

Initial Environmental Examination

February 2022

Cambodia: Second Greater Mekong Subregion Corridor Towns Development Project

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

Prepared by Ministry of Public Works and Transport for the Asian Development Bank. This is an updated version of the draft originally posted in October 2021 available on <https://www.adb.org/projects/documents/cam-46443-002-iee-1>.

ABBREVIATIONS

ADB	-	Asian Development Bank
AP	-	Affected people
BOD	-	Biological Oxygen Demand
C-EHS	-	Contractor Environmental, Health and Safety Officer
COD	-	Chemical Oxygen Demand
CSC	-	Construction Supervision Consultant
DED	-	Detailed Engineering Design
EHS	-	Environmental, Health and Safety
EMP	-	Environment Management Plan
ESC	-	Environment Safeguards Counterpart
ESO	-	Environment Safeguards Officer
GMS	-	Greater Mekong Subregion
GPS	-	Global Positioning System
GRC	-	Grievance Redress Committee
GRM	-	Grievance Redress Mechanism
I/NES	-	International and National Environmental Specialists
ICEM	-	International Centre for Environmental Management
IDF	-	Intensity, Duration and Frequency
IEE	-	Initial Environment Examination
IEIA	-	Initial Environmental Impact Assessment
IFC	-	International Finance Corporation
IPCC	-	Intergovernmental Panel on Climate Change
IUCN	-	International Union for Conservation of Nature
MAFF	-	Ministry of Agriculture Forestry and Fisheries
MAFF	-	Ministry of Agriculture Forestry and Fisheries
MOE	-	Ministry of Environment
MOWRAM	-	Ministry of Water Resources and Meteorology
MPS	-	Main Pump Station
MPWT	-	Ministry of Public Works and Transport
MSL	-	Mean Sea Level
O&M	-	Operation and Maintenance
PAM	-	Project Administration Manual
PDOE	-	Provincial Department of Environment
PDPWT	-	Provincial Department of Public Work and Transportation
PISCB	-	Project Implementation Support & Capacity Building
PIU	-	Project Implementation Unit
PMU	-	Project Management Unit
PSC	-	Project Steering Committee
RRP	-	Report and Recommendation of the President
SEC	-	Southern Economic Corridor
SPS	-	ADB's safeguard policy statement (2009)
TSS	-	Total Suspended Solids
UNDP	-	United Nations Development Program
UXO	-	Unexploded Ordinance

VO	-	Variation Order
WHO	-	World Health Organization
WSPs	-	Waste Stabilization Ponds
WWTP	-	Wastewater Treatment Plant

CURRENCY EQUIVALENTS

(as of 24 August 2021)

Currency unit	–	Riel
KR 1.00	=	\$ 0.000245
\$1.00	=	KR 4,0725

WEIGHTS AND MEASURES

dB	-	decibel
ha	-	hectare
km	-	kilometer
kg	-	kilogram
L	-	liter
LAeq	-	Equivalent Continuous Level 'A weighting' - 'A'-weighting = correction by factors that weight sound to correlate with the human ear
mm	-	millimeter
mg	-	milligram
m ³	-	cubic meter
m/s	-	meters per second

GLOSSARY

Khan or Srok	-	District level administration subdivision below province. Khan is used for cities and srok elsewhere
Sangkat	-	Commune level administration subdivision below district. A ministerial decision, signed by a Minister under
Prakas (Proclamation)	-	Cambodian law, which must conform to the Constitution and to the law or sub-decree to which it refers.
Prek	-	Creek or tidal stream in coastal areas

NOTE

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

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the [“terms of use”](#) section on ADB's website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
A. INTRODUCTION AND PURPOSE.....	1
B. KEY FINDINGS	1
C. ENVIRONMENTAL MANAGEMENT PLAN.....	2
D. CONCLUSION.....	3
I. INTRODUCTION.....	1
A. BACKGROUND AND INTRODUCTION.....	1
B. ADB AND DOMESTIC ENVIRONMENTAL DUE DILIGENCE.....	2
C. STRUCTURE OF THIS REPORT	2
II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK.....	2
A. ENVIRONMENTAL ASSESSMENT REQUIREMENTS OF ADB	2
B. ENVIRONMENTAL ASSESSMENT REQUIREMENTS OF CAMBODIA.....	2
C. LEGAL AND POLICY FRAMEWORK FOR ENVIRONMENTAL PROTECTION.....	3
D. AGENCIES RESPONSIBLE FOR ENVIRONMENTAL MANAGEMENT	6
III. DESCRIPTION OF THE PROJECT	7
A. RATIONALE	7
B. IMPACTS AND OUTCOME	8
C. PROJECT OUTPUTS.....	9
D. DETAILED SUBPROJECT DESCRIPTION	9
IV. DESCRIPTION OF THE ENVIRONMENT	30
A. INTRODUCTION	30
B. PROJECT AREA OF INFLUENCE	30
C. GEOGRAPHY AND TOPOGRAPHY.....	34
D. CLIMATE	35
E. WATER.....	41
F. AIR QUALITY AND NOISE.....	43
G. PROTECTED AREAS, FLORA AND FAUNA.....	44
H. SOCIO-ECONOMIC ENVIRONMENT.....	48
I. PHYSICAL CULTURAL ENVIRONMENT.....	49
V. ANTICIPATED IMPACTS AND MITIGATION MEASURES	50
A. POSITIVE IMPACT AND ENVIRONMENTAL BENEFITS	50
B. ENVIRONMENTAL IMPACT SCREENING	50
C. ACTIONS AND IMPACTS ASSOCIATED WITH PROJECT LOCATION, PLANNING AND DESIGN	51
D. ENVIRONMENTAL IMPACT AND MITIGATION MEASURES IN CONSTRUCTION.....	52
E. ENVIRONMENTAL IMPACT AND MITIGATION MEASURES IN OPERATION.....	62

VI.	ANALYSIS OF ALTERNATIVES.....	64
A.	NO PROJECT ALTERNATIVE.....	64
VII.	INFORMATION DISCLOSURE AND PUBLIC CONSULTATIONS	65
A.	IDENTIFICATION OF STAKEHOLDERS	65
B.	DISCUSSION GUIDE.....	65
C.	PUBLIC CONSULTATIONS DURING PROJECT PREPARATION AND DED PHASE.....	66
D.	PUBLIC CONSULTATIONS DURING PROJECT IMPLEMENTATION.....	72
E.	INFORMATION DISCLOSURE.....	72
VIII.	GRIEVANCE REDRESS MECHANISM	75
A.	GRM OBJECTIVE	75
B.	PROPOSED APPROACH.....	75
C.	ACCESS TO THE MECHANISM.....	76
D.	GRM STEPS AND TIMEFRAME	76
IX.	ENVIRONMENTAL MANAGEMENT PLAN	82
A.	SUMMARY	82
X.	CONCLUSIONS AND RECOMMENDATIONS.....	84
A.	PROJECT RISKS AND ASSURANCES.....	84
B.	CONCLUSIONS.....	84
C.	RECOMMENDATIONS	84

ANNEXES

1. **ANNEX: ENVIRONMENTAL STANDARDS FOR CAMBODIA**
2. **ANNEX: BOREHOLE LOG SAMPLE KAMPOT WWTP**
3. **ANNEX: AFFECTED PERSON MONITORING– CORRECTIVE ACTION FORM**

List of Tables

Table I-1 Variation order summary for CW01	1
Table II-1 Laws, Sub-decrees and Guidance for Environment and Health Protection	3
Table II-2 Key National Environmental Standards	5
Table II-3 National and International Effluent Standards	6
Table IV-1 Summary of Receptors for all Kampot Subprojects.....	31
Table IV-2 Kampot Rainfall Data (2013-2017).....	36
Table IV-3: Average temperature at Kampot station 2013-2017	36
Table IV-4: Humidity (%) in Kampot station 2013-2017	37
Table IV-5: Wind direction and speed (m/s) at Kampot station 2014-2016.....	37
Table IV-6: Water quality result in sewerage system in Kampot town.....	42
Table IV-7: Water Quality Analysis for Teuk Cheuu and Kbal Romeas River (Kampot)	43
Table IV-8: Air quality results in Kampot Town 2018	44
Table IV-9: Noise level at WWTP and main pumping station at Kampot subproject 2018 ...	44
Table IV-10: Vibration level at WWTP and main pumping station 2018	44
Table IV-11 Recorded plant species in the proposed WWTP, Cambodia	45
Table IV-12: List of bird species found in the Kampot WWTP area	47
Table IV-13: Fish, crab and mollusk species found in the Kampot WWTP area	47
Table IV-14: Monthly income and expenditure in Kampot subproject	48
Table IV-15: Water use in Kampot town from 2012 to 2016	48
Table VII-1: Guiding Questions and Information Requests for Stakeholder Consultations ..	65
Table VII-2: Example Environmental components used to guide stakeholder discussion ...	66
Table VII-3: Summary of Stakeholder Views in Kampot (2015)	67
Table VII-4: Public consultation with resort owner and villager around WWTP Kampot	69
Table VII-5: Summary of Stakeholder Views in Kampot for all Kampot Subprojects (2018) ..	69
Table VII-6 Trapeang Sangke Community Fishery Consultation	70
Table VIII-1: GRM Roles and Responsibilities.....	75
Table VIII-2: Sangkats and Villages for GRM Access and Implementation	75
Table VIII-3: Project Hotline Informal Contact with Affected People.....	78
Table VIII-4: Project Hotline Formal Contact with Affected People	78
Table IX-1: Key Functions for Project Implementation	83

List of Figures

Figure III-1 Second GMS Corridor Town Development Project	8
Figure III-2 Kampot Subproject locations	11
Figure III-3 Kampot Scope Change and Variation Order works locations.....	12
Figure III-4: Kampot Current Flooding Situation	13
Figure III-5 Kampot Drainage locations.....	14
Figure III-7 Kampot wastewater collection and WWTP locations	16
Figure III-8 Kampot Wastewater Catchment and Sangkat Boundary	18
Figure III-9: Layout of WWTP in Kampot subproject.....	18
Figure III-10: Layout of main pumping station	19
Figure III-6 Reinforced concrete segment cross section 0+625m to 2+225m.....	22
Figure III-7 Location of works under CW01/VO4	25
Figure III-8 Drainage areas	26
Figure IV-1: Kampot Urban Drainage Socio-Economic and Cultural Receptors Map	32
Figure IV-2: Kampot Urban Drainage and Waste Water Example Receptors.....	33
Figure IV-3: Geotechnical investigation boreholes, WWTP site in Kampot.....	35
Figure IV-4 Kampot Monthly Rainfall Data 2013-2017	36
Figure IV-5: Wind Direction in Kampot town 2014-2016.....	38
Figure IV-6: Identified natural hazards in project area.....	39
Figure IV-7: Expected climate change effects by 2050 expressed in change in annual, dry and wet season rainfall, and temperature	39
Figure IV-8: Flood mapping Kampot city, 2021.....	40
Figure IV-8 Environmental Quality Sampling Locations, Kampot.....	42
Figure IV-9 Open canal line 4b nypa palm density	46
Figure IV-10 Open canal line 4b nypa palm encroachment.....	46
Figure IV-11 Kampot Urban Socio-Economic and Cultural Receptors	49
Figure V-1 Impact Screening Matrix	51
Figure VII-1 Trapeang Sangke Community Fishery Map	71
Figure VII-2: Photo of the public consultation in Kampot (2018).....	73
Figure VII-3: Public consultation in Kampot (2018).....	74

EXECUTIVE SUMMARY

A. Introduction and Purpose

1. The project represents the second phase of the ongoing Greater Mekong Subregion Corridor Towns Development Project (the Project). It supports the Government of Cambodia in enhancing the competitiveness of Kampot town, located along the Southern Economic Corridor, one of the three main economic corridors in the Greater Mekong Subregion.

2. The Project will result in improved urban services in Kampot through wastewater management and urban drainage upgrading, and solid waste disposal. The Project will enhance climate resilience and will be in line with the “3Es” of economy, environment, and equity as outlined in the Urban Operational Plan of the Asian Development Bank (ADB).

3. Each subproject has a dedicated Initial Environmental Examination (IEE) and separate Environmental Management Plan (EMP) as follows:

- IEE and EMP for Kampot urban drainage, wastewater collection network and wastewater treatment plant (WWTP); and
- IEE and EMP for Kampot controlled landfill.

4. This IEE covers the Urban Drainage, Wastewater collection network and Wastewater Treatment Plant subproject. This IEE updates the original IEE (2015) based on the detailed engineering design (DED) for the original scope of the Kampot urban drainage, wastewater collection network and wastewater treatment plant (WWTP). This version includes updates for a major scope change and Variation Orders (see below). The major scope change is implemented through Variation Orders CW01/V03/VO4; this IEE update is based on the DED for CW01/V03/VO4. This version of the IEE supersedes all previous disclosed versions.

5. The project was classified as environment category B during project preparation under ADB's Safeguard Policy Statement (SPS 2009) and this classification remains valid as confirmed during the detailed engineering design phase. The changes, from the original IEE, reflected in this updated IEE include:

- Splitting the individual subprojects into separate IEEs
- Removal of Sihanoukville subprojects from the Project;
- New WWTP location
- Major scope change to wastewater collection and drainage works;
- Variation Order (CW01/VO1) for Kampot wastewater collection, treatment, drainage and sewerage, and project scope change for reallocation of unspent funds from the cancelled Sihanoukville subproject to the Kampot subproject;
- Variation Order (VO3) primarily for renovation of open canal 4b including installation of concrete lining and canal roads on the banks; and
- Variation Order (VO4) primarily for improvement of drainage for flood mitigation, open canal 4b and sewage interception improvements, a balancing pond at the main pumping station and primary treatment improvements.

B. Key Findings

6. For the urban drainage and wastewater collection subproject, the environmental baseline and impact assessment shows that local communities are the most sensitive receptors. The project area of influence includes a densely populated and busy commercial urban core.

7. Impacts during construction will be localized and short-term and limited to the common

impacts associated with any construction project and its associated groundworks. This includes the generation of noise, dust, pollutants, and traffic. These impacts will particularly be felt in the urban core where excavation for pipe networks will be required in higher density areas. Considerable waste quantities will be generated by the network cleaning which requires careful management and planning.

8. For the WWTP, the impacts will also be localized during construction, however will add to the cumulative noise and dust impacts for the area, as the site is adjacent to a large scale resort development.

9. The most significant environment risks associated with the subprojects are during the operation phase. The WWTP can cause environmental pollution if not managed and maintained effectively. Pollution can include medium term risks to water quality from WWTP effluent discharges, potentially affecting aquatic flora and fauna and human health downstream of the outfall. Therefore long term effective operational practices are required in accordance with the detailed engineering design requirements.

10. If effectively managed, the subproject will bring about environmental improvements to the local project areas and urban core. The current environment is being contaminated with uncollected sewage in Kampot. The growing pressures on the urban areas mean that this is likely to continue. In wet season flooding is regular as drainage is currently inadequate. The development of wastewater collection and treatment facilities and improved urban drainage will mean that the pollution of the environment and localized flooding should be reduced and the risks to human health and water quality will be reduced. In addition, the municipality will have improved disaster and climate change resilient infrastructure. However, the benefits of the Kampot WWTP can only be realized if the building owners connect to the sewer network laid by the project; the household connections are not included within the project scope.

C. Environmental Management Plan

11. The EMP aims to avoid impacts where possible and mitigate those impacts which cannot be eliminated to an acceptable and minimum level. The EMP includes detailed requirements for:

- Mitigation and monitoring measures during construction and operation;
- Institutional arrangements and project responsibilities;
- EMP budget for implementation
- Capacity building and training requirements
- Public consultation and information disclosure
- GRM including clearly defined timescale and responsibilities

12. The project includes a capacity building program to address technical and institutional issues and promote the sustainable provision of quality services. This is particularly relevant to maintaining operational standards for the WWTP. The Project Implementation Support and Capacity Building Consultant will be responsible for arranging relevant training. As set out in the EMP, environmental specific training will include the following, in addition to technical training relating to operation and maintenance to ensure subproject sustainability:

- EMP development and implementation
- Undertaking consultation with Affected People
- Implementing and using the Grievance Redress Mechanism
- Environmental protection for construction projects
- Environmental monitoring and reporting.

13. The key mitigation measures during construction will include requirements for:

- Good construction practices to be adopted to ensure minimal disturbance to affected persons from construction related nuisance, such as noise, dust and pollutant emissions.
- Access to properties and agricultural land to be maintained and encroachment avoided to allow people to continue their activities unimpeded.
- The contractor to submit site specific Construction Environmental Management Plans for key activities which will also require the contractor to develop appropriate maps to ensure all stakeholders are clear on where activities will take place.
- A community and occupational health and safety plan, emphasizing the need to address risks in particular to site operatives and people in the urban cores where excavations will be.

14. Mitigation and monitoring measures are also required for the operation phase. The importance of training in WWTP management should be emphasized if the investments are to be sustainable, and operations are to be effectively maintained as per the subproject designs. Recognizing that operator performance is critical to environmental performance, a detailed long-term operator training plan and associated budget is provided in the capacity development component of this project.

15. A Grievance Redress Mechanism will be established to receive comments and facilitate resolution of affected peoples' concerns and grievances about project social and environmental safeguards performance. It should address affected people's concerns promptly, using a transparent process that is readily accessible to all affected people. It will contain multiple entry points to allow affected people to approach the person or institution most suitable for them. It will be based on a project hotline approach to improve the resonance with the local people.

D. Conclusion

16. The main project risks related to environment include: (i) low institutional capacity for environmental management and the possibility that the PMU and Implementing Agency will fail to monitor the environmental impact and implement the EMP during the construction and operation of the project; (ii) the PMU and Implementing Agency fail to implement corrective actions as issues arise during project implementation (iii) inadequate budget is allocated for maintenance of the WWTP.

17. This IEE was undertaken to determine the environmental issues and concerns associated with the WWTP, sewage collection and drainage subproject. As a result of understanding the environmental baseline, receptors and project activities, the EMP was developed. The EMP, if implemented as directed, will mitigate impacts on the natural environment and affected people to an acceptable level. The key parties for implementing mitigation measures and monitoring are the construction contractors, Project Management Unit and the operators. The implementation of the EMP will be closely monitored and reported on by the relevant stakeholders in the project.

18. Overall, the project is anticipated to bring environmental benefits. It will serve to improve drainage and sewage management, reduce pollution impacts and will provide long term environmental improvements and health benefits for residents and visitors. At present more than 50% of house/buildings in the town area have a connection to the existing drainage system for disposal of sewage which is discharged untreated in the river. Construction of main sewer lines and the first stage of sewage flow interception from the existing drainage system for treatment in the WWTP will significantly reduce the discharge of untreated sewage in the river. The collection of sewage from separate household sewer connections under a future second stage will further enhance the environmental benefits of the WWTP.

I. INTRODUCTION

A. Background and introduction

19. The project represents the second phase of the ongoing Greater Mekong Subregion (GMS) Corridor Towns Development Project (the Project). It will support the Government of Cambodia in enhancing the competitiveness of Kampot town, located along the Southern Economic Corridor (SEC), one of the three main economic corridors in the GMS. The project will result in improved urban services through wastewater management, solid waste disposal practices, and urban drainage upgrading. The project will enhance climate resilience and will be in line with the “3Es” of economy, environment, and equity as outlined in the Urban Operational Plan of the Asian Development Bank (ADB)¹.

20. Each subproject under the Project has a dedicated Initial Environmental Examination (IEE) and separate Environmental Management Plan (EMP) as follows:

- IEE and EMP for Kampot urban drainage, wastewater collection network and wastewater treatment plant (WWTP); and
- IEE and EMP for Kampot controlled landfill.

21. This IEE covers the Urban Drainage, Wastewater collection network and Wastewater Treatment Plant subproject. This IEE updates the original IEE (2015) based on the detailed engineering design (DED) for the original scope of the Kampot urban drainage, wastewater collection network and wastewater treatment plant (WWTP). This version includes updates for a major scope change and Variation Orders (see Table I-1). The major scope change is implemented through Variation Orders CW01/V03/VO4; this IEE update is based on the DED for CW01/V03/VO4. This version of the IEE supersedes all previous disclosed versions.

22. The project was classified as environment category B during project preparation under ADB’s Safeguard Policy Statement (SPS 2009) and this classification remains valid as confirmed during the detailed engineering design phase. The changes, from the original IEE, reflected in this updated IEE include:

- Splitting the individual subprojects into separate IEEs;
- Removal of Sihanoukville subprojects from the Project;
- New WWTP location;
- Major scope change to wastewater collection and drainage works; and
- Variation Orders, see Table I-1 which summarizes the variation orders.

Table I-1 Variation order summary for CW01

Variation Order	Details	Safeguard Document Status
VO1 & Major Scope change	Project scope change for reallocation of unspent funds from the cancelled Sihanoukville subproject to the Kampot subproject	IEE /EMP update disclosed Dec 2020 DED is in VO3 and VO4
CW01/VO3	Primarily for renovation of open canal 4b including installation of concrete lining and canal roads on the banks.	IEE / EMP update disclosed Oct 2021 Based on DED
CW01/VO4	Primary treatment facility, pre-treatment tank, interceptor, new pumping station, balancing reservoir, improvement of	IEE / EMP Updated February 2022 Based on DED

¹ ADB (2015) 46443-002 Report and Recommendation of the President Proposed Loan Kingdom of Cambodia: Second Greater Mekong Subregion Corridor Towns Development Project

	drainage for flood mitigation, open canal 4b and sewage interception improvements.	
--	--	--

B. ADB and Domestic Environmental Due Diligence

23. The project was classified as environment category B during project preparation under ADB's Safeguard Policy Statement (SPS 2009) and this classification remains valid as confirmed during DED phase.

24. Domestic environmental due diligence requires an Initial Environmental Impact Assessments (IEIA) to be completed for each subproject. Details on the requirements for Ministry of Environment (MoE) approvals under Cambodian law are in Section II. The IEIA was given MoE approval for this subproject on June 21st 2019. The VOs included in this interim IEE update do not trigger the requirement to amend the domestic IEIA, which remains valid.

C. Structure of This Report

25. This IEE follows the format of an EIA in Appendix 1 of SPS 2009. The report structure supports the individual subproject EMPs prepared for each subproject, and which are based on the results of the IEE.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Environmental Assessment Requirements of ADB

26. Safeguard requirements for all projects funded by ADB are defined in SPS 2009 which establishes an environmental review process to ensure that projects undertaken as part of programs funded through ADB loans are environmentally sound; are designed to operate in compliance with applicable regulatory requirements; and are not likely to cause significant environmental, health, or safety hazards. SPS 2009 is underpinned by the ADB Operations Manual, Bank Policy (Operations Manual Section F1/BP, October 2013). The policy also promotes adoption of international good practice as reflected the World Bank Group's Environmental, Health and Safety (EHS) Guidelines. This IEE is intended to meet SPS 2009 requirements.

27. SPS 2009 environmental assessment requirements specify that:

- At an early stage of project preparation, the borrower/client will identify potential direct, indirect, cumulative, and induced environmental impacts on and risks to physical, biological, socioeconomic, and cultural resources and determine their significance and scope, in consultation with stakeholders, including affected people and concerned nongovernment organizations.
- The assessment process will be based on current information, including a project description, and appropriate environmental and social baseline data;
- Impacts and risks will be analyzed in the context of the project's area of influence;
- Environmental impacts and risks will be analyzed for all relevant stages of the project cycle, including preconstruction, construction, operations, decommissioning, and post-closure activities such as restoration; and
- The assessment will identify potential transboundary and global impacts.

B. Environmental Assessment Requirements of Cambodia

28. Environmental assessment in Cambodia is governed by the following laws and guidelines:

- **Sub-decree on EIA Process No. 72 (1999).** This law provides the detailed guidelines for implementation of the EIA Process. Its Annex requires the conduct of IEIA or EIA on the following activities under the Project: (i) waste processing, burning activities, all sizes; (ii) wastewater treatment plants, all sizes; (iii) drainage systems, >5,000 ha.
- **Declaration on Guideline for Conducting IEIA and EIA Reports No. 376 (2009).** This declaration specifies the basic contents of IEIA/EIA Reports, which should include: (i) introduction; (ii) legal framework; (iii) project description; (iv) description of the existing environment; (v) public participation; (vi) assessment of, and mitigation measures for, significant environmental impacts; (vii) environmental management plan; (viii) cost-benefit analysis; and (ix) conclusion and recommendations.

29. The Ministry of Environment (MoE) through its EIA Department regulates and monitors the EIA Process. The MoE is responsible for: (i) review and approval of IEIA/EIA reports in collaboration with other relevant ministries and (ii) monitoring the EMP implementation of Project Proponents/Owners throughout the different project phases. MoE operates at the municipal and provincial levels through its Provincial Department of Environment (PDoE).

30. The project owner (public or private) is required to submit the necessary project document (IEIA/EIA report) to MoE for review and approval. After submission of IEIA/EIA report, it should take a maximum of 30 working days for a decision. A registered company is required to complete IEIAs.

C. Legal and Policy Framework for Environmental Protection

31. The hierarchy of legislation in Cambodia is Royal Decree, Sub-decree, Ministerial Decision and Regulation. A Royal Decree ratifies laws passed by parliament and these can be supplemented by “Prakas” or ministerial decisions. These laws allow sub-decrees and regulations to be passed which can stipulate procedures and standards to be met to ensure compliance with the law. In addition, there are several guidance documents which are designed to support best practices as required in Cambodia.

32. Cambodia’s main legal framework for addressing environmental protection, management of natural resources and public consultation is the Law on Environmental Protection and Natural Resource Management (‘the Environment Law’), which was adopted in 1996.

33. A summary of other legislative and policy instruments relevant to the project is presented in Table II-1. The key environmental quality standards applied to the EMP for this IEE are listed in Table II-2 and presented in detail in Appendix 1. The most stringent limit (national or international) shall apply. Protocols of the Environment, Health and Safety Guidelines of the World Bank (2007) also apply and are reflected in the EMP mitigation measures where appropriate.

34. Cambodia is signatory to many international environmental treaties and conventions which provide a comprehensive legal framework related to coastal management. These include: the Coordinating Body of the Seas of East Asia (1995), Association of South East Asian Nations (1999), The International Convention for the Prevention of Pollution from Ships (known as MARPOL) (1994), Biodiversity convention (1994), Convention on International Trade in Endangered Species of Wild Fauna and Flora (known as CITES) (1997), Ramsar convention on Wetlands of International Importance (1999) and Climate Change convention (1995) (MOE 2006). The closest Ramsar site to the subproject areas is more than 170 km West in Peam Krasaob Wildlife Sanctuary, Koh Kong province.

Table II-1 Laws, Sub-decrees and Guidance for Environment and Health Protection

Law/Regulation/Guideline	Year	Summary
Law on the Protection of Cultural Heritage (NS/RKM/0196/26)	1996	Regulates the protection of national cultural heritage and cultural property in general against illegal destruction, modification, alteration, excavation, alienation, exportation or importation. Its Article 37 stipulates that in case of chance find of a cultural property

Law/Regulation/Guideline	Year	Summary
		during construction, work should be stopped and the person who found the property should immediately make a declaration to the local police, who shall, in turn, transmit the property to the Provincial Governor without delay.
Law on Forest enacted by National Assembly, 2002 promulgated by Preah Reach Kram/NS/RKM/0802/016	2002	<p>Defines the framework for management, harvesting, use, development and conservation of the forests.</p> <p>Objective: To ensure the sustainable management of forests for their social, economic and environmental benefits, including conservation of biological diversity and cultural heritage. Under this law the state ensures customary user rights of forest products and by-products for local communities. The Forestry Law states the roles and responsibilities for the management of all forests. It states that the management of forests is under the jurisdiction of the Ministry of Agriculture Forestry and Fisheries (MAFF) (except for management of flooded forests which is covered by a different law). Furthermore, it delegates the authority to manage Protected Areas to the Ministry of Environment.</p> <p>Article 4 under the Forestry Law states that prior to major forest ecosystem related activity that may significantly impact on the environment and social conditions, and environmental and social impact assessment should be conducted.</p>
Law on Land (NS/RKM/0801/14)	2001	Provides that: (i) unless it is in the public interest, no person may be deprived of ownership of his immovable property; and (ii) ownership deprivation shall be carried out according to legal forms and procedures and after an advanced payment of fair and just compensation. (Article 5)
Labor Law (1997) Decree No. CS/RKM/0397/01	1997	<p>This law governs relations between employers and workers resulting from employment contracts to be performed within Cambodia. The key sections relevant to this project include:</p> <p>Chapter VIII Health and Safety of Worker. The key provisions relate to the quality of the premises; cleaning and hygiene; lodging of personnel, if applicable (such as workers camp); ventilation and sanitation; individual protective instruments and work clothes; lighting and noise levels in the workplace.</p> <p>Article 230: Work places must guarantee the safety of workers. However, the only specific occupational health and safety Prakas relates to the garment industry and brick manufacture.</p> <p>Chapter IX Work-Related Accidents Article 248: All occupational illness, as defined by law, shall be considered a work-related accident. The law sets out how accidents should be managed in terms of compensation.</p>
Law on Water Resources Management (NS/RKM/0607/016)	2007	Requires license/permit/written authorization for the: (i) abstraction & use of water resources other than for domestic purposes, watering for animal husbandry, fishing & irrigation of domestic gardens and orchards; (ii) extraction of sand, soil & gravel from the beds & banks of water courses, lakes, canals & reservoirs; (iii) filling of river, tributary, stream, natural lakes, canal & reservoir; and (iv) discharge, disposal or deposit of polluting substances that are likely to deteriorate water quality and to endanger human, animal and plant health. (Articles 12 & 22) Its Article 24 stipulates that Ministry of Water Resources and Meteorology (MOWRAM), in collaboration with other concerned agencies, may designate a floodplain area as flood retention area.
Expropriation Law	2010	Defines the principles, mechanisms, and procedures of expropriation, and defining fair and just compensation for any construction, rehabilitation, and public physical infrastructure expansion project for the public and national interests and development of Cambodia.

