

Environmental Management Plan

July 2012

LAO: Greater Mekong Subregion Corridor Towns
Development Project

Kaysone Phomvihane Subproject, Lao PDR

Prepared by the Ministry of Natural Resources and Environment and Savannakhet Provincial
Department of Natural Resources for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 1 August 2012)

Currency Unit	–	kip (KN)
KN1.00	=	\$0.00012
\$1.00	=	KN8,013

ABBREVIATIONS

ADB	–	Asian Development Bank
AH	–	affected household
BPC	–	bio-physical and chemicals
BOD	–	biological oxygen demand
BTZ	–	Border Trade Zone
COD	–	chemical oxygen demand
CE	–	contractors' engineer
CTDP	–	Corridor Towns Development Project
DED	–	detailed engineering design
DPWT	–	District Public Works and Transport Office
EA	–	environmental assessment
ECC	–	environmental compliance certificate
ECO	–	environmental control officer
EIA	–	environment impact assessment
EMP	–	environment management plan
EMR	–	environmental monitoring report
EERT	–	external emergency response team
ERT	–	emergency response team
ERTL	–	emergency response team leader
ESMU	–	environment & social management unit
ESIA	–	environment and social impact assessment
ESO	–	environmental site officer
FGD	–	focus group discussion
GMS	–	Greater Mekong Subregion
GoL	–	Government of Lao PDR
GPS	–	global positioning system
IA	–	implementing agency
IEE	–	initial environmental examination
LAK	–	Lao Currency
LAR	–	land and resettlement
MONRE	–	Ministry of Natural Resources and Environment
MPCTC	–	Ministry of Post, Construction, Transport and Communication
MPWT	–	Ministry of Public Works and Transport
NGO	–	nongovernment organization
O&M	–	operation and maintenance
PCU	–	project coordination unit
PMU	–	project management unit
UDAA	–	Urban Development and Administration Authority
USD	–	United States Dollar
UXO	–	unexploded ordinance

WEIGHTS AND MEASURES

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

NOTE

In this report, "\$" refers to US dollars.

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I. INTRODUCTION

1. The environmental management plan (EMP) provided herein for the Kaysone subproject consolidates the five EMPs that were originally prepared for the five infrastructure investments (Table 1) of the subproject. The EMP for Kaysone is one of three EMPs that have been prepared for the three subprojects of Kaysone, Phine, and Dansavanh which form the Corridor Towns Development Project in Lao PDR. The parent Initial Environmental Evaluation (IEE) of all three subprojects of the CTDP in Lao PDR is found under separate cover.

A. Subproject Investments

The component investments of the Kaysone subproject are summarized below.

Table 1. Infrastructure Developments of Kaysone Subproject

Subproject	Component
Kaysone Phomvihane,	1) Upgraded solid waste management & sanitary landfill <ul style="list-style-type: none">• Decommissioning existing landfill• Modern landfill technology including leachate collection & treatment system• New compactor trucks
	2) Materials recovery facility (part of sanitary landfill) <ul style="list-style-type: none">• Higher volume with modern, efficient sorting technology
	3) Wastewater treatment plant & improved drainage <ul style="list-style-type: none">• Three, aerobic pond treatment plants• Stormwater drainage canals• Interceptor pipelines
	4) Mekong riverbank protection <ul style="list-style-type: none">• Modern slope protection materials & techniques
	5) Improved urban roads & drainage <ul style="list-style-type: none">• Road widening, lateral drainage, lighting, & signage

II. INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

2. At the feasibility stage the primary management framework overseeing the implementation of the environmental management plan (EMP) will be defined by the: 1) Ministry of Public Works and Transports (MPWT) who is the executing agency (EA) of the subproject; 2) the Provincial Department of Public Works and Transport (PDPWT) Savannakhet province who will be the implementing agency (IA) of subproject; 3) a project management unit (PMU) formed by the IA who will oversee implementation of the subproject in Kaysone and the subprojects in

Phine and Dansavanh; and 4) the project implementation team (PIT) established in Kaysone Phomvihane will coordinate project activities at the district level.

3. Along with the PMU an environmental control officer (ECO) will be identified. The ECO will form part of the environmental and social management unit (ESMU) for all four subprojects in Cambodia.

4. A Project Steering Committee (PSC) will be created to provide overall policy guidance and oversee implementation in accordance with the objectives and scope of the subproject. The PSC will be chaired by the Provincial Governor of Savannakhet with the Deputy Director General of MPWT-DHUP serving as Vice Chairman.

5. A Detailed Design and Supervision Consultant¹ (DDSC) will assist with detailed designs of the subproject, and will update the EMP to ensure EMP meets the final subproject designs. The ADB is responsible for monitoring to ensure subproject meets the environmental safeguards of the SPS (2009).

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

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

7. The responsibilities of the PIT are summarized below:

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

¹ DDSC to be defined.

5. Ensure the implementation of social and environmental safeguards and including timely disclosure of safeguards documents;
6. Ensure the implementation of the Consultation and Participation Plan, Gender Action Plan, and Stakeholder Communication Strategy;
7. Ensure implementation of resettlement plans including adequate measures to mitigate adverse resettlement impacts;
8. Coordinate implementation of environmental management plan, and submit regular monitoring reports to the PMU;
9. Coordinate the updating of the resettlement plans and monitor implementation of resettlement activities; and
10. Undertake monitoring of project activities based on the indicators and parameters in the DMF and prepare regular reports to the PMU on project achievements.

8. The PMU, PIT, ESMU and ECO with assistance from the DDSC ensure that the EMP becomes part of the construction contract, that the EMP is implemented, and that the contractor(s) abide by the EMP. The ECO should undertake regular site inspections and the results should be recorded and submitted to the relevant authorities as part of progress reporting.

A. Regulatory Framework and Guidelines for Kaysone Subproject Components

9. The specific regulations and guidelines for the Kaysone subproject investments are summarized in Table 2. The regulations and guidelines, *inter alia*, specify how the different types of infrastructure investments should be located, constructed, and managed to prevent or minimize negative impacts on the environment. The complete list of environment-related laws and regulations of GoL are described in Appendix A.

Table 2. Regulatory Framework and Guidelines Governing Subproject Investments.

Sanitary Landfill & MRF
<ul style="list-style-type: none"> • Decree No 520 / TCPC, dated 23 Feb 2007: on disposal site management regulating site selection and design of disposal sites. • Draft “unofficial” decree overall guidelines and requirements for all SWM components, including hazardous and medical waste has been consulted. • Decree No 1706 / MoH, dated July 2, 2004: on waste management from health care facilities (Articles 8-10,12,13,14-21). • Decree No 1705 / MoH, July 20, 2004 on sanitation of public areas (Articles 3, 4, 12, 15). • Decree No 520 / TCPC, dated 23 Feb 2007: on disposal site management, Article 9.
Wastewater Treatment
<ul style="list-style-type: none"> • USEPA, 2011. Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers, and Managers, USEPA United State Environmental Protection Agency. • U.S Department of Transportation, 2009. Urban Drainage Design Manual, Hydraulic Engineering, Circular No.22, 3rd Edition, Federal Highway Administration. • City of London, 2005 (<i>updated</i>). Sanitary Sewer Collection, Environmental and Engineering Services Department.

<ul style="list-style-type: none"> • Standard ATV A210E, 1989. Principles for dimensioning, Construction and Operation of Wastewater Lagoons for Communal Wastewater, Germany.
Mekong Riverbank Protection
<ul style="list-style-type: none"> • 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 • Highway Design Manual, Chapter 870 Channel and Shoe Protection Erosion Protection Control, 26 June, 2006. • Urban Drainage Design Manual, Hydraulic Engineering Circular No.22 Third Edition, U.S Department of Transportation, Federal Highway Administration, September 2009. Sanitary Sewer Collection, Environmental and Engineering Services Department, the corporation of the City of London, Updated: December 2005; • NRCS Stream Restoration Design Handbook, Stone Sizing Criteria, National Handbook, 210-NEH, August 2007. • The Manual and Study on Mekong Riverbank Protection Around the Vientiane Municipality, Lao PDR. Draft Final Report. JICA September 2004.
Urban Road Upgrades
<ul style="list-style-type: none"> • Lao PDR Road Design Manual with reference to AASHTO A Policy on Geometric Design of Highways and Streets, 5th edition. • RDA's Lao Bridge Design Manual, 1998 with reference to AASHTO LRFD Bridge Design Specifications, 4th, Edition, 2007 • Transport Research Laboratory's (TRL) Road Note 31, 4th edition. • Road Development Authority (RDA's) standards incorporating relevant standards from the AASHTO Highway Drainage Guidelines. • MPWT (2006). Specifications for drainage system, culverts, street lighting and tree planting
Environmental Standards
<ul style="list-style-type: none"> • National Environmental Standard Order No. 2734/PMU-WREA (2009): See Monitoring Plan (section V) below and Appendix B for GoL ambient surface water quality standards, and standards for wastewater discharge.

