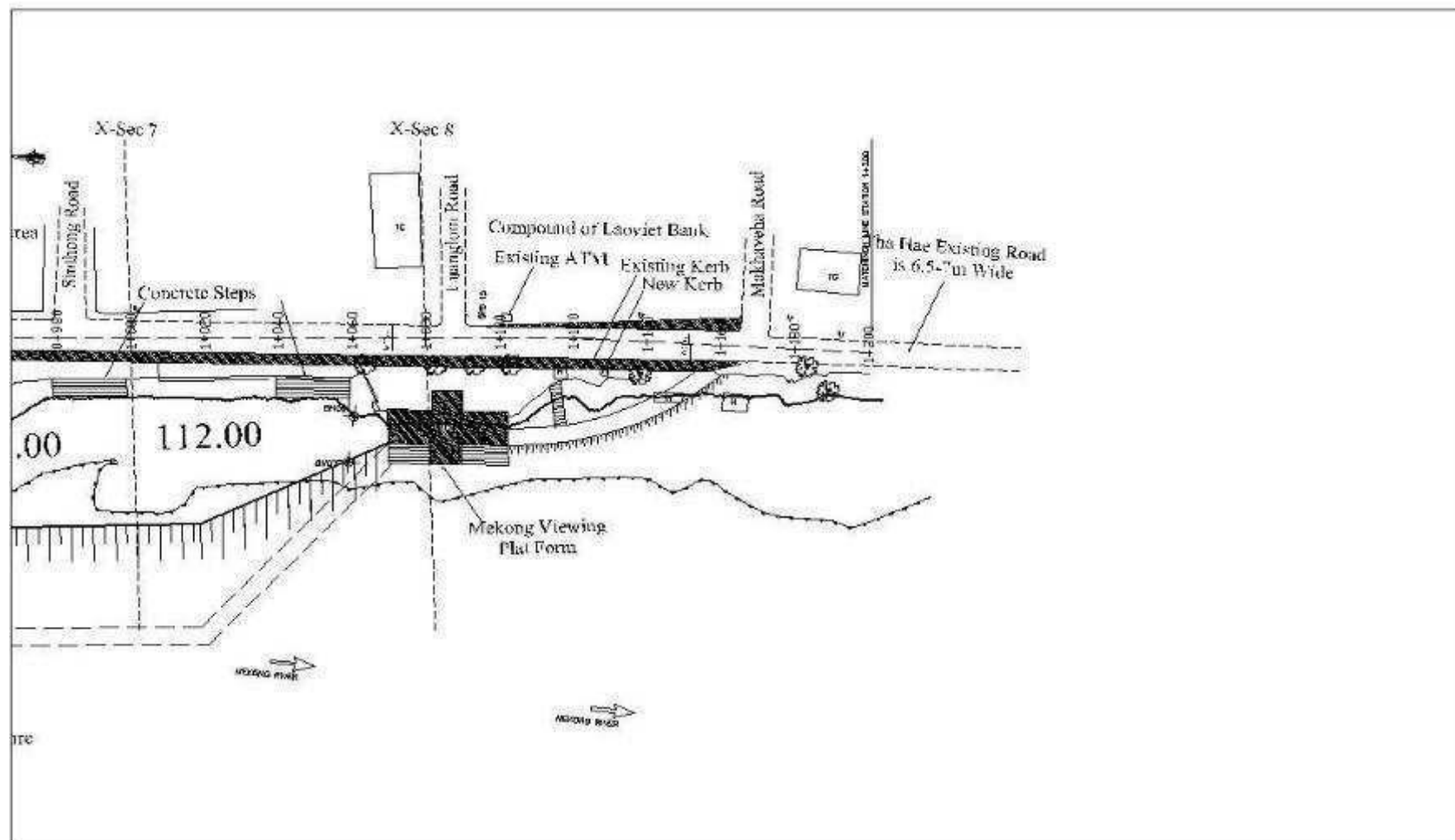


Figure 5: Embankment X-Sec 8

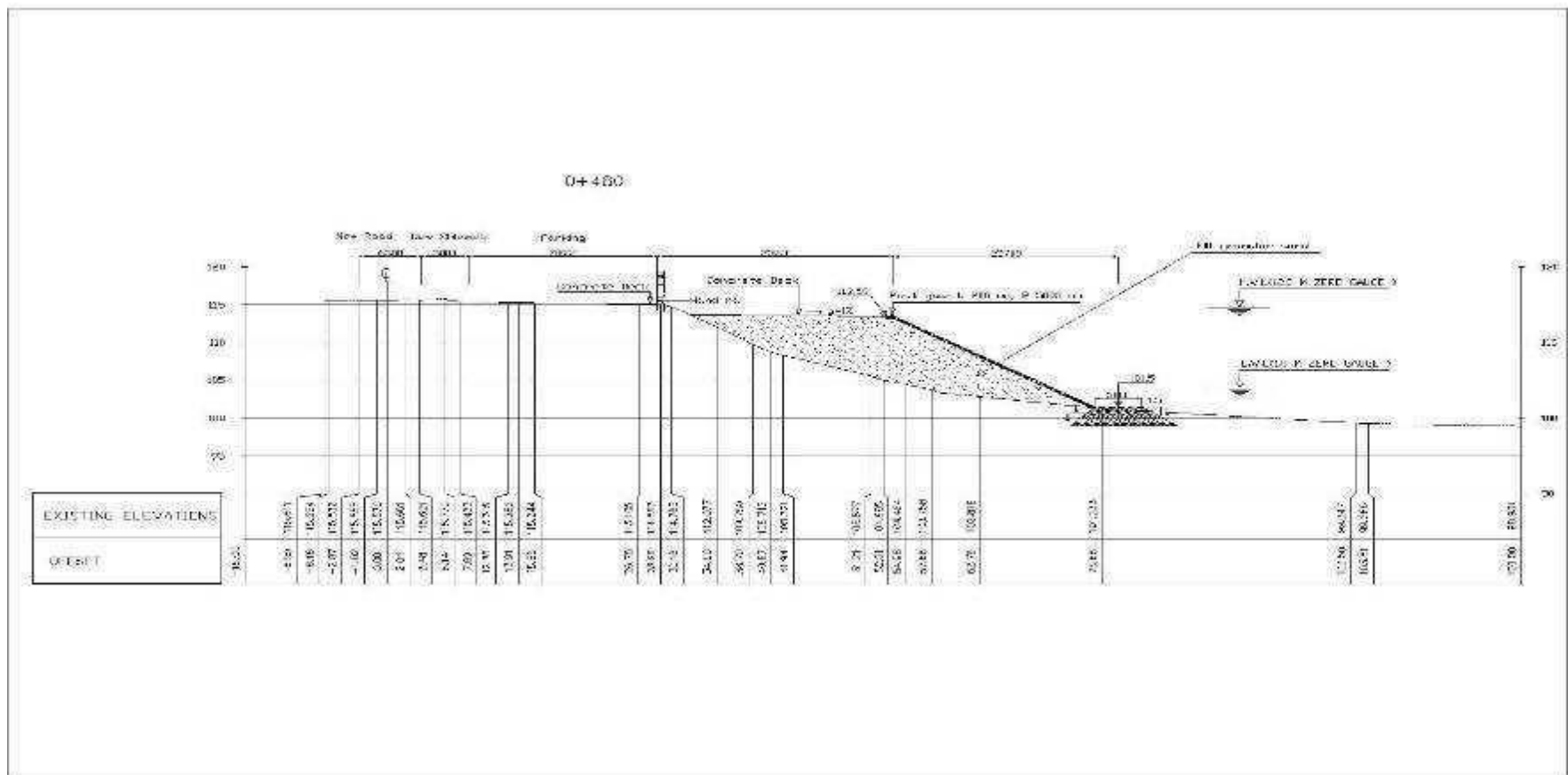


Figure 6. Cross section of X-Sec 1 - Ch. 0+480

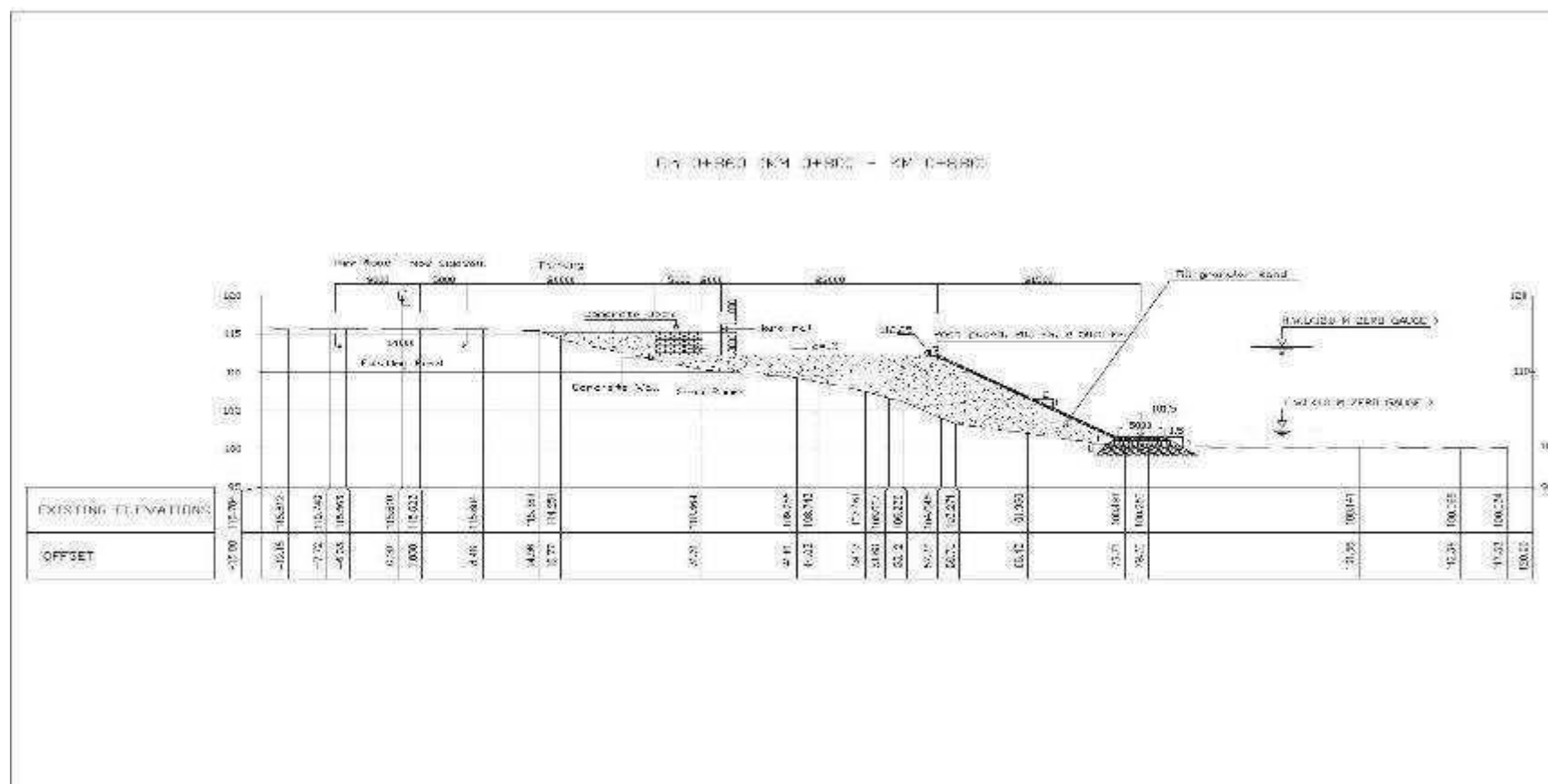
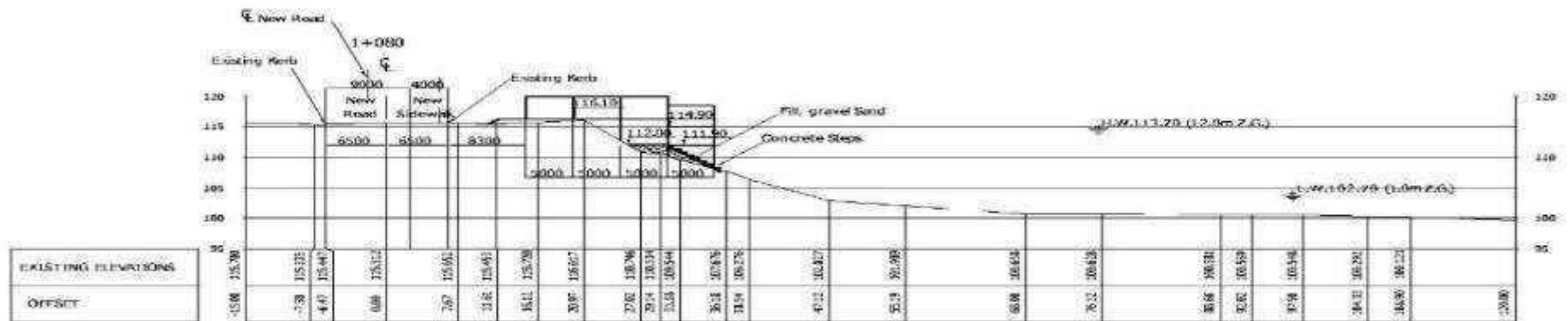


