

# Initial Environmental Examination

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January 2022

## Kingdom of Cambodia: Community-Based Tourism COVID-19 Recovery Project

## CURRENCY EQUIVALENTS

(as of 4 January 2022)

Currency unit	–	riel (KHR)
KHR 1.00	=	\$0.00024
\$1.00	=	KHR 4,075

## ABBREVIATIONS

ADB	–	Asian Development Bank
AIT	–	Asian Institute of Technology
AP	–	affected person
CSAF	–	Civil Society Alliance Forum
DFR	–	draft final report
EA	–	executive agency
EHS	–	environmental health and safety
ESIA	–	environment and social impact assessment
EMP	–	environmental management plan
GRM	–	Grievance Redress Mechanism
JICA	–	Japan International Cooperation Agency
IESIA	–	initial environment and social impact assessment
IPM	–	integrated pest management
MEF	–	Ministry of Economy and Finance
MoE	–	Ministry of Environment
MOU	–	memorandum of understanding
NAPV	–	national authority of Preah Vihear
PCU	–	project coordinating unit
PIC	–	project implementation consultancy
PIU	–	project implementation unit

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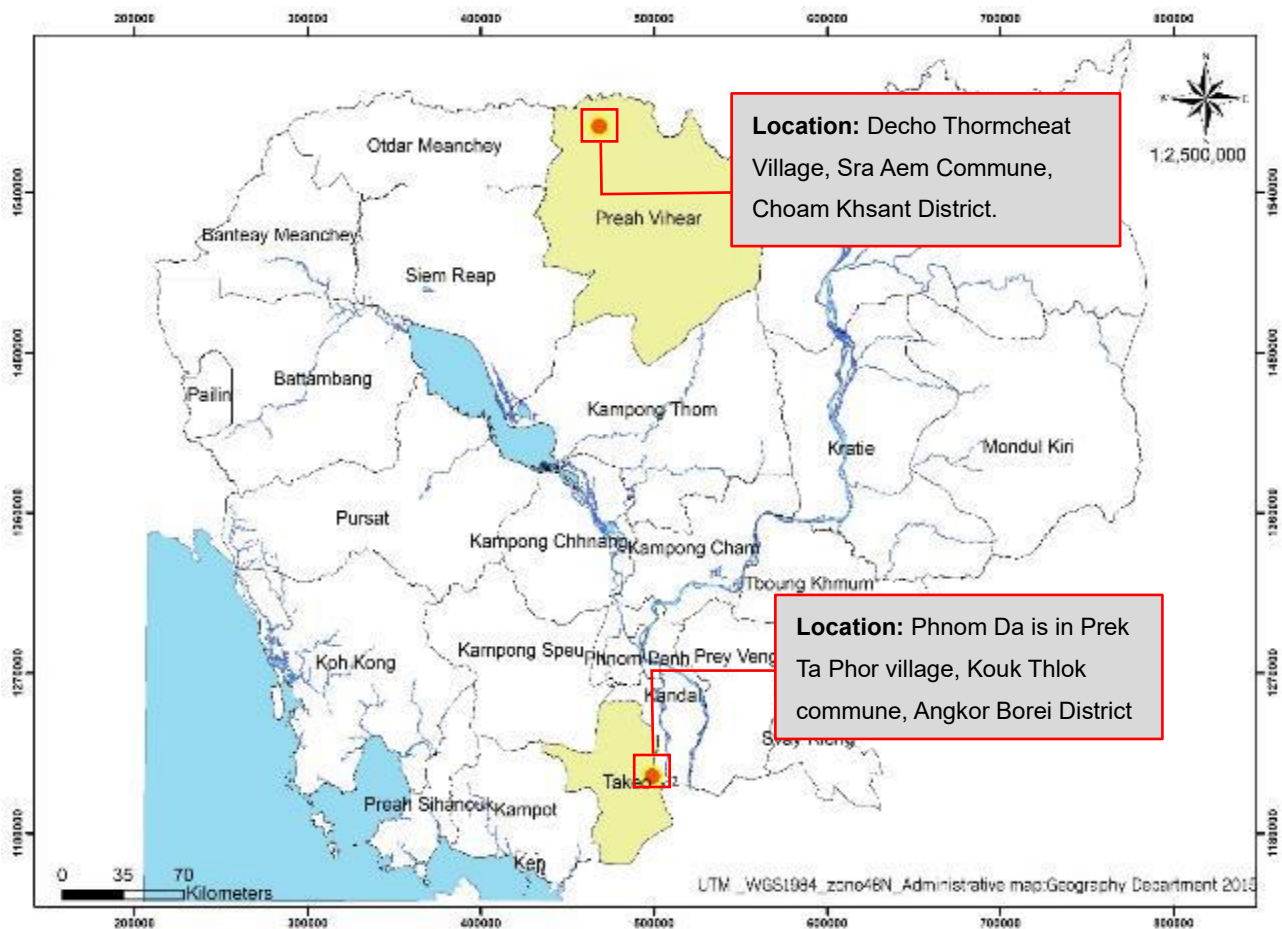


## I. PROJECT DESCRIPTION

### 1.1. Project Background

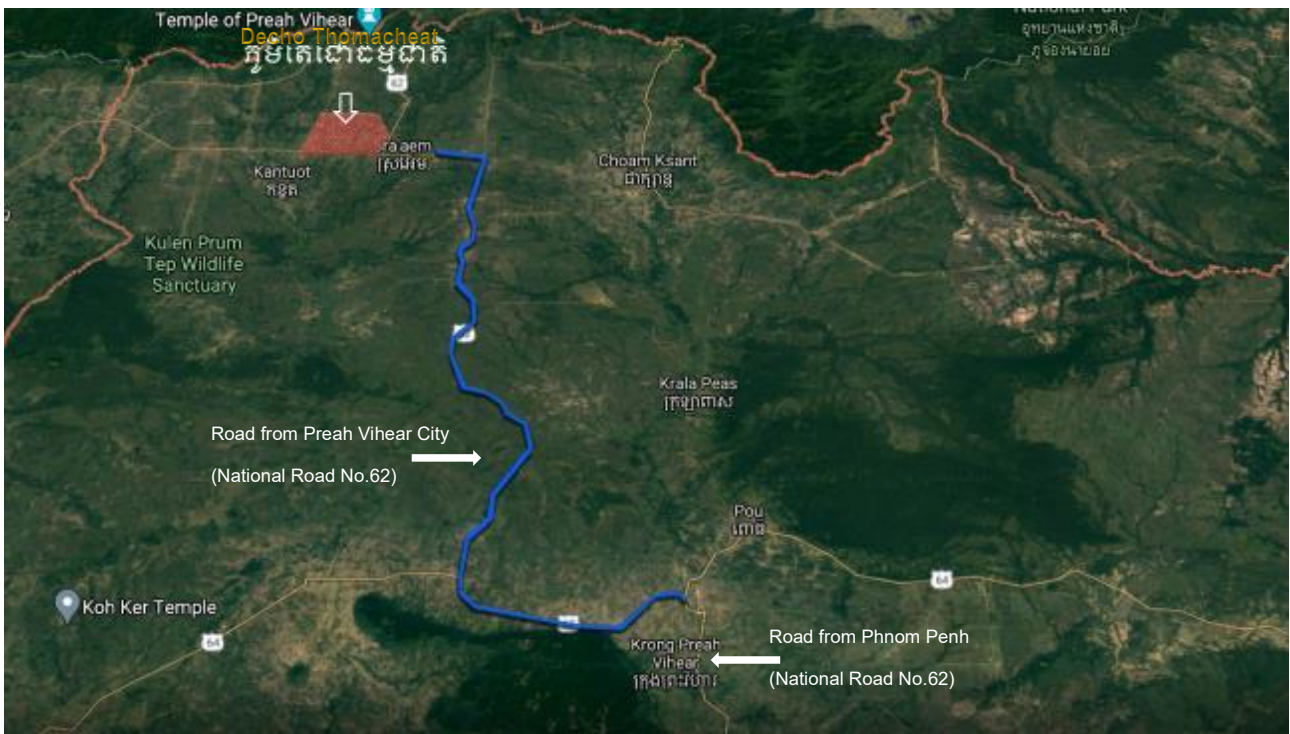
1. The proposed Community-Based Tourism COVID-19 Recovery Project will help accelerate post-coronavirus disease (COVID-19) recovery in rural communities living near Preah Vihear (Preah Vihear province) and Phnom Da (Takeo province) heritage sites (See Figure 1.1). The project aims to (i) strengthen local capacity for inclusive community-based tourism (CBT) development and promotion; (ii) support tourism and commercial agricultural livelihood activities; and (iii) enhance community-based public facilities and services. Initially, the project will promote domestic tourism, which is less effected by COVID-19 related travel restrictions. As Cambodia's borders open to international travel, the project focus will shift to promoting intra-regional tourism.

**Figure 1.1: Locations of Proposed Project**



2. Preah Vihear (PV) site is in northwest bordering Thailand, about 540 kilometers north of Phnom Penh, the modern capital city of Cambodia. It has the UNESCO world heritage site, Preah Vihear temple complex. In 2018, the Preah Vihear heritage site received 130,000 tourists (20% international, 80% national). The nearby village (Decho Thormcheat) is about 11 km south of the temple and about 70 kilometers from Preah Vihear City (See Figure 1.2), established about 10 years ago where most of the project activities will take place.

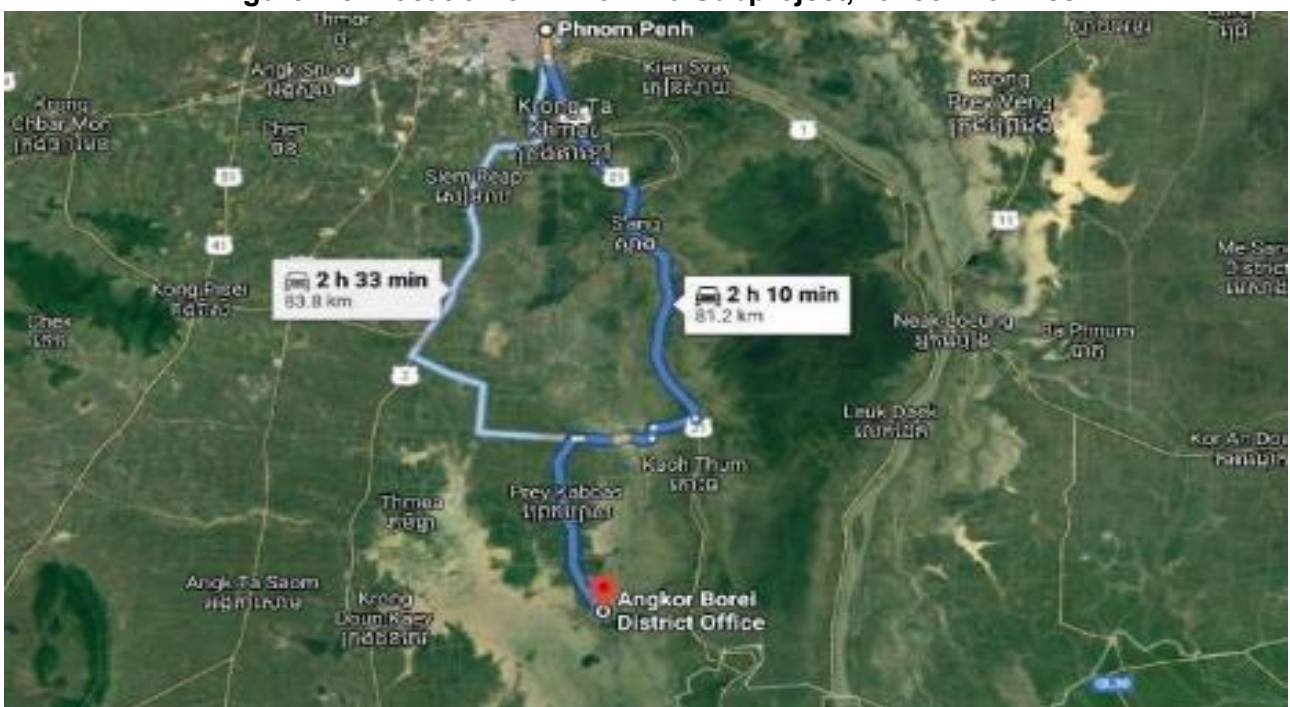
**Figure 1.2: Location of Decho Thormcheat Subproject, Preah Vihear Province**



3. Phnom Da temple is located in Prek Ta Phor village, Kork Thalork commune, Angkor Borei district, about 24 kilometers east of Takeo provincial town by water canal or about 81 kilometers south of Phnom Penh by the road.

4. Takeo province (TK), bordering Vietnam to the south, is about 81 km southeast of Phnom Penh. It is often recognized as “the cradle of the Cambodian civilization,” and contains several significant pre-Angkorian sites built between the 5th and the 8th century. Phnom Da is one of these cultural and historical sites that has been renovated to provide visitors a place to relax or research Cambodian history. The Phnom Da site had 20,000 tourists (10% international, 90% national). The project activity will include Phnom Da temple and the nearby Prek Taphor village in Angkor Borei district (See Figure 1.3).

**Figure 1.3: Location of Phnom Da Subproject, Takeo Province**



5. The project is classified Category B for environment under the ADB Safeguard Policy Statement (SPS, 2009), requiring an initial environmental examination (IEE). This IEE has been prepared based on information in the individual feasibility study reports (FSRs), search of relevant literature and existing information, on-site data collection, sample testing and assessments by the TRTA environmental consultant team. Based on the IEE, an environmental management plan (EMP) is developed to manage adverse environmental impacts and related issues in the construction and operational phases of the project.

## 1.2. Project Activities

6. The project will support tourism development through the following outputs:

- (i) **Output 1: Local capacity for community-based tourism development and promotion strengthened.** This output will benefit villagers by enhancing their capacity to provide tourism services. Under this output, the project will establish one CBT group in each project village, ensuring women's representation, to become local tour operators and service providers. Membership of the CBT groups will be open to all villagers throughout the life of the CBT groups. A national consulting firm will be recruited to support local communities to establish and manage CBT operations. The executing and implementing agencies will support the CBT groups to acquire certification and legal registration. Training will be provided on CBT group formation, guiding and servicing, hospitality, housekeeping, food and lodging hygiene, public health and COVID-19 prevention, environmental and waste management, and maintenance of the tourism infrastructure to be provided under output 3. While the CBT groups will have ownership of the tourism infrastructure, they will have the option to enter into sublease agreements with local businesses to have them manage restaurants at the tourist centers. The project will also provide a three-year marketing campaign to attract tourists. Trainings on sanitation and hygiene will follow the government's latest health and safety standards, which are updated in response to COVID-19.
- (ii) **Output 2: Community-based tourism and livelihood activities implemented.** The project will support villagers, including female headed households and those from vulnerable groups, to establish tourism livelihoods, such as guiding services, restaurants, transport operations, equipment rental, homestay operations, and handicraft and souvenir manufacturing. The project will also support high-value agriculture in both project villages, such as cucumbers, long beans, watermelons, chicken, tilapia, and freshwater prawns, by providing agricultural trainings and equipment. With proper marketing, high-value agriculture will be synergic with tourism and stabilize income during the low tourist season. Agritourism interventions will be supported in Techo Thamacheat village (for tilapia farming) and in Prek Taphor village (for prawn farming) so that, as an alternative to dine-in services at tourist centers, tourists can catch and grill fish and prawns after completing hatchery tours.
- (iii) **Output 3: Community-based public facilities and services enhanced.** As the project villages lack tourism infrastructure, the project will provide the necessary infrastructure to enhance the villages' appeal to tourists. The construction will include female laborers. As basic connectivity infrastructure is already in place, the project will focus on "last-mile" tourism infrastructure, including two tourist centers (with parking lots, restrooms, restaurants, and souvenir outlets); walking tracks; small piers; and support for homestays. The project will also implement CBT-managed waste collection services on a cost-recovery basis and support the expansion of potable water services to about 3,000 households in Techo Thamacheat village and surrounding areas, where the availability of clean water is identified as a constraint to

tourism development.<sup>1</sup> Asset maintenance will be performed by the CBT groups and farmers who will receive relevant training under output 1.

7. These outputs will result in the following outcome: tourism developed and income increased in project villages, and the following impacts: tourism products and destination diversified. Specific activities in two project areas are described in below tables with technical details further elaborated.

**Table 1.1: Preah Vihear Project Intervention**

<b>Project Sites</b>	<b>Description</b>
East Side O Svay Lake	O Svay Lake Tourist Facilities include kiosks for tourists, interpretation center, restaurants, car parking, restroom facilities with septic tank, small pier for Kayaks and longtail tourist boats. All toilets will multi-chamber septic tanks as the default design for all facilities.
Decho Thomacheat Village	<p>Homestay 5 pilot homestays (including renovated kitchens and bedrooms and improvements to guest amenities). The homestays will be utilized Khmer architectural and eco-friendly designs (natural materials). The homestays will include an integrated farming system. The project will help to build/improve toilets and related septic tanks in the pilot homestay.</p> <p>Jasmine cultivation are purchased by worshipers and tourists who visit the temple. Jasmine can also be used to produce tea and scented potpourri. The project plans to support water-saving techniques, e.g., water storage tanks, drip irrigation, and the use of organic fertilizers. Beneficiaries can be trained to produce herb tea sold in natural packaging (Smok).</p>
Decho Thomacheat Village	<p>Vegetation production will cover several crops: cucumber, long beans, and watermelon. The project will support the 20 farmers in Choam Khsant District Preah Vihear and 20 farmers in Angkor Borei District in Takeo. The project will support improved drip irrigation systems that require less water than existing practices.</p> <p>The intervention contributes to water conservation at the O Svay Lake, which serves as a reservoir as well as protection of the groundwater aquifer in the village and the contribution to climate change mitigation.</p> <p>Fishing Raising - Tilapia (can be included in homestay for up to 5 families). The project could support the technical fish raising training to reduce the mortality ratio from 30% to 10%. As well as to facilitate access to fish fingerlings which will be produced by NAPV – Japan JV fish hatchery which is being currently constructed. The site is near the villages.</p>
Decho Thomacheat Village	<p>Filtered Water Suppliers. The project will support and additional two Teuk Saat 1001 O-We water filtration facilities which will provide potable drinking water to an additional 600 families and tourists visiting the O Svay lake tourist facilities. As noted, that the water source of Teuk Saat 1001 is from O Svay Lake.</p> <p>CBT Waste Collection and Recycling This initiative will support the implementation of collection and recycling facilities at O Svay Lake, based on Banteay Chhmar CBT model.</p>

8. Regarding septic tank to treat wastewater from household, Ministry of Rural Development has issued the guideline for toilet installation at rural area including septic tank. As village land use planning, one plot of land (one hectare) in Decho Thormcheat village was reserved for solid waste dumping site. However, it is not operational and there is no formal waste collection service provided at this time without public funding for it in foreseeable future. Therefore, in order to prevent and protect environmental pollution due to increasing waste generation from tourism activity, the project is promoting the solid waste segregation through training in community and school while the garbage bin will so provide in designed area. The good practice of solid waste management in Banteay Chhmar Community-based tourism will be model for this project while the project does not have the funds to support civil works and operations of a sanitary landfill, the project could provide basic

<sup>1</sup> Potable water services are currently not available in Techo Thamacheat village. Potable water services are already in place in Prek Taphor village, Angkor Borei district.

technical support to the Provincial Department of Environment to further developed the landfill to achieve basic environmental standards for sanitary landfill.

**Table 1.2: Takeo Project Intervention<sup>2</sup>**

<b>Project Sites</b>	<b>Description</b>
Angkor Borei	<b>Angkor Borei Tourist Center</b> – Interpretation center to be built close to existing museum and include an interpretation center, car park, restaurant, souvenir outlet (inside restaurant), restrooms, boat landing, and cycling and walking paths. All toilet facilities will include triple chamber septic tanks. For tourists sites we will use compact wastewater treatment. Homestay 5 pilot homestays including same activities as in PV project village.
Asian Royal Palace (Komnou Pagoda)	The Archaeological Excavation Site is a nationally significant site protected under MOCFA the project will support stairs, a viewing platform and an information stand so tourists can view the excavation.
Angkor Borei Prawn Farm	Fresh Water Prawn Farming support for established hatcheries and local prawn farms. There are two existing Freshwater Prawn farms at Angkor Borei (AB). The oldest farm has been established for 13 years and the original fingerling operation has been supported by JICA with well supported infrastructure and equipment. The project will work provide equipment for developing new hatcheries. The site will be confirmed after project effectiveness.
Phnom Da	Boat Landing, stairs, viewing Platforms. Project can support boat landing pier, temple access, interpretation and directional signage, stairs and viewing platforms (with safety rails) and cycling and walking paths. Waste management equipment and services to be provided by the project as explained in below text.
Phnom Borei	Boat Landing, Stairs, Viewing Platforms. The project will support boat landing pier stairs and viewing platforms (with safety rails) and walking paths. Waste management equipment and services to be provided.

Source: Preliminary Feasibility Study (PFS), September 2020.

9. Agriculture activities considered by the project for support, such as fish/prawn ponds, planting of herb, flowers and vegetable will be in small scale and agriculture training. In order to response with fertilizer or pesticide used, the integrated pest management will be applied in the project training course by the enterprises to be partnered with these small agro-business under the project.

10. The compact wastewater treatment for all public tourist facilities (visitor centers, museums etc.) includes collection and disposal method. Fecal wastes and wash water are discharged all into septic tank. These will be ended up with 2-3 chamber septic tanks to remove SS and BOD through settlement and biodegradation. The septic tanks will be de-sludge according to the domestic requirements. The treated wastes are usually collected by farmer to use as fertilizer if needed. For homestay wastewater, a ventilated improved pit (VIP) latrine has been applied as it is the existing practice at project site. The VIP latrine has a ventilation pipe installed on the site of the latrine, to vent gases and associated odors out of the latrine to reduce odors. In the VIP latrine system, the solids and urine enter a pit. once it is full it is either covered with soil with a tree planted over the pit.

11. For VIP latrines, the vent pipe should be at least 100 cm in diameter, and extend at least 50 cm above the level of the roof of the latrine. The cabin should be relatively dark so that flies will fly towards the light at the top end of the pipe rather than out through the cabin. Because air should flow into the defecation hole and out of the pipe, the defecation hole should not have a cover. It is important for the door – which should have a space for air to pass into the cabin. It can also be constructed with “twin” or “double” pits, that is, with two pits. One of the pits is used until it is full, then the other is used while the excreta in the first pit decomposes for six months to two years. Since almost all of pathogens die during decomposition, so the matter can be safely handled and largely used as fertilizer.

12. In term of garbage collection in Takeo province, solid waste collection has covered only market and/or nearby resident area and disposed in an open dump. In practice for local people and villagers, at present the waste is burned or bury close to house individually.

<sup>2</sup> Project activity is updated by January 2021

## II. LEGAL FRAMEWORK FOR ENVIRONMENT

### 2.1. Domestic Legal and Policy Framework for Environmental Protection

13. The Government of Cambodia has established specific laws and regulations for forests, protected areas, and land management to ensure sustainable development. The key elements of the legal and policy framework for the project include the following:

- (i) Law on Environmental Protection and Natural Resources Management, enacted by National Assembly, 1996, and promulgated by Preah Reach Kram/NS/RKM-1296/36. This law has the following objectives:
  - To protect and promote environment quality and public health through prevention, reduction and control of pollution,
  - To assess the environmental impacts of all proposed projects prior to the issuance of a decision by the Government,
  - To ensure the rational and sustainable conservation, development, management and use of the natural resources of the Kingdom of Cambodia,
  - To encourage and provide possibilities for the public to participate in the protection of environment and the management of the natural resources, and
  - To suppress any acts that cause harm to the environment.
  - Under this law, the developers or project owners need to prepare an Initial Environmental Impact Assessment (IEIA) or a full Environmental Impact Assessment (EIA) report for their proposed or existing development projects
- (ii) Law on Natural Protected Areas enacted by National Assembly, 2008 promulgated by Preah Reach Kram/NS/RKM/0208/007;
- (iii) Law on Fisheries, enacted by National Assembly, 2006 and promulgated by Preah Reach Kram/SN/RKM/0506/011 (2006);
- (iv) Law on Forestry, enacted by National Assembly, 2002 promulgated by Preah Reach Kram/NS/RKM/0802/016;
- (v) Law on Land enacted by National Assembly, 2001 promulgated by Preah Reach Kram/NS/RKM/0801/14;
- (vi) Law on Water Resource Management, enacted by National Assembly, 2007 and promulgated by Preah Reach Kram/SN/RKM/0607/016;
- (vii) Land Law on Traffic, enacted by National Assembly 2014, promulgated by Preah Reach Kram/SN/RKM/0115/001 (2015)
- (viii) Law on Expropriation 2010 enacted by National Assembly 2009 and promulgated by Preah Reach Kram /No. NS/RKM/0210/003;
- (ix) Land Law on Traffic enacted by National Assembly, 2014 promulgated by Preah Reach Kram/SN/RKM/0115/001; and

14. Key directives in support of the Law on Environmental Protection and Natural Resources Management include:

- (i) Law on Protected Areas (2008)
- (ii) Sub-decree on Water Pollution Control (2009):
  - Annex 2: Effluent standard for pollution sources discharging wastewater to public water areas or sewer;
  - Annex 4: Water quality standard in public water areas for biodiversity conservation; and
  - Annex 5: Water quality standard in public water areas for public health protection.
- (iii) Sub-decree on Solid Waste Management (1999)
- (iv) Sub-decree on Air Pollution Control and Noise Disturbance (2000)
- (v) Sub-decree on Garbage and Urban Solid Waste Management (2015)
- (vi) Sub-Decree on Urban Solid Waste Management, No. 113, NKR-PR 2015
- (vii) Sub-decree on No. 235 on Drainage System Management and Waste Water Treatment Plan (MoI, MPWT and MoE, 2017)
- (viii) The Implementation of the Protection of Cultural Heritage; Prakas No. 021 on the Classification of Environmental Impact Assessment for Development Projects dated 03 February 2020.

15. Other pertinent regulations, policy, or guidelines for the project are as follows:
- (i) Technical Guidelines on Garbage and Urban Solid Waste Management (MOE, 2016)
  - (ii) Directive on Industrial Sludge Management (MOE, 2000);
  - (iii) Directive on Industrial Hazardous Waste Management (MOE, 2000);
  - (iv) Directive on Managing Health Wastes in the Kingdom of Cambodia (MOH, 2008)
  - (v) Preach Reach (Kep) Creation of Fisheries Communities (2005); and
  - (vi) Guidelines on establishment of protected forests, natural resources conservations, wildlife protection areas, protected forest for biodiversity conservation (2002 and 2004).
  - (vii) Management of Means of Water Transport 00067, RGC, MPWT Circular #003 (2011)
16. Government Occupational and Community Safety and Health (OHS) guidelines follow the OHS Programme for Cambodia (2010-2013) that was developed by the International Labor Organization (ILO). The draft guidelines provide the framework for instituting OHS at the workplace and in the community. The OHS guidelines for Cambodia will likely need to be supplemented with the international the IFC EHS/OHS Guidelines for Construction and Decommissioning, Waste Management Facilities, and Toll Roads. The contractor will have to identify the appropriate national and IFC OHS guidelines in their bid documents for joint review by the contractor and IA (Implementation Agency).
17. Additionally, the National MoH's guideline on Covid-19 and National Guideline for Infection prevention and control for healthcare facilities of Cambodia will be applied due to current situation Covid-19 outbreak to reduce the incidence and risk of preventable Nosocomial Infection (NI). Occupational and community health and safety, as laid out in the EHS guidelines, will be a cross-cutting assessment for the subprojects.

## **2.2. Protected area establishment and management**

18. Protected areas (PA) in Cambodia have been administered since 1993 by the Ministry of Environment (MoE). There are currently a total of 23 PA and wildlife conservation areas countrywide. Since promulgation of the Law on Natural Protected Areas in 2008, protected and conservation areas have been classified into eight categories, with the character and protection purpose of each category being defined in the law. The eight categories of natural protected areas (and their purpose) are:
- (i) National Park – A natural area in land and/or water territories, which is established to:
    - (a) Protect the area's role or roles in the ecosystem for the benefits of people of all generations;
    - (b) Limit the use that may harm or destroy biological resources, natural resources, cultural resources, and functions/roles of the area in relation to the objectives of the established area.
    - (c) Serve as bases for recreation, visits, education, research, and belief, provided that these activities do not cause threats to the natural environmental and local culture.
  - (ii) Wildlife sanctuary – An area in land and/or water territories, which requires active interventions for management purposes to ensure maintenance of habitats and/or to meet necessary conditions for any species of animals or plants.
  - (iii) Protected landscape – An area in land and/or water territories, in which human interactions with nature create uniqueness in natural beauty or ecology or culture, and generally abundant in biological resources. Maintaining the interaction that is traditional is important to age and life for defence, maintain and development of such area.
  - (iv) Multi-purpose-use management area – An area in land and/or water territories, which is rich in natural resources that are intact and require management activities to ensure long-term protection and maintenance of biological resources and ecosystem. In the meantime, it provides natural products and services for use to meet the community needs.
  - (v) Biosphere reserve – an area of biodiversity conservation and support of sustainable development and activities. The role reserve, Tonle Sap, is close to Battambang and

- Kampong Thom provinces. This reserve is included as a special entity due to its national importance;
- (vi) Natural Heritage Site – natural or semi-natural sites unique in ecosystem, beauty or cultural value;
  - (vii) Marine park – coastal areas with plants, wildlife and fish, with historical or cultural value; and
  - (viii) Ramsar Site – areas recognized for the importance of their wetlands and surrounding environment, including wildlife, habitats and ecosystems. It is estimated that 30% of Cambodia’s surface may be considered as wetland, and other areas may be brought under the Ramsar Convention in future.

19. Article 41 of the Law on Natural Protected Areas provides that protected and conservation areas shall be protected from any negative impacts. No development activities or projects are allowed in PA other than those expressly approved by MoE in terms of benefits to natural resource conservation and management purposes. Article 11 of this Law also stated that each protected area shall be divided into four (4) management zoning system which are summarized in Table 2.1 with particular reference to proposed activities under this project.

**Table 2.1: Cambodian requirements for eight categories of natural protected areas**

<b>Categories</b>	<b>Structures</b>	<b>Activities</b>	<b>Other requirements</b>
<b>Core Zone:</b> Management area(s) of high conservation values containing threatened and critically endangered species, and fragile ecosystems.	All structures not allow	All development activity not allow.	Access to the zone is prohibited except the Nature Conservation and Protection Administration's officials and researchers who, with prior permission from the Ministry of Environment, conduct nature and scientific studies for the purpose of preservation and protection of biological resources and natural environment with the exception of national security and defense sectors
<b>Conservation zone:</b> management area(s) of high conservation values containing natural resources, ecosystems, watershed areas, and natural landscape located adjacent to the core zone.	All structures not allow	All development activity not allow.	Access to the zone is allowed only with prior consent of the Nature Conservation and Protection Administration at the area with the exception of national security and defense sectors. Small-scale community uses of non-timber forest products (NTFPs) to support local ethnic minorities' livelihood may be allowed under strict control, provided that they do not present serious adverse impacts on biodiversity.
<b>Sustainable use zone:</b> management area(s) of high economic values for national economic development and management, and conservation of the protected area(s) itself thus contributing to the local community, and indigenous ethnic minorities' livelihood improvement.	All structure does not have MoE/authority permission	All activity does not have MoE/authority permission	After consulting with relevant ministries and institutions, local authorities, and local communities in accordance with relevant laws and procedures, the Royal Government of Cambodia may permit development and investment activities in this zone in accordance with the request from the Ministry of Environment.
<b>Community zone:</b> Management area(s) for socio-economic development of the local communities and indigenous ethnic minorities and may contain existing residential lands, paddy field and field garden or swidden (Chamkar).	All structure does not have MoE/authority permission	All activity does not have MoE/authority permission	Issuing land title or permission to use land in this zone shall have prior agreement from the Ministry of Environment in accordance with the Land Law.



### 2.3. Technical Guidelines and Standards for ambient and discharge

20. This section details the existing Cambodian laws and regulations for environmental standards. It also includes comparison with standards for best practice in pollution control in IFC Environmental Health and Safety General Guidelines.

#### 2.3.1. Water pollution control sub-decree

21. The sub-decree No 27 ANRK.BK on Water Pollution Control dated 13 October 2009. The purpose of this sub-decree is to regulate water pollution control in order to prevent and reduce the water pollution of public water so that the protection of human health and the conservation of biodiversity can be ensured. This sub-decree applies to all sources of pollution and all activities causing pollution of public water areas. The sub-decree also provides the pollution types, effluent standards, and water quality standards in different areas.

22. In addition, in 2018, the Ministry of Environment (MoE) issues the Declaration (Prakas) on the term of reference for environmental assessment of infrastructure and tourism development project. Ground and surface water quality Standards for environmental assessment of Tourism Development Project was issued in the Prakas.

23. The Royal Government of Cambodia has established a comprehensive policy on National Water Supply and Sanitation, covering both urban and rural water supplies. Based on this policy and to ensure access to safe drinking water to all people, it required the Drinking Water Quality Standard (DWS) for Cambodia. These standards are developed by an inter-ministerial process initiated by Ministry of Industry, Mines and Energy and concerned ministries with support from the World Health Organization.

24. It should be noted that some of the DWS differ from WHO guideline values. These differences were carefully noted and debated during the development of these Standards. In particular, the Arsenic standard of 50 ppb is higher than the WHO guideline value of 10 ug/l. The higher level of 50 ug/l was selected in recognition of several key facts: 1) it will be very difficult and costly to monitor and enforce a standard of 10 ug/l in Cambodia at the present time; 2) the potential health risk of ingesting water with arsenic levels between 10 and 50 ug/l is low relative to the risk posed by water with bacteriological contamination, and more attention should be placed on monitoring and enforcing the latter standard in Cambodia; and 3) other countries in the region are using 50 ppb as their standard. It was concluded that while 10 [ug/l] may be a desirable long-term goal for arsenic in drinking water, it was an impracticable level to use in Cambodia at the present time.

**Table 2.2: Ground Water and Drinking Water Quality Standard**

No.	Parameter	Unit	Groundwater	Drinking Water Quality <sup>a</sup>
1	pH	-	6.5-8.5	6.5-8.5
2	Electrical Conductivity (EC)	µs/cm	500-1500	NV
3	Total Dissolved Solid (TDS)	mg/l	<800	800
4	Turbidity	NTU	<5.0	5
5	Total Hardness (as CaCO <sub>3</sub> )	mg/l	<300	300
6	Chloride (Cl <sup>-</sup> )	mg/l	<250	250
7	Fluoride (F <sup>-</sup> )	mg/l	<1.5	1.5
8	Nitrate (NO <sub>3</sub> )	mg/l	<50	50
9	Sulphate (SO <sub>4</sub> )	mg/l	<250	250
10	Aluminum (Al)	mg/l	<0.2	0.2
11	Arsenic (As)	mg/l	<0.05	0.05
12	Cadmium (Cd)	mg/l	<0.003	0.003
13	Chromium (Cr-total)	mg/l	<0.05	0.05
14	Iron (Fe)	mg/l	<0.3	0.3
15	Manganese (Mn)	mg/l	<0.1	0.1
16	Mercury (Hg-total)	mg/l	<0.001	0.001
17	Thermo tolerant Coli form (E-Coli)	MPN/100ml	0	0
18	Total Coliform	MPN/100ml	0	0

MPN = Most Probable Number; NV = No value.

<sup>a</sup> Cambodian Drinking Water Quality Standard, 2004. This standard was adopted from WHO standard.

**Table 2.3: Surface Water Quality Standard of MoE**

No.	Parameter	Unit	Surface Water Standard*
1	pH	-	6.5-8.5
2	Dissolved Oxygen (DO)	mg/l	7.5-2.0
3	Total Dissolved Solid (TDS)	mg/l	<1000
4	Total Suspended Solid (TSS)	mg/l	25-100
5	Biochemical Oxygen Demand (BOD)5	mg/l	1.0-10
6	Chemical Oxygen Demand (COD)Mn	mg/l	<50
7	Oil and Grease	mg/l	<5.0
8	Detergent (MBAS)	mg/l	<5.0
9	Sulphate (SO4)	mg/l	<300
10	Total Nitrogen (TN)	mg/l	0.1-0.6
11	Total Phosphorus (TP)	mg/l	0.005-0.05
12	Arsenic (As)	mg/l	<0.01
13	Cadmium (Cd)	mg/l	<0.001
14	Iron (Fe-total)	mg/l	<1.0
15	Lead (Pb)	mg/l	<0.01
16	Mercury (Hg-Total)	mg/l	<0.0005
17	Total Coli form	MPN/100ml	<5000

\* The class for public health protection applies to this project and is presented in the table.