III. SUMMARY OF POTENTIAL IMPACTS

10. The potential impacts of the: 1) sanitary landfill & MRF, 2) three WWTPs, 3) Mekong riverbank protection; and 4) urban road upgrades in Kaysone are summarized in Table 3. The impacts are drawn from the consolidated IEE. The IEE indicates that potential impacts of the infrastructure developments are primarily construction-related and can be mitigated. The sanitary landfill component is unique because the potential impacts are linked to the effects of the existing dumpsite on the environment. The present and future impact of the dumpsite on the

environment is being clarified by the independent environmental compliance audit (ECA) of the dumpsite. The separate report on the ECA will be appended to the IEE.

A. WWTPs and Sanitary Landfill

11. Potential impacts of the operation of the sanitary landfill and WWTPs concern possible contamination of groundwater, and land & surface waters from the aerobic treatment lagoons, sludge management practices, and leachate from the landfill. The potential impacts will be addressed during the pre-construction phase when the detailed designs of the wastewater treatment system and landfill are completed, and when the sensitivity of the affected receiving environment(s) to the effluent & sludge from WWTPs, and landfill leachate are clarified.

B. Mekong Riverbank Protection

12. The potential impacts of the fortification of the Mekong riverbank in Kaysone are construction-related. The civil and earthworks, as well as construction barge traffic will negatively affect water quality, fish habitat, and navigation & community use of the river during the construction phase of the component.

C. Urban Road & Drainage Upgrades

13. The potential impacts of the upgrades to the urban roads and drainage in Kaysone are construction-related disturbances to adjacent households and businesses such as noise, dust, solid & liquid waste, construction traffic, and reduced community and commercial access. Operational impacts concern increased traffic congestion & accidents, and local air pollution.

Table 3. Summary of Potential Environmental Impacts of Kaysone Subproject

Pre-construction Phase
<ul style="list-style-type: none"> 1) Land acquisition and resettlement to be addressed by RAP. 2) Land clearing.
Construction Phase
<ul style="list-style-type: none"> 1) Civil works environmental impacts (e.g., dust, air pollution, noise, solid & liquid waste, erosion, sedimentation, local flooding, land & surface water pollution). 2) Potential unforeseen impact on valued ecological habitat, and cultural property & values after component site locations finalized at detailed designs. Pollution, loss of aquatic habitat of Mekong river. 3) Civil disturbance (e.g., increased traffic, reduced access, disrupted business & community activity, social issues from migrant workers, worker & public accidents). & Disruption of navigation & uses of nearshore Mekong river. Impaired use of roads to be upgraded, and disturbance to adjacent households. 4) Excavation of aerobic ponds of WWTPs exposing water table & groundwater to potential pollution from WWTP lagoons in operation. 5) Excavations for landfill exposing water table & groundwater to pollution from operation of landfill and leachate collection & treatment facility.

Operation Phase	
Sanitary landfill:	1) Pollution of groundwater, land, or downstream surface waters from leachate from landfill.
Wastewater treatment system:	2) Pollution of groundwater, or land from discharged treated effluent and treatment process sludge. Pollution of drainage system & Mekong river. 3) Disturbance to local community from operation of WWTPs.
Upgraded urban roads:	4) Increased traffic leading to increased, traffic congestion, accidents & air pollution.

D. Public Consultation

14. The stakeholder communication strategy that was developed for the IEE will be continued with the start of the pre-construction phase of the subproject. The first step will be the disclosure of the IEE to the affected stakeholders identified in the IEE for their review and comment.

1. Follow-up Consultation

15. As indicated in the IEE, the primary concern of the public of the subproject in Kaysone centred on the disturbances during construction of the upgrades to roads, and the effect of the upgraded road on increased traffic, and traffic accidents. These issues plus any others will be reviewed during follow-up consultations throughout the pre-construction, construction, and operation of the completed subproject components.

IV. MITIGATION PLAN

16. The mitigation measures of the EMP are presented in a comprehensive mitigation plan for the subproject which is summarized in Table 4. The plan includes the environmental issues and concerns raised at the stakeholder meetings. The plan identifies responsible parties, location, and timing. Indicative costs are tabled separately.

17. The mitigation plan combines the construction phase activities common to all components while highlighting activities and mitigations specific to a single component.

Table 4. Environmental Impact Mitigation Plan

Subpr oject	Potential Environ	Proposed Mitigation Measures	Locati	Timin	Activit y	Responsibility
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Activity	Environmental Impacts		Location	Timing	Reporting	Supervision	Implementation
<i>Pre-Construction, Detailed Design Phase</i>							
Confirmation of required resettlement and temporary relocations	No negative environmental impacts	1. Affected persons well informed well ahead of subproject implementation.	All affected persons in subproject component areas	Before project implemented	See resettlement plans	IA/PMU	Resettlement committees
Disclosure, & engagement of community	No community impacts	2. Initiate Information Disclosure and Grievance process of IEE	For all construction sites.	Beginning of project	Quarterly	IA/PMU	PIT
GoL approvals	No negative impact	3. Notify MoNRE of subproject initiation to complete EA requirements, and obtain required project permits and certificates.	Entire subproject	Before construction	As required	IA/PMU	IA/PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Detailed designs of subproject,	Minimize negative environmental impacts	<p>4. Work with DDSC² to complete detailed designs of the: 1) sanitary landfill & leachate treatment facility; 2) materials recovery facility; 3) three wastewater treatment systems including identification of final treated effluent and sludge quality; 4) Mekong river protection, and 5) upgraded road & drainage. Ensure the following measures are included:</p> <p>a) results of ECA are used to finalize design of new sanitary landfill, and finalize environmental monitoring requirements of entire landfill area;</p> <p>b) identification of spill management prevention plans, and emergency response plans for all construction sites of all five subproject components;</p> <p>c) no disturbance or damage to culture property and values;</p> <p>d) minimal acquisition of agriculture and forested lands;</p> <p>e) locate aggregate borrow pits and rock supply areas away from human settlements with fencing and access barriers;</p> <p>f) no, or minimal disruption to water supply, utilities, and electricity with contingency plans for unavoidable disruptions;</p> <p>g) no, or minimal disruption to normal pedestrian and vehicle traffic along all road segments with contingency alternate routes;</p> <p>h) for urban areas include specific plan to notify & provide merchants and residents of construction activities & schedule to minimize disruption to normal commercial and residential activities.</p>	Final siting	Before construction initiated	Once with detailed designs documents	IA/PMU	IA/PMU

² DDSC is detailed design and supervision consultant

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Update EMP	Positive environmental impacts	<ol style="list-style-type: none"> 5. Review final locations of three WWTPs, and receiving environments for treated effluent and waste sludge to determine sensitivity of groundwater, land, and surface waters to contamination with particular attention to Mekong river. 6. Review final location of sanitary landfill and leachate treatment facility, and determine sensitivity to groundwater, land, or surface waters to contamination. 7. Use results of ECA of existing dumpsite to apply any remedial actions identified by ECA, and to finalize environmental monitoring required of entire landfill site. 8. Document baseline water quality of Mekong river at riverbank protection site and at discharge points of treated effluent from WWTPs. Collect baseline air quality, noise, and vibration data at all construction sites. (See Environmental Monitoring Plan below) 9. Review finalized locations of all subproject component sites to confirm absence of valued ecological or cultural resources. 10. Identify any new potential impacts of subproject and include in EMP with special attention to existing dumpsite. 11. Update mitigation measures and monitoring requirements of EMP where necessary to meet detailed designs, and affected environments. 12. Submit updated EMP with new potential impacts to ADB to review. 13. Develop individual management subplans for: a) Construction drainage; b) Erosion; c) Noise and Dust; d) Contaminated Spoil Disposal; e) Solid and Liquid Waste Disposal; f) Construction & Urban Traffic; g) Utility and Power Disruption; h) Worker and Public Safety; i) Tree and Vegetation Removal and Site Restoration; j) Construction Materials Acquisition, Transport, & Storage, k) Cultural chance finds; and l) Remediation and monitoring of decommissioning of existing dumpsite (from ECA). 	All sites	Before construction initiated	Once with detailed design documents	IA/PMU	IA/PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
UXO survey, & removal	Injured worker or public	14. Ensure GoL is consulted and clears areas where necessary	All construction sites.	Beginning of subproject	Once	EA/GoL	GoL
Develop bid documents	No negative environmental impact	15. Ensure updated EMP is included in contractor tender documents, and that tender documents specify requirements of EMP must be budgeted. 16. Specify in bid documents that contractor must have experience with implementing EMPs, or provide staff with the experience.	All subproject areas	Before construction begins	Once for all tenders	DDSC	IA/PMU
Capacity development	No negative environmental impact	17. Develop and schedule training plan for PMU (PIU/ESMU/ECO) to be able to fully implement EMP, and to manage implementation of mitigation measures by contractors. 18. Create awareness and training plan for contractors whom will implement mitigation measures.	All subproject areas	Before construction begins	Initially, refresh later if needed	DDSC	DDSC
Recruitment of workers	Spread of sexually transmitted disease	19. Use local workers as much as possible, reducing #s of migrant worker	All work forces.	Throughout construction phase	Worker hiring stages	IA/PMU/PIT	Contractor's bid documents
<i>Construction Phase of Components – General Mitigations</i>							
Initiate EMP & subplans,	Prevent or minimize impacts	20. Initiate updated EMP including individual management subplans for different potential impact areas that are completed in pre-construction phase (see subplan guidance below).	For all construction sites	Beginning of construction	Once	DDSC	IA/PMU/PIT & contractors
Obtain & activate permits and licenses	Prevent or minimize impacts	21. Contractors to comply with all statutory requirements set out by GoL for use of construction equipment, and operation construction plants such as concrete batching.	For all construction sites	Beginning of construction	Once	DDSC	IA/PMU/PIT & contractors

