Environmental Management Plan - Updated

Project Number: 46293-004
Loan 3194-CAM

November 2019

CAM: Greater Mekong Subregion Tourism Infrastructure for Inclusive Growth Project

Kep Crab Market Environmental Improvements

Prepared by the Ministry of Tourism, Cambodia for the Asian Development Bank.

KINGDOM OF CAMBODIA
NATION RELIGION KING

MINISTRY OF TOURISM

ASIAN DEVELOPMENT BANK

MINISTRY OF TOURISM

INTERNATIONAL STANDARD COORDINATION UNIT

GREATER MEKONG SUBREGION TOURISM INFRASTRUCTURE FOR INCLUSIVE GROWTH

ADB LOAN No. 3194-CAM (SF)

Updated Environmental Management Plan (EMP)

Kep Crab Market Environmental Improvements

November 2019

VICA in Joint Venture with SBK

Executing Agency:	**Funding Agency:**	**VICA Consultants:**
Ministry of Tourism 1st Floor, Lot#3, Sangkat Veal Vong Khan 7 Mekara Phnom Penh, Cambodia	Asian Development Bank (ADB) 6 ADB Avenue, Mandaluyong City Metro Manila, Philippines	VICA Consultants Co. Ltd. *In Joint Venture with* SBK Cambodia, Ltd. 1st Floor, Ministry of Phnom Penh, Cambodia

ABBREVIATIONS

ADB	-	Asian Development Bank
CEMP	-	Contractor environmental management plan
DAFF	-	Department of Agriculture, Forestry and Fisheries
DDSC	-	Detailed design & supervision consultant
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
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
MIME	-	Ministry of Industry, Mines and Energy
MPWT	-	Ministry of Public Works and Transport
MOT	-	Ministry of Tourism
MOWRAM	-	Ministry of Water Resources and Meteorology
PAM	-	Project administration manual
PCR	-	Physical cultural resources
PCU	-	Project coordinating unit
PIU	-	Project implementation unit
PPTA	-	Project preparatory technical assistance
RP	-	Resettlement plan
ROW	-	Right Of Way
UXO	-	Unexploded ordinance
WWTF	-	Waste water treatment facility

WEIGHTS AND MEASURES

km	-	Kilometer
kg	-	Kilogram
ha	-	Hectare

CURRENCY EQUIVALENTS

(as of 8 September 2016)

Currency Unit	–	Riel KR
KR1.00	=	$0.000244
$1.00	=	KR4,095

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

TABLE OF CONTENTS

INTRODUCTION

1. The Environmental Management Plan (EMP) for the Crab Market Environmental Improvements in Kep Town provided herein is one of two EMPs that have been prepared for the subprojects of the GMS Tourism Infrastructure for Inclusive Growth Project (the project) in Cambodia. The other EMP addresses the Kampot Pier Development in Kampot Town, Kampot province. A single Initial Environmental Impact Assessment (IEIA) of both subprojects was prepared under separate cover. The separate EMPs are comprehensive and are developed as stand-alone management tools that are supported by the parent IEIA.

This is an Updated EMP Version of Kep Crab Market Environmental Improvements in pursuant of the ADB Aide Memoir of May 2, 2019 recommendations for the additional minor civil works to be carried out (Appendix 1)

The CEMP will be updated as well, and SBK-the assisting engineering firm will provide the contractor with the design and supervisor engineer with detailed work method prior to construction.

Further, the work will be completed within a week time or two by stages or component sections to minimize physical disturbance and to reduce the possible effect of foul odor from the cementing glue to be used. The coated area with epoxy glue application will be totally free from rain water or waste water. Likewise, an electric fan will be temporarily set up to disperse the foul odor as well as to hasten the drying of the glue.

A. Kep Crab Market Environmental Improvements

2. The environmental improvements at the crab market in Kep town will install a Waste Water Treatment Facility (WWTF) that has a built-in filtering system which does not require infiltration gallery, in place of the Anaerobic Baffler Reactor (ABR) septic system. The main function is to collect and treat wastewater from the market and adjacent restaurants aimed at improving tourist amenities in the said site. Table 1 presents the list of the subproject activities from the IEIA.

Table 1: Summary of Environmental Upgrades at Crab Market in Kep

Activity	General Specifications
Install a Waste Water Treating Facility (WWTF) to receive domestic waste. (The WWTF will be made of Fiberglass Reinforced Plastic)	• capacity 100 m^3/day • connected to public toilets, shops and restaurant stalls, not nearby hotels
Reclaim certain portion of the seafront at the northern side of the market	• location for the WWTF set-up • Landscaping and tree planting within the WWTF area
Expand crab market structure to the adjacent dry goods area,	• upgrade internal drainage • create area for future cold storage facilities in the crab market
Pave existing parking lot	Not Applicable
Install new public toilets	• link to WWTF
Upgrade existing waste management system of the market area	• include provisions for routine de-sludging of WWTF septic tanks at a MOE-approved disposal site • improve solid waste management practice in the crab market and vicinity.
Upgrade existing power supply and install improved lighting to the market and adjacent public open areas	

Install signage in key locations	
Improve crab market concrete walkway stairway to ensure safe and convenient access to the main plaza[1]	• comprised of pre-fabricated ramp, metal stair and interlocking concrete pavement blocks for easy installation and to minimize business disruption while being set up
Setting up of greywater collection sink with piping system connected to the WWTF at the crab boiling section[2]	• floor area of 54.1 m^2 will be coated with a two coat epoxy resin to seal the catchment area and connected to HDPE pipe that drains to the WWTF tank
Installation of two stainless steel sinks for used water from boiling crab collection pits	• used water from crab boiling will be drained to the WWTF through stainless steel sinks with connecting pipes
Connection of public toilet to WWTF	• Pipes connecting the septic tank of existing public toilet located at the South of Crab Market to the WWTF
Landscaping and fencing	• Renovation of small garden at Sdach Korn Statue with fencing along with planting ornamental trees for shade and aesthetics
Additional drainage pits	• To reduce overflow of runoff water from upper ground at the southern part to northward direction in front of the restaurants and finally draining to the sea.

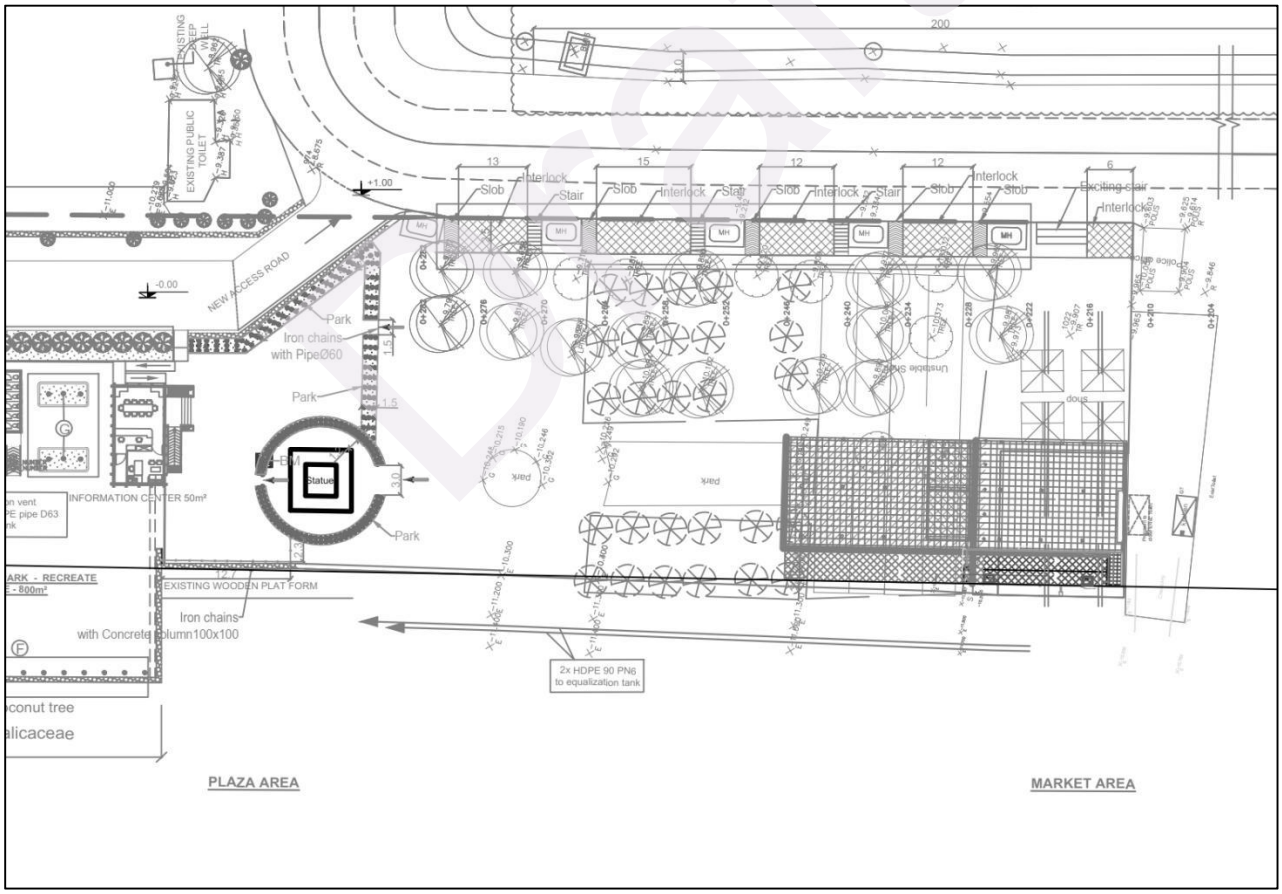


Figure 1: Top view of the additional improvement at the walkway and crab boiling section

[1] Additional physical improvement based on ADB Aide Memoir (May 2). Refer to Figure 1 for the sketch plan
[2] Additional physical improvement based on ADB Aide Memoir (May 2). Refer to Figure 2 for the sketch plan

