KINGDOM OF CAMBODIA

Nation Religion King

PHNOM PENH CAPITAL CITY

THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

IN PHNOM PENH

JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORING REPORT No.1

August 2021




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1. Introduction

The rising of city development has generated variety of major environmental problems. Therefore, water and air pollution has become an issue and harm to environment and people health with no adequate measures. In the project area, Boeung Choeung Ek lake is one of the biggest storage in the city which collected a part of the sewage and rainwater from the center city and discharge directly into this lake without proper treatment.

Environmental quality survey requires the determination of concentration of various parameters for both water and air quality in according to the regulation of Cambodia.

1.1 Project Location

The environmental monitoring was conducted in the project area and which is located in Sangkat Chhak Angre Ler, Khan Mean Chey, Phnom Penh as shown in the Figure 1.

Figure 1 Monitoring Locations

1.2 Objective

The purpose of the environment monitoring is to check and confirm if there are the influence and changes of the surrounding condition and circumstances due to implementation of the construction works during construction period by monitoring working safety, traffic and accident, solid waste management, quality of air, noise and water, economic disturbance, and ecosystem. The environmental monitoring is to follow up the Contractor's implementation on environmental mitigation measure and recommendation of monthly progress of work. Guidance and instruction will be prepared to guide the contractor to follow the environmental mitigation measure as stated in the approved IESIA report.

1.3 Scope of work

In order to assess the environmental quality in the proposed project area, three environmental parameters were conducted including water quality, air quality, noise and vibration. Water quality survey will be conducted by sampling the surface water from Boeung Choeung Ek lake in four different locations from the upstream to the downstream of the project area with 13 parameters are analyzed. Air quality survey will be conducted in two different locations of the project area with 6 parameters are analyzed. Noise and Vibration monitoring will have conducted in 3 different locations around the project area. The water quality, air quality, noise and vibration were sampled at field site.

1.4 Environmental Monitoring Items

The major tasks for the environmental monitoring in construction stage include:

- Field monitoring on Contractor's environmental mitigation measure performance in the project area
- Guidance to Contractor's environmental engineers on environmental monitoring aspect, in the field practice
- Recommend to Contractor to implement all EMP as stated in IESIA report and other environmental safeguards in construction contract documents
- Instruct Contractor to take an action to mitigate or rectify on other issues that find out in the construction stage.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
1. Project Before Construction Phase					
1.1 Socio-economy resource					
Resettlement	− Along the Access Road (Channel Maintenance Road) and sewerage treatment plant − Prek Takong 1 village	− The monitoring of compensation of resettlement and grievance redress	Once every 6 months	1. IRC-WG, IRC 2. DPWT 3. Local authorities	1. MoE 2. MEF 3. DoE 4. DLMUPC
2. Project Construction Phase					
2.1 Physical resource					
Soil erosion and slope failure	− Sand provider	− Confirmation of license issued by Ministry of Mines and Energy and Ministry of Water Resources and Meteorology	Before construction	1. DPWT 2. Contractor	1. Ministry of Mines and Energy 2. Ministry of Water Resources and Meteorology
Topography	− Building construction site − Access Road (Channel Maintenance Road) − Protection dike construction site − Spoiled soil dumping site	− The monitoring of the topography and the erosion at the infrastructure construction site − The monitoring of erosion at the road, protection dike's embankment and spoiled soil dumping site	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
Hydrology	− Canal from Trabek pumping station − Wastewater way, downstream of the drainage to Hun Neang road	− Monitoring of the obstruction of the flow of pumped wastewater	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Surface water quality	3 Sample locations near the project area − Location 1: X=0491822, Y=1274363 − Location 2: X=0491299, Y=1272570 − Location 3: X=0493103, Y=1268628 − Solid-liquid waste storage	− Monitoring of the water quality on the parameters: temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb and Total Coliform − Monitoring of solid-liquid waste management	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Soil quality	− Infrastructure construction site, generator and machinery storage − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the spill, leak of fuel on the soil.	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Air Quality	− Infrastructure construction site − Access Road (Channel Maintenance Road) − Temporary shelter of staff-workers − 2 location of air quality testing: location 1 X=0491356, Y=1272730, location 2 X=0491031, Y=1272740	− Monitoring of the material transportation on Rd. 271 − Monitoring of the odor condition at construction sites − Monitoring of air quality parameters: TSP; CO; NO_2; SO_2, O_3, PM10, PM2.5 and H_2S	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
Noise and vibration	− Infrastructure construction site − Road construction site from Rd. 271 to construction site − Temporary shelter of staff-workers − Noise and vibration testing locations are the same as air quality testing locations	− Monitoring of the noise and vibration from the material transportation, the operation of any machinery, generator and vehicle. − Monitoring of noise and vibration (Unit: dB)	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
2.2 Biological resources					
Ecosystem (Fish)	− Cheung Aek Lake near project area − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the water quality on the parameters temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb Total Coliform	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority
Ecosystem (Birds)	− Temporary shelter of staff-workers	− Monitoring of the crime on wildlife especially the aquatic birds	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
2.3 Socio-economic resources					
Resettlement	− Resident of AHs, lose their income in Prek Takong 1 village. − Area of 19.0736 ha for construction and expansion of the STP	− Monitoring of the livelihood of AHs (7HHs), lose their income. − Monitoring to ensure that no encroachment to the STP area.	Once every 6 months	1. DPWT 2. Local authority	1. MoE 2. MEF 3. DoE 4. DLMUPC 5. DOWRAM
Livelihood, occupations of the local community and gender	− Prek Takong 1 village − Temporary shelter of staff-workers	− Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability − Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	− Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. − Access Road (Channel Maintenance Road)	− Monitoring of the transportation (speed and load) − Monitoring of the parking − Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	− Infrastructure construction site − Generator, vehicle and machinery storage − Temporary shelter of staff-workers − First aid room	− Monitoring of solid-liquid waste management at temporary shelter − Monitoring of the clean water supply and sanitation − Monitoring of the safety equipment and work safety − Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

The environmental monitoring consists of two key activities have been applied in this monitoring stage, air and noise measurement; and water sampling and site monitoring in project area, the total will be controlled and managed by a time-based work plan.

- Air, noise and water quality sampling:
  - Air and noise sampling will conduct by MoE once every six months.
  - The water quality sampling conducts once every six months according to EMP of IESIA report. All sampling water will be analyzed by MoE lab in Phnom Penh.

- Road:
  Monitoring of the transportation (speed and load), parking and the damage road by the project. Monitoring locations such as Road.271, Hun Sen Blvd.(60m) and Hun Neang Blvd. and Access road for the Channel Maintenance Road.

- Public Health and Safety:
  Monitoring of Solid Liquid Waste management at temporary shelter, the clean water supply & sanitation and the safety equipment and work safety.

- Site monitoring:
  Use environmental monitoring checklist, visual and interview with project workers and people are living near the project area, and visual checking during the field observation on environmental mitigation measure that implemented or rectified by contractor. Visual

methodology also has been applied for other environmental monitoring items; however, degree of impact has been recorded and photographs to proof the impacts (good or bad) are used.

2.1 Water and Air Sampling Process

A. Water Sampling Process

For taken water samples, some important procedure had been applied in the following:

- Tools and equipment: water sampler, sample bottles, cool box, etc.
- Stamping the code number and sampling date on the sample bottle.
- Sampling taken was following the WHO technique for water sampling.

The samples would keep in the cool box quickly after taking, and at the same day were sent to MoE Lab in Phnom Penh for analyzing the parameters as required by the Water Quality Survey.

Figure 1 Water quality sampling tools and equipment

B. Air Sampling Process

Air quality sampling was conducted on-site in the proposed project. The sampling equipment were installed at a height of 1.2 to 1.5 meters above the ground, and air quality parameters were carried out within 1 hour, 8 hours, 24 hours according to each parameter method. Air quality parameters were analyzed in the laboratory of the MOE.


Figure 2 Air quality sampling tools and equipment

2.2 Cambodia Water and Air Quality Standard

After analysis, the water quality readings were compared with the Cambodia standards following to the Proclamation No. 116 B.K.MOE on the Introduction of Working Conditions for the Establishment of Factory and Handi-Craft Project as shown in Table 3. The air quality readings were compared with the Cambodia standards following to the Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project as shown in the Table 4.

Table 1 Cambodia water quality standard

No.	Parameter	Unit	Standard	Method
1	pH	-	5.0-9.0	Method pH Meter
2	Temperature	°C	<45	Method Thermometer
3	Turbidity	NTU	NV	Method Digital Turbid meter
4	Dissolved Oxygen (DO)	mg/L	>1.0	Method DO Meter
5	Total Dissolved Solid (TDS)	mg/L	<2000	Method 2540 C
6	Total Suspended Solid (TSS)	mg/L	<150	Method 2540 D
7	Biochemical Oxygen Demand (BOD)5	mg/L	<80	Method 5210 B
8	Chemical Oxygen Demand (COD)Cr	mg/L	<120	Method 5220.B
9	Sulphate (SO4)	mg/L	<500	Method 4500-SO42- B
10	Total Nitrogen (TN)	mg/L	<10	Method JIS K 0102 45
11	Total Phosphorus (TP)	mg/L	<1.0	Method JIS K 0102 46
12	Lead (Pb)	mg/L	<1.0	Method 3500-Pb C
13	Total Coli form	MPN/100ml	-	Method NF T90-413

Source: Standard from Proclamation No. 116 B.K.MOE on the Introduction of Working Conditions for the Establishment of Factory and Handi-Craft Project

Table 2 Cambodia air quality standard

No.	Parameter	Unit	Standard	Duration
1	Carbon Monoxide (CO)	mg/m^3	<20	8 hours
2	Nitrogen Dioxide (NO2)	mg/m^3	<0.10	24 hours
3	Sulfur Dioxide (SO2)	mg/m^3	<0.30	24 hours
4	Ozone (O_3)	mg/m^3	<0.2	1 hour
5	Hydrogen Sulfide (H2S)	ppm	NV	NV
6	Total Suspended Particles (TSP)	mg/m^3	<0.33	24 hours

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

C. Noise and Vibration

The noise and vibration was monitored from the material transportation, the operation of any machinery, generator and vehicle.

Monitoring form for Noise an d Vibration

Location1

26-May-2021

Monitoring form for Noise an d Vibration

Location3

27-May-2021

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May	June	July	Remark
1	Topography	One every 6 months				
2	Hydrology	One every 6 months				
3	Surface water quality	One every 6 months	Original data			
4	Soil quality	One every 6 months				
5	Air quality	One every 6 months	Original data			
6	Noise and Vibration	One every 6 months	Original data			
7	Ecosystem (Fish)	One every 6 months				
8	Ecosystem (Birds)	One every 6 months				
9	Livelihood, occupations of local community and gender	One every 6 months				
10	Road	One every 3 months			✓	Refer to monthly progress report submitted (Back data)
11	Public Health and Safety	One every 3 months			✓	Refer to monthly progress report submitted (Back data)
12	Site Safety Patrol form	Every month		✓	✓	Refer to monthly progress report submitted (Back data)
13	Other	If nessesary				

4. Conclusion

The project area is a part of the city where urbanization and economics are significantly growing, as well as its population. With these growing factors, more and more wastewater is discharged from the city center including households, industries restaurants, hotels, etc., and there is some part has been connecting to the sewer systems but some has not, resulting in severe environmental problems such water and air pollution.

The result on environment monitoring in three months from May to July 2021 as following:

4.1 Water quality

The water quality result from the analysis obtained from the laboratory of the MOE, some parameters were shown to be out of range limited from the Cambodia standard including DO, TSS, BOD5, COD, and TP. Otherwise, the concentration of these parameters noted that were higher than the standard in less level which not severely harm to the environmental and human health. Although the pollution level is not very harmful, but the water should be avoided for any consuming purpose.

4.2 Traffic

The traffic volume noted as in light-medium level and the living situation of the resident was not in dense area which can be assumed to have less pollution.

4.3 Air quality

The air quality in the project area, As the result of air quality obtained from the laboratory of the MOE, all parameters including CO, NO2, SO2, O_3, H2S, and TSP were found to be lower than the Cambodia standard which can be concluded that in the project area has a safe air quality which not harm to the environment and human health. Although the air quality is not harmful, measures should be set to prevent and minimized the impact from the proposed project.

5. Recommendation

Base on the field observation and results of environmental quality (water and air quality) from the laboratory analysis, some recommendation should be considered as following:

- Regularly check and monitor the project activities to ensure that there is no discharge of polluted water into the environment without proper treatment methods.
- Follow to the Cambodia regulation on water, wastewater management, air pollution control and other national and international standard if there are any wastewater generation activities and causing air pollution emission in the project.
- Observe the pollution change in this area or no affect due to the construction works and cooperate closely with the local authorities and other environmental experts from both private and public parties to control the pollution.
- Wastewater Treatment Plants and any wastewater control facility must be undertaken to prevent and minimize the negative impacts on the environment and human health.
- Set up mitigation measures to prevent and minimized the negative impacts of air pollution on the environment and human health.
- Regularly monitor the project works to ensure that there is no air pollution emission into the environment.

Remark:

None

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Phnom Penh Capital Administration

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THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

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JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORING REPORT No.2

November 2021




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1. Introduction

The rising of city development has generated variety of major environmental problems. Therefore, water and air pollution has become an issue and harm to environment and people health with no adequate measures. In the project area, Boeung Choeung Ek lake is one of the biggest storage in the city which collected a part of the sewage and rainwater from the center city and discharge directly into this lake without proper treatment.

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1.1 Project Location

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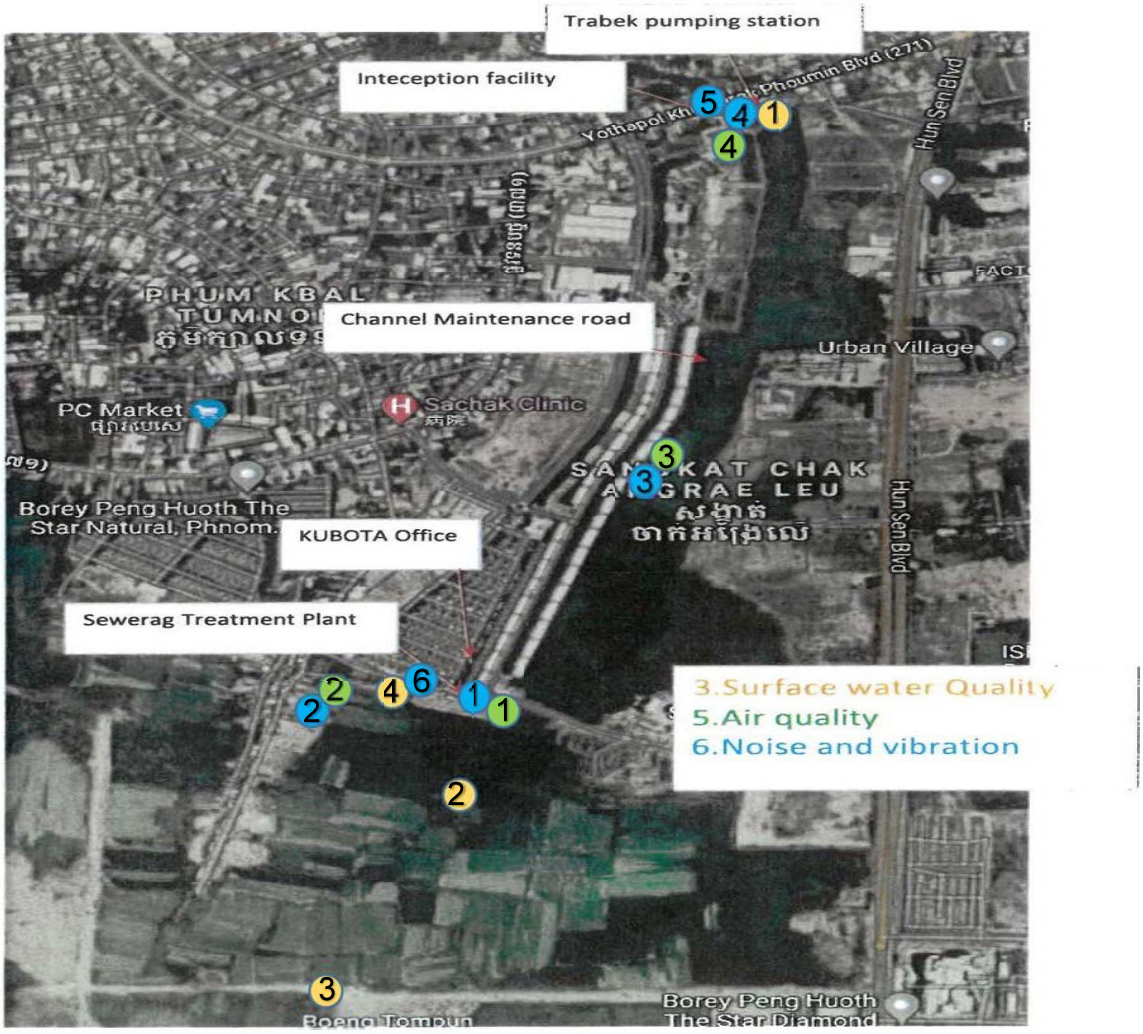

Figure 1 Monitoring Locations

1.2 Objective

The purpose of the environment monitoring is to check and confirm if there are the influence and changes of the surrounding condition and circumstances due to implementation of the construction works during construction period by monitoring working safety, traffic and accident, solid waste management, quality of air, noise and water, economic disturbance, and ecosystem.

The environmental monitoring is to follow up the Contractor's implementation on environmental mitigation measure and recommendation of monthly progress of work. Guidance and instruction will be prepared to guide the contractor to follow the environmental mitigation measure as stated in the approved IESIA report.

1.3 Scope of work

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1.4 Environmental Monitoring Items

The major tasks for the environmental monitoring in construction stage include:

- Field monitoring on Contractor's environmental mitigation measure performance in the project area
- Guidance to Contractor's environmental engineers on environmental monitoring aspect, in the field practice
- Recommend to Contractor to implement all EMP as stated in IESIA report and other environmental safeguards in construction contract documents
- Instruct Contractor to take an action to mitigate or rectify on other issues that find out in the construction stage.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
1. Project Before Construction Phase					
1.1 Socio-economy resource					
Resettlement	− Along the Access Road (Channel Maintenance Road) and sewerage treatment plant − Prek Takong 1 village	− The monitoring of compensation of resettlement and grievance redress	Once every 6 months	1. IRC-WG, IRC 2. DPWT 3. Local authorities	1. MoE 2. MEF 3. DoE 4. DLMUPC
2. Project Construction Phase					
2.1 Physical resource					
Soil erosion and slope failure	− Sand provider	− Confirmation of license issued by Ministry of Mines and Energy and Ministry of Water Resources and Meteorology	Before construction	1. DPWT 2. Contractor	1. Ministry of Mines and Energy 2. Ministry of Water Resources and Meteorology
Topography	− Building construction site − Access Road (Channel Maintenance Road) − Protection dike construction site − Spoiled soil dumping site	− The monitoring of the topography and the erosion at the infrastructure construction site − The monitoring of erosion at the road, protection dike's embankment and spoiled soil dumping site	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
Hydrology	− Canal from Trabek pumping station − Wastewater way, downstream of the drainage to Hun Neang road	− Monitoring of the obstruction of the flow of pumped wastewater	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Surface water quality	3 Sample locations near the project area − Location 1: X=0491822, Y=1274363 − Location 2: X=0491299, Y=1272570 − Location 3: X=0493103, Y=1268628 − Solid-liquid waste storage	− Monitoring of the water quality on the parameters: temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb and Total Coliform − Monitoring of solid-liquid waste management	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Soil quality	− Infrastructure construction site, generator and machinery storage − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the spill, leak of fuel on the soil.	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Air Quality	- Infrastructure construction site - Access Road (Channel Maintenance Road) - Temporary shelter of staff-workers - 2 location of air quality testing: location 1 X=0491356, Y=1272730, location 2 X=0491031, Y=1272740	- Monitoring of the material transportation on Rd. 271 - Monitoring of the odor condition at construction sites - Monitoring of air quality parameters: TSP; CO; NO_2; SO_2, O_3, PM10, PM2.5 and H_2S	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
Noise and vibration	- Infrastructure construction site - Road construction site from Rd. 271 to construction site - Temporary shelter of staff-workers - Noise and vibration testing locations are the same as air quality testing locations	- Monitoring of the noise and vibration from the material transportation, the operation of any machinery, generator and vehicle. - Monitoring of noise and vibration (Unit: dB)	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
2.2 Biological resources					
Ecosystem (Fish)	- Cheung Aek Lake near project area - Temporary shelter of staff-workers	- Monitoring of solid-liquid waste management - Monitoring of the water quality on the parameters temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb Total Coliform	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority
Ecosystem (Birds)	- Temporary shelter of staff-workers	- Monitoring of the crime on wildlife especially the aquatic birds	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
2.3 Socio-economic resources					
Resettlement	- Resident of AHs, lose their income in Prek Takong 1 village. - Area of 19.0736 ha for construction and expansion of the STP	- Monitoring of the livelihood of AHs (7HHs), lose their income. - Monitoring to ensure that no encroachment to the STP area.	Once every 6 months	1. DPWT 2. Local authority	1. MoE 2. MEF 3. DoE 4. DLMUPC 5. DOWRAM
Livelihood, occupations of the local community and gender	- Prek Takong 1 village - Temporary shelter of staff-workers	- Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability - Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	- Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. - Access Road (Channel Maintenance Road)	- Monitoring of the transportation (speed and load) - Monitoring of the parking - Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	- Infrastructure construction site - Generator, vehicle and machinery storage - Temporary shelter of staff-workers - First aid room	- Monitoring of solid-liquid waste management at temporary shelter - Monitoring of the clean water supply and sanitation - Monitoring of the safety equipment and work safety - Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

The environmental monitoring consists of two key activities have been applied in this monitoring stage, air and noise measurement; and water sampling and site monitoring in project area, the total will be controlled and managed by a time-based work plan.

- Air, noise and water quality sampling:
  - Air and noise sampling will conduct by MoE once every six months.
  - The water quality sampling conducts once every six months according to EMP of IESIA report. All sampling water will be analyzed by MoE lab in Phnom Penh.

- Road:
  Monitoring of the transportation (speed and load), parking and the damage road by the project. Monitoring locations such as Road.271, Hun Sen Blvd.(60m) and Hun Neang Blvd. and Access road for the Channel Maintenance Road.

- Public Health and Safety:
  Monitoring of Solid Liquid Waste management at temporary shelter, the clean water supply & sanitation and the safety equipment and work safety.

- Site monitoring:
  Use environmental monitoring checklist, visual and interview with project workers and people are living near the project area, and visual checking during the field observation on environmental mitigation measure that implemented or rectified by contractor. Visual methodology also has been applied for other environmental monitoring items; however, degree of impact has been recorded and photographs to proof the impacts (good or bad) are used.

2.1 Surface Water Sampling Process

For taken water samples, some important procedure had been applied in the following:

- Tools and equipment: water sampler, sample bottles, cool box, etc.
- Stamping the code number and sampling date on the sample bottle.
- Sampling taken was following the WHO technique for water sampling.

The samples would keep in the cool box quickly after taking, and at the same day were sent to MoE Lab in Phnom Penh for analyzing the parameters as required by the Water Quality Survey.

Figure 2 Water quality sampling tools and equipment

2.2 Air Sampling Process

Air quality sampling was conducted on-site in the proposed project. The sampling equipment were installed at a height of 1.2 to 1.5 meters above the ground, and air quality parameters were carried out within 1 hour, 8 hours, 24 hours according to each parameter method. Air quality parameters were analyzed in the laboratory of the MOE.

Figure 3 Air quality sampling tools and equipment

2.3 Noise and Vibration Sampling Process

The noise and vibration was monitored from the material transportation, the operation of any machinery, generator and vehicle.

Figure 4 Noise and Vibration sampling tools and equipment

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Remark
1	Topography	One every 6 months							✓	Refer to monthly progress report submitted (Back data)
2	Hydrology	One every 6 months							✓	Refer to monthly progress report submitted (Back data)
3	Surface water quality	One every 6 months	Original data						✓	Refer to monthly progress report submitted (Back data)
4	Soil quality	One every 6 months							✓	Refer to monthly progress report submitted (Back data)
5	Air quality	One every 6 months	Original data						✓	Refer to monthly progress report submitted (Back data)
6	Noise and Vibration	One every 6 months	Original data						✓	Refer to monthly progress report submitted (Back data)
7	Ecosystem (Fish)	One every 6 months							✓	Refer to monthly progress report submitted (Back data)
8	Ecosystem (Birds)	One every 6 months							✓	Refer to monthly progress report submitted (Back data)
9	Livelihood, occupations of local community and gender	One every 6 months							✓	Refer to monthly progress report submitted (Back data)
10	Road	One every 3 months			✓				✓	Refer to monthly progress report submitted (Back data)
11	Public Health and Safety	One every 3 months			✓				✓	Refer to monthly progress report submitted (Back data)
12	Site Safety Patrol form	Every month		✓	✓	✓	✓	✓	✓	Refer to monthly progress report submitted (Back data)
13	Other	If nessesary								

3.2 Water Quality

After analysis, the water quality readings were compared with the Cambodia standards following to the Proclamation No. 116 B.K.MOE on the Introduction of Working Conditions for the Establishment of Factory and Handy-Craft Project as shown in Table 3. The air quality readings were compared with the Cambodia standards following to the Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project as shown in the Table 4.

