Environmental Management Plan

(Draft) January 2018
Project 49387-002

Kingdom of Cambodia: Second Greater Mekong Subregion Tourism Infrastructure for Inclusive Growth Project

Preah Sihanouk Subprojects, Cambodia

CURRENCY EQUIVALENTS
(as of 26 September 2017)

currency unit	–	Riel KR
R1.00	=	$0.00024
$1.00	=	KR4,050

ABBREVIATIONS

ADB	-	Asian Development Bank
CEMP	-	contractor environmental management plan
DAFF	-	Department of Agriculture, Forestry and Fisheries
DOE	-	Department of Environment
DPWT	-	Department of Public Works and Transport
DOT	-	Department of Tourism
DOWRAM	-	Department of Water Resources and Meteorology
EA	-	executing agency
EIA	-	environmental impact assessment
EMC	-	environmental monitoring consultant
EMP	-	environment management plan
EO	-	environmental officer
ERT	-	emergency response team
EERT	-	external emergency response team
ESS	-	Environmental Safeguard Specialist
GMS	-	Greater Mekong Sub-Region
Government	-	Government of Cambodia
IEE	-	initial environment examination
IEIA	-	initial environmental impact assessment
MAFF	-	Ministry of Agriculture, Forestry and Fisheries
MOE	-	Ministry of Environment
MPWT	-	Ministry of Public Works and Transport
MOT	-	Ministry of Tourism
MOWRAM	-	Ministry of Water Resources and Meteorology
MRF	-	material recovery facility
PAM	-	project administration manual
PCU	-	project coordinating unit
PIU	-	project implementation unit
PMCES	-	project management and civil engineering support consultant
PPTA	-	project preparatory technical assistance
RP	-	resettlement plan
STF	-	septage treatment facility
SPS	-	safeguard policy statement (2009)

WEIGHTS AND MEASURES

km	-	kilometer
kg	-	kilogram
ha	-	hectare

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

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I. INTRODUCTION

1. The environmental management plan (EMP) provided herein addresses the Preah Sihanouk Seaside Access and Environmental Improvements subproject, and the Preah Sihanouk City–Koh Rong Passenger Piers Improvements subproject, in Preah Sihanouk province. This EMP is one of the two EMPs that have been prepared for the three subprojects of the Second GMS Tourism Infrastructure for Inclusive Growth Project in Cambodia. The other EMP addresses the Kep Solid Waste Management Improvements subproject in Kep province.

2. A single Initial Environmental Examination (IEE) of the three subprojects was prepared separately. The EMP for the subprojects in is comprehensive and developed as a separate stand-alone management tool that is supported by the parent IEE. The two subprojects in Preah Sihanouk are described below.

A. Preah Sihanouk Seaside Access and Environmental Improvements

3. The access and environmental improvements to Ocheutal and Otres beaches will consist of upgrading the existing access roads and footpaths along both beaches. Box culvert and V-channel lateral drains will be installed where necessary under and along upgraded beach roads, respectively. Improved lighting, and provision of public showers and toilets will also occur. Table 1 reproduces the list of subproject components from the IEE.

Table 1. Components of Preah Sihanouk subprojects

Preah Sihanouk Seaside Access and Environmental Improvements	• Improve traffic management, pedestrian walkways, and landscaping of Ferry Pier Road and 1.2km of northwestern section of Ocheutal Beach Road; • Improve a 1.75 km section of Ocheutal Beach Road to asphalt pavement; • Improve a 0.34 km section of Ocheutal Beach Road to concrete pavement; • Improve the 0.2 km X 3.5 meter wide footpath around a headland that connects Ocheutal and Otres beaches with concrete pavement with lighting; and • Improve the existing Otres beachfront road and crossroads (4.0 km) to concrete pavement • Upgraded roads to incorporate required lateral and cross drainage.
Preah Sihanouk City –Koh Rong Passenger Pier Improvements	• New 600 m^2 concrete pier at Victory beach with associated facilities: - ticketing & waiting areas; - food and beverage service facilities; - toilets; and - vehicle parking. • A new 750 m^2 concrete pier on Koh Touch beach, Koh Rong island with facilities: - ticketing & waiting areas; - toilets sanitation; - tourist information; - and retail kiosks

B. Preah Sihanouk City–Koh Rong Passenger Piers Improvements

4. The construction of new concrete piers on Victory beach in Preah Sihanouk City and on Koh Touch beach on Koh Rong island will consist of new concrete piers to support increased tourist boat activity. Both piers will also include support facilities such as waiting and ticketing building, and public toilet blocks. The new pier on Victory beach will also include a short access road from the main town road, and parking.

II. INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

5. At the feasibility stage the main management framework for implementation of the environmental management plan (EMP) for the Preah Sihanouk subprojects is summarized below.

6. The Ministry of Tourism (MOT), which is the executing agency (EA) for the project, will take overall responsibility for successful implementation of the EMP. The EA will establish a Phnom Penh-based Project Coordination Unit (PCU) under the supervision of a Project Steering Committee which, *inter alia*, will oversee Safeguards Coordination for the EMP. The provincial Department of Tourism (DOT) is the implementing agency (IA), in which a multisector project implementation unit (PIU) will be based. The PIUs with support from the IAs will implement the EMP. The PIU will include an Environmental Safeguards Specialist (ESS) who will lead the implementation of the EMP in conjunction with the Environmental Officer(s) (EO) of the construction contractor(s). The requirement for an experienced EO will be included in contractor tender documents.

7. The PCU's Safeguards Coordination Unit will provide operational guidance to the PIU for implementation of the EMP and will liaise with the ADB on safeguard reporting and issues. The Safeguards Specialist of the PIU will oversee the work of the EO of the contractor on the implementation of the CEMP for each construction package. [1]

8. External support to the IA/PIU for implementation of the EMP will be provided by the International and National Environment Specialists (ES) of the Project Management and Civil Engineering Support Consultant (PMCES) and an external Environmental Monitoring Institute (EMI) which will conduct the field sampling and laboratory analyses of environmental quality (e.g., water quality, air quality) that cannot be performed by the contractor or PMCES.

9. The responsibilities of the different agencies shown in the management framework are listed in Annex 1. Provided below is a summary of responsibilities for implementation of the EMP.

10. The responsibilities of the EA as supported by PCU in respect of environmental safeguards, include:

- Provide coordination for environmental and social safeguards and monitoring of the PIU;
- Liaise with ADB on the implementation of the EMP;
- With assistance from PIU submit semi-annual environmental monitoring reports to ADB; and
- Resolve with the PIU, and ADB if necessary, issues arising from the implementation of EMP.

[1] Contractor Environmental Management Plan prepared by contractor as part of bid documents based on updated EMP

- Oversee successful operation of Grievance Redress Mechanism (GRM) and support resolution of any submitted stakeholder grievances at project level if possible.
- With support from IA/PIU prepare report on Grievance Redress Mechanism (GRM) to be included in the semi-annual environmental monitoring report;

11. The responsibilities of the Environmental Safeguards Specialist of the PIU include:

- Assist the PMCES consultant with updating the EMP to meet final detailed subproject designs;
- Notify DOT to verify Government approvals of project are met, and that ADB IEE and EMP are compliant with requirements of Royal Government of Cambodia (RGC) sub-decree on EIA, No 72 ANRK.BK issued by the Ministry of Environment (MOE, 1999);
- Assist project owner (MOT) coordinate the preparation and submission of government IEIA or EIA by registered EIA firm as per 2014 Prakas requiring registered EIA firms in compliance government EIA law.
- Assist the PMCES consultant to include updated EMP in contractor tender documents, and to specify CEMP requirements for contractor bid documents;
- Undertake day-to-day management of EMP implementation activities;
- Work with the EMI on implementation of monitoring plan of EMP;
- Ensuring compliance with environmental loan covenants and assurances in respect of all subprojects;
- Lead follow-up meetings with all affected stakeholders;
- Prepare and submit quarterly reports on EMP implementation to PCU;
- Oversee implementation of the CEMP by contractor;
- Coordinate with environment specialists to ensure EMP implementation;
- Undertake regular construction site inspections to ensure the contractor implements the CEMP properly; and
- Ensure the contractor's EO submits monthly environmental monitoring reports on implementation of construction mitigation and monitoring measures.

12. The responsibilities of the international and national environmental specialists of the PMCES firm are detailed in the Terms of Reference for the two positions in Annex 2. Key responsibilities for the EMP are listed below:

- Update the EMP to meet final detailed designs of subprojects;
- Assist PIU add EMP requirements to bid documents;
- Assist PIU review submitted CEMPs;
- Provide technical direction and support to the PIU for implementation of the EMP;
- Oversee the design and delivery of capacity development and training for the PIU and EO of contractor(s);
- Provide advice and support to the EMI to conduct their monitoring activities;
- Review all reports prepared by the PIU, EMI, PCU and ADB; and
- Review the location of any possible contaminated sites near subprojects.

13. The responsibilities of contractor's Environmental Officer (EO):

- Implement the CEMP during construction; and
- Prepare and submit monthly reports on mitigation and monitoring activities of the CEMP and any environmental issues at construction sites.

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

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

15. The Department of Environment (DOE) is the provincial agency which oversees environmental management. The DOE with District staff provides direction and support for environmental protection-related matters.

16. The ADB provides guidance to EA/PCU with any issues related to IEE and EMP updates and reviews semi-annual environmental monitoring reports on EMP activities compiled and submitted by PCU.

A. Worker and Community Health and Safety

17. In 2003 the International Labour Organization (ILO) created the New Global Strategy for Occupational Safety and Health (OSH). Based on the OSH[2] the Ministry of Labour and Vocational Training (MLVT) through the Department of Occupational Safety & Health, developed the Occupational Safety and Health Master Plan (OSHM; 2009-2013) of Cambodia.

18. The OSHM, *inter alia,* addresses worker and public safety in the construction and operation of small-medium enterprises and notably rural roads. The EA/PCU as supported by the PIUs, must obtain and implement the directives of the OSHM. The pertinent associated law and directives is the Labour Law of Cambodia (1997) with specific reference to chapter VIII governing health and welfare of workers and the public.

19. To supplement the OSHM, the IFC/World Bank Environment, Health, and Safety Guidelines (2007) should also be consulted.

B. Regulatory Framework and Guidelines

20. Applicable regulations and guidelines for the seaside access and pier subprojects as drawn from the IEE are summarized in Table 2. The regulations and guidelines, *inter alia,* identify how aspects of subprojects should be managed to prevent or minimize negative impacts on the environment. The current environmental standards for Cambodia are provided in Annex 3. See the IEE for the complete legal and regulatory framework for environmental management.

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

Table 2. Regulations and Guidelines Applicable to Subprojects[3]

- Law on Environmental Protection and Natural Resources Management, Preah Reach Kram/NS-RKM-1296/36, enacted by Minister of Environment, 1996;
- Sub-decree on Water Pollution Control (2009):
  - Annex 2: Effluent standard for pollution sources discharging wastewater to public water areas or sewer;
  - Annex 4: Water quality standard in public water areas for biodiversity conservation; and
  - Annex 5: Water quality standard in public water areas for public health protection.
- Environmental Guidelines for Solid Waste Management in the Kingdom of Cambodia (2006);
- Directive Managing Health Wastes in the Kingdom of Cambodia (MOH, 2008); and
- Directive on Industrial Hazardous Waste Management (MOE, 2000); and
- RGC Decree Management of Urban Garbage and Solid Waste, No. 113, NKR-PR 2013.
- Management of Means of Water Transport 00067, RGC, MPWT Circular #003 (2011)

The operation of the completed piers and operation of tourist boats in the Koh Rong Marine Protected Area (MPA) must also adhere to environmental protection requirements prescribed in the IEE, which are also included as environmental loan assurances that are appended to the IEE.

III. SUMMARY OF POTENTIAL IMPACTS

21. The potential impacts of the upgraded access roads & road drainage, and footpaths to Otres and Ocheutal beaches, including installation of public showers and toilets, and the construction of the new piers and associated facilities on Koh Rong island and Victory beach are summarized in Table 3, followed by a detailed description of impacts and impact mitigation measures from the IEE.