Figure 7: Cross section of X-Sec 5 - Ch. 0+860



10. The typical cross sections for Tha Hae Road are presented below (Figure 9 and Figure 10).

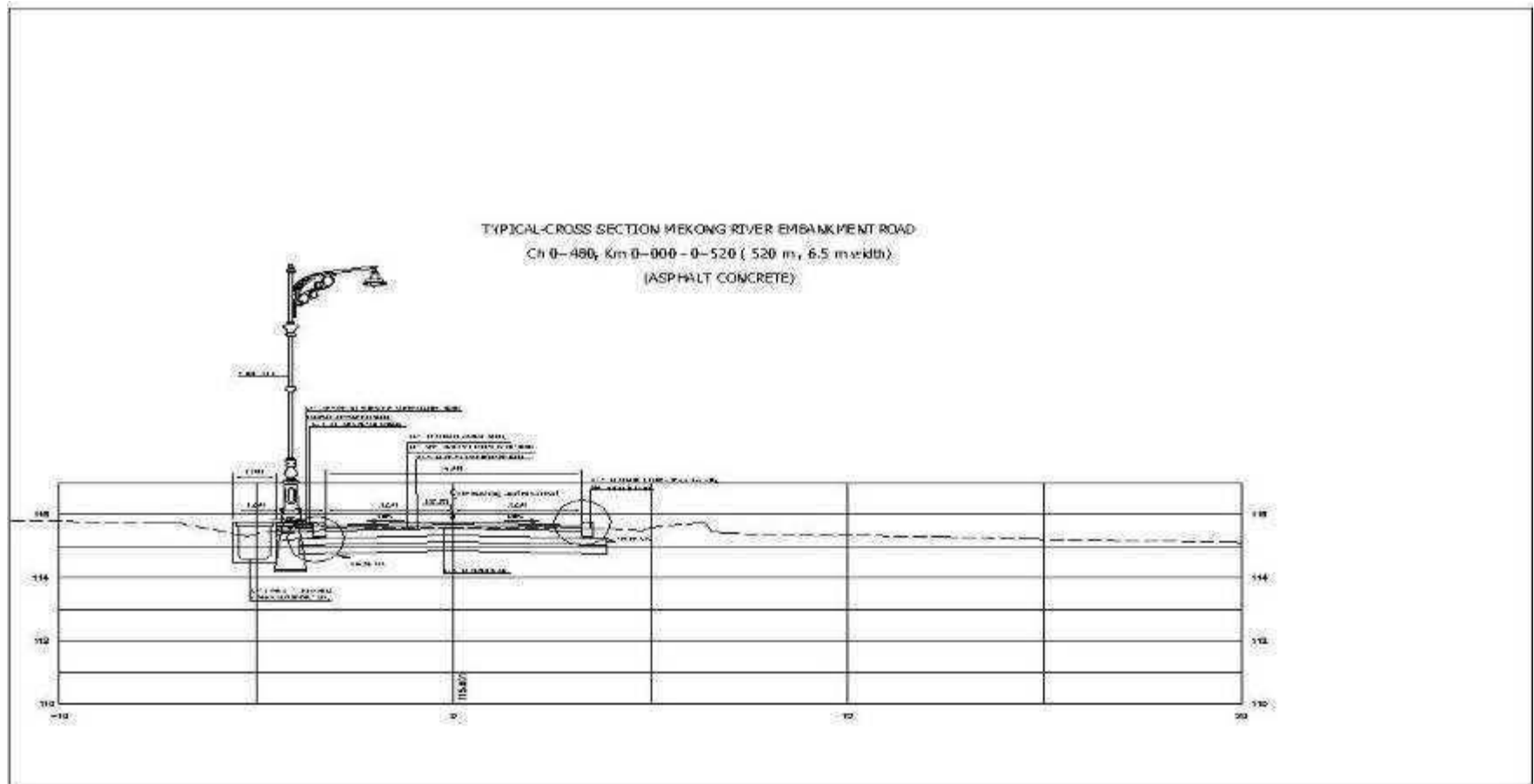


Figure 9. Cross section for Tha Hae Road X-Sec 1 - Ch. 0+480

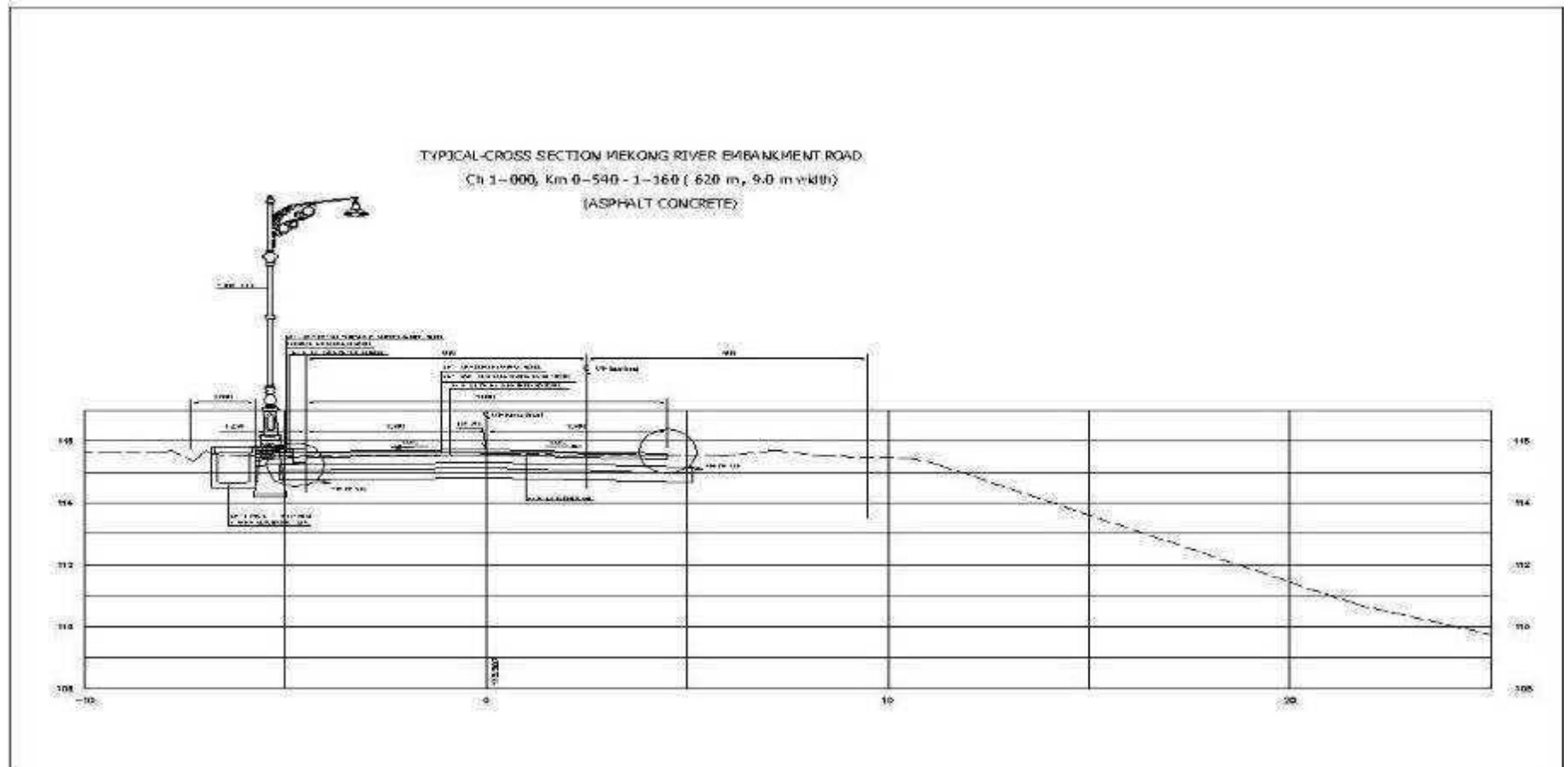


Figure 10: Cross section for Tha Hae Road X-Sec 1 - Ch. 1+000

B. Specification of Activities and Facilities

11. The specification of activities and facilities to be implemented by the Contractor is presented in the table below.

Table 2. Specification of activities and facilities

No.	Title	Specification of activities and facilities
1.	General Provisions	<ul style="list-style-type: none">• Diversion of traffic• Limited impact on existing services, utilities, building and structures, incl. relocation of electricity poles and removal of structures• Contractor's Establishment (workcamps)• Field surveying and measuring facilities• Laboratory and testing facilities• Engineer's facilities (office)
2.	Earth Works	<ul style="list-style-type: none">• Site clearance• Excavations (for roadway, culverts, structures, removal of topsoil on embankment)• Embankment reclamation by sand filling• Earthworks compaction• Backfill• Sourcing sand from borrow pits• Surplus materials disposal• Topsoil placing• Seeding, grassing
3.	Pavement Structures	<ul style="list-style-type: none">• Scarifying existing pavement• Granular sub-base work• Base course• Concrete paving• Reinforced concrete pavement, concrete curbs, gutters, and sidewalk
4.	Concrete Structures	<ul style="list-style-type: none">• Construction of embankment toe• Embankment slope protection (rip-rap)• Embankment stairs• Clearance and demolition of structures on work sites• Falsework and form work• Steel reinforcement for structure work• Concrete materials, production, and structure construction
5.	Drainage, Protection and Strengthening Work	<ul style="list-style-type: none">• Reinforced concrete box culverts & pipe culverts (conduits, fittings and boxes, stone riprap work, concrete slope protection, filter fabrics, and ditch protection where needed)
6	Embankment areas	<ul style="list-style-type: none">• Park areas• Shopping areas (concrete structure)• Toilet building• Trees and shrubs• Landscaping and beautification
7.	Road Appurtenances, Special and Miscellaneous Work	<ul style="list-style-type: none">• Pavement markings• Speed bumps and rumble strips• Road signs• Side walks• Street lighting

II. DESCRIPTION OF THE BASELINE ENVIRONMENT

A. Baseline Environment

12. A general description of the baseline environment is contained in the IEE. Key points are summarized below and additional information added.

a. Climate

13. The climate of Savannakhet is 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. The dry season (November to April) is dominated by the northeast monsoon. The average rainfall in Savannakhet is approximately 1,600 mm per year, which is about 170 mm less than the Lao average.
14. The temperatures in Savannakhet range from a minimum low of 13°C in January to a maximum high around 39°C in April. Savannakhet is the hottest and driest province of Lao PDR: the average temperature is estimated to be 26.1°C, which is about 2 degrees higher than the national average. The average number of hours of sunlight per year is estimated to be 2,280, which is about 256.8 hours longer than the national average.

b. Water Environment and Surface Water

15. The dominant surface water body is the Mekong River to which all other rivers/streams in Kaysome Phomvihane drain. The Mekong River flows almost 1,900 km through Laos. Five kilometers of this length passes by Kaysome Phomvihane, where its width varies between 1.25 km and 1.6 km.
16. 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 2016 and published in 2018. 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 3. Water quality class of the Mekong River at monitoring station 6: Savannkahet, 2009 - 2016

Water quality class	2009	2010	2011	2012	2013	2014	2015	2016
For the protection of aquatic life*	A	A	A	A	B	B	B	A
For the protection of human health*	A	A	A	B	B	C	B	B
For agricultural use**	A	A	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								

17. At Savannakhet, the water quality class for protection of aquatic life has declined from high in 2009-2012 to good from 2013 to 2015, attributed to a slight increase in total phosphorous concentration above the threshold, however, compared to 2015, the degree of water quality

impairment for the protection of aquatic life increased slightly in 2016. The water quality class for protection of human health has declined from high in 2011 to moderate in 2014, and improved to good in 2016. 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 2016 are presented in the figure below.

c. Landscape

18. The land use and characteristics along the embankment is a mixture of agricultural production, bush/shrub land, green spaces, and various other socio-economic use such as food stalls and small shops. The embankment can generally be described as a modified habitat.

d. Air quality

19. Ambient air quality data for Kaysone Phomvihane has not been reviewed as part of the IEE and no air quality monitoring has been conducted. Considering the project area and the nature of the project, dust and particulate matter are considered the most significant air quality indicators.

e. Noise

20. The project area is located in Kaysone Phomvihane, an urbanized area. Noise monitoring data has not been reviewed as part of the IEE. The project area is considered a normal urbanized area with respect to noise. Noise standards are included in Appendix B: Environmental Standards.

f. Road infrastructure

21. Tha Hae Road is the existing embankment road, which runs along the entire section of the embankment subproject. The width of the road changes along to the project area, being narrow at the starting point of the floating restaurant/old ferry ramp 6 ½ - 7 m. The section at the Immigration Building and boat terminal with is between 20 – 22 m. The rest of the sections range from 12 – 16 m.
22. The pavement of the Tha Hae Road has not been maintained for many years. There are several deep holes in the road surface at various locations. The condition of the road may deteriorate further, and driving is not comfortable at those sections. Therefore, renovation is required. There are some relatively long stretches featuring wide sidewalks paved with Concrete Paving Blocks (CPB) and including drainage channels. Some CPBs are damaged, displaced or simply missing and they need to be repair. Some sections of the sidewalks are concrete and are partly damaged with cracks occurring, they also need to be repair.

g. Drainage infrastructure

23. The UDAA is the agency responsible for operation and management of the drainage system in Kaysone Phomvihane. The drainage system consists of roadside drains and open channels before discharging to the Mekong River. The drainage system receives a significant part of the wastewater from Kaysone Phomvihane, which has no central wastewater collection

system, but only simple on-site treatment systems. Greywater is generally discharged to the drainage system without any treatment.

24. There are ditches and side drains along Tha Hae Road that connects with existing drainage infrastructure and outflows to Mekong River. Four similar interconnections are included in the design of the new project. Table 4 list the design characteristics for the 4 culverts and shows a typical section for a pipe side drain.

Table 4. List of pipe culverts

No	Station	Box Culvert		Diameter	FLOW	CENTER GRADE LEVEL	BOTTOM OF INLET LEVEL	BOTTOM OF OUTLET LEVEL	Slope	LENGTH OF PIPE	TYPE OF INLET	TYPE OF OUTLET	Structure, drop, manhole and wall			Body bottom of pipe		SAND Compac c
		Concrete 25 Mpa. (m ³)	Concrete 15 Mpa. (m ³)										REIN.F. (Ton)	Concrete 20Mpa. (m ³)	Concrete 15 Mpa. (m ³)			
																S (m)	H (m)	
1	0+320.0			1PC 100	L/R	115.684	114.174	113.814	3.0	12	MH	MH	4.380	0.696	0.70	6.768	4.368	13.104
2	0+360.0			1PC 100	L/R	115.597	113.332			36	MH	MH						
3	0+520.0			1PC 100	L/R	115.732	114.23	113.872	3.0	12	MH	MH	4.380	0.696	0.70	6.768	4.368	13.104
4	0+710.0			1PC 100	L/R	115.670	114.07	113.708	3.0	12	MH	MH	4.380	0.696	0.70	6.768	4.368	13.104
													13.14	2.09	2.10	20.30	13.10	38.31

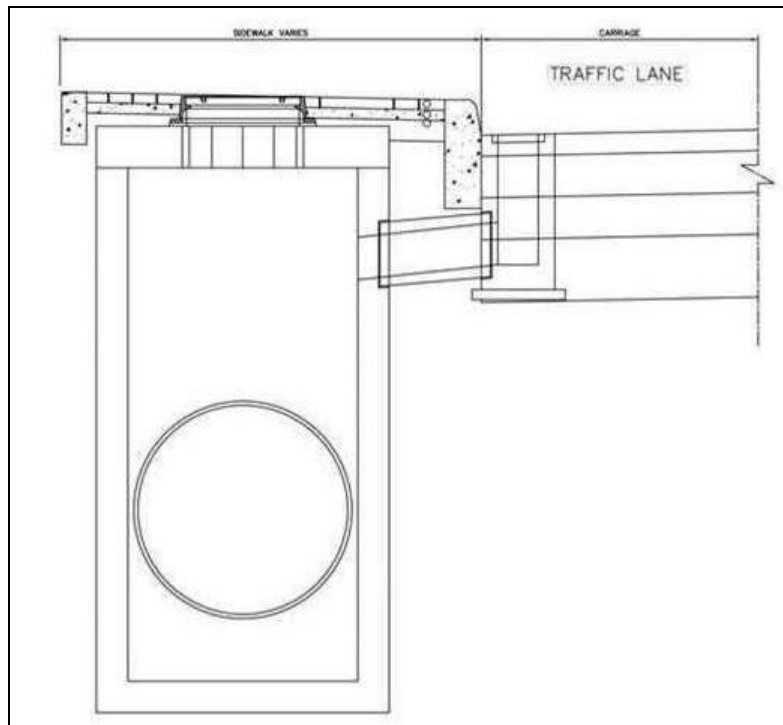


Figure 11. Pipe side drain typical section.

h. Flora and fauna

25. The project affected area is an urban area and characterized as a modified habitat. Trees along the embankment provide habitat as well as shade. The species found in the project area are: Ka thin (*Leucaena leucocephala*), Ya lao (*Miscanthus* sp.), *Alstonia scholaris* tree, *Muntingia calabura* trees with medium size, *Cassia Fistula* tree, Holy Banyan tree, *Senna Garrettiana* tree, and *Tamarindus Indica* trees (see complete list in Appendix F). No sensitive habitats or rare or endangered tree species are recorded from the project area. Two sacred trees are found (trees number 46 and 54 in Appendix F) which will be kept together with the rest of the trees apart from tree number 90 in Appendix F, this tree has an elevation of 112.5 m and the embankment reclamation level is 114 m.
26. Aquatic ecosystem next the embankment will be affected. 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.
27. 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. Aquatic animals and amphibians are also found in the area.
28. Aquatic ecosystems are generally highly sensitive to increased levels of turbidity and high levels of sediment in the water column, which are often prevalent during dredging and fluvial construction activities. As a short-term consequence, the fish may leave the area during construction. A more long-term consequence may be the destruction of fish breeding areas. Current fishing activities with net from the shore will be displaced. The fishing community is located approx. 150 m souths of the end of the embankment and they will be minor affected.
29. No sensitive habitats or rare or endangered aquatic species of flora or fauna are recorded from the project area.

i. River Hydraulics of Mekong River at Savannakhet

30. In the study area Mekong River forms a transboundary (international) river. The width of the Mekong River at Savannakhet is approx. 1,450-1,500 m, depending on the river level. A long island in the middle of the river separates the flow into two sub-channels: one along the Lao bank and the other along the Thai bank.
31. The reclamation will constitute a local blockage of the river flow along the embankment on the Savannakhet side. When the river discharge comes from upstream and meets the reclamation, there will occur a local redistribution of the transverse velocity field. At the toe of the rock slope and along the slope flow velocities may locally increase, and scour is expected to develop, however, it will be prevented by provision of adequate scour protection.
32. The increase in flow velocities is expected to occur along the initial part of the reclamation. In the downstream direction, it is expected that the transverse velocity field will be gradually transformed to a more uniform transverse velocity field without increased flow velocities locally along the slope, compared to the central part of the channel.

33. The transformation of the flow will take place along the embankment section. The embankment width will be 50 m after completion of the works (current width ranges from 20 – 40 m). The river width between the embankment and the island in the middle ranges from 550 to 650 m. Therefore, it is expected that a fully transformed velocity will never develop because the river width is ca. 10 – 15 times the embankment width.
34. The water level variations in the Mekong River at Savannakhet exhibit distinct seasonal variations. During the dry season the daily water level variations are generally rather moderate, so that in the period January – May the water level will normally vary within a range of about 1.0 m. At Savannakhet this is typically in the range 1.0 – 2.0 m Zero Gauge.

B. Physical Cultural and Social Resources

35. The river bank at Kaysone Phomvihane is an important resource for the townspeople, and plays a major role in their quality of life and cultural identity. The riverbank is used for recreation activities, such as cycling and playing petanque, as well as driving along the river bank on mopeds for the evening sundown.
36. The riverbank is also the venue for the Boun Ok Phansa and Boat Race Festival which takes place at a full moon in October every year. This commemorates the end of the monks' three months fast and retreat during the rainy season. The boat race is an extremely popular festive event in which villages compete against each other. The Viewing Platform is the focal point for the boat races and forms a grandstand to watch the racing.
37. The embankment also has significant spiritual importance. The Homma He Sak Shrine is located on the river bank. During the Boun Ok Phansa holiday, on the evening of Van Ok Phansa, a ceremony is held.
38. In addition to the recreational and cultural importance of the Mekong riverbank at Kaysone Phomvihane, it also provides the location for a range of different economic activities. These consist of the following: gardens and smallholders on the riverbank, a floating restaurant, a ferry terminal operating boats to Thailand, food stallholders, vendors selling garments, a fishing community, fish market and tuk-tuk operators.

III. SUMMARY OF ISSUES AND POTENTIAL IMPACTS

39. Potential impacts of the Mekong river embankment subproject are dominated by the effects of construction on water quality, habitat for aquatic and riparian biota, navigation, and other uses of the river. The river will be at risk of receiving sediment loads during construction from earthworks and stockpiles. Siltation and sedimentation will negatively affect aquatic biota in the river.
40. The reclamation structure will have a permanent impact on the site of the civil structure, including but not limited to:
 - (i) Impact on flows in Mekong River: Land filling has potential environmental impacts on the flow characteristics of the river caused by reducing the river channel width by approximately 50 m. The reclamation will constitute a local blockage of the river flow along the embankment on the Savannakhet side. River flow velocity will increase along the initial part of the reclamation and scour is also expected. However, these will only impact locally near the rock slope of the first part of the reclamation. The 2016 FS calculated that the flow velocity will increase 3-4%. The increases in

average flow velocities are expected to imply minor morphological changes in the channel between the embankment and the island.

- (ii) Loss of aquatic & other natural habitats in the riverbank reclamation area: Current terrestrial, riparian, and aquatic habitats will be lost or displaced in the reclamation area.

41. Potential impacts during the construction phase associated with the road improvement are temporary and short-term impacts such as noise, dust, solid and liquid waste, construction traffic, and reduced community and commercial access. 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.
42. Sensitive receptors in the project area includes various religious sites such as the Wat Sayaphum and the Mahesak Shrine as well as Holy Banyan trees. Two other infrastructures are within the reclamation area i.e. the viewing platform and the immigration building and ferry terminal.
43. A summary of issues and impacts associated with the embankment subproject are presented in Table 5.