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Worker camps	Pollution and social problems	<p>22. Locate worker camps away from human settlements.</p> <p>23. Ensure adequate housing and waste disposal facilities including pit latrines and garbage cans.</p> <p>24. A solid waste collection program must be established and implemented that maintains a clean worker camps</p> <p>25. Locate separate pit latrines for male and female workers away from worker living and eating areas.</p> <p>26. A clean-out or infill schedule for pit latrines must be established and implemented to ensure working latrines are available at all times.</p> <p>27. Worker camps must have adequate drainage.</p> <p>28. Local food should be provided to worker camps. Guns and weapons not allowed in camps.</p> <p>29. Transient workers should not be allowed to interact with the local community. HIV Aids education should be given to workers.</p> <p>30. Camp areas must be restored to original condition after construction completed.</p>	All worker camps	Throughout construction phase	Monthly	DDSC/IA/PMU/PIT	PIT/contractor
Training & capacity	Prevent of impacts through education	<p>31. Implement training and awareness plan for PMU (PIU/ESMU/ECO) and contractors.</p>	PMU/PIU offices, construction sites	Beginning of construction	After each event	DDSC	DDSC/PIT

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Implement Construction materials acquisition, transport, and storage subplan	Pollution, injury, increased traffic, disrupted access	<p>32. All borrow pits and quarries should be approved by GoL.</p> <p>33. Select pits and quarries in areas with low gradient and as close as possible to construction sites.</p> <p>34. Required aggregate volumes must be carefully calculated prior to extraction to prevent wastage.</p> <p>35. Pits and quarries should not be located near surface waters, forested areas, critical habitat for wildlife, or cultural property or values.</p> <p>36. If aggregate mining from fluvial environments is required small streams and rivers should be used, and dry alluvial plains preferred.</p> <p>37. All topsoil and overburden removed should be stockpiled for later restoration.</p> <p>38. All borrow pits and quarries should have a fence perimeter with signage to keep public away.</p> <p>39. After use pits and quarries should be dewatered and permanent fences installed with signage to keep public out, and restored as much as possible using original overburden and topsoil.</p> <p>40. Unstable slope conditions in/adjacent to the quarry or pit caused by the extractions should be rectified with tree planting.</p> <p>41. Define & schedule how materials are extracted from borrow pits and rock quarries, transported, and handled & stored at sites.</p> <p>42. Define and schedule how fabricated materials such as steel, wood structures, and scaffolding will transported and handled.</p> <p>43. All aggregate loads on trucks should be covered.</p> <p>44. Piles of aggregates at sites should be used/or removed promptly, or covered and placed in non traffic areas.</p>	For all construction areas.	Throughout construction phase	Monthly	DDSC/IA/PMU/PIT	PIT/contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Asphalt production, transport, and use	Air pollution, land and water contamination, and traffic & access problems,	<p>45. Locate asphalt plant well away from all human activity and settlements, and cultural (e.g., schools, hospitals), and ecological receptors. Bitumen production and handling areas should be isolated.</p> <p>46. Contractors must be well trained and experienced with the production, handling, and application of bitumen.</p> <p>47. All spills should be cleaned immediately and handled as per hazardous waste management plan, and according to GoL regulations.</p> <p>48. Bitumen should only be spread on designated road beds, not on other land, near or in any surface waters, or near any human activities.</p> <p>49. Bitumen should not be used as a fuel.</p>	For all construction areas.	Throughout construction phase	Monthly	DDSC & IA/PMU/PIT	PIT/contractor
Implement Spoil management subplan	Contamination of land and surface waters from excavated spoil, and construction waste	<p>50. Uncontaminated spoil to be disposed of in GoL-designated sites, which must never be in or adjacent surface waters. Designated sites must be clearly marked and identified.</p> <p>51. Spoil must not be disposed of on sloped land, near cultural property or values, ecologically important areas, or on/near any other culturally or ecologically sensitive feature.</p> <p>52. Where possible spoil should be used at other construction sites, or disposed in spent quarries or borrow pits.</p> <p>53. A record of type, estimated volume, and source of disposed spoil must be recorded.</p> <p>54. Contaminated spoil disposal must follow GoL regulations including handling, transport, treatment (if necessary), and disposal.</p> <p>55. Suspected contaminated soil must be tested, and disposed of in designated sites identified as per GoL regulations.</p> <p>56. Before treatment or disposal contaminated spoil must be covered with plastic and isolated from all human activity.</p>	All excavation areas	Throughout construction phase	Monthly	DDSC & IA/PMU & MoNRE	PIT/contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Implement Solid and liquid construction waste subplan	Contamination of land and surface waters from construction waste	<p>57. Management of general solid and liquid waste of construction will follow GoL regulations, and will cover, collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force.</p> <p>58. Areas of disposal of solid and liquid waste to be determined by GoL.</p> <p>59. Disposed of waste should be catalogued for type, estimated weight, and source.</p> <p>60. Construction sites should have large garbage bins.</p> <p>61. A schedule of solid and liquid waste pickup and disposal must be established and followed that ensures construction sites are as clean as possible.</p> <p>62. Solid waste should be separated and recyclables sold to buyers in community.</p> <p><u>Hazardous Waste</u></p> <p>63. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow GoL regulations.</p> <p>64. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents)</p> <p>65. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good condition well away from construction activity areas, all surface water, water supplies, and cultural and ecological sensitive receptors.</p> <p>66. All spills must be cleaned up completely with all contaminated soil removed and handled with by contaminated spoil subplan.</p>	All construction sites and worker camps	Throughout construction phase	Monthly	DDSC & IA/PMU & MoNRE	PIT/contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Implement Noise and dust subplan	Dust Noise	<p>67. Regularly apply wetting agents to exposed soil and construction roads.</p> <p>68. Cover or keep moist all stockpiles of construction aggregates, and all truck loads of aggregates.</p> <p>69. Minimize time that excavations and exposed soil are left open/exposed. Backfill asap.</p> <p>70. As much as possible restrict working time between 07:00 and 17:00. In particular are activities such as pile driving.</p> <p>71. Maintain equipment in proper working order</p> <p>72. Replace unnecessarily noisy vehicles and machinery.</p> <p>73. Vehicles and machinery to be turned off when not in use.</p> <p>74. Construct temporary noise barriers around excessively noisy activity areas where possible.</p>	All construction sites.	Fulltime	Monthly	DDSC & IA/PMU	PIT/contractor
Implement Utility and power disruption subplan	Loss or disruption of utilities and services such as water supply and electricity	<p>75. Develop carefully a plan of days and locations where outages in utilities and services will occur, or are expected.</p> <p>76. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages.</p> <p>77. Contact affected community to inform them of planned outages.</p> <p>78. Try to schedule all outages during low use time such between 24:00 and 06:00.</p>	All construction sites.	Fulltime	Monthly	DDSC & IA/PMU & Utility company	PIT/contractor
Implement Tree and vegetation removal, and site restoration subplan	Damage or loss of trees, vegetation, and landscape	<p>79. Contact local forestry department for advice on how to minimize damage to trees and vegetation.</p> <p>80. Restrict tree and vegetation removal to within RoWs.</p> <p>81. Within RoWs minimize removals, and install protective physical barriers around trees that do not need to be removed.</p> <p>82. All RoWs to be re-vegetated and landscaped after construction completed. Consult MoF to determine the most successful restoration strategy and techniques.</p>	All construction sites.	Beginning and end of subproject	Monthly	DDSC & IA/PMU	PIT/contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Implement Erosion control subplan	Land erosion	<p>83. Berms, and plastic sheet fencing should be placed around all excavations and earthwork areas.</p> <p>84. Earthworks should be conducted during dry periods.</p> <p>85. Maintain a stockpile of topsoil for immediate site restoration following backfilling.</p> <p>86. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready.</p> <p>87. Re-vegetate all soil exposure areas asap.</p>	All construction sites	Throughout construction phase	Monthly	DDSC & IA/PMU	PIT/contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Implement worker and public safety subplan	Public and worker injury, and health	<p>88. Proper fencing, protective barriers, and buffer zones should be provided around all construction sites.</p> <p>89. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all sites.</p> <p>90. Worker and public safety guidelines GoL should be followed.</p> <p>91. Population near blast areas should be notified 24 hrs ahead, and evacuated well before operation. Accepted GoL blast procedures and safety measures implemented.</p> <p>92. Speed limits should be imposed on all roads used by construction vehicles.</p> <p>93. Standing water suitable for disease vector breeding should be filled in.</p> <p>94. Worker education and awareness seminars for construction hazards should be given. A construction site safety program should be developed and distributed to workers.</p> <p>95. Appropriate safety clothing and footwear should be mandatory for all construction workers.</p> <p>96. Adequate medical services must be on site or nearby all construction sites.</p> <p>97. Drinking water must be provided at all construction sites.</p> <p>98. Sufficient lighting be used during necessary night work.</p> <p>99. All construction sites should be examined daily to ensure unsafe conditions are removed.</p>	All construction sites.	Fulltime	Monthly	DDSC & IA/PMU	PIT/contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Civil works	Degradation of water quality & aquatic resources	<p>100. Protective coffer dams, berms, plastic sheet fencing, or silt curtains should be placed between all earthworks and surface waters.</p> <p>101. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion.</p> <p>102. Earthworks should be conducted during dry periods.</p> <p>103. All construction fluids such as oils, and fuels should be stored and handled well away from surface waters.</p> <p>104. No waste of any kind is to be thrown in surface waters.</p> <p>105. No washing or repair of machinery near surface waters.</p> <p>106. Pit latrines to be located well away from surface waters.</p> <p>107. No unnecessary earthworks in or adjacent to water courses.</p> <p>108. No aggregate mining from rivers or lakes.</p> <p>109. All irrigation canals and channels to be protected the same way as rivers, streams, and lakes</p>	All construction sites	Throughout construction phase	Monthly	DDSC & IA/PMU	PIT/contractor
Civil works	Degradation of terrestrial resources	<p>110. All construction sites should be located away forested or all plantation areas as much as possible.</p> <p>111. No unnecessary cutting of trees.</p> <p>112. All construction fluids such as oils, and fuels should be stored and handled well away from forested and plantation areas.</p> <p>113. No waste of any kind is to be discarded on land or in forests/plantations.</p>	All construction sites	Throughout construction phase	Monthly	DDSC & IA/PMU	PIT/contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Implement Construction and urban traffic subplan	Traffic disruption, accidents, public injury	<p>114. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights.</p> <p>115. Post speed limits, and create dedicated construction vehicle roads or lanes.</p> <p>116. Inform community of location of construction traffic areas, and provide them with directions on how to best co-exist with construction vehicles on their roads.</p> <p>117. Increase the number of pedestrian crossings away from construction areas.</p> <p>118. Increase road and walkway lighting.</p>	All construction sites	Fulltime	Monthly	DDSC & IA/PMU	PIT/contractor
Implement Construction Drainage subplan	Loss of drainage & flood storage	<p>119. Provide adequate short-term drainage away from construction sites to prevent ponding and flooding.</p> <p>120. Manage to not allow borrow pits and quarries to fill with water. Pump periodically to land infiltration or nearby water courses.</p> <p>121. Install temporary storm drains or ditches for construction sites</p> <p>122. Ensure connections among surface waters (ponds, streams) are maintained or enhanced to sustain existing stormwater storage capacity.</p> <p>123. Protect surface waters from silt and eroded soil.</p>	All areas with surface waters	Design & construction phases	Monthly	DDSC & IA/PMU	PIT/contractor
Civil works	Damage to cultural property or values, and chance finds	<p>124. As per detailed designs all civil works should be located away from all cultural property and values.</p> <p>125. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for finds.</p> <p>126. Upon a chance find all work stops immediately, find left untouched, and PMU notified. If find deemed valuable, provincial cultural authorities must be notified.</p> <p>127. Work at find site will remain stopped until authorities allow work to continue.</p>	All construction sites	At the start, and throughout construction phase	Monthly	DDSC & IA/PMU	PIT/contractor
Construction of Sanitary landfill and MRF							

