

Initial Environmental Examination

May 2014

Cambodia: Flood Damage Emergency Reconstruction Project-Additional Financing

Prepared by Ministry of Water Resources and Meteorology for the Asian Development Bank.

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INITIAL ENVIRONMENTAL EXAMINATION



Ministry of Water Resources and Meteorology

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FLOOD DAMAGE EMERGENCY RECONSTRUCTION PROJECT – ADDITIONAL FINANCING: STAGE 2 SUBPROJECTS

May 2014

ABBREVIATIONS

| | | |
|----------------|---|--|
| ADB | - | Asian Development Bank |
| AP | - | Affected People |
| BTB | - | Battambang |
| BMC | - | Banteay Meanchey |
| CAR | - | Corrective Action Report |
| CTDP | - | Corridor Town Development Project |
| EA | - | Executive agency |
| EARF | - | Environmental Assessment and Review Framework |
| EIA | - | Environmental Impact Assessment |
| EMP | - | Environmental Management Plan |
| ES | - | Environmental Specialist |
| FDERP | - | Flood Damage Emergency Reconstruction Project |
| GRM | - | Grievance Redress Mechanism |
| IA | - | Implementing agency |
| IEE | - | Initial Environmental Examination |
| MCFA | - | Ministry of Culture and Fine Arts |
| MEF | - | Ministry of Economy and Finance |
| MOE | - | Ministry of Environment |
| MOWRAM | - | Ministry of Water Resources and Meteorology |
| MPWT | - | Ministry of Public Works and Transport |
| MRD | - | Ministry of Rural Development |
| O&M | - | operation and maintenance |
| PCMU | - | Project Coordination and Monitoring Unit |
| PIU | - | Project Implementation Unit |
| SPS | - | Safeguard Policy Statement |
| UXO | - | Unexploded ordnance |
| WB | - | World Bank |

WEIGHTS AND MEASURES

| | | |
|-----------------------|---|---|
| °C | - | Degree Celsius |
| Cm | - | Centimeter |
| dB(A) | - | Decibel (with A scale weighting) |
| ha | - | Hectare |
| Hours | - | hrs |
| km | - | Kilometer |
| km² | - | Square Kilometer |
| mm | - | Millimeter |
| m | - | Meters |
| m/s | - | Meter per Second |

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1. Introduction

1. The Asia Development Bank (ADB) and the Royal Government of Cambodia (RGC) has agreed to implement the Flood Damage Emergency Reconstruction Project-Additional Financing (FDERP-AF), which will be financed by a project loan from the ADB and grant for the Australian Government. The FDERP-AF is being implemented through the Ministry of Economy and Finance (MEF) as the executing agency (EA).

2. The purpose of this Initial Environmental Examination report (IEE) is to provide an assessment of the environmental concerns that need to be addressed with regards to the rehabilitation of part of flood damaged irrigation in six provinces. The project has been classified as environmental “B” Category, which requires an IEE to be carried out in accordance with the procedures described in “Environmental Guidelines for Selected Infrastructure Projects” Office of the Environment, (ADB 1993). The IEE is prepared in ADB’s IEE format as outlined in the “Environmental Assessment Requirements of the Asian Development Bank” (ADB 1998).

3. This IEE provides an initial rapid screening of the activities to be carried out under the Project in this additional financing, with the intention of identifying potentially significant environmental impacts, determining appropriate mitigation measures, and identifying if any further environmental assessment is required. With limited time of the preparation of the IEE, it is assessing only through existing secondary data from the project with very short field visit to some sub-projects.

2. Policy, Legal and Administrative Framework

4. Cambodia new Constitution (1993) was written and environmental considerations were included. Specifically Article 59 inter alia states: The State shall protect the environment and balance of abundant natural resources and establish a precise plan of management of land, water, air, wind, geology, ecological system, mines, energy, petrol and gas, rock and sand, gems, forests and forestry products, wildlife, fish and aquatic resources. And it was within this constitutional context that the Ministry of Environment (MoE) was established.

5. The MoE has the main mandate for environmental protection and “...to act as competent agency in the protection, prevention and control all activities which potentially affect the quality of the environment”. This mandate includes conservation, protected areas (including forest / mangrove management therein), environmental quality, environmental impact assessment and rational use and management of natural resources. However, there are many aspects of ENR management covered by the mandates of other ministries. Roles and responsibilities among different agencies overlap in key functional areas, including land tenure administration, coastal and marine resource management, wildlife conservation and protected area management.

6. In 1996 the Law on Environmental Protection and Natural Resource Management (No:NS/RKM/1296/36) came into force and it requires the government to prepare national and regional environmental plans and sub-decrees concerning a wide range of environmental issues, including EIAs, pollution prevention and control, public participation and access to

information. On 11 August 1999 a Sub-decree (No: 72 ANRK.BK) on EIA Processes was promulgated requiring submission of an initial EIA (IEIA) or EIA for selected projects.

7. In particularly the law on water resources management of the Kingdom of Cambodia come into force on 29 June 2007 which aims to foster the effective and sustainable management of the water resources to attain socio-economic development and the welfare of the people. This Law determines:

- the rights and obligations of water users,
- the fundamental principles of water resources management, and
- the participation of users and their associations in the sustainable development of water resources.

8. MOWRAM is mandated to take the leading role in water-related activities, with the aim of ensuring social and economic development, equitable and sustainable use of water for livelihoods, and enhancement of environmental quality under the following key performance areas: i) water resources management and development; ii) flood and drought management; iii) water-related legislation and regulation; iv) water resources information management. The Tonle Sap Authority (TSA) was created by Royal Decree in 2009 under MOWRAM, with an advisory and communication role among all stakeholders.

3. Description of the Project

9. The Project will restore critical public and social infrastructure assets necessary to restore livelihood, access in project provinces that will secure the social infrastructure services against future flooding. The Project has several small subprojects with below scope of works:

- Subproject CW01

The Emergency Reconstruction Work of Trapeang Thmor Irrigation System sub-project is located in Phnom Srok District, Banteay Meachey Province. The scope of the civil works includes:

Repairing and Improvement of Reservoir Embankment/ Dam – 5000 meter

- Slope Protection Works on Embankment of Reservoir (Inner Slope) – 3000 meter.
- Repairing of Main Canal No. MC-1, MC-2, MC-3, and Prey Morn Main Canal – 13,257.00 meter.
- Repairing of Drainage Canal No. DC-1, and DC-2- 2573 meter
- Laterite pavement Work at the broken location of canal embankments and dam repair – 18 Km.
- Grass Sodding Works at repaired location of embankment.

- Subproject CW02

The Tumnub Srae Loor sub-project is located in Thmar Pouk District, Banteay Meanchey Province. The scope of the civil works includes:

- Repair and Rehabilitation of dam (Embankment of Reservoir) – 6.4 Km
- Supplying and Laying of Laterite Pavement Work – 6.4 Km
- Installation of Gates on existing structures – 5 Locations
- Construction of New Intakes, including installation of gates – 2 Locations

- Subproject CW 03

The Chork Reservoir Irrigation System and Basac Reservoir Irrigation System are in Battambang Province. The scope of the civil works includes:

(1) Chork Reservoir Irrigation System

- Repair embankment/ dam of reservoir at damaged locations include crack location- 400 meter
- Improvement of Embankment service road with the provision of Laterite Pavement – 400 meter
- Slope Protection Works – 700 meter
- Grass sodding on side slope of dam – 400 meter

(2) Basac Reservoir Irrigation System

- Improvement/ Modification of Automatic Gate of Spillway- 3 nos and Intake Structures of hoist system 1 nos.
- Improvement / Rehabilitation of Canal System (MC-2)- 7.8 Km.
- Construction of box culverts- 3 locations
- Reshaping of Channels on downstream of the spillway structure.

- Subproject CW 04

The Tumnub Luok Irrigation System and Tumnub O Ang Krang Irrigation System sub-projects are in Udon Ratchanik Province. The scope of the civil works includes:

(1) Emergency Reconstruction of Tumnub Luok Irrigation System Sub-project

- Repairing/ Improvement of Embankment (dam) – 2.8 Km
- Excavation/ Renovation of Drainage Canal including construction of embankment along it – 5.00 Km
- Repair of Spillway – 1 nos
- Construction of new Head Regulator – 1 nos

(2) Emergency Reconstruction of Tumnub O Ang Krang Irrigation System

- Repairing/ Improvement of Embankment (dam) – 4.3 Km
- Repair of Spillway – 1 nos
- Repair of Head Regulator (Concrete Wall) – 1 nos

- Subproject CW 05

The Tumnub Rolous Irrigation Sub-project is in Kampong Thom Province. The scope of the civil works includes:

- Repair and Improvement of Embankment/ Dyke of reservoir- 4.76 Km
- Construction of new Spillway – 1 nos (Spillway Crest Length – 70 meter)
- Repairing of Gates at Head Regulator – 5 locations
- Laterite pavement on the crest of embankment/ dam – 4.76 Km

- Subproject CW 06

The Tumnub 95 Irrigation System in Preah Vihear, Tumnub Ta Saom Irrigation System at Siem Reap Province and Tumnub Kork Srok Irrigation System in Siem Reap Province, is a component of the ADB/GoA(DFAT) financed Flood Damage Emergency Reconstruction Project- Additional Financing (FDERP-AF). The scope of the civil works includes:

(1) Emergency Reconstruction Work for Tumnub 95 Irrigation System Sub-project

- Repairing of Embankment/ dam(Reservoir), including repairing the seepage holes – 336 meter
- Repairing of Regulators- 8 nos
- Construction of new Regulator – 1nos
- River Bank protection – 50 meter length in both sides at d/s of spillway
- Construction of Laterite Pavement – 336 meter
- Grass Sodding – 336 meter in length

(2) Emergency Reconstruction Work for Tumnub Ta Saom Irrigation System

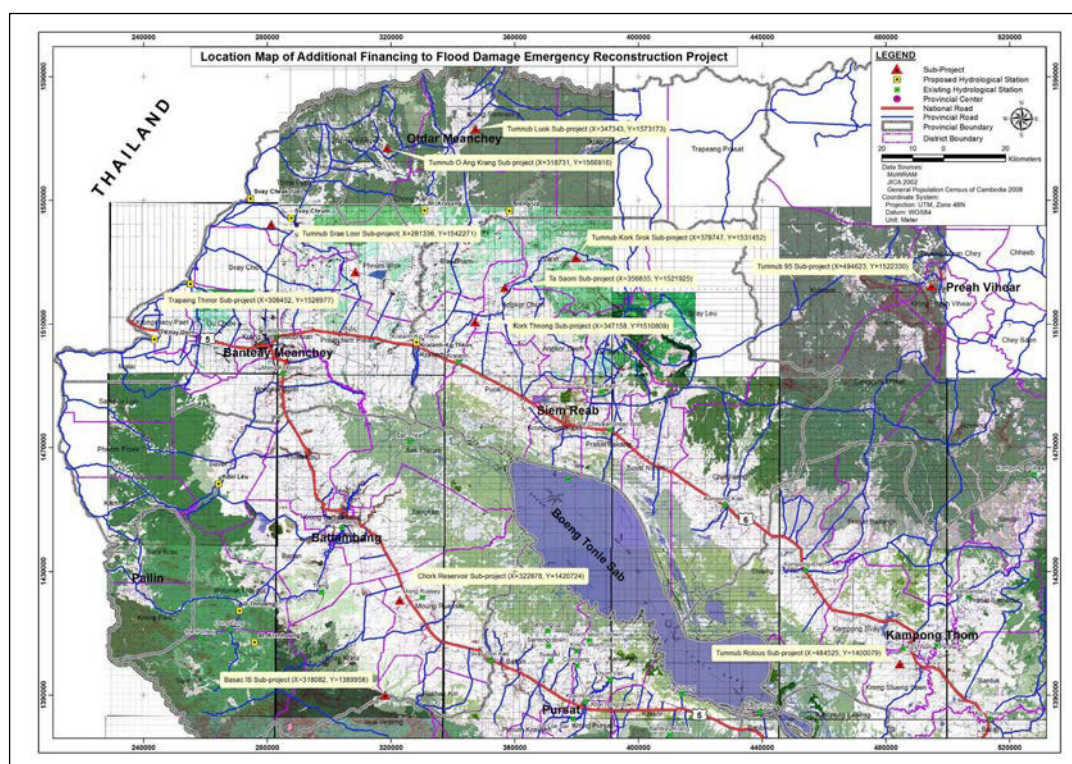
- Repairing of Embankment/ Dam (Reservoir) – 1050 meter
- Repairing of Main Canal -1674 meter
- Construction of Regulators- 3 nos
- Repairing of Pipe Culverts- 1 nos
- Construction of Laterite Pavement- 2624 meter
- Grass Sodding Work – 2624 meter in length

