

Environmental Management Plan

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

Vientiane Province:
Vang Vieng Landfill Improvements

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

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ABBREVIATIONS

ADB	Asian Development Bank
DPWT	Department of Public Works and Transport
DONRE	Department of Natural Resources and Environment
EA	Executing Agency
ECC	Environmental Compliance Certificate
EIA	Environment Impact Assessment
EMI	Environmental Monitoring Institute
EMP	Environment Management Plan
EMR	Environmental Monitoring Report
EERT	External Emergency Response Team
ERT	Emergency Response Team
ERTL	Emergency Response Team Leader
EO	Environmental Officer
IA	Project Implementing Agency
GMS	Greater Mekong Sub-Region
GPS	Global Positioning System
IEE	Initial Environmental Examination
MONRE	Ministry of Natural Resources and Environment
MPWT	Ministry of Public Works and Transport
O&M	Operation and Maintenance
PCU	Project Coordinating Unit
PIU	Project Implementation Unit
PMCES	Project Management & Civil Engineering Support Consultant
SS	Safeguard Specialist
UDAA	Urban Development and Administration Authority
USD	United States Dollar
UXO	Unexploded Ordnance

WEIGHTS AND MEASURES

km	Kilometre
kg	Kilogram
ha	Hectare
mm	Millimeter

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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 improve solid waste management in Vang Vieng, 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 of the updated IEE.
2. The primary purpose of the EMP for the Vang Vieng subproject 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 contractors to prepare their construction EMPs (CEMP) which they must include with their bids for construction package(s).
3. The EMP will be appended to contractor tender documents. The CEMPs will prescribe the mitigation and monitoring requirements for which contractors are responsible for their specific construction packages. The CEMPs will be reviewed and approved by the Project Management and Civil Engineering Support Consultant (PMCES) and Project Implementation Unit (PIU).

Subproject components

4. The improvements to solid waste management in Vang Vieng consist of the following two main components:
 - (i) upgrading of existing town dumpsite to a modern sanitary landfill (SLF); and
 - (ii) improvements to solid waste and septage collection and management in Vang Vieng and vicinity.
5. The SLF will consist of the following main components:
 - (i) four lined waste cells to be constructed serially over time;
 - (ii) a leachate collection and treatment system;
 - (iii) a septage treatment system;
 - (iv) a hazardous waste disposal cell;
 - (v) a materials recovery facility (MRF) to modernize waste recycling;
 - (vi) office, utility/storage buildings, and onsite waste loaders/movers; and
 - (vii) an upgraded 0.8km concrete access road to SLF.
6. Improved solid waste and septage collection will consist of:
 - (i) new compactor and vacuum trucks;
 - (ii) urban garbage bins of various sizes;
 - (iii) expanded catchment for solid waste collection;
 - (iv) new staff to work with operator (UDAA) of SLF; and
 - (v) training and capacity development of existing and new solid waste management staff.

II. SUMMARY INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

7. The primary management framework for the implementation of the environmental management plan (EMP) is summarized below. The Ministry of Information Culture and Tourism (MICT), the executing agency (EA) for the project, will take overall responsibility for the EMP. The EA will establish a Vientiane-based Project Coordination Unit (PCU) within the Tourism Development Department of MICT which, among other things, will appoint a Safeguards and Monitoring Coordination Officer for the EMP.

8. The Implementing Agencies (IA) are comprised the provincial Department of Information, Culture and Tourism (DICT), Department of Public Works and Transport (DPWT), and the Vang Vieng Urban Development Administration Authority (UDAA). A Project Steering Committee (PSC) will be established to provide policy and compliance oversight, comprised representatives from the DICT, DPWT, Department of Finance (DOF), Department of Planning and Investment (DFI), Department of Natural Resources and Environment (DONRE), UDAA, and representatives of other departments and agencies as required.

9. The Project Implementation Unit (PIU) resides in the Vang Vieng UDAA with support from Vientiane Provincial DPWT. The PIU will appoint a Safeguard Specialist, to be responsible for day-to-day implementation of the EMP. The PCU will coordinate inter-agency safeguard support to the PIU, and will liaise with the ADB on safeguard reporting and issues.

10. The PIU's Safeguards Specialist will oversee the work of the contractor's Environmental Officer (EO) for implementation of the contractor construction EMP (CEMP) for the construction package. External support to the PIU for implementation of the EMP will be provided by the Project Management and Civil Engineering Support Consultant's (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.

11. 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.

12. 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.

13. 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

14. 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 CEMP 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.
15. 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
16. The responsibilities of Environmental Officer (EO) of Contractor include:
- Oversee implementation of the contractor's CEMP for construction phase of subproject; and
 - Prepare and submit monthly reports on mitigation and monitoring activities of CEMP and any environmental issues at construction sites.
17. 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.
18. The Department of Natural Resources and Environment (DONRE) is the provincial agency which oversees environmental management of Vientiane province. The DONRE with District staff provides direction and support for environmental protection-related matters including application of the Law on Environmental Protection No. 02/99/NA (1999), EIA, and environmental standards.