22. The potential impacts of both subprojects primarily concern the civil works during the construction phase. The common short-term construction-related disturbances and impacts such as noise, dust, reduced access, increased traffic and risk of traffic accidents, worker and public safety, soil erosion and sedimentation, and solid and liquid waste will occur and can be managed and mitigated with standard construction practices. Further, the construction and operation of the completed piers must follow three IFC/World Bank EHS Guidelines (2007) for (i) Tourism & Hospitality Development, (ii) Shipping, and (iii) Ports, Harbours, & Terminals (2017).

23. The construction impacts of the piers will be much greater on the nearshore aquatic environment and habitat near the pier footprints. The terrestrial impacts will be relatively minor. Key impact mitigation measures for the pier construction are isolation of the pier construction areas with shoreline berms and in-water silt curtains to contain the major resuspension of sediments and lateral sedimentation of aquatic habitat. Disturbance of tourist activities especially on Koh Touch beach including tourist boat activity must be managed to minimize or not affect tourist business and livelihoods.

24. The primary potential impact of the access and environmental improvements on Otres and Ocheutal beaches will be on tourist activity and associated businesses. The focus of mitigation measures needs minimize or prevent disturbance to tourism. Scheduling the subproject during the low tourist season is one step to that result.

[3] From CAM IEE

Table 3. Summary of Potential Impacts of Subproject

Pre-construction Phase

- Some minor land acquisition will be required for the upgrades to the beachfront access roads of the Preah Sihanouk Seaside Access and Environmental Improvements subproject. The subproject will result in 23 affected households (AHs) having impacts to portions of their physical assets in two subproject locations at Ocheutal - end at Village 4; and Otres 1 and 2 in Village 6. Of these, 12 AHs (40 persons) will experience temporary impacts on their businesses during construction and 11 AHs (36 persons) will be affected by partial losses of concrete sidewalk, toilets, and fence. It is noted that one of the 12 AHs have four stores affected; therefore, a total of 15 stores will be affected. According to the Inventory of Losses (IOL), five stores will be affected, and ten stores will be partially affected. A total of 1,246 m2 of main and secondary structures will be partially impacted with a total area of 255 m2; one toilet with a total area of 40 m2, 723 m2 of concrete pavements; 228 m2 of concrete fence; and 7.0 m of wooden fence. A total of 13 fruit trees may be cut including two coconut trees and 11 banana trees. No severely affected households were identified. Required land acquisition is addressed in the separate inventory of losses (IoL) and LAR report.

Construction Phase

<u>Preah Sihanouk Seaside Access and Environmental Improvements</u>

- Disturbances from civil works such as dust, noise, reduced public access, disrupted business, and air pollution from NOx, SOx, & CO caused by increased truck traffic and heavy equipment use, soil and local stream pollution caused by equipment operation and maintenance, public and worker accidents, disruption of traffic, increased traffic accidents, land erosion and surface water sedimentation, drainage and flooding problems, solid and domestic waste from worker camps, social issues and community problems caused by migrant workers.
- Permanent loss of roadside vegetation for widened carriageway of upgraded access roads.
- Disturbance and potential disruption of seasonally high density tourist activity on both beaches.
- Disruption of normal small business activities (e.g., guesthouses, restaurants, equipment rentals) along beachfronts.

<u>Preah Sihanouk City– Koh Rong Passenger Pier Improvements</u>

- Common construction and civil works impacts listed above plus the following:
- Short-term acute disturbance to nearshore aquatic environment at both pier sites;
- Potential disruption of boat traffic near piers, especially on Kou Touch beach where three active piers are in operation.
- Nearshore water quality degradation from resuspended sedimentation and construction waste discharge; and
- Potential increase in boat congestion along sea lanes to/from the piers to mainland.

Operation Phase

- The anticipated increased tourist traffic along beach access roads will lead to increased traffic congestion, risk of accidents and air pollution. To a more minor extent the similar potential impact will arise from the targeted increased boat traffic to/from the new piers.
- Solid waste at both subproject pier sites arising from increased tourist visitation.
- Sanitation problems at all sites if new public toilets are not maintained sufficient, and O&M insufficient for regular septic tank pumping.
- Degradation of Koh Rong Marine Protected Area from the indiscriminate discharge tourist boat waste holding tanks into the ocean, boat traffic over designated protected MPA resources such

as coral reefs, fish refugia/spawning areas, and mangroves, fuel or oil spills from ad hoc tourist boat refueling activities, and from solid waste indiscriminately thrown from boats and piers in the ocean.

A. Public Consultation

25. The stakeholder consultation strategy that was developed for the IEE will be continued with the start of the pre-construction phase of the subprojects. The first step will be the disclosure of the draft IEE to the affected stakeholders that were consulted to obtain their review and comment (Table 4).

Follow-up Consultation

26. As indicated in the IEE, the major concern of the public and stakeholders of the two subprojects were disturbances, solid waste problems at the sites and increased traffic, and traffic accidents along the upgraded roads. These issues plus any others will be reviewed during follow-up consultations throughout the pre-construction, construction, and operation of the completed subproject components. All affected persons consulted during the initial consultations must be contacted at the beginning of the construction phase. The indicative follow-up public consultation plan is provided in Table 4.

Table 4. Indicative Public Consultation Plan

Organizer / support	Format	Frequency	Topic	Attendees
Pre-construction - Construction Stage				
PIU / PMCES	Same Public consultation format used during IEE, including site visits and informal interviews as needed	Once near end of pre-construction stage just before construction commences (public meetings), and as needed (site visits, informal interviews) thereafter during construction phase	Review of disclosed IEE. Presentation of planned activities and schedule; anticipated impacts and mitigation measures; GRM	Affected households, district representatives, and participants from consultations during IEE
Operational Stage				
PIU / PMCES	Public consultation, and site visits if necessary	Once in the first year	Effectiveness of mitigation measures, impacts of operation, comments and suggestions	Affected households, district representatives, participants of consultations during IEE
PMCES / PIU	Public satisfaction survey if desired or needed	Once just before Project Completion Report (PCR) issued	Public satisfaction with EMP implementation Comments and suggestions	Affected households, district representatives, participants of consultations during IEE

IV. IMPACT MITIGATION PLAN

27. The impact mitigation measures of the EMP are presented in the Mitigation Plan for the subprojects. Following the structure of the IEE, the Mitigation Plan is organized by the three development phases of the subprojects as defined by pre-construction, construction, and the post-construction operational phase. The mitigation plan addresses the environmental issues and concerns raised at the stakeholder meetings.

28. The mitigation plan combines construction phase impacts common to the components of both subprojects for which single mitigation measures are prescribed. In this way redundant mitigation measures are not re-stated numerous times. However, impacts and required mitigations specific to a subproject component are also identified. Or, common mitigations that are particularly important for a subproject component are underscored.

29. The mitigation plan identifies potential impacts, required mitigations, responsible parties, location, timing, and indicative costs. The mitigation plan is comprehensive, so it can be easily updated at the detailed design phase to fully address the potential impacts of the final subprojects designs.

1. Impact Mitigation Guidance for Contractors

30. Contractors will be required to prepare a contractor EMP (CEMP) for their construction packages and submit the CEMP as part of their bidding documents. The CEMPs will be developed from the EMP provide herein which will be included in the contractor tender documents. As indicated above, the CEMPs will be reviewed approved by the PMCES and PIU prior to commencement of construction. Provided below, to assist the contractors prepare there CEMPs, are the impacts and mitigation measures from the IEE of the two subprojects in Preah Sihanouk.

31. Potential environmental impacts of the two subprojects in Preah Sihanouk occur during construction phase from short-term disturbances and impacts caused by the construction of individual subproject components. Common impacts of the civil works will consist of for example, reduced and/or blocked public access to areas, disrupted business and recreation, noise, dust caused by increased truck traffic and heavy equipment use, soil and surface water pollution caused by equipment operation and maintenance, public and worker accidents, increased traffic congestion and traffic accidents, land erosion and shoreline sedimentation at the sites of the two piers, localized drainage and flooding problems, solid waste and domestic pollution from worker camps, and communicable diseases and other social problems caused by migrant workers. These short-term impacts and disturbances will occur at different levels of magnitude depending on the civil works activity and the subproject area.

a. Impact Mitigation measures

32. Construction management measures to mitigate common potential impacts associated with the construction phase of subproject components are presented below. The common impact mitigation measures presented below are to be developed by the contractors into their CEMPs for their construction packages for the subprojects. These generic construction impact mitigation measures are comprehensive at the feasibility design stage to ensure that a mitigation measure is identified for the potential impact of all design features of the final detailed designs of both subprojects. The generic impacts and impact mitigation measures described below are to be used by contractors to prepare the mitigation subplans of their CEMPs which are identified in the Mitigation Plan of Table 5 below.

33. **Air pollution control**. Contractors shall include all necessary measures to prevent or minimize air pollution and dust development by implementing the following air quality control measures. Most of these generic measures are applicable to all construction sites and construction activities as good practice, and are also described in the World Bank Group's EHS guidelines.

(i) Build access and aggregate hauling roads at sufficient distances from residential areas, especially schools and hospitals.
(ii) Assign haulage routes and schedules to avoid transport occurring in the central areas, traffic intensive areas, or residential areas. For the areas with high-demand for environmental quality, transport should be arranged at night.
(iii) Spray water or other wetting agents such as calcium chloride ($CaCl_2$) regularly on unpaved haul roads and access roads (at least once a day) to suppress dust; and erect hoardings around dusty activities.
(iv) Cover material stockpiles with dust shrouds or tarpaulin. For the backfill earthwork management measures will include surface press and periodic spraying and covering. The extra earth or dredge material should be cleared from the project site in time to avoid long term stockpiling.
(v) Minimize the storage time of construction and demolition wastes on site by regularly removing them off site.
(vi) Site concrete batching stations at least 300 m downwind of the nearest air quality protection target.
(vii) Equip asphalt, hot mix and batching plants with fabric filters and/or wet scrubbers to reduce the level of dust emissions.
(viii) Install wheel washing equipment or conduct wheel washing manually at each exit of the works area to prevent trucks from carrying muddy or dusty substance onto public roads.
(ix) Keep construction vehicles and machinery in good working order, regularly service and turn off engines when not in use.
(x) Vehicles with an open load-carrying case, which transport potentially dust-producing materials, shall have proper fitting sides and tail boards. Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin.
(xi) In periods of high wind, dust-generating operations shall not be permitted within 200 m of residential areas. Special precautions need to be applied near sensitive receptors such as schools, kindergartens and hospitals.
(xii) To avoid odor impacts caused by shoreline sediment dredging for pier or bridge foundations, transport dredged sediment in closed tank wagons to contain odor and prevent scattering along the way.
(xiii) Unauthorized burning of construction and demolition waste material and refuse is prohibited.

34. **Construction noise**. Contractors will be required to implement the following mitigation measures for construction activities to meet Cambodian and IFC/WHO recommended environmental noise standards and to protect sensitive receptors. Some measures are generic and are applicable to all construction sites and activities. They represent good practice and are effective measures and are in line with IFC's EHS guidelines.

(i) During daytime construction, the contractor will ensure that: (1) noise levels from equipment and machinery conform to the IFC EHS Standards, and properly maintain

machinery to minimize noise; (2) equipment with high noise and high vibration are not used near residences and only low noise machinery or the equipment with sound insulation is employed; (3) sites for concrete-mixing plants and similar activities will be located at least 300 m away from the nearest noise protection target; and (4) temporary noise barriers or hoardings will be installed around the equipment to shield residences when there are residences within 20 m of the noise source.

(ii) No construction should be allowed between the night time hours of 20:00 to 07:00.

(iii) Regularly monitor noise levels at construction site boundaries. If noise standards are exceeded by more than 3 dB, equipment and construction conditions shall be checked, and mitigation measures shall be implemented to rectify the situation.

(iv) Provide the construction workers with suitable hearing protection (ear muffs) according to the worker health and safety requirements of Cambodia.

(v) Control the speed of bulldozer, excavator, crusher and other transport vehicles travelling on site, adopt noise reduction measures on equipment, step up equipment repair and maintenance to keep them in good working condition.

(vi) Limit the speed of vehicles travelling on site (less than 8 km/h), forbid the use of horns unless absolutely necessary, minimize the use of whistles.

(vii) Maintain continual communication with the villages and communities near the construction sites, and avoid noisy construction activities during school examination periods.

35. **Surface water & coastal pollution**. The contractors will implement the following measures to prevent water pollution:

(i) Portable toilets and small package wastewater treatment plants will be provided on construction sites and construction camps for the workers and canteens. If there are nearby public sewers, interim storage tanks and pipelines will be installed to convey wastewater to those sewers.