**Table 2.4: Effluent Standard for Discharging Wastewater to Public Water Areas or Sewer**

Parameter	Unit	Allowable limits for pollutant substance discharging to		EHS guidelines <sup>3</sup> Standard <sup>3</sup>
		Protected public water area	Public water area and sewer	
1. Temperature	°C	<45	<45	NV
2. pH		6 – 9	5 – 9	6 – 9
3. BOOD5 (5 days at 200 C)	mg/l	<30	<80	30
4. COD	mg/l	<50	<100	125
5. Total Suspended Solids	mg/l	<50	<80	50
6. Total Dissolved Solids	mg/l	<1000	<2000	NV
7. Grease and Oil	mg/l	<5	<15	10
8. Detergents	mg/l	<5	<15	NV
9. Phenols	mg/l	<0.1	<1.2	NV
10. Nitrate (NO3)	mg/l	<10	<20	NV
11. Chlorine (free)	mg/l	<1.0	<2.0	NV
12. Chloride (ion)	mg/l	<500	<700	NV
13. Sulphate (as SO4)	mg/l	<300	<500	NV
14. Sulphide (as Sulphur)	mg/l	<0.2	<1.0	NV
15. Phoshate (PH4)	mg/l	<3.0	6>0	NV
16. Cyanide (CN)	mg/l	<0.2	<1.5	NV
17. Barium (Ba)	mg/l	<4.0	<7.0	NV
18. Arsenic (As)	mg/l	<0.1	<1.0	NV
19. Tin (Sn)	mg/l	<2.0	<8.0	NV
20. Iron (Fe)	mg/l	<1.0	<20	NV
21. Boron (B)	mg/l	<1.0	<5.0	NV
22. Manganese (Mn)	mg/l	<1.0	<5.0	NV
23. Cadmium (Cd)	mg/l	<0.1	<0.5	NV
24. Chromium (Cr)	mg/l	<0.2	<1.0	NV
25. Chromium (Cr)+6	mg/l	<0.05	<0.5	NV
26. Copper (Cu)	mg/l	<2.0	<1.0	NV
27. Lead (Pb)	mg/l	<0.1	1	NV
28. Mercury (Hg)	mg/l	<0.002	<0.05	NV
29. Nickel (Ni)	mg/l	<0.2	<1.0	NV
30. Selenium (Se)	mg/l	<0.2	<1.0	NV
31. Silver (Ag)	mg/l	<0.1	<0.5	NV

<sup>3</sup> Table 1.3.1 Indicative Values for Treated Sanitary Sewage Discharges

Parameter	Unit	Allowable limits for pollutant substance discharging to		EHS guidelines' Standard <sup>3</sup>
		Protected public water area	Public water area and sewer	
32. Zinc (Zn)	mg/l	<0.1	<3.0	NV
33. Molybdenum (Mo)	mg/l	<0.1	<1.0	NV
34. Ammonia (NH <sub>3</sub> )	mg/l	<5.0	<7.0	NV
35. DO	mg/l	>2.0	>1.0	NV
36. Polychlorinated Byphenyl	mg/l	<0.003	<0.003	NV
37. Calcium	mg/l	<150	<200	NV
38. Magnesium	mg/l	<150	<200	NV
39. Carbon Tetrachloride (CCl <sub>4</sub> )	mg/l	<3	<3	NV
40. Hexachloro Benzene (C <sub>6</sub> Cl <sub>6</sub> )	mg/l	<2	<2	NV
41. DTT	mg/l	<1.3	<1.3	NV
42. Endrin	mg/l	<0.01	<0.01	NV
43. Dieldrin (C <sub>12</sub> H <sub>8</sub> Cl <sub>6</sub> O)	mg/l	<0.01	<0.01	NV
44. Aldrin (C <sub>12</sub> H <sub>8</sub> Cl <sub>6</sub> )	mg/l	<0.01	<0.01	NV
45. Isodrin (C <sub>12</sub> H <sub>8</sub> Cl <sub>6</sub> )	mg/l	<0.01	<0.01	NV
46. Perchloro Ethylene (C <sub>2</sub> Cl <sub>4</sub> )	mg/l	<2.5	<2.5	NV
47. Hexachloro Butadiene	mg/l	<3	<3	NV
48. Chloroform (CHCl <sub>3</sub> )	mg/l	<1	<1	NV
49. 1.2 Dichloro Ethylene (C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> )	mg/l	<2.5	<2.5	NV
51. Trichloro Benzene (C <sub>6</sub> H <sub>3</sub> Cl <sub>3</sub> )	mg/l	<2	<2	NV
52. Hexachloro Cyclohexene	mg/l	<2	<2	NV

Note: The class for protected public water under Cambodian discharge standard will apply to this project.  
NV=No Value.

### 2.3.2. Air quality and pollution

25. The sub-decree N<sup>o</sup> 42 ANRK.BK on Air Pollution Control and Noise Disturbance is dated July 10<sup>th</sup>, 2000. Its purpose is to protect the quality of environment and public health from air pollutants and noise pollution (below tables). This sub-decree applies to all movable sources and immovable sources of air and noise pollution. It is also applied to evaluation of ambient air quality and to monitoring of air pollution status in Cambodia.

**Table 2.5: Ambient Air Quality Standard**

Parameters	Cambodian				IFC-EHS Guidelines <sup>a</sup> WHO interim target 1 µg/m <sup>3</sup>
	Period 1h Average mg/m <sup>3</sup>	Period 8h Average mg/m <sup>3</sup>	Period 24h Average mg/m <sup>3</sup>	Period 1year Average mg/m <sup>3</sup>	
Carbon monoxide (CO)	40	20	-	-	
Nitrogen dioxide (NO <sub>2</sub> )	0.3	-	0.1	-	200 (1 hr)
Sulfur dioxide (SO <sub>2</sub> )	0.5	-	0.3	0.1	125 (24hr)
Ozone (O <sub>3</sub> )	0.2	-	-	-	100 (8 hr)
Lead (Pb)	-	-	0.005	-	
Particulates (it is PM <sub>10</sub> or TSP in Cambodia?)	-	-	0.33	0.1	150 (PM <sub>10</sub> 24hr) 75 (PM <sub>2.5</sub> 24hr)

<sup>a</sup> Environmental, Health, and Safety Guidelines, IFC.

**Table 2.6: Maximum permitted noise level in public and residential area (dB (A))**

Location	Cambodian Standard			IFC-EHS Guidelines	
	06:00 to 18:00	18:00 to 22:00	22:00 to 06:00	Day 7.00-22.00	Night 22.00-7.00
Silence Area Hospital; Library, School, Nursery	45	40	35	55	5
Resident Area Hotel; Administration place, House	60	50	45		
Commercial, Services Areas and mix	70	65	50	70	70
Small Industrial factories intermingling in residential areas	75	70	50		

Source: Annex 6 of Sub-Decree on Air Pollution Control and Noise Disturbance, 2000

Note: This standard is applied to control of noise level of any source of activity that emitted noise into the public and residential areas.

26. The sub-decree also lists acceptable noise levels for motor vehicles, in the below table.

**Table 2.7: Maximum Permitted Vehicle Noise in Public and Residential Area**

Category of Vehicle	Maximum Noise Level Permitted [dB(A)]
Motorcycles, cylinder capacity of the engine does not exceed 125 cm <sup>3</sup>	85
Motorcycles, cylinder capacity of the engine exceeds 125 cm <sup>3</sup>	90
Motorized tricycles	90
Cars, taxis, passenger vehicle of not more than 12 passengers	80
Passenger vehicle constructed for carriage of more than 12 passengers	85
Truck permitted maximum weight does not exceed 3.5 tons	85
Truck permitted maximum weight does not exceed 3.5 tons	85
Truck engine is more than 150 kilowatt	89
Tractor or any other truck not elsewhere classified or described here	91

Source: Sub-Decree on Air Pollution Control and Noise Disturbance, 2000

### 2.3.3. Soil/Sediment Quality

27. Under Article 7 of the Sub-Decree on Solid Waste Management: “the disposal of waste in public sites or anywhere that is not allowed by authorities shall be strictly prohibited”. There are no quantitative parameters given but good sensible practice is expected. Such practices would include:

- (i) All general waste and food waste should be removed to a government approved landfill;
- (ii) All demolition waste must be removed to a government-approved location;
- (iii) All waste oil and grease should be disposed by a registered sub-contractor. The final destination of the oily wastes should be established

### 2.3.4. Hazardous Waste Management

28. There is no specific regulation for hazardous waste management and substances in Cambodia. However, this aspect is in the Sub-Decree on Water Pollution Control Annex 1, and Sub-Decree on Solid Waste Management, which give details of classifications of what are defined as hazardous wastes and substances. Any hazardous wastes and substances must be stored correctly and only disposed in a manner approved by MoE.

## 2.4. Regulations on EIA and consultation

29. Environmental impact assessment (EIA) in Cambodia is guided by the Royal Government of Cambodia (RGC) sub-decree No 72 ANRK.BK on EIA and Prakas No. 021 on the Classification of Environmental Impact Assessment for Development Projects dated 03 February 2020. In compliance with the sub-decree, all individuals, private companies, joint-venture companies, public companies, ministries and government agencies are obliged to conduct an EIA for proposed projects or activities, which must be pre-submitted for approval from the Ministry of Environment (MoE). The decree provides a list of project types that proponents use to screen projects for requiring either an EIA or Initial EIA (IEIA) which means simplified EIA for projects with medium level impacts. For projects with minimal to low adverse impacts, the requirements are get the Environmental Protection Contract/EMP approval from Ministry of Environment.

30. According to Prakas No. 120, issued by Ministry of Environment on April 11, 2018, on the deployment model of working conditions for infrastructure and tourism development, the planning of public participation consist of three stages: (1) information dissemination at the project site, (2) the interviews with local authorities, affected communities and stakeholders, and (3) the consultation workshops.

31. According to domestic EIA classification in Prakas No.21, dated on February 2020, no ESIA/IESIA is required for this project because each subproject activity is less than 10 ha. Consultations with the Provincial Departments of Environment (PDoE) of both PV and Takeo also

indicated the proposed project will not require either an IEIA or EIA, but the project is required to prepare the EMP and get approval on EMP from MoE.

## 2.5. Regulations on Cultural resource protection

32. Law on the Protection of Cultural Heritage signed by King Norodom Sihanouk, **Preah Reach Kram**<sup>4</sup>: dated January 25, 1996. In its *Article 1*, The purpose of this law is to protect the national cultural heritage and cultural property in general against illegal destruction, modification, alternation, exportation or importation. *Article 2* states that the national cultural heritage comprises cultural property created or discovered on national territory.

33. **Sub-Decree**<sup>5</sup>: on the Protection of Cultural Heritage signed by Prime Minister Hun Sen, dated September 17, 2002. *Article 1*, The purport of this sub-decree is implementation of cultural heritage protection through definition of cultural property and archaeological excavations. *Article 2*, It is to regulate the trade in cultural property and control the exporting and importing of cultural property.

34. **Decision (Sackdei Samrach)**: Decision No. 01 on the designation of the three areas to protect the temple complex in the provinces outside the of Angkor area, Siem Reap dated on January 06, 1997 by Ministry of Culture and Fine Arts. The relevant articles to the project are:

- (i) Article 1: Establish, identify and manage the protection of ancient temples, historical and prehistoric sites and historical sites in three zones: Zone 1: Temple zone; It is strictly forbidden to touch the boundary at a distance of 30 meters from the outer wall of the temple. If there is a pond around, set a distance of 30 meters from the outer pond of the temple enclosure wall. This area is not allowed to plant trees to avoid falling trees pressing on the temple enclosures. Zone 2: Is an Archeological park Zone; must be protected and maintained. This area is designated 300 meters from the boundary of the Zone 1. Zone 3: is the land use zone according to the regulations. It is bordered by 1500 meters outside the temple enclosure wall or 1500 meters from the pond around the outside enclosure.
- (ii) Article 2:
  - Zone 1: Areas must be strictly protected from harassment, even in the air, on the surface, such as underground construction of all kinds of small and large buildings in this area is prohibited. It is forbidden to pioneer, clear the forest, plant or cultivate other crops...
  - Zone 2: Areas to be maintained, protected and prohibited as follows:
    - Prohibit damage to natural resources, forests and cultural heritage in this area
    - It is forbidden to build houses or public buildings in the area. Can be built only with the permission of the Ministry of Culture and Fine Arts (MoCFA).
  - Zone 3: An area to be preserved as a resort and park for environmental protection, history and archeology: New construction is prohibited in the area. Except in special cases with the permission of the Ministry of Culture and Fine Arts, the construction shall not exceed 6 meters. Make a boundary pillar named after the temple.

35. PCR in Takeo project area have not yet been dividing the zones on cultural protection. Therefore, proposals in Takeo site need to seek opinion and permission from MoCFA and the material should not harmful and impact direct to heritage and preserve natural and cultural landscape. MoCFA already endorsed these proposals.

36. The heritage area in PV province has divided into 4 zones based on Royal Decree No. 0811/752 dated on 11 August 2011). Based on Sub-decree No. 42 dated 21 January 2014, the zoning function and requirements are summarized in below table. The project area in PV province falls in zone 3(a), thus needs to follow the requirements under Royal Decree for NA SP No.0811/752 described in Table 2.8. So far, all designed activities in PV area comply with these rules.

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<sup>4</sup> Preah Reach Kram, Norodom Sihanouk, Phnom Penh, January 25, 1996

<sup>5</sup> Sub decree Respecting Implementation of Cultural Heritage Protection, Royal Government of Cambodia, No.98, September 13, 2002

**Table 2.8: Cambodian legal requirements on cultural resources**

Zoning definition	Structures or activities prohibited, restricted or allowed	Another requirement
<p><b>Royal Decree for NASP No. 0811/752, 11 Sept 2011</b></p>	<p><b>Sub-Decree No. 42, 31Jan2014</b></p>	<p><b>Sub-Decree No. 42, 31Jan 2014</b></p>
<p><b>Zone 1:</b> The most important temple zone in the protected area is called the core zone, which needs to be protected at a high level. The core zone is defined as the whole temple, the structure of the temple of Preah Vihear, such as: moats, ancient ponds, barays, bridges, boundary markers, ancient caves, etc., and the area 30 meters from basement around the temple of Preah Vihear and the border line, Cambodia-Thailand, which includes both the historical stairs located east of Phnom Preah Vihear, with food to be kept 50 meters on each side.</p>	<p><b>Article 6:</b> The development inside core zone is prohibited, except for those developments that are useful for conservation work, promotion of the value of the Preah Vihear temple archaeological site, and the participation of the people in accordance with the zone management plan.</p> <p><b>Article 8:</b> All construction developments in core zone are prohibited except for the necessary construction developments and are determined and authorized by NASP.</p> <p><b>Article 10:</b> NASP must strictly protect the area of temple sites in one area and manage those areas for the purpose of archeological research, education or leisure.</p>	<p><b>Article 16:</b> All construction of tourist buildings in the Preah Vihear temple archaeological park must be approved by the NASP and comply with the technical standards, charge books and regulations of the NASP and the relevant authorities.</p> <p><b>Article 17:</b> NASP allows for the design of mid-range hospitality facilities for tourism services, such as: car parks, stalls, public toilets, waiting buildings, first aid buildings, information centers, research and conservation information centers, etc.</p>
<p><b>Zone 2:</b> Conservation zone, archeological park, natural resources and cultural landscape called buffer zone. Buffer zone, which are archeological sites to be protected as stated in this Royal Decree, shall be considered as public property of the State. Any sale or concession on land within this zone shall be considered void. The area is rich in archeological sites that need to be protected from land use and improper development. It is a protected zone for natural resources and cultural landscape, defined by the Royal Decree dated November 1, 1993 on the establishment and designation of natural protected zones.</p>	<p><b>Article 6:</b> The development of inside in the buffer zone is prohibited, except for those developments that are useful for conservation, tourism and promotion of the value of archeological sites and natural environment.</p> <p><b>Article 8:</b> All construction developments in buffer zone are prohibited except for the necessary construction developments and are determined and authorized by NASP.</p> <p><b>Article 15:</b> In managing tourism in buffer zone 2 NASP must:</p> <ul style="list-style-type: none"> <li>- Locate the reception area and parking lot in the buffer zone</li> <li>- Build infrastructure and create services to serve the conservation and development of tourism in the Preah Vihear temple area.</li> </ul>	<p><b>Article 28:</b> In Zone 3 and 4, NASP could allow the development of small-scale irrigation to increase agricultural production and for the personal use of its inhabitants without compromising the environment and archeology.</p>
<p><b>Zone 3:</b> It is a social, economic, cultural and tourism development zone located in the Samdech Techo Hun Sen Eco-Village Development Zone and along the road from the Eco-village border to the temple, which is the main entrance of the Preah Vihear temple archaeological site. The zone aims to preserve cultural and natural heritage by implementing measures to promote sustainable development and conduct environmental and archaeological impact assessments. In this zone 3, the National Authority of Preah Vihear and the Provincial Authority of Preah Vihear shall determine the master plan, land use plan, charge book, technical standards, infrastructure development master plan, urbanization, architectural construction in collaboration with the relevant institutions in accordance with the regulations and laws in force. This zone 3 is divided into two separate zones:</p> <ul style="list-style-type: none"> <li>- Zone <b>(3a)</b>: is a social land concession, a housing development zone, tourism infrastructure and</li> </ul>	<p><b>Article 7:</b> All developments in natural cultural park in the zone 3 the NASP and the Preah Vihear provincial authorities must determine the master plan for land use, orienting sustainable development in accordance with the policy of the Royal Government. All construction and demolition permits must be issued by NASP in collaboration with local authorities. For sites with suspected archeological remains, the competent authority must seek the cooperation of the NASP before issuing a land title.</p> <p><b>Article 8:</b></p> <ul style="list-style-type: none"> <li>- The zone 3 are economic and social development zones. All use of state-owned private land must be approved by the NASP with the participation of the competent authorities.</li> <li>- NASP and its competent authorities shall prepare develop technical standards, the types of land title and construction in zones (3a) and (3b).</li> <li>- Zone (3a) aims to preserve culture and nature through the implementation of measures to promote sustainable development and environmental impact assessment and natural cultural landscape.</li> </ul>	<p><b>Article 33:</b> In Zone 1 and Zone 2, NASP must not allow the establishment of villages or resettlement.</p> <p><b>Article 34:</b> In Zone 3 and Zone 4, NASP must create facilities to encourage and motivate people to grow agriculture, create jobs to improve their livelihoods.</p> <p><b>Article 35:</b> In Zone 1 and Zone 2, NASP is not allowed to have any pagodas or other religious sites except Wat Keo Sikkha Kirisvara</p>

Zoning definition	Structures or activities prohibited, restricted or allowed	Another requirement
<p>family economy with an area of 4.51 hectares within the GWS84 system.</p> <p>Zone 3a is divided into zone used for social concessions, public infrastructure, investment reserves for economic, cultural, tourism and administrative development, which are classified as state private property.</p> <ul style="list-style-type: none"> <li>- Zone (3b): It is a protected zone for forest cover and trees must be replanted in accordance with the axis of National Road No. 62. For the use of land for the purpose of family economic development, the distance shall not exceed 1,000 meters on either side of the road axis from the point A3 (469903/1575359) to the point P6 (469161/1585559).</li> </ul> <p>In order to preserve the natural landscape, all constructions are not allowed, with natural cover 50 meters from each side of the road axis, which is considered to be the public property of the state. Ownership demarcation and construction demarcation can be done from a distance of 50 meters from the road axis with the permission of the National Authority of Preah Vihear and the Provincial Authority of Vihear.</p>	<ul style="list-style-type: none"> <li>- Zone (3b) do not allow the construction and economic development of households that cause fires, loss of aesthetics, pollution and forest cover. The competent authority may grant ownership to the people within 50 meters from the axis of National Road No. 62 and not more than 1,000 meters from the axis of the road.</li> <li>- For Zone (3b) which is adjacent to the Eco-Techo village boundary along National Road No. 62 from coordinates (a) X:469904, Y:1575218; (b) X:468675, Y:1575219; (c) X: 468672, Y:1578459; (d) X: 4669904, Y: 1578459 together with the southern boundary of the Eco-Techo village, 170 meters from the axis of the road, the southern village is to maintain a green belt and reforestation shall be considered as private property of the state controlled by NASP as defined in the demarcation and zoning map of the Temple of Preah Vihear, which is an appendix to the Royal Decree 0811/752 September 10, 2011 on the Organization and management of Preah Vihear archaeological zoning.</li> </ul> <p><b>Article 18:</b></p> <ul style="list-style-type: none"> <li>- Reduce the negative impact of tourism development on the communities living there.</li> <li>- Set up tourist booths and handicraft centers to provide economic opportunities for residents.</li> <li>- Develop a master plan for hospitality in economic, cultural and tourism development areas to serve tourism services such as museums, botanic parks, stadiums, and tourism infrastructure and investment projects.</li> <li>- Encourage construction for vocational training for local people to specialize in tourism, agro-environment, handicrafts and small-scale industry, ensuring appropriate services.</li> </ul>	<p><b>Article 36:</b> In Zone 3 and Zone 4, the establishment of new pagodas in the villages must comply with the provisions of the law in force.</p> <p><b>Article 37:</b></p> <ul style="list-style-type: none"> <li>- No industrial development is allowed in the Preah Vihear temple archaeological site, except for small-scale handicrafts or services for the conservation of agriculture and tourism.</li> <li>- Properly managed solid and liquid waste made by handicrafts and services.</li> </ul>
<p><b>Zone 4:</b> A reserve zone for sustainable community development and conservation of genetic resources, plants and wildlife. This zone is defined as the remaining area from Zone 1, Zone 2 and Zone 3, which is located in Sraem Commune, Choam Ksan District, Preah Vihear Province.</p> <p>All land use as stated in the regulations set by the National Authority of Preah Vihear and Provincial Authority of Vihear. A map demarcating and dividing the Preah Vihear temple archaeological zone is contained in the appendix of this Royal Decree.</p>	<p><b>Article 8:</b></p> <p>Zone 4: is an area for local community development and the development of genetic resources, plants and wildlife. All land use in this area requires permission from the NASP and the Preah Vihear Provincial Authority.</p>	

## 2.6. ADB safeguard policy and requirements

37. On the basis of a rapid environmental appraisal in the feasibility stage, the subprojects have been initially classified as Category B for environment since impacts are assessed as site-specific and can be readily mitigated. This IEE has been prepared under the provisions of the ADB Safeguard Policy Statement 2009. ADB's specific requirements are reflected in this document.

38. International best practice has also been drawn from IFC Environmental Health and Safety (EHS) General Guidelines (World Bank Group 2007) and other applicable sectoral ones. A

comparison of EHS standards with domestic ones are made. The conclusion is EHS guidelines and targets will be used in this IEE for the assessment and mitigation of potential impacts on air and noise. Water quality standards will use the relevant Cambodian standards, as the EHS guidelines doesn't provide standard on ambient water quality. For the wastewater discharge, Cambodian standard class on "protected public water" will apply, which is also equally stringent as the discharge standard in the EHS guidelines.

39. The environmental policy 6 of ADB's SPS requires meaningful consultation and local disclosure of draft IEE/EMP in language and manner/places accessible by project affected people (PAP) and the public at large. A good practice is at least two weeks between local disclosure and consultation to allow decent time for the public viewing. PAPs should be notified by local newspapers, radio, TV, bulletin boards or social media, website as appropriate about the time, place of disclosure, and ways to send their feedback.

40. The EIA/IEE report shall document in detail the date, places, and manner of public disclosure in the country. For consultation, the EIA/IEE needs to document the topics, method, number of participants, their distribution by age, gender, education level, profession and ethnicity etc. as evidence of representativeness. Their main concerns expressed and how these concerns are addressed in the EMP or the project design should be documented in the EIA/IEE too.

### **III. CURRENT ENVIRONMENTAL AND SOCIAL CONDITIONS**

41. This chapter describes existing environmental resources (physical, biological, and socio-economic) within and surrounding the project area which are potentially affected by the project. Chapter content includes primary and secondary data such as laboratory test results (i.e., air quality, noise and vibration, surface water and ground water quality, and soil quality), direct observation, household survey and sensitive receptor interviews, and consultation with local authorities and other relevant authorities.

42. The chapter is organized by types of resources including physical resources (geology, topography, soil type, soil quality, hydrological system, surface and groundwater quality, climate and meteorology, air quality, and noise/vibration), biological resources (forest, wildlife, bird, and fisheries) and socio-economic resources (demography, settlement, living standard, migration, land ownership, land use, water consumption, infrastructure, education, healthcare and sanitation, and cultural heritages).

#### **3.1. Climate, Geology, Soils and Hydrology**

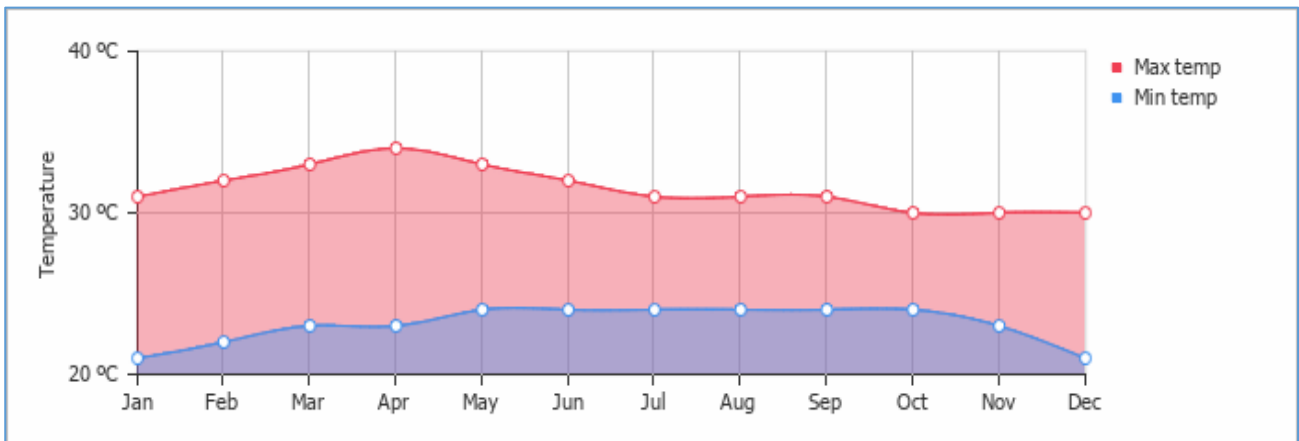
##### **3.1.1. Climate**

43. Cambodia's climate is tropical and characterized by typically high temperatures and two main seasons: a monsoon-driven rainy or wet season (May-October) with southwesterly winds ushering in clouds and moisture that accounts for about 80 to 90% of the country's annual precipitation; and a dry season (November-April), with cooler temperatures, particularly between November and January. Average temperatures are relatively uniform across the country, and are highest (26-40°C) in the early summer months before the rainy season begins. Temperatures remain at 25 to 27°C throughout the rest of the year. The wet season arrives with the summer monsoon, bringing the heaviest rainfall to the southeast and northwest. Mean monthly rainfall at this time of year can be more than 5,000 mm in some coastal areas.

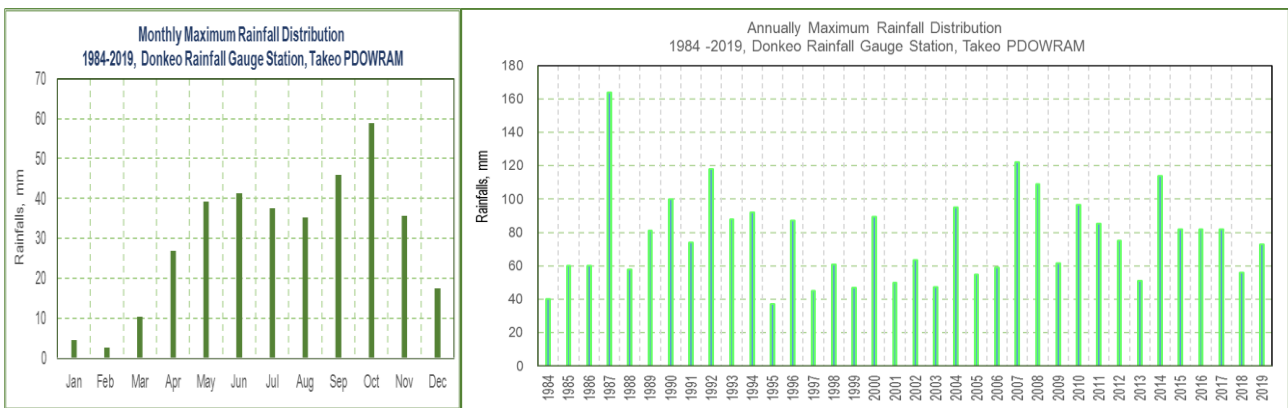
44. In Takeo Province, average temperatures range from 26.1°C in December and 28.9°C in April. Monthly rainfall data shows a seasonal pattern with the wet season occurring from April to November while the short four month long dry season occurs from December to March. The flood season months generally occur from July to November. The average annual rainfall observed in Takeo for the period 1984-2019 is 1,280 mm.



**Figure 3.1: Average Maximum and Minimum Temperature in Takeo province**



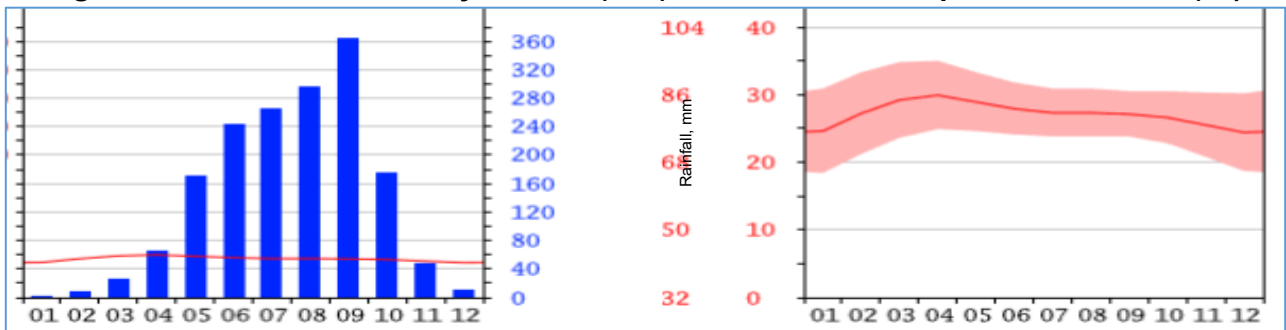
**Figure 3.2: Average Rainfall Distribution in Takeo Province**



Source: Provincial Department of Water Resources and Meteorology (PDOWRAM), 2019

45. In Preah Vihear Province, average temperatures range from 24.1°C in December and 29.6°C in April. Monthly rainfall data shows a seasonal pattern with the wet season occurring from April to November while the short four month long dry season begins in December and continues through March. The flood season generally occurs from July to November. The average annual rainfall observed in the province for the period 1984-2019 is 1,551 mm.

**Figure 3.3: Preah Vihear Yearly Rainfall (mm) and Maximum Temperature Patterns (°C)**



Source: <https://en.climate-data.org/>, available on July 2020

### 3.1.2. Topography and Geology

46. **Geology.** Cambodia was initially a continent under the sea covered with continental debris. Then, in the first era, the area was heavily influenced by the Kraveanh Mountains, with the emergence of old rocks such as granite, rock, coal, oil and metal. In the second era, the area was

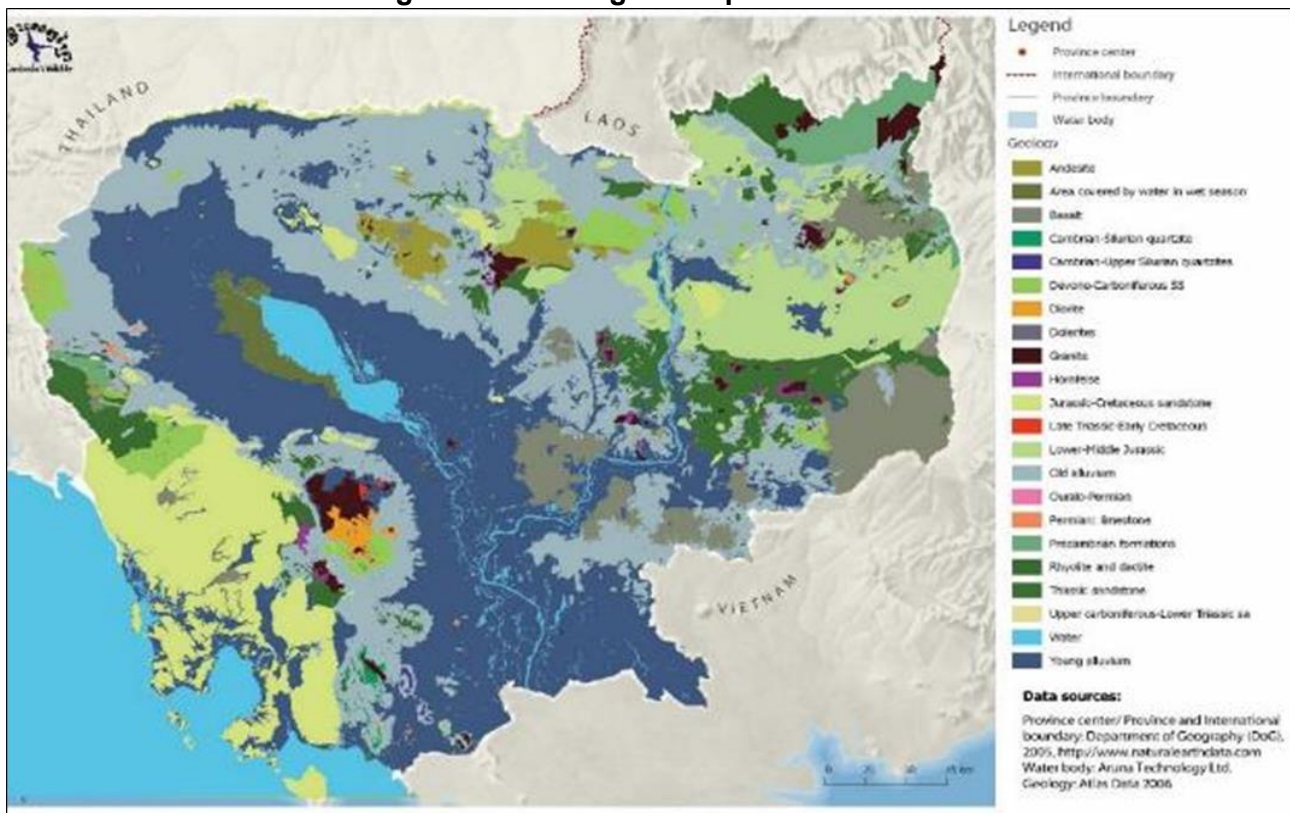
once again submerged. Debris rocks, supporting extensive flora and fauna, forming numerous mountains, especially the Kraveanh Mountains, the Dangrek Mountains, and the northeast plateau. In the third era, there was a series of young mountains eruptions and volcanic eruptions, which in turn formed the basaltic basin and the eastern plateau. In the fourth era, numerous waterways formed, especially the Mekong which transported sediment to the ocean. Sea level changes resulted in older sediment mountainous areas and new sediments in the Tonle Sap. Old and new sediments form today's central plains. As shown in Figure 3.4, based on JICA's 2002 data, the geology of the project area is of the Quaternary era. The Quaternary period is the latest in the fourth cycle, with a geological period dating to 2.6 million years ago (National Geographic Partners; LLC, 2015).

47. **Topography.** Cambodia is divided into three distinct zones: The lowlands, the highlands, and the mountains. The lowlands are geographically situated along the Mekong River and the Tonle Sap Lake, with an altitude of not more than 100 m above sea level. The highlands are located in the north and northeast, and are between 50 and 200 m high, while the plateau is between 8 and 20 m above sea level (JICA, 2002).

48. Preah Vihear Province is located in the plateau zone where surface water is scarce, with rainfall providing the main source of water for both domestic and agricultural activities. The province is vulnerable to flashflood and droughts.

49. The majority of Takeo Province is a combination of recent and quaternary floodplain deposits which have weathered to a Dystic plinthosol under the FAO soil classification. This is a clayey soil, dark in color owing to the accumulation of organic matter. It is very plastic when wet and difficult to puddle. Because of long period of submergence, the soil undergoes chemical changes to its mineral constituents giving it poor nutrient-holding property. The more elevated southern extension of the project area is on alluvial plain deposits weathering to a Gleyic Acrisol, a clay-rich soil associated with humid, tropical climates.

