Environmental Management Plan

Project Number: 49387-002
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Lao People's Democratic Republic: Second Greater Mekong Subregion Tourism Infrastructure for Inclusive Growth Project

Vientiane Province:
Nam Ngum Reservoir Access Improvements

Prepared by the Ministry of Information, Culture and Tourism for the Asian Development Bank.

CURRENCY EQUIVALENTS

(30 June 2020)

Currency Unit	–	LAK
K1.00	=	$0.00011
$1.00	=	9,000LAK

ABBREVIATIONS

DICT	-	Department of Information Culture and Tourism
DPWT	-	Department of Public Works and Transport
DOF	-	Department of Agriculture and Forestry
DONRE	-	District Office for Natural Resources and Environment
EA	-	environmental assessment
EIA	-	environment impact assessment
ECC	-	environmental compliance certificate
ECO	-	environmental control officer
EMP	-	environment monitoring plan
EA	-	executing agency
GMS	-	Greater Mekong Subregion
IA	-	implementing agency
IEE	-	initial environmental examination
EO	-	environmental officer
IUCN	-	International Union for Conservation of Nature
Lao PDR	-	Lao People’s Democratic Republic
MOF	-	Ministry of Agriculture and Forestry
MICT	-	Ministry of Information, Culture and Tourism
MONRE	-	Ministry of Natural Resources and Environment
MPWT	-	Ministry of Public Works and Transport
O&M	-	operation and maintenance
PMCES	-	Project Management and Civil Engineering Support Consultant
PIU	-	project implementation unit
PCU	-	project coordination unit
REA	-	rapid environment assessment
SS	-	safeguard specialist
UDAA	-	Urban Development and Administration Authority
UXO	-	unexploded ordnance
WREA	-	Water Resources and Environment Agency

WEIGHTS AND MEASURES

km:	kilometer
kg:	kilogram
ha:	hectare
mm:	millimeter

NOTE

In this report, "$" refers to US dollars unless otherwise stated.

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I. INTRODUCTION

1. The detailed design (DED) of the subproject of the second GMS Tourism Infrastructure for Inclusive Growth Project (TIIG) that will upgrade and improve infrastructure in Nam Ngum reservoir area, Lao PDR has been completed. The original IEE of the Feasibility Study (FS) of the subproject has been updated to meet the DED of the subproject and is reported separately. The environmental management plan (EMP) provided herein has been updated to support the updated Initial Environmental Examination (IEE).

2. The primary purpose of the EMP for the subproject in Nam Ngum is twofold:

1) prescribe required mitigation and monitoring requirements for potential environmental impacts of the subproject that are identified by the updated IEE, institutional responsibilities for implementation of the EMP, and the cost of the EMP implementation; and

2) provide the needed guidance for the successful bidder/contractor to prepare his construction EMP (CEMP) prior to commencement of construction works.

3. The EMP will be appended to contractor tender documents. The EMP prescribes the mitigation and monitoring requirements for which the contractors are responsible as per their specific construction packages. As indicated above, the CEMP will be reviewed and approved by the Project Management and Civil Engineering Support Consultant (PMCES) and the Project Implementation Unit (PIU) before commencement of construction works.

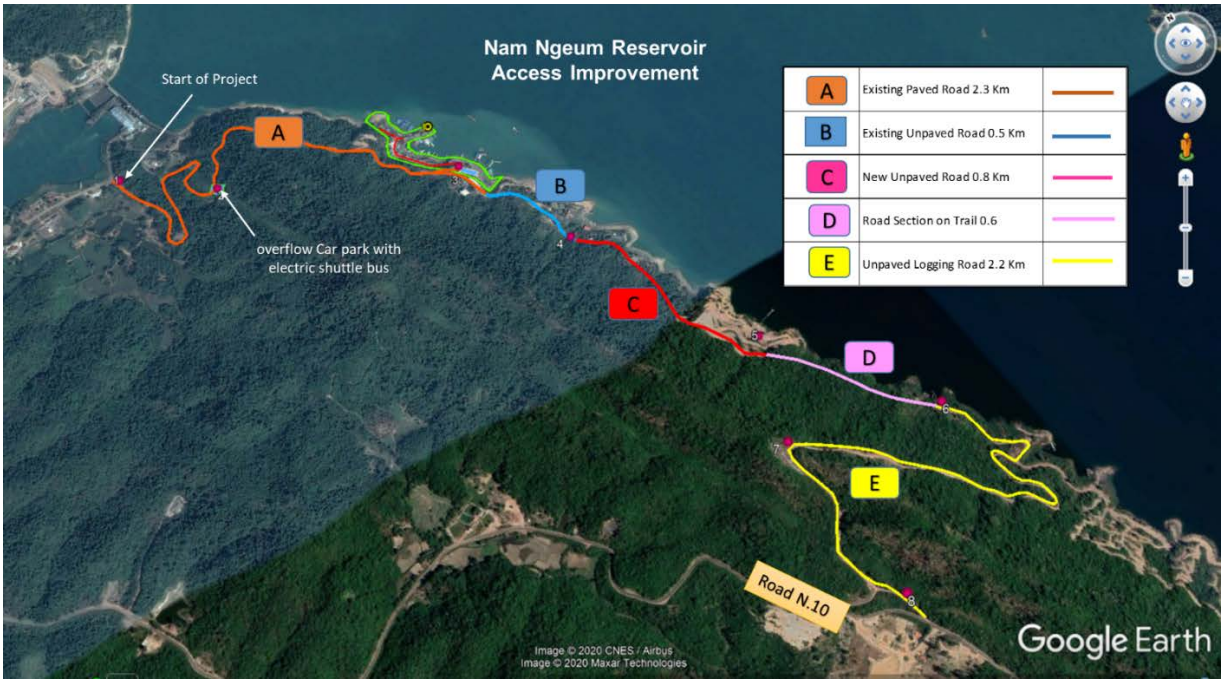
Subproject components

4. The improvements to the infrastructure and lay-out of the Nam Ngum reservoir area are summarized below and the main subproject components are displayed in Figure 1:

- Construction of lakeside boat marina with easy multi-level foot access. The marina will include appropriately access points to the restaurant boats, but also allow for improved private accessibility;
- Relocation of the lakeside market stalls to the 'hill side' of the access road to allow the market / vendor shops to maintain their activities to continue to serve visitors, keeping the overall area economically active;
- Re-design of the headland area (current location of the collapsed fisheries buildings) as a landscaped recreation area with look-out feature with a viewing deck and a pavilion;
- A public park / square at the central area of the site, including rehabilitating the warehouse into a combined information center, indoor shops / market / vendor shops and restaurants / coffee shops;
- Improving the present car park and build and overflow car park to the lakeside;
- Construction of new "loop road" providing access to the lakeside from two points on the Road No. 10;
- Development of a landscaped water recreation area with easy access to the water and storage for kayaks, sailing and other recreational vessels;
- Provision of wastewater receiving tank for boats, to be emptied by vacuum tanks for all boats;
- Improved solid waste management for the lakeside area, including improvement to private collection service and enforcement of use inside a "Green Zone" to be defined.

- Create adequate drainage channels and culverts, to be constructed along roads and leading from housing areas, for management of run-off rainwater, divert and discharge into the lake

Figure 1 Overview Map of the Subproject and its main components



Road section A indicated on the map in Figure 1 is the section from km 0+000 to km 2+160 also called Road Section 1, and the road sections B, C, D and E is the road section from km 2+160 to km 6+372 also called Road Section 2.

The planned improved infrastrucure in Nam Ngum includes re-development of the public marina area by the reservoir, expansion of the shore-area infrastructure to accommodate tour boats, construction of a large boardwalk area and redevelopment of the market area into a 3.200 m^2 public market for vendor shops and restaurants that incorporates wastewater pump-out station/holding tank at the marina. The sub-project also includes replacing abandoned, unsafe public buildings and piers with new public green space, pParking area and access road.

The direct beneficiaries of the subproject will be the market stall operators, hotels, and boat and water recreation equipment rentals. This will stem from the increased number of domestic and international tourists that will come to the area because of improved recreation and sanitation.

The overall construction schedule is presented in Table 2.

Table 1 Overall Construction Schedule

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Contract Signing and pre-construction activities																								
Construction of Road Section 1 (km 2+160 to km 6+372)																								
Construction of Road Section 2 (km 0+000 to km 2+160)																								
Walking Path and Boardwalk																								
Lakefront Landscaping (stairs, ramps, parking lot)																								
Lakefront Public Buildings																								
Lakefront shops																								
Port Facilities and Utilities																								

The contractor shall plan and implement the construction work in accordance with the following instructions:

- The work for Road Section 1 shall start first to provide access to the Marina.
- No work is permitted in Road Section 2 until the work of Road Section 1 is completed and opened to traffic.
- Traffiic to the marina shall be diverted from Road Section 2 to Section 1 while working on Road Section 2.
- Traffiic will not be allowed on Road Section 2 (from Nam Ngum Dam junction) while the Contractor works on Road Section 2
- The contractor shall provide necessary diversion road for movement of traffic to the marina.
- Work for development of the marina area must to be planned so that no tourist activity is affected.

II. SUMMARY OF INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

5. The primary management framework indicating allocation of responsibilities for the implementation of the environmental management plan (EMP) for the subproject is summarized below. The Ministry of Information, Culture and Tourism (MICT) which is the executing agency (EA) for the project will take overall responsibility for the successful implementation of the EMP. The EA has established a Project Coordination Unit (PCU) within the Tourism Development Department of MICT which, among other things, will provide Safeguards and Monitoring Coordination for the EMP.