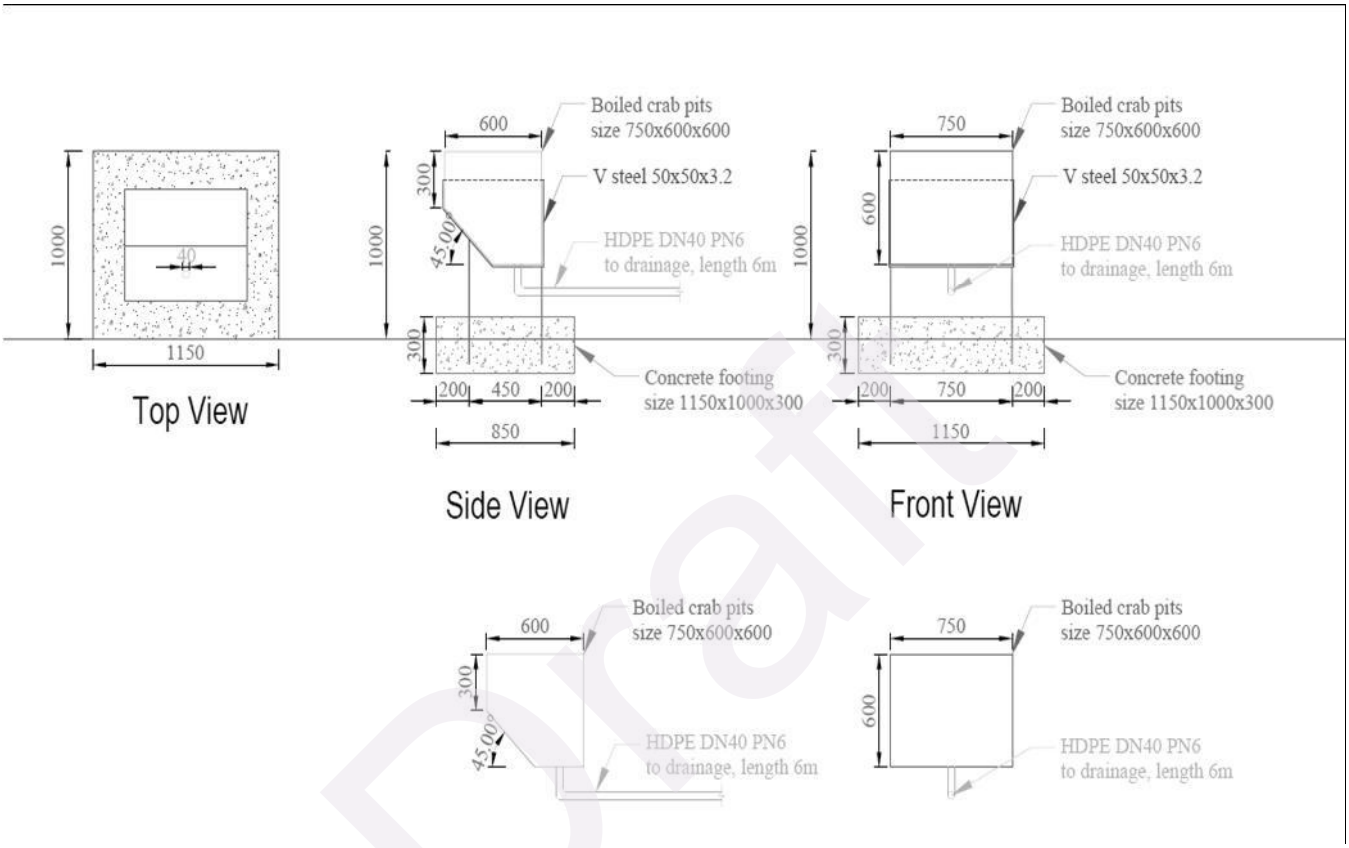


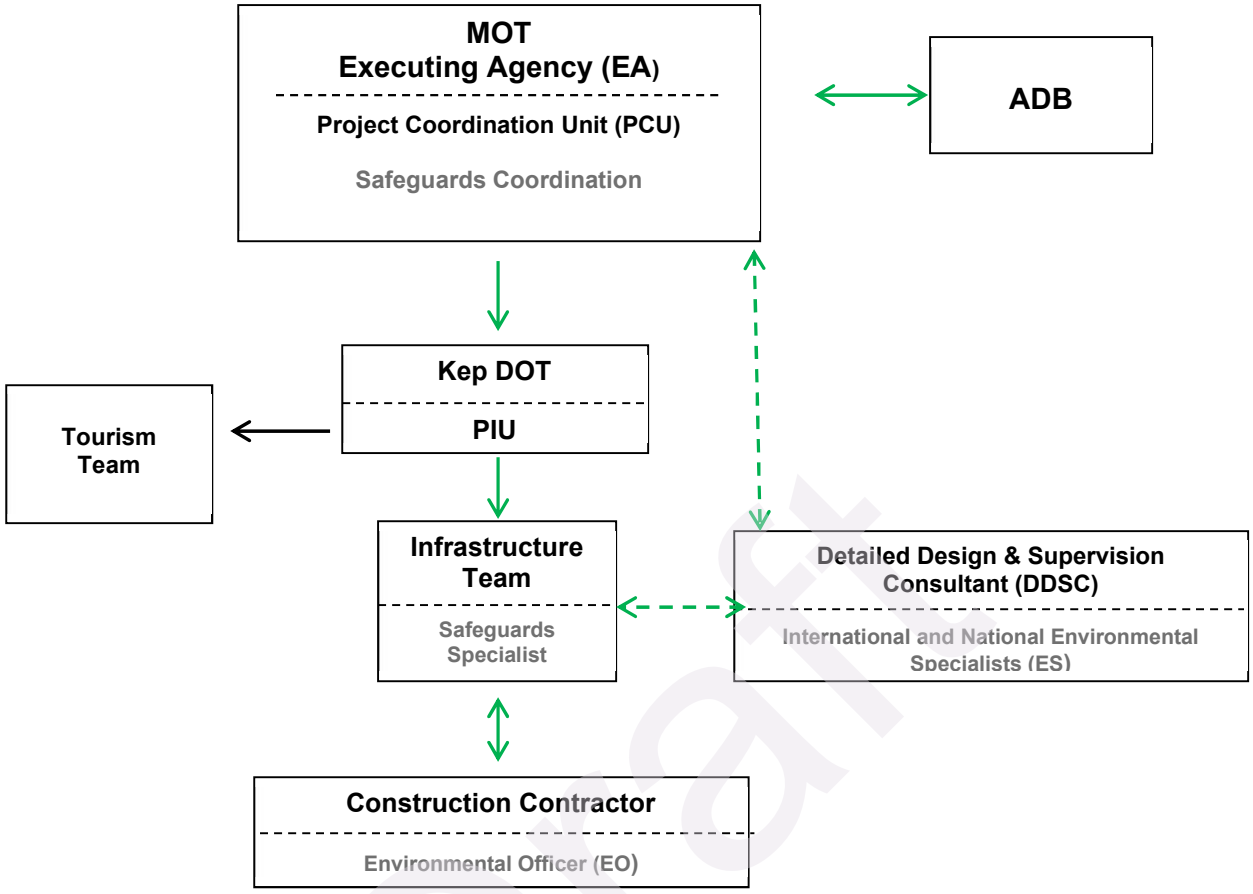
Figure 2: Sketch plan at scale of the collection sink for the used water for boiling crab

INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

3. At the feasibility stage the framework[3] for implementation of the environmental management plan (EMP) for the Kep Crab Market Environmental Improvements subproject is summarized in Figure 3. Appendix 2 presents the full project management structure in Cambodia.

[3] Adapted from the Project Administration Manual.

Figure 3: Management Framework for EMP Implementation



4. The Ministry of Tourism (MOT) which is the Executing Agency (EA) for the project will take overall responsibility for the successful implementation of the EMP. The EA will establish a Phnom Penh-based Project Coordination Unit (PCU) within the Tourism Development Department which, *inter alia*, provides Safeguards Coordination for the EMP. The provincial Department of Tourism (DOT), in which the project implementation unit (PIU) will be created to implement the EMP with support from the PCU. The PIU will be comprised of two technical teams (Infrastructure and Tourism). The infrastructure team will be cross-appointed from the Department of Public Works and Transport (DPWT). The infrastructure team will include a Safeguards Specialist who will lead the implementation of the EMP in conjunction with the Environmental Officer(s) (EO) of the construction contractor(s).

5. The Safeguards Coordination unit of the PCU 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[4] for the particular construction package.

6. External support to the PIU for the implementation of the EMP will be provided by the International and National Environment Specialists (ES) of the Detailed Design and Supervision Consultant (DDSC).

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

7. The responsibilities of the different agencies shown in the management framework in Figure 1 are listed in Appendix 3. Provided below is a summary of responsibilities for implementation of the EMP.

8. The responsibilities of the EA as supported by PCU include:

- Provide coordination for environmental and social safeguards and monitoring for PIU;
- Liaise with ADB on the implementation of the EMP; and
- Coordinate resolutions with PIU, and ADB if necessary on issues arising from the implementation of the EMP.

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

- Initially assist DDSC with updating the EMP to meet final detailed subproject designs;
- Notify DOT to verify Government approvals of project if they are met, and that the EMP is compliant with the requirements of the Royal Government of Cambodia (RGC) sub-decree on EIA, No 72 ANRK.BK issued by the Ministry of Environment (MOE, 1999);
- Assist DDSC for the inclusion of CEMP requirements in the contractor bid documents, particularly bid evaluations based on updated EMP;
- Undertake day to day management of EMP implementation activities;
- Work with EMC on implementation of the monitoring plan of EMP;
- Ensuring compliance with loan covenants and assurances in respect to all subprojects, including EMPs (as well as the GAP and resettlement plans);
- Lead follow-up meetings with all affected stakeholders;
- Prepare and submit quarterly reports on EMP implementation to PCU;
- Oversee implementation of CEMP by contractor;
- Coordinate with ES of DDSC for EMP implementation;
- Undertake regular construction site inspections to ensure that the contractor implements CEMP properly; and
- Ensure the EO of contractor submits monthly reports on construction mitigations and monitoring.

10. The responsibilities of the international and national ES of the DDSC are listed below:

- Update the EMP to meet final detailed designs of subprojects;
- Provide technical direction and support to PIU for implementation of EMP;
- Oversee design and delivery of capacity development and training of PIU and EO of contractor(s);
- Provide advice and support to EMC with their monitoring activities;
- Review all reports prepared by PIU and EMC for PCU and ADB; and
- Review location of any possible contaminated sites near subprojects.

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

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

12. The Department of Environment (DOE) is the provincial agency which oversees environmental management of Kampot and Kep. Each has its own provincial unit. The DOE with the district staff provides direction and support for environmental protection-related matters, including application of the Law on Environmental Protection and Natural Resources Management, enacted by National Assembly, 1996, promulgated by Preah Reach Kram/NS/RKM-1296/36; and environmental standards.

13. The ADB provides guidance to EA/PCU for any issues related to EMP, and reviews quarterly reports on EMP activities compiled and submitted by PCU.

B. Worker and Community Health and Safety

14. In 2003, the International Labour Organization (ILO) created the New Global Strategy for Occupational Safety and Health (OSH). Based on the OSH[5], the Government Ministry of Labour and Vocational Training (MLVT) through the Department of Occupational Safety and Health, is developing the Occupational Safety and Health Master Plan (OSHM; 2009-2013) of Cambodia.

15. The emerging 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 OSH Master Plan. 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.

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

C. Regulatory Framework and Guidelines for Kep Subproject Components

17. Applicable regulations and guidelines for the environmental improvements at the crab market are drawn from the IEIA are summarized in **Error! Reference source not found.**. The regulations and guidelines, *inter alia,* identify how solid waste and wastewater should be managed to prevent or minimize negative impacts on the environment. The current environmental standards for Cambodia are provided in Appendix 4. See the IEIA for complete legal and regulatory framework for environmental management in Kep province.