**Figure 3.4: Geological Map of Cambodia**



### 3.1.3. Soil Type

50. There are 16 recognized soil types in Cambodia.

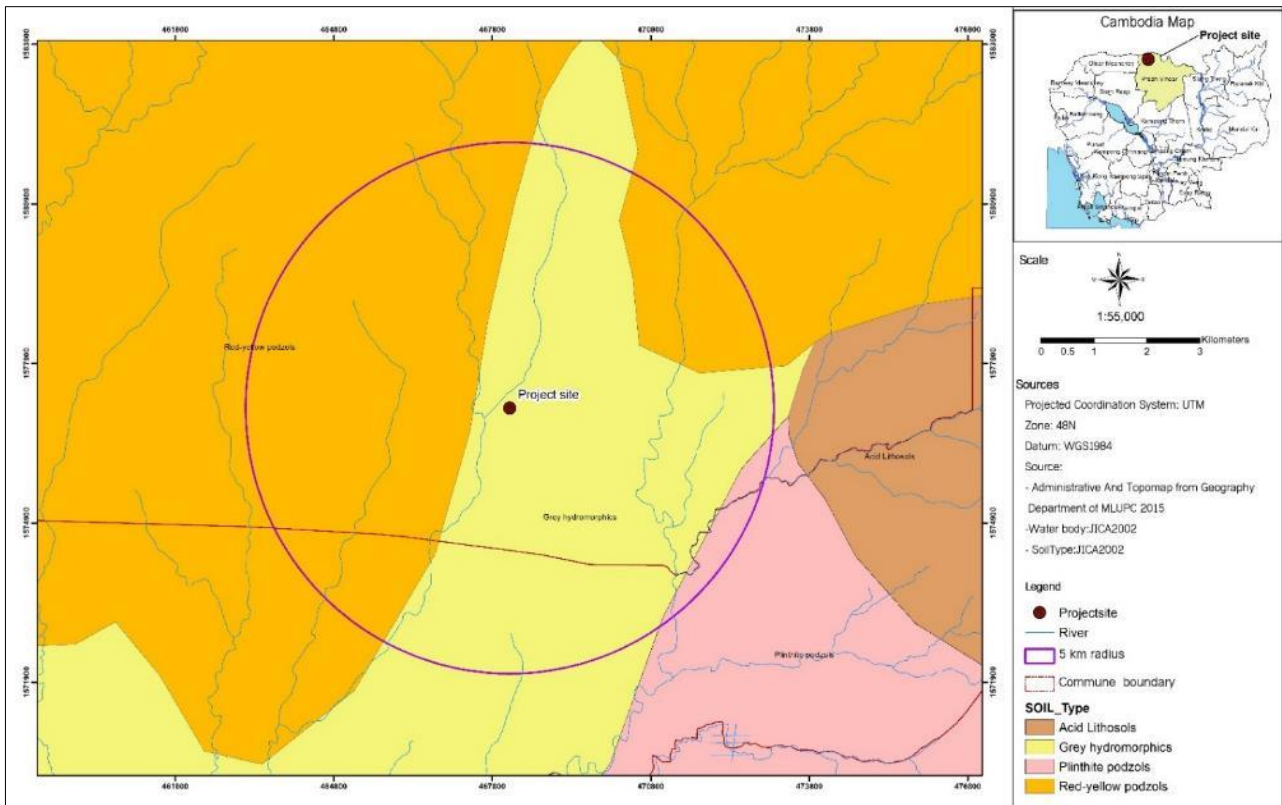
**Table 3.1: Soil Type and Size in Cambodia**

No.	Soil Type	Size (Trichit, 1981)	
		km <sup>2</sup>	Percentage
1.	Red yellow podzols	22,763	12.5
2.	Latosols	7,123	3.93
3.	Planosols	1,666	0.92
4.	Plinthite podzols	17,147	9.47
5.	Cultural hydromorphics	12,896	7.13
6.	Grey hydromorphics	17,252	9.53
7.	Plentithic hudromorphics	1,275	0.71
8.	Brown hydromorphics	6,701	3.72
9.	Alumisols	2,782	1.53
10.	Regurs	6,570	3.63
11.	Acid lithosols	45,271	25.00
12.	Basic lithosols	3,418	1.90
13.	Alluvial soils	17,064	9.43
14.	Brown alluvials	2,764	1.53
15.	Lacustrine alluvials	10,373	5.73
16.	Coastal complex	2,229	1.23
<b>Total (Land)</b>		<b>177,295</b>	-
<b>Water</b>		<b>3,721</b>	<b>2.06</b>
<b>Grand Total</b>		<b>181,035</b>	<b>100</b>

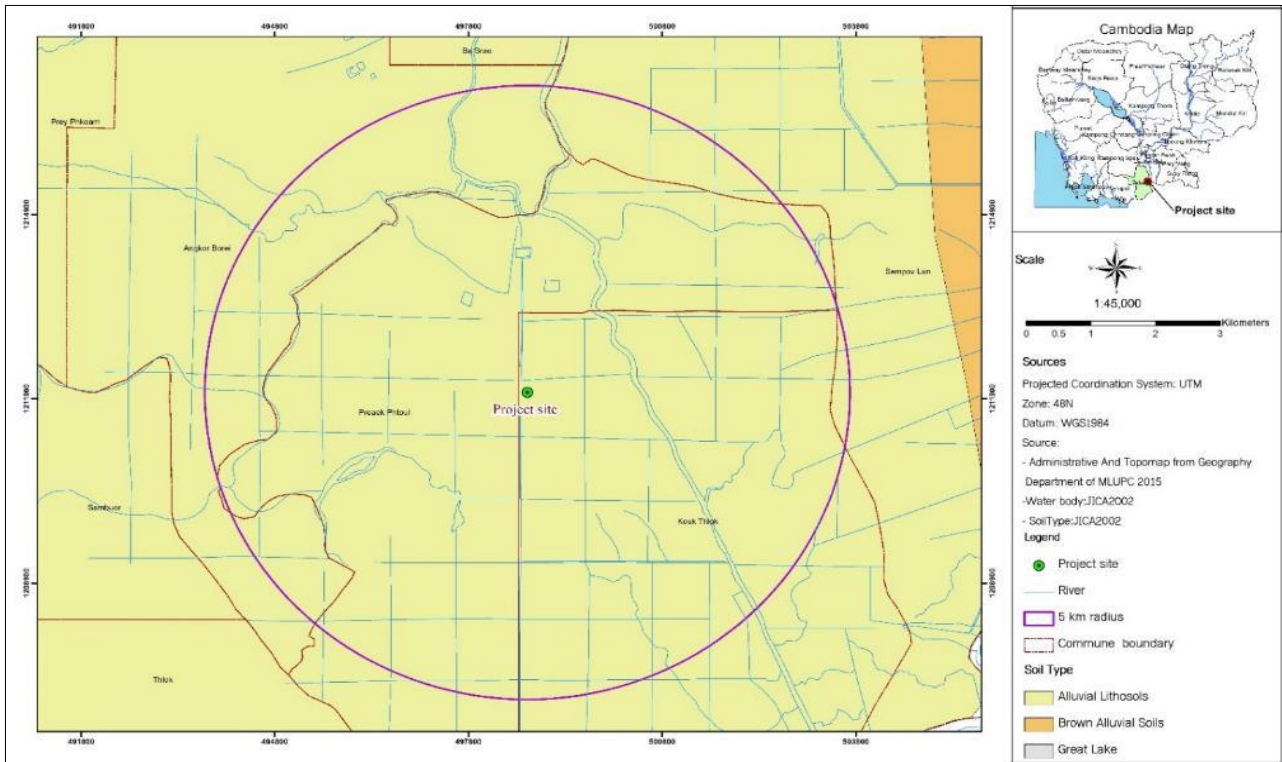
Source: Crocker, D (1963)

51. Using this soil type data, it was determined that in the project areas (5 km wide zone) there are two main soil types: in Preah Vihear, Grey hydromorphics, Plinthite podzols and red-yellow podzols as shown in **Figure 3.5**; and in Takeo, Alluvial Lithosols and as show in Figure 3.6.

**Figure 3.5: Soil Type at Preah Vihear Site**



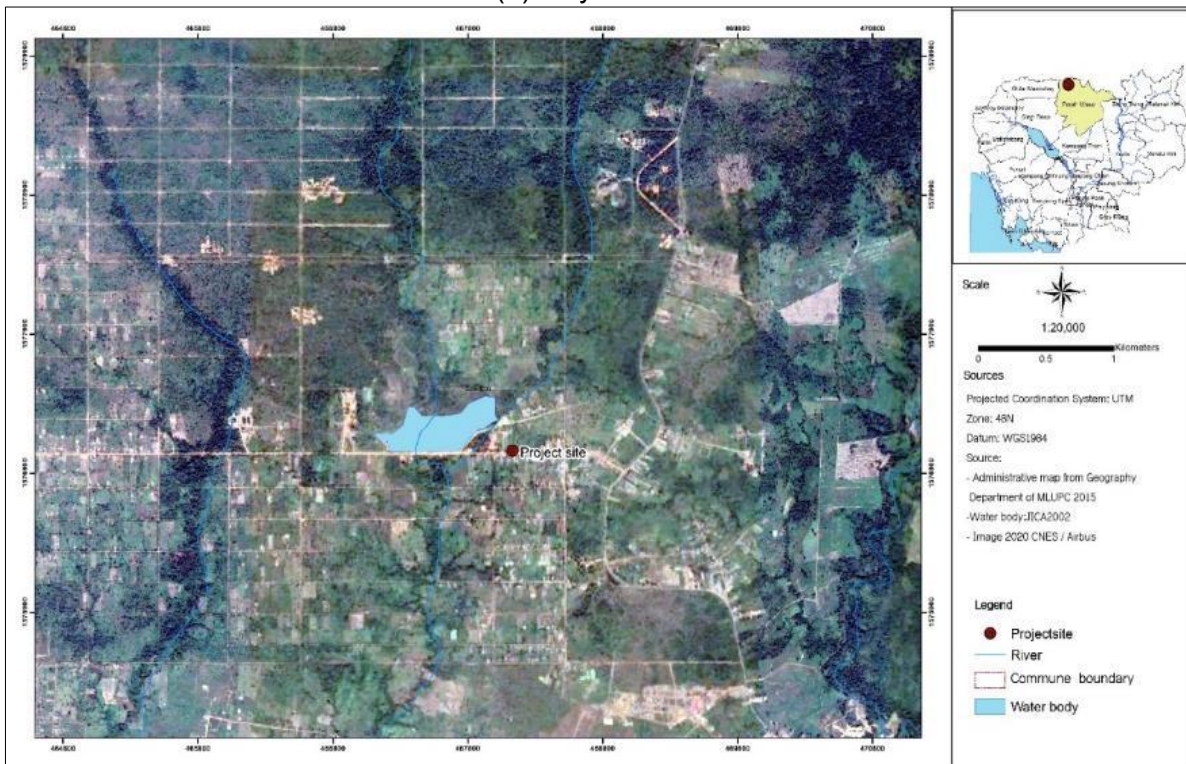
**Figure 3.6: Soil Type at Takeo Site**



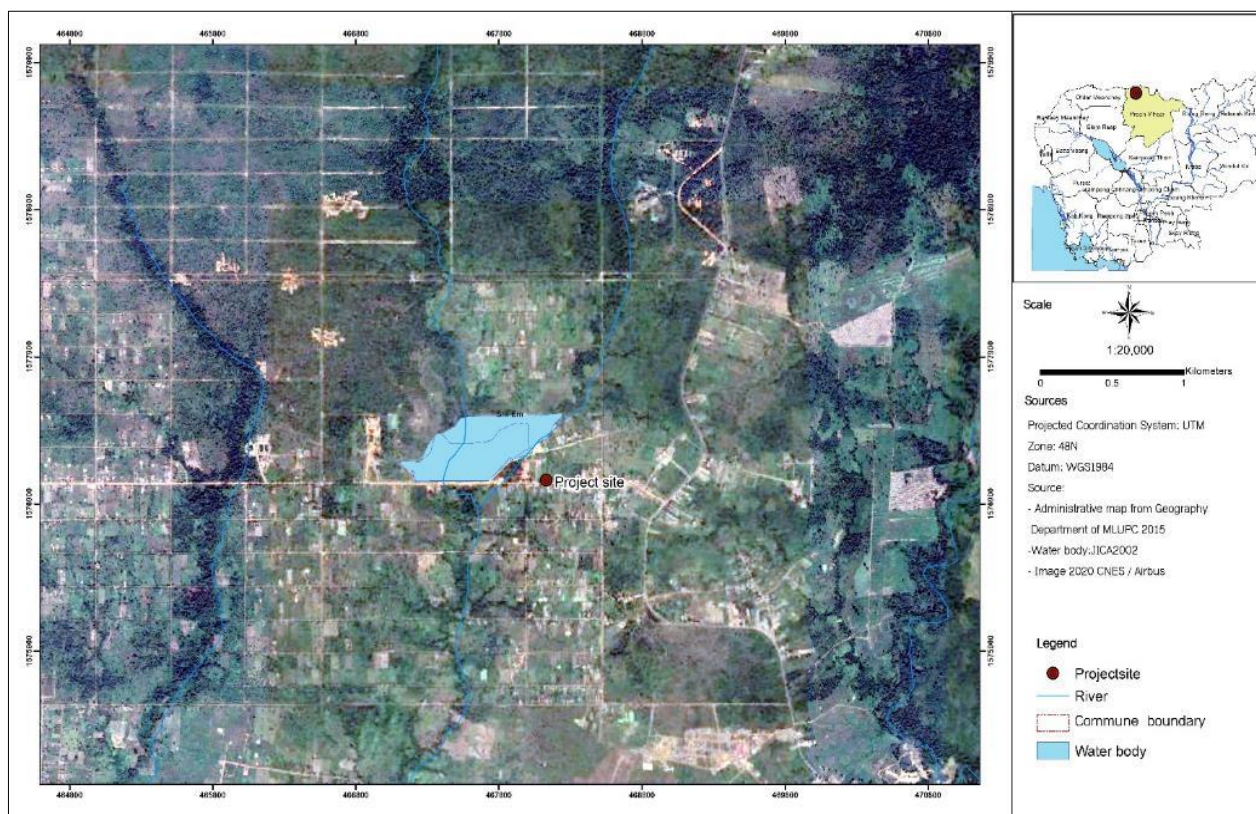
### 3.1.4. Hydrology

52. Decho Thormcheat, Preah Vihear. The main geographical features of the project area and surrounds are highland and mountain which consists of two streams (O Svay and Peamphean stream) and one lake as shown in **Figure 3.7**. The lake functions as a reservoir for water supply, primarily for irrigation. No data is available about water levels and catchment areas of the streams. Based on Google map the estimated catchment area of O Svay Lake is roughly 30 ha in rainy season and 19 ha in dry season.

**Figure 3.7: Preah Vihear Site Hydrology**  
(a). Dry Season



(b). Rainy Season



53. Phnom Da, Takeo Province. The main geographical features of the project area and surrounds are a low-lying area which is part of the Bassac River estuary in Angkor Borei district. This area is crisscrossed by a network of tributaries and man-made channels used for navigation, irrigation, and flood control. Within 5km of the project area there are major hydrological systems; Stung Angkor Borei, Canal 15, Canal 12 and other man-made channels as shown in Figure 3.8.

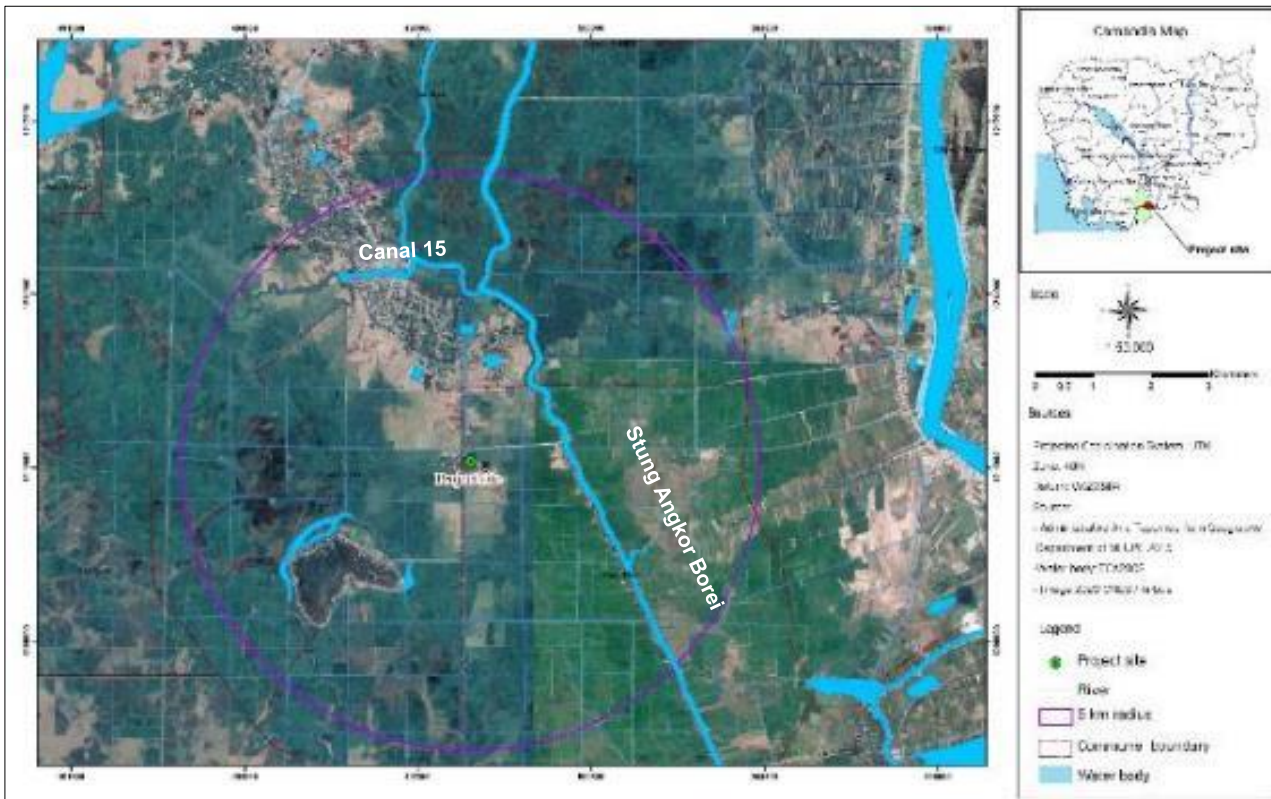
54. Stung Angkor Berei receives water from the Bassac River. Figure 3-9 shows how water flows out from Bassac River through Prek Ambel to Prek Kabal Khamaoch, which runs along the border between Takeo and Kandal provinces, to Stung Angkor Borey. Prek Taphor village is a seasonal flooded village experiencing six months of flood and six months of dry conditions. The village is situated 24 m above sea level.

55. Prek Taphor village is surrounded by the Angkor Borey River and several canals. The river and canals are the main water sources for rice cultivation, horticulture plantation, and freshwater prawn farming. Angkor Borey River is also the main economic transportation route for rice and other agricultural products between Phnom Da villagers and Vietnam as it is less than ten kilometers travel by boat.

56. The Angkor Borey and Bassac rivers provide a significant flow to Canal 15 during the dry season. Aside from surface flow, there is also groundwater discharge from an aquifer that seeps into Canal 15 during the dry months<sup>6</sup>. Water from Bassac River flows year-round into Canal 15, with the canal water level fluctuating depending on the Bassac River flow. During the dry months, the water level in Canal 15 is only 0.5 m. Delivery of water to paddy fields is by overland flow from overtopping of Canal 15 or its lateral canals (i.e., natural waterways and manmade canals). However, the smaller lateral canals dry up for three to four months each year as the water level in the whole system drops.

<sup>6</sup> Feasibility Study of Canal 15, MoWRAM, 2019.

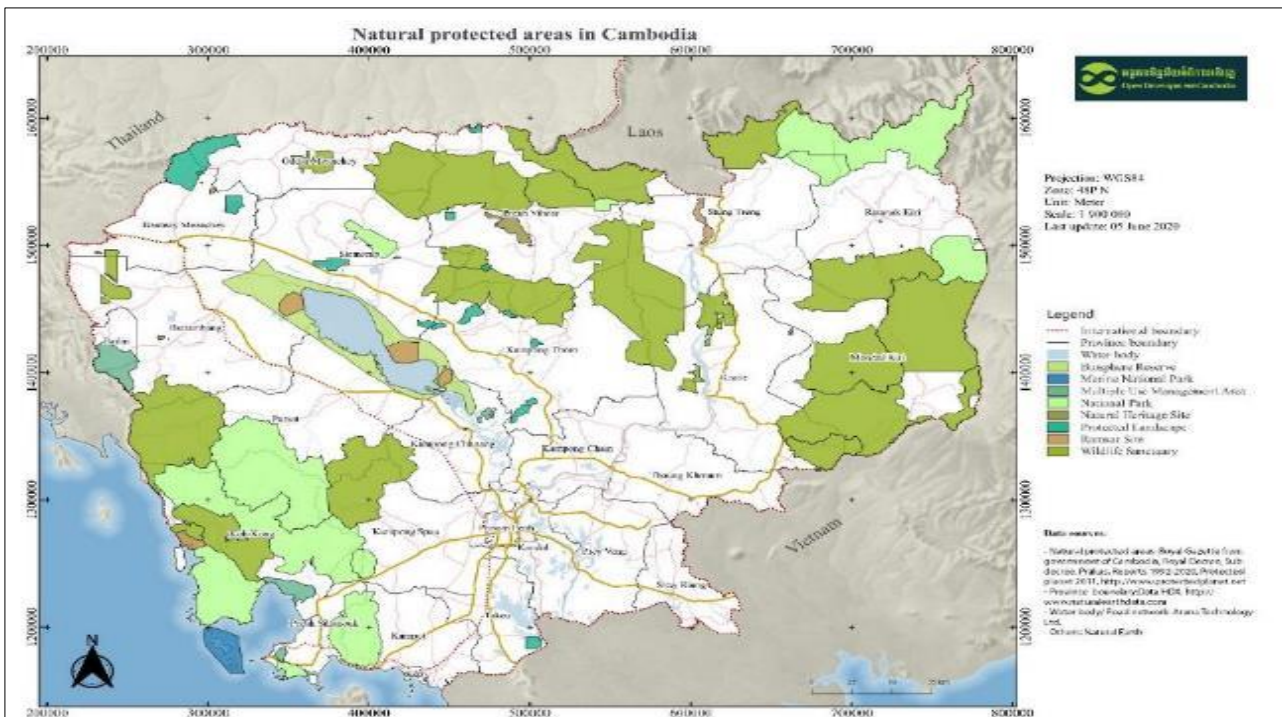
**Figure 3.8: Hydrology in Phnom Da (Takeo Site)**



### 3.2. Ecology and Biodiversity

57. There is three designated PA in the project provinces as shown in Figure 3.9. These are Kulen Promtep Wildlife Sanctuary and Preah Vihear Protected Landscape in Preah Vihear Province, and Boeung Prek Lapouv Management and Conservation Area in Takeo Province.

**Figure 3.9: Protected Areas relevant to Community-Based Tourism Project**



Source: NGO Open Development Cambodia: updated the MOE map with all Protected Areas in Cambodia, available on <https://data.opendevdevelopmentcambodia.net/km/dataset/e6083924-df52-4249-a044-9dfcde3e7245/resource/ae81c331-e6c7-47a4-b6b2-b7d71a2fa1a1/download/npas.jpg>

58. There are two PAs situated near the Preah Vihear project site as shown in Figure 3.10: Kulen Promtep Wildlife Sanctuary and Preah Vihear Protected Landscape. These PAs have not yet been zoned by MoE.

59. Kulen Promtep wildlife sanctuary is located 5 km south of the Decho Thormcheat project village, in the northern plains of Cambodia close to border with Thailand. The PA mainly lies within Preah Vihear Province, but also extends into Siem Reap and Oddar Meanchey provinces. Established in 1993, the PA covers an area of 402,500 ha, making it Cambodia's largest PA (ICEM, 2003)<sup>7</sup>. The Preah Vihear part of this area is jointly managed by MoE and the Wildlife Conservation Society.

60. The PA covers a lowland area with an average elevation of around 50 m above sea level, interspersed with a scattered hill such as Phnom Pol which reaches roughly 450 m above sea level. The Sen River, a major tributary of the Tonle Sap crosses the PA in the southeast and causes seasonal flooding during the rainy season. The PA has a low population density and limited agriculture.

61. The main habitats found in the PA are lowland open dipterocarp forest, lowland evergreen, and a large swampland area. This habitat is considered as highly important for large water birds such as Giant Ibis and Sarus Crane. These and other wildlife species found in the PA are under particular pressure from poaching, land encroachment and illegal logging. The Preah Vihear part of this PA area is mainly covered by open deciduous dipterocarp forest and grassland savannah, but also includes some semi-evergreen gallery forest.

62. The Preah Vihear Temple Protected Landscape is located 11 km north of the Preah Vihear project site. This PA covers a 5,000-ha area around the Preah Vihear temple. Habitat found in this northern plain landscape predominantly comprises Central Indochina dry forest.

**Figure 3.10: Preah Vihear Site and Protected Area**



63. The Boeung Prek Lapouv Management and Conservation Area for Sarus Crane and other birds in Takeo Province was established in 2007. The total PA area is 8,300 ha, comprising a buffer zone of 7,381 ha and a core protection zone of 919 ha. Also included in the PA is a fish sanctuary

<sup>7</sup> International Centre for Environmental Management. 2003. Cambodia, National Report on Protected Areas and Development. Review of Protected Area and Development in the Lower Mekong River Region. Indooroopilly, Australia: ICEM.

and an inundated forest protection zone. The Phnom Da project site is located approximately 20 km north of the PA boundary as shown in Figure 3.11.

**Figure 3.11: Boeung Prek Lapouv Management and Conservation Area**



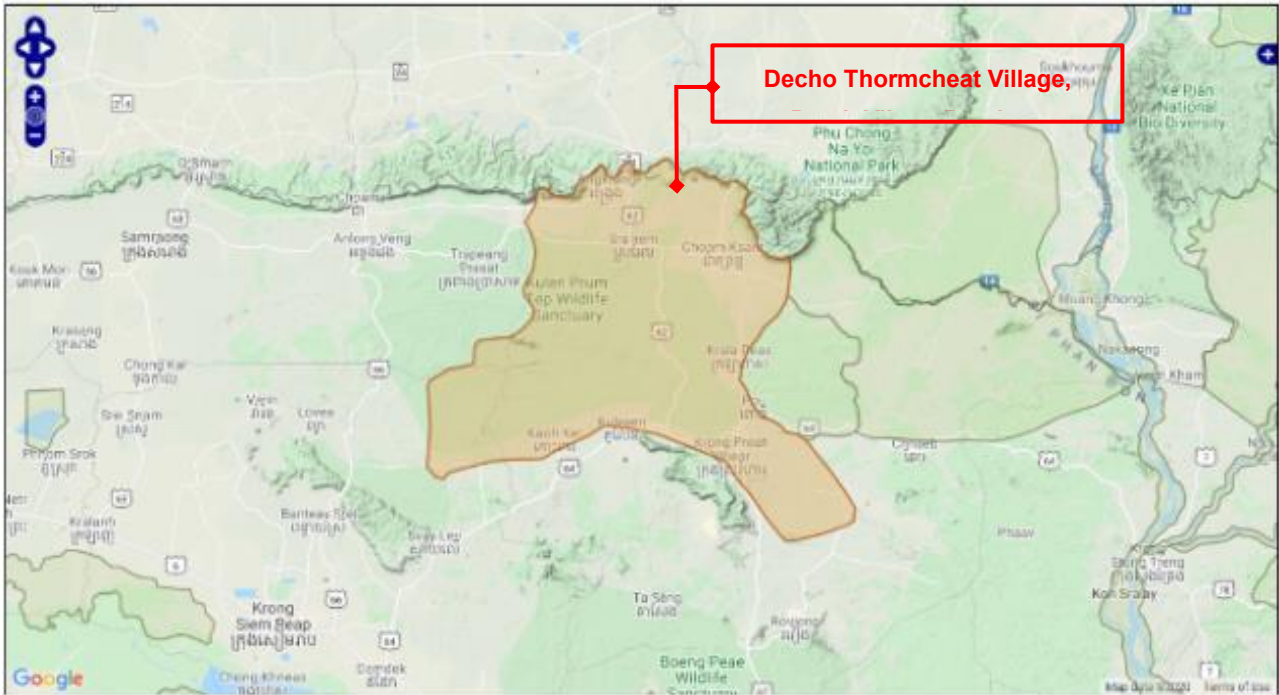
64. The PA provides habitat for many bird species, five of which are on the IUCN Red List: Bengal Florican (critically endangered), Black-faced Spoonbill (endangered), Greater Adjutant (endangered), Lesser Adjutant (vulnerable) and Sarus Crane (vulnerable). Population counts during the period 2003 to 2013 estimated that the Sarus Crane population using this PA represented 56% of the total Mekong Delta population and 31% of the total regional population of this species.

65. The PA core zone is restricted to all activities except those related to conservation or research, while the buffer zone comprises mixed agriculture and wetland, with conversion of wetland being prohibited. Despite this prohibition it is reported that during the period 2004 to 2011, 35% of the wetland area in the buffer zone had been converted to agriculture.

66. In addition to designated PA, screening of the project provinces using the IUCN Integrated Biodiversity Assessment Tool (IBAT) identified that the Decho Thormcheat project village is located within the Upper Stung Sen Catchment key biodiversity area (KBA) as shown in Figure 3.12. KBA are of an advisory nature, identifying biodiversity habitat which may be considered for future PA designation. A key distinction between PA and KBA is that development activities are not generally permitted within PA while there can be many existing development activities within a KBA. It is noted that 58% of the Upper Stung Sen Catchment KBA is already designated as PA. Additionally, the large provincial town of Theng Meanchey, the district town of Cham Khsan and several villages are located within this KBA, in addition to other economic activities such as agriculture.



**Figure 3.12: Upper Stung Sen Catchment KBA and the Decho Thormcheat Project Village**



Source: Birdlife International. <http://datazone.birdlife.org/site/factsheet/upper-stung-sen-catchment-iba-cambodia/map>

67. The KBA vegetation is dominated by open deciduous dipterocarp forest, transitioning to mixed deciduous and semi-evergreen forest in the west; permanent and seasonal wetlands; and grasslands. Much of the area becomes an inundated floodplain during the rainy season, while in the dry season, water is limited to a few permanent watercourses such as the Stung Sen River and its larger tributaries and pools. Along these watercourses, semi-evergreen forest and thick bamboo forest are distributed.

68. Of the 355 trigger species identified in the Upper Stung Sen Catchment KBA, 351 are birds. The KBA is therefore considered an important bird and conservation area or IBA. Much of the KBA is located within the Kulien Promtep Wildlife Sanctuary and the KBA supports one of the few breeding colonies of Darter Anhinga remaining outside of the Tonle Sap Lake floodplain. In addition, the KBA is an important breeding site for Sarus Crane and Lesser Adjutant. Other globally threatened and near-threatened species recorded in the KBA include Giant Ibis, White-shouldered Ibis, Greater Adjutant, Black-necked Stork and Grey-headed Fish Eagle.<sup>8</sup>

69. Other regionally significant faunal species found in the KBA are Alexandrine Parakeet, Woolly-necked Stork, and Great Slaty Woodpecker; and Long-tailed Macaque, Pig-tailed Macaque, Slow Loris, Silvered Langur, Pileated Gibbon, Asiatic Softshell Turtle, Elongated Tortoise, Yellow-headed Temple Turtle, Giant Asian Pond Turtle, Malayan Box Turtle, Gaur, Banteng, and Eld's Deer (Kong Kim Sreng, Ministry of Environment, pers. comm.).<sup>9</sup>

70. Fish populations in local water bodies in both project provinces appear to be unremarkable. Based on informal fisheries surveys conducted as part of project preparation in June 2020 at O Svay Lake in Preah Vihear Province and randomly sampled canals in Takeo Province, commonly found fish species were record as summarized in Table 3.2.

**Table 3.2: List of Fish Species in Preah Vihear and Takeo Provinces**

Common Name	Scientific Name
Whisker Sheatfish	<i>Kryptopterus limpok</i>
Blue Danio or Long-barbel Danio	<i>Danio regina</i> or <i>Danio pulcher</i>
Grey Featherback	<i>Notopterus notopterus</i>
Iridescent Mystus	<i>Mystus villatus</i>

<sup>8</sup> <http://datazone.birdlife.org/site/factsheet/upper-stung-sen-catchment-iba-cambodia>

<sup>9</sup> <http://datazone.birdlife.org/site/factsheet/upper-stung-sen-catchment-iba-cambodia/details>

Common Name	Scientific Name
Batrachian Walking Catfish	<i>Clarias batrachus</i>
Striped Tiger Nandid or Temminck's Kissing Gourami	<i>Pristolepis fasciatus</i> or <i>Hetostoma temmincki</i>
Spotted Spiny Eel	<i>Macrogathus siamensis</i>
Tree Spot Gounrami	<i>Trichogaster trichopterus</i>

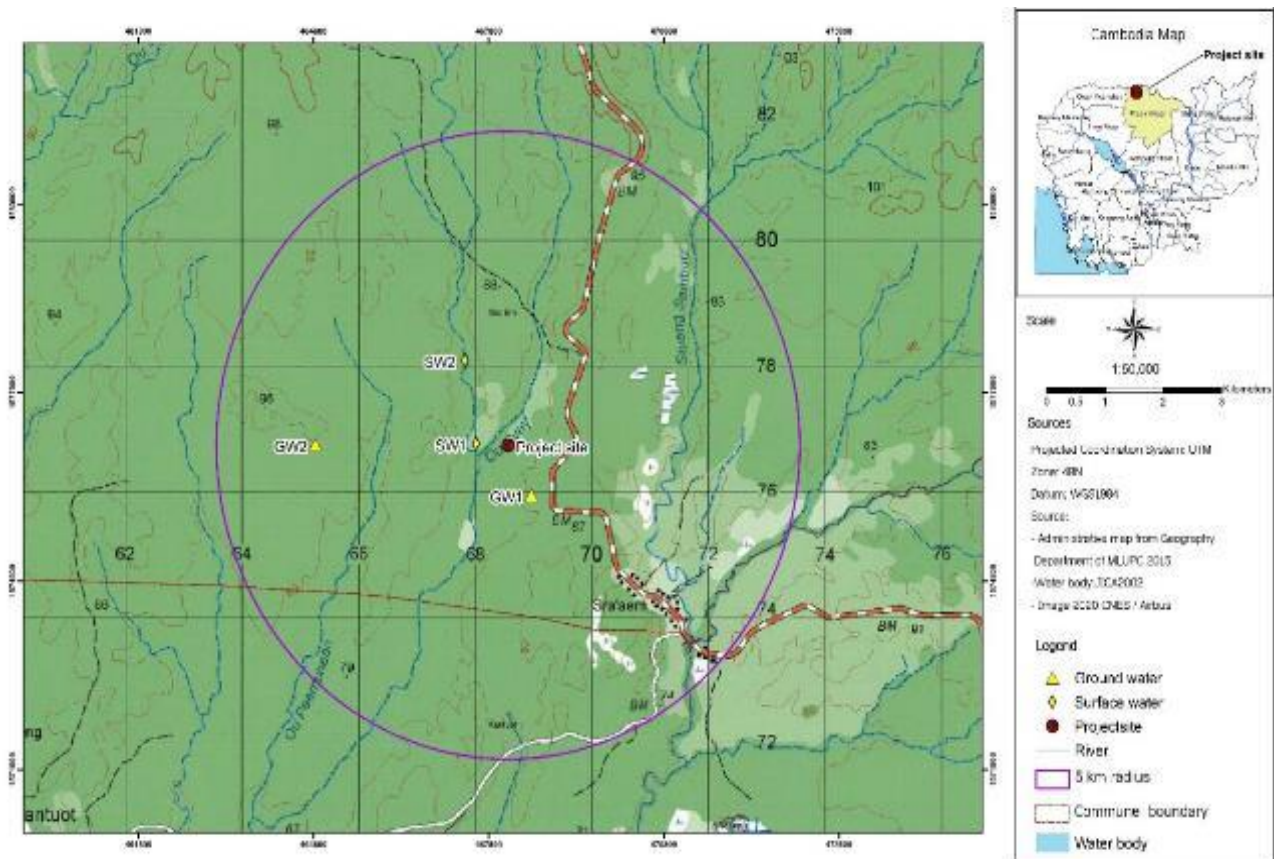
Source: Site Observation, June 2020

71. Based on interviews with the provincial Department of Environment and local authorities in Preah Vihear and Takeo provinces, it was concluded that project activities are unlikely to adversely affect important biodiversity habitat and/or vulnerable or endangered species. With exception of one proposed tourist site in Preah Vihear province, project activities are not in close proximity to sensitive habitats. A population of 200 Asia Openbill frequents O Svay Lake in Preah Vihear for feeding and roosting purposes. This stork species is classified as of least concern in the IUCN Red List. O Svay Lake is a popular tourist attraction offering both bird watch opportunities and a cultural Buddhist landscape. Care will be needed to avoid or minimize tourist disturbance to birds utilizing the lake. No important faunal species have been observed in close proximity to the Takeo project site.