Law/Regulation/Guideline	Year	Summary
Sub-decree on Water Pollution Control (Sub-decree No. 27 ANRK/BK)	1999	Regulates activities that cause pollution in public water areas in order to sustain good water quality so that the protection of human health and the conservation of biodiversity are ensured. Its Annexes 2, 4 and 5 provide the industrial effluent standards, including effluent from wastewater stabilization ponds, water quality standards for public waters for the purpose of biodiversity conservation, and water quality standards for public waters and health, respectively.
Sub-decree on Control of Air Pollution and Noise Disturbance (Sub-decree No. 42 ANK/BK)	2000	Regulates air and noise pollution from mobile and fixed sources through monitoring, curb and mitigation activities to protect the environmental quality and public health. It contains the following relevant standards: (i) ambient air quality standard (Annex 1); and (ii) maximum allowable noise level in public and residential areas (Annex 6). Article 3 A. "Source of pollution" is defined and separates mobile sources (including transport) and fixed sources such as factories and construction sites. Article 3 B. "Pollutant" is defined as smoke, dust, ash particle substance, gas, vapor, fog, odor, radio-active substance
Sub-decree on The Management of Drainage and Wastewater Treatment System (Sub-decree No. 235 ANKR.BK)	2017	This Sub-Decree aims to improve the management of drainage and wastewater treatment system in term of efficiency, transparency, and accountability to ensure safety, public health, and biodiversity conservation It includes definitions of key terms including: <ul style="list-style-type: none"> • Domestic wastewater/sewage • Wastewater • Sewer lines • Wastewater treatment system It includes effluent standards for discharge into a 'pipe system connected to a centralized wastewater treatment system'. The sub-decree does not define water quality of effluent from sewage treatment plants.

Table II-2 Key National Environmental Standards

Environmental Media	National Standard	International Standard
Ambient air quality	Sub-decree on Control of Air Pollution and Noise Disturbance, 2000 Annex 1, Ambient Air Quality Standard, of	World Health Organization (WHO) Air Quality Guidelines, global update 2005
Noise	Sub-decree on Control of Air Pollution and Noise Disturbance, 2000 Annex 6, Max. Standard of Noise Level Allowable in the Public and Residential Areas, of	WHO Guidelines for Community Noise, 1999
Groundwater quality (for drinking)	Drinking water Quality Standards, 2004	WHO Guidelines for Drinking-water Quality, Fourth Edition, 2011
Groundwater (ambient)	Ministry of Handicrafts and Industry Groundwater Quality Standards	EU Groundwater Directive 2006/118/EC
Surface water quality	Sub-decree on Water Pollution Control, 1999 Annex 4, Water Quality Standards for Public Waters for the Purpose of Biodiversity Conservation, and Annex 5, Water Quality Standards for Public Waters and Health	US EPA National Recommended Water Quality Criteria Mekong River Commission: Technical Guidelines for the Protection of Aquatic Life Mekong River Commission Technical Guidelines for the Protection of Human Health

Environmental Media	National Standard	International Standard
Effluent quality	Sub-decree on Water Pollution Control, 1999 Annex 2, Effluent standard (Discharged wastewater to public water areas or sewers)	IFC/World Bank EHS General Guidelines and Guidelines for Water and Sanitation

35. In accordance with sub-decree No. 27 on Water Pollution Control, the effluent standard required is shown in Table II-3. The table also compares national standards to IFC standards. IFC General EHS Guidelines and IFC EHS Guidelines for Water and Sanitation; both specify that compliance with national standards is required, if they exist, or IFC standards if none are available nationally or locally. Table 3 shows that the national standards will be followed as it is more practical based on the condition of Cambodia's context.

Table II-3 National and International Effluent Standards

Standard	Parameter*							
	COD	BOD	TSS	NO ₃	PO ₄	NH ₃	PH	Oil /Grease
National Standard Sub-decree No.27 Annex 2 Protected Public Water Area	<100mg/l	<80mg/l	<120mg/l	<20mg/l	<6mg/l	<7mg/l	5-9	<15
IFC ² Indicative Values for Sanitary Sewage Discharges	125	30	50	TN 10	TP 2	-	6-9	10

*COD-Chemical Oxygen Demand, BOD – Biological Oxygen Demand, TSS-Total Suspended Solids, TN-Total Nitrogen, TP-Total Phosphorous, NH₃ –Ammonia, PH-acidity/alkalinity scale, NO₃- Nitrate, PO₄-Phosphate.

D. Agencies responsible for Environmental Management

36. The national agencies that oversee environment and natural resources management are listed below. Most of Ministries have provincial line departments.

- Ministry of Environment;
- Ministry of Agriculture, Forestry and Fisheries;
- Ministry of Water Resources and Meteorology;
- Ministry of Mine and Energy;
- Ministry of Industry and Handicraft
- Ministry of Land Management; and Urban Planning;
- Ministry of Tourism;
- Ministry of Public Works and Transport; and
- National Climate Change Committee - a cross-ministerial policy body

² IFC General EHS Guidelines: Environmental Wastewater quality and ambient water quality

III. DESCRIPTION OF THE PROJECT

A. Rationale

37. Detailed description of the project rationale can be found in the project's ADB Report and Recommendation of the President³ (RRP). This is available on ADB's website and a summary is presented below:

<https://www.adb.org/sites/default/files/project-document/176005/46443-002-rrp.pdf>

38. The Project, covering Cambodia, the Lao People's Democratic Republic and Viet Nam, represents the second phase of the ongoing GMS Corridor Towns Development Project in these countries, which supports urban development along the East–West Economic Corridor and the Southern Economic Corridor. The location of the second GMS Corridor Towns Development Project is shown in Figure III-1.

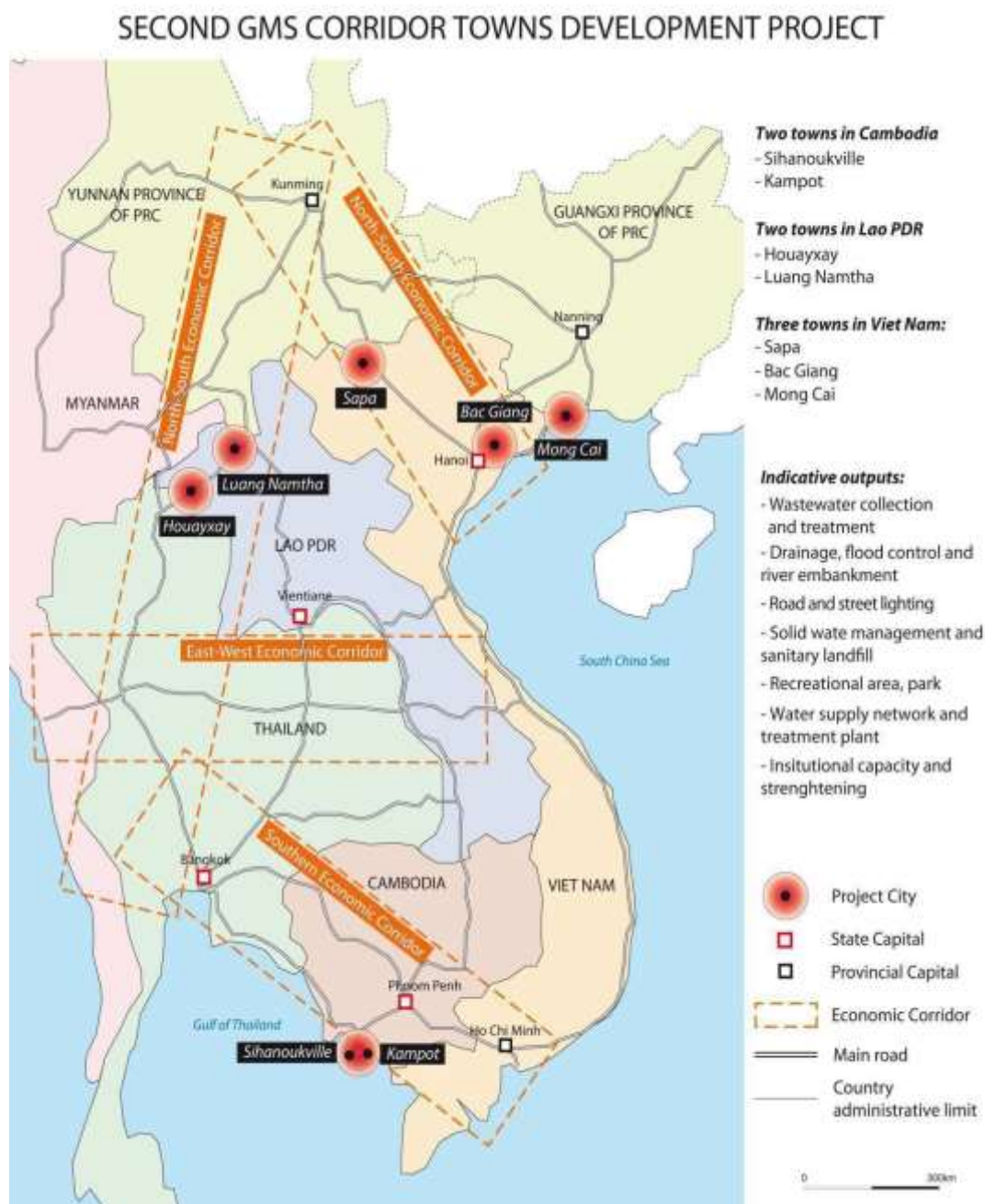
39. The focus on developing towns along economic corridors aims to maximize the benefits of increased trade and traffic flows so as to strengthen their competitiveness and catalyze wider economic growth in the region. The development of environmental infrastructure will promote green growth and improve the climate resilience of these towns in the future. The project supports the first four strategic thrusts of the GMS strategic framework, 2012–2022: (i) strengthening infrastructure linkages; (ii) facilitating cross border trade, investment, and tourism; (iii) enhancing private sector participation and competitiveness; and (iv) developing human resources.

40. Kampot has significant opportunities for increased economic activities and investments. While tourism development is at an early stage, visitor numbers are rising significantly, with tourism potential linked to Kampot's heritage architecture, proximity to the Bokor National Park, and a new river port that will offer seaborne access to the outlying holiday islands. Currently, there is no reticulated wastewater collection and treatment in Kampot, and urban flooding during the wet season is not uncommon as most drainage infrastructure was built during the French colonial times. Solid-waste collection is contracted out to the private sector, with collected waste being disposed of in a poorly managed dump site.

41. Sihanoukville was part of the second GMS Corridor Towns Development Project, as shown in Figure III-1, On request of the Government the Sihanoukville subproject has been cancelled and it was agreed to reallocate the funds freed up by this cancelation to the Kampot subproject.

³ ADB (2015) 46443-002 Report and Recommendation of the President Proposed Loan Kingdom of Cambodia: Second Greater Mekong Subregion Corridor Towns Development Project

Figure III-1 Second GMS Corridor Town Development Project



Source: ADB 2nd GMS Corridor Towns Development Project, TA-8425REG Final Report

B. Impacts and Outcome

42. As defined in the RRP, the Project impacts and outcome will be:

- **Impact:** promoting growth that is sustainable, inclusive, equitable, and resilient; creating employment, including through improving competitiveness; promoting equity through reducing poverty; improving environmental sustainability; and promoting efficiency through further strengthening institutional capacity and governance.
- **Outcome:** improved urban services in the two participating towns.

43. The environmental sustainability benefits for the wastewater network in Kampot are dependent on the individual building owners connecting to the network laid by the project. In addition, the sustainability of the drainage systems are also dependent on ensuring waste is kept out of any

open channels.

C. Project Outputs

44. The Project outputs as defined in the Project Administration Manual (PAM) are:

- **Output 1:** Strategic Local Economic Development Plans developed;
- **Output 2:** Priority urban infrastructure investments and upgrading implemented;
- **Output 3:** Institutional capacities for managing public investments strengthened; and
- **Output 4:** community awareness on project activities and environmental sustainability improved

45. The PAM is available on ADB's website at:

<https://www.adb.org/sites/default/files/project-document/176008/46443-002-pam.pdf>

46. The priority urban infrastructure investments (Output 2):

- Kampot town:
 - Urban Drainage
 - Wastewater collection
 - Wastewater Treatment Plant (WWTP)
 - Controlled Landfill

47. Project Implementation Support, Detailed Design, and Construction Supervision is undertaken for the project under consulting Package 1. Capacity building and Strategic Local Economic Development Plan implementation is undertaken under consulting Package 2. The focus of this updated IEE is on Output 2, drainage, wastewater collection and treatment plant. It refers to the other outputs as required.

D. Detailed Subproject Description

48. This section provides information on the subprojects but does not replicate the information provided in the DED report; this section summarizes the key designs features relevant to the IEE to enable the project impacts to be assessed.

49. Under a project scope change that resulted from the removal of the Sihanoukville subproject from the project and the reallocation the funds freed up to the Kampot subproject it is proposed to further strengthen the existing works. The rationale for this is as follows:

50. **Resolving conflicts with the existing combined drainage/sewerage system.** The original design did not consider the existing combined drainage sewerage system. To allow the existing system to continue to operate effectively without risk to the environment from failure, the two systems must integrate or interconnect where the new and existing lines intersect.

51. **Renovation of the drainage canal** that will involve; (i) the construction of an access road along one of the canal banks to facilitate the recurrent maintenance of the canal; (ii) the stabilization of canal banks at the outfall of the canal over a length of approximately 100 m with sheet piling, and; (iii) selective renovation of the canal section over the remaining canal length of 1.6 m using bioengineering solutions. The aim of the bioengineering measures will be to stabilize the canal banks ensuring a relatively uniform canal section and providing for a more controlled vegetation establishment which will not impede water flow.

52. **Improved Pre-Treatment.** The ability to maintain the investment is critical to its sustainability. The scope change will include improved pretreatment and primary sedimentation at

the Main Pumping Station (MPS), prolonging the effective life time of the **force main pipeline, through grease** removal and primary sedimentation prior to pumping.

53. **Flow control at the outfall of the open drainage canal.** To control the inflow of water from the river during high tide and thus reducing the risk of flooding of areas adjacent to the open drainage canal and to improve the discharge of drainage water during high tide, the open road culvert at the outfall of the open drainage canal will be changed to a gated culvert with pump gates. A pump gate structure is preferred to a conventional gated structure with a separate pumping station as the footprint is much smaller and the construction cost about 30% lower.

54. **Main Pumping Station site development and balancing reservoir.** Additional soil filling for the MPS site development and access to the MPS site and an additional MPS balancing reservoir that will store peak drainage run-off during intense storms and prevent flooding, therefore increasing the town's resilience to climate change uncertainty.

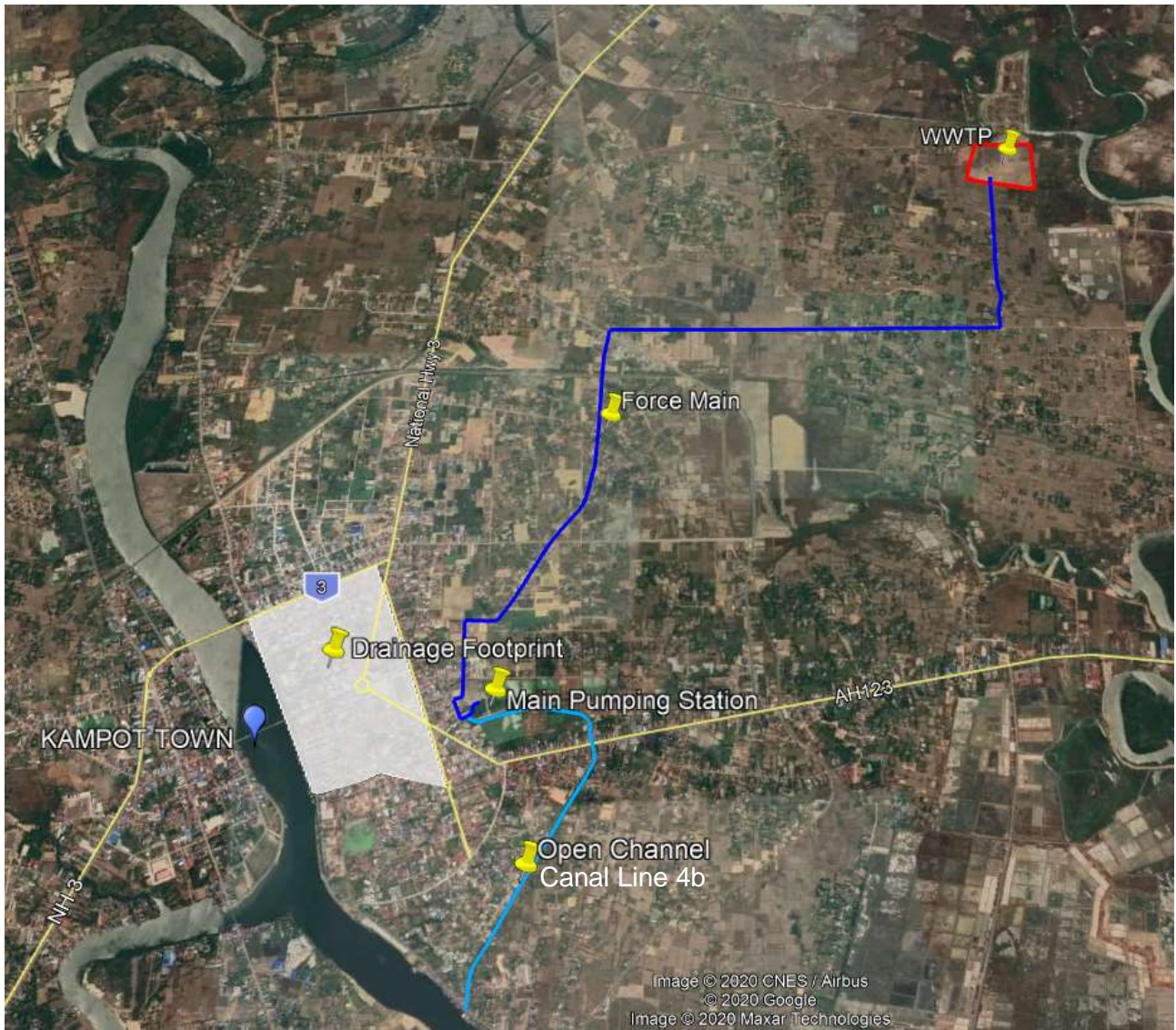
55. **Development of the sewerage system.** Collector lines and household connections have been removed from the project scope, replaced with the installation of main sewer lines in the sectors C2 and C3 in addition to the main sewer lines in the C3 area under the original project scope. As more than 50% of houses/buildings in the town are have a sewerage connection to the existing drainage system, the main sewer lines will intercept the sewage flow at strategic points in the existing system for conveyance to the WWTP and thus significantly reduce the discharge of raw sewage directly in the river.

56. **In addition, under contract variation VO1 of the ongoing works contract CW01** additional or supplementary works: including soil filling for the MPS site and access road; pavement reinstatement; repair of selected existing combined drainage/sewer lines will contribute to the effective construction and operation of the subproject, overcoming challenges such as unanticipated soil conditions, ineffective drainage discharge and contract errors/omissions which would otherwise hinder realization of the environmental benefits.

1. Subproject Locations

57. Location map for the drainage, wastewater collection and treatment plant subproject is shown in Figure III-2.

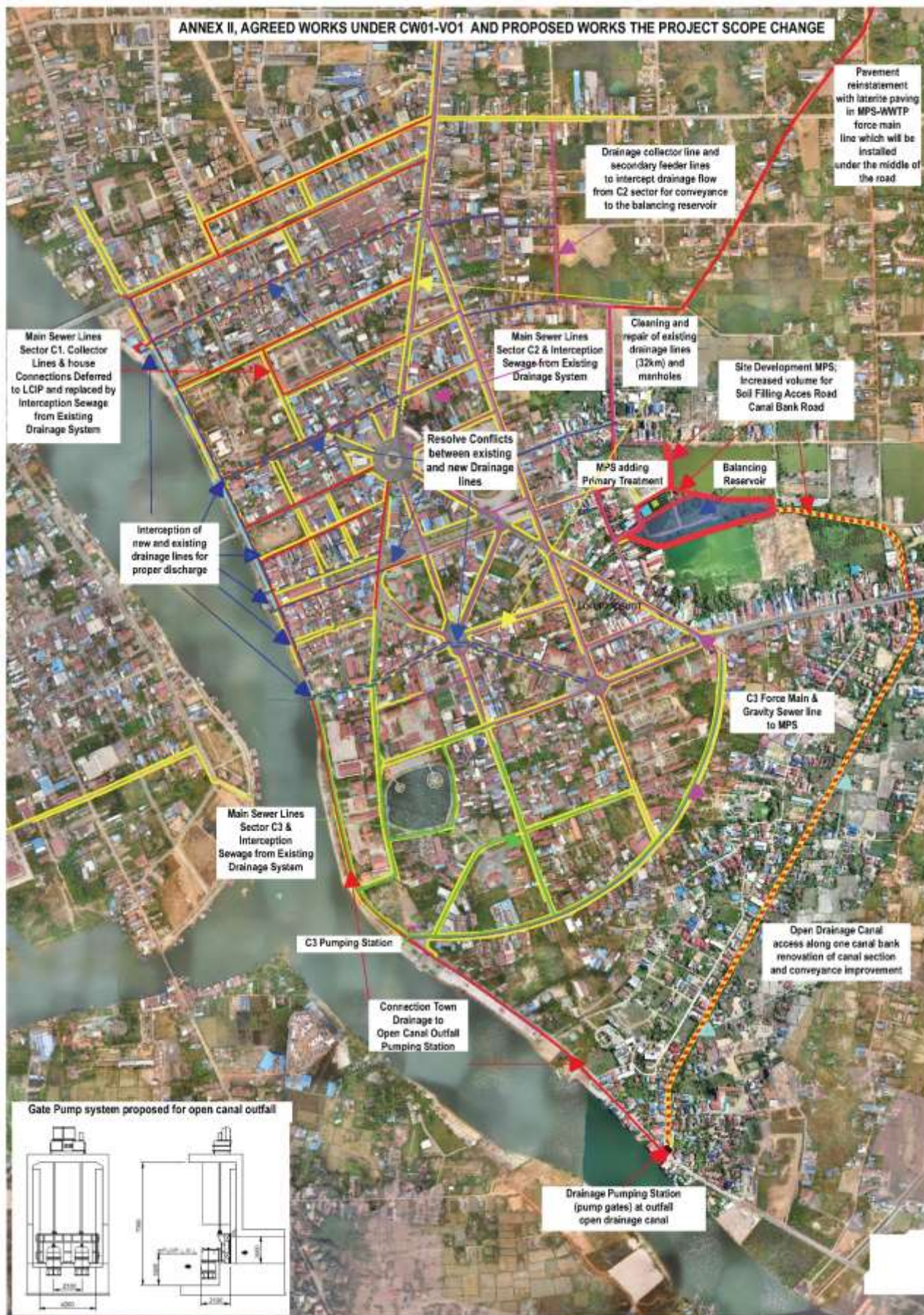
Figure III-2 Kampot Subproject locations



Source: PISCB Team

58. The location of the scope change works is shown in Figure III-3. The location is within the footprint of the existing works.

Figure III-3 Kampot Scope Change and Variation Order works locations



Source: PISCB Team

2. Kampot Drainage Subproject

59. The current drainage system is combined wastewater/storm water. This is mainly covered concrete pipe roadside drains, which mostly drain to outfalls at the Kampot. Periodic flooding occurs in parts of the town during the rainy season (June-November) including the center which is in a particularly flat low-lying area, difficult to drain by gravity. The area around the market is particularly flood prone.

60. This flooding is worsened through the poor regulatory context, in several ways including: (i) building construction of which the uncontrolled development of swamp areas reduces flood storage capacity; (ii) the construction of buildings and structures across flow paths and drainage channels; and (iv) limited maintenance of existing storm water channels. Examples of current flooding following several hours of rain are shown in Figure III-4.

61. Figure III-4 also shows the open drainage channel which is blocked with vegetation (Nypa palms) and is used for waste disposal due to poor waste collection service.

Figure III-4: Kampot Current Flooding Situation

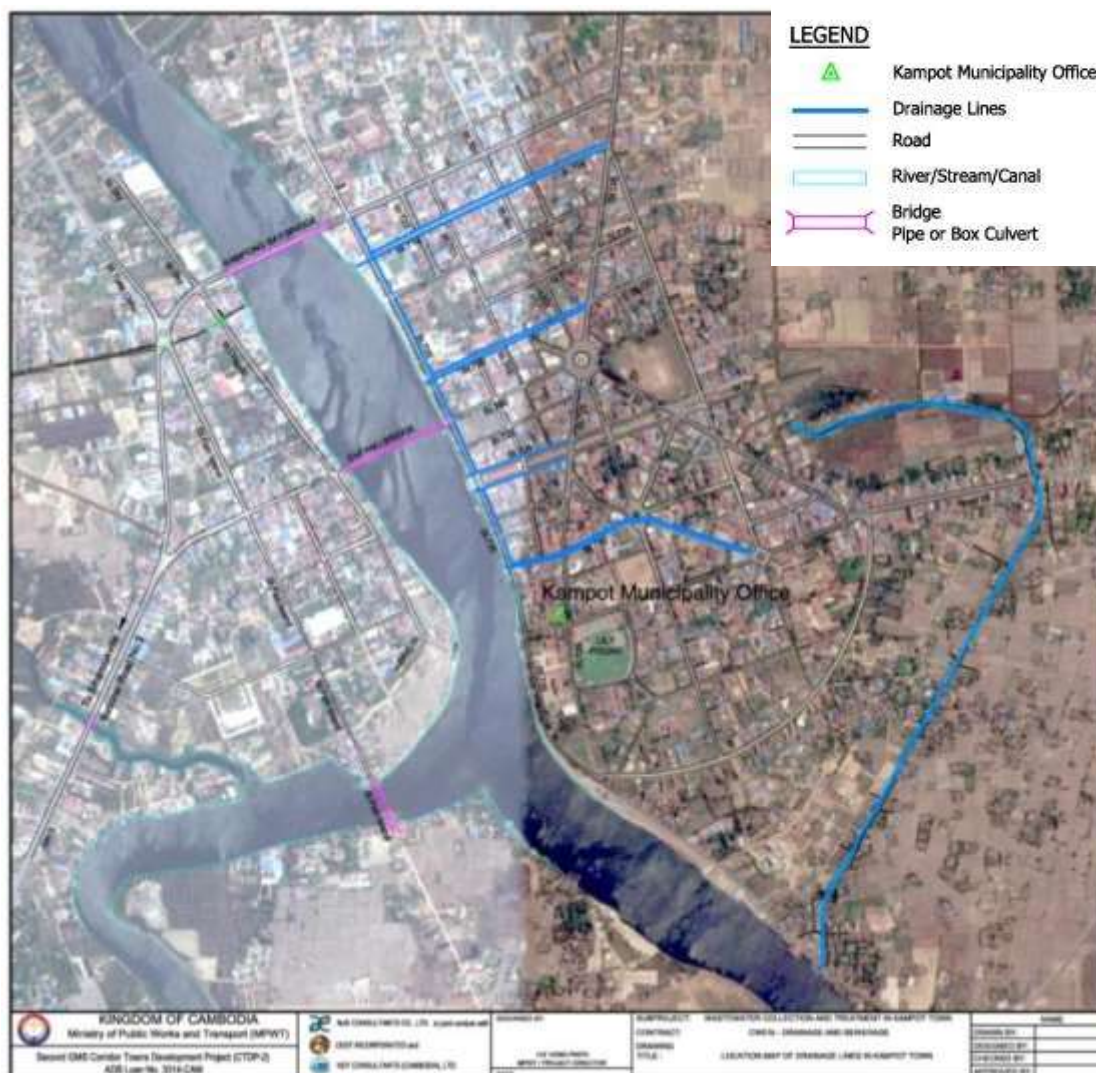


a. general flooding in town; b. flood around night market c. overgrown channel d. waste in open canal

Source: PISCB Team (2019 field visit)

62. The scope of drainage coverage was reduced from the Feasibility Study, due to budget considerations. The remaining priority areas and drainage lines are shown in Figure III-5

Figure III-5 Kampot Drainage locations



Source: PISCB Team

63. The drainage subproject will comprise:

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

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

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

- U-Drain Line 7a and Line 5 (From Traffic Roundabout D, Education Garden to Prek Kampot)
- U-Drain Line 6 (Connect to Line 2, Line 3, Line 4a1 & Line 5)
- Rehabilitation of Existing Open Canal Line 4b (From Boeung Chak to Kampot River)⁴ which is the subject of Variation Order VO3.

3. Kampot Sewage Collection and Wastewater Treatment Plant

65. Wastewater in Kampot presently flows untreated directly to the Teuk Chhou river through combined road drains, or via a canal southeast of town. The proportion of some form of pumpable septic tank in use in the centre of town is estimated at 70-80%⁵. There are 8 drain outfalls to the river in the town centre area which are malodorous during the dry season and low tide conditions when dilution is minimal.