19. The 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).

A. Worker and Community Health and Safety

20. 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.

21. Based on the New Global Strategies in Occupational Safety and Health (OSH) developed by the International Labour Organization (ILO) in 2003 the Ministry of Labour and Social Welfare (MLSW) of Government is currently developing the Lao PDR National OSH Programme¹. To facilitate the development of the OSH the National Occupational Health & Safety Programme (2005-2010) was initiated. However, the OHS specifications for Lao PDR need to be supplemented as needed by the OHS directives of the IFC EHS Guidelines for Construction and Decommissioning, Toll Roads, and Waste Management Facilities

22. 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 policy 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, Waste Management Facilities, 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 from the World Health Organization (WHO) on COVID-19 prevention and control.

23. DONRE with District staff provides direction and support for environmental protection-related matters including application of the Law on Environmental Protection No. 02/99/NA (1999), EIA, and environmental standards.

24. The ADB assists the PCU with timely guidance at each stage of project implementation following agreed implementation arrangements, and will review and approve 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.

B. Regulatory Framework and Guidelines for Vang Vieng Subproject

25. Specific regulations and guidelines for the solid waste management subproject in Vang Vieng are summarized in Table 1. Reference environmental standards for Lao PDR are found in Appendix B.

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

Table 1: Regulations and guidelines applicable to Vang Vieng subproject.

Solid Waste Management
<ul style="list-style-type: none"> • Decree No 520 / TCPC, (dated 23 Feb 2007), on Disposal Site Selection, Design, and Management, Articles 4-10, • Draft Decree on SWM (2009) [not approved in 2018].
Road Upgrades
<ul style="list-style-type: none"> • 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
Occupational and Public Health and Safety
<ul style="list-style-type: none"> • MSLW, Lao PDR Occupational, Safety, and Health Guidelines Programme, Draft 2005-2010 • IFC/World Bank, 2007. Environment, Health, and Safety Guidelines (EHS) for Waste Management Facilities, Toll Roads, and Construction and Decommission
Environmental Standards
<ul style="list-style-type: none"> • Agreement on National Environmental Standards, Order No. 2734/PMO-MONRE, 7 Dec 2009. Appendix B excerpts standards relevant to the Vang Vieng subprojects

III. SUMMARY OF POTENTIAL IMPACTS

26. The potential environmental impacts of improvements to solid waste management in Vang Vieng 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 Consultation

27. The second series of public consultations on the DED of subproject were conducted in Vang Vieng in October 2018. The issues and concerns of the consultations which are reported in the updated IEE are addressed by the EMP. Input from stakeholders on the subproject will continue through to the operational phase of the completed SLF which is summarized in Appendix C.

Table 2: Summary of potential impacts of solid waste subproject in Vang Vieng

Pre-construction Phase
<ul style="list-style-type: none"> • None, no resettlement or land acquisition compensation is required, however compensation for loss of income and transition allowance for vulnerable households (waste pickers) will be provided. (please refer to EGDRP for details)
Construction Phase
<ul style="list-style-type: none"> • dust and noise, • potential contamination of soil and the adjacent seasonal stream from possible erosion and heavy equipment maintenance that is too close to stream, • solid and liquid construction waste, • increased risk of traffic and risk of traffic accidents, • reduced local access to the area, • increased risk of public and worker injury, • periodic local drainage and flooding events, • possible disruption of waste picking and recycling, • contamination of groundwater from the excavations of waste cells, • depending on outside worker population, potential social problems with local community. • No external borrow pits will be required during construction because all required soil will be obtained on site of SLF
Operation Phase
<ul style="list-style-type: none"> • contamination of groundwater by new waste cells and leachate treatment system • increased traffic and risk of traffic accidents, noise and dust along upgraded access road.

IV. MITIGATION PLAN

28. The impact Mitigation Plan for solid waste management improvements in Vang Vieng is presented in Table 3. The tabled Mitigation Plan identifies potential impacts, required mitigations, responsible parties, location, timing, and any indicative costs. The potential impacts identified in Table 3 elaborate the impacts summarized in Table 2 above which are taken directly from the updated IEE.

29. Note that Mitigation Plan of Table 3 indicates that the responsibilities of the contractor(s) for implementation of the Mitigation Plan are essentially restricted to the mitigation subplans of the Construction Phase, with the IA, and PMCES being responsible for the implementation of the mitigations measures of the Pre-construction and Operation Phases. This distinction will assist the contractors to identify the mitigation activities and subplans for which they are responsible to finalize and implement.