(3) Emergency Reconstruction Work for Tumnub Kork Srok Irrigation System

- Repairing of Embankment/ Dam (Reservoir) -1972 meter
- Slope protection works on Embankment on reservoir side – 350 meter
- Repairing of Rip Rap and Masonry works on Regulators – 2 locations
- Construction of Spillway (30 meter length) with Bridge – 1 nos
- Construction of Laterite Pavement – 1972 meter
- Grass Sodding work – 1972 meter in length

10. This IEE includes the preparation of environmental assessments and environmental management plans (EMPs).

Figure 1: Location Map of Ten Subproject of FDERP-AF



4. Description of the Environment (Baseline Data)

4.1 Geography of Cambodia

11. Cambodia is located in Southeast Asia between latitudes 10° and 15° North and longitude 102° and 108° East, with a total land area of 181,035 km² extending approximately 580 km from east to west and 450 km from north to south. Cambodia shares its 2,438 km border with Thailand in the west and north, Laos in the north and Vietnam in the east and southeast. In the southwest Cambodia is bordered by the Gulf of Thailand with a 435 km coastline and an exclusive economic zone of 55,600 km². The coastal zone encompasses estuaries and bays and some 64 islands of various dimensions.

12. The dominant features of Cambodia landscape are the large, almost centrally located, Tonle Sap (Great Lake), the Bassac River and the Mekong River system, which cross the country from the north to the south. Topographically the country is divided into two distinct parts: (i) the central low lying or the central plains and the flat coastal areas; and (ii) the mountainous ranges and high plateau surrounding the low lying land. Surrounding the central plains, which cover three quarters of the country's area, are the more densely forested and sparsely populated highlands, comprising: the Cardamom and Elephant Mountains of the southwest and western regions; the Dangrek Mountain to the north adjoining the Korat plateau of Thailand; and the Ratanak Kiri plateau and Chlong highlands on the east merging with the central highlands of Vietnam.

Figure 2: Cambodia Administrative Map



Source: www.nationsonline.org

4.2 Climate

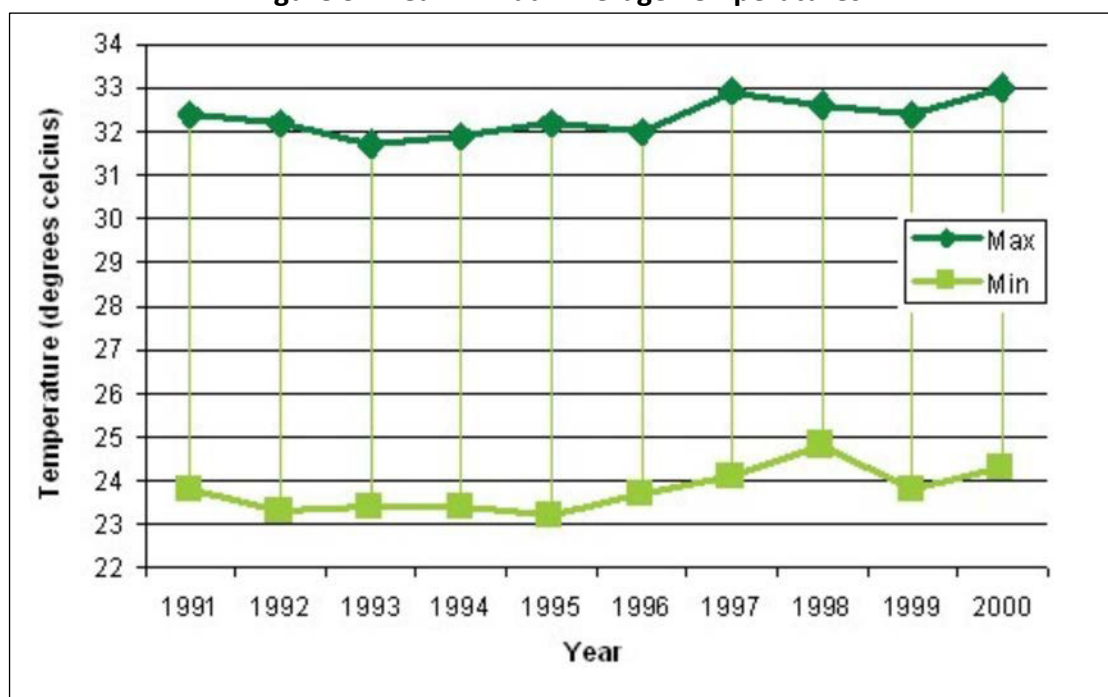
13. Cambodia's climate is tropical monsoon. There are two distinct seasons the dry season from November to April and the rainy from May to November. The northwest monsoon (wet) brings 90% of the rainfall, which varies generally between 1,200 and 2,000 mm per year across the country. Rainfall in the central area covering the Tonle Sap Basin-Lower Mekong Valley averages between 1,200 and 1,900 mm annually. The heaviest rainfall, over 3,000 mm per year, occurs along the coastal lowlands in the west. The northeast monsoon results in dry weather in the period of December to April. In any particular location, rainfall varies significantly from year to year, even in June and July periods of up to 15 days without rain are not uncommon. Relative humidity ranges from 65-70% in January and February to 85-90% in August and September.

14. The temperature changes regionally and seasonally. The warmest month is April, when temperature can rise above 38°C, and the coldest of about 22°C is January. The average annual temperature is 27°C. Figure 2.1 illustrates the average annual temperature in Cambodia from 1991 to 2000.

15. Mean wind speed in Cambodia is low in the order of 2 m per second. December is known as the month of strong steady wind from the north. Typhoons, which often devastate coastal Vietnam, rarely cause damage in Cambodia. Annual evaporation is of the order of 2,000 to 2,200 mm, being highest in March and April at 200 mm to 240 mm, and lowest in September-October at 120 mm to 150 mm.

(a). Temperature

Figure 3: Mean Annual Average Temperatures



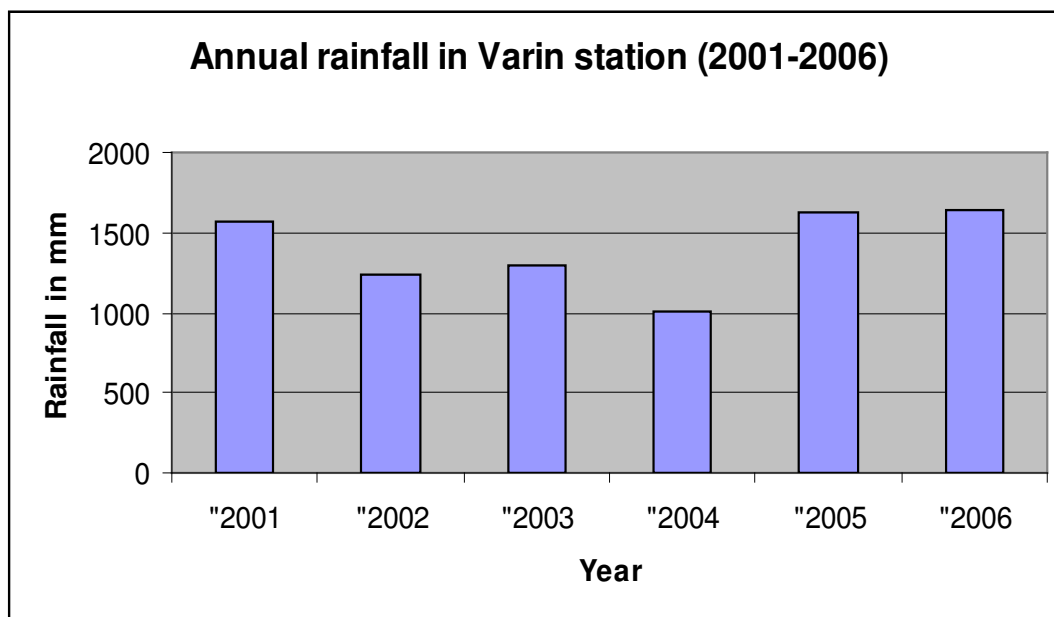
Source: Ministry of Water Resources and Meteorology, 2001

16. The average annual rainfall in the past 6 years (2001-2006) in Varin Station is about 1396 mm, (data from PDOWRAM office in Siem Reap). The monthly rainfall in Varin station showed in figure 4, September is highest rainfall in the project area (322mm). The rainy season

occurs during the southwest monsoon from May to October, and the northeast monsoon brings drier and cooler air from November to March, then hotter conditions prevail in April and early May producing a pronounced dry season. According to the Prey Veng, Kampong Cham, and Kampong Thom, they are located in floodplain areas like Siem Reap thus the wind effluence, temperature and rainfall are quite similar.

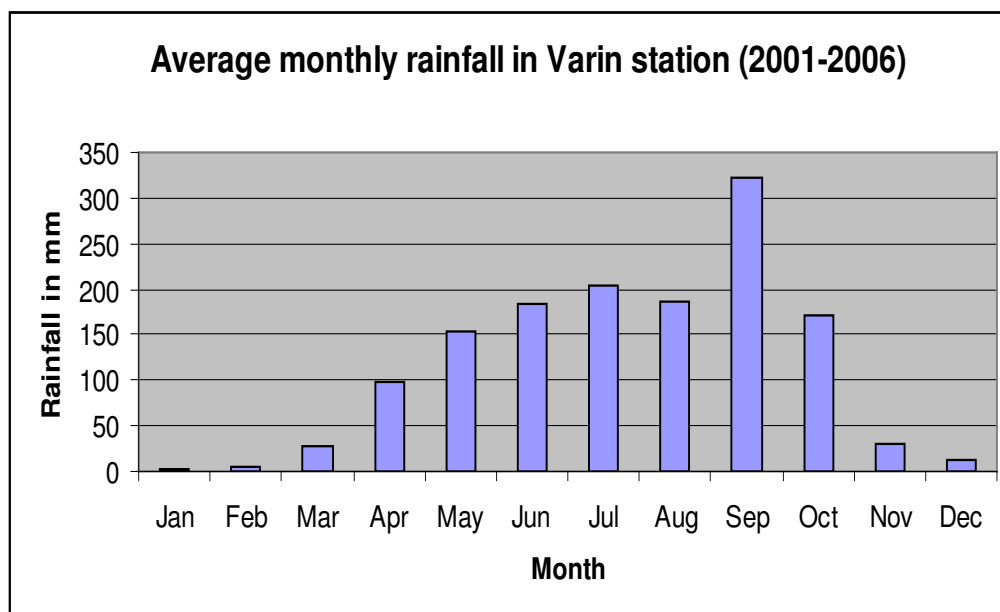
(b). Rainfall

Figure 4: Annual rainfall in Varin Station



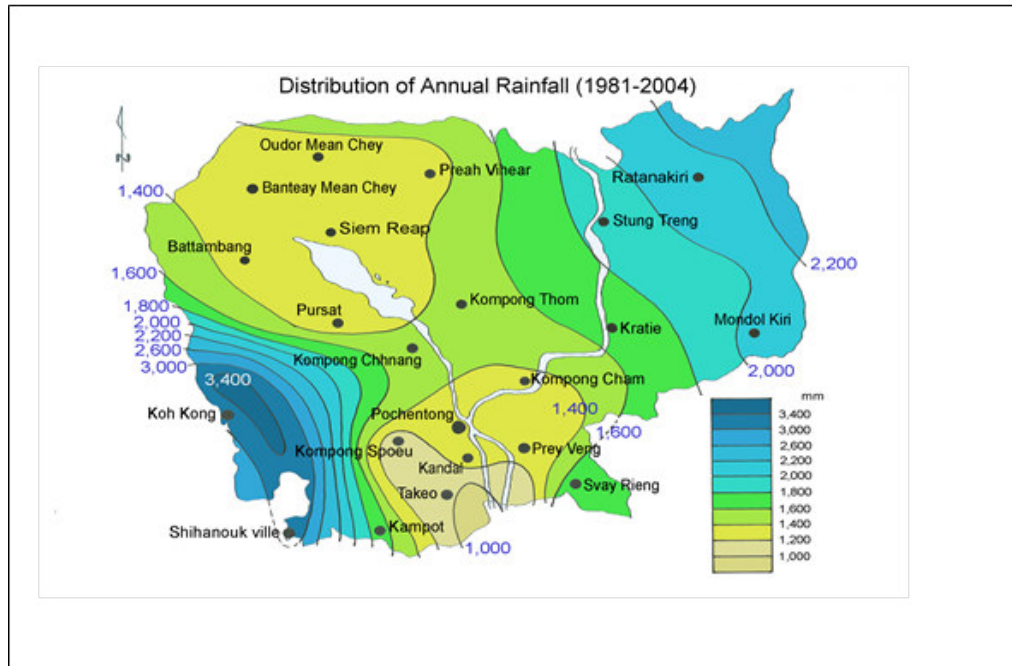
Source: Department of Water Resources and Meteorology, Siem Reap