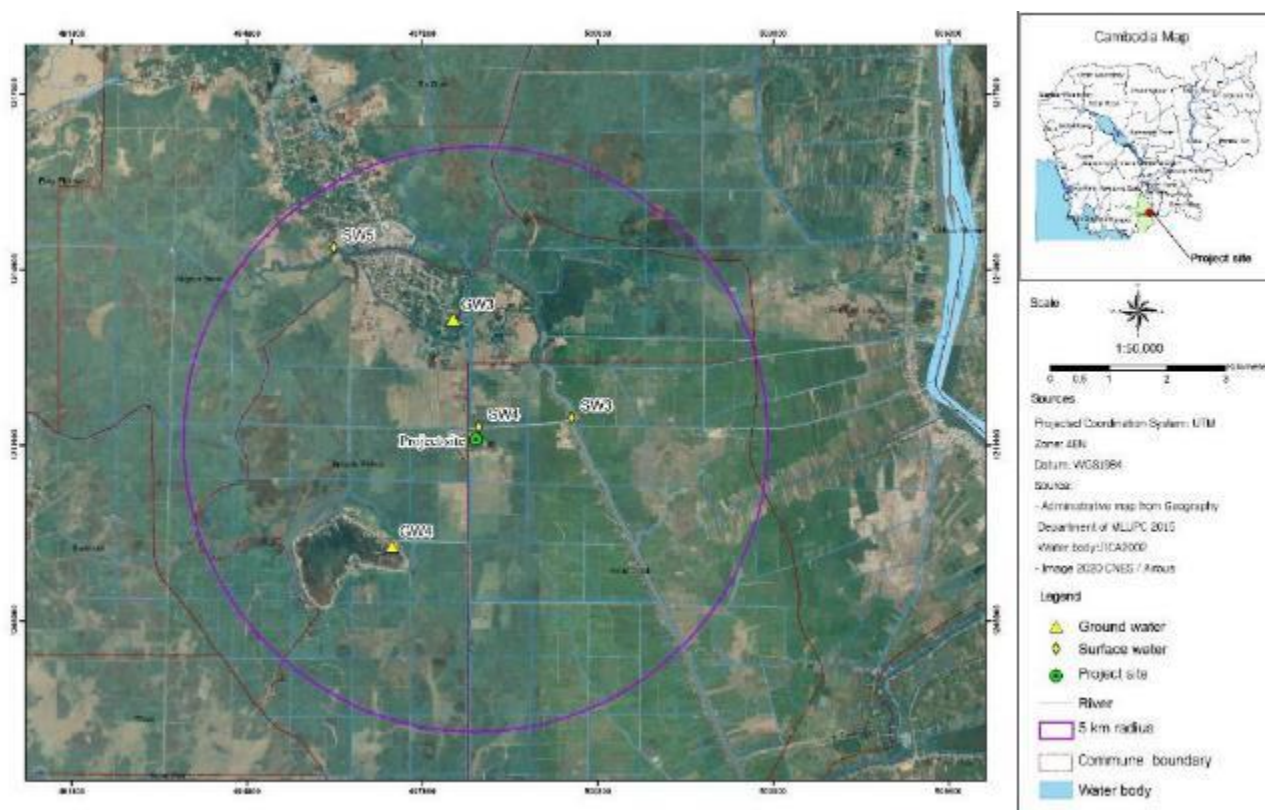
### 3.3. Water Environment

72. Water quality testing was conducted at five surface water and four ground water locations in the two project sites. Sampling locations are shown in figures 13 and 14 for Preah Vihear and Takeo provinces.

**Figure 3.13: Sampling Locations for Surface and Ground Water in Preah Vihear Province**



**Figure 3.14: Sampling Locations for Surface and Ground Water Quality in Takeo Province**



### 3.3.1 Surface Water Quality

73. As observed and confirmed in an interview with the local authority, there is one natural lake called O Svay (local name Srak Kdol) in Preah Vihear while the main surface water close to project site in Takeo Province is Angkor Borei River as shown in Photo 3.1. These surface water systems are multi-purpose, being used for irrigation, water supply and tourism.

**Photo 3.1: Overview of Surface Waters at Project Sites**



O Svay Lake, Preah Vihear Province

Angkor Borei River, Takeo Province

74. Surface water quality analyses were conducted to establish the baseline water quality within and around the project area. Samples were collected from five locations (Table 3.3) in compliance with laboratory guidelines, and analyses completed at MoE’s water quality laboratory. Analytical results were compared with applicable water quality standards as shown in Table 3.3.

**Table 3.3: Surface Water Sampling Location**

No.	Location
SW-01	O Svay Lake, Preah Vihear Province

No.	Location
SW-02	Upstream of O Svay Lake, Preah Vihear Province
SW-03	Angkor Borei River, Takeo Province
SW-04	Canal 12, Takeo Province
SW-05	Prawn Farm, Takeo Province

**Table 3.4: Surface Water Quality Analytical Results**

No.	Parameter	Unit	Result of Surface Water Testing					MoE Standard	EHS Guideline's Standard
			SW-01	SW-02	SW-03	SW-04	SW-05		
1	pH	-	6.99	7.23	7.03	6.94	9.61	6.5 – 8.5	6 - 9
2	Dissolved Oxygen (DO)	mg/L	3.4	6.6	3.9	4.2	7.8	2 – 7.5	NV
3	Total Dissolved Solid (TDS)	mg/L	25	10	128	165	153	<1000	NV
4	Total Suspended Solid (TSS)	mg/L	146	86	33	90	38	25-100	50
5	Biochemical Oxygen Demand (BOD) <sub>5</sub>	mg/L	3.8	2.6	2.7	2.4	7.2	1.0-10	30
6	Chemical Oxygen Demand (COD)	mg/L	9.01	8.62	5.9	5.11	9.8	<50	125
7	Oil and Grease	mg/L	1.13	8	10.33	3.8	10.2	<5.0	10
8	Detergent (MBAS)	mg/L	ND	ND	ND	ND	ND	<5.0	NV
9	Sulphate (SO <sub>4</sub> )	mg/L	9	2	44	61	53	<300	NV
10	Total Nitrogen (TN)	mg/L	1.39	0.98	0.69	0.66	2.08	0.1-0.6	10
11	Total Phosphorus (TP)	mg/L	0.07	0.05	0.05	0.05	0.42	0.005-0.05	2
12	Arsenic (As)	mg/L	0.001	0.0004	0.002	0.002	0.002	<0.01	NV
13	Cadmium (Cd)	mg/L	0.0002	ND	0.0002	ND	0.0002	<0.001	NV
14	Iron (Fe-total)	mg/L	4.35	2.19	0.34	0.66	0.2	<1	NV
15	Lead (Pb)	mg/L	0.0009	ND	ND	0.0008	ND	<0.01	NV
16	Mercury (Hg-Total)	mg/L	ND	ND	ND	0.0002	ND	<0.0005	NV
17	Total Coliforms	MPN/100 ml	2.1X10 <sup>3</sup>	1.1X10 <sup>5</sup>	2.1X10 <sup>3</sup>	4.3X10 <sup>3</sup>	4.3X10 <sup>3</sup>	<5000	NV

Note: NV=No Value

75. Analytical results show that most parameters meet the MoE standard while a few parameters exceed the standard (i.e., pH, oil and grease, TN, TP, Fe, and total coliforms). Of the five testing locations, only SW-05 (Prawn Farm Pond) had many parameters exceeding the MoE standard. Of these exceedances, elevated TN and TP are thought to be linked to the prawn water source where is from a canal which may be polluted by agriculture and other wastewater discharges. Similarly, elevated TSS values at SW-01 and SW-02 indicate high rainy season turbidity. At the sampling stations in Takeo province, the results indicate that surface water quality is affected by agriculture (excessive TN and TP parameter of SW-05 at prawn farm) and human source (excessive oil and grease parameter of SW-03 and e-coli in all samples) discharges.

### 3.3.2 Quality of Ground Water Used as a Drinking Water Source

76. Discussion with local authorities indicated that most residential areas utilize drinking water obtained from open-wells or hand-tube wells. Ground water from wells was sampled to determine whether quality meets applicable standards. Analytical results are shown in Table 3.4.

**Table 3.5: Groundwater Quality**

No.	Parameter	Unit	Analysis				MoE groundwater Standard	Drinking Water Quality Standard <sup>a</sup>
			GW-01	GW-02	GW-03	GW-04		
1	pH	-	6.3	6.23	6.27	6.66	6.5-8.5	6.5-8.5

No.	Parameter	Analysis					MoE groundwater Standard	Drinking Water Quality Standard <sup>a</sup>
		Unit	GW-01	GW-02	GW-03	GW-04		
2	Electrical Conductivity (EC)	µs/cm	596	452	505	11.41	500-1500	NV
3	Total Dissolved Solid (TDS)	mg/l	263	199	223	8500	<800	800
4	Turbidity	NTU	0	0	0	4	<5.0	5
5	Total Hardness (as CaCO <sub>3</sub> )	mg/l	50	49	7	31	<300	300
6	Chloride (Cl <sup>-</sup> )	mg/l	17	20	17	1400	<250	250
7	Fluoride (F <sup>-</sup> )	mg/l	0.26	0.15	0.29	0.69	<1.5	1.5
8	Nitrate (NO <sub>3</sub> )	mg/l	1	1.5	1	2	<50	50
9	Sulphate (SO <sub>4</sub> )	mg/l	0.7	0.55	34	1000	<250	250
10	Aluminum (Al)	mg/l	0.04	0.33	ND	0.91	<0.2	0.2
11	Arsenic (As)	mg/l	0.002	0.004	0.0004	0.009	<0.05	0.05
12	Cadmium (Cd)	mg/l	0.0002	0.0002	0.0003	0.003	<0.003	0.003
13	Chromium (Cr-total)	mg/l	0.001	0.002	0.003	0.006	<0.05	0.05
14	Iron (Fe)	mg/l	0.39	0.19	0.06	0.58	<0.3	0.3
15	Manganese (Mn)	mg/l	0.18	0.02	1.06	17.11	<0.1	0.1
16	Mercury (Hg-total)	mg/l	ND	ND	ND	ND	<0.001	0.001
17	Thermo tolerant Coli form (E-Coli)	MPN/100ml	0	0	0	0	0	0
18	Total Coliform	MPN/100ml	0	0	0	0	0	0

<sup>a</sup> Cambodian Drinking Water Quality Standard, 2004, is the same as groundwater standard issued by MoE. This standard was adopted from WHO standard on drinking water.

NV=No Value, ND=Not Detection

GW-01: Tubewell, Decho Thormcheat village, Preah Vihear Province.

GW-02: Pumpwell, Decho Thormcheat village, Preah Vihear Province.

GW-03: Pumpwell, Takeo Province.

GW-04: Tubewell, Takeo Province.

77. Ground water quality analytical results show that most parameter meet the MoE standard. Parameters exceeding the standard are TDS and Chloride (Cl<sup>-</sup>) at GW-04 in Phnom Borei, Takeo Province due to high salinity. In the Preah Vihear project area, ground water quality meets national standards.

78. In the Preah Vihear project area, drinking water is also supplied by a social enterprise which uses lake water as the water source. Source water is analyzed prior to establishing a water kiosk (i.e., supply point) to determine the level of pre-treatment required and regular water quality analysis is undertaken to confirm acceptable ongoing water quality.

### 3.4. Air Quality and Noise

79. **Air Quality.** No ambient air quality data exists for the project provinces. Both project sites are in predominantly agricultural lands and villages/residential areas where the air quality is sometimes affected by dust from tillage, smoke from rice stubble burning after harvest, and dust from unpaved roads. Generally, due to the absence of industry and low traffic volumes, air quality can be expected to be good, with low NO<sub>x</sub>, SO<sub>x</sub>, and CO concentrations. To verify, sample testing was conducted in Pham da village in Takeo Province, which has a higher and more economic activities compared to the Preah Vihear project area. Test results showing in Table 3.6 indicate that current air quality is well within both national standards and WHO guidelines.

**Table 3.6: Air Quality Results for Angkor Borei District, Takeo Province**

No	Parameter	Unit	Result	MoE Standard (hrs)	WHO Interim Target <sup>a</sup> (µg/m <sup>3</sup> )	Reference Method
1	Nitrogen Dioxide (NO <sub>2</sub> )	mg /m <sup>3</sup>	0.022	<0.1 (24hr)	200 (1 hr)	Method Saltzman [ISO 6768:1998(E)]
2	Sulfur Dioxide (SO <sub>2</sub> )	mg /m <sup>3</sup>	0.026	<0.3 (24hr)	125 (24hr)	Method Pararosaniline [ISO 6767:1990(E)]

No	Parameter	Unit	Result	MoE Standard (hrs)	WHO Interim Target <sup>a</sup> (µg/m <sup>3</sup> )	Reference Method
3	PM <sub>10</sub>	mg /m <sup>3</sup>	0.024	<0.05 (24hr)	150 (PM <sub>10</sub> 24hr)	Grimm Optical Method, Model: 107C

<sup>a</sup> Environmental, Health, and Safety Guidelines, IFC.

80. **Noise.** Ambient noise levels were measured in the project areas with a portable noise meter. Two Measurements were taken at two locations in each of the project provinces. Ten-minute averages, and maximum and minimum levels were recorded. Testing results as shown in Table 3.7 indicate that noise levels did not exceed MoE standards or EHS guidelines.

**Table 3.7: Ambient Noise Levels in Project Areas**

Provinces		Coordinate WGS1984 48P	Village	Commune	District	Max. (db(A))	Min. (db(A))	MoE Standard	EHS Guide line
Preah Vihear	#1	468000/1577172	Decho Thormcheat (Closed School)	Sra Aem	Choam Ksant	50.80	46.80	70	70
	#2	466900/1577111	Decho Thormcheat (Morodok Decho Pagoda)	Sra Aem	Choam Ksant	44.30	41.70		
Takeo	#3	497585/1215335	Kampong Luong (Angkor Borei Museum)	Angkor Borei	Angkor Borei	59.20	47.10		
	#4	498620/1212123	Prek Taphor (Phnom Da)	Preaek Phtoul	Angkor Borei	60.20	46.60		

### 3.5. Cultural heritage and resources

#### 3.5.1. Physical Cultural Resource in Preah Vihear

81. The Preah Vihear temple was built in the first half of the 11th century but its history dates back even earlier, to the 9th century. The temple was listed as a UNESCO World Heritage in 2008. The temple is located more than 10 km from the Decho Thormcheat village project site. In addition, there is a Buddhist monastery located at the west side of O Svay Lake, which is a cultural landscape of Buddhism belief and the center of the community.

82. Although the Department of Culture and Fine Arts of Preah Vihear Province is in charge of cultural properties, the temple's location is far from the administration office, safeguard human resources are limited, and access roads are poor condition. Consequently, conservation efforts are insufficient. Improved infrastructure is seen as key to facilitating tourist visits and extended stays in Decho Thormcheat village.

83. Since Decho Thormcheat village is a buffer zone of the heritage site, UNESCO requires that development activities maintain the value, integrity and authenticity of the area as buffer zone of the heritage site. These requirements are reflected in the cultural resources management plan as part of the EMP.

**Photo 3.2: Photo of Preah Vihear Temple**



Source: Heritage Impact Assessment, 2020

### **3.5.2. Cultural resources in Takeo Province Sites**

84. The main cultural resource in the Takeo Province project area is Phnom Da temple and mount located in Prek Ta Phor village. This village is situated about 4 km south of ancient city of Angkor Borei, and from Takeo provincial town. Angkor Borei was an important settlement of the Kingdom of Funan from the 1st to the mid-6th centuries. The site was first excavated in 1996, and was the subject of a full archeological excavation between 1999 and 2003. Unfortunately, excavations were disturbed by looting and illicit trafficking of Khmer antiquities, which continues as a serious problem today.

85. About 300 m southwest of the Phnom Da temple is another smaller temple called Arsrom Moha Eysei as shown in Figure 3.15. The temple is thought to have been built at the beginning of 7th century along the upper Mekong River and was moved to present location during the reign of Isanavarman I. It is built of a rare volcano stone similar to that found at the Borobudur temple in Indonesia. About 50 m southeast of Arsrom Moha Eysei there are some older brick structure foundation, which are damaged beyond recognition with only scattered brick and sandstone slabs remaining.

86. Angkor Borei including Phnom Da temple are currently on the UNESCO tentative list of UNESCO of candidate sites for world heritage designation, and the government is considering for nomination.

**Figure 3.15: Location of Phnom Da and Arsrom Moha Eysei**



### **3.6. Social-economic Environment**

#### **3.6.1. Decho Thomacheat village of Preah Vihear province**

87. Decho Thomacheat village is a newly established village covering an area of 2,525 ha. It is one of seven comprising the Sre Em commune of the Choam Khsan district of Preah Vihear Province. The village is located at the northern part of Preah Vihear provincial town, which is 81 m above sea level. It is 397 km from Phnom Penh capital by national road 62<sup>10</sup>.

88. The Decho Thomacheat village area encompasses the O Svay large water reservoir, which is the village's main water supply source for both agriculture and drinking water. The lake landscape is both naturally beautiful and hosts a water bird concentration during the rainy season which attracts many domestic tourists. Such tourist visits generate important employment for villagers.

89. The village composes by 1,183 households including 459 female headed households or 39% of total households. The total population of the village is 4,153 people including 2,031 women. There are no indigenous people living in the village. Eighty percent of the village population are soldier's families while the another 20% are immigrants from different areas around Preah Vihear Province. The village economy is dependent on rice farming cultivation, vegetables growing, livestock production, and small-scale fishing. Additionally, some households engage in small-scale trading. The government initially allocated 0.5 ha of housing land to all families in order to resettle and construct a house, and subsequently allocated another two hectares of rice field land to each household. However, by early 2020 are only about 30% had been granted this additional agricultural land. These plots are approximately 10 km from the village, which creates an access constraint for villagers.<sup>11</sup>

#### **3.6.2. Phnom Da, Khork Thlork commune Angkor Borey district of Takeo province**

90. The project village near the Phnom Da ancient and historical site was recently named as Prek Taphor village. The village comprises 187 households, with 646 persons including 335 women. The village has 25 female headed households or 13.37% of total households. There are no indigenous people living in the village. The village is accessible by waterway and is 23 km from Takeo provincial town.

91. Seventy percent of villagers are dry rice farmers. They plant two to three times annually using a rice varietal introduced by Vietnamese. Villages also engage in small scale fishing during the rainy season. Around 7% of the villagers are traders and 23% (43 men and 58 women) are seasonal labor migrants working both inside and outside of the village. A notable livelihood activity in the village is freshwater prawn fattening. This activity generates important revenue for the village and represents a potential tourist attraction. Presently, only one of two medium-size fattening farms remains in operation.

#### **3.6.3. Demographic Profile**

##### **3.6.3.1. *Population at Preah Vihear and Takeo provincial level***

92. Preah Vihear Province had a total population of 246,403 persons or 58,104 households in 2018, with a population growth rate of -0.25%. The province's population has grown by 17,013 persons just over the past three years, increasing from a 2015 population of 229,390 persons or 52,216 households. The proportion of the population living in rural areas of the province is 90% or 223,420 persons including 113,977 women. Average household size is 4.24 persons. The female population in the province was 51% in 2018, with women heading about 13.24% of households.

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<sup>10</sup> Village database and Key Informant Interviews with commune chief and village chief in June 2020.

<sup>11</sup> Village database and Key Informant Interviews with commune chief and village chief in June 2020.



**Table 3.8: Demographic data of Preah Vihear province**

Description	2015	2016	2017	2018
Population	229,390	238,661	247,015	246,403
Annual population growth (%)	0.57	4.04	3.5	-0.25
Total male population	114,368	119,168	127,320	120,532
Total female population	115,022	119,493	119,695	125,871
Total households	52,216	54,946	56,289	58,104
Female headed households (%)	12.77	13.11	14.15	13.24
Family size (person/family)	4.39	4.34	4.39	4.24
0-17 years old (%)	43.78	44.10	41.34	42.15
18-60 years old (%)	50.81	50.07	52.77	51.55
> 61 years old (%)	5.41	5.83	5.88	6.30

93. Takeo province had a total population of 1,026,201 persons or 221,736 households in 2018, with a population growth rate of 1.16%. The provincial population has grown by 23,012 persons just over past three years, compared to the 2015 population of 1 003 189 persons or 212959 households. About 19.08% of the total households in Takeo province are headed by women. The provincial annual population growth rate increased from 0.33% in 2015 to 1.16% in 2018. The proportion of the population living in rural areas of the province is 90.50% or 980,755 persons including 504,417 women. Average household size is 4.63. The female population was 51.4% in 2018.

**Table 3.9: Demographic data of Takeo province**

Description	2015	2016	2017	2018
Population	1,003,189	1,007,121	1,014,473	1,026,201
Annual population growth (%)	0.33	0.39	0.73	1.16
Total male population	486,338	488,278	495,593	498,512
Total female population	516,851	518,843	518,880	527,689
Total households	212,959	216,041	218,594	221,736
Female headed households (%)	18.77	18.69	18.81	19.08
Family size (person/family)	4.71	4.66	4.64	4.63
0-17 years old (%)	37.01	36.51	36.64	36.42
18-60 years old (%)	53.16	53.52	53.04	53.02
> 61 years old (%)	9.84	9.97	10.32	10.56

### **3.6.3.2. Education Level of the beneficiaries**

94. In Decho Thomacheat village of Preah Vihear Province, the educational level is very low, with only 2% of villagers having finished high school, 7% finished secondary school, 27% finished primary school, and 3% finished kindergarten. The illiteracy rate is 61%, mostly the women and female headed households.

95. In Phnom Da or Prek Taphor village of Angkor Borey district of Takeo province, the education level of villager is also very low and around 80% (75% for women) of villagers are illiterate. Approximately 20% of finished kindergarten (2% for female), primary school (11% for female), secondary school (9% for female), high school (2% for female) and university (1% for female).

### **3.7. Sensitive Receptors**

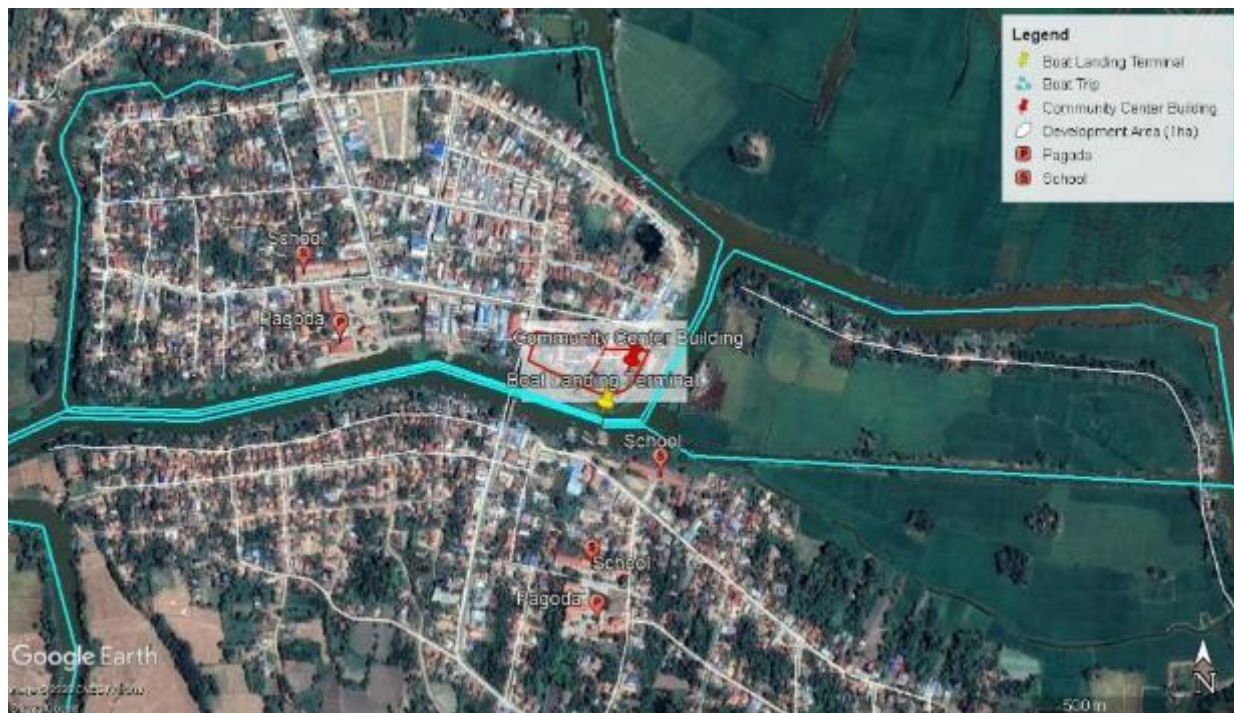
96. Within a radius of 5 km of the both project areas are schools and pagodas as shown in Figure 3.16. In addition, residential area is sensitive to disturbance from project activities, especially in the more densely populated residential area of Phnom Da.

**Figure 3.16: Location of Sensitive Receptor in Project Sites**

(a) Sensitive Receptors at the Phnom Da Site



(b) Sensitive Receptors Surrounding Community Building Center



(c) Sensitive Receptors at Decho Thomcheat Village



### 3.8. Public Infrastructure and Service

#### 3.8.1. Access to Water and Sanitation

97. In Decho Thomcheat, villagers collect water from 457 wells and 21 small-scale ponds for drinking water purposes and other uses. While most households treat their drinking water, some 20% consume untreated water. As highlighted in the Section 3.3.1 discussion of surface water quality, coliforms are a common contaminant, necessitating that water be boiling before consumption. It is noted that purchase of purified water from commercial supplier appears to be less costly than boiling water (e.g., boiling 20 L of water requires 4 kg of coal costing 1500 Reil/kilo (Cambodian Currency) or 0.375 USD/kg.<sup>12</sup> Besides access to clean water, about 34% of households have hygienic toilets (i.e., water flushed toilet with septic tank).<sup>13</sup> Remaining households use small dug pits as toilets. The project will support construction of hygienic toilets for pilot homestays and at tourist facilities. Training on good hygiene and sanitation will also be provided to villagers in addition to guidance on cost-effective toilet construction.

98. Pure drinking water supply in Decho Thomcheat village is largely provided by a social enterprise established by the Teuk Saat 1001 organization (i.e., a French NGO) in 2018. This facility is located on the eastern side of O Svay Lak. Additionally, three others private, family scale drinking water sellers operate in the Sra Em commune. These sellers also extract water from O Svay Lake. Water provided by Teuk Saat 1001 is filtered through sand, carbon and micro filters, and then undergoes ultraviolet disinfection. Water is bottled in 20-liter containers for distribution.

99. In Prek Tapor project village 49 households or 26% of the village population consume bought purified water while the remaining 74% of villagers consume water directly from the wells and ponds. Discussions with local authorities revealed a high risk of waterborne disease transmission in the village. Aside from unsatisfactory drinking water access, only 31 households or 17% of total households have access to toilets, of which only 26 households have a hygienic toilet. Except 31 houses or 17% of the total family who access to toilets. However, among these 31 houses, there are only 26 houses who have the hygiene toilet.

<sup>12</sup> Teuk Saat 1001 Report, 2020. (Does this report have its water quality test data? If yes, please add to the water section above)

<sup>13</sup> Village and commune database 2019.

100. The Prek Taphor village area is surrounded by water and two-thirds of the area can be inundated by water during the rainy season. Therefore, access to water is normally not a constraint. However, during the dry season, villagers struggle with access to clean drinking water, currently being restricted to one pumped well, one dug well and existing streams. Of the 187 households, only 44 have access to clean natural water sources, and instead rely on purified water purchased from private sellers<sup>14</sup>. Recently, a private water supplier connected tube water supply from Angkor Borei district to different communes, with the exception of a remaining 1.7 km stretch from including Phnom Borei and Phnom Da or Prek Taphor village which will be completed by the end of 2020<sup>15</sup>.

101. Both Preah Vihear and Takeo provinces predominantly rural areas, where access to proper sanitation toilets is limited. Construction of toilets is typically undertaken by individual households using available funds. As shown in Photos 3.6, household toilets are simple structures which are connected to septic tanks. Tanks are generally emptied by local pump trucks once per year. Septage removed is usually sent to a collected site licensed by the Provincial Department of Environment.

102. There is a public toilet at Phnom Da which is in disrepair and the project will build new toilets, whereas the toilets at Angkor Borei museum are in satisfactory condition. There are no public toilets at Phnom Borei, which is another mound in the project area, and people use restaurant toilets.

**Photo 3.3: Toilet in Project Sites**



(a). In Phnom Da, Takeo Site



(b). In Decho Thormcheat, Preah Vihear Site

### **3.8.2. Solid Waste Management**

103. In the Preah Vihear Province project area, at Decho Thormcheat village the commune set aside a two-hectare plot of land on which was established an uncontrolled landfill site, covering 1.5 ha by 2008. The landfill has a large excavated waste cell which is normally inundated with water and not suitable for landfilling operations during the wet season. There is no leachate pond or storm water cut off drains and perimeter fencing are not in place to capture wind-blown litter or prevent unauthorized site access. The underlying soil type is clay with low permeability and with additional site works the clay foundation will limit ground water contamination. The site is >600 m away from a surface water stream (i.e., Peamphean stream). There is currently no waste collection service operating in the commune, with households and businesses instead accumulating waste in small piles and then burning it.

104. In the Takeo Province project area, there is a waste collector who collects solid waste from the Angkor Borei wet market and delivers it to a private waste disposal site owned by the market manager in Samkaki village. The collection service does not cover household waste. The disposal site is >500 m away from the closest source of surface water which is the Takeo River. The site occupies approximately one hectare and has an average depth of four meters. The site is divided

<sup>14</sup> FGD with villagers in June 2020, Key Informant Interview with village chief and commune chief in June 2020 and Village database 2019.

<sup>15</sup> Key Informant Interview with District Governor in September 2020.

into three cells, of which one and one half are already filled with waste. The active landfill cell is inundated with water and water logged but leachate was not observed to be draining into surrounding rice fields during a site visit. The landfill site does not have fencing to capture wind-blown litter nor does it have controlled access. Machinery is not used to compact or cover the cells, and it appears that waste is burned on a regular basis. The access road is 300 meters from the main road and no problem with littering or windblown litter was observed in the surrounding rice fields. This suggests that waste collection vehicles are properly covered. The disposal site is more than five kilometers away from the Phnom Da Temple project area. In Prek Tapor village, solid waste disposal involves dumping or burning.

#### IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES

105. Based on the project activities so far as detailed in the Project prescription, applicable legal framework and baseline situation, potential environmental impacts of the proposed project from design, construction to operation stage are assessed.

##### 4.1. Design of project activities and alternatives

106. The long list of facilities subsequently went through an extensive screening process involving financial, technical, social and environmental criteria. The main environmental criteria for this initial screening were to avoid civil works in Protected Areas and minimize adverse impact on fragile ecosystems and physical cultural resources. Because all candidate facilities were already existing and well-used, no new alignments were considered and no encroachment on valuable ecology was found.

107. In PV province project area, the project originally pondered to enlarge or beautify the village lake for tourism. During discussion with the client and FS team, environmental consultant and ADB staff cautioned the potential adverse impacts and complex implication on water resources. They suggested just small improvement such as clean-up garbage etc. and to instead focus more on improving sanitation and waste management which lay the basis for tourism and contributing to environment and hygiene. This was taken by the project design for both project areas as central feature. The problem and baseline of sanitation and waste management is shown in Section 3.8 in Chapter III on baseline (Public Infrastructure and Service).

108. At Phnom Da/Prek Tapor village area, the preliminary work in IEE identified that every year in the past decades, about two third of the district area is flooded for half year during raining season. Climate change is expected to make the situation worse. Therefore, structures proposed to be supported by the project needs to consider in their site selection, e.g., on higher ground, especially their underground structures such as septic tanks.

109. Regarding PCR, the original proposal includes stairs and viewing plat form in both PV and Phnom Da temple surroundings. Given PV temple as UNESCO heritage and the candidate status of Phnom Da monuments and environs, the project team consulted with MOCFA and its Heritage Department in Phnom Penh. It has indicated that the proposed civil works for PV temple and Phnom Da including stairs, boardwalks and viewing platforms on the top of hill, could represent an impact on the integrity and authenticity at the monument sites. It is agreed not to build these structures near or in both temples areas. All these also show how the IEE process and associated consultation has optimized the project design.

110. **Biodiversity.** Screening of project activities identified that they are unlikely to adversely impact important biodiversity habitat. No activities are planned in close proximity to designated Protected Area (PAs) in the two project provinces. Similarly, although Decho Thorncheat village in Preah Vihear Province is located within the Upper Stung Sen Catchment KBA the majority of project activities will not occur near sensitive biodiversity habitat. No critical biodiversity habitats as defined in ADB SPS will be affected by project activities. Tourist visits to O Svay which is frequented by population of Asian Openbill stork (an IUCN Red List least concern species) for feeding and roosting purposes could adversely affect this habitat. If tourist numbers and wildlife interactions are not

properly managed there is the potential to disturb birds. Such impacts should be duly considered in planning and managing tourism activities.

## **4.2. Impacts during Construction**

111. There will be no construction activities associate with Output 1 and Output 2 since these are capacity building, marketing and promoting tourism activity and improving local livelihood. The main construction impacts will be in Output 3 and the civil works involved in improving and construction of small public infrastructure and facilities in both project sites.

### **4.2.1. Soil Erosion and Vegetation Loss**

112. The area's most vulnerable to erosion are temporary construction sites and other places where surface soil will be disturbed. This will include "clearing and grubbing work" along the length of the O Svay embankments in Preah Vihear and Stream Embankment in Takeo Province. The most effective erosion control will be interception drainage to protect disturbed surfaces from surface flows, see measures in the EMP.

113. Loss of vegetation and assets at the project site and along the project site. There will be loss of trees, and assets where they have encroached upon the along the steam embankment (Tourism Interpretation Center close to O Svay Lake and Canal where is in front Angkor Borei Museum). The construction activity will require removal of vegetation where it has established.

114. Before construction in all areas, the PMU and contractor will clearly mark trees which are to be retained. Contractors will erect fencing around these trees (extending to the canopy drip line) and convey the requirements to all machinery operators and residents to ensure that valuable trees are not damaged. After construction, removed trees and productive shrubs will be replaced with new plantings (see the EMP).

### **4.2.2. Impacts on Ecology and Biodiversity**

115. The Section 3.2 review of biodiversity habitat and species explained that potential impacts of project activities are likely to be minor since no activities are planned in close proximity to PA in either of the project provinces. Similarly, although the Decho Thormcheat project village is situated within the Upper Stung Sen Catchment KBA, project activities will predominantly occur within existing developed areas and modified habitat. Construction activities will however be expected to adversely affect local wildlife and aquatic species, including noise and vibration disturbance, loss of vegetation, and degradation of received water quality as a result of sediment runoff and contaminant discharges. Such impacts will be minor, short term, and localized, and can be effectively avoided or minimized through application of good construction practice, as described in the EMP.

### **4.2.3. Impacts on Air quality**

116. Gaseous air pollution. Construction machinery on all sites will consume petrol and diesel, releasing gaseous SO<sub>2</sub>, CO, and NO<sub>x</sub>. Equipment will be maintained to a high standard to ensure efficient running and fuel-burning. High-horsepower equipment will be provided with tail gas purifiers. Vehicles and machinery to be used on site by the contractors will be inspected for clean running condition by the CSAF.

117. Dust. Construction sites will potentially produce fugitive dust from material storage areas, dump sites, concrete mixing, excavation and general site usage – especially under windy conditions. Material stockpiles and concrete mixing equipment will be equipped with dust shrouds. The operators will regularly maintain the shrouds to ensure their effective operation. At construction sites, water spraying for the suppression of dust and maintenance of driving surfaces will be standard site management practice. Vehicles carrying soil, sand, or other fine materials to and from the construction sites will be covered. Dust-producing works in close proximity to sensitive receptors will be provided with additional safeguards.

#### **4.2.4. Noise Disturbance and Vibration**

118. Noise can be expected during construction from machinery operation and transport activities. Construction activities will involve haulage vehicles, bulldozers, excavators, concrete-mixing plants, rollers, and other heavy machinery. Noise intensity from these machines operating is typically around 80 decibels at the site (5 m from operating machinery). The transport of material, aggregate, concrete, and waste material to and from sites will also cause noise impacts along the haulage routes. Activities with intensive noise levels will not only have an impact on the residents, but may also cause injury to construction workers operating the equipment.

#### **4.2.5. Impacts on Water Environment**

119. Construction wastewater is produced from the maintenance and cleaning of mechanical equipment and vehicles, maintenance water for mixing and curing concrete, cooling water, construction office or workers' camp and lost water and soil during the construction period which is discharged as pollutants. The effluent commonly contains no poisonous and harmful substance, except suspended solid or sewage from toilet and camp. If discharged directly without any treatment, it still has the potential to impact existing water bodies. Some oil-containing wastewater can arise from machinery repairs and kitchen.

120. Polluted construction wastewater will not be discharged into the surrounding soil or into surface water systems. Sedimentation traps will be built, and after settling out of solids the waste residue in the traps will be cleared and transported to an approved site. Oil-containing wastewater will require the installation and maintenance of oil-water separators before the sedimentation trap.

#### **4.2.6. Impact of Solid Wastes**

121. The construction workforce will generate solid waste (food wastes, kitchen wastes, paper, and other solid waste including food-laden wash water). Proper disposal of this waste will be essential. It will be the responsibility of the construction contractors to provide toilets with pump-out and disposal facilities and sufficient garbage bins at strategic locations and ensure that they are (i) protected from birds and vermin; (ii) disposed regularly (using the nearest licensed solid waste landfill); and (iii) avoid overflow.