66. There is no central sewage treatment facility. There is no current organized septage disposal or treatment. Therefore, all wastewater is disposed of to the river without any treatment other than from septic tanks in some households

67. The WWTP aspects of the project cover the eastern part of the city where there is very dense population settlements, many commercial bases, as well as tourism facilities. The catchment area of the wastewater to be treated by the project is about 50% of the eastern sector of the city. The collection area is divided into three small catchments designated as C1, C2 and C3 with a total area of 176.1 ha, shown in Figure III-7.

68. The wastewater collected from C1 and C3 areas is by gravity to small separated pump stations called C1PS and C3PS, and then discharged by a small force main from each pump station to the main pump station which is located within the C2 area. The wastewater collected from C3 by gravity passes to the collection chamber at main pump station. The concentrated wastewater from all three catchments (C1, C2, and C3) is transmitted to the WWTP through a force main from main pumping station.

69. The proposed main pumping station with the required support facilities will be built on a 2.9-hectare lot located in Sangkat Krang Ampil. For this pump station, concrete piling is required.

70. Force Main - The concentrated wastewater from all three catchments (C1, C2, and C3) is transmitted to the WWTP through a force main with a length 6,080m of pipe alignment to the inflow chamber of the WWTP through over 6km of laterite and earth roads, passing under a rail way through trenchless work, and overlaying two irrigation canals by pipe bridges. Since the minimum earth cover is 1.2m, the excavation depth is shallow and vertical alignment can basically follow the ground level.

71. Treated water from the WWTP is to be discharged to a natural channel at the northern corner of WWTP site. The outfall of the treated water flows into a natural stream which finally discharges to the sea after approximately 10 km.

4. Design Considerations:

72. The DED is for a separate system (main and trunk sewers), as opposed to a combined system where storm water and sewage are collected and treated together. This is consistent with the project's feasibility study and with the national policy (National Guidelines on Water Supply and

⁴ DRP for Line 4b was approved by ADB in September 2019

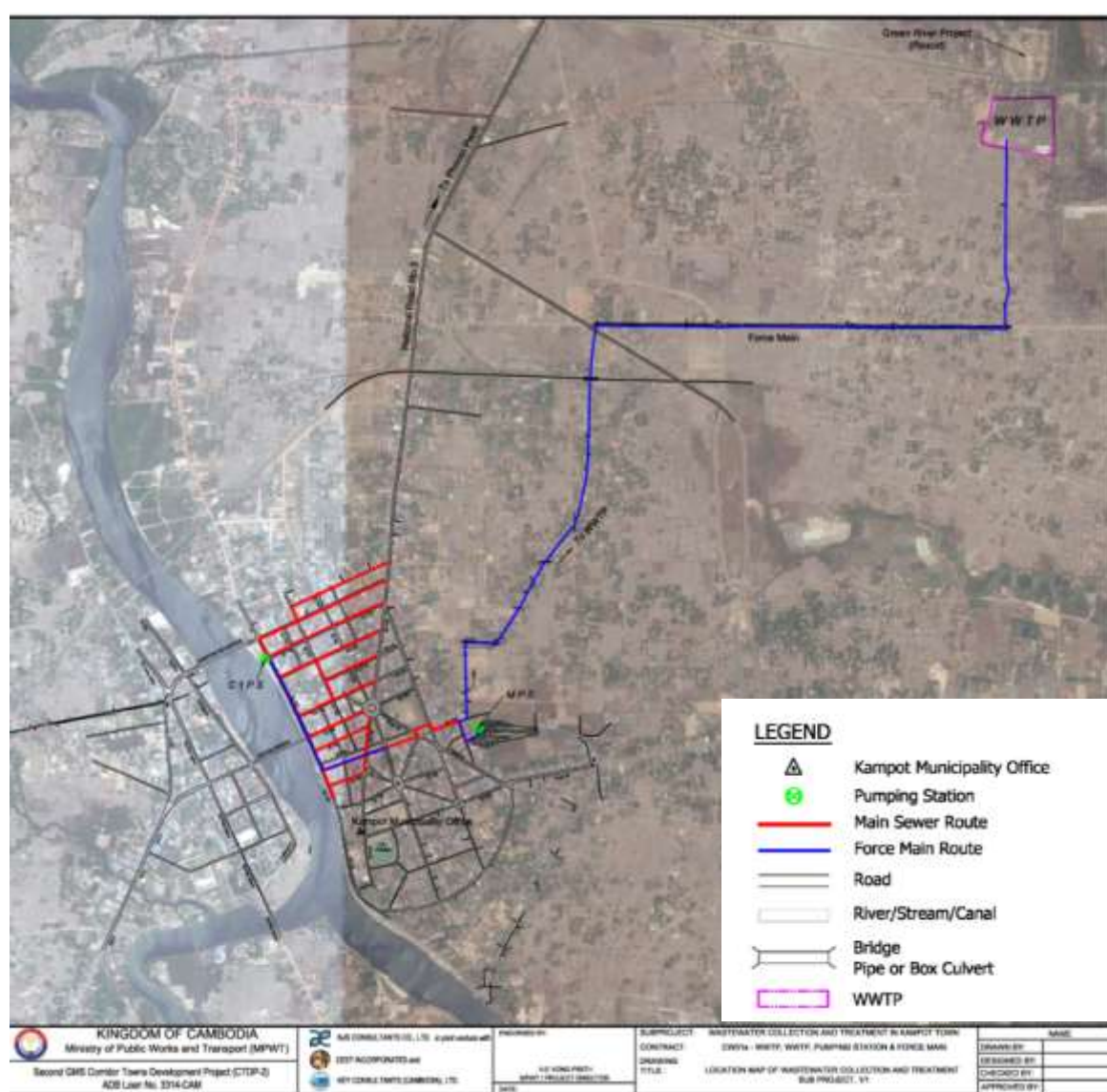
⁵ IEE (2015) for the Project PPTA

Sanitation (2003) which states that “the use of separate sewerage and drainage systems should be promoted and encouraged particularly in new installation areas”. It is also a preferable option for environmental considerations as the risks of untreated sewage overflow during storm events from the WWTP is less likely.

73. For the WWTP, waste stabilization ponds (WSPs) were proposed in the feasibility study, and the DED also pursued this method of treatment. WSPs are currently in use in Cambodia (Siem Reap, Sihanoukville, and the West-side of Battambang City) and there is good practical experience in operating WSPs. WSPs are therefore selected as the best option, providing good levels of treatment with the lowest possible operation and maintenance costs.

74. The design life of the WWTP is 20 years; construction and commissioning is to be completed in July 2022 or soon after, therefore the project timescale is up to or around 2040. The site is 10.1 hectares (ha). The location of the wastewater treatment network and WWTP is in Figure III-6. Figure III-7 shows the wastewater collection catchment and the layouts of the WWTP and main pumping station are shown in Figure III-8 and Figure III-9.

Figure III-6 Kampot wastewater collection and WWTP locations



Source: PISCB Team

75. The WWTP subproject will comprise:

WWTP Works:

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

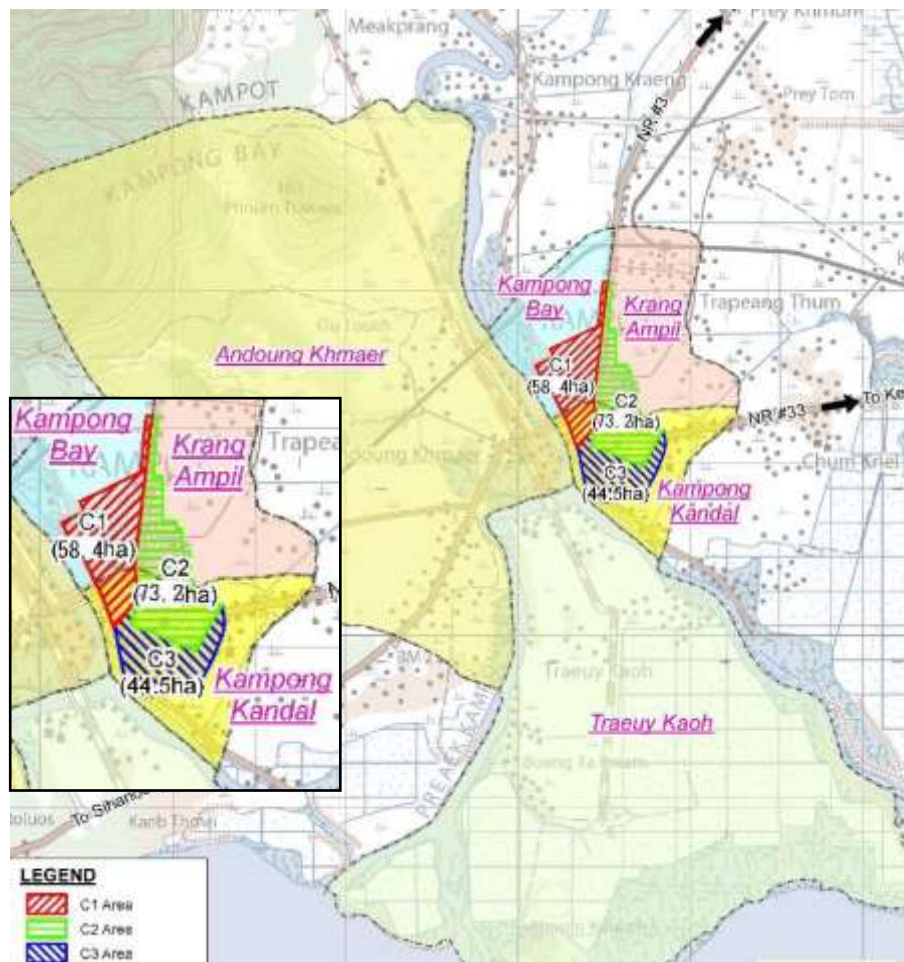
Ancillary works including:

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

76. The sewage collection system subproject will comprise the following investments, where C1, C2 and C3 refer to collections areas within the town as allocated by the project, see Figure III-7, with a total catchment of 176 ha:

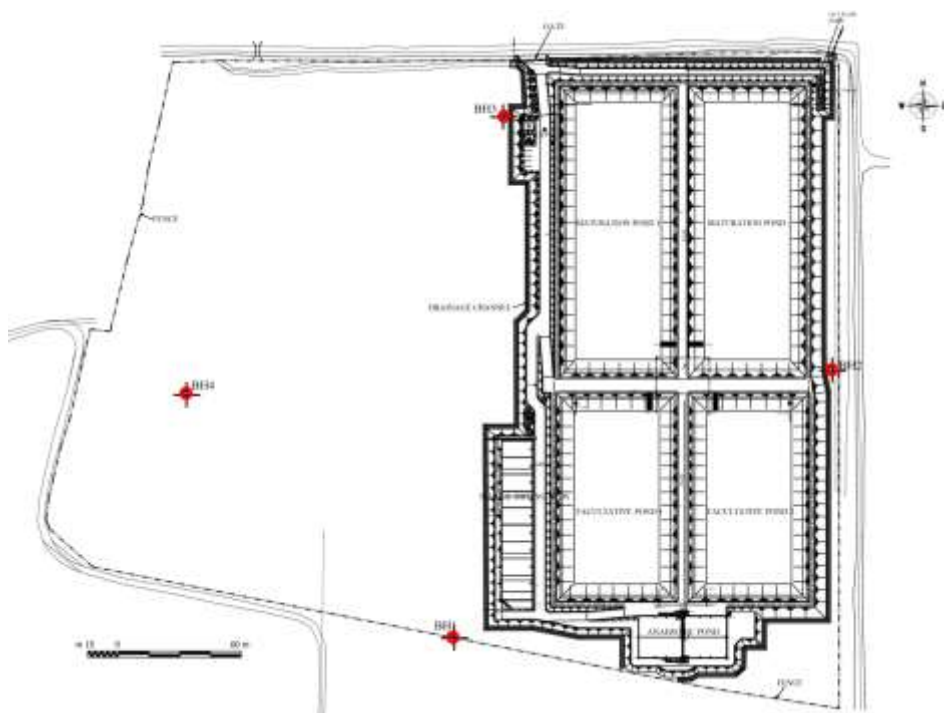
- Pumping stations
 - C1 lift Pump Station
 - Main Pump Station (MPS)
 - Power supply to be supplied by Electricite Du Cambodge, transformer to be supplied by the Project
 - Generator for backup power
- Force main
 - Force main 250 from C1
 - Force main 200 from C3
 - Force main 400 from MPS
- Main sewer
 - C1 area
 - C2 area
 - C3 area

Figure III-7 Kampot Wastewater Catchment and Sangkat Boundary



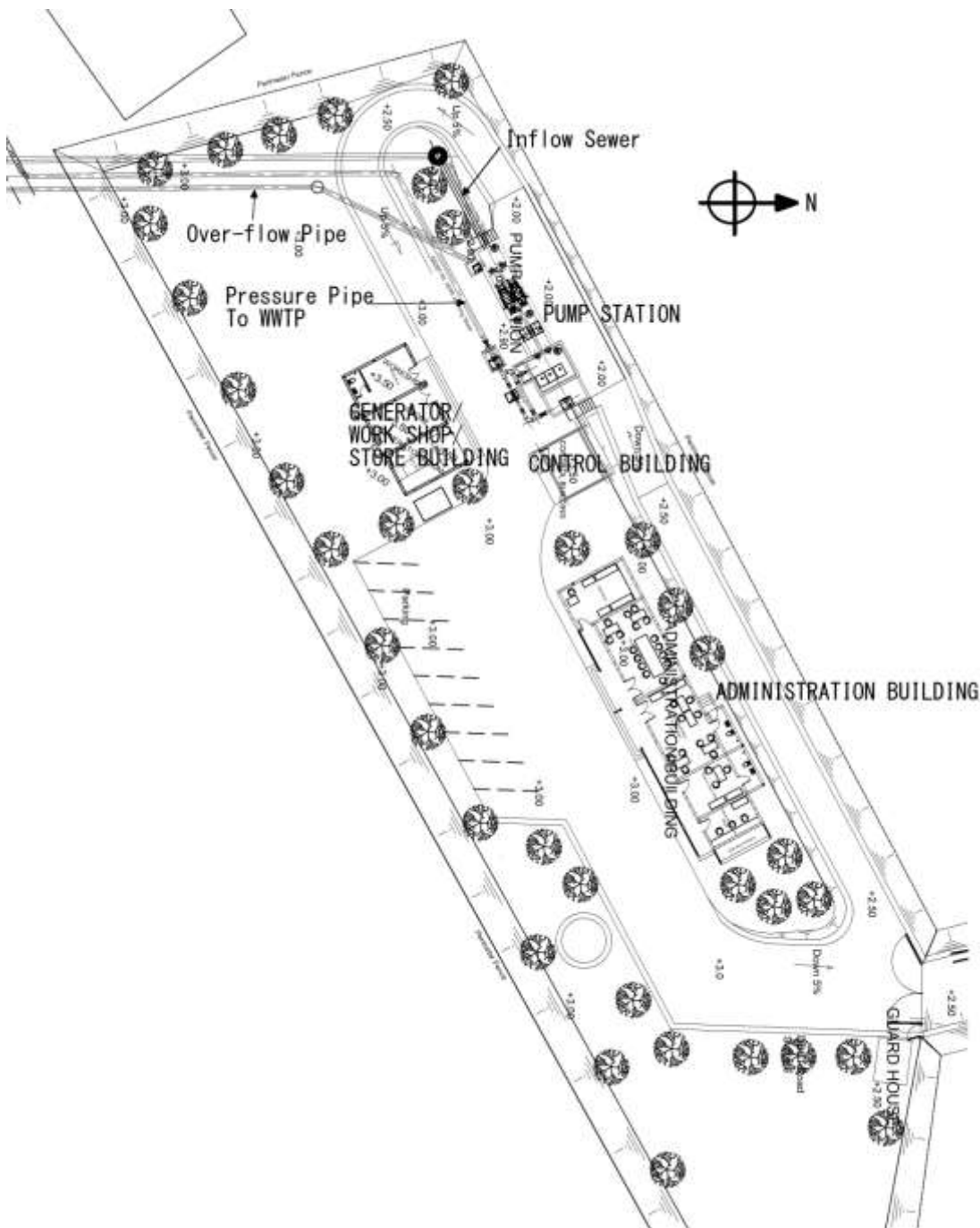
Source: PISCB Team

Figure III-8: Layout of WWTP in Kampot subproject



Source: PISCB Team

Figure III-9: Layout of main pumping station



Source: PISCB Team DED Report

77. This Subproject support potential climate change resilience in Kampot town through the improvement of storm drains and the installation of sewerage pipes that would reduce the adverse impact of perennial flooding and associated contamination of the local environment.

78. As per the feasibility study and DED, adaptation to flooding caused by climate change for critical flood mitigation structures will in general be designed to accommodate a 50-year return period rainfall event and adjusted with Climate Change compensation due to the expected increase in annual precipitation of 5%.

79. The factors considered in the design considerations included cost-effectiveness, current

climate variability and potential future risk. A margin of safety risk, as an extra height on the freeboard⁶, will be applied in the design of the structures.

80. The DED therefore considered the following design aspects as a result of climate change implications for Kampot WWTP:

- (i) Installation level of operation aspects of the system to above predicted flood levels. As a result of past flood data and relevant climate related reports, the DED team included:
 - a. Elevation over 3.5m (msl) for the control panel in lift pump stations
 - b. Elevation over 3.0m (msl) for the operational ground level, and over 3.5m (msl) of operational
 - c. facilities and buildings in main pump station
 - d. Elevation Over 3.5m (msl) for the operational ground
- (ii) Prevention of damage by flooding
 - a. All facilities to be above maximum flood levels and final treatment pond to be at an elevation of 3.55m (msl) with banks of 4.25m (msl)

81. For drainage considerations, the key factor is related to rainfall intensity, duration and frequency (IDF). The IDF calculated uses data from available reports including UN Development Program (UNDP) Climate Change Country Profiles and Intergovernmental Panel on Climate Change (IPCC)⁷ emissions scenarios. IDF curves were generated using projected rainfall increase of 14%⁸ up to 2060 for Sihanoukville, the closest location for which modeling data are available.

5. Scope change and variation order description

82. Under the variation order and major scope change, the following additional work will be implemented under the subproject, noting that the works contribute to both the drainage and sewerage elements of the subprojects:

83. Additions to the ongoing works under a variation order:

- Cleaning of the existing 32 km of drainage lines in the town center on the east bank of the river, including repair of approximately 500 manhole covers and replacement of approximately 90 manhole covers and pits
- Soil improvement at the WWTP site
- Pavement reinstatement and improvement of the roads under which the force main line from the MPS to the WWTP is installed
- Removal of Garbage from the open canal line 4b and cleaning of box culvert in the canal crossing with National Road 33 Demolition of foundations of houses relocated from the canal bank, under the resettlement plan.

84. Additional works defined under the scope change, to be implemented via Variation Orders:

6 freeboard is an additional height to be added to the structure from the top of the projected design flood level
 7 McSweeney et al, 2008, UNDP Climate Change Country Profiles: Cambodia the development scenarios used by the UNDP report are from: IPCC, 2000. Special report on Emission Scenarios: Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment report of the Intergovernmental Panel on Climate Change
 8 Project Management and Implementation Support, Detailed Design and Construction Supervision (Package 1) and Capacity Building (Package 2). Detailed Design Report: Urban Drainage in Sihanoukville Town (2018)

- Modification of the new drainage line parallel to the river to intercept the flows from both the new and existing drainage lines that drain towards the river and extend the line with 1.4 km to connect with the outfall of the open drainage canal 4b
- New 1.3 km main drainage collector line and 780 m of secondary collector lines
- Construction of C3 pumping station
- Open canal bank stabilization and vegetation control
- Pump gate structure construction at the outfall of the open drainage canal
- Connection of new and existing drainage system to the pumping station at the outfall of the open canal
- Soil filling at MPS and access road
- Sedimentation and pre-treatment facility construction at the MPS
- Balancing reservoir construction at MPS
- Installation of the main sewer lines in the sectors C2 and C3 in addition to the installation of main sewer lines in the sector C1 under the original project scope
- Survey relating to household connections to allow PISCB to redesign collector lines and house connections for implementation under the forthcoming Liveable Cities Investment Project⁹

85. **Variation Order CW01/VO3.** This IEE is updated in alignment with the project resettlement documents which are also updated to accommodate the change to the open canal line 4b works in VO3.

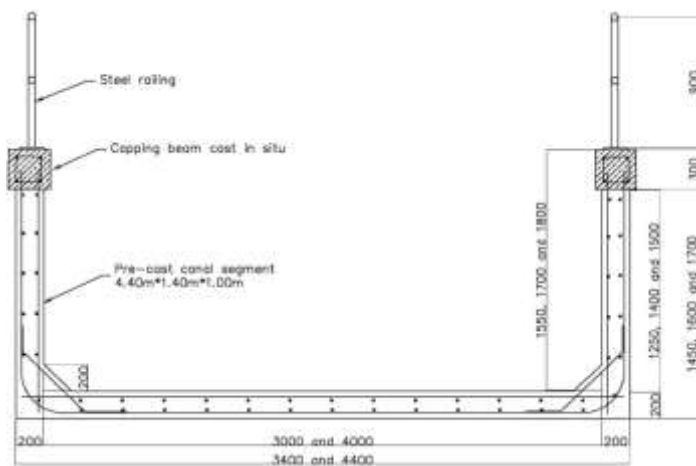
86. After a full hydraulic analysis of the drainage system in the town of Kampot it has been deemed necessary to fully renovate the open canal line 4b to improve the overall conveyance capacity and efficiency of the canal and eliminate the areas in the canal with excessive vegetation grows, canal bank deterioration and canal sections with stagnant water. The concrete lining replaces the limited improvement of the open canal which was originally planned as vegetation removal and installation of gabion boxes alone. The renovation of the open canal line 4 b will comprise the following:

- Removal of unsuitable material from the canal bed between station 0+785 and station 2+225 and installing a foundation layer for reinforced concrete canal lining that will consist of a layer of composite geotextile overlaid with a sand layer with a thickness of minimum 50 cm;
- Manufacture, transport and installation of rectangular reinforced concrete canal segments
- Construction of canal roads on both canal banks, DBST pavement, 3m wide either side between station 0+785 and station 2+225;
- Installation of a capping beam on the rectangular canal segments with a protective railing on both canal banks.

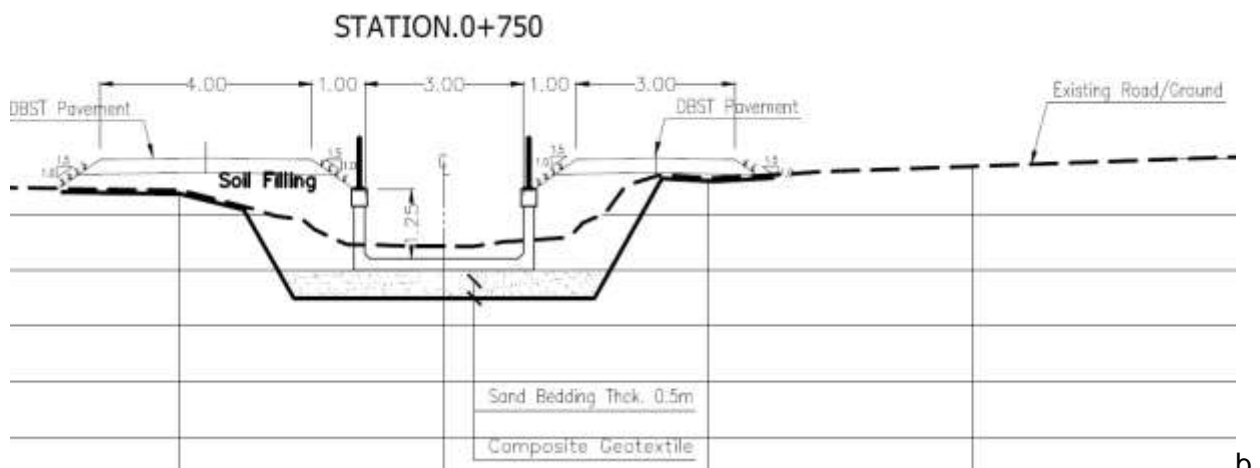
87. A typical canal segment is shown in the Figure III-10 **Error! Reference source not found.** a. and b. below, with drainage from the road surface into the canal. Pre-cast concrete segments will be manufactured off-site, transported by truck and installed onto the canal bed by a wheel mounted telescopic crane. The installation will require canal dewatering and use of a temporary cofferdam:

⁹ ADB project 53199-001 currently under preparation. The project will focus on enhancing urban planning, building community resilience, and providing infrastructure that will facilitate long-term sustainable and economic growth.

Figure III-10 Reinforced concrete segment cross section 0+625m to 2+225m



a.



b.

Source: PISCB team, Detailed Engineering Design

88. **Variation Order CW01/VO4.** This IEE is updated in alignment with the project resettlement documents which are also updated to accommodate the works in CW01/VO2 as necessary.

89. CW01/VO4 comprises 5 parts. Parts 1 and 4 relate to contractual and financial issues which do not impact on the IEE. The content of Parts 2 and 3 affect the civil works as follows, and the location of the works is shown in Figure III-11 **Error! Reference source not found.**:

90. **Part 2, WWTP, Force Mains, and Sewerage Pumping Stations, USD \$1,369,370.**

a) **Construction of a primary treatment facility and interception of sewage flow from the drainage area 2 at the MPS.** The force main is too long to allow for effective cleaning and has an uneven slope and many sharp bends that will accelerate the build-up of deposits in the pipe line. To prolong the effective life time of the pipe line, grease removal and primary sedimentation is required prior to pumping. Primary treatment will also prevent the discharge of raw sewage in the open canal that traverses the urban area in case of pump or pipeline failure. In addition, the sewage flow from the main drainage outfall for the drainage area 2 will be intercepted for conveyance to the WWTP. The primary treatment facility will include the following structures in addition to the structures included in the original design:

- An overflow and sewage interceptor structure for the drainage in the new realigned line 4, with a pumping station to lift the intercepted flow to the primary treatment facility.

- An improved pre-treatment tank that replaces the grid collector in the original design. The pre-treatment is proposed with 2 channels: one channel fitted with a mechanical bar screen and one channel fitted with a manual screen as stand by in case of mechanical or other problems with the mechanical bar screen.
- A rectangular concrete sedimentation tank with a volume 315 m³ with a sludge pumping facility. The third tank is proposed as standby unit but will be operated as normal but in case of maintenance, only two tanks will operate. Sludge will be collected in a storage tank for transport and further treatment at the WWTP.

b) **Construction of a balancing reservoir at the MPS and renovation of the section of the open canal** between the MPS, station 0+350 and the NR-33, station 0+725, which includes the following works:

- A balancing reservoir with embankments having an area of 1.7 ha and a storage capacity of 25.500 m³ for storage of excess rainwater inflow from drainage area 2 during heavy rain storms. The balancing reservoir will be joined with the open canal line 4b by a gated control structure.
- Improvement of the Open canal Line 4 b from station 0+350 to 0+725 with reshaping and RCC lining, including the construction of a canal embankment road on the right bank of the canal section.
- A provision for collection of the drainage/sewage flow from houses/establishments along the open canal and connection to the combined drainage /sewerage system.

c) **Interception of the sewage flow from the existing and new drainage lines in drainage area 1**, and conveyance to the MPS. This will require the following works:

- Construction of the C2 pumping station.
- Modification of the C1 pumping station to receive sewage flow intercepted from the existing and new drainage lines. For the section of the force main that traverses the town center trenchless installation using horizontal directional drilling is proposed to limit damage to existing pavement and interruption of commercial activities.
- The construction of the sewage flow interceptors in the drainage area no.1.

91. **Part 3, Urban Drainage and Sewerage; Improvement of the town area combined drainage/sewerage collection system, USD \$2,623,99**

92. **Part 3 Drainage lines.** Updated mapping of flooding caused by rainstorms show that the areas most vulnerable to flooding in the town center are the market area and the commercial area south of the market and the area around the stadium and the area south of the stadium. The proposed new drainage lines have been realigned to more effectively reduce or eliminate flooding in these flood prone areas. The revised drainage areas are derived from data extracted from drone imagery collected in January 2020 (see Figure III-12 **Error! Reference source not found.**).

a) **Drainage area 1** will require the following works:

- U-drain Line 2 remains as per the original design
- U-drain Line 1 has been added to strengthen the drainage in the flood prone commercial area south of the market area
- U-Drain Line 3 has been limited to the left (south) side of the road as on the right side of the road installation of a new U-Drain line would require the removal of an existing drainage line over the full lengths of the proposed alignment.
- U-Drain Line 4 has been relocated to drainage area 2 to improve the drainage in the flood prone area around the stadium and south of the stadium.
- U-Drain Line 6 along the Prek has been replaced with a drainage trunk line.