Figure 5: Average rainfall in Varin Station



Source: Department of Water Resources and Meteorology, Siem Reap

Figure 6: Distribution of Annual Rainfall in Cambodia



Source: Department of Meteorology, Ministry of Water Resources and Meteorology

4.3 Water resource

17. According to the JICA data set (2002), the hydrology of the project area, especially Siem Reap is determined by three systems: (i) the hydrological conditions that prevail in the upper catchment areas of the Koulen mountain escarpment as modified by the nearly level plain area that surrounds the road and is evident as channelised flow in the drainage channels that cross the plains area, (ii) locally derived drainage that originates from the plain as overland flow. This becomes channelized below the road and then joins one of watercourses and enters the Tonle Sap via the Stueng Siem Reap and Stueng Chi Kraeng, and (iii) the operation of the Tonle Sap itself. The Tonle Sap is the largest freshwater area in SE Asia and is an important regulating feature of the lower Mekong River, which by acting as storage; both moderates flood flows during the wet season and maintains low flows during the dry season.

18. As for Prey Veng and Kampong Cham, the hydrology of the area is affected by two main systems: (i) locally derived drainage from its plain and catchment, and (ii) the natural flowing and drainage from the lower Mekong River. However, for subprojects in Kampong Thom, the hydrology of the area is affected by two main systems: (i) locally derived drainage from its plain and catchment, and (ii) the natural flowing and drainage from the lower Tonle Sap River.

4.4 Ground water

19. Groundwater is an important source of domestic water in the study area for both residential development and commercial development. However, it has been a problem during the dry season, both water quality and quantity, in some of the areas. However, there is no detailed data on groundwater availability in the study area is available.

4.5 Ecological environment

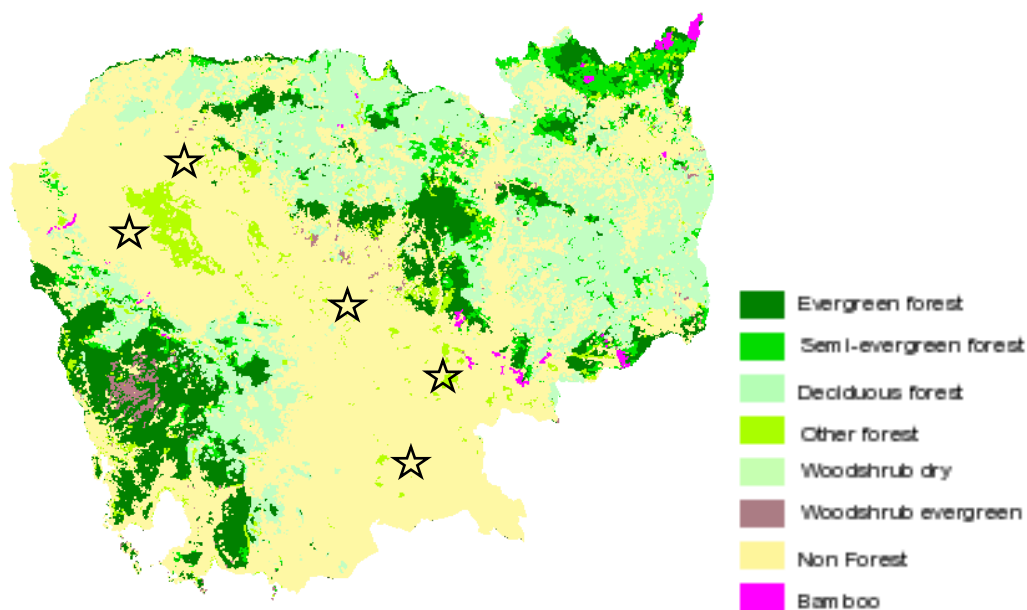
4.5.1 Forest and vegetation

20. The natural forest in project areas has almost completed. The land areas are dominated by agricultural land (see Figure 6 below). Agricultural activities including rice field and vegetation are increasing in the project areas. The proposed sites of road improvement are not close to any sensitive projected areas or protected biodiversity under control by government. Only some economic trees such as coconut, mango, papaya, banana, jackfruit and others are found at some sections of the project roads will be minimally affected.

4.5.2 Rare or Endangered Species

21. Given the largely urban, economic developmental nature and result on land encroachment of the project area, no rare or endangered species are expected to be present now.

Figure 7: Land covers context



Source: CTD, 2012

4.5 Protected areas

22. Protected Areas in Cambodia are under control by Ministry of Environment (MOE). Twenty-three of protected and wildlife conservative areas were created in 1993, of which are located in the project province, only Kampong Thom and Siem Reap (Table 2). This law doesn't create any protected areas in Prey Veng, and Kampong Cham yet in 1993 (Table 2).

23. Law of the projected areas also described that every protected area shall be protected and controlled from any negative impacts of every activity mentioned in article 41. Every development or project in the protected areas will be banned except those are approved by Minister of Ministry of Environment in terms of benefits to natural resource conservation and

management purposes. Referring to the Royal Decree on the creation and designation of protected areas (1993), these protected areas cover 3,273,200 ha, approximately 18% of the country's land area. This is under the direct legal framework of the new Protected Areas Law promulgated in February 2008.

Table 1: Description of the protected areas administrated by the MOE

| Protected area | Surface area (ha) | Province |
|--|-------------------|--|
| Natural Parks: 871,250 ha | | |
| Bokor | 140,000 | Kampot |
| Botum Sakor | 171,250 | Koh Kong |
| Kep | 5,000 | Kep |
| Kirirum | 35,000 | Kampong Speu and Koh Kong |
| Phnom Kulen | 37,500 | Siem Reap |
| Ream | 150,000 | Sihanouk-Ville |
| Virachey | 332,500 | StuengTreng and Rattanakiri. |
| Wildlife Preserves: 2,030,000 ha | | |
| Boeng Per | 242,500 | Kampong Thom |
| KulenPromtep | 402,500 | Siem Reap, Oddor Meanchey and PreahVihear |
| Lumphat | 250,000 | Rattanakiri and Mondulkiri. |
| PeamKrasoab | 23,750 | Koh Kong |
| Phnom Namlear | 47,500 | Mondulkiri |
| Phnom Oral | 253,750 | Koh Kong, Pursat and Kampong Chhnang |
| Phnom Prich | 222,500 | Mondulkiri and Kratie |
| Phnom Samkos | 333,750 | Koh Kong and Pursat |
| RoneamDonsam | 178,750 | Battambang |
| Snoul | 75,000 | Kratie |
| Protected scenic view areas: 500,950 ha | | |
| Angkor | 10,800 | Siem Reap |
| BanteayChmar | 81,200 | BanteayMeanchey |
| Dung Peng | 27,700 | Koh Kong |
| PreahVihear | 5,000 | PreahVihear |
| Samlot | 60,000 | Battambang |
| Tonle Sap | 316,250 | Kampong Chhnang, Kampong Thom, Siem Reap, Battambang and Pursat. |

Source: Royal decree on the creation and designation of protected areas (1993)

4.6 Wildlife

24. As given the above forest cover land, the wildlife is very rare in the project areas. Most of the areas are converted to be agricultural and residential. No rare or endangered fauna are resident within or adjacent to the proximity of the project roads. None of the roads passes through any forested or protected areas.

4.7 Fisheries

25. Fish are an important vitamin of the diet of the people living in Cambodia. The roads are located in a flood plain that is linked to the Tonle Sap Lake and the Lower Mekong River where are very essential of fish production. The production of the lake is estimated about 65kg per ha

per year, which is more than five times that of most tropical freshwater bodies (World Bank, 2003). According to the GMS (2002) the most common fish has been found in the Lake and flood plain areas presented in the Table 2.

Table 2: Fish commonly found in the Tonle Sap and Floodplain area

| Local Name | Scientific Name | Comments |
|-----------------|-------------------------------------|-----------------------|
| TreiRos/ Ptuok | <i>Channa striata</i> | Migrates for breeding |
| TreiAndengTun | <i>Clarias macrocephalus</i> | Migrates for breeding |
| TreiChhpin | <i>Barbodes gonionotus</i> | |
| Trei Riel | <i>Henicorhynchus siamensis</i> | |
| Chhlang | <i>Mystus filamentus</i> | |
| TreiKes | <i>Micronema bleekeri</i> | |
| TreiKagnchruk | <i>Botia modesta</i> | |
| TreiKamphleanh | <i>Trichogaster trichopterus</i> | Migrates for breeding |
| TreiKamphleav | <i>Kryptopterus moorei</i> | Migrates for breeding |
| KanhChanhChras | <i>Pseudambassis notatus</i> | |
| KanhChos | <i>Mystus mysticetus</i> | Migrates for breeding |
| KanTrob | <i>Pristolepis fasciata</i> | |
| KhongVeng | <i>Dangilalineata</i> | Migrates for breeding |
| Kranh | <i>Anabas testudineus</i> | Migrates for breeding |
| Krosphnom | <i>Poropuntius deauratus</i> | Migrates for breeding |
| AngkatPrak | <i>Cyclocheilichthys microlepis</i> | |
| Slat | <i>Notopterus notopterus</i> | |
| Ta Aun/ Kramorm | <i>Ompok bimaculatus</i> | |
| SrakaKdam | <i>Cyclocheilichthys repasson</i> | Migrates for breeding |

Source: GMS, 2002

5. Screening of potential environmental impacts and mitigation measures

5.1 Environmental Assessment Methodology

26. The Initial Environmental Examination (IEE) provides an analysis of possible impacts associated with restoration of irrigation renovation, and is prepared based only on secondary data, a review of previous reports, and EARF. The main purpose is to assess potential impacts on physical, biological and socio-economic environments and find possible measurement for mitigation or avoidance.

27. Impacts are analyzed in terms of 4 key aspects: project location; design; construction; and operation. The impacts are classified according to the degree of impacts which are defined as follows:

- Not significant (D1): No impact from the project activity

- Small impact (D2) - low probability of occurrence and low magnitude of any impact occurring on the environment.
- Moderate impact (D3) – Moderate probability of occurrence and moderate magnitude of any impact occurring on the environment.
- Major impact (D4) – high probability of occurrence and high magnitude of any impact occurring on the environment.
- (+) = beneficial impact

28. The impacts are also assessed according the duration of occurrence as follows:

- Short term = less than 1 year,
- Medium term = 1 to 5 years,
- Long term = More than 5 year.