Table 5. Summary of Potential Environmental Impacts

Issues and Impacts	Type	Overall Subproject Magnitude
I. Pre-Construction Phase		
Land acquisition and resettlement to be addressed by Resettlement Plan	Negative	Low
Displacement of people, loss of assets & income	Negative	Low
II. Construction Phase		
Civil works related environmental impacts		
Land clearing, loss of fruit trees and decorative trees	Negative	Moderate
Dust/suspended particles/air pollution	Negative	Significant
Noise and vibration	Negative	Significant
Generation of spoils, solid waste	Negative	Significant
Land & surface water pollution	Negative	Moderate
Erosion, sedimentation, siltation	Negative	Significant
Traffic	Negative	Moderate
Reduced access, and disrupted business and community activity (incl. business along the embankment and the operation of the ferry terminal).	Negative	Significant
Accidental damage to properties/structures	Negative	Low

Community health and safety hazard	Negative	Moderate
Workers' health & safety hazard	Negative	Moderate – Significant
Degeneration of Mekong River, impairment of aquatic & other natural habitats in riverbank, loss/disturbance of aquatic fauna sediments, wastes, spoils	Negative	Moderate – Significant
III. Operation Phase		
Impact on flows in Mekong River	Negative	Moderate
Loss of aquatic & other natural habitats in the riverbank reclamation area	Negative	Significant
Loss of safe/direct/easy access to river by concerned riverbank communities for domestic needs, recreation, socio-economic activities, fishing	Positive	Moderate
Controlled loss of land in subproject sites due to erosion/slope failure	Positive	Significant
Prevention of loss of lives, protection, of households living on top of Embankment	Positive	Significant
Prevention of loss of structures & income from gardens on top of Embankment	Positive	Significant
Prevention of damage to infrastructures on top of riverbanks	Positive	Significant
Protection of physical cultural resources from damages due to erosion	Positive	Least – Significant
Improved access	Positive	Moderate
Improved traffic safety as a result of pavements, pedestrian crossings, improved signage and speed limit enforcement	Positive	Moderate

Impact of sand winning

44. During the preparation of the 2016 FS, 3 sand winning operations in Savannakhet were visited, (1) site along the left bank of Mekong River, 6 km south of Savannakhet, (2) site in the middle of the river, 3 km north of the bridge and near the high voltage substation; (3) site north of the bridge (Figure 12). The sand winning operations informed that they operate under Environmental Permits issued by DONRE on an annual basis for 5 hectares concession areas. Sand winning is conducted in the period November to end of June in accordance with the permit. The combined annual volume of the three operations is approximately 350,000 m³ of sand and 100,000 m³ of gravel per year. The volume of sand estimated for the embankment is 300,000 m³. Report on the winning operations is included in APPENDIX F: Mekong River Embankment – Supply and Cost of Sand.
45. The contractor will select the quarries to source the filling materials. The quarries could be current sand winning operators or establish own borrow pits at approved sides. Current and new quarries must have updated environmental permits issued by DONRE. All borrow pits and quarries should be approved by DONRE and established and operated in line with applicable Lao guidelines or IFC EHS Guidelines for Construction Materials Extraction. Contractor will submit reports on quantities, transport and storage in the project area (these form the basis for the Aggregate Management Plan). PMU/CSCS will conduct and

Environmental Due Diligence on the queries including transport and storage in project area. The contractor can only use borrow pits and quarries for which PMU/CSCS has issued no-objection based on the Environmental Due Diligence.



Figure 12: Sand winning plants in Savannakhet

IV. REGULATORY FRAMEWORK AND GUIDELINES

- 46. The specific regulations and guidelines for the Kaysone subproject component are summarized in Table 6. The regulations and guidelines, inter alia, specify how the infrastructure investment should be located, constructed, and managed to prevent or minimize negative impacts on the environment. The complete list of environment-related laws and regulations of Lao PDR are described in Appendix A.
- 47. Environmental standards are listed in Appendix B. Where Lao PDR regulations differ from the environmental standards provided by the Environmental, Health and Safety Guidelines of the World Bank (2007), the reference will be whichever is more stringent.

Table 6. Regulatory Framework and Guidelines

Environmental Standards
<ul style="list-style-type: none"> • National Environmental Standard Order No. 81/GOL (2017) See Monitoring Plan (section V) below and Appendix B for Lao PDR ambient surface water quality standards, and standards for wastewater discharge. • 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 Public Works and Transport 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).

- Law on Water and Water Resources (2017). Article 31. Prohibitions: Not allowed to conduct any development activities without permission, construct or build in the riverbank, near river and in the river body.

Urban Road Upgrades

- Lao PDR Road Design Manual with reference to AASHTO A Policy on Geometric Design of Highways and Streets, 5th edition.
- RDA's Lao Bridge Design Manual, 1998 with reference to AASHTO LRFD Bridge Design Specifications, 4th, Edition, 2007
- Transport Research Laboratory's (TRL) Road Note 31, 4th edition.
- Road Development Authority (RDA's) standards incorporating relevant standards from the AASHTO Highway Drainage Guidelines.
- MPWT (2006). Specifications for drainage system, culverts, street lighting and tree planting

V. CONTRACTOR REQUIREMENTS

48. Environmental mitigation and management issues concerning the subproject arise during construction and operation phase. Mitigation should thus be centered on the need to ensure that the contractor acts in an environmentally responsible way. Therefore, an environmental management plan (EMP) should form part of the contract for construction. The EMP specifies the approach to construction site preparation and operation including pollution control and waste management.
49. In the context of the project the construction contractors should commit to respect the following principles during the whole period of the construction activities:
 - (i) to manage construction activities with diligence and with the awareness that the important objectives are to protect the environment and to minimize construction impacts, by employing the best control mechanisms, procedures and processes within the limits of their economic feasibility;
 - (ii) to comply with Lao PDR and ADB and to provide self-monitoring to ensure compliance;
 - (iii) to respect internationally recognized good practices in the fields of concern;
 - (iv) to provide effective environmental briefing to construction staff;
 - (v) to ensure adherence to the EMP throughout the construction stage;
 - (vi) to efficiently implement measures outlined in the EMP;
 - (vii) to submit regular monitoring reports; and
 - (viii) Admit regular monitoring and auditing of activities.

50. All contractual and legal obligations relating to the EMP should apply to both the construction contractors and their subcontractors. It should be the responsibility of the construction contractors to provide adequate resources to ensure effective implementation and control of the EMP. Each subcontractor should be accountable to its respective contractor for compliance with the measures presented in the EMP. Construction contractors and their subcontractors should ensure that the entire project staff is briefed and procedures are understood and followed.

VI. MITIGATION MEASURES AND PLAN

51. The mitigation measures of the EMP are presented in a comprehensive mitigation plan for the subproject component summarized in Table 7. The plan includes the environmental issues and concerns raised at the stakeholder meetings. The plan identifies responsible parties, location, and timing. Indicative costs are tabled separately.
52. The mitigation plan combines the construction phase activities common to all components while highlighting activities and mitigations specific to a single component.
53. The recommended mitigation measures consist of actions, activities, plans and documents (including resettlement/compensation plan, environmental compliance certificates, Contractor's EMP) that need to be undertaken, observed, obtained, prepared to prevent, mitigate, or compensate for, the adverse impacts enumerated in Table 1. The broad measures are as follows; while the specific measures are presented in Table 7:
- (ix) Incorporating in detailed design the concern on loss of easy and safe access to the river by riverbank communities for domestic needs, recreation, water, socio economic activities and/or fishing for food when embankment is in place.
 - (x) Specifying environmentally preferred construction practices, materials and technologies, where possible, in the detailed design and/or bidding documents, such as (but not limited to) techniques that would ensure prevention of slope failure and erosion during rains while constructing, materials that would allow easy and affordable maintenance and repair considering the capacity of the UDAA.
 - (xi) Prompt compensation for losses associated with ROW acquisition according to the approved Resettlement/Compensation Plan.
 - (xii) Ensuring the engagement of an environment-responsible Contractor by incorporating the ADB-cleared Subproject EMP into the bidding documents for use as basis in the preparation of Contractor's EMP (CEMP), addressing as minimum the requirements of the Subproject EMP. Bidders' CEMPs to be quantitatively and qualitatively evaluated against the Subproject EMP. CEMP of winning bidder to be cleared by ADB prior to awarding of Contract. The contract for civil works to explicitly stipulate the obligations of parties involved to institute the mitigation measures properly and carry out environmental monitoring according to the ADB-cleared CEMP and Subproject EMP, both to be appended in the Contract. The Contract to stipulate some tie-up of progress payment and collection of performance bond with the performance in CEMP/Subproject EMP implementation.
 - (xiii) Good and environment-friendly engineering practices that avoid first, and (if unavoidable) mitigate, adverse impacts; and full implementation of the CEMP/Subproject EMP.

- (xiv) Quality construction supervision and environmental monitoring by the PMIU.
- (xv) Sufficient funds for sustained quality of operation and maintenance.
- (xvi) Observance of the grievance redress mechanism and prompt action/ resolution of lodged grievances.

Table 7. Environmental Impacts Mitigation Measures Plan

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost	Responsibility	
							Super- vision	Implemen- tation
Pre-Construction Phase								
Detailed Engineering Design								
Consultation/ Disclosure, & community engagement	Community grievances	1. Pre-construction consultation with affected people, including dissemination of project level Grievance Redress Mechanism (GRM). 2. Pre-construction consultation with disrupted business and community activities. 3. Pre-construction consultation with Ferry operation company and immigration building to ensure continuous operation during construction phase.	For all construction sites.	Before construction (but not later than 3 months after NTP)	Once regular GRM reporting	Management cost/ integrated in PMU budget	IA/PMU	PIT/GPP
GoL approvals	-	4. Subproject EMP submitted to DONRE for approval. 5. Updated EMP shall be submitted to EAs/IAs for approval and endorsement to ADB. 6. The Contractor shall ensure that required permits and clearances have been obtained from relevant government agencies.	Entire subproject	Before bidding Before construction	Once As required	Management cost/ integrated in PMU budget	IA/PMU	IA/PMU
Bid documents	-	7. Updated EMP included in contractor tender documents, and tender documents specify that requirements of EMP must be budgeted. 8. Bid documents specify that contractor must have experience with implementing EMPs, or provide staff with the experience.	Entire subproject	Before bidding	Once	Management cost/ integrated in PMU budget	IA/PMU	CSCS
Unsustained effectiveness due to: No/inadequate maintenance Inadequate consideration of inland flooding & the necessary outfall of flood waters to river		9. Consider in the design the maintenance capability of concerned agency and incorporate in design of embankment the provision for outfalls/discharge of inland flood waters.	Entire subproject	Before construction	As required	Management cost/ integrated in PMU budget	IA/PMU	IA/PMU
Unsustainable supply of gravel, sand, soil or unsustainable extraction of these materials to meet the		10. Prepare a Subproject Aggregate Management Plan (AMP), confirming location of sources, estimating supply of, & demand for, aggregates and transport. This will form basis for contractor's AMP.	Entire subproject	Before construction	As required	Integrated in Contractor's contract	CSCS	Contractor

construction demand. Impacts related to material transport		11. Environmental Due Diligence of the sand wining operators, quarries, transportation and storage in the construction side.	Entire subproject	Before and through construction phase	As required	Management cost/ integrated in PMU budget	IA/PMU	CSCS
Land Acquisition, Obtaining Approvals, and Community Preparation								
Loss of land, structures/ or parts of structures, crops/trees, income		12. Finalize Resettlement/Compensation Plan, after Detailed Measurements Surveys, through highly consultive & participatory process	All affected	Before construction	As required	Management cost/ integrated in PMU budget	IA/PMU	PIT
		13. At least 30 days before awarding of contract for civil works, losses shall have been fully compensated for	All affected	Before construction	As required			
Procurement								
Bid documents	-	14. Updated EMP included in contractor tender documents, and tender documents specify that requirements of EMP must be budgeted. 15. Bid documents specify that contractor must have experience with implementing EMPs, or provide staff with the experience.	Entire subproject	Before construction begins	Once	Management cost/ integrated in PMU budget	IA/PMU	IA/PMU
Construction Phase								
Initiate EMP & subplans	Prevent or minimize impacts	16. Contractor to submit Contractor's Environmental Management Plan (CEMP), addressing at a minimum the subproject EMP, including subplans (refer below).	For all construction sites	Before construction	Once	Integrated in Contractor's contract	CSCS	Contractor
Community engagement	Community grievances	17. Contractor to establish Grievance Mechanism and signpost contact information (phone number and website).	For all construction sites	Before construction	Once	Integrated in Contractor's contract	CSCS	Contractor
Obtain & activate permits and licenses	Prevent or minimize impacts	18. Contractors to comply with all statutory requirements set out by Lao PDR for use of construction equipment, and operation construction plants such as concrete batching.	For all construction sites	Before construction	Once	Integrated in Contractor's contract	CSCS	Contractor
Physical / Chemical Environment								
Implement Construction materials acquisition, transport, and storage subplan	Pollution, injury, increased traffic, disrupted access	19. Submit plan for use of borrow pits and quarries for pre-approval. All borrow pits and quarries should be approved by DONRE and established and operated in line with applicable Lao guidelines or IFC EHS Guidelines for Construction Materials Extraction. 20. Submit plan for transport and storage of constructions materials, including filling materials for pre-approval. 21. Select pits and quarries in areas with low gradient. 22. Pits and quarries should not be located near sensitive surface waters, forested areas, critical habitat for wildlife,	For all construction areas, incl. borrow pits and quarries	Throughout construction phase	Monthly	Integrated in Contractor's contract	CSCS	Contractor

		<p>or cultural property or values.</p> <p>23. All topsoil and overburden removed should be stockpiled for later restoration.</p> <p>24. All borrow pits and quarries should have a fence perimeter with signage to keep public away.</p> <p>25. After use, pits and quarries should be dewatered and permanent fences installed with signage to keep public out, and restored using original overburden and topsoil.</p> <p>26. Unstable slope conditions in/adjacent to the quarry or pit caused by the extractions should be rectified with tree planting.</p> <p>27. Define & schedule how materials are extracted from borrow pits and rock quarries, transported, and handled & stored at sites.</p> <p>28. All aggregate loads on trucks should be covered.</p> <p>29. Piles of aggregates at sites should be used/or removed promptly, or covered and placed in non traffic areas.</p>						
Reduced access, and disrupted business and community activity (i.e.: Immigration building and ferry company; Shrine house; Viewing platform)	30. Ensure safe access to the business and community activities within the embankment.	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor	
	31. In case of temporary relocation, relocation place to ensure easy and safe access to the business and community activities within the embankment.							
Dust/suspended particles from: <ul style="list-style-type: none">- Earthworks (clearing, grubbing, levelling, excavation)- Transport of fine aggregate, cement- Movements of construction vehicles- Stockpile of dry soil, sand, cement- Loading/unloading of the aggregates cement and other materials- Dry exposed areas	32. Confine clearing, grubbing & excavation to the Staking Plan & Excavation Management Plan.	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor	
	33. Limit segment length to what can only be excavated & protected in a day. Keep lining/protection & bedding works following as close as possible to excavation work. Excavation segments shall have been properly lined/protected & bedded at the end of each day's work (8AM – 5PM).							
	34. Watering of stockpiles of soil/sand and excavated materials, at least 2xday							
	35. Protecting stockpiles of soil/sand with a wind barrier/screen							
	36. Covering of trucks tarpaulin, especially those carrying soil, sand and cement. Trucks to maintain min. 2 feet freeboard.							
	37. Limit speed of all construction-associated vehicles to 20 km/h in Subproject site and unpaved access to embankment							
	38. Minimize drop heights when loading/unloading soil onto							

	truck/ground. Spray water on soil being loaded/unloaded						
Gas emissions from: - Exhaust of operating construction equipment/vehicles, including generator sets - Burning of solid/hazardous wastes - Overall power/energy use in construction	39. Reduced vehicular movements through: - Coordinated transport of materials, spoils and waste - Closer sites for spoils reuse and source of materials - Worker's accommodations at walking distances, or providing mass transport for workers - Bigger capacity trucks for hauling of wastes/spoils, where access roads allow. 40. Limit engine idling to a maximum of 5 minutes 41. Use existing power poles. Minimize use of generators. Use clean-fueled generators. 42. No burning of wastes, indiscriminate dumping of wastes. 43. Use well maintained vehicles/equipment, with emissions test certificate	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
Odor from: - Poorly managed solid and hazardous wastes - Poor sanitation practices of workers - Gas emission sources	44. Application of gas emission mitigation measures 45. Properly store and promptly dispose of, organic and hazardous wastes 46. Require trucks hauling wastes to the landfill and transporting chemicals to construction sites to have appropriate covers 47. Consider weather conditions (wind/temperature) when scheduling activities that generate odor 48. Where applicable, install barriers around potential odor generators, located against prevailing wind directions 49. Provide adequate sanitation facilities, adequate water supply. Strictly enforce observance of sanitation practices	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
Noise from: - Operating equipment/vehicles (especially those diesel-fed and without efficient mufflers) - Process such as cutting, mixing, unloading of aggregates, among others	50. Enclose generator sets and position it at appropriate distance away. 51. Use equipment that emit least noise e.g., electricity powered equipment, hydraulic tools, those with efficient mufflers. 52. Restrict use of noise equipment from 8 AM – 5 PM. Overtime work not go past 10 PM, observe reduced noise level, no noisy equipment coordinated with villages office, communities informed 3 days ahead. 53. Strategically locate noise generators at maximum distance possible from noise receptors. 54. Spread out schedule of material, spoil and waste transport, in the day (off-peak traffic hours), or early evening.	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor

	<ul style="list-style-type: none"> ○ Appropriate stockpiling areas, on flat grounds and away from or not obstructing main surface drainage routes ○ Disposal of unsuitable and excess soils as soon as possible ○ Require hauling trucks appropriate cover, min 2 feet freeboard <ul style="list-style-type: none"> - Program the delivery of fine aggregates to sites, to avoid stockpiling more than what is needed - Use any combination of the following to prevent fine aggregates from being eroded/carried away by wind and rain: sediment trap, silt fence, sandbag, barrier net, earth bund, speed stilling hump, along surface drainage routes and on the embankment boundary with Mekong River, limiting stockpile to a max. 2 m height and/or diversion drains to reroute surface runoff 						
	<p>63. Implement measures to mitigate potential adverse impact from use and storage of hazardous substances:</p> <ul style="list-style-type: none"> - Have safe storage, with visible caution signage, secure from unauthorized entry or use and can contain spillage - Have equipment clearly leaking oil repaired immediately off site - Use less hazardous substances - Store no more hazardous substances on site than needed 						
Unnecessary loss of land due to erosion or slope failure triggered by earthworks and ground vibration and rains/floods	<p>64. Implement Slope Management Plan to mitigate land loss from slope failure during construction</p> <p>65. Slope Management Plan to combine such measures as (but not limited to):</p> <ul style="list-style-type: none"> - Segmented cut and fill works, define max m at a time - Sufficient slope protection and temporary drainage - Detailed records of encountered site conditions as work progresses, especially soil irregularities and groundwater seepage <p>66. When needed, verify subsoil profile, provide suitable temporary erosion control blankets, construct during low river level months.</p> <p>67. Implement Slope Management Plan to mitigate land loss from slope failure during construction Berms and plastic sheet fencing should be placed around all</p>	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor

Community health/safety hazard from, among others: - Dust, noise, gas emissions, odor, vibration - Affected water resources - Inadequate waste/wastewater management - Spillage of hazardous substance - Movement of construction-related vehicles/equipment - Increased traffic - Potential landslide/erosion - Unsafe alternative access provided - Rise of communicable/transmittable disease with entry of workers	96. Implement recommended measures to mitigate: - Dust, gas emission, odor, noise, vibration - Degeneration of water resources - Traffic/road blocking and access blocking	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
	97. Install adequate/appropriate lighting, reflectorized barrier to mark the restricted top of the riverbank (min. 20 m wide) to stop public entry						
	98. Safe access for pedestrians to blocked properties						
	99. Emergency response preparedness (procedures, trained staff, equipment, tools and supplies), including for fire-fighting.						
	100. Coordinate with village authorities for the implementation of safety measure and information drive.						
	101. In case of "chance find" UXO immediately coordinate with village concerned and proper authorities for proper handling.						
	102. Establish pedestrian crossings away from construction areas and ensure adequate lighting.						
	103. Install all warning signs properly where necessary in the construction area.						
	104. Define detour for road section, where are needed for excavation or paving road.						
Workers' health/safety hazard from, among others: - Dust, noise, gas emissions, odor, vibration - Inadequate waste/wastewater management - Poor sanitation practices - Exposure to hazardous substance	105. Reflection must be installed where are risk to accident and warning public beware.	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
	106. Flagmen must be employed where are potential traffic congestion during construction.						
	107. Material transportation must be avoided during peak hours.						
	108. Be avoided construction, where are potential increase traffic congestion during peak hours.						
	109. Worker safety guidelines of GoL or IFC EHS Guidelines should be followed, whichever is more stringent.						
	110. Elaborate and manage the Plan for Occupational Health and Safety (OHS)) for the works (refer Basic Specifications).	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
	111. Worker education and awareness seminars for construction hazards should be given. A construction site safety program should be developed and distributed to workers.						
	112. Strictly enforce use of protective wears, e.g., eye masks, nose masks, ear mufflers, helmets, gloves, appropriate footwear.						