Table 1 Cambodia water quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Method	November 2021			
					No.1	No.2	No.3	No.4
1	pH	-	5.0-9.0	Method pH Meter	6.9	7.06	7.04	7.04
2	Temperature	°C	<45	Method Thermometer	24.9	24.98	25.0	24.98
3	Turbidity	NTU	NV	Method Digital Turbid meter	0.00	80.00	60.0	48.0
4	Dissolved Oxygen (DO)	mg/L	>1.0	Method DO Meter	0.40	0.00	0.2	2.4
5	Total Dissolved Solid (TDS)	mg/L	<2000	Method 2540 C	158.0	221.0	216.0	254.0
6	Total Suspended Solid (TSS)	mg/L	<150	Method 2540 D	51.0	152.0	45.0	42.0
7	Biochemical Oxygen Demand (BOD)5	mg/L	<80	Method 5210 B	24.80	24.81	27.32	82.6

8	Chemical Oxygen Demand (COD)Cr	mg/L	<120	Method 5220.B	85.0	47.0	65.0	103.0
9	Sulphate (SO4)	mg/L	<500	Method 4500-SO42- B	31.0	34.0	20.0	20.0
10	Total Nitrogen (TN)	mg/L	<10	Method JIS K 0102 45	12.80	11.7	14.0	14.89
11	Total Phosphorus (TP)	mg/L	<1.0	Method JIS K 0102 46	0.65	0.49	0.79	1.66
12	Lead (Pb)	mg/L	<1.0	Method 3500-Pb C	ND	ND	ND	0.0008
13	Total Coli form	MPN/100ml	-	Method NF T90-413	1.1×10^{6}	4.6×10^{5}	1.5×10^{5}	1.1×10^{5}

Source: Standard from Proclamation No. 116 B.K.MOE on the Introduction of Working Conditions for the Establishment of Factory and Handy-Craft Project

3.3 Air Quality

Based on the field observation on 08th -10th November 2021, the construction works which comprise of various activities could cause air pollution through exhausted gas from transportation vehicles, and other machineries. Dust emission also causes air pollution by the transportation of construction materials, excavated soil, and backfill sand. However, these activities will only cause air pollution in a short period.

The air quality and noise level were monitored in the project area on 08th-10th November 2020 in order to follow up the impact from the project activities. According to the result below the air qualities are below the standard so no air pollution from the construction activities (see in Table 2 below).

Table 2 Cambodia air quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Duration	November 2021			
					No.1	No.2	No.3	No.4
1	Carbon Monoxide (CO)	mg/m^3	<20	8 hours	0.96	0.232	1.44	1.44
2	Nitrogen Dioxide (NO2)	mg/m^3	<0.10	24 hours	0.016	0.01	0.011	0.011
3	Sulfur Dioxide (SO2)	mg/m^3	<0.30	24 hours	0.013	0.024	0.015	0.015
4	Ozone (O_3)	mg/m^3	<0.2	1 hour	0.012	0.017	0.007	0.007
5	Hydrogen Sulfide (H2S)	ppm	NV	NV	ND	ND	ND	ND
6	Total Suspended Particles (TSP)	mg/m^3	<0.33	24 hours	0.098	0.108	0.117	0.072
7	PM10	mg/m^3	<0.05	-	0.022	0.013	0.027	0.027
8	PM2.5	mg/m^3	<0.025	-	0.023	0.014	0.023	0.023

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

3.4 Noise and Vibration

Noise and vibration happened from the construction machinery such as excavation of drainage' line, road cutting machine, driving sheet pile and transporting of top soil from the project site to disposal site. In date of observation only few construction machineries (excavator and dump trucks) are working on the platform in different place where close to residential area.

Table 1 show that the average noise level in daytime (65.0 dB(A)) is lower than maximum permitted noise level in commercial and service areas and mix. The transportation of soil by trucks from construction site to disposal site are between 5 to 10 trips per day so comparing the normal traffic situation, the transportation activities is much lower. In conclusion, the higher noise level is not mainly from the construction activities but from the traffic in the area itself.

Table 1: Noise standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	November 2021						
					No.1	No.2	No.3	No.4	No.5	No.6	Ave
1	LAeq	dB	-	3 hours	72.2	65.4	61.5	63	63.8	64.5	**65.0**
2	LAF Max	dB	-	3 hours	85.1	79.4	84.7	78.9	84.8	94.8	**84.6**
3	LAF 5	dB	<85dB	3 hours	78.1	68	68.1	65.7	66.7	66.2	**68.8**

Table 2: Vibration standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration		November 2021					
					No.1	No.2	No.3	No.4	No.5	No6	Ave
1	LVA eg	dB	-	3 hours	49.3	40.2	56.5	41.1	35	51.9	**45.6**
2	LVA max	dB	-	3 hours	67.2	65.1	78.4	60	50.7	73.1	**65.7**
3	LVA 10	dB	<75dB	3 hours	51.8	51.8	59.7	42.9	37.6	58.4	**50.3**

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

4. Conclusion

The project area is a part of the city where urbanization and economics are significantly growing, as well as its population. With these growing factors, more and more wastewater is discharged from the city center including households, industries restaurants, hotels, etc., and there is some part has been connecting to the sewer systems but some has not, resulting in severe environmental problems such water and air pollution.

The result on environment monitoring in three months from August to October 2021 as following:

4.1 Topography

The topography and erosion in the construction site was satisfactory. There is no erosion of the road was observed and the temporary dike was installed to protect the cofferdam's embankment.

4.2 Hydrology

There is no obstruction of the flow of pump waste water at the Trabeck Pumping station and the downstream of drainage to Hun Neang road.

4.3 Surface of Water quality

The water quality result from the analysis obtained from the laboratory of the MOE, some parameters were shown to be out of range limited from the Cambodia standard including DO,

TSS, BOD5, COD, and TP. Otherwise, the concentration of these parameters noted that were lower than the standard in less level which not severely harm to the environmental and human health. Although the pollution level is not very harmful, but the water should be avoided for any consuming purpose.

4.4 Soil quality

The liquid waste generated from the project sites and worker camps were managed properly by providing adequate toilets in all construction sites. All the machinery was checked to prevent the spill leaking of fuel on the soil.

4.3 Air quality

The air quality in the project area, As the result of air quality obtained from the laboratory of the MOE, all parameters including CO, NO2, SO2, O_3, H2S, and TSP were found to be lower than the Cambodia standard which can be concluded that in the project area has a safe air quality which not harm to the environment and human health. Although the air quality is not harmful, measures should be set to prevent and minimized the impact from the proposed project.

4.4 Noise and vibration

The average noise level in the project area were lower than the Cambodia standard which suggested that the project activities don't cause any harmful the noise and vibration of the surrounding project sites.

4.5 Safety

Workers equipped with PPE (Personal Protection Equipment) during working hour in the construction site. The safety tools as iron fence, traffic signs, firefighting, helmets, boots, glasses and gloves have been provided to workers and installed in the construction site to ensure the safety of the workers and workplaces. The safety signs installed ahead of the construction sites to inform road users and to avoid traffic accident. In every morning, workers do morning exercise and toolbox meeting before starting work. The morning exercise and toolbox meeting checked the condition of workers' health to avoid accident

5. Recommendation

Base on the field observation and results of environmental quality (water and air quality) from the laboratory analysis, some recommendation should be considered as following:

- Regularly check and monitor the project activities to ensure that there is no discharge of polluted water into the environment without proper treatment methods.
- Follow to the Cambodia regulation on water, wastewater management, air pollution control and other national and international standard if there are any wastewater generation activities and causing air pollution emission in the project.
- Observe the pollution change in this area or no affect due to the construction works and cooperate closely with the local authorities and other environmental experts from both private and public parties to control the pollution.
- Wastewater Treatment Plants and any wastewater control facility must be undertaken to prevent and minimize the negative impacts on the environment and human health.
- Set up mitigation measures to prevent and minimized the negative impacts of air pollution on the environment and human health.

- Regularly monitor the project works to ensure that there is no air pollution emission into the environment.
- The contractor must spray water regularly during working at site the access road in order to prevent dust emission to the passengers, or resident living near the site.

Remark:

Name and Signature

KINGDOM OF CAMBODIA

Nation Religion King

PHNOM PENH CAPITAL CITY

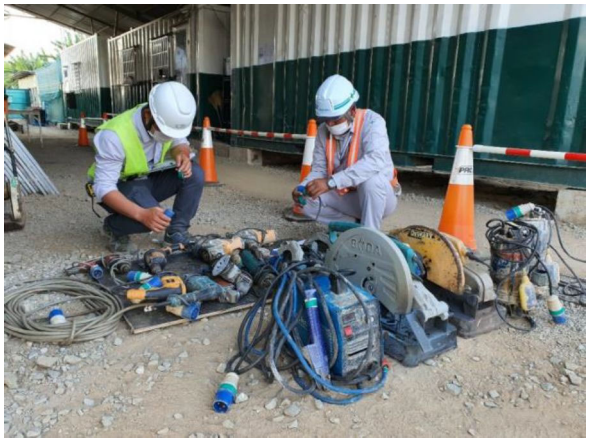
THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

IN PHNOM PENH

JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORING REPORT No.3

February 2022



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1. Introduction

The rising of city development has generated variety of major environmental problems. Therefore, water and air pollution has become an issue and harm to environment and people health with no adequate measures. In the project area, Boeung Choeung Ek lake is one of the biggest storage in the city which collected a part of the sewage and rainwater from the center city and discharge directly into this lake without proper treatment.

Environmental quality survey requires the determination of concentration of various parameters for both water and air quality in according to the regulation of Cambodia.

1.1 Project Location

The environmental monitoring was conducted in the project area and which is located in Sangkat Chhak Angre Ler, Khan Mean Chey, Phnom Penh as shown in the Figure 1.

Figure 1 Monitoring Locations

1.2 Objective

The purpose of the environment monitoring is to check and confirm if there are the influence and changes of the surrounding condition and circumstances due to implementation of the construction works during construction period by monitoring working safety, traffic and accident, solid waste management, quality of air, noise and water, economic disturbance, and ecosystem.

The environmental monitoring is to follow up the Contractor's implementation on environmental mitigation measure and recommendation of monthly progress of work. Guidance and instruction will be prepared to guide the contractor to follow the environmental mitigation measure as stated in the approved IESIA report.

1.3 Scope of work

In order to assess the environmental quality in the proposed project area, three environmental parameters were conducted including water quality, air quality, noise and vibration. Water quality survey will be conducted by sampling the surface water from Boeung Choeung Ek lake in four different locations from the upstream to the downstream of the project area with 13 parameters are analyzed. Air quality survey will be conducted in two different locations of the project area with 6 parameters are analyzed. Noise and Vibration monitoring will have conducted in 6 different locations around the project area. The water quality, air quality, noise and vibration were sampled at field site.

1.4 Environmental Monitoring Items

The major tasks for the environmental monitoring in construction stage include:

- Field monitoring on Contractor's environmental mitigation measure performance in the project area
- Guidance to Contractor's environmental engineers on environmental monitoring aspect, in the field practice
- Recommend to Contractor to implement all EMP as stated in IESIA report and other environmental safeguards in construction contract documents
- Instruct Contractor to take an action to mitigate or rectify on other issues that find out in the construction stage.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
1. Project Before Construction Phase					
1.1 Socio-economy resource					
Resettlement	– Along the Access Road (Channel Maintenance Road) and sewerage treatment plant – Prek Takong 1 village	– The monitoring of compensation of resettlement and grievance redress	Once every 6 months	1. IRC-WG, IRC 2. DPWT 3. Local authorities	1. MoE 2. MEF 3. DoE 4. DLMUPC
2. Project Construction Phase					
2.1 Physical resource					
Soil erosion and slope failure	– Sand provider	– Confirmation of license issued by Ministry of Mines and Energy and Ministry of Water Resources and Meteorology	Before construction	1. DPWT 2. Contractor	1. Ministry of Mines and Energy 2. Ministry of Water Resources and Meteorology
Topography	– Building construction site – Access Road (Channel Maintenance Road) – Protection dike construction site – Spoiled soil dumping site	– The monitoring of the topography and the erosion at the infrastructure construction site – The monitoring of erosion at the road, protection dike's embankment and spoiled soil dumping site	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
Hydrology	– Canal from Trabek pumping station – Wastewater way, downstream of the drainage to Hun Neang road	– Monitoring of the obstruction of the flow of pumped wastewater	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Surface water quality	3 Sample locations near the project area – Location 1: X=0491822, Y=1274363 – Location 2: X=0491299, Y=1272570 – Location 3: X=0493103, Y=1268628 – Solid-liquid waste storage	– Monitoring of the water quality on the parameters: temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb and Total Coliform – Monitoring of solid-liquid waste management	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Soil quality	– Infrastructure construction site, generator and machinery storage – Temporary shelter of staff-workers	– Monitoring of solid-liquid waste management – Monitoring of the spill, leak of fuel on the soil.	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Air Quality	− Infrastructure construction site − Access Road (Channel Maintenance Road) − Temporary shelter of staff-workers − 2 location of air quality testing: location 1 X=0491356, Y=1272730, location 2 X=0491031, Y=1272740	− Monitoring of the material transportation on Rd. 271 − Monitoring of the odor condition at construction sites − Monitoring of air quality parameters: TSP; CO; NO_2; SO_2, O_3, PM10, PM2.5 and H_2S	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
Noise and vibration	− Infrastructure construction site − Road construction site from Rd. 271 to construction site − Temporary shelter of staff-workers − Noise and vibration testing locations are the same as air quality testing locations	− Monitoring of the noise and vibration from the material transportation, the operation of any machinery, generator and vehicle. − Monitoring of noise and vibration (Unit: dB)	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
2.2 Biological resources					
Ecosystem (Fish)	− Cheung Aek Lake near project area − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the water quality on the parameters temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb Total Coliform	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority
Ecosystem (Birds)	− Temporary shelter of staff-workers	− Monitoring of the crime on wildlife especially the aquatic birds	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
2.3 Socio-economic resources					
Resettlement	− Resident of AHs, lose their income in Prek Takong 1 village. − Area of 19.0736 ha for construction and expansion of the STP	− Monitoring of the livelihood of AHs (7HHs), lose their income. − Monitoring to ensure that no encroachment to the STP area.	Once every 6 months	1. DPWT 2. Local authority	1. MoE 2. MEF 3. DoE 4. DLMUPC 5. DOWRAM
Livelihood, occupations of the local community and gender	− Prek Takong 1 village − Temporary shelter of staff-workers	− Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability − Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	− Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. − Access Road (Channel Maintenance Road)	− Monitoring of the transportation (speed and load) − Monitoring of the parking − Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	− Infrastructure construction site − Generator, vehicle and machinery storage − Temporary shelter of staff-workers − First aid room	− Monitoring of solid-liquid waste management at temporary shelter − Monitoring of the clean water supply and sanitation − Monitoring of the safety equipment and work safety − Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

The environmental monitoring consists of site monitoring in project area, the total will be controlled and managed by a time-based work plan.

2.1 Road Monitoring

Monitoring of the transportation (speed and load), parking and the damage road by the project. Monitoring locations such as Road.271, Hun Sen Blvd.(60m) and Hun Neang Blvd. and Access road for the Channel Maintenance Road.

2.2 Public Health and Safety

Monitoring of Solid Liquid Waste management at temporary shelter, the clean water supply & sanitation and the safety equipment and work safety.

2.3 Site monitoring

Use environmental monitoring checklist, visual and interview with project workers and people are living near the project area, and visual checking during the field observation on environmental mitigation measure that implemented or rectified by contractor. Visual methodology also has been applied for other environmental monitoring items; however, degree of impact has been recorded and photographs to proof the impacts (good or bad) are used.

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Feb-22	Remark
1	Topography	Onec every 6 months							✔		Refer to monthly progress report submitted (Back data)
2	Hydrology	Onec every 6 months							✔		Ditto
3	Surface water quality	Onec every 6 months	Original data						✔		Ditto
4	Soil quality	Onec every 6 months							✔		Ditto
5	Air quality	Onec every 6 months	Original data						✔		Ditto
6	Noise and Vibration	Onec every 6 months	Original data						✔		Ditto
7	Ecosystem (Fish)	Onec every 6 months							✔		Ditto
8	Ecosystem (Birds)	Onec every 6 months							✔		Ditto
9	Livelihood, occupations of the local community and gender	Onec every 6 months							✔		Ditto
10	Road	Onec every 3 months			✔				✔	✔	Ditto
11	Public Health and Safety	Onec every 3 months			✔				✔	✔	Ditto
12	Site Safety Patrol form	Every month		✔	✔	✔	✔	✔	✔	✔	Ditto
13	Others	If neessary									

3.2 Road Monitoring

Monitoring item:		Monitoring indicator : Hiromasa Arai
Road		The transportation (speed and load) The parking The repair of damaged road by the project
Term	Date	Results
1	11-Feb-22	The transportation (speed and load) Location :Sewerage Treatment Plant Detail : Entrance of Sewerage Treatment Plant ※Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Location :Sewerage Treatment Plant Detail : Entrance of Sewerage Treatment Plant ※Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Location :Sewerage Treatment Plant Detail : Check the Hun Neang Road ※No damage to roads observed. (Satisfactory) / Unsatisfactory

2	11-Feb-22	The transportation (speed and load) Location :Channel Maintenance Road Detail : Entrance of Cannel Maintenance Road ※Overspeed and overload are not observed.	(Satisfactory) / Unsatisfactory
		The parking Location :Channel Maintenance Road Detail : Entrance of Cannel Maintenance Road ※Illegal parking near the site is not observed.	(Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Location :Channel Maintenance Road Detail : Cheak the Hun Neang Road ※Illegal parking near the site is not observed.	(Satisfactory) / Unsatisfactory

Before	After
	
Road	Road
Hun Neang Road	Hun Neang Road
1-Jun-21	11-Feb-22

Before	After
	
Road	Road
Hun Neang Road	Hun Neang Road
1-Jun-21	11-Feb-22

3.3 Public Health and Safety

Report of Health Safety and Environment (HSE) for Month

Implementation date :11/Feb/2022 Location :STP,CMR,IF

The following forms shall be applied for monitoring to ensure that HSEM Plan is fully followed and
implemented during the execution of the work.

No.	Item	Monitoring Cycle	Remark
1	Topography	Onec every 6 months	—
2	Hydrology	Onec every 6 months	—
3	Surface water quality	Onec every 6 months	—
4	Soil quality	Onec every 6 months	—
5	Air quality	Onec every 6 months	—
6	Noise and Vibration	Onec every 6 months	—
7	Ecosystem (Fish)	Onec every 6 months	—
8	Ecosystem (Birds)	Onec every 6 months	—
9	Livelihood, occupations of the local community and gender	Onec every 6 months	—
10	Road	Onec every 3 months	✔
11	Public Health and Safety	Onec every 3 months	✔
12	Site Safety Patrol form	Every month	✔
13	Others	If neessary	—

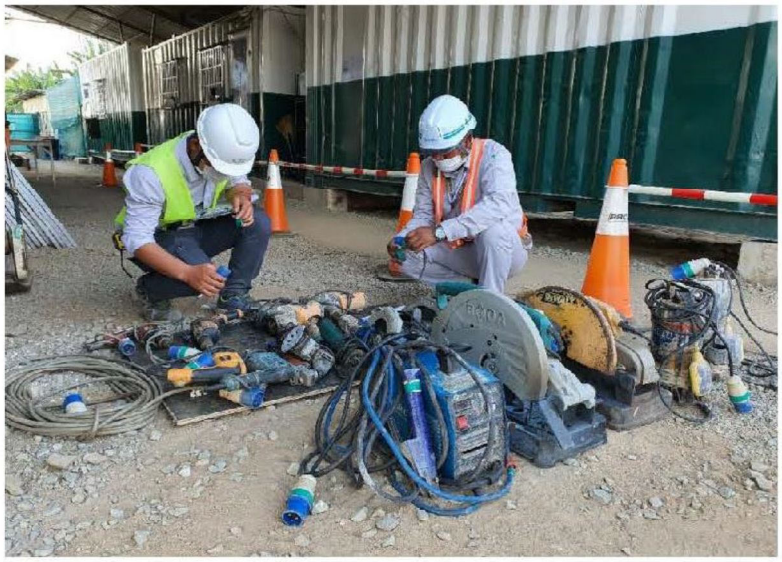
11. Monitoring form for Public Health and Safety

Monitoring item:		Monitoring indicator : Hiromasa Arai
Public Health and Safety		Solid-liquid waste management at temporary shelter The clean water supply and sanitation The safety equipment and work safety The first aid room
Term	Date	Results
1	11-Feb-22	Solid-liquid waste management at temporary shelter Location :Sewerage Treatment Plant,Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-10 Other) ※Periodically collected Solid-liquid waste from septic tank. (Satisfactory) / Unsatisfactory
		The clean water supply and sanitation Location :Sewerage Treatment Plant,Interception Facility Detail : No.12, Result of site safety patrol (Items: 2-6 Water Supply) ※Disinfecting and cleaning toilets (Satisfactory) / Unsatisfactory
		The safety equipment and work safety Location :Sewerage Treatment Plant,Interception Facility,Channel Maintenance Road Detail : No.12, Result of sate safety patrol (Items: 6,7 Safety and Protective equipment) ※Tool inspection is done every monthly (Satisfactory) / Unsatisfactory
		The first aid room Location :Kubota office Detail : No.12, Result of site safety patrol (Items: 6-5 Other) ※Checking stock of First aid Kid and COVID test (Satisfactory) / Unsatisfactory
2		Solid-liquid waste management at temporary shelter Location : Detail : No.12, Result of site safety patrol (Items:) Satisfactory / Unsatisfactory
		The clean water supply and sanitation Location : Detail : No.12, Result of site safety patrol (Items:) Satisfactory / Unsatisfactory
		The safety equipment and work safety Location : Detail : No.12, Result of site safety patrol (Items:) Satisfactory / Unsatisfactory
		The first aid room Location : Detail : No.12, Result of site safety patrol (Items:) Satisfactory / Unsatisfactory

Public Health and Safety

Disinfecting toilets

Sewerage Treatment Plant

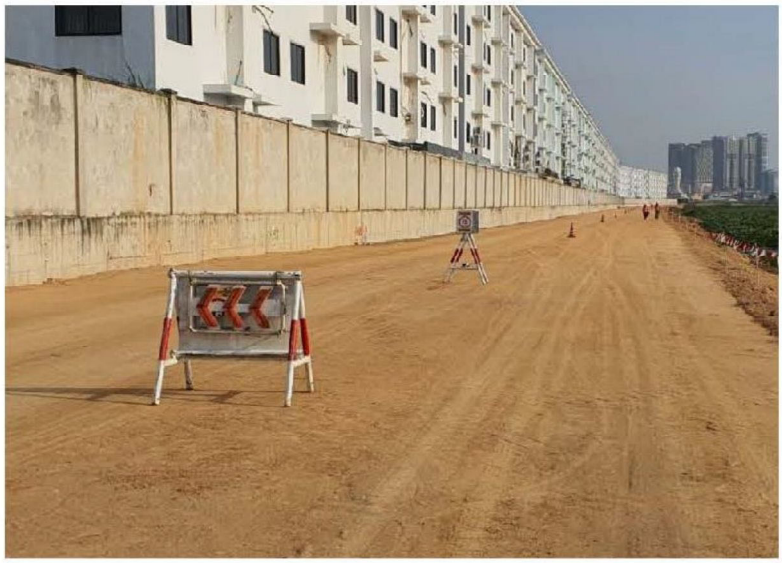


Public Health and Safety

Public Health and Safety

Inspection tool

Sewerage Treatment Plant



Public Health and Safety

Information and caution signe are indicate properly.

Channel Maintenace Road

Public Health and Safety

The rubbish bine are install and separate properly in the construction site

Interception Facility

Public Health and Safety

Traffic control man assigned both sides when heavy vehicle grossing On the public road.

Channel Maitenace Road

Public Health and Safety

First aid kid

COVID-TEST

Kubota office

3.4 Site Safety Patrol Form

Location :Channel Maintenance road Sewarage Treatment Plamt	Inspector : Mr. Vann Sari
Date :11-February-2022	Time :15:00
Work Description	

No.	Item	Eval	No.	Item	Eval
1	**Site Security/Safety**		**4**	**Earthwork**	
1-1	Perimeter fencing	○	4-1	Earthwork arrangement/planning	○
1-2	Signage	○	4-2	Shoring	/
1-3	Lighting	○	4-3	Site security/signage	○
1-4	Other	○	4-4	Other	○
2	**Site cleaning/hygiene**		**5**	**Scaffold**	
2-1	Site	○	5-1	Condition of scaffolds	/
2-2	Office	○	5-2	Condition of foundation	/
2-3	Road	○	5-3	Condition of supports	/
2-4	Latrines	○	5-4	Site security/signage	/
2-5	First aid room	○	5-5	Other	/
2-6	Water supply	○	**6**	**Safety equipment**	
2-7	Other	○	6-1	Equipment condition	○
3	**Environment**		6-2	Wire condition	○
3-1	Erosion protection	○	6-3	Hoist work procedure	○
3-2	Dust protection	○	6-4	Site security/signage	○
3-3	Dust bins/waste collection	○	6-5	Other	○
3-4	Operation of machinery	○	**7**	**Protective Equipment**	
3-5	Crime on wildlife	○	7-1	Helmet	○
3-6	Oil leakage	○	7-2	Work wear	○
3-7	Obstruction of water flow	○	7-3	Protective footwear	○
3-8	Separation of garbage	○	7-4	Work gloves	△
3-9	Odor condition	○	7-5	Protective eyewear	○
3-10	Other	○	7-6	Mask	○
			7-7	Safety harness	/
			7-8	Other	○

Evaluation	Good	○	Improve	△	Unsafe	×	N/A	/

Comment : Scaffolding at storage area should be kept in Lower condition to prevent fall down. Soap bottle should be provided for Gas/oxygen Checking of Leaking.