5.2 Screening of environmental impacts

29. This section covers a preliminary screening of potential environmental impacts of the project (FDERP-AF) for stage two as follows:

- (i) Pre-construction: Occurring during project design and during completion of detailed design and land acquisition.
- (ii) Construction: Occurring during project construction that includes the vegetation clearing, earthworks, and irrigation construction.
- (iii) Operation: Occurring after completion of irrigation construction.

5.3 Environmental problem related to project design

Loss of tree and natural forest (D2)

30. Although the project will only restore existing irrigations, which were damaged by flooding, there are some possible potential impacts on trees and natural forest including:

- (i) Trees immediately adjacent to the works are affected minimally by the reconstruction.
- (ii) Primary natural forest are selected for borrow pits for sub-base material for irrigation dams.

Mitigation: Ensure there are acceptable alternative borrow pit areas that would have an overall beneficial advantage in terms of improved livelihood and reduced environmental impact. The borrow pits will need to be re-vegetated before being handed back to the owner, or may be used for fish raising.

Monitoring: i. Detailed Design; Evolve acceptable concepts and designs in consultation with communities. Responsibility: EA/IA/Consultant.
ii. Construction: Check Contractor's work monthly.
Responsibility: EA/IA/Consultant.

Protection of cultural heritage (D2)

31. The subproject will only restore existing irrigations, thus it will not really affect the cultural and heritage sites and artifacts. However, some alternative approaches need to be considered by project manager or engineer to avoid any possible impact.

Mitigation: Before starting to implement the project, education about archaeological site and artifact for all workers should be done to avoid damaging this archaeological site whenever they found out an archaeological site and artifact in the subproject sites. Thus work has to be stopped immediately and the Project Manager should be notified; then contact to APSARA authority.

Monitoring: Responsibility: Contractor/EA/IA/ES/Engineer

Fish migration (D2)

32. While rehabilitation of irrigation infrastructure can change post-flood fish movement, the subprojects will not really affect flood fish migration. However, some alternative approaches need to be considered by engineer/designer to avoid any possible impact.

Mitigation: Waterway for fish movement should be considered. A construction should be provided during dry season.

Monitoring: Responsibility: EA/IA/ES/Engineer

Downstream impact (D3)

33. Most of irrigation is challenging water quantity, especially during dry season. The water remained mostly only during rainy season thus the downstream farmers have not enough water for crop or vegetation.

Mitigation: - Engineer/designer should consider sources of water and storage capacity.
-IWRM's concept should be applied.

Monitoring: Responsibility: EA/IA/ES/Engineer

Loss of agricultural land (D3)

34. The project will only improve an existing irrigations thus there is no or only minimal impact on agricultural land through improper disposal of soil or borrow pit.

Mitigation: develop alternative uses for borrow pit areas where is not negative impact on agricultural land.

Monitoring: responsibility: EA/IA/ES/Settlement Specialist/Engineer

Loss of natural trees/protected area for borrow pits

35. The damaged irrigation dams may be filled by qualitative soil where will be possibly taken in the protected area or flooded forest area for this borrow pit. If as given the above mentioned, some trees and protected area will affect respectively.

Mitigation: develop alternative uses for borrow pit areas where is not negative impact on the protected areas or avoid impact on trees.

- Monitoring: i. Detailed Design; Acceptable concepts and designs will need to be further considered with the stakeholders. Responsibility: EA/IA/ES.
ii. Construction: Checking Contractor's work. Responsibility: EA/IA/Consultant.

5.4 Environmental problem related to project construction

Protection of cultural heritage

36. Although the project will only restore existing irrigations, it might have archaeological sites on the ground.

Mitigation: When an archaeological site or artifact is found, work is to be stopped immediately and the Project Manager should notify. Then the Contractor should: (i) call the Apsara Authority to assess the site and determine whether and how it should be preserved; (ii) Document and photograph the site and area immediately around it; (iv) Do not proceed with construction until advised by Apsara Authority.

Monitoring: IA/EA/ES Monthly (Monitor should check at the site during construction and also interview with workers, villagers, etc. (especially in Krapeu Main Canal subproject))

Dust Impacts (D2)

37. Dust from transportation of construction materials to site and irrigation works during construction will be a problem to communities who live closing irrigation construction, especially during dry season. The dust will impact on aesthetics and public health through breathing and polluting water quality.

Mitigation: - The Contractor will be required to have a dust abatement program that includes spraying water on work areas and surrounding construction area that may be located close 50 m to villager residents, school, hospital and pagoda. - *Vehicles transporting materials are to be covered to reduce spills and dust.*

Monitoring: IA/EA/ES Monthly (Monitor should check at the site during construction and also interview with villagers, teacher etc.)

Noise Impacts (D2)

38. Construction equipment may cause temporary and localized noise and vibration generation. Sources of noise include transportation of material, vehicle and equipment used at the irrigation work site where is close to villager's residents. These will impact on communities where is close to work areas.

Mitigation: The Contractor will need to ensure that construction within 100m of a village is to be limited to lunch hours and night time.

Monitoring: Contractor/IA/EA/ES, monthly.

Human wastes from construction (D2)

39. Sources of the human waste will be generated by workers that will impact on environment and public health in the communities around the work site.

Mitigation: Provision of sanitary facilities (toilets, digging soil etc.) with proper waste disposal will be provided by contractors.

Monitoring: Contractor/IA/EA/ES, monthly.

Solid waste (D3)

40. Solid waste include residue from construction material and worker's eating food and drinking generating plastic bag, white plastic for food package, plastic bottle and glass bottle. Solid waste can create nuisance, encourage disease vectors (such as flies and rats), block drainage system and hazard to human health and environment.

Mitigation: Contractor should ensure that (i) sufficient garbage containers are to be provided in construction camps and at work site, and be emptied daily, the waste being disposed of in an approved landfill or site and (ii) every camp and work site should be clean during stay and before moving to a new sites.

Monitoring: Contractor daily, IA/EA/ES, monthly (Monitor should check at the Camp Site during stay and after moving out).

Traffic congestion and transport of equipment (D2)

41. The traffic congestion is normally occurred by illegal and disorder parking of equipment.

Mitigation: Contractor should ensure that: (i) drivers of construction vehicles will comply with national speed limit. (ii) construction vehicles will drive at low speeds, especially at market, school, hospital, urban areas. (iii) keep road space or bypass for travelers to avoid traffic jams. (iv) vehicle for construction should park at designated safe places.

Monitoring: Contractor daily; IA/EA/ES, monthly.

Traffic accident (D2)

42. Traffic accidents happen accidentally when driver will drive over speed, careless or unprofessional driving.

Mitigation: Contractor should respond: (i) *Construction vehicles will comply with national speed limited; (iii) Construction vehicles will drive at low speeds, especially at market, school, hospital, urban areas. (iv) Vehicle for construction should park at designated safe places.*

Monitoring: Contractor daily; IA/EA/ES, monthly.

Movement of people and animal (D2)

43. Some sections may be a passing way of animals and people. Therefore a temporary bypass or bridge should be provided for ensuring normal passing activities of local people and animals.

Mitigation: Constructor should: (i) disclose information about the construction date to nearby community. (ii) provide a temporary bypass or bridge during construction.

Monitoring: contractor daily/IA/EA/ES, monthly

Worker's safety and Health (D2)

44. Accidents inevitably happen and when they do work. The Contractor will need to have an effective Worker Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities.

Mitigation: Preparation of a Worker Health and Safety Plan

Monitoring: Contractor daily, IA/EA monthly.

Soil erosion (D3)

45. The potential for soil erosion occur normally during clearing, embankments and earthworks on excavated areas and new cover soil. These will have the ability to provide additional sediment to the water body by rainfall and runoff and will be also damage adjacent land and cause deterioration in water quality, especially life span of irrigation.

Mitigation: The contractor will be required to implement soil and erosion controls to minimize soil erosion and sedimentation of waterways and runoff. The alternative approaches should be: (1) good construction practices shall help to mitigate soil erosion and siltation and (2) re-vegetation of construction area to reduce runoff and flow.

Monitoring: Constructor daily/IA/EA/ES monthly.

Water contamination (D2)

46. The most severe water quality impact would be from diesel or waste oil. These substances are toxic to living organisms.

Mitigation: Contractor has to ensure that: (i) Diesel and waste oil are to be handled and stored carefully to prevent leakage or spill. (ii) Waste oil is to be collected, stored and disposed at an approved site (according to national standard). (iii) Storage is to be in drums, raised off the ground, covered to keep rain out and surrounded by a bund to contain any spills and simplify clean up. (iv) The Contractor shall prepare a Spill Management Plan (including measures to be taken and equipment to be used) to ensure adequate cleanup of any spills.

Monitoring: Contractor daily; IA/EA/ES monthly.

Loss of trees (D2)

47. The project will only improve the existing irrigation where damaged during flooding. Thus only some trees will be affected minimally.

Mitigation: Trees clearing should be avoided as much as possible and trees planting carried out where appropriate in order to enhance the environments around the irrigation.

Monitoring: IA/EA/ES monthly.

Transmission of sexually communicable diseases (D3)

48. HIV/AIDS is still prevalent in Cambodia thus it may happen unexpectedly through workers from various provinces.

Mitigation: Preparation of Health Plan and Education of workers on transmittable diseases.

Monitoring: IA/EA/ES monthly.

Stagnant water areas (breeding mosquito victors) (D2)

49. Stagnant water can create habitats for mosquito vectors that may remain in borrow pits, wastewater and in discarded solid waste such as old tires, plastics and containers that may be disposed by workers around worker camps. Borrow pits and other excavation areas are unlikely to be a major problem as any water that is caught in them is expected to be turbid and unsuitable for the malaria mosquito larvae to develop in.

Mitigation: Contractor must ensure that (i) solid waste disposed into safe landfill. (ii) Siting camps distant to community's removal of still water areas, and (iii) borrow pits may improve to be pond for fish raising or storage water for community utilization.

Monitoring: Contractor daily; IA/EA/ES monthly.

5.5 Environmental problems related to project operation

Inadequate Operation and Maintenance (D3)

50. Poor and inadequate operation and maintenance (O&M) of the rehabilitated irrigation systems could cause unintended adverse environmental impacts and long life of the irrigation. Hence the O & M mechanism should be developed for sustainable operation of the irrigation.

Mitigation: The IA/EA/Consultant should develop an acceptable operation and maintenance of the irrigation system. The developed operation and maintenance must implement fairly. Responsibility for implementation: local authority/irrigation community/IA/EA

Monitoring: IA/EA monthly for 1 year after irrigation completion for construction.

Water Pollution (D2)

51. Subprojects will rehabilitate damaged irrigation infrastructure and is not anticipated to increase use of agricultural chemicals beyond pre-flood levels.

Mitigation: Public awareness on effect of pesticide and chemical use.

Monitoring: Local authority daily.

52. The list of potential impacts and mitigation measures identified for the Irrigation Improvement Project is discussed in Table 6. All of the works involves restoration of existing irrigation, so the impacts will be normal incremental in nature, and major impacts are not expected. No impacts are expected on sensitive areas such as protected areas, wildlife, and natural resources conservation and cultural and heritage sites. The majority of the impacts will

only be during project construction. The related mitigation measures which are available for these limited impacts are also presented in Table 6.