30. The CEMP to be developed by the contractor prior to the construction phase, must relate to the mitigation measures and plan for monitoring of these as described in this EMP. The CEMP must furthermore detail additional measures, that may be identified. This may include, but not be limited to the siting of sources of materials (i.e. borrow pits, quarries and batching plants), disposal areas, construction camps, utilities and other related construction activities.

Table 3: Impact mitigation plan

Subproject Activity	Potential Environmental Impacts	Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost ² (USD)	Responsibility	
							Supervision	Implementation
Before construction commences								
Disclosure, & re-engagement of community	No community impacts	1. Confirm initiation Information Disclosure and Grievance Redress Mechanism of IEE and distribute construction activity schedule to affected community and businesses including waste pickers at dumpsite to allow continued waste picking/recycling.	For all construction sites.	A few weeks before construction starts	once	No marginal cost ³	IA/PIU	PIU
Government approvals	No negative impact	2. Confirm with DONRE for required project permits and certificates.	Entire subproject	Before construction begins	once	No marginal cost	PIU/DONRE	DONRE
Contact current waste pickers at dumpsite	No negative impact on waste pickers	3. Inform waste pickers of future training and placement at future new MRF.	Existing dumpsite	Before construction	As required	No marginal cost	PMCES/PIU	PMCES/PIU
Final design of subproject,	Minimize negative environmental impacts	4. PMCES ⁴ to ensure the following management measures are organized and in place: a) identification of spill management prevention plans, and emergency response plans for all construction activities at new SLF site and along access road; b) locate possible concrete batch plant location for access and internal roads at least 300m from all local villages 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 road and NR-13 with set contingency alternate routes/detours planned. f) erect/install signage at intersection of access road and along NR-13 to warn public and motorists of construction schedule along access road and at new SLF site, and of increased vehicle traffic along NR-13.	Final siting	Before construction initiated	Once with final designs documents	No marginal cost	PMCES/EA	PMCES/PIU
		5. Review and ensure climate change mitigation and	Capped existing					

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 supervision consultant to be determined

		resilience measures of DED are integrated with subproject implementation.	waste cell. Peripheral drainage of SLF and access road drainage					
Final EMP	Positive environmental impacts	6. Finalize IEE and this EMP where necessary to meet any late changes to subproject final design to protect affected environments. If there are changes, submit the revised 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	No negative impact	7. Notify DONRE, DPWT to confirm locations of sites for disposal areas for construction waste for subproject, and obtain required permits.	Entire subproject	Before construction	As required	No marginal cost	PIU/DONRE/DAF/DICT	PIU
UXO survey, & removal	Injured worker or public	8. Ensure Government and UXO LAO is consulted and clears areas where necessary at SLF property and along access road	All construction sites.	Beginning of subproject	Once	See Monitoring Plan below	EA/PIU	UXO LAO
Develop bid documents	No negative environmental impact	9. Ensure this updated EMP is included in contractor tender documents, and that tender documents specify requirement for site-specific, budgeted CEMP. 10. 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	11. Contractors to comply with all statutory requirements of Government for use of construction equipment, and operation 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	12. Finalize and schedule training plan for (PIU/SS) to be able to fully implement EMP, and to manage implementation of mitigation measures by contractors. 13. Create awareness and training plan for contractors who 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	14. 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	15. Prepare site-specific CEMP(s) for different potential impacts of construction of new SLF, and access road upgrades.	All construction sites	Ahead of construction	Once	No marginal cost	PMCES/PIU	Contractors

Construction Phase								
Worker camps	Pollution and social problems	<p>16. Locate worker camps away from nearby Ban Khuanmark and Ban Phongvieng village 1km from SLF site.</p> <p>17. Ensure placement of adequate housing and waste disposal facilities including pit latrines and garbage cans.</p> <p>18. A solid waste collection program must be established and implemented that maintains clean worker camps</p> <p>19. Locate separate pit latrines for male and female workers at least 50m from worker living and eating areas.</p> <p>20. 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.</p> <p>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.</p> <p>22. Worker camp must have adequate drainage.</p> <p>23. Local food should be provided to worker camps. Guns and weapons not allowed in camps.</p> <p>24. Interaction of transient workers with local community should be discouraged. HIV Aids test and education should be given to workers.</p> <p>25. Camp areas must be restored to original condition after construction completed.</p>	All worker camps	Throughout construction phase	Monthly	No marginal cost	PMCES/PIU	contractor
Training & capacity	Prevention of impacts through education	<p>26. Implement training and awareness plan for PIU/SS and contractors on local civil and environment protection laws.</p> <p>27. Introduce awareness and recycling training for waste pickers, regarding specific types of recyclable waste and management of health and safety.</p>	PIU office, construction sites	Beginning of construction	After each event	No marginal cost	PMCES	PMCES/PIU
Construction materials acquisition, transport, and storage sub-plan	Pollution, injury, increased traffic, disrupted access	<p>28. All topsoil and overburden removed for waste cells should be stockpiled on site for later restoration.</p> <p>29. Remaining unstable slope conditions on SLF property should be rectified with tree planting, or if necessary quicker grass planting.</p> <p>30. Define & schedule how needs material from slopes on northern boundary of SLF are extracted, moved, and stored on site.</p> <p>31. All piles of aggregates on SLF property and along</p>	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	PMCES/PIU	contractor