Kubota

The Project for Sewerage System Development in Phnom Penh

METAWATER

Number: 9

Monthly Safety Patrol Record

Date: 11/February/2022 **Location: CMR,STP & Intake facility**

No	Photo of Before	Photo of After	Action
1			Mr. Kuntea
	Scaffolding storage should be lower.	Scaffolding were arranged and kept properly (Improvement).	Date Close 11-Feb-2022
2			Mr. Kuntea
	Soap should be provided to keep for checking of gas cylinder/Oxygen.	soap was kept for checking of gas/Oxygen leaking. (Improvement)	Date Close 11-Feb-2022
3	Safety petrol by contractor and sub contractor		Record by
			Mr.Sari
	Check site safety condition at STP, CMR & Intake facility.		Date Close 11-Feb-2022

For Suggestion:

Electrical socket should be installed the cover box to prevent wet from rainy.

Action by:	Checked by:	Checked by:	Confirmed by:	Confirmed by:
Site Engineer Norak	HSE Engineer Norak	Site Engineer Kubota	HSE Engineer Kubota	Chief Engineer Kubota

4. Conclusion

The monitoring this time was to check the surrounding roads and the health and safety of the site. For hygiene management in the site, body temperature is measured and disinfected every morning before the morning meeting, and as for the toilets, disinfection and cleaning is done every day. In addition, the First Aid Room is equipped with a first aid kit and COVID test to prevent the spread of COVID.

Remark:

Name and Signature

KINGDOM OF CAMBODIA

Nation Religion King

PHNOM PENH CAPITAL CITY

THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

IN PHNOM PENH

JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORI NG REPORT No. 4

May 2022

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1. Introduction

The rising of city development has generated variety of major environmental problems. Therefore, water and air pollution has become an issue and harm to environment and people health with no adequate measures. In the project area, Boeung Choeung Ek lake is one of the biggest storages in the city which collected a part of the sewage and rainwater from the center city and discharge directly into this lake without proper treatment.

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1.1 Project Location

The environmental monitoring was conducted in the project area and which is located in Sangkat Chak Angre Leu, Khan Mean Chey, Phnom Penh as shown in the Figure 1.

Figure 1: Monitoring Locations

1.2 Objective

The purpose of the environment monitoring is to check and confirm if there are the influence and changes of the surrounding condition and circumstances due to implementation of the construction works during construction period by monitoring working safety, traffic and accident, solid waste management, quality of air, noise and water, economic disturbance, and ecosystem.

The environmental monitoring is to follow up the Contractor's implementation on environmental mitigation measure and recommendation of monthly progress of work. Guidance and instruction will be prepared to guide the contractor to follow the environmental mitigation measure as stated in the approved IESIA report.

1.3 Scope of work

In order to assess the environmental quality in the proposed project area, three environmental parameters were conducted including water quality, air quality, noise and vibration. Water quality survey will be conducted by sampling the surface water from Boeung Choeung Ek lake in four different locations from the upstream to the downstream of the project area with 13 parameters are analyzed. Air quality survey will be conducted in two different locations of the project area with 6 parameters are analyzed. Noise and Vibration monitoring will have conducted in 6 different locations around the project area. The water quality, air quality, noise and vibration were sampled at field site.

1.4 Environmental Monitoring Items

The major tasks for the environmental monitoring in construction stage include:

- Field monitoring on Contractor's environmental mitigation measure performance in the project area
- Guidance to Contractor's environmental engineers on environmental monitoring aspect, in the field practice
- Recommend to Contractor to implement all EMP as stated in IESIA report and other environmental safeguards in construction contract documents
- Instruct Contractor to take an action to mitigate or rectify on other issues that find out in the construction stage.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
1. Project Before Construction Phase					
1.1 Socio-economy resource					
Resettlement	− Along the Access Road (Channel Maintenance Road) and sewerage treatment plant − Prek Takong 1 village	− The monitoring of compensation of resettlement and grievance redress	Once every 6 months	1. IRC-WG, IRC 2. DPWT 3. Local authorities	1. MoE 2. MEF 3. DoE 4. DLMUPC
2. Project Construction Phase					
2.1 Physical resource					
Soil erosion and slope failure	− Sand provider	− Confirmation of license issued by Ministry of Mines and Energy and Ministry of Water Resources and Meteorology	Before construction	1. DPWT 2. Contractor	1. Ministry of Mines and Energy 2. Ministry of Water Resources and Meteorology
Topography	− Building construction site − Access Road (Channel Maintenance Road) − Protection dike construction site − Spoiled soil dumping site	− The monitoring of the topography and the erosion at the infrastructure construction site − The monitoring of erosion at the road, protection dike's embankment and spoiled soil dumping site	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
Hydrology	− Canal from Trabek pumping station − Wastewater way, downstream of the drainage to Hun Neang road	− Monitoring of the obstruction of the flow of pumped wastewater	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Surface water quality	3 Sample locations near the project area − Location 1: X=0491822, Y=1274363 − Location 2: X=0491299, Y=1272570 − Location 3: X=0493103, Y=1268628 − Solid-liquid waste storage	− Monitoring of the water quality on the parameters: temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb and Total Coliform − Monitoring of solid-liquid waste management	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Soil quality	− Infrastructure construction site, generator and machinery storage − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the spill, leak of fuel on the soil.	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
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Noise and vibration	- Infrastructure construction site - Road construction site from Rd. 271 to construction site - Temporary shelter of staff-workers - Noise and vibration testing locations are the same as air quality testing locations	- Monitoring of the noise and vibration from the material transportation, the operation of any machinery, generator and vehicle. - Monitoring of noise and vibration (Unit: dB)	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
2.2 Biological resources					
Ecosystem (Fish)	- Cheung Aek Lake near project area - Temporary shelter of staff-workers	- Monitoring of solid-liquid waste management - Monitoring of the water quality on the parameters temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb Total Coliform	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority
Ecosystem (Birds)	- Temporary shelter of staff-workers	- Monitoring of the crime on wildlife especially the aquatic birds	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
2.3 Socio-economic resources					
Resettlement	- Resident of AHs, lose their income in Prek Takong 1 village. - Area of 19.0736 ha for construction and expansion of the STP	- Monitoring of the livelihood of AHs (7HHs), lose their income. - Monitoring to ensure that no encroachment to the STP area.	Once every 6 months	1. DPWT 2. Local authority	1. MoE 2. MEF 3. DoE 4. DLMUPC 5. DOWRAM
Livelihood, occupations of the local community and gender	- Prek Takong 1 village - Temporary shelter of staff-workers	- Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability - Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	- Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. - Access Road (Channel Maintenance Road)	- Monitoring of the transportation (speed and load) - Monitoring of the parking - Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	- Infrastructure construction site - Generator, vehicle and machinery storage - Temporary shelter of staff-workers - First aid room	- Monitoring of solid-liquid waste management at temporary shelter - Monitoring of the clean water supply and sanitation - Monitoring of the safety equipment and work safety - Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

The environmental monitoring consists of two key activities have been applied in this monitoring stage, air and noise measurement; and water sampling and site monitoring in project area, the total will be controlled and managed by a time-based work plan.

- Air, noise and water quality sampling:

Air and noise sampling will conduct by MoE once every six months. The water quality sampling conducts once every six months according to EMP of IESIA report. All sampling water will be analyzed by MoE lab in Phnom Penh.

- Road:

Monitoring of the transportation (speed and load), parking and the damage road by the project. Monitoring locations such as Road.271, Hun Sen Blvd.(60m) and Hun Neang Blvd. and Access Road forthe Channel Maintenance Road.

- Public Health and Safety:

Monitoring of Solid Liquid Waste management at temporary shelter, the clean water supply & sanitation and the safety equipment and work safety.

- Site monitoring:

Use environmental monitoring checklist, visual and interview with project workers and people are living near the project area, and visual checking during the field observation on environmental mitigation measure that implemented or rectified by contractor. Visual methodology also has been applied for other environmental monitoring items; however, degree of impact has been recorded and photographs to proof the impacts (good or bad) are used.

2.1 Surface Water Sampling Process

For taken water samples, some important procedure had been applied in the following:

- Tools and equipment: water sampler, sample bottles, cool box, etc.
- Stamping the code number and sampling date on the sample bottle.
- Sampling taken was following the WHO technique for water sampling.

The samples would keep in the cool box quickly after taking, and at the same day were sent to MoE Lab in Phnom Penh for analyzing the parameters as required by the Water Quality Survey.

Figure 2: Water quality sampling tools and equipment

2.2 Air Sampling Process

Air quality sampling was conducted on-site in the proposed project. The sampling equipment were installed at a height of 1.2 to 1.5 meters above the ground, and air quality parameters were carried out within 1 hour, 8 hours, 24 hours according to each parameter method. Air quality parameters were analyzed in the laboratory of the MOE.

Figure 3: Air quality sampling tools and equipment

2.3 Noise and Vibration Sampling Process

The noise and vibration were monitored from the material transportation, the operation of any machinery, generator and vehicle.

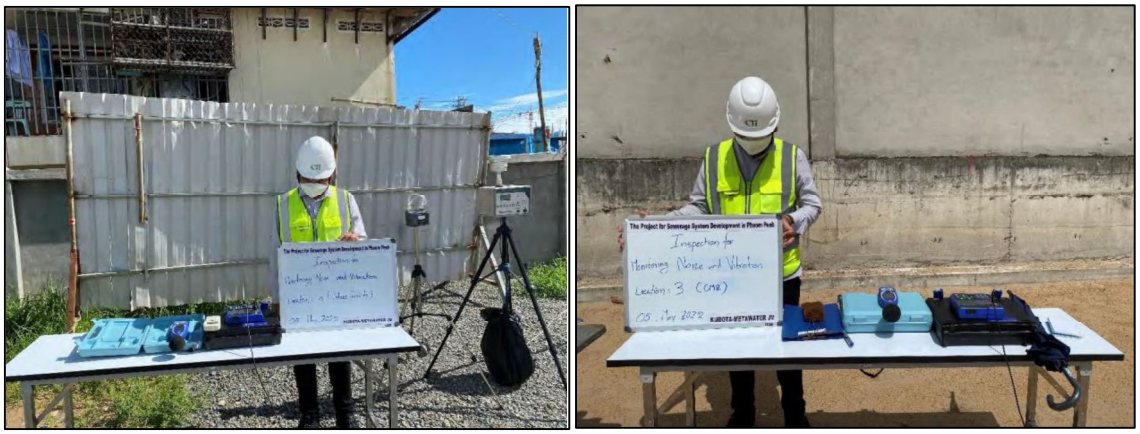

Figure 4: Noise and Vibration sampling tools and equipment

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Feb-22	May-22	Remark
1	Topography	Onec every 6 months							✔		✔	Refer to monthly progress report submitted (Back data)
2	Hydrology	Onec every 6 months							✔		✔	Ditto
3	Surface water quality	Onec every 6 months	Original data						✔		✔	Ditto
4	Soil quality	Onec every 6 months							✔		✔	Ditto
5	Air quality	Onec every 6 months	Original data						✔		✔	Ditto
6	Noise and Vibration	Onec every 6 months	Original data						✔		✔	Ditto
7	Ecosystem (Fish)	Onec every 6 months							✔		✔	Ditto
8	Ecosystem (Birds)	Onec every 6 months							✔		✔	Ditto
9	Livelihood, occupations of the local community and gender	Onec every 6 months							✔		✔	Ditto
10	Road	Onec every 3 months			✔				✔	✔	✔	Ditto
11	Public Health and Safety	Onec every 3 months			✔				✔	✔	✔	Ditto
12	Site Safety Patrol form	Every month		✔	✔	✔	✔	✔	✔	✔	✔	Ditto
13	Others	If neessary										

3.2 Water Quality

After analysis, the water quality readings were compared with the Cambodia standards following to the Proclamation No. 116 B.K.MOE on the Introduction of Working Conditions for the Establishment of Factory and Handy-Craft Project as shown in Table 3. The air quality readings were compared with the Cambodia standards following to the Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project as shown in the Table 4.

Table 1: Cambodia water quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Method	May-21	May-22				
						No.1	No.2	No.3	No.4	Ave
1	pH	-	5.5-9.0	Method pH Meter	7.275	6.64	6.68	6.66	6.98	6.74
2	Temperature	Degree C	<40	Method Thermometer	25	25.00	25.00	24.98	25.00	25.00
3	Turbidity	NTU	NV	Method Digital Turbid meter	58.5	74.00	88.00	20.00	64.00	61.50
4	Dissolved Oxygen (DO)	mg/L	2.0-7.5	Method DO Meter	0.25	0.00	1.00	3.00	4.50	2.13
5	Total Dissolved Solid (TDS)	mg/L	<2000	Method 2540 C	202.5	300.00	229.00	238.00	258.00	256.25
6	Total Suspended Solid (TSS)	mg/L	<100	Method 2540 D	129.5	60.00	116.00	10.00	67.00	63.25
7	Biochemical Oxygen Demand (BOD)5	mg/L	<60	Method 5210 B	70.26	71.24	38.52	22.80	42.69	43.81
8	Chemical Oxygen Demand (COD)Cr	mg/L	<120	Method 5220.B	129.75	148.00	43.00	58.00	94.00	85.75
9	Sulphate (SO4)	mg/L	<500	Method 4500- SO42- B	63	67.00	79.00	9.00	19.00	43.50
10	Total Nitrogen (TN)	mg/L	<40	Method JIS K 0102 45	22.75	10.60	10.70	12.95	15.70	12.48
11	Total Phosphorus (TP)	mg/L	<6.0	Method JIS K 0102 46	1.645	0.42	0.40	0.53	0.85	0.55
12	Lead (Pb)	mg/L	<0.3	Method 3500- Pb C	0.5	ND	ND	ND	ND	ND
13	Total Coli form	MPN/100ml	<1000	Method NF T90-413	1.425×10^{6}	4.6×10^{7}	9.3×10^{5}	4.3×10^{5}	2.4×10^{4}	5.15×10^{5}

Source: Standard from Annex2 of Effluent for discharging Liquid waste on the Sub Decree No.103 SDC.PK On the Amendment Article 4, Article 9, Article 11, Article 12, Article 17 and table of Annex 2, Annex 3, Annex 4 and Annex 5 of Sub-decree 27 SDC.PK dated on 6th April, 1999 on Water Pollution Control that issued on June 29, 2021 of Royal government of Cambodia.

3.3 Air Quality

Based on the field observation on 04th -05th May 2022, the construction works which comprise of various activities could cause air pollution through exhausted gas from transportation vehicles, and other machineries. Dust emission also causes air pollution by the transportation of construction materials, excavated soil, and backfill sand. However, these activities will only cause air pollution in a short period.

The air quality and noise level were monitored in the project area on 04th -05th May 2022 in order to follow up the impact from the project activities. According to the result below the air qualities are below the standard so no air pollution from the construction activities (see in Table 2 below).

Table 2: Cambodia air quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Duration	May-21	May-22				
						No.1	No.2	No.3	No.4	Ave
1	Carbon Monoxide (CO)	mg/m3	<20	8 hours	1.08	1.203	1.238	1.127	1.770	1.335
2	Nitrogen Dioxide (NO2)	mg/m3	<0.10	24 hours	0.016	ND	0.012	0.017	ND	0.015
3	Sulfur Dioxide (SO2)	mg/m3	<0.30	24 hours	0.021	0.011	0.018	0.012	0.017	0.015
4	Ozone (O3)	mg/m3	<0.2	1 hour	0.0008	0.007	0.015	0.010	0.009	0.010
5	Hydrogen Sulfide (H2S)	ppm	NV	NV	ND	ND	ND	ND	ND	ND
6	Total Suspended Particles (TSP)	mg/m3	<0.33	24 hours	0.092	0.075	0.050	0.095	0.085	0.076
7	PM10	mg/m^3	<0.05	-	0.029	0.021	0.026	0.019	0.019	0.021
8	PM2.5	mg/m^3	<0.025	-	0.021	0.019	0.024	0.016	0.018	0.019

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

3.4 Noise and Vibration

Noise and vibration happened from the construction machinery such as excavation of drainage' line, road cutting machine, driving sheet pile and transporting of top soil from the project site to disposal site. In date of observation only few construction machineries (excavator and dump trucks) are working on the platform in different place were close to residential area.

Table 1 show that the average noise level in daytime (65.0 dB(A)) is lower than maximum permitted noise level in commercial and service areas and mix. The transportation of soil by trucks from construction site to disposal site are between 5 to 10 trips per day so comparing the normal traffic situation, the transportation activities is much lower. In conclusion, the higher noise level is not mainly from the construction activities but from the traffic in the area itself.

Table 3: Noise standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	May-21	May-22						
						No.1	No.2	No.3	No.4	No.5	No.6	Ave
1	LAeq	dB	-	3 hours	59.06	56.6	53.5	54.8	61.5	67.2	58.1	**58.6**
2	LAF Max	dB	-	3 hours	84.86	86.3	77.5	85	89.4	91.3	79.7	**84.9**
3	LAF 5	dB	<85dB	3 hours	59.98	58.7	58.7	36.3	66.8	70	60.8	**58.6**

Table 4: Vibration standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	May-21	May-22						
						No.1	No.2	No.3	No.4	No.5	No6	Ave
1	LVA eg	dB	-	3 hours	43.88	37.8	33.4	37.9	85.2	35.6	84.7	**52.43**
2	LVA max	dB	-	3 hours	68.85	61.6	36.9	55	114.4	48.9	113.8	**71.77**
3	LVA 10	dB	<75dB	3 hours	45.58	37.8	36.1	40.5	44.6	38	63.1	**43.35**

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

4. Conclusion

The project area is a part of the city where urbanization and economics are significantly growing, as well as its population. With these growing factors, more and more wastewater is discharged from the city center including households, industries restaurants, hotels, etc., and there is some part has been connecting to the sewer systems but some has not, resulting in severe environmental problems such water and air pollution.

The result on environment monitoring in three months from February to April 2022 as following:

4.1 Topography

The topography and erosion in the construction site was satisfactory. There is small erosion along of the slope of road cause by rain was observed. However, repair work was conducted to maintenance road and slope condition. Temporary drainage was introduced to discharge the rainwater.

4.2 Hydrology

The flow of pump waste water at Trabeck Pumping Station and the downstream drainage to Hun Neang Road remains unobstructed. However, due to filling works that constrict the channel on the south side of the STP, the water level in Chueng Ek Lake risen up to EL+8.2m at the Interception Facility in March (the high-water level EL+8.5m). Despite this, the Ministry of Water Resources which conducting the dredging in the Chueng Ek lake has extending the waterway.

4.3 Surface of Water quality

The water quality result from the analysis obtained from the laboratory of the MOE, Total Nitrogen (TN) parameters was shown to be out of range limited from the Cambodia standard. Otherwise, the concentration of these parameters noted that were lower than the standard in less level which not severely harm to the environmental and human health. Although the pollution level is not very harmful, but the water should be avoided for any consuming purpose.

4.4 Soil quality

The liquid waste generated from the project sites and worker camps were managed properly by providing adequate toilets in all construction sites. All the machinery was checked to prevent the spill leaking of fuel on the soil.

4.5 Air quality

The air quality in the project area, As the result of air quality obtained from the laboratory of the MOE, all parameters including CO, NO2, SO2, O3, and TSP were found to be lower than the Cambodia standard which can be concluded that in the project area has a safe air quality which not harm to the environment and human health. Although the air quality is not harmful, measures should be set to prevent and minimized the impact from the proposed project.

4.6 Noise and vibration

The average noise level in the project area were lower than the Cambodia standard which suggested that the project activities don't cause any harmful the noise and vibration of the surrounding project sites.

4.7 Safety

Workers equipped with PPE (Personal Protection Equipment) during working hour in the construction site. The safety tools as iron fence, traffic signs, firefighting, helmets, boots, glasses and gloves have been provided to workers and installed in the construction site to ensure the safety of the workers and workplaces. The safety signs installed ahead of the construction sites to inform road users and to avoid traffic accident. In every morning, workers do morning exercise and toolbox meeting before starting work. The morning exercise and toolbox meeting checked the condition of workers' health to avoid accident

5. Recommendation

Base on the field observation and results of environmental quality (water and air quality) from the laboratory analysis, some recommendation should be considered as following:

- Regularly check and monitor the project activities to ensure that there is no discharge of polluted water into the environment without proper treatment methods.
- Follow to the Cambodia regulation on water, wastewater management, air pollution control and other national and international standard if there are any wastewater generation activities and causing air pollution emission in the project.
- Observe the pollution change in this area or no affect due to the construction works and cooperate closely with the local authorities and other environmental experts from both private and public parties to control the pollution.
- Wastewater Treatment Plants and any wastewater control facility must be undertaken to prevent and minimize the negative impacts on the environment and human health.
- Set up mitigation measures to prevent and minimized the negative impacts of air pollution on the environment and human health.
- Regularly monitor the project works to ensure that there is no air pollution emission into the environment.
- The contractor must spray water regularly during working at site the access road in order to prevent dust emission to the passengers, or resident living near the site.

Remark:

Name and Signature

KINGDOM OF CAMBODIA

Nation Religion King

PHNOM PENH CAPITAL CITY

THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

IN PHNOM PENH

JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORING REPORT No. 5

November 2022




Contents

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1. Introduction

The rising of city development has generated variety of major environmental problems. Therefore, water and air pollution has become an issue and harm to environment and people health with no adequate measures. In the project area, Boeung Choeung Ek lake is one of the biggest storages in the city which collected a part of the sewage and rainwater from the center city and discharge directly into this lake without proper treatment.

Environmental quality survey requires the determination of concentration of various parameters for both water and air quality in according to the regulation of Cambodia.

1.1 Project Location

The environmental monitoring was conducted in the project area and which is located in Sangkat Chak Angre Leu, Khan Mean Chey, Phnom Penh as shown in the Figure 1.

Figure 1: Monitoring Locations

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The purpose of the environment monitoring is to check and confirm if there are the influence and changes of the surrounding condition and circumstances due to implementation of the construction works during construction period by monitoring working safety, traffic and accident, solid waste management, quality of air, noise and water, economic disturbance, and ecosystem.

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Livelihood, occupations of the local community and gender	- Prek Takong 1 village - Temporary shelter of staff-workers	- Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability - Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	- Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. - Access Road (Channel Maintenance Road)	- Monitoring of the transportation (speed and load) - Monitoring of the parking - Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	- Infrastructure construction site - Generator, vehicle and machinery storage - Temporary shelter of staff-workers - First aid room	- Monitoring of solid-liquid waste management at temporary shelter - Monitoring of the clean water supply and sanitation - Monitoring of the safety equipment and work safety - Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

The environmental monitoring consists of two key activities have been applied in this monitoring stage, air and noise measurement; and water sampling and site monitoring in project area, the total will be controlled and managed by a time-based work plan.

- Air, noise and water quality sampling:

Air and noise sampling will conduct by MoE once every six months. The water quality sampling conducts once every six months according to EMP of IESIA report. All sampling water will be analyzed by MoE lab in Phnom Penh.

- Road:

Monitoring of the transportation (speed and load), parking and the damage road by the project. Monitoring locations such as Road.271, Hun Sen Blvd.(60m) and Hun Neang Blvd. and Access Road for the Channel Maintenance Road.

- Public Health and Safety:

Monitoring of Solid Liquid Waste management at temporary shelter, the clean water supply & sanitation and the safety equipment and work safety.

- Site monitoring:

Use environmental monitoring checklist, visual and interview with project workers and people are living near the project area, and visual checking during the field observation on environmental mitigation measure that implemented or rectified by contractor. Visual methodology also has been applied for other environmental monitoring items; however, degree of impact has been recorded and photographs to proof the impacts (good or bad) are used.

2.1 Surface Water Sampling Process

For taken water samples, some important procedure had been applied in the following:

- Tools and equipment: water sampler, sample bottles, cool box, etc.
- Stamping the code number and sampling date on the sample bottle.
- Sampling taken was following the WHO technique for water sampling.

The samples would keep in the cool box quickly after taking, and at the same day were sent to MoE Lab in Phnom Penh for analyzing the parameters as required by the Water Quality Survey.

Figure 2: Water quality sampling tools and equipment

2.2 Air Sampling Process

Air quality sampling was conducted on-site in the proposed project. The sampling equipment were installed at a height of 1.2 to 1.5 meters above the ground, and air quality parameters were carried out within 1 hour, 8 hours, 24 hours according to each parameter method. Air quality parameters were analyzed in the laboratory of the MOE.

Figure 3: Air quality sampling tools and equipment

2.3 Noise and Vibration Sampling Process

The noise and vibration were monitored from the material transportation, the operation of any machinery, generator and vehicle.