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Excavations for cells	Penetration of water table	128. As part of ECA verify that excavations for cells of new landfill will not penetrate or come too close to water table	All landfill cells, and excavations	Throughout excavation period	Monthly	DDSC & IA/PMU	PIT/Contractor
	Soil permeability	129. As part of ECA clarify permeability of soils, and overall sensitivity of groundwater to new sanitary landfill & leachate treatment and disposal.	All landfill cells, and excavations	Before excavations	Monthly	DDSC & IA/PMU	PIT/Contractor
Specific Mitigations for Construction of WWTPs and Drain Canals & Pipelines							
Excavations for ponds	Penetration of water table	130. Verify that excavations for aerobic treatment ponds and new drain canals will not penetrate or come too close to water table	WWTP & canal excavations	Throughout excavation period	Monthly	DDSC & IA/PMU	PIT/Contractor
	Soil permeability	131. Clarify permeability of soils, and overall sensitivity of groundwater to aerobic ponds & pond sludge disposal.	WWTPs	Before excavations	Monthly	DDSC & IA/PMU	PIT/Contractor
Excavations near surface waters	Sedimentation	132. Excavations for new canals, pipelines, & WWTPs at Houay Longkong, & Savanxay market areas not near surface waters, wet excavate regularly, and cover until replaced, or removed. Use berms where needed to contain excavate.	All excavation locations	Throughout excavation period	Monthly	DDSC & IA/PMU	PIT/Contractor
Construction of discharge structure(s)	Sedimentation of river, loss of fish habitat, land erosion & pollution	133. Minimize any civil works near Mekong river by constructing all discharge structures as much as possible on land. Minimize placement & size of concrete foundation/footings in surface waters where applicable. 134. Ensure terrestrial locations of treated leachate disposal, & WWTPs effluent & sludge disposal are not near sensitive ecological or community /cultural property or values.	All structures locations & treated effluent & leachate discharge locations	Throughout construction of discharge	Monthly	DDSC & IA/PMU	PIT/Contractor
Construction of WWTPs	Public injury, aesthetics and noise disturbance	135. Install elevated treed perimeter berms around WWTPs including treatment ponds, and the landfill site including leachate treatment facility to isolate both facilities from community. Security fences should surround both facilities inside the facility berms.	WWTP & landfill facilities	Permanent	n/a	DDSC & IA/PMU	PIT/Contractor
Specific Mitigations for Construction of Mekong Riverbank Protection							

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
Civil works near shoreline	Sedimentation	136. Isolate all excavations & piled excavate away from river as much as possible, wet piles regularly, and cover until replaced, or removed. Use erosion berms, and install industrial silt curtain parallel in river to separate entire construction zone from river.	Entire riverbank site	Throughout construction period	Monthly	DDSC & IA/PMU	PIT/Contractor
Construction barge traffic in river	Disrupted community boat navigation, and increased collisions	137. Establish a well marked, nearshore access lane for barge traffic. Attempt to schedule barge traffic during periods of low river traffic	In river in front of construction area	Throughout construction period	Monthly	DDSC & IA/PMU	PIT/Contractor
Shoreline filling to fortify riverbank	Loss of aquatic habitat	138. Attempt to minimize filling as much as possible. Conduct works when fish are not using area to be filled.	In river in front of construction area	Throughout construction period	Monthly	DDSC & IA/PMU	PIT/Contractor
<i>Post-construction Operation of WWTPs and Facilities</i>							
Operation of WWTPs, pipelines, & discharge	Land and surface water pollution	139. Ensure all treatment process, pipeline, and WWTP equipment stays in good working order.	WWTPs & below discharge points	Continuously	Biannual	"Kaysone Wastewater Treatment DOPWT"	
Operation of WWTPs	Land and water pollution	140. Develop and implement a regular testing protocol for the quality of disposed sludge and discharged treated wastewater.	Sludge beds at discharge	Periodically	Biannual	"Kaysone Wastewater Treatment DOPWT"	
Operation of WWTPs	Land and water pollution	141. Implement engineering and management systems to prevent and manage emergency spills and discharge situations	WWTPs & pipelines	Continuously	Biannual	"Kaysone Wastewater Treatment DOPWT"	
Operation of WWTPs	Groundwater and soil pollution	142. Implement specially designed treatment lagoons that do not contaminate groundwater or underlying soil	Aerobic ponds	Continuously	Biannual	"Kaysone Wastewater Treatment DOPWT"	
Operation of WWTPs, pipelines, & discharge	Worker and public injury	143. Educate workers in workplace safety. Prevent public access to WWTPs property and pipeline areas, and discharge areas with fencing and warning signage.	WWTPs and pipelines	Continuously	Biannual	"Kaysone Wastewater Treatment DOPWT"	

