

# Initial Environmental Examination

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September 2014

## Cambodia: Provincial Roads Improvement Project

Prepared by the Ministry of Rural Development for the Asian Development Bank.  
This is an updated version of the draft originally posted in September 2011 available  
on <http://www.adb.org/projects/documents/rural-roads-improvement-project>.

## CURRENCY EQUIVALENTS

(As at September 2014)

Currency Unit	–	Riel
\$ 1.00	=	RI 4,200

## NOTES

The fiscal year (FY) of the Government of Kingdom of Cambodia ends in December  
In this report, "\$" refers to US dollars.

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## ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADB	Asian Development Bank
APL	Angkor Protected Landscape
APSARA	Authority for Protection and Management of Angkor and the Region of Siem Reap
BOD	biological oxygen demand
DBST	Double Bituminous Surface Treatment
DOE	Department of Environment
EA	Executing Agency
EIA	Environmental Impact Assessment
EMP	Environmental Management
Plan GoC	Government of Cambodia
FS	Feasibility Study
GPS	global positioning system
GRM	grievance redress mechanism
HIV/AIDS	human immunodeficiency virus/acquired immune deficiency syndrome
IEE	Initial Environmental Examination
MAG	Mines Advisory Group
MCFA	Ministry of Culture and Fine Arts
MEF	Ministry of Economy and Finance
MOE	Ministry of Environment
MPWT	Ministry of Public Works and Transport
MRD	Ministry of Rural Development
MT	motorized transport
NR	National Road
NTFP	non-timber forest products
PDPWT	Provincial Department of Public Works and Transport
PDRD	Provincial Department of Rural Development
PPTA	Project Preparation TA
RCVIS	Road Crash & Victim Information System
REA	Rapid Environmental Assessment
RI	Riel
ROW	right of way
RP	Resettlement Plan
SBST	Single Bituminous Surface Treatment
SEIA	Summary Environmental Impact Assessment
SEO	Social and Environmental Unit (in MRD)
SPS	ADB's Safeguard Policy Statement (2009)
TA	technical assistance
TSP	Total Suspended Particulates
TSBR	Tonle Sap Biosphere Reserve
UNESCO	United Nations Educational Scientific and Cultural Organization
US\$	United States Dollar
UXO	Unexploded Ordnance
WB	World Bank

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## **I. EXECUTIVE SUMMARY**

1. The TOR require the Consultants to prepare the Initial Environmental Examination (IEE) for the project roads and the CBF in accordance with both ADB Social Safeguards Policy 2009 and the Government guidelines, and to confirm if the project should be categorized as B or re-categorized, and recommend on mitigation measures for the Environmental Management Plan including its implementation and monitoring.
2. Consultations were conducted with all stakeholders, including the MPWT and its social and environment unit, Ministry of the Environment, Ministry of Agriculture Forests and Fisheries, the Ministry of Culture and Fine Arts, their Provincial Departments in the project area, and relevant NGO's.
3. Detailed maps were obtained and field studies undertaken to identify the proximity of places of religious, cultural, and traditional value, and Sites of Special Ecological Interest such as protected areas, natural reserves and national parks.
4. Only minor environmental impacts are anticipated. Such impacts will be experienced during site works mainly due to dust and noise emissions as well as potential occupational and community health and safety risks, but can be mitigated. Some minor mitigation measures will be specified but no major impacts have been identified.
5. Some slopes on NR13 will be eased from 1:2 to 1:3 to improve slope stability. Road 314D will be improved by filling in of old roadside narrow rectangular borrow pits which are a source of vector breeding.
6. Provision of a concrete road on 150B at the approach to Taches market will reduce airborne dust and improve muddy conditions during rain and flooding.
7. A short section of NR53 will have its alignment adjusted slightly on the opposite side to PAWS to avoid a concrete marker post of PAWS which has been placed actually outside the PAWS boundary close to the shoulder of the road.
8. None of the eastern project roads (NR13, 314D and the CBF) are in close proximity to any protected areas of ecological significance.
9. For the western roads, none traverses the transition, buffer or core zones of ecologically protected areas.
10. Road 150B has an eastern section of 5.5 kms which connects NR5 to Tonle Sap river. It terminates at the village of Ta Ches at the ferry crossing point of the river. This point is the nearest that any project road approaches to the boundaries of Tonle Sap Biosphere Reserve. Road 150B is approximately 4.5 kms from the boundary of the outer zone, known as the Transition zone. There will be no impacts from the road on TLSBR.
11. NR 53 runs alongside part of the eastern boundary of Phnom Aural Wildlife Sanctuary for a distance of approximately 6.5 kms. The boundary is defined in the Royal Decree 1993 and is indicated by concrete marker posts. Site surveys have been conducted to confirm the exact location of the boundary markers, and these have agreed by local villagers and the Provincial Department of Environment officers. The PDE officers confirmed that NR53 does not intrude into the PAWS.
12. Road 151B marks the most southern point of the western project roads. This road is further away from PAWS than NR53 and more than 50 kms from Kirirom National Park. No adverse environmental impacts are anticipated from this section of the project road on protected areas.
13. The Sub-decree No 72 ANRK.BK. Date 11, August 1999 contains an annex "List of the projects that require an Initial Environmental Impact Assessment". This stipulates that an IEE is required for "National Road Construction 100 Kilometers and bridges 30 tonnes". As this project is rehabilitation of existing roads, and the only major bridge will be 25 tonnes