- U-Drain Line 7 has been cancelled because of potential resettlement impact and since the drainage of the target area of line 7 will be improved with the realignment of line 4.

b) **Drainage area 2** will require the following works:

- Line 4, box culvert, will realign the main outlet for the drainage area 2 to the MPS and line 4b reservoir. This section of the main drainage outlet has to be realigned as it is presently located in private property
- Line 4.1 and 4.2 will improve the discharge from the existing drainage system in the drainage area 2 to the open canal line 4b
- Line 4.3 to 4.6 will strengthen the drainage around the stadium and bus park and the area south of the stadium which are the most flood-prone areas in the town center.
- After installation of drainage lines in earthen or laterite road the pavement will be upgraded to DBST. A total of 2.5 km of unpaved road in drainage area 2 will be upgraded to DBST pavement

d) **Part 3 collection of drainage/sewage flow improvements.** River level gauging data from MOWRAM show that the median high tide water level in the river is 2.33 m and the median low tide water level is 1.20m. With the street level in the urban center ranging between 2.60 and 3.50 m with a median level of 2.80m, there is little differential hydraulic head available for the existing and new and existing drainage lines which severely reduced the outflow from the drainage system in drainage area 1 around high tide in the river. If heavy rainfall coincides with high tide, flooding of the town center is unavoidable. Pumped drainage is the only long-term solution for solving the flooding problem in the urban center on the east bank. For this purpose, the following works are included:

- **A new drainage trunk line**, (box culvert) installed in the riverside road from the new bridge, station 0+100 to station 2+200. The trunk line will include manholes, junction boxes to connect it to the existing drainage lines and the new U-Drain lines. At the location of the C1 and C2 sewage pump stations flow dividers will be constructed to divert the sewage flow to the C1 and C2 pumping stations.
- **Pavement upgrade from DBST to concrete** on the riverside road. The installation of the drainage trunk line together with the junction boxes and connection to the existing and new drainage lines, sewer interceptor structures and overflow structures will cause considerable damage to the existing pavement of the river side road. On request of the provincial Authorities, the reinstatement of pavement will be done by upgrading the existing DBST pavement to concrete pavement from the new bridge, station 0+000 to station 1+600. From station 1+600 to station 2+400 the DBST pavement will be reinstated over the full width of the road carriage way.
- **A gate pump pumping station** will be constructed at the outfall of the open canal line 4b. The gated RCC structure on a pile foundation will be joined with the existing road culvert and will comprise of 2 gates, each with 2 pumps.

c) **Sewage flow interception.** The installation of main sewer lines, collector lines and house connection in the C1 town area as included in the original DED and BoQ has been cancelled. In the original DED, no reference is made to the existing combined drainage/sewerage system in the town. This is an extensive system with about 32 km of pipelines and 1,200 junction boxes/manholes/rainwater inlets which covers the complete urban center of the town of the east bank of the river. More than 50% of the houses and buildings in the town area have a combined drainage/sewerage connection to the existing drainage lines. The original construction drawings do not show the existing drainage/sewerage lines and the existing house/building connections. It is therefore impossible to construct the sewer system as designed. To address the immediate problem of the discharge of large volumes of raw sewage from the existing drainage system into the Kampot river, priority has been assigned to interception of the sewage flow from the existing drainage system as follows:

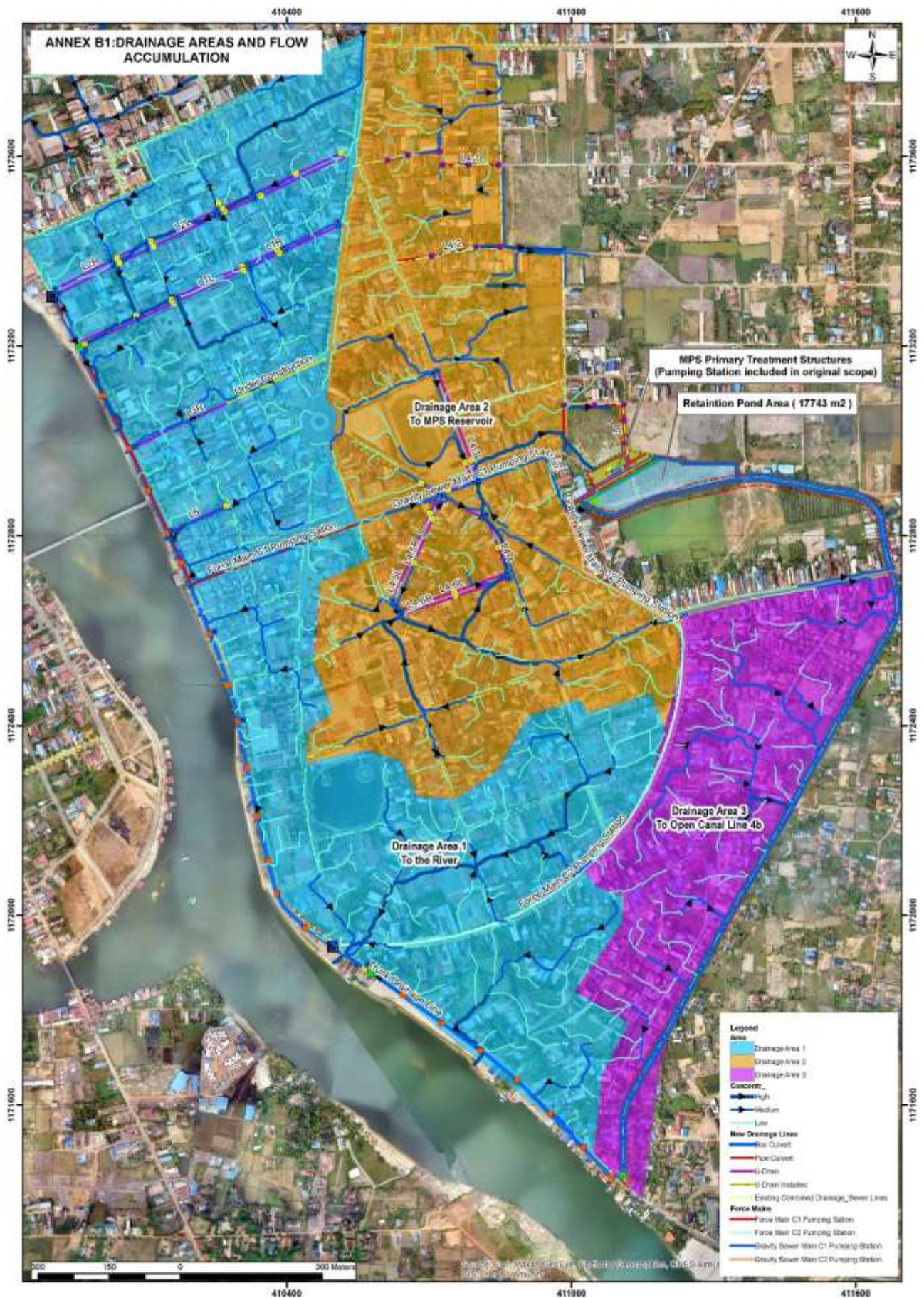
- **Construction of flow dividers/sewage flow interceptors** at the C1 and C2 pumping stations for the drainage area 1 and at the MPS for the drainage area.

Figure III-11 Location of works under CW01/VO4



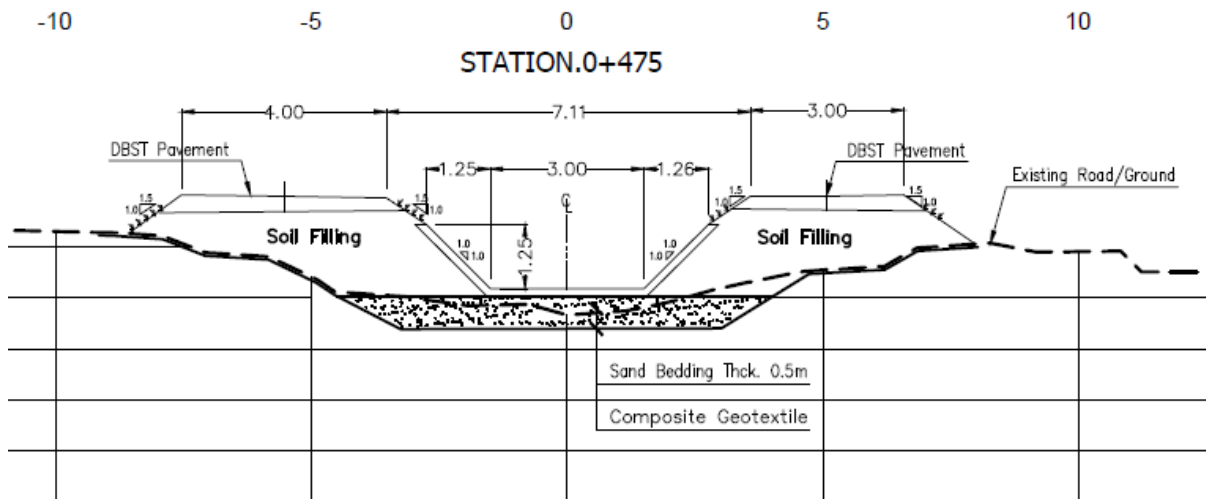
Source: PISCB team, Detailed Engineering Design for CW01/VO4

Figure III-12 Drainage areas



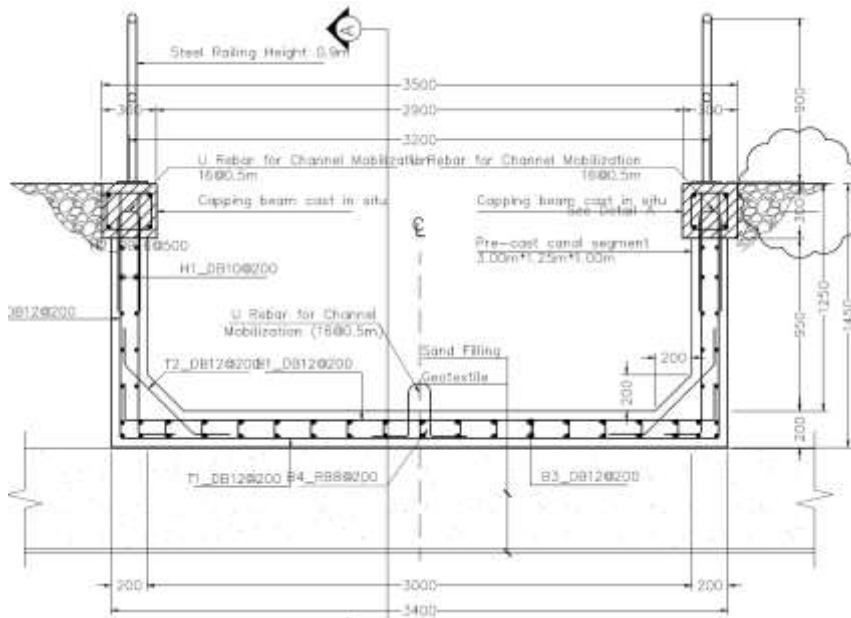
Source: PISCB team, Detailed Engineering Design for CW01/VO4

Figure III-13 Line 4B cross section under CW01/VO4 STA0+475m



Source: PISCB team, Detailed Engineering Design for CW01/VO4

Figure III-14 Line 4B rectangular concrete channel lining detail under CW01/VO4



Source: PISCB team, Detailed Engineering Design for CW01/VO4

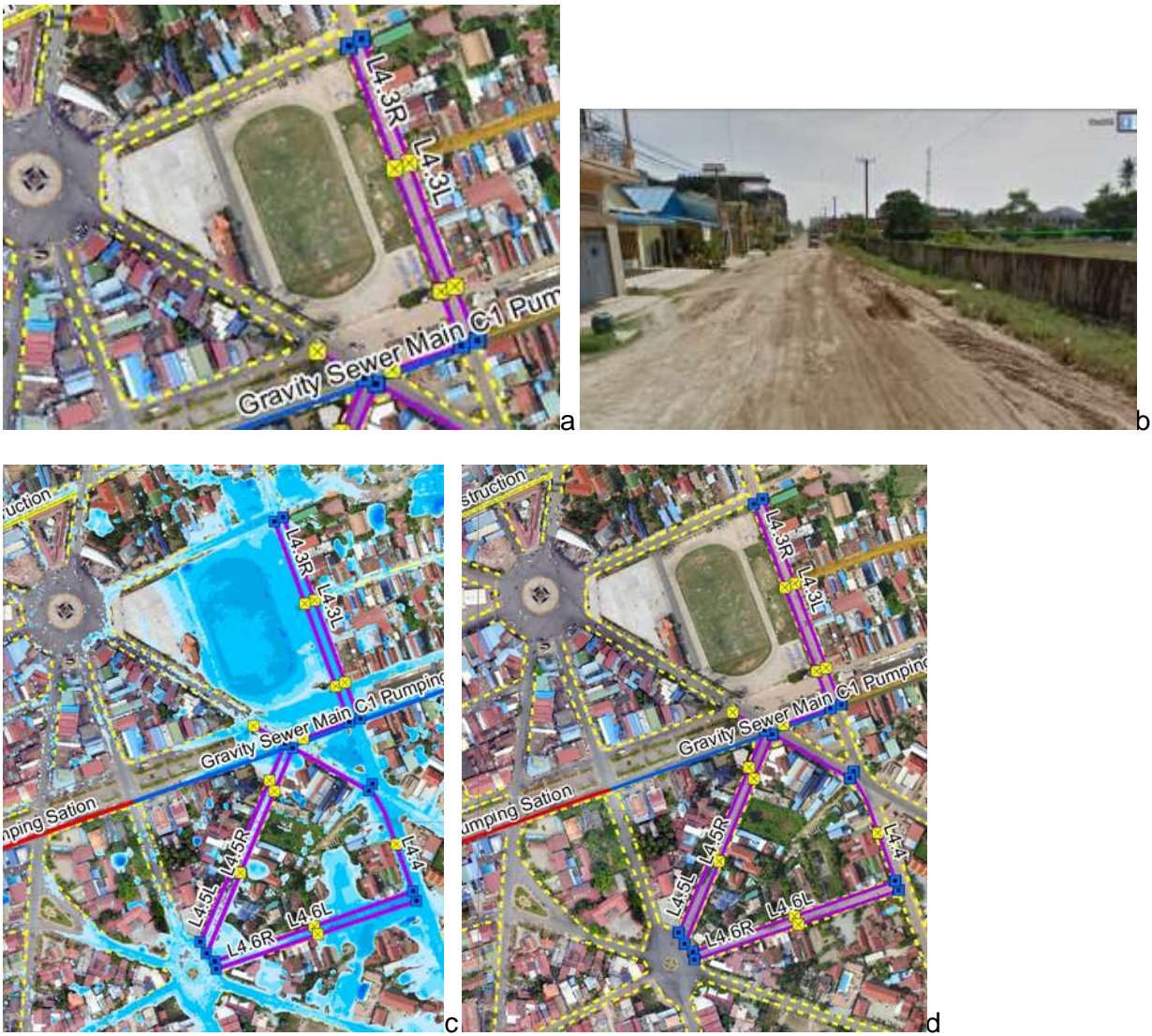
Figure III-15 Location of new C2 Pumping Station under CW01/VO4



Source: PISCB / Google Earth

93. Under CW01/VO4 drains are relocated from other areas, due to engineering requirements but are within the same drainage area footprint. U-drain Line 4 is adjacent to the stadium will be installed as shown below, to alleviate a particularly flood-prone area of the city. The figure below (a) shows a part of the new drain alignment next to the stadium, and (b) the road in which the drain will be laid. Figures c. and d. show the full U-drain and the flood mapping.

Figure III-16 Location of new U-drain line 4 under CW01/VO4



Source: PISCB / Google Earth

IV. DESCRIPTION OF THE ENVIRONMENT

A. Introduction

94. The description of the affected environment in Kampot focuses on the immediate subproject areas that could possibly be affected by the investments, or the environmental features that could influence the successful implementation and operation of the completed subprojects. Regional environmental information is included where relevant.

95. Environmental baseline information was obtained from the 2015 IEE which primarily used recent provincial State of the Environment Reports prepared by the Provincial Departments of Environment (PDOEs) and supplemented with information from other reports where available. For this update, additional more recent reports were used where available, and baseline data was provided by the IEIA and field visits.

96. Detailed descriptions of the socioeconomic and demographic profiles of Kampot are provided in the relevant social assessment reports.

B. Project Area of Influence

97. All subproject sites were visited for the preparation of this IEE, with particular attention paid to identifying:

- Sensitive natural environmental receptors such as water bodies, biodiversity and wildlife habitats;
- Sensitive human receptors;
- Cultural and heritage sites; and
- Potential health and safety issues

98. According to SPS 2009, the area of influence encompasses:

- (i) The primary project site(s) and related facilities that the borrower/client develops or controls. The primary project sites for this project include direct construction sites, pipelines, access roads, disposal areas, and construction camps.
- (i) Associated facilities that are not funded as part of the project whose viability and existence depends exclusively on the project. No associated facilities are anticipated for this project.
- (ii) Effects from cumulative impacts from further planned development of the project, other sources of similar impacts. No cumulative impacts in this regard are anticipated as a result of this or similar projects.
- (iii) Effects from unplanned but predictable developments caused by the project that may occur later or at a different location. As a result of this project, it is anticipated that the development of the urban centres will continue, leading to further developments around the subproject areas.

99. For construction, a borrow sites will be required, the location of which will not be confirmed until the contractor is in place. The EMP will provide guidance on criteria for the borrow site establishment and rehabilitation if a new site is established.

100. The area of influence i.e. the area which is affected by the project, also depends on the environmental impact being considered. Local impacts with a narrow area of influence are those impacts arising from noise, dust and amenity issues. A larger area of influence results from impacts which contribute to global issues such as the embodied carbon associated with the manufacture, supply and use of concrete products, and the carbon emissions associated with material transport.

SPS 2009 requires the assessment to identify potential transboundary effects, such as air pollution, and global impacts, such as emission of greenhouse gases.

101. For the purposes of this EMP, the area of influence for amenity issues (noise and dust) is taken to be 250 m, based on noise levels, as follows:

- WHO Community Noise Limits: One Hour LAeq 55 dBA (Decibel average, Outside; residential receptor, day time limit)
- Construction Noise: Backhoe excavator 80dBA at 15m and concrete mixer 79dBA at 15m. Source: Construction Noise Handbook (www.fhwa.dot.gov), US Department of Transport.
- Noise attenuation factor: a conservative 6 dBA each time the distance from the point source is doubled. Source: US Occupational Safety and Health Administration (www.osha.gov/dts/osta/otm/new_noise/). Note that in soft vegetated environments such as in agricultural fields at the WWTP site, the noise attenuation will be significantly increased meaning the area of influence could be narrowed. However, this would not be the case where vegetation is removed or in urban areas.
- Calculation: At 250m the noise at a receptor is approximately 55 dBA (WHO limit).

102. A summary of receptors for each subproject is shown in Table IV-1. These are within the area of influence for the subproject, including the scope change and variation order.

Table IV-1 Summary of Receptors for all Kampot Subprojects

Subproject:	Urban Drainage and Wastewater collection & treatment (combined due to overlap in urban core)	
Receptors	Description	GPS Co-Ordinate or Alignment (Line = L)
Surface Water	Prek Kampong Bay / Teuk Cheuu – drainage outfall receptors	Outfall 1 Street 174 10°36'45.72"N, 104°10'33.94"E
		Outfall 2 Street 720- 10°36'35.73"N, 104°10'39.63"E
		Outfall 3, Street 724 (Kampot Fish Market) 10°36'27.05"N, 104°10'43.62"E
		Outfall Street 739 - 10°36'19.84"N, 104°10'46.65"E
		Outfall Open Canal line 4b 10°35'44.64"N 104°11'14.09"E
	Canal from Hydropower Plant - Adjacent to WWTP (60m to site boundary)	10°38'28.95"N, 104°12'52.57"E
	Prek Kbal Romeas- 280m to WWTP site boundary	10°38'24.36"N, 104°13'6.19"E
	Open canal sedimentation	Open canal 4b
Socio-Economic	Ephemerally wet low land area	MPS Balancing Pond
	Densely populated residential & commercial areas	All
	Kampot Market (L2.2)	10°36'55.93"N, 104°10'50.23"E
	Kampot Night Market (L3.1, 3.2)	10°36'40.91"N, 104°10'52.78"E
	Kampot Fish Market (force main and drainage L6-3)	10°36'27.05"N, 104°10'43.62"E
	Power supplies - cables and electricity poles in residential areas and commercial areas	All
Cultural	Resort	10°38'32.72"N, 104°12'50.12"E
	Mosque	10°35'49.41"N, 104°11'18.48"E

Subproject:	Urban Drainage and Wastewater collection & treatment (combined due to overlap in urban core)	
	Wat Kampong Bay (Pagoda)	10°36'46.78"N, 104°11'4.65"E
	Wat Prey Tom (Pagoda) 750m from force main	10°38'9.50"N, 104°11'43.60"E
	Pres Mae Pagoda	10°36'49.11"N, 104°10'34.55"E
Education / Healthcare	Primary School Keat Minh	10°36'21.78"N, 104°11'4.36"E
	Chinese school	10°36'48.09"N, 104°10'34.93"E
	Krang Apil Health Center	10°36'41.95"N, 104°10'38.47"E
	Kampot Referral Hospital	10°36'37.43"N, 104°10'40.68"E
	Bokor clinic and Maternity	10°36'51.13"N, 104°10'42.16"E
Ecological	11,400 (estimate) Nypa palm	Open Canal 4b
	No fauna noted in biodiversity survey	-
Land / Land Use	Existing roads, channels and degraded site for WWTP	-

Source: PISCB Team

103. Photographs showing the site environment and relevant receptors are shown in Figure IV-1 to Figure IV-2. These receptors are discussed in the following sections. The receptors include those identified for the major scope change and variation orders.

Figure IV-1: Kampot Urban Drainage Socio-Economic and Cultural Receptors Map

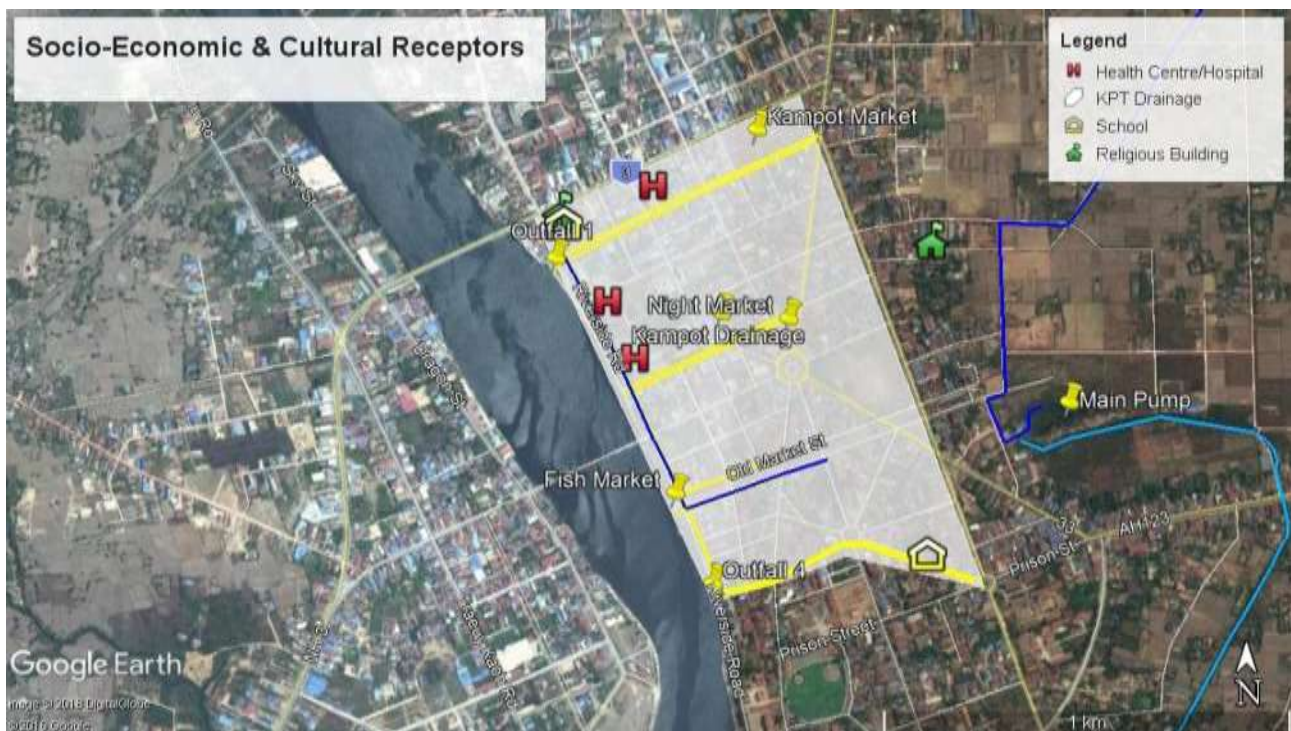


Figure IV-2: Kampot Urban Drainage and Waste Water Example Receptors



a. Force Main - example street

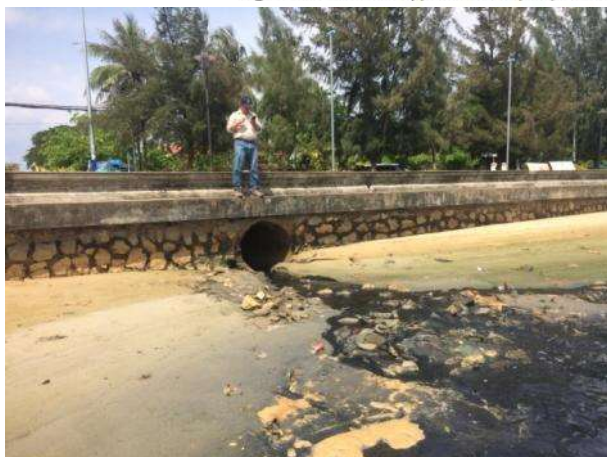


b. Drainage - at market area



c. WWTP Habitat identified in Biodiversity Report

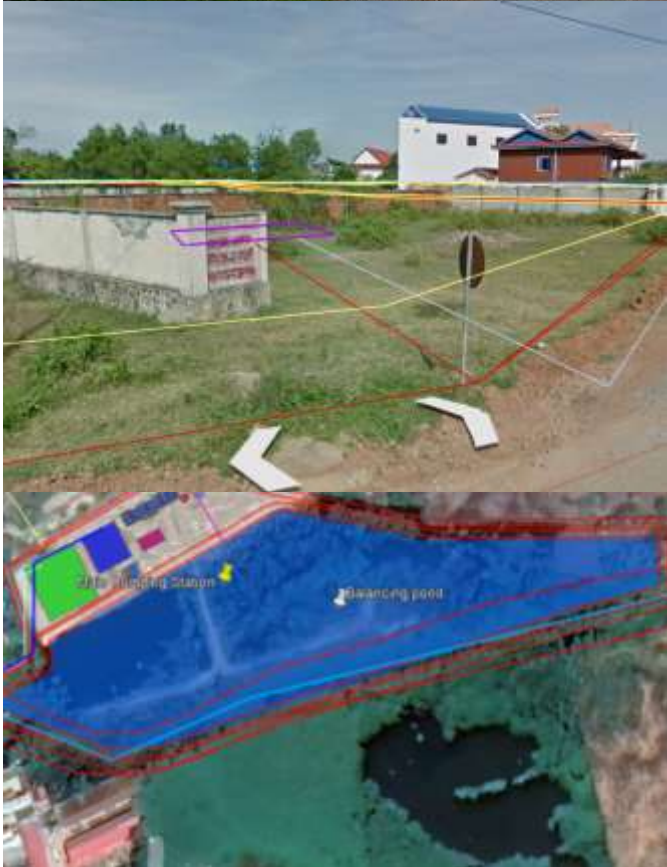
Figure 2. Habitat types in the proposed WWTP site



d. Drainage discharge to beach



e. Force Main crosses railway and electricity poles are close to route [poles do not require relocation]



f. house next to new C2 pumping station in CW01/VO4

Natural low land area for drainage used for balancing pond

Source: PISCB Team, (a google street view, b, d, e 2019 PISCB field visit, c Biodiversity Report f & g google earth)

C. Geography and Topography

6. Geographic Location and Topography

104. The province of Kampot is located in southwestern Cambodia with a total coastline of 73 kilometers. The province occupies 4,873 km² and consists of 8 districts (khan), 92 communes (sangkat), and 104,993 households. The total population of the province is 528,405.

105. The topography and land use of the coastal zone south of Kampot town is characterized by a mix of relatively sparse agriculture, salt harvesting fields, and mangrove forests which occur along the rivers of Prek Kampong Bay/Teuk Chhou which flows through the town centre and Prek Kbal which flows past the WWTP site; both rivers enter Kampot Bay. The salt producing operations (seawater evaporation) adjacent to Prek Kampong Bay/Teuk Chhou are extensive and dominate the

peri-urban land use of the area. Kampot town lies in the flood plain and estuary of the Teuk Prek Kampong Bay/Teuk Chhou river.

7. Geology and Soils

106. A geotechnical survey was undertaken to inform the DED which gives detail on the soil types in the subproject areas. The location of the boreholes for the WWTP are shown in Figure IV-3. 11 soil sampling locations to a depth of 5m were located along the force main sewer alignment and a borehole was completed at the main pumping station site.

Figure IV-3: Geotechnical investigation boreholes, WWTP site in Kampot



Source: Geotechnical report, August 2017

107. The borehole logs for the WWTP site show that the soil is soft, firm then stiff sandy clay to 6.45m where a band of poorly graded silty sand occurs to 12.45m. Clay with gravels occur until 16.95, after which dense silty sand is found to the end of the borehole at 25.95m. Groundwater was encountered at 0.5m. An example borehole log for the WWTP site is shown in Annex 2.

108. The borehole log for the main pumping station shows a similar range of clays in the upper layers 0 to 9.45 m, after which silty sands occur in different density bands until the end of the borehole at 30.45 m. Groundwater was encountered at 1m.

109. Soil analysis along the force main sewer alignment shows sandy clay with gravel to 0.5m then silty clay with gravel to 5m (end of test).

D. Climate

8. Rainfall

110. This section uses climate information from the urban drainage subproject DED urban for Kampot.

111. Cambodia is located in Southeast Asia in the tropical zone, just 10°-13° north of the equator. Like most of Southeast Asia, Cambodia is warm to hot year round. Cambodia's climate is dominated by tropical monsoonal conditions, divided into two distinct seasons, rainy and dry. The rainy season starts around late May and ends around late October and the dry season covers from

the months of November to April.