Figure 4: Noise and Vibration sampling tools and equipment

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Feb-22	May-22	Nov-22	Remark
1	Topography	Onec every 6 months							✔		✔	✔	Refer to monthly progress report submitted (Back data)
2	Hydrology	Onec every 6 months							✔		✔	✔	Ditto
3	Surface water quality	Onec every 6 months	Original data						✔		✔	✔	Ditto
4	Soil quality	Onec every 6 months							✔		✔	✔	Ditto
5	Air quality	Onec every 6 months	Original data						✔		✔	✔	Ditto
6	Noise and Vibration	Onec every 6 months	Original data						✔		✔	✔	Ditto
7	Ecosystem (Fish)	Onec every 6 months							✔		✔	✔	Ditto
8	Ecosystem (Birds)	Onec every 6 months							✔		✔	✔	Ditto
9	Livelihood, occupations of the local community and gender	Onec every 6 months							✔		✔	✔	Ditto
10	Road	Onec every 3 months			✔				✔	✔	✔	✔	Ditto
11	Public Health and Safety	Onec every 3 months			✔				✔	✔	✔	✔	Ditto
12	Site Safety Patrol form	Every month		✔	✔	✔	✔	✔	✔	✔	✔	✔	Ditto
13	Others	If neessary											

3.2 Water Quality

After analysis, the water quality readings were compared with the Cambodia standards following to the Proclamation No. 116 B.K.MOE on the Introduction of Working Conditions for the Establishment of Factory and Handy-Craft Project as shown in Table 3. The air quality readings were compared with the Cambodia standards following to the Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project as shown in the Table 4.

Table 1: Cambodia water quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Method	May-21	November-22				
						No.1	No.2	No.3	No.4	Ave
1	pH	-	5.5-9.0	Method pH Meter	7.275	6.79	6.89	6.93	6.88	6.87
2	Temperature	Degree C	<40	Method Thermometer	25	58.6	24.99	25.00	25.00	33.40
3	Turbidity	NTU	NV	Method Digital Turbid meter	58.5	76.00	48.00	120.00	74.00	79.50
4	Dissolved Oxygen (DO)	mg/L	2.0-7.5	Method DO Meter	0.25	0.00	1.80	2.84	2.83	1.86
5	Total Dissolved Solid (TDS)	mg/L	<2000	Method 2540 C	202.5	288.00	255.00	227.00	284.00	263.5
6	Total Suspended Solid (TSS)	mg/L	<100	Method 2540 D	129.5	93.00	103.00	233	63.00	123
7	Biochemical Oxygen Demand (BOD)5	mg/L	<60	Method 5210 B	70.26	97.82	54.93	48.60	97.85	74.8
8	Chemical Oxygen Demand (COD)Cr	mg/L	<120	Method 5220.B	129.75	203	102	93	196	148.5
9	Sulphate (SO4)	mg/L	<500	Method 4500-SO42- B	63	30	37	28	40	33.75
10	Total Nitrogen (TN)	mg/L	<40	Method JIS K 0102 45	22.75	21	28	18	29	24
11	Total Phosphorus (TP)	mg/L	<6.0	Method JIS K 0102 46	1.645	3.61	2.64	2.81	3.32	3.14
12	Lead (Pb)	mg/L	<0.3	Method 3500-Pb C	0.5	0.002	ND	ND	0.001	0.00075
13	Total Coli form	MPN/100ml	<1000	Method NF T90-413	1.425×10^{6}	1.1×10^{7}	4.6×10^{5}	1.1×10^{7}	4.6×10^{6}	2.85×10^{6}

Source: Standard from Annex2 of Effluent for discharging Liquid waste on the Sub Decree No.103 SDC.PK On the Amendment Article 4, Article 9, Article 11, Article 12, Article 17 and table of Annex 2, Annex 3, Annex 4 and Annex 5 of Sub-decree 27 SDC.PK dated on 6th April, 1999 on Water Pollution Control that issued on June 29, 2021 of Royal government of Cambodia.

3.3 Air Quality

Based on the field observation on 03rd -04th November 2022, the construction works which comprise of various activities could cause air pollution through exhausted gas from transportation vehicles, and other machineries. Dust emission also causes air pollution by the transportation of construction materials, excavated soil, and backfill sand. However, these activities will only cause air pollution in a short period.

The air quality and noise level were monitored in the project area on on 03rd -04th November 2022 in order to follow up the impact from the project activities. According to the result below the air qualities are below the standard so no air pollution from the construction activities (see in Table 2 below).

Table 2: Cambodia air quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Duration	May-21	November-22				
						No.1	No.2	No.3	No.4	Ave
1	Carbon Monoxide (CO)	mg/m3	<20	8 hours	1.08	3.333	2.446	2.233	3.678	2.922
2	Nitrogen Dioxide (NO2)	mg/m3	<0.10	24 hours	0.016	0.032	0.025	0.038	0.030	0.023
3	Sulfur Dioxide (SO2)	mg/m3	<0.30	24 hours	0.021	0.114	0.017	0.023	0.232	0.096
4	Ozone (O3)	mg/m3	<0.2	1 hour	0.0008	0.026	0.029	0.023	0.147	0.056
5	Hydrogen Sulfide (H2S)	ppm	NV	NV	ND	ND	ND	ND	ND	ND
6	Total Suspended Particles (TSP)	mg/m3	<0.33	24 hours	0.092	0.126	0.060	0.047	0.227	0.115
7	PM10	mg/m³	<0.05	-	0.029	0.028	0.024	0.020	0.026	0.0245
8	PM2.5	mg/m³	<0.025	-	0.021	0.020	0.022	0.019	0.024	0.021

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

3.4 Noise and Vibration

Noise and vibration happened from the construction machinery such as excavation of drainage' line, road cutting machine, driving sheet pile and transporting of top soil from the project site to disposal site. In date of observation only few construction machineries (excavator and dump trucks) are working on the platform in different place were close to residential area.

Table 3 show that the average noise level in daytime (63.85 dB(A)) is lower than maximum permitted noise level in commercial and service areas and mix. The transportation of soil by trucks from construction site to disposal site are between 5 to 10 trips per day so comparing the normal traffic situation, the transportation activities is much lower. In conclusion, the higher noise level is not mainly from the construction activities but from the traffic in the area itself.

Table 3: Noise standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	May-21	November-22						
						No.1	No.2	No.3	No.4	No.5	No.6	Ave
1	LAeq	dB	-	3 hours	59.06	58.60	69.2	60.1	59.4	66.6	69.2	**63.85**
2	LAF Max	dB	-	3 hours	84.86	97.9	92.75	85.8	81.8	86.7	92.7	**89.60**
3	LAF 5	dB	<85dB	3 hours	59.98	57.80	73.80	64.50	63.00	70.10	73.80	**61.16**

Table 4: Vibration standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	May-21	May-22						
						No.1	No.2	No.3	No.4	No.5	No6	Ave
1	LVA eg	dB	-	3 hours	43.88	38.50	79.90	88.70	83.30	36.80	48.70	**62.65**
2	LVA max	dB	-	3 hours	68.85	57.80	114.00	120..40	112.20	49.10	64.00	**86.25**
3	LVA 10	dB	<75dB	3 hours	45.58	39.9	28.20	37.50	39.90	38.7	51.60	**39.30**

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

4. Conclusion

The project area is a part of the city where urbanization and economics are significantly growing, as well as its population. With these growing factors, more and more wastewater is discharged from the city center including households, industries restaurants, hotels, etc., and there is some part has been connecting to the sewer systems but some has not, resulting in severe environmental problems such water and air pollution.

The result on environment monitoring in three months from May to November 2022 as following:

4.1 Topography

The topography and erosion in the construction site was satisfactory. There is erosion along of the slope of road cause by rain was observed. However, repair work was conducted to maintenance road and slope condition.

4.2 Hydrology

The flow of pump waste water at Trabeck Pumping Station and the downstream drainage to Hun Neang Road remains unobstructed. The condition of box culvert crossing Hun Neang road was observed and water flow normally.

4.3 Surface of Water quality

The water quality result from the analysis obtained from the laboratory of the MOE, Total suspension solid (TSS) parameters was shown to be out of range limited from the Cambodia standard. It was observed that this area was at south side of the STP which contaminated by nearby filling work. Although the pollution level is not very harmful, but the water should be avoided for any consuming purpose.

4.4 Soil quality

The liquid waste generated from the project sites and worker camps were managed properly by providing adequate toilets in all construction sites. All the machinery was checked to prevent the spill leaking of fuel on the soil.

4.5 Air quality

The air quality in the project area, As the result of air quality obtained from the laboratory of the MOE, all parameters including CO, NO2, SO2, O3, and TSP were found to be lower than the Cambodia standard which can be concluded that in the project area has a safe air quality which not harm to the environment and human health. Although the air quality is not harmful, measures should be set to prevent and minimized the impact from the proposed project.

4.6 Noise and vibration

The average noise level in the project area were lower than the Cambodia standard which suggested that the project activities don't cause any harmful the noise and vibration of the surrounding project sites.

4.7 Safety

Workers equipped with PPE (Personal Protection Equipment) during working hour in the construction site. The safety tools as iron fence, traffic signs, firefighting, helmets, boots, glasses and gloves have been provided to workers and installed in the construction site to ensure the safety of the workers and workplaces. The safety signs installed ahead of the construction sites to inform road users and to avoid traffic accident. In every morning, workers do morning exercise and toolbox meeting before starting work. The morning exercise and toolbox meeting checked the condition of workers' health to avoid accident

5. Recommendation

Base on the field observation and results of environmental quality (water and air quality) from the laboratory analysis, some recommendation should be considered as following:

- Regularly check and monitor the project activities to ensure that there is no discharge of polluted water into the environment without proper treatment methods.
- Follow to the Cambodia regulation on water, wastewater management, air pollution control and other national and international standard if there are any wastewater generation activities and causing air pollution emission in the project.
- Observe the pollution change in this area or no affect due to the construction works and cooperate closely with the local authorities and other environmental experts from both private and public parties to control the pollution.
- Wastewater Treatment Plants and any wastewater control facility must be undertaken to prevent and minimize the negative impacts on the environment and human health.
- Set up mitigation measures to prevent and minimized the negative impacts of air pollution on the environment and human health.
- Regularly monitor the project works to ensure that there is no air pollution emission into the environment.
- The contractor must spray water regularly during working at site the access road in order to prevent dust emission to the passengers, or resident living near the site.

Remark:

Name and Signature

KINGDOM OF CAMBODIA

Nation Religion King

PHNOM PENH CAPITAL CITY

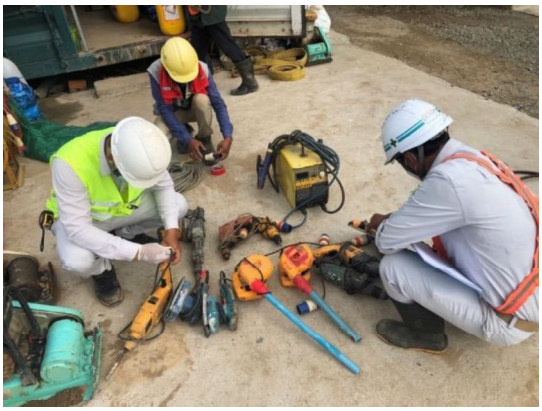
THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

IN PHNOM PENH

JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORING REPORT No. 6

February 2023




Contents

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1. Introduction

The rising of city development has generated variety of major environmental problems. Therefore, water and air pollution has become an issue and harm to environment and people health with no adequate measures. In the project area, Boeung Choeung Ek lake is one of the biggest storages in the city which collected a part of the sewage and rainwater from the center city and discharge directly into this lake without proper treatment.

Environmental quality survey requires the determination of concentration of various parameters for both water and air quality in according to the regulation of Cambodia.

1.1 Project Location

The environmental monitoring was conducted in the project area and which is located in Sangkat Chak Angre Leu, Khan Mean Chey, Phnom Penh as shown in the Figure 1.

Figure 1: Monitoring Locations

1.2 Objective

The purpose of the environment monitoring is to check and confirm if there are the influence and changes of the surrounding condition and circumstances due to implementation of the construction works during construction period by monitoring working safety, traffic and accident, solid waste management, quality of air, noise and water, economic disturbance, and ecosystem.

The environmental monitoring is to follow up the Contractor's implementation on environmental mitigation measure and recommendation of monthly progress of work. Guidance and instruction will be prepared to guide the contractor to follow the environmental mitigation measure as stated in the approved IESIA report.

1.3 Scope of work

In order to assess the environmental quality in the proposed project area, three environmental parameters were conducted including water quality, air quality, noise and vibration. Water quality survey will be conducted by sampling the surface water from Boeung Choeung Ek lake in four different locations from the upstream to the downstream of the project area with 13 parameters are analyzed. Air quality survey will be conducted in two different locations of the project area with 6 parameters are analyzed. Noise and Vibration monitoring will have conducted in 6 different locations around the project area. The water quality, air quality, noise and vibration were sampled at field site.

1.4 Environmental Monitoring Items

The major tasks for the environmental monitoring in construction stage include:

- Field monitoring on Contractor's environmental mitigation measure performance in the project area
- Guidance to Contractor's environmental engineers on environmental monitoring aspect, in the field practice
- Recommend to Contractor to implement all EMP as stated in IESIA report and other environmental safeguards in construction contract documents
- Instruct Contractor to take an action to mitigate or rectify on other issues that find out in the construction stage.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
1. Project Before Construction Phase					
1.1 Socio-economy resource					
Resettlement	− Along the Access Road (Channel Maintenance Road) and sewerage treatment plant − Prek Takong 1 village	− The monitoring of compensation of resettlement and grievance redress	Once every 6 months	1. IRC-WG, IRC 2. DPWT 3. Local authorities	1. MoE 2. MEF 3. DoE 4. DLMUPC
2. Project Construction Phase					
2.1 Physical resource					
Soil erosion and slope failure	− Sand provider	− Confirmation of license issued by Ministry of Mines and Energy and Ministry of Water Resources and Meteorology	Before construction	1. DPWT 2. Contractor	1. Ministry of Mines and Energy 2. Ministry of Water Resources and Meteorology
Topography	− Building construction site − Access Road (Channel Maintenance Road) − Protection dike construction site − Spoiled soil dumping site	− The monitoring of the topography and the erosion at the infrastructure construction site − The monitoring of erosion at the road, protection dike's embankment and spoiled soil dumping site	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
Hydrology	− Canal from Trabek pumping station − Wastewater way, downstream of the drainage to Hun Neang road	− Monitoring of the obstruction of the flow of pumped wastewater	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Surface water quality	3 Sample locations near the project area − Location 1: X=0491822, Y=1274363 − Location 2: X=0491299, Y=1272570 − Location 3: X=0493103, Y=1268628 − Solid-liquid waste storage	− Monitoring of the water quality on the parameters: temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb and Total Coliform − Monitoring of solid-liquid waste management	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Soil quality	− Infrastructure construction site, generator and machinery storage − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the spill, leak of fuel on the soil.	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Air Quality	- Infrastructure construction site - Access Road (Channel Maintenance Road) - Temporary shelter of staff-workers - 2 location of air quality testing: location 1 X=0491356, Y=1272730, location 2 X=0491031, Y=1272740	- Monitoring of the material transportation on Rd. 271 - Monitoring of the odor condition at construction sites - Monitoring of air quality parameters: TSP; CO; NO_2; SO_2, O_3, PM10, PM2.5 and H_2S	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
Noise and vibration	- Infrastructure construction site - Road construction site from Rd. 271 to construction site - Temporary shelter of staff-workers - Noise and vibration testing locations are the same as air quality testing locations	- Monitoring of the noise and vibration from the material transportation, the operation of any machinery, generator and vehicle. - Monitoring of noise and vibration (Unit: dB)	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
2.2 Biological resources					
Ecosystem (Fish)	- Cheung Aek Lake near project area - Temporary shelter of staff-workers	- Monitoring of solid-liquid waste management - Monitoring of the water quality on the parameters temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb Total Coliform	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority
Ecosystem (Birds)	- Temporary shelter of staff-workers	- Monitoring of the crime on wildlife especially the aquatic birds	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
2.3 Socio-economic resources					
Resettlement	- Resident of AHs, lose their income in Prek Takong 1 village. - Area of 19.0736 ha for construction and expansion of the STP	- Monitoring of the livelihood of AHs (7HHs), lose their income. - Monitoring to ensure that no encroachment to the STP area.	Once every 6 months	1. DPWT 2. Local authority	1. MoE 2. MEF 3. DoE 4. DLMUPC 5. DOWRAM
Livelihood, occupations of the local community and gender	- Prek Takong 1 village - Temporary shelter of staff-workers	- Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability - Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	- Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. - Access Road (Channel Maintenance Road)	- Monitoring of the transportation (speed and load) - Monitoring of the parking - Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	- Infrastructure construction site - Generator, vehicle and machinery storage - Temporary shelter of staff-workers - First aid room	- Monitoring of solid-liquid waste management at temporary shelter - Monitoring of the clean water supply and sanitation - Monitoring of the safety equipment and work safety - Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

The environmental monitoring consists of two key activities have been applied in this monitoring stage site monitoring in project area, the total will be controlled and managed by a time-based work plan.

- Road:

Monitoring of the transportation (speed and load), parking and the damage road by the project. Monitoring locations such as Road.271, Hun Sen Blvd.(60m) and Hun Neang Blvd. and Access Road for the Channel Maintenance Road.

- Public Health and Safety:

Monitoring of Solid Liquid Waste management at temporary shelter, the clean water supply & sanitation and the safety equipment and work safety.

- Site monitoring:

Use environmental monitoring checklist, visual and interview with project workers and people are living near the project area, and visual checking during the field observation on environmental mitigation measure that implemented or rectified by contractor. Visual methodology also has been applied for other environmental monitoring items; however, degree of impact has been recorded and photographs to proof the impacts (good or bad) are used.

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May-21	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Remark
1	Topography	Onec every 6 months							✔				Refer to monthly progress report submitted (Back data)
2	Hydrology	Onec every 6 months							✔				Ditto
3	Surface water quality	Onec every 6 months	Original data						✔				Ditto
4	Soil quality	Onec every 6 months							✔				Ditto
5	Air quality	Onec every 6 months	Original data						✔				Ditto
6	Noise and Vibration	Onec every 6 months	Original data						✔				Ditto
7	Ecosystem (Fish)	Onec every 6 months							✔				Ditto
8	Ecosystem (Birds)	Onec every 6 months							✔				Ditto
9	Livelihood, occupations of the local community and gender	Onec every 6 months							✔				Ditto
10	Road	Onec every 3 months				✔			✔			✔	Ditto
11	Public Health and Safety	Onec every 3 months				✔			✔			✔	Ditto
12	Site Safety Patrol form	Every month	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	Ditto
13	Others	If neessary											

3.2 Road Monitoring

Monitoring item:		Monitoring indicator : Hiromasa Arai
Road		The transportation (speed and load) The parking The repair of damaged road by the project
Term	Date	Results
1	10-Feb-23	The transportation (speed and load) Location :Sewerage Treatment Plant Detail : Entrance of Sewerage Treatment Plant ※Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Location :Sewerage Treatment Plant Detail : Entrance of Sewerage Treatment Plant ※Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Location :Sewerage Treatment Plant Detail : Check the Hun Neang Road ※No damage to roads observed. (Satisfactory) / Unsatisfactory

2	10-Feb-23	The transportation (speed and load) Location :Channel Maintenance Road Detail : Entrance of Cannel Maintenance Road ※Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Location :Channel Maintenance Road Detail : Entrance of Cannel Maintenance Road ※Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Location :Channel Maintenance Road Detail : Cheak the Hun Neang Road ※ It was observed that road dusty and damaged by land owner. Satisfactory / (Unsatisfactory)

Before	After
	
Road	Road
Hun Neang Road	Hun Neang Road
1-Jun-21	10-Feb-23

Before

Road
Hun Neang Road
1-Jun-21

After

Road
Hun Neang Road
10-Feb-23

※ Damage and dirt to the road is observed.

Illegal parking near the site is not observed.

Part of road damaged condition and photo

Road damage was observed at the entrance to the landowner's backfill area on the side of the site.

Detail photo

Point of road damage will be discussed and repaired by landowner and road manager. The damaged road was temporary repaired (Backfilled with sand and install steel plates to prevent settlement)

3.3 Public Health and Safety

Report of Health Safety and Environment (HSE) for Month

Implementation date :10/February/2023 Location :STP,CMR,IF

The following forms shall be applied for monitoring to ensure that HSEM Plan is fully followed and implemented during the execution of the work.

No.	Item	Monitoring Cycle	Remark
1	Topography	Onec every 6 months	—
2	Hydrology	Onec every 6 months	—
3	Surface water quality	Onec every 6 months	—
4	Soil quality	Onec every 6 months	—
5	Air quality	Onec every 6 months	—

6	Noise and Vibration	Onec every 6 months	—
7	Ecosystem (Fish)	Onec every 6 months	—
8	Ecosystem (Birds)	Onec every 6 months	—
9	Livelihood, occupations of the local community and gender	Onec every 6 months	—
10	Road	Onec every 3 months	✔
11	Public Health and Safety	Onec every 3 months	✔
12	Site Safety Patrol form	Every month	✔
13	Others	If neessary	—

Monitoring item:		Monitoring indicator : Hiromasa Arai
Public Health and Safety		Solid-liquid waste management at temporary shelter The clean water supply and sanitation The safety equipment and work safety The first aid room
Term	Date	Results
1	10-Feb-23	Solid-liquid waste management at temporary shelter Location :Sewerage Treatment Plant and Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-10 Other) ※Periodically collected Solid-liquid waste from septic tank. (Satisfactory) / Unsatisfactory
		The clean water supply and sanitation Location :Sewerage Treatment Plant and Interception Facility Detail : No.12, Result of site safety patrol (Items: 2-6 Water Supply) ※Disinfecting and cleaning toilets (Satisfactory) / Unsatisfactory
		The safety equipment and work safety Location :Sewerage Treatment Plant,Interception Facility,Channel Maintenance Road Detail : No.12, Result of sate safety patrol (Items: 6,7 Safety and Protective equipment) ※Machinery and tool inspection is done every monthly (Satisfactory) / Unsatisfactory
		The first aid room Location :Kubota and Norak office Detail : No.12, Result of site safety patrol (Items: 6-5 Other) ※Checking stock of First aid Kid and COVID test (Satisfactory) / Unsatisfactory

2	10-Feb-23	Solid-liquid waste management at temporary shelter Location : Detail : No.12, Result of site safety patrol (Items:) Satisfactory / Unsatisfactory	
		The clean water supply and sanitation Location : Detail : No.12, Result of site safety patrol (Items:) Satisfactory / Unsatisfactory	
		The safety equipment and work safety Location : Detail : No.12, Result of site safety patrol (Items:) Satisfactory / Unsatisfactory	
		The first aid room Location : Detail : No.12, Result of site safety patrol (Items:) Satisfactory / Unsatisfactory	

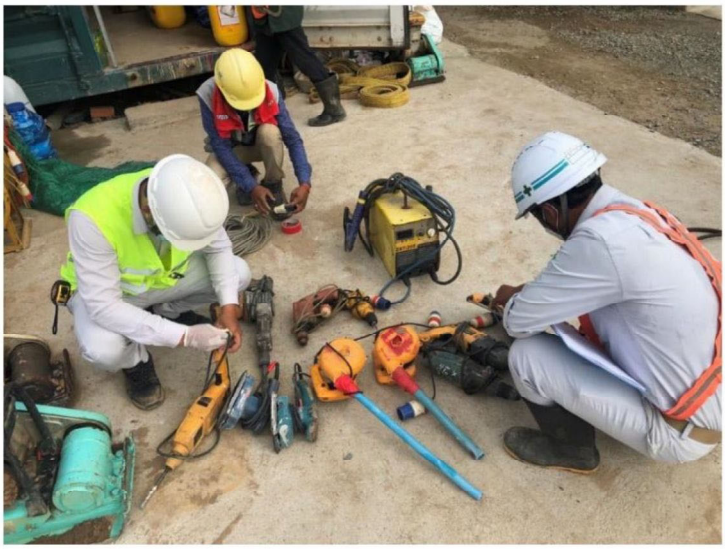
Public Health and Safety

The trash bins were installed and separated properly on the construction site.

Public Health and Safety

Alcohol is used for hand washing in the drinking water area to prevent the spread of COVID-19.

Sewerage Treatment Plant



Public Health and Safety

Public Health and Safety

Inspection tool and heavy machinery

Sewerage Treatment Plant

Public Health and Safety

ELB tested to confirm the appropriate rating and to see if it was in good working order.

Sewerage Treatment Plant

Public Health and Safety

Traffic control man assigned both sides when heavy vehicle grossing On the public road.

Public Health and Safety

First aid kid

COVID-TEST

Kubota office

and Norak office.

3.4 Site Safety Patrol Form

Location :Channel Maintenance road Sewarage Treatment Plant	Inspector : Vann Sari
Date :10-February-2023	Time :09:00 AM
Work Description	

No.	Item	Eval	No.	Item	Eval
1	**Site Security/Safety**		**4**	**Earthwork**	
1-1	Perimeter fencing	○	4-1	Earthwork arrangement/planning	○
1-2	Signage	○	4-2	Shoring	○
1-3	Lighting	○	4-3	Site security/signage	○
1-4	Other	○	4-4	Other	○
2	**Site cleaning/hygiene**		**5**	**Scaffold**	○
2-1	Site	○	5-1	Condition of scaffolds	○
2-2	Office	○	5-2	Condition of foundation	○
2-3	Road	○	5-3	Condition of supports	○
2-4	Latrines	○	5-4	Site security/signage	○
2-5	First aid room	○	5-5	Other	△
2-6	Water supply	○	**6**	**Safety equipment**	
2-7	Other	△	6-1	Equipment condition	○
3	**Environment**		6-2	Wire condition	○
3-1	Erosion protection	△	6-3	Hoist work procedure	○
3-2	Dust protection	○	6-4	Site security/signage	○
3-3	Dust bins/waste collection	○	6-5	Other	○
3-4	Operation of machinery	○	7	**Protective Equipment**	
3-5	Crime on wildlife	／	7-1	Helmet	○
3-6	Oil leakage	○	7-2	Work wear	○
3-7	Obstruction of water flow	○	7-3	Protective footwear	○
3-8	Separation of garbage	○	7-4	Work gloves	○
3-9	Odor condition	○	7-5	Protective eyewear	○
3-10	Other	○	7-6	Mask	○
			7-7	Safety harness	○
			7-8	Other	△

Evaluation	Good	○	Improve	△	Unsafe	×	N/A	／

Comment :

Finishing materials should be removed, and the area in front of the main pump building access should be kept clear.