capacity, then according to MOE Legislation, an IEE will not be required by the Cambodian MoE for road works.

14. To avoid or mitigate negative impacts arising from the project, an environmental management plan (EMP) detailing mitigation measures and monitoring activities has been prepared as part of the IEE.

15. Public consultations involving affected people and local officials have been conducted during the preparation of the IEE in compliance with ADB information disclosure and consultation requirements through focus group discussions and individual interviews in all project affected provinces. Environment was not seen as a major issue by those persons interviewed.

16. Climate change adaptation was included in the project. The residents knowledge of climate change induced affects, and adaptation strategies, was limited. However, they were strongly in favor of water capture projects.

17. In order to enhance water capture several sub projects have been included under a Climate Change Component of Loan 2839. These include a consultancy and civil works for :

A dam at Chiprong near Tuek Phos

Deepening of Lake Khset

Water retention dikes in Kampong Leaeng

Water supply and distribution in Kampong Leaeng

None of these civil works are new projects but are rehabilitation of existing works or improvement projects. None of them will have adverse environmental impacts.

18. Deepening of Lake Khset will involve dredging of 350,000 m<sup>3</sup> of material. Under the Cambodian Ministry of Environment Sub-decree No 72 ANRK.BK. (1999) any dredging of more than 50,000 m<sup>3</sup> material must be approved by them. Therefore an abstract of this IEE will be submitted to them as an initial EIA (IEIA) in accordance with the regulations.

19. Samples of the material to be dredged have been taken and analysed for a range of environmental parameters including pesticides and heavy metals. This was carried out by an accredited laboratory in Cambodia. No adverse chemicals were detected and the results for NPK show the material would be a useful fertiliser.

20. Water supply in Kampong Leaeng may involve groundwater abstraction. The safe yield rate of water pumping will be established by tests in the future. Some concerns have been raised over arsenic content in the groundwater. According to test previously conducted by MOWRAM (see main report for reference) arsenic levels in groundwater in Kampong Leaeng are low and within the Cambodian Standard for drinking water. However, it is recommended that this be confirmed by taking a water sample during the yield test and having a laboratory analysis conducted.

21. The civil works under climate change will also include construction of an Emergency Response Management Centre. This will be located on Kampong Leaeng in a newly constructed building with communications equipment. No adverse environmental effects are associated with this new building.

22. Proposed civil works for utilisation of a water tower in Tuek Phos for water supply has been dropped from the previous program as these works have already been undertaken by Ministry of Energy. The budget for this subproject has been reassigned to another subproject.

23. Temporary environmental impacts caused by the civil works have been identified and mitigation measures are given in the environmental management plan (EMP). The EMP (and EMMP) is included in the IEE.