		<p>access road must be covered at all times.</p> <p>32. All aggregate loads on trucks transported from outside of SLF must be covered.</p>						
Excavated spoil management sub-plan	Contamination of soil and adjacent seasonal stream from excavated spoil, and construction waste	<p>33. A record of type, estimated volume, and source of disposed spoil must be recorded.</p> <p>34. Excavated contaminated spoil from waste cells must be handled following DONRE regulations including transport, treatment (if necessary), and disposed on SLF property as planned for all waste cell excavations.</p>	All excavation areas	Throughout construction phase	Monthly	See Monitoring Plan for contaminated soil analyses	PMCES & PIU & DONRE	contractor
Solid and liquid construction waste sub-plan	Contamination of land and surface waters from construction waste	<p>35. Management of general construction solid and liquid waste from SLF site and access road construction sites must follow DONRE regulations, and will cover, collection, handling, transport, recycling, and offsite disposal of waste created from construction activities and worker force.</p> <p>36. Offsite disposed of construction waste should be catalogued for type, estimated weigh, and source.</p> <p>37. Construction sites should have large garbage bins for worker and construction waste that separates recyclables from waste to be disposed at DONRE-approved sites.</p> <p>38. A schedule of solid and liquid construction waste pickup and disposal from SLF and along access road must be established and implemented to ensure construction sites are clean as possible.</p> <p>39. Install temperature sensors, for avoidance of spontaneous fires in the landfill cells.</p> <p><u>Hazardous Waste</u></p> <p>40. Collection, storage, transport, treatment and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow DONRE regulations.</p> <p>41. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents)</p> <p>42. Wastes must be stored above ground on concrete surfaces in closed, well labeled, ventilated plastic bins in good condition 30m from construction activity areas, adjacent stream, and nearby villages.</p> <p>43. All spills must be cleaned up completely with all contaminated soil removed and handled as contaminated spoil.</p>	All construction sites and worker camps	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU & DONRE	contractor

Noise and dust sub-plan	Dust Noise	<p>44. Regularly apply wetting agents (e.g., water, CaCl₂) as needed to exposed soil, SLF access road, and approach sections NR-13. Water truck must be on site for immediate watering as needed.</p> <p>45. Cover or keep moist all stockpiles of construction aggregates, and all truckloads of aggregates.</p> <p>46. Minimize time that excavations and exposed soil are left open/exposed. Backfill immediately.</p> <p>47. As much as possible restrict working time between 07:00 and 17:00. In particular are activities such as pile driving.</p> <p>48. Maintain vehicles and equipment in proper working order with a monthly service schedule</p> <p>49. Replace unnecessarily noisy vehicles and machinery.</p> <p>50. Vehicles and machinery to be turned off when not in use.</p> <p>51. Construct temporary noise barriers around excessively noisy activity areas where possible.</p> <p>52. Monitor existing cells for spontaneous fires and that groundwater is not affected during construction phase</p>	All construction sites.	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor
Implement utility and power disruption sub-plan	Loss or disruption of utilities and services to local villages such as water supply and electricity	<p>53. Develop plan of days and locations where outages in utilities and services will occur, or are expected.</p> <p>54. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages.</p> <p>55. Contact Ban Khuanmark and Ban Phongvieng villages to inform them of planned outages.</p> <p>56. Try to schedule all outages during low use time such between 24:00 and 06:00.</p>	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	<p>57. Contact provincial forestry department for advice on how to minimize damage to trees and vegetation.</p> <p>58. Restrict tree and vegetation removal to within SLF property and along RoW of access road.</p> <p>59. Minimize tree removal, and install protective physical barriers around trees that do not need to be removed.</p> <p>60. SLF property and ROW of access road needs to be re-vegetated and landscaped after construction completed. Consult provincial forestry department to determine the most successful restoration strategy and techniques.</p>	All construction sites.	Beginning and end of subproject	Monthly	No marginal cost	PMCES & PIU	contractor