(ii) Sedimentation tanks will be installed on construction sites to treat process water (e.g. concrete batching for bridge construction) and muddy runoff with high concentrations of suspended solids. If necessary, flocculants such as polyacryl amide will be used to facilitate sedimentation.

(iii) Construction machinery will be repaired and washed at special repairing shops. No onsite machine repair and washing shall be allowed.

(iv) Material stockpiles will be protected against wind and runoff waters which might transport them to surface waters.

(v) Dedicated fuel storage areas must be established away from public areas and marked clearly.

(vi) Storage of bulk fuel should be on covered concrete pads away from the public and worker camp, and 300m from surface waters. Fuel storage areas and tanks must be clearly marked, protected, and lighted. Contractors should be required to have an emergency plan to handle fuel and oil spillage.

(vii) Mitigation of water quality impacts during bridge and pier construction will be based on water quality monitoring results.

(viii) Berms and/or silt curtains should be constructed around all excavation/trench sites and along all surface waters to prevent soil erosion and surface water sedimentation.

36. **Earthworks & soil erosion mitigation**. The contractors will implement the following measures related to earthwork management:

(i) Present and past land use should be reviewed to assess whether excavated soils

are contaminated spoil. Contaminated spoil should be disposed at a nearby landfill or a location approved by DOE.

(ii) Confirm location of the borrow pit and temporary spoil storage and final disposal sites, securing permits from relevant DOE.

(iii) Develop borrow pit and spoil disposal site management and restoration plan, to be approved by responsible authority; obtain permit for the clearance of excavated earthworks.

(iv) Construct intercepting ditches and drains to prevent runoff entering construction sites, and diverting runoff from sites to existing drainage.

(v) Construct hoardings and sedimentation ponds to contain soil loss and runoff from the construction sites.

(vi) Limit construction and material handling during periods of rains and high winds.

(vii) Stabilize all cut slopes, embankments, and other erosion-prone working areas while works are going on.

(viii) Stockpiles shall be short-termed, placed in sheltered and guarded areas near the actual construction sites, covered with clean tarpaulins, and sprayed with water during dry and windy weather conditions.

(ix) All earthwork disturbance areas shall be stabilized with thatch cover within 30 days after earthworks have ceased at the sites.

(x) Immediately restore, level and plant landscape on temporary occupied land upon completion of construction works.

(xi) Implement all soil erosion protection measures as defined in the soil and water conservation reports.

37. **Ecological impacts**. The contractors will implement the following measures to prevent ecological impact during construction:

(i) Protect existing trees & vegetation where no construction activity is planned.

(ii) Protect existing trees and grassland during construction; where a tree must be removed, or an area of grassland disturbed, replant trees and re-vegetate the area after construction.

(iii) Remove trees or shrubs only as the last resort if they impinge directly on the permanent works or necessary temporary works.

(iv) Prior to commencement of construction, tag and conspicuously mark all the trees to be preserved to prevent damage to these trees by construction workers.

(v) Construction workers are prohibited from capturing any wildlife in the project areas.

38. **Occupational health and safety**. The construction industry is considered hazardous. The civil works contractors will implement adequate precautions to protect the health and safety of construction workers and the public. Contractors will manage occupational health and safety risks by applying the following measures:

(i) Care must be taken to ensure that sites for all earthworks (e.g., excavations, trenches) and dredging that are suspected to have unexploded ordnance (UXO) are surveyed by the expert authorities prior to construction. If such ordnance is detected clearing work will need to be commissioned prior to undertaking civil works.

(ii) Construction site sanitation: (1) Each contractor shall provide adequate and functional systems for sanitary conditions, toilet facilities, waste management, labor dormitories and cooking facilities. Effectively clean and disinfect the site. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse piles and

timely remove solid waste; (2) Exterminate rodents on site at least once every 3 months, and exterminate mosquitoes and flies at least twice each year; (3) Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas on construction site, and appoint designated staff responsible for cleaning and disinfection; (4) Work camp wastewater shall be discharged into the municipal sewer system or treated on-site with portable system.

(iii) Occupational safety: (1) Provide safety hats and safety shoes to all construction workers; (2) Provide safety goggles and respiratory masks to workers doing asphalt road paving and tunnel blasting; (3) Provide ear plugs to workers working near noisy PME.

(iv) Food safety: Inspect and supervise food hygiene in canteen on site regularly. Canteen workers must have valid health permits. Once food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.

(v) Disease prevention, health services: (1) All contracted labor shall undergo a medical examination which should form the basis of an (obligatory) health/accident insurance and welfare provisions to be included in the work contracts. The contractors shall maintain records of health and welfare conditions for each person contractually engaged; (2) Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents; (3) Specify (by the PIUs and contractors) the person(s) responsible for health and epidemic prevention responsible for the education and propaganda on food hygiene and disease prevention to raise the awareness of workers.

(vi) Social conflict prevention: No major social risks and/or vulnerabilities are anticipated because of the project. The project construction workers will be engaged locally. Civil works contracts will stipulate priorities to (1) employ local people for works, (2) ensure equal opportunities for women and men, (3) pay equal wages for work of equal value, and to pay women's wages directly to them; and (4) not employ child or forced labor.

39. **Community health and safety**. Temporary traffic diversions, continual generation of noise and dust on hauling routes, and general hindrance to local accesses and services are common impacts associated with construction works within or nearby local settlements. The project may also contribute to road accidents by heavy machinery on existing roads, temporarily blocking pavements for pedestrians etc. The potential impacts on community health and safety will be mitigated through many activities defined in the EMP. The contractors will implement the following measures:

(i) Temporary traffic management: A traffic control and operation plan will be prepared together with the local traffic police prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.

(ii) Information disclosure: Residents and businesses will be informed in advance through media of the construction activities, given the dates and duration of expected traffic disruption.

(iii) Construction sites: Clearly marked signs will be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations etc. and raising awareness on safety issues. Heavy machinery will not be used at night and all such equipment will be returned to its overnight storage area/position before nightfall. All sites will be made secure, discouraging access by members of the public through appropriate fencing whenever appropriate. Open

excavations should be fenced, and trenches covered where public walkways or vehicles must cross.

b. Subproject-specific impacts and mitigation measures

Preah Sihanouk Seaside Access and Environmental Improvements.

40. The upgrading of the existing access roads, foot paths, and supporting drainage of Ocheutal and Otres beaches along with the construction of public toilets and showers represents mild road and small building construction interventions with respect to environmental impacts. The same short-term impacts and disturbances caused by road corridor developments and large building construction of noise, dust, solid and domestic waste production, traffic congestion and increased risk of traffic accidents, restricted access, soil erosion and surface water (shoreline) sedimentation, drainage and flooding, and contaminated soil from oil, grease and gas, and possible damage to physical cultural or heritage resources will potentially occur but they will occur at a much smaller magnitude. The planned road and footpath upgrades are relatively minor, and the shower and toilet facilities are small structures. The implementation of the road/path and drainage components will be coordinated with the implementation of Second Corridor Towns Development Project and the Provincial Water Supply and Sanitation Sector Project.

41. General impact mitigation measures normally applied to road works summarized above will be applied at Otres and Ocheutal beach. A major focus of the impact mitigation will be avoiding or minimizing any disruption or interference of the heavy tourist activities along the beaches. As such a well-marked public telephone hotline to the PIU will be posted at all construction sites as part of the GRM.

Preah Sihanouk City–Koh Rong Passenger Piers Improvements

42. The potential construction impacts and disturbances of the shoreline and nearshore activities of the two pier subprojects summarized below are common to the short-term construction impacts and disturbances that will be caused by the seaside access improvements at Otres and Ocheutal beaches subproject in Preah Sihanouk City.

Aquatic wildlife habitat

43. Construction of new coastal piers temporarily destroys or disrupts the benthic community of plants and animals because the construction of foundations and pile driving damage or destroy benthic habitats on which fish communities depend for food and reproduction. Pier construction also re-surfaces anoxic sediments which degrades water quality. The short-term impacts will be minor because the piers sites are located over large natural sandy beach deposits which naturally are low productive areas compared to the sensitive coral reef, mangrove, fish refugia/spawning, and sea grass areas of the other areas of the Koh Rong Marine Protected Areas, and inshore areas of eastern Preah Sihanouk and adjacent Kampot province.

Mitigation

44. For all pier works vehicles must be kept out of the pier construction. Infilling along shorelines should be avoided or minimized. Silt curtains should be placed around entire pier construction area to contain sediment, and to minimize exposure of aquatic biota and habitat to transported and deposited silt.

Terrestrial habitat

45. The impact to terrestrial environments from pier developments arise from the land-based associated support facilities. Specifically, the cleared footprints of the walkways and promenades to the piers, service buildings such as tourist information centers and shelters, and bathrooms, parking lots, and access roads. However, the extent of terrestrial impacts from the two piers will be minimal because the coastal sites have already been mostly cleared by previous activities. The extent of tree loss will be greatest at Victory Beach site. There are no rare and endangered terrestrial wildlife that will be affected by the pier developments.

Mitigation

46. The removal of vegetation from shorelines should be avoided, or at least minimized. If vegetation is removed for the pier facilities, it should be replaced with local like-for-like species, or with more robust vegetation varieties.

Water quality

47. A major short-term impact of civil construction works on coastal water quality is caused from soil erosion and sedimentation. Local suspended sediment levels (TSS) will reach maximum possible concentrations which can last over long periods of time depending on the extent of pier and shoreline facilities development. However, the natural tide and currents at the sites will dissipate suspended sediment. As indicated above excavation/disruption of the sea bottom and nearshore area also re-surfaces anoxic and any toxic material lying in the sediments.

48. The other common source of surface water pollution during construction phase is from oil, gas, and grease from the operation [and maintenance] of heavy equipment in, and near surface waters. Fuel tanks can leak, and spent oil and grease can also be discharged in or near the lakes or streams.

Mitigation

49. Silt curtains should be installed to isolate the pier and shoreline works. At a minimum silt curtains should be placed on downstream side of work area to contain suspended sediment. Regular water quality monitoring will be conducted during dredging and embankment rehabilitation works to ensure that temporary disruption of the water quality through sediment stir-up is contained within the direct area of work. Any dredging or excavation at the shoreline should be minimized. Fuel and vehicle/equipment lubricants must be handling at a dedicated, well signed, fenced site that has a concrete floor. Refueling of vehicles must occur at the site, refueling of boats must be carefully environmentally controlled at a marine location away from public areas. Spill response procedures and spill kits for organic pollutants such as gas/diesel fuels, and oils must be provided by contactors and PIU with required training provided.

Noise

50. Operation of heavy excavation equipment, pile driving for footings, and movement of large construction vehicles creates noise. Tourists and residents within 60-90 m surrounding the pier and facilities construction sites could become annoyed by noise generated from construction activities. Pile driving could create noise exceeding the government or the WHO standard for noise at sensitive sites if applied.

Mitigation

51. The operation of heavy vehicles for the pier works and associated facilities on the should be scheduled during the hours of 07:00 and 18:00. All heavy equipment should be kept in good working order. Noise monitoring will be conducted regularly at sensitive sites to ensure that noise levels are contained within the WHO standard of 55-70 dB(A) during daytime. Temporary noise barriers shall be used in case noise levels exceed the standard value.

Dust and air pollution

52. The operation of heavy equipment will emit SOx, NOx, and CO_2. The local levels of these gases can be high depending on how well equipment is maintained in proper working condition, and if uncontrolled vehicle idling is allowed. In addition to air pollution, exhaust from heavy equipment can become a significant nuisance to residents.

53. The operation of heavy trucks along construction roads Victory beach will create dust. The dust levels can be significant depending on the amount of sand and small aggregate is transported along the roads, and how much mud and sand accumulates on the roads that is spread from the tires of the construction vehicles.

Mitigation

54. Wetting agents (such as water or calcium chloride ($CaCl_2$) should be applied regularly to all construction roads. Trucks carrying aggregate should always be covered. All construction vehicles should be kept in good working order.

Solid and domestic waste

55. The pier and shoreline facilities construction will generate solid waste and domestic waste from workers, and from discarded construction materials in the form of discarded concrete, wood forming, reinforcing bar, and sheet piling. Work camps, whether temporary or long term, provide places to eat and sleep for workers. Camps provide pit latrines and supplies of potable water for cooking and bathing. Domestic liquid and solid waste can become a local problem depending on the size of the camp, and compliance with formal waste management procedures.