24. To ensure that the project is carried out in accordance with the EMP requirements, MPWT will specify details of the implementation of the EMP in the tender documents and civil works contracts. These will form part of the tender documents which becomes legally binding on the selected contractor.
25. ESO (previously SEO) is operational but needs capacity building. The detailed design and implementation supervision consultant will provide on-the-job training to the field personnel of the ESO of MPWT to build their capacity in environmental management and monitoring. The new ongoing Climate Change consultancy will assist in this.
26. All potential environmental impacts have been identified. The project is confirmed as being Category B according to ADB guidelines.

## **II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK**

### **A. Policy Framework**

27. In 1993 the Royal Government of Cambodia confirmed a new Constitution in which environmental considerations were included for the first time. Specifically Article 59 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.

28. The hierarchy of legislation in Cambodia is :

- Royal Decree signed by the King
- Sub-decree signed by the Prime Minister
- Ministerial Decision signed by a Minister
- Regulation issued by a Ministry

29. The major legislation in Cambodia is the Royal Decree which ratifies laws passed by parliament. These can be supplemented by “prakas” or ministerial decisions. These laws allow sub decrees and regulations to be passed which can stipulate procedures and standards to be met in order to ensure compliance with the law. Many of these sub-decrees and standards have been drafted but have not yet been ratified by parliament. However, contractors are still expected to make sure their operations comply with the draft regulations.

### **B. Legal Framework**

#### **1. Laws on Environment**

30. 1996 the Law on Environmental Protection and Natural Resource Management (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.

31. Other ministries explicitly mentioned at the time were Ministry of Water Resources, Hydrology and Meteorology and Ministry of Land Use Management, Urbanization and Construction. The list was later expanded to include the Ministry of Public Works and Transport, Ministry of Agriculture, Forestry and Fisheries, Ministry of Rural Development, Ministry of Health and Ministry of Tourism.

#### **2. Laws on Historical Monuments**

32. There is a general law in Cambodia which covers all national monuments. This is the "Law on Protection of Cultural and National Heritage", (1996). This is supplemented by the "Decision on the Definition of 3 Zones to Protect Temple Surrounding Areas in All Provinces and Municipalities Except Angkor Wat", 1996. These laws protect small temples or ancient structures.

#### **3. Laws on Nature Reserves**

33. Royal Decree "Protected Natural Areas" issued in November 1993 gives protection to environment, land, forests, wetlands and coastal zones. This decree covers 23 locations representing 18% of Cambodia's total area and is under the jurisdiction of MoE.

#### **4. Laws on Wildlife**

34. The “Joint Prakas of the Ministry of Environment and the Ministry of Agriculture on Prohibition of Hunting and Catching of Wildlife Animals” (1996) specifically bans hunting of animals and birds for food. A contractor’s workers must observe this law.

#### **5. Subsidiary Laws on Environmental Protection**

##### **a. Sub-decrees and Regulations**

35. The “Law on Environmental Protection and Natural Resource Management” (1996) is “enabling legislation”, in that it enables the Ministry of Environment to pass sub-decrees and regulations to protect the environment. This subsidiary legislation lays down quantitative standards which must be met by contractors in their operation.

36. Several sub-decrees are already laws. Others have been drafted and are expected to become law in the near future. These standards give parameters and values which must be measured to check compliance with the regulations. Even if the regulations are in draft form, the contractors are expected to comply with them.

##### **b. Sub-Decree on Air and Noise Pollution Control**

###### **i. Air Quality**

37. The air pollution regulations are contained in Sub-Decree on Air and Noise Pollution. For dust control, there should no visible emissions from stockpiles of materials, crushers or batching plants. At sensitive receptors a standard of TSP < 0.33 mg/m<sup>3</sup> 24 hour average should be met. All vehicles should be well maintained and comply with the air quality regulations.