Table 2: Regulations and Guidelines Applicable to Subproject.

Waste Management
• Law on Environmental Protection and Natural Resources Management, enacted by National Assembly, 1996, promulgated by Preah Reach Kram/NS/RKM-1296/36; o Sub-decree on Water Pollution Control (1999): - Annex 1: Industrial effluent standards (including WWTPs); - Annex 2: Water quality standards for public water & biodiversity; and - Annex 3: Water quality standards for public waters and health. • Directive Managing Health Wastes in the Kingdom of Cambodia (MOH, 2008); and • Directive on Industrial Sludge Management (MOE, 2000).

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

SUMMARY OF ENVIRONMENTAL CONCERNS AND POTENTIAL IMPACTS

18. The new location of the of the WWTF at the northern side of the Crab Market requires the reclamation of certain portion of the sea front due to the limited land area for the said facility. In terms of elevation, it is also at the lowest ground level and may likely become the drainage pathway of run-off water going down to the sea.

20. The WWTF system does not treat wastewater by itself. A built-in infiltration system is another component of the entire set-up that detoxifies and assimilates the treated waste water and discharges it back to the ground.

21. Four (4) corollary concerns that have to be addressed attendant to the new location:

a. Seepage or/and salt water intrusion. The area where to set up the WWTF should be strongly and firmly stabilized with heavy concrete piles as foundation. The excavated hole to lay the tanks and the entire set up must be water proofed with strong quality sealant against seepage and salt water intrusion.
b. Run-off water direction of flow. A well paved concrete drainage for run-off rain water should be properly constructed, by-passing the WWTF location to help maintain a stable ground, thus, reduce the danger of soil slippage and caving in of the foundation.
c. Air quality and smell. The direction of wind would either be driven northward or southward due to the open sea air current pushing inward. This may likely dispel foul odor coming from the WWTF by convection. In this case, there is a need to plant buffer trees and other broad leaf vegetation as air quality and temperature conditioner, wind breaker, shade, and for aesthetics.
d. Treated waste water effect on marine life. Directly discharging the treated waste water to the sea may adversely affect the rich marine life in the immediate coastal environment. Fisherfolks in the area depend greatly on the crab, squid and fish catch from near shore fishery ground for their food and source of income. In this case, there is a need to constantly monitor the quality of the treated waste water to ensure that it meets the required threshold standard (i.e., effluent water quality <30 mg/l) without causing any subsequent change in the marine life population. Likewise, it is recommended to conduct a yearly macro-benthic assessment along the intertidal flat where the treated waste water is discharged. The aim is to determine any change in the composition of the substrate that serves as food for marine life.

22. With the improvement of the environmental service in the Crab Market, it is expected to increase both the number and frequency of tourists going to the area. As such, there will also be corresponding increase in magnitude of both solid waste and sewage. Aside from installing additional units of public toilets, integrated solid waste management should be introduced.

23. As regards to solid waste status, the total volume of collected stuff from the market and restaurants is approximately 400 kg/day on the average from Monday to Friday. It increases double (i.e., 800 kg)/day during Saturday and Sunday because of the growing number of tourists during the weekends. Thus, the total waste generation in the market including restaurants is approximately about 2,000 kg during working day (Monday to Friday) and 1,600 kg during weekend or a total of 3,600 kg/week. About 30 % of this total volume of waste is food residue, being recycled by the restaurant owners for their animal feeds.

24. In terms of waste composition, the estimates are as follows: organic (50 %), plastic and Styrofoam materials (20%), tin cans and plastic bottles (10 %), paper (5%) and mixed wastes

(15%). Current fee for waste collection is 40,000 Riel (US $10) per month for each restaurant owner.

25. On entirely different matter, it was found out during the Environmental Safeguard Specialists' ocular visit and interview with restaurant owners at the crab market on September 15, 2016 that most of the restaurants have succeeded in tapping the ground water within the site. However, the depth of the water table ranges from 30 to 40 meters. One restaurant operator reported to have driven 68 meters long metal pipe to the ground to get a better quality ground water. This means the water table is low, which implies less probability for underground water contamination. On the other hand, to augment the current supply of water that is drawn underground, there is a need to practice rainwater harvesting and domestic water recycling as mitigation measure

26. Ground water quality analysis in crab market area shows the following results: Total Fe 0.07 mg/l, E.Coli 0.00 (MPN in 100 ml), total coliform 50 (MPN in 100 ml), Arsenic 0.00 mg/l, pH 8.2. Based on the said values, the ground water is considered good quality comparing to WHO standard (Appendix 5).

27. The excavation and earth filling works required for the WWTF septic tanks, though does not pose danger any longer on the water table, however, another concern is the possibility of caving in, if the ground foundation and surrounding reinforcement is loose and weak.

28. With the additional civil works to be introduced pursuant of the recently concluded ADB Review Mission recommendations of May 2, 2019, (i.e., improvement of the concrete crab market walkway stairway to the main plaza and setting up at the crab boiling section, a water collection sink connected to a PVC pipe that drains into the WWTF tank), there is no significant negative impacts anticipated.

29. This is because there will be no major civil works to be implemented, instead the contractor will install a pre-fabricated ramp and metal stair with interlocking concrete pavement blocks as flooring and access to the market main plaza. Likewise, setting up of the used boiled water collection sink/catchment pit with PVC pipe connected to the WWTF tank does not require heavy equipment but minor carpentry and masonry works.

30. Further, the epoxy coating to be used as a sealing material for the water collection sink will have no harmful effect on human health. There will be normal odor associated with application of the epoxy resin during the application and this will be touch dry in two hours and odorless within 6 hours. The area to be treated is well ventilated and the impact on vendors will be temporary and site specific.

31. Except for slight inconvenience on the part of the five (5) vendors directly affected at the main front section of the market and those located in the crab boiling section, the proposed works do not pose any negative impact on the environment, public health and safety and people's livelihood. Thus, no resettlement or compensation is required.

32. The additional improvements will result to improved sanitation, prevent contaminated waste water from being discharged to the sea and provide greater safety and convenience for tourists and the public visiting this part of the Kep Crab Market.

33. In general, the potential impacts of the environmental improvements will occur as a result of the civil works during the construction phase. The short-term construction-related disturbances

and impacts such as noise, dust, reduced access, increased traffic and accidents, worker and public safety, soil erosion & sedimentation, and solid and liquid waste can be managed and mitigated. The same is true for soil erosion and sedimentation near the shoreline adjacent to the market by constructing good drainage system as well as beautify the immediate environment with ornamental trees and flowering plants. Table 3 presents the environmental concerns related to waste water treatment facility. Table 4 shows the environmental impacts.

Table 3: Summary of environmental concerns in relation to the WWTF

Conditions To Be Examined	Assessment	Environmental Concern/Issue
1. UXO clearance	No data available	No certainty of how free is the area from UXO
2. Soil structure and parent material	No indication of limestone rock formation as soil parent material where the waste water treatment facility will be set up.	Caving-in and seepage may likely to occur under loose soil aggregates and with no solid bedrock parent material as ground foundation of the waste treating facility
3. Water table	Water table is extremely low as indicated by the 30-40 meters long pipes driven to the ground	Possible contamination of the water table from the treatment facility if there is leakage
4. Elevation	Relatively at the lowest elevation	Run-off rain water may likely converge to where the treating facility is set up before draining to the sea
5. Location	Shoreline reclamation area	Danger of sea water backflow during high tide
6. Effluent coming from the treatment facility	Not yet in operation but effluent should be: • BOD <30mg/l • T-N <30mg/l	If the discharged treated waste water exceeds the threshold limits, this may affect the offshore marine ecology, i.e., change in composition & chemistry of the substrate serving as food for fish, crabs, etc.
7. Ground water quality	Total Fe 0.07 mg/l, E.Coli 0.00 (MPN in 100 ml), total coliform 50 (MPN in 100 ml), Arsenic 0.00 mg/l, pH 8.2	Change in pH and other chemical properties that affect the portability for drinking and domestic use
8. Offshore macro-benthic fauna	To be determined during the operation phase	Discharging the treated waste water to the sea may affect the composition and population of macro-benthic fauna
9. Air quality (smell)	To be assessed during the operation phase	When the WWTF is in operation, it is possible that the ambient air in the immediate vicinity be affected
10. Solid waste management	Results of the recent ocular visit and interview among restaurant operators indicates the need for a more integrated and coordinated solid waste management system	With the anticipated increasing frequency and number of visitors to the crab market after improving the environmental services, this would result to doubling magnitude of the current volume of solid waste in the restaurant and market place

Table 4: Summary of Potential Environmental Impacts by the Subproject at the Crab Market

Pre-construction Phase

• No resettlement is anticipated. • Some land clearing
Construction Phase
<u>New WWTF Septic System</u> • Reclamation of certain portion of the beach front that may require special kind of massive fill in materials for the foundation, alongside with effective sealant material for water proofing of the WWTF set up • Redirection of surface run-off water flow away from the WWTF area by constructing a well paved concrete drainage channels towards the sea • Temporary and slight to heavy disruption of business operation in the crab market and restaurants • Disturbances due to civil works causing dust and noise pollution, reduced and/or blocked public access, disrupted business and recreation. Likewise, air pollutants in the form of NOx, SOx, & CO caused by increased truck traffic and heavy equipment add to the danger. Further, soil and surface water contamination caused by equipment operation and maintenance, alongside with public and worker accidents, disruption of traffic, increased traffic accidents, drainage and flooding problems, solid and domestic waste from worker camps, social issues and community problems caused by migrant workers, all these create temporary inconvenience in the area. • Permeation of the water table resulting from excavations for the WWTF tanks • Sedimentation of the adjacent beach area due to soil erosion in land clearings can cause water quality degradation. • Insufficient land available for WWTF set-up, requiring infilling (reclaiming) of certain portion of the beach front adjacent to the market • Landscape the WWTF area with ornamental trees and vegetative cover as wind breaker, temperature and air quality conditioner and for aesthetics. <u>Other Environmental Improvements</u> • Construction-related impacts as above
Operation Phase
• Failure of medium-term and long-term sustainability of the passive wastewater treatment capacity of the WWTF. • Lateral leakage of unassimilated gallery field wastewater to coastal beach creating water quality and aesthetic pollution problems • Periodic septage spill or overflow in market area from poorly executed sludge removal from WWTF tanks, or too infrequent sludge removal and disposal at a MOE-approved disposal site • Discharging treated waste water to the sea, resulting to possible alteration of the immediate coastal waters ecology • Air quality within the immediate premise of the waste water treating system may potentially be affected, resulting to a foul odor. • Better sanitation, substantial reduced contaminated waste water directly being discharged to the sea • Greater safety and convenience for tourists and the public frequenting the site

D. Public Consultation

26. The stakeholder consultation strategy that was developed for the IEIA will be continued at the start of the pre-construction phase of the subproject. The first step will be the disclosure of the finalized IEIA to the affected stakeholders for their information and compliance.