#### **4.2.7. Social Disturbance**

122. Improper Work Schedules and construction traffic and activities can disturb social life of villagers, their access to livelihood activities, market, school and religious activities. Haulage of materials and movement of plant and machinery will take place on local roads, which are often barely able to cope with local traffic demands. Potential impacts include: Disruption to livelihoods, commercial and social activities; noise; dust; road safety; road surface and drainage damage.

123. The civil work plan and scheduling will be approved by the commune councils, taking into account the local people's need for access, e.g., during harvesting and planting periods, through consultation before construction planning. They will include (i) sequential work scheduling (to ensure that only short stretches are worked on at a time), (ii) provision of access to existing residences and services, and (iii) temporary land occupation. For details on measures, see the EMP.

#### **4.2.8. Impacts on Health and Safety**

124. Safety and health of both workers and residents may be threatened by construction activities. The impact on public, occupational health and safety during the construction period can be summarized as follows and mitigation measures will be proposed in EMP.

- (i) Staff/workers who are not taught or trained on construction work may be affected during working such as having accidents which may cause injury or death,
- (ii) In case there is no proper management for hygiene and sanitation such as no provision of proper aeration, protection equipment in case of emergency, garbage, etc. in the campsites' areas, there may be impact on staff's health

- (iii) Staff/workers who are non-local people may be suffering from diarrhea by having not proper cooked and non-clean food
- (iv) Health of staff/workers and people nearby may be affected from dust, smoke and noise
- (v) In case construction equipment and transportation vehicles are not properly checked-up and maintained, they may cause impact on health of staff/workers and people nearby the project

#### 4.2.9. Impacts on Cultural Resources and Properties

125. The project design dropped the lookout view at Phnom Da and only keeps the viewing structure around the excavation site. According to the regulation of Heritage Protection Law of Cambodia, it allows light structure when it is more than 30 meters from the Cultural property boundary, in this case the temple enclosure wall. Light construction for tourism has small impact, because the wooden structure just installs on the rock. It might need to drill the rock to connect pin and the pillar of wooden for supporting upper structure.

126. Museum Site, Ex-pagoda building, Monk residential building: The renovation or conservation in purpose for develop tourism as the buildings was dated more than 60 years better conduct a preservation work and apply the facilities for tourism. The buildings are inside the District compound, for the renovation work might not using heavy machine, no need to dig down to make foundation.

127. The project aims to arrange the river front to open for establish walk way canopy, which creating an esthetic landscape to attract local and foreign tourist want visit the museum compound and also well understand of Cultural awareness and lean about history of Angkor Borei, Phnom Da and related sites. If the construction conducted by light material of wood or similar material may not need to dig down depth foundation, so the impact also minimize. Furthermore, in case when the construction needs to base support foundation such as concrete pillar or foundation base, in this case when they open the hole at the location of foundation and also related with the size of they may need to check with the soil layer with archaeological experts for record or if found any evident.

128. **Dust** generated by civil work includes pollutants that may harm cultural relics. Falling dust may change or fade colors of cultural relics. Dust is often a good carrier of bacteria and mould especially in wet climate. When falling dust in the air combines with moisture and falls on the surface of cultural relics, a film of surface cover that is hard to be cleaned would be fairly suitable for the existence and breeding of microorganism such as bacteria and mould. Due to short duration of exposure, distance of planned structure from temples and related ancient structures, such impacts are expected to be moderate. Frequent rainfall in the tropic can also help to clean the dust falling on relics and sites. Specific measures to further protect the heritage and mitigate the dust impacts are in the EMP.

129. **Noise and Vibration.** In construction, main vibration sources are from vibration of different machines in operation, such as excavation, transport, backfill and mixing. Such vibration has features of impacts, discontinuity, etc.; on construction site. Given aging cultural relics and lack repairs, they are fragile, the harm of vibration on them would be more significant than that on ordinary modern buildings or structures. Therefore, equipment and machines to be used during civil work near the cultural relics and temples need to be carefully selected, e.g., small hand tools with low vibration. However, vibration dissipated rapidly over distance from its source. Given the distance of structures planned in Takeo site to the ancient structures and in Prear Vihear Site to the Buddhist monastery near the lake, the impacts are moderate and can be readily mitigated by the EMP measures.

130. Chance-find might be uncovered during construction. It is also desirable to undertake an archaeological survey to mitigate cultural impact. However, it might not be realized given the limited time and budget of the project. Therefore, a chance-find procedure (in the EMP) is crucial to immunize impact of construction and best protect the uncovered relics.



### 4.3. Impacts during Operation

131. The project has the following positive impacts on the local populations during the operation phase; (i) control of landscape quality, (ii) increased conservation awareness, (iii) enhanced role of women, (iv) increased cultural awareness, (v) improve local livelihood, (vi) maintenance of archaeologically significant sites, (vi) economic growth and (vii) poverty reduction. While the negative impacts are also concern due to increase of tourist and operation of some activities of the project.

#### 4.3.1. Impacts on Air Quality

132. During operation phase, air quality may be potentially impacting due to emission from motor vehicles and airborne dust on the road. At Decho Thormcheat village, the paved road is only few kilometers from the junction of village and NR.62. The remaining road in the village is laterite road. In addition, Takeo site, the road connectivity from Phnom Da and Phnom Borei is also laterite road. The main pollutant are CO, NO<sub>x</sub>, and TSP. Therefore, during project operation, number of movement tourist's vehicle is increase which can effect on air pollution.

133. During the operational phase, air quality may be potentially affected due to dust dispersion, air pollutants, and increased greenhouse gas emissions from fuel combustion of project activities e.g., increased number of restaurants, increased garbage which lead to possible burning garbage and agro-residues. The main gases emitted by motorbike, vehicles of tourist and burning are THC, NO<sub>x</sub> and CO. The VOC, PM and CO<sub>2</sub> emissions. For vehicular traffic, the overall impact to GHG and non-GHG air emissions from the increased vehicle traffic is expected due to relatively increasing in tourism traffic.

134. Community Center in Angkor Borei district, Tourism center in Decho Thormcheat is installed the toilet with septic tank collection system which includes abundant albumen and other organic matters that would decay easily and generate sensitive smell matters such as hydrogen sulphide and ammonia. Environmentally friendly toilets in project site are foam blocked toilets, which do not emit odor and would have negligible impacts on the ambient environment. Flush toilets would generate some odor and management shall be strengthened on these toilets through cleaning in a timely manner. If such measures are taken, flush toilets would have minimal impacts on the air.

#### 4.3.2. Noise Disturbance

135. The higher noise levels at the project site are from motorcycles and these will increase in the generated traffic volumes significantly more than other vehicle types. Baseline noise level is described in Section 3.4 in Chapter III. During operation, there are vary sources of noise disturbance and its potential impacts are including; (i) traffic noise from tourist's vehicle and (ii) tourist noise. Tourists would generate some social noise when visit the tourism site. Compared to similar projects, such social noise generally ranges 60 – 70 dB (A). The impacts of social life noise can be mitigated by strengthening tourism administration and reminding tourists.

#### 4.3.3. Impacts on Water Quality

136. As described in Section 3.8, the project sites have no public drainage connectivity. After the project in operation, the potential environmental impacts on water include:

- (i) Impacts of Surface Run-off from agriculture/planting supported by the project. The impacts of O Svay Lake Pathway<sup>16</sup> and Angkor Borei Museum River side<sup>17</sup> works on surface water environment during operation is mainly from the surface rainwater runoff, the major pollutants of which are SS and oil stain. These pollutants would have certain impacts on the water quality of water bodies once they enter the latter with rainwater runoff. Current water exceeds standard on some parameters already show run off from farming (use of fertilizer etc.). It will not increase after the project since the project will provide training on strengthen agriculture activity with using organic fertilizer rather than chemical fertilizer which is highly pollution on water quality.

<sup>16</sup> In Preah Vihear Site.

<sup>17</sup> River Side in front of Angkor Borei Museum.

- (ii) Impacts of Solid Waste Disposal. The number of solid wastes will be generated from tourist and other tourism activity. Absent of waste management program/plan will impacts of water bodies where sites are close to the project e.g., O Svay Lake, Angkor Borei River, and other man-made canal in Angkor Borei district.
- (iii) Risks of malfunctioning of sanitation facilities (toilets, septic tanks, and village level sewage treatment) can generate odour, impacts on surface and ground water, manure and septic treatment and disposal as well as soil, health and safety issues etc. In case septic tank is full without timely clean-up or damaged, there is leak of and/or uncontrolled wastewater from septic tanks and toilet which could lead to water pollution and spreading pathogens and disease.

#### **4.3.4. Impacts of Solid Waste on Environment**

137. As described in Section 3.8.2 of Chapter III on Solid Waste Management, none domestic waste collection service in both project sites. In practice, solid waste was collected individually by families and then burning or buries in their house yard. In addition, in Angkor Borei district, there is one service provider who is responsible to collect waste from Angkor Borei market.

138. Tourism activities tend to increase the volume of non-biodegradable and other solid wastes; plastics, bottles, cans, scattered toilet paper are frequent sights. These can be impacts on air quality, water quality, soil quality and health and safety. The odor Pollution due to domestic waste generation. During the transfer of garbage, some organic garbage, during decomposition, would emit odor, which is the main impacts on air quality.

139. An absent of waste management and sufficient garbage bin, tourist and other tourism service will disposal waste body which is near by the project sites. Thus, it impacts on water quality, soil quality as well as health and safety in community especially during raining season or if the dumping site of inundated.

#### **4.3.5. Impacts on Ecology and Biodiversity**

140. Increased access and frequency of tourism activities involving wildlife viewing can adversely affect wildlife; for example, disturbance of birds feeding and roosting in O Svay Lake in Preah Vihear Province. Noise disturbances and physical intrusion can stress wildlife and cause out-migration to other habitat which may be less optimal to wildlife breeding, resting and reproductive needs. It is essential therefore that noise and other tourism-related disturbances, especially during peak seasons and traditional holidays involving noisy celebrations, be minimized through sustainable tourism practice, better planning and management, and awareness raising, see the EMP.

#### **4.3.6. Impacts on Physical Cultural Resources**

141. The project is designed to market and attract more tourists to the temples at Preah Vihear and Phnom Da and tourist facilities funded by the project. It is expected that the number of tourists will increase over time, however in the short-term tourist numbers will be significantly less than at their peak for these two temple sites in 2019. Current estimates indicate that it will take at least 2 years to recover or exceed the same number as 2019 tourist arrivals.<sup>18</sup>

142. After the project is completed, it would attract more tourists, improving the reputation of cultural relic's sites and scenic areas. It can promote the development of tourism for nearby cultural relics, greatly enrich people's livelihood, and expand the funding channels for cultural relic's protection. Therefore, the project would have economic and social benefits.

143. However, increase in tourists would increase the probability of misconduct and low awareness on cultural resources protection. Some individual may inscribe on ancient buildings, threw garbage in temple ground, damage ancient structures, or smoke or picnic in undesignated areas causing fire risk to cultural resources and forest etc. Awareness needs to be raised to promote protection of cultural heritage. Rational planning and controlling the number of tourists is needed.

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<sup>18</sup> PV has 148,150 (Year to date 98,660) and Takeo site has 31,700 in 2019 (Year to Date 13,400).

144. The repair and maintenance of protected cultural sites involved can cause damage if not follow the principles of protecting cultural relics and specific technical requirements and the work should be undertaken by an entity with the qualification certificate for cultural relic projects.

#### **4.4. Induced and cumulative Impacts**

145. Cumulative impact refers to the impacts that result from the incremental impact on an areas or resources used or directly/indirectly impacted by the project, from other existing, planned activities. The International Finance Corporation (IFC) (2012) defines cumulative impacts as “those that result from successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned and/or reasonably anticipated future ones”.<sup>19</sup>

146. After the project, influx of tourist is expected to grow and with their overnight stay increased. Together with existing social-economic activities of the residents, this will add pressure on local utilities such as water supply and sanitation, public services such as garbage and solid waste management, leading to cumulative impacts on the environment.

147. With tourism development, the existing problems of poaching, encroaching and illegal trafficking of artifacts etc. might increase. People from outside the project villages might be drawn in by the business opportunity and thus lead to some induced impacts on the ecosystem and its conservation effort, and on physical cultural resources and archaeological and conservation work. Unfortunately, the earlier archaeological project near Takeo project area was disturbed by looting and illicit trafficking of Khmer antiquities, which continues as a problem. Tourism development and influx of people might exacerbate such problem if the management remains weak as before.

### **V. CLIMATE CHANGE IMPACT ASSESSMENT**

148. ADB requires screening for climate risk and identification of climate-proofing options at the project level. Rural infrastructure and public services, and small-scale, high-value agricultural production and processing activities contemplated under the project are vulnerable to anticipated changes in climate conditions including changing temperatures and unreliable rainfall. This rapid assessment considers existing and projected future climate conditions in the two project provinces, the vulnerability of project outputs, and adaptation measures that are commensurate with climate change risks and the small-scale nature of project activities. Preparation of the assessment involved desk review of existing information and available modelling information on climate change in the project provinces, and identification of recommended measures to reduce vulnerability and climate change impacts. The assessment was subject to some limitations, including; lack of specificity of proposed project activities in each of the project provinces at the preliminary stage of project design, inability to travel to the project locations to undertake ground truthing due to Covid-19 restrictions, and lack of opportunity to collect new data or to undertake sensitivity analysis.

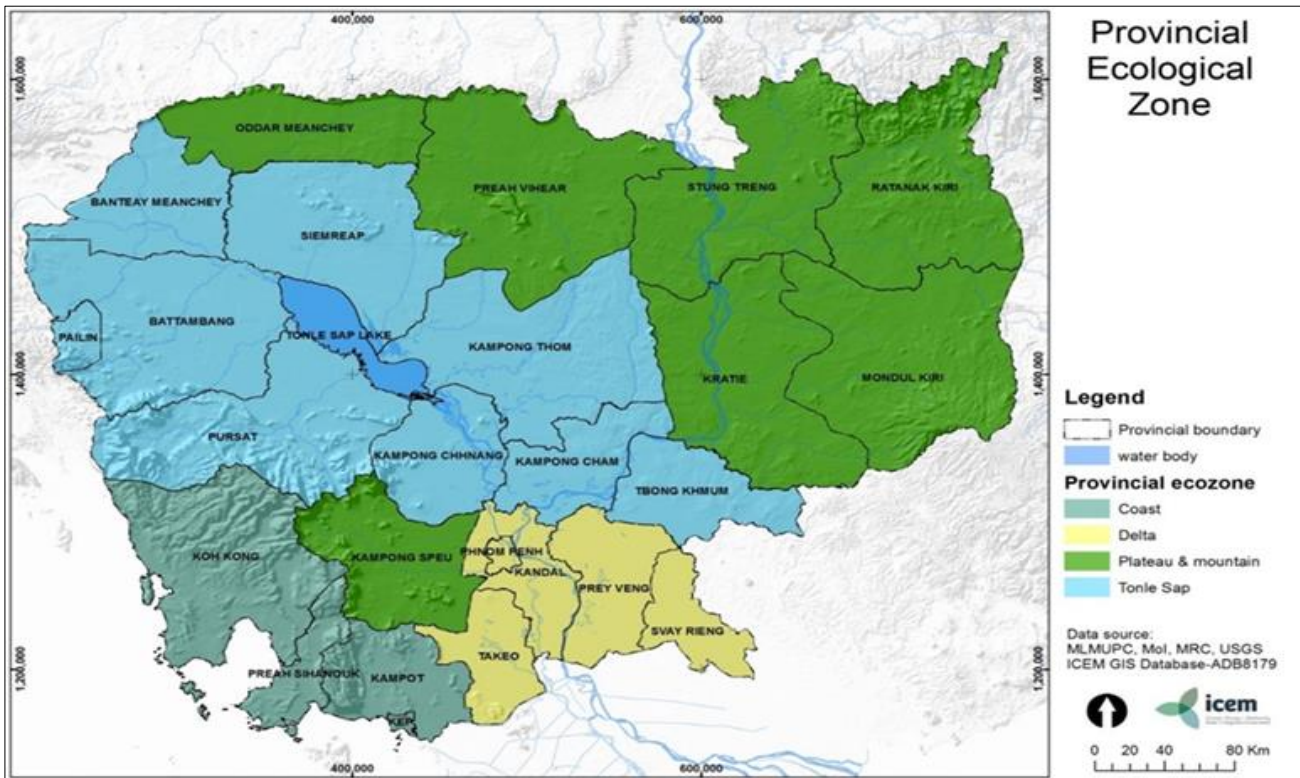
#### **4.5. Climate Change Projections**

149. Cambodia is regarded as one of the most climate change vulnerable countries in Southeast Asia. Geographically and ecologically, it consists of four ecozones: Tonle Sap, Delta, Plateau and Mountain, and Coastal ecozones (Figure 5.1). Climate related impacts manifest differently in these ecozones, with provinces such as Preah Vihear in the Plateau and Mountain zone facing serious impacts of intense rainfall-related flooding and droughts while provinces such as Takeo in the flat Delta and Tonle Sap zones are at risk from impacts of river flooding, droughts, and storms.

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<sup>19</sup> IFC Performance Standards on Environmental and Social Sustainability, January 2012, International Finance Corporation, World Bank Group

**Figure 5.1: Eco-zones of Cambodia**



150. Climate variability and frequency of extreme climate events are expected to increase markedly in Cambodia with incrementally increasing temperatures and changes in rainfall patterns. Anticipated climate changes can be projected using the Cambodia Climate Change Decision Support System developed by the International Center for Environmental Management (ICEM) in early 2019. With this tool, two climate change scenarios, RCP8.5 and RCP4.5 (IPCC5), can be selected to project climate change and anticipate likely changes in the occurrence of floods and droughts. This assessment uses the RCP 8.5 scenario based upon the wetter wet season and drier dry season conditions of the IPSL-CM5A-MR general circulation model. This scenario was chosen because of the nature of the project's outputs involving rural infrastructure and public services, and agriculture production and value-added processing, each of which is affected differently by critical climate-influenced factors such as excessive rain, heatwaves, and drought. Results generated by the model include baseline and projected changes in precipitation and temperature through to year 2050.

151. The modelling results for projected changes in precipitation indicate that rainy season rainfall in Preah Vihear and Takeo provinces is likely to increase by +4.5% and +2.8% by 2050. Rainfall in the dry-season is likely to decrease by -13.6% in Preah Vihear and increase by 4.0% in Takeo by 2050. Preah Vihear Province is therefore projected to be substantially wetter in the wet season and drier in the dry season whereas Takeo Province is likely to be slightly wetter in both wet and dry seasons. More specifically, outcomes of predicted climate changes are: (i) changes in the duration of seasons with a tendency for shorter rainy season and longer dry season, (ii) the rainy season will start later and end earlier, (iii) the number of rainfall events in the rainy season will reduce and the gap between rain events will be longer, and (iv) moisture content in the wet season will be higher and in the dry season will be lower. The shorter rainy season together with increasing precipitation and decreasing number of rain events will lead to increased frequency and intensity of intense rainfall that could generate large amounts of storm water, leading to more frequent flooding in the rainy season. Conversely, the dry season will become longer, hotter and drier, leading to more frequent occurrence of droughts.

#### **4.6. Vulnerability Assessment**

152. Anticipated project activities have varying vulnerabilities and adaptive capacities to climate extremes of floods, storms and droughts as considered in this section.

#### **4.7. Climate vulnerability of rural infrastructure and public services**

153. The project recognizes the importance of improved tourist access walkways and bicycle paths, safe drinking water supply<sup>20</sup>, sanitation, and solid waste management to the attractiveness and sustainability of promoting tourist homestay. Proposed access improvements combined with existing village roads and tracks are important to drawing tourists to natural and heritage attractions. Additionally, it is necessary to have basic sanitation (e.g., septic tanks, latrines or public toilets), and garbage collection. The extent of project investment is to be determined during detailed design, taking into consideration the most suitable options, cost effective and easy to operate and maintain by villagers.

154. The two project provinces are located in the Plateau and Delta zones of Cambodia which have different topographies. In Preah Vihear Province the ground elevation varies between high and low terrain with consequent rapid runoff of water causing soil erosion. Takeo Province is generally low elevation flood plain with a more elevated southern area on alluvial plain. The flood season in Takeo is normally from July to early November with peak flows between September and November as a result of upwelling of the Bassac River system in the east together with runoff water from surrounding areas in the western side. Lower terrain rural infrastructure and public services in both provinces are sensitive to flooding, especially where infrastructure is not properly designed to ensure adequate drainage and minimize flooding. Damage to such infrastructure largely depends on the severity of floods and their impacts on flood depth and duration.

155. It is evident that small rural infrastructure and services to be funded by the project will be vulnerable to flood damage, and that this risk is likely to increase in the future. It is desirable therefore for the project to invest in climate proofing during project design and implementation rather than waiting to invest in climate proofing if and when needed at a later point in time.

156. Adaptation measures which might be considered in infrastructure design and engineering to make them more resilient to future climate change include:

- (i) Applying locally-adapted design and specifications.
- (ii) Sourcing of good quality construction materials that are strong, durable and resistant to degradation.
- (iii) Designing and maintaining cross and side drains along walking and cycling paths to ensure that they remain functional and do not become damaged or fill up with soil, vegetation, and garbage.
- (iv) Designing and constructing embankments along low-lying sections of walking and cycling paths to decrease susceptibility to flooding, and bio-engineering embankment slopes using local resilient grass and trees.
- (v) Establishing a clear and effective mechanism for maintenance of walkways and paths, involving active participation of local people.
- (vi) Introducing water conservation measures including recycling, rainwater harvesting, storm water retention for reuse, and pollution control through improved sanitation.
- (vii) Raising awareness among villagers and tourists on garbage reduction and recycling, and adopting basic landfill management practices (e.g., regularly covering garbage layers with soil, avoiding scattering of waste, prohibiting waste burning).

##### **4.7.1. Climate vulnerability of agricultural production and processing facilities**

157. Agricultural production and value-added processing facilities, particularly production, are moderately to highly vulnerable to climate change. Climate change causes reductions in vegetable production, affects tea and seed spice yields, reduces poultry reproductive capacity, and limits aquaculture productivity. Additionally, agriculture post-harvesting processing needs to adapt to changing climate conditions. Generally, climate change adversely affects food production and facilities intended to add value to local agricultural products.

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<sup>20</sup> Villages currently rely on readily available bottled water as a drinking water source. The project therefore does not contemplate funding potable water supply system improvements.

#### **4.7.1.1. Small-scale, high value vegetable cultivation**

158. Climate change is a primary cause of low vegetable production, reducing average yields for most vegetables. Increasing temperatures, reduced irrigation water availability, and flooding are major limiting factors in sustaining and increasing vegetable productivity. Under changing climatic situations crop failures, shortage of yields, reduction in quality, and increasing pest and disease problems are common.

159. Vegetables are generally sensitive to environmental extremes, with higher temperatures in particular causing low yields due to heat stress. Erratic rainfall patterns additionally result in pronounced reductions in vegetable production due to shorter growing seasons. Rain-fed agriculture will be most impacted due to rainfall variability and reduction in number of rainy days. Changes in temperature and rainfall also fosters the spread of pathogens and the evolution of new strains of insect pests and fungal, bacterial and viral diseases.

160. Adaptation responses can include:

- (i) Planting climate resilient vegetables (i.e., stress resistant vegetable crop varieties).
- (ii) Adopting production systems for improved water-use efficiency and adapt to hot and dry conditions (e.g., changing sowing or planting dates in order to combat likely heat spells and water stress periods).
- (iii) Providing irrigation during critical stages of crop growth and conserving soil moisture (e.g., water harvesting through ponds and utilization in the form of drip, mist and sprinkler; mulching with crop residues and plastic mulches to help conserve soil moisture).
- (iv) Growing vegetables on raised beds during the rainy season will increase yield due to improved drainage.
- (v) In instances of excessive soil moisture due to heavy rain, producing vegetables inside clear plastic rain shelters to reduce the direct impact on developing plants and field water logging.
- (vi) Cultivating grafted plants in crops such tomato, capsicum, eggplant and cucurbits (i.e., grafting plants onto temperature, drought and flooding resistance rootstocks enhances the environmental-stress tolerance of vegetable crops).
- (vii) Building farmer knowledge of integrated pest control.

#### **4.7.1.2. Tea and black pepper cultivation**

161. Tea being a primarily rain fed crop requires certain soil and air temperature as well as specific moisture conditions for its growth. Climate change related alterations in local weather conditions—prominently changing rainfall patterns resulting in frequent flood and droughts, temperature increase, change in relative humidity, and sunshine hours—causes yield losses and a reduction in tea quality. Tea requires adequate and well distributed rainfall, with excess and shortage of water affecting growth. Waterlogging in particular is a major stressor which affects the growth and survival of plants. Additionally, the probability of pest infestation increases with increasing temperature, with stressed plants being more susceptible to pest attack.

162. Adaptation measures can include:

- (i) Planting of drought tolerant cultivar.
- (ii) Adopting organic agriculture practices such as reducing chemical load through integrated nutrient management, and adopting integrated pest management to avoid environmental pollution and residue in processed tea, mulching with vegetative matter, and applying green manure to increase soil fertility.
- (iii) Planting of shade trees to reduce temperature, and protect land from periods of extreme rainfall.
- (iv) Improving drainage to avoid prolonged water-logged conditions.
- (v) Irrigating plants during periods where rainfall is insufficient.
- (vi) Rainwater harvesting to provide stored water for irrigation and to maintain humidity in tea plantations during periods of moisture stress.

- (vii) Crop diversification including planting spices such as black pepper to provide economic returns if the tea crop fails.

163. Increasing maximum and minimum daily temperature and decreasing annual rainfall generally affect yields of spice crops like seed spices and black pepper, with pronounced weather changes having a major impact on productivity.

164. Adaptation measures can include:

- (i) Adopting integrated agroforestry practices involving planting pepper plants among trees to provide shade and moderate temperature.
- (ii) Planting boundary trees around pepper plantations.
- (iii) Applying mulch to conserve soil moisture.
- (iv) Irrigating plants during periods where rainfall is insufficient.
- (v) Harvesting rainwater to provide stored water for irrigation.

#### **4.7.1.3. Poultry production**

165. Poultry are particularly vulnerable to climate change because birds can only tolerate a narrow temperature range. Consequently, reproductive capacity may substantially decrease under even moderate temperature changes. Furthermore, more dramatic events such as storms increase bird stress and may adversely affect productivity.

166. Adaptation responses which can be adopted by poultry farms include:

- (i) Improving poultry housing systems to maintain optimal seasonal temperatures and reduce the risk of heat stress through enhanced ventilation and cooling.
- (ii) Building poultry sheds capable of coping with more intense weather events and increased rainfall, including more robust construction and improved drainage systems to accommodate floods and frequent rainfall.
- (iii) Reducing stocking density in sheds during periods of extreme temperatures.

#### **4.7.1.4. Aquaculture**

167. Planned inland pond aquaculture is vulnerable to direct and indirect impacts of climatic change, including changing rainfall patterns, more intense storms, increased temperature, and drought. Consequences are increased variation in water levels resulting in either drying up or over-flooding of ponds, shortening the growing season and reducing harvests; and higher temperatures affecting water quality (e.g., decreased oxygen levels), worsening dry season mortality, and increasing risk of pathogens.

- (i) Adaptation responses can include:
- (ii) Integrating pond aquaculture with agriculture reduces farmers' vulnerability to drought and provides a source of high-quality protein to supplement crops.
- (iii) Anticipating flooding risk, communities can construct artificial flood defenses and/or maintain natural ones to provide some degree of flood protection.
- (iv) In flood prone areas, utilizing fish and prawn strains and techniques which maximize production, introducing shorter culture periods, and minimizing capital investment to reduce stock loss and associated costs.

#### **4.7.1.5. Agriculture post-harvest processing**

168. Agriculture facilities for packaging, processing, storing and distributing produce are somewhat less vulnerable to climate change compared to food production but still need to adapt to current and future conditions. Existing facilities may require upgrading and new facilities appropriately designed. Recognizing the small scale of contemplated project activities, specific guidance is not provided on siting criteria and technical specifications for processing facilities but generally attention should be given to siting facilities to minimize risk of flooding and managing solid waste and by-products, wastewater, air emissions, and energy consumption.

169. Climate change adaptation measures which can be applied to the design of new facilities or renovation of existing facilities, include the following:

- (i) In response to hotter temperatures, designing buildings to optimize orientation, insulation, glazing and shading, and landscaping to help to enhance natural ventilation.
- (ii) Anticipating drought and water shortages, harvesting rainwater.
- (iii) Anticipating more intense storms, avoiding building in flood zones and elevate mechanical and electrical equipment.
- (iv) Anticipating power interruptions, designing mechanical systems to operate on DC power and provide site-generated electricity from renewable energy.

#### **4.8. Adaptation and mitigation measures**

170. Adaptation and mitigation measures specifically relating to climate change during the project design and operation phases are included in the EMP. Construction phase measures have not been specified as these are already anticipated in planned small-scale project civil works.

171. Incorporation of identified adaptation measures in design and construction will contribute significantly to the climate change resilience of planned infrastructure. However, project activities will be more costly as a result, with adaptation costs added to business-as-usual base costs. For agricultural production, it is assumed that autonomous climate change adaptation by growers will occur incrementally as climate changes affect productivity and yields. For agricultural processing facilities, increased costs should be factored into project activity budgets to implement building adaptation measures designed for hotter future temperatures, and drought and water shortages; and identified measures to address storms and floods and power interruptions to proof against extreme events. Tourism infrastructure adaptation options are necessarily constrained by available project funding. Recommended adaptation measures are therefore proportional to planned project activities, relying on small, appropriate technologies and good practice. Expected costs of adaptation measures adopted by the project will be elaborated following detailed project design.

#### **4.9. Monitoring and Evaluation**

172. Monitoring of climate change resilience measures should initially identify the extent to which technically feasible and affordable measures have been incorporated into the project design and/or are being adopted and implemented. In the longer term, the effectiveness of the adaptation measures should be monitored through the project's design and monitoring framework including indicators of the sustainability of climate change mitigation efforts and impacts of climate change weather events on project infrastructure.

## **VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE**

#### **4.10. Objectives and methodology**

173. The consultations of IEE drafts aimed to interface with the individuals and institutions who may be affected by the activity of the project and to get their feedback and suggestions on how to reduce adverse impacts and enhance positive impacts. In addition, it sought to get all stakeholders informed about the project and gave them an opportunity to offer their opinions and monitor the implementation of the project. It is also to collect data, comments and recommendations from all stakeholders in general and numbers of issues related to the proposed development project aiming to prepare a quality full report of environmental and social impacts assessment.

174. According to Prakas No. 120 Pr.B.St, issued by Ministry of Environment on April 11, 2018, on the deployment model of working conditions for infrastructure and tourism development, the planning of public participation consist of three stages: (1) information dissemination at the project site, (2) the interviews with local authorities, affected communities and stakeholders, and (3) the consultation workshops.

175. ADB's policy on disclosure and consultation are described in Chapter II on legal framework. More specifically, meaningful consultation shall be as representative as possible, thus needs to first identify all affected people and vulnerable groups as targets for disclosure and consultation. Public



consultation should focus more on affected people instead of local officials. It can be through public or focus group meetings, individual interview and questionnaire survey or a combination.

176. The IEE report shall document in detail the date, places, and manner of public disclosure in the country. For consultation, the topics, method, number of participants, their distribution by age, gender, education level, profession etc. need to be documented in the IEE report as evidence of representativeness. Their main concerns expressed and how these concerns are addressed in the EMP or the project design should be documented in the IEE too.

#### **4.11. First round Disclosure and Consultation**

##### **4.11.1. Preliminary Information Dissemination**

177. On June 2020, the TRTA consultant team met and informed to relevant stakeholder, local authority and local people in Preah Vihear and Take Provinces about the project development. Stakeholder for this preliminary disclosure and consultation are:

178. Provincial Department:

- (i) Provincial Department of Environment
- (ii) Provincial Department of Agriculture, Forestry and Fishery
- (iii) Provincial Department of Culture and Find Art
- (iv) Provincial Department of Planning
- (v) Provincial Department of Tourism
- (vi) Provincial Department of Women Affair

179. Local Authority

- (i) Preah Vihear vice governor
- (ii) Takeo Vice Governor
- (iii) Choam Khsant District Office
- (iv) Sra Aem commune Office
- (v) Angkor Borei District Office
- (vi) Communes' office in Angkor Borei district

180. Local People (30 participants; including 10 female) in communes, Angkor Borei district, Takeo province and Sra Aem commune, Choam Khsant distict, Preah Vihear province. Mainly through household visits.

##### **4.11.2. Interviews and Focus Group Discussions with Local People**

181. The discussions with local authorities, affected communities and stakeholders took place on June 2020 in the form of focus group discussions (FGD) with two groups (See Photo 6.1). The discussions aimed to (1) disseminate information about the project, project owner, and the scope of the project, and the environmental and social impacts assessment of the project, (2) explore the trend of local people's livelihoods and other infrastructure development projects; and (3) seek feedback and give the floor to the community representatives and affected persons to raise their concerns, suggestions and recommendations to the project owner and consulting team.

**Photo 6.1: Focus Group Discussion with Local People**



(a). At Preah Vihear Site.



(b). At Phnom Da, Takeo Site.

#### **4.11.3. The Interviews with Local Authorities and Provincial Departments**

182. Key Informants Interview (KII) with local authorities and relevant provincial departments took place on June 2020 at each units and departments. The purposes of these interviews were to (1) disseminate project information including project owner, the scope of the project, and the environmental assessment of the project, (2) give the opportunities for local authorities and relevant provincial departments raising their concerns, suggestions and recommendations to project owner and the consulting team to improve the environmental and social impacts assessment report.

183. As the local authorities, they are happy with the project because it would make some positive impacts, such as:

- (i) Promoting tourism activity in Preah Vihear and Takeo province
- (ii) Improving the livelihood of local people in target provinces.
- (iii) Raising awareness on bird protection in O Svay Lake, Preah Vihear province
- (iv) Contributing to the national economic development
- (v) Making the communities more developed

184. On the other hand, they expressed some concerns including:

- (i) The dust is rising to people and commuters through transporting trucks during the construction phase
- (ii) Noise disturbance may affect the nearby pagodas and schools

**Photo 6.2: Meeting with Local Authority**



Meeting with Preah Vihear Vice-governor



Meeting with local Authority in Chroam Khsant District, Preah Vihear Province



Meeting with Takeo governor



Meeting with local authority in Angkor Borei District, Takeo Province

**Photo 6.3: Consultation with Relevant Provincial Department**



Provincial Department of Environment, Takeo Province



Provincial Department of Culture and Find Art, Takeo Province

**4.12. Second round IEE Disclosure and Consultation**

185. To comply with ADB's requirement and domestic requirements by MoE, a second-round consultation was conducted after sufficient local disclosure of full draft IEE/EMP was completed and translated in Khmer language. The public announcement on IEE/EMP has posted on CSAF Facebook and website, District/commune information board of each target province on 18 November 2020 as show in below Photo. During late December 2020, the consultation workshop was arranged into 4 groups; two (2) groups of provincial consultation and two (2) groups of community consultation. The consultation workshop was held from 28 – 31 December 2020, total participant is 83 participants with 16 females. List of participants is in Appendix 3. In addition, the consultation at central level with ministry of environment, ministry of agriculture, forestry and fishery, and ministry of Culture and Fine Art in Phnom Penh, during mid-December 2020.

**Table 6.1: Summary table for consultation and group meetings**

Meeting	Women (%)	Age range	Education level	Profession
Meeting 1: 28 December 2020, Takeo Provincial Hall, 17 participants	35%	25 – 50	At least bachelor degree	Multi discipline (provincial department of all relevant stakeholder e.g., Department of Environment, depart. Of cultural and fine art
Meeting 2: 28 December 2020, Angkor Borei Admin District Office, 23 participants	13%	25 – 50	At least secondary school	Local people and commune committee, from commune office, district office, village.