<ul style="list-style-type: none"> - Operating equipment and handling of tools - Movement of construction-related vehicles/equipment - Increased traffic - Weak excavated slope, sudden collapse - Rise of communicable/transmittable diseases in Subproject communities - Exposure to extreme weather 	113. Orient workers, prior to mobilization, on occupational health and safety hazard and strict observance of safety measures.						
	114. Implement recommended measures to mitigate dust, gas emission, odor, noise, vibration, traffic.						
	115. Install adequate lighting, safe accesses to and from work areas						
	116. Provide safe accommodations with reliable supply of potable water, adequate sanitation facilities.						
	117. Provide adequate water for washing and safe drinking, and adequate sanitation facilities, in construction sites.						
	118. Minimize impact on individual workers operating vibrating equipment/tools through: <ul style="list-style-type: none"> - Mechanizing/automating all, or more than 50% of the works. - Ensuring that worker's daily exposure limit value (ELV) is kept within standard limit, as specified by manufacturer: Break up of continuous use of equipment by individual worker, introduce 3 shifts/day in use of the equipment. - Pre-construction orientation and training on safe operation/handling of hazardous equipment's/tools. - Strict enforcement of wearing protective clothing/gear prescribed when using vibrating equipment. 						
	119. Require workers to submit health certificates for employment and for worker's health baselined data.						
	120. Arrange with nearest primary and tertiary health institution for health and emergency care of workers.						
	121. Set up emergency response team equipped with adequate staff, equipment, tools and supplies, including for fire-fighting and first aid kits						
Disruption of, impact on, socio-economic activities due to interruption of infrastructure services, access and road blocking.	122. In case of "chance find" UXO, immediately coordinate with village concerned and proper authorities for proper handling.						
	123. Provide safe alternative access for blocked properties.	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
	124. Immediately advise utility companies on any accidental damages to existing utility for quick restoration service.						
	125. Issue prior notice on scheduled service interruption, 1 week ahead. Interruption not to go beyond 2 hours, for repair of impacted lines.						

Disruption of access to natural resources (river) for recreation and/or for livelihood	126. Provide safe alternative access, as agreed with affected communities.	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
Impact on resources/socio-economic activities on which vulnerable groups depend to sustain their families	127. Provide safe alternative access, as agreed with affected communities.	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
	128. Implement measures to mitigate impacts (degeneration) of the Mekong River.						
Damages to cultural resources, including "chance find" ones	129. Prior coordination with relevant villages for the protection of existing physical cultural resources in close proximity, and for the appropriate action to take with "chance find".	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
Improper closure of construction sites	130. Prior to demobilization, the contractor will remove all wastes and spoils from the construction sites and construction-related areas, and will undertake restoration of the disturbed sites. The contractor shall submit for approval to the Engineer a Site Restoration Plan upon completion of work for each site.	All construction sites.	Fulltime	Monthly	Integrated in Contractor's contract	CSCS	Contractor
Operation Phase							
Increased erosion in the unprotected section downstream along/or across the protected bank.	131. Desirably, complete the riverbank protection downstream. If cannot be implemented in near future, monitor closely the unprotected sections. Provide protection immediately when warranted.	All construction sites.	Continuously	For each event		IA/PMU based on information from PDPWT	
Operation of new & upgraded roads Increased risk of accident or injury.	132. Enforce well marked speed limits and educate public on new road safety.	All construction sites.	Continuously				

VII. MONITORING AND REPORTING

54. The environmental monitoring plan for the EMP is provided in Table 8. The monitoring plan focuses on all the construction and post-construction operation phases of the subproject and consists of environmental indicators, the sampling locations & frequency, method of data collection, and responsible parties. Estimated costs are tabled separately. The purpose of the monitoring plan is to determine the effectiveness of the impact mitigations, and to document any unexpected positive or negative environmental impacts of the subproject.

A. Environmental Standards for Subproject

55. Environmental standards are listed in Appendix B. Where Lao PDR regulations differ from the environmental standards provided by the Environmental, Health and Safety Guidelines (General and applicable) of the World Bank (2007), the reference will be whichever is more stringent.

B. Performance Monitoring

56. Performance monitoring is required to assess the overall performance of the EMP. Select indicators of major components of the environment that will be affected primarily by the construction phase are drawn from the mitigation and monitoring plans and summarized in Table 9.

57. Under the CSCS, Environmental Specialists will be employed to support the implementation of the environmental monitoring program. The IA/PMU and PIT will provide logistical support where necessary for the implementation of the environmental monitoring plan.

58. After the construction phase is completed and the components are in operation the impact of the new infrastructure developments on traffic patterns and urban development should be monitored by the EA.

C. Reporting

59. Regular reporting on the implementation of mitigation measures, and on monitoring activities during construction phase of the subproject is required. Reporting should document progress and the results of mitigation. The Reporting will be conducted at different levels and is the overall responsibility of the PMU. The mitigation and monitoring plans (Table 7 and Table 8) summarize proposed timing of reporting. The Contractor will report on monthly basis on implementation of the mitigation plan. Environmental monitoring reports will be prepared quarterly for the EA by the PMU and PIT supported by the CSCS Environmental Specialists and send to the DoNRE and ADB. A semi-annual Safeguards Monitoring Report will be submitted to DoNRE and ADB. A draft format and outline for the Environmental Monitoring Report is provided in the APPENDIX D: Draft format for Environmental Monitoring Report. DoNRE will conduct an audit on the Environmental Monitoring twice a year during the construction phase of the project.

Table 8. Environmental Monitoring Plan

Aspect/Parameter to be monitored	Location	Means of Monitoring	Frequency	Reporting	Responsibility	
					Compliance Monitoring	Implement
Environmental mitigation implemented according to the CEMP/EMP	All construction sites	Field observations Consulting affected residents Review of grievances	Regular and random Random Regular	Monthly	CSCS	Contractor
Ambient air quality (TSP, PM ₁₀ , SO _x , NO _x , and CO), baseline and periodically during construction against Lao PDR standards.	Sensitive receptors and control points upwind and downwind of construction site.	Following recognized methodology, method specified in 88/GOL (2017).	Prior to construction (but not later than 3 months after NTP) Quarterly	Before construction Quarterly	CSCS	Contractor
Water quality upstream and downstream construction site. Baseline and annual monitoring of: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, BOD5, temperature, TDS, NH3, NH4, other nutrient forms of N & P, sulphides, surfactants, turbidity (NTU). Quarterly monitoring of: Temperature, pH, COD, BOD5, TSS, turbidity (NTU), oil and grease. Establish baseline prior to construction and periodically during construction	Upstream and downstream of construction site.	Following recognized methodology, method specified in 81/GOL (2017). Following methodology method specified in 2016 Lower Mekong Regional Water Quality Monitoring Report, Mekong River Commission.	Prior to construction (but not later than 3 months after NTP)	Before construction Quarterly	CSCS	Contractor
Monthly Environmental Monitoring Report submitted following prescribed outline	Subproject	Review of Contractor's Report	Regular	Monthly	CSCS	Contractor
Lodged grievances acted upon and grievance mechanism observed	Subproject	Review of grievances Consultation with village authorities	Regular Regular	Monthly	CSCS	Contractor
a) Incidence of worker or public	All construction sites	Review of incidents and sick leave	Regular	Monthly	CSCS	Contractor

Aspect/Parameter to be monitored	Location	Means of Monitoring	Frequency	Reporting	Responsibility	
					Compliance Monitoring	Implement
accident or injury; b) incidence investigation; c) corrective measures identified; and d) corrective measures implemented.		Review of investigation and corrective measures	Regular			
a) Environmental incidences / accidents; b) incidence investigation; c) corrective measures identified; and d) corrective measures implemented.	All construction sites	Review of incidents register Review of investigation and corrective measures	Regular Regular	Monthly	CSCS	Contractor
Quarterly Environmental Monitoring Report submitted following prescribed outline	Subproject	Review of Report	Quarterly	Quarterly	PMU	CSCS
Semi-Annual Safeguards Monitoring Report submitted following prescribed outline	All subprojects	Review of Report	Semi-Annual	Semi-Annual	PMU / DONRE / ADB	CSCS
Traffic accidents	New or upgraded roads.	Regular record keeping.	Continuously	For each event	IA/PMU based on information from PDPWT	
Incidence of flooding	Subproject	Surveys, public complaints	Seasonal for 5 years	Seasonal	IA/PMU	
River morphology at the project site	Subproject	Review of bathymetric surveys	Before construction: 1survey During construction: each 3 month After construction: each 6 month up to 2 years.		IA/PMU	

Table 9. Performance Monitoring Indicators for Mekong River Embankment Subproject

Major Environmental Component	Key Indicator	Performance Objective	Data Source
Pre-construction Phase			
Public Consultation & Disclosure	Affected public & stakeholders	Meetings with stakeholders contacted during IEE & new stakeholders convened for follow-up consultation & to introduce grievance mechanism.	Minutes of meeting, and participants list
Bid Documents	Requirements of EMP (CEMP)	EMP appended to bidding documents with clear instructions to bidders for CEMP.	Bid documents
Review and approval of the CEMP	EMP, AMP and Environmental Due Diligence	Mitigation measures implemented and subplans implemented	Approval letters from PMU
Construction Phase			
Surface water quality / Degeneration of Mekong water	Surface water quality standards in Lao PDR	Mitigation measures implemented	Contractor and CSCS monitoring reports
Air quality	Dust and suspended particles from construction sites	Dust control measures implemented.	Contractor and CSCS monitoring reports
Noise	Noise from construction sites	Noise control measures implemented, work scheduling to minimize nighttime work.	Contractor and CSCS monitoring reports
Soil quality	Solid & liquid waste from all construction activities	Rigorous program of procedures & rules to collect and store all waste from sites practiced.	Contractor and CSCS monitoring reports
Hazardous materials & waste	Oil, gasoline, grease, alum, chlorine, soda, as above	Rigorous program of procedures to manage and store all waste from construction sites practiced.	Contractor and CSCS monitoring reports
Public & worker safety	Frequency of injuries	Adherence to Lao PDR policy and site-specific procedures to prevent accidents. Incidents are investigated and corrective actions identified and implemented.	Contractor reports
Cultural property	Incidence of damage, or complaints	No valued cultural property, or unearthed valuable relic is damaged in any way.	Public input, contractor reports and CSCS reports

Grievances and Grievance Redress Mechanism	Grievances lodged	Lodged grievances are acted upon and the Grievance Redress Mechanism (GRM) is followed.	Hotline number posted at construction site, grievances/complaints received through website, GRM reports.
Traffic	Frequency of disruptions & blocked roadways	Disruptions, stoppages, or detours are managed to absolute minimum.	Public input, contractor reports and CSCS reports
<i>Operation Phase of Components</i>			
Traffic safety	Frequency of accidents	No increase in pre- construction frequency.	PDPWT
Incidence of flooding	Frequency of floods	No increase in pre-construction frequency.	PDPWT

VIII. ESTIMATED COST OF EMP

60. The cost for implementing the EMP includes costs for implementing the environmental mitigation, management, and monitoring measures. The costs for implementing impact mitigation measures are integrated in the Construction contract. The costs for implementing monitoring measures should be priced by the Contractor in their bid.
61. The estimated cost for the budgeted items of the implementation of the EMP for Kaysone Phomvihane Embankment are summarized in Table 10, excluding the costs that should be integrated in the Construction Contract, Construction Supervision Contract, or the PMU budget.

Table 10. Cost Estimation of EMP for Kaysone Phomvihane Embankment

Activity	Indicative Cost (USD)			
	Integrated into Construction Contract	Integrated into Supervision Contract (CSCS)	Integrated into PMU Budget	Training, Technical Assistance & Services Budget
Environmental Mitigation				
Construction Phase Implementation of Mitigation Plan	Estimated range (60,000 – 70,000)	Estimated 5,000	Subproject cost	
Environmental Monitoring				
Construction Phase				
Monitoring of community & workers' health and safety	7,500 USD/year	2,400 USD/year	Subproject cost	
Monitoring of Environmental mitigation and management	7,500 USD/year	2,400 USD/year	Subproject cost	
Baseline and quarterly monitoring of surface water quality	Subproject cost	Subproject cost		
Baseline and quarterly monitoring of ambient noise	Subproject cost	Subproject cost		
Baseline and quarterly monitoring of ambient air quality, incl. TSP and PM10	Subproject cost	Subproject cost		
Subject to complaints/grievances, additional air quality and noise monitoring against	Subproject cost	Subproject cost		
Performance Monitoring				
Project audit by DoNRE audit	4,000 USD/year (2 audits /year)			
Seminars/Workshops				

Sub-Total (USD)				
Contingency at 10%				
Total (USD)				

IX. INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

62. The primary management framework overseeing the implementation of the environmental management plan (EMP) is defined by the: 1) Ministry of Public Works and Transports (MPWT) who is the executing agency (EA) of the subproject; 2) the Provincial Department of Public Works and Transport (PDPWT) Savannahket province who is the implementing agency (IA) of subproject; 3) a project management unit (PMU) formed by the IA to oversee implementation of the subproject; and 4) the project implementation team (PIT) established in Kaysone Phomvihane, to coordinate project activities at the district level.
63. A Construction Supervision Consulting Services (CSCS) Consultant with environmental expertise will be appointed. The CSCS will be responsible to ensure that the Contractor implements the EMP during the Contract Period, to establish monitoring programme, review the EMP, and supervise its implementation. During the construction phase, the Contractor will generally be responsible for implementation of the mitigation measures as specified in the mitigation plan and the CSCS will supervise the implementation.
64. The Contractor's Environmental Representative (ER) will be the construction contractor's focal point for all environmental matters and is routinely on-site for the duration of the construction works. The ER is an appropriately briefed technical officer (often the CC site engineer). The ER carries out regular inspections of the CC activities in relation to environmental issues, and provides day-to-day advice to contractor personnel about environmental issues. The Environmental Representative will have the authority to instruct any area of the Contractor's operations to implement the requirements of the Environmental Management Plan (pre-construction).

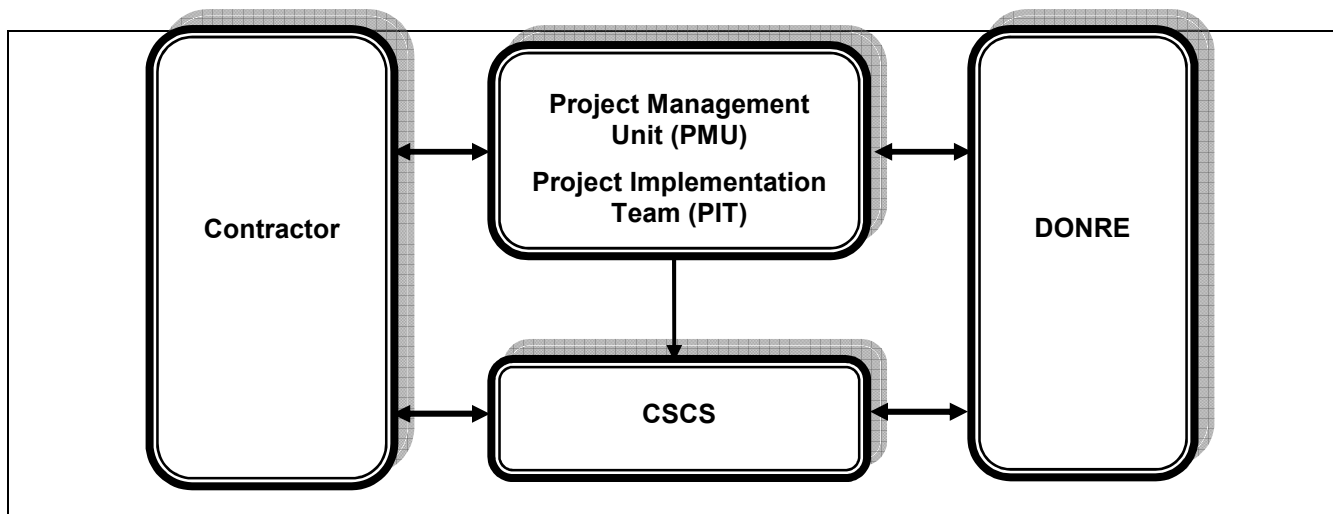


Figure 13. Organizational chart for EMP implementation

65. The responsibilities of the IA/PMU are summarized below:

1. Overall responsibility for project implementation and coordination of project activities;
2. Supervise the activities of the Project Implementation Teams organized within the District Authorities;
3. Undertake procurement of goods, works and services including recruitment of consultants for project management support, capacity development and training, independent audit and safeguards monitoring;
4. Develop and adapt a project performance management system in monitoring project activities using indicators and parameters in the design and monitoring framework;
5. Obtain necessary approvals and clearances of environment and resettlement from MONRE prior to awarding of civil works contracts;
6. Manage separate project financial records and accounts, and prepare financial reports;
7. Supervise the implementation of social and environmental safeguards and including timely disclosure of safeguards documents;
8. Supervise the implementation of the Consultation and Participation Plan, Gender Action Plan, and Stakeholder Communication Strategy;
9. Supervise the implementation of the resettlement plans including adequate measures to mitigate adverse resettlement impacts;
10. Ensure that environment management plans and gender considerations are incorporated in the detailed engineering designs and included in the civil works contracts;
11. Undertake regular quality control inspection of project facilities;
12. Manage the handover of project facilities to agencies responsible for operation and maintenance;
13. Prepare and submit quarterly and annual physical and financial progress reports to the EA; and
14. Undertake monitoring of compliance of social and environmental safeguards.