6. The Implementing Agency (IA) for the subproject is the Vientiane Provincial Department of Information, Culture and Tourism (DICT). A provincial Project Steering Committee (PPSC) will be established comprised of representatives from the DICT, DPWT, Department of Finance (DOF), Department of Planning and Investment (DFI), Department of Natural Resources and Environment (DONRE), and representatives of other departments and agencies as required.

7. The Project Implementation Unit (PIU) will reside in the DICT Office with close coordination and support regarding infrastructure works as needed from the Department of Public Works and Transport (DPWT) and Provincial Office of Public Works and Transport (OPWT). The PIU will assign a Safeguard Specialist (SS), and will be responsible for day to day implementation of the EMP for both subprojects. The PCU will coordinate agency safeguard support to the PIU and will liaise with the ADB on safeguard reporting and issues when necessary.

8. The PIU's Safeguards Specialist will oversee the work of the contractor's Environmental Officer (EO) for implementation of the contractor EMP (CEMP) for the construction package. External support to the PIU for implementation of the EMP will be provided by the PMCES' International and National Environment Specialists (IES/NES) and an external Environmental Monitoring Institute (EMI). The EMI will conduct environmental sampling and laboratory analyses specified by the EMP that cannot be performed directly by the contractor or PMCES.

9. The responsibilities of the different agencies in the management framework are listed in Appendix A. Below is a summary of responsibilities for implementation of the EMP.

10. Responsibilities of the EA include:

- Coordinate environmental and social safeguards and monitoring for IA/PIU;
- Oversee successful operation of Grievance Redress Mechanism (GRM) and resolve any submitted stakeholder grievances at project level if possible.
- With support from IA/PIU prepare reports on Grievance Redress Mechanism (GRM) as needed;
- Liaise with ADB on the implementation of the EMP;
- With support from IA/PIU complete and submit semi-annual environmental monitoring reports to ADB and
- Coordinate with IA, and ADB if necessary, on issues arising from the implementation of EMP and any required corrective actions or updates.

11. Responsibilities of IA include:

- Oversee and provide support for implementation of EMP by PIUs
- Liaise with PCU and EA on issues with safeguards and EMP identified by PIUs

- With assistance from PIU prepare reports to EA on EMP implementation including semiannual environmental monitoring reports for ADB

12. The responsibilities of the Safeguards Specialist (SS) of PIU include:

- Assist IES/NES of PMCES with any final updating of EMP before construction commences, and inform contractor;
- Notify DONRE to verify Government approvals of project are met, and that EMP is compliant with Environmental Compliance Certificate (ECC) of project;
- Assist PMCES with inclusion of EMP requirements in contractor bid documents including bid evaluations based on updated EMP;
- With IES/NES of PMCES review and approve submitted CEMPs of contractors;
- Undertake day to day management of EMP implementation activities;
- Work with EMI on implementation of monitoring plan of EMP;
- Ensuring compliance with loan covenants and assurances in respect of all subprojects, including EMPs (as well as IPPs, GAPs and resettlement plans);
- Lead follow-up meetings with all affected stakeholders;
- Prepare and submit quarterly reports on EMP implementation to PCU;
- Oversee implementation of CEMP by contractor;
- Coordinate with IES/NES of PMCES for EMP implementation;
- Undertake regular construction site inspections to ensure contractor implements CEMP properly; and
- Ensure EO of contractor submits monthly reports on construction mitigation and monitoring.

13. Key responsibilities of the IES/NES of the PMCES for the EMP are listed below:

- Perform any final updates to EMP prior to start of construction and inform contractor;
- Provide technical direction and support to PIUs for EMP implementation;
- Support PIUs with review of contractor CEMPs
- Oversee design and delivery of capacity development and training of PIU and contractor's EO;
- Provide advice and support to EMI with their monitoring activities;
- Receive monitoring reports from EMI and with SS/PIUs prepare semiannual monitoring reports for IA/EA for ADB; and

14. The responsibilities of Environmental Officer (EO) of Contractor include:

- Implement contractor's CEMP for construction phase of subproject; and
- Prepare and submit monthly reports on mitigation and monitoring activities of CEMP and any environmental and H&S issues at construction sites.

15. The responsibilities of Environmental Monitoring Institute (EMI) include:

- Implement the environmental sampling required for monitoring plan of EMP that cannot be conducted by the contractor and PIU.
- Perform required laboratory analyses for monitoring program detailed in EMP; and
- Prepare and submit quarterly reports to PIU on monitoring activities.

16. The Provincial Department of Natural Resources and Environment (PONRE) is the agency which oversees environmental management of Vientiane province. PONRE is mandated to issue, suspend or withdraw Environmental Compliance Certificates for IEEs.

The District Office of Natural Resources and Environment (DONRE) is mandated to monitor compliance with environmental regulations and conditions stipulated in Environmental Compliance Certificates (normally 3-4 times per year during construction phase).

17. ADB provides guidance to EA/PCU/IA with any issues related to EMP, and reviews biannual reports on EMP activities compiled and submitted by PCU which are disclosed on the ADB website pursuant to ADB's Public Communications Policy (2011). The ADB assists the PCU with timely guidance at each stage of project implementation following agreed implementation arrangements, and will review and approved detailed design documents, updated IEEs/EMPs, project progress reports, semi-annual safeguard monitoring reports and project completion report. ADB will field one or two missions per year depending on need.

A. Regulatory Framework and Guidelines for the Nam Ngum upgrading Subproject

18. Specific regulations and guidelines for the subproject are summarized in Table 1. Reference environmental standards for Lao PDR are found in Appendix B.

Table 2 Relevant regulations and guidelines applicable to subproject.

Road Upgrades
• Lao PDR National Road Design Manual of April 2018. • Lao PDR Road Design Manual with reference to AASHTO A Policy on Geometric Design of Highways and Streets, 5th 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
Riverbank Works
• The Manual and Study on Mekong Riverbank Protection, Lao PDR. Draft Final Report. JICA September 2004. • California Bank and Shore Rocks Slope Protection Design, Practitioner's Guide and Field Evaluations of Riprap Methods Final Report No. FHWA-CA-TL-95-10, Caltrans Study No. F90TL03, Third Edition - Internet October 2000, Prepared in Cooperation with the US Department of Transportation Federal Highway Administration.
Occupational and Public Health and Safety
• MSLW, Lao PDR Occupational, Safety, and Health Guidelines Programme, Draft 2005-2010 • IFC/World Bank, 2007. Environment, Health, and Safety Guidelines (EHS) for Construction and Decommission, and Toll Roads
Environmental Standards
• Agreement on National Environmental Standards, Decree on National Environmental Standards, No 81, dated 21 February 2017

III. SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES.

19. The potential environmental impacts of subproject from the updated IEE are summarized in Table 2. The required mitigation measures for the three phases of the implementation of the subproject (pre-construction, construction, and operation) are detailed in the Mitigation Plan below.

Public Consultations

20. The second series of public consultations on the subproject was conducted for the DED of the subproject in Nam Ngum in February and June 2020, respectively. These consultations were followed-up by a final pre-construction-contract-award consultation with the affected housholds on 08 December 2020. The issues and concerns of the consultations which are reported in the updated IEE are addressed by the EMP. Input from stakeholders will continue through to the operational phase as summarized in Appendix C.

Table 3 Summary of potential impacts of subproject in Nam Ngum subproject area

Pre-construction Phase
• 35 households will be affected, and will be compensated in accordance with the Resettlement Plan
Construction Phase
Upgraded access roads, parking lots in Nam Ngum and surrounding area: • Reduced and/or blocked public access, • Disrupted business and recreation • Noise and dust caused by construction truck traffic and heavy equipment use, • Soil and surface (pond) water pollution caused by equipment operation and maintenance, • Disruption of forest areas, adjacent to protection forest area (Phu-En) • Worker, and increased risk of public accidents/injury, • Disruption of traffic and increased traffic accidents, • Local drainage and flooding problems, • Solid and domestic waste from worker camps, • Social issues and community problems caused by migrant workers. Shoreline road/retaining wall, upgrading of urban infrastructure in marina area of Nam Ngum: • Erosion and sedimentation of Nam Ngum reservoir lake • Destruction of nearshore aquatic habitat • Nearshore aquatic habitat damage, • Disrupted boating and fishing near the site.
Operation Phase
• Increased traffic and risk of traffic accidents primarily along Nam Ngum access road. • Increased pollution of Nam Ngum reservoir lake from increased discarded solid waste from tourists, and bilge, gas, and oil from the anticipated increase in boat traffic. • Increased boat congestion along Nam Ngum lake shoreline.

A. Worker and Community Health and Safety

21. Central to construction and operation phase of the subproject is to ensure workers and the public are not harmed from construction activities and ultimately the operation of the completed subproject.

22. Based on the New Global Strategies in Occupational Safety and Health (OSH) developed by the International Labour Organization (ILO) in 2003, the Lao Ministry of Labour and Social Welfare (MLSW) assisted with the development of the Lao PDR National OSH Programme[1]. To facilitate the development of the OSH, the National Occupational Health & Safety Programme (2005-2010) was initiated. However, for this subproject, the OSH of Lao will be supplemented by the IFC Environmental Health and Safety Guidelines for Occupational Health and Safety, and for Construction and Decommissioning, and Toll Roads. The contractor will have to identify the appropriate national and IFC OHS guidelines in their bid documents for review by the PMCES.