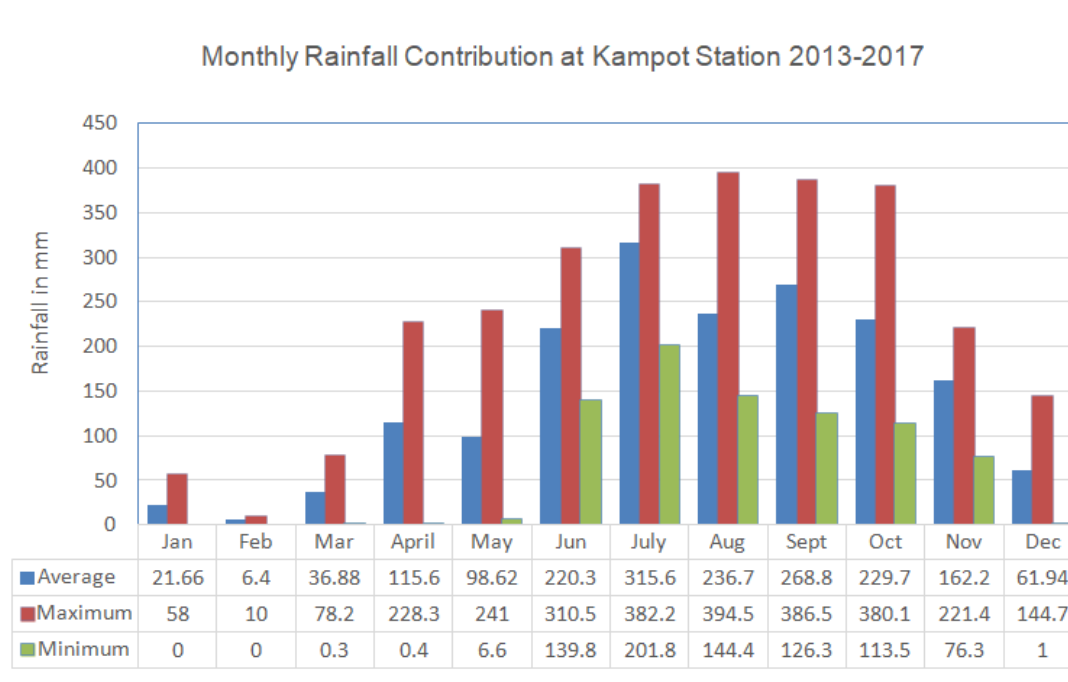
112. Based on rainfall data (2013-2017) obtained from Department of Meteorology in Phnom Penh and Office of Meteorology in Kampot Province, Table IV-2 shows rainfall statistics. Figure IV-4 gives monthly detail for rainfall data.

Table IV-2 Kampot Rainfall Data (2013-2017)

Town	Annual Average (mm)	Annual Maximum (mm)	Annual Minimum (mm)
Kampot	1774.4	1998.5	1568.5

Source: Department of Meteorology in Phnom Penh and Office of Meteorology in Kampot

Figure IV-4 Kampot Monthly Rainfall Data 2013-2017



Source: DED Report, Kampot Urban Drainage (2018)

9. Temperature and Humidity

113. Inter-annual variations in climate are caused by the El Niño Southern Oscillation. El Niño episodes influence the behavior of the monsoons in this region, and generally bring warmer and drier than average winter conditions across south-east Asia, whilst La Niña episodes bring cooler than average summers (UNDP Cambodia Climate Change Profile). Cambodia experiences hot tropical temperatures.

114. Temperature (Table IV-3) and humidity (Table IV-4) data were obtained from the Department of Meteorology of MoWRAM (2013-2017).

115. For Kampot city, the average annual minimum temperature is 22.7°C, while the average annual maximum temperature is 34.2°C. The highest temperature was 39°C and was recorded in April 2003 and 2011, and the lowest minimum temperature was 19.1 °C and was recorded in February 2011. Humidity averages from 66% to 80% throughout the year, over the last five years.

Table IV-3: Average temperature at Kampot station 2013-2017

Year/Month	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec
2013 Max	34	36.6	36	37.7	37.7	37	35.2	34.3	33.8	33	32.7	33.1

	Min	20.5	23.2	23.5	23.6	24.4	24.2	23.3	23.2	23.7	23.3	23.3	20
2014	Max	31.3	30.7	33	33.1	34.7	33	33	34	33	34	33.5	33
	Min	16	20	21.8	22	24.8	23.7	23	23	22.5	23.5	21.5	19.8
2015	Max	32.5	33.7	35.2	35.2	25.8	36.5	33.8	34.1	34.2	33.5	33.7	33.3
	Min	19.4	19.9	23	23	24.6	23.4	24.1	24.3	23.9	23.5	23	22.4
2016	Max	33.3	35.5	33.3	34.9	35.3	36.7	34.2	33.9	35	33.8	32.9	32.2
	Min	21	19.4	23.8	23.6	25	23.4	24.2	24.2	23.12	24.1	23.2	22.2
2017	Max	34.7	35.4	36.6	36	34.2	34.9	32.9	33.9	33.7	33.7	32.6	32.9
	Min	21	20.7	22.5	24.2	24	23.3	23.2	23.4	24.3	23.2	23.3	16.2
Average		26.4	27.5	28.9	29.3	29	29.6	28.7	28.8	28.7	28.6	28	26.5

Source: Department of Meteorology of MoWRAM, Kampot

Table IV-4: Humidity (%) in Kampot station 2013-2017

Year/month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
2013	71.3	71.6	68.2	70.4	72.3	71	59.4	76.2	86.3	75.3	73.1	63.2
2014	62.1	69.6	67.7	68.5	68.2	74	74.4	77.5	81.9	80.9	76.4	78.4
2015	66.1	69.3	70.3	72.4	67.8	74.3	76	77	79.3	76.8	76.4	70.1
2016	71.3	63.3	70	66.7	73.3	78	76.8	77.5	74.7	80.9	75.3	72.1
2017	61	65.7	70.2	73.5	78.1	73.5	78	78.6	78.3	78.3	76.8	67.4
Average	66.3	67.9	69.3	70.3	72	74.1	72.9	77.4	80.1	78.4	75.6	70.2

Source: Department of Meteorology of MoWRAM, Kampot

10. Wind

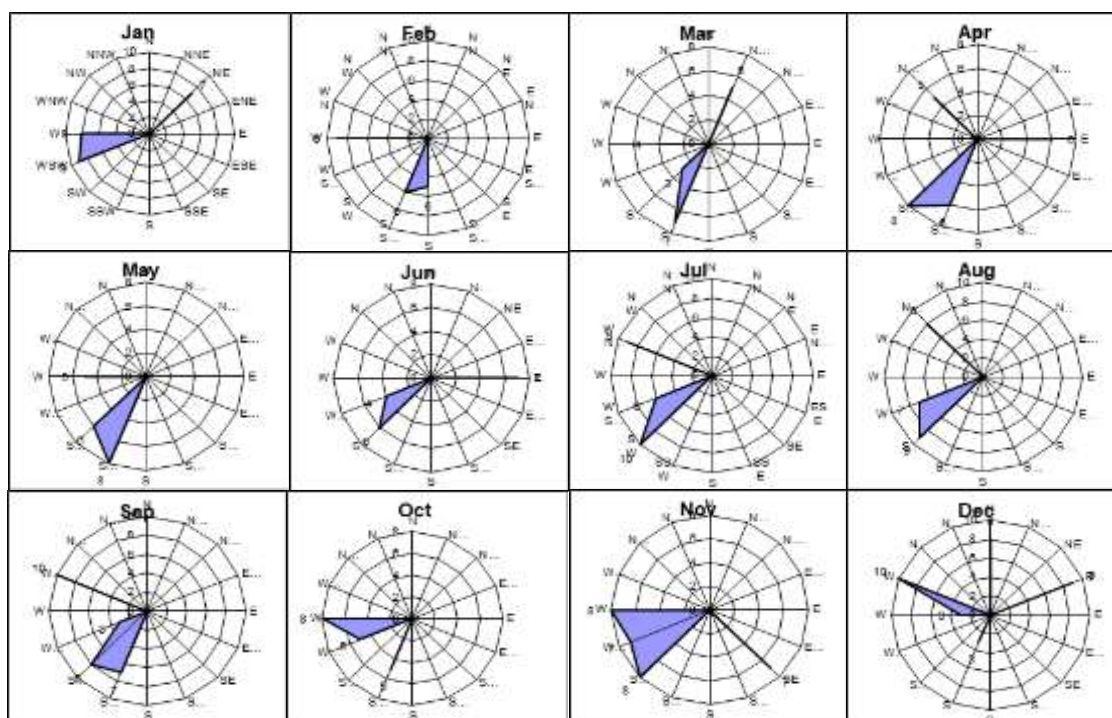
116. Wind speed data and wind roses are provide below showing a clear west to south-south-west wind is dominant in Kampot.

Table IV-5: Wind direction and speed (m/s) at Kampot station 2014-2016

Year/Month		Jan	Feb	Mar	Apr.	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Av/
2014	Direction	WN W	SW	W	NW	W	W	WN W	NW	WN W	WS W	W	SSW	6.6
	Speed	8	6	4	5	5	4	9	8	10	5	8	3	
2015	Direction	NE	S	NNE	E	SSW	E	SW	NW	SW	SSW	SW	N	7
	Speed	7	5	5	6	8	7	10	8	8	5	8	8	
2016	Direction	WS W	W	SSW	SSW	SW	W	WS W	SW	SSW	SSW	SE	ENE	7.2
	Speed	9	9	7	8	6	6	6	9	7	5	7	9	
Average		8	7	5	6	7	6	8	8	8	5	7	7	

Source: Source: Department of Meteorology of MoWRAM, Kampot

Figure IV-5: Wind Direction in Kampot town 2014-2016



Source: Department of Meteorology of MoWRAM, Kampot

11. Natural Hazards and Climate Change

117. Information in this section is from the final report from TA 8425-REG: Second Greater Mekong Subregion Corridor Towns Development Project: Integrated Disaster Risk Management. This report was completed in June 2017 by The International Centre for Environmental Management (ICEM)¹⁰. The key findings of the report include:

- **Critical and social infrastructure is threatened by climate and geophysical hazards.** The most prevalent climate hazards include river floods, urban floods, drought, erosion and sedimentation, tropical storms and typhoons. Geophysical hazards include landslides.
- **Besides the new and changing vulnerabilities relating to growing urbanization, there are added impacts from climate change that threaten the project towns.** Climate trends and anecdotal evidence suggest each town is already experiencing the impacts of climate change.
- **Drought spells in the wet season will increase, but also the frequency and duration of flooding [will increase].** The intense rainfalls will trigger erosion and landslides and flash floods in urban areas. The *El Niño–Southern Oscillation* will cause extended droughts, increase the number of tropical storms and so the frequency of high-intensity rainstorms.

118. **Natural Hazards.** Through consultation with local stakeholders, the report identifies and maps natural hazards and past extreme climate events. The natural hazards identified in Kampot are shown in Figure IV-6.

119. **Climate change impacts.** Climate change is projected to bring more extreme conditions to the GMS countries. This includes increasing the frequency and severity of climate and hydrological

¹⁰ ICEM (2017) TA8425-REG Second Greater Mekong Subregion Corridor Towns Development Project: Integrated Disaster Risk Management (46443-001) KEY FINDINGS AND LESSONS LEARNED and FINAL REPORT Prepared for Asian Development Bank

events. Sea level rise, storm surge, increased flood levels and flood duration, and more extensive and unpredictable droughts threaten populations and critical infrastructure across the region. The ICEM developed a downscaled climate change model for Kampot province. The model looked at reliable projections with time horizons of 2030, 2050, and 2100. The results are presented for annual and seasonal (dry and wet) rainfall as well as for temperature increase in Figure IV-7.

120. ICEM's predictions show that the monsoon will start later than today, the duration of the time when rainfall occurs will become shorter, the time between consecutive rainfalls will become longer, and the rainfall intensity will increase. All these will have a mostly negative effect specifically on the agricultural and social-economic development of the countries.

Figure IV-6: Identified natural hazards in project area

Country	Ca
Natural hazard/city	Kampot
Floods (rivers)	x
Flash flood (urban)	x
Flash flood	
Drought	x
Landslides	
Erosion and sedimentation	x
Earthquakes	
Tropical storms and typhoons	x
Storm surge	x
Tsunami	
Sea level rise	x
Heatwaves	x

Source: ICEM Final Report: Integrated Disaster Risk Management (2017)

Figure IV-7: Expected climate change effects by 2050 expressed in change in annual, dry and wet season rainfall, and temperature

Country	Cam
Climate parameter/town	Kampot
Increase in annual rainfall (%)	+ 6.8
Increase in dry season rainfall (%)	- 4.0
Increase in wet season rainfall (%)	+ 9.5
Increase in annual temperature (°C)	+ 2.6
Increase in dry season temperature (°C)	+ 2.3
Increase in wet season temperature (°C)	+ 2.9

Source: ICEM Key Findings and Lessons Learned: Integrated Disaster Risk Management (2017)

121. In support of the ICEM findings on urban flooding being a risk in Kampot, updated mapping of flooding caused by rainstorms during implementation (Figure IV-8) shows that the areas most vulnerable to flooding in the town center are the market area and the commercial area south of the market and the area around the stadium and the area south of the stadium.

Figure IV-8: Flood mapping Kampot city, 2021



Source: PISCB Design Team

E. Water

12. Surface Water

122. **Kampot WWTP** is located within 300m of Prek Kbal Romeas, a tidal stream which leads to the sea approximately 10 km to the south. The site is adjacent to a canal which takes water from the hydropower plant approximately 12 km to the North West. Downstream from the WWTP Prek Kbal Romeas is used for fishing as it has a Community Fishery located on it, approximately 10 km from the WWTP.

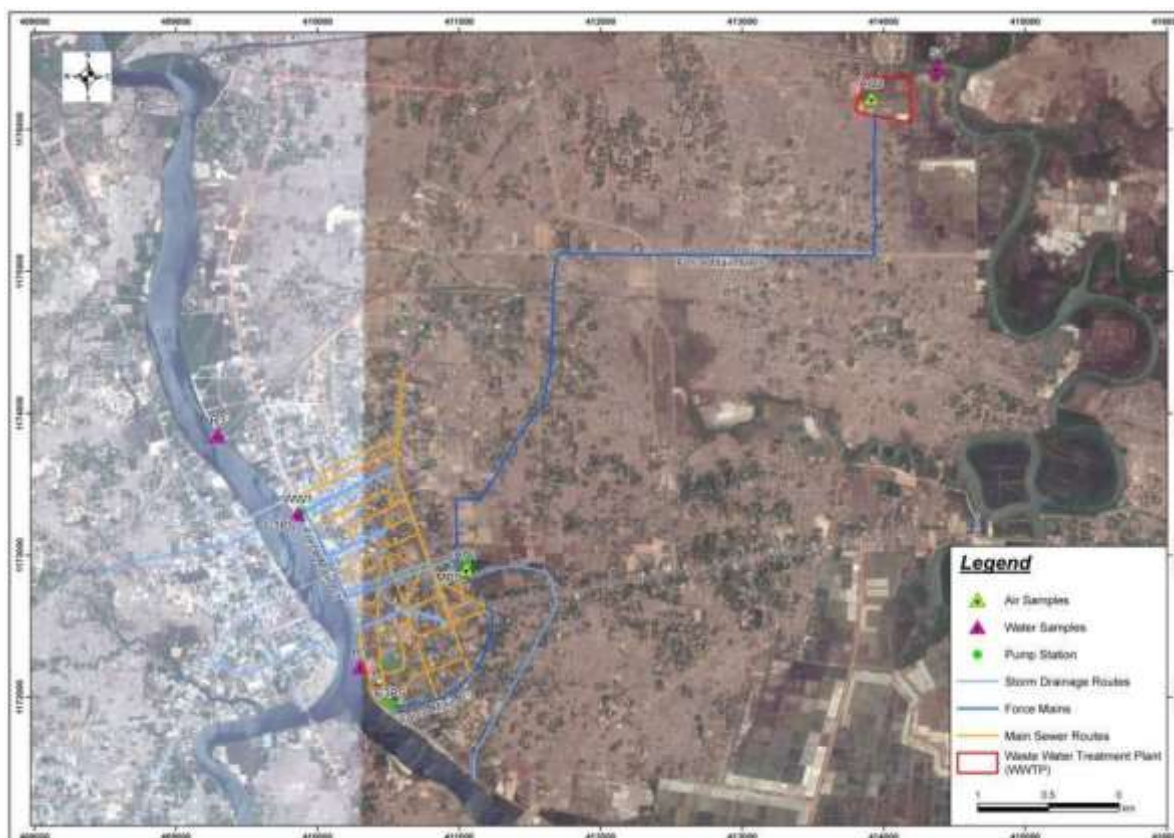
123. The biodiversity report¹¹ for the site notes that the tidal creek is wetland plays important role in regulating natural inflow and outflow movement of water and rainfall. It was also noted that the hydrological regime in the area may have already been altered due to significant in filling and development such as the new resort area to the north of the WWTP which is approximately 8 ha.

124. **Kampot drainage** includes outfalls into Prek Kampong Bay/Teuk Cheuu river. Depending on the section of the river referred to, locally this river has two names. The river drains into the sea approximately 5.5 km from the town centre. The open canal to the east of the town is a permanent surface water body, that discharges into Prek Kampong Bay/Teuk Cheuu river. It has not been sampled during the preparation of the IEE but a visual inspection shows it to be of low quality, heavily contaminated with sewage and solid waste and highly sedimented. In addition the MPS and balancing reservoir are located in an area which recently is ephemerally wet during the rainy season; historical satellite imagery from 2011 show the area to be dry. It is a naturally low area (approximately 3m (asl), compared to the adjacent main road, 4m (asl). The water is not a significant source for irrigation or any domestic use as the area is not agricultural but is increasingly urbanised. The water in the low land is not connected to any surface water stream.

125. **Kampot water quality analysis.** Water quality analysis was undertaken for the IEIA, in March 2018. Figure IV-9 shows the sample locations where WW1 is a wastewater channel, R1, R3 and S1 are surface water samples.

11 H Chamnan (2018) Rapid Environmental Assessment Report Proposed Wastewater Collection and Treatment Plant Kampot Province

Figure IV-9 Environmental Quality Sampling Locations, Kampot



Source: IEIA, 2018

126. Table IV-6 shows water analysis results for 5th March 2018 taken for the Kampot WWTP and sewerage network subproject. The table shows the parameters that did not meet the standard in bold, indicating heavy pollution from sewage, as indicated by a high Biological Oxygen Demand (BOD); at BOD levels of 100 ppm (mg/l) or greater, the water supply is considered very polluted with organic waste¹². Given that the sample was apparently taken from a channel known to convey sewage to the river, this is not unexpected.

Table IV-6: Water quality result in sewerage system in Kampot town

SAMPLE WW1				
NO	Parameters	Unit	Result	Standard
1	PH	-	8.2	6.5-8.5
2	Temperature	°C	23	<45
3	DO (dissolved Oxygen)	mg/L	0	>1.0
4	Turbidity	NTU	170	<120
5	Total Suspended solids TSS	mg/L	160	<80
6	Biological Oxygen Demand (BOD)5	mg/L	135	<100
7	Chemical Oxygen Demand (COD)Mn	mg/L	395	<15
8	Oil and Grease	mg/L	10.6	<0.1
9	Arsenic (As)	mg/L	0.01	<45
10	Cadmium (Cd)	mg/L	0.002	<0.5
11	Copper (Cu)	mg/L	0.006	<0.1
12	Lead (Pb)	mg/L	0.005	<0.1
13	Mercury) Total)	Mg/L	0.0007	<0.005
14	Total Coli form	MPN/100	46×103	NV

¹² <https://www.water-research.net/index.php/glossary>

Standard: Water Quality Standard in public water areas for bio-diversity conservation Sub-decree No. 42 ANRK.BK on Water Pollution Control, MOE, 1999 (*Annex 2 - Effluent standard for pollution sources discharging wastewater to public water areas or sewer*)

Source: Ministry of Environment Testing Laboratory

127. Table IV-7 shows water analysis results for three locations in Teuk Cheuu river, taken on 5th March 2018 for the Kampot drainage subproject. The parameters are all within the prescribed standard.

Table IV-7: Water Quality Analysis for Teuk Cheuu and Kbal Romeas River (Kampot)

No	Parameters	Unit	Results / Sample Number			Standard
			R-01 ^(a)	R-03 ^(b)	S-01 ^(c)	
1	pH	-	7.5	7.4	8	6.5 - 8.5
2	Temperature	oC	21	22	25	-
3	DO	mg/L	6.4	6.4	5.8	2 - 7.5
4	Turbidity	NTU	2	0	16	-
5	TSS	mg/L	47	6	59	25 -100
6	(BOD) ₅	mg/L	7.9	0.85	9.4	1-10
7	(COD) _{Cr}	mg/L	20	4	28	-
8	Oil and Grease	mg/L	3.8	0.24	4.86	-
9	Arsenic (As)	mg/L	0.003	ND	0.005	-
10	Cadmium (Cd)	mg/L	0.0006	ND	0.0004	-
11	Copper (Cu)	mg/L	0.0005	ND	0.0008	-
12	Lead (Pb)	mg/L	0.0003	ND	0.0002	-
13	Mercury (Total)	Mg/L	0.0002	ND	0.0003	-
14	Total Coli form	MPN/100	2.4×10 ³	1.4×10 ²	14.6×10 ³	<5000
(a) Teuk Cheuu River X=410301 Y=1172212 (b) Teuk Cheuu River X=409296 Y= 1173844 (c) Kbal Romeas River X=414377 Y=1176433 Standard: Water Quality Standard in public water areas for bio-diversity conservation Sub-decree No. 42 ANRK.BK on Water Pollution Control, MOE, 1999 (Annex 4)						

Source: Ministry of Environment Testing Laboratory

13. Marine environment

128. Marine water quality is not routinely tested in Cambodia so no data are available. It is noted that factors likely to lower marine water quality are increasing in Cambodia. These factors include increasing developments, land infill, deforestation in watershed catchments, sparse solid waste collections and untreated industrial effluents. Also the coast of Cambodia suffers from marine litter pollution as seen in mangrove coastal villages in neighbouring Koh Kong province.

F. Air Quality and Noise

129. Typically, in Cambodia, outside Phnom Penh or town centers there are few industrial pollution sources and the volume of vehicular traffic is low mean air quality is fair. Noise is generated from construction, particularly in urban centers which are growing rapidly. Kampot WWTP site is adjacent to a large resort development which will impact on air and noise during its construction. The main pumping station is in a more rural area which does not have any significant noise sources. Key noise sensitive receptors are residents living around the sites including access roads, during construction and operation.

130. **Kampot air, noise and vibration analysis.** Figure IV-9 shows the locations of the sampling, conducted for the IEIA on 16th March 2018. Based on the results of Table IV-8 to Table IV-10, the air quality is good as standards are met. The noise data are measured in LAeq (A-

weighted equivalent sound level) which normally gives a single value¹³, not a range as provided here, which makes comparison with the standard difficult. Also the vibration data are provided in decibels (dB) but it is more common to use hertz.

Table IV-8: Air quality results in Kampot Town 2018

Parameters	Unit	WWTP Site (AQ2)	Main Pumping Station (AQ1)	National Standard(a)
CO	mg/m3	0.54	1.86	20
NO2	mg/m3	0.014	0.017	0.1
SO2	mg/m3	0.01	0.011	0.3
TSP	mg/m3	0.047	0.063	0.33
PM 10	mg/m3	0.023	0.037	0.05
(a) Sub-decree No. 42 ANRK.BK on Air Pollution Control and Noise Disturbance, MoE 2000.				

Source: Ministry of Environment Testing Laboratory

Table IV-9: Noise level at WWTP and main pumping station at Kampot subproject 2018

Time	Standard dB(A)	Result, dB(A)		
		LAeq	Lmax	Lmin
WWTP site, 2018 (AQ2 sample)				
Day (6:00 - 18:00)	60	38-69	47-95	35-38
Evening (18:00 - 22:00)	50	12-44	55-60	35-36
Night (22:00 - 6:00)	45	41-45	52-60	35-37
Main pumping station (AQ1 sample)				
Day (6:00 - 18:00)	60	52-58	62-83	46-49
Evening (18:00 - 22:00)	50	47-51	56-64	44-46
Night (22:00 - 6:00)	45	47-52	51-79	45-47
Standard: Sub-decree No. 42 ANRK.BK on Air Pollution Control and Noise Disturbance, MoE , 2000				

Source: Ministry of Environment Testing Laboratory

Table IV-10: Vibration level at WWTP and main pumping station 2018

Time	Standard, dB	Result, dB		
		LAeq	Lmax	Lmin
WWTP site, 2018 (AQ2 sample)				
Day (6:00 - 18:00)	65	12.8-13	14.2-18.4	11.2-11.6
Night (18:00 - 6:00)	60	12.7-18.0	14.1-44.0	11.2-11.6
Main pumping station (AQ1 sample)				
Day (6:00 - 18:00)	65	12.8-13.4	14.6-24.5	11.1-11.6
Night (18:00 - 6:00)	60	12.8-12.9	14.1-17.2	11.2-11.6
Standard: Sub-decree No. 42 ANRK.BK on Air Pollution Control and Noise Disturbance, MoE , 2000				

Source: Ministry of Environment Testing Laboratory

G. Protected Areas, Flora and Fauna

14. 1. Protected Areas and Critical Habitat

131. The closest protected areas to the project sites are Bokor National Parks, approximately 15km to the west of Kampot town. Given the distance of Bokor national park to the subproject sites and its drainage (draining towards the project sites), it is not considered at risk of impact from the project.

15. Flora

¹³ Gracey and Associates, Sound and Vibration Basics

132. The urban sites associated with urban drainage and sewer networks are not located in areas of significant flora. The pipe networks are within the right of way which intermittently contain typical urban vegetation including stands of bamboo and urban trees. This vegetation is sparse. ADB commissioned a report¹⁴ from a biodiversity specialist for the WWTP subproject. This report is the key information source information on both flora and fauna for the subproject sites and is cited as the biodiversity report within the text.

133. **Kampot WWTP** is on a site which is a mixture of bare soil in the majority of the site, and grasses with some melaleuca species shrubs (myrtle) to the north of the site. Grassland is also located to the west of the site. Table IV-11 shows the recorded vegetation species from a flora assessment within the biodiversity report of the WWTP site, which includes a number of mangrove trees *Rhizophora mucronata*, Poir.

Table IV-11 Recorded plant species in the proposed WWTP, Cambodia

No	Scientific Name/Species	Local Name	Family	IUCN Red List	Cambodia classification
1	<i>Rhizophora mucronata</i> , Poir	Korng Kang	Rhizophoraceae	LC	
2	<i>Eugenia spp</i>	Pring	Myrtaceae	N/A	Common species
3	<i>Melaleuca leucadendron</i> , L	Smach	Myrtaceae	N/A	
4	<i>Combretum quadrangulare</i> , Kurz.	Sangker	Combretaceae	N/A	Common species

Note: IUCN = International Union for Conservation of Nature; LC = Least Concern; N/A = Not Applicable (not yet assessed)

Source: H Chamnan (2018) Rapid Environmental Assessment Report Proposed Wastewater Collection and Treatment Plant Kampot Province

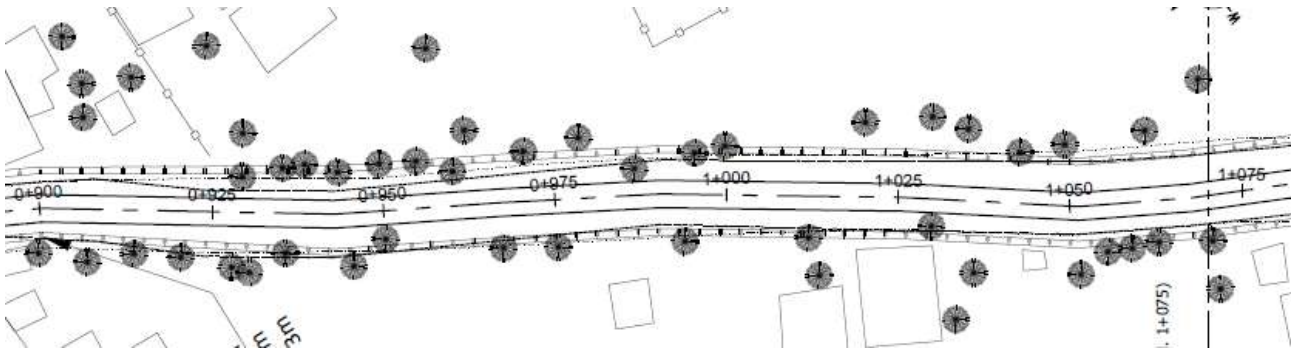
134. **Kampot urban drainage.** Along the open canal (line 4b) there are many Nypa palm *Nypa fruticans* (Dem Chak, Khmer name) growing in the canal and they interfere with the design flow of the canal. Based on the detailed design and subsequent Bill of Quantities, 11,400 Nypa palm trees¹⁵ will be removed from the canal (length approximately 2.2km), with a trunk diameter of 300mm. Nypa palm tree grows very fast; every one to two years local people cut the trees in the canal to promote flow of water. Nypa palm IUCN conservation status is Least Concern. According to the Resettlement Report (revised 2018) 46 of these trees are to be investigated by the General Department of Resettlement which has the legal mandate to determine the affected assets.

135. A typical section of the open canal line 4b shown below indicates how nypa palm trees are growing within the canal, impeding the flow with both their trunks and roots and the trees then 'trap' waste which collects in the canal.