66. The responsibilities of the PIT are summarized below:

1. Coordinate the implementation of project activities at the district level;
2. Ensure the implementation of the approved work plans and program of activities;
3. Prepare and submit regular quarterly and annual physical and financial progress reports to the PMU;
4. Oversee and coordinate civil works and construction activities;
5. Ensure the implementation of social and environmental safeguards and including timely disclosure of safeguards documents;

6. Ensure the implementation of the Consultation and Participation Plan, Gender Action Plan, and Stakeholder Communication Strategy;
 7. Ensure implementation of resettlement plans including adequate measures to mitigate adverse resettlement impacts;
 8. Coordinate implementation of environmental management plan, and submit regular monitoring reports to the PMU;
 9. Coordinate the updating of the resettlement plans and monitor implementation of resettlement activities; and
 10. Undertake monitoring of project activities based on the indicators and parameters in the Design and Monitoring Framework (DMF) and prepare regular reports to the PMU on project achievements.
67. The PMU, PIT, and ECO with assistance from the DED ensure that the EMP becomes part of the construction contract and with assistance from the CSCS that the EMP is implemented and that the Contractor abides by the EMP. The ECO should undertake regular site inspections and the results should be recorded and submitted to the relevant authorities as part of progress reporting.

A. Consultation and Public Participation Process

68. 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 grouped discussions.
69. The consultations aimed on environmental issues and concerns affecting the community. Specifically, the objectives of the consultation meetings are the following:
 - (i) To present the proposed projects to the stakeholders;
 - (ii) To solicit views of the stakeholders relative to the proposed project;
 - (iii) To identify the most important project components for the locals;
 - (iv) To identify possible environmental issues inherent on the proposed project and
 - (v) To identify mitigation measures to address these issues in the project design.
70. 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. Further information and consultations will be carried out before construction starts (during the first year of the project) and during the construction period.
71. 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 concerned by compensation and/or resettlement.
72. 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.

73. At the end of the construction activities in a dedicated site, 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 of the site.

B. Grievance Redress Mechanism

74. The PMU will appoint 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. The 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. During operation, the GPP will liaise with the UDAA and the DPWT (the operators) for the management of the mechanism until loan closure.
75. 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.
76. 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.
77. 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.

X. EMERGENCY RESPONSE PLAN

78. The Contractor must develop emergency and incident response procedures for the construction phase. In the operational phase the operator/civil authorities will have responsibility for any emergencies or serious incidents. In the construction phase the key players include: a) Emergency Response Team (ERT) of the Contractor as initial responder; b) the District and City fire and police departments, emergency medical service, and the Department of Public Health (DPH), collectively referred to as the External Emergency Response Team (EERT), as ultimate responders. The Contractor will provide and sustain the required technical, human and financial resources for quick response during construction.

Table 11. Roles and Responsibilities in Emergency Incident Response in construction phase

Entity	Responsibilities
Contractor Team (ERT)	<ul style="list-style-type: none"> • Communicates/alerts the EERT. • Prepares the emergency site to facilitate the response action of the EERT, e.g., vacating, clearing, restricting site. • When necessary & requested by the EERT, lends support/ provides assistance during EERT's response operations.
External Emergency Response Team (EERT)	<ul style="list-style-type: none"> • Solves the emergency/incident
Contractor Resources	<ul style="list-style-type: none"> • Provide and sustain the people, equipment, tools & funds necessary to ensure Subproject's quick response to emergency situations. • Maintain good communication lines with the EERT to ensure prompt help response & adequate protection, by keeping them informed of Subproject progress.

79. The ERT will be led by the senior Contractor engineer (designated ERTL) on site with a suitably trained foreman or junior engineer as deputy. Trained first-aiders and security crew will be the core members of the ERT.

80. The Contractor will ensure that ERT members are physically, technically and psychologically fit for their emergency response roles and responsibilities.

81. Prior to the mobilization of civil works, the Contractor, through its Construction Manager, ERTL, in coordination with the PMU, will meet with the ultimate response institutions to discuss the overall construction process, including, but not limited to:

- a) Subproject sites;
- b) construction time frame and phasing;
- c) any special construction techniques and equipment that will be used;
- d) any hazardous materials that will be brought to and stored in the construction premise and details on their applications and handling/management system;
- e) the Contractor's Emergency Management Plan
- f) names and contact details of the ERT members

82. The objective of this meeting is to provide the ultimate response institutions the context for:

- a) their comments on the adequacy of the respective Emergency Management Plans
- b) their own assessment of what types, likely magnitude and likely incidence rate of potential hazards are anticipated

c) the arrangements for coordination and collaboration.

83. To ensure effective emergency response, prior to mobilization of civil works, the Contractor will:

- a) set up the ERT;
- b) set up all support equipment and facilities in working condition
- c) make arrangements with the EERT;
- d) conduct proper training of ERT members, and encouraged and train volunteers from the work force;
- e) conduct orientation to all construction workers on the emergency response procedures and facilities, particularly evacuation procedures, evacuation routes, evacuation assembly points and self-first response, among others; and
- f) conduct drills for different possible situations.

84. To sustain effective emergency response throughout Subproject implementation an adequate budget shall be provided to sustain the capabilities and efficiency of the emergency response mechanism, the emergency response equipment, tools, facilities and supplies. Drills and reminders will take place regularly, the former at least every two months and the latter at least every month.

A. Alert Procedures

85. Means of communicating, reporting and alerting an emergency situation may be any combination of the following: i) audible alarm (siren, bell or gong); ii) visual alarm (blinking/rotating red light or orange safety flag); iii) telephone (landline); iv) mobile phone; v) two-way radio; and vi) public address system/loud speakers. Some rules relative to communicating/alerting will be:

- a) Whoever detects an emergency situation first shall immediately:
 - Call the attention of other people in the emergency site,
 - sound the nearest alarm, and/or
 - report/communicate the emergency situation to the ERT.
- b) Only the ERTL and, if ERTL is not available, the Deputy ERTL are authorized to communicate with the EERT. Exceptional cases to this rule may be necessary and should be defined in the Emergency Management Plans.
- c) When communicating/alerting an emergency to the EERT, it is important to provide them with at least: i) the type of emergency situation; ii) correct location of the emergency; ii) estimated magnitude of the situation; iii) estimated persons harmed; iv) time it happened; v) in case of a spill, which hazardous substance spilled; and vi) in case of fire and explosion, what caused it. Such details would allow the EERT to prepare for the appropriate response actions.

86. For an effective reporting/alerting of an emergency situation:

- a) The names and contact details of the relevant persons and institutions should be readily available in, or near to, all forms of communication equipment, and strategically posted (at legible size) in all Subproject sites and vehicles:

- Most relevant construction/operations staffs namely, the ERTL, Deputy ERTL, first-aiders, supervising engineers, foremen
 - EERT institutions/organizations
 - Concerned village authority/ies
 - PMU Office, ESMU
- b) All Subproject sites should have good access to any combination of audible and visual alarms, landline phones, mobile phones and two-way radio communication at all times.
- c) Contractor's construction vehicles should also be equipped with the appropriate communication facilities.

B. Emergency Response Situations

87. The following tables suggest general procedures that will be refined and described in more detail in the Emergency Management Plans of the Contractor.

Table 12. Evacuation Procedure

Procedure	Remarks
<ul style="list-style-type: none"> Move out as quickly as possible as a group, but avoid panic. 	<ul style="list-style-type: none"> All workers/staff, sub-contractors, site visitors to move out, guided by the ERT.
<ul style="list-style-type: none"> Evacuate through the directed evacuation route. 	<ul style="list-style-type: none"> The safe evacuation shall have been determined fast by the ERTL/Deputy ERTL & immediately communicated to ERT members.
<ul style="list-style-type: none"> Keep moving until everyone is safely away from the emergency site and its influence area. 	<ul style="list-style-type: none"> A restricted area must be established outside the emergency site, all to stay beyond the restricted area.
<ul style="list-style-type: none"> Once outside, conduct head counts. 	<ul style="list-style-type: none"> Foremen to do head counts of their sub-groups; ERTL/Deputy ERTL of the ERT.
<ul style="list-style-type: none"> Report missing persons to EERT immediately 	<ul style="list-style-type: none"> ERTL/Deputy ERTL to communicate with the EERT
<ul style="list-style-type: none"> Assist the injured in evacuation & hand them over to the ERT first-aiders or EERT medical group 	<ul style="list-style-type: none"> ERT to manage injured persons to ensure proper handling.
<ul style="list-style-type: none"> If injury warrants special care, DO NOT MOVE them, unless necessary & instructed/directed by the EERT. 	<ul style="list-style-type: none"> ERTL/Deputy ERTL communicates with EERT to get instructions/directions in handling the injured.

Table 13. Response Procedure During Medical Emergency

Procedure	Remarks
<ul style="list-style-type: none"> Administer First Aid regardless of severity immediately. 	<ul style="list-style-type: none"> Fundamentals when giving First Aid: Safety first of both the rescuer and the victim. Do not move an injured person unless: victim is exposed to more danger when left where they are, e.g., during fire, chemical spill it would be impossible for EERT to aid victims in their locations, e.g., under a collapsed structure instructed or directed by the EERT. First AID to be conducted only by a person who has been properly trained in giving First Aid.
<ul style="list-style-type: none"> Call the EERT emergency medical services &/or nearest hospital. 	<ul style="list-style-type: none"> ERTL/Deputy ERTL or authorized on-site emergency communicator
<ul style="list-style-type: none"> Facilitate leading the EERT to the emergency site. 	<ul style="list-style-type: none"> ERTL/Deputy ERTL to instruct: an ERT member on-site to meet EERT in access road/strategic location. He/she shall hold orange safety flag to get their attention & lead them to site. Other ERT members to clear access road for smooth passage of the EERT.
<ul style="list-style-type: none"> If applicable, vacate site & influence area at once, restrict site, suspend work until further notice. 	<ul style="list-style-type: none"> Follow evacuation procedure

Table 14. Response Procedure in Case of Fire

Procedure	Remarks
<ul style="list-style-type: none"> Alert a fire situation. 	<ul style="list-style-type: none"> Whoever detects the fire shall immediately: call the attention of other people in the site, sound the nearest alarm, and/or

	<ul style="list-style-type: none"> Foreman or any ERT member among the construction sub-group contacts the fire department (in this case it should be agreed on that it is alright for any ERT member in the sub-group to alert the fire department) report/communicate the emergency situation to the ERTL/Deputy ERTL.
<ul style="list-style-type: none"> Stop all activities/operations and evacuate. 	<ul style="list-style-type: none"> All (non-ERT) workers/staff sub-contractors, site visitors and concerned public to move out to safe grounds following the evacuation procedure.
<ul style="list-style-type: none"> Activate ERT to contain fire/control fire from spreading. 	<ul style="list-style-type: none"> Guided by the training they undertook, ERT members assigned to mitigate the fire shall assess their own safety situation first before attempting to control fire spread.
<ul style="list-style-type: none"> Call the nearest fire & police stations &, if applicable, emergency medical services. 	<ul style="list-style-type: none"> When alerting the EERT, ERTL will give the location, cause of fire, estimated fire alarm rating, any injuries.
<ul style="list-style-type: none"> Facilitate leading the EERT to the emergency site. 	<ul style="list-style-type: none"> ERTL/Deputy ERTL to instruct: an ERT member to meet the EERT in the access road or strategic location and lead them to the site. He/she shall hold the orange safety flag to get their attention and lead them to the site. some ERT members to stop traffic in, & clear, the access road to facilitate passage of the EERT.
<ul style="list-style-type: none"> ERT to vacate the site as soon as their safety is assessed as in danger. 	<ul style="list-style-type: none"> Follow appropriate evacuation procedure.

XI. APPENDIX A: ENVIRONMENTAL PROTECTION LAWS & STRATEGIES

Law or Decree	Article	Relating To	Content
Constitution of the Lao PDR People's Democratic Republic (1991, amended 2003)	17	Environment in general	"All organizations and citizens must protect the environment and natural resources: land, underground, forests, fauna, water sources and atmosphere."
Environmental Protection Law (2013) Revised version)	5	Environmental Protection Policy(s) (new)	The State promotes protection and rehabilitation of social and natural environment through dissemination of regulations and Environmental information, building of awareness and knowledge, training and conducting campaigns for individuals and organizations; both domestic and international, to recognize importance of social and natural environment in daily livelihoods and in strictly implement the Environmental protection regulations, methods and measures.
	10	Impact on Social Environment (new)	An impact on social environment is an adverse impact on human life and health, properties and livelihoods, including shelters of people, and on cultural and historical heritages.
	11	Impact on Natural Environment (new)	An impact on natural environment is an adverse impact on natural ecological fundamentals, natural resources, biodiversity, arable land, water sources, climate change and natural heritages.
	13	Environmental Protection Practices (new)	Environmental protection consists of these key following practices: (i) Environmental prevention (ii) Pollution control (iii) Toxic chemical control and waste disposal (iv) Environmental certification and permission (v) Promotion and public participation
	14	Environmental Prevention (revised)	Environmental prevention is an action of safeguarding and preventing against any natural or manmade events, which may possibly happen, are happening or already happened, leading to damages or depletions of social and natural environment

	19	Strategic Environmental Assessment (new)	<p>A strategic environmental assessment (SEA) is a process of anticipating an impact that may affect social and natural environment, while developing policies, strategic plans, and programs, including considerations towards impacts of climate change. This impact assessment shall determine methods and measures to avoid or mitigate impacts on social and natural environment in order to accomplish sustainable development goals.</p> <p>While developing the policies, strategic plans, and programs, particularly of energy and mining, agriculture and forestry, industry and commerce, public works and transportation, post-telecommunication and communication, information-culture and tourism sector, a strategic environmental assessment shall be conducted, except a plan, which applies to uses of small-scale areas and subject to the Integrated Spatial Plans.</p>
	21	Initial Environmental Examination (new)	Initial Environment Examination (IEE) is a data examination, exploration and analysis to anticipate possible minor environmental impacts, while identifying appropriate methods and measures to prevent, avoid or mitigate environmental impacts from investment projects or activities including considerations of climate change.
	22	Environmental Impact Assessment (revised)	<p>Environment Impact Assessment (EIA) shall be a process of addressing an issue in order to anticipate impacts that may affect the environment, society and nature, derived from investment projects or activities, along with considerations related to climate change in Lao PDR, and development of reports. Apart from reporting, there shall</p> <p>be development of Environmental Social Management and Monitoring Plans. Both the report and the plan shall be approved by MONRE prior to functioning investment projects and activities. The process of assessing impacts from the investment project and the activity on the environment, society and nature, shall comply with the specific regulations.</p>
	29	Pollution control (revised)	Pollution is a chemical substance, radiation, dust, smoke, including noise, light, odour, vibration and heat mixing in the air, soil, and water with concentration exceeding the National Environmental Quality Standards or National Pollution Control Standards, as the results of manmade or nature, affecting human life and health, animals, plants, other living creatures and ecosystem
	32	National Pollution Control Standards (new)	<p>The National Pollution Control Standards are identification of pollutant concentrations emitted by persons, legal entities and organizations with permission, from any sources into the air, soil or water. The Government shall identify the National Pollution Control</p> <p>Standards based on the proposal from MONRE upon coordinating with line sectors.</p>
	36	Toxic Chemical Control	The natural resources and environmental sector is directly responsible in coordinating with other line sectors for inspection and endorsement of toxic chemical lists, which are under periodical

			Management by the sector.
	38	Waste Disposal (new)	Disposal of general wastes, particularly rubbish, shall be separation for different purposes such as recycle, reuse, reprocess as new products and elimination with methods and techniques within identified areas based on regulations.
	55	Responsibilities in Environmental Rehabilitation (new)	Persons, legal entities or organization implementing investment projects or activities, which create environmental and social impacts, shall correct, improve, rehabilitate and remunerate damages within the affected areas.
		Environmental Protection Fund (revised)	The State promotes establishment of the Environmental Protection Fund used in environmental researches, prevention, correction, and rehabilitation. Implementation and performance of the EPF shall be stipulated by the specific regulations.
Water and Water Resources Law 24/Dec-2007	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
Lao Forestry Law (amended 24-Dec-2007)	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
	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
Wildlife and Aquatic Law (24 Dec-2007)	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.
Land Law (2003)	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.
Decree on Land Lease or Concession (2009)	39	Obligation of Person or Legal Entity Who Leases or Obtains Concession	The person or legal entity that 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."
Road Law (1999)	15	Public Road Construction	The public road contractor shall perform the work in accordance with design documents, and shall ensure quality, safety and environmental protection.
	19	Compensation for Land Acquired for Public Road Activities	If, in the construction of various kinds of public roads, it is necessary to use land that is legally owned by a private person or by an organization, the owner of the expropriated land used for public road construction shall receive reasonable compensation
Prime Ministerial Decree No. 112/PM on Environmental Impact Assessment (2010)		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.
Ministerial Instruction on the Process of Initial Environmental Examination of the Investment Projects and Activities. No. 8029/MONRE, 17 December 2013		The process of Initial Environmental Examination of investment projects and activities.	Instruction for implementing and extending the provisions prescribed under Article 21 of the Law on Environmental Protection (Amended) No. 29/NA, Dated 18 December 2012.
Ministerial Instruction on the Process of Environmental and Social Impact Assessment of the Investment Projects and Activities. No. 8030/MONRE, 17		The Process of Environmental and Social Impact Assessment of the Investment Projects and Activities.	Instruction for implementing and extending the provisions prescribed under Article 22 of the Law on Environmental Protection (Amended) No. 29/NA, Dated 18 December 2012.