23. The emerging OSH, *inter alia,* addresses worker and public safety in the construction and operation of small-medium enterprises and notably rural roads. The EA/PCU as supported by the PIUs must obtain and implement the directives of the OSH Programme. Pertinent associated laws and policies include the Labour Law of Lao PDR, and Decree No. 24/PR of the President of Republic, dated 21 April 1994, promulgating law No. 002/NA of 14 March 1994, concerning Labour. Similar to required OSH above, the need of the IFC EHS guidelines and supported OHS of Construction and Decommissioning, and Toll Roads to supplement the OSH directives needs to be clarified by contractors and PMCES.

To protect the health and safety of workers as well as communities, a project-level COVID-19 risk assessment should be carried out. All contractors should be requested to update or prepare respective health and safety (H&S) plans, addressing COVID-19 health risks in the CEMP prior to commencement of construction. These H&S plans should be aligned with any government regulations and guidelines on COVID-19 prevention and control.

IV. IMPACT MITIGATION PLANS

25. The Impact Mitigation Plans for the subproject are presented in *Table 3 Impact mitigation plan for the Pre-Construction Period, Table 4 Impact mitigation plan for the Construction Period and Table 5 Impact mitigation plan for the Operating Period*. The Mitigation Plans identify potential impacts, required mitigations, responsible parties, location, timing, and any indicative costs. The potential impacts identified in Mitigation Plans are based on the updated IEE (Dec-2020) as summarized in Table 2.

26. Note that Mitigation Plans indicate the responsibilities of the contractor(s) for implementation of the measures. These are not restricted to the impact mitigation plan for the construction period, but also include measures to be implemented in the period between contract award and notice to proceed with the construction work.

27. The mitigation measures which are summarized in the impact mititation tables set out measures which are common to all construction works as well as some that are project specific. There are two types of mitigation measures:

(i) Measures that will permanently become part of the infrastructure such as landscape planning, road signage, engineering measures for preventing soil erosion should be included within the main civil works contact costs, and are not double-counted as part of the EMP costs.
(ii) Temporart measures during the construction stage (e.g. dust suppression by watering, use of quiet / low noise powered mechanical equipment, will need to be included in the tender documents to ensure that contractors budget these items in their bids

[1] ILO, 2009. Asean-Oshnet, Occupational Safety and Health Practices.

Table 4 Impact mitigation plan for the Pre-Construction Period

Pre-Construction Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[2] (USD)	Supervision	Implementation
Disclosure, & re-engagement of community (in Lao language)	No community impacts	1. Confirm initiation Information Disclosure and Grievance Redress Mechanism of IEE and distribute construction activity schedule to affected community and businesses	For all construction sites.	A few weeks before construction starts	once	No marginal cost[3]	IA/PIU	PIU
Contact tourist & commercial boat companies	No negative impact	2. Inform tourist companies and commercial boat companies of schedule of civil works for lake boat dock, and all shoreline civil works.	Nam Ngum resort area	Before construction	As required	No marginal cost	PMCES/PIU	PMCES/PIU
Government approvals	No negative impact	3. Confirm with DONRE for required project permits (i.e. environmental and UXO) and certificates at appropriate time after contractors procured and before contract award..	Entire subproject	Before construction begins	once	No marginal cost	PIU/DONRE	DONRE
Final design of the subproject	Minimize negative environmental impacts	4. PMCES[4] to ensure the following management measures are organized, included in the CEMP and in place: a) identification of spill management prevention plans, and emergency response plans for all construction activities at all sites in Nam Ngum; b) locate concrete batch plant location(s) for access roads away from villages and individual households with fencing and access barriers d) ensure no disruption to water supply, utilities, and electricity to local villages with set contingency plans for any unavoidable disruptions planned; e) no disruption to normal pedestrian and vehicle traffic along all access roads with set of contingency alternate	Final siting	Before construction initiated	Once with final designs documents	No marginal cost	PMCES/EA	PMCES/PIU

[2] Costs will need to be updated by contractors.
[3] No marginal cost indicates that costs to implement mitigation are to be built into cost estimates of contractor bid documents
[4] PMCES is Project management and civil engineering support consultant to be determined

Pre-Construction Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[2] (USD)	Supervision	Implementation
Identification and use of construction materials from subproject area		routes planned. f) Install signage along access roads & footpaths to inform public and motorists of construction activities and schedule, and of increased vehicle traffic. g) Install signage at Nam Ngum entry parking and at main plaza by the boat docks and restaurant area, which provides boaters of construction activities, and construction schedule h) Schedule the construction work to minimise the duration of impacts on the affected people in the marina area						
		5. Use of sand, gravel materials and from borrow areas must be in accordance with DONRE approved locations and with prior permissions. Selection of spoil disposal sites must be approved by PIU and DONRE.	Borrow areas and spoil disposal sites				PMCES/PIU	Contractor
		6. Review and ensure climate change resilience measures of DED are integrated with subproject implementation	Access roads, and stormwater drain at port					
Final EMP	Positive environmental impacts	7. Finalize IEE and this EMP where necessary to meet any late changes to subproject final design to protect affected environments. If changed submit final IEE and EMP to ADB for review and approval prior to bidding.	All sites	Before construction initiated	Once with detailed designs documents	No marginal cost	PMCES	EA/PIU
Confirm Government approved construction waste disposal sites, and borrow pits	No negative impact	8. Notify DONRE & DPWT to confirm locations of disposal areas for construction waste, and borrow pits, and obtain required permits.	For entire subproject	Before construction	As required	No marginal cost	PIU/DONRE/ DAF/DICT	PIU
UXO survey, & removal	Injured worker or public	9. Ensure Government and UXO LAO is consulted and clears areas where necessary in subproject area	All construction sites.	Beginning of subproject	Once	See Monitoring Plan below	EA/PIU	UXO LAO

Pre-Construction Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[2] (USD)	Supervision	Implementation
Develop bid documents	No negative environmental impact	10. Ensure that this updated EMP is included in contruction tender documents, and that tender documents specify requirement for site-specific, budgeted CEMP. 11. Specify in bid documents that contractor must have experience with implementing EMPs and provide designated environment, health and safety staff with experience.	All subproject areas	Before construction begins	Once for all tenders	No marginal cost	PMCES/EA	PIU
Obtain & activate permits and licenses	Prevent or minimize impacts	12. Contractors to comply with all statutory requirements of the Government for use of construction equipment, and operation of construction plants such as concrete batching.	For all construction sites	Beginning of construction	Once	No marginal cost	PMCES	PIU & contractors
Capacity development	No negative environmental impact	13. Finalize and schedule training plan for PIU/SS to be able to fully implement EMP, and to manage implementation of mitigation measures by contractors. 14. Create awareness and training plan for contractors whom will implement mitigation measures.	All subproject areas	Before construction begins	Initially, refresher later if needed	No marginal cost	PMCES	PMCES/PIU
Recruitment of workers	Spread of sexually transmitted disease	15. Use local workers as much as possible thereby reducing number of migrant workers. This directive should be included in tender documents	All construction areas.	Throughout construction phase	Worker hiring stages	No marginal cost	EA/PIU	Contractor's bid documents
Prepare CEMP	Prevent or minimize impacts	16. Prepare site-specific CEMP(s) for different potential impacts of construction phase of all subproject components.	All construction sites	Ahead of construction	Once	No marginal cost	PMCES/PIU	Contractors

Table 5 Impact mitigation plan for the Construction Period

Construction Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[5] (USD)	Supervision	Implementation
Worker camps	Pollution and social problems	17. Locate worker camps away from village area and individual houses in Nam Ngum. 18. Ensure adequate housing and waste disposal facilities including pit latrines and garbage cans. 19. A solid waste collection program must be established and implemented that maintains clean worker camps 20. Locate separate pit latrines for male and female workers 50m from worker living and eating areas. 21. A clean-out or infill schedule for pit latrines must be established and implemented to ensure clean operable latrines are available at all times. 22. Worker camp must have adequate drainage. 23. Local food should be provided to worker camps. Guns and weapons not allowed in camps. 24. Interaction of transient workers with local community should be discouraged. HIV Aids test and education should be given to workers. 25. Camp areas must be restored to original condition after construction completed.	All worker camps	Throughout construction phase	Monthly	No marginal cost	PMCES/PIU	contractor
Training & capacity	Prevention of impacts through education	26. Implement training and awareness plan for PIU/SS and contractors on local civil and environment protection laws.	PIU office, construction sites	Beginning of construction	After each event	No marginal cost	PMCES	PMCES/PIU

[5] Costs will need to be updated by contractors.

