# Environmental Management Plan

September 2019

# CAM: Second Greater Mekong Sub-Region Corridor Towns Development Project

# CW01: Kampot Wastewater Collection and Treatment, and Drainage and Sewerage

Prepared by the Ministry of Public Works and Transport for the Asian Development Bank.

# Environmental Management Plan

September 2019

# Kingdom of Cambodia: Second Greater Mekong Sub-region Corridor Towns Development Project,

# Sub-Project

# Wastewater Collection & Treatment and Urban Drainage in Kampot Town

Prepared by Ministry of Public Work and Transportation for Asian Development Bank

## ABBREVIATIONS

| | | |
|---|---|---|
| ADB | - | Asian Development Bank |
| AP | - | Affected people |
| CEMP | - | Contractor Environmental Management Plan |
| C-EHS | - | Contractor Environmental, Health and Safety Officer |
| DOE | - | Department of Environment |
| EA | - | Executing Agency |
| EMP | - | Environment Management Plan |
| ESO | - | Environment Safeguards Officer |
| ESC | - | Environment Safeguards Counterpart |
| EMR | - | Environmental Monitoring Report |
| GRC | - | Grievance Redress Committee |
| GRM | - | Grievance Redress Mechanism |
| GPS | - | Global Positioning System |
| HH | - | Household |
| IEE | - | Initial Environment Examination |
| I/NES | - | International and National Environmental Specialists |
| PISCB | - | Project Implementation Support and Capacity Building Consultants |
| PDoE | | Provincial Department of Environment |
| PIU | - | Project Implementation Unit |
| PMU | - | Project Management Unit |
| PSC | - | Project Steering Committee |
| PCR | - | Project Completion Report |
| MPS | - | Main Pump Station |
| MOE | - | Ministry of Environment |
| MPWT | - | Ministry of Public Works and Transport |
| NR | - | National Road |
| PSC | - | Project Steering Committee |
| PDPWT | - | Provincial Department of Public Work and Transportation |
| SPS | - | ADB's safeguard policy statement (2009) |
| WWTP | - | Wastewater Treatment Plant |

## WEIGHTS AND MEASURES

| | | |
|---|---|---|
| km | - | kilometer |
| kg | - | kilogram |
| mm | - | millimeter |
| mg | - | milligram |
| m3 | - | Cubic meter |
| ha | - | hectare |
| L | - | liter |

**NOTE**

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

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# I. INTRODUCTION

## 1.1 Purpose

1. This is the environmental management plan (EMP) for the subprojects in Kampot city, Kampot province Sub-projects the Second Greater Mekong Sub-region Corridor Towns Development Project (the project) in Cambodia. The EMP defines mitigation and monitoring measures and describes the institutions, responsibilities and mechanisms to monitor and ensure compliance. Such institutions and mechanisms will seek to ensure continuous improvement of environmental protection activities during preconstruction, construction, and operation of the sub-projects in order to prevent, reduce, or mitigate adverse impacts.

2. This EMP is prepared for construction of a wastewater collection network, a wastewater treatment plant (WWTP) and drainage. The other sub-projects under GMS Two will have individual EMPs. The integrated Initial Environmental Examination (IEE) that covers all the sub-projects is a separate document.

3. This EMP may be subject to further updates when the IEE for this sub-project is finalized.

## 1.2 Budget

4. The costs for EMP implementation comprise:

- Training and Capacity Building : $10,000 (See Table 4)
- Environmental Quality Monitoring: Pre-Construction $7,250 (Costs are included in domestic Initial Environmental Impact Assessment (IEIA))
- During Construction per year $21,700 (see Table 8)

5. Other aspects of the EMP including mitigation measures, reporting, affected people consultation and EMP monitoring are included in other budgets depending on the organization responsible for the aspect e.g. Project Management Unit (PMU) operational budget or included in contractor's bid price.

## 1.3 Outline of Technical Approach

### 1.3.1 Drainage

6. The drainage sub-project will comprise:

- Reinforced concrete U-drain with concrete cover
- Rehabilitation of earth channel
- Laterite pavement on the crest of embankments
- Grass sodding on the side slopes
- Construction of terminal structure
- Drain Inlet pipe culvert
- Drainage manholes
- Outfall Structures
- Catch basin pits
- Gabion Box Channel Wall

7. The drainage construction will include the alignments as follows:.

- U-Drain Line 2 (From NR#3 to Prek Kampot) to Collection
- U-Drain Line 3 (From NR#3 to Prek Kampot)
- U-Drain Line 4a1 (From NR#3 to Prek Kampot)

- U-Drain Line 7a and Line 5 (From Traffic Roundabout D, Education Garden to Prek Kampot)
- U-Drain Line 6 (Connect to Line 2, Line 3, Line 4a1 & Line 5)
- Rehabilitation of Existing Open Canal Line 4b (From Boeung Chak to Kampot River)

### 1.3.2 Sewage Collection and Wastewater Treatment Plant

8. The WWTP sub-project will comprise:

WWTP Works:

- Anaerobic: A pond (normally at least 3-5m deep) where sewage is digested anaerobically
- Facultative: A pond (normally 1.5-2.5m deep) where both anaerobic and aerobic digestion of sewage takes place
- Maturation: A pond (normally 0.9-1.5m deep) primarily responsible for pathogen removal by various ways mechanisms, including UV disinfection and daily high pH levels.
- Sludge Drying Beds: Sludge generation rate: 0.04 m3/person/year, sludge application thickness: 200 to 400 mm and sludge drying time: 4 to 6 weeks, depending on prevailing weather conditions.

Ancillary works including:

- Water tanks for freshwater supply (to be tankered in)
- Fencing around the entire site
- Septage receiving chamber
- Internal roads
- Operations house
- Storm drainage channels
- Lighting monitoring (CCTV camera) works

9. The sewage collection system sub-project will comprise the following investments, where C1, C2 and C3 refer to collections areas within the town as allocated by the project:

Pumping stations
- C1 lift Pump Station
- C3 lift Pump Station
- Main Pump Station (MPS)
- Power supply to be supplied by EDC, transformer to be supplied by the Project
- Generator for back up power

Force main
- Force main 250 from C1
- Force main 200 from C3
- Force main 400 from MPS

Trunk sewer
- C1 area
- C2 area
- C3 area

Collection sewer and Pipe work for household connection
- Collection sewers
- House connection pipe work (house owner to independently arrange connection)

# II. SUMMARY OF POTENTIAL RECEPTORS & IMPACTS

10. The impacts of the project are influenced by the presence of receptors in the sub-project area. Without receptors, there will not be any impacts. The receptors are summarized in Table 1.

11. In addition to these site specific receptors, housing, businesses and access requirements are also considered impact receptors.

Table 1 Receptors in Sub-Project Area

| **Receptors** | **Description** | **GPS Co-Ordinate or Alignment (Line = L)** |
|---|---|---|
| Surface Water Receptors | Prek Kampong Bay – drainage outfall receptors | Outfall 1 Street 174 10°36'45.72"N, 104°10'33.94"E<br>Outfall 2 Street 720- 10°36'35.73"N, 104°10'39.63"E<br>Outfall 3, Street 724 (Kampot Fish Market) 10°36'27.05"N, 104°10'43.62"E<br>Outfall Street 739 - 10°36'19.84"N, 104°10'46.65"E<br>Outfall Open Channel 10°35'44.64"N 104°11'14.09"E |
| | Prek Kbal Romeas-Adjacent to WWTP | 10°38'24.36"N, 104°13'6.19"E |
| Socio-Economic | Densely populated residential & commercial areas | All |
| | Kampot Market (L2.2) | 10°36'55.93"N, 104°10'50.23"E |
| | Kampot Night Market (L3.1, 3.2) | 10°36'40.91"N, 104°10'52.78"E |
| | Kampot Fish Market (force main and drainage L6-3) | 10°36'27.05"N, 104°10'43.62"E |
| | Power supplies - cables and electricity poles in residential areas and commercial areas | All |
| | Resort | 10°38'32.72"N, 104°12'50.12"E |
| Cultural Receptors | Mosque | 10°35'49.41"N, 104°11'18.48"E |
| | Wat Kampong Bay (Pagoda) | 10°36'46.78"N, 104°11'4.65"E |
| | Wat Prey Tom (Pagoda) | 10°38'9.50"N, 104°11'43.60"E |
| | Pres Mae Pagoda | 10°36'49.11"N, 104°10'34.55"E |
| School/Hospital Receptors | Primary School Keat Minh | 10°36'21.78"N, 104°11'4.36"E |
| | Chinese school | 10°36'48.09"N, 104°10'34.93"E |
| | Krang Apil Health Center | 10°36'41.95"N, 104°10'38.47"E |
| | Kampot Referral Hospital | 10°36'37.43"N, 104°10'40.68"E |
| | Bokor clinic and Maternity | 10°36'51.13"N, 104°10'42.16"E |

12. A summary of impacts on the receptors is presented below:

- **Air Quality.** Moderate temporary air quality impacts during the construction stage of the project are anticipated because of fugitive dust generation associated with all construction works, and earth works. Odor will be an impact during WWTP operation.
- **Noise.** Noise impacts will be temporary and localized at all construction sites as construction machinery and vehicles generate noise as they operate. Other noise sources include loading and unloading of equipment and materials and breaking and reconstruction road surfaces during excavation.
- **Surface Water.** There are two rivers in the project site. Short term construction impacts may be seen in terms of increasing turbidity from construction activities. The Prek Kbal Romeas river (10°38'24.36"N, 104°13'6.19"E) at the WWTP site and Prek Kampong Bay (10°36'35.04"N, 104°10'37.53"E) in Kampot town. Effluent discharge into Prek

Kbal Romeas river may impact on water quality if effluent standards are not met. During operation, drainage outfalls will discharge water which will typically contain small quantities of micro-plastics from car tyre wear and hydrocarbons.

- **Solid waste management**. Impacts on resource use and impacts associated with disposal will arise from waste generated during construction. This includes generation of inert wastes e.g. spoil, biodegradable wastes e.g. cleared vegetation, and hazardous wastes e.g. oily wastes. During operation, waste from the WWTP will include dried sludge and chemicals packaging.
- **Community and Occupational Health and Safety**. Construction sites and access roads will necessarily mean health and safety risks not only to construction workers, but also to people living and working around the WWTP and alignments . Community risks come from unauthorized access to construction sites and construction traffic i.e. heavy vehicles which the community may not be used to on their neighborhood roads and changes in road priorities for traffic movements. Occupational risks come from a range of activities including the use of heavy machinery, earth moving, and use of chemicals during construction and operation of the WWTP.