###### **ii. Noise**

38. The noise regulations are contained in Sub-Decree on Air and Noise Pollution. The regulations do not stipulate a level for noise from construction sites but refer to mixed commercial / industrial and residential property. Neither do they give the measurement method. Therefore the following standards are recommended. Noise levels at the perimeter of any site should not exceed :

- Continuous Equivalent Level (Leq) = 75dB(A) 12 hours daytime (0700-1900)
- Continuous Equivalent Level (Leq) = 65dB(A) 12 hours nighttime (1900-0700)

The descriptor “Continuous Equivalent Level (Leq)” is a commonplace measurement and most noise monitoring equipment measures it directly. The measurement is made at the construction site perimeter which makes monitoring easier as it does not require one gaining access to a private residence. The level of 75dB(A) daytime / 65 dB(A) nighttime is a “good” standard and commonly used in countries such as Singapore and Malaysia.

###### **iii. Vibration**

39. There is no standard for vibration in Cambodia. Therefore the following standard is recommended. The vibration levels at any vibration sensitive property or location should be less than 1mm/second peak particle velocity (ppv). The level of 1mm/second ppv is a good “standard” and is derived from the US Bureau of Mines publications for avoidance of damage and the UK GLC (Greater London Council) standard for avoidance of nuisance.

**c. Sub-Decree on Water Pollution Control (No. 27 ANRK.BK 1999)**

40. As a minimum, all discharges of liquid wastes from construction camps, work sites or operations, to streams or water courses should be: BOD  $\leq$  50mg/L; Turbidity  $<$  5 NTU; SS  $\leq$  50 mg/L; Temperature  $<$  45°C; pH = 6-9; Oil & Grease  $\leq$  5 mg/L and Dissolved Oxygen  $>$  4mg/L.

There is no legal standard for performance of septic tanks but they should be checked for correct operation: that is absence of smell; no overflowing; and no surface water logging.

**d. Sub-Decree on Solid Waste Management (No. 36 ANRK.BK 1999)**

41. Under the Sub-Decree on Solid Waste Management (No. 36 ANRK.BK 1999), Article 7 “the disposal of waste in public sites or anywhere that is not allowed by authorities shall be strictly prohibited”. There are no quantitative parameters given but good sensible practice is expected. Such practices would include :

- All general waste and food waste should be removed to a government approved landfill.
- All demolition waste must be removed to a government approved location.
- All waste oils and greases should be removed by a registered subcontractor. The final destination should be established.

Failure to employ sensible precautions may cause sanitation problems to workers living in camps and also may result in prosecution.

**e. Hazardous Substances**

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

**C. Administrative Framework**

43. There are two particular types of areas of special ecological interest in relation to this project. These are :

**1. Protected Areas**

44. Cambodia has a network of 23 natural protected areas managed through the Ministry of Environment (MoE). These areas cover 2.2 million hectares or 18% of Cambodia’s land area and include most of its important habitats. The Forest Administration has also designated protected forests bringing the total area under protection to around 25% which is more than twice the global average. Protected Areas are sites which are protected by Royal Decrees, Laws and Regulations. Such mandatory stipulations are promulgated in Khmer language. These have been obtained and if necessary, translated. The Khmer version takes precedence over the translated version.

45. In 2008 Cambodia introduced the Protected Area Law (No. NS/RKM/0208/007), which defines:

- (i) national parks
- (ii) wildlife sanctuaries
- (iii) protected landscapes

- (iv) multiple use areas
- (v) Ramsar sites
- (vi) biosphere reserves
- (vii) natural heritage sites and
- (viii) marine parks

Details are :

**National Parks** (IUCN category II) – Natural and scenic area of significance for their scientific, educational and recreational values.

**Wildlife Sanctuaries** (IUCN category IV) – Natural area where nationally significant species of flora or fauna, natural communities, or physical features require specific intervention for their perpetuation.

**Protected Landscapes** (IUCN category V) – Nationally significant natural and semi-natural landscapes that must be maintained to provide opportunities for recreation.

**Multiple-Use Areas** (IUCN category VIII) – Areas that provide for the sustainable use of water resources, timber, wildlife, fish, pasture, and recreation with the conservation of nature primarily oriented to support these economic activities. The Tonle Sap Multiple-Use Area was nominated as Cambodia's first Biosphere Reserve in 1997. The Boeung Chmar portion of Tonle Sap Multiple-Use Area (28,000 ha) is designated as a Ramsar site.