Meeting	Women (%)	Age range	Education level	Profession
Meeting 3: 29 December 2020, Sa aem commune office, 20 participants	20%	25 – 50	Same as above	Local people and commune committee.
Meeting 4: 30 December 2020, Preah Vihear Provincial Hall, 23 participants	8.69%	25 – 50	At least bachelor degree	Multi discipline (provincial department of all relevant stakeholder e.g., Department of Environment, depart. Of cultural and fine art
Meeting in PPH with Ministries (MoE, MoCFA, MoAFF etc.)	12.5%	35 – 55	At least bachelor degree	<ul style="list-style-type: none"> <li>- Department of Environmental Impacts Assessment of MoE</li> <li>- Department of Forestry, Ministry of Agriculture, Forestry and Fishery</li> <li>- General Department of Heritage, Department of Archaeology and Prehistory, Protection and Preservation of Ancient Buildings, MoCFA</li> </ul>

**Table 6.2: Results of feedback and consultation**

Meetings	Positive Impacts	Negative Impacts	Suggestion/Recommendation
<b>Summary of Meeting in Takeo Province</b>			
Provincial level	Promote people in the community to have a prosperous life and increase national and international tourists to visit historical sites to study, research and entertain.	Since Angkor Borei is a historical site with many ancient temples and ancient sites, the project could affect the heritage of the area.	During the project implementation, if any archeological site, underground and underwater artifacts are affected, study and consult with cultural experts, including the Department of Culture and Fine Arts and the MoCFA to find a solution as soon as possible to participate in promoting and maintaining the protection of heritage in a stable manner
	I would like to support this project because it can improve the lives of the people who live there and also promote tourism.		The contractor in the project work, please provide personal safety equipment to the workers for safety during construction.
	I would support the project activity.	Car parking might have significant impacts	<ul style="list-style-type: none"> <li>- Shall study in detailed design for car parking space.</li> <li>- The project should study the detailed blueprint of the project study area in accordance with the environmental assessment for easy feedback</li> <li>- The project should study the impact of food store where they sale food along canal<sup>21</sup> because the master plan of Takeo province designates this river as a waterway for tourism, agriculture and trade.</li> </ul>
in Angkor Borei	Support the project		<ul style="list-style-type: none"> <li>- People has requested to support technlogy on prawn hatchery and improve market.</li> </ul>
<b>Summary of Meeting in Preah Vihear Province</b>			
At provincial level meeting.	<ul style="list-style-type: none"> <li>- conservation of local resources for development</li> <li>- improving the livelihoods of the community and provide employment opportunities that</li> </ul>	<ul style="list-style-type: none"> <li>- May challenges between communities and people outside related to the benefits of the project</li> </ul>	<ul style="list-style-type: none"> <li>- Should be widely disseminated to relevant people to create a community and ask for voluntary participation</li> <li>- All expected challenges should be stated in the community charter to seek the consent of the community and stakeholders.</li> </ul>

<sup>21</sup> Food stores which are located along the canal where is in front of Angkor Borei Museum. As the result of social impacts assessment, there will no impacts on those food store.

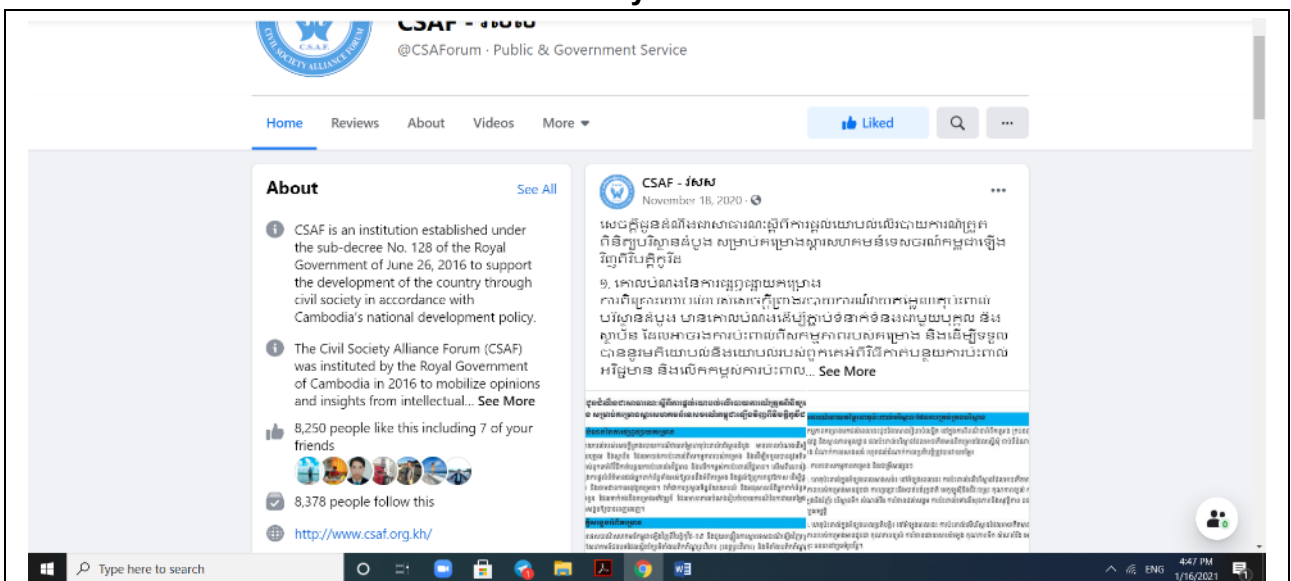
<b>Meetings</b>	<b>Positive Impacts</b>	<b>Negative Impacts</b>	<b>Suggestion/Recommendation</b>
	can help solve unsustainable problems	- May challenges in organizing tourism products from within the community	- A mechanism should be set up to facilitate community support
	<ul style="list-style-type: none"> <li>- Promote tourism, entertainment</li> <li>- Establish agricultural markets</li> <li>- Increase local profits, especially to farmers</li> </ul>		<ul style="list-style-type: none"> <li>- Community Tourism Commission should organize agro-tourism</li> <li>- The committee should have the expertise and local authorities involved</li> <li>- Request the construction contractor to abide by the contract and respect the road traffic, law on Good roads protect the lives of people living near the project site</li> </ul>
			<ul style="list-style-type: none"> <li>- Community skills training should be encouraged first so that they can participate Eco-tourism effectively.</li> <li>- Focus on the environment to promote aesthetics, hygiene and well-being of local communities and tourists</li> <li>- Arrange standard accommodation for tourists and set reasonable prices</li> <li>- Establish various service systems that serve all needs of tourists and have a wide dissemination of ecotourism to Attractive</li> <li>- Shall be involved in conserving natural resources to serve local ecotourism</li> <li>- Shall be an appropriate distribution of benefits to the communities involved.</li> </ul>
Local people in Sa aem commune	Support the project	No any concern about pollution since the project construction is short term.	- As homestay owner, villagers request the project to provide more support on homestay facilities and provide more training to attract tourist.
<b>Summary of Meeting at Central Level (MoE, MoCFA and MoAFF)</b>			
Central Level	Support the project	No any concern about pollution since the project construction is short term.	<ul style="list-style-type: none"> <li>- After the Ministry of Environment reviewed the EMP, the Ministry suggested that any mitigation measures that could not be used It does not need to be mentioned in the report, because when the project is implemented, only practical measures will be taken and monitoring.</li> <li>- During the implementation of the project, EA should invite the Ministry of Environment to participate in monitoring.</li> <li>- The Ministry of Agriculture, Forestry and Fisheries requests the project to consider planting more trees in the project area to help increase Aesthetics as well as participation in replanting trees.</li> </ul> <p>discussion with MoCFA summarised below:</p> <ol style="list-style-type: none"> <li>i. Phnom Da is too sensitive to build stairs and a viewing platform at this tentatively listed UNESCO World Heritage site so the civil works as it is likely to impact on the integrity and authenticity of the site</li> <li>ii. The existing car park, toilets and, boat landing at Phnom Da is considered to be "complementary" and can be accepted once engineer team submit</li> </ol>

Meetings	Positive Impacts	Negative Impacts	Suggestion/Recommendation
			the detailed design and site plans for this work. iii. The civil works at Angkor Borei museum is the responsibility of the District Administration Office. MoCFA will have an interest if the contractor discovers artifact during excavation works and there is a procedure for these discoveries

Source: Public Consultation, December 2020.

186. Meaningful consultation to safeguard the environment and local residents will continue throughout the construction and operation phases of Output 3. The implementing agency will be responsible for organizing the public consultations, with the support of the project implementation consultant.

**Photo 6.4: Disclose Activity of IEE/EMP Announcement**



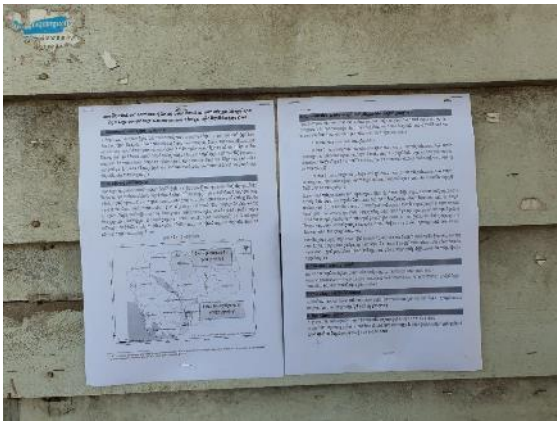
Announcement Post on CSAF Facebook, available on <https://www.facebook.com/CSAFForum>



At Angkor Borei District Office, Takeo Province



At Prek Taphor Commune, Angkor Borei District, Takeo Province



At Sa Eam Commune, Choam Khsant District, Preah Vihear province

**Photo 6.5: Public Consultation in Preah Vihear and Takeo Province**



Meeting at Angkor Borei Administration Office, 28 December 2020



Meeting at Sa aem Commune Office, 29 December 2020



Meeting at Preah Vihear Provincial Hall, 30 December 2020

## VII. ENVIRONMENT MANAGEMENT PLAN

### 4.13. Introduction

187. The Environmental Management Plan (EMP) is a set of actions and arrangements to mitigate the adverse impacts assessed and found during IEE process. It is developed in line with applicable domestic and ADB guidelines and standards, drawn on experience in the EMPs of similar projects and WB/IFC's EHS guidelines and related international good practice. It includes a number of components crucial to effective environmental management within the project: (i) organizational responsibilities and arrangement; (ii) mitigation measures of impacts during construction and operation; (iii) EMP training plan; and (iv) monitoring scheme and reporting requirements.

188. The EMP will be incorporated into tender documents, construction contracts, and operational management procedures and implementation of the EMP will be a contractual requirement. Contractors and the PMUs will implement these measures, depending upon subproject phases. The effectiveness of these measures will be carefully monitored to determine whether adjustments are needed.

### 4.14. Institutional arrangement and Responsibility

189. To effectively implement the environmental management plan (EMP), the participation of all relevant stakeholders is required, in particular, The Executive Agency (EA), Project Coordinating Unit (PCU), Project Implementation Unit (PIU) as the project owners. However, it is important that each party is responsible for things that it is best equipped and/or engaged for. The mechanism in supervision and related reporting are briefly outlined here.

190. **During construction**, supervision, monitoring and reporting of EMP implementation should have the following layers at most, in order to be cost-effective:

- (i) Routinely checking on-site by the Supervision Engineer especially the resident ones who are supposed to be on site daily and need to submit to PIUs/PCU at least a monthly report anyway about civil work progress and quality - Just include performance on the EMP in their reports;
- (ii) The PCU/PIUs assisted by the PIC/environmental consultants need to carry out on-site inspection on regular or random basis, and record the findings and remedies they required etc. in writing;
- (iii) Quantitative monitoring: will be undertaken by external monitoring entity engaged by the PCU. The contract for the monitor needs to request them to submit the testing results with explanation if the result comply with applicable standards or not, and analysis of the reasons for non-compliance;
- (iv) Based on work of a-c, the PIUs can easily compile reports to the PCU which in turn can readily prepare semi-annual report to the ADB on environment performance of the project and the EMP implementation



191. **During operation**, supervision and reporting will be undertaken mainly by the PIUs and overall inspection by PCU:

- (i) The PIU needs to carry out on-site supervision and inspection on regular basis (at least once a month), and record the findings and corrections etc. in writing and forward to PCU;
- (ii) Quantitative monitoring: will be undertaken by external monitoring entity engaged by the PCU. The contract with monitor needs to request them to submit the testing results with explanation if the result comply with applicable standards or not, and analysis of the reasons for non-compliance;
- (iii) Based on work of e-f, the PIUs can easily compile reports to the PCU which in turn can readily prepare semi-annual report to the ADB on environment performance of the project and the EMP during operation

192. Based on the above mechanism, the implementation arrangements of responsibilities for major parties are summarized in the Table 7.1 below.

**Table 7.1: Responsibility for Environment Management and Supervision**

Major parties	Environmental Responsibility
	<b>Design and preparation phase</b>
Civil Society Alliance forum (CSAF) as EA/PCU	<ul style="list-style-type: none"> <li>- CSAF is EA/PCU (Executive Agency/Project Coordinating Unit), is responsible for overall project implementation including the environment and social safeguard by:               <ul style="list-style-type: none"> <li>o Appoint Safeguards Officer, who will coordinate with the project's environmental specialists to ensure compliance with the Environmental Management Plan (EMP);</li> <li>o Establish and coordinate project Grievance Redress Mechanism (GRM).</li> <li>o Coordinating with other government institutions and donor, and PIUs to facilitate the implementation of the EMP</li> </ul> </li> </ul>
Safeguard Officer of PCU Environment Specialists of project implement consultancy (PIC)	<ul style="list-style-type: none"> <li>Safeguard officer of the PCU assisted by Environmental consultants shall:               <ul style="list-style-type: none"> <li>o ensure that EMP has been incorporate into bidding document and contracts agreement of all work</li> <li>o Engage the environmental monitor/ labs if needed;</li> <li>o Conduct EMP training, capacity building and set up GRM</li> </ul> </li> </ul>
Project Implantation Unit (PIU):	<ul style="list-style-type: none"> <li>- PIUs are responsible for EMP implementation in their respective project area, under the guidance of PCU and assisted by the PIC.</li> <li>- PIUs will designate one counterpart staff who will be responsible for safeguard including the implementation of the EMP.</li> <li>- Participate in the EMP training and related preparation work;</li> </ul>
Ministry of Environment (MoE) Provincial Dept. of Environment	<ul style="list-style-type: none"> <li>- Review and Approve domestic EMP and other needed permits;</li> <li>- join/participate the site visit on environmental monitoring when needed</li> </ul>
	<b>Construction phase</b>
Civil Society Alliance forum (CSAF) as EA/PCU, and its Safeguard Officer  Two PIUs in the project provinces: National authority of Preah Vihear (NAPV) for PV site. Angkor Borei District Administration Office as PIU in Takeo sites	<ul style="list-style-type: none"> <li>- PCU and PIUs will be overall responsibility in ensuring the project compliance of safeguard policies and compliance reporting during construction at central level and in two project areas respectively               <ul style="list-style-type: none"> <li>o Ensure the contractor compliance with the EMP during construction;</li> <li>o Establish and coordinate project Grievance Redress Mechanism (GRM).</li> <li>o Ensure the compliance with the approved EMP during construction;</li> <li>o Disclose information about whole project on CSAF website e.g., monitoring report, consultation meeting etc.</li> <li>o Coordinating with other government institutions and donor, and PIUs to facilitate the implementation of the EMP</li> <li>o Submit the semi-annually monitoring report to ADB</li> <li>o As project owner they oversee all aspects relating to construction and safeguards in all the project's interventions including civil work.</li> <li>o Supervise on project's consultant</li> </ul> </li> <li>- Safeguard Officer of PCU will support all above work of the PCU related to environment, in particular: Conduct site visit to supervise the EMP</li> </ul>

	implementation and prepare reports to ADB as a means to the end- protect the environment and cultural resources.
Contractor	<ul style="list-style-type: none"> <li>- Implementing the EMP measures during construction.</li> <li>- Ensuring compliance with Occupational Health and Safety standards (including Covid-19 prevention).</li> <li>- Appoint an environmental health and safety (EHS) and GRM staff who will be responsible for ensuring EMP implementation and compliance with EHS requirements and issue relating to GRM</li> <li>- Provide the training on environmental health and Safety to contractor workforce (e.g., waste management, Covid-19, HIV and public health).</li> </ul>
Supervision Engineers	<ul style="list-style-type: none"> <li>- Supervise on routine (daily) basis the work of contractors to ensure their compliance with the EMP and covenants of the contract.</li> <li>- Report to PCU for resolution and rectification of non-compliance with the EMP.</li> <li>- Participate in the resolving complaints arising from complaints by affected people.</li> </ul>
PIC environmental consultant	<ul style="list-style-type: none"> <li>- Assist PCU and PIUs on all work related to environment and cultural resources protection</li> <li>- Supervise on-site the EMP implementation</li> <li>- Help conduct EMP training and capacity building</li> <li>- Collect data and help prepare semi-annual monitoring report</li> </ul>
External environmental monitor	Conduct quantitative environmental monitoring (air quality, surface and ground water quality, noise level), analysis and reporting to PCU and PIUs.
Relevant agencies and stakeholders	Local authorities e.g., commune office, village heads will participate with all project activity.
	<b>Operation phase</b>
Civil Society Alliance forum (CSAF) as EA/PCU, and its Safeguard Officer	PCU will be overall responsibility in ensuring the project compliance of safeguard policies and compliance reporting during operation and ensure the tourism facility managers compliance with the EMP after construction and during operation.
PIUs as Owner/Operator of public sector investment by the project	<ul style="list-style-type: none"> <li>- Ensure to follow the EMP for operation of public toilets, garbage collection, sanitation pilots at homestay households, promote good agriculture practice with model farmers.</li> <li>- Coordinate with different government departments and communities to maximize the benefits of the project for beneficiaries.</li> <li>- Engage labs/external environmental agency to conduct quantitative monitoring according to environmental monitoring plan.</li> </ul>
Private owners /operators: - Water supplier enterprises	<ul style="list-style-type: none"> <li>- Ensuring the filtration equipment at the water facility is maintained so that water compliance with the standard issued by Ministry Industry and Handicraft.</li> <li>- Ensure the water supplied /sold are tested according to national requirements and meet drinking water standard of Cambodia.</li> </ul>
- Agricultural operators (prawn hatchery)	<ul style="list-style-type: none"> <li>- Supported by Asian Institute of Technology (AIT) to monitor the water quality</li> <li>- Recycling and reuse of wastewater produced by hatchery which can be used in the larger growing pond for mature fresh water prawn</li> </ul>
External environmental monitor	Conduct quantitative environmental monitoring (air quality, surface and ground water quality, noise level), analysis and reporting to PCU.
Relevant agencies and stakeholders	Local authorities e.g., commune office, village heads will participate with all project activity.

Note: EA=Executing Agency, PMU=Project Management Unit, PIU=Project Implementing Unit, PIC=Project Implementing Consultants, EMP=Environmental Management Plan

#### 4.15. Mitigation Measures

193. Based on the impacts assessment and risk analysis, past experience of similar projects, applicable national requirements and international good practice as reflected in the IFC's EHS general guidelines, concrete measures are developed to mitigate adverse impacts and risks during preparation, construction and operation phase of the project, see Table 7.2. The Physical cultural resources (PCR) Management plan and mitigation measure related to health and safety (H&S) and covid19 measures are also included in this EMP.

194. **Table 7.2** summarizes the potential impacts, and specifies corresponding mitigation measures designated to minimize those impacts. The majority of costs associated with the

implementation of the EMP measures will be absorbed within the costs for (i) detailed design; (ii) construction contracts; and (iii) operation and maintenance budgets. Estimated costs are provided in the following table as line items (EMP implementation training and GRM establishment) or, in the case of construction costs, to provide an indication of the scale of the measure and to assist in assessing construction tenders (to see whether adequate allowance is made for mitigation measures).

**Table 7.2: Potential Impacts and Mitigation Measures**

Major Impacts	Mitigation Measures and/or Safeguards	Who Implement	Who Supervise	Budget estimate (\$1,000)
<b>1. Design and pre-construction</b>				
Improper institutional set-up overlooking environment issues, also in bidding and contracting	<ol style="list-style-type: none"> <li>1. Assignment of a PCU safeguards Officer;</li> <li>2. Prepare bids and construction contracts, include EMP and environmental contract clauses for contractors, namely the special conditions</li> <li>3. Contractors will assign an environmental health and safety (EHS) officer who will be responsible for daily and weekly monitoring and reporting on EHS</li> <li>4. Establishment of the GRM in the pre-construction phase</li> <li>5. Training on the EMP and health and safety requirements covering the implementation and supervision applying to all project outputs to PMU and local PIUs staff and contractors</li> </ol>	PCU and PIUs, safeguard officer, PIC	PCU	5
The construction site management planning and organization	<ul style="list-style-type: none"> <li>- Construction site boundaries and site use</li> <li>- Timing of construction (with respect to wildlife visitation periods, social activities to minimize disturbance)</li> <li>- Construction site inspections before work starts to identify areas to avoid</li> <li>- Plan and design wastewater and solid waste disposal arrangement and facilities;</li> <li>- Specify Constraints on the siting of construction camps and preliminary locations.</li> <li>- Education and capacity building on ecological protection to all foremen, technicians and workers.</li> <li>- Sequential work scheduling to ensure that only short stretches are worked on at a time</li> <li>- Provision of access to existing residences and services</li> </ul>	Contractor	PCU/PIU's safeguard officer, and PIC	Including in construction Cost
Site preparation, Loss of vegetation and assets	<ol style="list-style-type: none"> <li>1. Before construction in all areas, the PIU and contractor will clearly mark trees which are to be retained</li> <li>2. Contractors will erect fencing around these trees (extending to the canopy drip line) and convey the requirements to all machinery operators and residents to ensure that valuable trees are not damaged.</li> <li>3. After construction, removed trees and productive shrubs will be replaced with new plantings.</li> </ol>	Contractor	PCU/PIU's safeguard officer, and PIC	Including in construction Cost
<b>2. Construction phase</b>				
2.1. Soil Erosion	<p>Construction plans will include erosion control prescriptions for construction work areas, including:</p> <ul style="list-style-type: none"> <li>- Constructing intercepting ditches and drains to prevent runoff entering construction sites, and diverting runoff from sites to existing drainage;</li> <li>- Limiting construction and material handling during periods of rains and high winds; and</li> <li>- Stabilizing all cut slopes, embankments, and other erosion-prone working areas while works are going on. All earthwork disturbance areas shall be stabilized and restored and/or revegetated within 30 days after earthworks have ceased at the sites</li> </ul>	Contractor	PIU/PCU Supervision Engineer PIC	3
2.2. Ecology From i) Land preparation activities; (ii) Soil Backfilling activities; (iii) Construction activities for public infrastructure and facilities; (iv) Waste and wastewater management, (v)	<p>In order to minimize and avoid the impacts, some following activity will be implanted:</p> <ul style="list-style-type: none"> <li>- The project will collaborate with local authorities to prevent bird poaching and hunting. The project will also advise workers not to destroy vegetation and not to hunt birds in the project's vicinity</li> <li>- Untreated wastewater or hazardous waste discharge into nearby public water bodies will be prohibited</li> <li>- Signs demanding 'No Hunting' will be installed in the project area. Bird hunting is prohibited and illegal</li> <li>- The project regularly inspects construction machinery and vehicles to prevent any engine oil leakage during operations, which would potentially affect water quality due to runoff</li> <li>- The Project has to ensure that no discharge of wastewater or hazardous waste into the water sources; O Svay Lake, Canal 12 and Stung Angkor Borei</li> </ul>	Contractor	PIU/PCU Supervision Engineer PIC	5

Major Impacts	Mitigation Measures and/or Safeguards	Who Implement	Who Supervise	Budget estimate (\$1,000)
Disturbance or displacement of individuals				
2.3. Air quality; Gaseous air pollution from petrol and diesel, releasing gaseous SO <sub>2</sub> , CO, and NO <sub>x</sub> ; Dust from dumps, excavating, concrete mixing, stockpiles etc.	Equipment will be maintained to a high standard to ensure efficient running and fuel-burning. High-horsepower equipment will be provided with tail gas purifiers. Vehicles and machinery to be used on site by the contractors will be inspected for clean running condition by the CSAF/PIC and local PIUs	Contractor	Same as above	2
	Material stockpiles and concrete mixing equipment will be equipped with dust shrouds. The operators will regularly maintain the shrouds to ensure their effective operation. At construction sites, water spraying for the suppression of dust and maintenance of driving surfaces will be standard site management practice. Vehicles carrying soil, sand, or other fine materials to and from the construction sites will be covered. Dust-producing works in close proximity to sensitive receptors will be provided with additional safeguards.	Contractor	Same as above	2
2.4. Noise and Vibration: Transport, vehicles, bulldozer, excavator, concrete-mixing plants, rollers, other heavy machinery.	<ul style="list-style-type: none"> <li>- Noise can be expected during construction from machinery operation and transport activities. Construction activities will involve haulage vehicles, bulldozers, excavators, concrete-mixing plants, rollers, and other machinery.</li> <li>- Noise intensity from these machines operating is typically around 80 decibels at the site (5 m from operating machinery).</li> <li>- The transport of material, aggregate, concrete, and waste material to and from sites will also cause noise impacts along the haulage routes. Activities with intensive noise levels will not only have an impact on the residents, but may also cause injury to construction workers operating the equipment.</li> </ul>	Contractor	PIU/PCU Supervisor Engineer PIC	5
2.5. Water Environment Wastewater is produced from the maintenance and cleaning of mechanical equipment and vehicles, maintenance water for mixing and curing concrete, cooling	Polluted construction wastewater will not be discharged into the surrounding soil or into surface water systems. Sedimentation traps will be built, and after settling out of solids the waste residue in the traps will be cleared and transported to an approved site. Oil-containing wastewater will require the installation and maintenance of oil-water separators before the sedimentation trap	Contractor	Same as above	3
	contractors need to provide toilets with pump-out and disposal facilities and sufficient garbage bins at strategic locations and ensure that they are: <ul style="list-style-type: none"> <li>- protected from birds and vermin;</li> <li>- disposed regularly (using the nearest licensed solid waste landfill); and avoid overflow</li> </ul>	Contractor	Same as above	1
	<ul style="list-style-type: none"> <li>- Storage facilities for fuels, oil, cement, and chemicals will be within secured areas on impermeable surfaces, provided with bunds and spill salvage equipment;</li> <li>- Vehicles and equipment will be properly staged in designated areas to prevent contamination of soil and surface water;</li> <li>- Vehicle, machinery, and equipment maintenance and re-fueling will be carried out in such a way that spilled materials do not seep into the soil;</li> <li>- Oil traps will be provided for service areas and parking areas; and</li> <li>- Permanent (at works site) and temporary fuel storage and refilling areas will be located at least 50 m from waterways, lake, canals or channels and will be protected by spill trays and temporary drainage bunds. All spills will be cleaned up and spill material removed from site</li> </ul>	Contractor	Same as above	3

Major Impacts	Mitigation Measures and/or Safeguards	Who Implement	Who Supervise	Budget estimate (\$1,000)
2.6. Social Disturbance	<p>The traffic management plan will include the following with details decided after consulting local community: Identified haulage routes should (i) be with the informed consent of affected communities; and (ii) avoid schools, temples and village centers. Haulage times will (i) define the set periods of truck movements; and (ii) avoid times of school start, lunch and school finish. The plan will also include access planning around working areas to avoid plant operators choosing their own routes and accidental land loss, erosion and disruption of cropping activities.</p> <p>Measures to protect the community will include:</p> <ul style="list-style-type: none"> <li>- Publicizing planned work schedules and locations well in advance of construction;</li> <li>- Implementing safety measures around the construction sites to protect the public, including warning signs to alert the public to potential safety hazards, and barriers to prevent public access to construction sites and unsafe areas, especially deep excavations, unstable soil and areas where machinery is operating;</li> <li>- Ensure regular co-ordination and consultation between contractor's EHS officer and village heads to ensure that any concerns are addressed quickly;</li> <li>- Ensure community is aware of the project GRM and its contact points.</li> </ul> <p>For the residential areas lining the project community health and safety will be safeguarded by the followings:</p> <ul style="list-style-type: none"> <li>- Extensive consultation by contractors with residents before construction commences;</li> <li>- Agreement with residents on work schedules and work periods each day;</li> <li>- Dust suppression, through watering and dust shrouds, to be maintained throughout the construction phase. Dust protection to be provided for residences as required;</li> <li>- Noise suppression, through maintenance of noise insulation on machines, scheduling and minimizing machine running, to be maintained throughout the construction phase. Temporary noise barriers to be erected along both sides of the construction easement to protect residences;</li> <li>- Obtain informed consent from residents for vehicular and worker access along the easement;</li> <li>- Ensure all potentially affected persons are made aware of Grievance Redress Mechanism (GRM), GRM entry points and procedures.</li> </ul>	Contractor	PIU/PCU Supervision Engineer PIC	Including into construction Cost
	<ul style="list-style-type: none"> <li>- Publicizing planned work schedules and locations well in advance of construction;</li> <li>- Implementing safety measures around the construction sites to protect the public, including warning signs to alert the public to potential safety hazards, and barriers to prevent public access to construction sites and unsafe areas, especially deep excavations, unstable soil and areas where machinery is operating;</li> <li>- Ensure regular co-ordination and consultation between contractor's EHS officer and village heads to ensure that any concerns are addressed quickly;</li> <li>- Ensure community is aware of the project GRM and its contact points.</li> </ul>	Contractor	Same as above	Including into construction Cost
	<p>For the residential areas lining the project community health and safety will be safeguarded by the followings:</p> <ul style="list-style-type: none"> <li>- Extensive consultation by contractors with residents before construction commences;</li> <li>- Agreement with residents on work schedules and work periods each day;</li> <li>- Dust suppression, through watering and dust shrouds, to be maintained throughout the construction phase. Dust protection to be provided for residences as required;</li> <li>- Noise suppression, through maintenance of noise insulation on machines, scheduling and minimizing machine running, to be maintained throughout the construction phase. Temporary noise barriers to be erected along both sides of the construction easement to protect residences;</li> <li>- Obtain informed consent from residents for vehicular and worker access along the easement;</li> <li>- Ensure all potentially affected persons are made aware of Grievance Redress Mechanism (GRM), GRM entry points and procedures.</li> </ul>	Contractor	Same as above	
2.7. Solid Wastes: include garbage and Hazardous and polluting materials. pollution of soil, surface water and groundwater:	<ul style="list-style-type: none"> <li>- Provide toilets with pump-out and disposal facilities and sufficient garbage bins at strategic locations and ensure that they are protected from birds and vermin;</li> <li>- Disposed regularly (using the nearest licensed solid waste landfill); and avoid overflow.</li> <li>- Storage facilities for fuels, oil, cement, and chemicals will be within secured areas on impermeable surfaces, provided with bunds and spill salvage equipment;</li> <li>- Vehicles and equipment in designated areas to prevent contamination of soil and surface water;</li> <li>- Vehicle, machinery, and equipment maintenance and re-fueling will be carried out in such a way that spilled materials do not seep into the soil; oil traps will be provided for service areas and parking areas;</li> <li>- Fuel storage and refilling areas be located at least 50 m from waterways, lake, canals or channels and will be protected by spill trays and temporary drainage bunds. All spills will be cleaned up.</li> </ul>	Contractor	PIU/PCU Supervision Engineer PIC	Including into construction Cost
2.8. Uncover relics during excavation, due to closeness to ancient sites and structures	<p><b>Chance-find procedure:</b></p> <ul style="list-style-type: none"> <li>• If artifacts are discovered during excavation, the civil work will be stopped immediately with the site protected.</li> <li>• In the meantime, the foremen and workers as well as the contractors need to report to Provincial Department of Culture and Fine Arts (DoCFA) or its local offices immediately.</li> <li>• DoCFA will conduct investigation and document the discovery.</li> <li>• If satisfy there is no more artifact presence, they will issue the order to continue the work.</li> </ul>	Contractor	PIU/PCU Supervision Engineer PIC	Including into construction Cost

Major Impacts	Mitigation Measures and/or Safeguards	Who Implement	Who Supervise	Budget estimate (\$1,000)
<b>3. Operation</b>				
3.1. Air: Gaseous air pollution, odor	<ul style="list-style-type: none"> <li>- Strengthen the traffic management in term of vehicle regulate check-up to reduce vehicle idling to reduce generation of vehicle exhaust.</li> <li>- Oil smoke from restaurants: restaurants are banned in/close to bird area at O Svay Lake;</li> <li>- Equip garbage bins and transferring area; arrange designated staff to clean and spray disinfectants and dispose the garbage timely to reduce odor.</li> <li>- Strengthen management of public toilets, reduce faeces storage and use sealing covers to reduce odor.</li> <li>- Septic tanks shall be cleaned at least twice a year</li> </ul>	PIU	PCU	Operational Cost
3.2. Noise: From Operation of infrastructure and tourism facilities	<ul style="list-style-type: none"> <li>- The impacts of social life noise shall be mitigated by strengthening both tourism center administration and reminding tourists;</li> <li>- Vehicle noise: Horn shall be prohibited when vehicles enter/exit to/from parking lots. Minimize the frequency of boosting and idle speed of motor vehicles;</li> <li>- Equipment noise: Low-noise equipment shall be used in water pump room, fan room and power distribution room to reduce noise and prevent noise pollution.</li> </ul>	PIU	PCU	Operational Cost
3.3. On water environment. Water pollution due to improper waste management and discharge wastewater into the lake.	<ul style="list-style-type: none"> <li>- Control on accidental septic tank spill on surface water: (i) staff shall be designated to monitor septic tank regularly, (ii) educate the villagers/homestay owners to regularly clear up septic tank and properly dispose of the septage; (iii) in case spilling, the emergency clean-up is required.</li> <li>- In case of abnormalities with the discharge, the outlet valve shall be closed and sewage be stored in the septic tank.</li> <li>- Feces from public toilets of all project site shall be discharged into septic tanks for treatment.</li> </ul>	PIU	PCU	Operational Cost
3.4. Solid Waste: Tourism activities can increase solid wastes; plastics, bottles, cans, etc.	<ul style="list-style-type: none"> <li>- Install garbage bins in different type of waste e.g., green bin for organic waste, yellow bin for bottle/glass waste, and grey bin for plastic waste;</li> <li>- Install sign board on waste segregation and instruction sign for waste disposal;</li> <li>- Under this project, educate the community and school to segregate waste is part of waste deduction to environment and well manage</li> </ul>	PIU	PCU	Operational Cost
3.5. Impacts on Ecology and KBA Noise Disturbance on Environment and species, air pollution on vegetation and birds due to air emission from mobile pollutant sour	<ul style="list-style-type: none"> <li>- Installation of signs shall be set up at appropriate locations of major tour sites, ancient and famous trees not to shout out, or destroy habitats of birds, beasts and other wild animals, or tread on vegetation</li> <li>- Number of ticket or allowing tourist enter the tourist site shall be controlled during high seasons</li> <li>- Management of tour vehicles shall be strengthened to avoid pollution of exhaust on sensitive plants and avoid frightening to animals and provide them with a peaceful living environment</li> <li>- Garbage cleaning and floating substances removing systems shall be established and improved to ensure timely collection and removal of garbage dumped by tourists</li> <li>- When needed, introduce max allowed tourists/day or per year to heritage sites ...</li> </ul>	PIU	PCU	Operational Cost

#### 4.15.1. Physical Cultural Resources Management plan

195. According to the regulation of Heritage protection Law of Cambodia, it allows light structure when it is more than 30 meters from the Cultural property boundary, in this case the temple enclosure wall. Light construction for tourism development is permitted.

196. **Decho Thormcheat Village.** Since Decho Thormcheat village is in the development zone where is no restriction on development specifically relating to heritage protection. However, there is a monastery near the lake where the project civil work will take place. Therefore, the following measures need to be followed during construction and operation.

197. **For Project Site in Takeo province,** based on the meeting with MoCFA, the excavation site at Wat Kumnou is considered as complementary small scale civil work which include stair, viewing platform, hand rail and interpretation panel. MoCFA will provide final approval when the project provides the detailed site plan for these portions of civil works.

**Table 7.3: Measures to protect physical cultural resources**

Impacts	Mitigation and protective measures	Implement by	Supervise by
<b>I. Detailed design and preparation</b>			
investment not integrated or not in harmony with PCR;  Activities or structures not permitted by Authority in charge of PCR	<ol style="list-style-type: none"> <li>1. New structures to be built by the project shouldn't exceed height requirements (normally two-floor near the PCRs); new or renovation of PCRs need to use the traditional methods in the same style with same or similar material as much as possible to keep the integrity and authenticity of PCRs.</li> <li>2. For this portion of the works, the project will observe the 30 meters minimum distance from the monuments as specified on the applicable national decree. The project will not directly support management of tourists at Phnom these sites which will be the responsibility of MOCFA</li> <li>3. The civil works interventions at the existing Angkor Borei Museum Site are not within MOCFA registered heritage zones or sites. The site is under the site is under the jurisdiction of the Angkor Borei District Administration Office. MOCFA will only have an interest in the site works if the contractor discovers artifact during excavation works and there is a procedure for these discoveries outlined in section 2.5. Regulations on Cultural Resource Protection.</li> <li>4. Engage PCR expert to guide and review the detailed design of structures near the PCRs.</li> <li>5. Obtain endorsement or clearance from MoCFA and provincial department on culture relics on FS before detailed design;</li> </ol>	Design team	PCU and PIUs,
Over-touristic, and business to disturb environ and local life	<ol style="list-style-type: none"> <li>6. Suggest and design the survey and data to be collected during operation phase;</li> <li>7. Based on operation data, to predict and Rational planning to control tourist number;</li> <li>8. Planning of needed public service and infrastructure based on survey and projection</li> </ol>	PCU and PIUs	MoCFA
<b>II. Construction phase</b>			
Dust, noise, and Vibration	<ul style="list-style-type: none"> <li>• Will avoid the use of heavy machinery.</li> <li>• Excavation of footing and septic tank will be completed using manual labor.</li> <li>• Water will also be used for dust dispersion.</li> <li>• Strengthening vehicle management, cleaning mud and dust on a periodic basis</li> <li>• keep road surface clean, spraying water on a periodic basic, and covering up or enclosing transportation vehicles etc.</li> </ul>	Contractors	PCU and PIUs MoCFA



<b>Impacts</b>	<b>Mitigation and protective measures</b>	<b>Implement by</b>	<b>Supervise by</b>
Solid wastes management	Raise awareness among workers on PCR protection, in addition to Following general measures in Table 7-2		
Storm water and site run off	Include cut off drain, sand bag to slow the velocity of water and reduce discharge of sediments to adjoining properties and water ways to protect the PCRs;		
<b>III. Operation phase</b>			
Overgrowth of vegetation on PCRs threaten their integrity	<ol style="list-style-type: none"> <li>1. Regular maintenance of the site and temple by weeding the grass and cutting down the trees present a direct threat to the monuments.</li> <li>2. Regularly clear the vegetation that grows on the temples under a regular maintenance program.</li> </ol>	PCU and PIUs	MoCFA
PCR located in remote area far from central of administration, lack of human resource	<ol style="list-style-type: none"> <li>1. provincial gov improve infrastructure to make better circuit tours around and access to PCRs for their better conservation and oversight;</li> <li>2. Government provides more resources for PCR.</li> <li>3. Enhance capacity building and awareness raising.</li> </ol>		
damages PCR, looting, illicit trafficking of artifacts etc.	Awareness raising on PCR protection and promoting good behavior: by booklet, signs, fine for violation etc.		
Fire risks and electric hazard	<ol style="list-style-type: none"> <li>1. Control zone for fire prevention shall be demarcated and fire extinguishers shall be provided.</li> <li>2. Power use in cultural relic buildings shall be strictly managed; short circuit and overload protection facilities shall be installed for power distribution lines and electrical fire monitoring system shall be set up;</li> <li>3. Power lines entering into cultural relic buildings shall be clearly separated;</li> <li>4. Cold-light source shall be used for lighting; and switches shall be enclosed.</li> </ol>		
Over-touristic damaging PCRs	Manage tourism development according to the tourist control and related plan, update the plan periodically.		