December 2013			
Ministerial Agreement on the Endorsement and Promulgation of List of Investment Projects and Activities Requiring for Conducting the Initial Environmental Examination or Environmental and Social Impact Assessment. No. 8056/MONRE, 17 December 2013	1	Screening decision on conduct of IEE or ESIA	To endorse and promulgate a list of Investment Projects and Activities which shall conduct the Initial Environmental Examination or Environmental and Social Impact Assessment (Amended).

XII. APPENDIX B: ENVIRONMENTAL STANDARDS

Environmental standards are presented below. Where Lao PDR regulations differ from the environmental standards provided by the general and applicable Environmental, Health and Safety Guidelines of the World Bank (2007), the reference will be whichever is more stringent.

The basis for the Lao PDR standards are:

- National Environmental Standard Order No. 81/GOL (2017), updated from Environmental Protection Law No. 02/99/NA, dated 3 April, 1999.
- The Agreement on National Environment Standards in Laos, December 7, 2009. Prime Minister Office and WREA in Lao PDR.
- Decree on mandate of Water Resources and Environmental Administration dated 149/PM, dated 10 May 2007.
- Water Resources and Environment Administration No 2734/PMO, WREA (now MONRE) Vientiane, dated 7 December, 2009.

Table 15. Surface water quality standards in Lao PDR

We use the most stringent categorize standard as standard categorize for measurement in Mekong Embankment subproject.

No	Substances	Symbol	Unit	Standard Value					Method of Measurement
				1	2	3	4	5	
1	Color, Odor and Taste	-	-	N	N	N	N	N	
2	Temperature	t	°C	N					Thermometer
3	Potential of Hydrogen	pH	-	6-8	6-8	5-9	5-9	ND	Electronic pH Meter
4	Dissolved Oxygen	DO	mg/l	>7	6	4	2	<2	Azide Modification
5	COD	COD	ml/l	<5	5-7	7-10	10-12	>12	Potassium permanganate
6	BOD ₅	BOD ₅	mg/l	1.5	1.5	1.5	1.5	1.5	Azide Modification at 20 degrees C, 5 days
7	Total Coliform Bacteria	Coliform Bacteria	MPN/100 ml	N	5000	20,000	None	ND	Multiple Tube Fermentation Technique
8	Fecal Coliform Bacteria	Fecal Coliform	MPN/ 100 ml	N	1000	4000	None	ND	
9	Nitrate-Nitrogen	NO ₃ -N	mg/l	N	5	5	5	ND	Cadmium Reduction
10	Ammonia-Nitrogen	NH ₃ -N	mg/l	N	0.5	0.5	0.5	ND	Distillation Nesslerization
11	Phenols	C ₆ H ₅ -OH	mg/l	N	0.005	0.005	0.005	ND	Distillation, 4-Amin

									anti-pyrenne
12	Copper	Cu	mg/l	N	1.5	1.5	1.5	ND	Atomic Absorption Direct Aspiration
13	Nickel	Ni	mg/l	N	0.1	0.1	0.1	ND	
14	Manganese	Mn	mg/l	N	1.0	1.0	1.0	ND	
15	Zinc	Zn	mg/l	N	1.0	1.0	1.0	ND	
16	Cadmium	Cd	mg/l	N	0.003	0.003	0.003	ND	
17	Chromium, Hexavalent	Cr ⁶⁺	mg/l	N	0.05	0.05	0.05	ND	
18	Lead	Pb	mg/l	N	0.01	0.01	0.01	ND	
19	Mercury	Hg	mg/l	N	0.001	0.001	0.001	ND	Atomic Absorption Cold Vapor
20	Arsenic	As	mg/l	N	0.01	0.01	0.01	ND	Atomic Absorption Direct Aspiration
21	Cyanide	CN ⁻	mg/l	N	0.7	0.07	0.07	ND	Pyridine-Barbituric
22	Alpha -Radioactive	α	Becquere l/l	N	0.1	0.1	0.1	ND	Counting machine
23	Beta -Radioactive	β	Becquere l/l	N	1.0	1.0	1.0	ND	
24	Total Organochlorine	-	mg/l	N	0.05	0.05	0.05	ND	Gas Chromatography
25	DDT	C ₁₄ H ₉ Cl ₅	mg/l	N	1.0	1.0	1.0	ND	
26	Alpha -BHC	αBHC	mg/l	N	0.02	0.02	0.02	ND	
27	Dieldrin	C ₁₂ H ₈ Cl ₆ O	mg/l	N	0.1	0.1	0.1	ND	
28	Aldrin	-	mg/l	N	0.1	0.1	0.1	ND	
29	Heptachlor and Heptachlor Epoxide	-	mg/l	N	0.2	0.2	0.2	ND	
30	Endrin	-	mg/l	N	None	None	None	ND	

Remark:

Category 1: High water quality as natural, with production processing or contaminate any chemic element and without any waste water contamination

Category 2: Source of water for drinking and consumption with clean processing and omits diseases, this type of water is suitable for aquatic animal conservation, fishery, water sport and other

Category 3: Source of water for drinking and consumption with clean processing and omits diseases, this type is suitable for agriculture, animal feeding and other

Category 4: Source of water for drinking and consumption with clean processing and omits diseases, this type is suitable for industry, waste water treatment from the town or community and other.

Category 5: Water source for transportation, water treatment place or basin from the town.

Source: National Environment Standard, Decree No: 81/GoL 2017.

Table 16. Ambient Air Quality Standard

Parameters	Symbol	Average Time Unit: mg/m ³					Method of Measurement
		Hours			1 month	1 year	
		1 hr	8 hr	24 hr			
Carbon monoxide	CO	30	9	-	-	-	Non-dispersive infrared detection
Nitrogen dioxide	NO ₂	0.11	-	-	-	.02	Chemilumine scene method
Sulphur dioxide	SO ₂	0.13	-	0.05	-	0.10	UV Fluorescence (1hr, 24hr, 1yr) or Pararosaniline (1hr,4hr)
Total Suspended Particulate	TSP	-	-	0.33	-	0.10	Gravimetric
Particulate Matter less than 10 microns	PM-10	-	-	0.12	-	0.05	Gravimetric or Beta Ray or Taper Element Oscillating Microbalance or Dichotomous
Ozone	O ₃	0.20	0.14	-	-	-	Chemiluminescence or UV Absorption Phoptometry
Lead	Pb	-	-	-		0.00015	Atomic Absorption Spectrometer

Table 17. Noise Standard

Standards	Method of Measurement
Maximum Sound Level (L _{max}) should not exceed 115 dB(A)	Equivalent Sound Level (Leq) from Fluctuating Noise
Leq 24 hour not exceeding 70 dB(A)	Equivalent Sound Level (Leq) from Steady Noise

Table 18. Noise Standards for continue disturbing

Sound level Standard	Measure Method
Sound level during the normal and disturbing must not excess 10 dB (A)	In the case noise disturbing less than 1 hour, measure the sound level as one-hour Leq 1hour
	Noise disturbing continues over 1 hour, measure base on the real condition
	Noise disturbing not continue in 1 hour, measure for one-hour (Leq 1 hour)
	Specific quiet areas like school, hospital, government office and other quiet places during 22:00-6:00 and measure as sound average 5 minutes (Leq 5min) and plus with 3 dB (A)

XIII. APPENDIX C: PROJECT LEVEL GRIEVANCE REDRESS MECHANISM

Purpose of the Mechanism

The grievance redress mechanism (or, the mechanism) is meant for persons seeking satisfactory resolution to their complaints on the environmental performance of the Subproject. 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.

Access to the Mechanism

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. The Project Management and Implementation Unit (PMIU), through its Grievance Point Person (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.

The Grievance Redress Mechanism

Grievances raised on environmental impacts are critical to the health and wellness of APs. Hence, prompt responses/actions are critical to avoid prolonging the misery of affected persons (APs). Prior to the public disclosure of the mechanism, the PMIU shall have engaged/designated a Grievance Point Person (GPP) to handle environmental grievances lodged prior to construction, during construction and during operation. The GPP will be under the supervision of the Environmental Engineer of the PMIU. 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. During operation, the GPP will liaise with the Kaysone Phomvihane UDAA (operator) for the management of the mechanism until loan closure.

Informally, an AP can approach or call the village heads, Contractor, Kaysone, 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 PMIU 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) concerned sector agency, DPWT or UDAA; iv) PMIU, through its GPP, or v) third parties, e.g., NGO, religious groups.

Step 2: Grievance Documentation/Registration

The GPP and the concerned sector agency (CSA) will be responsible for documenting and registering complaints received during construction and operation, respectively. Other potential complaint recipients shall make sure that the received complaints are directed to, documented by, and registered

with, the GPP/CSA as soon as possible. The GPP/CSA 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 of the AP and Contractor/CSA 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/CSA 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/CSA 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, GPP/CSA 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/CSA shall monitor the effectiveness of the resolution. Monitoring and evaluation shall be properly documented and included in the Project Environmental Monitoring Report of the PMIU.

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 (VH). The VH shall immediately: (i) record the appeal; (ii) contact the GPP, Contractor/CSA 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 VH to raise the grievance to the District Court. It is highly unlikely that grievance redress process will reach the level wherein APs need to go through the “appeal” stage.

XIV. APPENDIX D: DRAFT FORMAT FOR ENVIRONMENTAL MONITORING REPORT

1. Introduction and Project Overview

Project Number and Title:		
Safeguards Category	Environment	
	Indigenous Peoples	
	Involuntary Resettlement	
Reporting period:		
Last report date:		
Key sub-project activities since last report:	This section can include, among others, the following: <ul style="list-style-type: none"> • Activities of Proponent • Progress of Work (% physical completion) • Changes of Surrounding Environment • Status of Permits / Consents 	
Report prepared by:		

2. Environmental Performance Monitoring

a. Summary of Compliance with EMAP Requirements (Environmental Performance)

EMAP Requirements	Compliance Status (Yes, No, Partial)	Comment or Reasons for Non-Compliance	Issues for Further Action
Use environmental impact as main heading and EMAP as listing (see example below)	Use EMoP list as basis for rating/evaluating compliance (see example below)		
Rise of employment opportunities: <ul style="list-style-type: none"> • Job openings of the project should give priority to local communities. • Recruitment of local laborers should be stipulated in the contract for construction 	<ul style="list-style-type: none"> • Field inspections and interviews with communities - DONE • Note each complaint case in the field – 3 COMPLAINTS RECEIVED • Set up grievance centre and report as part of monitoring action plan – NOT DONE 		

b. Issues for Further Action

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
List of EMoP measures or activities not completed (last column of previous table)			
New Issues from This Report			

c. Other activities

- Other issues not covered by EMAP/EMoP
- Environmental monitoring as required by GOI (e.g., air quality, water sampling)

3. Involuntary Resettlement Performance Monitoring

a. Summary of Compliance with RP Requirements

RP Requirements	Compliance status Yes/No/Partial	Comment or Reasons for Compliance, Partial Compliance/Non- Compliance	Issues for Further Action ¹
Establishment of personnel in PMU/PIU			
Public consultation and socialization process		Provide information on: <ul style="list-style-type: none"> • Public consultation, participation activities carried out • Inclusive dates of these activities To be elaborated on in Item 5	
Land area to be acquired is identified and finalised			
Land acquisition completed			

¹ To be elaborated further in table 3.b (Issues for Further Action)

Establishment of Resettlement Site(s)		Please state: <ul style="list-style-type: none"> • Number of AHs to be relocated as per agreed RP • Number of AHs already relocated • Number of houses built • Status of installation of community facilities to be provided as per agreed RP 	
Compensation payments for affected assets is completed		Please state: <ul style="list-style-type: none"> • Total Number of Eligible AHs and APs (as per agreed RP) • Number of AHs and APs compensated as of this monitoring period • Total Budget allocation as per agreed RP • Total budget disbursed to AHs as of this monitoring period 	
Transport assistance for relocating affected households		As above	
Additional assistance to vulnerable affected household		Please state: <ul style="list-style-type: none"> • Total Number of vulnerable AHs and APs (as per agreed RP) • Agreed forms of assistance as per RP • Number of AHs and APs assisted as of this monitoring period 	
Income Restoration Program		Please state progress per income restoration feature/activity and actual period of implementation	
Temporary impacts have been addressed (affected properties restored to at least pre-project conditions)		Please state: <ul style="list-style-type: none"> • Total Number of AHs affected by temporary impacts as per agreed RP • Actual Number of AHs and total area affected by temporary impacts (if this differs from the projected number, such as in cases of unforeseen project impacts) • Status of restoring affected property 	
Capacity building activities			

b. Issues for Further Action

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
List of RP activities not completed (last column of previous table)			
New Issues from This Report			

4. Occupational, Health and Safety (OHS) Performance Monitoring

a. OHS for worker

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
New Issues from This Report			

b. Public Safety

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			

New Issues from This Report			

5. Information Disclosure and Socialization including Capability Building

- Field Visits (sites visited, dates, persons met)
- Public Consultations and meetings (Date; time; location; agenda; number of participants disaggregated by sex and ethnic group, not including project staff; Issues raised by participants and how these were addressed by the project team)
- Training (Nature of training, number of participants disaggregated by gender and ethnicity, date, location, etc.)
- Press/Media Releases
- Material development/production (e.g., brochure, leaflet, posters)

6. Grievance Redress Mechanism

Summary:

- Number of new grievances, if any, since last monitoring period: _____
- Number of grievances resolved: _____
- Number of outstanding grievances: _____

Type of Grievance	Details (Date, person, address, contact details, etc.)	Required Action, Responsibility and Timing	Resolution
Old Issues from Previous Reports			
New Issues from This Report			

7. Conclusion

- Important results from the implementation of EMAP/EMoP and RP monitoring
- Recommendations to improve EMAP/EMoP and RP management, implementation, and monitoring

8. Attachments

1. Consents / permits
2. Monitoring data (water quality, air quality, etc.)
3. Photographs
4. Maps

XV. APPENDIX E: MEKONG EMBANKMENT CONSULTATION

A. Introduction

The 2016 FS planned some consultations prior to the submission of the Final FS Report, but due to time constraints and insufficient personnel resources the consultations were not performed. Their views on the reclamation scheme along the Mekong embankment are considered to be of potential significance. This regards amongst others:

- Lao National Mekong Committee (LNMC) under MONRE.
- Hydrology Department of MONRE.
- Management staff of Customs Department in Customs Building at Mekong River front.
- Management staff of Passenger Ferry Company operating the cross-river ferry service to Mukdaharn on the Thai side from the Customs Building.
- The association behind the Shrine House, located at the river front, opposite Wat Xayaphoum.
- Village chiefs in the three villages along the embankment.

During the week from 21 May to 25 May 2018 the consultant team visited the project area, including existing infrastructure and performed the following pending consultations:

- Management staff of Customs Department in Customs Building at Mekong River front.
- Management staff of Passenger Ferry Company operating the cross-river ferry service to Mukdaharn on the Thai side from the Customs Building.
- The association behind the Shrine House, located at the river front, opposite Wat Xayaphoum.
- Village chiefs in the three villages along the embankment.
- Management staff of platform view located at Mekong River front.
- Management staff of the restaurant operation at the platform view.

Table 29 (Chapter 2) summarizes the main findings of the field visit, the consultations and the impact of the embankment construction considering two scenarios; (1) no action is deemed in order to reduce the impact; and (2) remediation, which considers measures to reduce the impact. Finally, Table 29 includes recommendations for the Detailed Engineering Design (DED) team.

Field visits were conducted in order to assess the impact of the embank construction on the infrastructures, facilities, trees and embankment uses.

The consultant prepared a questionnaire, which was used during the consultations. The questionnaire allowed the different stakeholders to express their views and concerns regarding the construction of the embankment. Section F below includes the minutes of these consultations.

The consultant team performed separate consultations with the village chiefs in the three villages along the embankment. The concerns and expected impacted raised by the village chiefs regarding the villagers were the same for the three villages. Therefore, Table 29 summarizes the outcome as one single entry, *“Village Authorities for the three villages”*

The administrative authority behind the Shrine House is Xayyaphoum village. The consultation with the village chief was focus both on the villagers and on the Shrine House. Table 1 summarizes in a separate row the consultations regarding the Shrine House.

B. Impact and recommendations summary

Table 19: Impact during construction and recommendation summary after consultations.

Consultation	Impact during construction		Recommendations:
	No action	Remediation	
Ferry & Immigration office 22/05/18 09:00	Building have to be demolish, high compensation cost New relocation for the immigration building and ferry companies.	Integrate the building to the design to avoid demolish. During constructions ferry operations would have to be relocated or temporary ceased.	It is recommended to integrated the building in the design, at the same time, improve the access to ferry and include a dock for ferries.
Viewing platform 23/05/18 09:00	Building have to be demolish: high compensation cost. Compensation might be needed for the operators of the restaurant.	Integrate the building to the design to avoid demolish. During constructions restaurant might need to close and compensation is expected.	It is recommended to integrate the building in the design, at the same time, enhance the infrastructure to include some grades, which will be used both for the boat racing festival and embankment current activities: fishing, exercise.
Floating restaurant 24/05/18 11:00	The floating restaurant is not within the project area and therefore only minor impacts are expected regarding dust and noise. The access road will be use and those might damage the infrastructure.	The embankment will start at the old access to the ferry. The design could consider to integrate the old ramp to be used to bring the boats to the water during the boat racing festival.	It is recommended to use this area to improve the access to the water for the boats participating in the boat racing festival.
Village Authorities for the three village	Villagers: No impact. Construction: Impacts related to noise, dust and traffic. Trees: Remove trees and plant new trees after construction.	Integrated the trees in the design so they will not have to be removed. Trees can be integrated with design level 2.5 m below embankment level.	It is recommended to include the trees in the design where possible. Else, new trees to be planted after construction. The embankment has to become useful both economical and recreational.
Xayyaphoum/ Srhine house: 24/05/18 15:00	Building have to be demolish: high compensation cost. Severe cultural impact. Might not be accepted by the villagers.	Integrate the building to the design to avoid demolish.	It is recommended to integrate the building in the design, at the same time, enhance the infrastructure to include some grades, which will be used both for the boat racing festival and embankment current activities: fishing, exercise.