1. Follow-up Consultation

27. As indicated in the IEIA, the primary concern of the public and stakeholders of the subproject were disturbances during the construction phase, particularly disruption to business at the crab market. These issues plus any others will be reviewed during follow-up consultations

throughout the pre-construction, construction, and operation of the completed subproject components. The affected persons consulted in the crab market must be contacted regularly during the preconstruction and construction phase

MITIGATION PLAN

28. The mitigation measures of the EMP are presented in Table 5. Guided by the structure of the IEIA, the Mitigation Plan follows three (3) development phases as the basis of the interventions: *pre-construction, construction*, and the *post-construction operational phase*. The mitigation plan addresses the environmental issues and concerns raised during the previous stakeholders' meetings.

29. The mitigation plan combines the construction phase impacts common to the environmental improvement activities of the market. A single mitigation measure prescribed may not be re-stated numerous times to avoid redundancy. However, for impacts that require specific mitigations, they should be included as separate list. Likewise, common mitigations that are particularly critical for a subproject component should be underscored.

30. The mitigation plan identifies the impacts, required mitigations, responsible parties, location, timing, and indicative costs. The mitigation plan is comprehensive enough to guide the careful and sound detailed designing of civil works aimed to fully address the potential impacts of the subproject. There is the need to coordinate work activities with the restaurant owners and other related business operators at the Crab Market to minimize possible disruption of their routine business activity during the construction phase

Table 5: Environmental Impact Mitigation Plan

Subproject Activity	Potential Environ-mental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Report-ing	Estima-ted Cost[6] ($)	Responsibility	
							Supervi-sion	Implemen-tation
Pre-Construction, Detailed Design Phase								
Confirmation of no required resettlement, relocations, and compensation	No negative environ-mental impacts	1. Affected persons and merchants of crab market were well informed way ahead of subproject implementation.	All affected persons in subproject areas	Before project implement ed	See resettle-ment plans	See resettle-ment plan	PIU/SS	Resettle-ment committees
Disclosure, and engagement of community	No community impacts	2. Initiate Information Disclosure and Grievance process of IEIA	For all construct-ion sites.	Beginning of project	Quarterly	No margin al cost[7]	PIU/SS	PIU
Government approvals	No negative impact	3. Notify DoE of subproject initiation to complete EA requirements, and obtain required project permits and certificates.	Entire subproject	Before construct-ion	As required	No margin al cost	PIU/DoE	DoE

[6] Costs will be updated during detailed design phase.
[7] No marginal cost indicates that costs to implement mitigation are to be built into cost estimates of bids of contractors

Detailed designs of subproject,	Minimize negative environmental impacts	4. Work with DDSC[8] to complete detailed designs of the ABR septic system and other environmental improvements. Ensure the following measures are included: a) identification of spill management prevention plans, and emergency response plans for all construction sites; b) no disturbance or damage to cultural property and values; c) minimal acquisition of agriculture and forested lands; d) locate aggregate burrowed 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 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. h) with quick ocular assessment on the soil type and properties, as well as land area size,	Final siting	Before construction initiated	Once with detailed designs documents	No marginal cost	DDSC	EA/PIU

[8] DDSC is detailed design and supervision consultant to be determined

		determine whether or not there is enough land area for WWTF set-up or else, expand the area to be reclaimed along the beach front. i) finalize disposal site for sludge from WWTF						
Update EMP	Positive environ-mental impacts	5. Confirm the appropriate location and positioning of the WWTF tanks and infiltration gallery with DoE and DPWT 6. Confirm absence of valued ecological or cultural resources in the affected area. 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, e.g air quality and smell, open wells, immediate coastal waters ecology, etc.,. 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.	All sites	Before construction initiated	Once with detailed designs docu-ments		DDSC	EA/PIU
CEMP to include detailed comprehensive subplans	Positive impact	11. Review and adopt the CEMP with the following subplans: a) Construction drainage; b) Erosion; c) Noise and Dust; d) Contaminated Spoil Disposal; e) Solid and Liquid Waste Disposal; f) Construction & Urban Traffic; g) Utility and Power Disruption; h) Worker and Public	All affected areas	Before construction initiated	Once with detailed designs documents	No marginal cost	DDSC	PIU & contractors

		Safety; i) Tree and Vegetation Removal and Site Restoration; j) Construction Materials Acquisition, and Transport, & Storage and k) Cultural Probability Discovery.						
Create awareness of physical cultural resources in the area	No negative environ-mental impact	12. DoT to review potential locations of physical cultural resources (PCR), and explain possible PCR to contractors and DDSC	All subproject areas	Before construct-ion begins	Once	No margin al 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 burrowed pits and disposal areas for construction and hazardous waste for subprojects, and obtain required permits.	Entire subproject	Before constructi on	As required	No margin al cost	PIU/D oE/ DAFF/ DPWT	PIU
UXO survey, & removal	Injured worker or public	14. Ensure the Government is consulted on UXO, and suspicious areas to be inspected where it is necessary	All construct-ion sites.	Beginning of subproject	Once	See Monitor -ing Plan below	EA/PI U	Governm ent
Obtain & activate permits and licenses	Prevent or minimize impacts	15. Contractors to comply with all statutory requirements set out by Government for the use of construction, and operation equipment and plants, such as concrete batching.	For all construct-ion sites	Beginning of construct-ion	Once	No margin al cost	DDSC	PIU & contracto rs
Develop bid documents	No negative environ-mental 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 bid documents that contractor must have experience with implementing EMPs, or provide staff with the experience.	All subproject areas	Before construct-ion begins	Once for all tenders	No margin al cost	DDSC	PIU
Capacity development	No negative environ-mental impact	18. Develop and schedule training plan for (PIU/SS) to be able to fully implement EMP, and to manage	All subproject areas	Before constructi on begins	Initially, refresher later if needed	No margin al cost	DDSC	DDSC

		implementation of mitigation measures by contractors. 19. Create awareness and training plan for contractors who will implement the mitigation measures.						
Recruitment of workers	Spread of sexually transmitted disease	20. Use local workers as much as possible thereby reducing number of migrant worker	All work forces.	Through-out construct-ion phase	Worker hiring stages	No marginal cost	EA/PIU	Contractor's bid documents
Construction Phase of Environmental Improvements at Crab Market								
Implement EMP and sub-plans	Prevent or minimize impacts	21. Present and adopt the updated EMP together with the CEMP featuring the individual management sub-plans for different potential impact areas that are completed in pre-construction such as: a) Construction drainage; b) Erosion; c) Noise and Dust; d) Contaminated Spoil Disposal; e) Solid and Liquid Waste Disposal; f) Construction & Urban Traffic; g) Utility and Power Disruption; h) Worker and Public Safety; i) Tree and Vegetation Removal and Site Restoration; j) Construction Materials Acquisition, and Transport, & Storage and k) Cultural Probability Discovery by chance sub-plan guidance on the succeeding items below).	For all construct-ion sites	Beginning of construct-ion	Once	No marginal cost	DDSC	PIU & contractors
Obtain and activate permits and licenses	Prevent or minimize impacts	22. 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 construct-ion sites	Beginning of construct-ion	Once	No marginal cost	DDSC	PIU & contractors
Worker camps	Pollution and social problems	23. Locate workers' camps away from human settlements. 24. Ensure adequate	All worker camps	Through-out construct-ion phase	Monthly	No marginal cost	DDSC / PIU	contractor

		housing and waste disposal facilities including pit latrines and garbage cans. 25. A solid waste collection program must be promoted, established and implemented that will maintain a clean workers camps 26. Locate separate pit latrines for male and female workers away from workers' living and eating areas. 27. A clean-out or infill schedule for pit latrines must be established and implemented to ensure working latrines are available at all times. 28. Workers camps must have adequate drainage. 29. Local food should be provided to worker's camps. Guns and weapons are not allowed in 'the camps. 30. Transient workers should not be allowed to interact with the local community. HIV Aids education should be given to workers. 31. Camp areas must be restored to original condition after construction completed.						
Training and capacity building	Prevent of impacts through education	32. Implement training and awareness plan for PIU/SS and contractors.	PIU office, construct-ion sites	Beginning of construct-ion	After each event	No margina l cost	DDSC	DDSC/ PIU
Implement construction materials acquisition, transport, and storage sub-plan	Pollution, injury, increased traffic, disrupted access	33. All burrowed pits and quarries should be approved by DoE. 34. Select pits and quarries in areas with low gradient and as close as possible to construction sites. 35. Required aggregate volumes must be carefully calculated prior to extraction to prevent wastage. 36. Pits and quarries	For all construct-ion areas.	Through-out construct-ion phase	Monthly	No margina l cost	DDSC /PIU	contract or

		should not be located near surface waters, forested areas, critical habitat for wildlife, or cultural sites with historical or spiritual values. 37. If aggregate mining from fluvial environments is required, small streams and rivers should be used, and preferably dry alluvial plains 38. All topsoil and overladen decomposing materials that were removed should be stockpiled for later restoration. 39. All burrowed pits and quarries should have a fence perimeter with signage to ensure public safety,. 40. Used pits and quarries should be dewatered and restored as much as possible using original overburden and topsoil. Likewise, permanent fences must be installed with signage to ensure public safety. 41. Unstable slope in within/adjacent to the quarry or pit caused by ground scraping or excavation should be rehabilitated with deep rooting trees. 42. Carefully determine and schedule how soil materials and massive elements are being extracted from burrow pits and rock quarries and transported, handled & stored on-sites. 43. Carefully determine and schedule how fabricated materials such as steel, wood structures, and scaffolding will be transported and handled.						