Mitigation

56. A formal waste collection and disposal program should be instated at all sites which must be approved by the provincial DOEs. All waste construction material must be stored and removed from site daily or weekly. Worker living areas must be provided with adequate garbage bins, and garbage collected and transported to local landfill regularly. Pit latrine areas must be kept clean, and buried when camp closed.

Reduced road access, increased traffic, and risk of traffic accidents

57. Construction traffic on existing roadways to Victory beach could block normal local traffic thereby reducing access. This will be particularly relevant to the tourist/urban core areas of Preah Sihanouk where traffic density is highest. The increased construction vehicle traffic that will occur with the pier works, and along routes to sediment disposal sites will affect normal traffic patterns and volumes. Along with the increase in large truck traffic will be an increase in the risk of traffic accidents.

Mitigation

58. A traffic management plan must be put in place for local and construction traffic near the pier development sites. Enforced speed limits must be well posted, and additional traffic direction signs to assist both construction and local traffic should be posted outside and inside construction zones and along construction truck routes. The traffic management plan shall be developed by the works contractors as part of their construction environmental management plan (CEMP), and be submitted to local (provincial and city) traffic control authorities for approval.

Boat transportation & fishing/aquaculture

59. Pier construction and associated shoreline works could interfere with local boat traffic along the affected coastlines. Pier works will also potentially affect fishing activities.

Mitigation

60. Shoreline signage should be placed above and below pier and shoreline work areas, and community information leaflets should be distributed to warn and educate users of the water bodies of the subproject activities. The user community should be consulted so that the pier development activities can be scheduled to avoid user activities. The PIUs, with support from the EA, will be responsible to inform all users of the affected sections of Koh Touch and Victory beaches of the types and schedules of activities that could disrupt uses of the surfaces waters.

Protected Areas, and Cultural Property and Values of Subprojects

61. There are no known rare or endangered terrestrial wildlife species or critical habitat in the affected areas of the two Preah Sihanouk subprojects. The *Preah Sihanouk Seaside Access and Environmental Improvements* subproject is not near Ream National Park. However, the pier to be constructed on Koh Touch beach, Koh Rong island as part of the *Preah Sihanouk City–Koh Rong Passenger Piers Improvements* subproject is located inside the Koh Rong Marine Protected Area (MPA). Though inside the MPA, Koh Touch beach is located in the Multiple Use Zone of the MPA and, thus the new pier is not near the sensitive ecological features of the MPA including the Koh Rong Protected Area located south of the Multiple Use Zone. Nonetheless, extra careful construction management measures are required for the new pier on Koh Touch beach, and for construction boat travel through the MPA from Preah Sihanouk City.

62. There are no physical cultural resources that are at risk of being damaged by the subprojects. Thus, the construction phase activities that are implemented along with specified mitigation measures should not negatively affect cultural resources and values.

2. Impact Mitigation Plan

63. The Impact Mitigation Plan for the subprojects in Preah Preah Sihanouk is provided below in Table 5. The plan identifies the impact mitigation activities that must occur during the three phases of subproject implementation defined by *Pre-construction, Construction* and *Operation.* The mitigation plan addresses the environmental issues and concerns raised at the stakeholder meetings.

64. As indicated above, the mitigation plan combines construction phase impacts common to the components of both subprojects for which single mitigation measures are prescribed. In this way redundant mitigation measures are not re-stated numerous times. However, impacts and required mitigations specific to a subproject component are also identified. Or, common mitigations that are particularly important for a subproject component are emphasized.

65. The mitigation plan identifies potential impacts, required mitigations, responsible parties, location, timing, and indicative costs. The mitigation plan is comprehensive, so it can be easily updated at the detailed design phase to fully address the potential impacts of the final subprojects designs.

Table 5. Environmental Impact Mitigation Plan

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
Pre-Construction, Detailed Design Phase of both Subprojects								
Confirmation of any resettlement, relocations, and compensation	No negative environmental impacts	1. Affected persons well informed well ahead of subproject implementation.	Any affected persons in subproject areas	Before project implemented	See resettlement plans	See resettlement plan	PIU/SS	Resettlement committees
Disclosure and engagement of community	No community impacts	2. Initiate public consultation on detailed engineering designs, establish GRM and ensure disclosure of project related information.	For all construction sites.	Beginning of project	Quarterly	No marginal cost[5]	PIU/SS	PIU
Government approvals	No negative impact	3. Notify MoE of subproject initiation to complete EA requirements, and obtain required project permits and certificates.	Entire subproject	Before construction	As required	No marginal cost	PIU/DoE	DoE
Detailed designs of subproject	Minimize negative environmental impacts	4. Work with PMCES[6] to complete detailed designs of the seaside access and pier subprojects including incorporation of climate change resilience measures from CRVA of subprojects. Ensure the following mitigation measures are updated to meet detailed designs accordingly: **<u>For both subprojects</u>** a) identification of spill management prevention plans, and emergency response plans for all construction sites; b) no disturbance or damage to culture property and values; c) minimal acquisition of agriculture and forested lands; d) locate aggregate borrow pits and rock supply areas away from human settlements with fencing and access barriers; e) no, or minimal disruption to village water supplies along access roads, utilities, and electricity with contingency plans for unavoidable disruptions; f) no, or minimal disruption to normal pedestrian and vehicle traffic along all road segments with	Final siting	Before construction initiated	Once with detailed designs documents	No marginal cost	PMCES	EA/PIU

[4] Costs will be updated during detailed design phase.
[5] No marginal cost indicates that costs to implement mitigation are to be built into cost estimates of bids of contractors.
[6] PMCES is project management and supervision consultant.