13. The layout of drainage is shown in Figure 1. The layout of the wastewater collection and wastewater treatment plan is shown in Figure 2.Figure 2

Figure 1. Layout of the drainage

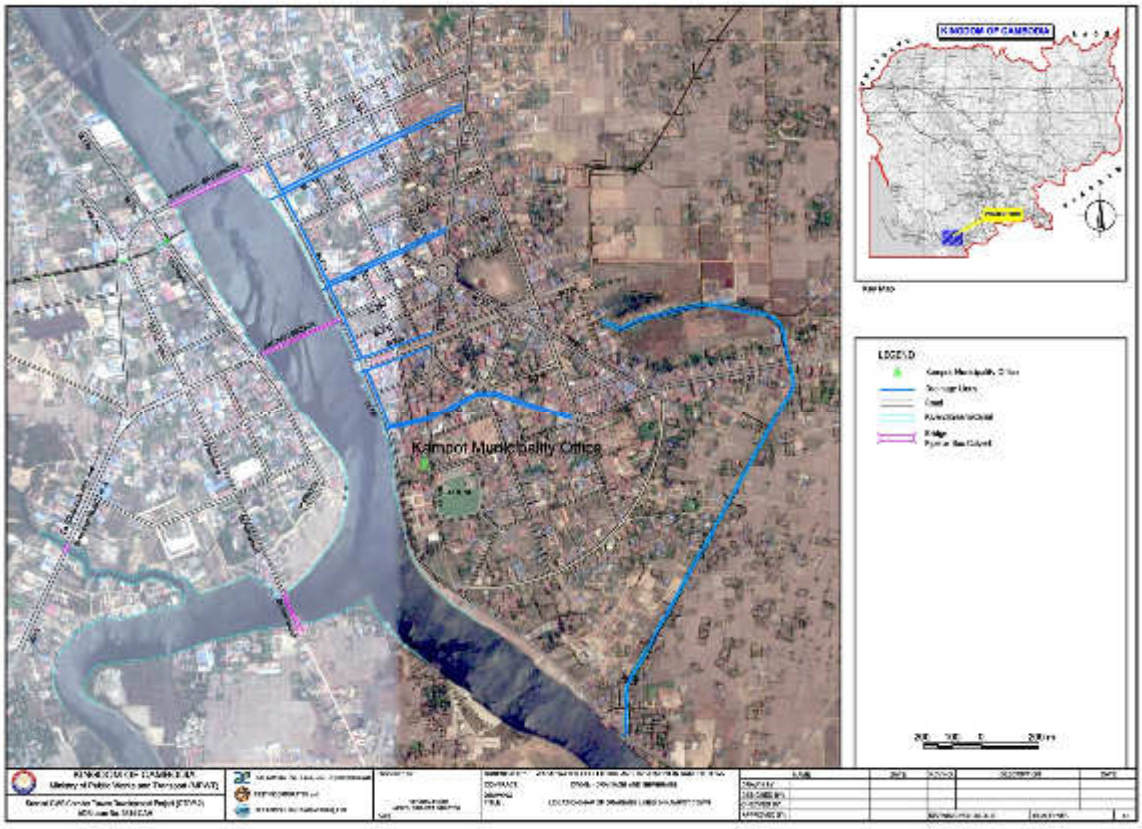
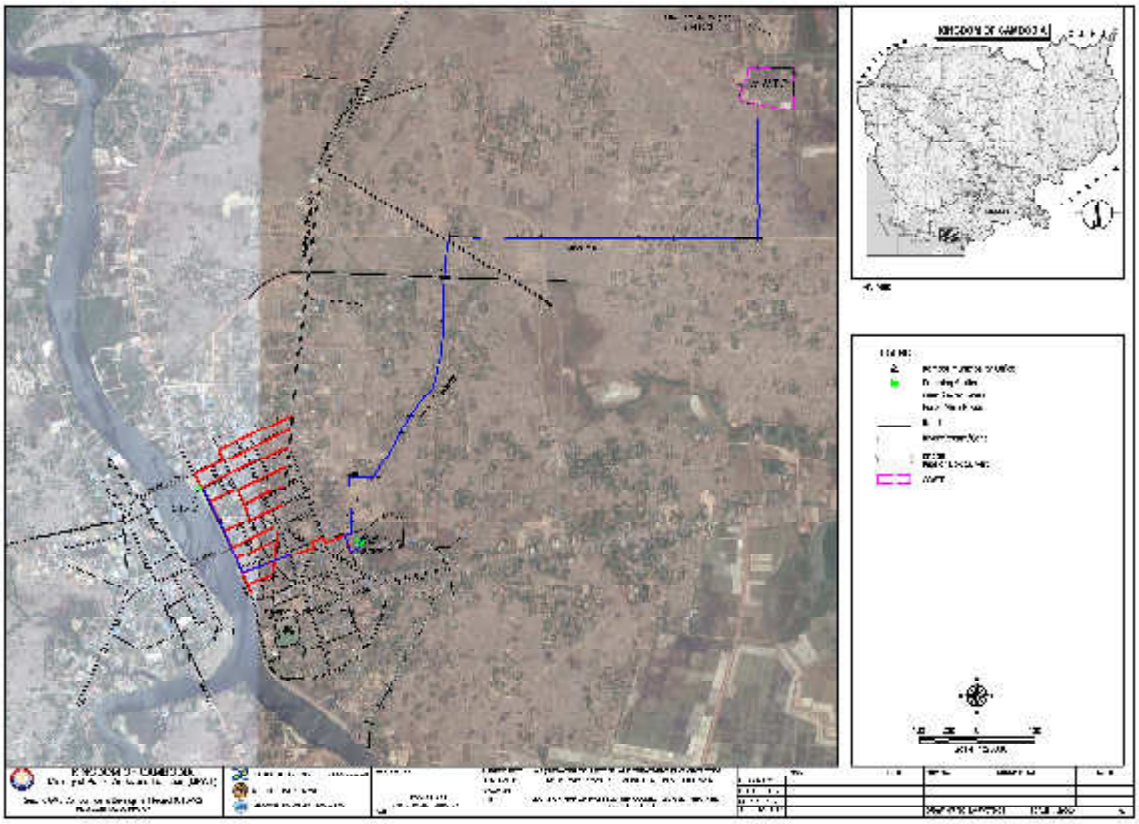



Figure 2: Layout of wastewater collection and wastewater treatment plan



# III. INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

14. The key institutions, organizations and stakeholders relevant to environmental safeguards are set out below.

15. The overall responsibility for EMP implementation and compliance with loan assurances lies with the Executing Agency, the Ministry of Public Works and Transport. The EA has established a Project Management Unit (PMU) based in Phnom Penh, responsible for general project implementation. The Implementing Agency is the Provincial Department of Public Works and Transport (PDPWT) in sub-project city. The PDPWT has established a Project Implementation Unit (PIU) in Kampot, comprising relevant provincial government representatives including the Provincial Department of the Environment.

16. A summary of the key functions for project implementation and environmental safeguards is presented in Table 2 and detail on the responsibilities of each function is in Table 3.. To date the PMU has assigned a named Ministry of Public Works and Transport (MPWT) engineer with environmental and social safeguard experience to the role of PMU-ESO and a staff member has been nominated and named for the PIU-ESC role[1].

Table 2 Key Functions for Project Implementation

| Role | Abbreviation | Location | Summary of Overall Function |
|---|---|---|---|
| Project Steering Committee | PSC | Phnom Penh | Policy and technical guidance for subproject implementation |
| Project Management Unit | PMU | Phnom Penh within MPWT | Responsible for general project implementation and reporting |
| PMU Environment Safeguards Officer | PMU-ESO | Phnom Penh within PMU | Existing MPWT staff seconded/assigned to the PMU for the environmental management of the Project EMP compliance across the sub-projects for environmental safeguards – Full Time |
| Project Implementation Unit | PIU | Provinces within PDPWT | Responsible for sub-project implementation |
| PIU Environmental Safeguard Counterpart | PIU-ESC | Provinces within PIU | Nominated person responsible for sub-project environmental monitoring and support to PMU-ESO |
| Contractor Environmental, Health and Safety Officer | C-EHS | Construction Site | Mitigation measure implementation and reporting |
| Project Implementation Support & Capacity Building Consultants | PISCB | Phnom Penh | Project final design and implementation, support and capacity development<br>Engineering supervision for all construction and reporting through engagement of a PISCB Construction Supervision Consultant (PISCB-CSC) |
| PISCB International and National Environment Specialists | PISCB -I/NES | Phnom Penh within PISCB team | Environmental safeguards and reporting support during design and implementation - Intermittent |
| Asian Development Bank | ADB | - | Review project progress, compliance with covenants and advise on corrective actions |

[1] All PMU and PIU staff are named in Prakas No. 149 (21 March 2016) on the Establishment of Project Management Unity for 2nd Corridor Town Development Project under ADB's Loan by MPWT

Table 3: Responsible for Environmental Safeguards

| Institution | Prior to Construction including Detailed Engineering Design | During Construction | During Operation and Decommissioning |
|---|---|---|---|
| Executing Agency | • Ministry of Public Works and Transport responsible for ensuring the implementation of the mitigation in the EMP and for ensuring compliance with loan covenants<br>• Collaborate with the Ministry of Environment (MoE) for the Subproject's compliance with the Government's environmental safeguard requirements on IEIA and EMP implementation | | |
| PSC | • Oversee implementation in conformity with the Project's development objectives and scope<br>• Assist in coordination among government agencies involved in Project implementation including MoE<br>• Ensure coordinated and efficient Project implementation activities including EMP implementation | | |
| PDPWT | Collaborate with Provincial Department of Environment (PDoE) & relevant provincial agencies on matters concerning the environmental management of the Subproject. | | |
| PMU / PMU-ESO | • Update IEE & EMP<br>• Coordinate with Design Consultant to ensure the incorporation of updated findings & mitigation measures in design & bidding documents.<br>• Ensure EMP is part of the bidding documents, EMP clauses are incorporated in bidding documents, contracts.<br>• Ensure MoE approval of IEIA Report has been secured prior to awarding of civil works.<br>• Review contractor's Construction EMP (C-EMP) against ADB and IEIA requirements<br>• Conduct affected people consultation<br>• Participate in training provided by PISCB | • Conduct inspections and spot checks to monitor the performance of the Contractor in implementing the C-EMP/EMP<br>• Review & verify (through site visits) Monthly Environmental Progress Reports of Contractor<br>• EMP implementation site visits<br>• Review environmental quality monitoring results.<br>• Prepare the Project's Semi-Annual environmental Monitoring Reports for submission to ADB.<br>• Implement the Grievance Redress Mechanism (GRM) for environmental issues<br>• Conduct appropriate consultation and monitoring of effect of construction on affected people<br>• Participate in training provided by PISCB | • Review relevant operator monitoring reports.<br>• Prepare the Project's Annual Environmental Monitoring Report (EMR) for submission to ADB, until loan closure or as agreed.<br>• Ensure all GRM complaints are closed out to affect person's satisfaction |
| PIU-ESC | • Coordinate and collaborate relevant provincial agencies, as necessary<br>• Support PMU-ESO<br>• Conduct affected people consultation<br>• Prepare draft Semi-Annual EMR. Submit to PMU for finalization for Project's EMR.<br>• Establish GRM for Environmental Issues<br>• Participate in training provided by PISCB | • Collate monthly EMRs of Contractor, and submit to the PMU.<br>• If a licensed laboratory will be engaged to do independent environmental quality monitoring, oversee & manage the quarterly conduct of the environmental effects monitoring<br>• Prepare the draft Semi-Annual EMR and submit to the PMU for finalization and incorporation to the Project's Semi-Annual EMR.<br>• Implement the GRM for environmental issues<br>• Conduct appropriate consultation and monitoring of effect of construction on affected people<br>• Participate in training provided by PISCB | • Review relevant operator monitoring reports<br>• Support reporting requirements of PMU.<br>• Ensure all GRM complaints are closed out to affect person's satisfaction |
| PISCB-N/IES | • Provide technical advice/assistance, IEE/EMP update<br>• Review bidding documents, review C-EMP against the EMP; confirm subproject readiness.<br>• Ensure environmental considerations included in Detailed Design | • Provide technical advice/assistance, e.g., preparation of Semi-Annual EMR for ADB, review of results of environmental effects monitoring.<br>• Environmental related training for PMU, PIU, contractors and other stakeholders | • Organize, prior to project completion report (PCR) mission, a survey to assess community satisfaction with project implementation and EMP implementation performance. Draft environment sections of the PCR. |