Construction Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[5] (USD)	Supervision	Implementation
Construction materials acquisition, transport, and storage sub-plan	Pollution, injury, increased traffic, disrupted access	27. All topsoil and overburden removed for subproject should be stockpiled on site for later restoration. 28. Any unstable slope conditions on the bank of Nam Ngum reservoir lake should be rectified with tree planting, or quicker growing grasses if necessary. 29. Define & schedule how needed material from bank on Mekong river is to be extracted, moved, and stored on site. 30. All piles of aggregates along access road and along Mekong river must be covered. 31. All aggregate loads on trucks transported from outside subproject area must be covered.	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	PMCES/PIU	contractor
Excavated spoil management sub-plan	Contamination of soil and Nam Ngum lake or ponds from excavated spoil, and construction waste	32. Any uncontaminated excavated spoil that needs to be disposed outside of subproject area must be disposed of in DONRE-designated sites. 33. A record of type, estimated volume, and source of disposed spoil must be recorded. 34. Any excavated contaminated soil must be handled following DONRE regulations including transport, treatment (if necessary), and disposal site selection. 35. Spoil may only be disposed at the designated spoil disposal sites approved by PIU and DONRE	All excavation areas	Throughout construction phase	Monthly	See Monitoring Plan for contaminated soil analyses	PMCES & PIU & DONRE	contractor

Construction Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[5] (USD)	Supervision	Implementation
Solid and liquid construction waste sub-plan	Contamination of land and Nam Ngum lake from construction waste	36. Management of general construction solid and liquid waste from subproject sites must follow DONRE regulations, and will cover, collection, handling, transport, recycling, and offsite disposal of waste created from construction activities and worker force. 37. Offsite disposed of construction waste should be catalogued for type, estimated weigh, and source. 38. Construction sites should have sufficient large garbage bins in a designated site that are covered, and which enable separation of recyclables from waste that must be disposed in DONRE-approved sites. 39. A schedule of solid and liquid construction waste pickup and disposal all subproject sites must be established and implemented to ensure construction sites are clean as possible. <u>Hazardous Waste</u> 40. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow DONRE regulations. 41. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents) 42. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good condition 30 m from construction activity areas, Nam Ngum Reservoir, and residences. 43. All spills must be cleaned up completely with all contaminated soil removed and handled as contaminated spoil.	All construction sites and worker camps	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU & DONRE	contractor

Construction Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[5] (USD)	Supervision	Implementation
Noise, air/dust and vibration sub-plan	Dust Noise	44. Regularly apply wetting agents (e.g., water, $CaCl_2$) as needed to exposed soil, access roads, and footpaths when dust created. A water truck must be on site in Nam Ngum for immediate watering as needed. 45. Cover or keep moist all stockpiles of construction aggregates, and all truckloads of aggregates. 46. Minimize time that excavations and exposed soil are left open/exposed. Backfill immediately. 47. Monitor and ensure that noise level does not exceed Maximum Sound Level (L_{max}) should not exceed 115 dB(A) 48. Monitor that dust and particle levels do not exceed standards as iin accordance with Ambient Air Quality Standard (Appendix B) 49. Monitor vibrations at the nearest vibration-sensitive receptor at the start of and during blasting, or during the use of non-blasting equipment causing vibration. 50. As much as possible restrict working time between 07:00 and 17:00. In particular are activities such as pile driving. 51. Maintain vehicles and equipment in proper working order with a monthly service schedule 52. Replace unnecessarily noisy vehicles and machinery. 53. Vehicles and machinery to be turned off when not in use. 54. Construct temporary noise barriers around excessively noisy activity areas.	All construction sites.	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor

Construction Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[5] (USD)	Supervision	Implementation
Implement utility and power disruption sub-plan	Loss or disruption of utilities and services to local villages such as water supply and electricity	55. Develop plan of days and locations where outages in utilities and services will occur, or are expected. 56. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages. 57. Contact affected Det and Khone villages, and affected residents in Nakasang to inform them of planned outages. 58. Try to schedule all outages during low use time such between 24:00 and 06:00.	All construction sites.	Fulltime	Monthly	No marginal cost	PMCES & PIU & Utility company	contractor
Tree and vegetation removal, and site restoration sub-plan	Damage or loss of trees, vegetation, and landscape	59. Contact provincial forestry department for advice on how to minimize damage to trees and vegetation. 60. Restrict tree and vegetation removal to within RoW of access roads and footpaths. 61. Minimize tree removal, and install protective physical barriers around trees that do not need to be removed. 62. ROW of access roads/footpaths, and affected bank of Nam Ngum Reservoir needs to re-vegetated and landscaped after construction completed. Consult provincial forestry department ahead of all earthworks to determine the most successful restoration strategy and techniques. 63. As part of landscape beautification and as compensation for removal of vegetation for road construction, ensure that re-planting of trees and vegetation are in line with planned landscaping as defined in the BoQ, item 616, regarding types and numbers of trees and bushes to be planted at designated locations in the sub-project.	All construction sites.	Beginning and end of subproject	Monthly	No marginal cost	PMCES & PIU	contractor
Erosion control sub-plan	Land erosion	64. Berms, and plastic sheet fencing should be placed around all excavations and earthwork areas to contain erosion. 65. Earthworks should be conducted during dry periods if possible. 66. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor

Implement worker and public safety sub-plan	Public and worker injury, and health	67. Proper fencing, protective barriers, and buffer zones should be provided around all construction sites to protect public. 68. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all sites. 69. Worker and public safety guidelines should be followed (Lao PDR OSH Programme section III) as well as the IFC EHS OHS guidelines for Toll Roads and Construction and Decommission. 70. Conduct COVID-19 risk assessment and instruct all contractors to update / prepare their respective health and safety (H&S) plans, which are part of their EMP, addressing COVID-19 health risks. 71. Speed limits suitable for the size and type of construction vehicles, and current traffic patterns should be developed, posted, and enforced on all roads used by construction vehicles. 72. Standing water suitable for disease vector breeding should be filled in. 73. Worker education and awareness seminars for construction hazards should be given at beginning of construction phase, and at ideal frequency of monthly. A construction site safety program should be developed and distributed to workers. 74. Appropriate safety clothing and footwear should be mandatory for all construction workers. 75. Adequate medical services must be on site or nearby all construction sites. 76. Drinking water must be provided at all construction sites. 77. Sufficient lighting must be used during necessary night work. 78. All construction sites should be examined daily to ensure unsafe conditions are removed. Unsafe conditions should be recorded in SLF construction diary	All construction sites.	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor
Civil works	Degradation of water quality of Nam Ngum	79. Earthen berms, plastic sheet fencing, or in-lake silt curtains must be placed between all earthworks for shoreline retaining wall/road, stormwater drain relocation,	Mekong river sites	Throughout construction	Monthly	No marginal cost	PMCES & PIU	contractor

Construction Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[5] (USD)	Supervision	Implementation
	Reservoir	and new pier steps and the Mekong river 80. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. 81. Earthworks must be conducted during dry periods. 82. All construction fluids such as oils, and fuels should be stored and handled carefully and not get into contact with water resources and the lake. 83. No waste of any kind is to be thrown in the Nam Ngum reservoir lake 84. No washing or repair of machinery on or near the shore of the lake 85. Pit latrines to be located well away from the lake		phase				
Cultural chance finds subplan	Damage to cultural property or values, and chance finds	86. As per detailed designs all civil works should be located 50 m from all cultural property and values. DICT identified potential sites and types of PCR in pre-construction phase. 87. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for finds. 88. Upon a chance find all work stops immediately, find left untouched, and PIU notified to determine if find is valuable. Culture section of DICT notified by telephone if valuable. 89. Work at find site will remain stopped until DICT allow work to continue.	All construction sites	At the start, and throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor

Construction Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[5] (USD)	Supervision	Implementation
Construction and urban traffic sub-plan	Traffic disruption, accidents, public injury	90. Inform residents and business owners about upcoming construction work that may cause inconveniences or disruptions, and in consultation with the affected people implement measures to prevent or minimize the impacts 91. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights along all access roads and footpaths. 92. Post enforced speed limits, and create dedicated construction vehicle roads or lanes along access roads if possible. 93. Install signage on access roads indicating construction activities and schedule. 94. Create pedestrian walkway areas around construction sites.	All construction sites	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor
Construction drainage sub-plan	Loss of drainage & flood storage	95. Provide adequate short-term drainage away from construction sites to prevent ponding and flooding. 96. Install temporary storm drains or ditches on construction sites where necessary 97. Ensure natural stormwater runoff at all construction sites is maintained and not disrupted.	All areas with surface waters	Design & construction phases	Monthly	No marginal cost	PMCES & PIU	contractor

Table 6 Impact mitigation plan for the Operating Period

Operation Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[6] (USD)	Supervision	Implementation
Operation of upgraded marina	Boat accidents due to increased	98. Dedicated shoreline lanes should be set for different boat type and sizes. Enforced speed limits for all boats should	At the marina	Fulltime	Biannual	O&M	DPWT	

[6] Costs will need to be updated by contractors.

Operation Period Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[6] (USD)	Supervision	Implementation
	traffic Water pollution from boaters & tourists	be posted in area. 99. Boats and tourists that use marina must be required to dispose of all garbage in dedicated bins at the marina. 100. Gas and oils should be kept away from water as much as possible						
Operation of all upgraded access roads	Increased traffic accidents & air pollution	101. Properly designed traffic calming devices like speed humps 102. Install signage with a speed limit of 30 km/h on all roads. 103. Police control of speed limits, vehicle roadworthiness, and driver license and alcohol use 104. Mandate regular vehicle inspections to ensure all vehicles kept in good working condition. 105. Upgraded access road drainage culverts or ditches must be regularly cleaned and maintained	All upgraded access roads	Biannually	Annually	O&M	DPWT	

V. MONITORING PLAN

24. The environmental monitoring plan for the subproject is provided in Table 6. The monitoring plan consists of environmental indicators, the sampling locations & frequency, method of data collection, responsible parties, and estimated costs. The purpose of the monitoring plan is to determine the effectiveness of the impact mitigations, to document any unexpected positive or negative environmental impacts of the subproject, and to determine the proper functioning of the components of the subproject. The indicative costs of monitoring are shown in Table 6.