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		contingency alternate routes; g) For residential areas include specific plan to notify & provide residents and merchants of construction activities & schedule to minimize disruption to normal commercial and residential activities. **For Koh Rong and Preah Sihanouk piers subproject** h) with clear signage and land-based fencing direct all boat, tourist, and local traffic away from pier construction sites; i) install in-water silt curtains around pier construction footprints to contain resuspended sediment & turbidity; j) build temporary shoreline earth berms to prevent soil erosion and sedimentation of nearshore water; k) temporary piles of construction aggregate must be covered, kept away from shoreline, and enclosed with berms or plastic fencing to prevent wind erosion, and runoff erosion into water l) as much as possible keep all construction vehicles and equipment out of the water, and not equipment maintenance occurring near the water.						
Update EMP	Positive environmental impacts	5. Confirm siting of all subproject components with DOT 6. Review finalized RoWs of upgraded access roads to confirm absence of valued ecological or cultural resources. 7. Re-clarify with DoE that no known rare or endangered species inhabit the subproject areas 8. Identify any new potential environmental impacts of subproject and include in EMP. 9. Update mitigation measures and monitoring requirements of EMP where necessary to meet detailed designs, and to protect affected environments. 10. Submit updated EMP with new potential impacts to ADB to review. 11. PMCES and PIU to review and assist contractors finalize the following mitigation subplans that contractors prepare for their CEMPs from standard construction practices for their bid documents for : a) Construction drainage; b) Erosion; c) Noise and Dust; d) Contaminated Spoil Disposal; e) Solid and Liquid	All sites	Before construction initiated	Once with detailed designs documents		PMCES	EA/PIU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		Waste Disposal; f) Construction & Urban Traffic; g) Utility and Power Disruption; h) Worker and Public Safety; i) Tree and Vegetation Removal and Site Restoration; j) Construction Materials Acquisition, Transport, & Storage, and k) Cultural chance finds.						
Create awareness of physical cultural resources in area	No negative environmental impact	12. DoT to review potential locations of physical cultural resources, and explain possible PCR to contractors and PMCES	All subproject areas	Before construction begins	Once	No marginal cost	DoT	DoT/PIU
Confirm Government approved construction waste disposal sites	No negative impact	13. Notify DoE, DAFF and DPWT to confirm locations of sites for borrow pits and disposal areas for construction and hazardous waste for subprojects, and obtain required permits.	Entire subproject	Before construction	As required	No marginal cost	PIU/DoE/ DAFF/DPWT	PIU
UXO survey and removal	Injured worker or public	14. Ensure Government arranges clearance and certification of areas where necessary	All construction sites.	Beginning of subproject	Once	See Monitoring Plan below	EA/PIU	Government
Obtain and activate permits and licenses	Prevent or minimize impacts	15. Contractors to comply with all statutory requirements set out by Government for use of construction equipment, and operation construction plants such as concrete batching.	For all construction sites	Beginning of construction	Once	No marginal cost	PMCES	PIU & contractors
Develop bid documents	No negative environmental impact	16. Ensure updated EMP is included in contractor tender documents, and that tender documents specify requirements of CEMP must be budgeted. 17. Specify in tender documents that contractor must have staff experienced with implementing EMPs, and must provide a dedicated environmental officer (EO) for the construction package.	All subproject areas	Before construction begins	Once for all tenders	No marginal cost	PMCES	PIU
Capacity development	No negative environmental impact	18. Develop and schedule training plan for (PIU/SS) to be able to fully implement EMP, and to manage implementation of mitigation measures by contractors. 19. Create awareness and training plan for contractors whom will implement mitigation measures.	All subproject areas	Before construction begins	Initially, refresher later if needed	No marginal cost	PMCES	PMCES
Recruitment of workers	Spread of sexually transmitted disease	20. Specify in tender documents that contractor must use local workers as much as possible thereby reducing migrant workers	All work forces.	Throughout construction phase	Worker hiring stages	No marginal cost	EA/PIU	Contractor's bid documents
Construction Phase of both Subprojects								
Initiate EMP and sub-plans	Prevent or minimize impacts	21. Initiate updated EMP & CEMP including individual management sub-plans for different potential impact areas that are completed in pre-construction phase (see sub-plan guidance below).	For all construction sites	Beginning of construction	Once	No marginal cost	PMCES	PIU & contractors
Worker camps	Pollution and social problems	22. Locate worker camps away from human settlements. 23. Ensure adequate housing and waste disposal facilities	All worker camps	Throughout construction	Monthly	No marginal cost	PMCES/PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		including pit latrines and garbage cans. 24. A solid waste collection program must be established and implemented that maintains a clean worker camps 25. Locate separate pit latrines for male and female workers away from worker living and eating areas. 26. A clean-out or infill schedule for pit latrines must be established and implemented to ensure working latrines are available at all times. 27. Worker camps must have adequate drainage. 28. Local food should be provided to worker camps. Guns and weapons not allowed in camps. 29. Interaction of transient workers with local community should be discouraged. HIV/Aids education should be given to workers. 30. Camp areas must be restored to original condition after construction completed.		phase				
Training and capacity building	Prevent of impacts through education	31. Implement training and awareness plan for PIU/SS and contractors.	PIU office, construction sites	Beginning of construction	After each event	No marginal cost	PMCES	PMCES/PIU
Implement construction materials acquisition, transport, and storage sub-plan	Pollution, injury, increased traffic, disrupted access	32. All borrow pits and quarries should be approved by DoE. 33. Select pits and quarries in areas with low gradient and as close as possible to construction sites. 34. Required aggregate volumes must be calculated prior to extraction to prevent wastage. 35. Pits and quarries should not be located near surface waters, forested areas, critical habitat for wildlife, or cultural property or values. 36. If aggregate mining from fluvial environments is required small streams and rivers should be used, and dry alluvial plains preferred. 37. All topsoil and overburden removed should be stockpiled for later restoration. 38. All borrow pits and quarries should have a fence perimeter with signage to keep public away. 39. After use pits and quarries should be dewatered and permanent fences installed with signage to keep public out, and restored as much as possible using original overburden and topsoil. 40. Unstable slope conditions in/adjacent to the quarry or pit caused by the extractions should be rectified with tree planting.	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	PMCES/PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		41. Define & schedule how materials are extracted from borrow pits and rock quarries, transported, and handled & stored at sites. 42. Define and schedule how fabricated materials such as steel, wood structures, and scaffolding will be transported and handled. 43. All aggregate loads on trucks should be covered.						
Concrete production and application	Air pollution, land and water contamination, and traffic & access problems,	44. Piles of aggregates at sites should be used/or removed promptly, or covered and placed in non-traffic areas 45. Stored bagged cement well away from all human activity and settlements, and cultural (e.g., schools, hospitals), and ecological receptors. Concrete production and handling areas should be isolated. 46. Contractors must be well trained and experienced with the production, handling, and application of concrete. 47. All spills should be cleaned immediately and handled as per hazardous waste management plan, and according to Government regulations. . .	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor
Implement spoil management sub-plan	Contamination of land and surface waters from excavated spoil, and construction waste	48. Uncontaminated spoil to be disposed of in Government-designated sites, which must never be in or adjacent surface waters. Designated sites must be clearly marked and identified. 49. Spoil must not be disposed of on sloped land, near cultural property or values, ecologically important areas, or on/near any other culturally or ecologically sensitive feature. 50. Where possible spoil should be used at other construction sites, or disposed in spent quarries or borrow pits. 51. A record of type, estimated volume, and source of disposed spoil must be recorded. 52. Contaminated spoil disposal must follow Government regulations including handling, transport, treatment (if necessary), and disposal. 53. Suspected contaminated soil must be tested, and disposed of in designated sites identified as per Government regulations. 54. Before treatment or disposal contaminated spoil must be covered with plastic and isolated from all human	All excavation areas	Throughout construction phase	Monthly	See Monitoring Plan for contaminated soil analyses	PMCES & PIU & DoE	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		activity.						
Implement solid and liquid construction waste sub-plan	Contamination of land and surface waters from construction waste	55. Management of general solid and liquid waste of construction will follow Government regulations, and will cover, collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force. 56. Areas of disposal of solid and liquid waste to be determined by Government. 57. Disposed of waste should be catalogued for type, estimated weigh, and source. 58. Construction sites should have large garbage bins. 59. A schedule of solid and liquid waste pickup and disposal must be established and followed that ensures construction sites are as clean as possible. 60. Solid waste should be separated, and recyclables sold to buyers in community. <u>Hazardous Waste</u> 61. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow Government regulations. 62. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents) 63. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good condition well away from construction activity areas, all surface water, water supplies, and cultural and ecological sensitive receptors. 64. All spills must be cleaned up completely with all contaminated soil removed and handled with by contaminated spoil sub-plan.	All construction sites and worker camps	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU & DoE	contractor
Implement noise and dust sub-plan	Dust Noise	65. Regularly apply wetting agents to exposed soil and construction roads. 66. Cover or keep moist all stockpiles of construction aggregates, and all truck loads of aggregates. 67. Minimize time that excavations and exposed soil are left open/exposed. Backfill immediately after work is completed. 68. As much as possible restrict working time between 07:00 and 17:00. 69. Maintain equipment in proper working order 70. Replace unnecessarily noisy vehicles and machinery. 71. Vehicles and machinery to be turned off when not in	All construction sites.	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		use. 72. Construct temporary noise barriers around excessively noisy activity areas where possible.						
Implement utility and power disruption sub-plan	Loss or disruption of utilities and services such as water supply and electricity	73. Develop carefully a plan of days and locations where outages in utilities and services will occur, or are expected. 74. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages. 75. Contact affected community to inform them of planned outages. 76. Try to schedule all outages during low use time such between 24:00 and 06:00.	All construction sites.	Fulltime	Monthly	No marginal cost	PMCES & PIU & Utility company	contractor
Implement tree and vegetation removal, and site restoration sub-plan	Damage or loss of trees, vegetation, and landscape	77. Contact provincial forestry department for advice on how to minimize damage to trees and vegetation 78. Restrict tree and vegetation removal to within RoWs. No tree cutting near Preah or Koh Rong national parks. 79. Within RoWs minimize removals, and install protective physical barriers around trees that do not need to be removed. 80. All RoWs to be re-vegetated and landscaped after construction completed. Consult provincial forestry department to determine the most successful restoration strategy and techniques. Three trees should be replanted for each tree that has to be removed	All construction sites.	Beginning and end of subproject	Monthly	No marginal cost	PMCES & PIU	contractor
Implement erosion control sub-plan	Land erosion	81. Berms and plastic sheet fencing should be placed around all excavations and earthwork areas. 82. Earthworks should be conducted during dry periods. 83. Maintain a stockpile of topsoil for immediate site restoration following backfilling. 84. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready. 85. Re-vegetate all soil exposure areas immediately after work is completed.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor
Implement worker and public safety sub-plan	Public and worker injury, and health	86. Proper fencing, protective barriers, and buffer zones should be provided around all construction sites. 87. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all sites.	All construction sites.	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		88. Worker and public safety guidelines of the Government should be followed. See draft Occupational Safety & Health Master Plan of Ministry of Labor & Vocational Training 89. Population near blast areas should be notified 24 hrs. ahead, and evacuated well before operation. Accepted Government blast procedures and safety measures implemented. 90. Speed limits suitable for the size and type of construction vehicles, and current traffic patterns should be developed, posted, and enforced on all roads used by construction vehicles in Sihanoukville. 91. Standing water suitable for disease vector breeding should be filled in. 92. Worker education and awareness seminars for construction hazards should be given at beginning of construction phase, and at ideal frequency of monthly. A construction site safety program should be developed and distributed to workers. 93. Appropriate safety clothing and footwear should be mandatory for all construction workers. 94. Adequate medical services must be on site or nearby all construction sites. 95. Drinking water must be provided at all construction sites. 96. Sufficient lighting be used during necessary night work. 97. All construction sites should be examined daily to ensure unsafe conditions are removed.						
Civil works	Degradation of water quality & aquatic resources	98. Protective coffer dams, berms, plastic sheet fencing, or silt curtains should be placed between all earthworks and ocean shorelines & nearby surface waters. 99. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. 100. Earthworks should be conducted during dry periods. 101. All construction fluids such as oils, and fuels should be stored and handled well away from ocean shorelines & surface waters. 102. No waste of any kind is to be thrown in ocean and surface waters. 103. No washing or repair of machinery near ocean	All construction sites	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		shoreline and surface waters. 104. Pit latrines to be located well away from surface waters. 105. No unnecessary earthworks in or adjacent to water courses. 106. No aggregate mining from ocean, rivers or lakes. 107. All irrigation canals and channels to be protected the same way as rivers, streams, and lakes						
Civil works	Degradation of terrestrial resources	108. All construction sites should be located away forested or all plantation areas as much as possible. 109. No unnecessary cutting of trees. 110. All construction fluids such as oils, and fuels should be stored and handled well away from forested and plantation areas. 111. No waste of any kind is to be discarded on land or in forests/plantations.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor
Implement construction and urban traffic sub-plan	Traffic disruption, accidents and public injury	112. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights. 113. Post speed limits, and create dedicated construction vehicle roads or lanes. 114. Inform community of location of construction traffic areas, and provide them with directions on how to best co-exist with construction vehicles on their roads. 115. Demarcate additional locations where pedestrians can develop road crossings away from construction areas. 116. Increase road and walkway lighting.	All construction sites	Fulltime	Monthly	No marginal cost	PMCES & PIU	contractor
Implémente construction drainage sub-plan	Loss of drainage & flood storage	117. Provide adequate short-term drainage away from construction sites to prevent ponding and flooding. 118. Manage to not allow borrow pits and quarries to fill with water. Pump periodically to land infiltration or nearby water courses. 119. Install temporary storm drains or ditches for construction sites 120. Ensure connections among surface waters (ponds, streams) are maintained or enhanced to sustain existing stormwater storage capacity. 121. Protect surface waters from silt and eroded soil.	All areas with surface waters	Design & construction phases	Monthly	No marginal cost	PMCES & PIU	contractor
Cultural chance finds sub-plan	Damage to cultural property or values,	122. As per detailed designs all civil works should be located away from all cultural property and values.	All construction sites	At the start, and throughout	Monthly	No marginal cost		

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
	and chance finds	DoT identified potential sites and types of PCR in pre-con phase. 123. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for finds. 124. Upon a chance find all work stops immediately, find left untouched, and PIU notified to determine if find is valuable. Culture section of DoT notified by telephone if valuable. 125. Work at find site will remain stopped until DoT allows s work to continue.		construction phase			PMCES & PIU	contractor
Construction Phase of Seaside Access and Environment Improvements								
Beachfront tourism activity sub-plan	Significant disruption of tourist activities and business	126. The large construction works (i.e., road upgrades) should be planned to explicitly avoid high tourist area or periods, which must be coordinated with the implementation of the Second Corridor Towns Development Project (CTDP2), and the Provincial Water Supply & Sanitation Project (PWSSP). 127. Placement of clear warning signs and fences for construction activities should occur, and pedestrian and vehicle detours and temporary access should be constructed around all construction sites	All construction sites at Otres and Ocheutal beaches	At the start, and throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor
Construction of New Piers on Koh Touch and Victory Beaches								
MPA & aquatic habitat protection sub-plan	Significant damage and disturbance to nearshore aquatic habitat & water quality	128. In-water silt curtains and shoreline earth berms should be placed to isolate and contain the erosion and sedimentation impacts from the pier construction footprints. 129. No construction materials, vehicles, or equipment must be stored, parked, or maintained on shoreline, and must be kept as far away from the shoreline as practicable. 130. Boats transporting construction materials to Koh Rong island must stay in designated navigation lanes away from identified sensitive ecological zones of MPA (e.g., coral reefs, fishing refugia/spawning). 131. Construction boats must not discharge solid or liquid waste into ocean. 132. Construction boat operators must understand and have on board the map and activity restriction inside	At pier sites on Victory and Koh Touch beaches, and in sea lanes between Koh Rong and Sihanoukville	At the start, and throughout construction phase	Monthly	No marginal cost	PMCES & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		the Koh Rong MPA for reference during construction. 133. Construction of the tourist piers must adopt the general IFC EHS Guidelines for [Construction] Ports, Harbours, and Terminals, with specific reference to Environmental Protection, Waste Management, and Occupational Health & Safety.						
Post-construction Operation of Upgraded Access Roads to beaches including New Road to Victory beach pier								
Operation of upgraded/new access roads	Increased risk of accident or injury.	134. Enforce well marked speed limits, provide guard rails along road where needed, and educate beach communities on new road safety rules.	Upgraded / new access road	Fulltime	Biannual	O&M	DPWT	
	Increased air pollution and noise	135. Ensure vehicles maintained in proper working condition	Upgraded / new access road	Periodic checks	Biannual	O&M	DPWT	
Post-construction Operation of Both Subprojects								
Solid and sanitary waste management sub-plan	Local pollution, and habitat degradation from tourist waste, and human safety	136. Sufficient O&M budget must be provided to support a dedicated program to collect and dispose solid waste from the beachfront areas, and piers & associated pier support facilities. Solid waste from Koh Rong island must be transported to Preah Sihanouk to be disposed in DOE-approved landfill. 137. Sufficient O&M budget must be provided to support a dedicated program to pump septage from septic tanks connected to the new toilet blocks for disposal in DOE approved landfill. from the beachfront areas. 138. The operation of the completed components of the subprojects must adopt the General IFC Guidelines for Tourism & Hospitality with specific reference to provisions set out for Environmental Protection & Occupational Health & Safety	At both subproject three subproject sites	Fulltime	Biannual	O&M	DOT/DPWT	
		139.						
Operation of Koh Rong Island and Preah Sihanouk Piers								
Marine environment and Koh Rong MPA protection	Marine pollution, habitat degradation, and human safety	140. The FA/MAFF Koh Rong MPA guidelines & activity restrictions for the MPA designated use zones must be followed. 141. The project environmental loan assurances tabled in IEE for the protection of the KR-MPA must be followed	At both pier sites, and along established sea lanes	Fulltime	Biannual	O&M	DOT/DPWT	

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[4] ($)	Responsibility	
							Supervision	Implementation
		with specific reference to solid & waste management, sea lane navigation, and boat refueling & maintenance. 142. The IFC EHS Guidelines for Shipping must be adopted for all tourist boat & pier operations with specific reference to provisions outlined for Environmental Protection, Boat Operation & Maintenance, and Occupational Health & Safety. 143. The operation of the new piers including tourist boat operation must adopt the General IFC Guidelines for Tourism & Hospitality with specific reference to provisions set out for Environmental Protection & Occupational Health & Safety	between Koh Rong Island and Sihanoukville					

V. MONITORING PLAN

66. The environmental monitoring plan for the EMP is provided in Table 6. The monitoring plan focuses on all three phases (pre-construction, construction and post-construction operation) of the subprojects 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.

67. A study of groundwater quality and the depth of the water table at the existing dumpsite is required during the preconstruction phase. See Appendix B of IEE.