		44. All aggregate loads in trucks should be covered.						
DBST production, and application	Air pollution, land and water contami-nation, and traffic & access problems,	45. Piles of aggregates on-sites should be used/or removed the soonest, or at least be covered and placed in no traffic areas 46. Stored DBST materials should be kept at a certain distance from all human activity and settlements, and cultural (e.g., schools, hospitals), and ecological receptors. Bitumen production and handling areas should be isolated. 47. Contractors must be well trained and experienced on the chemical content, handling, and application of bitumen. 48. All spills should be cleaned immediately and handled as per hazardous waste management plan, and according to Government regulations. 49. Bitumen should only be spread on designated road beds, not on other areas near or in any surface waters, or close to any human activities. 50. Bitumen should not be used as a fuel.	For all construct-ion areas.	Through-out construct-ion phase	Monthly	No margina l cost	DDSC & PIU	contract or
Implement spoil manage-ment sub-plan	Contami-nation of land and surface waters from excavated spoil, and construct-ion waste	51. Sites for uncontaminated garbage and litters from various sources must never be located near to adjacent surface waters. Designated sites must be clearly marked and identified. 52. Any organic or fresh spoil from any source must not be disposed in sloping land, near cultural sites,	All excavation areas	Through-out construct-ion phase	Monthly	See Monitor-ing Plan for contami-nated soil analyse s	DDSC & PIU & DoE	contract or

		ecologically important/sensitive areas of high value. 53. If possible, spoils should be used at the other construction sites, or be disposed in quarries or burrowed pits. 54. The type, estimated volume, and source of disposed spoil must be recorded. 55. Contaminated spoil disposal procedures must follow Government regulations including handling, transport, treatment (if necessary), and disposal. 56. Suspected contaminated soil must be tested, and disposed in designated sites identified as per Government regulations. 57. Before treatment or disposal of contaminated spoil, they must be covered with plastic and isolated from all human activity.						
Implement solid and liquid construction waste sub-plan	Contami-nation of land and surface waters from construct-ion waste	58. Management of solid and liquid waste from construction will follow Government regulations, and will cover, collection, handling, transport, recycling, and disposal of waste 59. Disposal areas for solid and liquid waste must be determined by the Government. 60. Disposed waste should be catalogued in terms of type, estimated weigh, and source. 61. Construction sites should have large garbage bins. 62. A schedule of solid and liquid wastes collection and disposal must be set	All construct-ion sites and worker camps	Through-out construct-ion phase	Monthly	No margina l cost	DDSC & PIU & DoE	contract or

		and followed to ensure that the construction sites are as clean as possible. 63. Solid waste should be separated and recyclables be sold to buyers in the community. <u>Hazardous Waste</u> 64. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow Government regulations. 65. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents) 66. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good condition far away from construction activity areas, all surface water, drinking sources , and cultural and ecological sensitive receptors. 67. All spills must be cleaned up completely with all contaminated soil being removed and handled with care.						
Implement noise and dust sub-plan	Dust Noise	68. Regularly apply wetting agents in exposed soil and construction roads. 69. Cover or keep from moist all stockpiles of construction items, and truckloads of aggregates. 70. Shorten the time that excavations and exposed soil are left open. Backfill immediately after work is completed. 71. As much as possible, restrict working time between 07:00 and 17:00. In particular are activities, such as	All construct-ion sites.	Fulltime	Monthly	No margina l cost	DDSC & PIU	contract or

		pile-driving. 72. Maintain equipment in good working condition 73. Replace unnecessarily noisy vehicles and machinery. 74. Turn off vehicles and machinery when not in use. 75. 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	76. Develop carefully a plan of days and locations where power outages in utilities and services will occur, or are expected. 77. Contact local utilities and services with schedule, and identify possible contingency back-up plans for power outages. 78. Contact affected community to inform them of planned power outages. 79. Try to schedule all power outages during low use time such between 24:00 and 06:00.	All construct-ion sites.	Fulltime	Monthly	No marginal cost	DDSC & PIU & Utility company	contractor
Implement tree and vegetation removal, and site restoration sub-plan	Damage or loss of trees, vegetation, and landscape	80. Contact provincial forestry department for advice on how to minimize damage on trees and vegetation 81. Restrict tree and vegetation removal within Right Of Way (ROW). No tree cutting near Kep national park. 82. Within ROW, minimize removals, and install protective physical barriers around trees that do not need to be cut. 83. All ROW have to be re-vegetated and landscaped after construction is completed. Consult provincial forestry department to	All construct-ion sites.	Beginning and end of subproject	Monthly	No marginal cost	DDSC & PIU	contractor

		determine the most successful restoration strategy and techniques. Three (3) seedlings should be replanted for each tree that has to be removed						
Implement erosion control sub-plan	Land erosion	84. Elastic sheet layer should be placed around all excavations and earthwork areas. 85. Earth moving and removal works should be conducted during dry periods. 86. Maintain a stockpile of topsoil for immediate site restoration following the backfilling process. 87. Protect exposed or cut slopes with vegetative cover, and follow a slope stabilization measures. 88. Re-vegetate all soil exposure areas immediately after civil work is completed	All construct-ion sites	Through-out construct-ion phase	Monthly	No margina l cost	DDSC & PIU	contract or
Implement worker and public safety sub-plan	Public and worker injury, and health	89. Proper fencing, protective barriers, and buffer zones should be provided around all construction sites. 90. Sufficient signage and information disclosure should be placed in hazardous and blind locations in all sites. Also, site supervisors and night guards shall be deployed in critical sections of the working area. Worker and public safety guidelines of Government should be followed. See draft Occupational Safety & Health Master Plan of Ministry of Labor and Vocational Training. 91. Population near blast areas should be notified 24 hours ahead, and	All construct-ion sites.	Fulltime	Monthly	No margina l cost	DDSC & PIU	contract or

		evacuated well before operation. Accepted Government blast procedures and safety measures implemented. 92. 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 Kep. 93. Standing water that serves as breeding ground for disease vector should be eliminated 94. Worker education and awareness seminars for construction hazards should be given at the beginning of the construction phase, and on a monthly schedule. A construction site safety program should be developed and distributed to workers. 95. Appropriate safety clothing and footwear should be mandatory for all construction workers. 96. Adequate medical services must be on site or nearby all construction units. 97. Safe and clean drinking water must be provided in all construction units. 98. Sufficient lighting is used during necessary night work. 99. All construction sites should be examined daily to ensure high certainty of safety						
Beachfront reclamation for the WWTF area	Danger of seepage and caving in of the excavated burrowed pit for the	100. Use concrete massive fill in materials as ground foundation for the WWTF 101. Build a strong elevated concrete and well sealed	Reclama-tion area	Prior to the setting up of the WWTF	Prior to the setting up of the WWTF	Require s addition-al huge amount around 100,000	DPW T	Contrac tor

	WWTF set up	embankment along the waterline to protect the WWTF from high tide backflow 102. Use special kind of water proof sealant to prevent water table contamination and seepage leaking into the WWTF system						
Civil works	Degrada-tion of water quality & aquatic resources	103. Protective, elastic sheet layer should be placed between all earthworks and nearby surface waters. 104. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. 105. Earth moving and excavation works should be conducted during dry periods. 106. All construction fluids such as oils, and fuels should be stored and handled well away from surface waters. 107. No waste of any kind is to be thrown in surface waters. 108. No washing or repairing of machinery near surface waters. 109. Pit latrines should be located far away from surface waters. 110. No unnecessary earth moving or excavation works in or adjacent to water courses. 111. No aggregate mining activities in rivers or lakes. 112. All irrigation canals and channels should be protected in same way as rivers, streams, lakes	All construct-ion sites	Through-out construct-ion phase	Monthly	No margina l cost	DDSC & PIU	contract or
Civil works	Degradatio n of terrestrial resources	113. All construction sites should be located away from forested or plantation areas as much as possible. 114. No unnecessary cutting of trees.	All construct-ion sites	Through-out construct-ion phase	Monthly	No marginal cost	DDSC & PIU	Contrac tor

		115. All construction fluids, such as oils, and fuels should be stored and handled far away from forested and plantation areas. 116. No effluent or liquid waste of any kind is to be spilled on the ground or in forests/plantations.						
Civil works	Temporary and slight to heavy interruption of business operation	117. Public awareness campaign for tourists & the business sector re: temporary inconvenience expected at the market and restaurants 118. Setting up of temporary market just few meters away from the construction area	Market and restaurants	Through-out construct-ion phase,	While the WWTF & drainage system are being construct-ed	No marginal cost	DDSC & PIU	Contractor
Implement construction and urban traffic sub-plan	Traffic disruption, accidents, public injury	119. Schedule construction vehicle movement during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights. 120. Post speed limits, and create exclusive construction vehicle roads or lanes. 121. Inform community of location of construction traffic areas, and provide them with directions on how to best co-exist with construction vehicles on the specified roads. 122. Demarcate additional locations where pedestrians can develop road crossings away from construction areas. 123. Increase road and pathway lighting.	All construct-ion sites	Fulltime	Monthly	No marginal cost	DDSC & PIU	contractor
Rain water canal construction and implement a-tion of	Alteration of the natural flow of run-off water and	124. Re-route run-off water main passage away from the WWTF set up area towards the sea front 125. Provide adequate	All areas with surface waters	Design & construct-ion phases	Monthly	No marginal cost	DDSC & PIU	Contractor

temporary construction drainage sub-plan	existence of temporary drainage & flood storage	short-term drainage away from construction sites to prevent ponding and flooding. 126. Manage not to allow burrowed pits and quarries be filled with water by pumping periodically and discharge it to the infiltration areas or nearby water courses. 127. Install temporary storm drains or ditches for construction sites 128. Ensure connections among surface waters (ponds, streams) are maintained or enhanced to sustain existing storm water storage capacity. 129. Protect surface waters from silt and eroded soil.						
Civil works: cultural object probability discovery sub-plan	Damage to cultural property or values, and by chance discovery of historical material objects	130. As per detailed designs, all civil works should be located away from cultural property and values. DoT identified potential sites and types of Physical and Cultural Resources (PCR) in pre-construction phase should be considered in choosing location for civil works. 131. By chance discovery of historical relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for such element of surprise. 132. Upon discovery by chance of cultural and historical objects, all work should stop immediately. Then look for more untouched remains, and notify PIU to determine if the discovered objects are valuable. The	All construct-ion sites	At the start , and through-out constructi on phase	Monthly	No margina l cost	DDSC & PIU	contract or