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
ge							
Operation of WWTPs, pipelines, & discharge	Emergency spills and untreated sludge & effluent discharges	144. Regularly review accident prevention management plan, and test emergency response plan for equipment failure and spills.	WWTPs, pipelines, discharge	Periodically	Biannual	"Kaysone Wastewater Treatment DOPWT"	
Operation of WWTPs	Vector habitat & disease	145. Cover all standing water as much as possible	WWTPs	Periodically	Biannual	"Kaysone Wastewater Treatment DOPWT"	
Operation of WWTPs, pipelines, & discharge	Sickness caused by operation of WWTPs and pipeline network	146. Coordinate with local public health officials to monitor incidence of water and air-borne sickness or disease in the local community and worker force that could be caused by the operation of WWTP and pipeline network	Areas affected by WWTPs P & pipeline network	fulltime	Biannual	"Kaysone Wastewater Treatment DOPWT"	
Operation of WWTPs, pipelines, & discharge	Air, surface water, and groundwater pollution caused by operation of WWTPs & pipelines	147. Coordinate with MoNRE for regular monitoring of the downstream quality of receiving environments of treated discharge, and also the quality of local groundwater and ambient air that potentially are influenced by WWTPs & pipelines.	Areas affected by WWTPs & pipeline network	biannually	Annual	"Kaysone Wastewater Treatment DOPWT"	
<i>Post-construction Operation of Sanitary Landfill & MRF</i>							
Operation of landfill, & facilities	Land and surface water pollution	148. Ensure landfill liner, pipelines, and leachate collection & treatment facility stay in good working order.	Landfill & leachate facility	Continuously	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	
Operation of landfill	Land and water pollution	149. Develop and implement a regular testing protocol for the quality of treated leachate.	Leachate facility	Periodically	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	
Operation of landfill	Land and water pollution	150. Implement engineering and management systems to prevent and manage emergency leachate spills and discharge situations	Leachate facility	Continuously	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	
Operation of landfill	Groundwater and soil	151. Implement specially designed leachate collection "lagoon" that contains & does not contaminate groundwater or	Leachate	Continuously	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
	pollution	underlying soil	facility				
Operation of landfill, & facilities	Worker and public injury	152. Educate workers in workplace safety. Prevent public access to landfill property and with fencing and warning signage.	Landfill & leachate facility	Continuously	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	
Operation of landfill, & facilities	Emergency spills and untreated leachate discharges	153. Regularly review accident prevention management plan, and test emergency response plan for equipment failure and spills.	Leachate facility	Periodically	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	
Operation of landfill, & facilities	Disease vector & vermin habitat	154. Cover all standing water as much as possible, and cover landfill areas as soon as possible	Landfill & leachate facility	Periodically	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	
Operation of landfill, & facilities	Sickness caused by operation of landfill & leachate facility	155. Coordinate with local public health officials to monitor incidence of water and air-borne sickness or disease in the local community and worker force that could be caused by the landfill & treated leachate disposal	Community "downstream" of landfill & leachate disposal area	fulltime	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	
Operation of landfill, & facilities	Air, surface water, and groundwater pollution caused by landfill & leachate	156. Coordinate with MoNRE for regular monitoring of the downstream quality of receiving environments of treated discharge, and also the quality of local groundwater and ambient air that potentially are influenced by landfill & leachate management.	Areas "downstream" of landfill & leachate disposal	biannually	Annual	"Kaysone Solid Waste Management DOPWT, UDAA"	
<i>Post-construction Operation of all New or Upgraded Roads</i>							
Operation of new & upgraded	Increased risk of accident or injury.	157. Enforce well marked speed limits, provide guard rails along road, and educate public on new road safety.	New or upgraded roads,	Fulltime	Biannual	IA/PMU	

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Responsibility	
						Supervision	Implementation
roads in Kaysone	Increased air pollution & noise	158. Enforce speed limits, ensure vehicles maintained in proper working condition	New or upgraded roads	Periodic checks	Biannual	IA/PMU	

V. MONITORING PLAN

18. The environmental monitoring plan for the EMP is provided in Table 5. The monitoring plan focuses on all three phases (pre-construction, construction, post-construction operation) of the subproject and consists of environmental indicators, the sampling locations & frequency, method of data collection, and responsible parties. Estimated costs are tabled separately. The purpose of the monitoring plan is to determine the effectiveness of the impact mitigations, and to document any unexpected positive or negative environmental impacts of the subproject.

A. Environmental Standards for Subproject Components

19. Environmental standards for ambient water quality, and for wastewater effluent quality in urban areas in Lao PDR are provided by the National Environmental Standard Order No. 2734/PMU-WREA (2009). The wastewater and sanitary landfill components in particular will need to adhere to these national standards. The list of standards is found in Appendix B. The environmental standards provided by the Environmental, Health and Safety Guidelines of the World Bank (2007) (e.g., ambient air quality & noise) should be followed to supplement standards not provided by the GoL.

20. An independent environmental monitoring consultant (EMC) will be required to implement the environmental monitoring program. The IA/PMU and PIT will provide logistical support to the EMC where necessary for the implementation of environmental monitoring plan.

21. After the construction phase is completed and all five components are in operation the impact of the new infrastructure developments on traffic patterns and urban development should be monitored by the EA. The quality of the effluent of the WWTP, and “downstream” surface and groundwater water quality of the receiving environments should also be monitored by MoNRE. Similarly, the quality of the discharged treated leachate, and “downstream” surface and groundwater quality of the receiving environments should also be monitored by MoNRE. Groundwater monitoring for the new sanitary landfill will occur in conjunction with groundwater monitoring for the decommissioned dumpsite that will most likely be required as per the results of the ECA.

22. Monitoring the success of the resettlement the few households in Kaysone, and the temporary relocation of secondary structures will be undertaken as part of the separate RAP prepared for the subproject.

B. Performance Monitoring

23. 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 6.

VI. REPORTING

24. 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 PMU and should be conducted in conjunction with the regular meetings with stakeholders as part of the stakeholder communication strategy. The mitigation and monitoring plans (Tables 4 and 5) summarize proposed timing of reporting. Environmental monitoring reports will be prepared quarterly for the EA by the IA/PMU and PIT and sent to the MoNRE and ADB. The reports will table all indicators measured with the monitoring plan of EMP including performance monitoring indicators (Table 6), and will include relevant GoL environmental quality standards.

ENVIRONMENTAL EFFECTS MONITORING						
Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility	
					Supervision	Implementation
<i>Pre-construction Phase – Update Baseline Conditions</i>						
Update baseline on sensitive receptors (e.g., cultural property & values, new schools or hospitals, rare/endangered species, critical habitat), and aquatic resources and human uses of affected surface waters.	Final sites of sanitary landfill, MRF, WWTPs & pipelines, Mekong riverbank area including river, & in RoWs of urban roads	Original field work, community consultations	Once	Once	IA/PMU	Environmental Monitoring Consultant
A) Air quality: dust, CO, NOx, SOx, noise, wind, temperature, and vibration levels B) Surface & groundwater water quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, BOD ₅ , temperature, TDS, NH ₃ , NH ₄ , other nutrient forms of N & P, sulphides, surfactants.	A): At construction sites at each component B): At affected surface waters (e.g., Mekong river), and above & below effluent, sludge, & leachate discharge/disposal sites Groundwater should be sampled at domestic wells near the WWTPs, landfill, and discharge/disposal sites for WWTPs effluent & sludge, and leachate from landfill. See ToR for ECA for sampling at landfill site	Using field and analytical methods approved by MoNRE.	(A & B): One day and one night measurement during rainy & dry seasons	One baseline supplement report before construction phase starts	IA/PMU	Environmental Monitoring Consultant
Inventory of present and past land uses that could cause contaminated soil.	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by MoNRE.	Once	Once	IA/PMU	Environmental Monitoring Consultant
Construction Phase of Sanitary Landfill & MRF, WWTPs & Canals/pipelines, Mekong Riverbank Protection, & Urban Road Upgrades						
Analysis of soil quality (heavy metals (As, Cd, Pb, oil & grease, hydrocarbons)	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by MoNRE.	D): Once if needed	Once	IA/PMU	Environmental Monitoring Consultant

Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility	
					Supervision	Implementation
<p>A) Air quality: dust, CO, NOx, SOx, noise, wind, temperature, and vibration levels</p> <p>B) Surface & groundwater quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, BOD₅, temperature, NH₃, and other nutrient forms of N & P.</p> <p>C) Analysis of soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons.</p> <p>D) Domestic (worker) and construction solid waste inside & outside construction sites including worker camps.</p> <p>E) Public comments and complaints</p> <p>F) Incidence of worker or public accident or injury</p>	<p>A & B): Baseline sites of pre-construction phase.</p> <p>C) At sites where contaminated soil is suspected.</p> <p>D) All construction sites and worker camps</p> <p>E) Using hotline number placed at construction areas</p> <p>F) At all construction areas</p>	<p>A – C : Using field and analytical methods approved by MoNRE.</p> <p>Include visual observations of dust and noise from contractor & public reports .</p> <p>D) Visual observation</p> <p>E) Information transferred by telephone hotline number posted at all construction sites.</p> <p>F) regular reporting by contractors/PMU</p>	<p>(A – B): Quarterly during construction periods</p> <p>Daily visual records</p> <p>C) Once at start of excavations</p> <p>D) Monthly</p> <p>E) Continuous public input</p> <p>F) Continuous</p>	Monthly	(A - D):	
					IA/PMU	Monitoring Consultant
					E & F) & daily observations:	
					IA/PMU	PIT/contractor
Operation of Sanitary Landfill						
Air quality: dust, noise and vibration levels	At landfill	Using field and analytical methods approved by MoNRE.	Quarterly for 5 years	Biannual	"Kaysone Solid Waste Management DOPWT, UDAA"	
Worker & public injury associated with landfill operations	On property of landfill including truck transport.	Regular record keeping	Continuously	For each event	"Kaysone Solid Waste Management DOPWT, UDAA"	

Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility	
					Supervision	Implementation
Treated leachate quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, BOD ₅ , temperature, TDS, NH ₃ , NH ₄ , other nutrient forms of N & P, sulphides, surfactants.	At finalized locations of treated leachate disposal	Using field and analytical methods approved by MoNRE.	Biannually, or when public complaint arises	For each event	"Kaysone Solid Waste Management DOPWT, UDAA"	
Ambient water quality of receiving environments, and groundwater quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, BOD ₅ , temperature, TDS, NH ₃ , NH ₄ , other nutrient forms of N & P, sulphides, surfactants.	In receiving environment above and below landfill & leachate disposal areas, and in ultimate downstream receiving river. Groundwater at same domestic wells sampled during pre-construction phase near the landfill and location of leachate disposal. See results of ECA.	Using field and analytical methods approved by MoNRE.	Quarterly for 5 years	Biannually	"Kaysone Solid Waste Management DOPWT, UDAA"	
Soil quality: heavy metals (As, Cd, Pb,) nutrients (N&P), and ToC	At terrestrial leachate disposal locations	Using field and analytical methods approved by MoNRE.	Quarterly for 5 years	Biannually	"Kaysone Solid Waste Management DOPWT, UDAA"	
Operation of WWTPs & Canals & Pipelines						
Air quality: dust, noise and vibration levels	At WWTPs	Using field and analytical methods approved by MoNRE.	Quarterly for 5 years	Biannually	"Kaysone Wastewater Treatment DOPWT, UDAA"	
Worker & public injury associated with WWTPs & pipeline networks	On property of WWTPs, & pipelines.	Regular record keeping	Continuously	For each event	"Kaysone Wastewater Treatment DOPWT, UDAA"	
Wastewater discharge quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, BOD ₅ , temperature, TDS, NH ₃ , NH ₄ , other nutrient forms of N & P, sulphides, surfactants.	At finalized effluent discharges	Using field and analytical methods approved by MoNRE.	Biannually, or when public complaint arises	For each event	"Kaysone Wastewater Treatment DOPWT, UDAA"	

Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility	
					Supervision	Implementation
Ambient water quality of receiving environments, and groundwater quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, BOD ₅ , temperature, TDS, NH ₃ , NH ₄ , other nutrient forms of N & P, sulphides, surfactants.	In receiving environment above and below WWTP discharges, and in ultimate downstream receiving river, i.e., Mekong river. Groundwater at same domestic wells sampled during pre-construction phase near the WWTP and location of sludge disposal	Using field and analytical methods approved by MoNRE.	Quarterly for 5 years	Biannually	"Kaysone Wastewater Treatment DOPWT, UDAA"	
WWTP sludge quality: ToC, heavy metals (As, Cd, Pb,) coliforms, pH, BOD, and nutrients (N&P)	After removal from ponds and before disposal at designated landfill or agricultural fields	Using field and analytical methods approved by MoNRE.	Quarterly for 5 years	Biannually	"Kaysone Wastewater Treatment DOPWT, UDAA"	
Operation of All New and Upgraded Roads						
Air quality: dust, CO, NO _x , SO _x , noise and vibration levels	Baseline sites of pre-construction phase.	Using field and analytical methods approved by MoNRE.	Quarterly for 5 years	Biannually	IA/PMU	
Traffic accidents	New or upgraded roads.	Regular record keeping.	Continuously	For each event	IA/PMU	
Incidence of flooding	Adjacent to new or upgraded roads	Surveys, public complaints	Seasonal for 5 years	Seasonal	IA/PMU	

Table 6. Performance Monitoring Indicators for Kaysone Subproject

Major Environmental Component	Key Indicator	Performance Objective	Data Source
Pre-construction Phase			
Public Consultation & Disclosure	Affected public & stakeholders	Meetings with stakeholders contacted during IEE & new stakeholders convened for follow-up consultation & to introduce grievance mechanism	Minutes of meeting, and participants list
EMP	Updated EMP	All stakeholders contacted during IEE re-contacted for follow-up consultation	EMP
Bid Documents	Requirements of EMP (CEMP ³)	EMP appended to bidding documents with clear instructions to bidders for CEMP	Bid documents
Training of PMU/PIU/ECO	Training course(s) & schedule	By end of P-C phase, required course(s) that will be delivered are designed and scheduled	Course(s) outline, participants, and schedule
Construction Phase			
All subproject areas	Critical habitat, rare or endangered species <i>if present</i>	All <i>present</i> critical habitat and R & E species if unchanged, and unharmed	Monitoring by EMC ⁴
Affected water quality	TSS, DO, BOD, COD, pH, oil & grease, nutrient forms of T & N, metals (Pb, Fe, As), in for example affected reaches of Mekong river	GoL environmental standards & criteria met	Monitoring by EMC
Air quality	SOx, NOx, dust, , CO, noise, vibration at all construction sites	Levels never exceed pre-construction baseline levels	EMC & contractor monitoring reports,
Soil quality	Solid & liquid waste from all construction activities including camps	Rigorous program of procedures & rules to collect and store all waste from construction camps and sites practiced.	Contractor and EMC monitoring reports
Hazardous materials & waste	Oil, gasoline, grease, alum, chlorine, soda, as above	Rigorous program of procedures to manage and store all waste from construction camps and sites	Contractor and EMC monitoring reports

³ Contractor Environmental Management Plan developed from EMP in contractor bidding document

⁴ Environmental Monitoring Consultant hired to implement Environmental Monitoring Plan

Major Environmental Component	Key Indicator	Performance Objective	Data Source
		practiced.	
Public & worker safety	Frequency of injuries	Adherence to GoL policy and site-specific procedures to prevent accidents	Contractor reports
Cultural property	Incidence of damage, or complaints	No valued cultural property, or unearthed valuable relic is harmed in any way	Public input, contractor reports, public input, EMC reports
Traffic	Frequency of disruptions & blocked roadways	Disruptions, stoppages, or detours are managed to absolute minimum.	Public input, contractor reports, EMC reports
Operation Phase of Components			
Soil & surface water quality	Contamination from disposed landfill leachate, and WWTP sludge	Leachate treated to GoL specifications and disposed in approved location.	Public input, MoNRE inspections, Kaysone SW. regular reporting
Groundwater quality	Contamination from landfill cells, and aerobic ponds of WWTPs	Groundwater not penetrated, no contamination	MoNRE well sampling, Kaysone SW. regular reporting
Worker health & safety	Exposure and hazardous activities & equipment	No accidents will occur following procedures of O&M manual for solid waste transport & landfill operations.	GoL reports, & Kaysone SW. regular reporting
Traffic safety	Frequency of accidents	No increase in pre-construction frequency	PDPWT
Air quality	SO _x , NO _x , dust, , CO, noise, at WWTPs, landfill, along upgraded roads	Levels never exceed pre-construction baseline levels	MoNRE,

VII. ESTIMATED COST OF EMP

25. 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.