An equivalent length of access ladder should be prepared for workers to go inside the sludge thickener tank.

Kubota

The Project for Sewerage System Development in Phnom Penh

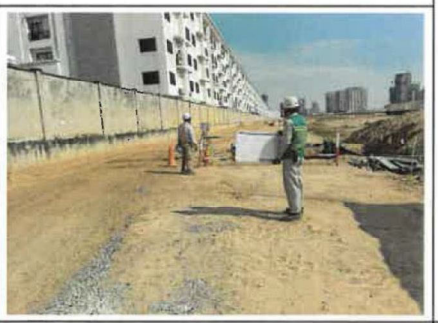
METAWATER

Number: 21

HSE Monthly Safety Patrol Record

Date: 10/February/2023 **Location: STP, CMR & Intake facility**

No	Photo of Before	Photo of After (Improvement)	Action
1			Mr. Sameth
	Finishing materials should be removed, and the area in front of the main pump building access should be kept clear. [MPB]		Date Close 10-Feb-2023
2			Mr. Sameth
	An equivalent length of access ladder should be prepared for workers to go inside the sludge thickener tank. [MPB]		Date Close 10-Feb-2023

	Activity of site safety patrol	Record by
	 	Mr. Vann Sari
	Check site safety health and environmental condition at STP, CMR & Intake facility.	Date 10-Feb-2023

For Suggestion:
Please continue to use a safety belt when working at height.
Please continue to wear safety goggles, rubber gloves, and a mask for anticorrosive painting work.
And scaffolding opening should be closed properly before use.

Action by:	Checked by:	Checked by:	Confirmed by:	Confirmed by:
Site Engineer Norak	HSE Engineer Norak	Site Engineer Kubota	HSE Chief Engineer Kubota	Chief Engineer Kubota

4. Conclusion

This time, the monitoring was to examine the nearby roadways as well as the site's health and safety. Every morning before the morning meeting for hygiene management on the site, body temperature is checked and disinfected, and toilets are disinfected and cleaned daily. Furthermore, to prevent the spread of COVID 19, the first aid room is equipped with a first aid kit and a COVID test..

Remark:

Name and Signature

KINGDOM OF CAMBODIA

Nation Religion King

PHNOM PENH CAPITAL CITY

THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

IN PHNOM PENH

JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORING REPORT No. 7

May 2023

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List of Table

1. Introduction

The rising of city development has generated variety of major environmental problems. Therefore, water and air pollution has become an issue and harm to environment and people health with no adequate measures. In the project area, Boeung Choeung Ek lake is one of the biggest storages in the city which collected a part of the sewage and rainwater from the center city and discharge directly into this lake without proper treatment.

Environmental quality survey requires the determination of concentration of various parameters for both water and air quality in according to the regulation of Cambodia.

1.1 Project Location

The environmental monitoring was conducted in the project area and which is located in Sangkat Chak Angre Leu, Khan Mean Chey, Phnom Penh as shown in the Figure 1.

Figure 1: Monitoring Locations

1.2 Objective

The purpose of the environment monitoring is to check and confirm if there are the influence and changes of the surrounding condition and circumstances due to implementation of the construction works during construction period by monitoring working safety, traffic and accident, solid waste management, quality of air, noise and water, economic disturbance, and ecosystem.

The environmental monitoring is to follow up the Contractor's implementation on environmental mitigation measure and recommendation of monthly progress of work. Guidance and instruction will be prepared to guide the contractor to follow the environmental mitigation measure as stated in the approved IESIA report.

1.3 Scope of work

In order to assess the environmental quality in the proposed project area, three environmental parameters were conducted including water quality, air quality, noise and vibration. Water quality survey will be conducted by sampling the surface water from Boeung Choeung Ek lake in four different locations from the upstream to the downstream of the project area with 13 parameters are analyzed. Air quality survey will be conducted in two different locations of the project area with 6 parameters are analyzed. Noise and Vibration monitoring will have conducted in 6 different locations around the project area. The water quality, air quality, noise and vibration were sampled at field site.

1.4 Environmental Monitoring Items

The major tasks for the environmental monitoring in construction stage include:

- Field monitoring on Contractor's environmental mitigation measure performance in the project area
- Guidance to Contractor's environmental engineers on environmental monitoring aspect, in the field practice
- Recommend to Contractor to implement all EMP as stated in IESIA report and other environmental safeguards in construction contract documents
- Instruct Contractor to take an action to mitigate or rectify on other issues that find out in the construction stage.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
1. Project Before Construction Phase					
1.1 Socio-economy resource					
Resettlement	− Along the Access Road (Channel Maintenance Road) and sewerage treatment plant − Prek Takong 1 village	− The monitoring of compensation of resettlement and grievance redress	Once every 6 months	1. IRC-WG, IRC 2. DPWT 3. Local authorities	1. MoE 2. MEF 3. DoE 4. DLMUPC
2. Project Construction Phase					
2.1 Physical resource					
Soil erosion and slope failure	− Sand provider	− Confirmation of license issued by Ministry of Mines and Energy and Ministry of Water Resources and Meteorology	Before construction	1. DPWT 2. Contractor	1. Ministry of Mines and Energy 2. Ministry of Water Resources and Meteorology
Topography	− Building construction site − Access Road (Channel Maintenance Road) − Protection dike construction site − Spoiled soil dumping site	− The monitoring of the topography and the erosion at the infrastructure construction site − The monitoring of erosion at the road, protection dike's embankment and spoiled soil dumping site	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
Hydrology	− Canal from Trabek pumping station − Wastewater way, downstream of the drainage to Hun Neang road	− Monitoring of the obstruction of the flow of pumped wastewater	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Surface water quality	3 Sample locations near the project area − Location 1: X=0491822, Y=1274363 − Location 2: X=0491299, Y=1272570 − Location 3: X=0493103, Y=1268628 − Solid-liquid waste storage	− Monitoring of the water quality on the parameters: temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb and Total Coliform − Monitoring of solid-liquid waste management	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Soil quality	− Infrastructure construction site, generator and machinery storage − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the spill, leak of fuel on the soil.	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Air Quality	- Infrastructure construction site - Access Road (Channel Maintenance Road) - Temporary shelter of staff-workers - 2 location of air quality testing: location 1 X=0491356, Y=1272730, location 2 X=0491031, Y=1272740	- Monitoring of the material transportation on Rd. 271 - Monitoring of the odor condition at construction sites - Monitoring of air quality parameters: TSP; CO; NO_2; SO_2, O_3, PM10, PM2.5 and H_2S	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
Noise and vibration	- Infrastructure construction site - Road construction site from Rd. 271 to construction site - Temporary shelter of staff-workers - Noise and vibration testing locations are the same as air quality testing locations	- Monitoring of the noise and vibration from the material transportation, the operation of any machinery, generator and vehicle. - Monitoring of noise and vibration (Unit: dB)	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
2.2 Biological resources					
Ecosystem (Fish)	- Cheung Aek Lake near project area - Temporary shelter of staff-workers	- Monitoring of solid-liquid waste management - Monitoring of the water quality on the parameters temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb Total Coliform	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority
Ecosystem (Birds)	- Temporary shelter of staff-workers	- Monitoring of the crime on wildlife especially the aquatic birds	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
2.3 Socio-economic resources					
Resettlement	- Resident of AHs, lose their income in Prek Takong 1 village. - Area of 19.0736 ha for construction and expansion of the STP	- Monitoring of the livelihood of AHs (7HHs), lose their income. - Monitoring to ensure that no encroachment to the STP area.	Once every 6 months	1. DPWT 2. Local authority	1. MoE 2. MEF 3. DoE 4. DLMUPC 5. DOWRAM
Livelihood, occupations of the local community and gender	- Prek Takong 1 village - Temporary shelter of staff-workers	- Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability - Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	- Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. - Access Road (Channel Maintenance Road)	- Monitoring of the transportation (speed and load) - Monitoring of the parking - Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	- Infrastructure construction site - Generator, vehicle and machinery storage - Temporary shelter of staff-workers - First aid room	- Monitoring of solid-liquid waste management at temporary shelter - Monitoring of the clean water supply and sanitation - Monitoring of the safety equipment and work safety - Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

The environmental monitoring consists of two key activities have been applied in this monitoring stage, air and noise measurement; and water sampling and site monitoring in project area, the total will be controlled and managed by a time-based work plan.

- Air, noise and water quality sampling:

Air and noise sampling will conduct by MoE once every six months. The water quality sampling conducts once every six months according to EMP of IESIA report. All sampling water will be analyzed by MoE lab in Phnom Penh.

- Road:

Monitoring of the transportation (speed and load), parking and the damage road by the project. Monitoring locations such as Road.271, Hun Sen Blvd.(60m) and Hun Neang Blvd. and Access Road for the Channel Maintenance Road.

- Public Health and Safety:

Monitoring of Solid Liquid Waste management at temporary shelter, the clean water supply & sanitation and the safety equipment and work safety.

- Site monitoring:

Use environmental monitoring checklist, visual and interview with project workers and people are living near the project area, and visual checking during the field observation on environmental mitigation measure that implemented or rectified by contractor. Visual methodology also has been applied for other environmental monitoring items; however, degree of impact has been recorded and photographs to proof the impacts (good or bad) are used.

2.1 Surface Water Sampling Process

For taken water samples, some important procedure had been applied in the following:

- Tools and equipment: water sampler, sample bottles, cool box, etc.
- Stamping the code number and sampling date on the sample bottle.
- Sampling taken was following the WHO technique for water sampling.

The samples would keep in the cool box quickly after taking, and at the same day were sent to MoE Lab in Phnom Penh for analyzing the parameters as required by the Water Quality Survey.

Figure 2: Water quality sampling tools and equipment

2.2 Air Sampling Process

Air quality sampling was conducted on-site in the proposed project. The sampling equipment were installed at a height of 1.2 to 1.5 meters above the ground, and air quality parameters were carried out within 1 hour, 8 hours, 24 hours according to each parameter method. Air quality parameters were analyzed in the laboratory of the MOE.

Figure 3 Air quality sampling tools and equipment

2.3 Noise and Vibration Sampling Process

The noise and vibration were monitored from the material transportation, the operation of any machinery, generator and vehicle.

Figure 5: Noise and Vibration sampling tools and equipment

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Remark
1	Topography	Onec every 6 months							✔	Refer to monthly progress report submitted (Back data)
2	Hydrology	Onec every 6 months							✔	Ditto
3	Surface water quality	Onec every 6 months	Original data						✔	Ditto
4	Soil quality	Onec every 6 months							✔	Ditto
5	Air quality	Onec every 6 months	Original data						✔	Ditto
6	Noise and Vibration	Onec every 6 months	Original data						✔	Ditto
7	Ecosystem (Fish)	Onec every 6 months							✔	Ditto
8	Ecosystem (Birds)	Onec every 6 months							✔	Ditto
9	Livelihood, occupations of the local community and gender	Onec every 6 months							✔	Ditto
10	Road	Onec every 3 months				✔			✔	Ditto
11	Public Health and Safety	Onec every 3 months				✔			✔	Ditto
12	Site Safety Patrol form	Every month		✔	✔	✔	✔	✔	✔	Ditto
13	Others	If neessary								

3.2 Monitoring of Topography

The project for Sewer System Development in Phnom Penh — Environment Management

1. Monitoring form for Topography

Monitoring item:		Monitoring indicator : Hiromasa Arai
Topography		The topography and the erosion at the infrastructure construction site Erosion at the road, protection dike's embankment and spoiled soil dumping site
Term	Date	Results
1	12-May-2023	Location :Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-1 Erosion protection) * No erosion due to complete capping concrete for steel sheet pile. (Satisfactory) / Unsatisfactory
2	12-May-2023	Location :Channel Maintenance Road Detail : No.12, Result of site safety patrol (Items: 3-1 Erosion protection) * No erosion a long the access road. (Satisfactory) / Unsatisfactory
3	12-May-2023	Location :Sewerage Treatment Plant Detail : No.12, Result of site safety patrol (Items: 3-1 Erosion protection) * No erosion a long the coffer dam. The coffer dam is protected by grass sodding. (Satisfactory) / Unsatisfactory
Comment/Condition		

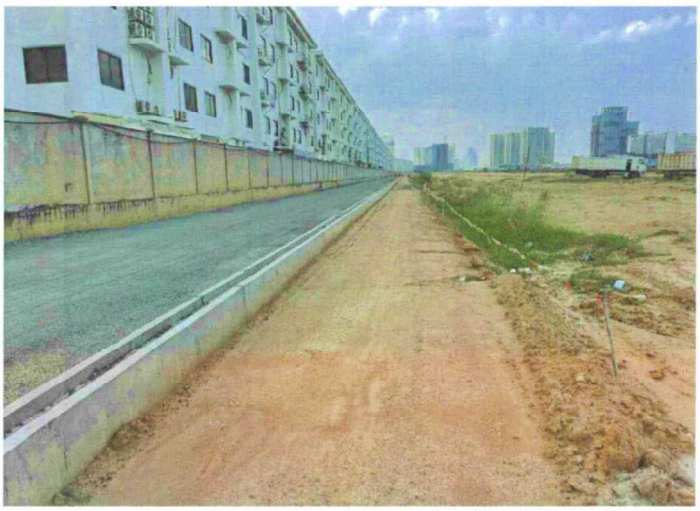
The Consultant — Resident Engineer

Date of Return
21th / June / 2023

Takayuki NOJIMA

Topography

Interception facility



Topography

Channel Maintenance Road

Topography

Sewerage Treatment Plant

3.3 Monitoring of Hydrology

The project for Sewer System Development in Phnom Penh — Environmental Management

2. Monitoring form for Hydrology

Monitoring item:		Monitoring indicator : Hiromasa Arai
Hydrology		Obstruction of the flow of pumped waste water
Term	Date	Results
1	12-May-2023	Location :Trabeck Pumping station Detail : No.12, Result of site safety patrol (Items: 3-7 Obstruction of water flow) *The watercourse from Trabeck pumping station was flow as normal (Satisfactory) / Unsatisfactory
2	12-May-2023	Location :Downstream of drainage to Hun Neang road Detail : No.12, Result of site safety patrol (Items: 3-7 Obstruction of water flow) *No obstruction was observed in the box culvert under Hun Neang Road. (Satisfactory) / Unsatisfactory
Comment/Condition		started. Bridge construction on New Hung Nean Rd.

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Date of Return
24th June / 2023

野島貴行
Takayuki NOJIMA

3.4 Water Quality

After analysis, the water quality readings were compared with the Cambodia standards following to the Proclamation No. 116 B.K.MOE on the Introduction of Working Conditions for the Establishment of Factory and Handy-Craft Project as shown in Table 3. The air quality readings were compared with the Cambodia standards following to the Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project as shown in the Table 4.

Table 1: Cambodia water quality standard and water quality in the project area (3 locations)

No.	Parameter	Unit	Standard	Method	May-21	May-2023			
						No.1	No.2	No.3	Ave
1	pH	-	5.5-9.0	Method pH Meter	7.275	7.02	6.83	6.98	**6.94**
2	Temperature	Degree C	<40	Method Thermometer	25	25.00	24.97	25.00	**24.99**
3	Turbidity	NTU	NV	Method Digital Turbid meter	58.5	14.00	13.00	17.00	**14.66**
4	Dissolved Oxygen (DO)	mg/L	2.0-7.5	Method DO Meter	0.25	2.80	4.40	2.30	**3.16**
5	Total Dissolved Solid (TDS)	mg/L	<2000	Method 2540 C	202.5	236.00	187.00	264.00	**229.00**
6	Total Suspended Solid (TSS)	mg/L	<100	Method 2540 D	129.5	13.00	16.00	31.00	**20.00**
7	Biochemical Oxygen Demand (BOD)5	mg/L	<60	Method 5210 B	70.26	34.18	27.36	27.95	**29.82**
8	Chemical Oxygen Demand (COD)Cr	mg/L	<120	Method 5220.B	129.75	74.00	54.00	64.00	**64.00**
9	Sulphate (SO4)	mg/L	<500	Method 4500-SO42- B	63	8.40	12.10	17.30	**12.60**
10	Total Nitrogen (TN)	mg/L	<40	Method JIS K 0102 45	22.75	12.20	10.30	17.30	**13.26**
11	Total Phosphorus (TP)	mg/L	<6.0	Method JIS K 0102 46	1.645	1.75	1.75	2.32	**1.94**
12	Lead (Pb)	mg/L	<0.3	Method 3500-Pb C	0.5	ND	0.02	0.04	**0.02**
13	Total Coli form	MPN/100ml	<1000	Method NF T90-413	1.425×10^{6}	1.1×10^{8}	2.3×10^{6}	4.3×10^{5}	**1.12×10^{8}**

Source: Standard from Annex2 of Effluent for discharging Liquid waste on the Sub Decree No.103 SDC.PK On the Amendment Article 4, Article 9, Article 11, Article 12, Article 17 and table of Annex 2, Annex 3, Annex 4 and Annex 5 of Sub-decree 27 SDC.PK dated on 6th April, 1999 on Water Pollution Control that issued on June 29, 2021 of Royal government

3. Monitoring form for Surface water quality

Monitoring item:		Monitoring indicator : Hiromasa Arai
Surface water quality		The water quality on the parameters: Temperature, pH, Turbidity, TDS, TSS, DO, BOD, COD, SO4, TN, TP, Pb and Total Coliform Solid-liquid waste management
Term	Date	Results
1	30-May-23	The water quality on the parameters Location : No.1 (Trabek pumping station) Detail : Attached file "3-1" *Test results are below Cambodian standards or below pre-construction (Satisfactory) / Unsatisfactory
2	30-May-23	The water quality on the parameters Location : No.2 and 4 (East and west side of STP in Cheung Aek Lake) Detail : Attached file "3-1" *Test results are below Cambodian standards or below pre-construction (Satisfactory) / Unsatisfactory
3	30-May-23	The water quality on the parameters Location :No.3 (South side of STP in Cheung Aek Lake) Detail : Attached file "3-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
Comment/Condition		Beside of STP : TDS 87, TSS 16, BOD 27.36

The Consultant Resident Engineer

Date of Return
21st June 2023

Takayuki NOJIMA

3.5 Monitoring of Soil Quality

The project for Sewer System Development in Phnom Penh — Environmental Management

4. Monitoring form for Soil quality

Monitoring item:		Monitoring indicator : Hiromasa Arai
Soil quality		Solid-liquid waste management Spill, leak of fuel on the soil
Term	**Date**	**Results**
1	12-May-2023	Solid-liquid waste management Location :Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-10 other) * No solid-liquid waste spill on the soil (Satisfactory) / Unsatisfactory
		Spill, leak of fuel on the soil Location :Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-6 Oil leakage) * No machine oil leaked on the soil (Satisfactory) / Unsatisfactory
2	12-May-2023	Spill, leak of fuel on the soil Location : Chhannel Maintenace Road Detail : No.12, Result of site safety patrol (Items: 3-6 Oil leakage) * No machine oil leaked on the soil (Satisfactory) / Unsatisfactory
3	12-May-2023	Solid-liquid waste management Location : Sewerage Treatment Plant(North side of STP) Detail : No.12, Result of site safety patrol (Items: 3-10 other) * No solid-liquid waste spill on the soil (Satisfactory) / Unsatisfactory
		Spill, leak of fuel on the soil Location : Sewerage Treatment Plant(West side of STP) Detail : No.12, Result of site safety patrol (Items: 3-6 Oil leakage) * No machine oil leaked on the soil (Satisfactory) / Unsatisfactory
Comment/Condition		

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Date of Return
21th /June / 2023

野島 高行
Takayuki NOJIMA

3.6 Air Quality

Based on the field observation on 30th -31st May 2023, the construction works which comprise of various activities could cause air pollution through exhausted gas from transportation vehicles, and other machineries. Dust emission also causes air pollution by the transportation of construction materials, excavated soil, and backfill sand. However, these activities will only cause air pollution in a short period.

The air quality and noise level were monitored in the project area on 30th -31st May 2023 in order to follow up the impact from the project activities. According to the result below the air qualities are below the standard so no air pollution from the construction activities (see in Table 2 below).

Table 2: Cambodia air quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Duration	May-21	May-2023				
						No.1	No.2	No.3	No.4	Ave
1	Carbon Monoxide (CO)	mg/m3	<20	8 hours	1.08	2.155	1.050	1.750	1.250	**1.551**
2	Nitrogen Dioxide (NO2)	mg/m3	<0.10	24 hours	0.016	0.021	0.028	0.020	0.016	**0.021**
3	Sulfur Dioxide (SO2)	mg/m3	<0.30	24 hours	0.021	0.167	0.105	0.128	0.134	**0.133**
4	Ozone (O3)	mg/m3	<0.2	1 hour	0.0008	0.063	0.069	0.086	0.083	**0.075**
5	Hydrogen Sulfide (H2S)	ppm	NV	NV	ND	ND	ND	ND	ND	**ND**
6	Total Suspended Particles (TSP)	mg/m3	<0.33	24 hours	0.092	0.092	0.053	0.025	0.031	**0.050**
7	PM10	mg/m³	<0.05	-	0.029	0.024	0.018	0.022	0.025	**0.022**
8	PM2.5	mg/m³	<0.025	-	0.021	0.022	0.017	0.019	0.021	**0.0197**

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

5. Monitoring form for Air quality

Monitoring item:		Monitoring indicator : Hiromasa Arai
Air quality		The material transportation on Rd. 271 The odor condition at construction sites Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S
Term	Date	Results
1	30-May-23	The odor condition at construction sites Location. 1 (Sewerage Treatment Plant) Detail : No.12, Result of site safety patrol (Items:3-9 Order condition) *Toilets are clean every day (Satisfactory) / Unsatisfactory
		Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S Location.1 (Sewerage Treatment Plant) Detail : Attached file "5-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
2	30-May-23	Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S Location.2 (West side of STP) Detail : Attached file "5-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
3	31-May-23	Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S Location.3: (Channel Maintenance Road) Detail : Attached file "5-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
4	31-May-23	The odor condition at construction sites Location.4: (Interception Facility) Detail : No.12, Result of site safety patrol (Items:3-9 Order condition) *Toilets are clean every day (Satisfactory) / Unsatisfactory
		Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S Location.4: (Interception Facility) Detail : Attached file "5-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
Comment/Condition		

The Consultant Resident Engineer

Date of Return
2th June / 2023

野島高行
Takayuki NOJIMA

Air quality

Location.1

(Sewerage Treatment Plant)

Air quality

Location.2

(West side of STP)

Air quality

Location.3

(Channel Maintenance Road)

3.7 Monitoring of Noise and Vibration

Noise and vibration happened from the construction machinery such as excavation of drainage' line, road cutting machine, driving sheet pile and transporting of top soil from the project site to disposal site. In date of observation only few construction machineries (excavator and dump trucks) are working on the platform in different place were close to residential area.

Table 3 show that the average noise level in daytime (78.10 dB(A)) is lower than maximum permitted noise level in commercial and service areas and mix. The transportation of concrete and base course materials by trucks so comparing the normal traffic situation, the transportation activities is much lower. In conclusion, the higher noise level is not mainly from the construction activities but from the traffic in the area itself.

Table 3: Noise standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	May-21	May-2023						
						No.1	No.2	No.3	No.4	No.5	No.6	Ave
1	LAeq	dB	-	3 hours	59.06	79.30	69.70	98.60	68.90	79.90	73.40	**78.3**
2	LAF Max	dB	-	3 hours	84.86	97.30	85.70	96.10	89.80	97.10	90.20	**90.2**
3	LAF 5	dB	<85dB	3 hours	59.98	82.80	74.10	74.00	72.50	82.40	78.10	**78.1**

Table 4: Vibration standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	May-21	May-2023						
						No.1	No.2	No.3	No.4	No.5	No6	Ave
1	LVA eg	dB	-	3 hours	43.88	83.20	33.40	76.30	36.90	42.10	78.70	**58.43**
2	LVA max	dB	-	3 hours	68.85	114.20	53.80	113.10	57.60	53.20	111.10	**83.83**
3	LVA 10	dB	<75dB	3 hours	45.58	51.70	35.30	34.50	40.00	44.20	48.40	**42.35**

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

6. Monitoring form for Noise and Vibration

Monitoring item:		Monitoring indicator : Hiromasa Arai
Noise and Vibration		The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Noise and vibration (Unit: dB)
Term	Date	Results
1	30-May-2023	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 1 : (Sewerage Treatment Plant) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Location. 1 :(Sewerage Treatment Plant) Detail : Attache file "6-1" *Test results are below Japanese standards. (Satisfactory) / Unsatisfactory
2	30-May-2023	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 2 : (West side of STP) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Location. 2 :(Village) Detail : Attache file "6-1 " *Test results are below Japanese standards (Satisfactory) / Unsatisfactory
3	31-May-2023	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 3 : (Channel Maintenance Road) Detail : No.12, Result of site safety patrol (Items: 3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Location. 3 : (Channel Maintenance Road) Detail : Attache file "6-1" *Test results are below Japanese standards (Satisfactory) / Unsatisfactory
Comment/Condition		

The Consultant

Date of Return
21th / June / 2023

Takayuki NOJIMA

6. Monitoring form for Noise and Vibration

Monitoring item:		Monitoring indicator : Hiromasa Arai
Noise and Vibration		The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Noise and vibration (Unit: dB)
Term	Date	Results
4	31-May-23	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 4 : (Interception Facility) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory)/ Unsatisfactory
		Noise and vibration (Unit: dB) Location. 4 : (Interception Facility) Detail : Attache file "6-1" *Test results are below Japanese standards (Satisfactory)/ Unsatisfactory
5	30-May-23	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 5: (Rd.271) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) * Noise and vibration are caused by the public traffic near village (Satisfactory)/ Unsatisfactory
		Noise and vibration (Unit: dB) Location. 5: (Rd.271) Detail : Attache file "6-1" *Test results are below Japanese standards (Satisfactory)/ Unsatisfactory
6	30-May-23	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 6 (Temporary of workshop) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory)/ Unsatisfactory
		Noise and vibration (Unit: dB) Location. 6 (Temporary of workshop) Detail : Attache file "6-1" *Test results are below Japanese standards. (Satisfactory)/ Unsatisfactory
Comment/Condition		Traffic increased.