**Ramsar Sites** – There are two sites in the IUCN categories IV and VIII above and one site in the middle stretches of the Mekong River between Stung Treng and the border with Laos.

46. The Law on Forestry Management prohibits the hunting of wildlife within such protected areas. As well as maintaining checkpoints and providing rangers, the Ministry of Environment (MoE) has an active community education program to promote environmental awareness especially within the rural communities.

47. This law is recent (2008) and many of the protected areas predate this by many years. Both the original legislation and the most current have been reviewed during this project. Several protected areas, of differing designations, are located in proximity to several of the road segments, and these are discussed.

## 2. Important Bird Area

48. An **Important Bird Area (IBA)** is an area recognized as being a globally important habitat for the conservation of bird populations. Currently there are about 10,000 IBAs worldwide. The program was developed and sites are identified by BirdLife International. These sites are small enough to be entirely conserved and differ in their character, habitat or ornithological importance from the surrounding habitat.

49. **BirdLife International** is an international organization working to protect the world's birds and their habitats. It is a global conservation federation with a worldwide network of over 100 partner organizations. BirdLife International was founded in 1922 and was originally known as the International Council for Bird Preservation, acting as a lobbying group. It changed its name in 1993 to Birdlife International and is the official IUCN Authority for the Red List for birds.

50. Often IBAs form part of a country's existing protected area network, and so are protected under national legislation. Cambodia's Phnom Aural Wildlife Sanctuary and Phnom Samkos Wildlife Sanctuary both contain designated IBAs.



### 3. Cambodian IEE Requirements

51. On 11 August 1999 a Sub-decree (72 ANRK.BK) on EIA Processes was promulgated requiring an initial EIA (IEIA) or EIA for selected projects listed in the sub-decree annex to be submitted by public or private project owners to the MOE for review.

Table II-1 List of Projects that require an Initial Environmental Impact Assessment

No.	Type and activities of the projects	Size / Capacity
<b>A. Industrial</b>		
<b>a) Foods, Drinks, Tobacco</b>		
1	Food processing and caned	500 Tones/year
2	All fruit drinks manufacturing	1,500 Litres / day
3	Fruit manufacturing	500 ones/year
4	Orange Juice manufacturing	All sizes
5	Wine manufacturing	All sizes
6	Alcohol and Beer brewery	All sizes
7	Water supply	10,000 Users
8	Tobacco manufacturing	10,000 Boxes/day
9	Tobacco leave processing	350 Tones/ year
10	Sugar refinery	3,000 Tones / year
11	Rice mill and cereal grains	3,000 Tones / year
12	Fish, soy bean, chili, tomato sources	500,000 Litres/ year
<b>b) Leather tanning, Garment and Textile</b>		
13	Textile and dyeing factory	All sizes
14	Garments, washing, printing, dyeing	All sizes
15	Leather tanning, and glue	All sizes
16	Sponge- rubber factory	All sizes
<b>c) Wooden production</b>		
17	Plywood	100,000m <sup>3</sup> /year(log)
18	Artificial wood	1,000 m <sup>3</sup> /year (log)
19	Saw mill	50,000m <sup>3</sup> /year (log)
<b>d) Paper</b>		
20	Paper factory	All sizes
21	Pulp and paper processing	All sizes
<b>e) Plastic, Rubber and Chemical</b>		
22	Plastic factory	All sizes
23	Tire factory	500 Tones /year
24	Rubber factory	1,000 Tones /year
25	Battery industry	All sizes
26	Chemical production industries	All sizes
27	Chemical fertilizer plants	10,000 Tones /year
28	Pesticide industry	All sizes