		<p>61. Plan for line of trees to be planted in vicinity of SLF, to function as living fence.</p> <p>62. Create a landscaping plan in cooperation with PMCES specialists, indicating trees and vegetation to be affected by construction work.</p>						
Erosion control sub-plan	Land erosion	<p>63. Berms, and plastic sheet fencing should be placed around all excavations and earthwork areas to contain erosion.</p> <p>64. Earthworks should be conducted during dry periods if possible.</p> <p>65. Protect exposed or cut slopes of SLF with planted vegetation, and have a slope stabilization protocol ready.</p>	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	<p>66. Proper fencing, protective barriers, and buffer zones should be provided around all construction sites along access road to protect public.</p> <p>67. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all sites.</p> <p>68. Worker and public safety guidelines should be followed (Lao PDR OSH Programme section III, and IFC EHS for Waste Management Facilities, Toll Roads, and Construction and Decommission).</p> <p>69. Set 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.</p> <p>70. Standing water suitable for disease vector breeding should be filled in.</p> <p>71. 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.</p> <p>72. Appropriate safety clothing and footwear must be mandatory for all construction workers.</p> <p>73. Adequate medical services must be on site or nearby all construction sites.</p> <p>74. Drinking water must be provided at all construction sites.</p> <p>75. Sufficient lighting must be used during necessary night work.</p> <p>76. All construction sites must be examined daily to ensure unsafe conditions are removed. Unsafe</p>	All construction sites.	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor

		conditions should be recorded in SLF construction diary						
Civil works	Degradation of water quality of adjacent stream	77. Protective berms, plastic sheet fencing, or silt curtains should be placed between all earthworks and the stream near eastern boundary of SLF property 78. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. 79. Earthworks should be conducted during dry periods. 80. All construction fluids such as oils, and fuels should be stored and handled at least 50m away from stream near eastern boundary of SLF property 81. No waste of any kind is to be thrown in the adjacent stream. 82. No washing or repair of machinery within 50m the adjacent stream. 83. Pit latrines to be located 100m from the adjacent stream.	SLF construction sites	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor
	Degradation of groundwater quality	84. Ensure the established depth of water table at SLF site is clearly understood by excavators when the first waste cell is excavated	Area of waste cell #1					
Cultural chance finds sub-plan	Damage to cultural property or values, and chance finds	85. As per detailed designs all civil works should be located away from all cultural property and values. DICT identified potential sites and types of PCR in pre-construction phase. 86. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for finds. 87. 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. 88. 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 and urban traffic sub-plan	Traffic disruption, accidents, public injury	89. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights along access road and on NR-13. 90. Post speed limits, and create dedicated construction vehicle roads or lanes along access road if possible. 91. Install signage on NR-13 and access road to inform community of location of construction traffic	All construction sites	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor

		<p>areas, and provide them with directions on how to best co-exist with construction vehicles on their roads.</p> <p>92. Create pedestrian walkway areas around construction sites on access road.</p>						
Construction drainage sub-plan	Loss of drainage & flood storage	<p>93. Provide short-term drainage diversions from construction sites to prevent ponding and flooding.</p> <p>94. Install temporary storm drains or ditches on construction sites when natural drainage is disturbed from civil works activities</p> <p>95. Ensure natural stormwater runoff around SLF site and along access road is maintained.</p>	All areas with surface waters	Design & construction phases	Monthly	No marginal cost	PMCES & PIU	contractor
Operation of completed SLF and access road								
Operation of completed SLF	Pollution of groundwater and downstream wetlands area	<p>96. Regularly monitor groundwater quality from test boreholes BH4 and BH2 that were established as part of the DED to ensure waste cells and leachate treatment system are operating properly.</p> <p>97. Septage treatment: Inspect septage pond, monitor sludge depths, consider if need for desludging and pumping.</p> <p>98. Landfill gas flaring: Monitor and operate gas flaring process, in accordance to the procedure as described in the IEE (Chapter 3.B.1, section 72, p. 26)</p> <p>99. Leachate treatment: Monitor the biological anaerobic and aerobic treatment process, ensuring effectiveness and that extraction system complies with regulatory maximum levels, provide early warning of the potential for overflow.</p> <p>100. Hazardous waste disposal: Conduct quarterly inspections, ensure and monitor that hazardous waste is sufficiently secured in the designated waste cell.</p>	SLF	Quarterly	Annually	O&M	UDAA	
Operation of upgraded access road	Increased traffic accidents & air pollution	<p>101. Enforce clearly post speed limits on all roads.</p> <p>102. Mandate regular vehicle inspections to ensure all vehicles kept in good working condition.</p> <p>103. Upgraded access road drainage culverts or ditches must be regularly cleaned and maintained</p>	SLF access road	Biannually	Annually	O&M	DPWT	

V. MONITORING PLAN

30. The environmental monitoring plan for the subproject is provided in Table 4. 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 select components of the SLF. The indicative costs of monitoring are shown in Table 6.

A. Monitoring strategy

31. The strategy for monitoring some environmental parameters such as dust levels is to conduct continuous or daily *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. If this is not possible, the equipment operation must be stopped and rescheduled.

32. Environmental standards for ambient water quality in urban areas in Lao PDR (Appendix B) are provided by the National Environmental Standard Order No. 2734/PMU-WREA (2009). 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.

33. An independent environmental monitoring institute (EMI) will be required to perform the groundwater 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 6.

1. Performance Monitoring

34. 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. 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 5.