		Culture Section of DoT should be notified by telephone if discovered objects are valuable. 133. Work at the discovery by chance site will remain at halt until DoT allows work to resume and continue.						
Landscaping the WWTF Area with ornamental trees and green vegetation	Positive: provides air quality condition-er, wind break, shade and for aesthetics	134. Plant ornamental trees and flowering vegetation along the peripheral boundaries of the WWTF area with *Kibatalia gitinggensis*, *Plumeria acuminate, Canna indica)* etc.,	WWTF and Infiltration Area Peripheral Boundary					
Post-construction Operation of Improved Environmental Facilities at Crab Market								
Operation of WWTF septic system	Land and surface water pollution	135. Ensure WWTF tanks in good working condition.	Market area	Though-out	Bi-annual	O&M	DPWT	
Operation of WWTF septic system	Land and surface water pollution	136. Ensure sludge is pumped from WWTF tanks regularly, and be trucked out to MOE-approved disposal site, following proper procedures	Market area to disposal site	Though-out	Bi-annual	O&M	DPWT	
Operation of WWTF septic system	Ground-water and water pollution	137. Ensure sufficient land area and soil depth available for infiltration gallery of WWTF system.	Market	Periodi-cally	Bi-annual	O&M	DPWT	
Operation of WWTF septic system	Land and water pollution	138. Implement engineering and management systems to prevent and manage emergency septage spills and leakage situations	WWTF system and MOE septage disposal site	Though-out	Bi-annual	O&M	DPWT	
Operation of WWTF septic system	Worker and public injury	139. Educate workers in workplace safety.	WWTF system and MOE septage disposal site	Though-out	Bi-annual	O&M	DPWT	
Operation of WWTF septic system	Emer-gency spills and untreated wastewa-ter discharge	140. Regularly review accident prevention management plan, and test emergency response plan for equipment failure& spills.	WWTF system and MOE septage disposal site	Periodi-cally	Bi-annual	O&M	DPWT	
Water quality analysis of	Keep track of possible	141. Conduct a yearly water quality analysis to determine the pH,	WWTF system and					

underground water	contami-nants affecting the water table	salinity, conductivity, nitrate, phosphate content and other chemicals that may potentially permeate the water table,.(Effluent water quality BOD <30 mg/l)	market area and vicinity				
Discharge treated waste water from the WWTF to the sea	Potential adverse effect on sea water quality of the	142. Conduct water quality analysis of treated waste water coming from the WWTF to determine the nutrient level, fecal or e-coli level, pH, Total Suspended Solids, phosphates, nitrates, 143. Conduct macro-benthic assessment once a year to determine the changes in the composition and population of byvalves, anthropods, crustaceans and the substrates as food for marine life	Intertidal flat where the treated waste water is being discharged	Regularly	Once a year	1,000	PDoE
Implement an Integrated Solid Waste Manage-ment at the Crab Market and vicinity	Positive: ensure sanitary, clean and safe immediate surround-ing	144. Practice waste segregation & recycling 145. Provide adequate solid waste bins along the streets within the market premise and vicinity 146. Daily collection of solid waste 147. Set up a Material Recovery Facility away from the Crab Market 148. Continuous education and information drive on solid waste management 149. Impose local ordinance for the adoption of no littering policy as well as the strict observance of solid waste segregation 150. Impose fines and penalties for violators 151. Organize community-based solid waste monitoring team	Market and vicinities	Regularly	daily	1,000	PDoE

MONITORING PLAN

31. The environmental monitoring plan for the EMP is summarized in Table 6. The monitoring plan focuses on all three phases (*pre-construction, construction, post-construction operation*) of the subproject and consists of environmental indicators, the sampling locations 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.

32. An investigation of the permeability and thickness of the soils and the depth of the water table at the crab market is required during the preconstruction phase. The nearness of domestic wells to the crab market also needs to be determined (see monitoring plan below).

E. Environmental Standards for Subproject Components

33. 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.

34. An independent environmental monitoring consultant (EMC) will be required to implement the environmental monitoring program. The EMC will be responsible for the sampling of environmental parameters that must be analyzed in a laboratory. The safeguards specialist and EO will coordinate with the EMC. The DDSC/PIU will provide logistical support to the EMC where necessary for the implementation of environmental monitoring plan.

35. After construction phase is completed the performance of the improved environmental facilities at the crab market should be monitored by the DPWT (refer to Table 7). The natural environment of the crab market area should be monitored by DOE with assistance from the DOT.

F. Performance Monitoring

36. 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 subproject. Indicators of major components of the environment that will be affected primarily by the construction phase are drawn from the mitigation and monitoring plans as presented in Table 7.

REPORTING

37. Regular reporting on the implementation of mitigation measures and on monitoring activities during construction phase of the subproject is required. Reporting is the responsibility of PIU and should be conducted in conjunction with regular meetings with stakeholders as part of the continuation of stakeholder communications. The mitigation and monitoring plans (There is the need to coordinate work activities with the restaurant owners and other related business operators at the Crab Market to minimize possible disruption of their routine business activity during the construction phase

38. Table 55 and Table 6) summarize the proposed timing of reporting. A report on environmental monitoring and implementation of the EMP 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 DDSC. The PIU report will also be sent to the DOE and consolidated by the PCU for transmission to ADB. 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 prepared by the EO, PIU, and EMC will be developed by the ES of the DDSC at detailed design.

Table 6: Environmental Monitoring Plan

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	**Location**	**Means of Monitoring**	**Frequency**	**Reporting**	**Responsibility** Supervision / Implementation		**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 of the crab market	Crab market area	Original field work, community consultations	Once	Once	EA/PIU/	Environmental Monitoring Consultant	$1,500
Groundwater quality and depth (e.g., As, Pb, Fe, Cd, Cu), E-coliform, TDS, H_2S, N02, NH_3, TFe, other nutrient forms of N & P. Location of nearest domestic wells	Crab market area	Original data collection from boreholes	Once	Once	EA/PIU	Environmental Monitoring Consultant	$10,000
Soil permeability and thickness	Crab market area	Original data collection from boreholes	Once	Once	EA/PIU	Environmental Monitoring Consultant	$5,000
A) Air quality: dust, CO, NOx, SOx, noise, wind, temperature, and vibration levels B) Near shore 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	Crab market area	Using field and analytical methods approved by DoE.	One day and one night measurement during rainy & dry seasons.	One baseline supplement report before construction phase starts	PIU	Environmental Monitoring Consultant	A) $1,500 B) $3,000
Inventory of present and past land uses that could cause contaminated soil.	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by DoE.	Once	Once	PIU	Environmental Monitoring Consultant	$500
Construction Phase of Environmental Improvements at Crab Market							
Loose soil structure and no bedrock parent material at the		Ocular inspection with ground and soil permeability testing	Prior to the installation of the	Once	PIU	Environmental Monitoring Consultant	No marginal cost

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	**Location**	**Means of Monitoring**	**Frequency**	**Reporting**	**Responsibility** Supervision / Implementation		**Estimated Cost (USD)**
					Supervision	**Implementation**	
proposed reclamation area at the nearshore (for the WWTF set-up)	Northside section of the market area		WWTF set-up				
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 Consultant	$1,000
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, wind, temperature, and vibration levels B) Nearshore 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 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	A & B): Baseline sites of pre-construction phase. 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	A – C: Using field and analytical methods approved by DoE. 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	(A – B): Quarterly during construction periods Daily visual records C) Once at start of excavations D) Monthly E) Continuous public input F) Continuous	Monthly	(A - D):		
					PIU	Monitoring Consultant	A & B: $5,000/yr C: $1,200/yr D: $0
					(E & F) & daily observations:		
					EA/PIU	contractor	E: $500/yr F: $0
Operation of Completed Environmental Facilities at Crab Market							
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/yr

ENVIRONMENTAL EFFECTS MONITORING						
Environmental Indicators	**Location**	**Means of Monitoring**	**Frequency**	**Reporting**	**Responsibility** Supervision / Implementation	**Estimated Cost (USD)**
					Supervision / **Implementation**	
Incidence of flooding	Crab Market Area	Surveys, public complaints	Seasonal for 5 years	Seasonal	DPWT	$500/yr
Incidence of garbage and litter	Crab Market Area	Visual inspection	Weekly	Quarterly	MoT	O&M
Groundwater quality at market (e.g., As, Pb, Fe, Cd, Zn), coliform bacteria, TDS, H_2S, BOD_5, TN, NH_3, TP, other nutrient forms of N & P	From sampling sites of pre-construction phase	Using field and analytical methods approved by DoE.	Biannually	Biannually	DPWT/DoE	$3000/yr
Nearshore water quality at crab market: 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	At sampling sites of pre-construction phase	Using field and analytical methods approved by DoE.	Biannually	Biannually	DPWT/DoE	$2000/yr
Composition and abundance of macro-benthic fauna, e.g., bivalves (clams), gastropods (snails), polychaete worms (saltwater segmented worms), crustaceans (crabs, shrimps and their relatives) and gobiid fish, etc.,	Inter-tidal flat within 50 meters from where the treated waste water is discharged	Macro-benthic sampling	Annually	Annually	PDoE	$1,000
Litter free public area and strict compliance of systematic solid waste segregation, collection and recycling	Crab market and immediate vicinity	ocular survey and inspection	Daily	Daily	PDoE	$1,000

Table 7: Performance Monitoring Indicators for Improvements at Crab Market

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 IEIA and new stakeholders convened for follow-up consultation & to introduce grievance mechanism	Minutes of meeting and participants list
EMP	Updated EMP	All stakeholders contacted during IEIA re-contacted for follow-up consultation	EMP
Bid Documents	Requirements of EMP (CEMP)[9]	EMP appended to bidding documents with clear instructions to bidders for CEMP	Bid documents
Training of PMU/PIU/ safeguards specialists	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
Protection of groundwater	Depth and risk of exposure to WWTF tanks and filtration	Safe WWTF design	Pre-construction GW and soils study
Construction Phase			
All subproject areas	Critical habitat, rare or endangered species *if present*	All present critical habitat and rare and endangered species unharmed	Monitoring by EMC[10]
Reclaimed area for WWTF foundation/lateral reinforcement stability and ground soil impenetrability	Strongly and heavily built ground foundation and lateral reinforcement of the WWTF with no seepage at all sides	No caving in or loosely embedded fill in materials as ground foundation, as well as no sign of seepage surrounding the entire WWTF set up	Contractor and EMC Consultant
Groundwater quality	Heavy metals, coliform bacteria, TDS, H_2S, BOD_5, TN, NH_3, TP, nutrient forms of N & P[11]	Government environmental standards and criteria met	Monitoring by EMC
Coastal water quality	TSS, DO, BOD, COD, pH, oil & grease, nutrient forms of T & N, metals (Pb, Fe, As) [12]	Government environmental standards and criteria met	Monitoring by EMC
Air quality	SOx, NOx, dust, CO, noise, vibration[13]	Levels never exceed pre-construction baseline levels	EMC & contractor monitoring reports,
Soil quality	Solid & liquid waste	Rigorous program of procedures and rules to collect and store all waste	Contractor and EMC monitoring reports

[9] Contractor Environmental Management Plan developed from EMP in contractor bidding document
[10] Environmental Monitoring Consultant hired to assist implementation of Environmental Monitoring Plan
[11] See Annex 4 for environmental standards for analyses by laboratory in Phnom Penh
[12] Footnote 11
[13] Footnote 11

Major Environmental Component	Key Indicator	Performance Objective	Data Source
		from construction camps and sites practiced.	
Hazardous materials and waste	Oil, gasoline, grease, alum, chlorine and soda	Rigorous program of procedures to manage and store all waste from construction camps and sites practiced.	Contractor and EMC monitoring reports
Public and worker safety	Frequency of injuries	Adherence to Government policy and site-specific procedures to prevent accidents[14]	Contractor reports
Cultural property	Incidence of damage, or complaints	No valued cultural property, or unearthed valuable relic is harmed in any way	Public input, contractor reports, public input, EMC reports
Traffic	Frequency of disruptions & blocked roadways	Disruptions, stoppages, or detours are managed to absolute minimum.	Public input, contractor reports, EMC reports
Operation of Completed Crab Market Improvements			
Traffic safety in market area	Frequency of accidents	No increase in pre-construction frequency	DPWT
Groundwater quality	Heavy metals, coliform bacteria, TDS, H_2S, BOD_5, TN, NH_3, TP, nutrient forms of N & P[15]	Government environmental standards & criteria met	D/MOE
Coastal water quality at the market site	TSS, DO, BOD, COD, pH, oil & grease, nutrient forms of T & N, metals (Pb, Fe, As)[16]	Government environmental standards & criteria met	D/MOE
Treated waste water coming from the WWTF	Effluent water quality: BOD <20 mg/l T-N < 20mg/l	Government environmental standards and criteria met	D/MOE
Composition and abundance of macro-benthic fauna	diversity and population count of bivalves (clams), gastropods (snails), polychaete worms (saltwater segmented worms), crustaceans (crabs, shrimps and their relatives) and fish, etc.,	no subsequent alteration of macro-benthic fauna composition, and decreased in abundance as a result of the discharged treated waste water to the sea	PDoE
Air Quality	Maintained fresh and normal air smell within the WWTF set up and immediate vicinity	No foul or obnoxious odor resulting from the WWTF	PDoE

[14] MLVT's new Occupational Safety & Health Master Plan needs to be applied , *or* IFC World Bank EHS (2007)
[15] See Annex 4 for environmental standards
[16] Footnote 11

ESTIMATED COST OF EMP

38. 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. Appendix 6 presents the government costing for laboratory analyses.