Table 3: Matrix of Possible Potential Environmental Impact and Mitigation Measures: Irrigation Subprojects

| Issue | Mitigation measures | Significance | Duration | Who responsible? | Monitoring/ management |
|---|--|--------------|-------------|--|--|
| 1. Recommendation during project design phase | | | | | |
| Protected areas | - The subprojects are not in protected areas, however, it may have some trees or vegetation along irrigation canal thus engineer should design to avoid damaging trees as possible. | D2 | Long term | Engineer and Environment Specialist (ES) | Implementing Agency (IA)/Executing Agency (EA)/Environment Specialist (ES) |
| Protection of cultural heritage | - The subprojects are not in Protection of cultural heritage areas, however, project manager and engineer should pay attention to avoid damaging cultural and heritage sites and artifacts as possible. | D2 | Medium term | Contractor/ ES/APSARA Authority | IA/EA/ES |
| Fish migration | - Engineer should design to avoid or reduce any impact on fish migration. Water way for fish movement should be provided. The construction should be implemented during dry season. | D2 | Short term | Engineer/ES | IA/EA/ES |
| Downstream impact (water quantity) | - Most of irrigation are challenging to water quantity, especially during dry season. The water remained mostly only during rainy season thus the downstream farmers have no enough water for crop or vegetation. Thus sources of water and storage capacity are very important for Engineer Consideration. Concepts of Integrated Water Resource Management (IWRM) should be applied. | D4 | Long term | Engineer/ES | IA/EA/ES/Engineer |
| Loss of natural trees/protected area for borrow pits | - Develop alternative uses for borrow pit areas where is not negative impact on livelihood and protected areas. | D2 | Medium term | Engineer/Contractor Engineer | (IA)/Executing Agency (EA)/Environment Specialist (ES) |
| Loss of agricultural land for borrow pits | - Develop alternative uses for borrow pit areas where is not negative impact on livelihood and protected areas. - Incorporation of replacing damages during project design. | D3 | Long term | Engineer/Contractor Engineer | Implementing Agency (IA)/Executing Agency (EA)/Environment Specialist (ES) |

| Issue | Mitigation measures | Significance | Duration | Who responsible? | Monitoring/management |
|--|---|--------------|-------------|--------------------------------|--|
| 2. Recommendation during project construction phase | | | | | |
| Protection of cultural heritage | <p>The subproject is not in Protection of cultural heritage areas, however, when an archaeological site or ancient grave is found, work is to be stopped immediately and the Project Manager has to be notified. Then the Contractor takes the following:</p> <ul style="list-style-type: none"> - Isolate the location, then call the Apsara Authority or relevant authority to assess the site and determine whether and how it should be preserved; - Document and photograph the site and area immediately around it; - Do not proceed with construction until advised by Apsara Authority or relevant authority. <p>When an archaeological artifact is found, work is, again, stopped immediately and the Project Manager and Apsara Authority notified to assess the artifact and determine whether and how it should be excavated and moved. The Contractor should:</p> <ul style="list-style-type: none"> - Document and photograph the artifact and the area immediately around it; - Do not proceed with construction until advised by Apsara Authority or other relevant authority. | D2 | Medium term | Contractor/ES/APSARA Authority | Implementing Agency (IA)/Executing Agency (EA)/Environment Specialist (ES) |
| Dust from construction works | <ul style="list-style-type: none"> - Water shall be sprayed during construction if the construction zone will be located close 50m to urban areas such as village, hospital, school and so on to ensure that dust is minimized throughout the construction zone. | D2 | Short Term | Contractor/Engineer | IA/EA/ES Investigator should check and observe at the site during construction and also interview with some villagers, school teacher |

| Issue | Mitigation measures | Significance | Duration | Who responsible? | Monitoring/management |
|--|---|--------------|------------|---------------------|--|
| Dust and material Transportation | <ul style="list-style-type: none"> - Dry material handling and transport generate large amounts of dust thus: <ul style="list-style-type: none"> ▪ The Contractor shall prepare a dust control program. ▪ Water shall be sprayed where dry materials are handled, crushed and transported. ▪ Vehicles transporting materials are to be covered to reduce spills and dust. | D2 | Short Term | Contractor/Engineer | IA/EA/ES Investigator should check and observe at the site during construction and also interview with villagers living around the area |
| Air pollution and noise | <ul style="list-style-type: none"> - Vehicle and equipment emissions cause air pollution and noise: Hence, vehicles and equipment are to be maintained to meet Cambodian emission and noise standards. - Construction within 100m of a village or town is to be limited to lunch hours and night time. | D2 | Short term | Contractor/Engineer | IA/EA/ES |
| Human wastes from construction | <ul style="list-style-type: none"> - Provision of sanitary facilities (toilets, digging soil etc.) with proper waste disposal, especially a construction area closed to village or resident, will be provided by contractors. | D2 | Short term | Contractor/Engineer | IA/EA/ES Investigator should observe at a worker camp area during construction and also interview with some villagers in the village etc. |
| Solid waste generation from construction camp, work sites and workers | <ul style="list-style-type: none"> - Solid waste can create nuisance and bad odor, encourage disease vectors (such as flies and rats), block drainage system and hazard to environment. Hence, sufficient garbage containers are to be provided in construction camps and at work site, and be emptied daily, the waste being disposed of in an approved landfill or site. - Every camp and work site should be clean during stay and before moving to a new sites. | D3 | Short term | Contractor/Engineer | IA/EA/ES Investigator should observe at a worker camp area during construction |

| Issue | Mitigation measures | Significance | Duration | Who responsible? | Monitoring/management |
|---|---|--------------|-------------|---------------------|-----------------------|
| Traffic and transport of equipment | <ul style="list-style-type: none"> - Construction vehicles will comply with national speed limited - Construction vehicles will drive at low speeds, especially at market, school, hospital, urban areas | D2 | Short term | Contractor/Engineer | IA/EA/ES |
| Traffic Jam and accident | <ul style="list-style-type: none"> - Keep road space or bypass for travelers to avoid traffic jams. - Vehicle for construction should park at designated safe places. - Construction vehicles will drive at low speeds, especially at market, school, hospital, urban areas | D2 | Short term | Contractor/Engineer | IA/EA/ES |
| Soil erosion | <ul style="list-style-type: none"> - Eroded material/soil from embankments cause deterioration in water quality and impact on some aquatic resources and short life span of the irrigation. Hence good construction practices shall help to mitigate soil erosion and siltation. Additionally re-planting of vegetation will also help to mitigate erosion. | D3 | Long term | Contractor/Engineer | IA/EA/ES |
| Water contamination | <ul style="list-style-type: none"> - The most severe water quality impact would be from diesel or waste oil of generator and truck. These substances are toxic to living organisms, water quality and soil deterioration. Hence the below mitigation approaches should be followed: <ol style="list-style-type: none"> (1) Diesel and waste oil are to be handled and stored carefully to prevent leakage or spill. Waste oil is to be collected, stored and disposed at an approved site (according to national standard) or to be sold. (2) Storage is to be in drums, raised off the ground, covered to keep rain out and surrounded by a bund to contain any spills and simplify clean up. (3) The Contractor shall prepare a Spill Management | D3 | Medium term | Contractor/Engineer | IA/EA/ES |

| Issue | Mitigation measures | Significance | Duration | Who responsible? | Monitoring/management |
|---|---|--------------|-------------|---------------------|---|
| Movement of people and animals | <ul style="list-style-type: none"> - Some sections may be a passing way of animals and people. Therefore a temporary bypass or bridge should be provided for ensuring normal passing activities of local people and animals. | D2 | Medium term | Contractor/Engineer | IA/EA/ES Investigator should observe at the worker camp area during construction and also interview with villagers in the village etc. |
| Worker safety and health | <ul style="list-style-type: none"> - Workers should wear protection equipment during works to ensure that they are safe and good health. - A contractor should develop a guideline on working mechanism, health and safety during construction. Manager should educate his workers on health and safety projection. | D3 | Short term | Contractor/Engineer | IA/EA/ES Investigator should check and observe at a construction site during construction. |
| Transmission of sexually communicable diseases | <ul style="list-style-type: none"> - Provide sanitation and portable water. - Education of workers on transmittable diseases. | D3 | Long term | Contractor/Engineer | A/EA/ES |
| Stagnant water areas (breeding mosquito) | <ul style="list-style-type: none"> - Siting camps distant to communities and removal of still water areas. | D2 | Long term | Contractor/Engineer | IA/EA/ES monthly |
| 3. Recommendation during project operation | | | | | |
| Inadequate Operation and Maintenance | <ul style="list-style-type: none"> - Poor and inadequate operation and maintenance (O&M) of the rehabilitated irrigation systems could cause unintended adverse environmental impacts and long life of the irrigation. Hence the O & M mechanism should be developed for sustainable operation of the irrigation. | D3 | Long term | IA/EA | IA/EA/Local Authorities |

| Issue | Mitigation measures | Significance | Duration | Who responsible? | Monitoring/management |
|------------------------|---|--------------|------------|-------------------------|-------------------------|
| Water Pollution | - Subprojects will rehabilitate damaged irrigation infrastructure and is not anticipated to increase use of agricultural chemicals beyond pre-flood levels. | D2 | Short term | IA/EA/Local Authorities | IA/EA/Local Authorities |

Note: D1 = Not significant, D2 = small impact, D3 = moderate impact, D4 = big impact; Short term = less than 1 year, medium term = 1 to 5 years, long term = More than 5 year.

6. Potential positive environmental and social impacts

6.1 During project construction:

53. Livelihood/income (+D3): A key positive impact will be the increased opportunities for local people to be employed in construction works. The construction contractor will be encouraged to maximize the employment of local people in the construction works. However, contractor should also provide enough training to them before starting works.

6.2 During project operation:

54. Easier access water for agriculture (+D3): The improvement of the irrigation system will reduce risk of dry land which will benefit to farmers at the irrigation areas where can access water from the rehabilitated irrigation.

55. Livelihood/Income (+D3): The improvement of the irrigations will increase different kind of agricultural activities such as crop, vegetation, rice and livestock raising etc. These activities will provide job for local people and will reduce immigration for jobs.

56. Improved public access (+D3): The improved irrigation will provide benefit to improving road access/irrigation dam to rice field, especially local communities.

7. Institutional Requirements and Monitoring Program

7.1 Institutional Arrangement

57. MEF is the EA (executing agency) for the Project through its Project Coordination and Monitoring Unit (PCMU), which will be assisted by PCMU consultants. The PCMU has an Environment Focal Person to coordinate environmental and social safeguards planning and implementation, and these tasks will be assisted by Safeguards Specialist within the PCMU consultant team. The PCMU will ensure that the respective IA properly follows the IEE and review framework (EARF) during subproject implementation. Each PIU has a Safeguards Focal Persons, and they in turn will be supported by an Environment Specialist within the IA's consultant team. The PIUs will undertake screening and classification of subprojects for submission to the PCMU and ADB. PIUs will prepare safeguards documents for approved subprojects. Safeguards documents will be reviewed and approved by the PCMU and ADB. PIUs will be tasked with the day-to-day implementation and monitoring of safeguards plans. PIUs will also obtain all clearances and fulfill government requirements. The PIUs will also have provincial offices with a Safeguards Coordinator who will be responsible for data required for safeguards plan preparation and monitoring and progress reports, and coordination with relevant departments such as department of environment to consult and/or obtain endorsement if necessary.

7.2 Monitoring program

58. The PIUs will monitor and measure the progress of EMP implementation. The monitoring activities will correspond with the project's risks and impacts and will be identified in the IEEs for subprojects. Appendix 1 provides a content outline for monitoring reports. In addition to recording information of the work, deviation of work components from original scope, the PIUs will undertake site inspections and document review to verify compliance with the EMP and progress toward the final outcome.

59. Supervision consultants will submit monthly monitoring and implementation reports to the PIUs, who will take follow-up actions, if necessary. PIUs will submit quarterly monitoring and implementation reports to the PCMU. The PCMU will submit semi-annual monitoring reports to ADB. Project budgets will reflect the costs of monitoring and reporting requirements. Monitoring reports will be posted in a location accessible to the public.

60. The PCMU will document monitoring results, identify the necessary corrective actions, and reflect them in a corrective action plan. Each quarter the PCMU will study the compliance with the action plan developed in the previous quarter. Compliance with loan covenants will be screened by the EA.