¹⁴ H Chamnan (2018) Rapid Environmental Assessment Report Proposed Wastewater Collection and Treatment Plant Kampot Province

¹⁵ VO3 does not increase the number of trees to be removed. This remains as per the original BoQ.

Figure IV-10 Open canal line 4b nypa palm density



Source: PISCB team

Figure IV-11 Open canal line 4b nypa palm encroachment



16. Fauna

136. **Kampot WWTP.** The biodiversity report confirms that no large or significant fauna is present in the project sites. The mangrove trees close to Kampot WWTP may once have been a habitat for rare and endangered otter species, but research suggests they are not present in the subproject areas as no sightings are known about and they were not reported as present in the biodiversity report for this project.

137. The Biodiversity report for Kampot WWTP notes that no fauna was observed during field visits. This includes bird's species and states that the ecosystem of the tidal creek should not be

affected by the WWTP with respect to fauna.

138. The original IEE for this project noted that mangrove is the habitat for the rare smooth coated and hairy-nosed otters. Given the location of the WWTP, and the proximity to mangrove, the likelihood of otters in the vicinity of Prek Kbal Romeas was discussed with the International Otter Survival Fund and Conservation International¹⁶. A report was provided¹⁷ that includes sightings in Ream National Park where 39 camera locations took 327 photos of primarily smooth coated otters. The report acknowledges that knowledge of otter distribution remains limited and that in particular further study of coastal sites and is required to improve understanding. The report notes that degradation and conversion of wetlands and wet forests into rice fields, shrimp farms, and other land uses is steadily reducing habitat for otters, while overfishing is depleting their food sources. Therefore given the nature of the wetlands close to the WWTP where salt farms are present and a new resort is under construction, it is unlikely to be a favourable habitat for otters.

139. During consultation with Community Fishery members in relation to Kampot WWTP, the common bird species observed in the area were noted and given in Table IV-12 and common river fauna was listed in Table IV-13. All the species listed are common to the area and do not have local or international protection status, classified as Least Concern or not yet assessed for by IUCN, as checked on IUCN Redlist, August 2018.

Table IV-12: List of bird species found in the Kampot WWTP area

No	Scientific Name	English Name	Khmer Name
1	<i>Hirundo daurich</i>	Red-rumped Swallow	Tro Cheakkam Khnang Krahorm
2	<i>Hirundo rustica</i>	Barn swallow	Tro Cheakkam
3	<i>Acridotheres javanicus</i>	White-vented Myna	Sarika
4	<i>Phylloscopus inornatus</i>	Yellow-browed Warbler	Chab Chenhcherm Leoung
5	<i>Passer flaveolus</i>	Plain-backed Sparrow	Chan Srok
6	<i>Himantopus himantopus</i>	Black-winged stilt	Cherng Tean
7	<i>Vanellus indicus</i>	Red-wattled Lapwing	Trode Vech
8	<i>Corvus macrorhynchos</i>	Large-billed Crow	Kok Teuk
9	<i>Phalacrocorax niger</i>	Little cormorant	Kok Teuk Touch
10	<i>Phalacrocorax fuscicollis</i>	Indian cormorant	Kok Teuk Mothyom
11	<i>Phalacrocorax carbo</i>	Great Cormorant	Kok Teuk Tom
12	<i>Amaurornis Phoenicurus</i>	White-breasted waterhen	Maon Teuk

Source: Community Fishery Consultation, PISCB team, August 2018

Table IV-13: Fish, crab and mollusk species found in the Kampot WWTP area

No	Scientific Name	English Name	Khmer Name
1	<i>Liza vaigiensis</i>		Trey Kbok
2	<i>Lophiodes naresi</i>		Trey King Kuok
3	<i>Xenoccephalus</i> sp.		Trey Kantuy Krabei
4	<i>Clarias nieuhofi</i>		Trey Andaing Poy
5	<i>Arius</i> sp		Trey Ka ok
6	<i>Lutjanus johnii</i>		Trey Ang Kery
7	<i>Lethrinus lentjan</i>	Pinkear emperor	Trey Krab Khnol
8	<i>Sillago sihama</i>	Silver sillago	Trey Pro Luos
9	<i>Siganus canaliculatus</i>	Whitespotted spinefoot	Trey Kantang Kra-oub
10	<i>Psammoperca waigiensis</i>	Sand bass	Trey Spong
11	<i>Eleutheronema tetradactylum</i>	Fourfinger	Trey Karav
12	<i>Carcharhinus dussumieri</i>	Whitecheek shark	Trey Chhlam Sar
13	<i>Drepane punctata</i>	Sicklefish	Trey Slek Bas
14	<i>Gazza minuta</i>	Toothpony	Trey Sambou Hea

¹⁶ Personal Communication with Helen Stephenson, International Otter Survival Fund

¹⁷ Heng S. Et al (2016) The hairy-nosed otter *Lutra sumatrana* in Cambodia: distribution and notes on ecology and conservation

No	Scientific Name	English Name	Khmer Name
15	Achiroides melanorhynchus		Trey Andat Chhke
16	Monacanthus chinensis	Fanbellied leantherjacket	Trey Kou
17	Rachycentron canadus	Cobia	Trey Phtuok
18	Penaeus sp		Bong Kea
19	Penaeus monodon	Giant tiger Prawn	Bong Kea Khleung
20	Scylla serrata		Kdam Thmar
21	Episesarma versicolor	Violet vinegar crab	Kdam Chor
22	Eucrate alcocki		Kdam Sleek Cher
23	Ozium guttatus	Spottedbelly rock crab	Kdam Pkor Leann
24	Portunus pelagicus		Kdam Ses
25	Anadara nodifera	Nodular Ark	Kreng Chheam

Source: Community Fishery Consultation, PISCB team, August 2018

H. Socio-Economic Environment

140. The information in this section is taken from a household socio-economic survey conducted with 50 households in Kampot (May 2018), during the preparation of the IEIA.

141. **Occupations.** According to interviews with local people in three villages (Krang, Mouy Uksophea and Kampong Bay village) show that there were six main occupations found in the project area. The highest percentage is small scale business, 66.7% follow by farmer, Non-Governmental Organisations (NGO) and private company staff.

142. **Income and expenditure.** According to the socio-economic survey conducted in three villages (Krang, Mouy Uksophea and Kampong Bay village), the highest average income is pharmacist (966 \$/month) and follow by private company staff (800 \$/month) and small scale business (685 \$/month). The lowest average income is farmer (500\$/month). The expenditure and income is given in Table IV-14.

Table IV-14: Monthly income and expenditure in Kampot subproject

No.	Occupation	Monthly income (\$)	Monthly expend (\$)
1	Pharmacist	966	416
2	Staff of private company	800	425
3	Small scale business	685	351
4	NGO	625	250
5	House Rental	600	300
6	Farmer	500	200
7	Other	650	350

Source: IEIA conducted by KCC, 2018

143. **Water and energy use.** The water use in Kampot town increases every year due to increasing population size; Table IV-15 shows that water use increased by 51% between 2012 and 2016.

Table IV-15: Water use in Kampot town from 2012 to 2016

Data	Unit	2012	2013	2014	2015	2016
Annual Water Supply	m ³	1,449,418	1,635,809	1,828,787	2,130,954	2,193,243
Daily Water Supply	m ³	3,971	4,482	5,010	5,838	6,009
Annual Water Use	m ³	1,178,629	1,344,923	1,570,918	1,899,425	1,989,063
Daily Average Water Use:	m ³	3,229	3,685	4,304	5,204	5,449
1. Residential Water Use	m ³	2,791	3,205	3,107	3,725	4,037
2. Trading Water Use	m ³	98	129	880	1,101	977
3. Institutional Water Use	m ³	340	359	318	378	436

Source: Water supply Authority in Kampot town

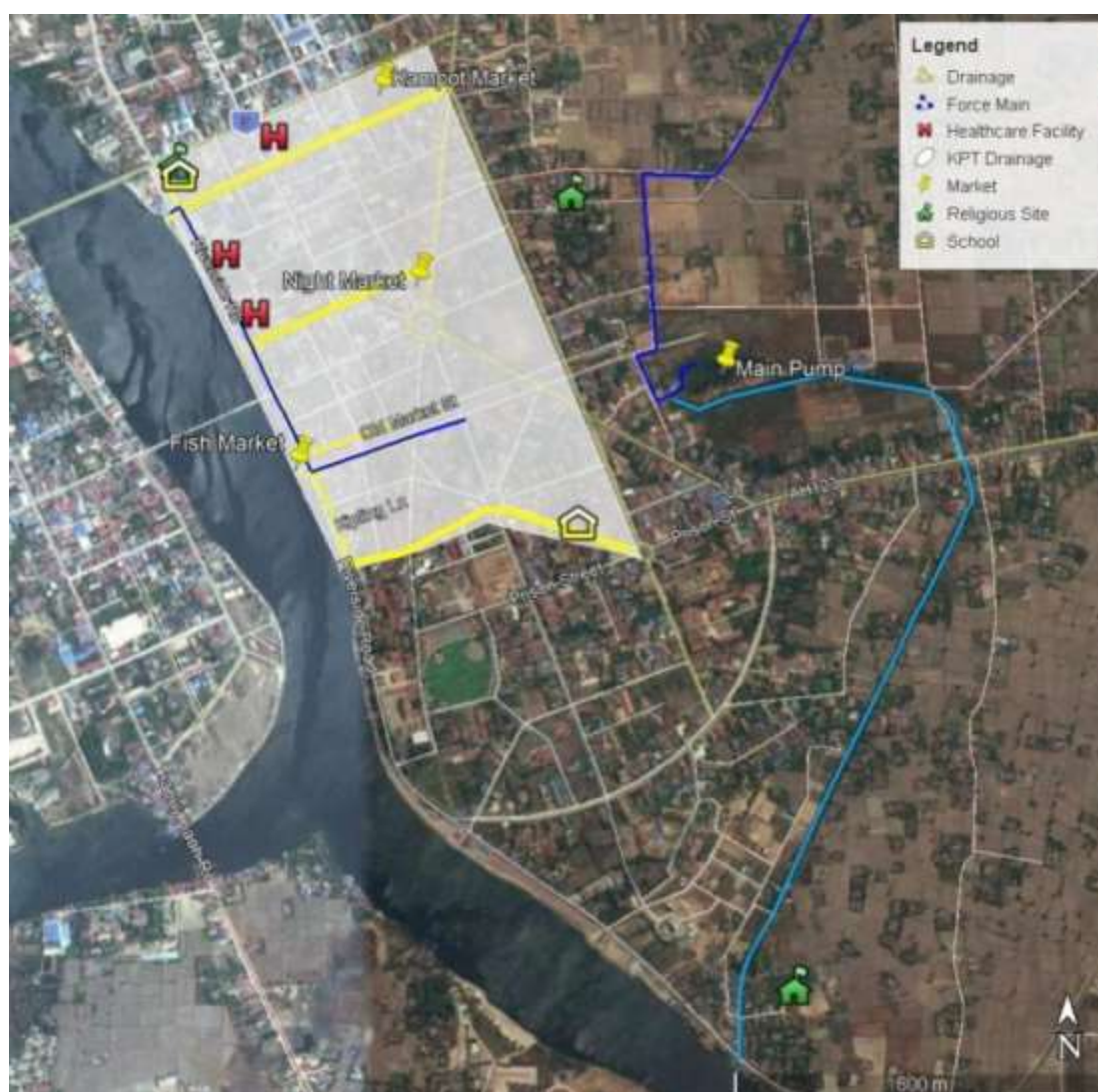
144. The capacity of power supply in Kampot province is 3.08 MW. This is imported from

Vietnam through Kampong Trach district to supply in Kampot town. In 2015, power directly supplied by Electricite Du Cambodge via 22KV voltage distribution and the 3338km of low voltage network (0.4Kv) was used by over 11,00 consumers.

145. **Kampot Solid Waste Management.** Waste management is intermittent in the town with collections taking place for disposal at the dumpsite in some areas of the town but not all. Outside the urban core, collection usually does not take place and residents are required to manage their waste according to their own preferences. Typically in Cambodia this includes burning, burial or dumping elsewhere informally.

146. Figure IV-12 shows three health care facilities and two schools within the area of influence of construction. This includes the main Kampot hospital, a maternity clinic and a small health center.

Figure IV-12 Kampot Urban Socio-Economic and Cultural Receptors



Source: PISCB Team

I. Physical Cultural Environment

147. Figure IV-12 above shows the locations of three religious sites within the urban area which are within the area of influence of the project. Additionally, Prey Tom Pagoda (10°38'9.50"N, 104°11'43.60"E) is 750 m from the force main as it approaches the WWTP but this is considered outside the area of influence including access issues. No historic cultural buildings including colonial architecture will be affected by the project.

V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

A. Positive Impact and Environmental Benefits

148. The subprojects will bring about improved urban environment and climate change-resilience, significantly contributing to an improvement in the lives of residents. In particular, Kampot residents will benefit from a wastewater treatment plant which is anticipated to significantly improve the urban environment. For the wastewater collection and treatment in Kampot, the benefits will only be realized if the residents and businesses use the connections laid by the project and connect to the sewer network.

B. Environmental Impact Screening

149. Screening environmental impacts allows minor impacts to be screened out, allowing the EMP to focus on those impacts which are most in need of mitigation measures. The following section screens the potential impacts according to the following factors and recommends mitigating activities on this basis:

- **“Receptor”**: the resource (human/natural environment/economic/social) which is potentially going to receive and have to cope with an impact.
- **“Sensitivity”**: ability to cope with an impact and/or its importance to the country of Cambodia. It is generally accepted that human health is always a high sensitivity receptor, however in terms of environmental/natural resources, the sensitivity varies according to the receptor e.g. scrubland with no significant biodiversity is considered less sensitive than a mature forest which supports ecosystems and livelihoods.
- **“Magnitude”**: the size of the potential impact. Impacts may be short term and considered low magnitude (e.g. noise or temporary reduction of income during a short construction project) or high magnitude (e.g. the poor disposal of large quantities of hazardous waste into a water course).

150. Where an impact may occur, if there is no receptor to receive the impact, mitigating actions will not be required. This follows the source-pathway-receptor model, whereby in order for there to be an impact, the pollutant or issue (source) needs to be present, the pathway to a receptor is needed (such as fissures in rocks, or water for human consumption) and a receptor must be present to receive the impact, such as humans, flora or fauna.

151. **Potential impact significance.** The following matrix was used during the screening process to anticipate the potential significance of impact, in order to identify the most significant likely impacts to be addressed in the Environmental Management Plan:

Figure V-1 Impact Screening Matrix

		Magnitude of Impact		
		LOW	MEDIUM	HIGH
Receptor Sensitivity & Importance	LOW	Low	Low	Medium
	MEDIUM	Low	Medium	High
	HIGH	Medium	High	High

152. **Residual impact significance.** The residual significance of the impact is the potential impact that remains following mitigation. This more accurately describes the impacts of the project as it is anticipated that the requirements of the EMP will be followed and impacts satisfactorily mitigated.

C. Actions and Impacts Associated with Project Location, Planning and Design

153. Actions associated with the planning phase, prior to construction, that are considered to support sound environmental safeguards are:

- (i) Institutional strengthening. Establishment of PMU and PIU offices and nomination of appropriate staff for each. Includes issuing a Prakas to formally define the offices in relation to the project. Prior to the start of construction, an environmental capacity building and training program will be instigated by the PISCB team. The training will focus on ADB's and Cambodia's relevant environmental, health and safety laws, regulations and policies; implementation of the EMP, environmental monitoring, requirements for information disclosure, public consultation and the project GRM.
- (ii) Grievance Redress Mechanism will be established and functioning prior to construction as detailed in Section VIII of this IEE.
- (iii) This IEE will be updated throughout the project as required, including when the phased completion of project designs takes place. This will result in EMPs also being updated if required.
- (iv) EMPs will be included in the bidding documents. Contractors will then be aware of the required mitigation measures and can budget accordingly for them.
- (v) Disclosure and Consultation. This will take place before construction and will be repeated during the implementation phase, as detailed in Section VII of this IEE.
- (vi) Environmental quality baseline. The environmental baseline is analysed for all subprojects including air quality, nearest water body quality, noise and vibration as required by the IEIA and reported in this IEE.
- (vii) Unexploded ordinance (UXO). UXO clearance will be required prior to any construction activities taking place.
- (viii) WWTP Design for effluent standards. The WWTP engineer confirms that the three pond approach design will be adequate to meet national standards for all parameters. Therefore the effluent can be discharged in accordance with the Sub-decree on Water Pollution Control, 1999.

- (ix) Noise from pumping stations. The roofs to the pumping stations are made of concrete with a steel access cover which will protect the resident from noise. For the main pumping station the screens protrude above ground level and there is an opening for these, however the pumps are submersible which reduces noise. A tree screen is specified in the Bill of Quantities for the main pumping station which will also mitigate noise impacts.

154. No specific indirect, cumulative or induced impacts are anticipated in the design phase.

D. Environmental Impact and Mitigation Measures in Construction

155. The impacts on environmental receptors identified for construction are set out according to the activities anticipated during construction. This makes the EMP as practical as possible for the contractors and operators who are required to follow the mitigation measures within the EMP, as they implement their activities.

156. These impacts and mitigation measures apply to all subprojects in Kampot as indicated for each construction activity. The specific EMPs will include site specific references to receptors as required, to ensure the contractor and operators are clear on the locations of the key receptors and mitigation measures.

157. Where indirect, cumulative or induced impacts are anticipated, this is specifically mentioned.

17. Land clearance and grubbing – Kampot WWTP

158. **Potential Impacts.** The clearing and grubbing shall consist of clearing the sites of vegetation, grubbing stumps and roots from the WWTP. Potential impacts will be associated with the noise from clearance process, and the disposal of waste arisings. There will be some loss of vegetation and associated ecosystem services from the secondary vegetation growing in the sites.

- **Potential Impact Significance:** Low – the impacts are short term and are not in the immediate vicinity of significant numbers of housing.
- **Residual Impact Significance:** Low – mitigation measures will be applied to ensure the impacts are as low as possible.

159. **Mitigation Measures.** The mitigation measures are covered by those defined below for solid waste management, use of machinery and equipment and flora. Therefore no further mitigation is needed for land clearance and grubbing.

18. Construction staging area.

160. **Potential Impacts.** A staging area will be required for storing machinery, stockpiles and equipment required for construction. For drainage and sewage subprojects, this site will be located well outside the construction area; the main potential impact from a staging area is on soil quality from machinery and fuel storage, and the noise and traffic associated with vehicle movements. The site(s) will not be located close to surface water body.

161. **Potential Impact Significance: Medium** – the staging areas will not be located close to residential receptors or water bodies, but impacts on land quality maybe medium term if management of the site is poor.

162. **Residual Impact Significance: Low** – impacts can be lowered through good practice and appropriate siting of the staging area.

163. **Mitigation Measures.** The contractor will provide a map to identify the staging area and this will not be within 20m of a water course and the other mitigation measures in the EMP such as

fuel storage and vehicle maintenance requirements will be followed. A plan for restoration following construction will be required.

19. Earthworks and excavations

164. **Potential Impacts.** The impacts from earthworks and trench excavation in urban areas and along public roads include noise, air quality impacts and traffic generated by construction vehicles as well as road closures or restrictions. The earthworks from the MPS balancing pond embankment and fill either side of the concrete lining for the canal line 4b improvements and will also contribute to noise and dust generation. The impact screening is:

- **Potential Impact Significance: High** – potential sensitive receptors, impacts may be intense in crowded urban areas and will contribute to cumulative impacts from general traffic
- **Residual Impact Significance: Medium** – impacts can be lowered through good practice but traffic / road network disturbance cannot be avoided

165. Recommended mitigation measures to reduce impacts from urban excavations include:

- (i) Water will be sprayed at least twice per day on construction sites, material handling areas when fugitive dust is noticeably generated.
- (ii) All topsoil and overburden removed should be stockpiled for later restoration
- (iii) A Traffic Management Plan will be provided (see Community Health, Safety and Urban Access).
- (iv) Trained traffic marshals will be used to direct large construction vehicle movements.
- (v) Minimize time that excavations and exposed soil are left open/exposed. Backfill immediately after work is completed.

20. Drain Clearance

166. **Potential Impacts.** The impacts from clearing a considerable length of drainage network which will contain sewage and other debris may affect land and water quality, depending on where within the network the activity takes place and how it is managed. The impact screening is:

- **Potential Impact Significance: High** – sensitive receptors including surface water quality
- **Residual Impact Significance: Low** – impact can be mitigated through good practice

167. Recommended mitigation measures to reduce impacts from drain clearance activities include:

- (i) The contractor will specify the methodology for drain clearance and measures to prevent a spillage
- (ii) If sewage is unintentionally spilled, discharged, leaked or otherwise deposited in the open environment, the contractor will be responsible for any clean-up and disinfection of the affected area
- (iii) The contractor will follow the Solid Waste Management sub-plan requirements for disposal of the material from drain clearance.

21. Open Canal Line 4b Clearance and Renovation

168. **Potential Impacts.** The impacts will result from disturbance of the vegetation and banks during the construction of gabions and installation of the concrete lining segments, resulting in increased sedimentation and short term cumulative impacts on the already low water quality as the canal sections are dewatered and a cofferdam installed, as per contract requirements. The removal of debris and house foundations from the canal is anticipated to mobilise some wastes during

clearance, contributing to further waste emissions into the river. The impact screening is:

- **Potential Impact Significance: Medium** – the baseline water quality is already extremely low but will contribute to additional sediment loading and waste mobilization;
- **Residual Impact Significance: Low** – impact can be mitigated through good practice

169. Recommended mitigation measures to reduce impacts from drain clearance activities include:

- (i) The contractor will specify the methodology (method statement) for: 1) waste clearance and foundation removal to reduce further mobilisation of waste into the water body through use of screens or other simple techniques; and 2) coffer dam and dewatering.;
- (ii) Where possible the works will be undertaken in the dry season.

22. Spoil Management

170. **Potential Impacts.** Spoil will be generated during excavations, open canal line 4b renovations and rehabilitation of existing channels for drainage works. Inappropriate spoil disposal can impact on receptors including land quality, agricultural production and surface waters. Receptors maybe highly sensitive, such as water bodies if spoil is allowed to creep into water, and the impacts can be long term. The impact screening is:

- **Potential Impact Significance: High** – sensitive receptors
- **Residual Impact Significance: Low** – simply mitigated

171. With adequate spoil disposal methods, the impact of generating and disposal of soil will be minimal. Mitigation Measures include a Spoil Management Plan which sets out the following, in advance of construction:

- (i) A map of where spoil will be disposed.
- (ii) Preference must be given to use of spoil other construction sites, or disposed in spent quarries or borrow pits.
- (iii) **Uncontaminated spoil** to be disposed of in Government approved sites, which will not be on agriculturally productive land, within 50m of a water course, including stream, river or irrigation channel, on sloped land, within 50 m of cultural heritage sites, within 100 m of any other culturally or ecologically sensitive feature.
- (iv) **Contaminated spoil** disposal must be tested for contaminants then follow Government regulations including handling, transport, treatment (if necessary), and disposal and will be isolated from human contact and environmental receptors by plastic sheeting or similar.
- (v) A record of type, estimated volume, and source of disposed spoil must be recorded.

23. Solid and Liquid Waste

172. **Potential Impacts.** Wastes will be generated throughout construction and will impact on resource use associated with waste production. This includes generation of inert wastes e.g. spoil, biodegradable wastes e.g. cleared vegetation, hazardous wastes e.g. oily wastes and liquid wastes such as sewage from any construction worker sanitation facilities. Significant quantities of waste will also be generated from cleaning the existing drain system, including the open canal and the removal of foundations from the side of the canal. The impact screening is:

- **Potential Impact Significance: High** – sensitive receptors and hazardous wastes
- **Residual Impact Significance: Medium** – simply mitigated but resource use cannot be avoided and waste disposal facilities are poor and of limited capacity

173. With adequate waste disposal approaches, including prevention of waste from being generated through recycling, waste generation should not have significant impacts on environmental receptors. The following mitigation measures are recommended:

- (i) Manage general solid and liquid waste from construction in line with Government regulations, and will cover, collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force.
- (i) Make clear arrangements for storage and transportation of all hazardous and non-hazardous waste to an authorized and approved disposal point (approved by Provincial Department of Environment).
- (ii) Segregate recyclables at source and given/sold to recycler (plastic, metal, card, paper as a minimum)
- (iii) Store all solid waste in containers with lids, more than 25 m from all surface water, water supplies, and cultural and ecological sensitive receptors.
- (iv) Prohibit burning of waste at all times;
- (v) Provide all vehicles/drivers with plastic bags for waste collection and prevent any unauthorized waste disposal with particular attention paid to prevention of waste entering water ways including drainage ditches
- (vi) Provide a schedule of solid and liquid waste pickup and disposal must be established and followed that ensures construction sites are as clean as possible.
- (vii) All spills must be cleaned up completely with all contaminated soil removed and handled in accordance with spoil management mitigation measures.
- (viii) For **cleaning of the existing drainage system** the sub-plan will
 - A) determine the quantity of all debris, silt, and accumulated solids removed from the drainage.
 - B) define how and where the debris will be transported and disposed.
 - C) provide the necessary authorizations or agreements for drainage debris disposal.
- (ix) Under no circumstances shall the removed sewage or solids be dumped onto streets or into ditches, catch basins, storm drains, sanitary or combined drainage manholes, or otherwise improperly disposed.

24. Occupational Health and Safety and Emergency Response

174. **Potential Impacts.** Occupational health risks are particularly a concern in construction sites where excavations, heavy machinery and equipment is used. The excavation depths for the wastewater collection is 1.2m which is shallow enough not to anticipate the need for additional trench supports but this will be decided on by a case by case basis¹⁸. The receptors (construction workers) are considered sensitive and the magnitude of an impact will be high, should life changing injury or a fatality occur. The impact screening is:

¹⁸ IFC/World Bank EHS Guidance for Occupational H&S does not give guidance on shoring excavations. Other jurisdictions such as UK Health and Safety Executive recommend shoring at 1.2m but is dependent on the likelihood of material slippage.

- **Potential Impact Significance: High** – sensitive receptors
- **Residual Impact Significance: Low** –accidents can be largely avoided through good practice.

175. For the avoidance of occupational accidents and injury to workers, the following mitigation measures are recommended:

- (i) Assurance that all workers are equipped with, and use Personal Protective Equipment (PPE).
- (i) Specifications for the PPE to be used on site and the contractors' approach to enforcement of its use by workers
- (ii) Sufficient signage giving occupational health and safety warnings and information disclosure within all construction sites – sub-plan to include example warnings.
- (iii) Details of worker education and awareness seminars for construction hazards will be given. A construction site safety program will be developed and distributed to workers.
- (iv) Details of daily toolbox meetings (safety briefings)
- (v) Details of the site accident record book which will be maintained where all major or minor accidents and incidents are recorded with actions taken.
- (vi) An Environment Health and Safety qualified engineer or staff member will be engaged for the contract and adequate first aid equipment provided on site.
- (vii) Drinking water must be provided at all construction sites.
- (viii) Provision of risk assessment and method statement for transport of pre-fabricated canal sections to the open canal line 4b renovation site.

176. In addition, an emergency response plan will be required, detailing preventative measures for all types of incidents covered in the plan. This will include: Worker injury, Spillage, Fire, and other incidents anticipated by the contractor.

177. As of March 2020, COVID-19 protection measures are required for all Contractors. Any EMPs written after this date will include specific COVID-19 measures to be followed by the Contractor. For contracts started before this date, contractors are required to demonstrate their consideration of COVID-19 transmission and prevention, and how they are managing the issues on active construction sites.

25. Construction Workers and Camp Management

178. **Potential Impacts.** The influx of workers from outside the area may cause social problems, particularly if the workers are from overseas and are not familiar with local customs and laws. Also the establishment of worker camps, if used in the construction phase, can cause water and soil contamination and will produce household type wastes. The impact screening is:

- **Potential Impact Significance: Medium** – potential sensitive receptors, low magnitude/duration of impact
- **Residual Impact Significance: Low** –impacts can be avoided through good practice

179. For the avoidance of social and environmental concerns and for the welfare of any workers housed in a construction workers' camp, the following mitigation measures are recommended:

- (i) A map showing camp lay out, welfare facilities, and first aid kit locations.

- (ii) Accommodation facilities including separate toilets for male and female workers, adequate drainage to prevent flooding, security including a no weapons policy and waste disposal areas.
- (iii) Pit latrines to be located at least 200m from surface waters, and in areas of suitable soil profiles and above the groundwater levels
- (iv) A clean-out or infill schedule for pit latrines must be established and implemented to ensure working latrines are available at all times.
- (v) Worker camps will have adequate drainage.
- (vi) Providing fire fighting equipment will be provided in all camps and will have adequate signage and prescribed testing intervals.

180. In addition, if a camp is not required, mitigation measures will include:

- (i) Adequate waste disposal facilities including garbage cans for workers.
- (ii) Welfare facilities including water for washing, drinking and include facilities for male and female workers
- (iii) toilets for male and female construction workers with a cleaning schedule
- (iv) The contractor will give priority to local labor force and retain evidence of how local labor recruitment efforts were undertaken
- (v) Relevant training for all construction workers (HIV/Aids, Cambodian laws, GRM, Occupational Health and Safety)

181. The mitigation measures in the EMP include a preference for use of local workers, then workers renting houses within the area, instead of a camp. If this is not possible suitable accommodation will be provided in order to meet ILO Minimum Work Camp Standards, as a supplementary table in EMP. In addition to ILO Requirements¹⁹, International Finance Corporation requirements are included in the EMP to the extent practicable. Good camp housekeeping will be maintained includes sound waste management; relevant training on local laws and health protection measures provided including on COVID-19; first aid kits are required; communal areas will be provided; strict food hygiene standards will be maintained.