26. The preliminary cost for the implementation of the EMP for Kaysone is approximately USD \$274,000 without MRF costs (Table 7). With the MRF the estimated budget would be approximately \$279,000. The preliminary costs for the individual investments are as follows:

- Sanitary Landfill: \$96,000.
- MRF: \$5,500.
- Wastewater Treatment: \$76,000.
- Mekong Riverbank Protection: \$49,000.
- Urban Road & Drainage Upgrade; \$52,000.

27. An additional budget allocation of an estimated \$100,000 for the cost of the ECA should be provided. This budget will be need ahead of the pre-construction phase because the results of the ECA are needed for the detailed designs of the sanitary landfill.

28. An estimated budget of USD\$11,000., is required for capacity building for environmental management. The costs will need to be updated by the DDSC in conjunction with the PMU during the pre-construction phase.

Table 7. Preliminary Cost Estimation of EMP for Kaysone.

Activity	Indicative Cost (USD)			
	Integrated in to Construction and O&M Contract	Integrated in to Detailed Design Contract	Integrated in to PMU/PIU Budget	Training, Technical Assistance & Services Budget
Environmental Mitigation	-			
A. Pre-Construction Phase				
A.1 Engineering mitigation measures		Design cost		
A.2 Preparation of GoL IEE & EIA		Design cost	ESMU cost	97000
A.3 ECC application		Design cost	ESMU cost	3500
A.4 Community awareness campaign			ESMU cost	7600
A.5 Resettlement, compensation activities			ESMU cost	15000
B. Construction Phase				
B.1 Implementation of construction engineering best practice as mitigation measures	Subproject cost			
C. Operation Phase				
C.1 Implementation of mitigation measures in design	Subproject cost	-	-	
C.2 Implementation of operational practices as mitigation measures	Subproject cost			
Environmental Effects Monitoring				
A. Pre-Construction Phase				
A.1 Establishment of baseline environmental data			ESMU cost	11200

Activity	Indicative Cost (USD)			
	Integrated in to Construction and O&M Contract	Integrated in to Detailed Design Contract	Integrated in to PMU/PIU Budget	Training, Technical Assistance & Services Budget
B. Construction Phase				
B.1 Monitoring of air, noise, vibration, water			ESMU cost	14400
B.2 Monitoring of community & workers' health and safety			ESMU cost	7600
C. Operation Phase				
C.1 Monitoring of air, noise, water (2 years)			ESMU cost	12000
C.2 Monitoring of community health and safety (2 years)			ESMU cost	16800
Sub-Total (USD)	-			
D. Performance Monitoring				
D.1 ESMU Audits				8000
D.2 Project Audits			ESMU Cost	46500
Miscellaneous & Contingency				
Seminars/Workshops				10000
Transport (use of vehicle)			ESMU Cost	
Equipment & Supplies	Subproject cost		ESMU Cost	
Sub-Total (USD)				249600
Contingency at 10%				24960
Total (USD)				274560

VIII. EMERGENCY RESPONSE PLAN

29. 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) the District and City 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.

30. 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 / provides assistance during EERT's response operations.
External Emergency Response Team (EERT)	<ul style="list-style-type: none"> - Solves the emergency/incident
Contractor Resources	<ul style="list-style-type: none"> - Provide and sustain the people, equipment, tools & funds necessary to ensure Subproject's quick response to emergency situations. - Maintain good communication lines with the EERT to ensure prompt help response & adequate protection, by keeping them informed of Subproject progress.

31. 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.

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

33. Prior to the mobilization of civil works, the Contractor, through its Construction Manager, ERTL, in coordination with the PMU/PCU, 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

34. 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.

35. 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) made 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.

36. 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

37. 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 situation; ii) correct location of the emergency; iii) estimated magnitude of the situation; iv) estimated persons harmed; v) time it happened; vi) 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 situation:

- (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
 - PMU Office, ESMU
- (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

The following tables suggest general procedures that will be refined in the final EMP during detailed design, and described in more detail in the Emergency Management Plans of the Contractor.

Table 9. Evacuation Procedure

Procedure	Remarks
<ul style="list-style-type: none"> ▪ Move out as quickly as possible as a group, but avoid panic. 	<ul style="list-style-type: none"> ▪ All workers/staff, sub-contractors, site visitors to move out, guided by the ERT.
<ul style="list-style-type: none"> ▪ Evacuate through the directed evacuation route. 	<ul style="list-style-type: none"> ▪ The safe evacuation shall have been determined fast by the ERTL/Deputy ERTL & immediately communicated to ERT members.
<ul style="list-style-type: none"> ▪ Keep moving until everyone is safely away from the emergency site and its influence area. 	<ul style="list-style-type: none"> ▪ A restricted area must be established outside the emergency site, all to stay beyond the restricted area.
<ul style="list-style-type: none"> ▪ Once outside, conduct head counts. 	<ul style="list-style-type: none"> ▪ Foremen to do head counts of their sub-groups; ERTL/Deputy ERTL of the ERT.
<ul style="list-style-type: none"> ▪ Report missing persons to EERT 	<ul style="list-style-type: none"> ▪ ERTL/Deputy ERTL to communicate

Procedure	Remarks
immediately.	with the EERT.
<ul style="list-style-type: none"> ▪ Assist the injured in evacuation & hand them over to the ERT first-aiders or EERT medical group 	<ul style="list-style-type: none"> ▪ ERT to manage injured persons to ensure proper handling.
<ul style="list-style-type: none"> ▪ If injury warrants special care, DO NOT MOVE them, unless necessary & instructed/directed by the EERT. 	<ul style="list-style-type: none"> ▪ ERTL/Deputy ERTL communicates with EERT to get instructions/directions in handling the injured.

Table 10. Response Procedure During Medical Emergency

Procedure	Remarks
<ul style="list-style-type: none"> ▪ Administer First Aid regardless of severity immediately. 	<ul style="list-style-type: none"> ▪ Fundamentals when giving First Aid: <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.
<ul style="list-style-type: none"> ▪ Call the EERT emergency medical services &/or nearest hospital. 	<ul style="list-style-type: none"> ▪ ERTL/Deputy ERTL or authorized on-site emergency communicator
<ul style="list-style-type: none"> ▪ Facilitate leading the EERT to the emergency site. 	<ul style="list-style-type: none"> ▪ ERTL/Deputy ERTL to instruct: <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.
<ul style="list-style-type: none"> ▪ If applicable, vacate site & influence area at once, restrict site, suspend work until further notice. 	<ul style="list-style-type: none"> ▪ Follow evacuation procedure.

Table 11. Response Procedure in Case of Fire

Procedure	Remarks
<ul style="list-style-type: none"> ▪ Alert a fire situation. 	<ul style="list-style-type: none"> ▪ Whoever detects the fire shall immediately: <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

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

IX. INSTITUTIONAL CAPACITY REVIEW AND NEEDS

38. Currently there is little capacity for environmental assessment and management amongst subproject staff (e.g., PMU/PIT) in Kaysone. The DDSC with assistance from the designated ESMU and ECO of the subproject will develop and deliver training courses to the PIU/PMU staff. The purpose of the courses is to strengthen the ability of the IA/PMU and PIT to oversee implementation of the EMP by construction contractors, and EMC

39. The ECO who may be the only full-time environmental member of the ESMU should attend training courses as required. Costs for training should be included with costs for implementation of the EMP.

40. Training also must include the operational phase of the WWTP and facilities. The Kaysone Solid Waste & Wastewater Agencies must be able to manage the environmental issues associated with the operation of the WWTP and landfill. Whereas, the PDPTW and DOPWT must be able to manage the environmental issues associated with the operation of the upgraded urban roads, and fortified and commercialized Mekong riverbank in Kaysone.

41. Training on the implementation of an EMP is should focus on two thematic areas. The first area should be principles environmental management focused on the potential impacts of

infrastructure development on the natural and social environment. The second area should be environmental safeguard requirements of the ADB and GoL with specific focus on the EMP.