A. Monitoring strategy

25. The strategy for monitoring some environmental parameters such as noise and dust levels is to conduct daily through *qualitative* observations, not periodic (e.g., quarterly) quantitative measurements that provide limited information and which require expensive laboratory analyses. When the common occurrence of dust on construction sites and along roads is observed by contractor staff or the public from for example truck traffic, excavation operations, or from wind-blown aggregate piles, the problem should be remediated immediately by the contractor with wetting agents that are on standby for quick and immediate application. Similarly, when noise levels are considered too high either qualitatively or from a portable onsite sound meter the equipment/vehicle producing the noise should be immediately checked for working condition and repaired immediately. Or, the equipment operation stopped and rescheduled.

26. Environmental standards for ambient water quality in urban areas in Lao PDR (Appendix B) are provided by the National Environmental Standards, No 81, dated 21 February 2017. The environmental standards provided by the Environmental, Health and Safety Guidelines of the IFC/World Bank (2007) (e.g., ambient air quality & noise) should be followed to supplement standards that are not provided by the Government.

27. An independent environmental monitoring institute (EMI) will be required to perform the surface water sampling and laboratory analyses that cannot be conducted by the IA, PMCES or contractors. The SS will coordinate with the EMI under the direction of the PMCES/PIU who will provide logistical support to the EMI where necessary. The PMCES will be given a budget for the EMI which will come from the loan. The budget for the work of the EMI will become the costs for monitoring which are estimated in Table 8.

1. Performance Monitoring

28. Performance monitoring is required to assess the overall performance of the EMP. A performance monitoring system is normally developed by the EA for the entire subproject. Selected 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 7.

2. Reporting

29. Regular reporting on the implementation of mitigation measures, and on monitoring activities during construction phase of the subproject is required. Reporting is the responsibility of PIU and should be conducted in conjunction with regular meetings with stakeholders as part of the continuation of stakeholder communications. The mitigation and monitoring plans (Tables 3 and 4) summarize proposed timing of reporting. A report on environmental monitoring and implementation of EMP will be prepared quarterly for the EA/PCU by the PIU. For the quarterly report the PIU report will compile monthly reports provided by the EO of contractor, the reports of the EMI on monitoring, and input from the IES/NES of the PMCES. The PIU reports will be

compiled into the semi-annual environmental safeguards monitoring report that the EA/PIU submits to the ADB and DONRE.

30. The reports will track all indicators measured in the EMP monitoring plan, including performance monitoring indicators (Table 7) and will include relevant Government environmental quality standards.

Table 7 Environmental monitoring plan

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility		Estimated Cost[7] (USD)
					Supervision	Implementation	
Just before Construction Commences - Update Baseline							
Remaining public and stakeholder issues and concerns of construction activities including construction schedule.	At District office of Nam Ngum.	Repeated community consultations	Once	Once	EA/PIU	PIU	$500.
Water quality in Nam Ngum reservoir lake and at port / boatlanding area: pH, oil & grease, TSS, turbidity, dissolved oxygen, BOD, Fe, Zn	Two sites on shoreline of Nam Ngum lake at the marina	Using methods approved by DONRE and implemented by Lao National University				EMI	$400.
Construction Phase subproject							
A) Water quality in Nam Ngum lake and at port: pH, oil & grease, TSS, turbidity, dissolved oxygen, BOD, Fe, Zn B) Qualitative dust and noise levels	A) Shoreline sites of pre-construction sampling Nam Ngum lake and at port B) B1.)Along all access roads to be upgraded. Monitor that noise levels does not exceed max. sound level (Lmax), of 115 dB(A).	A & B): Using field methods approved by DONRE. C) Visual inspections including complaints from local community or workers.	A) quarterly to end of construction	A): Quarterly	A – D): PMCES/PIU	A): EMI B - E): Contractor, & contractor to mitigate issue immediately	A): $3,000 B – E): As per Contractor BoQ

[7] Units costs of parameter analyses conducted for DED by Lao National University (Appendix D)

C) Qualitative level of unmanaged and uncontained worker (domestic) and construction solid waste. D) Public comments and complaints E) Incidence of worker or public accident or injury	B2.) Monitor that dust standards as defined in Ambient Air Quality Standard B3) Monitor vibrations during blasting or drilling at nearest vibration-sensitive receptor. C) All construction sites, worker camp living and pit latrine areas D) From all project-affected community areas, from hotline telephone number placed at all construction sites. E) At all construction areas	D) Information transferred by hotline telephone number, through GRM, and direct public complaint at construction site. E) Regular reporting by contractors	B - E) Continuously daily observations recorded	B – E): Monthly	E): EA/PIU E): EA/PIU	PIU and contractor, with issue addressed immediately PIU and contractor, with issue addressed immediately	
Operation of Completed Subproject							
Vehicle traffic accidents including boats Incidence of road flooding	Nam Ngum lake, and along upgraded subproject roads.	Regular record keeping.	Continuous	For each event	DPWT		O&M

Table 8 Performance monitoring indicators for subproject

Major Environmental Component	Key Indicator	Performance Objective	Data Source
Pre-construction Phase			
Public Consultation and Disclosure	Affected public and stakeholders	Continued meetings with stakeholders contacted during DED and through GRM	Minutes of meeting, and participants list
EMP	EMP finalized	No significant environmental contamination or problems	Contractor, EMI, and DPWT reports
Bid Documents	Completed with appended EMP [8]	EMP appended to bidding documents with clear instructions to bidders for CEMP	Bid documents
CEMP(s)	CEMP(s) prepared by contractor(s)	CEMP(s) reviewed and approved by PMCES/PIU	Bid documents and PMCES/PIU
Training of PIU/SS	Training course(s) & schedule	By end of preconstruction phase, required course(s) that will be delivered are designed and scheduled	Course(s) outline, participants, and schedule
Background quality of Nam Ngum Reservoir	Parameters identified in Monitoring Plan	Understanding basis for potential impact of construction at the marina	EMI
Construction Phase			
Air quality at along access roads	Qualitative dust, noise	Levels managed to minimum	contractor monitoring reports,
Public and worker safety	Frequency of incidents	Adherence to Government policy and site-specific procedures to prevent accidents	Contractor reports
Traffic	Frequency of disruptions, accidents, and blocked access	Disruptions, stoppages, or detours are managed to minimum.	Public input, contractor reports,
Operation of Completed Subproject			
Public safety	Incidence of traffic accidents on access road	No deviation from baseline frequency	DPWT

VI. ESTIMATED COST OF EMP

31. The marginal costs for implementing the EMP are primarily for environmental monitoring because the costs for implementing impact mitigation measures are included with the construction costs in contractor bid documents. The estimated costs for the implementation of the EMP summarized in Table 8. The costs of the qualitative environmental monitoring during construction phase is easily assumed by management overhead. The water sampling costs (USD) are based on the general parameter unit costs of the analyses conducted for comparable sub-projects under TIIGP2-LAO, including V4 (Appendix D).

32. An estimated budget of $5,000.00 is required for capacity building for environmental management in conjunction with other capacity development activities of the subproject. The costs will need to be updated by the PMCES in conjunction with the PIU just before the construction phase begins.

[8]Contractor Environmental Management Plan developed from EMP in contractor bidding document

Table 9: Estimated costs for environmental monitoring plan of EMP

Activity Type	Estimated Cost[9] (USD)
Pre-construction Phase	$900
Construction Phase	$3,000
Post-construction Operation Phase	$0.0
Capacity development and training	$5,000.00
Total	**$7,840.00**

VII. INSTITUTIONAL CAPACITY REVIEW AND NEEDS

33. Currently there is insufficient understanding, experience and capacity for environmental management among provincial and municipal authorities responsible. i.e., DICT / PIU for overseeing successful implementation of the EMP, and for environmental management of the completed subproject. The required capacity development and training of DICT / DPWT operation and management of completed subproject components will be developed by the future PMCES that will be retained by the project (Norconsult pers. communication, 2018) and beyond the scope here.

34. A dedicated environmental expert has been appointed to PIU/DICT/DPWT, which is a requirement for monitoring and ensuring environmental compliance, before, during and after the construction process. The PMCES (NES) with assistance from the SS of the subproject will develop and deliver training courses to the DICT/DPWT staff responsible for the implementation of the subproject. The purpose of the course(s) is to strengthen abilities of PIU to oversee implementation of the EMP by construction contractors, and EMI.

35. The SS who will be full-time environmental member of the PIU as well as the EO of the contractor should attend training courses as required. Costs for training should be included with costs for implementation of the EMP.

36. Training on the implementation of an EMP should address two thematic areas. The first area should introduce principles of environmental management focusing on the potential impacts of subproject activities on the natural and social environment. The second area should be environmental safeguard requirements of the ADB and the Government with specific focus on the preparation of an EMP, and contractor EMPs (CEMP). Table 9 lists the indicative course topics and target participants. The estimated budget of USD $5.000 is listed in Table 8.