61. ADB will review project performance against the EA's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the Project's risks and impacts. Monitoring and supervising of environmental safeguards will be integrated into the project performance management system. ADB will monitor projects on an ongoing basis until a project completion report is issued. ADB will carry out the following monitoring actions to supervise project implementation:

- i. conduct periodic site visits for projects with adverse environmental impacts;
- ii. review the periodic monitoring reports submitted by the executing agency to ensure that adverse impacts and risks are mitigated as planned and as agreed with ADB;
- iii. work with executing agency to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the legal agreements, and exercise remedies to re-establish compliance as appropriate; and
- iv. prepare a project completion report that assesses whether the objective and desired outcomes of the safeguard plans have been achieved, taking into account the baseline conditions and the results of monitoring.

8. Information disclosure, consultation and participation

62. MEF is the EA (executing agency) for the Project through its Project Coordination and Monitoring Unit (PCMU), which will be assisted by PCMU consultants. The PCMU has an Environment Focal Person to coordinate environmental and social safeguards planning and implementation, and these tasks will be assisted by Safeguards Specialist within the PCMU consultant team. The PCMU will ensure that the respective IAs properly follow the IEEs and Environmental Assessment Review Framework (EARF) during subproject implementation. Each PIU has a Safeguards Focal Persons, and they in turn will be supported by an Environment Specialist within the IA's consultant team. They will have the primary responsibility for disclosing information to the public and APs – Affected Persons.

63. The PIUs will undertake screening and classification of subprojects for submission to the PCMU and ADB. PIUs will prepare safeguards documents for approved subprojects. Safeguards documents will be reviewed and approved by the PCMU and ADB. PIUs will be tasked with the day-to-day implementation and monitoring of safeguards plans. PIUs will also obtain all clearances and fulfill government requirements. The PIUs will also have provincial offices with a Safeguards Coordinator who will be responsible for consulting with other Stakeholders, obtaining data required for safeguards plan preparation, monitoring and progress reports, and coordination with relevant departments such as department of environment to consult and/or obtain endorsement if necessary.

64. A series of consultation meetings with local authorities and communities have been conducted during the project development and design related to resettlement, design, environment and social factors. Furthermore the preparation of local community consultation should be continued for every stage of project design and implementation, thus realistic impacts and issues will be updated and all impacts will be mitigated timely. All such meetings encourage the full participation of the local community.

9. Grievance Redress Mechanism

65. During site preparation and construction phases, there may be complaints related to the environmental performance of the project. To ensure that there will be a mechanism to resolve such complaints, the IAs shall undertake the following prior to start of site works:

- i) establish a grievance redress mechanism (GRM)
- ii) make public the existence of the GRM through public awareness campaigns
- iii) ensure that names and contact numbers of representatives of the IAs and contractors are placed on the notice boards outside the construction site and at local government offices (e.g., provincial and commune levels)

66. Through a Grievance Redress Committee (GRC), promptly address affected people's concerns, complaints, and grievances about the project's environmental performance at no costs to the complainant and without retribution. The GRC, which shall be established before commencement of site works, shall have members from the IAs (e.g. MOWRAM), commune councils, local NGO, 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.

67. IAs shall make public the existence of this grievance redress mechanism through public awareness campaigns. They shall set-up a hotline for complaints and the hotline shall be publicized through the media and numbers placed on the notice boards outside the construction site and at local government offices (e.g., provincial, district, commune, village levels). Locally affected people will still be able to express grievances through the commune councils and these would be referred through the usual channels in those committees.

68. The GRC will receive, follow-up and prepare monthly reports regarding all complaints, disputes or questions received about the Project and corresponding actions taken to resolve

the issues. The GRC will also use the punitive clauses of the 1996 Law on Environmental Protection and Natural Resources Management in conjunction with MOE to prosecute offending parties.

69. Villagers and APs are encouraged to voice complaints and these are to be duly investigated and reported through the contractor to the IA and so to MEF.

70. Environmental monitoring must be carried out by the construction supervision inspectors. Response to complaints will be based on the following schedule:

- Complaint made to contractor or others
- Response by contractor or construction supervision consultants' inspectors.
- Weekly compiling of checklists by inspectors. Copies of checklists to be given to contractors as official notification of action being required, confirmation of receipt obtained by contractor signing copy, and joint inspection carried out if necessary.
- Monthly progress reports by inspectors by consolidating weekly reports.
- Corrective Action Reports (CARs) from contractors, as soon as action taken.
- Monthly progress meetings with contractors at which CARs from previous month examined and checked.
- Three monthly progress reports to ADB detailing problems and Corrective Actions taken.
- Regular checks by the Local Environmental Specialist and regular oversight checks by International Environmental Specialist.
- Checks with complainants that they are satisfied

71. Review of progress must be checked on a daily basis by the inspectors. Any urgent issues must be drawn to the contractors' attention immediately. Failure by the contractor to respond in a timely or adequate manner must be raised with them at the monthly progress meetings.

10. Conclusion and Recommendation

72. Based on the study of the existing environmental and social conditions in the project areas and potential impacts from project implementation, it is found that the project will result in overall benefits to the communities livelihood.

73. During construction a series of temporary negative impacts including dust, noise, road safety, worker's safety, wastewater, solid waste and water contamination will occur, however, those impacts are avoidable and can be reduced by environmental control and mitigation measures. In the operational stage, the project will provide benefits mostly for the improvement of community livelihoods, public health, tourism and public amenity.

74. In order to reduce and adverse impacts, the following alternative approaches are recommended:

1. The environmental mitigation measures and environmental monitoring plan which are presented in the IEE report should be understood and implemented.
2. Good cooperation between all stakeholders, especially IA, EA and local authorities, will be essential to ensure effective outcomes.

3. Consultation with the local community should be implemented on an on-going basis to address any concerns and issues arising during project construction and operation.
4. Further investigation should be undertaken to confirm suitable design of borrow pits (if required), with an objective to provide an enhanced range of multiple use options for the farmers whose land is excavated and lost to normal farm production.

75. The IEE identifies a range of potential impacts and outlines suitable mitigation measures together with a monitoring program. Implementation of the proposed mitigation measures, the monitoring program and associated recommendations will help to avoid/reduce any adverse impacts to insignificant levels. It is concluded that as the likely impacts are not significant, no detailed EIA study is required.

APPENDIX 1: ENVIRONMENTAL AND SOCIAL MONITORING REPORT OUTLINE

The level of detail and comprehensiveness of a monitoring report is commensurate with the complexity and significance of social and environmental impacts. A safeguard monitoring report may include the following elements:

- (a) Background/context of the monitoring report (adequate information on the project, including physical progress of project activities, scope of monitoring report, reporting period, and the monitoring requirements including frequency of submission as agreed upon);
- (b) Changes in project scope and adjusted safeguard measures, if applicable;
- (c) Qualitative and quantitative monitoring data;
- (d) Monitoring parameters/indicators and methods based on the monitoring plan/program previously agreed upon with ADB;
- (e) Monitoring results compared against previously established benchmarks and compliance status (e.g., national environmental emission and ambient standards and/or standards set out in the Bank Group's Environmental, Health and Safety Guidelines; timeliness and adequacy of environmental mitigation measures; involuntary resettlement compensation rates and timeliness of payments, adequacy and timeliness of involuntary resettlement rehabilitation measures including serviced housing sites, house reconstruction, livelihood support measures, and training; budget for implementing environment management plan (EMP), resettlement plan, or indigenous people plan, timeliness and adequacy of capacity building, etc.);
- (f) Monitoring results compared against the objectives of safeguards or desired outcomes documented (e.g. involuntary resettlement impacts avoided or minimized; livelihood restored or enhanced; indigenous people (IP's) identity, human right, livelihood systems and cultural uniqueness fully respected; indigenous people not suffer adverse impacts, environmental impacts avoided or minimized, etc.);
- (g) If noncompliance or any major gaps identified, include a corrective action plan;
- (h) Records on disclosure of monitoring information to affected communities;
- (i) Identification of key issues, or complaints from affected people, or recommendations for improvement;
- (j) Monitoring adjustment measures recommended based on monitoring experience/trends and stakeholders response;
- (k) Information about actual institutional arrangement for implementing the monitoring program/plan provided or adjusted, as may be required;
- (l) Proposed items of focus for the next report and due date.