2. Reporting

35. 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 (Table 3 and Table 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.

36. The reports will track all indicators measured in the EMP monitoring plan, including performance monitoring indicators (Table 5) and will include relevant Government environmental quality standards.

Table 4: Environmental monitoring plan

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility		Estimated Cost ⁵ (USD)
					Supervision	Implementation	
<i>Just before Construction Commences - Update Baseline</i>							
Remaining public and stakeholder issues and concerns of construction activities including construction schedule.	Ban Phongvieng and Ban Khuanmark villages and households near existing dumpsite on NR-13.	Repeated community consultations	Once	Once	EA/PIU	PIU	\$1,000.
Groundwater quality at depth at SLF: 20 parameters analyzed as part of DED	Repeat of groundwater quality analysis at boreholes BH4 (above SLF control), BH3 (future Cell #1 site) and BH2 (below SLF control)	Using methods approved by DONRE and implemented by Lao National University				EMI	\$1,000.
Construction Phase of SLF and Access Road							
A) Qualitative dust and noise levels (monitoring of ambient air, surface and groundwater quality) B) Qualitative turbidity levels C) Qualitative level of unmanaged and uncontained worker (domestic) and construction solid waste.	A) Along access road and on SLF boundary and at Ban Phongvieng village B) In stream adjacent to SLF property C) All construction sites, worker camp living and pit latrine areas D) From all project-affected community areas, from hotline telephone number placed along	A – B): Using simple visual field observation methods approved by DONRE. Groundwater and ambient air quality to be monitored by testing of relevant parameters. C) Visual inspections including complaints from	Continuously daily observations recorded of site diary	Quarterly / Semi-Annual	A – C): PMCES /PIU D): EA/PIU	Contractor, & contractor to mitigate issue immediately PIU and contractor, with issue addressed immediately	A – E): As per Contractor BoQ

⁵ Units costs of parameter analyses conducted for DED by Lao National University

D) Public comments and complaints E) Incidence of worker or public accident or injury	access road and at gate to SLF. E) At all construction areas	local community or workers. D) Information transferred by hotline telephone number, through GRM, and direct public complaint at construction site. E) Regular reporting by contractors			E): EA/PIU	PIU and contract or, with issue addressed immediately	
Operation of Completed SLF and Upgraded Access Road							
Proper function of waste cells, and leachate treatment system of SLF: groundwater quality at SLF: 20 parameters analyzed as part of DED, odour, dust, noise at villages	1) Borehole wells BH4, BH3, and BH2 at SLF, 2) Water quality in seasonal stream 3) Ban Phongvieng and Ban Khuanmark villages	Using field and analytical methods approved by DONRE and Lao National University. Verbal consultations, complaint records	Quarterly for 3 years then biannually for next 12 years	Biannual	UDAA		1): \$8,100 2): \$2,700. 3) \$0.0
Proper function and operation of landfill gas flaring / ventilation	LFG management	Monitoring procedure of equipment manufacturer	Biannually				
Proper functioning of septage treatment, leachate treatment and hazardous waste management.	Septage treatment monitoring	Monitoring procedure in accordance to described management and monitoring processes in Table 4	Quarterly		UDAA		
Vehicle traffic accidents	Upgraded / improved subproject roads.	Regular record keeping.	Continuous	For each event	DPWT		\$0.0

Table 5: Performance monitoring indicators for Vientiane subprojects

Major Environmental Component	Key Indicator	Performance Objective	Data Source
<i>Pre-construction Phase</i>			
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 UDAA reports
Bid Documents	Completed with appended EMP ⁶	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 groundwater quality at SLF	Parameters analyzed for DED	Clearer understanding of impact of existing dumpsite	EMI
<i>Construction Phase</i>			
Air quality at SLF	Ambient air quality monitoring and testing, noise	Levels managed to minimum	contractor monitoring reports,
Public and worker safety	Frequency of injuries	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,
<i>Operation of Completed SLF</i>			
Proper function of waste cells and leachate treatment system of SLF	Groundwater parameters analyzed for DED at boreholes BH4, BH3, BH2, and effluent of leachate treatment system (below wetland)	SLF operating properly	EMI/UDAA reports
Waste collection performance	Cleanliness, absence of solid waste litter in Vang Vieng and waste collection serviced villages. Keep records and data for daily amount of solid and hazardous waste received at SLF.	Improved solid waste collection system working as designed	
Public safety	Incidence of traffic accidents on access road	No deviation from baseline frequency	DPWT

⁶Contractor Environmental Management Plan developed from EMP in contractor bidding document

VI. ESTIMATED COST OF EMP

37. 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. From Table 4 the estimated costs for the implementation of the EMP for solid waste management improvement in Vang Vieng are summarized in Table 6. The costs of the qualitative environmental monitoring during construction phase is easily assumed by management overhead. The groundwater sampling costs (USD) are based on the parameter unit costs of the analyses conducted for the DED (Appendix D).