Table 10. Indicative training on EMP Implementation

Course Topic Areas	Target Participants	Period
Introduction to EIA, Lao PDR EIA policy framework & procedures, and environmental standards, and ADB Safeguard Policy	EA, PIU/SS,	Pre-construction phase: shortly after PMCES is hired
Purpose and content of an EMP. Development and implementation of the EMP	EA, PIU/SS, contractor EOs	Construction phase shortly after

[9] To be updated with EMP at Detailed Design Phase

Course Topic Areas	Target Participants	Period
for subproject. Review of contractor CEMPs		construction packages are let
Protection of aquatic and terrestrial environment from road construction, and Mekong riverbank civil works	PIU/SS, contractor EOs	Construction phase shortly after construction packages are let
Grievance Redress Mechanism, & public consultation	EA/PIU/SS, contractor EOs, Nakasang and Det and Khone village leaders	Construction phase shortly after construction packages are let
Occupational and community health and safety	PIU/SS, contractor EOs	Construction phase shortly after construction packages are let
Traffic management and safety on roads	PIU	Operation phase shortly before subprojects are completed

VIII. EMERGENCY RESPONSE PLAN

37. The Contractor must develop emergency or incident response procedures during construction. In the operational phase the operator/civil authorities will have responsibility for any emergencies or serious incidents. The construction phase should ensure:

i) Emergency Response Team (ERT) of the Contractor as initial responder;
ii) District fire and police departments, emergency medical service, the Department of Public Health (DPH), collectively referred to as the External Emergency Response Team (EERT), as ultimate responders.

38. 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

Entity	Responsibilities
Contractor Team (ERT)	- 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 / helps during EERT's response operations.
External Emergency Response Team (EERT)	- Solves the emergency/incident
Contractor Resources	- 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.

39. 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.

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

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

i) subproject sites;
ii) construction time frame and phasing;
iii) any special construction techniques and equipment that will be used; i
iv) any hazardous materials that will be brought to and stored in the construction premise and details on their applications and handling/management system;
v) the Contractor's Emergency Management Plan
vi) names and contact details of the ERT members

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

i) their comments on the adequacy of the respective Emergency Management Plans
ii) their own assessment of what types, likely magnitude and likely incidence rate of potential hazards are anticipated
iii) the arrangements for coordination and collaboration.

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

i) set up the ERT;
ii) set up all support equipment and facilities in working condition
iii) make arrangements with the EERT;
iv) conducted proper training of ERT members, and encouraged and trained volunteers from the work force; v) conducted 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 vi) conducted drills for different possible situations.

44. 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

45. 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:

(i) 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.

(ii) 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.

(iii) When communicating/alerting an emergency to the EERT, it is important to provide them with at least: i) the type of emergency; 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.

46. For an effective reporting/alerting of an emergency:

(i) 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
- PIU Office, SS

(ii) 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.

(iii) Contractor's construction vehicles should also be equipped with the appropriate communication facilities.

B. Emergency Response Situations

47. The following tables suggest general procedures that will be finalized just before construction commences, and will be described in more detail in the Emergency Management Plans of the Contractor.

Table 12: Evacuation procedure

Procedure	Remarks
▪ Move out as quickly as possible as a group, but avoid panic.	▪ All workers/staff, sub-contractors, site visitors to move out, guided by the ERT.
▪ Evacuate through the directed evacuation route.	▪ The safe evacuation shall have been determined fast by the ERTL/Deputy ERTL & immediately communicated to ERT members.
▪ Keep moving until everyone is safely away from the emergency site and its influence area.	▪ A restricted area must be established outside the emergency site, all to stay beyond the restricted area.
▪ Once outside, conduct head counts.	▪ Foremen to do head counts of their sub-groups; ERTL/Deputy ERTL of the ERT.
▪ Report missing persons to EERT immediately.	▪ ERTL/Deputy ERTL to communicate with the EERT.
▪ Assist the injured in evacuation & hand them over to the ERT first-aiders or EERT medical group	▪ ERT to manage injured persons to ensure proper handling.

Procedure	Remarks
▪ If injury warrants special care, DO NOT MOVE them, unless necessary & instructed/directed by the EERT.	▪ ERTL/Deputy ERTL communicates with EERT to get instructions/directions in handling the injured.

Table 13: Response procedure during medical emergency

Procedure	Remarks
▪ Administer First Aid regardless of severity immediately.	▪ 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.
▪ Call the EERT emergency medical services and/or nearest hospital.	▪ ERTL/Deputy ERTL or authorized on-site emergency communicator
▪ Facilitate leading the EERT to the emergency site.	▪ 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.
▪ If applicable, vacate site & influence area at once, restrict site, suspend work until further notice.	▪ Follow evacuation procedure.

Table 14: Response procedure in case of fire

Procedure	Remarks
▪ Alert a fire situation.	▪ Whoever detects the fire shall immediately: - call the attention of other people in the site, - sound the nearest alarm, and/or - 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 to the ERTL/Deputy ERTL.

Procedure	Remarks
▪ Stop all activities/operations and evacuate.	▪ All (non-ERT) workers/staff sub-contractors, site visitors and concerned public to move out to safe grounds following the evacuation procedure.
▪ Activate ERT to contain fire/control fire from spreading.	▪ 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.
▪ Call the nearest fire & police stations &, if applicable, emergency medical services.	▪ When alerting the EERT, ERTL will give the location, cause of fire, estimated fire alarm rating, any injuries.
▪ Facilitate leading the EERT to the emergency site.	▪ 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.
▪ ERT to vacate the site as soon as their safety is assessed as in danger.	▪ Follow appropriate evacuation procedure.

APPENDIX A: INDICATIVE RESPONSIBILITIES OF KEY MANAGEMENT UNITS OF EMP

EMP Implementation organizations	Roles and Responsibilities
Executing agency (EA) (MICT)	➢ Overall responsibility for the execution of the project ➢ Reviews the project implementation progress ➢ Reviews and endorses any proposed change in the project scope or implementation arrangements ➢ Supervises compliance with loan covenants
Project Coordination Unit (PCU), inside MICT	➢ Project preparation, including the setting up of financial and management systems and procedures, and the procuring of PCU office equipment ➢ Consultant recruitment and supervision ➢ Review and approval of goods and civil works contracts, including bid documents ➢ Coordination between the concerned agencies at the national and provincial levels ➢ Coordination of activities of the PIUs and the inputs of concerned stakeholders ➢ Coordination of all reporting aspects of the project ➢ Coordination of institutional strengthening measures ➢ Ensuring compliance with ADB Loan covenants, assurances and safeguard requirements, as well as with national and provincial policies and regulations ➢ Provision of administrative and technical support to the PIUs ➢ Preparation of consolidated Project accounts to be forwarded to ADB ➢ Advice to PIUs on revenue-enhancing activities related to the recovery of costs of constructing, operating, and maintaining Project facilities and equipment; ➢ Coordination of project audits ➢ All specified monitoring, evaluation and reporting activities ➢ Communication of Project's outcomes, outputs, and activities to all stakeholders ➢ Provide coordination for safeguards and monitoring for PIU
Provincial Project Steering Committee (PPSC)	➢ Ensuring that concerns of all stakeholders are adequately reflected in the project ➢ Coordination of project implementation between the concerned agencies ➢ Confirming compliance with local regulations and provincial policies ➢ Overseeing budgeting and disbursement of counterpart funds ➢ Overseeing implementation of resettlement plans, compensation schemes and all other project safeguard procedures
Project Implementation Units (PIU) DICT, DPWT	➢ Coordination and supervision of consultants' inputs on the appraisal of feasibility studies, and conceptual and detailed designs construction ➢ Procurement of goods and civil works contracts, including the preparation of bid documents and bid evaluations ➢ Approving payments to contractors and maintaining disbursement records ➢ Ensuring that institutional-strengthening and capacity-building initiatives involving DMOs, private partners, SMEs and CBTOs are implemented in line with agreed Project designs, schedules and budgets ➢ Ensuring compliance with loan covenants and assurances in respect of all sub projects, including updating of IEEs, EMPs, IPPs, GAPs, resettlement plans ➢ Oversee implementation of EMP by contractor EO, and EMI ➢ Prepare quarterly reports on EMP implementation for PCU ➢ Coordinate with PMCES to design and deliver capacity development & training. ➢ Meetings with all concerned stakeholders ➢ Quarterly progress and monitoring-and-evaluation reporting to the PCU
Project Management & Supervision Consultant (PMCES)	➢ Completes detailed designs of subprojects with PIU ➢ Update EMP to meet final detailed designs of subprojects ➢ Supervises and assists PIU with contractor management

EMP Implementation organizations	Roles and Responsibilities
	➢ Provides technical advice and support when needed to PIU and EMI ➢ Designs and oversees delivery of all training and capacity development of PIU for construction and operation of completed subprojects including EMP. ➢ Provides advisory role for implementation of EMP by PIU and EMI
Environmental Monitoring Institute(EMI)	➢ Implements environmental sampling for EMP ➢ Conducts laboratory analyses of environmental quality samples from field sampling ➢ Prepares periodic monitoring reports for PIU
Environmental Officer (EO) of Contractor	➢ Implements the CEMP for the construction phase ➢ Maintains a daily log of environmental issues at the construction sites ➢ Prepares brief monthly summaries of mitigation activities and environmental issues at constructions site to PIU.
ADB	➢ Assists PCU through timely guidance at each stage of project implementation following agreed implementation arrangements ➢ Review all documents that require ADB approval ➢ Review of monitoring reports on EMP implementation to ensure EMP meets SPS (2009) ➢ Approval of procurement activities ➢ Periodic project review missions, a mid-term review and a completion mission for the project ➢ Ensuring compliance of all loan covenants ➢ Timely processing of withdrawal applications and release of eligible funds ➢ Ensuring compliance of financial audit recommendations ➢ Regularly updates project information disclosure on the ADB website

APPENDIX B: REFERENCE ENVIRONMENTAL STANDARDS

Water Resources and Environment Administration No 2734 / PMO.WREA (now MONRE)
Vientiane, 7 Dec 2009

Agreement on the National Environmental Standards

Based on the Environmental Protection Law No. 02/99/NA, dated 3 April 1999.
Based on decree on mandate of Water Resources and Environmental Administration dated 149/PM, dated 10 May 2007.