| | | | |
|---|---|---|---|
| | • Environmental related training for PMU, PIU, contractors and other stakeholders<br>• Incorporate mitigation measures in design & bidding documents<br>• Incorporate EMP as part of bidding documents, EMP clauses in bidding documents, contracts<br>• Support PMU/PIU with appropriate consultation | • Support PMU/PIU with appropriate consultation<br>• Site visits to check on construction, EMP implementation and affected people, in collaboration with PMU | |
| ADB | • Review and clear updated IEE/EMP<br>• Review bidding documents, clear C-EMP, confirm readiness of subproject. | • Review Project EMRs.<br>• Carry out review missions | |
| Contractor | • Prepare a C-EMP that addresses as minimum the requirements of the EMP. | • Appoint a qualified Environment Health and Safety (C-EHS) staff member to be responsible for EMP implementation and reporting<br>• Implement mitigation measures & conduct internal EMP implementation monitoring.<br>• Conduct environmental quality monitoring as prescribed in SPS-compliant EMP. (If an independent Licensed Laboratory will not be engaged.)<br>• Prepare Monthly EMRs. | |
| Operator | | | • Implement mitigation measures & conduct internal EMP implementation monitoring.<br>• Prepare Monthly and Annual EMRs. |
| Licensed Lab (if used) | • Conduct environmental quality monitoring as prescribed in the EMP | | • Conduct monitoring as specified by the operator |
| MoE/PDoE | • Review, comment on approve IEIA Report | • Monitor compliance with approved IEIA & EMP. | • Monitor compliance with environmental standards. |
| Municipality | • Facilitate obtaining the necessary inputs from and/or participation/cooperation of, concerned communes and villages through collaboration with their Commune Councils.<br>• Facilitate (& participate in) GRM dissemination and implementation | • Participate in the monitoring of the performance of Contractor in EMP implementation.<br>• Review EMRs & results of environmental effects monitoring<br>• Facilitate & participate in GRM dissemination and implementation. | |
| Commune Councils | • Facilitate & participate in GRM dissemination and implementation | • Participate in the monitoring of the performance of Contractor in EMP implementation.<br>• Review EMRs & results of environmental effects monitoring.<br>• Facilitate & participate in GRM dissemination and implementation. | |

## 3.1 Institutional Capacity Review and Needs

17. Currently there is little experience of monitoring and implementing environmental mitigation measures particularly at a provincial level. There is little enforcement of environmental or health and safety legislation and routine environmental monitoring is not undertaken apart from in major urban centers (air quality) or major rivers (water quality).

18. During the update of this EMP the team checked the capacity and experience at MPWT and found that there are a number of people who have fulfilled the role of 'focal point' for safeguards on project by project basis. The project will co-ordinate with this existing environmental safeguard office (ESO) in MPWT and will include ESO staff in training and reviews.

19. In addition, through understanding existing municipal services and operations in Kampot, it is clear that there is limited ability for operation and maintenance. The limiting factors affecting the operators' ability to maintain adequate standards are likely to be a function of (i) a lack of technical capacity and experience; (ii) lack of staff and (iii) insufficient budget.

20. A training program is set out in Table 4 which addresses the safeguard reporting and implementation requirements during construction, and the environmental and social risks from operations.

21. The PISCB-I/NES will perform key roles in supporting the PMU-ESO in implementing the EMP and ensuring the pre-construction requirements are in place.

Table 4: Capacity building and training requirement

| Subject / Content | Participants | Trainer/Organization | When/Frequency | Days / event | # of participants | Cost ($) USD |
|---|---|---|---|---|---|---|
| **EMP development and implementation**<br>EMP function<br>Roles and responsibilities,<br>EMP monitoring (Site Visits)<br>Reporting on Environmental Safeguards | PMU, PIU, contractors | PISCB -I/NES | Twice -<br>Once before, and once 6 months after construction starts | 2 | 10 | 10,000 |
| **Consultation with Affected People**<br>Consulting during construction, types of consultation, methods | PMU, PIU | PISCB -I/NES | Once before to construction | 0.5 | 6 | |
| **Grievance Redress Mechanism** – roles, responsibilities and implementation | PMU, PIU, contractors, Commune Councils | PISCB -I/NES | Twice -<br>Once before, and once 6 months after construction starts | 1 | 10 | |
| **Environmental protection**<br>Pollution control on construction sites (air, noise, wastewater, solid waste) | PMU, PIU, contractors | PISCB -I/NES | Once (during project implementation) | 2 | 10 | |
| **Environmental monitoring** -Monitoring methods, data collection and processing, reporting systems | PMU, PIU, contractors, | PISCB -I/NES<br>& MoE (environmental analyst) | Once (at beginning of project construction) | 2 | 10 | |
| Drainage System and Wastewater collection and WWTP | Included as part of the annual budget from Waste water unit under provincial department of transportation. The scope of the training is currently under discussion with MPWT and will include Operation and Maintenance of WWTP and an exposure visit to an operational site in Sihanoukville and Siem Reap province | | | | | |

# IV. MITIGATION PLAN

23. The mitigation measures of the EMP are presented in the mitigation plan for the subproject in Table 6. The mitigation plan is organized by the pre-construction; construction; and post construction / operational phase. This. The mitigation plan addresses the environmental issues and concerns raised at the stakeholder meetings

24. Construction Environmental Management Plan. The Contractor is expected to develop a Construction Environmental Management Plan (C-EMP) based on Table 5 which represents minimum mitigation measure requirements for construction contractors. The Contractor will also provide detailed activity specific sub-plans which set out the contractor's approach to mitigating the highest risks, as identified by the Environmental Impacts section of the IEE or those impacts which are best monitored through provision of a detailed map.

Table 5: EMP mitigation Measure

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| **PRE-CONSTRUCTION** | | | | | |
| Confirmation of required resettlement, relocations, & compensation | No negative environmental impacts | 1. 34 Affected households well informed ahead of subproject implementation on a timescale in accordance with the project Resettlement Action Plan. | See resettlement plans | Inter ministerial Resettlement committees | EA/IA |
| Disclosure, & engagement of community | No community impacts | 2. Initiate Information Disclosure and Grievance process of IEE at Kampot City | Include in project cost | PMU | PMU |
| GRM Dissemination | - | 3. Provide contractor with GRM contact details to be used for:<br>A. GRM sign boards<br>B. GRM Contact Cards for Affected People | Included in Project cost | PMU | PMU |
| | | 4. Erect sign boards at the construction site entrance with:<br>A. Project details<br>B. GRM procedures and contact details<br>5. Print 'GRM Contact Cards' for all workers to give to complainants and keep cards with all vehicles, machinery and site managers/foremen<br>6. Affected People Training. Contractor to raise awareness of all workers on how to respond when an affected person or member of the public has a complaint i.e. direct the person to the most senior site manager present at the time and provide a 'GRM Contact Card' | Included in Bid Price | Contractor | PMU |
| Final Design | Climate Change | 7. Final design of storm drainage uses published reports[3] to quantify the anticipated climate change impact on each phenomenon for the design of town drainage flooding. | Included in Project cost | PISCB | EA |

[2] Costs will need to be updated during detailed design phase
[3] McSweeney et al, 2008, UNDP Climate Change Country Profiles: Cambodia the development scenarios used by the UNDP report are from:

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| | | 8. 1.8m high fill for WWTP site to avoid flooding (flash flood and rain flood). | | | |
| Construction EMP (C-EMP) | All | 9. The contractor(s) will develop a Construction EMP (C-EMP) that includes the mitigation measures set out in this table as a minimum and will include detailed individual management sub-plans for:<br>A. Spoil Management;<br>B. Solid and Liquid Waste Management;<br>C. Occupational Health and Safety and Emergency Response;<br>D. Construction Workers and Camp Management (**if required**) and.<br>E. Community Health and Safety and Urban Access.<br><br>10. The CEMP will include a map of each construction site, with copies held by the Contractor and PIU, showing as a minimum:<br><br>a). Access routes, b). storage areas for waste, c). storage area for chemicals and fuels, d) concrete and asphalt mixing, e) stockpile storage areas (on & off site), f) first aid kit and equipment used in emergency response, g) location of worker camps (if required). | Included in Bid price | Contractor (C-EHS) | PMU/ PISCB |
| Obtain & activate permits and licenses | Compliance obligations | 11. Contractors to comply with all statutory requirements set out by Government for use of construction equipment, and operation construction plants.<br>12. Contractor to ensure all required permits including materials extraction permits or permissions for materials extraction from quarry (10°41'12.80"N, 104°12'28.15"E) are in place prior to construction. | Include in bid price | Contractor | PMU |
| UXO CLEARANCE | - | 13. Obtain clearance from the Military confirming that no UXO is present in the project sites including:<br>a) All land to which is used for resettlement purposes (for people/businesses/farmland)<br>b) All construction sites including 50 m either side of any access roads | Included in Bill of Quantities | Military | PMU |
| Construction EMP (CEMP) Approvals | All | 14. Approval of C-EMP and individual sub-plans (A to E) including site maps as required by CEMP. | Include in Project cost | PMU/ PISCB | EA |
| **CONSTRUCTION PHASE** | | | | | |
| Spoil Management Sub-Plan A | Contamination and degradation of land, agricultural | 15. Measures in the sub-plan related to **spoil management** will include as a minimum:<br>a) A map of where spoil will be disposed<br>b) Preference must be given to use of spoil other construction sites, or disposed in spent quarries or borrow pits<br>c) **Uncontaminated spoil** to be disposed of in Government approved | Included in bid price | Contractor | PMU / PDOE |

IPCC, 2000. Special report on Emission Scenarios: Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment report of the Intergovernmental Panel on Climate Change,

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| | areas, and surface waters | sites, which will not be on agriculturally productive land, within 50m of a water course, including stream, river or irrigation channel, on sloped land, within 50 m of cultural heritage sites, within 100 m of any other culturally or ecologically sensitive feature.<br>d) **Contaminated spoil** disposal must be tested for contaminants then follow Government regulations including handling, transport, treatment (if necessary), and disposal and will be isolated from human contact and environmental receptors by plastic sheeting or similar.<br>e) A record of type, estimated volume, and source of disposed spoil must be recorded | | | |
| Implementation of Solid and Liquid Waste Management Sub-Plan B | Contamination of land and surface waters from construction waste | 16. Sub-plan will include measures to explain how the contractor will:<br>a) Manage general solid and liquid waste from construction in line with Government regulations, and will cover, collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force.<br>b) Make clear arrangements for storage and transportation of all hazardous and non-hazardous waste to an authorized and approved disposal point (approved by Provincial Department of Environment).<br>c) Segregate recyclables at source and given/sold to recycler (plastic, metal, card, paper as a minimum)<br>d) Store all solid waste in containers with lids, more than 25 m from all surface water, water supplies, and cultural and ecological sensitive receptors.<br>e) Prohibit burning of waste at all times;<br>f) Provide all vehicles/drivers with plastic bags for waste collection and prevent any unauthorized waste disposal with particular attention paid to prevention of waste entering water ways including drainage ditches<br>g) Provide a schedule of solid and liquid waste pickup and disposal must be established and followed that ensures construction sites are as clean as possible.<br>h) All spills must be cleaned up completely with all contaminated soil removed and handled in accordance with Spoil Management Sub-Plan A. | Included in bid price | Contractor | PIU/ PMU |
| Implementation of Occupational Health and Safety and Emergency Response Sub-Plan C | Human health and safety | 17. Occupational **H&S measures** to be included in the management sub-plan will include:<br>a) Assurance that all workers are equipped with, and use Personal Protective Equipment (PPE).<br>b) Specifications for the PPE to be used on site and the contractors' approach to enforcement of its use by workers<br>c) Sufficient signage giving occupational health and safety warnings and information disclosure within all construction sites – sub-plan to include example warnings.<br>d) Details of worker education and awareness seminars for construction hazards will be given. A construction site safety program will be | Included in bid price | Contractor | PIU/ PMU |