26. Community Health, Safety and Urban Access

182. **Potential Impacts.** During excavations, movement of construction vehicles, and general construction, the local community can be affected by health and safety risks and access to their businesses, particularly given the urban nature of the work and the proximity of buildings to the construction areas. The impact screening is:

- **Potential Impact Significance: Medium** – potential sensitive receptors.
- **Residual Impact Significance: Low** – impacts can be avoided through good practice

183. Recommended mitigation measures to prevent community accidents and injury and ensure safe access to property includes a Community Health, Safety and Urban Access Plan which will set out:

- (i) For urban sites: Traffic Management Plan. It identifies how the contractor will ensure traffic is directed through construction areas, signs and warnings used, information disclosure on traffic e.g. road closures or change of lane priorities for urban projects, and how speeds will be controlled for the safety of staff and the public. It includes

¹⁹ ILO (2009) Workers' housing. ILO Helpdesk Factsheet No. 6

controls on construction traffic including speed limits and identifies routes acceptable for construction vehicles.

- (i) For urban sites: Details of appropriate fencing or protective barriers, lighting and buffer zones which will be provided around all construction sites including barriers with lighting where needed on access roads and populated locations.
- (ii) Mud on public roads will be removed at the end of each day and signs warning of mud/skid risk will be placed on the road. Other spillages on public roads will be removed immediately.
- (iii) For all sites: Details of sufficient signage giving community dangers / warnings and information disclosure outside all construction sites.
- (iv) 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.
- (v) For urban excavations (sewers and/or drainage) safe access will be maintained for pedestrians and vehicles to schools, markets, houses, pagodas and commercial establishments. Temporary safe access will be constructed where needed. No temporary access shall be greater than 3:1 slope to allow access to all.
- (vi) For all sites: The contractor will ensure access to private land surrounding the construction sites.

27. Raw material extraction (quarries and borrow sites)

184. **Potential Impacts.** Existing quarries will be used for extraction of the aggregates therefore there is less impact than if a new site was to be established however asphalt and concrete batching plants may be required for WWTP building construction and finishing road surfaces including DBST pavements along the open canal line 4b. A borrow site will be required for the scope change/CW01/VO3&4 soil works at the MPS and fill material will be required for open canal line 4b renovation works. The impacts will vary according to whether a new site will be established or an existing one used. Impact from a new site may result in loss of scrub vegetation and change of landforms, as well as the noise, dust and disruption to people if the site is located close to a residential property.

- **Potential Impact Significance: High** –humans may be affected if close to their property. Some loss of habitat through removal of flora for a new site.
- **Residual Impact Significance: Low** –impacts can be lowered or even avoided through good site selection

185. Recommended mitigation measures to reduce impacts from use of a borrow site include:

- (i) Selection of an area which is not: close to housing areas or any isolated residential property; covered with mature established vegetation; close to surface water.
- (ii) Relevant permissions will be obtained prior to establishment of a borrow site.
- (iii) If an existing borrow site is used, the mitigation measures for 'Transport, Storage and Use of Construction Materials' shall apply.

28. Transport, Storage and Use of Construction Materials

186. **Potential Impacts.** The use of heavy construction vehicles to move construction materials including loose aggregates and any pre-fabricated structures such as concrete U-drains, can impact on the local community by increasing the risk of traffic incidents and the air pollution (dust and fumes) associated with vehicle use and the movement of loose materials. Asphalt and concrete batching plants may be required for WWTP building construction and finishing road surfaces and will

be associated with air quality impacts. Open canal line 4b renovation will require the off-site manufacture of concrete forms which are to be handled by crane into place. This issue also covered in 'Occupational Health and Safety' mitigation measures. The impact screening is:

- **Potential Impact Significance: High** – potential sensitive receptors, impacts maybe intense in crowded urban areas
- **Residual Impact Significance: Medium** – impacts can be lowered through good practice but disturbance (dust and traffic) cannot be avoided

187. Recommended mitigation measures to reduce impacts from construction material transport, storage and use include:

- (iv) Define and schedule how materials are transported, and handled and stored at sites.
- (i) Define and schedule how fabricated materials such as steel, wood structures will be transported and handled.
- (ii) Define access route for delivery truck, crane and pre-fabricated concrete structures to the open canal line 4b.
- (iii) Trucks carrying dry construction materials such as earth; aggregate will be covered with tarpaulins or other suitable cover.
- (iv) Driving on unmade roads, trucks will be limited to 15 kph. Warning sign to inform road users of turning heavy vehicles will be used where trucks cross or turn off the National Road #3.
- (v) Asphalt and concrete batching facilities will be located at least 500m downwind from the nearest dwellings in order to reduce the impact of fumes on humans and to be fitted with necessary equipment such as bag house filters to reduce fugitive dust emissions.
- (vi) Water will be sprayed on material storage areas where fugitive dust is generated and where vehicles are transporting materials on unmade roads, generating dust, where human receptors are within 300m.
- (vii) A new borrow site will require correct permissions and licences before it can be established.

29. Use of Machinery and Equipment

188. **Potential impacts.** Static or mobile machinery and equipment will produce noise which can impact on local residents and business owners, particularly in crowded urban areas. This will contribute to the cumulative impacts of existing traffic noise. The use of equipment may impact on water or soil quality if the machinery is not kept in good order, or is repaired in the wrong location e.g. near a sensitive receptor. Also there are inherent occupational health and safety risks to when using construction equipment. The impact screening is:

- **Potential Impact Significance: High** – potential sensitive receptors, cumulative noise impacts in crowded urban areas and WWTP site
- **Residual Impact Significance: Medium** – noise impacts can be lowered through good practice but cannot be avoided, pollution and health and safety impacts can be avoided.

189. Recommended mitigation measures to reduce impacts from use of machinery and equipment are:

- (i) Maintain all exhaust systems in good working order; undertake regular equipment maintenance;

- (ii) Restrict construction activities using heavy machinery between 8 am - 5 pm
- (iii) Provide advance warning to the community on timing of noisy activities including all cultural, education and health receptors listed in this EMP. Seek suggestions from community members to reduce noise annoyance, particularly related to noise sensitive activities at receptors
- (iv) Public notification of construction operations will incorporate noise considerations; information procedure of handling complaints through the Grievance Redress Mechanism will be disseminated.
- (v) Ensure noise monitoring is undertaken near sensitive receptors, particularly dwellings when construction machinery is operational
- (vi) Construction vehicles and machinery will be maintained to a high standard to minimize emissions
- (vii) All construction workers will use appropriate Personal Protective Equipment (PPE) including ear defenders when operating machinery;
- (viii) No washing or repair of machinery within 50m of surface waters including rivers.
- (ix) Vehicles and machinery to be turned off when not in use.
- (x) Construct temporary noise barriers around excessively noisy activity areas where noise standards (WHO and national) will be breached.

30. Storage and Use of chemicals and fuels

190. **Potential impacts.** Chemicals such as degreasers, oils and fuels are required for the operation of equipment such as generators, and vehicles. The area of influence includes a number of water bodies which would be susceptible to pollution from poorly stored and used chemicals and fuels. Therefore standard good practice is required. The impact screening is:

- **Potential Impact Significance: Medium** – potential sensitive water receptors, but magnitude of any spillage should be limited
- **Residual Impact Significance: Low** – impacts can be avoided through good practice.

191. Recommended mitigation measures to reduce impacts from storage and use of chemicals and fuels are:

- (i) Refuelling only in designated areas which are to be 50 m from a water course and drip trays to be used when refuelling or topping up / changing machinery fluids
- (i) Construction fluids such as oils, and fuels should be stored and handled on a bunded impermeable surface; a bund will be provided around any above ground fuel storage tanks with a capacity of 110% of the largest single tank.
- (ii) All chemicals and fuels will be in labelled containers

31. Civil Works around Utilities and Services – sewage and drainage subprojects

192. In addition to specific measures relating to excavations, general civil works can result in the accidental or planned disruption to utilities and services.

- **Potential Impact Significance: Medium** – disruptive to households; anticipated that major users such as healthcare facilities have back up power source.
- **Residual Impact Significance: Low** – impacts can be avoided through good practice.

193. Mitigation measures include:

- (i) Develop plan of days and locations where outages in utilities and services will occur, or are expected. For any unavoidable outages, schedule during low use time between 24:00 and 06:00
- (ii) Contact local utilities and services providers with schedule, and identify possible contingency back-up plans for outages.
- (iii) Contact affected community to inform them of planned outages.

32. Flora. Drainage and Sewage Subprojects

194. **Potential Impacts.** Impacts on high value flora are limited, as shown by the specialist reporting for the project area of influence. There is a loss of 11,400 (estimate) nypa palm trees along the drainage channels. Although these palm trees perform an ecosystem service, they are anticipated to be of low ecological value as they are cut every two years as they are invasive, and do not have time to become established. The impact screening is:

- **Potential Impact Significance: Medium/Low** – low value/sensitivity flora receptor but a relatively large number of trees at the edge of an urban space
- **Residual Impact Significance: Medium/Low** – impacts cannot be avoided as tree removal is required and compensation planting is not possible (budget constraints).

195. Recommended mitigation measures to reduce impacts on flora are:

- (i) Only vegetation will be cleared from within the WWTP site boundary and within the design width of the open canal line 4b.
- (ii) Any other unanticipated vegetation removal requires approval from the PMU.

33. Fauna.

196. The baseline assessment shows there are no significant impacts on fauna as it is generally not present in the project area of influence.

34. Drain construction and civil works near water bodies

197. The renovation of the open canal line 4b and WWTP site civil works may impact on sedimentation of the Kampong Bay river and Kbal Romeas river and loss of soil through erosion and loss of soil during excavations. This has potential to impact on water quality and aquatic fauna within the rivers; the river bodies both currently meet water quality standards for total suspended solids and have relatively low turbidity. In Kampot, the project may contribute to cumulative impacts increasing sedimentation during construction, particularly at the WWTP site, which is surrounded by developments including a new resort adjacent to the same water body. The impact screening is:

- **Potential Impact Significance: Medium** – highly sensitive receptor, low magnitude impact as short term potential one off events
- **Residual Impact Significance: Low** – loss of soil into water bodies can be minimized.

198. Recommended mitigation measures to reduce impacts of soil loss into rivers are:

- (i) Earthworks should be conducted during dry periods.

- (i) Berms, and plastic sheet fencing will be placed around all excavations and earthwork areas.
- (ii) Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready especially for WWTP dyke.
- (iii) Rip rap in areas of steep slope liable to erosion in wet season at WWTP site
- (iv) Maintain a stockpile of topsoil for reuse for re-vegetation
- (v) Re-vegetate or reinstate all areas of exposed soil immediately after work is completed using native species.

35. Restoration and Repair

199. **Mitigation measures.** At the end of construction, construction workers camp, staging areas, and access roads will may contain waste, spoil and other debris. Also the use of public highways and proximity to private properties during excavation may cause unforeseen damage from heavy vehicles and equipment, e.g. damage to road surfaces or properties near the open canal line 4b. The project Bill of Quantities includes repairs caused by such damage and is also included in the EMP for consistency. The construction contract documents also require full reinstatement of pavements and highways excavated during construction.

- **Potential Impact Significance: Medium** – these sites will not be near sensitive receptors
- **Residual Impact Significance: Low** –impacts can be lowered through site clear up and rehabilitation.

200. Recommended mitigation measures to deliver restoration and repair are:

- (i) Plan of how camp / staging areas will be restored to original condition after construction completed
- (ii) Retention of topsoil to support vegetation screening;
- (iii) Waste, spoil and removal of any contaminated land e.g. oils spills;
- (iv) Repair road damage and other accidental damage and reinstate pavement after excavations to the quality specified in the bill of quantities.

E. Environmental Impact and Mitigation Measures in Operation

36. General Community Nuisance

201. **Potential impacts.** The WWTP may cause odor and pest nuisance if poorly managed.

- **Potential Impact Significance:** Medium – the community is sensitive to the impacts from the site but will not be living close to the site e.g. may pass by on a journey.
- **Residual Impact Significance:** Medium – mitigation measures will be applied to ensure the impacts are as low as possible but cannot be fully mitigated.

202. **Mitigation Measures.** The WWTP operator should be contactable and provide a signboard outside the site; public complaints will be recorded. Tree screening is required (to be planted during construction) in order to reduce nuisance impacts from the WWTP. See Visual Impact below.

37. Operations and Maintenance.

203. **Potential Impacts.** Without a budget for O&M being ring-fenced and clear procedures on how O&M will be performed, the WWTP may begin to operate ineffectively and can impact on water quality, soil quality and local residents will be subject to odor issues if the drainage network is not cleared of silt with the provided equipment. The release of poorly treated wastewater will potentially be of environmental consequence because it is concentrated in one discharge point, rather than without a WWTP where there are many dilute discharge points. It is critical that the designed effluent standards are met and maintained. The impact screening is:

- **Potential Impact Significance:** High— highly sensitive human receptors and potentially large magnitude impacts from concentrated wastewater release
- **Residual Impact Significance:** Low —can be minimized through good practices including a budget

204. **Mitigation measures.** Measures to support sound O&M are based on the development of an O&M manual, which provides clear methods and procedures for all aspects of the WWTP operation; a network inspection, cleaning and maintenance schedule; ring fencing appropriate budget; ensuring relevant staff attend training and disseminate knowledge to colleagues; environmental analysis program and procedures for emergency situations.

38. Occupational Health and Safety

205. **Potential Impacts.** The operations of the subprojects will mean potential health and safety risks to staff, particularly for the WWTP around the use and handling of chemicals and the health risks associated with raw sewage and sewage sludge.

- **Potential Impact Significance: High**— highly sensitive human receptors with long term occupational exposure to potential risks
- **Residual Impact Significance: Low** —can be minimized through good practices in the work place

206. **Mitigation measures.** Include the development of rigorous site specific health and safety procedures which sets out how the operators will complete a comprehensive H&S training programme; Undertake risk assessments; Use of appropriate PPE; Undertake health assessments; develop emergency procedures and provide access to first aid.

39. Visual impact

207. The WWTP will be clearly visible in the flat landscape from the resort to the north and all such plants are associated with organic odors.

208. **Mitigation measures.** The biodiversity report for the WWTP recommended a tree screen to the north of the site. The screen will be planted and the number of trees will be increased from 40 (in the initial final bill of quantities) to a double row of a suitable species of trees with 4m centres planted along the northern edge of the WWTP site. Leadtrees (*Leucaena leucocephala*) were identified for other sites in the project, which are not native but naturalised in Cambodia, and a fast growing deep rooted tree species.

VI. ANALYSIS OF ALTERNATIVES

A. No Project Alternative

209. This is not a viable alternative to the subprojects which are all necessary improvements to the urban centre of Kampot as set out by the Rationale for the project summarised in this IEE and detailed in the project's RRP. The subproject will provide valuable environmental improvements to areas which currently have no sewage treatment and experience flooding from poor storm water drainage.

210. **Location.** During the project preparatory phase, a number of WWTP sites were considered. The first site for the WWTP was closer to the town centre, and too small for the area required for the planned anaerobic treatment lagoons. Moreover, the proximity to the town centre would have increased the risk of the facility becoming a major aesthetic environmental problem due to odour and noise.

VII. INFORMATION DISCLOSURE AND PUBLIC CONSULTATIONS

211. The stakeholder consultation strategy during project preparation embodied the principles of meaningful engagement, transparency, participation, and inclusiveness to ensure that affected and marginalized groups such as women and the poor were given equal opportunities to participate in the design of the project, in accordance with the requirements ADB's Safeguard Policy Statement (2009), and the ADB Public Communication Policy (2012).

212. The consultation approach on environmental issues during project preparation and DED phase has meant collaboration between the environmental and social teams and has included data collection from:

- (i) Household and village leader interviews conducted by the social development team;
- (ii) Where possible separate consultations with provincial agencies and other stakeholders with by social development team; and
- (iii) Individual and focus group interviews by the environmental team.

213. Public Consultation is continuing during the detailed design and construction phases as per the Access to Information Policy (2018) and general requirements of Cambodia.

A. Identification of Stakeholders

214. Stakeholders were identified and engaged in a participatory manner. Stakeholder communication to date has focused on institutional stakeholders, affected communities, and persons directly affected by proposed subproject interventions. The stakeholders involved in the design of the project include:

- Institutional stakeholders invited including the (i) project Executing Agency and PIUs (ii) provincial agencies (e.g., Environment, Women's Affairs, Commerce, Tourism, Water Resources, Public Works & Transport); private sector groups, and chambers of commerce;
- Communities living near the subproject areas who will benefit from the project, and who have an interest in identifying measures to enhance or maximize the benefits;
- Communities within the subproject area who may be directly and/or adversely affected, and who have an interest in the identification and implementation of measures to avoid or minimize negative impacts;
- Vulnerable and/or marginalized groups who have an interest in the identification and implementation of measures that support and promote their involvement and participation in the project; and
- Other institutions or individuals with a vested interest in the outcomes and/or impacts of the project.

B. Discussion Guide

215. Five open-ended questions, and information requests were posed guide discussions of the stakeholders.

Table VII-1: Guiding Questions and Information Requests for Stakeholder Consultations

- | |
|--|
| <ol style="list-style-type: none"> 1. What will be the benefits of the subproject? Please list benefits of project. 2. Do you have any environmental concerns with the subproject?
Please list environmental concerns of subproject. 3. Do you any have environmental concerns with the construction activities of the subproject? |
|--|

Please list environmental concerns of construction phase activities.

- 4.** Do you have environmental concerns with the **completed operation phase** of the completed subproject?

Please list environmental concerns of the operation of completed subproject.

- 5.** Do you think the subproject design or operation should be changed to prevent negative environmental, or community impacts?

Please list changes to subproject that you think will prevent or reduce negative environmental, or community impacts?

216. To help orient the discussions on environmental issues and concerns of subprojects a list of environmental components (Table VII-1) was introduced to the stakeholders ahead of the question and answer period. The stakeholders were encouraged to add their own components of environment to the discussions.

Table VII-2: Example Environmental components used to guide stakeholder discussion

- | | |
|--|--|
| • drinking water quality and availability | • terrestrial and aquatic animals, e.g., fish, birds, small mammals |
| • surface water quality and quantity | • ecological protected areas (e.g., national parks, wildlife sanctuaries), |
| • groundwater quality and quantity | • land and coastal zone uses (e.g., agriculture, fisheries, forestry, navigation, aquaculture, commercial, other), |
| • air quality climate | • public safety |
| • land and soil quality | • public movement and access |
| • coastal zone, ocean, rivers, reservoirs, | • physical cultural values (e.g., pagodas, cemeteries, monuments) |
| • mangroves, trees, other vegetation, | |
| • coastal and terrestrial resources e.g., seagrass beds, mangroves, forests, salt beds | |

C. Public Consultations during Project Preparation and DED phase

217. The environmental consultative meetings were conducted in Kampot City Hall on Feb 20, 2015. The meeting was separated between the provincial department levels, and community levels. The consultation in 2015 included discussion on all subprojects in Kampot, not only the subproject within the scope of this IEE.

218. The provincial department level the meeting was conducted in the provincial hall office and chaired by the Vice Governor. Five provincial departments invited to participate defined by Environment, Tourism, Land Management, Public Works, and the Municipality of Kampot. The community level meeting was conducted in a different room. The participants of the community-level meeting represented all areas of the different subproject components. The forty (40) participants including individual villagers, representative of villages, and community level representatives for the entire subproject service area.

219. The individual consultation with local people conducted during the DED phase was conducted in 26 April 2018; the consultation included discussion on all subprojects in Kampot, not only the subproject within the scope of this IEE. Consultation with Trapeang Sangke Community Fishery was conducted on 16 August 2018. There were seven 7 participants include chief and vice-chief of Trapeang Sangke Community Fishery.

220. Under CW01/VO3/VO4 further specific consultations have not been undertaken however the affected people living around the open canal line 4b will be consulted as part of regular project activities (affected people monitoring) as it is the location of existing works.

221. **Consultation Outputs.** The stakeholder consultations showed overall positive support for the subprojects in Kampot. Table VII-3 summarizes the comments and concerns of the stakeholders

from consultation undertaken for the original IEE (2015), during project preparation. Note that not all of the responses are now relevant as the scope of the project i.e. the removal of Sihanoukville and available finalized budget has changed.

222. Table VII-4 summarizes stakeholder views specific to the WWTP and Table VII-6 specifically considers Trapeang Sangke community fishery considerations raised during consultation, both during the DED phase.

223. Table VII-5 gives a summary of stakeholder consultation views during the DED phase for all Kampot subprojects. The consultation conducted for this Kampot subproject is considered relevant to the scope change works, as similar civil works are taking place within the same footprint and therefore the area of influence is the same for both the existing and scope change construction works.

Table VII-3: Summary of Stakeholder Views in Kampot (2015)

Benefits of subprojects expressed by stakeholders	<ul style="list-style-type: none"> • Improved living standard of people due to upgraded and construct new waste water treatment system; • Improve drainage system in the town with upgraded capacity; • Reduced flooding in rainy season due to improved drainage systems; • Rivers will be less polluted due to new waste water treatment plants; • Improved environments from new sanitation landfill in Kampot • Kampot will be cleaner due to the new infrastructure of subprojects; • The provincial development plans of Kampot will be supported by subprojects; • Increased GDP in Kampot due to subprojects; • Reduce the disease from infection from drainage and sewage when systems are separated; • City is clean with good infrastructure;
Stakeholder View	Subprojects Safeguard Response
Construction phase issues	<ul style="list-style-type: none"> • Noise from construction activities; • Air pollution from dust during constructing; • Waste from the construction material; Remain some soils after construction in front of house; • Dust and noise from the construction activities; • Disturbance to the people living next to project site during the construction; • Traffic congestion may disturb to tourist and people living in Kampot; • Traffic Accident during construction; • Block entrance road to home of people living along the project construction; • Wastewater from camp of workers; • Construction Workers may infect HIV/AIDS to local people; • Drug Traffic with workers; • Affect to income of people have shop in front of house when project construct the drainage and sewage system; • Affect to people income due to loss structure without compensate; <ul style="list-style-type: none"> • For the construction phase of both subprojects in Kampot the EMPs specify mitigation sub-plans for constructions disturbances such as noise, dust, solid and liquid waste management, traffic congestion, public & worker safety, blocked access, and management of waste from worker camps. • The EMPs also prescribe measures to prevent or reduce social issues arising between the community and worker force such as HIV/Aids • The separate social impact and land acquisition assessments prescribe compensation measure for lost income or property due to subprojects • Tree loss mitigation, and site restoration plans are included in the two EMPs for the subprojects in Kampot. • All potential loss or damage to structures and cultural property will be avoided as per specifications of EMP.

	<ul style="list-style-type: none"> • Affect to structures and tree along the road and proposed area of project. 	
Operation phase issue	<ul style="list-style-type: none"> • It may pollute the water in Kbal Romeas River due to wastewater treatment plant does not have the good capacity to treat. • It may affect to people living along the road to landfill due to waste collection truck. • It may obstruct/destroy the sewage system/pipe and drainage system during operating due to there is not good management and cooperation. • It may affect to waste collectors in landfill due to trucks drive so fast. • if landfill managed by company, they will not apply the technical management. 	<ul style="list-style-type: none"> • Incorporated into the operational phase of the new WWTP in Kampot is regular monitoring of treated effluent quality to ensure effluent meets original design criteria for environmental protection • Included with the new and improved landfills in both towns is a re-designed operations and schedule of garbage trucks traveling to/from the landfills to increase safety and reduce costs. This will include speed limits along access roads in and town. • The new drainage system that is installed will include new stormwater drain as and new wastewater drains so there is no risk of damaging existing drains during operation • The private companies that may operate the new/improved landfills will have to abide by the new rules of operations in order to obtain and then retain their government issued licenses to operate the landfill
Suggested impact mitigation measures	<ul style="list-style-type: none"> • Construction on roads for drainage and sewage system will be finished by block before starting to another place. • Traffic on the road should have facilitator to resolve during construction. • Sub-constructor has to spray water on road that they used during construction. • Good machineries should be used during construction to avoid air pollution. • Waste water and solid waste management system should be done in order to minimize the environmental impacts; • Keep the existing vegetation along the canal/river bank as possible or plant more if not exist; • Standard construction management on both safety and environment should be applied; • Human resources development on the operation and management of waste water treatment plant and landfill should be applied. • Compensate affected people if there are lost assets. • For sewage and drainage system, it should have the responsible team to resolve all matters during operation; if the project doesn't establish this team, 	<ul style="list-style-type: none"> • The drainage upgrades will be done in discrete sections with the new drains of a section being completed and operational before the next section is started. • Throughout the construction phase and into the operational phase construction traffic will be managed to minimize congestions, and prevent accidents with the public. • As part of the mitigation sub-plans for dust, water or other wetting agents will be used on all construction roads to prevent dust • Similarly, contractors will have to keep all construction vehicles in good working order. • All construction wastewater will isolated and disposed according to Cambodian regulations. • The site restoration sub-plan of <ul style="list-style-type: none"> • EMP includes riverbank vegetation. • Existing Ministry of Labor and ILO regulations for worker and public safety will be applied to the subprojects during construction and operational phases. • The subprojects incorporate a capacity development and training program for all agencies responsible for the operation and maintenance of the new infrastructure in Kampot and Sihanoukville.

	<p>we will have the problem again. This team has to control and prepare the penalty for villager or who destroy the system.</p> <ul style="list-style-type: none"> • All affection has to give the compensation; • Subcontractor has to spray water on used road regularly to avoid dust; • Solid waste generated from project has to collect to dispose every day; • In the operation phase, landfill has to management properly as technical, thus monitoring from provincial level has to be done to avoid company does freely. During transport, waste must not be allowed to fall on to roads. • All waste collection trucks must be cleaned regularly. 	<ul style="list-style-type: none"> • Asset loss compensation is part of the pre-construction phase of the subprojects as indicated above. • As part of capacity development and training, the roles and responsibilities of the operators of the new Kampot WWTP and drainage systems, and appropriate penalties for public violators will be clarified in order to ensure the sustainability of the new systems. • Solid waste will be collected daily according to the needs of each sector in the towns. • Strict operating guidelines and rules for the new and upgraded landfill site will be identified and enforced to ensure the sustainability of effective solid waste management including operation of covered garbage trucks.
--	---	--

Source: Original Project IEE, Project Preparation Phase (2015)

Table VII-4: Public consultation with resort owner and villager around WWTP Kampot

Date 02/07/2018	Comments / Requests / Questions / Issues	Safeguard Response
Resort Owner and villager	<ul style="list-style-type: none"> • Local people are happy with the project • The project will not impact to them • They are not concerned about odor from WWTP • The resort owner supports the project and he requests to discharge the wastewater from the resort to the new WWTP. • The project is benefit the people in town and my resort • Do not pollute the Kbal Romeas River during operation 	<p>The WWTP project appears to be very well received. In response to a number of specific concerns:</p> <ul style="list-style-type: none"> • The design considers the receiving water body for effluent and engineers consider it appropriate • The operator will be responsible for effluent during operation. The project has limited impact on implementing recommendations for operation.

Source: H Chamnan (2018) Rapid Environmental Assessment Report proposed waste water collection and treatment plant.

Table VII-5: Summary of Stakeholder Views in Kampot for all Kampot Subprojects (2018)

Meeting at Kampot Department of Public Work and Transportation office 13-11-2018		
14-11-2018	Comments / Requests / Questions / Issues	Safeguard Response
DPWT, DWRAM, DOLMUP&C, DOA, DRD, DOWA, DoT, Krong Kampot, Thmei Commune Commune, Kampong Bay Commune, Krang Ampil Commune, Kampong Kandal Commune, Chum	<ul style="list-style-type: none"> • All agree with, and support the two sub-projects (Urban Drainage, Wastewater collection network and Wastewater Treatment Plant (WWTP) and control landfill. • Request that the project owner/contractor should inform before construction • Request to compensate if the project destroy the pipe line 	<p>The comments from this consultation are remarkably similar to those above on the previous day, therefore the same responses apply as above.</p>

Kreal Commune, Trapeang Chum Commune	<ul style="list-style-type: none"> • Must provide construction schedule to Water Supply Authority prior to construction of the drainage • Worry about the flood and smell impact to local people who live near the WWTP site. • Flood management in WWTP • Request to provide adequate traffic control during construction • The distance of manhole should be between 50 to 100m • Worry about the remaining soil in front of people's house after construction • Block entrance road to home of people living along the project construction • Boundary the landfill site • Request to consider on women and children in landfill especially on hygiene and health • The location of landfill should locate in the downstream • Request to protect local people who work close to landfill site • Request on capacity building on landfill and WWTP management • Collaborate with local authority • Schedule collection time during operation • Everyday waste collection • Control on workers' health before and after finishing construction • Must provide personal protected equipment (PPE) to workers and staffs • Request to cash salary every month • Salary of worker should be follow government policy • Provide detail design to provincial governor • Conduct a meeting with local authority before construction 	
Note: DPWT=Department of Public Work and Transportation, DOE=Department of Environment, DWRAM=Department of Water Resource and Meteorology, DOLMUP&C=Department of Land Management, Urban Planning and Construction, DOA=Department of Agriculture, DRD=Department of Rural Development, DOWA=Department of Women Affair.		