29	Painting manufacturing	All sizes
30	Fuel chemical	All sizes
31	Liquid, powder, solid soaps manufacturing	All sizes
<b>f) Mining production other than metal</b>		
32	Cement industry	All sizes
33	Oil refinery	All sizes
34	Gas factory	All sizes
35	Construction of oil and gas pipeline	2 Kilometres
36	Oil and gas separation and storage facilities	1,000,000 Litres
37	Fuel stations	20,000 Litres
38	Mining	All sizes
39	Glass and bottle factory	All sizes
40	Bricks, roofing tile manufacturing	150,000 piece /month
41	Flooring tile manufacturing	90,000 piece /month
42	Calcium carbide plants	All sizes
43	Producing of construction materials(Cement)	900 tones/month
44	Cow oil and motor oil manufacturing	All sizes
45	Petroleum study research	All sizes
<b>g) Metal industries</b>		
46	Mechanical industries	All sizes
47	Mechanical storage factory	All sizes
48	Mechanical and shipyard enterprise	All sizes
<b>h) Metal Processing Industrials</b>		
49	Manufacturing of harms, barbed wires, nets	300 Tones/month
50	Steel mill, Irons, Aluminum	All sizes
51	All kind of smelting	All sizes
<b>i) Other Industries</b>		
52	Waste processing, burning	All sizes
53	Waste water treatment plants	All sizes
54	Power plants	5 MW
55	Hydropower	1 MW
56	Cotton manufacturing	15 Tones/month
57	Animal's food processing	10,000 Tones/year
<b>B. AGRICULTURE</b>		
58	Concession forest	10,000 Hectares
59	Logging	500 Hectares
60	Land covered by forest	500 Hectares
61	Agriculture and agro-industrial land	10,000 Hectares
62	Flooded and coastal forests	All sizes
63	Irrigation systems	5,000 Hectares
64	Drainage systems	5,000 Hectares
65	Fishing ports	All sizes

<b>C. TOURISM</b>		
66	Tourism areas	50 Hectares
67	Golf Course	18 Holes
<b>D. INFRASTRUCTURE</b>		
68	Urbanization development	All sizes
69	Industrial zones	All sizes
70	Construction of bridge-roads	30 Tonnes weight
71	Buildings	Height 12 m or floor 8,000 m <sup>2</sup>
72	Restaurants	500 Seats
73	Hotels	60 Rooms
74	Hotel adjacent to coastal area	40 Rooms
75	National road construction	100 Kilometers
76	Railway construction	All sizes
77	Port construction	All sizes
78	Air port construction	All sizes
79	Dredging	50,000 m <sup>3</sup>
80	Damping site	200,000 people

52. The Sub-decree No 72 ANRK.BK. Date 11, August 1999 Annex “List of the projects that require an Initial Environmental Impact Assessment” refers to “National Road Construction 100 Kilometers and bridges 30 tonnes”. As this project is rehabilitation of existing roads, and bridges are 25 Tonnes capacity, an IEE will not be required for road sections. This has been confirmed in discussions with MoE.

53. Deepening of Lake Khset will involve dredging of 350,000 m<sup>3</sup> of material. Under the Cambodian Ministry of Environment Sub-decree No 72 ANRK.BK. (1999) any dredging of more than 50,000 m<sup>3</sup> material must be approved by them. Therefore an abstract of this IEE will be submitted to them as an initial EIA (IEIA) in accordance with the regulations.

54. Other civil works to be carried out under this loan 2839 are not listed under the Cambodian Ministry of Environment Sub-decree No 72 ANRK.BK. (1999) and do not require approval by MoE.

### **III. DESCRIPTION OF THE PROJECT**

#### **A. The Project Overview**

55. The Government of Cambodia has requested the Asian Development Bank (ADB) for project preparatory technical assistance (TA) to prepare the Provincial Roads Improvement Project. This project is a priority project in the Government's key infrastructure development agenda as it provides all-year access to provincial and rural agricultural communities of Prey Veng and Svay Rieng provinces of southeastern Cambodia. The project aims to rehabilitate 87 kilometers (km) of provincial roads in Prey Veng and Svay Rieng provinces to paved condition to provide a safer, cost-effective provincial road network with all-year access to markets and other social services for provincial centers of southeastern Cambodia. A new cross border facility (CBF) will be constructed at Prey Var-Mocva to facilitate efficient cross border transport and trade between Cambodia and Vietnam. The project will support a sustainable road maintenance regime in the Ministry of Public Works and Transport (MPWT), HIV/AIDS and human trafficking prevention program, and climate change adaptation measures.