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| | | developed and distributed to workers.<br>e) Details of daily toolbox meetings (safety briefings)<br>f) Details of the site accident record book which will be maintained where all major or minor accidents and incidents are recorded with actions taken.<br>g) An Environment Health and Safety qualified engineer or staff member will be engaged for the contract and adequate first aid equipment provided on site.<br>h) Warning signs will be set up if mud is likely on public roads. Mud will be removed at the end of each day. Other spillages on public roads will be removed immediately.<br>i) Drinking water must be provided at all construction sites<br><br>18. The **Emergency Response Plan** will set out detailed Preventative Measures for all types of incidents covered in the Emergency Plan. This will include:<br>j) Prevention of Injury and Accidents – to include Personal Protective Equipment requirements for construction workers, training requirements<br>k) Prevention of Spillage - All construction fluids such as oils, and fuels will be stored on hard standing with sealed drainage with a capacity of 110% of the largest fuel container, will include procedures on refueling and maintaining vehicles.<br>l) Prevention of Fire – to include measures for Ignition Sources including prevention of smoking on construction site, management of flammable materials and liquid.<br>m) Other Incidents – prevention measures relevant to other issues considered relevant by the contractor<br><br>19. The Contractor will develop **Emergency Response Procedures** prior to construction. The procedures will cover actions to be taken in case of:<br>n) Worker injury (e.g. construction or traffic accident)<br>o) Spillage (e.g. fuel spillage)<br>p) Fire (e.g. fuel or chemicals storage area); and<br>q) Any other incidents anticipated by the contractor. | | | |
| Implementation of Construction Workers and Camp Management Sub-Plan D | Contamination of water, soil, waste production and social issues | 20. If a camp for construction workers is required the contractor will set out a management plan which includes:<br>a) A map showing camp lay out, welfare facilities, and first aid kit locations.<br>b) Accommodation facilities including separate toilets for male and female workers, adequate drainage to prevent flooding, security including a no weapons policy and waste disposal areas.<br>c) Pit latrines to be located at least 200m from surface waters, and in areas of suitable soil profiles and above the groundwater levels | Included in bid price | Contractor | PIU/ PMU |

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| | | d) A clean-out or infill schedule for pit latrines must be established and implemented to ensure working latrines are available at all times.<br>e) Worker camps will have adequate drainage.<br>f) Providing firefighting equipment will be provided in all camps and will have adequate signage and prescribed testing intervals.<br>g) Plan of how camp areas will be restored to original condition after construction completed<br>21. If a construction camp is not required, the contractor will not require a Management Plan but will:<br>h) Provide adequate waste disposal facilities including garbage cans for workers.<br>i) Provide welfare facilities including water for washing, drinking and include facilities for male and female workers<br>j) Provide toilets for male and female construction workers with a cleaning schedule<br>k) The contractor will give priority to local labor force and retain evidence of how local labor recruitment efforts were undertaken.<br><br>22. The contractor will ensure training is delivered to construction workers on the following and the contractor will provide a training schedule:<br>l) HIV Aids education awareness<br>m) Cambodian laws for foreign labor regarding: hunting, fishing and traffic rules<br>n) Grievance Redress Mechanism – how to deal with affected people who make a complaint to a worker<br>o) Occupational Health and Safety and Emergency Procedures. | | | |
| Implement Community Health, Safety and Urban Access sub-plan E | Community and Business Access and health and safety | 23. Community **H&S measures** to be included in the management sub-plan will include:<br>a) Details of appropriate fencing or protective barriers, lighting and buffer zones which will be provided around all construction sites including barriers with lighting where needed on access roads and populated locations.<br>b) Sufficient signage and information disclosure, and site supervisors and should be placed at all sites.<br>c) Details of Warning signs which will be set up if mud is likely on public roads. Mud will be removed at the end of each day. Other spillages on public roads will be removed immediately.<br>d) Details of signage and speed controls if public roads are to be affected by construction traffic.<br>e) Details of sufficient signage giving community dangers / warnings and information disclosure outside all construction sites, include example warnings.<br>f) Speed limits suitable for the size and type of construction vehicles, and current traffic patterns should be developed, posted, and enforced | Included in bid price | Contractor | PIU/ PMU |

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| | | on all roads used by construction vehicles.<br>24. For **urban excavations** (sewers and drainage) measures to be included in the sub-plan will detail how the contractor will ensure:<br>g) Access will be safely maintained for pedestrians and vehicles to schools, markets, houses, pagodas and commercial establishments<br>h) Temporary safe access will be constructed by the contractor where needed.<br>i) No temporary access shall be greater than 3:1 slope to allow access to all.<br>j) For **WWTP** construction measures to be included in the sub-plan will detail how the contractor will ensure access to farm land surrounding the WWTP | | | |
| Earthworks and excavations | Noise and Air Quality, Soil resources, traffic | 25. Water will be sprayed at least twice per day on construction sites, material handling areas when fugitive dust is noticeably generated.<br>26. All topsoil and overburden removed should be stockpiled for later restoration<br>27. The contractor will provide a **Traffic Management Plan** to the PMU for approval which will include:<br>a) How the contractor will inform the community and businesses of construction traffic routes<br>b) Any advice/information the contractor will give to affected people during construction<br>c) How the contractor will manage traffic including any road closures specifying management around Kampot Market, Kampot Night Market and Kampot Fish Market.<br>28. Trained traffic marshal will be used to direct vehicle movements on and around construction sites and in all urban areas.<br>29. Minimize time that excavations and exposed soil are left open/exposed. Backfill immediately after work is completed | Included in bid price | Contractor | PIU/ PMU |
| Transport, Storage and Use of Construction Materials | Air pollution, Community Health & Safety, Traffic | 30. Define and schedule how materials are extracted from quarry, transported, and handled and stored at sites.<br>31. Define and schedule how fabricated materials such as steel, wood structures will be transported and handled.<br>32. Trucks carrying dry construction materials such as earth; aggregate will be covered with tarpaulins or other suitable cover.<br>33. Driving on unmade roads, trucks will be limited to 15 kph. Warning sign to inform road users of turning heavy vehicles will be used where trucks cross or turn off the National Road #3.<br>34. Asphalt and concrete batching facilities will be located at least 500m downwind from the nearest dwellings in order to reduce the impact of fumes on humans and to be fitted with necessary equipment such as bag house filters to reduce fugitive dust emissions.<br>35. Water will be sprayed on material storage areas where fugitive dust is generated and where vehicles are transporting materials on unmade roads, generating dust, where human receptors are within 300m. | Include in bid price | Contractor | PISCB/ PIU |

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| Use of Machinery & Equipment | Noise, Water Quality | 36. Maintain all exhaust systems in good working order; undertake regular equipment maintenance;<br>37. Restrict construction activities using heavy machinery between 7 am-5 pm; In particular are activities such as pile driving.<br>38. Provide advance warning to the community on timing of noisy activities including all cultural, education and health receptors listed in this EMP. Seek suggestions from community members to reduce noise annoyance, particularly related to noise sensitive activities at receptors<br>39. Public notification of construction operations will incorporate noise considerations; information procedure of handling complaints through the Grievance Redress Mechanism will be disseminated.<br>40. Ensure noise monitoring is undertaken near sensitive receptors, particularly dwellings when construction machinery is operational<br>41. Construction vehicles and machinery will be maintained to a high standard to minimize emissions<br>42. All construction workers will use appropriate Personal Protective Equipment (PPE) including ear defenders when operating machinery;<br>43. No washing or repair of machinery within 50m of surface waters including rivers..<br>44. Vehicles and machinery to be turned off when not in use.<br>45. Construct temporary noise barriers around excessively noisy activity areas where possible. | Included in Bid Price | Contractor | PIU/ PMU |
| Storage and Use of chemicals and fuels | Water quality<br>Soil quality | 46. Refueling only in designated areas which are to be 50 m from a water course and drip trays to be used when refueling or topping up / changing machinery fluids<br>47. Construction fluids such as oils, and fuels should be stored and handled on a bunded impermeable surface; a bund will be provided around any above ground fuel storage tanks with a capacity of 110% of the largest single tank.<br>48. All chemicals and fuels will be in labeled containers. | Included in Bid Price | Contractor | PIU/ PMU |
| Civil Works | Loss or disruption of utilities and services | 49. Develop plan of days and locations where outages in utilities and services will occur, or are expected.<br>50. Contact local utilities and services providers with schedule, and identify possible contingency back-up plans for outages.<br>51. Contact affected community to inform them of planned outages.<br>52. For any unavoidable outages, schedule during low use time between 24:00 and 06:00. | Include in Bid cost | Contractor | PIU & Utility company |
| Flora | Damage or loss of trees, vegetation, and landscape | 53. Only vegetation will be cleared from within the WWTP site boundary and within the design width of the earth open drainage channel.<br>54. Any other vegetation removal requires approval from the PMU | Include in Project cost | Contractor | PMU/ PIU |
| All Activities | Damage to public areas, | 55. The contractor will repair any damage caused such as damage from heavy vehicles to local roads, on completion of construction. The repairs | Included in Bid Price | Contractor | PIU/PMU |

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| | roads, infrastructure or private property | will be to pre-project condition or better at the cost of the contractor. | | | |
| Open Earth Drain Construction and WWTP Site Civil Works | Sedimentation of Kampong Bay river and Kbal Romeas river and loss of soil through erosion | 56. Berms, and plastic sheet fencing should be placed around all excavations and earthwork areas.<br>57. Earthworks should be conducted during dry periods.<br>58. Maintain a stockpile of topsoil for reuse<br>59. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready especially for earth drainage and WWTP dyke.<br>60. Rip rap in areas of steep slope liable to erosion in wet season at WWTP site<br>61. Re-vegetate or reinstate all areas of exposed soil immediately after work is completed using native species. | Include in Project cost | Contractor | PISCB & PIU |
| **POST-CONSTRUCTION** | | | | | |
| Operation of drainage system | Periodic back-up and local flooding | 1. Improved drains must be regularly cleaned and surfaced to maintain design capacity flows. The operator will:<br>a) Detail and implement an inspection and cleaning schedule for all drains and outfall debris screens<br>b) Detail and implement a schedule of maintenance or drains and man hole covers and ensure all repairs are completed before the start of each rainy season | O&M cost | DPWT | MPWT |
| All WWTP operations | Site based H&S | 1. The operator will develop site specific H&S procedures which will ensure the operator will<br>• Develop and implement a comprehensive H&S training programme<br>• Undertake risk assessments for high risk processes and roles and appropriate mitigation measures<br>• Use of appropriate PPE including measures to enforce its use and PPE for specific situations including handling chemicals;<br>• Electrical safety testing of WWTP equipment prior to use<br>• Undertake health assessments (annual medical) for workers and analysis of results to identify trends<br>• Emergency Procedures – actions required under emergency situations including worker accident, fire, chemical spill and other measures as required by the operator.<br>2. Give access to first aid and appropriate health and safety information for all staff. | O&M cost | DPWT | MPWT |
| All WWTP operations (operation and maintenance (O&M)) | Water quality, odor, soil quality | 2. As part of O&M manual, the operator will provide clear methods and procedures for all aspects of the WWTP operation, including the following key issues:<br>• all stages of wastewater treatment<br>• all stages of septic tank evacuation at WWTP<br>• sludge management and options for sludge reuse | O&M cost | DPWT | MPWT |

| Subproject Activity | Potential Environmental Impacts | Proposed Mitigation Measures | Estimated Cost[2] ($) | Responsibility | |
|---|---|---|---|---|---|
| | | | | Implementation | Supervision |
| | | • **preventative maintenance & inspection program** for all site plant and machinery (include: key spare parts, power supply maintenance, inspections program, on site drainage, pumping stations)<br>• **environmental analysis program** and procedures (effluent, sludge, surface water analysis)<br>• solid waste management (containment, storage, transport, disposal)<br>• disposal of screenings, grit and sand;<br>• Site maintenance including:<br>3. other aspects appropriate to the site operation | | | |

# V. MONITORING AND REPORTING PLAN

25. During project implementation, monitoring will be reported to the PMU and will form the basis of the required reporting. The monthly reports will provide the majority of the information for the semi- annual reports. Templates are provided by the support consultants to assist the responsible roles for monitoring and reporting.