C. Questionnaires

Ferry & Immigration office		Date:	22-05-2018
		Time:	09:00
Contact information for ferry			
Name:	Mr. Thanongsin	Surname:	Thepphavongsa
Phone number:	99555560	Occupation/ position:	Head of immigration office/ provincial police
Address:			
Infrastructure/Property			
Location:		Private property	State property
Coordinates:	16°33'28 N 104°44'42" E	Leased:	Yes / No
Altitude:	139–140 m (road 142 m)	Lease length:	
Area:	620 m ²		
Type of building:	2 store concrete building		
Description:	Upstairs floor is not currently used. In the past, it was used as restaurant, bar and gaming place. Downstairs floor is used as ferry terminal and immigration procedures, ferries from Savannakhet to Mukdaharn. Area per floor is 620 m ² .		
Issued title/official document:			
Owner's name:		Owner's surname:	
Owner's phone:			
Owner's address:			
Consultation			
How many boats are operating?			
The ferry company owns 10 boats. However, ferry only operates 4 times a day. The schedule of the boats is fixed with counterpart in Thailand.			
How many direct employees? How many people working in the boat services?			
The ferry company employs 14 people. 10 operating the boats and 4 administrative staff. Immigration employs 42 people.			
How many indirect employees? Associated activities to the ferry? Vendors ...			
Associated activities are outside the building including small local food sellers / footstall and tuk tuk transport services.			
How many people per boat?			
Morning passengers are around 30 – 40 people. Afternoon passengers 10 – 20 people. Daily average is 100 – 120 people.			
Future plans of the owner/lease regarding the building:			
There is no plan, plan is depended on the direction levels of the province			
If there is an embankment project, what is your plan during the construction and after the construction?			
They expect to keep working and provide the services.			
What do you want to see if the building is integrated in to embankment design?			

Ferry company: <ul style="list-style-type: none"> - Would like space or design for arriving and leaving more safety and easy to access to leave the boats and improve/easy access to the boat between immigration office and ferry. - Ferry parking must be designed into the embankment
Any suggestion/considerations regarding the design/construction of the embankment?
Immigration officials: <ul style="list-style-type: none"> - Dust and noise control should be controlled so it would still be possible to work. - Official raise up that the space for the immigration procedures is limited, including the waiting area for the ferry users. They would like more space. - During the construction, project must be provided detour for the passengers to access the ferry during the construction.
Any other comments:
Officials from the immigration office stated that the building was once flooded up to almost to the ceiling. (We assume this flooding refers to the flooding in 2011, however there was as well another flooding in 2008.

The Mekong Viewing Platform - Administration		Date:	23/05/2018
		Time:	09:00 – 10:30
Contact information			
Name:	Mr. Sytha	Surname:	Songvilay
Phone number:	58533522	Occupation/position:	Head of Kaysone Phomvihane district administration office
Address:	District Administration Office other option Mr. Inpong (91635999)		
Infrastructure/Property			
Location:		Private property	State property
Coordinates:	16°33'15 N 104°44'42" E	Leased:	Yes
Altitude:	134 m (road 137 m)	Lease length:	02/2020
Area:	597 m ²	Year of construction:	02/2006
Type of building:	2 stores open concrete building		
Description:	Main floor, access level, is a viewing platform, it was built for the boat race festival. The rest of the year it is use it as restaurant. Small floor under the main one for restrooms and kitchen. The base of the platform is only structure pillars.		
Issued title/official document:			
Owner's name:		Owner's surname:	
Owner's phone:			
Owner's address:			
Consultation			
Future plans of the owner/lease regarding the building:			
The platform view is state property and it was constructed mainly for the annual boat race. The rest of the time, the space is leased to a restaurant company, with a three/five year leased contract which is renovated every year.			

If there is an embankment project, what is your plan during the construction and after the construction?
The state is aware about the embankment and if it happens they will study the situation. They would consider either reducing the fee for the lease or cancelled the fee during the construction time. It will depend on the situation.
What do you want to see if the building is integrated in to embankment design?
They would like to integrate a grade, for the people to watch the boat race. There is no need for a place to take the boats out of the water. They did mention that this place should be in the floating restaurant. Better access for the boats using the old ferry access.
Any suggestion/considerations regarding the design of the embankment?
They would also like to integrate a path along the river at the river level.
Any other comments:
Regarding the vendors along the embankment, they are temporary vendors and there is actually no need to compensate them. There are 4 market locations (2 day, 2 night) in Savannakhet where they can be relocated.

The Mekong Viewing Platform - Restaurant		Date:	23/05/2018
		Time:	09:00 – 10:30
Contact information			
Name:	Mrs. Khodsa	Surname:	Banhyavongsa
Phone number:	020 9989 1877		
Address:			
Infrastructure/Property			
Location:		Private property	State property
Coordinates:	16°33'15 N 104°44'42" E	Leased:	Yes
Altitude:	134 m (road 137 m)	Lease length:	02/2020
Area:	597 m ²		
Type of building:	2 stores open concrete building		
Description:	Main floor, access level is a viewing platform, the main purpose if for the boat race festival. Small floor under the main one for restrooms and kitchen. The base of the platform is only structure pillars.		
Issued title/official document:			
Owner's name:		Owner's surname:	
Owner's phone:			
Owner's address:			
Consultation			
Future plans of the owner/lease regarding the building:			
The platform view is state property and it was constructed mainly for the annual boat race. The rest of the time, the space is leased to a restaurant company, with a three/five year leased contract which is renovated every year.			

If there is an embankment project, what is your plan during the construction and after the construction?
The manager of the restaurant is only concern if she would be able to operate the restaurant. Even it has been agreed that if she can't operate the restaurant she will not pay leasing fee, however there are other fess that she will have to keep paying, e.g. water, electricity. If it would not be possible to operate the restaurant this issue will have to be discussed with the district authority.
If the restaurant can't not be operated during the construction, the manager claims that she should be entitled to some compensations because she has invested some money to get the restaurant running. According to her, she had invested 85 millions to open the restaurant, and the restaurant makes per months between 7-8 Million. She opened March 2013.
She built the kitchen in the below of view platform floor, minibar, tables and chairs have installed the view platform floor.
Her rent expiries in 2020, so the manager is not concern what to do after the embankment construction.
What do you want to see if the building is integrated in to embankment design?
Any suggestion/considerations regarding the design of the embankment?
Any other comments:

Village Authority: Xayyaphoum		Date:	24/05/2018
		Time:	10:00 am
Contact information			
Name:	Mr. Syphaeng	Surname:	Phimmakaysone
Phone number:		Occupation:	Village head
Address:	Xayyaphoum village office		
Infrastructure/Property			
Location:		Private property	State property
Coordinates:		Leased:	Yes / No
Altitude:		Lease length:	
Type of building:			
Description:			
Issued title/official document:			
Owner's name:		Owner's surname:	
Owner's phone:			
Owner's address:			
Consultation			
What are potential impacts from embankment during the construction			

<ol style="list-style-type: none"> 1. The representative was mainly concern for the fishing activity. Most part of the embankment is currently being used for fishing, therefore, during the construction there will be no fish. 2. It might impact regarding the construction phase for health & safety of villagers, who use and stay close to the project areas. 3. The common issue as temporary vendors along the current embankment which also included Pho restaurant near the view platform (Sala Khamekong). 4. There is one family who feeding pigs and settled the embankment areas, this family has not permitted or register for settle those, areas, authority has not recognized any right on the land.
What is your suggestion for mitigating the impact from construction during construction??
<ol style="list-style-type: none"> 1. Control dust and dirt along the public road and provide traffic properly during the construction or if possible to blockade the construction site from the public. 2. There is available market space for all vendor, such night market, night plaza and Savan ITECT, Thapthala Market. 3. All vendors agreed that they will move to other locations when there is construction, the construction must be informed in advance 1-2 weeks. 4. Family, who temporary settled, will leave, when there is construction as agreed with village authority.
Future plans of the owner/lease regarding the building?
People located in the project area, are temporary, they don't pay rent and they are aware the project might happen. Same applies to the owner of the pig farm. According to the authority, this owner has already agreed to move during the construction.
If there is an embankment project, what is your plan during the construction and after the construction?
What do you want to see if the building is integrated in to embankment design?
<ol style="list-style-type: none"> 1. They would like to include stairs to the embankment for easy access to the water. Also from the desk view to the water. 2. They would like to integrate the existing are, including the trees in the design, also include a path and open space under the trees in order for the people to do exercise. They would like some sort of steps from the desk view to the Shrine House. 3. They also suggest an infrastructure which would be easy to clean.
Any suggestion/considerations regarding the design of the embankment?
See above
Any other comments:

<u>Village Authority: Ban Thahae</u>		Date:	24/05/2018
		Time:	14:00
Contact information			
Name:	Vilayphone	Surname:	Inthavong
Phone number:	99655966	Occupation:	Village chief
Address:			
Infrastructure/Property			
Location:		Private property	State property
Coordinates:		Leased:	Yes / No
Altitude:		Lease length:	

Type of building:			
Description:			
Issued title/official document:			
Owner's name:		Owner's surname:	
Owner's phone:			
Owner's address:			
Consultation			
What are potential impact from embankment construction during the construction			
<ol style="list-style-type: none"> 1. It might impact regarding the construction phase for health & safety of villagers, who use and stay close to the project areas. 2. The common issue as temporary vendors along the current embankment however those villagers have not gotten permissions and they are only temporary. 3. There will not much impact for the people from that village, since the infrastructures close to the embankment are mainly offices. 4. The village authority, raised the issue that some of the villager has started constructing now because they have been told that they will be compensated. 			
What is your suggestion for mitigating the impact from construction during construction?			
<ol style="list-style-type: none"> 1. Control dust and dirt along the public road and provide traffic properly during the construction or if possible to blockade the construction site from the public. 2. There is available market space for all vendor, such night market, night plaza and Savan ITECT, Thapthala Market. 3. All vendors agreed that they will move to other locations when there is construction, the construction must be informed in advance 1-2 weeks. 4. Family, who temporary settled, will leave, when there is construction as agreed with village authority. 			
Future plans of the owner/lease regarding the building:			
People located in the project area, are temporary, they don't pay rent and they are aware the project might happen.			
If there is an embankment project, what is your plan during the construction and after the construction?			
She recommends that the embankment should cover until Liber Bank Building.			
What do you want to see if the building is integrated in to embankment design?			
<ol style="list-style-type: none"> 1. The embankment has to become economically useful as well. 2. Embankment to be use as a recreational area. 			
Any suggestion/considerations regarding the design of the embankment?			
Any other comments:			

Village Authority: Xayyaphoum / Shrine House	Date:	25/05/2018	
	Time:	15:00	
Contact information			
Name:	Mrs. Keopasomlath	Surname:	Phengpasak

Phone number:	020 99529229	Occupation:	
Address:			
Infrastructure/Property			
Location:		Private property	State property
Coordinates:	16°33'37 N 104°44'40" E	Leased:	Yes / No
Altitude:	136 m (road level 130)	Lease length:	
Area:	House: 100 m ² All: 1000 m ²		
Type of building:	Shrine house		
Description:			
Issued title/official document:			
Owner's name:		Owner's surname:	
Owner's phone:			
Owner's address:			
Consultation			
What are potential impact from embankment construction during the construction?			
1. The main impact is the Shrine House. This building does not belong to anyone, but this village are the main responsible for the maintenance. Same for the tree in the area. Shrine house is collective owner of Kaysone Phomvihane district			
What is your suggestion for mitigating the impact from construction during construction??			
1. Integrate shrine into embankment design as priority. 2. It belongs to collective, believers might not satisfy with the demolition options 3. Buddhist day, shrine is required for operating for daytime, but normal day, it is operating only morning section. 4. Construction phase must be sure that the shrine can operate as stated above by design construction for avoid these areas.			
Future plans of the owner/lease regarding the building:			
If there is an embankment project, what is your plan during the construction and after the construction?			
What do you want to see if the building is integrated in to embankment design?			
1. The embankment has to become economically useful as well. 2. Embankment to be use as a recreational area.			
Any suggestion/considerations regarding the design of the embankment?			
Any other comments:			

Floating Restaurant	Date:	24/05/2018
	Time:	11:00

Contact information			
Name:	Somsack	Surname:	Chalernpathom
Phone number:	041 252125	Occupation:	
Address:			
Infrastructure/Property			
Location:		Private property	State property
Coordinates:	16°33'43 N 104°44'38" E	Leased:	Yes / No Privat concession
Altitude:	Restaurant: 137 m Floating: 135	Lease length:	
Type of building:	Open restaurant, mainly wooden infrastructure		
Description:	Two different infrastructures for the restaurant and floating. Open house at the old ferry ramp and floating restaurant.		
Issued title/official document:			
Owner's name:		Owner's surname:	
Owner's phone:			
Owner's address:			
Consultation			
What are potential impact from embankment construction during the construction?			
The owner doesn't expect big impacts from the embankment construction a part from dust and noise, which should be kept low. The owner expects keep opening/running the restaurant during the construction. The owner is neither concern regarding the impact view.			
What is your suggestion for mitigating the impact from construction during construction?			
See above			
Future plans of the owner/lease regarding the building:			
If there is an embankment project, what is your plan during the construction and after the construction?			
What do you want to see if the building is integrated in to embankment design?			
Any suggestion/considerations regarding the design of the embankment?			
Any other comments:			

XVI. APPENDIX F: MEKONG RIVER EMBANKMENT – SUPPLY AND COST OF SAND

Background

The filling material for the Mekong Embankment is proposed to be sand/granular material (partially gravel). In the FS Report, 2012, Norconsult assumed that the supply of sand would take place by pumping. This is extracts from the FS Report:

101. For the embankment fill, materials below the normal flood level will be used, being granular materials as river sand or mixed river sand and gravel. The investigation found that the river sand and gravel deposit at about 4.5-5km downstream of the site will be the sources of river sand and gravel. Another source is located upstream of the island in the middle of the river right in front of Kaysone Phomvihane. From this location, materials may be transported by ferry or gathered through pumping. The sources are large and renewable as they are carried out by flood events every year.

145. The embankment fill above the water level on the river will be done in layers, all embankment materials of mixed river sand and gravel shall be deposited in layers up to 100cm thick before compaction, and each layer shall be retained under water ponding (pumping up from the river). The density of embankment materials after placing shall be not less than 95% standard density.

In Vientiane similar embankment works have been executed, but here the sand has been supplied by trucks, as shown on this photograph. During execution of these works there was a continuous flow of trucks for the supply of sand to the site, a burden for the local environment.



In their

cost

estimate of the Embankment Sub-project Norconsult (2012) assumed an unit price for sand/granular of 2.70 USD per m³.

The PMSCD Consultant prepared a revised cost estimate in November 2014. Here, an unit price of 13.64 USD per m³ was assumed for the sand/granular material. This means that the unit price was increased by a factor 5, and this price adjustment was the main reason behind the overall cost estimate for this subproject increased by a factor 2, from about 7.5 million USD to 14.7 million USD, which set the project on “hold” for a period.

Although not specifically mentioned in the available cost estimates, it is implicitly understood that the unit price for the cost item, “Embankment fill material from Mekong River (Sand/Granular)”, includes:

- the supply of sand,
- transport to the site,
- compaction and
- shaping etc.

For estimation of realistic unit prices of sand/granular material it is necessary to consider the construction methods, including the mode of transport to the site and material for filling/compaction/shaping at the site.

Location of possible sand resources

As appearing from the above extract from the FS Report 2012 there are different locations with possibility of sand winning in Mekong River, near Savannakhet. One possibility is in the middle of Mekong River, near Lao-Thai Friendship Bridge 2. Another possibility is along the left bank of Mekong River, some 6 km south of Savannakhet, see below images.

It should be possible to do sand winning in Mekong River both north and south of the bridge.



From a Google Earth image from 28 March 2016 (dry season conditions) the length of the downstream resource is measured to about 1,500 m and the width to about 200 m, ie. a surface area

of about 300,000 m². To illustrate the consequences for this downstream sand resource, a total filling supply of 500,000 m³ will correspond to an average excavation of 1.67 m for the whole resource. This is very substantial.

Sand winning plants at Savannakhet

1. Inspection of sand winning plant north of Savannakhet on 2 July 2016 and 19 September 2016

Location: about 1.8 km north of the Thai-Lao Friendship Bridge

Name of Company: Gravel and Sand Thaoudom Company

Years of operation: Since 2009

Contact Person: Mr. Vixai Kilouxaichanto, phone 55540899

Distance to site: about 7 km

Annual Production: appr. 60,000 m³ sand, appr. 10,000 m³ gravel

On 2 July 2016 a large sand winning plant, between the embankment road and the river bank, was briefly visited. The distance to the embankment site is about 7 km.

Photos from this sand winning plant are shown on the pages overleaf. A staff member of the sand winning plant informed that the unit price for the sand was 20,000 Kip per m³, corresponding to about 2.50 USD per m³. This is the price ex. plant, ie. not including transport to the site, compaction and shaping.

Hence, the unit price assumed by Norconsult in October 2012 seems to have been the raw price of sand ex. plant.

At the plant there is a ramp, from which an excavator is used to unload sand from barges. The sand is then transported on board trucks up the slope for storage at the plant, near the embankment road. Upon time of inspection total storage of sand on land (rough visual estimate) was a few thousand cubicmeters.

In addition there was a stockpile of sand at the foot of the river bank, and a small barge loaded with sand.

On 19 September it was informed that all sand is dredged (suction) from the middle of the river. They obtain an annual permit from DONRE covering sand winning in an area of 5 ha. Sand winning only takes place in the period, November – June (8 months annually).

2. Inspection of sand winning plant north of Savannakhet on 19 September 2016

Location: about 800 m south of the Thai-Lao Friendship Bridge

Name of Company: Tonphanith Product Sand and Gravel

Years of operation: since 2000 (16 years in business now)

Contact Person: Miss Noo Tonphanith; Managing Director

Distance to site: about 4 km

Annual Production: 70,000-80,000 m³ sand, about 20,000 m³ gravel

This is another sand winning plant north of Savannakhet, about 4 km from the Embankment site. This was visited on 19 September, where information was obtained from Ms. Noo Tomphanith.

An annual permit for sand winning is issued by DONRE. It covers an area of 5 ha in the river. The permit does not give any limit on production within this area. Limitations are that sand winning shall take place at least 1 km from the bridge and at least 200 m from river banks. The latter is only a formal limitation, since the good sand resources are in the middle of the river, far from the bank. They are not allowed to sell sand for usage in Thailand.