The Consultant Resident Engineer

Date of Return
24th June 2023

野島貴行
Takayuki NOJIMA

Noise and Vibration

Location.1

(Sewerage Treatment Plant)

Noise and Vibration

Location.2

(West side of STP)

Noise and Vibration

Location.3

(Channel Maintenance Road)

3.8 Monitoring of Ecosystem

The project for Sewer System Development in Phnom Penh — Environmental Management

7. Monitoring form for Ecosystem (Fish)

Monitoring item:		Monitoring indicator : Hiromasa Arai
Ecosystem (Fish)		Solid-liquid waste management The water quality parameters: pH, Turbidity, TDS, TSS, DO, BOD, COD, SO4, TN, TP, Pb and Total Coliform
Term	Date	Results
1	30-May-23	Solid-liquid waste management Location : Location. 2 （East side of STP in Cheung Aek Lake) Detail : No.12, Result of site safety patrol(Items: 3-10 Other) *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
		The water quality on the parameters Location : Location. 2 （East side of STP in Cheung Aek Lake) Detail : Attached file "3-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
Comment/Condition		

The Consultant — Resident Engineer

Date of Return
21th June 2023

Takayuki NOJIMA

8. Monitoring form for Ecosystem (Birds)

Monitoring item:		Monitoring indicator : Hiromasa Arai
Ecosystem (Birds)		The crime on wildlife especially the aquatic bird
Term	Date	Results
1	12-May-2023	The crime on wildlife especially the aquatic bird Location :Sewerage Treatment Plant, Chhanel Maintenance Road and Interception facility Detail : No.12, Result of site safety patrol (Items:3-5 Crime on wildlife) *Have not confirmed crime on aquatic bird (Satisfactory) / Unsatisfactory
Comment/Condition		
The Consultant		Resident Engineer Date of Return 24th/June/2023 Takayuki NOJIMA

9. Monitoring form for Livelihood, occupations of the local community and gender

Monitoring item:		Monitoring indicator : Hiromasa Arai
Livelihood, occupations of the local community and gender		The staff-worker selection by prioritize the locals, gender equality as well as the disability Work safety
Term	Date	Results
1	12-May-23	The staff-worker selection by prioritize the locals, gender equality as well as the disability Location :Sewerage Treatment Plant,Channel Maintenance Road, and Interception Facility Detail : No.12, Result of site safety patrol (Items:3-10 Other) * Employment is done equal. (Satisfactory) / Unsatisfactory
		Work Safety Location :Sewerage Treatment Plant,Channel Maintenance Road, and Interception Facility Detail : No.12, Result of site safety patrol (Items: 7) * All the workers and staff had provided safety education And requirement personal protective equipment. (Satisfactory) / Unsatisfactory
Comment/Condition		
The Consultant		Resident Engineer Date of Return 24th/June/2023 Takayuki NOJIMA

3.9 Monitoring of Road

The project for Sewer System Development in Phnom Penh — Environment Management

10. Monitoring form for Road

Monitoring item:		Monitoring indicator : Hiromasa Arai
Road		The transportation (speed and load) The parking The repair of damaged road by the project
Term	Date	Results
1	12-May-23	The transportation (speed and load) Location :Sewerage Treatment Plant Detail : Entrance of Sewerage Treatment Plant ※Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Location :Sewerage Treatment Plant Detail : Entrance of Sewerage Treatment Plant ※Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Location :Sewerage Treatment Plant Detail : Check the Hun Neang Road ※No damage to roads observed. (Satisfactory) / Unsatisfactory
2	12-May-23	The transportation (speed and load) Location :Channel Maintenance Road Detail : Entrance of Cannel Maintenance Road ※Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Location :Channel Maintenance Road Detail : Entrance of Cannel Maintenance Road ※Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Location :Channel Maintenance Road Detail : Cheak the Hun Neang Road ※ It was observed that road dusty and damaged by land owner. ※ It not an effect of our project Satisfactory / (Unsatisfactory)
Comment/Condition		Other construction activities are on going nearby our project.
The Consultant		Resident Engineer
Date of Return 21th June, 2023		野島孝行 Takayuki NOJIMA

Before	After
	
Road	Road
Hun Neang Road	Hun Neang Road
1-Jun-21	12-May-23

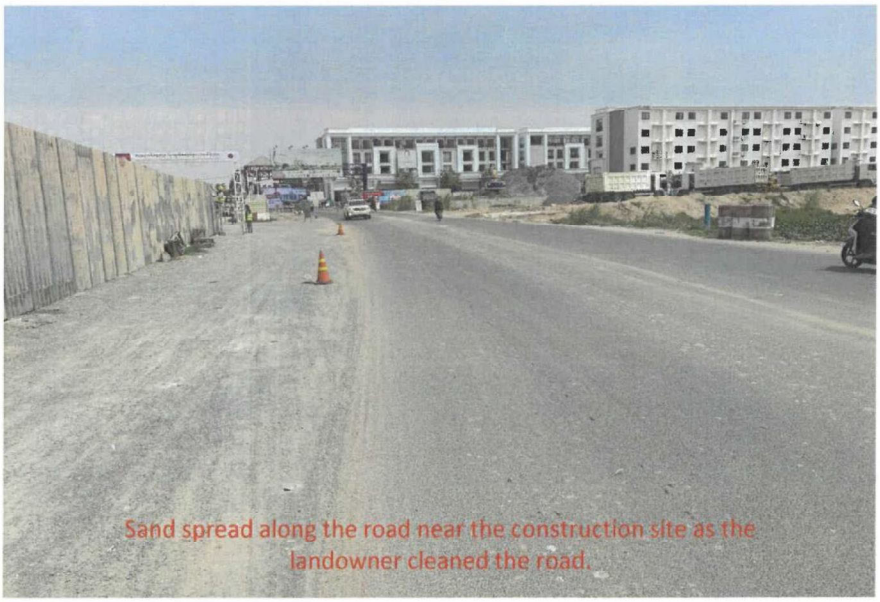
Before	After
	
Road	Road
Hun Neang Road	Hun Neang Road
1-Jun-21	12-May-23

※ Damage and dirt to the road is observed.
Illegal parking near the site is not observed.

Part of road damaged condition and photo

Road damage was observed at the entrance to the landowner's backfill area on the side of the site.

Detail photo



Point of road damage will be discussed and repaired by landowner and road manager.

※The road damage point was temporarily repaired .
(backfilled with sand and Install steel plates to prevent settlement)

3.10 Monitoring of Public Health and Safety

The project for Sewer System Development in Phnom Penh — Environment Mnagement

11. Monitoring form for Public Health and Safety

Monitoring item:		Monitoring indicator: Hiromasa Arai
Public Health and Safety		Solid-liquid waste management at temporary shelter The clean water supply and sanitation The safety equipment and work safety The first aid room
Term	Date	Results
1	12-May-23	Solid-liquid waste management at temporary shelter Location :Sewerage Treatment Plant and Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-10 Other) ※Periodically collected Solid-liquid waste from septic tank. (Satisfactory) / Unsatisfactory
		The clean water supply and sanitation Location :Sewerage Treatment Plant and Interception Facility Detail : No.12, Result of site safety patrol (Items: 2-6 Water Supply) ※Disinfecting and cleaning toilets (Satisfactory) / Unsatisfactory
		The safety equipment and work safety Location :Sewerage Treatment Plant, Interception Facility, and Channel Maintenance Road Detail : No.12, Result of sate safety patrol (Items: 6,7 Safety and Protective equipment) ※Machinery and tool inspection is done every monthly (Satisfactory) / Unsatisfactory
		The first aid room Location :Kubota and Norak office Detail : No.12, Result of site safety patrol (Items: 6-5 Other) ※Checking stock of First aid Kid and COVID test (Satisfactory) / Unsatisfactory
Comment/Condition		

The Consultant — Resident Engineer

Date of Return
2/th June / 2023

Takayuki NOJIMA

Public Health and Safety

The trash bins were installed and separated properly on the construction site.

Public Health and Safety

Alcohol is used for hand washing in the drinking water area to prevent the spread of COVID-19.

Sewerage Treatment Plant

Public Health and Safety

Public Health and Safety

Inspection tool and heavy machinery

Sewerage Treatment Plant

Public Health and Safety

ELB tested to confirm the appropriate rating and to see if it was in good working order.

Sewerage Treatment Plant

Public Health and Safety

Traffic control man assigned both sides when heavy vehicle grossing On the public road.

Public Health and Safety

First aid kid

COVID-TEST

Kubota office and Norak office.

3.11 Site Safety Patrol

12. Site Safety Patrol Check Sheet

Location :Channel Maintenance road Sewarage Treatment Plant	Inspector : Vann Sari
Date :12-May-2023	Time :15 : 00 PM
Work Description	

No.	Item	Eval	No.	Item	Eval
1	**Site Security/Safety**		**4**	**Earthwork**	
1-1	Perimeter fencing	○	4-1	Earthwork arrangement/planning	△
1-2	Signage	○	4-2	Shoring	／
1-3	Lighting	○	4-3	Site security/signage	○
1-4	Other	△	4-4	Other	○
2	**Site cleaning/hygiene**		**5**	**Scaffold**	○
2-1	Site	△	5-1	Condition of scaffolds	○
2-2	Office	○	5-2	Condition of foundation	○
2-3	Road	○	5-3	Condition of supports	○
2-4	Latrines	○	5-4	Site security/signage	○
2-5	First aid room	○	5-5	Other	△
2-6	Water supply	○	.6	**Safety equipment**	
2-7	Other	○	6-1	Equipment condition	○
3	**Environment**		6-2	Wire condition	○
3-1	Erosion protection	○	6-3	Hoist work procedure	○
3-2	Dust protection	○	6-4	Site security/signage	○
3-3	Dust bins/waste collection	○	6-5	Other	○
3-4	Operation of machinery	○	**7**	**Protective Equipment**	
3-5	Crime on wildlife	／	7-1	Helmet	○
3-6	Oil leakage	○	7-2	Work wear	○
3-7	Obstruction of water flow	○	7-3	Protective footwear	○
3-8	Separation of garbage	○	7-4	Work gloves	○
3-9	Odor condition	○	7-5	Protective eyewear	○
3-10	Other	△	7-6	Mask	○
			7-7	Safety harness	△
			7-8	Other	○

Evaluation	Good	○	Improve	△	Unsafe	×	N/A	／

Comment :

The temporary walkway should be well-arranged along the center access. [STP]

The steel deck should not be kept near the excavation area. and should be removed before installing concrete storm pipe. [STP- East side]

Unused materials must be removed, and the area must be kept clean. [FSF]

Kubota

The Project for Sewerage System Development in Phnom Penh

METAWATER

Number: 24

HSE Monthly Safety Patrol Record

Date: 12/May/2023

Location: STP, CMR & Intake facility

No	Photo of Before	Photo of After (Improvement)	Action
1			Mr. Sameth
	The temporary walkway should be well-arranged along the center access. [STP]		Date Close 13-May-2023
2			Mr. Sameth
	The steel deck should not be kept near the excavation area. and should be removed before installing concrete storm pipe. [STP- East side]		Date Close 12-May-2023
3			Mr. Sameth
	Unused materials must be removed, and the area must be kept clean. [FSF]		Date Close 13-May-2023

	Activity of site safety patrol	Record by
	 	Mr. Vann Sari
	Check site safety health and environmental condition at STP, CMR & Intake facility.	Date Close 12-May-2023
For Suggestion: Please continue to maintain the temporary access walkway. All unused materials should be removed and the site should be kept properly cleaned. Please continue to take care to avoid falls or collapses of heavy machinery while excavating and installing concrete storm pipes.		
Action by: Site Engineer Norak	Checked by: HSE Engineer Norak	Checked by: Site Engineer Kubota
Confirmed by: HSE Chief Engineer Kubota	Confirmed by: Chief Engineer Kubota	

4. Conclusion

The project location is in a region of the city where urbanization, economic development, and population growth are all on the rise. As a result of these factors, an increasing amount of wastewater is discharged from the city center, including from households, industries, restaurants, and hotels, and some of it has been connected to sewer systems while others have not, resulting in severe environmental problems such as water and air pollution.

The result of environmental monitoring in three months from February 2023 to May 2022 is as follows:

4.1 Topography

The topography and erosion on the construction site were satisfactory. There is erosion along the slope of the road, and cofferdams caused by rain were observed. Additionally, the cofferdam around STP has been protected by grass sodding. Although the repair work was conducted to maintain road and slope conditions.

4.2 Hydrology

The flow of pump waste water at Trabeck Pumping Station and the downstream drainage to Hun Neang Road remain unobstructed. There is a bridge under construction near the box culvert crossing Hun Neang Road. However, it was observed, and water flowed normally.

4.3 Surface of Water quality

The water quality examination received from the MOE laboratory confirms that it is within the range set by Cambodian standards. The area concerned has been found to be on the south side of the STP, which had been polluted by neighboring filling activity. Despite the fact that the contamination level is not particularly dangerous, the water should be avoided for any consumption purposes.

4.4 Soil quality

The liquid waste generated from the project sites and worker camps was managed properly by providing adequate toilets on all construction sites. All the machinery was checked to prevent the spillage of fuel on the soil.

4.5 Air quality

The air quality in the project area, as a result of the air quality obtained from the laboratory of the MOE, all parameters, including CO, NO2, SO2, O3, and TSP, were found to be lower than the Cambodian standard, so it can be concluded that the project area has safe air quality that does not harm the environment or human health. Although the air quality is not harmful, measures should be taken to prevent and minimize the impact of the project.

4.6 Noise and vibration

The Existing Hun Neang Road has increased in volume in recent months. However, the average noise level in the project area is still lower than the Cambodian standard, which suggests that the project activities don't cause any harmful noise or vibration at the surrounding project sites.

4.7 Safety

Workers are equipped with PPE (Personal Protection Equipment) during working hours on the construction site. Safety tools such as an iron fence, traffic signs, firefighting equipment, helmets, boots, glasses, a safety belt, and gloves have been provided to workers and installed on the construction site to ensure the safety of the workers and workplaces. The safety signs were installed ahead of the construction sites to inform road users to slow down, pay attention, and avoid traffic accidents. Every morning, workers join morning exercise and toolbox meetings before starting work. The morning exercise and toolbox meeting checked the condition of the workers' health to avoid accidents. The workers have been selected daily to point out any recommendations or unsafe activities observed at the site.

5. Recommendation

Based on the field observation and the results of environmental quality (water and air quality) from the laboratory analysis, some recommendations should be considered as follows:

- Regularly check and monitor the project activities to ensure that there is no discharge of polluted water into the environment without proper treatment.
- Follow the Cambodian regulations on water, wastewater management, air pollution control, and other national and international standards if there are any wastewater generation activities causing air pollution emissions in the
- Observe the pollution change in this area or no change due to the construction works and cooperate closely with the local authorities and other environmental experts from both private and public parties to control the pollution.

- Wastewater Treatment Plants and any wastewater control facility must be undertaken to prevent and minimize the negative impacts on the environment and humans.
- Set up mitigation measures to prevent and minimize the negative impacts of air pollution on the environment and humans.
- Regularly monitor the project's work to ensure that there is no air pollution emission into the
- The contractor must spray water regularly while working at the site and on the access road in order to prevent dust emissions to passengers or residents living near the site.

Remark:

Name and Signature

KINGDOM OF CAMBODIA

Nation Religion King

PHNOM PENH CAPITAL CITY

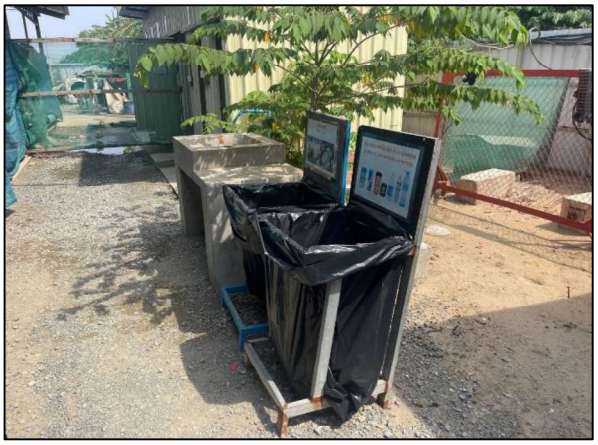
THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

IN PHNOM PENH

JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORING REPORT No.8

August 2023



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1. Introduction

Numerous significant environmental issues have been brought on by the growth of urban development. Due to the lack of proper safeguards, water and air pollution has grown to be a problem, harming both the environment and human health. Boeung Choeung Aek Lake, one of the largest storages in the city, is located in the project area. Without sufficient treatment, sewage and rainwater from the center city are collected and dumped into this lake. According to Cambodian regulations, environmental quality studies must determine the concentrations of numerous indicators for both water and air quality.

1.1 Project Location

The environmental monitoring was conducted in the project area and which is located in Sangkat Chhak Angre Ler, Khan Mean Chey, Phnom Penh as shown in the Figure 1.

Figure 1 Monitoring Locations

1.2 Objective

The goal of environmental monitoring is to determine and confirm whether there are influences and changes in the surrounding conditions and circumstances as a result of the construction works being carried out during the construction period by monitoring working safety, traffic and accidents, solid waste management, air, noise, and water quality, economic disruption, and ecosystems.

The purpose of the environmental monitoring is to check in on the Contractor's execution of environmental mitigation measures and to provide recommendations for the monthly progress of work. Guidance and instructions will be developed to assist the contractor in implementing the environmental mitigation measures outlined in the approved IESIA report.

1.3 Scope of work

Three environmental factors were analyzed to determine the environmental quality in the proposed project area: water quality, air quality, noise, and vibration. A water quality survey will be carried out by sampling surface water from Boeung Choeung Aek lake at four distinct places from upstream to downstream of the project area and analyzing 13 parameters. Six parameters will be examined during an air quality study in two distinct sites within the project area. Monitoring for noise and vibration will take place at six distinct places across the project area. At the field site, water quality, air quality, noise, and vibration were all measured.

1.4 Environmental Monitoring Items

The following are the key environmental monitoring duties during the construction stage:

- Field monitoring of the contractor's performance in environmental mitigation measures in the project area
- Environmental monitoring features in field practice are advised to the contractor's environmental engineers.
- Recommend to the contractor that all EMPs as outlined in the IESIA study, as well as other environmental safeguards, be included in construction contract documents.
- Instruct the contractor to take measures to reduce or correct any further concerns uncovered during the construction phase.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
1. Project Before Construction Phase					
1.1 Socio-economy resource					
Resettlement	– Along the Access Road (Channel Maintenance Road) and sewerage treatment plant – Prek Takong 1 village	– The monitoring of compensation of resettlement and grievance redress	Once every 6 months	1. IRC-WG, IRC 2. DPWT 3. Local authorities	1. MoE 2. MEF 3. DoE 4. DLMUPC
2. Project Construction Phase					
2.1 Physical resource					
Soil erosion and slope failure	– Sand provider	– Confirmation of license issued by Ministry of Mines and Energy and Ministry of Water Resources and Meteorology	Before construction	1. DPWT 2. Contractor	1. Ministry of Mines and Energy 2. Ministry of Water Resources and Meteorology
Topography	– Building construction site – Access Road (Channel Maintenance Road) – Protection dike construction site – Spoiled soil dumping site	– The monitoring of the topography and the erosion at the infrastructure construction site – The monitoring of erosion at the road, protection dike's embankment and spoiled soil dumping site	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
Hydrology	– Canal from Trabek pumping station – Wastewater way, downstream of the drainage to Hun Neang road	– Monitoring of the obstruction of the flow of pumped wastewater	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Surface water quality	3 Sample locations near the project area – Location 1: X=0491822, Y=1274363 – Location 2: X=0491299, Y=1272570 – Location 3: X=0493103, Y=1268628 – Solid-liquid waste storage	– Monitoring of the water quality on the parameters: temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb and Total Coliform – Monitoring of solid-liquid waste management	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Soil quality	– Infrastructure construction site, generator and machinery storage – Temporary shelter of staff-workers	– Monitoring of solid-liquid waste management – Monitoring of the spill, leak of fuel on the soil.	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Air Quality	− Infrastructure construction site − Access Road (Channel Maintenance Road) − Temporary shelter of staff-workers − 2 location of air quality testing: location 1 X=0491356, Y=1272730, location 2 X=0491031, Y=1272740	− Monitoring of the material transportation on Rd. 271 − Monitoring of the odor condition at construction sites − Monitoring of air quality parameters: TSP; CO; NO_2; SO_2, O_3, PM10, PM2.5 and H_2S	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
Noise and vibration	− Infrastructure construction site − Road construction site from Rd. 271 to construction site − Temporary shelter of staff-workers − Noise and vibration testing locations are the same as air quality testing locations	− Monitoring of the noise and vibration from the material transportation, the operation of any machinery, generator and vehicle. − Monitoring of noise and vibration (Unit: dB)	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
2.2 Biological resources					
Ecosystem (Fish)	− Cheung Aek Lake near project area − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the water quality on the parameters temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb Total Coliform	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority
Ecosystem (Birds)	− Temporary shelter of staff-workers	− Monitoring of the crime on wildlife especially the aquatic birds	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
2.3 Socio-economic resources					
Resettlement	− Resident of AHs, lose their income in Prek Takong 1 village. − Area of 19.0736 ha for construction and expansion of the STP	− Monitoring of the livelihood of AHs (7HHs), lose their income. − Monitoring to ensure that no encroachment to the STP area.	Once every 6 months	1. DPWT 2. Local authority	1. MoE 2. MEF 3. DoE 4. DLMUPC 5. DOWRAM
Livelihood, occupations of the local community and gender	− Prek Takong 1 village − Temporary shelter of staff-workers	− Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability − Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	− Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. − Access Road (Channel Maintenance Road)	− Monitoring of the transportation (speed and load) − Monitoring of the parking − Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	− Infrastructure construction site − Generator, vehicle and machinery storage − Temporary shelter of staff-workers − First aid room	− Monitoring of solid-liquid waste management at temporary shelter − Monitoring of the clean water supply and sanitation − Monitoring of the safety equipment and work safety − Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

Environmental monitoring will consist of site monitoring in the project area, with the total regulated and managed by a time-based work plan.

2.1 Road Monitoring

The project's monitoring of transportation (speed and load), parking, and road damage Road 271, Hun Sen Blvd. (60 m), Hun Neang Blvd., and the Channel Maintenance Road access road are all being monitored.

2.2 Public Health and Safety

Monitoring of Solid Liquid Waste Management at Temporary Shelters, as well as clean water supply and sanitation, as well as safety equipment and workplace safety.

2.3 Site monitoring

Use an environmental monitoring checklist, visual and oral interviews with project workers and people living near the project area, and inspections on environmental mitigation measures performed or rectified by the contractor during the field observation. Other environmental monitoring items also use the visual approach; despite this, the degree of effect has been documented, and images are used to prove the affects (good or negative).