68. Environmental standards for ambient water quality for Cambodia are found in Annex 3. The environmental standards provided by the Environmental, Health and Safety Guidelines of the IFC/World Bank (2007) (e.g., ambient air quality and noise) should be followed to supplement standards that are not provided by the Government.

69. An independent environmental monitoring institute (EMI) will be required to assist with the implementation of the environmental monitoring program. The EMI will be responsible for the sampling of environmental parameters that must be analyzed in a laboratory. The safeguards specialists and EO will coordinate with the EMI. The PMCES will be given a budget for the EMI. The PMCES/PIU will provide logistical support to the EMI where necessary for the implementation of environmental monitoring plan.

70. After construction is completed and the upgraded and new access roads are in operation the impact of the upgraded road on traffic patterns and frequency of accidents should be monitored by the DPWT.

A. Performance Monitoring

71. Performance monitoring is required to assess the overall performance of the EMP. A project performance management system will be developed by the EA for the entire project. Select indicators of major components of the environment that will be affected primarily by the construction phase are drawn from the mitigation and monitoring plans and summarized in Table 7.

VI. REPORTING

72. Regular reporting on the implementation of mitigation measures, and on monitoring activities during construction phase of the subproject, is required. Reporting is the responsibility of PIU and PCU. It should be conducted in conjunction with regular meetings with stakeholders as part of the continuation of stakeholder communications. The mitigation and monitoring plans and Table 6 summarize proposed timing of reporting. A report on environmental monitoring and implementation of EMPs will be prepared quarterly for the EA/PCU by the PIU. The PIU report will compile monthly reports provided by the EO of contractor, the reports of the EMC on monitoring, and input from the ES of the PMCES. The PIU report will also be sent to the DOE and PCU for consolidation and transmission to ADB in semi-annual safeguards monitoring reports. The reports will contain all indicators measured with the monitoring plan of EMP including performance monitoring indicators (Table 7) and will include relevant Government environmental quality standards. Templates for the monitoring reports to be used by the PCU, PIU and EMI will be developed by the PMCES environmental specialist at detailed design.

Table 6: Environmental Monitoring Plan

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	**Location**	**Means of Monitoring**	**Frequency**	**Reporting**	**Responsibility**		**Estimated Cost (USD)**
					Supervision	**Implementation**	
Pre-construction Phase – Update Baseline Conditions							
Update baseline understanding of sensitive receptors (e.g., cultural property & values, new schools or hospitals, rare/endangered species, critical habitat), and aquatic resources and human uses beach areas	Final RoWs for beachfront access road upgrades, and pier sites	Original field work, community consultations	Once	Once	EA/PIU	Environmental Monitoring Institute	$800
A) Air quality: dust, CO, NOx, SOx, noise, wind, temperature, and vibration levels B) Affected surface water quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, pH, DO, COD, BOD_5, temperature, TDS, NH_3, NH_4, other nutrient forms of $_N$ & P	4 sites along beachfronts and at foot pier locations	Using field and analytical methods approved by DoE.	One day and one night measurement during rainy and dry seasons.	One baseline supplement report before construction phase starts	PIU	Environmental Monitoring Institute	$4,000
Inventory of present and past land uses that could cause contaminated soil.	Possible contaminated soils at excavation or civil works sites, for example river bed of outfall of Preah Sihanouk sewage treatment lagoon at bridge to headland connecting Otres and Ocheutal beaches.	Using field and analytical methods approved by DoE.	Once	Once	PIU	Environmental Monitoring Institute	$500
Construction Phase of Both Subprojects							
Analysis of soil quality (heavy metals (As, Cd, Pb, oil & grease, hydrocarbons).	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by DoE.	Once if needed	Once	PIU	Environmental Monitoring Institute	$2,000
Exposed groundwater	At all excavation sites	Visual observations	Continuous	For every occurrence	PIU	PIU/contractor	No marginal cost
A) Air quality: dust, CO, NOx, SOx, noise, B) Affected surface water quality: TSS, heavy metals (As, Cd, Pb,) oil and grease,	A & B) Baseline sites of pre-construction phase.	A – C: Using field and analytical methods approved by DoE.	(A – B): Quarterly during construction periods	Monthly	(A - D):		

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	**Location**	**Means of Monitoring**	**Frequency**	**Reporting**	**Responsibility**		**Estimated Cost (USD)**
					Supervision	**Implementation**	
pH, DO, COD, BOD_5, temperature, TDS, NH_3, NH_4, other nutrient forms of $_N$ & P C) Analysis of soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons. D) Domestic (worker) and construction solid waste inside & outside construction sites including worker camps. E) Public comments and complaints F) Incidence of worker or public accident or injury	C) At sites where, contaminated soil is suspected. D) All construction sites and worker camps E) Using hotline number placed at construction areas F) At all construction areas	Include visual observations of dust and noise from contractor & public reports. D) Visual observation E) Information transferred by telephone hotline number posted at all construction sites. F) regular reporting by contractors/PIU	Daily visual records C) Once at start of excavations D) Monthly E) Continuous public input F) Continuous		PIU	Environmental Monitoring Institute	A & B: $5,000/yrX1.5 C: $1,000 D: $0.0
					(E & F) & daily observations:		
					EA/PIU	contractor	E: $300/yrX1.5 F: $0
Operation of Upgraded Access Roads & New Piers							
Air quality: dust, CO, NOx, SOx, noise and vibration levels	Baseline sites of pre-construction phase.	Using field and analytical methods approved by DoE	Quarterly for 5 years	Biannual	DPWT		$2,000/yrX3
Solid waste	Along beachfront access roads, and at piers						$500/yrX3
Water level and qualitative water quality	At piers	Graduated staff gauge & public information notice board	Continuously	Biannual	Public, and pier & boat operators		$0.0
Vehicle & boat accidents	Upgraded roads, and at and along channels to piers.	Regular record keeping.	Continuously	For each event	DPWT		$0.0
Incidence of flooding	Adjacent to upgraded road	Surveys, public complaints	Seasonal for 5 years	Seasonal	DPWT		$0.0

Table 7. Performance Monitoring Indicators for Subprojects

Major Environmental Component	Key Indicator	Performance Objective	Data Source
Pre-construction Phase			
Public Consultation and Disclosure	Affected public and stakeholders	Meetings with stakeholders contacted during IEE and new stakeholders convened for follow-up consultation and to introduce grievance mechanism	Minutes of meeting, and participants list
EMP	Updated EMP	All stakeholders contacted during IEE re-contacted for follow-up consultation	EMP
Bid Documents	Requirements of EMP (CEMP)[7]	EMP appended to bidding documents with clear instructions to bidders for CEMP	Bid documents
Training of DOT/ /PIU/ESS/DPWT	Training course(s) and schedule	By end of pre-construction phase, required course(s) that will be delivered are designed and scheduled	Course(s) outline, participants, and schedule
Construction Phase			
Coastal water quality	TSS, DO, BOD, COD, pH, oil and grease, nutrient forms of T & N, metals (Pb, Fe, As)[8]	Government environmental standards & criteria met	Monitoring by EMI
Air quality	SOx, NOx, dust, CO, noise, vibration	Levels never exceed pre-construction baseline levels	EMC and contractor monitoring reports,
Soil quality	Solid and liquid waste	Rigorous program of procedures & rules to collect and store all waste from construction camps and sites practiced.	Contractor and EMI monitoring reports
Hazardous materials & waste	Oil, gasoline, grease, alum, chlorine, soda	Rigorous program of procedures to manage and store all waste from construction camps and sites practiced.	Contractor and EMI monitoring reports
Public and worker safety	Frequency of injuries	Adherence to Government policy and site-specific procedures to prevent accidents[9]	Contractor reports
Cultural property including grave sites	Incidence of damage, or complaints	No valued cultural property or unearthed valuable relic is harmed in any way	Public input, contractor reports, public input, EMI reports
Traffic	Frequency of disruptions and/or blocked roadways	Disruptions, stoppages, or detours are managed to absolute minimum.	Public input, contractor reports, EMC reports

[7] Contractor Environmental Management Plan developed from EMP
[8] Footnote 11
[9] MLVT's new Occupational Safety and Health Master Plan needs to be applied or IFC World Bank EHS (2007)

Major Environmental Component	Key Indicator	Performance Objective	Data Source
Operation Phase of Upgraded Piers and Access Roads			
Traffic safety	Frequency of vehicle and boat accidents	No increase in pre-construction frequency	DPWT
Air quality	SOx, NOx, dust, CO, noise along upgraded road	Levels never exceed pre-construction baseline levels	D/MOE,

VII. ESTIMATED COST

73. The marginal costs for implementing the EMP are primarily for environmental monitoring because the costs for implementing impact mitigation measures are included with the construction costs in contractor bid documents.

74. The preliminary costs for implementing the EMP for the subprojects in Preah Sihanouk are summarized in Table 8. These costs include per diem technician fees. Note that the estimated will need to be reviewed and updated at detailed design stage.

75. An estimated budget of $7,000 is required for capacity building for environmental management in conjunction with other capacity development activities of the project included in Output 3. The costs will need to be updated by the PMCES in conjunction with the PIU during the pre-construction phase. The estimated costs for monitoring summarized in Table 8 below are for the environmental and social/cultural monitoring, and information gathering identified in Table 6. The costs will become part of the budget assigned to the PMCES by the project owner which will be used to contract the EMI to do the field monitoring and required laboratory analyses of certain parameters.

Table 8: Estimated costs for Environmental Monitoring Plan

Activity Type	Estimated Cost (USD)*
Pre-construction Phase	
Updating Environmental Baseline	
cultural receptors (PCR)	$800
environmental quality	$4,500
Construction Phase	
environmental quality	$10,500
public consultation	$450
Post-construction Operation Phase	
environmental quality	$6,000
Training	**$8,000**
Total	**$30,250**

* Costs for major part of PMCES budget for EMI

VIII. EMERGENCY RESPONSE PLAN

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

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

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

Table 9: Roles and Responsibilities in Emergency Incident Response

Entity	Responsibilities
Contractor Team	- Communicates / alerts the EERT. - Prepares the emergency site to facilitate the response action of the EERT, e.g., vacating, clearing, restricting site. - When necessary and requested by the EERT, lends support / helps during EERT's response operations.
External Emergency Response Team	- Solves the emergency/incident
Contractor Resources	- Provide and sustain the people, equipment, tools and funds necessary to ensure Subproject's quick response to emergency situations. - Maintain honest communication lines with the EERT to ensure prompt help response & adequate protection, by keeping them informed of Subproject progress.

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

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

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

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

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

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

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

i) set up the ERT;
ii) set up all support equipment and facilities in working condition
iii) made arrangements with the EERT;
iv) conducted proper training of ERT members, and encouraged and trained volunteers from the work force;
v) conduct orientation to all construction workers on the emergency response procedures and facilities, particularly evacuation procedures, evacuation routes, evacuation assembly points, and self-first response, among others; and
vi) conduct drills for different possible situations.

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

A. Alert Procedures

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

(i) Whoever detects an emergency first shall immediately:
- call the attention of other people in the emergency site,
- sound the nearest alarm, and/or
- report/communicate the emergency to the ERT.

(ii) Only the ERTL and, if ERTL is not available, the Deputy ERTL are authorized to communicate with the EERT. Exceptional cases to this rule may be necessary and should be defined in the Emergency Management Plans.

(iii) When communicating/alerting an emergency to the EERT, it is important to provide them with at least: (i) the type of emergency; (ii) correct location of the emergency; (ii) estimated magnitude of the situation; (iii) estimated persons harmed; iv) time it happened; (v) in case of a spill, which hazardous substance spilled; and (vi) in case of fire and explosion, what caused it. Such details would allow the EERT to prepare for the appropriate response actions.

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

(i) The names and contact details of the relevant persons and institutions should be readily available in, or near to, all forms of communication equipment, and strategically posted (at legible size) in all subproject sites and vehicles:
   - Most relevant construction/operations staffs namely, the ERTL, Deputy ERTL, first-aiders, supervising engineers, foremen
   - EERT institutions/organizations
   - Concerned village authority/ies
   - PIU Office, SS

(ii) All subproject sites should have good access to any combination of audible and visual alarms, landline phones, mobile phones and two-way radio communication at all times.