Sand winning must only take place in the period, November – June (8 months per year), so the monsoon period, July – October is excluded from sand winning, which is a joint Lao-Thai regulation. Normally, sand winning is done at depths up to 5 m, during the low-flow season at 2-3 m water depth.

Sand winning takes place 2-3 km north of the bridge. All sand winning takes place by suction. The company operates 11 barges and 4 small suction dredgers for the sand winning. The barges have a capacity of 20-25 m³ each. It takes typically 10 minutes to fill a barge.

It was informed that they never face difficulties with fishermen. They do not fishing near the dredging area.

The number of employees is about 20 permanent and 10 temporary staff.

Price for sand supply is 25,000 Kip/m³ ex. plant, about 40,000 Kip/m³ for supply in town. It was informed that they normally do not supply sand on barges directly to sites at the river bank – difficult to unload. They prefer sand supply by truck transportation.

3. Inspection of sand winning plant south of Savannakhet on 21 August 2016 and 19 September 2016

Location: about 1½-2 km south of Houay Longkong embankment

Name of Company: Phan Phonsavanh Sand – Gravel Co., Ltd.

Years of operation: since 1985 (> 30 years in business now)

Contact Person: Mr. Phantha Inthavongsa, Director

Distance to site: about 4 km from Central Section

Annual Production: about 200,000 m³ sand, 40,000-50,000 m³ gravel

A brief inspection to another sand winning plant, was at first made on 21 August 2016. The company, was visited on 21 September, where information was obtained from Mr. Phantha Inthavongsa.

Selected photos from the site are shown overleaf.

The origin of the sand is the very large sand resource (beach) along the left bank of Mekong, a few km further south. This sand formation is normally not submerged during the concession period, so it is accessible by vehicles. Normally, they carry out sand winning by suction, but they may also do it by excavation. The best sand quality is obtained by suction.

Issuance of annual permit by DONRE takes place as described above, with the same limitations. Before issuance of a new permit, the sand formation is surveyed prior to identification of a new 5 ha area.

The number of employees is 25. It is a family-operated company.

Price for sand supply depends on the quality. High quality sand (no or very little content of silt) is 30,000 Kip/m³ ex. Plant, about 50,000 Kip/m³ for supply in town. Supply takes place by truck.

For less good quality sand the price is 25,000 Kip/m³ ex. plant.

Price for gravel is significantly higher: 90,000 Kip/m³ ex. plant, about 120,000 Kip/m³ for supply in town.

They informed that they should not face any problem with an annual sand supply of 200,000 m³/year for the Mekong Embankment.

Time schedule of implementation and installation capacity during construction

The time schedule of implementation of the Mekong Embankment Sub-project has not been prepared yet. However, at a preliminar stage a construction period with total duration of 2½ years is envisaged. It is assumed that all sand/granular filling activities will take place during a period of 24 months or 730 days. There will be some days of downtime (weather and mechanical failures), and there should be one day off per week for labors rest and to relieve the urban environment from the impact of ongoing construction works. It is assumed that the net period with filling activities will be 500 days. With a total filling volume of 500,000 m³, the mobilized capacity for filling activities should then be in the order of 1,000 m³/working day.

Transport to site, Option 1 – Barge Transport and Pumping

According to the description in the FS Report (2012) Norconsult envisaged that the sand/granular material can be placed in the embankment by pumping. This is assessed to be possible.

From the site of sand winning the barge may be transported directly to the site, where the barge can moor along the bank. If pumping equipment is not onboard the barge, a floating pipe may be placed at the actual place of filling, and a pump connected to the pipe. The barge-full can be pumped directly into the slope as filling material. After emptying the barge it can return to the sand winning site for refilling.

On the slope there shall be equipment for compaction, shaping of the sand and for handling the pumping pipe with discharge arrangement, which will be needed to be moved regularly, while pumping takes place.

The method of direct pumping into the embankment fill is assessed to be very cost-effective, compared to unloading the sand/granular by excavator, loading a truck with subsequent transport to the site. In addition, it is also considered to be environmentally-friendly, since intensive truck transportation on the road between the sand winning plant and the site is avoided. A barge-full of sand/granular has a much higher capacity than one truck.

Taking into account the need for mobilization of additional earthworks equipment at the reclamation site, the unit price assumed by Norconsult (2012), 2.70 USD per m³, does not seem realistic.

It is suggested to use a unit price of 6.00 USD per m³. It shall however, be noted, that the companies described above, do mainly use truck transportation for supply of sand.

General comments on use of Marine equipment on Mekong River in Lao PDR

Waterborne transport along Mekong River is nowadays not playing the same significant role in the transportation pattern within Lao PDR as some 30 years ago, due to the improvement of road networks. In addition, several rocky shoals constitute a hindrance to navigation on Mekong, in particular between Savannakhet and Pakse, where there are some very narrow parts with limited navigation opportunities. River transportation between Lao PDR and Cambodia is impossible.

Also, there are shoals along the sector between Savannakhet and Vientiane, however not constituting the same constraints as from Savannakhet towards Pakse, and the river is fairly navigable in the wet season.

At Savannakhet, barge transportation is very limited and mainly confined to local sand winning in Mekong River. Availability of river barges is not great, but it should be possible to mobilize barges upstream to undertake construction works for the Mekong Embankment in Savannakhet.

Transport to site, Option 2 – Truck Transportation

The method of direct pumping into the embankment fill is assessed to be very cost-effective, compared to unloading the sand/granular by excavator, loading a truck with subsequent transport to the site. The use of trucks implies an additional mode of transport, and truck transportation between the sand winning plant and the construction site can besides the costs involved be an environmental burden. The use of trucks can potentially also imply a need for repair or rehabilitation of the road used, when construction work is complete, implying an additional cost.

As stated above the mobilized capacity for filling activities should be in the order of 1,000 m³/day, in order to limit the construction period to 2½ years.

A truck load can be assumed to be 8 m³ or 16 tonnes, whereby it will require 125 truck loads per day to obtain a capacity of 1,000 m³/day. By assuming a working day of 10 hours (600 minutes), a truck load will then be required every 5 minutes.

For transportation of the sand/granular to the site by truck, the key cost drivers behind the daily cost of operation of one truck are:

- The distance to be covered by truck (e.g. between sand winning plant and the site)
- The cycle time for one truck load

From Norconsult's FS Report on Roads (Kaysone Phomvihane Urban Roads, 2012) some operating costs are given for various earthwork equipment, see this list.

Equipments Cost

Item	Description	Unit Price \$ per Working Hour
I	Earthworks Equipment	
1	Hydraulic Excavator	45
2	Dump Truck 6 m ³ (for earthworks and aggregates)	20
3	Dump Truck 10 m ³ (for earthworks and aggregates)	26
4	Water browser with spray bar 12L capacity	26
5	Motor Grader – Cat.12 G or similar (50%, say, fitted with scarifiers)	54
6	Bulldozer – Cat D7 or similar	60
7	Wheeled loader – Cat. 950B FEL or similar	45
8	Vibrating roller, smooth steel wheels, 5-7 ton	42
9	Towed roller with tamping feet, 10-15 ton	25

For dump truck the hourly price is presented as 20 and 26 USD/hr for a 6 and 10 m³ load respectively. With one cycle per hour (should be realistic with the 7 km road distance) the price for truck transportation then becomes roughly the same as the cost of sand ex. plant. With an assumption of an 10-hour working day it may become necessary to mobilize about 12 trucks for the construction works, dependant upon their size.

In addition equipment shall be mobilized for shaping, compaction etc.

For the Savannakhet site with a distance of 7 km between sand winning plant and the site, it is suggested to use a unit price of 9.00 USD per m³, for supply of sand by trucks. The unit price used by the PMSCD Team in November 2014, 13.98 USD per m³, seems to be exaggerated for the Mekong Embankment site.

To this it shall be noted that it could be investigated whether it is possible to rehabilitate and use the former ferry ramp, located next to the site, for the supply of sand/granular. This should be more cost-effective, and the local environment will be relieved for the intensive truck traffic. A negative impact will be that operations on the ferry ramp will be disturbance for the floating restaurant in the construction phase.

XVII. APPENDIX G: EXISTING TREES RECORD (RIGHT SIDE)

No	Tree name (Lao)	Diameter(m)	KM	N	E	ELE
1	ຕົ້ນຫຼວງ	0,35	0+000	1.831.114,00	472.722,00	115,99
2	ຕົ້ນຄູນ	0,2	0+020	1.831.109,00	472.724,00	115,87
3	ຕົ້ນກຳກະເລົາ	0,12	0+020	1.831.101,00	472.728,00	115,83
4	ຕົ້ນສຳສາ	1	0+020	1.831.097,00	472.726,00	115,73
5	ຕົ້ນຫຼວງ	0,2	0+040	1.831.090,00	472.728,00	115,93
6	ຕົ້ນໝາກສະຕໍ່	0,1	0+040	1.831.086,00	472.723,00	115,56
7	ຕົ້ນຄູນ	0,45	0+040	1.831.080,00	472.728,00	115,60
8	ຕົ້ນຕີນເປັດ	0,8	0+040	1.831.080,00	472.723,00	115,47
9	ຕົ້ນຕີນເປັດ	0,7	0+060	1.831.072,00	472.723,00	115,46
10	ຕົ້ນຕີນເປັດ	0,55	0+060	1.831.066,00	472.722,00	115,49
11	ຕົ້ນກຳກະເລົາ	0,18	0+060	1.831.071,00	472.732,00	115,90
12	ຕົ້ນຕີນເປັດ	0,8	0+080	1.831.060,00	472.724,00	115,45
13	ຕົ້ນສຳສາ	0,8	0+080	1.831.053,00	472.728,00	113,42
14	ຕົ້ນຕີນເປັດ	0,6	0+080	1.831.045,00	472.723,00	115,139
15	ຕົ້ນສຳສາ	0,4	0+080	1.831.048,00	472.720,00	115,52
16	ຕົ້ນຕີນເປັດ	0,9	0+100	1.831.045,00	472.723,00	115,43
17	ຕົ້ນຕີນເປັດ	0,9	0+100	1.831.034,00	472.726,00	115,44
18	ຕົ້ນຫຼວງ	0,28	0+100	1.831.030,00	472.736,00	115,98
19	ຕົ້ນຫຼວງ	0,27	0+120	1.831.018,00	472.736,00	115,00
20	ຕົ້ນໝາກຕາກົບ	0,2	0+120	1.831.019,00	472.726,00	115,38
21	ຕົ້ນເດືອ	1	0+120	1.831.008,00	472.727,00	115,41
22	ຕົ້ນຄູນ	0,4	0+140	1.830.993,00	472.730,00	115,80
23	ຕົ້ນໄມ້ໃຫຍ່ທາງເຂົ້າຫໍ	1,3	0+160	1.830.071,00	472.750,00	115,78
24	ຕົ້ນໄມ້ໃຫຍ່ທາງເຂົ້າຫໍ	1,3	0+160	1.830.955,00	472.752,00	115,76
25	ຕົ້ນຕານ	0,6	0+200	1.830.936,00	472.749,00	115,80
26	ຕົ້ນສະຝາງ	0,55	0+200	1.830.923,00	472.744,00	115,61
27	ຕົ້ນຕານ	0,7	0+200	1.830.921,00	472.746,00	115,63
28	ຕົ້ນຍົມ	0,13	0+200	1.830.923,00	472.741,00	115,65
29	ຕົ້ນໝາກຂາມ	0,45	0+200	1.830.921,00	727.437,00	115,58
30	ຕົ້ນສະຝາງ	0,7	0+220	1.830.914,00	472.741,00	115,60
31	ຕົ້ນຕານ	0,5	0+220	1.830.919,00	472.749,00	115,60
32	ຕົ້ນສະຝາງ	0/6	0+220	1.830.905,00	472.743,00	115,57
33	ຕົ້ນສະຝາງ	0,6	0+220	1.830.897,00	472.743,00	115,55
34	ຕົ້ນຄູນ	0,35	0+240	1.830.894,00	472.743,00	115,54
35	ຕົ້ນຕານ	0,6	0+240	1.830.893,00	472.747,00	115,60
36	ຕົ້ນຕານ	0,6	0+240	1.830.889,00	472.748,00	115,60
37	ຕົ້ນຕານ	0,6	0+240	1.830.885,00	472.754,00	115,90

No	Tree name (Lao)	Diameter(m)	KM	N	E	ELE
38	ຕົ້ນຄູນ	0,4	0+260	1.830.871,00	472.748,00	115,61
39	ຕົ້ນຕານ	0,8	0+260	1.830.866,00	472.749,00	115,63
40	ຕົ້ນສະຟາງ	0,9	0+260	1.830.857,00	472.748,00	115,57
41	ຕົ້ນສະຟາງ	0,9	0+280	1.830.844,00	472.750,00	115,20
42	ຕົ້ນກາງຂອງ	1	0+320	1.830.815,00	472.757,00	115,50
43	ຕົ້ນຕານ	0,5	0+320	1.830.815,00	472.757,00	115,56
44	ຕົ້ນຕີນເປັດ	0,55	0+320	1.830.813,00	472.759,00	115,52
45	ຕົ້ນຕີນເປັດ	1	0+320	1.830.808,00	472.758,00	115,57
46	ຕົ້ນໄພ	3	0+320	1.830.796,00	472.757,00	114,00
47	ຕົ້ນຕີນເປັດ	0,9	0+360	1.830.755,00	472.760,00	115,05
48	ຕົ້ນງົວ	0,4	0+360	1.830.761,00	472.756,00	113,58
49	ຕົ້ນຫຼກວງ	0,2	0+360	1.830.764,00	472.758,00	113,85
50	ຕົ້ນຫຼກວງ	0,15	0+360	1.830.764,00	472.767,00	115,57
51	ຕົ້ນຕານ	0,6	0+380	1.830.761,00	472.762,00	115,18
52	ຕົ້ນຕານ	0,4	0+380	1.830.757,00	472.756,00	14,73
53	ຕົ້ນຕີນເປັດ	0,8	0+380	1.830.747,00	472.762,00	115,05
54	ຕົ້ນໄພ	3	0+380	1.830.478,00	472.746,00	114,24
55	ຕົ້ນຫຼກວງ	0,3	0+400	1.830.734,00	472.767,00	115,80
56	ຕົ້ນງົວ	0,3	0+400	1.830.278,00	472.761,00	115,35
57	ຕົ້ນກຳກະເລົາ	0,1	0+400	1.830.722,00	471.770,00	115,75
58	ຕົ້ນງົວ	0,6	0+420	1.830.708,00	472.768,00	115,70
59	ຕົ້ນກຳກະເລົາ	0,2	0+420	1.830.709,00	472.773,00	115,80
60	ຕົ້ນສຳສາ	0,6	0+440	1.830.688,00	472.769,00	114,50
61	ຕົ້ນຄູນ	0,3	0+440	1.830.683,00	472.772,00	115,85
62	ຕົ້ນແປ່ກ	0,3	0+460	1.830.673,00	472.774,00	115,10
63	ຕົ້ນຫຼກວງ	0,2	0+460	1.830.676,00	472.779,00	115,45
64	ຕົ້ນຫຼກວງ	0,2	0+460	1.830.662,00	472.778,00	115,67
65	ຕົ້ນຕານ	0,5	0+480	1.830.658,00	472.775,00	115,70
66	ຕົ້ນສຳສາ	0,7	0+480	1.830.651,00	472.777,00	114,75
67	ຕົ້ນຄູນ	0,2	0+500	1.830.645,00	472.782,00	114,90
68	ຕົ້ນສຳສາ	0,75	0+500	1.830.643,00	472.773,00	115,50
69	ຕົ້ນຫຼກວງ	0,3	0+500	1.830.636,00	472.784,00	115,65
70	ຕົ້ນສັກ	0,7	0+500	1.830.628,00	472.785,00	115,52
71	ຕົ້ນຕາກົບ	0,2	0+560	1.830.564,00	472.785,00	115,90
72	ຕົ້ນຕາກົບ	0,2	0+560	1.830.562,00	472.793,00	115,65
73	ຕົ້ນຄູນ	0,2	0+560	1.830.554,00	472.787,00	115,00
74	ຕົ້ນຈຳປາ	0,3	0+580	1.830.552,00	472.792,00	115,67
75	ຕົ້ນຫຼກວງ	0,3	0+600	1.830.537,00	477.293,00	115,60
76	ຕົ້ນຕີນເປັດ	0,5	0+600	1.830.526,00	747.289,00	115,58

No	Tree name (Lao)	Diameter(m)	KM	N	E	ELE
77	ຕົ້ນຫຼວງ	0,2	0+640	1.830.486,00	472.803,00	115,70
78	ຕົ້ນກໍາກະເລົາ	0,3	0+660	1.830.474,00	472.803,00	115,75
79	ຕົ້ນກໍາກະເລົາ	0,3	0+660	1.830.455,00	472.805,00	115,65
80	ຕົ້ນຄູນ	0,2	0+680	1.830.445,00	472.806,00	115,71
81	ຕົ້ນກໍາກະເລົາ	0,25	0+700	1.830.435,00	472.806,00	115,64
82	ຕົ້ນຄູນ	0,2	0+700	1.830.426,00	472.807,00	115,67
83	ຕົ້ນຫຼວງ	0,25	0+740	1.830.416,00	472.808,00	115,61
84	ຕົ້ນຄູນ	0,3	0+760	1.830.398,00	472.811,00	115,63
85	ຕົ້ນດອກແຄ	0,1	0+780	1.830.374,00	472.815,00	115,54
86	ຕົ້ນຕາກົບ	0,1	0+780	1.830.365,00	472.816,00	115,64
87	ຕົ້ນກໍາກະເລົາ	0,2	0+780	1.830.361,00	472.808,00	115,66
88	ຕົ້ນຕາກົບ	0,1	0+800	1.830.351,00	472.817,00	115,59
89	ຕົ້ນຕາກົບ	0,1	0+800	1.830.342,00	472.813,00	115,60
90	ຕົ້ນສໍາສາ	0,24	0+820	1.830.333,00	472.819,00	112,5
91	ຕົ້ນກໍາກະເລົາ	0,2	0+820	1.830.337,00	472.815,00	115,77
92	ຕົ້ນກໍາກະເລົາ	0,2	0+820	1.830.333,00	472.815,00	115,82
93	ຕົ້ນຄູນ	0,15	0+840	1.830.322,00	472.812,00	115,79
94	ຕົ້ນກໍາກະເລົາ	0,2	0+840	1.830.284,00	472.817,00	115,81