26. The key monitoring mechanisms and costs are shown in Table 6. The monitoring plan focuses on all three phases (pre-construction, construction, post-construction operation) of the subproject components, and consists of environmental indicators, the sampling locations and 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, and to document any unexpected positive or negative environmental impacts of the subproject.

Table 6: Monitoring Type and Cost

| Monitoring | Purpose | Estimated Cost or Source of Budget |
|---|---|---|
| 1. **Project readiness monitoring** | Monitoring to check progress on project readiness and close gaps through corrective actions<br>**See Table 8.** | No additional cost, part of project activities |
| **2. Project phase environmental quality monitoring** | To be conducted by a competent authority or person appointed by the Contractor, involving the collection and analyses of air quality, noise and water quality data at designated monitoring locations for assessing compliance with applicable environmental quality and emission standards during construction<br>**See Table 9.** | Pre-Construction $16,750<br>During Construction **per year** $18,750 |
| **3. EMP compliance monitoring** | Monthly monitoring to be conducted by the Construction Supervision Company.<br>Monthly EMP Issues and Health and Safety monitoring to be provided by the Contractor<br>PIU-ESC to verify EMP compliance during project implementation through site visits<br>**See Table 10** | No additional cost, part of project implementation activities |
| **4. Affected People monitoring** | A consultative approach. This is to be conducted by the PIU via consulting affected people on the impacts during construction.<br>**See Table 10** | No additional cost, part of project implementation activities |
| **5. Operational phase environmental quality monitoring** | This is required as part of the operation of the drainage system and wastewater collection and WWTP will be undertaken by the **PDPWT See Table 9** | Included in operator O&M costs |

27. Contractors will bear the costs for all mitigation measures during construction, including those specified in the tender and contract documents as well as those to mitigate unforeseen impacts due to their construction activities.

28. The operator, PDPWT, will be responsible for operation and the cost is included in annual budget plan.

## 5.1 Project Readiness Monitoring

29. Before construction, the PISCB Consultant will monitor the project's readiness on environmental management based on a set of indicators and report it to ADB and PMU, see Table 7Table 7. This assessment will formally demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts, or suggest corrective actions to ensure that all requirements are met.

Table 7: Project Readiness Assessment Indicators

| Indicator | Criteria | Are the Criteria met? Yes/No | If No, What Corrective action is needed? | Date for Corrective Action Completion |
|---|---|---|---|---|
| 1. EMP update | EMP updated after domestic IEIA approval and detailed design & approved by ADB/MoE | Y/N | | |
| 2. Compliance with loan covenants | The borrower complies with loan covenants related to project design and environmental management | Y/N | | |
| 3. Public involvement effectiveness | Meaningful consultation completed | Y/N | | |
| | GRM established with entry points | Y/N | | |
| 4. Environmental supervision and monitoring in place | Recruitment of MPWT staff as set out in the Institutional Arrangements for this EMP | Y/N | | |
| | Nomination of government staff for PIU roles as set out in the Institutional Arrangements for this EMP | Y/N | | |
| 5. Bidding documents and contracts with environmental safeguards | Bidding documents and contracts incorporate the environmental activities and mitigation measures required by this EMP | Y/N | | |
| | Bidding documents and contracts incorporate the Particular Conditions for bidding (see Appendix 3) | Y/N | | |
| 6. EMP financial support | The required funds have been set aside for EMP implementation including training and capacity building | Y/N | | |

## 5.2 Environmental Quality Monitoring

30. During construction, the impact on the sensitive environmental receptors will be monitored and compared against the relevant national standard. During operation, the relevant operator will be expected to maintain an adequate budget to ensure environmental monitoring can be undertaken as specified in Table 8.

Table 8: Environmental Quality Monitoring

| ENVIRONMENTAL EFFECTS MONITORING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Environmental Indicators** | **Location** | **Means of Monitoring** | **Frequency** | **Reporting** | **Responsibility** | | **Estimated Cost (USD) Per Year** |
| | | | | | **Implement** | **Supervision** | |
| **PRE-CONSTRUCTION** | | | | | | | |
| A) Ambient air quality (2 samples): CO, NO2, SO2, TSP, O3, Pb, PM 10 and PM 2.5.<br><br>B) Ambient noise and Vibration<br><br>C) Surface water quality: Kbal Romeas river (1 point), Prek Kampong Bay (2 points) water quality: pH, TDS, TSS, DO, BOD5, COD, Oil and Grease, Detergent, $SO_4$, TN, TP, Pb, AS, Cd, Hg and Total Coliform.<br><br>D) Sewerage water: pH, TSS, BOD5, COD, Oil and Grease, Detergent, TN, TP, $NH_3$ and Coliform. | A & B)<br>• Main pumping station (x=411050, Y=1172290);<br>• WWTP site (X=413914, Y=1176221)<br><br>C)<br>• Kbal Romeas river (X=414377, Y=1176433);<br>• Prek Kampong Bay Sample 1 (X=410301, Y=1172212<br>• Prek Kampong Bay Sample 2 (X=409296, Y=1173844).<br><br>D)<br>• (X=409862, Y=1173289) | Using field and analytical methods approved by MoE. | A & B & C &D Once before construction phase starts | Once baseline report before construction phase starts. | PISCB | PMU | A & B: $6,500<br><br>C & D: $750 |
| E) Mine Clearance and Unexploded ordnance | Include in Urban drainage and Wastewater collection and WWTP Bill of Quantities | | | | | | |
| **Sub-total (Prior to construction for baseline data):** | | | | | | | **$ 16,750** |
| **CONSTRUCTION** | | | | | | | |
| F) Ambient air quality (2 samples): CO, NO2, SO2, TSP, O3, Pb, PM 10 and PM 2.5.<br><br>G) Ambient noise and Vibration<br><br>H) Surface water quality: | F & G)<br>• main pumping station (x=411050, Y=1172290)<br>• WWTP site (X=413914, Y=1176221)<br>• Hospital<br>• Central Market<br><br>(during construction of | Using field and analytical methods approved by DoE. | F & G Annually<br><br>H & I Quarterly | Every Six month during construction | Contractor | PMU/PIU/PISCB/ MoE | F & G: $13,000<br><br>H & I: $3,000 |

| ENVIRONMENTAL EFFECTS MONITORING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Environmental Indicators** | **Location** | **Means of Monitoring** | **Frequency** | **Reporting** | **Responsibility** | | **Estimated Cost (USD) Per Year** |
| | | | | | **Implement** | **Supervision** | |
| Kbal Romeas river (1 point), Prek Kampong Bay (2 points) water quality: pH, TDS, TSS, DO, BOD5, COD, Oil and Grease, Detergent, $SO_4$, TN, TP, Pb, AS, Cd, Hg and Total Coliform.<br><br>I) Sewerage water: pH, TSS, BOD5, COD, Oil and Grease, Detergent, TN, TP, $NH_3$ and Coliform. | drainage/sewage network at these locations)<br><br>H)<br>• Kbal Romeas river (X=414377, Y=1176433);<br>• Prek Kampong Bay Sample 1 (X=410301, Y=1172212<br>• Prek Kampong Bay Sample 2 (X=409296, Y=1173844).<br><br>I)<br>• X=409862, Y=1173289 | | | | | | |
| J) Field observation from related Ministry or department e.g. MoE, DoE | Project location | Using field observation | Every 3 month | | Contractor | MoE/DoE | $ 5,700[4] |
| | | | | | | **Sub-Total (Construction) Per Year:** | **$21,700** |
| **OPERATION PHASE** | | | | | | | |
| WWTP | | | | | | | |
| K) Surface water quality: Kbal Romeas river (downstream and upstream of outfall), | K)<br>• WWTP site (X=413914, Y=1176221) | Using field and analytical methods approved by DoE. | L)<br>Every 3 month | Every Six month during operation. | PDPWT | MPWT | Annual budget |
| L) Odor | Resort to North of site | Using field observation and Meeting with Resort Management | Every 3 month | Annually | PDPWT | MPWT | Annual budget |
| M) Household Connections to Sewerage | PDPWT | Site visit to houses to check connections and public awareness and communications to encourage connections | Every month within the first year of full operation, after this every 6 months | Annually | PDPWT | MPWT | Annual budget |
| Drainage | | | | | | | |
| N) Condition of drainage network and refuse | All of network | Field Observations | Start and end of dry season and | Annually | PDPWT | MPWT | Annual budget |

[4] Budgets for MoE staffs to monitor on environmental problem during construction stage

| ENVIRONMENTAL EFFECTS MONITORING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Environmental Indicators** | **Location** | **Means of Monitoring** | **Frequency** | **Reporting** | **Responsibility** | | **Estimated Cost (USD) Per Year** |
| | | | | | **Implement** | **Supervision** | |
| removal | | | cleaning according to schedule (specified in EMP Mitigation Measures) | | | | |

## 5.3 EMP Compliance and Affected People Monitoring

31. In order for the EMP to be effective, all its mitigation measures in the EMP must be monitored to ensure they are implemented. Table 9 defines the responsibilities of the Construction Supervision Company to support the PMU in monitoring the monthly progress against the EMP during construction. Note this applies to construction only; during operation, it is the responsibility of the appropriate ministry or its line department to ensure monitoring of operational facilities is incorporated in the operations and maintenance manual and carried out routinely.

32. The contractor will provide a basic monthly monitoring report focusing on Health and Safety and identify any potential issues with future EMP compliance. This will not duplicate the more detailed monitoring and reporting to be undertaken by the PISCB-CSC. Locally based PIU-ESC is responsible for site visits to check on the actual impacts on people of the project and identify any adjustments in the EMP required.

Table 9: EMP Compliance and Affected People Monitoring

| **Environmental Indicators** | **Location** | **Method & Frequency** | **Responsibility** | | **Estimated Costs (USD)** |
|---|---|---|---|---|---|
| | | | **Implement** | **Verify** | |
| **Construction Phase – All Sub-Projects** | | | | | |
| Air Quality & Noise | Civil works sites | Monthly checking against mitigation measures specified in this EMP | PISCB-CSC | PISCB –NES and PMU-ESO | Included in CSC contract |
| Flora | Civil works sites | Monthly checking against mitigation measures specified in this EMP | PISCB-CSC | | Included in CSC contract |
| Water Quality | Civil works sites | Monthly checking against mitigation measures specified in this EMP | PISCB-CSC | | Included in CSC contract |

| Environmental Indicators | Location | Method & Frequency | Responsibility | | Estimated Costs (USD) |
|---|---|---|---|---|---|
| | | | Implement | Verify | |
| Resource use and natural resource contamination | Implementation location for Spoil Management Sub-Plan A<br>Implementation location for f Solid and Liquid Waste Management Sub-Plan B | Monthly checking against mitigation measures specified in this EMP | PISCB-CSC | | Included in CSC contract |
| Human health and safety | Implementation location for Occupational Health and Safety and Emergency Response Sub-Plan C<br>Implementation location for Community Health and Safety and Urban Access Sub-Plan E | Monthly checking against mitigation measures specified in this EMP | PISCB-CSC<br><br>Contractor EHS | | Included in CSC contract |
| Contamination of water, soil, waste production and social issues | Implementation location for f Construction Workers and Camp Management Sub-Plan D | Monthly checking against mitigation measures specified in this EMP | PISCB-CSC | | Included in CSC contract |
| Community Issues - At all construction locations<br>• Environmental impacts of civil works (e.g., solid & liquid waste, erosion, local flooding, pollution).<br>• Any unforeseen impacts caused by accidentally e.g. through spillages<br>• Civil nuisance (e.g., noise, disrupted business & farming activity, social issues, community health and safety).<br>• Impaired use of access roads (e.g. traffic issues and access).<br>• GRM and its procedures & key contacts | | Consultation interview with Affected People Using the form in Appendix 1 and Site Observations.<br><br>4-6 weeks after construction starts<br>Monthly until end of construction | PIU-ESC | | Included in PIU staff/travel budget |

## 5.4 Environmental Policy and Standards

33. The construction and operation phases of the projects shall follow relevant environmental quality standards. These are presented in Appendix 4 for reference. These quality standards relate to i) air quality, ii) ambient surface water quality, iii) groundwater quality, vi) soil quality, v) effluent quality.