39. The preliminary costs for the implementation of the EMP for the Crab market improvements in Kep are summarized in 8. These costs include per diem technician fees. Note that a margin for cost uncertainty has been added to the total EMP cost.

40. An estimated budget of $15,000 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 DDSC in conjunction with the PIU during the pre-construction phase.

Table 8: Estimated Costs for Environmental Monitoring Plan

Activity Type	Estimated Cost ($)
Pre-construction Phase	
Updating Environmental Baseline	
cultural receptors	$1,500.00
Groundwater and soils study	$15,000.00
environmental quality	$5,000.00
Construction Phase	
environmental quality	$14,400.00
structural safety (reclamation area)	
public consultation	$1,000.00
Post-construction Operation Phase	
environmental quality	$37,000.00
public input	$ 2,500.00
Additional Civil Works Improvement: Consultation and Monitoring	$500,00
Total	**$76,500.00**

EMERGENCY RESPONSE PLAN

41. The contractor must develop emergency or accident response procedures during construction. In the operational phase the operator/civil authorities will have responsibility for any emergencies or serious accidents (Table 9). 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.

42. 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 / provides assistance during EERT's response operations.
External Emergency Response Team	- Solves the emergency/accident
Contractor Resources	- Provide and sustain the people, equipment, tools and funds necessary to ensure Subproject's quick response to emergency situations. - Maintain good communication lines with the EERT to ensure prompt help response & adequate protection, by keeping them informed of Subproject progress.

43. 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.

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

45. 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

46. 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 accident rate of potential hazards are anticipated
iii) the arrangements for coordination and collaboration.

47. 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.

48. 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 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.

G. Alert Procedures

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

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

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

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

50. For an effective reporting/alerting of an emergency situation:

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

H. Emergency Response Situations

51. Table 10 and Table 11 suggest general procedures that will be contextualized during the detailed designing and will be contained 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 - 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 situation 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	• When alerting the EERT, ERTL will give the

Procedure	Remarks
applicable, emergency medical services.	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.

INSTITUTIONAL CAPACITY REVIEW AND NEEDS

51. Currently there is little experience and capacity for environmental assessment and management amongst national counterparts responsible for the implementation of the EMP i.e., DOT/PIU and DPWT in Kep province. The DDSC with assistance from the safeguards specialist of the subproject will develop and deliver training courses to the DOT/PIU and DPWT staff responsible for the implementation of the subproject. 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 EMC

52. There should be a Provincial Safeguards Officer to be hired or designated on concurrent position from the Provincial Tourism Office who will be a full-time member of the PIU and together with the contractor's EO should attend training courses as required. Costs for training should be included with costs for implementation of the EMP.

53. Training on the implementation of an EMP should address three 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 third area should provide training and raising awareness on solid waste and liquid waste management to the sellers at crab market.

54. This will be mainly carried out by the National Environmental Safeguard Specialist given the limited engagement time of the International Safeguard Specialist.

55. A separate Technical Assistance (TA) is needed for the conduct of UXO survey, detection and clearance, considering the needed service requires highly specialized knowledge and skill. (Refer to Appendix 7 for the TA Terms of Reference). Likewise, a separate TOR for the conduct of Macro-benthic Survey is shown in Appendix 8.

.

APPENDIX 1: ADB AIDE MEMOIRE (MAY 2, 2019) EXCERPT FOR ENVIRONMENTAL SAFEGUARD (KEP CRAB MARKET)

Attachment 6

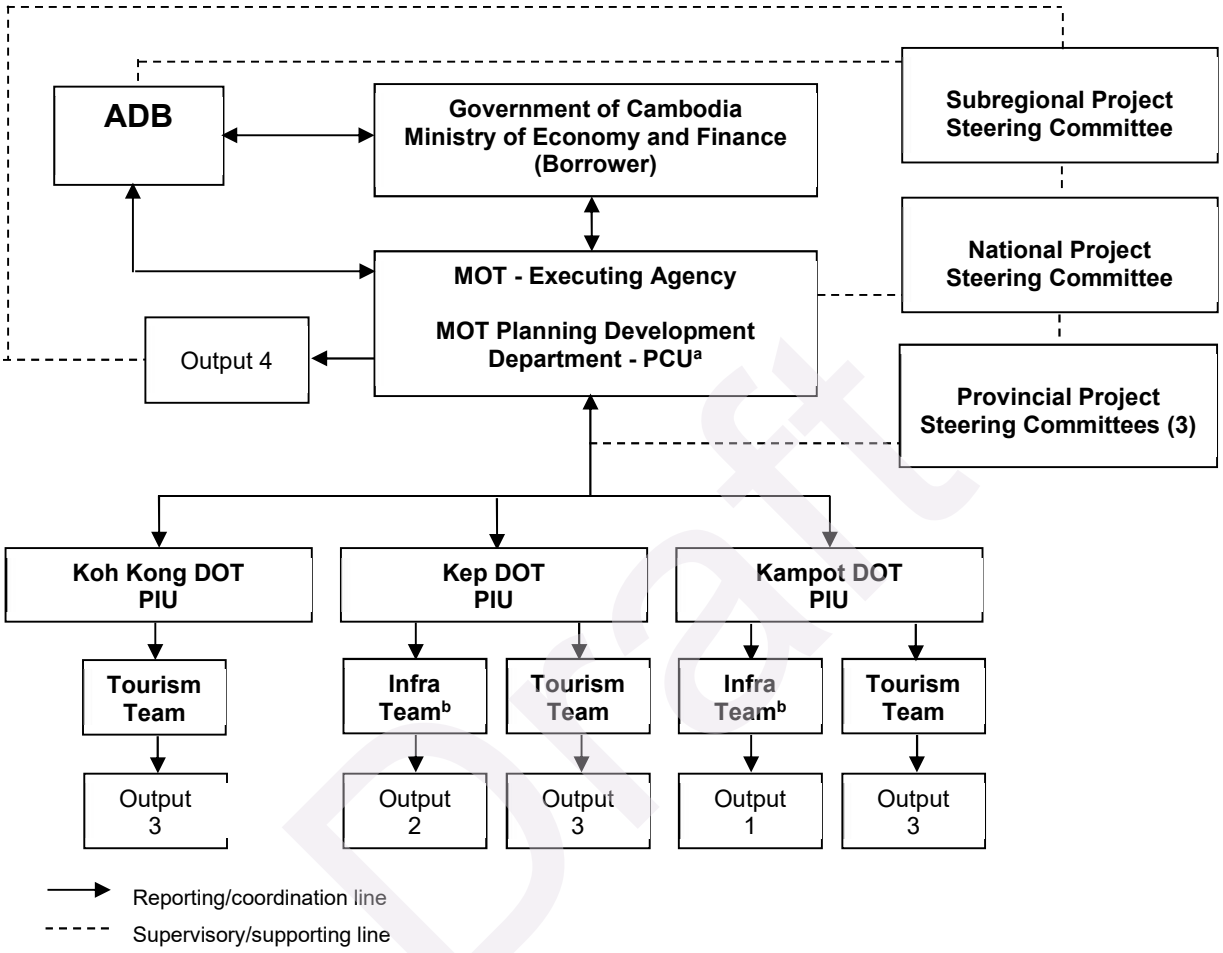
Excerpt Relating to ADB Instructions for Updating the EMP for the Kep Crab Market

Environmental Safeguards:
The Project is classified as Category B for environment. An Initial Environmental Examination (IEE) and the Environmental Management Plans (one for Kampot Pier Development, and one for Kep Crab Market Environmental Improvement) have been prepared and uploaded to the ADB website in March 2014. The IEE has been updated and approved in principles by the Ministry of Environment (MOE) on 12 March 2017 that the Ministry of Tourism (MOT) shall respect the Environmental Protection Contract No. 002 of MOT Letter dated 21 February 2017. The updated EMPs for Kep Crab Market Environmental Improvement and Kampot Pier Development subprojects have been uploaded on the ADB website in December 2017 and July 2018.

Kep Crab Market: The Mission visited Kep Crab Market Environmental Improvement and observed that the civil works of the treatment plant are completed and there is no significant issue on the implementation of the EMP. The Mission also interviewed several vendors near the subproject sites and they confirmed that there is no issue or complaints at this time. The Mission also visited the proposed additional works including improving/flooring curbside for walkway in front of the crab market and a crab boiled waste water collection pit at the crab market. *The Mission suggests that the EMP will require to be updated to include the additional works*. MOT shall also inform MOE before construction works commence regarding the additional works based on the MOE Letter dated 12 March 2017.

Source:
Aid Memoir, date 02 May 2019,
Detailed Inputs on Environmental Safeguards (by Sour Sethy and Sokha Ouk)

APPENDIX 2: MANAGEMENT ORGANIZATION OF THE PROJECT IN CAMBODIA



The Ministry of Economy and Finance and Ministry of Public Works and Transport will each appoint a coordinator to the PCU.

[b] Infrastructure team members are seconded from the DPWT.

ADB = Asian Development Bank; DOT= Department of Tourism; Infra = infrastructure; MOT = Ministry of Tourism; PCU = project coordination unit; PIU = project implementation unit.