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May-21	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Remark
1	Topography	Onec every 6 months		✔						✔				Refer to monthly progress report submitted (Back data)
2	Hydrology	Onec every 6 months		✔						✔				Ditto
3	Surface water quality	Onec every 6 months	Original data	✔						✔				Ditto
4	Soil quality	Onec every 6 months		✔						✔				Ditto
5	Air quality	Onec every 6 months	Original data	✔						✔				Ditto
6	Noise and Vibration	Onec every 6 months	Original data	✔						✔				Ditto
7	Ecosystem (Fish)	Onec every 6 months		✔						✔				Ditto
8	Ecosystem (Birds)	Onec every 6 months		✔						✔				Ditto
9	Livelihood, occupations of the local community and gender	Onec every 6 months		✔						✔				Ditto
10	Road	Onec every 3 months		✔			✔			✔			✔	Ditto
11	Public Health and Safety	Onec every 3 months		✔			✔			✔			✔	Ditto
12	Site Safety Patrol form	Every month	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	Ditto
13	Others	If neessary												

3.2 Road Monitoring

Monitoring item:		Monitoring indicator : Hiromasa Arai
Road		The transportation (speed and load) The parking The repair of damaged road by the project
Term	Date	Results
1	12-Aug-23	The transportation (speed and load) Location :Sewerage Treatment Plant Detail : Entrance of Sewerage Treatment Plant ※Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Location :Sewerage Treatment Plant Detail : Entrance of Sewerage Treatment Plant ※Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Location :Sewerage Treatment Plant Detail : Check the Hun Neang Road ※No damage to roads observed. (Satisfactory) / Unsatisfactory

2	12-Aug-23	The transportation (speed and load) Location :Channel Maintenance Road Detail : Entrance of Cannel Maintenance Road ※Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Location :Channel Maintenance Road Detail : Entrance of Cannel Maintenance Road ※Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Location :Channel Maintenance Road Detail : Cheak the Hun Neang Road ※ It was observed that road dusty and damaged by land owner. ※ It not an effect of our project Satisfactory / (Unsatisfactory)

Before

After

Before

After

Road
Hun Neang Road
1-Jun-21

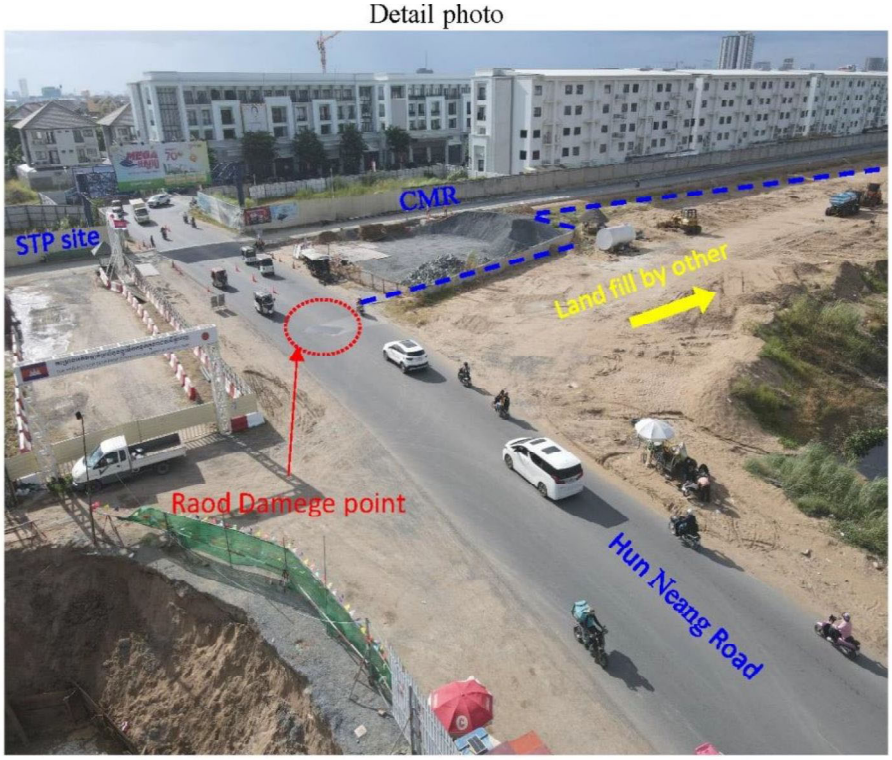
Road
Hun Neang Road
12-Aug-23

※ Damage and dirt to the road is observed.
Illegal parking near the site is not observed.

Part of road damaged condition and photo

Road damage was observed at the entrance to the landowner's backfill area on the side of the site.

Detail photo



Point of road damage will be discussed and repaired by landowner and road manager.

※The road damage point was temporarily repaired .
(backfilled with sand and Install steel plates to prevent settlement)

3.3 Public Health and Safety

Report of Health Safety and Environment (HSE) for Month

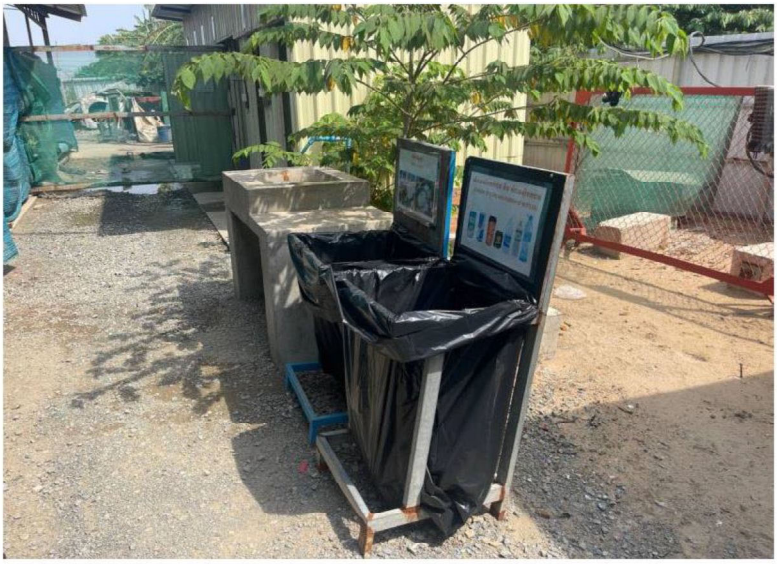
Implementation date :11/Aug/2023 Location :STP,CMR,IF

The following forms shall be applied for monitoring to ensure that HSEM Plan is fully followed and implemented during the execution of the work.

No.	Item	Monitoring Cycle	Remark
1	Topography	Onec every 6 months	—
2	Hydrology	Onec every 6 months	—
3	Surface water quality	Onec every 6 months	—
4	Soil quality	Onec every 6 months	—
5	Air quality	Onec every 6 months	—
6	Noise and Vibration	Onec every 6 months	—
7	Ecosystem (Fish)	Onec every 6 months	—
8	Ecosystem (Birds)	Onec every 6 months	
9	Livelihood, occupations of the local community and gender	Onec every 6 months	—
10	Road	Onec every 3 months	✔
11	Public Health and Safety	Onec every 3 months	✔
12	Site Safety Patrol form	Every month	✔
13	Others	If neessary	—

Monitoring form for Public Health and Safety

Monitoring item:		Monitoring indicator: Hiromasa Arai
Public Health and Safety		Solid-liquid waste management at temporary shelter The clean water supply and sanitation The safety equipment and work safety The first aid room
Term	Date	Results
1	12-Aug-23	Solid-liquid waste management at temporary shelter Location :Sewerage Treatment Plant and Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-10 Other) ※Periodically collected Solid-liquid waste from septic tank. (Satisfactory) / Unsatisfactory
		The clean water supply and sanitation Location :Sewerage Treatment Plant and Interception Facility Detail : No.12, Result of site safety patrol (Items: 2-6 Water Supply) ※Disinfecting and cleaning toilets (Satisfactory) / Unsatisfactory
		The safety equipment and work safety Location :Sewerage Treatment Plant, Interception Facility, and Channel Maintenance Road Detail : No.12, Result of sate safety patrol (Items: 6,7 Safety and Protective equipment) ※Machinery and tool inspection is done every monthly (Satisfactory) / Unsatisfactory
		The first aid room Location :Kubota and Norak office Detail : No.12, Result of site safety patrol (Items: 6-5 Other) ※Checking stock of First aid Kid and COVID test (Satisfactory) / Unsatisfactory

	Public Health and Safety The trash bins were installed and separated properly on the construction site.
	Public Health and Safety Alcohol is used for hand washing in the drinking water area to prevent the spread of COVID-19. Sewerage Treatment Plant
	Public Health and Safety Public Health and Safety Inspection tool and heavy machinery Sewerage Treatment Plant

Public Health and Safety

ELB tested to confirm the appropriate rating and to see if it was in good working order.

Sewerage Treatment Plant

Public Health and Safety

Traffic control man assigned both sides when heavy vehicle grossing On the public road.

Public Health and Safety

First aid kid

COVID-TEST

Kubota office and Norak office.

3.4 Site Safety Patrol Form

Location :Channel Maintenance road Sewarage Treatment Plant	Inspector : Vann Sari
Date :11-Aug-2023	Time :09:00 AM
Work Description	

No.	Item	Eval	No.	Item	Eval
1	**Site Security/Safety**		**4**	**Earthwork**	
1-1	Perimeter fencing	○	4-1	Earthwork arrangement/planning	○
1-2	Signage	○	4-2	Shoring	／
1-3	Lighting	○	4-3	Site security/signage	○
1-4	Other	○	4-4	Other	○
2	**Site cleaning/hygiene**		**5**	**Scaffold**	○
2-1	Site	△	5-1	Condition of scaffolds	○
2-2	Office	○	5-2	Condition of foundation	○
2-3	Road	○	5-3	Condition of supports	○
2-4	Latrines	○	5-4	Site security/signage	○
2-5	First aid room	○	5-5	Other	○
2-6	Water supply	○	**6**	**Safety equipment**	
2-7	Other	○	6-1	Equipment condition	○
3	**Environment**		6-2	Wire condition	○
3-1	Erosion protection	○	6-3	Hoist work procedure	○
3-2	Dust protection	○	6-4	Site security/signage	○
3-3	Dust bins/waste collection	○	6-5	Other	○
3-4	Operation of machinery	○	7	**Protective Equipment**	
3-5	Crime on wildlife	／	7-1	Helmet	○
3-6	Oil leakage	○	7-2	Work wear	○
3-7	Obstruction of water flow	○	7-3	Protective footwear	○
3-8	Separation of garbage	○	7-4	Work gloves	△
3-9	Odor condition	○	7-5	Protective eyewear	○
3-10	Other	○	7-6	Mask	○
			7-7	Safety harness	○
			7-8	Other	○

Evaluation	Good	○	Improve	△	Unsafe	×	N/A	／

Comment :
Unused materials and concrete debris should be removed, and the site should be properly cleaned. [SDT]

Rubbish and concrete waste should be removed to properly clean the site. [MPB]

Kubota

The Project for Sewerage System Development in Phnom Penh

METAWATER

Number: 27

HSE Monthly Safety Patrol Record

Date: 11/August/2023 Time: 09:00 am Location: STP, CMR & Intake facility

No	Photo of Before	Photo of Improvement	Action
1			Mr. Sameth
	Unused materials and concrete debris should be removed, and the site should be properly cleaned. [SDT]		Date Close 11-Aug-2023
2			Mr. Sameth
	Rubbish and concrete waste should be removed to properly clean the site. [MPB]		Date Close 11-Aug-2023
Activity of site safety patrol			
			**Record by** Mr. Vann Sari
	Check site safety health and environmental condition at STP, CMR & Intake facility.		Date Close 14-July-2023

For Suggestion:

The electrical cable on the access road is provided for use at each location to install formwork and must be removed when heavy machinery or trucks pass.

While using a small grinding or cutting machine, guard protection should be installed properly.

Action by:	Checked by:	Checked by:	Confirmed by:	Confirmed by:
Site Engineer Norak	HSE Engineer Norak	Site Engineer Kubota	HSE Chief Engineer Kubota	Chief Engineer Kubota

4. Conclusion

The monitoring was carried out to assess the neighboring roadways as well as the health and safety of the site.

According to the study, the present road condition is temporary sand backfilling and temporary steel plate installation. The road damaged location would be discussed and repaired by the landowner.

The site's health and hygiene management continue, with body temperature monitoring and alcohol hand disinfection before the daily morning meeting, and the bathrooms are disinfected and cleaned every day. For the prevention of heat stroke, the workplace has a drinking water filtration system, hot and cold-water dispensers, and ice-making devices for all personnel. To avoid the spread of COVID-19, the First Aid Room has prepared a first aid kit and a COVID-19 fast test kit at Contractor and subcontractor offices.

Remark:

Name and Signature

KINGDOM OF CAMBODIA

Nation Religion King

PHNOM PENH CAPITAL CITY

THE PROJECT FOR SEWERAGE SYSTEM DEVELOPMENT

IN PHNOM PENH

JAPAN'S GRANT AID PROJECT

ENVIRONMENTAL MONITORING REPORT No. 9

November 2023 (Final Report)

Contents

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1. Introduction

The rising of city development has generated variety of major environmental problems. Therefore, water and air pollution has become an issue and harm to environment and people health with no adequate measures. In the project area, Boeung Choeung Ek lake is one of the biggest storages in the city which collected a part of the sewage and rainwater from the center city and discharge directly into this lake without proper treatment.

Environmental quality survey requires the determination of concentration of various parameters for both water and air quality in according to the regulation of Cambodia.

1.1 Project Location

The environmental monitoring was conducted in the project area and which is located in Sangkat Chak Angre Leu, Khan Mean Chey, Phnom Penh as shown in the Figure 1.

Figure 1: Monitoring Locations

1.2 Objective

The purpose of the environment monitoring is to check and confirm if there are the influence and changes of the surrounding condition and circumstances due to implementation of the construction works during construction period by monitoring working safety, traffic and accident, solid waste management, quality of air, noise and water, economic disturbance, and ecosystem.

The environmental monitoring is to follow up the Contractor's implementation on environmental mitigation measure and recommendation of monthly progress of work. Guidance and instruction will be prepared to guide the contractor to follow the environmental mitigation measure as stated in the approved IESIA report.

1.3 Scope of work

In order to assess the environmental quality in the proposed project area, three environmental parameters were conducted including water quality, air quality, noise and vibration. Water quality survey will be conducted by sampling the surface water from Boeung Choeung Ek lake in four different locations from the upstream to the downstream of the project area with 13 parameters are analyzed. Air quality survey will be conducted in two different locations of the project area with 6 parameters are analyzed. Noise and Vibration monitoring will have conducted in 6 different locations around the project area. The water quality, air quality, noise and vibration were sampled at field site.

1.4 Environmental Monitoring Items

The major tasks for the environmental monitoring in construction stage include:

- Field monitoring on Contractor's environmental mitigation measure performance in the project area
- Guidance to Contractor's environmental engineers on environmental monitoring aspect, in the field practice
- Recommend to Contractor to implement all EMP as stated in IESIA report and other environmental safeguards in construction contract documents
- Instruct Contractor to take an action to mitigate or rectify on other issues that find out in the construction stage.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
1. Project Before Construction Phase					
1.1 Socio-economy resource					
Resettlement	− Along the Access Road (Channel Maintenance Road) and sewerage treatment plant − Prek Takong 1 village	− The monitoring of compensation of resettlement and grievance redress	Once every 6 months	1. IRC-WG, IRC 2. DPWT 3. Local authorities	1. MoE 2. MEF 3. DoE 4. DLMUPC
2. Project Construction Phase					
2.1 Physical resource					
Soil erosion and slope failure	− Sand provider	− Confirmation of license issued by Ministry of Mines and Energy and Ministry of Water Resources and Meteorology	Before construction	1. DPWT 2. Contractor	1. Ministry of Mines and Energy 2. Ministry of Water Resources and Meteorology
Topography	− Building construction site − Access Road (Channel Maintenance Road) − Protection dike construction site − Spoiled soil dumping site	− The monitoring of the topography and the erosion at the infrastructure construction site − The monitoring of erosion at the road, protection dike's embankment and spoiled soil dumping site	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
Hydrology	− Canal from Trabek pumping station − Wastewater way, downstream of the drainage to Hun Neang road	− Monitoring of the obstruction of the flow of pumped wastewater	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Surface water quality	3 Sample locations near the project area − Location 1: X=0491822, Y=1274363 − Location 2: X=0491299, Y=1272570 − Location 3: X=0493103, Y=1268628 − Solid-liquid waste storage	− Monitoring of the water quality on the parameters: temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb and Total Coliform − Monitoring of solid-liquid waste management	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. Local authority
Soil quality	− Infrastructure construction site, generator and machinery storage − Temporary shelter of staff-workers	− Monitoring of solid-liquid waste management − Monitoring of the spill, leak of fuel on the soil.	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Air Quality	- Infrastructure construction site - Access Road (Channel Maintenance Road) - Temporary shelter of staff-workers - 2 location of air quality testing: location 1 X=0491356, Y=1272730, location 2 X=0491031, Y=1272740	- Monitoring of the material transportation on Rd. 271 - Monitoring of the odor condition at construction sites - Monitoring of air quality parameters: TSP; CO; NO_2; SO_2, O_3, PM10, PM2.5 and H_2S	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
Noise and vibration	- Infrastructure construction site - Road construction site from Rd. 271 to construction site - Temporary shelter of staff-workers - Noise and vibration testing locations are the same as air quality testing locations	- Monitoring of the noise and vibration from the material transportation, the operation of any machinery, generator and vehicle. - Monitoring of noise and vibration (Unit: dB)	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoT 4. Local authority
2.2 Biological resources					
Ecosystem (Fish)	- Cheung Aek Lake near project area - Temporary shelter of staff-workers	- Monitoring of solid-liquid waste management - Monitoring of the water quality on the parameters temperature; pH; Turbidity, TDS; TSS; DO; BOD; COD; SO_4; TN; TP; Pb Total Coliform	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DOWRAM 4. DoAFF 5. Local authority
Ecosystem (Birds)	- Temporary shelter of staff-workers	- Monitoring of the crime on wildlife especially the aquatic birds	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoAFF 4. Local authority
2.3 Socio-economic resources					
Resettlement	- Resident of AHs, lose their income in Prek Takong 1 village. - Area of 19.0736 ha for construction and expansion of the STP	- Monitoring of the livelihood of AHs (7HHs), lose their income. - Monitoring to ensure that no encroachment to the STP area.	Once every 6 months	1. DPWT 2. Local authority	1. MoE 2. MEF 3. DoE 4. DLMUPC 5. DOWRAM
Livelihood, occupations of the local community and gender	- Prek Takong 1 village - Temporary shelter of staff-workers	- Monitoring of the staff-worker selection by prioritize the locals, gender equality as well as the disability - Monitoring of work safety	Once every 6 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DoLVT 4. Local authority.

Resource	Monitoring Locations	Methodology and Parameters	Monitoring Cycles	Responsible/ implementing Institutions	Monitoring Institutions
Road	- Rd. 271, Hun Sen Blvd. (60m) and Hun Neang Blvd. - Access Road (Channel Maintenance Road)	- Monitoring of the transportation (speed and load) - Monitoring of the parking - Monitoring of the repair of damaged road by the project	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. DoE 3. DPWT 4. Local authority (local traffic police)
Public Health and Safety	- Infrastructure construction site - Generator, vehicle and machinery storage - Temporary shelter of staff-workers - First aid room	- Monitoring of solid-liquid waste management at temporary shelter - Monitoring of the clean water supply and sanitation - Monitoring of the safety equipment and work safety - Monitoring of the first aid room	Once every 3 months	1. DPWT 2. Contractor	1. MoE 2. MOT 3. DoE 4. DoLVT 5. DoH 6. Local authority

2. Methodology

The environmental monitoring consists of two key activities have been applied in this monitoring stage, air and noise measurement; and water sampling and site monitoring in project area, the total will be controlled and managed by a time-based work plan.

- Air, noise and water quality sampling:

Air and noise sampling will conduct by MoE once every six months. The water quality sampling conducts once every six months according to EMP of IESIA report. All sampling water will be analyzed by MoE lab in Phnom Penh.

- Road:

Monitoring of the transportation (speed and load), parking and the damage road by the project. Monitoring locations such as Road.271, Hun Sen Blvd.(60m) and Hun Neang Blvd. and Access Road for the Channel Maintenance Road.

- Public Health and Safety:

Monitoring of Solid Liquid Waste management at temporary shelter, the clean water supply & sanitation and the safety equipment and work safety.

- Site monitoring:

Use environmental monitoring checklist, visual and interview with project workers and people are living near the project area, and visual checking during the field observation on environmental mitigation measure that implemented or rectified by contractor. Visual methodology also has been applied for other environmental monitoring items; however, degree of impact has been recorded and photographs to proof the impacts (good or bad) are used.

2.1 Surface Water Sampling Process

For taken water samples, some important procedure had been applied in the following:

- Tools and equipment: water sampler, sample bottles, cool box, etc.
- Stamping the code number and sampling date on the sample bottle.
- Sampling taken was following the WHO technique for water sampling.

The samples would keep in the cool box quickly after taking, and at the same day were sent to MoE Lab in Phnom Penh for analyzing the parameters as required by the Water Quality Survey.

Figure 2: Water quality sampling tools and equipment

2.2 Air Sampling Process

Air quality sampling was conducted on-site in the proposed project. The sampling equipment were installed at a height of 1.2 to 1.5 meters above the ground, and air quality parameters were carried out within 1 hour, 8 hours, 24 hours according to each parameter method. Air quality parameters were analyzed in the laboratory of the MOE.

Figure 4 Air quality sampling tools and equipment

2.3 Noise and Vibration Sampling Process

The noise and vibration were monitored from the material transportation, the operation of any machinery, generator and vehicle.

Figure 5: Noise and Vibration sampling tools and equipment

3. Results

3.1 Environment Monitoring Items

No.	Item	Monitoring Cycle	May-22	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Remark
1	Topography	Onec every 6 months						✔	Refer to monthly progress report submitted (Back data)
2	Hydrology	Onec every 6 months						✔	Ditto
3	Surface water quality	Onec every 6 months	Original data					✔	Ditto
4	Soil quality	Onec every 6 months						✔	Ditto
5	Air quality	Onec every 6 months	Original data					✔	Ditto
6	Noise and Vibration	Onec every 6 months	Original data					✔	Ditto
7	Ecosystem (Fish)	Onec every 6 months						✔	Ditto
8	Ecosystem (Birds)	Onec every 6 months						✔	Ditto
9	Livelihood, occupations of the local community and gender	Onec every 6 months						✔	Ditto
10	Road	Onec every 3 months			✔			✔	Ditto
11	Public Health and Safety	Onec every 3 months			✔			✔	Ditto
12	Site Safety Patrol form	Every month		✔	✔	✔	✔	✔	Ditto
13	Others	If neessary							

3.2 Monitoring of Topography

The project for Sewer System Development in Phnom Penh — Environment Management

1. Monitoring form for Topography

Monitoring item:		Monitoring indicator : Hiromasa Arai
Topography		The topography and the erosion at the infrastructure construction site Erosion at the road, protection dike's embankment and spoiled soil dumping site
Term	Date	Results
1	10-Nov-2023	Location :Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-1 Erosion protection) * No erosion due to complete capping concrete for steel sheet pile. (Satisfactory) / Unsatisfactory
2	10-Nov-2023	Location :Channel Maintenance Road Detail : No.12, Result of site safety patrol (Items: 3-1 Erosion protection) * No erosion a long the access road.(grass sodding was done) (Satisfactory) / Unsatisfactory
3	10-Nov-2023	Location :Sewage Treatment Plant Detail : No.12, Result of site safety patrol (Items: 3-1 Erosion protection) * No erosion a long the coffer dam. The coffer dam is protected by grass sodding. (Satisfactory) / Unsatisfactory
Comment/Condition		

The Consultant — Resident Engineer

Date of Return
17th Nov 2023

Takayuki NOJIMA

Topography

Interception facility

Topography

Channel Maintenance Road

Topography

Sewerage Treatment Plant

3.3 Monitoring of Hydrology

The project for Sewer System Development in Phnom Penh — Environmental Management

2. Monitoring form for Hydrology

Monitoring item:		Monitoring indicator : Hiromasa Arai
Hydrology		Obstruction of the flow of pumped waste water
Term	Date	Results
1	10-Nov-2023	Location :Trabeck Pumping station Detail : No.12, Result of site safety patrol (Items: 3-7 Obstruction of water flow) *The watercourse from Trabeck pumping station was flow as normal (Satisfactory) / Unsatisfactory
2	10-Nov-2023	Location :Downstream of drainage to Hun Neang road Detail : No.12, Result of site safety patrol (Items: 3-7 Obstruction of water flow) *No obstruction was observed in the box culvert under Hun Neang Road. (Satisfactory) / Unsatisfactory
Comment/Condition		

The Consultant — Resident Engineer

Date of Return
17th / Nov / 2023

Takayuki NOJIMA

3.4 Water Quality

After analysis, the water quality readings were compared with the Cambodia standards following to the Proclamation No. 116 B.K.MOE on the Introduction of Working Conditions for the Establishment of Factory and Handy-Craft Project as shown in Table 3. The air quality readings were compared with the Cambodia standards following to the Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project as shown in the Table 4.