## 5.5 Reporting

34. Environmental monitoring reports will be prepared semi-annually for the EA by the Project Management and Implementation Support consultants in collaboration with PMU's Environmental Safeguard Officer and sent to MPWT's Environmental Safeguard Office, MoE and ADB. The reports will table all indicators measured with the monitoring plan of EMP including performance monitoring indicators, and will include relevant national environmental quality standards. Table 10 gives reporting requirements during the project implementation.

Table 10. Monitoring and Reporting Requirements

| No. | Report | Frequency | Purpose | From | To |
|---|---|---|---|---|---|
| 1 | CSC EMP Monitoring Report | Monthly | EMP Implementation Progress | CSC | PMU/PISCB |
| 2 | Contractors' Environment Health and Safety Progress Report | Monthly | EHS Progress | Contractor | PMU |
| 3 | Site Visit Report | Monthly | Verify EMP implementation Confirm EMP and GRM are working (consultation and observation) | National Env Specialist with PIU-ESC | PMU-ESO/PISCB |
| 4 | Environmental Quality Monitoring | Varies - as per monitoring table in EMP | Relevant environmental parameters | Contractor (or laboratory) | PMU (PMU-ESO to send to EA) |
| 5 | Environmental Monitoring Report (Integrated safeguards monitoring report format) | Semi-Annual | Full EMP Implementation and Adherence to Environmental Covenants/Conditions | PMU | MoE/ADB |

# VI. PUBLIC CONSULTATION AND PARTICIPATION

35. The Consolidated IEE for this sub-project contains details of the consultation undertaken during preparation of these sub-projects. This includes:

(i) Consultation during project preparation in 2014
(ii) Consultation at detailed design phase in 2018 during the preparation of the final EMP.

36. In addition, consultation will take place during implementation. The PIU and PMU will collaborate to undertake consultation interviews within 4-6 weeks of construction starting and then again, every 3 months until the end of construction. This is set out in the Environmental Monitoring Plan provided in the Environmental Management Plan for each sub-project.

37. Informal monitoring interviews with affected people will focus on complaints about community disturbance from construction activities, such as construction noise, dust, solid waste and wastewater, as well as public concerns about ecological protection, soil / land concerns and access issues. A sample Environmental Monitoring Interview Form is given in Appendix 1. This will contribute to project monitoring

# VII. GRIEVANCE REDRESS MECHANISM

## 7.1 Objective

38. A grievance redress mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) demonstrate concerns about community members and their environmental well-being; and (iii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations. The GRM is accessible to all members of the community and is free of charge.

39. The GRM is set out here in accordance with the approved approach established during Project Preparation, which remains valid. This is a separate grievance system to that managed by General Department of Resettlement which deals with resettlement issues only.

## 7.2 Proposed Approach

40. The following roles and responsibilities for the GRM is set out in Table 11.

Table 11: GRM Roles and Responsibilities

| Role | Responsibilities in GRM |
|---|---|
| MPWT / Executing Agency | • Establish the GRM<br>• Set up a Grievance Redress Committee (GRC) |
| Grievance Redress Committee (GRC) | **Members:**<br>• Sangkat representative<br>• Village leaders or representative<br>• PIU-ESC<br>• PMU-ESO<br>• Municipality representatives<br>• Provincial representatives<br>**Function:**<br>• GRM Access Point and Decision Making<br>• Monitor and record complaints |
| PMU-ESO | • Oversight of GRM implementation and use<br>• Co-ordination with PIU-ESC<br>• GRM Record keeping and document storage of all GRM complaints (Formal or Informal)<br>• Contact with ADB if Affected People appeal the process<br>• GRM reporting |
| PIU-ESC | • GRM implementation at the town level<br>• Responsible for keeping the PMU informed |
| Contractor | • Entry point for people during construction |
| Local Government Institutions and representatives (village, sangkat, municipality) | • Entry point for people during construction |

41. Table 12 shows sangkats/communes and villages within the project area. Representatives such as Village Chief will be included in the GRM committee and will be key access points for GRM implementation:

Table 12: Sangkats and Villages for GRM Access and Implementation

| Sub-Project Component | District/ town | Commune / Sangkat | Village |
|---|---|---|---|
| Wastewater and Drainage Networks | Kampot Town | Kampong Bay | Kampong Bay Choeung |
| | | | Kampong Bay Tbong |
| | | Kraing Ampil | Kraing |
| | | | Svay Thum |
| | | Kampong Kandal | Mouy Ousaphea |
| | | | Sovann Sakor |
| WWTP Site | Tuek Chhou | Kampong Samrong | Kampong Samrong |

## 7.3 Access to the Mechanism and Communication

42. The PMU-ESO and counterparts in the PIUs, will ensure that:

- The public, especially the residents and business owners, in the main areas of influence of the subprojects, are aware of their rights to access, and will have access to, the GRM free of administrative and legal charges;
- The GRM is fully disclosed prior to construction: (a) in public consultations or social/community events, (b) through posters displayed in the offices of the PMU, PIU, Kampot Municipality and concerned Villages/Sangkats and at strategic places within the main areas of influence of subprojects (posters to include names and contact details of the PMU-ESO and PIU-ESC); and (c) sign boards at construction sites.
- Access points will participate in GRM issues and will include:

  Village representative, e.g. Village Chief
  Sangkat representative e.g. from Sangkat Committee
  Municipal government representative
  PIU-ESC and PMU-ESO

43. The GRM will be communicated to the public and affected people as a Project Hotline; this is considered to be more resonant with people than a ‘grievance redress mechanism’. This will include a project hotline notice board to be located in each active construction site for all subprojects which must include three locations around the town in for the drainage and sewage network construction and construction camps and staging areas.

44. The project hotline notice board will include the following information and will require a designated telephone number which is for the project and not personal to individual members of staff

## Project Hotline

**Project**: Construction of [drainage and sewage network / Wastewater Treatment Plant / or landfill] in [town]

**For suggestions, questions or problems related to the project, please contact any of these phone numbers: Call, SMS or Telegram**

| Name | Role or Company | Phone Number |
|---|---|---|
| | Project Management Office, Ministry of Public Works and Transport, Phnom Penh, | |
| | Project Implementation Office, Phnom Penh, Department of Public Works and Transport, [Town] | |
| | Sangkat [town] | |
| | Village Chief, [village] | |
| | Construction Contractor, [company name] | |
| | Construction Site Supervisor, Project Management and Implementation Consultants | |

You can also contact ADB directly:

ADB, Phnom Penh Office:
[Name] and [Phone Number] and [email address]

ADB Southeast Asia Department of ADB, Manila, Philippines:
[Name] and [Phone Number] and [email address]

### 7.4 GRM Steps and Timeframe

45. Informal **Approach.** Informally, an affected person (AP) can lodge complaint directly to the Contractor during construction or Operator during operation.

46. The contractor will initially ensure its worker /staff member hands a GRM Contact Card (required by this EMP) to the complainant. The contractor will also immediately inform the PMU

of the complaint. If possible, the contractor will rectify the problem within one day of the complaint.

47. The PMU will screen the complaint within one day of receipt. If screening reveals the complaint as Project-related and valid, the Contractor will act within three days from confirmation that the complaint is valid, by PMU, if the problem was not rectified immediately.

48. For at least a week after confirmation of completion, the PIU will monitor the effectiveness of the action/resolution taken. After which, PIU will secure a written confirmation of satisfaction from the AP

49. Formal **Approach.** If informally lodged complaint is valid but is not acted on within four days from receipt of complaint, or if AP is not satisfied with the resolution undertaken by the Contractor/Operator, AP can access the formal mechanism, which comprises of four stages.

**First Stage**. For valid environmental complaints, the steps and timeframe involved in addressing complaint at the first stage are presented below.

| **Step 1** | **AP Complaint (Day 1)** |
|---|---|
| • Complaint is filed by Access Point at Kampot town level, verbally or in writing, with an access point.<br>• Complaint is passed to PMU-ESO | |
| **Step 2** | **Screening (Day 2)** |
| • PMU-ESO screens complaint<br>• AP is immediately informed of the screening results<br>• An AP with complaint screened as non-Project-related and/or invalid will be advised that he/she can raise his/her complaint to the second stage; and receiving agent will formally forward the complaint to the Kampot District Office | |
| **Step 3** | **Investigation, Discussion and Agreement (Day3-4)** |
| • PIU, Contractor and AP will discuss the complaint at the site within 2 days of screening.<br>• Agreement on actions and measures and time involved will be made with the AP.<br>• Agreement will be documented and filed by PMU-ESO; PIU, AP, Contractor/Operator will have copies. | |
| **Step 4** | **Implementing the Agreed-on Resolution (Day 5-10)** |
| • If required action is minor, i.e., not requiring further investigation and would be quick and easy to implement, the Contractor/Operator will immediately implement the agreed action. (starting Day5)<br>• If required action is major, i.e., requiring further investigation and/or procurement of supplies/parts, the Contractor/Operator will: (i) immediately provide the most suitable interim measure to reduce the magnitude of the impact (starting Day 5); and (ii) start work on the major action within 5 days from discussion (or not later than Day 10 since receipt of complaint).<br>• AP will be advised by the PIU that his/her complaint may be raised to the second level of the GRM, if he/she so prefers when: (i) minor action is not implemented on time; (ii) interim measure is not implemented on time; or (iii) major action is not implemented on time. | |
| **Step 5** | **Confirmation of Completed Action** |
| • Contractor/Operator will secure a written confirmation of completed action from the AP and furnish the PIU a copy. | |
| **Step 6** | **Confirmation of Satisfaction (1 week after confirmation of completed action)** |
| • The PIU will monitor the effectiveness of the resolution for at least a week after receipt of confirmation of completed action from the Contractor/Operator. After which, PIU will secure a | |

written confirmation of satisfaction from the AP.

**Second Stage.** For actions not taken within the agreed timeframe and when AP is dissatisfied with the action taken at the First Stage, AP can raise his/her complaint to the District Office GRC Representative. The District Office has 15 days within which to resolve the complaint to the satisfaction of all concerned. If the complaint cannot be solved at this stage, the District Office will bring the case to the Provincial Grievance Redress Committee representative.

**Third Stage – Provincial Level Appeal**. If the AP remains dissatisfied (or, in the event the issue/impact persists despite actions undertaken), AP can appeal for assistance from the district in the elevation of his/her complaint to the provincial authority. The provincial authority shall call all parties concerned to review the history of the grievance and resolution process taken and assess the validity of the appeal.

Within 30 days of the submission of the grievance, the Provincial GRC representative must make a written decision and submit copies to the MPWT, GRC members and the AP.
If appeal is found not valid, the provincial authority shall write the AP and declare the grievance closed. In the event of an appeal, the MPWT shall immediately report to the PMU. The PMU shall ensure that the ADB is immediately informed.