Surface water quality standards in Lao PDR

No	Substances	Symbol	Unit	Standard Value	Method of Measurement
1	Color, Odor and Taste	-	-	N	-
2	Temperature	t	°C	N'	Thermometer
3	Potential of Hydrogen	pH	-	5-9	Electronic pH Meter
4	Dissolved Oxygen	DO	mg/l	6	Azide Modification
5	COD	COD	ml/l	5	Potassium permanganate
6	BOD_5	BOD_5	mg/l	1,5	Azide Modification at 20 degree C, 5 days
7	Total Coliform Bacteria	Coliform Bacteria	MPN/100 ml	5000	Multiple Tube Fermentation
8	Fecal Coliform Bacteria	Fecal Coliform	MPN/ 100 ml	1000	
9	Nitrate-Nitrogen	NO_3-N	mg/l	<5.0	Cadmium Reduction
10	Ammonia-Nitrogen	NH_3-N	mg/l	0.2	Distillation Nesslerization
11	Phenols	C_6H_3-OH	mg/l	0.005	Distillation, 4-Amin anti-pyrenne
12	Copper	Cu	mg/l	0.1	Atomic Absorption Direct Aspiration
13	Nickel	Ni	mg/l	0.1	
14	Manganese	Mn	mg/l	1.0	
15	Zinc	Zn	mg/l	1.0	
16	Cadmium	Cd	mg/l	0.005	
17	Chromium, Hexavalent	Cr^{6+}	mg/l	0.05	
18	Lead	Pb	mg/l	0.05	
19	Mercury	Hg	mg/l	0.002	Atomic Absorption Cold Vapor

No	Substances	Symbol	Unit	Standard Value	Method of Measurement
20	Arsenic	As	mg/l	0.01	Atomic Absorption Direct Aspiration
21	Cyanide	CN^-	mg/l	0.005	Pyridine-Barbituric
22	Alpha ¬Radioactive	α	Becquere l/l	0.1	Counting machine
23	Beta ¬ Radioactive	β	Becquere l/l	1.0	
24	Total Organochlorine	-	mg/l	0.05	Gas Chromatography
25	DDT	$C_{14}H_9Cl_5$	mg/l	1.0	
26	Alpha -BHC	αBHC	mg/l	0.02	
27	Dieldrin	$C_{12}H_8Cl_6O$	mg/l	0.1	
28	Aldrin	-	mg/l	0.1	
29	Heptachlor and Heptachlor Epoxide	-	mg/l	0.2	
30	Endrin	-	mg/l	None	

Drinking Water Quality Standards

Bacteriological Parameters

Parameters	Units	Concentration
Fecal Coliform	MPN/100ml	0
Total Coliform	MPN/100ml	<2.2
Entero virus	MPN/100ml	0

Physical -Chemical Parameters

No.	Parameters	Symbol	Unit	Concentration	
				Minimum	Maximum
1	Aluminum	Al	mg/l	0.1	0.2
2	Ammonia	NH_3	mg/l	0.5	1.5
3	Chloride	Cl^-	mg/l	200	250
4	Copper	Cu	mg/l	1.0	2.0
5	Iron	Fe	mg/l	0.3	<1
6	Manganese	Mn	mg/l	0.1	0.5
7	Sodium	Na	mg/l	200	250
8	Sulphate	SO_4^{2-}	mg/l	200	250
9	Hydrogen Sulphide	H_2S	mg/l	0.05	0.1
10	Conductivity	Ec	µs/cm	-	<1,000
11	Total dissolved solids	TDS	mg/l	500	600
12	Sodium Chloride	NaCl	mg/l	100	300-350
13	Potential of Hydrogen	pH	-	6.5	8.5
14	Temperature	T	^0C	25	35
15	Hardness	-	mg/l	50	300
16	Turbidity	-	NTU	-	<10
17	Taste and Odor	-	-	-	Acceptable
18	Color	-	TCU	-	5

19	Residual Chloride (if Chlorine disinfection is used)	Cl_2	mg/l	-	<0.2

Health Significant Chemical Parameters

No.	Parameters	Symbol	Unit	Maximum Concentration
1	Antimony	Sb	mg/l	0.005
2	Arsenic	As	mg/l	0.01-0.05
3	Barium	Ba	mg/l	0.7
4	Boron	B	mg/l	0.50
5	Cadmium	Cd	mg/l	0.003
6	Chromium	Cr	mg/l	0.05
7	Cyanide	CN^-	mg/l	0.07
8	Fluoride	F^-	mg/l	1.5
9	Lead	Pb	mg/l	0.01
10	Mercury	Hg	mg/l	0.001
11	Nitrate	NO^-_3	mg/l	50
12	Nitrite	NO^-_2	mg/l	3
13	Selenium	Se	mg/l	0.01

A. Priority Parameters

No.	Parameters	Symbol	Unit	Maximum Concentration
1	Iron	Fe	mg/l	<1
2	Manganese	Mn	mg/l	<0.5
3	Arsenic	As	mg/l	<0.05
4	Fluoride	F^-	mg/l	<1.5
5	Nitrate	NO_3^-	mg/l	50
6	Nitrite	NO_2^-	mg/l	3
7	Nitrite Nitrogen	NO_2^-N	mg/l	1
8	Potential of Hydrogen	pH	-	6.5-8.5
9	Coliform	-	MPN/100ml	0
10	Conductivity	Ec	µs/cm	1000
11	Residual Chloride (if Chlorine disinfection is used)	Cl_2	mg/l	0.2
12	Total Hardness	-	mg/l	<300
13	Turbidity	-	NTU	<10
14	Taste and Odor	-	-	Acceptable

Groundwater Standards for Drinking Purposes

Characteristics	Parameters	Symbol	Unit	Permitted Standard Value	
				Suitable	Maximum
Physical	1. Color	-	Platinum-Cobalt (Pt-Co)	5	15
	2. Turbidity	-	JTU	5	20
	3. Potential of Hydrogen	pH	-	7.0-8.5	6.5-9.2
Chemical	4. Iron	Fe	mg/l	≤0.5	1
	5. Manganese	Mn	mg/l	≤0.3	0.5
	6. Copper	Cu	mg/l	≤1.0	1.5
	7. Zinc	Zn	mg/l	≤5.0	15
	8. Sulphate	SO_4^{2-}	mg/l	≤200	250
	9. Chloride	Cl^-	mg/l	≤250	600
	10. Fluoride	F^-	mg/l	≤0.7	1
	11.Nitrate	NO_3^-	mg/l	≤15	45
	12. Total Hardness as CaCO3	Total $CaCO_3$	mg/l	≤300	500
	13.Non-carbo-nate hardness as CaCO3	Non $CaCO_3$	mg/l	≤200	250
Toxic chemical substances	14. Total solids	TS	mg/l	≤600	1,200
	15. Arsenic	As	mg/l	None	0.05
	16. Cyanide	CN^-	mg/l	None	0.1
	17. Lead	Pb	mg/l	None	0.05
	18. Mercury	Hg	mg/l	None	0.001
	19. Cadmium	Cd	mg/l	None	0.01
	20. Selenium	Se	mg/l	None	0.01
Bacteria	21. Coliform bacteria	Coliform	MPN/100 ml	<2.2	<2.2
	22. E. coli bacteria	E. coli	-	None	None
	23. Standard plate count	-	Colonies/ml	≤500	-

Soil Quality Standards for Residential and Agriculture

No.	Substances	Symbol	Unit	Standard Value	Method of Measurement
I. Volatile Organic Compound					
1	Benzene	C_6H_6	mg/kg	0.5	Gas Chromatography or Gas Chromatography/. Mass Spectrometry (GC/MS) or other methods approved by DONRE
2	CarbonTetrachloride	CCI_4	mg/kg	89	
3	1,2 Dichloroethane	CH_2CI-CH_2CI	mg/kg	230	
4	1,1 Dichloroethylene	$CCI_2=CH_2$	mg/kg	1,700	
5	Cis 1,2 Dichloroethylene	CHCl=CHCl	mg/kg	57	
6	Trans-1.2-Dichloroethylene	CHCl=CHCl	mg/kg	520	
7	Dichloromethane	CH_2CI_2	mg/kg	28	
8	Ethly benzene	lC_2ClC-CH_3	mg/kg	630	
9	Styrene	C_6H_5-$CH=CH_2$	mg/kg	8.4	
10	Tetrachloroethylene	C_2Cl_4	mg/kg	210	
11	Toluene	C_6H_5-CH_3	mg/kg	6.5	
12	Trichloroethylene	$CI_2C=CHCI$	mg/kg	2.5	
13	1.1.1 Trichloroethane	CI_3C-CH_3	mg/kg	3.5	
14	1.1.2 Trichloroethane	CI_2CH-CH_2CI	mg/kg	43	
15	Total Xylenes	(CH_3-C_6H_4-CH_3)	mg/kg	63	
II. Heavy Metals					
1	Arsenic	As	mg/kg	3.9	Inductively Coupled Plasma-Atomic Emission Spectrometry or Inductively Coupled Plasma-Mass Spectrometry or Atomic Absorption, Gaseous Hydride or Atomic Absorption, Borohydride Reduction or other Methods Approved by DONRE
2	Cadmium and its compounds	Cd	mg/kg	37	
3	Hexavalent Chromium	Cr^{+6}	mg/kg	300	Coprecipitation or Colorimetric or Chelation/ Extraction or other Methods Approved by DONRE
4	Lead	Pb	mg/kg	400	Inductively Coupled Plasma-Atomic Emission