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

B. Emergency Response Situations

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

Table 10: Evacuation Procedure

Procedure	Remarks
• Move out as quickly as possible as a group, but avoid panic.	• All workers/staff, sub-contractors, site visitors to move out, guided by the ERT.
• Evacuate through the directed evacuation route.	• The safe evacuation shall have been determined fast by the ERTL/Deputy ERTL and immediately communicated to ERT members.
• Keep moving until everyone is safely away from the emergency site and its influence area.	• A restricted area must be established outside the emergency site, all to stay beyond the restricted area.
• Once outside, conduct head counts.	• Foremen to do head counts of their sub-groups; ERTL/Deputy ERTL of the ERT.
• Report missing persons to EERT immediately.	• ERTL/Deputy ERTL to communicate with the EERT.
• Assist the injured in evacuation & hand them over to the ERT first-aiders or EERT medical group	• ERT to manage injured persons to ensure proper handling.
• If injury warrants special care, DO NOT MOVE them, unless necessary & instructed/directed by the EERT.	• ERTL/Deputy ERTL communicates with EERT to get instructions/directions in handling the injured.

Table 11: Response Procedure during Medical Emergency

Procedure	Remarks
• Administer First Aid regardless of severity immediately.	• Fundamentals when giving First Aid: - Safety first of both the rescuer and the victim. - Do not move an injured person unless: - victim is exposed to more danger when left where they are, e.g., during fire, chemical spill - it would be impossible for EERT to aid victims in their locations, e.g., under a collapsed structure

Procedure	Remarks
	- instructed or directed by the EERT. • First Aid to be conducted only by a person who has been properly trained in giving First Aid.
• Call the EERT emergency medical services &/or nearest hospital.	▪ ERTL/Deputy ERTL or authorized on-site emergency communicator
• Facilitate leading the EERT to the emergency site.	• ERTL/Deputy ERTL to instruct: - an ERT member on- site to meet EERT in access road/strategic location. He/she shall hold orange safety flag to get their attention & lead them to site. - Other ERT members to clear access road for smooth passage of the EERT.
• If applicable, vacate site & influence area at once, restrict site, suspend work until further notice.	• Follow evacuation procedure.

Table 12: Response Procedure in Case of Fire

Procedure	Remarks
• Alert a fire situation.	• Whoever detects the fire shall immediately: - call the attention of other people in the site, - sound the nearest alarm, and/or - Foreman or any ERT member among the construction sub-group contacts the fire department (in this case it should be agreed on that it is alright for any ERT member in the sub-group to alert the fire department) - report/communicate the emergency to the ERTL/Deputy ERTL.
• Stop all activities/operations and evacuate.	• All (non-ERT) workers/staff sub-contractors, site visitors and concerned public to move out to safe grounds following the evacuation procedure.
• Activate ERT to contain fire/control fire from spreading.	• Guided by the training they undertook, ERT members assigned to mitigate the fire shall assess their own safety situation first before attempting to control fire spread.
• Call the nearest fire & police stations &, if applicable, emergency medical services.	• When alerting the EERT, ERTL will give the location, cause of fire, estimated fire alarm rating, any injuries.
• Facilitate leading the EERT to the emergency site.	• ERTL/Deputy ERTL to instruct: - an ERT member to meet the EERT in the access road or strategic location and lead them to the site. He/she shall hold the orange safety flag to get their attention and lead them to the site. - some ERT members to stop traffic in, & clear, the access road to facilitate passage of the EERT.
• ERT to vacate the site as soon as their safety is assessed as in danger.	• Follow appropriate evacuation procedure.

IX. INSTITUTIONAL CAPACITY REVIEW AND NEEDS

85. Currently there is insufficient experience and capacity for environmental assessment and management amongst national counterparts responsible for EMP implementation. i.e., DOT/PIU and DPWT in Preah Sihanouk province. No dedicated environmental staff exists in the DOT. The PMCES with assistance from the safeguards specialists will develop and deliver training courses to the DOT/PIU and DPWT staff responsible for the implementation of the subprojects. The purpose of the course(s) is to strengthen the ability of the PIU/PCU to oversee implementation of the EMP by construction contractors and the EMC.

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

51. Training on the implementation of an EMP should address two thematic areas. The first area should be principles environmental management focused on the potential impacts of subproject activities on the natural and social environment. The second area should be environmental safeguard requirements of the ADB and Government with specific reference to the EMP. The training topics are listed in Table 12. An indicative budget of USD $8,000 has been assigned which is included in Table 7.

Table 13. Indicative training on EMP Implementation

Course Topic Areas	Target Participants	Period	Indicative Cost (USD)
Introduction to EIA, CAM EIA policy framework & procedures, and environmental standards, and ADB Safeguard Policy	EA, PIU/ESS	Pre-construction phase: shortly after PMCES is hired	$1,500
Purpose and content of an EMP. Development and implementation of the EMPs for the Preah Sihanouk subprojects. Development and implementation of contractor EMPs (CEMP)	EA, PIU/ESS, contractor EOs	Construction phase shortly after construction packages are let	$2,000
Protection of coastal zone, KR-MPA, terrestrial habitat, and conservation & protection forests from road, boat & pier operations, and piers during construction & operation	PIU/ESS, contractor EOs	Construction phase shortly after construction packages are let	$2,000

Course Topic Areas	Target Participants	Period	Indicative Cost (USD)
Grievance Redress Mechanism, & public consultation	EA/PIU/ESS, contractor EOs	Construction phase shortly after construction packages are let	$1,000
Occupational and community health and safety	PIU/SS, contractor EOs	Construction phase shortly after construction packages are let	$1,000
Vehicle and boat traffic management and safety. on ocean	PMU	Operation phase shortly before subprojects are completed	$1,000

ANNEX 1: INDICATIVE RESPONSIBILITIES FOR PROJECT MANAGEMENT AND EMP

EMP Implementation organizations	Roles and Responsibilities
Executing agency (EA) (MOT)	➢ Overall responsibility for the successful execution of the project & EMP ➢ Reviews the project implementation progress ➢ Reviews and endorses any proposed change in the project scope or implementation arrangements ➢ Oversees compliance with environmental loan covenants
Project Coordination Unit (PCU)	➢ Provide support to EA for EMP implementation issues ➢ Project preparation, including the setting up of financial and management systems and procedures, and the procuring of PCU office equipment ➢ Consultant recruitment and supervision ➢ Review and approval of goods and civil works contracts, including bid documents ➢ Coordination between the concerned agencies at the national and provincial levels ➢ Coordination of activities of the PIUs and the inputs of concerned stakeholders ➢ Coordination of all reporting aspects of the project ➢ Coordination of institutional strengthening measures ➢ Ensuring compliance with ADB Loan covenants, assurances and safeguard requirements, as well as with national and provincial policies and regulations ➢ Provision of administrative and technical support to the PIUs ➢ Preparation of consolidated project accounts to be forwarded to ADB ➢ Advice to PIUs on revenue-enhancing activities related to the recovery of costs of constructing, operating, and maintaining project facilities and equipment; ➢ Coordination of project audits ➢ All specified monitoring, evaluation and reporting activities ➢ Communication of project's outcomes, outputs, and activities to all stakeholders ➢ Provide coordination for safeguards and monitoring for PIU
Project Steering Committee (PSC)	➢ Ensuring that concerns of all stakeholders are adequately reflected in the project ➢ Coordination of project implementation between the concerned agencies ➢ Confirming compliance with local regulations and provincial policies ➢ Overseeing budgeting and disbursement of counterpart funds ➢ Overseeing implementation of resettlement plans, compensation schemes and all other project safeguard procedures ➢ When necessary provide support to EA for EMP issues
Project Implementation Units (PIUs) inside DoT	➢ Coordination and supervision of consultants' inputs on the appraisal of feasibility studies, and conceptual and detailed designs construction ➢ Procurement of goods and civil works contracts, including the preparation of bid documents and bid evaluations ➢ Approving payments to contractors and maintaining disbursement records

EMP Implementation organizations	Roles and Responsibilities
	➢ Ensuring that institutional-strengthening and capacity-building initiatives involving DMOs, private partners, SMEs and CBTOs are implemented in line with agreed project designs, schedules and budgets ➢ Ensuring compliance with loan covenants and assurances in respect of all subprojects, including updating of IEEs, EMPs, GAPs, resettlement plans ➢ ESS oversees implementation of EMP by contractor EO, and EMC ➢ ESS prepare quarterly reports on EMP implementation for PCU ➢ Coordinate with PMCES to design and deliver capacity development & training. ➢ Coordinating the process of establishing appropriate cost-recovery mechanisms ➢ Coordinating the implementation of identified Public-Private Partnership (PPP) initiatives; ➢ Meetings with all concerned stakeholders ➢ Quarterly progress and monitoring-and-evaluation reporting to the PCU
Project Management & Civil Engineering Support Consultant (PMCES)	➢ Completes detailed designs of subprojects with PIU ➢ With PIU update EMP to meet final detailed designs of subprojects ➢ With PIU review CEMPs of contractors ➢ Supervises and assists PIU with contractor management ➢ Provides technical advice and support when needed to PIU and EMC ➢ Designs and oversees delivery of all training and capacity development of PIU for construction and operation of completed subprojects including EMP. ➢ Provides advisory role for implementation of EMP by PIU and EMC
Environmental Monitoring Institute (EMI)	➢ Implements environmental sampling for EMP ➢ Conducts laboratory analyses of environmental quality samples from field sampling ➢ Prepares periodic monitoring reports for PIU
Environmental Officer (EO) of Contractor	➢ Implements the CEMP for the construction phase ➢ Maintains a daily log of environmental issues at the construction sites ➢ Prepares brief monthly summaries of mitigation activities and environmental issues at constructions site to PIU.
ADB	➢ Assists PCU through timely guidance at each stage of project implementation following agreed implementation arrangements ➢ Review all documents that require ADB approval ➢ Review of monitoring reports on EMP implementation to ensure EMP meets SPS (2009) ➢ Approval of procurement activities ➢ Periodic project review missions, a mid-term review and a completion mission for the project ➢ Ensuring compliance of all loan covenants ➢ Timely processing of withdrawal applications and release of eligible funds ➢ Ensuring compliance of financial audit recommendations ➢ Regularly updates project information disclosure on the ADB website

ANNEX 2: INDICATIVE TORs FOR ENVIRONMENTAL SPECIALISTS and EMI

International Environmental Specialist. With assistance from the national environmental specialist, the international consultant of PMCES will be responsible for updating the provincial EMP at detailed design, and assisting the PIU with overall environmental management of the implementation of the subproject in Cambodia. The consultant will:

(i) update environmental management plan (EMP) to ensure that EMP addresses the detailed design and engineering of subproject. Updates to EMP include mitigation and monitoring plans, budget, and capacity development needs of executing agency (EA/PCU) and PIU (DOT / DPWT);
(ii) with national consultant design comprehenisve training plan for safeguards specialist/PIU and on principles of EIA, and the purpose, content, and roles and responsibilities for implementation of updated EMP highlighting environmental issues of subproject;
(iii) ensure that all relevant safeguards of the EMP are adequately addressed in the bidding documents (instruction to bidders), and in the evaluation criteria for awarding contracts;
(iv) Coordinate and work with the PIU to ensure that contractors finalize their respective site-specific CEMPs based on the updated EMP and the actual site conditions;
(v) oversee the implementation of the EMP relating to construction phase activities including handling of construction spoil and waste, water and air quality protection, public nuisance impacts (noise, dust, traffic, blocked access, workers, and camps), and public safety;
(vi) coordinate with the DOT on all relevant environmental regulatory compliance issues (e.g. noise and dust from construction sites, sanitation in workers campsite etc);
(vii) prepare ToR(s) for survey, detection, and removal of unexploded ordnance (UXO) at all civil works sites. Ensure that EA and/or PIU consult Government authorities to assist with TOR development and implementation;
(viii) with PIU/DPWT, prepare TORs for the follow-up interviews and consultations with the same affected stakeholder and local residents contacted during the preliminary design, on issues and concerns arising during project construction. Of particular concern are upgrades to landfill access road;
(ix) prepare TOR(s) for external national environment monitoring institute (EMI) for conducting water and air quality sampling, and laboratory analyses for the monitoring plans for the EMP;
(x) coordinate with PWDT to address vehicle traffic issues, respectively during landfill access road upgrades;
(xi) advise PIU/DPWT on environment-related concerns arising during sub-projects construction, and recommend corrective measures;
(xii) with PIU/DPWT, ensure dissemination to stakeholders the results of environment quality monitoring and implementation of safeguards, especially among households or small businesses near the civil construction works areas;
(xiii) assist EA and PIU/DPWT prepare regular reports the PIU must submit to the EA on implementation of EMP, environmental, issues, and corrective actions;
(xiv) assist PIU/DPWT prepare report template for construction contractors to report monthly on mitigation activities, and environmental issues that occur during construction phase; and
(xv) prepare a quarterly status report on implementation of EMP, environmental issues, and public safety protection to be submitted through the PIU and EA to the provincial DOT and ADB.