38. 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 construction commences.

Table 6: Estimated costs for environmental monitoring plan of EMP

Activity Type	Responsible	Estimated Cost ⁷ (USD)
Pre-construction Phase	PIU	\$2,000
Construction Phase	Contractor	As per Contractor Contract
Post-construction Operation Phase	UDAA	\$10,800
Capacity development and training	PIU	\$5,000
Total		\$17,800

VII. INSTITUTIONAL CAPACITY REVIEW AND NEEDS

39. Currently, understanding and experience with the operation of sanitary landfills is absent in Vang Vieng, and there is insufficient understanding, experience and capacity for environmental management among provincial and municipal authorities responsible. i.e., DICT/PIU, and UDAA for overseeing successful implementation of the EMP, and for environmental management of the completed SLF. The required capacity development and training of UDAA and DPWT staff on SLF operation, as well as waste pickers on awareness and health & safety, and management will be developed from by the PMCES that will be retained by the project.

40. No dedicated environmental experts are currently appointed to UDAA. The PMCES with assistance from the SS of the subproject will develop and deliver training courses to the DICT/PIU staff responsible for the implementation of the subproject. The purpose of the course(s) is to strengthen the ability of the PIU/PMU to oversee implementation of the EMP by construction contractors, and EMI.

41. 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.

⁷ To be updated with EMP at Detailed Design Phase

42. Training on the implementation of an EMP should address two thematic areas. The first area should introduce principles environmental management focused 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 7 lists the indicative course topics and target participants. The estimated budget of USD \$5.000 is listed in Table 6

Table 7: 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. Training on environmental monitoring and reporting procedures.	EA, UDAA*, PIU/SS,	Pre-construction phase: shortly after PMCES is hired
Purpose and content of an EMP. Development and implementation of the EMP for Vang Vieng solid waste management improvements Review of contractor EMPs (CEMP)	EA, PIU/SS, contractor EOs	Construction phase shortly after construction packages are let
Protection of aquatic and terrestrial environment from road and landfill construction	PIU/SS, contractor EOs	Construction phase shortly after construction packages are let
Grievance Redress Mechanism, & public consultation	EA/PIU/SS, contractor EOs	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	PMU	Operation phase shortly before subprojects are completed

* Not included is special course for UDAA for the operation and maintenance of the New SLF. TRAINING?

43. Separate to the training plan in Table 7 will be the development of the capacity and programming of the Vang Vieng Office of Natural Resources and Environment (ONRE) for monitoring water table and groundwater quality at the SLF. The scope and details of the capacity development will be finalized by PMCES.

VIII. EMERGENCY RESPONSE PLAN

44. 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.

45. The Contractor will provide and sustain the required technical, human and financial resources for quick response during construction.

Table 8: Roles and responsibilities in emergency incident response

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 / helps 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.

46. 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.

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

48. 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

49. 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.

50. 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.

51. 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

52. 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; iii) estimated magnitude of the situation; iv) estimated persons harmed; v) 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.

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

53. 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 9: 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.
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 10: Response Procedure During Medical Emergency

Procedure	Remarks
Administer First Aid regardless of severity immediately.	Fundamentals when giving First Aid: <ul style="list-style-type: none"> - Safety first of both the rescuer and the victim. - Do not move an injured person unless: <ul style="list-style-type: none"> - 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 &/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: <ul style="list-style-type: none"> - 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.

Procedure	Remarks
If applicable, vacate site & influence area at once, restrict site, suspend work until further notice.	Follow evacuation procedure.

Table 11: Response Procedure in Case of Fire

Procedure	Remarks
Alert a fire situation.	Whoever detects the fire shall immediately: <ul style="list-style-type: none"> - 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.
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: <ul style="list-style-type: none"> - 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 RESPONSIBILITY OF KEY MANAGEMENT UNITS OF EMP

EMP Implementation organizations	Roles and Responsibilities
Executing agency (EA) (MICT)	<ul style="list-style-type: none"> ➤ 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 ➤ Responsibility for overseeing successful GRM
Project Coordination Unit (PCU), inside MICT	<ul style="list-style-type: none"> ➤ 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)	<ul style="list-style-type: none"> ➤ 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

EMP Implementation organizations	Roles and Responsibilities
Project Implementation Units (PIUs) DICT, DPWT, UDAA	<ul style="list-style-type: none"> ➤ 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)	<ul style="list-style-type: none"> ➤ Completes detailed designs of subprojects with PIU ➤ Update EMP to meet final detailed designs of subprojects ➤ Supervises and assists PIU with contractor management ➤ 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)	<ul style="list-style-type: none"> ➤ Implements environmental sampling for EMP ➤ Conducts laboratory analyses of environmental quality samples from field sampling ➤ Prepares periodic monitoring reports for PIU based on specific monitoring tasks
Environmental Officer (EO) of Contractor	<ul style="list-style-type: none"> ➤ 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	<ul style="list-style-type: none"> ➤ Assists PCU through timely guidance at each stage of project implementation following agreed implementation arrangements ➤ Review all documents that require ADB approval