5	Manganese and its compounds	Mn	mg/kg	1,800	Spectrometry or Inductively Coupled Plasma-Mass Spectrometry or Atomic Absorption, Direct Aspiration or Atomic Absorption, Furnace Techniques or other Methods Approved by DONRE
6	Mercury and its compounds	Hg	mg/kg	23	Cold-Vapor Technique or other Methods Approved by DONRE
7	Nickel, soluble salts	Ni	mg/kg	1,600	Inductively Coupled Plasma-Atomic Emission Spectrometry or Inductively Coupled Plasma-Mass Spectrometry or Atomic Absorption, Direct Aspiration or Atomic Absorption, Furnace Techniques or other Methods Approved by DONRE
8	Selenium	Se	mg/kg	390	
III. Pesticides					
1	Atrazine	$C_8H_{14}ClN_5$	mg/kg	22	Gas Chromatography or other Methods Approved by DONRE
2	Chlordane	-	mg/kg	16	Gas Chromatography/ Mass Spectrometry (GC/MS) or other Methods Approved by DONRE
3	2,4 D	-	mg/kg	690	Gas Chromatography or High Performance Liquid Chromatography/ Thermal Extraction/ Gas Chromatography/Mass Spectrometry (TE/GC/MS) or other Methods Approved by DONRE
4	DDT	DDT	mg/kg	17	Gas Chromatography or Gas Chromatography/ Mass Spectrometry (GC/MS) or other Methods Approved by DONRE
5	Dieldrin	$C_{12}H_8Cl_6O$	mg/kg	0.3	
6	Heptachlor	Cl_7	mg/kg	1.1	
7	Heptachlor Epoxide	-	mg/kg	0.5	
8	Lindane	-	mg/kg	4.4	
IV. Others					
1	Benzo(a)pyrene	-	mg/kg	0.6	Gas Chromatography/ Mass Spectrometry (GC/MS) or Thermal Extraction Gas Chromatography/ Mass Spectrome-

No.	Substances	Symbol	Unit	Standard Value	Method of Measurement

					try (TE/GC/MS) Chromatography/ Fourier Transform Infrared (GC/FT-IR) Spectrometry or other Methods Approved by DONRE
2	Cyanide and its compounds	CN^-	mg/kg	11	Total and Amenable Cyanide: Distillation, or Total Amenable Cyanide (Automated Colorimetric, with off-line Distillation), or Cyanide Extraction Procedure for Solids and Oils or other Methods Approved by DONRE
3	PCBs	-	mg/kg	2.2	Gas Chromatography or other Methods Approved by DONRE
4	Vinyl Chloride		mg/kg	1.5	Gas Chromatography or Gas Chromatography/ Mass Spectrometry (GC/MS) or other Methods Approved by DONRE

Ambient Air Quality Standard

Parameters	Symbol	Average Time Unit: mg/m3					Method of Measurement
		Hours			1 month	1 year	
		1 hr	8 hr	24 hr			
Carbon monoxide	CO	30	10.26	-	-	-	Non dispersive infrared detection
Nitrogen dioxide	NO_2	0.32	-	-	-	-	Chemilumine scene method
Sulphur dioxide	SO_2	0.78	-	0.30	-	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	-	-	-	-	Chemiluminescence or UV Absorption Phoptometry
Lead	Pb	-	-	-	1.5	-	Atomic Absorption Spectrometer

Noise Standard

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

Noise Standards for Other Places

Type of Area	Standard Value in dB(A)		
	6.00-18.00	18.00-22.00	22.00-6.00
Quiet areas: hospitals, libraries, treatment places, kindergarten and schools	50	45	40
Residential areas: hotels and houses	55	55	45
Commercial and service areas	70	70	50
Small industrial factories located in residential areas	70	70	50

General Industrial Wastewater Discharge Standards
Standards for General Industries

No.	Parameters	Symbols	Unit	Maximum Concentration
1	BOD_5	BOD_5	mg/l	40
2	Ammonia Nitrogen	NH_3-N	mg/l	4
3	Total Suspended Substances	TSS	mg/l	40
4	Potential of Hydrogen	pH	-	6-9.5
5	Total Dissolved Substances	TDS	mg/l	3,500
6	Phenols	C_6H_5OH	mg/l	0.3
7	Phosphorous	P	mg/l	1.0
8	Silver	Ag	mg/l	0.1
9	Zinc	Zn	mg/l	1.0
10	Sulphide	S	mg/l	1.0
11	Free Chlorine	Cl_2	mg/l	1.0
12	Chloride	Cl^-	mg/l	500
13	Iron	Fe	mg/l	2.0

14	Fluoride	F	mg/l	15
15	Cyanide	CN^-	mg/l	0.1
16	Copper	Cu	mg/l	0.5
17	Lead	Pb	mg/l	0.2
18	Oil and Grease	-	mg/l	5
19	Nickel	Ni	mg/l	0.2
20	Mercury	Hg	mg/l	0.005
21	Manganese	Mn	mg/l	1.0
22	Arsenic	As	mg/l	0.25
23	Barium	B	mg/l	1.0
24	Cadmium	Cd	mg/l	0.03
25	Chromium	Cr^{+6}	mg/l	0.1
26	Total Chromium	Total Cr	mg/l	0.5

Wastewater Discharge Standards from the Urban Area
Wastewater Discharge Standards

No.	Parameters	Symbol	Standards				
			A	B	C	D	E
1.	Biochemical Oxygen Demand	BOD_5	Not more than (mg/l)				
			30	40	50	60	200
2.	Suspended Solids	SS	Not more than (mg/l)				
			30	40	50	50	60
3.	Settle able Solids	-	Not more than (mg/l)				
			0.5	0.5	0.5	0.5	-
4.	Total Dissolved Solids	TDS	Not more than (mg/l)				
			3000	2500	2000	1500	-
5.	Chemical Oxygen Demand	COD	Not more than (mg/l)				
			120	130	150	350	400
6.	Sulphide	S^{2-}	Not more than (mg/l)				
			1.0	1.0	3.0	4.0	-
7.	Total Kjeldahl Nitrogen	TKN	Not more than (mg/l)				
			35	35	40	40	-
8.	Fat Oil and Grease	-	Not more than (mg/l)				
			20	20	20	20	100
9.	Temperature	t	Not more than (degree Celsius)				
			40	40	40	40	40
10.	Potential of Hydrogen	pH	Not more than				
			6-9.5	6-9.5	6-9.5	6-9.5	6-9.5

APPENDIX C: INDICATIVE PLAN FOR REMAINING PUBLIC CONSULTATION

Organizer / support	Format	Frequency	Topic	Attendees
Just Before Commencement of Construction				
PIU / PMCES	Same public consultation format used during FS and DED stages, including site visits and informal interviews as needed	Once just before construction commences (public meetings), and as needed (site visits, informal interviews with business persons including Mekong fishers) and thereafter during construction phase as needed	Presentation of planned construction activities and schedule; anticipated impacts and mitigation measures; and GRM	Same affected households, district representatives, and participants from consultations for DED.
Operational Stage				
PIU / PMCES	Public consultation and site visits	Once in the first year	Effectiveness of mitigation measures, impacts of operation, comments and suggestions	Same affected households, district representatives, participants from consultations of DED
PMCES / PIU	Public satisfaction survey if desired or needed	Once just before Project Completion Report (PCR) issued	Public satisfaction with EMP implementation comments and suggestions	Same affected households, district representatives, participants from consultations of DED

APPENDIX D: UNITS COSTS FOR WATER QUALITY ANALYSES

Lao National University Unit Costs

	Parameters	Unit Cost (US$)
1	Temperature	7.00
2	pH	7.00
3	Conductivity EC	15.00
4	Chemical Oxygen Demand $(COD)_{Cr}$	15.00
5	Total Dissolves Suspended (TDS)	15.00
6	Arsenic (As)	27.00
7	Cadmium (Cd)	20.50
8	Iron (Fe)	20.50
9	Lead (Pb)	20.50
10	Zine (Zn)	20.50
11	Copper (Cu)	20.50
12	Oil and grease	20.50
13	Total and faecal coliform bacteria (MPN)	23.50
14	Total Nitrogen (T-N)	16.00
15	Ammonia ion (NH_4^+)	13.00
16	Nitrate (NO_3^-)	13.00
17	Nitrite (NO_2^-)	13.00
18	Total Phosphorus (T-P)	16.50
19	Phosphate (PO_4^{3-})	16.50
20	Hydrogen sulphide H2S	13.00
21	Subtotal	333.50
5% Management fee of Faculty of Natural Science (FNS)		16.68
	TOTAL	350.18