APPENDIX 2: ENVIRONMENTAL MANAGEMENT PLAN

Table 4: Environmental Management Plan

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|----------------------------------|--|--|--------------------------|-------------------------------|----------------|-------------|
| | | | | | Implementation | Monitoring |
| Pre-construction | | | | | | |
| Location of proposed subprojects | Lack of mechanism to address environmental complaints | Establish a grievance redress mechanism (GRM), as described in the IEE (Section 9). | Proposed project | No additional cost | MPWT/PMU | IA/ES |
| | | Make public the existence of the GRM through public awareness campaigns. | Proposed project section | No additional cost | MPWT/PMU | IA/ES |
| | | Ensure that names and contact numbers of representatives of MOWRAM and contractor are placed on the notice boards outside the construction site and at local government offices (e.g., provincial and commune levels) | Proposed project section | No additional cost | MPWT/PMU | IA/ES |
| | Encroachment on historical/ cultural areas | Excavation for sourcing fill materials for the subproject shall not be undertaken within conservation areas. | Proposed project section | No additional cost | Contractor | IA/ES |
| | | Prior to implementation of the subprojects, MCFA and MOWRAM shall be informed. This is to ensure that MCFA will be able to appoint its officials to coordinate with IA so as to avoid impacts to undiscovered archaeological relics during site works. | Proposed project section | No additional cost | Contractor | IA/ MCFA/ES |
| | | Prior to start of site works, the contractor shall advise MCFA and MOWRAM of the schedule. The contractor shall coordinate with the officials of this agency to ensure that construction activities are carried out consistent with the policies and regulations and laws of Cambodia. | Proposed project section | No additional cost | Contractor | IA/MCFA/ES |
| Location of borrow areas | Siting of borrow areas could cause damage to ecologically sensitive sites, productive land and nuisance to sensitive receptors (residential areas, schools, hospital etc.) | Borrow pits shall not be established in national, provincial, district and village conservation forests and other ecologically sensitive and protected areas. | Borrow sites | Part of contractor's bid cost | Contractor | IA/ES |
| | | Borrow sites shall not be located in productive land. | Borrow sites | Part of contractor's bid cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|---|---|--|--------------------------|-------------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| Location of construction camps/workers camps and other project facilities | Siting of various project facilities could adversely affect sensitive receptors (residential areas, etc.) due to dust emission, wastewater generation, etc. | Workers camp location and facilities shall be located at least 300 m from settlements and agreed with local communities and local officials. | Proposed project section | No additional cost | Contractor | IA/ES |
| | | Siting of asphalt plants, concrete mixing plants, crushing plants and other facilities that cause high dust and/or gaseous emissions will be at least 300 m from settlements and other sensitive receptors (schools, hospitals, etc.) | Proposed project section | No additional cost | Contractor | IA/ES |
| | | Necessary environmental clearance/approval shall be obtained prior to establishment and operation and other facilities. | Proposed project section | Part of contractor's bid cost | Contractor | IA/ES |
| Project design | Climate change and hydrological impacts | Incorporate in the project design the measures that have been developed under the Climate Change Adaptation Component of the Project (e.g., ecosystem-based adaptation measures). | Proposed project section | Part of project cost | Consultant | IA/ES |
| | Fish migration | Engineer should design to avoid or reduce any impact on fish migration. Water way for fish movement should be provided. The construction should be implemented during dry season. | Proposed project section | Part of contractor's bid cost | Engineer/ES | IA/ES |
| | Downstream impact (water quality) | Most of irrigation are challenging to water quantity especially during dry season. The water remained mostly only during rainy season thus the downstream farmers have no enough water for crop or vegetation. Thus sources for water and storage capacity are very important for Engineer consideration. Concepts of integrated water resources management should be applied. | Proposed project section | Part of contractor's bid cost | Engineer/ES | IA/ES |
| Site preparation | Disruption to community utilities | Prior to commencement of site works, relocate or re-provision water supply pipelines, irrigation canals and other facilities that may be affected by construction works This will be done in agreement with the local community and the utility company. | Proposed project section | Part of contractor's bid cost | Contractor | IA/ES |
| Construction Phase | | | | | | |
| Operation of construction equipment, | Encroachment/damage to historically/culturally significant areas. | All project-related activities shall be implemented consistent with the policies, rules and regulations and laws of the Kingdom of Cambodia. | Proposed project section | No additional cost | Contractor | IA/ES/MCFA |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|--|--|---|--------------------------|-------------------------------|---------------------|------------|
| | | | | | Implementation | Monitoring |
| excavation works, spoils and waste disposal, transport of construction materials | | The contractor shall ensure that Project activities shall not cause damage to any archaeological site or cultural heritage. | Proposed project section | No additional cost | Contractor | IA/ES/MCFA |
| | | Spoils and other construction wastes shall not be disposed within the sites. Disposal shall only be to sites approved by concerned authorities. | Proposed project section | No additional cost | Contractor | IA/ES |
| | | The contractor shall ensure that all project-related trucks and vehicles (i.e., those owned by the contractor, sub-contractor, suppliers, etc.) are not overloaded to avoid damage to access roads (village road). | Proposed project section | No additional cost | Contractor/Engineer | IA/ES |
| | | <p>The project is not in protection of cultural heritage areas. However, the following 'chance-find' principles will be implemented by the contractor for the Project road to account for any undiscovered items identified during construction:</p> <p>a. In coordination with MCFA, workers will be provided orientation in the location of cultural/heritage zones within the construction area and in the identification of potential items of cultural/heritage significance.</p> <p>b. Upon discovery of any objects of possible archaeological significance that may be uncovered during construction, the site supervisor shall immediately suspend construction activities affecting the area and shall alert MCFA or its provincial or district offices to inspect the site.</p> <p>c. Work will remain suspended until a site assessment has been made by MCFA, an agreement has been reached as to any required mitigation measures (which may include excavation and recovery of the item), and the contractor has been given permission by the concern authorities to proceed with the construction activities.</p> | Proposed project section | No additional cost | Contractor | IA/ES/MCFA |
| Earthworks, excavation activities, transport of materials, operation of construction equipment, vehicles and other facilities (asphalt plants, | Air pollution due to elevated levels of dust and gaseous emissions | Construction equipment will be maintained to a good standard. Immediate repairs of any malfunctioning construction vehicles and equipment shall be undertaken. | Proposed project section | Part of contractor's bid cost | Contractor | IA/ES |
| | | Equipment and vehicles not in use shall be switched off. | Proposed project section | No additional cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|--|--|---|--|-------------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| crushing plants, concrete mixing plants), stockpiling and waste disposal | | Machinery and vehicles causing excessive pollution (e.g., visible smoke) will be banned from construction sites. | Proposed project section | No additional cost | Contractor | IA/ES |
| | | All construction equipment and vehicles shall have valid certifications indicating compliance to vehicle emission standards. | Proposed project section | No additional cost | Contractor | IA/ES |
| | | On rainless day undertake watering, at least twice per day, on dusty and exposed areas at construction yards, materials stockpile, construction sites, access roads, borrow sites and other project areas where residential sites and other sensitive receptors are located nearby. | Proposed project section | Part of contractor's bid cost | Contractor | IA/ES |
| | | Tightly cover trucks transporting construction materials (sand, soil, cement, gravel, etc.) to avoid spills and dust emission. | Proposed project section | No additional cost | Contractor | IA/ES |
| | | Impose speed limits on construction vehicles to minimize dust emission along areas where sensitive receptors are located (houses, schools, hospitals, temples, etc.). | Proposed project section | No additional cost | Contractor | IA/ES |
| | | Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors. | Proposed project section | No additional cost | Contractor | IA/ES |
| | | Burning of wastes generated at the construction sites, work camps and other project-related activities shall be strictly prohibited. | Proposed project section and other project-related areas (workers camps, etc.) | No additional cost | Contractor | IA/ES |
| | | Provide temporary covers (e.g., tarpaulins, grass, etc.) on long term materials and spoils stockpiles. | Throughout project sites | Part of contractor cost | Contractor | IA/ES |
| | | Clean road surfaces of debris/spills from construction equipment and vehicles | Proposed project section | Part of contractor | Contractor | IA/ES |
| | | Install temporary fencing or barriers around particularly dusty activities in vicinity of sensitive receivers. | Throughout project sites | Part of contractor | Contractor | IA/ES |
| | | Locations for stockpiling spoils, fill and other materials with high dust content shall be at least 300 m from the nearest residential areas and other sensitive receivers. | Throughout project sites | No additional cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|--|--|--|--------------------------------|-------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| Earthworks, transport of materials, operation of construction equipment and vehicles | Elevated noise and vibration levels that could cause nuisance and damage to properties | No noisy construction-related activities (e.g., transport of materials along residential areas and other sensitive receptors, piling, use of jackhammer, etc.) will be carried out from 2100 hrs to 0600 hrs along residential areas, hospitals and other sensitive receptors. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Noisy construction activities will be avoided during religious or cultural events in close proximity to the roadside such as Friday prayers attended by Muslim Cham, when ethnic Khmer are attending temple festivals or holding weddings, | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | All construction equipment and vehicles shall be well maintained, regularly inspected for noise emissions, and shall be fitted with effective muffler and other appropriate noise suppression equipment consistent with applicable national and local regulations. | Throughout project sites | Part of contractor cost | Contractor | IA/ES |
| | | Use only vehicles and equipment that are registered and have necessary permits. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Truck drivers and equipment operators shall avoid, as much as possible, the use of horns in densely populated areas and where there other sensitive receptors are found such as schools, temples, hospital, etc. are located. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Impose speed limits on construction vehicles to minimize noise emission along areas where sensitive receptors are located (houses, schools, temples, hospitals, etc.). | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Avoid noisy construction activities in vicinity of sensitive receivers during night time or other sensitive periods (e.g. during school hours in vicinity of schools) | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Truck drivers and equipment operators shall avoid, the use of horns | Throughout project sites | No additional cost | Contractor | IA/ES |
| Various construction activities, operation of construction and workers camps | Improper handling and disposal of wastes could cause odor and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the | Segregate and regularly collect wastes at worker camps and offices. | Construction and workers camps | Part of contractor cost | Contractor | IA/ES |
| | | Construction/workers' camps shall be provided with garbage bins. | Construction and workers camps | Part of contractor cost | Contractor | IA/ES |
| | | Prohibit disposal of solid wastes into canals, rivers, other watercourses, agricultural field and public areas. | Throughout project sites | No additional cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|---|---|--|----------------------------|-------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| | landscape. | There will be no site-specific landfills established by the contractors. All solid waste will be regularly collected and removed from the work camps and disposed to areas approved by local authorities. | Throughout project sites | Part of contractor cost | Contractor | IA/ES |
| | | Prohibit burning of construction and domestic wastes. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Recyclables shall be recovered and sold to recyclers. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Residual and hazardous wastes shall be disposed of in disposal sites approved by local authorities. | Throughout | Part of contractor cost | Contractor | IA/ES |
| | | Ensure that wastes are not haphazardly dumped within the project site and adjacent areas | project sites | No additional cost | Contractor | IA/ES |
| Establishment and operation of construction and workers camps | Operation of these facilities will generate solid and liquid wastes and if improperly handled, these could cause health problems and pollution. | Drainage shall be provided to facilitate the rapid removal of surface water from all areas and prevent flooding and accumulation of stagnant water. | Construction/Workers camps | Part of contractor cost | Contractor | IA/ES |
| | | Provide adequate housing for all workers at the construction camps and establish clean canteen/eating and cooking areas. | Construction/Workers camps | Part of contractor cost | Contractor | IA/ES |
| | | Portable lavatories (or at least pit latrines in remote areas) shall be installed and open defecation shall be prohibited and prevented by cleaning lavatories daily and by keeping lavatory facilities clean at all times. | Construction/Workers camps | Part of contractor cost | Contractor | IA/ES |
| | | Provide separate hygienic sanitation facilities/toilets and bathing areas with sufficient water supply for male and female workers. | Construction/Workers camps | Part of contractor cost | Contractor | IA/ES |
| | | Wastewater effluents from contractors' workshops and equipment washing- yards will be passed through gravel/sand beds and all oil/grease contaminants will be removed before wastewater is discharged. Oil and grease residues shall be stored in tightly covered drums. Such wastes shall be disposed consistent with national and local regulations. | Construction/Workers camps | Part of contractor cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|-----------------------|--|---|--|-------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| | | Construction/workers camps shall be cleaned up after use to the satisfaction of MPWT/SEO/Consultant and local community. All waste materials shall be removed and disposed to disposal sites approved by local authorities. | Construction/Workers camps | Part of contractor cost | Contractor | IA/ES |
| | | Land used for campsites shall be restored to the original condition as far as practicable and the area shall be planted with appropriate trees/shrubs as soon as practicable after it is vacated and cleaned. | Construction/Workers camps | Part of contractor cost | Contractor | IA/ES |
| Borrow site operation | Operation of borrow sites could cause adverse impacts to surface water quality, elevated dust emission during excavation and transport, erosion and siltation of nearby watercourses, damage to productive land and ecologically sensitive areas and pose health and safety risks. | Prior to extraction, topsoil (about 15 cm) shall be stockpiled, preserved and then refilled after completion of borrow pit operation for rehabilitation purposes after excavation is over. | All quarries and borrow areas operated for the project | No additional cost | Contractor | IA/ES |
| | | Dust control during transport (e.g., water spraying on access roads and provision of truck cover) and excavation shall be undertaken in areas where there are sensitive receptors such as residential areas, school, hospital, etc. | All quarries and borrow areas operated for the project | Part of contractor cost | Contractor | IA/ES |
| | | Long-term material stockpiles shall be covered to prevent wind erosion. | All quarries and borrow areas operated for the project | Part of contractor cost | Contractor | IA/ES |
| | | During borrow site operation, provide adequate drainage to avoid accumulation of stagnant water. | All quarries and borrow areas operated for the project | Part of contractor cost | Contractor | IA/ES |
| | | Borrow sites must be selected amongst those offering the highest ratio between extractive capacity (both in terms of quality) and loss of natural state. | All quarries and borrow areas operated for the project | No additional cost | Contractor | IA/ES |
| | | Borrow sites lying close to the alignment, with a high level of accessibility and with a low hill gradient, are preferred. | All quarries and borrow areas operated for the project | No additional cost | Contractor | IA/ES |
| | | Upon completion of extraction activities, borrow pits shall be dewatered and fences shall be installed, as appropriate, to minimize health and safety risks. | All quarries and borrow areas operated for the project | Part of contractor cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|--|---|---|--|-------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| | | Implement compensatory planting (at least one is to one ratio) if trees will have to be removed at quarry and borrow sites. | All quarries and borrow areas operated for the project | Part of contractor cost | Contractor | IA/ES |
| | | Borrow pits will be left in a tidy state with stable side slopes and proper drainage in order to minimize soil erosion, siltation of nearby bodies of water and to avoid creation of water bodies favorable for mosquito breeding. | All quarries and borrow areas operated for the project | Part of contractor cost | Contractor | IA/ES |
| | | To avoid drowning when pits become water-filled, measures such as fencing, providing flotation devices such as a buoy tied to a rope, etc. shall be implemented. | All quarries and borrow areas operated for the project | Part of contractor cost | Contractor | IA/ES |
| | | It is possible that villagers may request borrow pits to be left excavated so that they may be used as water reservoirs or fishponds. If this were to be agreed between the contractors and the villagers, all the full safety measures detailed above must be observed. Such agreements would be formalized in writing between the contractors and the villagers after full discussion with all concerned parties. | All quarries and borrow areas operated for the project | No additional cost | Contractor | IA/ES |
| Use of hazardous substances such as fuel, oil, bitumen, etc. | Pollution and safety risks due to use of hazardous materials and disposal of hazardous wastes | Store fuel and hazardous substances and wastes in paved areas with roof and embankment. If spills or leaks do occur, undertake immediate clean up. | Throughout project sites | Part of contractor cost | Contractor | IA/ES |
| | | Train relevant construction personnel in handling of fuels and other hazardous substances as well as spill control procedures. | All project roads | Part of contractor cost | Contractor | IA/ES |
| | | Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored. | Throughout project sites | Part of contractor cost | Contractor | IA/ES |
| | | Segregate hazardous wastes (oily wastes, used batteries, fuel drums) and ensure that storage, transport and disposal shall not cause pollution and shall be undertaken consistent with national and local regulations. | Designated storage sites | No additional cost | Contractor | IA/ES |
| | | Store waste oil, lubricant and other hazardous materials and wastes in tightly sealed containers to avoid contamination of soil and water resources. | Designated storage sites | Part of contractor cost | Contractor | IA/ES |
| | | Ensure all storage containers of hazardous substances and wastes are in good condition with proper labeling. | Designated storage sites | Part of contractor cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|--|---|---|--------------------------|-------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| | | Regularly check containers for leakage and undertake necessary repair or replacement. | Designated storage sites | Part of contractor cost | Contractor | IA/ES |
| | | Store hazardous materials above flood level. | Designated storage sites | No additional cost | Contractor | IA/ES |
| | | Storage areas for fuel, oil, lubricant, bitumen and other hazardous substance will be located at least 100 m away from any watercourses. | Designated storage sites | Part of contractor cost | Contractor | IA/ES |
| | | Where significant amount of oily wastewater or spill/leakage of oil and grease may occur (e.g., equipment maintenance areas), drainage leading to an oil-water separator shall be provided for treatment of wastewater. The oil- water separator shall be regularly skimmed of oil and maintained to ensure efficiency. Discharge of oil-contaminated | Throughout project sites | Part of contractor cost | Contractor | IA/ES |
| | | Vehicle maintenance and refueling will be confined to areas in construction sites designed to contain spilled lubricants and fuel. | Throughout project sites | Part of contractor cost | Contractor | IA/ES |
| | | Adequate precaution will be taken to prevent oil/lubricant/ hydrocarbon contamination of channel beds. Spillage if any will be immediately cleared with utmost caution to leave no traces. | Throughout project sites | No additional cost | Contractor | IA/ES |
| Transport of materials and spoils, operation of construction equipment and various construction activities | Damage to community utilities such as water supply pipes, irrigation canals, drainage, etc. may occur during construction activities. | The contractor shall not allow overloading of trucks used for all project- related activities. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | The contractor shall immediately repair any damage caused by the Project to community facilities such as water supply, power supply, irrigation canals, drainage and the like. Adequate compensation shall be paid to affected parties, as necessary. | Throughout project sites | Part of contractor cost | Contractor | IA/ES |
| | | Access roads damaged during transport of construction materials and other project-related activities shall be reinstated upon completion of construction works. | Throughout project sites | Part of contractor cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|--|---|--|--------------------------|-------------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| Box culvert works, stockpiling of construction materials and spoils, use of hazardous materials and earthworks | Deterioration of surface water quality, flooding and flow obstruction of watercourses | Firmly consolidate river banks using stones, concrete and other suitable retaining measures at each bridge construction site and ensure that reservoir shall be kept free of excavation spoil and construction debris, floating and submerged. | Throughout project sites | Part of contractor's bid cost | Contractor | IA/ES |
| | | Spoils, construction wastes and construction materials stockpile area shall be located away from reservoir/ water bodies and under no circumstances will these materials be dumped into watercourses. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Prohibit placement of construction materials, waste storage/reservoir or equipment in or near drainage channels and water courses. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Discharge of oily wastewater, fuel, hazardous substances and wastes, and untreated sewage to watercourses/reservoir and on the ground/soil shall be prohibited. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Provide adequate drainage at the construction sites and other project areas to avoid flooding of surrounding areas and minimize flow obstruction of existing watercourses. | Throughout project sites | Part of contractor's bid cost | Contractor | IA/ES |
| Operation of construction equipment and vehicles, site works, spoils disposal and presence of workers | Impacts to flora and fauna | Spoils and all types of wastes shall not be dumped into forested areas, agricultural land, densely vegetated areas, and water courses. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Workers shall be prohibited from collecting firewood and construction materials from surrounding forests, and from hunting wild animals. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | As the project will not require road widening, ensure that construction works are carried out without unnecessary clearing of roadside vegetation. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | The contractor shall prohibit cutting of trees for firewood and for use in for construction-related activities | Throughout project sites | No additional cost | Contractor | IA/ES |
| Construction works, operation of workers camps | Health and safety risks to workers and the public | Conduct orientation for construction workers regarding emergency response procedures and equipment in case of accidents (e.g., spills of hazardous substances, etc.), fire, etc.; health and safety measures; prevention of HIV/AIDS, malaria, diarrhea, and other related diseases. | Throughout project sites | Part of contractor's bid cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|------------------|--|--|---|-------------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| | | Provide drainage at construction sites and workers camps to prevent water logging/ accumulation of stagnant water and formation of breeding sites for mosquitoes. | Throughout project sites | Part of contractor's bid cost | Contractor | IA/ES |
| | | Provide firefighting equipment and appropriate emergency response equipment (based on on-going construction activities) at the work areas and at construction and workers camps. | Throughout project sites | Part of contractor's bid cost | Contractor | IA/ES |
| | | Provide first aid facilities that are readily accessible by workers. | Throughout project sites | Part of contractor's bid cost | Contractor | IA/ES |
| | | At the workers camps, provide adequate housing for all workers at the construction camps, provide reliable supply of potable water, install separate hygienic sanitation facilities/toilets and bathing areas with sufficient water supply for male and female workers and establish clean eating areas and kitchen. | Workers camps | Part of contractor's bid cost | Contractor | IA/ES |
| | | Provide workers with appropriate safety equipment/devices (such as dust mask, hard hats, safety shoes, goggles, ear plugs, etc.) and strictly require them to use these as necessary. | Throughout project sites | Part of contractor's bid cost | Contractor | IA/ES |
| | | Install sign boards, lighting system at the construction sites, borrow pits, or places which may cause accidents for people and workers | Throughout project sites, where appropriate | Part of contractor's bid cost | Contractor | IA/ES |
| | | Strictly impose speed limits on construction vehicles along residential areas and where other sensitive receptors such as schools, hospitals, and other populated areas are located. | Throughout project sites, where appropriate | No additional cost | Contractor | IA/ES |
| | | Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Barriers (e.g., temporary fence) shall be installed at construction areas to deter pedestrian access to these areas except at designated crossing points. | Throughout project sites, where appropriate | Part of contractor's bid cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|---|--|---|---|-------------------------------|----------------|------------|
| | | | | | Implementation | Monitoring |
| | | Sufficient lighting at night as well as warning signs shall be provided in the periphery of the construction site. | Throughout project sites, where appropriate | Part of contractor's bid cost | Contractor | IA/ES |
| | | The general public/local residents shall not be allowed in high – risk areas, e.g., excavation sites and areas where heavy equipment is in operation. | Throughout project sites, where appropriate | No additional cost | Contractor | IA/ES |
| | | Ensure proper collection and disposal of solid wastes within the construction camps consistent with local regulations. | Construction /workers camps | Part of contractor's bid cost | Contractor | IA/ES |
| | | Provide fencing on all areas of excavation greater than 2 m deep. | Throughout project sites, where appropriate | Part of contractor's bid cost | Contractor | IA/ES |
| | | Ensure reversing signals are installed on all construction vehicles. | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Measures to prevent malaria shall be implemented (e.g., provision of insecticide treated mosquito nets to workers, spraying of insecticides, installation of proper drainage to avoid formation of stagnant water, etc.). | Construction /workers camps | Part of contractor's bid cost | Contractor | IA/ES |
| | | Discharge of untreated sewage shall be prohibited. | Construction/ Workers camps | Part of contractor's bid cost | Contractor | IA/ES |
| Operation of construction/workers camps | Social conflicts | Regularly inform in advance the local officials and local residents on the location and schedule of construction activities which may cause impacts on the environment and life of people (e.g., road sections to be constructed; roads used for transport, locations of worker camps etc.) | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Locate construction camps away from communities (at least 300 m away) in order to avoid social conflict in using resources and basic amenities such as water supply. | Construction/ workers camps | No additional cost | Contractor | IA/ES |
| | | Maximize number of local people employed in construction works especially women (gender 25%) | Throughout project sites | No additional cost | Contractor | IA/ES |
| | | Maximize goods and services sourced from local commercial enterprises. | Throughout project sites | No additional cost | Contractor | IA/ES |