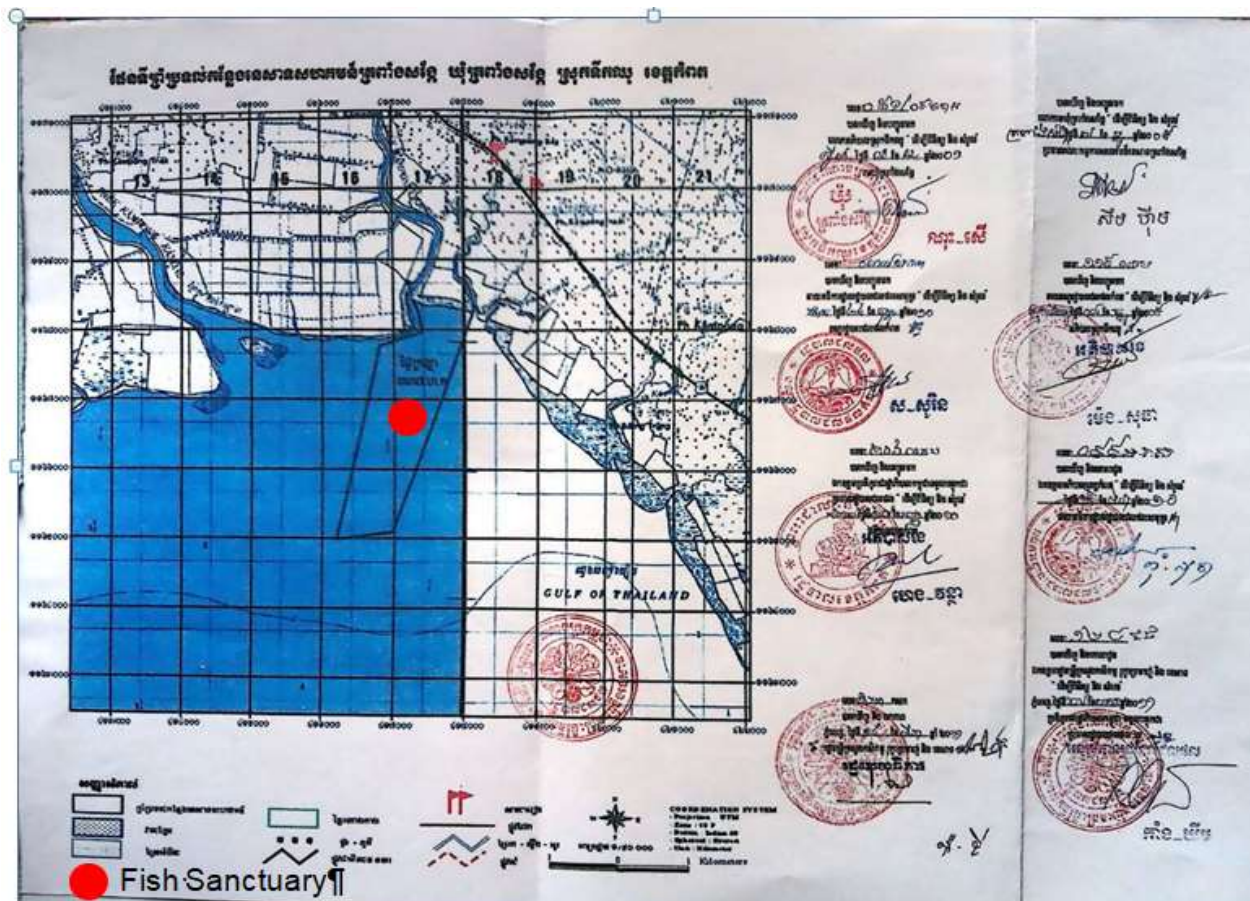
Table VII-6 Trapeang Sangke Community Fishery Consultation

Questions for Community Fishery	Record of Discussion
CF Information How many families / CF members are there? How long as the CF been established?	507 families, 734 members Established in 2009
Location of CF area? Looking at the map of the WWTP for Kampot, show where the CF boundary? Where is the CF Fish Sanctuary?	The CF fish Sanctuary is 45 ha and is 11km from the WWTP site. See Figure VII-1
Prek Kbal Romeas – Fish & Non-fish What are the common fish species taken from the river? What non-fishery products are taken from the river?	Table IV-12 and Table IV-13 The fish catch has declined in the last 5 years

Describe how fish catch has changed in the last 5 years? Better or worse, no change?	
Prek Kbal Romeas – Mangrove Has the quality of mangrove changed in the last 20 years? If Yes, describe how it has changed? What is the status (quality) of mangrove in your CF?	The quality of mangrove has changed due to construction of salt farm, cutting and extension of land ownership. The mangrove in CF is good (existing 31 ha, regrowth 25 ha) and remaining only 10 ha for growing.
Prek Kbal Romeas – Water Flow & Quality Has the flow of water in the river changed in the last 5 – 10 years? If yes, how has it changed? What is the reason for the change? Has the CF noticed a change in water quality in the last 5 – 10 years? If yes, what does the CF think is the reason for the change? How has this change in water quality affected the person?	The water flow has changed since last 5 year due to sea level rise. Yes, change in water quality. High turbidity due to land filling in 2010 The affected on person is itchy
Our Project Does the CF have any concerns about our project and the WWTP? In addition to the mitigation measures in the EMP (the consultation team will have discussed these) what else does the CF want to see? Would the CF be interested in any project support for CF improvements such as mangrove planting? (explain the would need more discussion /budget)	The committees said they lost confidence in all project even in this project. No answer regarding additional mitigation measures. Two projects are growing mangrove and extending tourism services already.

Source: PISCB Team consultation August 2018

Figure VII-1 Trapeang Sangke Community Fishery Map



Source: Trapeang Sangkae Community Fishery Committee

D. Public Consultations during Project Implementation

224. Consultation will take place during implementation. The PIU Environmental Safeguard Counterpart will undertake consultation, supported by PISCB, following the finalization of the detailed design, and will conduct consultation interviews within 4-6 weeks of construction starting and then again every 3 months until the end of construction. This is set out in the Environmental Monitoring Plan provided in the Environmental Management Plan for each subproject.

225. It is suggested that the consultations take the form of meetings and site-based discussions and include the following types of topics:

- Environmental impacts of civil works (e.g., solid & liquid waste, erosion, local flooding, pollution);
- Any unforeseen impacts caused accidentally e.g. through spillages;
- Civil nuisance (e.g., noise, dust, disrupted business & farming activity, social issues, community health and safety);
- Traffic issues and access; and
- GRM and its procedures including details of persons to contact and contact details

226. In summary, informal monitoring interviews with affected people will focus on complaints about community disturbance from construction activities, as well as public concerns about ecological protection, soil / land concerns and access issues. This will contribute to project monitoring. Consultation monitoring templates are developed for use by the PIU for this project. Appendix 3 gives an example of corrective action form that will be used if problems arise during consultation.

E. Information Disclosure

227. Environmental information on the project, including the IEE and other safeguards information will be disclosed in accordance with ADB's Public Communications Policy (2011) and SPS (2009). This includes:

- The EMPs will be translated into Khmer and be available for review PDPWT offices;
- The IEE will be disclosed on ADB's project website (www.adb.org) on approval;
- Copies of the IEE are available upon request; and
- Semi-annual environmental reports on project's compliance with the Environmental Management Plan (EMP) and other necessary information will be available at www.adb.org.

Figure VII-2: Photo of the public consultation in Kampot (2018)



Individual interview with local people in Kampot subproject



Public consultation with CF in Kampot subproject

Source: PISCB

Figure VII-3: Public consultation in Kampot (2018)

1. Public consultation with Kampot governor and related department (date 14/11/2018)	
	
	
Meeting with Resort Manager Kampot (2/7/2018)	Meeting with local villager near WWTP site Kampot (2/7/2018)

Source: H Chamnan (2018) Rapid Environmental Assessment Report proposed waste water collection and treatment plant.

VIII. Grievance Redress Mechanism

A. GRM Objective

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

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

B. Proposed Approach

230. The roles and responsibilities for the GRM are set out in Table VIII-1.

Table VIII-1: GRM Roles and Responsibilities

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

231. Table VIII-2 shows sangkats/communes and villages within the project area. Representatives of each, such as Village Chief, will be included in the GRM committee and will be key access points for GRM implementation:

Table VIII-2: Sangkats and Villages for GRM Access and Implementation

Subproject Component	District/ town	Commune / Sangkat	Village
Kampot Wastewater and Drainage Networks	Kampot Town	Kampong Bay	Kampong Bay Choeung
			Kampong Bay Tbong
		Kraing Ampil	Kraing

			Svay Thum
		Kampong Kandal	Mouy Ousaphea
			Sovann Sakor
Kampot WWTP Site	Tuek Chhou	Kampong Samrong	Kampong Samrong

C. Access to the Mechanism

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

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

D. GRM Steps and Timeframe

1.1. Communication on the GRM: Project Hotline

233. The GRM will be communicated to the public and affected people as a Project Hotline; this is considered to be more resonant with people than a 'grievance redress mechanism'. This will include a project **hotline notice board** to be located in each construction site for the WWTP and at 3 locations around Kampot town in for the sewage and/or drainage network construction.

234. The project hotline notice board will include the following information and will require the telephone numbers to be updated should the member of staff leave the organisation mentioned on notice board.

Project Hotline

Project: Construction of drainage and sewage network / Wastewater Treatment Plant for Kampot town

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

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

You can also contact ADB directly:

ADB, Phnom Penh Office:

[Name] and [Phone Number] and [email address]

ADB Southeast Asia Department of ADB, Manila, Philippines:

[Name] and [Phone Number] and [email address]

Complaints Receiving Officer, Accountability Mechanism

Asian Development Bank

ADB Headquarters, 6 ADB Avenue, Mandaluyong City 1550, Metro Manila, Philippines

(+632) 632-4444 loc. 70309

(+632) 636 2086

amcro@adb.org

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

1.2. Recording Project Hotline or GRM issues: Steps and Timeline

235. Complaints should be managed centrally by the PMU-ESO. Records should be kept of complaints made to the other access points, and the date they were passed to PMU for investigation but the main burden of recording detailed information should be on the PMU-ESO. All complaints should be compiled centrally by PMU-ESO to ensure none are missed and trends are identified.

This should include all formal and informal complaints. The format of the recording both within the PMU and within other identified access points.

236. For comments, suggestions or minor issues that can be managed within the construction area, the Hotline Access Point will record the following information, and will inform the PMU:

Table VIII-3: Project Hotline Informal Contact with Affected People

TIMING	For Hotline Access Point Person	
Day 1	Date of Contact to Hotline [or verbal contact with GRM access point]	<i>Example: 25-08-19</i>
	Name of Person & Contact Details [If Given]	<i>K. Srey, 012 90129901</i>
	Construction Site / Project Activity [relevant to person]	<i>Wastewater treatment site</i>
	Suggestion / Comment / Complaint: [give detail]	<i>Suggestion: Contractor moves broken concrete pile away from path to improve access</i>
	Date PMU (Phnom Penh) Informed:	<i>26-08-19</i>
	Name of Person in PMU Informed:	<i>T. Pheap, PMU-ESO</i>
Day 2	Action Taken: [for suggestions / comments, for questions, for complaints]	<i>Site Supervisor informed. Concrete moved the next day.</i>
	For PMU: Follow Up	
Day 4	Follow Up with Affected Person [date of call, site visit, evidence e.g. photograph from AP or Hotline Access Point]	<i>Called K. Srey. Confirmed concrete moved and access is clear</i>
	Further action or resolved? [describe if the problem is solved or action needed]	<i>Resolved</i>

237. For issues that cannot be resolved on site, by discussion with the contractor, the PMU will use the following table to record and resolve the issue.

Table VIII-4: Project Hotline Formal Contact with Affected People

TIMING	For Hotline Access Point Person	
Day 1	Date of Contact to Hotline [or verbal contact with GRM access point]	<i>Example 22-02-19</i>
	Name of Person & Contact Details [If Given]	<i>D. Than, 092 90129901</i>
	Construction Site / Project Activity [relevant to person]	<i>Drain excavation</i>
	Suggestion / Comment / Complaint: [give detail]	<i>Complaint: Contractor has cut off water supply to house</i>
	Date PMU (Phnom Penh) Informed:	<i>22-02-19</i>
	Name of Person in PMU Informed:	<i>T. Pheap, PMU-ESO</i>
Day 2	Action Taken: [for suggestions / comments, for questions, for complaints]	<i>Site Supervisor informed. Contractor disagrees.</i>
	For PMU: Follow Up	
Day 4	Follow Up with Affected Person [date of call, site visit, evidence e.g. photograph from AP or Hotline Access Point]	<i>Called D. Than. Confirmed water supply not restored</i>
	Further action or resolved? [describe if the problem is solved or action needed]	<i>Not resolved Contractor disagrees. Water supply was never connected.</i>

	For PMU if Complaint Not Resolved:	
Day 5	Complaint Screening: [explain why it is valid/not valid]	<i>Valid complaint. All houses in the road have a water supply.</i>
	Date Person informed of Screening [tell affected person if PMU considers the complaint valid]	<i>26-02-19</i>
Day 6-7	Investigation & Agreement [discuss on site with PMU, PIU, Contractor and others as required. Identify a solution]	<i>Meeting on site. Contractor will replace the PVC water pipe. Agreed on 28-02-19</i>
	Date for implementing resolution [to be completed within 15 days of initial complaint]	<i>30-02-19</i>
Day 16	Implementation Follow Up [Contact PIU/Contractor/Site Supervisor and get evidence from site e.g. photographs of completed works]	<i>PIU photos via Telegram of completed pipe work. Discussed with contractor by phone</i>
Day 20	Solution Satisfaction Follow Up [Contact Affected Person, obtain signed letter of satisfaction that complaint resolved]	<i>Call to D. Than. Water supply restored. Letter is signed. PIU sent copy via Telegram</i>

238. **Informal Approach (minor issues).** Informally, an affected person (AP) can give a suggestion, comment, question or complaint through:

- Directly to the Contractor during construction;
- Directly to any other Access Point such as village chief; or
- Use the project hotline contact numbers.

239. During operation the affected people will be required to contact the operator as the project hotline approach and PMU, as an office, will no longer be operating.

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

241. For minor issues, if possible the contractor will rectify the problem within one day of any complaint or implementable suggestion. For more significant issues, that may require changes to construction practices, project design or additional budget, the PMU will use the formal approach to managing the affected persons comments/complaints.

242. **Formal Approach (significant issues).** If the issue cannot be resolved informally or the affected person is not satisfied with the resolution so far, the PMU will be required to screen the complaint and engage with other stakeholders as needed to find a solution. As set out in Table VIII-4 the steps to be followed by the PMU are:

- **Complaint Screening.** Screening to check the complaint is valid i.e. is as a result of the project activities. Affected Person is immediately informed of the screening results. If the complaint/issue is screened as non-Project-related and/or invalid, the affected person will be advised that he/she can raise his/her complaint to the second stage of the complaint process; and the PMU-ESO will formally forward the complaint to the District Office
- **Investigation & Agreement.** PIU, Contractor and affected person will discuss the complaint at the site within 2 days of screening. Agreement on actions and measures and a date for implementation of resolution will be agreed. Agreement will be documented using Table VIII-4 and filed by PMU-ESO; PIU, AP, Contractor/Operator will have copies.
- **Implementation Follow Up.** PMU-ESO will follow up to check the implementation of the resolution. The PMU-ESO will obtain evidence on implementation through, site visit and /or photographs and will contact the contractor, PIU and Site Supervisor.

- **Solution Satisfaction Follow Up.** Four days after implementation of the solution the PMU-ESO will contact the affected person to confirm that the solution is working. PIU will secure a written confirmation of satisfaction from the affected person and will forward this to the PMU-ESO.

1.3. Managing Unresolved Complaints

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

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

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

245. **ADB Intervention.** If a resolution is not found, affected people should be encouraged to contact the i) ADB Cambodia Resident Mission or ii) the Southeast Asia Department of ADB in Manila. Finally the Accountability Mechanism of the ADB can be used. The Affected Person should contact the Complaints Receiving Officer of the ADB via the following addresses which will be included in the subproject Hotline signboard:

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

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

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

247. The Project's GRM should not impede access to the country's jurisdiction or administrative remedies. Accessing the country's legal system and GRM can be done at the same time. If efforts to resolve disputes using the grievance procedures remain unresolved or unsatisfactory, the AP has the right to directly discuss his/her concern/complaint with ADB.

248. The PMU-ESO will record all complaints, suggestions, comments including those dealt with within the project site and those elevated to the GRC. This will include all resolutions and satisfaction of affected people.

249. The number of grievances recorded and resolved and the outcomes will be displayed at the offices of PIU, PMU and Municipality and reported in the monthly progress reports, semi-annual monitoring reports during construction and annual monitoring reports during operation, submitted to ADB.

250. All costs involved in resolving complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the PMU. In cases where affected people do not have the writing skills or are unable to express their grievances verbally, they may seek third-party assistance.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Summary

251. The EMP aims to avoid impacts where possible and mitigate those impacts which cannot be eliminated to an acceptable and minimum level. The EMP includes detailed requirements for:

- Mitigation and monitoring measures;
- Institutional arrangements and project responsibilities;
- EMP budget for implementation
- Capacity building and training requirements
- Public consultation and information disclosure
- GRM including clearly defined timescale and responsibilities

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

253. A summary of the key functions for project implementation and environmental safeguards is presented in Table IX-1. To date the Project Management Unit (PMU) has assigned a named Ministry of Public Works and Transport (MPWT) engineer with environmental and social safeguard experience to the role of PMU-ESO and a staff member has been nominated and named for the PIU-ESC role²⁰.

²⁰ All PMU and PIU staff are named in Prakas No. 149 (21 March 2016) on the Establishment of Project Management Unit for 2nd Corridor Town Development Project under ADB's Loan by MPWT

Table IX-1: Key Functions for Project Implementation

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

X. CONCLUSIONS and RECOMMENDATIONS

A. Project Risks and Assurances

254. The main project risks related to environment include: (i) low institutional capacity for environmental management and the possibility that the PMU and Implementing Agency will fail to monitor the environmental impact and implement the EMP during the construction and operation of the project; (ii) the PMU and Implementing Agency fail to implement corrective actions as issues arise during project implementation (iii) inadequate budget is allocated for maintenance of the WWTP, sewers and drainage network.

255. The Government and MPWT have assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, procurement, consulting services, and disbursement. These are set out in relevant project documents including the PAM.

B. Conclusions

256. This IEE was undertaken to determine the environmental issues and concerns associated with all subprojects. As a result of understanding the environmental baseline, receptors and project activities, an EMP is developed. The EMP, if implemented as directed, will mitigate impacts on the natural environment and affected people to an acceptable level. The key parties for implementing mitigation measures and monitoring are the construction contractors, Project Management Unit and the operators. The implementation of the EMP will be closely monitored and reported on by the relevant stakeholders in the project.

257. The most significant impacts from the project will arise from facility operation, for the WWTP. As a result, there is a comprehensive training and capacity building component to the project which is essential for ensuring the investment is both financially and environmentally sustainable and beneficial.

258. A robust Grievance Redress Mechanism will be established, as outlined in this IEE and the EMPs. It will ensure that all unplanned impacts which cause grievances for affected people are managed and a satisfactory outcome brought about swiftly.

259. Overall, the project is anticipated to bring environmental benefits to the project cities. It will serve to improve drainage, sewage and reduce pollution impacts and will provide long term environmental improvements and health benefits for residents and visitors. The collection of sewage from separate household sewer connections under a future second stage will further enhance the environmental benefits of the WWTP.

C. Recommendations

260. The project will require agreements from the Government that the key risks from the subprojects will be mitigated as set out in the EMP. In particular the implementation of construction mitigation measures, and the provision of adequate O&M budgets for operation in accordance with the design recommendations.

261. A key recommendation made with regards to the future sustainability of the subproject:

- A clear programme of encouraging separate household sewer connections in Kampot to ensure residents and businesses connect to the town sewers and their wastewater is treated as per the project design.

ANNEXES

1. ANNEX: ENVIRONMENTAL STANDARDS FOR CAMBODIA

(1) Ambient Air Quality Standards

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

Parameter	Averaging Period	Standard	
		Unit	Value
Nitrogen Dioxide (NO ₂)	24 hours	mg /m ³	0.1
Sulfur Dioxide (SO ₂)	24 hours	mg /m ³	0.3
Carbon Monoxide (CO)	8 hours	mg /m ³	20
Ozone (O ₃)	1 hours	mg /m ³	0.2
Lead (Pb)	24 hours	mg /m ³	0.005
TSP	24 hours	mg /m ³	0.33
PM 2.5 (use WHO value in Cambodia)	24 hours	mg /m ³	0.025
PM 10 (use WHO value in Cambodia)	24 hours	mg /m ³	0.05

A comparison with international standards (WHO) is as follows:

Pollutant	CAM averaging Period	Sub-decree No. 42 ($\mu\text{g}/\text{m}^3$)	WHO Averaging Period	WHO Ambient Air Quality Guidelines ($\mu\text{g}/\text{m}^3$)
Sulphur Dioxide (SO ₂)	1 hour	500	10 min	500
	24 hour	300	24 hour	20
	Annual	100		
Nitrogen Dioxide (NO ₂)	1 hour	300		
	24 hour	100	1 hour	200
			Annual	40
Carbon Monoxide (CO)	1 hour	40,000		
	8 hour	20,000		
Ozone (O ₃)	1 hour	200	8 hour	100
Lead (Pb)	24 hour	5		
			Annual	
Benzo-a-pyrene (C ₂₀ H ₁₂)				
Particulate Matter (PM ₁₀)			24 hour	50
			Annual	20
Particulate Matter (PM _{2.5})			24 hour	25
			Annual	10
Total suspended particles	24 hour	330		
	Annual	100		

(2) Ambient Noise Standards

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

Areas	Time Period	Standard
-------	-------------	----------

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

(3) Surface Water Quality Standard

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

Annex 2 of Sub-decree on Water Pollution Control

Effluent standards for pollution sources discharging wastewater to public water areas or sewer. The standard for Public Water Area and Sewer applies to the WWTP effluent.

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
1	Temperature	0C	< 45	< 45
2	pH		6 – 9	5 - 9
3	BOD5 (5 days at 200 C)	mg/l	< 30	< 80
4	COD	mg/l	< 50	< 100
5	Total Suspended Solids	mg/l	< 60	< 120
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 (NO ₃)	mg/l	< 10	< 20
11	Chlorine (free)	mg/l	< 1.0	< 2.0
12	Chloride (ion)	mg/l	< 500	< 700
13	Sulphate (as SO ₄)	mg/l	< 300	< 500
14	Sulphide (as Sulphur)	mg/l	< 0.2	< 1.0
15	Phosphate (PO ₄)	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 (NH ₃)	mg/l	< 5.0	< 7.0
35	DO	mg/l	>2.0	>1.0
36	Polychlorinated Byphenyl	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	DDT	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	Hexachloro cyclohexene	mg/l	<2	<2

Annex 4 of Sub-decree on Water Pollution Control

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

Source: Sub-decree No. 27 ANRK.BK on Water Pollution Control, MOE, 1999.

a) River

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

b) Lakes and Reservoirs

Parameter	Standard	
	Unit	Value
pH	mg/l	6.5 – 8.5
COD	mg/l	1 – 8
Suspended Solid	mg/l	1 – 15
Dissolved Oxygen	mg/l	2.0 - 7.5
Coliform	MPN/100ml	< 1000
Total Nitrogen	mg/l	1.0 – 0.6
Total Phosphorus	mg/l	0.005 – 0.05

Annex 5 of Sub-decree on Water Pollution Control:

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

No	Parameter	Unit	Standard Value
1	Carbon tetrachloride	µg/l	< 12
2	Hexachloro-benzene	µg/l	< 0.03
3	DDT	µg/l	< 10
4	Endrin	µg/l	< 0.01
5	Dieldrin	µg/l	< 0.01
6	Aldrin	µg/l	< 0.005
7	Isodrin	µg/l	< 0.005
8	Perchloroethylene	µg/l	< 10
9	Hexachlorobutadiene	µg/l	< 0.1
10	Chloroform	µg/l	< 12

11	1,2 Trichloroethylene	µg/l	< 10
12	Trichloroethylene	µg/l	< 10
13	Trichlorobenzene	µg/l	< 0.4
14	Hexachloroethylene	µg/l	< 0.05
15	Benzene	µg/l	< 10
16	Tetrachloroethylene	µg/l	< 10
17	Cadmium	µg/l	< 1
18	Total mercury	µg/l	< 0.5
19	Organic mercury	µg/l	0
20	Lead	µg/l	< 10
21	Chromium, valent 6	µg/l	< 50
22	Arsenic	µg/l	< 10
23	Selenium	µg/l	< 10
24	Polychlorobiohenyl	µg/l	0
25	Cyanide	µg/l	< 0.005

(6) Groundwater Quality Standard (for drinking) from Ministry of Handicrafts and Industry

Based on WHO (2003) Standards

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

2. ANNEX: BOREHOLE LOG SAMPLE KAMPOT WWTP

Sub-Contractor: Partner of Construction and Development Services Inc.	Method : Rotary Auger Casing Size : 150 mm Northing: 1176087 Easting: 414000 Elevation:m	Date started : 14/06/2017 Date finished : 14/06/2017 Project : Second GMS, Corridor Towns Development Project Location: B.1/WW TP site , Kampot Province
Client: Key Consultant Cambodia., Ltd		

Sampling Depth, m		Type of Sampling U / SPT	Strata, (m)	Legend	Description of soil	▲ SPT - N Value Blow/300mm				Depth to water flow: 6.50m Depth to water Level: 0.50m	
From	To					N1=150mm	N2=300mm	N3=450mm	N4=N2+N3	▲ SPT , N (Blow/300mm) 0 10 20 30 40 50 60 70 80 90 100	
D1:1.50 -	1.95	SPT	1.50		Soft gray, sandy CLAY	1	2	2	4		
D2:3.00 -	3.45	SPT	1.50		Firm gray, light-red, lean CLAY	1	3	4	7		
D3:4.50 -	4.95	SPT	3.00		Stiff gray, light-red, sandy lean CLAY	3	4	6	10		
D4:6.00 -	6.45	SPT				4	6	7	13		
D5:7.50 -	7.95	SPT	6.00		Medium dense light-gray, poorly graded silty SAND	4	6	6	12		
D6:9.00 -	9.45	SPT				3	5	6	11		
D7:10.50 -	10.95	SPT				4	5	8	13		
D8:12.00 -	12.45	SPT				4	6	8	14		
D9:13.50 -	13.95	SPT	4.50		Hard gray light-red, sandy lean CLAY with gravel	9	14	50	64		
D10:15.00 -	15.45	SPT				7	10	20	30		
D11:16.50 -	16.95	SPT				7	11	22	33		
D12:18.00 -	18.45	SPT	9.00		Very dense brown, light-gray, silty SAND	>50	>50	>50	100		
D13:19.50 -	19.95	SPT				>50	>50	>50	100		
D14:21.00 -	21.45	SPT				>50	>50	>52	100		
D15:22.50 -	22.95	SPT				>50	>50	>50	100		
D16:24.00 -	24.45	SPT				>50	>50	>50	100		
D17:25.50 -	25.95	SPT				>50	>50	>50	100		
					END OF SPT TEST 25.95m DEPTH						

Consistency	Very soft	Soft	Firm	Stiff	Very Stiff	Hard
Blows 30Cm, Clay	Less 2	2 - 4	4 - 8	8 - 15	15 - 30	> 30
Relate. Density, Blows/300mm		Very Loose	Loose	Med. Dense	Dense	Very Dense
Fine		1 - 2	3 - 6	7 - 15	16 - 30	?
medium		2 - 3	4 - 7	8 - 20	21 - 40	> 40
coarse		3 - 6	5 - 9	10 - 25	26 - 45	> 45
Unit weight of granular soil base, γ_{sat} , kN/m ³		11 - 16	14 - 18	17 - 20	17 - 22	20 - 23

LEGEND

	Stiff to hard sandy clay, lean Clay
	Firm to stiff silty clay/ lean Clay
	stiff to hard clay, fat Clay
	Clayey sand, Silty Sand
	V. Soft to soft clay, organic clay

	Fill/topsoil
	Gravelly Sand, Clean Sand
	Silty coarse sand with gravel
	Weather Rock
	Sandstone

Standard Penetration	
Test (SPT)	
SPT	
SPT - N Value	

3. ANNEX: AFFECTED PERSON MONITORING– CORRECTIVE ACTION FORM

When to use this form:

1. After Consultation with Affected People including Key Informant Interviews and Focus Group Discussions when consultation shows a problem or correction needs to be implemented.

PMU Staff Responsible: <i>(name and role)</i>	Name:	Role:
Date this form is completed		
Form Issued to and Agreed by: <i>(person responsible for corrective action)</i>	Signature:	Date:

Date Consultation Held			
Details of Consultation <i>-Key informant Interview or Focus group Discussion or Other</i> <i>-Location</i>			
Affected Person/Organisation Contact details (if available): <i>-Name & Contact Details</i>			
Details of Issue: <i>-Issues as described during consultation</i> <i>-Actions taken so far</i>			
Corrective Action Needed - Next steps for PMU to resolve the issue			
Who Needs To Take Action	What Actions are Needed		
Example: Contractor	Example: Reduce noise on site after 6pm		
Example: CSC/Contractor	Example: Reduce dust levels by moving aggregate storage		
Deadlines for Corrective Action			
Date Person/Organisation informed about the Corrective Action they need to Take	Date Corrective Action Must be Completed		
Example: Contractor – 1 st April 2018	Example: Immediately		
Example: CSC/Contractor – 1 st April 2018	Example: By 8th April		