**Fourth Stage – ADB Special Mission or Judicial System**. If the complainant is still unsatisfied, the PMU/EA will inform ADB to convene a special mission to attempt a resolution prior to use of the Cambodian judicial system

**Accountability Mechanism of the ADB.** In addition, affected people may always contact the Complaints Receiving Officer of the ADB:

Complaints Receiving Officer, Accountability Mechanism
Asian Development Bank
ADB Headquarters, 6 ADB Avenue, Mandaluyong City 1550, Metro Manila, Philippines
(+632) 632-4444 loc. 70309
(+632) 636 2086
amcro@adb.org

Instructions available here: http://www.adb.org/site/accountability-mechanism/how-file-complaint.

50. The Project's GRM should not impede access to the country's jurisdiction or administrative remedies. Accessing the country's legal system and GRM can be done at the same time. If efforts to resolve disputes using the grievance procedures remain unresolved or unsatisfactory, AP has the right to directly discuss his/her concern/complaint with the ADB's Urban Development and Water Division, Southeast Asia Department through the ADB Cambodia Resident Mission.

51. The PMU, PIU and GRC will keep records of all lodged and documented/referenced complaints, actions/resolutions taken, AP's written confirmations of completed action and satisfaction, complaints raised to higher levels, lessons learned. The number of grievances recorded and resolved and the outcomes will be displayed at the offices of PIU, PMU and Municipality and reported in the monthly progress reports, semi-annual monitoring reports during construction and annual monitoring reports during operation, submitted to ADB.

52. The PMU will do periodic review of the effectiveness of the GRM in each town and record information on the effectiveness of the mechanism, especially on the project's ability to prevent and address complaints. All costs involved in resolving complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the PMU. In cases where AP does not have the writing skills or are unable to express their grievances verbally, he/she may seek third-party assistance of his/her choice.

# IX. CONCLUSION

53. The EMP, if implemented as directed, will mitigate impacts on the natural environment and affected people to an acceptable level. The key parties for mitigation measure implementation are the construction contractors and the operator. The implementation of this EMP will be closely monitored and reported on by the relevant stakeholders in the project.

54. The most significant impacts from the project will arise from wastewater collection and WWTP operation. As a result, there is a comprehensive training and capacity building component to the project which is essential for ensuring the investment is financially and environmentally sustainable and beneficial which will mean effective WWTP operation and effective maintenance of the drainage network.

55. A robust Grievance Redress Mechanism will be established. It will ensure that all unplanned impacts which cause grievances for affected people are managed swiftly and a satisfactory outcome brought about.

56. Overall, the project is anticipated to bring environmental benefits to the city and its residents. It will serve to improve the current waste management situation and will provide long term environmental improvements.

## Appendix 1 Affected Person Monitoring Form

### Consultation / Interview Form

| Date of Interview | | Interviewer Name | |
|---|---|---|---|
| **Interview Site:** *Where is the interview held? In school, on the road, in shop* | | **Stakeholder Name & Status:** *Full name, status is business owner, school teacher, religious leader, resident* | |
| **Construction Site & Date Construction Started** *Which road, GPS location if available* | | **Has this stakeholder been interviewed before?** *Yes (when were they interviewed) No* | |

### Interview Discussion Points:

| 1. NOISE | Record of Discussion |
|---|---|
| **Before the project started, was the person disturbed by noise? If yes, explain how and when.** *Where did the noise come from? E.g. traffic, machinery, people, music* *When did it disturb the person? E.g. all day, at night, intermittently* | |
| **During the construction, is the person disturbed by noise from the project? If yes, explain how and when.** *What type of noise and where did the noise come from? All day, at night, intermittently?* | |
| **If noise from construction is a problem, what changes does the person suggest are made?** | |
| **2. AIR QUALITY** | **Record of Discussion** |
| **Before the project started, was the person affected by air pollution or dust? If yes, explain how and when.** *Where did the pollution or dust come from? E.g. traffic, machinery, construction, burning garbage, cooking stoves* *When was the dust or pollution a problem? E.g. all day, at night, intermittently* | |
| **During the project, is the person disturbed by dust or pollution? If yes, explain how and when.** *What type of noise and where did the noise come from? E.g. increased traffic congestion, construction machinery, construction workers, burning construction garbage etc* *When did it disturb the person? E.g. all day, at night, intermittently* | |
| **If dust or air pollution from the construction is a problem, what changes does the person suggest are made?** | |

| 3. VEGETATION AND LAND USE | Record of Discussion |
|---|---|
| **Before the project started, what was the vegetation like in the project area?** *E.g. pasture land, trees, shrubs, rice fields.* | |
| **During the project, has the person found the vegetation situation has changed? If yes, explain how and when.** | |
| **If impact on vegetation is unacceptable, what changes does the person suggest are made?** | |
| **4 COMMUNITY SAFETY** | **Record of Discussion** |
| **Before the project started, can you describe the community safety situation in the project area?** *E.g. no problems, some accidents, difficulty crossing the roads* | |
| **During the project, has the person found the community safety situation has changed? If yes, explain how and when.** *Slower traffic so easier to cross the roads, construction vehicles are making a crossing harder / easier, more accidents / less accidents, construction site dangers* | |
| **If change in road safety is unacceptable, what changes does the person suggest are made?** | |
| **5. WATER QUALITY** | **Record of Discussion** |
| **Before the project started, was the person affected by poor water quality? If yes, explain how and when.** *Ground water ? Surface Water ? which Water source ? How was it polluted ?* | |
| **During the project, is the person affected by water pollution? If yes, explain how and when.** *Ground water ? Surface Water ? which Water source ? How is quality being affected ?* | |
| **If water quality from the construction is a problem, what changes does the person suggest are made?** | |
| **6. ACCESS** | **Record of Discussion** |
| **During the project, is the person affected by reduced access to their business, home or land ?** **Access to what is limited, and how ?** | |
| **If access limitations are not acceptable, please suggest changes which can be made ?** | |
| **7. OTHER ISSUES** | **Record of Discussion** |
| **Any other issues about the construction sites that the person wants to discuss?** *E.g. wastewater concerns, waste disposal, Other concerns, labor force,* | |

## Appendix 2 GRM – Complaint Recording Form

| | |
|---|---|
| **PIU Staff Responsible: (name and role)** | |
| **Date: (of this record)** | |

| | |
|---|---|
| **Date of Complaint:** | |
| **Date Resolution Required by** (5-10 days from initial complaint): | |
| **Complaint Made by:** (Name & Contact Details) | |
| **Method of Complaint:** (direct to PMU, via Contractor, Via Commune People's Council) | |
| **Details of Complaint:** (issues, actions taken so far, when did it start – all details needed) | |
| **PMU Actions:** (Next steps for PMU to resolve the issue or to move complaint to next level) | |
| **Follow Up Actions Needed and Date:** (PMU to follow up on resolution if needed, e.g. check contractor actions) | |

## Appendix 3 Particular Conditions (for Bidding Documents)

57. The following clauses shall be added to the Bidding Document, Section 8 Particular Conditions in relation to the Environmental Safeguards for the Project:

58. The contractor will undertake to develop and submit to the PMU/CSC for approval, a site specific Construction Environmental Management Plan with the following management sub-plans:

A. Spoil Management;
B. Solid and Liquid Waste Management;
C. Community and Occupational Health and Safety and Emergency Response;
D. Construction Workers' Camp Management (if required).
E. Community Health and Safety and Urban Access

59. The management sub-plans will be sufficiently detailed as to allow a clear understanding of the approach the contractor will take to mitigate environmental impacts during construction. The contractor will adhere to the management sub-plans at all times unless prior agreement has been given by the PMU under extenuating circumstances.

60. The Contractor will commit to ensuring a full time environmental health and safety officer on site who is competent, nominated to manage health and safety risks, and who can implement the EMP requirements for occupational health and safety and ensure relevant health and safety legislation is followed.

61. The Contractor will commit to enabling the project staff or consultants tasked with monitoring, full access to all information and data required in order that the Environmental Management Plan can be fully monitored.

## Appendix 4: Environmental Standards For Cambodia

### (1) Ambient Air Quality Standards

Source: Sub-decree **No. 42 ANRK.BK** on Air Pollution Control and Noise Disturbance, MoE 2000.

| Parameter | Averaging Period | Standard | |
|---|---|---|---|
| | | Unit | Value |
| Nitrogen Dioxide (NO2) | 24 hours | mg /$m^3$ | 0.1 |
| Sulfur Dioxide (SO2) | 24 hours | mg /$m^3$ | 0.3 |
| Carbon Monoxide (CO) | 8 hours | mg /$m^3$ | 20 |
| Ozone ($O_3$) | 1 hours | mg /$m^3$ | 0.2 |
| Lead (Pb) | 24 hours | mg /$m^3$ | 0.005 |
| TSP | 24 hours | mg /$m^3$ | 0.33 |
| PM 2.5 (use WHO value in Cambodia) | 24 hours | mg /$m^3$ | 0.025 |
| PM 10 (use WHO value in Cambodia) | 24 hours | mg /$m^3$ | 0.05 |

### (2) Ambient Noise Standards

Source: Sub-decree **No. 42 ANRK.BK** on Air Pollution Control and Noise Disturbance, MoE , 2000 and WHO. Bold highlights most stringent standard to be followed.

| Areas | Time Period (24 hours) | Standard | |
|---|---|---|---|
| | | National Standard (dB(A)) | WHO Community Noise (dB(A)) |
| RES: Residential Area<br>MIX: Mixed Residential and Small Industries Area<br>I&C: Industrial and Commercial | Day time (from 6:00am to 6:00pm) | RES: 60<br>MIX: 75 | RES: 55 (serious annoyance)<br>**RES: 50 (moderate annoyance)**<br>**I&C: 70 (hearing impairment)** |
| | Evening Time (from 6:00pm to 10:00pm) | **RES: 50**<br>MIX: 70 | RES: 55 (moderate annoyance)<br>**I&C: 60 (hearing impairment)** |
| | Night time (from 10:00pm to 6:00am) | **RES: 45**<br>**MIX: 50** | RES: 45 (moderate annoyance)<br>I&C: 60 (hearing impairment) |

### (3) Surface Water Quality Standard

Referring to Sub-decree **No. 27 ANRK.BK** on Water Pollution Control, MoE, 1999, the standards of water quality are divided as follows:

**Annex 2 of Sub-decree on Water Pollution Control**
**Effluent standard for pollution sources discharging wastewater to public water areas or sewer**

| No | Parameters | Unit | Allowable limits for pollutant substance discharging to | |
|---|---|---|---|---|
| | | | Protected public water area | Public water area and sewer |
| 1 | Temperature | 0C | < 45 | < 45 |
| 2 | pH | | 6 – 9 | 5 - 9 |
| 3 | BOD5 ( 5 days at 200 C ) | mg/l | < 30 | < 80 |
| 4 | COD | mg/l | < 50 | < 100 |
| 5 | Total Suspended Solids | mg/l | < 50 | < 80 |
| 6 | Total Dissolved Solids | mg/l | < 1000 | < 2000 |
| 7 | Grease and Oil | mg/l | < 5.0 | < 15 |
| 8 | Detergents | mg/l | < 5.0 | < 15 |
| 9 | Phenols | mg/l | < 0.1 | < 1.2 |
| 10 | Nitrate (NO3 ) | mg/l | < 10 | < 20 |
| 11 | Chlorine ( free ) | mg/l | < 1.0 | < 2.0 |
| 12 | Chloride ( ion ) | mg/l | < 500 | < 700 |
| 13 | Sulphate ( as SO4 ) | mg/l | < 300 | < 500 |
| 14 | Sulphide ( as Sulphur ) | mg/l | < 0.2 | < 1.0 |
| 15 | Phosphate ( PO4 ) | mg/l | < 3.0 | < 6.0 |
| 16 | Cyanide ( CN ) | mg/l | < 0.2 | < 1.5 |

| | | | | |
|---|---|---|---|---|
| 17 | Barium ( Ba ) | mg/l | < 4.0 | < 7.0 |
| 18 | Arsenic ( As ) | mg/l | < 0.10 | < 1.0 |
| 19 | Tin ( Sn ) | mg/l | < 2.0 | < 8.0 |
| 20 | Iron ( Fe ) | mg/l | < 1.0 | < 20 |
| 21 | Boron ( B ) | mg/l | < 1.0 | < 5.0 |
| 22 | Manganese ( Mn ) | mg/l | < 1.0 | < 5.0 |
| 23 | Cadmium ( Cd ) | mg/l | < 0.1 | < 0.5 |
| 24 | Chromium ( Cr )+3 | mg/l | < 0.2 | < 1.0 |
| 25 | Chromium ( Cr )+6 | mg/l | < 0.05 | < 0.5 |
| 26 | Copper ( Cu ) | mg/l | < 0.2 | < 1.0 |
| 27 | Lead ( Pb ) | mg/l | < 0.1 | < 1.0 |
| 28 | Mercury (Hg ) | mg/l | < 0.002 | < 0.05 |
| 29 | Nickel ( Ni ) | mg/l | < 0.2 | < 1.0 |
| 30 | Selenium ( Se ) | mg/l | < 0.05 | < 0.5 |
| 31 | Silver ( Ag ) | mg/l | < 0.1 | < 0.5 |
| 32 | Zinc ( Zn ) | mg/l | < 1.0 | < 3.0 |
| 33 | Molybdenum ( Mo ) | mg/l | < 0.1 | < 1.0 |
| 34 | Ammonia ( NH3 ) | mg/l | < 5.0 | < 7.0 |
| 35 | DO | mg/l | >2.0 | >1.0 |
| 36 | Polychlorinated Byphemyl | mg/l | <0.003 | <0.003 |
| 37 | Calcium | mg/l | <150 | <200 |
| 38 | Magnesium | mg/l | <150 | <200 |
| 39 | Carbon tetrachloride | mg/l | <3 | <3 |
| 40 | Hexachloro benzene | mg/l | <2 | <2 |
| 41 | DTT | mg/l | <1.3 | <1.3 |
| 42 | Endrin | mg/l | <0.01 | <0.01 |
| 43 | Dieldrin | mg/l | <0.01 | <0.01 |
| 44 | Aldrin | mg/l | <0.01 | <0.01 |
| 45 | Isodrin | mg/l | <0.01 | <0.01 |
| 46 | Perchloro ethylene | mg/l | <2.5 | <2.5 |
| 47 | Hexachloro butadiene | mg/l | <3 | <3 |
| 48 | Chloroform | mg/l | <1 | <1 |
| 49 | 1,2 Dichloro ethylene | mg/l | <2.5 | <2.5 |
| 50 | Trichloro ethylene | mg/l | <1 | <1 |
| 51 | Trichloro benzene | mg/l | <2 | <2 |
| 52 | Hexaxhloro cyclohexene | mg/l | <2 | <2 |

***Remark***: The Ministry of Environment and the Ministry of Agriculture, Forestry and Fishery shall collaborate to set up the standard of pesticides which discharged from pollution sources.

### Annex 4 of Sub-decree on Water Pollution Control

### (4) Water Quality Standard in public water areas for bio-diversity conservation

**Source:** Sub-decree **No. 42 ANRK.BK** on Water Pollution Control, MOE, 1999.

### a) River

| Parameter | Standard | |
|---|---|---|
| | Unit | Value |
| pH | mg/l | 6.5 – 8.5 |
| BOD5 | mg/l | 1 – 10 |
| Suspended Solid | mg/l | 25 – 100 |
| Dissolved Oxygen | mg/l | 2.0 - 7.5 |
| Coliform | MPN/100ml | < 5000 |

### b) Lakes and Reservoirs

| Parameter | Standard | |
|---|---|---|
| | Unit | Value |
| pH | mg/l | 6.5 – 8.5 |
| COD | mg/l | 1 – 8 |
| Suspended Solid | mg/l | 1 – 15 |
| Dissolved Oxygen | mg/l | 2.0 - 7.5 |

| | | |
|---|---|---|
| Coliform | MPN/100ml | < 1000 |
| Total Nitrogen | mg/l | 1.0 – 0.6 |
| Total Phosphorus | mg/l | 0.005 – 0.05 |

**Annex 5 of Sub-decree on Water Pollution Control:**

**(5) Water Quality Standard (ground and surface water) in public water areas for public health protection (not non-potable water)**

| No | Parameter | Unit | Standard Value |
|---|---|---|---|
| 1 | Carbon tetrachloride | µg/l | < 12 |
| 2 | Hexachloro-benzene | µg/l | < 0.03 |
| 3 | DDT | µg/l | < 10 |
| 4 | Endrin | µg/l | < 0.01 |
| 5 | Diedrin | µg/l | < 0.01 |
| 6 | Aldrin | µg/l | < 0.005 |
| 7 | Isodrin | µg/l | < 0.005 |
| 8 | Perchloroethylene | µg/l | < 10 |
| 9 | Hexachlorobutadiene | µg/l | < 0.1 |
| 10 | Chloroform | µg/l | < 12 |
| 11 | 1,2 Trichloroethylene | µg/l | < 10 |
| 12 | Trichloroethylene | µg/l | < 10 |
| 13 | Trichlorobenzene | µg/l | < 0.4 |
| 14 | Hexachloroethylene | µg/l | < 0.05 |
| 15 | Benzene | µg/l | < 10 |
| 16 | Tetrachloroethylene | µg/l | < 10 |
| 17 | Cadmium | µg/l | < 1 |
| 18 | Total mercury | µg/l | < 0.5 |
| 19 | Organic mercury | µg/l | 0 |
| 20 | Lead | µg/l | < 10 |
| 21 | Chromium, valent 6 | µg/l | < 50 |
| 22 | Arsenic | µg/l | < 10 |
| 23 | Selenium | µg/l | < 10 |
| 24 | Polychlorobiohenyl | µg/l | 0 |
| 25 | Cyanide | µg/l | < 0.005 |

**(6) Groundwater Quality Standard (for drinking) from Ministry of Handicrafts and Industry Based on WHO (2003) Standards**

| No 1 | Parameter | Standard | |
|---|---|---|---|
| | | Unit | Value |
| 2 | pH | - | 6.5-8.5 |
| 3 | Turbidity | NTU | 5.0 |
| 4 | Chloride (Cl-) | mg/l | 250 |
| 5 | Sulphate (SO4) | mg/l | 250 |
| 6 | Aluminum (Al) | mg/l | 0.2 |
| 7 | Copper (Cu) | mg/l | 1.0 |
| 8 | Iron (Fe) | mg/l | 0.3 |
| 9 | Manganese (Mn) | mg/l | 0.1 |
| 10 | Zinc (Zn) | mg/l | 3.0 |
| 11 | Total Coli form | MPN/100ml | 0 |
| 12 | Mercury (Hg) | mg/l | 0.001 |
| 13 | Lead (Pb) | mg/l | 0.01 |
| 14 | Arsenic (As) | mg/l | 0.05 |
| 15 | Nitrate (NO3) | mg/l | 50 |
| 16 | Nitrite (NO2) | mg/l | 3 |

**(7) Effluent Quality Standard**

(Effluent from WWP and from Leachate Treatment Facility at the controlled disposal facility)

**Source:** Sub-decree **No. 42 ANRK.BK** on Water Pollution Control, MOE, 1999.

| No | Parameter | Standard (Allowable limits for pollutant substance discharging) to | | |
|---|---|---|---|---|
| | | Unit | Value (Protected public water area) | Value (Public water area and sewer) |
| 1 | Temperature | 0C | < 45 | < 45 |
| 2 | pH | | 6 – 9 | 5 - 9 |
| 3 | BOD5 ( 5 days at 200 C ) | mg/l | < 30 | < 80 |
| 4 | COD | mg/l | < 50 | < 100 |
| 5 | Total Suspended Solids | mg/l | < 50 | < 80 |
| 6 | Total Dissolved Solids | mg/l | < 1000 | < 2000 |
| 7 | Grease and Oil | mg/l | < 5.0 | < 15 |
| 8 | Detergents | mg/l | < 5.0 | < 15 |
| 9 | Phenols | mg/l | < 0.1 | < 1.2 |
| 10 | Nitrate (NO3 ) | mg/l | < 10 | < 20 |
| 11 | Chlorine ( free ) | mg/l | < 1.0 | < 2.0 |
| 12 | Chloride ( ion ) | mg/l | < 500 | < 700 |
| 13 | Sulphate ( as SO4 ) | mg/l | < 300 | < 500 |
| 14 | Sulphide ( as Sulphur ) | mg/l | < 0.2 | < 1.0 |
| 15 | Phosphate ( PO4 ) | mg/l | < 3.0 | < 6.0 |
| 16 | Cyanide ( CN ) | mg/l | < 0.2 | < 1.5 |
| 17 | Barium ( Ba ) | mg/l | < 4.0 | < 7.0 |
| 18 | Arsenic ( As ) | mg/l | < 0.10 | < 1.0 |
| 19 | Tin ( Sn ) | mg/l | < 2.0 | < 8.0 |
| 20 | Iron ( Fe ) | mg/l | < 1.0 | < 20 |
| 21 | Boron ( B ) | mg/l | < 1.0 | < 5.0 |
| 22 | Manganese ( Mn ) | mg/l | < 1.0 | < 5.0 |
| 23 | Cadmium ( Cd ) | mg/l | < 0.1 | < 0.5 |
| 24 | Chromium ( Cr )+3 | mg/l | < 0.2 | < 1.0 |
| 25 | Chromium ( Cr )+6 | mg/l | < 0.05 | < 0.5 |
| 26 | Copper ( Cu ) | mg/l | < 0.2 | < 1.0 |
| 27 | Lead ( Pb ) | mg/l | < 0.1 | < 1.0 |
| 28 | Mercury (Hg ) | mg/l | < 0.002 | < 0.05 |
| 29 | Nickel ( Ni ) | mg/l | < 0.2 | < 1.0 |
| 30 | Selenium ( Se ) | mg/l | < 0.05 | < 0.5 |
| 31 | Silver ( Ag ) | mg/l | < 0.1 | < 0.5 |
| 32 | Zinc ( Zn ) | mg/l | < 1.0 | < 3.0 |
| 33 | Molybdenum ( Mo ) | mg/l | < 0.1 | < 1.0 |
| 34 | Ammonia ( NH3 ) | mg/l | < 5.0 | < 7.0 |
| 35 | DO | mg/l | >2.0 | >1.0 |
| 36 | Polychlorinated Biphenyl | mg/l | <0.003 | <0.003 |
| 37 | Calcium | mg/l | <150 | <200 |
| 38 | Magnesium | mg/l | <150 | <200 |
| 39 | Carbon tetrachloride | mg/l | <3 | <3 |
| 40 | Hexachloro benzene | mg/l | <2 | <2 |
| 41 | DTT | mg/l | <1.3 | <1.3 |
| 42 | Endrin | mg/l | <0.01 | <0.01 |
| 43 | Dieldrin | mg/l | <0.01 | <0.01 |
| 44 | Aldrin | mg/l | <0.01 | <0.01 |
| 45 | Isodrin | mg/l | <0.01 | <0.01 |
| 46 | Perchloro ethylene | mg/l | <2.5 | <2.5 |
| 47 | Hexachloro butadiene | mg/l | <3 | <3 |
| 48 | Chloroform | mg/l | <1 | <1 |
| 49 | 1,2 Dichloro ethylene | mg/l | <2.5 | <2.5 |
| 50 | Trichloro ethylene | mg/l | <1 | <1 |
| 51 | Trichloro benzene | mg/l | <2 | <2 |
| 52 | Hexaxhloro cyclohexene | mg/l | <2 | <2 |