#### **4.15.2. Health and Safety Management**

198. The movement into the area of construction workers from outside the communities (estimated so far as 20-30 workers, others will be local labors) will have potential for the spread of infection – in particular, COVID-19. The PCU and Project Consultants will work with contractors ensure that the risk of COVID-19 is assessed and measures taken in line with the ADB's Interim Advisory Note<sup>22</sup> and Guidance on managing risk from COVID-19 on construction sites and in workers' housing is described below.

199. Sources of Information: Guidance is being updated regularly as knowledge of COVID-19 improves. This document is based on good international practice, using guidance from World Health Organization (WHO), International Labor Organization (ILO) and national guidance from the UK and Canada and a review of other national government public information on COVID-19.

200. Quarantine or Isolation for COVID-19: WHO defines '*quarantine*' as the separation of a person who is not ill but who may have been exposed to an infectious person, with the objective of monitoring their symptoms and ensuring the early detection of cases. '*Isolation*' is the separation of a person who is showing symptoms or has confirmed COVID-19 to prevent the spread of infection or contamination. Contractors must ensure the safe quarantine or isolation of workers and that this does not impact on their employment status.

<sup>22</sup> ADB 2020, Interim Advisory Note: Protecting the Safety and Well-Being of Workers and Communities from COVID-19. <https://www.adb.org/publications/safety-well-being-workers-communities-covid-19>

<b>Construction site measures for COVID-19 control</b>	
1. Form a joint team to plan and organize return to work	<ul style="list-style-type: none"> <li>• Develop or convene a joint occupational safety and health committee with members representing the employer and workers.</li> <li>• Train team members on the basic principles for the formulation and implementation of occupational safety and health preventive and control measures.</li> <li>• Develop and communicate a work plan on safe working for COVID-19. Such plan should be fully aligned with any government regulations and guidelines on COVID-19 prevention and control, or in the absence thereof, with international good practice guidelines as may be updated from time to time.</li> </ul>
2. Assess risk to decide who, when, and how to work	<ul style="list-style-type: none"> <li>• Undertake a risk assessment to determine the preventive and control measures.</li> <li>• Ensure preventative measures are in place before resuming or beginning construction work.</li> </ul>
3. Adopt engineering, organizational and administrative measures	<ul style="list-style-type: none"> <li>• Avoid physical interaction and maintain physical distancing requirements as prescribed by national policy, or in the absence thereof, international good practice.</li> <li>• Ventilate enclosed workplaces including work camps and communal spaces.</li> <li>• Avoid concentration of workers - limit the capacity of common areas such as work camp dining rooms and changing rooms to allow the minimum separation of 2 meters and organize one-way systems. This includes sleeping areas which must be a minimum of 2 meters between beds.</li> <li>• Put in place training and information on COVID-19 and measures required for its management.</li> <li>• The construction site is to be segregated to the extent possible in zones or other methods to keep different crews physically separated at all time.</li> <li>• Stagger break and lunch schedules to minimize the number of people in close proximity to one another.</li> </ul>
4. Regularly clean and disinfect	<ul style="list-style-type: none"> <li>• Increase the frequency of cleaning and disinfection, in particular heavily trafficked areas and common areas, including work camps.</li> <li>• All door handles, railings, ladders, switches, controls, eating surfaces, shared tools and equipment, taps, toilets, and personal areas are wiped down at least twice a day with a disinfectant.</li> <li>• Discourage the sharing of items such as cups, glasses, plates, tools.</li> </ul>
5. Promote personal hygiene	<ul style="list-style-type: none"> <li>• Provide workers with the conditions and means necessary for frequent hand washing (soap, water or alcohol gel) with a posted hand washing protocol at site entries, exits, bathrooms, communal areas, offices, and any other areas with commonly touched surfaces.</li> <li>• Inform workers of the need to avoid physical contact when greeting, and avoid touching eyes, nose and mouth.</li> <li>• Inform workers of the need to cover the mouth and nose with a disposable handkerchief when coughing or sneezing or the crook of their arm.</li> <li>• Dispose of tissues in a lined and covered waste bin and wash hands afterwards.</li> </ul>
6. Provide personal protective equipment (PPE) and inform workers of its correct use	<ul style="list-style-type: none"> <li>• Identify appropriate PPE related to the tasks and health and safety risks faced by workers according to the results of risk assessment and the level of risk, and provide it to workers free of charge and in sufficient number, along with instructions, procedures, training and supervision.</li> <li>• Non-medical face-coverings (such as homemade cloth masks) should be worn as mitigation for catching and transmitting the virus, but are not to be treated as substitutes for proper handwashing.</li> </ul>
7. Health surveillance and insurance	<ul style="list-style-type: none"> <li>• Before entering the site, staff and visitors must confirm that they are not currently exhibiting flu-like symptoms.</li> <li>• Monitor the health status of workers, develop protocols for cases of suspected and confirmed COVID-19. The protocol will state that: <ul style="list-style-type: none"> <li>○ Workers with symptoms or confirmed cases must be isolated within the construction camp or stay at home for 7 days after symptoms started.</li> <li>○ If symptoms persist after 7 days the person must isolate.</li> <li>○ People who have been in close contact with the person with confirmed COVID-19 be quarantined for 14 days.</li> </ul> </li> <li>• All workers in quarantine or isolation must be provided with adequate food, water, medical assistance and sanitation.</li> </ul>

<b>Construction site measures for COVID-19 control</b>	
	<ul style="list-style-type: none"> <li>Identify workers who have had close contact with people infected with COVID-19 and follow national medical guidance.</li> <li>Communicate confirmed cases of COVID-19 infection to the appropriate authorities.</li> <li>All workers should be provided with health insurance that includes COVID-19 treatment</li> </ul>
8. Consider other hazards, including psychosocial	<ul style="list-style-type: none"> <li>Promote a safe and healthy working environment free from violence and harassment.</li> <li>Encourage health promotion and wellbeing in the workplace through enough rest, balance of physical and mental activity and adequate work- life balance.</li> <li>Implement prevention and control measures for the use and storage of chemicals, particularly those used for disinfection during COVID-19.</li> </ul>
9. Review and update preventive and control measures as the situation evolves	<ul style="list-style-type: none"> <li>Periodically monitor prevention and control measures to determine whether they have been adequate to avoid or minimize risk, and identify and implement corrective actions for continuous improvement.</li> <li>Establish and maintain records related to work-related injuries, illnesses and incidents, worker exposures, monitoring of the work environment and workers' health.</li> </ul>

<b>Worker Camp Siting and Management Mitigation Measures for Health and Safety and COVID-19</b>	
Source: Adapted from ILO Workers' Housing Factsheet No.6	
1. Siting	<ul style="list-style-type: none"> <li>Not in area liable to flooding, landslide or other natural disaster</li> <li>Not in area affected by construction dust, noise, sewage or other pollution</li> <li>Not in a residential area</li> </ul>
2. Minimum housing standards	<ul style="list-style-type: none"> <li>a separate bed for each worker</li> <li>beds should not be arranged in tiers of more than two;</li> <li>separate accommodation of the sexes or to accommodate couples</li> <li>adequate natural light during the daytime and adequate artificial light</li> <li>adequate ventilation to ensure sufficient movement of air</li> <li>adequate supply of safe potable water</li> <li>adequate sanitary facilities (see below);</li> <li>adequate drainage</li> <li>Adequate furniture for each worker to secure his or her belongings, such as a locker.</li> <li>common dining rooms, canteens or mess rooms, located away from sleeping areas</li> <li>appropriately situated and furnished laundry facilities</li> <li>reasonable access to plug sockets for charging telephones and other devices</li> <li>Rest and recreation rooms and health facilities, where not available in community.</li> </ul>
3. Minimum accommodation	<ul style="list-style-type: none"> <li>Sleeping space: inside over 198 centimeters by 80 centimeters sleeping</li> <li>headroom of over 203 centimeters allowing full free movement</li> <li>Beds minimum 2m apart for COVID-19 risk management</li> </ul>
4. Sanitation Facilities	<ul style="list-style-type: none"> <li>One toilet, one tap / basin, one toilet for every 6 people, Provision of soap</li> <li>Convenient location to accommodation, Ventilation to open air</li> <li>Separate facilities for men and women</li> <li>Fresh cold running water; Clean and hygienic</li> <li>Septic tank/sewage treatment, or pit latrines located at least 200m from surface waters, and in areas of suitable soil profiles and above the groundwater levels</li> </ul>
5. Health and Safety within worker accommodation	<ul style="list-style-type: none"> <li>Separate area for sick workers to prevent transmission of disease</li> <li>Smoke detector in sleeping area; Fire safety throughout accommodation such as fire extinguishers, fire alarms, fire blankets</li> <li>Worker training in fire prevention and procedures</li> <li>Fire exit sign, adequate means of escape and clearly maintained exit</li> <li>Security lighting within camp and for sanitation block and lighting for route from sleeping area to sanitation block.</li> <li>Electrical cables to be in safe condition, elevated and not in areas liable to flood</li> </ul>
6. Inspection	<ul style="list-style-type: none"> <li>2 weekly inspection to inspect for cleanliness, state of repair of building, accommodation and fire equipment.</li> <li>Record inspection results and retain for review</li> </ul>

#### 4.16. Environmental Monitoring Plan

201. The primary objective of the environmental monitoring especially quantitative ones are to verify the actual status of environment and pollution discharged, and also to provide evidence if the mitigation measures are effective or not so as to improve timely.

202. An environmental monitoring plan is presented in Table below, responsible by PCU and PIUs and assisted by PIC/Environmental consultants. The extra cost of monitoring, e.g., by labs, can be paid by contractors during construction and by operators during operation. The plan includes the scope of monitoring and frequency. The monitoring results will be assessed and corrective management implemented in cases of non-compliance.

**Table 7.4: Environmental Monitoring Plan**

Parameters	Location	Frequency	Methods
Cutting of trees and shrubs	Construction sites and around	At beginning and end	Visual check for flora and fauna loss, including hunting or poaching
dust	Construction sites, camp sites and access roads	Weekly	Visual, use instrument to measure if in dispute or has complaints
Air emissions	Construction sites and camp sites and access roads	Monthly	Visual, use instrument to measure if in dispute or has complaints
Noise	Conduct noise measuring level	Every 3 months	Can use portable noise device of contractors or PCU/PIC; or hire external monitor/labs
water contamination	At discharge outlets of camp site and Construction site	weekly	Visual, use instrument to measure if in dispute or has complaints
<b>During operation</b>			
Pathogen (total Coli form and E-coli <sup>23</sup> ) and BOD, COD, NH <sub>3</sub> -N	Outlets of Septic tanks of public toilets,	Every 3 months per MoE requirements	Tested by Lab
Drinking water sold/supplied, 17 Parameters required by Cambodian standard	Water supply enterprise 1001 at PV site drinking water quality test	Every 3 months	Tested by Lab

EHS = Environmental Health and Safety, PCU = project coordinating unit, PCR = project completion report.

#### 4.17. Training Plan and reporting requirements

203. Training for PCU and contractors in the preparation and implementation of construction and implementation of the Training for PCU and contractors in the preparation and implementation of construction or site environmental management plans and implementation of the mitigation and management measures listed in below Table, will be delivered by the project's environment specialist.

**Table 7.5: EMP Training Program**

Training	Attendees	Content	Timing and length (days)	No. of persons	Total Cost
EMP measures implementation (all Outputs)	PCU, PIU and contractors	Development and adjustment of the EMP and its implementation. Roles and responsibilities, monitoring, supervision and reporting procedures	Once prior to the project implementation	20	\$4,000
GRM	Same as above	Roles and responsibilities, procedures	Once prior to implementation	70	\$7,000
Environmental protection (all Outputs)	Same as above plus foremen and workers	Pollution control on construction sites (air, noise, wastewater, and solid waste) Awareness-raising for workers on threatened birds, no hunting,	Once (at beginning of subproject construction)	15	\$2,500

<sup>23</sup> Annex 2-Effluent Standard of Wastewater Discharge, Sub-decree on Water Pollution Control.

Training	Attendees	Content	Timing and length (days)	No. of persons	Total Cost
Environmental monitoring	PCU/PIUs	Monitoring methods, data collection and processing, reporting systems	Same as above	20	\$1,000
<b>Total budget</b>					<b>\$14,000</b>

Note: Cost is 100 US\$/person/day.

204. Other training requirements promoting environmental sustainability and referenced in this EMP (other than the EMP implementation training) will be undertaken as part of the project capacity building and training component and are costed in the feasibility study reports for the subproject and are described and costed in detail in the project administration manual. These are described in the IEE and thus not included as EMP implementation costs.

205. Reporting on the environmental performance by the project is one of the means to push for environmental and PCR protection mainly through the EMP implementation. Thus, ADB requires the project owner to report on this regularly, usually semi-annually. Key content for such periodic report are covered in the **indicative Outline of monitoring report:**

- (i) **Introduction:** (a) Concise project description (can be copied every time but indicates changes); (b). Project progress in this reporting period: copy from the overall progress report to ensure consistency, or make a reference if it is too lengthy.
- (ii) **Mitigation measures:** their implementation status (fully followed or not, if not, which parts are not and why; actual performance and findings, any issues and gaps, reasons for them, corrective actions proposed and/or remedy already taken; (Note: no need to repeat the EMP measures, as the EMP is publicized for everyone to see).
- (iii) **Quantitative monitoring:** summary of results and conclusion, explain if comply with applicable standards or not, and analyze the reasons of non-compliance. (Note: full data and original reports' scans submitted in the annex);
- (iv) **Training:** carried out during this period, how, to whom, results and effects; If no training carried out during the period, say so in Intro or Conclusion without this chapter;
- (v) **Any complaints through GRM:** what, when and where, how they are resolved etc. If no grievances during the period, say so in Intro or Conclusion without this chapter;
- (vi) **Requirements for the changes in the project:** if 1a exists in this reporting period, explain domestic EIA requirements, progress made, and how to also meet ADB requirements.
- (vii) **Conclusion** on this reporting period and recommendations/work plan for the next.

#### 4.18. Grievance Redress Mechanism

##### 4.18.1. Proposed Mechanism

206. The PCU will establish a Project Public Complaint Unit (PPCU) which will act as a central recording and coordinating unit for the civil works subprojects. For each subproject, PCU will ensure that the GRM is publicized locally so that the community is fully aware of the mechanism and the local focal points which will provide access to the GRM. The establishment of the grievance redress mechanism (GRM) at the PIU and its initial implementation will be supported by the PCU's safeguards officer and national environmental specialist (NES). The PPCU will consist of the PCU's safeguards officer, the nominated provincial safeguards officer and two representatives of the village and farming communities for which the subproject is implemented (one male and one female) and one representative from the Commune Council Office.

207. The GRM will be accessible to all members of the community, including more vulnerable groups such as women and youth. Multiple points of entry, including face-to-face meetings, written complaints, telephone conversations, or e-mail, will be available to communities to access the GRM. Opportunities for confidentiality and privacy for complainants will remain confidential.

208. When construction starts, a sign will be erected at each construction site providing the public with updated project information and summarizing the GRM process including contact details for the GRM local focal points. The contact persons for different GRM entry points; PCU and focal point where relevant, contractors, and operators of project facilities, will be identified prior to construction. The provincial environmental safeguards focal point will be the contact person at the subproject level. The contact details for the GRM focal points including phone numbers, email and office addresses, will be publicly disseminated on information boards at construction sites, worker's camp site and on the project and local government websites.

209. The preferred action sequence for complaints handling is that the complaint will be investigated and if considered legitimate be resolved by the unit receiving the complaint. If this is not possible, the complaint should be referred to the PCU (the wider membership of which will enable a response and actions which are appropriate and coordinated).

- (i) The PCU will maintain records of complaints and actions taken to correct them. This data will be included in the PCU's reports, particularly semi-annual monitoring report to the ADB. The project coordinating unit of the CSAF shall undertake the following prior to start of site works: Establish a grievance redress mechanism (GRM) prior to site works
- (ii) Make public the existence of the GRM through public awareness campaigns
- (iii) Ensure that names and contact numbers of representatives of the PCU as well as safeguard officer and contractors are placed on the notice boards outside the construction site and at subnational level of local government offices (e.g., provincial, district, commune and village levels)

210. The Grievance Redress Committee (GRC) shall be established before commencement of site works and shall be chaired by Project Coordinating Unit (PCU) and supported by the PCU's safeguards officer. The Grievance Redress Committee (GRC) shall have members from the PCU (e.g. NPAV and Angkor Borei Administrative District Office) commune councils, and women's organization. Grievances can be filed in writing or verbally with any member of the GRC. The committee will have 15 days to respond with a resolution. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the Government's judicial or administrative remedies.

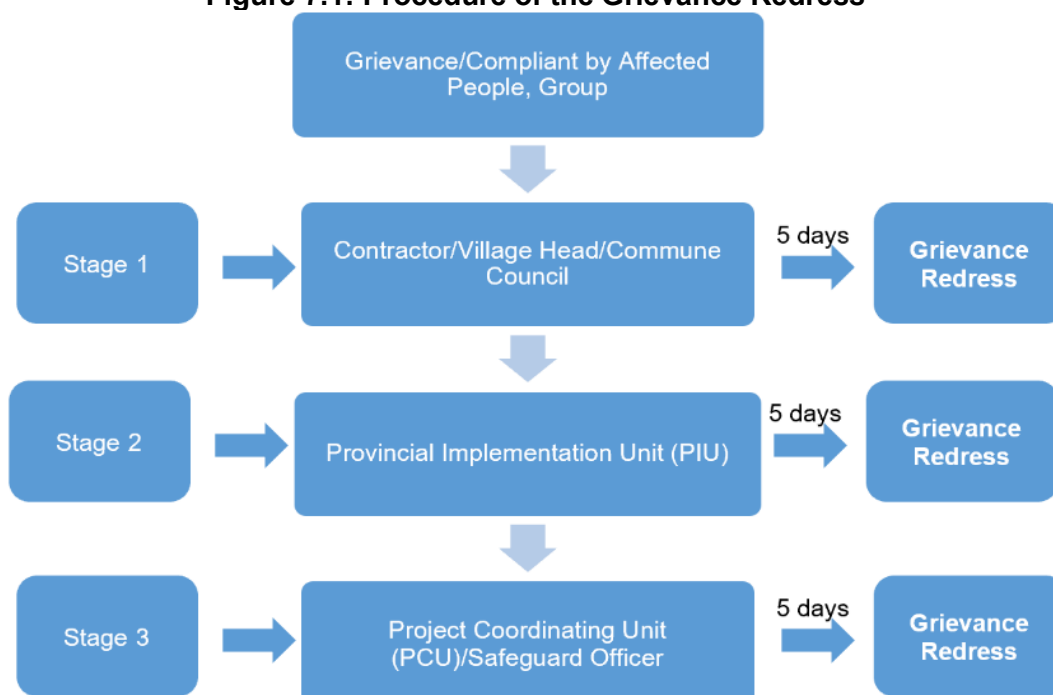
#### **4.18.2. Procedure and Timeframe**

211. The procedure and timeframe for the GRM are described as follows (see below Figure). The process of grievance redress resolution should be as follow:

- (i) Stage 1: If a concern arises during construction, the affected person will submit a written or oral complaint to the contractor, or village chief/commune directly to address the issue. However, whenever possible, the contractor, or village chief/commune will resolve the issue directly with the affected person. The contractor will give a clear reply within 5 working days.
- (ii) Stage 2: If no appropriate solution can be found, the contractor should forward the complaint to the PIU point within five working days. The complainant may also decide to submit a written or oral complaint to the PIU, either directly or via one of the GRM entry points.
- (iii) Stage 3: If no appropriate solution, PIU within five working days, the complainant may also decide to submit a written or oral complaint to PCU/environmental safeguards. The PCU will investigate and identify the solution and provide a clear reply for the complainant within five working days. The safeguard officer of the PCU will assist in replying to the affected person. The PCU will, in a timely manner convey the complaint/grievance and suggested solution to the contractors or operators of facilities. The contractors during construction and the operators during operation will implement the agreed upon redress solution and report the outcome to the PPCU within seven working days

212. The PCU will maintain records of complaints and actions taken to correct them. This data will be included in the PCU's QPR and Semi-annual Environmental and Social Safeguards Monitoring Reports to the ADB.

**Figure 7.1: Procedure of the Grievance Redress**



213. During construction, Civil works contractors will be required to frequently communicate and consult with the communities in the project area of influence, especially those near the project areas. Eye-catching public notice boards will be set at each work site to provide information on the purpose of the project activity, the duration of disturbance, the responsible entities on-site (contractor, implementing agency), and the grievance redress mechanism (GRM). This subplan details are in the table below and included in EMP implementation costs.

**Table 7.6: Environment Consultation and Communication Plan**

Organizer	Format	Frequency	Subject	Attendees
<b>Pre-Construction Stage</b>				
EA and Implementation consultant	Targeted public consultation & site visits	Before construction at each site	Agreement with affected persons and sensitive receivers on heavy machinery work. Consultation on safety of nearby communities.	Affected persons in impacts zone of construction activities
<b>Construction Stage</b>				
EA and Implementation consultant	Public consultation & site visits	Once each year during construction	Adjusting of mitigation measures, if necessary; construction impact; comments and suggestions	Residents in project areas

Source: TRTA consultants, 2020

## VIII. CONCLUSIONS

### 4.19. Positive Impact and Environmental Benefits

214. The project has the following positive impacts on the local populations during the operation phase; (i) control of landscape quality, (ii) increased conservation awareness, (iii) enhanced role of women, (iv) increased cultural awareness, (v) improve local livelihood, (vi) maintenance of archaeologically significant sites, (vi) economic growth and (vii) poverty reduction. While the negative impacts are also concern due to increase of tourist.

#### **4.20. Assurances**

215. The main assurance, which will be guaranteed by a fund covenant, is that: The Government will ensure that the preparation, design, construction, implementation, operation and decommissioning of the Project and all Project facilities comply with (a) all applicable laws and regulations of the Kingdom of Cambodia (Cambodia) relating to environment, health and safety; (b) the provisions in ADB's Safeguards Policy Statement, 2009 (SPS) relating to the environment; and (c) all measures and requirements set forth in each Initial Environmental Examination (IEE), Environment Management Plan (EMP), and any corrective or preventative actions set forth in the Safeguards Monitoring Reports to be provided to ADB.

#### **4.21. Conclusion**

216. It is concluded that: (i) developments under all project outputs have significant potential benefits for the rural populations of these areas; and that (ii) the design features and construction management safeguards will address the range of potential adverse environmental impacts identified through the Project EMP and checked via the environmental monitoring program. The environmental assessment has confirmed that the subprojects are environment category B under the ADB SPS and that the design, mitigation and monitoring measures identified in the IEE and EMP, if effectively implemented, will reduce environmental impacts to an acceptable level.



# ANNEXES

## Annex 1: Baseline monitoring data of Air Quality

គ្រួសារសំណាក: Sample Source: **Asian Development Bank**

គម្រោងប្រតិបត្តិការ: Survey Point: គម្រោងគាំទ្រសេដ្ឋកិច្ចកម្រិតក្រុមគ្រួសារក្រោយជំងឺ COVID-19 (Community-Based Tourism COVID-19 Recovery Project) ជុំវិញទីក្រុងភ្នំពេញ រាជធានីភ្នំពេញ  
 (ក្រុមគ្រួសារនៅ វត្តភ្នំព័រ, 017 48 P.048/062 / 121534)

ថ្ងៃយកសំណាក: Sampling date: August 07, 2023

រយៈពេល: Sampling Period: 09:30 AM to 09:00 AM next day

ល.រ No.	ប៉ារ៉ាម៉ែត្រ Parameter	ឯកតា Unit	លទ្ធផល Result	សង្ខេប Standard	វិធីសាស្ត្រវិភាគ Reference Method
1	Nitrogen Dioxide (NO <sub>2</sub> )	mg/m <sup>3</sup>	0.027	<0. (24 ម៉ោង)	Method Saltman (ISO 8178: 884 (F))
2	Sulfur Dioxide (SO <sub>2</sub> )	mg/m <sup>3</sup>	0.096	<0.3 (24 ម៉ោង)	Method Papanastoline (ISO 8767:1990 (E))
3	PM10	mg/m <sup>3</sup>	0.084	<0.5 (24 ម៉ោង)	Method Method Grimm Optical Method, Model: 1070

**សំគាល់:**  
 1- ព័ត៌មាន និងស្ថានភាពស្រាប់ពីការត្រួតពិនិត្យស្រុកស្រាវជ្រាវ ត្រូវបានបញ្ជូនទៅក្រុមការងារស្រាវជ្រាវ និងសម្រេច ( ឯកសារលេខ ១២០ ប្រ.ក.ប.រ ចុះថ្ងៃទី ១១ ខែ កញ្ញា ឆ្នាំ ២០១៧ )  
 2- ល្បឿនខ្យល់ ០.៣០ ម៉ែត្រ ដល់ ២.៥ ម៉ែត្រ

ចេញនៅភ្នំពេញ ថ្ងៃទី ១៨ ខែ ធ្នូ ឆ្នាំ ២០២០  
 ចេញនៅភ្នំពេញ ថ្ងៃទី ១៨ ខែ ធ្នូ ឆ្នាំ ២០២០

បានឃើញនៅថ្ងៃទី ១៨ ខែ ធ្នូ ឆ្នាំ ២០២០  
**អគ្គនាយក**  
 Was seen on site:  
 Director General

ចេញនៅភ្នំពេញ ថ្ងៃទី ១៨ ខែ ធ្នូ ឆ្នាំ ២០២០  
**ប្រធានមន្ទីរពិសោធន៍**  
 Data of Issue:  
 Director

ថ្ងៃទី ១៨ ខែ ធ្នូ ឆ្នាំ ២០២០  
**អ្នកវិភាគ**  
 Analyst

Annex 2: Baseline monitoring data of Water Quality

ព្រះរាជាណាចក្រកម្ពុជា  
ជាតិ សាសនា ព្រះមហាក្សត្រ



ក្រសួងធនធានទឹក  
អគ្គនាយកដ្ឋានការពារទឹកស្អាត

មន្ទីរពិសោធន៍  
LABORATORY

លេខ: ២០៩-I

ព្រឹត្តិប័ត្រវិភាគ  
ANALYSIS REPORT

ប្រភពនៃគំរូ/ Sample Source : Aasiñ Development Bank  
 ថ្ងៃ ខែ ឆ្នាំគំរូ/ Sample Date: August 14, 2020  
 ប្រភេទគំរូ/ Type of Sample: SW-01, ពិភពដំបូង/ គម្រោង: គម្រោង TA-966L: Community-Based Tourism COVID-19 Recovery Project ស្ថិតក្នុងក្រុងព្រៃសែន/ សង្កាត់ស្រែស្រោច ខេត្តសៀមរាប, UTM 48 P ៤៦75834 / 157 ០៥៩

ល.រ No	ឈ្មោះប៉ារ៉ាម៉ែត្រ Parameter	ឯកតា Unit	លទ្ធផល Result	ស្តង់ដារ Standard	វិធីសាស្ត្រវិភាគ Reference Method
1	pH	-	6.99	6.5-6.5	Method pH Meter
2	Dissolved Oxygen (DO)	mg/L	3.46	7.5-2.0	Method DO Meter
3	Total Dissolved Solid (TDS)	mg/L	25.00	<1000	Method 100 Lab Meter
4	Total Suspended Solid (TSS)	mg/L	145.00	25-100	Method 2540 D
5	Biological Oxygen Demand (BOD) <sub>5</sub>	mg/L	3.60	1.0-1.0	Method 5210 B
6	Chemical Oxygen Demand (COD) <sub>Mn</sub>	mg/L	9.01	<50	Method JIS K 0102
7	Oil and Grease	mg/L	1.12	<5.0	Method 5520 D
8	Detergent (MEAS)	mg/L	ND	<5.0	Method 5540 C
9	Sulfate (SO <sub>4</sub> )	mg/L	9.00	<300	Method 4500-SO <sub>4</sub> <sup>2-</sup> a
10	Total Nitrogen (TN)	mg/L	1.39	0.1-0.8	Method JIS K 0102 4E
11	Total Phosphorus (TP)	mg/L	0.07	0.005-0.05	Method JIS K 0102 4E
12	Arsenic (As)	mg/L	0.001	<0.01	Method 3500-As D
13	Cadmium (Cd)	mg/L	0.0002	<0.001	Method 3500-Cd C
14	Iron (Fe-total)	mg/L	4.35	<1.0	Method 3500-Fe C
15	Lead (Pb)	mg/L	0.0009	<0.01	Method 3500-Pb C
16	Mercury (Total)	mg/L	ND	<0.0005	Method ICP-MS
17	Total Col form	MPN/100ml	2.1X10 <sup>2</sup>	<5000	Method NF T90-4.3

សំគាល់: 1- ការយកសំណាក ការរក្សាទុក និងការដឹកជញ្ជូនសំណាកមកមន្ទីរពិសោធន៍ក្រុមហ៊ុន ( គំរូទាំង ) អនុវត្តតាមបទដ្ឋានជាតិ។  
 2- Standard បំពង់ និងក្របខ័ណ្ឌស្របតាមលើសំណាកសម្រាប់វិភាគដែលបានកំណត់ និងប្រើប្រាស់តាមបទដ្ឋានជាតិ និងប្រើប្រាស់តាមបទដ្ឋានជាតិ។  
 3- ND Mean Not Detected ( Lower than L.D. ), NV Mean No Value.  
 4- គោលបំណងនៃការវិភាគ Base Line Study for community based tourism project

លេខគោលការណ៍ ថ្ងៃ: ០៤ ខែ កញ្ញា ឆ្នាំ ២០២០  
 លេខគោលការណ៍ ថ្ងៃ: ០៤ ខែ កញ្ញា ឆ្នាំ ២០២០

បានឃើញនៅថ្ងៃ: ០៤ ខែ កញ្ញា ឆ្នាំ ២០២០  
 អគ្គនាយក  
 Was seen on date:  
 Director General

ក្រសួងធនធានទឹក  
 Date of Issue:  
 Director

អនុវិភាគ  
 Analyst

ហ៊ុន ស៊ីណា



**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងទឹក និង**  
**អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន**  
**មន្ទីរពិសោធន៍**  
**LABORATORY**  
ទីស្នាក់ការ: ២០៧-II

**ព្រឹត្តិប័ត្រវិភាគ**  
**ANALYSIS REPORT**

ប្រភពនៃគំរូ/Sample Source : Asian Development Bank  
ថ្ងៃ ខែ ឆ្នាំគំរូ/Date: August 14, 2020  
ប្រភេទគំរូ/Type of Sample: SW-02, ទីតាំងរស់នៅស្ថាប័ន គម្រោង/TA 9881: Community-Based Tourism COVID-19 Recovery Project ភ្នំពេញ ក្រុងក្រុងក្រុងក្រុងក្រុង  
សម្រេចនៅ ឃុំស្រែចម្ការ ស្រុកជាំក្បាល ខេត្តព្រះវិហារ, UTM 48 P 046739L / 15.8412

ល.រ No	ឈ្មោះប៉ារ៉ាម៉ែត្រ Parameter	ឯកតា Unit	លទ្ធផល Result	តម្លៃស្រប Standard	វិធីសាស្ត្រពិសោធន៍ Reference Method
1	pH	-	7.23	6.5-8.5	Method pH Meter
2	Dissolved Oxygen (DO)	mg/L	6.50	7.5-2.0	Method DO Meter
3	Total Dissolved Solid (TDS)	mg/L	10.03	<1000	Method ino-Lab Meter
4	Total Suspended Solid (TSS)	mg/L	86.01	25-100	Method 2540 D
5	Biochemical Oxygen Demand (BOD) 5	mg/L	2.60	1.0-10	Method 5210 B
6	Chemical Oxygen Demand (COD)Mn	mg/L	6.62	<30	Method JIS K 0102
7	Oil and Grease	mg/L	5.00	<5.0	Method 5520 D
8	Detergent (MPAS)	mg/L	ND	<5.0	Method 5540 C
9	Sulphate (SO4)	mg/L	2.00	<300	Method 4500-SO4 <sup>2-</sup> B
10	Total Nitrogen (TN)	mg/L	0.98	0.1-0.6	Method JIS K 0102 45
11	Total Phosphorus (TP)	mg/L	0.05	0.005-0.05	Method JIS K 0102 46
12	Arsenic (As)	mg/L	0.0004	<0.01	Method 3503-As C
13	Cadmium (Cd)	mg/L	ND	<0.001	Method 3503-Cd C
14	Iron (Fe-total)	mg/L	2.19	<1.0	Method 3500-Fe C
15	Lead (Pb)	mg/L	ND	<0.01	Method 3500-Pb C
16	Mercury (Total)	mg/L	ND	<0.0005	Method ICP-MS
17	Total Coliform	MPN/100ml	1,1X10 <sup>3</sup>	<5000	Method NF T90-413

**សំគាល់:**  
1- ការយកសំណាក ការរក្សាទុក និងការដឹកជញ្ជូនសំណាកតាមបន្តិចស្ថានភាព (គិតជា) អនុវត្តតាមវិធានស្តង់ដារ។  
2- Standard Value ត្រូវបានយកមកពីការវិនិច្ឆ័យរបស់អង្គការសុខភាពពិភពលោក និងការវិនិច្ឆ័យរបស់អង្គការសុខភាពពិភពលោក។  
3- ND Mean Not Detected (Lower than LD.) N/V Mean No Value.  
4- គោលបំណងនៃការវិភាគ Base Line Study for community based tourism project

បានឃើញនៅថ្ងៃទី ០៤ ខែ កញ្ញា ឆ្នាំ ២០២០  
អគ្គនាយក  
Was seen on date:  
Director General

បានឃើញនៅថ្ងៃទី ០៤ ខែ កញ្ញា ឆ្នាំ ២០២០  
ប្រធានមន្ទីរពិសោធន៍  
Date of Issue:  
Director

បានឃើញនៅថ្ងៃទី ០៤ ខែ កញ្ញា ឆ្នាំ ២០២០  
អ្នកវិភាគ  
Analyzer



**គា ស៊ីណា**



**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងសុខាភិបាល**  
**អគ្គនាយកដ្ឋានគាំពារសុខាភិបាល**  
**មន្ទីរពិសោធន៍**  
**LABORATORY**  
NOBAP: ២០៩-III