X. APPENDIX A: ENVIRONMENTAL PROTECTION LAWS & STRATEGIES

Law or Decree	Article	Relating To	Content
<i>Constitution of the Lao People's Democratic Republic (1991, amended 2003)</i>	17	Environment in general	"All organizations and citizens must protect the environment and natural resources: land, underground, forests, fauna, water sources and atmosphere."
<i>Environmental Protection Law (1999)</i>	5	Environment in general	Conservation takes priority over mitigation and restoration. Socio-economic development planning must include planning for environmental protection
<i>Environmental Protection Law (1999)</i>	8	EIA Process	MONRE is main agency to issue regulations for EIA. People affected by projects, mass organizations, and local administrations are to be involved in the EIA process
	10	Responsibility of those engaged in development works	Those engaged in development works must adhere to safeguards, and to standards and regulations issued by GOL agencies
	14	Responsibility of those engaged in development works	Those engaged in development works must abide by laws on land, forests, water, etc.
	16	Responsibility toward cultural, historical, natural heritage sites	Those engaged in development works must abide by laws and regulations to protect such heritage sites
	22	Pollution control	All are responsible for control of pollution, and applying technologies appropriate to control such pollution
	23	Hazardous wastes / emissions	Restrictions to hazardous wastes and means to control such wastes and emissions
	28	Damage to environment	Those causing damage to environment are responsible for repair through appropriate GOL agencies
	38, 39	Local environmental management and monitoring	Stipulates responsibilities of local administrations (provinces, municipalities, special districts, districts) to establish environmental management and monitoring units
	40	Local environmental responsibilities	Stipulates responsibilities of village administrations to follow environmental regulations
<i>Water and Water Resources Law (1996)</i>	4	Rights to use water resources	Defines rights, obligations, and procedures to gain approval for use of water resources
	18	Permission for use	Stipulates that medium and large scale uses require feasibility studies, EIAs, and mitigation plans, before permission is granted for use of the resource

Law or Decree	Article	Relating To	Content
	22	Principles in water resource development management	Stipulates that water resource development must be consistent with national and sector plans, must ensure preservation of the natural beauty of the resources, and must protect against harmful effects of water
<i>Water and Water Resources Law (1996)</i>	25	Promotion of Watershed and Water Resource Protection for Hydropower Development	Stipulates that 'hydropower projects must be developed with due concern for environmental protection, flood protection, water supply, irrigation, navigation, fisheries and others.'
	29	Water and water resource protection	Requires that water resources be protected from becoming spoilt, polluted, or drying up, and that forest and land resources be protected to help protect the water resources
<i>Lao Forestry Law (amended 2007)</i>	5	Policy on forest and forest land	The GOL has the policy to preserve, regenerate, and develop forests and forest land to help preserve the environment, water resources, biodiversity, and people's livelihoods.
	9 to 13	Forest types	Classify the various types of forests according to use, including forests for village use
	26	Preservation of water resources in forest zones	Stipulates the preservation of water resources in forest zones for those areas where waterways originate and flow, including strict management and regulations to control logging, shifting cultivation, and destructive forest uses
	70	Conversion of forestland	Stipulates that forestland can be converted to other land type if it brings a high level of benefits to the nation and to livelihoods of the people, and is included in the national development plan
	71	Types of converted forestland	Stipulates that for uses such as dam construction, the timber and forest resources to be harvested in those areas are property of the State
<i>Wildlife and Aquatic Law (2007)</i>	31	Use for Household purposes	Allows use by village households of wildlife and aquatic species in the common and general category list in particular seasons or permitted areas, using tools or equipment that do not adversely affect habitats or compromise the species population.
	32	Customary Use	Allows use of wildlife or aquatic species in the common and general category list by village households for "necessary cultural beliefs."

Law or Decree	Article	Relating To	Content
	52	Prohibitions	Prohibits taking of wildlife, including parts of the animals, from their habitats; tormenting wildlife and aquatics; illegal catching, hunting, trading and possession; catching aquatic and hunting in conservation zones, in breeding season, or when pregnant; devastation of habitats and feeding zones.
<i>Land Law (2003)</i>	6	Protection of Land and Environment	Declares that all individuals and organizations are obliged to protect the land from degradation,
	14	Changes in Land Category	Land use can be changed if it does not cause social or environmental harm and if prior approval is obtained from the authorities.
<i>Decree on Land Lease or Concession (2009)</i>	39	Obligation of Person or Legal Entity Who Leases or Obtains Concession	The person or legal entity who leases land or obtains a concession is obligated, among other things, "not to cause any damage to the quality of land and negative impact to the natural environment and the society."
<i>Road Law (1999)</i>	15	Public Road Construction	Construction of public roads must include protection of the environment
<i>Prime Ministerial Decree No. 112/PM on Environmental Impact Assessment (2010)</i>		Stipulates the need for Environmental Impact Assessment	Stipulates rights of those affected by projects, and need for participation. Outlines the process of conducting the EIA, preparing environmental management and monitoring plans, social management and monitoring plans, issuing environmental compliance certificates, monitoring compliance with the various plans, establishing the institutional framework including grievance procedures.
<i>Decree on Compensation and Resettlement of People Affected by Development Projects (2006)</i>		Establish the procedures for compensation and resettlement for project affected people	Defines the principles, rules, and measures to mitigate adverse impacts and to compensate for damages that may result from involuntary acquisition or repossession of land and of fixed or movable assets, including changes in land use and restrictions to access of community or natural resources

XI. APPENDIX B: WATER QUALITY & WASTEWATER DISCHARGE STANDARDS

Table1. Surface water quality standards in Lao PDR

No.	Parameter	Unit	Standard Value
1	Color, Odor, Taste	-	Natural Level
2	Temperature	°C	Natural Level
3	pH	-	5 - 9
4	DO	mg/l	6
5	COD _{Mn}	mg/l	5
6	BOD ₅	mg/l	1.5
7	Coliform Bacteria	MPN/100 ml	5,000
8	Faecal Coliform	MPN/100 ml	1,000
9	NO ₃ -N	mg/l	< 5.0
10	NH ₃ -N	mg/l	0.2
11	C ₆ H ₅ -OH	mg/l	0.005
12	Cu	mg/l	0.1
13	Ni	mg/l	0.1
14	Mn	mg/l	1.0
15	Zn	mg/l	1.0
16	Cd	mg/l	0.005
17	Cr ⁶⁺	mg/l	0.05
18	Pb	mg/l	0.05
19	Hg	mg/l	0.002
20	As	mg/l	0.01
21	CN ⁻	mg/l	0.005
22	Radioactivity - Gross α	Becquerel/l	0.1
23	Radioactivity - Gross β	Becquerel/l	1.0
24	Total organochlorine	mg/l	0.05
25	DDT	μ g/l	1.0
26	α BHC	μ g/l	0.02
27	Dieldrine	μ g/l	0.1
28	Aldrin	μ g/l	0.1
29	Heptachlor & Heptachlor epoxide	μ g/l	0.2
30	Endrin	μ g/l	ND

Source: The Agreement of National Standards of Environment in Laos, March 2009. Prime Minister Office and WREA

Table 2. Standards for wastewater discharge in urban areas in Lao PDR

No.	Parameter	Unit	Maximum Allowable Concentration
1	BOD ₅	mg/l	40
2	NH ₃ -N	mg/l	4
3	TSS	mg/l	40
4	pH	mg/l	6 – 9.5
5	TDS	mg/l	3,500
6	C ₆ H ₅ OH	mg/l	0.3
7	P	mg/l	1.0
8	Ag	mg/l	0.1
9	Zn	mg/l	1.0
10	S	mg/l	1.0
11	Cl ₂	mg/l	1.0
12	Cl ⁻	mg/l	500
13	Fe	mg/l	2.0
14	F	mg/l	15
15	CN	mg/l	0.1
16	Cu	mg/l	0.5
17	Pb	mg/l	0.2
18	Oil and fat	-	5
19	Ni	mg/l	0.2
20	Hg	mg/l	0.005
21	Mn	mg/l	1.0
22	As	mg/l	0.25
23	B	mg/l	1.0
24	Cd	mg/l	0.03
25	Cr ⁶⁺	mg/l	0.1
26	Total Cr	mg/l	0.5

Source: *The Agreement on National Environment Standards in Laos, December 7, 2009. Prime Minister Office and WREA in Lao PDR.*

Table 3. Standards for wastewater discharge in urban area in Lao PDR

No.	Parameter	Unit	Permissible Values				
			A	B	C	D	E
1	BOD ₅	mg/l	20	30	50	60	200
2	Suspended Solid	mg/l	30	40	50	50	60
3	Settleable Solids	mg/l	0.5	0.5	0.5	0.5	-
4	Total Dissolved Solids (TDS)	mg/l	3,000	2,500	2,000	1,500	-
5	COD	mg/l	120	130	150	350	400
6	Sulfide	mg/l	1.0	1.0	3.0	4.0	-
7	Total Kjeldahl Nitrogen (TKN)	mg/l	35	35	40	40	-
8	Fat oil and grease	mg/l	20	20	20	20	100
9	Temperature	°C	40	40	40	40	40
10	pH	-	6-9.5	6-9.5	6-9.5	6-9.5	6-9.5

Source: The Agreement on National Environment Standards in Laos, December 7, 2009. Prime Minister Office and WREA in Lao PDR.