EMP Implementation organizations	Roles and Responsibilities
	<ul style="list-style-type: none">➤ 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	BOD5	BOD5	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 ₆ H 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	Atomic Absorption Cold Vapor
19	Mercury	Hg	mg/l	0.002	
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	-	mg/l	0.05	Gas Chromatography

	Organochlorine				
25	DDT	C ₁₄ H ₉ Cl ₅	mg/l	1.0	
26	Alpha -BHC	αBHC	mg/l	0.02	
27	Dieldrin	C ₁₂ H ₈ Cl ₆ O	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
Enterovirus	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 ₂ S	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	°C	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-
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

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	Color	-	Platinum-Cobalt (Pt-Co)	5	15
	Turbidity	-	JTU	5	20
	Potential of Hydrogen	pH	-	7.0-8.5	6.5-9.2
Chemical	Iron	Fe	mg/l	≤0.5	1
	Manganese	Mn	mg/l	≤0.3	0.5
	Copper	Cu	mg/l	≤1.0	1.5
	Zinc	Zn	mg/l	≤5.0	15
	Sulphate	SO ₄ ²⁻	mg/l	≤200	250
	Chloride	Cl ⁻	mg/l	≤250	600
	Fluoride	F ⁻	mg/l	≤0.7	1
	Nitrate	NO ₃ ⁻	mg/l	≤15	45
	Total Hardness as CaCO ₃	Total CaCO ₃	mg/l	≤300	500
	Non-carbo- nate hardness as CaCO ₃	Non CaCO ₃	mg/l	≤200	250
Toxic chemical substances	Total solids	TS	mg/l	≤600	1,200
	Arsenic	As	mg/l	None	0.05
	Cyanide	CN ⁻	mg/l	None	0.1
	Lead	Pb	mg/l	None	0.05
	Mercury	Hg	mg/l	None	0.001
	Cadmium	Cd	mg/l	None	0.01
	Selenium	Se	mg/l	None	0.01
Bacteria	Coliform bacteria	Coliform	MPN/100 ml	<2.2	<2.2
	E. coli bacteria	E. coli	-	None	None
	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 ₆ H ₆	mg/kg	0.5	Gas Chromatography or Gas Chromatography/. Mass Spectrometry (GC/MS) or other methods approved by DONRE
2	CarbonTetrachloride	CCl ₄	mg/kg	89	
3	1,2 Dichloroethane	CH ₂ Cl-CH ₂ Cl	mg/kg	230	
4	1,1 Dichloroethylene	CCl 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 ₂ Cl ₂	mg/kg	28	
8	Ethly benzene	IC ₂ ClC-CH ₃	mg/kg	630	
9	Styrene	C ₆ H ₅ -CH=CH ₂	mg/kg	8.4	
10	Tetrachloroethylene	C ₂ Cl ₄	mg/kg	210	
11	Toluene	C ₆ H ₅ -CH ₃	mg/kg	6.5	
12	Trichloroethylene	Cl ₂ C=CHCl	mg/kg	2.5	
13	1.1.1 Trichloroethane	Cl ₃ C-CH ₃	mg/kg	3.5	
14	1.1.2 Trichloroethane	Cl ₂ CH-CH ₂ Cl	mg/kg	43	
15	Total Xylenes	(CH ₃ -C ₆ H ₄ -CH ₃)	mg/kg	63	
II. Heavy Metals					
1	Arsenic	As	mg/kg	3.9	Inductively Coupled Plasma-Atomic Emission Spectrometry or Inductive- ly Coupled Plasma-Mass Spectrometry or Atomic Absorption, Gaseous Hyd- ride 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 Colori- metric or Chelation/ Extraction or other Methods Approved by DONRE
4	Lead	Pb	mg/kg	400	Inductively Coupled Plasma-Atomic Emission Spectrometry or Inductive- ly Coupled
5	Manganese and its compounds	Mn	mg/kg	1,800	

					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 ₈ H 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 ₈ Cl ₆ O	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 Chromato- graphy/ Mass Spectrometry (TE/GC/MS) Chromato- graphy/ Fourier Transform Infrared (GC/FT-IR) Spec- trometry 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/m ³					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	-	-	-	-	Chemiluminescence 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 (Leq) from Fluctuating Noise
Leq 24 hour not exceeding 70 dB(A)	Equivalent Sound Level (Leq) 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 ₆ H ₅ OH	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) 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 GROUNDWATER 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	Zinc (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 H ₂ S	13.00
21	Subtotal	333.50
	5% Management fee of Faculty of Natural Science (FNS)	16.68
	TOTAL	350.18