| Project Activity | Potential Environmental Impacts/Concerns | Proposed Mitigation Measures | Location | Estimated Cost | Responsibility | |
|------------------------------|---|--|----------------------|----------------------|--|------------|
| | | | | | Implementation | Monitoring |
| Increased number of vehicles | Elevated noise levels | Along schools, hospitals, etc., provide traffic signs prohibiting blowing of horns and impose speed limits | Proposed access road | Part of project cost | Provincial DPWT, Local traffic authority | IA/ES |
| | Road safety risks | Implementation of a community-based road safety program under the Project to increase safety awareness. The program includes education program for schools, drivers, road users, and the community. | Proposed access road | Part of project cost | Provincial DPWT | IA/ES |
| | | Proper maintenance of traffic signs, markings and other devices used to regulate traffic at appropriate places. | Proposed access road | Part of project cost | PDPWT, Local traffic authority | IA/ES |
| | Potential damage to the archaeologically significant sites: BCT and BCPL. | Under the Project, each project province shall be provided with portable weigh scales to control overloading of trucks. This measure will help ensure that overloaded trucks shall not be allowed to pass through PSP and other Project roads. | Proposed access road | Part of project cost | PDPWT | MCFA |
| | | Speed restrictions shall be implemented within PSP to minimize vibration due to passage of trucks and other vehicle types. Traffic calming devices such as speed bumps shall also be provided, as necessary. | Proposed access road | Part of project cost | PDPWT | MCFA |

APPENDIX 3: ENVIRONMENTAL AND SOCIAL MONITORING REPORT OUTLINE

The level of detail and comprehensiveness of a monitoring report is commensurate with the complexity and significance of social and environmental impacts. A safeguard monitoring report may include the following elements:

- Background/context of the monitoring report (adequate information on the project, including physical progress of project activities, scope of monitoring report, reporting period, and the monitoring requirements including frequency of submission as agreed upon);
- Changes in project scope and adjusted safeguard measures, if applicable;
- Qualitative and quantitative monitoring data;
- Monitoring parameters/indicators and methods based on the monitoring plan/program previously agreed upon with ADB;
- Monitoring results compared against previously established benchmarks and compliance status (e.g., national environmental emission and ambient standards and/or standards set out in the Bank Group's Environmental, Health and Safety Guidelines; timeliness and adequacy of environmental mitigation measures; involuntary resettlement compensation rates and timeliness of payments, adequacy and timeliness of involuntary resettlement rehabilitation measures including serviced housing sites, house reconstruction, livelihood support measures, and training; budget for implementing environment management plan (EMP), resettlement plan, or indigenous people plan, timeliness and adequacy of capacity building, etc.);
- Monitoring results compared against the objectives of safeguards or desired outcomes documented (e.g. involuntary resettlement impacts avoided or minimized; livelihood restored or enhanced; indigenous people (IP's) identity, human right, livelihood systems and cultural uniqueness fully respected; indigenous people not suffer adverse impacts, environmental impacts avoided or minimized, etc.);
- If noncompliance or any major gaps identified, include a corrective action plan;
- Records on disclosure of monitoring information to affected communities;
- Identification of key issues, or complaints from affected people, or recommendations for improvement;
- Monitoring adjustment measures recommended based on monitoring experience/trends and stakeholders response;
- Information about actual institutional arrangement for implementing the monitoring program/plan provided or adjusted, as may be required;
- Proposed items of focus for the next report and due date.

References:

1. EARF, 2012: Cambodia: Food Damage Emergency Reconstruction Project; Environmental Assessment and Review Framework.
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