The consultant should have an advanced university degree the environmental sciences and at least 7 years experience implementing and managing environmental assessment of infrastructure projects in Southeast Asia countries (preferably Cambodia) including: a) understanding of ADB and national environmental safeguard requirements; b) experience working with and supervising the activities of provincial and national environmental management agencies with environmental safeguards; and c) designing and delivering training and capacity development programs to provincial environment, project implementing units.

National Environmental Specialist. Assist the international environmental specialist, of the PMCES including acquisition of information new information to update the EMP at detailed design, and work with the PIU with overall environmental management of the implementation of the subprojects in Cambodia. The national consultant will assist with:

(i) updating environmental management plan (EMP) to ensure that the EMP address the detailed design and engineering of subproject.;
(ii) deliver initial training to M/DOT and DPWT on the purpose, content, and roles and responsibilities for implementation of updated EMP;
(iii) ensure relevant safeguards of the EMP are addressed in the bid documents and in evaluation criteria for awarding contracts;
(iv) help PIU to ensure that contractors prepare their respective site-specific plans based on the updated EMP and the actual site conditions;
(v) help the international consultant oversee the implementation of all safeguards of the EMP relating to construction phase activities including handling of construction spoil and waste, water and air quality protection, public nuisance impacts (noise, dust, traffic, blocked access, workers, and camps), and public safety;
(vi) assist coordination with the DOT on all relevant environmental regulatory compliance issues (e.g. noise and dust from construction sites, sanitation in workers campsite etc);
(vii) with PIU/DPWT, prepare TORs for the follow-up interviews and consultations with the same affected stakeholder and local residents contacted during the preliminary design, on issues and concerns arising during project construction. Of particular concern are upgrades to landfill access road;
(viii) assist PWDT to address vehicle traffic issues, respectively during road upgrades;
(ix) with the international consultant advise the PIU/DPWT on environment-related concerns arising during sub-projects construction, and recommend corrective measures;
(x) with PIU/DPWT, ensure dissemination to stakeholders the results of environment quality monitoring and implementation of safeguards, especially among households or small businesses near the civil construction works areas;
(xi) assist with all EMP reporting.

The consultant should have a university degree in the environmental sciences and at least 5 years with environmental assessment of infrastructure projects in Cambodia including: a) understanding of ADB and national environmental safeguard requirements; b) experience working with international consultants; and c) delivering training and capacity development programs to provincial project implementing units.

Environmental Monitoring Institute (EMI). Under the direction of the IES/NES and PIU, the EMI will assist with implementation of the EMP by providing field sampling and laboratory analysis support for the air quality and water quality variables of the Environmental Monitoring

Plan that require scientific sampling and handling, and laboratory analyses. The EMI will do the following:

(i) be contracted by the PMCES to support the NES/IES with the implementation of Environmental Monitoring Plan (MP) of EMP;
(ii) review and confirm with PMCES the scope of the updated MP that must be implemented by the EMI;
(iii) conduct the field sampling of environmental variables and perform associated laboratory analyses on field samples for the updated MP in consultation and under direction of the with IES/NES;
(iv) conduct the field sampling and laboratory analyses following the procedures of the APHA (2013)[10], or equivalent MOE-accepted environmental sampling and analysis procedures;
(iv) prepare and submit to the NES/IES, reports on field sampling and laboratory analyses activities and results according to the report formats and schedule pre-agreed with the NES/IES including QA/QC results for field & laboratory data as per AWWA (2013).
(v) if requested assist IES/NES with training of MOT and other project counterparts as part of the capacity & training program for environmental management and protection of Output 3 of the project; and
(vi) if requested provide ad hoc in-field guidance to EOs of contractors with their qualitative environmental monitoring activities of their CEMPs.

[10] (America Public Health Association, 2013). Standard Methods for the Examination of Water & Wastewater, Vol .4

ANNEX 3: ENVIRONMENTAL STANDARDS FOR CAMBODIA

From Government Sub-decree on Water Pollution Control (1999)
http://www.wepa-db.net/policies/law/cambodia/02.htm

Table 1. Effluent standard for pollution sources discharging wastewater to public water areas or sewer access

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
1	Temperature	^{0}C	< 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

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.

Table 2: Water Quality Standard in public water areas for bio-diversity conservation

I. For River

No	Parameter	Unit	Standard Value
1	pH	mg/l	6.5 – 8.5
2	BOD5	mg/l	1 – 10
3	Suspended Solid	mg/l	25 – 100
4	Dissolved Oxygen	mg/l	2.0 - 7.5
5	Coliform	MPN/100ml	< 5000

II. Lakes and Reservoirs

No	Parameter	Unit	Standard Value
1	pH	mg/l	6.5 – 8.5
2	COD	mg/l	1 – 8
3	Suspended Solid	mg/l	1 – 15
4	Dissolved Oxygen	mg/l	2.0 - 7.5
5	Coliform	MPN/100ml	< 1000
6	Total Nitrogen	mg/l	– 0.6
7	Total Phosphorus	mg/l	0.005 – 0.05

III. Coastal Water

No	Parameter	Unit	Standard Value
1	pH	mg/l	7.0 – 8.3
2	COD	mg/l	2 – 8
3	Dissolved Oxygen	mg/l	2 - 7.5
4	Coliform	MPN/100ml	< 1000

5	Oil content	mg/l	0
6	Total Nitrogen	mg/l	– 1.0
7	Total Phosphorus	mg/l	0.02 – 0.09

Table 3. Water Quality Standard in public water areas for public health protection

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

ANNEX 4: GOVERNMENT COST NORMS FOR LABORATORY ANALYSES

ល.រ	បរិយាយ	តម្លៃសេវា (រៀល)	រយៈពេលផ្តល់សេវា (ថ្ងៃធ្វើការ)	សុពលភាព
24	Chloride(C1-)	28,000	3ថ្ងៃ	
25	Manganese(Mn)	60,000	5ថ្ងៃ	
26	Magnesium(Mg)	60,000	5ថ្ងៃ	
27	Alumium	70,000	5ថ្ងៃ	
28	Iron(Fe)	70,000	5ថ្ងៃ	
29	Copper (Cu)	70,000	5ថ្ងៃ	
30	Zinc(Zn)	70,000	5ថ្ងៃ	
31	Cadmium(Cd)	90,000	5ថ្ងៃ	
32	Selenium(Se)	80,000	5ថ្ងៃ	
33	Mercury(Hg)	90,000	5ថ្ងៃ	
34	Nickel(ni)	80,000	5ថ្ងៃ	
35	Chromium(C)	80,000	5ថ្ងៃ	
36	Lead(Pb)	80,000	5ថ្ងៃ	
37	A·senic(As)	80,000	5ថ្ងៃ	
38	Total Coli form	36,000	7ថ្ងៃ	
39	Feacal Coliform	36,000	7ថ្ងៃ	
40	Total Bacteria	36,000	5ថ្ងៃ	
41	Pathogen Staphylococcus	40,000	7ថ្ងៃ	
42	E-Coli	40,000	7ថ្ងៃ	

ល.រ	បរិយាយ	តម្លៃសេវា (រៀល)	រយៈពេលផ្តល់សេវា (ថ្ងៃធ្វើការ)	សុពលភាព
43	Feacal Streptococcus	40,000	7ថ្ងៃ	
44	Total Nitrogen(TN)	36,000	4ថ្ងៃ	
45	Thermo tolerant Coli form	28,000	7ថ្ងៃ	
46	Barium(Ba)	60,000	5ថ្ងៃ	
47	Beryllium(Be)	60,000	5ថ្ងៃ	
48	Bismuth(Bi)	60,000	5ថ្ងៃ	
49	Boron(B)	60,000	5ថ្ងៃ	
50	Calcium(Ca)	52,000	5ថ្ងៃ	
51	Cobalt(Co)	60,000	5ថ្ងៃ	
52	Cesium(Cs)	72,000	5ថ្ងៃ	
53	Gallium(Ga)	60,000	5ថ្ងៃ	
54	Indium(In)	60,000	5ថ្ងៃ	
55	Potassium(k)	52,000	5ថ្ងៃ	
56	Lithium(Li)	52,000	5ថ្ងៃ	
57	Molybdenum(Mo)	60,000	5ថ្ងៃ	
58	Rubidium(b)	80,000	5ថ្ងៃ	
59	Sodium(Na)	52,000	5ថ្ងៃ	
60	Silver(Ag)	80,000	5ថ្ងៃ	
61	Strontium(S)	80,000	5ថ្ងៃ	

ល.រ	បរិយាយ	តម្លៃសេវា (រៀល)	រយៈពេលផ្តល់សេវា (ថ្ងៃធ្វើការ)	សុពលភាព
62	Titanium(Ti)	80,000	5ថ្ងៃ	
63	Vanadium(V)	80,000	5ថ្ងៃ	
64	Uranium(U)	80,000	5ថ្ងៃ	
65	Ortophosphate(PO4)	24,000	3ថ្ងៃ	
66	Poliphosphate(PO4--)	24,000	4ថ្ងៃ	
67	Carbondioxide(CO2)	24,000	3ថ្ងៃ	
68	Salinity(NaC1)%	24,000	2ថ្ងៃ	
69	Chromium(C 3)	24,000	3ថ្ងៃ	
70	Chromium Exavalend(C 6)	24,000	4ថ្ងៃ	
71	Sulphite(SO2)	28,000	5ថ្ងៃ	
72	Sulfide(S)	28,000	4ថ្ងៃ	
73	Brome(B)	40,000	5ថ្ងៃ	
74	Iron(Fe+3)	40,000	5ថ្ងៃ	
75	Iron(Fe+2)	40,000	5ថ្ងៃ	
76	Color	28,000	3ថ្ងៃ	
77	Chlorohpyll,a	28,000	3ថ្ងៃ	
78	Transparency	20,000	3ថ្ងៃ	
79	Ammonium(NH4)	28,000	3ថ្ងៃ	
80	HydrogenCarbonate(HCO3)	20,000	3ថ្ងៃ	

ល.រ	បរិយាយ	តម្លៃសេវា (រៀល)	រយៈពេលផ្តល់សេវា (ថ្ងៃធ្វើការ)	សុពលភាព
81	Silicon(SiO2)	60,000	5ថ្ងៃ	
82	Chlorine(c1-)	28,000	3ថ្ងៃ	
83	NO_2 (ពិនិត្យក្នុងពេល២៤ម៉ោង)	280,000	7ថ្ងៃ	
84	SO_2 (ពិនិត្យក្នុងពេល២៤ម៉ោង)	280,000	7ថ្ងៃ	
85	TSP			
	ពិនិត្យក្នុងពេល1ម៉ោង	100,000	5ថ្ងៃ	
	ពិនិត្យក្នុងពេល8ម៉ោង	200,000	5ថ្ងៃ	
	ពិនិត្យក្នុងពេល២៤ម៉ោង	480,000	5ថ្ងៃ	
86	PM10			
	ពិនិត្យក្នុងពេល1ម៉ោង	100,000	5ថ្ងៃ	
	ពិនិត្យក្នុងពេល8ម៉ោង	200,000	5ថ្ងៃ	
	ពិនិត្យក្នុងពេល24ម៉ោង	480,000	5ថ្ងៃ	
87	PM2.5			
	ពិនិត្យក្នុងពេល1ម៉ោង	100,000	5ថ្ងៃ	
	ពិនិត្យក្នុងពេល8ម៉ោង	200,000	5ថ្ងៃ	
	ពិនិត្យក្នុងពេល24ម៉ោង	480,000	5ថ្ងៃ	
88	Noise	200,000	5ថ្ងៃ	
	ពិនិត្យក្នុងពេល8ម៉ោង	60,000	5ថ្ងៃ	
	ពិនិត្យក្នុងពេល24ម៉ោង	120,000	5ថ្ងៃ	