Table 1: Cambodia water quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Method	May-21	November-2023				
						No.1	No.2	No.3	No.4	Ave
1	pH	-	5.5-9.0	Method pH Meter	7.275	6.97	7.01	6.94	7.01	**6.98**
2	Temperature	Degree C	<40	Method Thermometer	25	24.99	25.00	25.00	25.00	**25.00**
3	Turbidity	NTU	NV	Method Digital Turbid meter	58.5	50.00	140.00	28.00	6.00	**56.00**
4	Dissolved Oxygen (DO)	mg/L	2.0-7.5	Method DO Meter	0.25	1.30	5.70	3.20	6.60	**4.2**
5	Total Dissolved Solid (TDS)	mg/L	<2000	Method 2540 C	202.5	243.00	169.00	171.00	229.00	**203.00**
6	Total Suspended Solid (TSS)	mg/L	<100	Method 2540 D	129.5	8.00	49.00	18.00	3.00	**19.5**
7	Biochemical Oxygen Demand (BOD)5	mg/L	<60	Method 5210 B	70.26	42.45	23.17	57.67	11.13	**33.60**
8	Chemical Oxygen Demand (COD)Cr	mg/L	<120	Method 5220.B	129.75	71.00	39.00	88.00	21.00	**54.75**
9	Sulphate (SO4)	mg/L	<500	Method 4500-SO42- B	63	14.00	10.00	9.00	16.00	**12.25**
10	Total Nitrogen (TN)	mg/L	<40	Method JIS K 0102 45	22.75	17.00	9.60	10.20	15.00	**12.95**
11	Total Phosphorus (TP)	mg/L	<6.0	Method JIS K 0102 46	1.645	2.13	1.83	1.55	1.94	**1.86**
12	Lead (Pb)	mg/L	<0.3	Method 3500-Pb C	0.5	ND	ND	0.02	ND	**0.005**
13	Total Coli form	MPN/100ml	<1000	Method NF T90-413	1.425×10^{6}	1.1×10^{9}	1.1×10^{9}	4.6×10^{8}	2.4×10^{7}	**6.71×10^{8}**

Source: Standard from Annex2 of Effluent for discharging Liquid waste on the Sub Decree No.103 SDC.PK On the Amendment Article 4, Article 9, Article 11, Article 12, Article 17 and table of Annex 2, Annex 3, Annex 4 and Annex 5 of Sub-decree 27 SDC.PK dated on 6th April, 1999 on Water Pollution Control that issued on June 29, 2021 of Royal government

Summary of Environmental Monitoring of Surface water quality

The water quality on the parameters	Temperature	pH	Turbidity	TDS	TSS	DO	BOD	COD	SO4	TN	TP	Pb	Total Coli form
Unit	℃	—	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	MPN/ 100ml
Standard	<45	5.0-9.0	—	<200	<200	>1.0	<200	<300	<500	<40	<6.0	<0.5	—
Location.1: (Trabek pumping station)													
May 21	25.00	7.17	60.00	304.00	140.00	0.00	85.00	174.00	30.00	26.00	0.98	0.004	1.1×10^{6}
Nov-21	24.90	6.90	0.00	158.00	51.00	0.40	24.80	85.00	31.00	12.80	0.65	ND	1.1×10^{6}
May-22	25.00	6.64	74.00	300.00	60.00	0.00	71.24	148.00	67.00	10.60	0.42	ND	$4.6X10^{7}$
Nov-22	58.60	6.79	76.00	288.00	93.00	0.00	97.82	203.00	30.00	21.00	3.61	0.002	1.1×10^{7}
May-23	25.00	7.02	14.00	236.00	13.00	2.80	34.18	74.00	8.40	12.20	1.75	ND	1.1×10^{8}
Nov-23	24.99	6.97	50.00	243.00	8.00	1.30	42.45	71.00	14.00	17.00	2.13	ND	1.1×10^{9}

3. Monitoring form for Surface water quality

Monitoring item:		Monitoring indicator : Hiromasa Arai
Surface water quality		The water quality on the parameters: Temperature, pH, Turbidity, TDS, TSS, DO, BOD, COD, SO4, TN, TP, Pb and Total Coliform Solid-liquid waste management
Term	Date	Results
1	03-Nov-23	The water quality on the parameters Location : No.1 (Trabek pumping station) Detail : Attached file "3-1" *Test results are below Cambodian standards. (Satisfactory) / Unsatisfactory
2	03-Nov-23	The water quality on the parameters Location : No.2 (East and west side of STP in Cheung Aek Lake) Detail : Attached file "3-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
3	03-Nov-23	The water quality on the parameters Location :No.3 (South side of STP in Cheung Aek Lake) Detail : Attached file "3-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
4	03-Nov-23	The water quality on the parameters Location :No.3 (STP from pond/outfall area after treatment) Detail : Attached file "3-1" *Test results are below Cambodian standards (Satisfactory) / Unsatisfactory
Comment/Condition		

The Consultant Resident Engineer

Date of Return
11th / Nov / 2023

Takayuki NOJIMA

The project for Sewer System Development in Phnom Penh — Environmental Management

4. Monitoring form for Soil quality

Monitoring item:		Monitoring indicator : Hiromasa Arai
Soil quality		Solid-liquid waste management Spill, leak of fuel on the soil
Term	**Date**	**Results**
1	10-Nov-2023	Solid-liquid waste management Location :Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-10 other) * No solid-liquid waste spill on the soil — Satisfactory / Unsatisfactory
		Spill, leak of fuel on the soil Location :Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-6 Oil leakage) * No machine oil leaked on the soil — Satisfactory / Unsatisfactory
2	10-Nov-2023	Spill, leak of fuel on the soil Location : Chhannel Maintenace Road Detail : No.12, Result of site safety patrol (Items: 3-6 Oil leakage) * No machine oil leaked on the soil — Satisfactory / Unsatisfactory
3	10-Nov-2023	Solid-liquid waste management Location : Sewage Treatment Plant(North side of STP) Detail : No.12, Result of site safety patrol (Items: 3-10 other) * No solid-liquid waste spill on the soil — Satisfactory / Unsatisfactory
		Spill, leak of fuel on the soil Location : Sewage Treatment Plant(West side of STP) Detail : No.12, Result of site safety patrol (Items: 3-6 Oil leakage) * No machine oil leaked on the soil — Satisfactory / Unsatisfactory
Comment/Condition		

The Consultant — Resident Engineer

Date of Return
11th Nov 2023

Takayuki NOJIMA

3.6 Air Quality

Based on the field observation on 03rd – 04th November 2023, the construction works which comprise of various activities could cause air pollution through exhausted gas from transportation vehicles, and other machineries. Dust emission also causes air pollution by the transportation of construction materials, excavated soil, and backfill sand. However, these activities will only cause air pollution in a short period.

The air quality and noise level were monitored in the project area on 03rd – 04th November 2023 in order to follow up the impact from the project activities. According to the result below the air qualities are below the standard so no air pollution from the construction activities (see in Table 2 below).

Table 2: Cambodia air quality standard and water quality in the project area (4 locations)

No.	Parameter	Unit	Standard	Duration	May-21	November-2023				
						No.1	No.2	No.3	No.4	Ave
1	Carbon Monoxide (CO)	mg/m3	<20	8 hours	1.08	5.360	1.175	2.110	3.024	**2.917**
2	Nitrogen Dioxide (NO2)	mg/m3	<0.10	24 hours	0.016	0.084	0.111	0.015	0.051	**0.065**
3	Sulfur Dioxide (SO2)	mg/m3	<0.30	24 hours	0.021	0.404	0.221	0.058	0.024	**0.176**
4	Ozone (O3)	mg/m3	<0.2	1 hour	0.0008	0.210	0.127	0.098	0.142	**0.144**
5	Hydrogen Sulfide (H2S)	ppm	NV	NV	ND	ND	ND	ND	ND	**ND**
6	Total Suspended Particles (TSP)	mg/m3	<0.33	24 hours	0.092	0.014	0.019	0.019	0.017	**0.017**
7	PM10	mg/m³	<0.05	-	0.029	0.023	0.020	0.023	0.028	**0.023**
8	PM2.5	mg/m³	<0.025	-	0.021	0.022	0.017	0.020	0.024	**0.020**

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

5. Monitoring form for Air quality

Monitoring iten		Monitoring indicator : Hiromasa Arai
Air quality		The material transportation on Rd. 271 The odor condition at construction sites Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S
Term	Date	Results
1	3-Nov-23	The odor condition at construction sites Location. 1 (Sewage Treatment Plant) Detail : No.12, Result of site safety patrol (Items:3-9 Order condition) *Toilets are clean every day (Satisfactory) Unsatisfactory
		Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S Location.1 (Sewerage Treatment Plant) Detail : Attached file "5-1" *Test results were found SO2 and O3 increase a little bit compared to Cambodian standards. Cause of the traffic on the public road near the project site. Main heavy machinery work has been completed at our site Satisfactory (Unsatisfactory)
2	3-Nov-23	Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S Location.2 (West side of STP) Detail : Attached file "5-1" *Test results were found NO2 increase a little bit compared to Cambodian standards. Cause of starting construction of house near the observed area. Main heavy machinery work has been completed at our site. Satisfactory (Unsatisfactory)
3	4-Nov-23	Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S Location.3: (Channel Maintenance Road) Detail : Attached file "5-1" *Test results are below Cambodian standards (Satisfactory) Unsatisfactory
4	4-Nov-23	The odor condition at construction sites Location.4: (Interception Facility) Detail : No.12, Result of site safety patrol (Items:3-9 Order condition) *Toilets are clean every day (Satisfactory) Unsatisfactory
		Air quality parameters: CO, NO2, SO2, O3, PM10, PM2.5 and H2S Location.4: (Interception Facility) Detail : Attached file "5-1" *Test results are below Cambodian standards (Satisfactory) Unsatisfactory
omment/Conditio		Air quality on location 1 increased due to increasing traffic volume on public road cause by people bypass of sky bridge construction.
The Consultant		Resident Engineer
Date of Return 17th Nov / 2023		Takayuki NOJIMA

Air quality

Location.1

(Sewerage Treatment Plant)

Air quality

Location.2

(West side of STP)

Air quality

Location.3

(Channel Maintenance Road)

3.7 Monitoring of Noise and Vibration

Noise and vibration happened from the construction machinery such as excavation of drainage' line, road cutting machine, driving sheet pile and transporting of top soil from the project site to disposal site. In date of observation only few construction machineries (excavator and dump trucks) are working on the platform in different place were close to residential area.

Table 3 show that the average noise level in daytime (62.84 dB(A)) is lower than maximum permitted noise level in commercial and service areas and mix. The transportation of concrete and base course materials by trucks so comparing the normal traffic situation, the transportation activities is much lower. In conclusion, the higher noise level is not mainly from the construction activities but from the traffic in the area itself.

Table 3: Noise standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	May-21	November-2023						
						No.1	No.2	No.3	No.4	No.5	No.6	Ave
1	LAeq	dB	-	3 hours	59.06	58.90	55.70	57.50	58.90	63.00	62.50	**59.41**
2	LAF Max	dB	-	3 hours	84.86	80.80	81.90	83.30	84.50	87.20	84.80	**83.75**
3	LAF 5	dB	<85dB	3 hours	59.98	64.70	60.30	60.40	62.20	65.80	63.68	**62.84**

Table 4: Vibration standard and in the project area (6 locations)

No.	Parameter	Unit	Standard	Duration	May-21	November-2023						
						No.1	No.2	No.3	No.4	No.5	No6	Ave
1	LVA eg	dB	-	3 hours	43.88	38.80	40.30	80.90	81.40	90.00	79.40	**68.46**
2	LVA max	dB	-	3 hours	68.85	55.90	58.70	111.60	113.60	123.90	112.00	**95.95**
3	LVA 10	dB	<75dB	3 hours	45.58	41.00	44.30	32.00	39.00	39.40	38.90	**39.10**

Source: Standard from Proclamation No. 120 B.K.MOE on the Introduction of Working Condition for the Development of Infrastructure and Tourism Project

6. Monitoring form for Noise and Vibration

Monitoring item:		Monitoring indicator : Hiromasa Arai
Noise and Vibration		The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Noise and vibration (Unit: dB)
Term	Date	Results
1	3-Nov-2023	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 1 : (Sewage Treatment Plant) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Detail : Attache file "6-1" *Test results are below Japanese standards. (Satisfactory) / Unsatisfactory
2	3-Nov-2023	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 2 : (West side of STP) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Detail : Attache file "6-1 " *Test results are below Japanese standards (Satisfactory) / Unsatisfactory
3	4-Nov-2023	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 3 : (Channel Maintenance Road) Detail : No.12, Result of site safety patrol (Items: 3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Detail : Attache file "6-1" *Test results are below Japanese standards (Satisfactory) / Unsatisfactory
Comment/Condition		

The Consultant

Date of Return
17th / Nov / 2023

Takayuki NOJIMA

6. Monitoring form for Noise and Vibration

Monitoring item:		Monitoring indicator : Hiromasa Arai
Noise and Vibration		The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Noise and vibration (Unit: dB)
Term	Date	Results
4	04-Nov-23	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 4 : (Interception Facility) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Detail : Attache file "6-1" *Test results are below Japanese standards (Satisfactory) / Unsatisfactory
5	04-Nov-23	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 5: (Rd.271) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Test results are below Japanese standards (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Detail : Attache file "6-1" *Test results are below Japanese standards (Satisfactory) / Unsatisfactory
6	03-Nov-23	The noise and vibration from the material transportation, the operation of any machinery, generator and vehicle Location. 6 (Temporary of workshop) Detail : No.12, Result of site safety patrol (Items:3-4 Operation of machinery) *Proper maintenance and careful operation (Satisfactory) / Unsatisfactory
		Noise and vibration (Unit: dB) Detail : Attache file "6-1" *Test results are below Japanese standards. (Satisfactory) / Unsatisfactory
Comment/Condition		
The Consultant		Resident Engineer
Date of Return 17th / Nov / 2023		Takayuki NOJIMA

Noise and Vibration

Location.1

(Sewerage Treatment Plant)

Noise and Vibration

Location.2

(West side of STP)

Noise and Vibration

Location.3

(Channel Maintenance Road)

3.8 Monitoring of Ecosystem

The project for Sewer System Development in Phnom Penh — Environmental Management

7. Monitoring form for Ecosystem (Fish)

Monitoring item:		Monitoring indicator : Hiromasa Arai
Ecosystem (Fish)		Solid-liquid waste management The water quality parameters: pH, Turbidity, TDS, TSS, DO, BOD, COD, SO4, TN, TP, Pb and Total Coliform
Term	Date	Results
1	3-Nov-23	Solid-liquid waste management Location : Location. 2 （East side of STP in Cheung Aek Lake) Detail : No.12, Result of site safety patrol(Items: 3-10 Other) *Test results are below Cambodian standards (Satisfactory) Unsatisfactory
		The water quality on the parameters Location : Location. 2 （East side of STP in Cheung Aek Lake) Detail : Attached file "3-1" *Test results are below Cambodian standards (Satisfactory) Unsatisfactory
Comment/Condition		

The Consultant — Resident Engineer

Date of Return
7th / Nov / 2023

Takayuki NOJIMA

8. Monitoring form for Ecosystem (Birds)

Monitoring item:		Monitoring indicator : Hiromasa Arai
Ecosystem (Birds)		The crime on wildlife especially the aquatic bird
Term	Date	Results
1	10-Nov-2023	The crime on wildlife especially the aquatic bird Location :Sewage Treatment Plant, Chhanel Maintenance Road and Interception facility Detail : No.12, Result of site safety patrol (Items:3-5 Crime on wildlife) *Have not confirmed crime on aquatic bird (Satisfactory / Unsatisfactory)
Comment/Condition		
The Consultant		Resident Engineer
Date of Return 17th / Nov / 2023		Takayuki NOJIMA

9. Monitoring form for Livelihood, occupations of the local community and gender

Monitoring item:		Monitoring indicator : Hiromasa Arai
Livelihood, occupations of the local community and gender		The staff-worker selection by prioritize the locals, gender equality as well as the disability Work safety
Term	Date	Results
1	10-Nov-23	The staff-worker selection by prioritize the locals, gender equality as well as the disability Location :Sewage Treatment Plant,Channel Maintenance Road, and Interception Facility Detail : No.12, Result of site safety patrol (Items:3-10 Other) * Employment is done equal. (Satisfactory) Unsatisfactory
		Work Safety Location :Sewage Treatment Plant,Channel Maintenance Road, and Interception Facility Detail : No.12, Result of site safety patrol (Items: 7) * All the workers and staff had provided safety education And requirement personal protective equipment. (Satisfactory) / Unsatisfactory
Comment/Condition		
The Consultant		Resident Engineer
Date of Return 17th / Nov / 2023		Takayuki NOJIMA

3.9 Monitoring of Road

The project for Sewer System Development in Phnom Penh — Environmental Management

10. Monitoring form for Road

Monitoring item:		Monitoring indicator : Hiromasa Arai
Road		The transportation (speed and load) The parking The repair of damaged road by the project
Term	Date	Results
1	10-Nov-23	The transportation (speed and load) Location : Sewage Treatment Plant and Channel Maintenance Road Detail : Entrance of Sewage Treatment Plant *Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Detail : Entrance of Sewerage Treatment Plant *Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Detail : Check the Hun Neang Road *Observed that road damaged by land owner's machinery Satisfactory / (Unsatisfactory)
2	10-Nov-23	The transportation (speed and load) Location : Interception Facility Detail : Entrance of Interception Facility *Overspeed and overload are not observed. (Satisfactory) / Unsatisfactory
		The parking Detail : Entrance of Interception Facility *Illegal parking near the site is not observed. (Satisfactory) / Unsatisfactory
		The repair of damaged road by the project Detail : 271 road *No damage to roads observed. (Satisfactory) / Unsatisfactory
Comment/Condition		The road damaged location is still temporary repair. this not cause by project construction activities.

The Consultant — Resident Engineer

Date of Return
17th Nov '2023

Takayuki NOJIMA

Before	After
	
Road	Road
Hun Neang Road	Hun Neang Road
1-Jun-21	10-Nov-23

Before	After
	
Road	Road
Hun Neang Road	Hun Neang Road
1-Jun-21	10-Nov-23

Part of road damaged condition and photo

Road damage was observed at the entrance to the landowner's backfill area on the side of the site.

Detail photo

Point of road damage will be discussed and repaired by landowner and road manager.

※The road damage point was temporarily repaired .
(backfilled with sand and Install steel plates to prevent settlement)

3.10 Monitoring of Public Health and Safety

The project for Sewer System Development in Phnom Penh — Environmental Mnagement

11. Monitoring form for Public Health and Safety

Monitoring item:		Monitoring indicator : Hiromasa Arai
Public Health and Safety		Solid-liquid waste management at temporary shelter The clean water supply and sanitation The safety equipment and work safety The first aid room
Term	Date	Results
1	10-Nov-23	Solid-liquid waste management at temporary shelter Location :Sewage Treatment Plant and Interception Facility Detail : No.12, Result of site safety patrol (Items: 3-10 Other) * No solid-liquid waste spill on the soil and no odor (Satisfactory) Unsatisfactory
		The clean water supply and sanitation Location :Sewage Treatment Plant Detail : No.12, Result of site safety patrol (Items: 2-6 Water Supply) *Use water supply from PPWSA .(Interception Facility And STP) (Satisfactory) Unsatisfactory
		The safety equipment and work safety Location :Sewage Treatment Plant, Channel Maintenance Road, and Interception Facility Detail : No.12, Result of sate safety patrol (Items: 6 and 7 Safety and Protective equipment) * Provided safety education and proper protective equipment Tools checking before use (Satisfactory) Unsatisfactory
		The first aid room Location : Kubota and Norak Office Detail : No.12, Result of site safety patrol (Items: 2-5) * Confirm first aid kit and Emergency equipment (Satisfactory) Unsatisfactory
Comment/Condition		

The Consultant — Resident Engineer

Date of Return
17th/Nov/2023

Takayuki NOJIMA

Public Health and Safety

Disinfecting toilets

Sewerage Treatment Plant

Public Health and Safety

Inspection tool

Sewerage Treatment Plant

Public Health and Safety

First aid kit

COVID-TEST

Kubota office

3.11 Site Safety Patrol

The project for Sewer System Development in Phnom Penh — Environment Management

12. Site Safety Patrol Check Sheet

Location : Sewarage Treatment Plant Channel Maintenance road Interception Facility	Inspector : Vann Sari
Date :10-November-2023	Time :09 : 00 am
Work Description	

No.	Item	Eval	No.	Item	Eval
1	**Site Security/Safety**		**4**	**Earthwork**	
1-1	Perimeter fencing	○	4-1	Earthwork arrangement/planning	○
1-2	Signage	○	4-2	Shoring	／
1-3	Lighting	○	4-3	Site security/signage	○
1-4	Other	○	4-4	Other	△
2	**Site cleaning/hygiene**		**5**	**Scaffold**	
2-1	Site	△	5-1	Condition of scaffolds	○
2-2	Office	○	5-2	Condition of foundation	○
2-3	Road	○	5-3	Condition of supports	○
2-4	Latrines	○	5-4	Site security/signage	○
2-5	First aid room	○	5-5	Other	○
2-6	Water supply	○	**6**	**Safety equipment**	
2-7	Other	○	6-1	Equipment condition	○
3	**Environment**		6-2	Wire condition	○
3-1	Erosion protection	○	6-3	Hoist work procedure	○
3-2	Dust protection	○	6-4	Site security/signage	○
3-3	Dust bins/waste collection	○	6-5	Other	○
3-4	Operation of machinery	○	**7**	**Protective Equipment**	
3-5	Crime on wildlife	／	7-1	Helmet	△
3-6	Oil leakage	○	7-2	Work wear	○
3-7	Obstruction of water flow	○	7-3	Protective footwear	○
3-8	Separation of garbage	○	7-4	Work gloves	△
3-9	Odor condition	○	7-5	Protective eyewear	○
3-10	Other	○	7-6	Mask	○
			7-7	Safety harness	○
			7-8	Other	○

Evaluation	0	○	Improve	△	Unsafe		N/A	／

Comment :
It was observed that the worker was not wearing personal protective equipment properly. Unused materials should be removed, and the site should be properly cleaned. [SDB]

Kubota

The Project for Sewerage System Development in Phnom Penh

METAWATER

Number: 30

HSE Monthly Safety Patrol Record

Date: 10/November/2023 Time: 09:00 am

Location: Sewerage Treatment Plan, Channel Maintenacnce Road, and Interception Facility

No	Photo of Before	Photo of Improvement	Action
1			Mr. Sameth
	It was observed that the worker was not wearing personal protective equipment properly.		Date Close 10-Nov-2023
2			Mr. Sameth
	Unused materials should be removed, and the site should be properly cleaned. [SDB]		Date Close 10-Nov-2023
	Activity of site safety patrol		
			**Record by** Mr. Vann Sari
	Check site safety, health, and environmental conditions at the Sewerage Treatment Plan, Channel Mintenance Road, and Interception Facility.		Date Close 10-Nov-2023

For Suggestion:

- Please continue to take care and wear proper PPE, such as fall arrest, to avoid dropping materials on someone during the removal workshop.
- A flagman should be assigned to safety control for heavy machinery for lifting and soil removal from the workshop.

Action by:	Checked by:	Checked by:	Confirmed by:	Confirmed by:
Site Engineer Norak	HSE Engineer Norak	Site Engineer Kubota	HSE Chief Engineer Kubota	Chief Engineer Kubota

4. Conclusion

The project location is in a region of the city where urbanization, economic development, and population growth are all on the rise. As a result of these factors, an increasing amount of wastewater is discharged from the city center, including from households, industries, restaurants, and hotels, and some of it has been connected to sewer systems while others have not, resulting in severe environmental problems such as water and air pollution.

The result of environmental monitoring showing that before construction start in May 2021 to after finish construction in November 2023 is as follows:

4.1 Topography

Within the project area, the topography and erosion on the construction site were satisfactory. However, as indicated by road observations, there is a damaged road on the Hun Neang Road caused by neighboring construction activity.

4.2 Hydrology

The flow of pump waste water at Trabeck Pumping Station, as well as the downstream drainage to Hun Neang Road, are unaffected. A bridge is being constructed near the box culvert that crosses Hun Neang Road. It was, however, noted, and the water flowed regularly.

4.3 Surface of Water quality

The MOE laboratory test of the water quality verifies that it is within the acceptable limits specified by Cambodian standards. The negatively impacted area was found to be on the south side of the STP, which had been contaminated by nearby filling work. Despite the fact that the pollution level is not extremely harmful, the water should not be consumed.

4.4 Soil quality

By providing appropriate toilets on all construction sites, the liquid waste generated by the project sites and worker camps was adequately managed. All machinery was inspected to ensure that no gasoline was spilled on the ground.

4.5 Air quality

As a result of the air quality obtained from the MOE laboratory, all parameters, including CO, NO2, SO2, O3, and TSP, were found to be lower than the Cambodian standard, implying that the project area has safe air quality that does not harm the environment or human health. Although the air quality is not hazardous, precautions should be taken to prevent and mitigate the project's impact.

4.6 Noise and vibration

The traffic on the existing Hun Neang Road has risen in recent months due to divers traffic from sky bridge construction. The average noise level in the project area exceeds the Cambodian standard. However, we observed that the project operations generate no hazardous noise or vibration at the nearby project sites.

4.7 Safety

Workers are equipped with PPE (Personal Protection Equipment) during working hours on the construction site. Safety tools such as an iron fence, traffic signs, firefighting equipment, helmets, boots, glasses, a safety belt, and gloves have been provided to workers and installed on the

construction site to ensure the safety of the workers and workplaces. The safety signs were installed ahead of the construction sites to inform road users to slow down, pay attention, and avoid traffic accidents. Every morning, workers join morning exercise and toolbox meetings before starting work. The morning exercise and toolbox meeting checked the condition of the workers' health to avoid accidents. The workers have been selected daily to point out any recommendations or unsafe activities observed at the site.

5. Recommendation

Based on the field observation and the results of environmental quality (water and air quality) from the laboratory analysis, some recommendations should be considered as follows:

- Regularly check and monitor the project activities to ensure that there is no discharge of polluted water into the environment without proper treatment.
- Follow the Cambodian regulations on water, wastewater management, air pollution control, and other national and international standards if there are any wastewater generation activities causing air pollution emissions from the project.
- Observe the pollution change in this area or no change due to the construction works and cooperate closely with the local authorities and other environmental experts from both private and public parties to control the pollution.
- Wastewater Treatment Plants and any wastewater control facility must be undertaken to prevent and minimize the negative impacts on the environment and humans.
- Set up mitigation measures to prevent and minimize the negative impacts of air pollution on the environment and humans.
- Regularly monitor the project's work to ensure that there is no air pollution emission.
- The contractor must spray water regularly while working at the site and on the access road in order to prevent dust emissions to passengers or residents living near the site.

Remark:

Name and Signature