**ព្រឹត្តិប័ត្រវិភាគ**  
**ANALYSIS REPORT**

ប្រភពនៃសំណាក/Sample Source : Asian Development Bank					
ថ្ងៃ ខែ ឆ្នាំទទួលសំណាក/Date : August 10, 2020					
ប្រភេទសំណាក/Type of Sample : SW-03, ទឹកស្ទឹងអង្គរធើរ (A-958) : Community-Based Tourism COVID-19 Recovery Project ស្ថិតក្នុងក្រុងភ្នំពេញ ក្រុងភ្នំពេញ ក្រុងអង្គរធើរ, ឃុំអង្គរធើរ, ឃុំអង្គរធើរ, ឃុំអង្គរធើរ, ឃុំអង្គរធើរ 11M 4B P 0500354 / 1212366					
ល.រ No	ចំណីវិស័យ Parameter	ធាតុ Unit	លទ្ធផល Result	ស្តង់ដារ Standard	វិធីវិភាគ Reference Method
1	pH	-	7.03	6.5-9.5	Method pH Meter
2	Dissolved Oxygen (DO)	mg/L	3.90	7.5-2.0	Method DO Meter
3	Total Dissolved Solid (TDS)	mg/L	128.00	<1000	Method mo-Lab Meter
4	Total Suspended Solid (TSS)	mg/L	33.00	25-100	Method 2540 D
5	Biochemical Oxygen Demand (BOD) <sub>5</sub>	mg/L	2.70	1.0-10	Method 5210 B
6	Chemical Oxygen Demand (COD) Mn	mg/L	5.90	<50	Method JIS K 0102
7	Oil and Grease	mg/L	10.32	<5.0	Method 5520 D
8	Detergent (MBAS)	mg/L	ND	<5.0	Method 5540 C
9	Sulphate (SO <sub>4</sub> )	mg/L	44.00	<300	Method 4520-SC4 <sup>2</sup> B
10	Total Nitrogen (TN)	mg/L	0.69	0.1-0.6	Method JIS K 0102 45
11	Total Phosphorus (TP)	mg/L	0.05	0.005-0.05	Method JIS K 0102 46
12	Arsenic (As)	mg/L	0.002	<0.01	Method 3500-As D
13	Cadmium (Cd)	mg/L	0.0002	<0.001	Method 3500 Cd C
14	Iron (Fe-total)	mg/L	0.34	<1.0	Method 3500-Fe C
15	Lead (Pb)	mg/L	ND	<0.01	Method 3500-Pb C
16	Mercury (Total)	mg/L	ND	<0.0005	Method 82P-M8
17	Total Coliform	MPN/100ml	2.1X10 <sup>3</sup>	<500	Method MF 130-413

**សំគាល់:**

- 1- ការវាយតម្លៃណាមួយ អាចខុសគ្នាពីលទ្ធផលដែលបានកម្រិតវិភាគពីក្រុមហ៊ុន ដោយសារតែការប្រើប្រាស់ឧបករណ៍
- 2- <50000 បង្ហាញពីលទ្ធផលដែលទាបជាង ឬមិនមានលទ្ធផល ដោយសារតែការប្រើប្រាស់ឧបករណ៍ ឬការប្រើប្រាស់ឧបករណ៍
- 3- ND Mean Not Detected (Lower than LOD), NY Mean No Value.
- 4- គោលបំណងនៃការវិភាគ Base Line Study for community based tourism project

បានឃើញនៅថ្ងៃទី ០៩ ខែ កញ្ញា ឆ្នាំ ២០២០  
**អគ្គនាយក**  
 Was seen on date:  
 Director General

ប្រកាសចេញនៅថ្ងៃទី ០៩ ខែ កញ្ញា ឆ្នាំ ២០២០  
**ប្រធានមន្ទីរពិសោធន៍**  
 Date of Issue:  
 Director

បានឃើញនៅថ្ងៃទី ០៩ ខែ កញ្ញា ឆ្នាំ ២០២០  
**អ្នកវិភាគ**  
 Analyze



**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងបរិស្ថាន**  
**អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន**  
**មន្ទីរពិសោធន៍**  
**LABORATORY**  
TEL: ២០៩-៧៧៧៧៧

**ព្រឹត្តិប័ត្រវិនិច្ឆ័យ**  
**ANALYSIS REPORT**

ប្រភពសំណាក/Sample Source : Asian Development Bank  
 ថ្ងៃ ខែ ឆ្នាំទទួលបានសំណាក/Date: August 10, 2020  
 ប្រភេទសំណាក/Type of Sample: SW-04, មីក្រូប្រហូលេខ២ នៃគម្រោងTA-9691: Community-Based Tourism COVID-19 Recovery Project ស្ថិតក្នុងភូមិភូមិព្រៃកោង ឃុំពោធិ៍សាត់ ស្រុកមង្គល្ហី ខេត្តកែវ, UTM 48 P ០4897937 1212217

ល.រ No	ឈ្មោះប៉ារ៉ាម៉ែត្រ Parameter	ឯកតា Unit	លទ្ធផល Result	ស្តង់ដារ Standard	វិធីសាស្ត្រពិសោធន៍ Reference Method
1	pH	-	6.94	6.5-8.5	Method pH Meter
2	Dissolved Oxygen (DO)	mg/L	4.20	7.5-8.0	Method DO Meter
3	Total Dissolved Solid (TDS)	mg/L	155.00	<1000	Method Inc-Lab Meter
4	Total Suspended Solid (TSS)	mg/L	90.00	25-100	Method 2540 D
5	Biological Oxygen Demand (BOD)5	mg/L	2.40	1.0-10	Method 5210 B
6	Chemical Oxygen Demand (COD)Mn	mg/L	5.11	<50	Method JS K D12P
7	Oil and Grease	mg/L	3.80	<5.0	Method 5520 D
8	Detergent (MBAS)	mg/L	ND	<5.0	Method 5540 C
9	Sulphate (SO4)	mg/L	61.00	<300	Method 4505-SO4 <sup>2-</sup> B
10	Total Nitrogen (TN)	mg/L	0.95	0.1-0.5	Method JIS K 0102 45
11	Total Phosphorus (TP)	mg/L	0.05	0.005-0.05	Method JIS K 0102 46
12	Arsenic (As)	mg/L	0.002	<0.01	Method 5500-As D
13	Cadmium (Cd)	mg/L	ND	<0.001	Method 5500-Cd C
14	Iron (Fe-total)	mg/L	0.66	<1.0	Method 3500-Fe C
15	Lead (Pb)	mg/L	0.0009	<0.01	Method 3500-Pb C
16	Mercury (Total)	mg/L	0.0002	<0.0505	Method IC-P.MS
17	Total Coliform	MPN/100ml	4.7x10 <sup>2</sup>	<5000	Method NF T80-413

**សំគាល់:**  
 1- ការយកសំណាក ការរក្សាទុក និងការដឹកជញ្ជូនសំណាកមកមន្ទីរពិសោធន៍ក្រុមហ៊ុន (គំរោង) បានធ្វើដោយខ្លួនឯង។  
 2- Standard ពិបាក និងខ្ពស់ជាងស្តង់ដារកម្ពុជា និង ស្តង់ដារអន្តរជាតិ ត្រូវដឹងពីរបៀបប្រើប្រាស់ស្តង់ដារ និងសមាមាត្រ យោងតាមប្រការ ១០០ របស់កម្ពុជា ឬ ១១ ២១ ២១០០ របស់អន្តរជាតិ។  
 3- ND Mean Not Detected (Lower than LDL), NY Mean No Value.  
 4- ជាលទ្ធផលនៃការវិភាគ Base Line Study for community based tourism project

ចេញរបាយនៅ ថ្ងៃទី ០៩ ខែ កញ្ញា ឆ្នាំ២០២០  
 អង្គការ: Was seen on date: Director General  
 ព្រះរាជាណាចក្រកម្ពុជា  
 អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន  
 មន្ទីរពិសោធន៍

ចេញរបាយនៅ ថ្ងៃទី ០៩ ខែ កញ្ញា ឆ្នាំ២០២០  
 ប្រភេទបញ្ជីសំណាក: Date of Issue: Director  
 អ្នកវិភាគ: Analyzer

ហេង វណ្ណៈ  
 ស៊ីណា



**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងធនធានទឹក និង អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន**  
**មន្ទីរពិសោធន៍**  
**LABORATORY**  
TEL: ២០៩-៧៧៧៧៧៧

**ព្រឹត្តិប័ត្រវិភាគ**  
**ANALYSIS REPORT**

ប្រភពទឹក/Sample Source : Asian Development Bank  
 ថ្ងៃ ខែ ឆ្នាំ គ្រប់គ្រង/Date: August 10, 2020  
 ប្រភេទសំណាក/Type of Sample: SW-DB, ទឹកស្រះចិញ្ចឹមសត្វ គម្រោង TA-9881: Community-Based Tourism COVID-19 Recovery Project ស្ថិតក្នុងក្រុងកំពង់ឆ្នាំង ឃុំអង្គុប្បី ក្រសួងព្រៃធ្មេរ គម្រោង UTM 48 P 0466265/ 1215278

ល.រ No	ប៉ារ៉ាម៉ែត្រ Parameter	ធាតុ Unit	លទ្ធផល Result	សង្ខេប Standard	វិធីសាស្ត្រវិភាគ Reference Method
1	pH		9.51	6.5-8.5	Method pH Meter
2	Dissolved Oxygen (DO)	mg/L	7.80	7.5-2.0	Method DO Meter
3	Total Dissolved Solid (TDS)	mg/L	153.00	<1000	Method ino-Lab Meter
4	Total Suspended Solid (TSS)	mg/L	99.00	25-100	Method 2540 D
5	Biochemical Oxygen Demand (BOD) <sub>5</sub>	mg/L	7.20	1,0-10	Method 5210 B
6	Chemical Oxygen Demand (COD) <sub>Mn</sub>	mg/L	9.60	<50	Method JIS K 0102
7	Oil and Grease	mg/L	10.20	<5.0	Method 6620 D
8	Detergent (MBS)	mg/L	ND	<5.0	Method 6540 I
9	Sulphate (SO <sub>4</sub> )	mg/L	53.00	<300	Method 4500-SO <sub>4</sub> <sup>2-</sup> B
10	Total Nitrogen (TN)	mg/L	2.06	0.1-0.6	Method JIS K 0102-45
11	Total Phosphorus (TP)	mg/L	0.42	0.005-0.05	Method JIS K 0102-46
12	Arsenic (As)	mg/L	0.002	<0.01	Method 3100-As D
13	Cadmium (Cd)	mg/L	0.0002	<0.001	Method 3500-Cd C
14	Iron (Fe-Total)	mg/L	0.20	<1.1	Method 3500-Fe C
15	Lead (Pb)	mg/L	ND	<0.01	Method 3500-Pb C
16	Mercury (Total)	mg/L	ND	<0.0005	Method JCP-M8
17	Total Coli កាណា	MPN/100ml	4.3x10 <sup>4</sup>	<5000	Method NF TSD-413

**សំគាល់:**  
 1- ការយកសំណាក ការក្រាបខ្មុក និងការដឹកជញ្ជូនសំណាកមកមន្ទីរពិសោធន៍ក្រុមហ៊ុន (គំរោង) អាចប្រជាយន្តជំនាញ  
 2- Standard ព័ត៌មាន និងលំដាប់គុណភាពទឹកផ្ទៃដី សម្រាប់កម្ពុជាអាចរកបាននៅទីស្នាក់ការកណ្តាលអង្គការសហប្រជាជាតិ ខេត្តសៀមរាប; អាចរកបានក្នុងទម្រង់ឯកសារ ១៥០ ក្រ.ក.ស.ស លើកិច្ចព្រមព្រៀង ១១ ខែ ២០១៧  
 3- ND Mean Not Detected (Lower than LOD), NV Mean No Value.  
 4- គោលបំណងនៃការវិភាគ Base Line Study for community based tourism project

បានឃើញនៅថ្ងៃទី ១០ ខែ កក្កដា ឆ្នាំ ២០២០  
 អគ្គនាយក:  
 Was seen on date:  
 Director General

10 ក្រុងកំពង់ឆ្នាំង ថ្ងៃទី ០៩ ខែ កក្កដា ឆ្នាំ ២០២០  
 ប្រធានមន្ទីរពិសោធន៍  
 Date of Issue:  
 Director

10 ក្រុងកំពង់ឆ្នាំង ថ្ងៃទី ០៩ ខែ កក្កដា ឆ្នាំ ២០២០  
 អ្នកវិភាគ  
 Analyzer

*Sina*  
**នា. ស៊ីណា**

*[Signature]*  
**ឆែក រដ្ឋ**

*[Signature]*



**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងសុខាភិបាល**  
**អគ្គនាយកដ្ឋានគាំពារសុខាភិបាល**  
**មន្ទីរពិសោធន៍**  
**LABORATORY**  
0038247-២០៩-៧៧៧៧៧៧

**ត្រីប្រឹក្សាប្រតិភាគ**  
**ANALYSIS REPORT**

ប្រភពគំរូសារ/Sample Source : Asian Development Bank,  
ថ្ងៃទី ខែ ឆ្នាំទទួលបានសំណាក/Date: August 14 2020  
ប្រភេទសំណាក /Type of Sample: GW-01, ទឹកអណ្តូងតូច គម្រោងTA-8881: Community-Based Tourism COVID-19 Recovery Project ព្រឹក ព្រំប្រទល់ស្រុកស្រែចម្រើន  
សង្កាត់បឹងកក់ ក្រុងសៀមរាប ខេត្តសៀមរាប, UTM 48 P 0468529 / 1676286

ល.រ No	ប៉ារ៉ាម៉ែត្រ Parameter	ឆ្នាត Unit	លទ្ធផល Result	សង្ខេប Standard	វិធីសាស្ត្រពិភាគ Reference Method
1	pH	-	6.30	6.5-9.5	Method pH-meter
2	Electrical Conductivity( EC )	µscm	590.00	500-1500	Method Water Quality Meter
3	Total Dissolved Solid(TDS)	mg/L	263.30	<800	Method Water Quality Meter
4	Turbidity	NTU	0.30	<5.0	Method Digital Turbidimeter
5	Total Hardness(as CaCO3)	mg/L	90.00	<300	Method 2340 C
6	Chloride( Cl <sup>-</sup> )	mg/L	17.00	<250	Method 4500-Cl F
7	Fluoride( F <sup>-</sup> )	mg/L	0.25	<1.5	Method 4500-F F
8	Nitrate( NO3 )	mg/L	1.00	<50	Method 4500-NO3 C
9	Sulfate( SO4 )	mg/L	0.70	<250	Method 4500-SO4 <sup>2-</sup> B
10	Aluminum( Al )	mg/L	0.04	<0.2	Method 3500-Al C
11	Arsenic( As )	mg/L	0.002	<0.05	Method 3500-As D
12	Cadmium( Cd )	mg/L	0.0002	<0.003	Method 3500-Cd C
13	Chromium ( Cr total )	mg/L	0.001	<0.05	Method 3500-Cr C
14	Iron ( Fe )	mg/L	0.38	<0.3	Method 3500-Fe C
15	Manganese ( Mn )	mg/L	0.18	<0.1	Method 3500-Mn C
16	Mercury( Hg total )	mg/L	ND	<0.001	Method ICP-MS
17	Thermo tolerant Coliform( E-Coli )	MPN/100ml	0	0	Method NF T90-413
18	Total Coliform	MPN/100ml	0	0	Method NF T90-413

**សំគាល់:**  
 1- ការយកសំណាក ការក្របខ្ទឹម និងការជីកជម្រកូនសំណាកកម្មវិធីពិសោធន៍ក្រុមហ៊ុន( គំរូលេខ ) អនុវត្តដោយខ្លួនឯង  
 2- Standard ចំពោះប្រភេទសំណាកកម្រិតសុខភាពស្រស់ស្អាតសម្រាប់ប្រើប្រាស់សម្រាប់ប្រើប្រាស់ផ្ទះ និងសាលា យោងតាមស្តង់ដារ WHO ឆ្នាំ២០១១ ទំព័រ ១១ តាម ទំព័រ ១១១១  
 3- ND Mean Not Detected ( Lower than LOD ), NV Mean No Value  
 4- ការបំពេញនៃការវិភាគ ផ្តល់របាយការណ៍ដោយស្វ័យប្រវត្តិ ចាប់ពីថ្ងៃទី ១៤ ខែ កញ្ញា ២០២០

បានបើកប្រើថ្ងៃទី ០៤ ខែកញ្ញា ឆ្នាំ២០២០  
 អគ្គនាយក  
 Was seen on date:  
 Director General

បានប្រើប្រាស់ថ្ងៃទី ០៤ ខែកញ្ញា ឆ្នាំ២០២០  
 ប្រធានមន្ទីរពិសោធន៍  
 Date of Issue:  
 Director

បានប្រើប្រាស់ថ្ងៃទី ០៤ ខែកញ្ញា ឆ្នាំ២០២០  
 អនុវិភាគ  
 Analyzer



**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងបរិស្ថាន**  
**អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន**  
**មជ្ឈមណ្ឌលសាងសង់**  
**LABORATORY**  
លេខអាស័យដ្ឋាន: ២០៩-៧៧៧ ផ្លូវលេខ ៧

**ព្រឹត្តិប័ត្រវិភាគ**  
**ANALYSIS REPORT**

ប្រភពគំរូសាមញ្ញ/Sample Source : Asian Development Bank.  
ថ្ងៃ ខែ ឆ្នាំទទួលបានសំណាក/Data : August 14, 2020  
ប្រភេទគំរូសាមញ្ញ/Type of Sample: GW 02, ទឹកអណ្តូងទឹក គម្រោង TA-0681: Community-Based Tourism COVID-19 Recovery Project ស្ថិតក្នុងភូមិក្រវាញ ឃុំក្រវាញ ស្រុកក្រវាញ ខេត្តព្រះវិហារ, UTM 49 P 0464831 / 15 / 2020

ល.រ No	ឈ្មោះប៉ារ៉ាម៉ែត្រ Parameter	ឯកតា Unit	លទ្ធផល Result	ចំណុចស្រប Standard	វិធីសាស្ត្រស្រប Reference Method
1	pH	-	6.23	6.5-9.5	Method pH meter
2	Electrical Conductivity (EC)	µS/cm	452.00	500-1500	Method Water Quality Meter
3	Total Dissolved Solids (TDS)	mg/L	199.00	<800	Method Water Quality Meter
4	Turbidity	NTU	0.03	<5.0	Method Digital Turbidimeter
5	Total Hardness(as CaCO <sub>3</sub> )	mg/l	49.00	<300	Method 2340 C
6	Chloride(Cl <sup>-</sup> )	mg/L	20.00	<250	Method 4500-Cl F
7	Fluoride(F <sup>-</sup> )	mg/L	0.15	<1.5	Method 4500-F F
8	Nitrate(NO <sub>3</sub> )	mg/L	1.50	<50	Method 4500-NO <sub>3</sub> C
9	Sulphate(SO <sub>4</sub> )	mg/L	0.5b	<250	Method 4500-SO <sub>4</sub> B
10	Aluminum(Al)	mg/L	0.33	<0.2	Method 3000-Al C
11	Arsenic (As)	mg/L	0.004	<0.05	Method 3503-As D
12	Cadmium(Cd)	mg/L	0.002	<0.003	Method 3500-Cd C
13	Chromium (Cr-total)	mg/L	0.007	<1.05	Method 3500-Cr C
14	Iron (Fe)	mg/L	0.19	<0.3	Method 3500-Fe C
15	Manganese (Mn)	mg/L	0.02	<0.1	Method 3500-Mn C
16	Mercury(Hg-total)	mg/L	ND	<0.001	Method 30P-MS
17	Thermotolerant Coliform (E-Coli)	MPN/100ml	0	0	Method MP 100-413
18	Total Coliform	MPN/100ml	0	0	Method MP 100-413

**សំគាល់:**  
1- គល់យកសំណាក ភាពក្រវាញ ទឹកអណ្តូងទឹក គម្រោងគាំពារគម្រោងកម្មវិធីសាងសង់ក្រវាញ ឃុំក្រវាញ ស្រុកក្រវាញ ខេត្តព្រះវិហារ  
2- ND: Not Detected ត្រូវបានបញ្ជាក់ថាមិនមាននៅក្នុងគំរូសាមញ្ញទឹកដែលបានប្រើប្រាស់ ដូចជា ទឹកស្អាត ទឹកស្រាវ ទឹកស្រក់ ទឹកស្រក់  
3- ND Mean Not Detected (Lower than LOD), NV Mean No Value  
4- គល់ប៉ារ៉ាម៉ែត្រវិភាគ រៀបចំដោយកម្មវិធីសាងសង់ប្រព័ន្ធបរិស្ថាន ប្រព័ន្ធបរិស្ថាន FIA

បានបញ្ជូននៅថ្ងៃទី ០៧ ខែ កញ្ញា ឆ្នាំ២០២០  
អគ្គនាយក  
Was sent on date:  
Director General

10 ថ្ងៃក្រោយនៅ ថ្ងៃទី ០៨ ខែ កញ្ញា ឆ្នាំ២០២០  
ប្រធានមជ្ឈមណ្ឌលសាងសង់  
Date of Issue:  
Director

កញ្ញា ២០២០ នៅ ថ្ងៃទី ០៨ ខែ កញ្ញា ឆ្នាំ២០២០  
អង្គការ  
Analyzer



*[Signature]*  
**លោក វណ្ណ**

*[Signature]*





**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងបរិស្ថាន**  
**អគ្គនាយកដ្ឋានការពារបរិស្ថាន**  
**មជ្ឈមណ្ឌលសាកល្បង**  
**LABORATORY**  
២០៩-VIII

**ព្រឹត្តិប័ត្រវិភាគ**  
**ANALYSIS REPORT**

ប្រភពសំណាក/Sample Source: Asian Development Bank  
 ថ្ងៃ ខែ ឆ្នាំទទួលសំណាក/Date: August 10, 2020  
 ប្រភេទសំណាក/Type of Sample: GW-03, គម្រោងវិនិយោគសម្រាប់គាំទ្រការធានាសុខភាពសាធារណៈ ក្នុងកំឡុងពេលជំងឺកូវីដ-១៩ (Community-Based Tourism COVID-19 Recovery Project ស្ថិតក្នុងតំបន់ភ្នំពេញ និងជុំវិញភ្នំពេញ)  
 ឃុំ/ក្រុមប្រឹក្សា/ស្រុក/ខេត្ត/រាជធានី: UTM 48 P 0408327 / 1214353

ល.រ No	ប៉ារ៉ាម៉ែត្រ Parameter	ឯកតា Unit	លទ្ធផល Result	ស្រងាប់ Standard	វិធីសាស្ត្រវិភាគ Reference Method
1	pH	-	6.27	6.5-8.5	Method pH meter
2	Electrical Conductivity (EC)	µs/cm	505.00	500-1500	Method Water Quality Meter
3	Total Dissolved Solids (TDS)	mg/L	223.00	<600	Method Water Quality Meter
4	Turbidity	NTU	0.00	<5.0	Method Digital Turbiditymeter
5	Total Hardness (as CaCO <sub>3</sub> )	mg/L	7.00	<300	Method 2340 C
6	Chloride (Cl <sup>-</sup> )	mg/L	17.00	<250	Method 4500-Cl F
7	Fluoride (F <sup>-</sup> )	mg/L	0.29	<1.5	Method 4500-F F
8	Nitrate (NO <sub>3</sub> <sup>-</sup> )	mg/L	1.00	<50	Method 4500-NO <sub>3</sub> C
9	Sulphate (SO <sub>4</sub> <sup>2-</sup> )	mg/L	34.00	<250	Method 4500-SO <sub>4</sub> <sup>2-</sup> D
10	Aluminum (Al)	mg/L	ND	<0.2	Method 3503-Al C
11	Arsenic (As)	mg/L	0.0004	<0.05	Method 3503-As D
12	Cadmium (Cd)	mg/L	0.0003	<0.003	Method 3503-Cd C
13	Chromium (Cr total)	mg/L	0.005	<0.05	Method 3503-Cr C
14	Iron (Fe)	mg/L	0.08	<0.3	Method 3503-Fe C
15	Manganese (Mn)	mg/L	1.36	<0.1	Method 3503-Mn C
16	Mercury (Hg total)	mg/L	ND	<0.001	Method JCP-MS
17	Thermo tolerant Coli form (E-Coli)	MPN/100ml	0	0	Method NF 190-413
18	Total Coli form	MPN/100ml	0	0	Method NF 190-413

**សំគាល់:**  
 1- ការបកស្រាយលទ្ធផល គួរយកចិត្តទុកដាក់ និងការដឹកជញ្ជូនសំណាកមកមជ្ឈមណ្ឌលវិភាគត្រូវតែប្រុងប្រយ័ត្ន (គំរោង ប្រដាប់ប្រើប្រាស់ស្អាត និងស្រស់)  
 2- Standard គិតតាម អង្គការសុខភាពពិភពលោក (WHO) និងស្តង់ដារជាតិកម្ពុជា (SQC) និងស្តង់ដារសុខភាពសាធារណៈ (WHO) និងស្តង់ដារសុខភាពសាធារណៈ (WHO) និងស្តង់ដារសុខភាពសាធារណៈ (WHO)  
 3- ND Mean Not Detected (Lower than LOD), NV Mean No Value  
 4- គ្រោងបកស្រាយវិភាគ ត្រូវប្រើប្រាស់យោងលើលទ្ធផលវិភាគ និងស្តង់ដារសុខភាពសាធារណៈ (WHO) និងស្តង់ដារសុខភាពសាធារណៈ (WHO) និងស្តង់ដារសុខភាពសាធារណៈ (WHO)

បានឃើញនៅថ្ងៃទី ០៩ ខែ វិច្ឆិកា ឆ្នាំ ២០២០  
 អគ្គនាយក  
 Was seen on date:  
 Director General

បញ្ជាក់យោងថ្ងៃទី ០៩ ខែ វិច្ឆិកា ឆ្នាំ ២០២០  
 ប្រធានមជ្ឈមណ្ឌលវិភាគ  
 Date of Issue:  
 Director

បញ្ជាក់យោងថ្ងៃទី ០៩ ខែ វិច្ឆិកា ឆ្នាំ ២០២០  
 អង្គការ  
 Analyzer



**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**ក្រសួងបរិស្ថាន**  
**អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន**  
**មន្ទីរពិសោធន៍**  
**LABORATORY**  
ទូរស័ព្ទ: ២០៩-២៩៧៩៧៧

**រ្វឹក្វឹម្រឹក្វឹក**  
**ANALYSIS REPORT**

ប្រភពដំបូង: Asean Development Bank.  
ថ្ងៃ ខែ ឆ្នាំ: August 10, 2020  
ប្រភេទគំរូ: GW-04, គម្រោងសម្រាប់ គម្រោង (A-988): Community-Based Tourism COVID-19 Recovery Project ព្រំប្រទល់ភ្នំពេញ  
ឃុំ/ក្រុមប្រឹក្សា: ព្រះអង្គរវាំង, UTM 48 P 0457279 / 12:0288

ល.រ	ប៉ារ៉ាម៉ែត្រ	ឯកតា	លទ្ធផល	ស្រងូត	វិធីសាស្ត្រពិសោធន៍
No	Parameter	Unit	Result	Standard	Reference Method
1	pH	-	5.86	6.5-8.5	Method pH meter
2	Electrical Conductivity (EC)	mcsm/cm	11.41	500-1500	Method Water Quality Meter
3	Total Dissolved Solid (TDS)	mg/L	6500.00	<600	Method Water Quality Meter
4	Turbidity	NTU	4.03	<5.0	Method Digital Turbidimeter
5	Total Hardness (as CaCO3)	mg/L	31.00	<300	Method 2340 C
6	Chloride (Cl-)	mg/L	1400.00	<250	Method 4500-Cl F
7	Fluoride (F-)	mg/L	0.68	<1.5	Method 4500-F F
8	Nitrate (NO3)	mg/L	2.00	<60	Method 4500-NO3 C
9	Sulphate (SO4)	mg/L	1000.00	<260	Method 4500-SO4 <sup>2-</sup> B
10	Aluminum (Al)	mg/L	0.91	<0.2	Method 3500-Al C
11	Arsenic (As)	mg/L	0.039	<0.05	Method 3500-As D
12	Cadmium (Cd)	mg/L	0.003	<0.003	Method 3500-Cd C
13	Chromium (Cr total)	mg/L	0.006	<0.05	Method 3500-Cr C
14	Iron (Fe)	mg/L	0.68	<0.5	Method 3500-Fe C
15	Manganese (Mn)	mg/L	17.11	<0.1	Method 3500-Mn C
16	Mercury (Hg-total)	mg/L	ND	<0.001	Method ICP-MS
17	Thermo-tolerant Coli form (E-Coli)	MPN/100ml	0	0	Method NF T90-413
18	Total Coli form	MPN/100ml	0	0	Method NF T90-413

សំគាល់: 1- ការវាយតម្លៃគុណភាពគីមី និងការដឹកជញ្ជូនសំណាកមកមន្ទីរពិសោធន៍ក្រុមប្រឹក្សា (គីឡូម៉ែត្រ) អាចបណ្តាលឱ្យមានការប្តូរ  
2- Standard គឺជាតម្លៃបច្ចេកទេសសម្រាប់ការប្រើប្រាស់ប្រព័ន្ធប្រព្រឹត្តិការណ៍ប្រព័ន្ធប្រព្រឹត្តិការណ៍ និងសម្រាប់ការប្រើប្រាស់ប្រព័ន្ធប្រព្រឹត្តិការណ៍  
3- ND Mean Not Detected (Lower than LD-), NV Mean No Value  
4- គោលបំណងនៃការវាយតម្លៃគុណភាពគីមីនេះគឺសម្រាប់ប្រើប្រាស់ប្រព័ន្ធប្រព្រឹត្តិការណ៍ និងសម្រាប់ការប្រើប្រាស់ប្រព័ន្ធប្រព្រឹត្តិការណ៍

បានឃើញនៅថ្ងៃទី ០៤ ខែកញ្ញា ឆ្នាំ២០២០  
អគ្គនាយក  
Was seen on date:  
Director General

10 ព្រះអង្គរវាំង ថ្ងៃទី ០៤ ខែកញ្ញា ឆ្នាំ២០២០  
ប្រធានមន្ទីរពិសោធន៍  
Date of Issue  
Director

អង្គការ  
Analyzer



*Sina*  
**ស៊ីណា**

*[Signature]*  
**អេក ឌី**

*[Signature]*

Annex 3: List of Participants of Public Consultation

បញ្ជីអង្គការ

ថ្ងៃចុះហត្ថលេខា... ឆ្នាំ ២០២០

ថ្ងៃចុះហត្ថលេខា... ឆ្នាំ ២០២០

ខ្លឹមសារ : ... ៧១៩៦៨

ទីកន្លែង : សាលាស្រុកអង្គប្រឹក្សា

ល.រ	គោត្តនាម និង នាម	ភេទ	តួនាទី	អង្គការ	លេខទូរស័ព្ទ	ហត្ថលេខា
1	គឹម ស៊ីមសាន					
2	លី ភី	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០២០៦២៥១២៧៨	
3	ស៊ុន គ្រាវី	ស្រី	ប្រធានាធិការ	សម្ព័ន្ធមិត្តភាព	០១៧៣២៨៥៧៧	
4	ស៊ុន ខុន	ប្រុស	ប្រធានាធិការ	សម្ព័ន្ធមិត្តភាព	០១២៤៥៧៤៤៤	
5	ស៊ុន សុខា	ស្រី	ប្រធានាធិការ	សម្ព័ន្ធមិត្តភាព	០១៧៩៣១១១១១	
6	ស៊ុន វិធី	ស្រី	ប្រធានាធិការ	សម្ព័ន្ធមិត្តភាព	០១២៥០៦៨០៤៦	
៧	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០១៧៦០៨៨៤៤៤	
៨	ស៊ុន វិធី	ស្រី	ប្រធានាធិការ	សម្ព័ន្ធមិត្តភាព	០១២៤៥៧៤៤៤	
9	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០១៧៥០៥០៥០	
10	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០១៧៨៤៤៤៤៤	
11	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០១៧៧៧៧៧៧៧	
12	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០១៧៧៧៧៧៧៧	
13	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០១៨៧៨៦១១	
14	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០៨៨២១១១១១	
15	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	សម្ព័ន្ធមិត្តភាព	០១៧២៤៥៦៧	
16	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	ADB	០១២២១០១០	
17	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	ADB	០១២៤៨១៣៣	
18	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	AVI	០១៧៩៥១៥៥	
19	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	ស.ស.ស	០១២៤៨៥៥៥	
២០	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	ស.ស.ស	០១៥៨៩៩៩៩	
២១	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	ស.ស.ស	០១២៤៤៤៤៤	
២២	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	AVI	០១៧៩៥១៥៥	
២៣	ស៊ុន ស៊ីមសាន	ប្រុស	អគ្គនាយក	ADB	០១៥៨៤៨៧៧	

សរុប ២៣ អង្គការ (២៣ អង្គការ)



**ព្រះបរមរាជវាំង**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**រដ្ឋបាលខេត្តព្រះវិហារ**  
ទីបាត់ការអន្តរាស័យ

**បញ្ជីបញ្ជី**

កិច្ចប្រជុំពិគ្រោះយោបល់សាធារណៈពាក់ព័ន្ធនឹងគម្រោងស្ថាបនាសហគមន៍ទេសចរណ៍កម្ពុជាឡើងវិញពីប្រតិភូដ៏ខ្ពង់ខ្ពស់  
សាលប្រជុំ VIDEO CONFERENCE ជាន់ទី១ អគាររដ្ឋបាលខេត្ត ថ្ងៃទី ៣០ ខែ ធ្នូ ឆ្នាំ ២០២០

ល.រ	ឈ្មោះ	ភេទ	តួនាទី	អង្គភាព	លេខទូរស័ព្ទ	ហត្ថលេខា
1	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន		
2	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	077233311	
3	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	085871222	
4	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	012923203	
5	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	0972221888	
6	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	0975919200	
7	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	012619136	
8	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	0977220152	
9	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	012993711	
10	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	0974417228	
11	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	015848787	
12	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	0122188838	
13	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	085899898	
14	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	092424207	
15	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	012488378	
16	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	012710101	
17	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន		
18	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន		
19	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន		
20	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន		
21	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន		
22	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន		
23	លោក វណ្ណឌី វណ្ណឌី	ប្រុស	នាយកប្រឹក្សា	អគ្គនាយកដ្ឋាន	08647586	

**ព្រះរាជាណាចក្រកម្ពុជា**  
**ជាតិ សាសនា ព្រះមហាក្សត្រ**

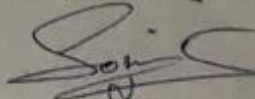
**មន្ទីរក្រសួង**

ស្តីពី: កិច្ចសន្យា ទំនាក់ទំនង ការប្រគល់ ដីស្រែ ឲ្យ ក្រសួង កសិកម្ម រុក្ខាប្រមាញ់ និង តាមដាន (T19681)

ល.រ	គោត្តនាម នាម	ភេទ	តួនាទី	អង្គភាព	ហត្ថលេខា	លេខទូរស័ព្ទ
1	គ. គុណ	ស្រី	អគ្គនាយក	កសិកម្ម	Wapron	095395995
2	ម. ម៉ាត	ប្រុស	អគ្គនាយក	កសិកម្ម	D. Chhith	012488838
3	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	Chhep	085849828
4	ស៊ី. ឌី	ប្រុស	អគ្គនាយក	កសិកម្ម	Yuth	09442402
5	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	AVI	012959255
6	ស. សុខា	ស្រី	អគ្គនាយក	កសិកម្ម	Yuth	012408930
7	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	AVI	012210101
8	ស. សុខា	ស្រី	អគ្គនាយក	កសិកម្ម	ADB	012488378
9	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	AVI	012938353
10	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	AVI	017516280
11	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	AVI	01282997
12	ស. សុខា	ស្រី	អគ្គនាយក	កសិកម្ម	AVI	016846668
13	ស. សុខា	ស្រី	អគ្គនាយក	កសិកម្ម	AVI	012236101
14	ស. សុខា	ស្រី	អគ្គនាយក	កសិកម្ម	AVI	098899296
15	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	AVI	07421852
16	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	AVI	01685588
17	ស. សុខា	ប្រុស	អគ្គនាយក	កសិកម្ម	AVI	097748558

សរុបចំនួន... 11... នាក់ ព្រមទាំង... 6... នាក់

ថ្ងៃទី... 28... ខែ... 12... ឆ្នាំ 2020

  
 រៀបចំដោយ... គិត... កសិកម្ម

**ជាតិ សាសនា ព្រះមហាក្សត្រ**

**បញ្ជីបញ្ជីប្រាក់**

ថ្ងៃ..... ខែ..... ឆ្នាំពួកទោស័កព.ស២៥៦៤

ថ្ងៃទី ១១ ខែ ៥ ឆ្នាំ២០២០

ស្តីពី ការត្រួតពិនិត្យលិខិតបញ្ជីបញ្ជីប្រាក់ដែលបានបញ្ជូនឱ្យឃើញ  
 ដែលបានបញ្ជូនឱ្យឃើញនៅថ្ងៃទី ១១ ខែ ៥ ឆ្នាំ ២០២០

ល.រ	នាមនិងគោត្តនាម	ភេទ	តួនាទី	អង្គភាព	លេខទូរស័ព្ទ	ហត្ថលេខា
1.	ស្រី វិសិដ្ឋ	ប	អគ្គនាយក	ទ.ស.ស. DCH	012488833	D. V...
2.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	085899898	[Signature]
3.	ស្រី វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	09442918	[Signature]
4.	ស្រី វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	86011115	[Signature]
5.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	09442918	[Signature]
6.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	098666583	[Signature]
7.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	097333521	[Signature]
8.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	0913772666	[Signature]
9.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	097793921	[Signature]
10.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	0719527950	[Signature]
11.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	668942950	[Signature]
12.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	0887190889	[Signature]
13.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	088.223931	[Signature]
14.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	0711666305	[Signature]
15.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.		
16.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.		
17.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.		
18.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	01271491	[Signature]
19.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	015948787	[Signature]
20.	លោក វិសិដ្ឋ	ប	អគ្គនាយក	វ.ស.ស.	012488378	[Signature]