APPENDIX 3: KEY MANAGEMENT UNITS' RESPONSIBILITIES FOR EMP IMPLEMENTATION

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

EMP Implementation organizations	Roles and Responsibilities
	➢ Prepare quarterly reports on EMP implementation for PCU ➢ Coordinate with DDSC 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
Detailed Design & Supervision Consultant (DDSC)	➢ Completes detailed designs of subprojects with PIU ➢ Update EMP to meet final detailed designs of subprojects ➢ Supervises and assists PIU with contractor management ➢ Provides technical advice and support when needed to PIU and 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 Consultant (EMC)	➢ Implements environmental sampling for EMP ➢ Conducts laboratory analyses of environmental quality samples from field sampling ➢ Prepares periodic monitoring reports for PIU
Environmental Officer (EO) of Contractor	➢ Implements the CEMP for the construction phase ➢ Maintains a daily log of environmental issues at the construction sites ➢ Prepares brief monthly summaries of mitigation activities and environmental issues at constructions site to PIU.
ADB	➢ Assists PCU through timely guidance at each stage of project implementation following agreed implementation arrangements ➢ Review all documents that require ADB approval ➢ Review of monitoring reports on EMP implementation to ensure EMP meets SPS (2009) ➢ Approval of procurement activities ➢ Periodic project review missions, a mid-term review and a completion mission for the project ➢ Ensuring compliance of all loan covenants ➢ Timely processing of withdrawal applications and release of eligible funds ➢ Ensuring compliance of financial audit recommendations ➢ Regularly updates project information disclosure on the ADB website

APPENDIX 4: ENVIRONMENTAL STANDARDS FOR CAMBODIA

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

Table a. 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 b: 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 c. 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

APPENDIX 5: GROUND WATER QUALITY ANALYSIS AT KEP CRAB MARKET

KINGDOM OF CAMBODIA

Ministry of Water Resources and Meteorology | **Nation Religion King**

Department of Hydrology and River Works

Water Quality Result

Sampling Owner	GMS Tourism Infrastructure for Inclusive Growth Project (RRP CAM 46293-00
Sampling Location:	Kep Crab Market
Sampling Sources:	Ground Water
Sampling Date:	14-Oct-16
Analysis Date:	14-18 October 2016

Items	Unit	Standard for Drinking Water (WHO)	Result
TSS	mg/l	1000	1.1
pH	pH unit	6.5 - 8.5	8.2
Ec	us/cm		3,210.0
TDS	mg/l	1000	1,512.0
SO4	mg/l SO4	250	279.3
Cl	mg/l Cl	250	384.6
Hardness	mg/l as CaCO3	500	1,134.5
Tot.Fe	mg/l Fe	0.3	0.07
NO2	mg/l NO2	0.1	0.00
Al	mg/l Al	0.2	0.02
Cr	mg/l Cr	0.05	0.04
F	mg/l F	1.3	0.65
As	mg/l As	0.1	0.00
Cu	mg/l Cu	1	0.09
Cd	mg/l Cd	0.005	0.00
E-Coli	MPN in100ml	0	0
Total Coloform	MPN in100ml	100	50

Phnom Penh, Date 10 October 2016

Department of Hydrology and River Works

Deputy Director

APPENDIX 6: GOVERNMENT COST NORMS FOR LABORATORY ANALYSES

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
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
81	Silicon(SiO2)	60,000	5ថ្ងៃ	
82	Chlorine(c1-)	28,000	3ថ្ងៃ	
83	NO_2 (តិនិត្យក្នុងពេល២៤ម៉ោង)	280,000	7ថ្ងៃ	
84	SO_2 (តិនិត្យក្នុងពេល២៤ម៉ោង)	280,000	7ថ្ងៃ	
85	TSP			
	តិនិត្យក្នុងពេល1ម៉ោង	100,000	5ថ្ងៃ	
	តិនិត្យក្នុងពេល8ម៉ោង	200,000	5ថ្ងៃ	
	តិនិត្យក្នុងពេល២៤ម៉ោង	480,000	5ថ្ងៃ	
86	PM10			
	តិនិត្យក្នុងពេល1ម៉ោង	100,000	5ថ្ងៃ	
	តិនិត្យក្នុងពេល8ម៉ោង	200,000	5ថ្ងៃ	
	តិនិត្យក្នុងពេល24ម៉ោង	480,000	5ថ្ងៃ	
87	PM2.5			
	តិនិត្យក្នុងពេល1ម៉ោង	100,000	5ថ្ងៃ	
	តិនិត្យក្នុងពេល8ម៉ោង	200,000	5ថ្ងៃ	
	តិនិត្យក្នុងពេល24ម៉ោង	480,000	5ថ្ងៃ	
88	Noise	200,000	5ថ្ងៃ	
	តិនិត្យក្នុងពេល8ម៉ោង	60,000	5ថ្ងៃ	
	តិនិត្យក្នុងពេល24ម៉ោង	120,000	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	

APPENDIX 7: TERMS OF REFERENCE FOR UXO CLEARANCE OPERATOR

Contract			
Project	**Tourism Infrastructure for Inclusive Growth Project**		
Expertise	UXO Clearance Operator		
Source	Cambodian Mine Action Committee	**Category**	Independent

Important note: These Terms of Reference may be revised during implementation by the Client

Objective:
The main objective of the consultancy is to undertake a detailed UXO ground survey and clearance of the proposed subproject sites in Kep Crab Market and Kampot Pier Construction Site. The PCU/PIU needs the assurance to be provided by the consultant that a full UXO survey has been carried out to the said sites where the Project Contractor proposes to introduce massive earth filling and excavation works to build the foundation of the required infrastructure as specified in the civil works plan.

Tasks:
The Consultant will perform the following tasks:

1. Undertake a fully detailed survey of the two (2) subproject sites through the use of recognized ground UXO survey techniques,

2. Fully describe the methodology he proposes to use in carrying out the survey and detection of UXO presence, including the equipment to be used,

3. Carry out on daily basis the Safe Clearance or Rendering Harmless of UXO encountered, through the survey being conducted,

4. Establish a suitable area away from the center of population and commerce which will be suitable for the “Clearance” or “Rendering Harmless of UXO, following the consultation with the Provincial Development Committee (PPC), Cambodian Mine Action Committee,and Local Police Unit,

5. Familiarize himself/herself with the GMS Tourism Infrastructure for Inclusive Growth-CAMBODIA Project by reviewing existing documents and survey reports related to the said project,

6. Present ground survey result to the Head of the Police Unit, PPC, PIU and other affected stakeholders, and

7. Set up data base/log registration system of UXO encountered to be retained and managed by the Local Police Unit and the Ministry of National Defense.

Deliverables:
Before any survey work activities commence, the Consultant should provide full Risk Assessment and detailed Methods Statements within an overall “Health and Safety” work plan of how the survey will be undertaken, together with the required UXO clearance envisaged for all known types of Indochina War Ordinance used by the Americans, Chinese and Russians in the 70s.

1. Detailed information on how to clear any UXO where possible, by removal to land for safe disposal in designated safe keeping areas,

2. Programme showing a breakdown of the whole target area to be surveyed and cleared in terms of time and dates. This is to enable the public to be notified in advance through media information dissemination to ensure safety and minimal disturbance in their routine activities,

3. A full UXO Ground Survey and Resultant Clearance of targeted areas within the time frame agreed between the consultant and PCU. The survey is required to commence in Kep Crab Market on October__, 2016 and Kampot proposed pier area on November___, 2016.

4. Daily Survey Record sheets showing the coordinates of the targeted areas surveyed with UXOs encountered and resultant Clearance activity undertaken with precise spatial position and ground location,

5. On completion, the Consultant will provide a detailed written report (6 copies) related to the full survey carried out, including daily journal of activities undertaken together with detailed map showing the coordinates, types and sizes of all UXOs detected and cleared. A final written confirmation that all known UXOs disclosed by the survey work have been rendered harmless and safe is also required.,

6. Safe working practice guidelines relating to ground survey with minimum risk in an area where the presence of UXOs is known to exist and how to deal with an emergency situation resulting from the activity, and

7. Guidelines to provide awareness/identification of UXOs for ground survey, detection and clearing staff.

Qualifications and Skills

The successful applicant must have at least 10 years experience working in the area of UXO Survey techniques (including ground, underwater and Resultant UXO Clearance). It is expected that the Consultant will be able to demonstrate appropriate previous Military Training for undertaking this role. He/She must also be familiar with working in countries such as Cambodia, Laos, Vietnam and other countries with UXOs. He/She should be able to demonstrate experience in the following areas:

1. A “Safety First” working culture

2. Modern ground and underwater surveying techniques related to UXOs

3. Safe clearance and making UXO harmless detected during the course of the survey

4. Ability to solve variable problems in an isolated setting with limited technical resources available

APPENDIX 8: TERMS OF REFERENCE FOR MACRO-BENTHIC SURVEY

Contract			
Project	**Tourism Infrastructure for Inclusive Growth Project**		
Expertise	Wetland Ecologist/Marine Biologist		
Source	International	**Category**	Independent

Important note: These Terms of Reference may be revised during implementation by the Client

Objective:
The main objective of this consultancy is to undertake a detailed macro-benthic survey in the intertidal flats or nearshore where the treated waste water from the WWTF is being discharged, in particular, the Kep Crab Market area. The PCU/PIU needs the continuous periodic monitoring and assessment of the composition and abundance of the macro-benthic fauna as affected by treated waste water being drained into the sea.

Tasks:
The Consultant will perform the following tasks:

1. Conduct macro-benthic sampling. It should be done during low tide (preferably at the lowest low tide) and at least once a month.

2. Establish plots for vegetation sampling for macro-benthos using a 0.5m x 0.5m (0.25 m2) quadrat. A minimum of three quadrat will be sampled per vegetation plot. Location of the quadrats shall be: one at the seaward periphery, one at the center, and one at the landward periphery for each circular plot. The location of each quadrat shall be marked using handheld GPS for mapping purposes.

3. Collect soil samples for each quadrat at a depth between 25 and 30cm using a corer or spade. The soil samples must be placed in a 0.5-mm sieve and rinsed with water immediately after collection. All organisms that are retained in the sieve must be collected and placed in plastic bottles or Ziploc bags with ethyl alcohol. Each bottle or Ziploc bag shall be labeled as follows: Location, Transect No., Quadrat No., and Plot No

4. Conduct counting and identification of the epifauna for each quadrat to the lowest taxonomic rank.

5. Collect reference samples to verify taxonomic identifications. High definition photographs of the quadrat and associated organisms must be taken. For macro-fauna, photographs of the whole organism must be taken; macro shots of the head/oral region, aperture, segmentations, whorls and other key structures must also be taken for identification.

6. Measure the key features of each identified fauna using a caliper, ruler, or Image J software. For microfauna, photographs shall be taken using a camera fitted in the dissecting microscope.

7. Conduct post-processing of the photos by using a digital image editor (e.g. Photoshop, GIMP, Photofiltre). Reference collections with tissue must be preserved in ethanol or diluted formalin. For molluscan shells, samples must be stored in dry plastic or paper boxes.

8. Establish a data base on the collected, identified, counted and measured fauna as benchmark for continuous monitoring overtime.

Deliverables

1. List of macro-benthic fauna with the associated vegetation composition
2. Inventory report to include fauna composition, distribution, abundance and status
3. Photo documentation
4. Survey Report

Qualifications and Skills

The successful applicant must have at least 10 years experience doing wetlands assessment, especially in mangrove forest and coastal waters, and marshland. He/She must have strong background in wetland or marine ecology combined with fishery.