56. Roads are the principal mode of transportation in Cambodia. The road network of approximately 39,600 km includes: (i) national roads (primary national highways) with a total length of about 2,100 km; (ii) provincial roads (secondary national highways) with a total length of about 9,500 km; and (iii) about 28,000 km of rural roads. Management of national and provincial roads is the responsibility of MPWT, whereas management of rural roads is the responsibility of the Ministry of Rural Development.

57. The TA is included in the ADB Cambodia Country Operation and Business Plan (COBP) 2009–2012. The business plan aims to provide pro-poor and socially inclusive growth by enhancing environmentally sustainable agriculture and rural development by diversifying rural growth and bolstering poverty reduction efforts.

58. The remote rural economy is becoming increasingly dependent on the improved national road network, yet the provincial road network, with a paved ratio of 11%, continues to deteriorate because of the rapid growth in traffic, combined with a lack of maintenance financing, and poor road maintenance standards.

59. National Road (NR) 13 that links NR 1 and NR8 in north-south direction and NR 314D linking NR 1 with CBF at Prey Var-Mocva are two provincial roads that are vital for transport within Prey Veng and Svay Rieng provinces and for cross-border transport and trade. These roads do not provide all-year accessibility. During the inception phase the improvement of continuous sections of Road 150B, NR53 and Road 151B which traverse Kampong Chhnang and Kampong Speu provinces were included in the project scope. The output for these roads is civil works. This output has associated detailed design and implementation supervision (DDIS) consulting services, and land acquisition and resettlement studies required for the project roads.

60. The impact of the project is improved access to markets, jobs, social services, and cross border transport and trade in Prey Veng and Svay Rieng provinces.

61. The outcome of the project is the safe, cost effective, all-year access provided in the road network of provincial agricultural areas of Prey Veng, Svay Rieng Kampong Chhnang and Kampong Speu provinces.

62. The outputs of the project are :

- Civil works to: (a) improve, to paved condition, NR 13 connecting NR 8 and NR1, between Komchay Mear and Prosot, 65 km; and NR 314D from Prosot town to the border of Vietnam at Prey Var-Mocva, 25 km; and construct a new CBF at Prey Var-Mocva and (b) Civil works to improve roads 150B, NR53 and a short length of road 151B, Total length 69 km approximately. This output has associated detail design and

implementation supervision (DDIS) consulting services, and land acquisition and resettlement required for roads and the CBF.

- Improved road asset management through axle load control at strategic locations of national and provincial roads, to expand the ongoing axle load control programs of MPWT.
- Increased road safety and safeguards by implementing: (a) a community-based road safety awareness program in line with the national program; (b) an HIV/AIDS and human trafficking prevention program; and (c) a sex-disaggregated baseline socioeconomic survey of beneficiaries.
- Climate change adaptation to assess vulnerability to climate change in National Roads and vulnerability mapping for National Roads to improve planning for climate changes by introducing ecosystem-based adaptation strategies.
- An emergency management control centre
- Water capture, storage and distribution systems.
- Efficient project management support to MPWT. As well as the support in the design, approach and methodology for the improvement of the project roads from the engineering perspective, there are many innovative features. These include road asset management through axle load control, road safety, social safeguards, effective gender mainstreaming, and climate change adaptation. With the CBF at Prey-Var Mocva, the project has regional cooperation features as well.
- A symposium on axle load control for the EA's staff and a two day training course on FIDIC also for EA staff.

63. The project roads are given below. (Table III-1) and their locations shown in Figure III-1 and Figure III-2.

Table III-1 Project Road Lengths

Road	Province	From	To	Length, km
NR13	Prey Veng/ Svay Rieng	NR8	NR1	62.4
314D	Svay Rieng	NR1 at Proseth	Border at Prey Vor	25.6
150Ba (east of NR5)	Kampong Chhnang	NR5	Taches market	5.6
150Bb (west of NR5)	Kampong Chhnang	NR5	Tuek phos	25.6
Alangkae Local road	Kampong Chhnang	150B	150B	3.0
NR53	Kampong Chhnang	Tuek Phos (culvert 7)	Junction with 151B	31.8
151B	Kampong Speu	NR53	Thnal Bambeak (Amleang)	3.6
Total				157.6

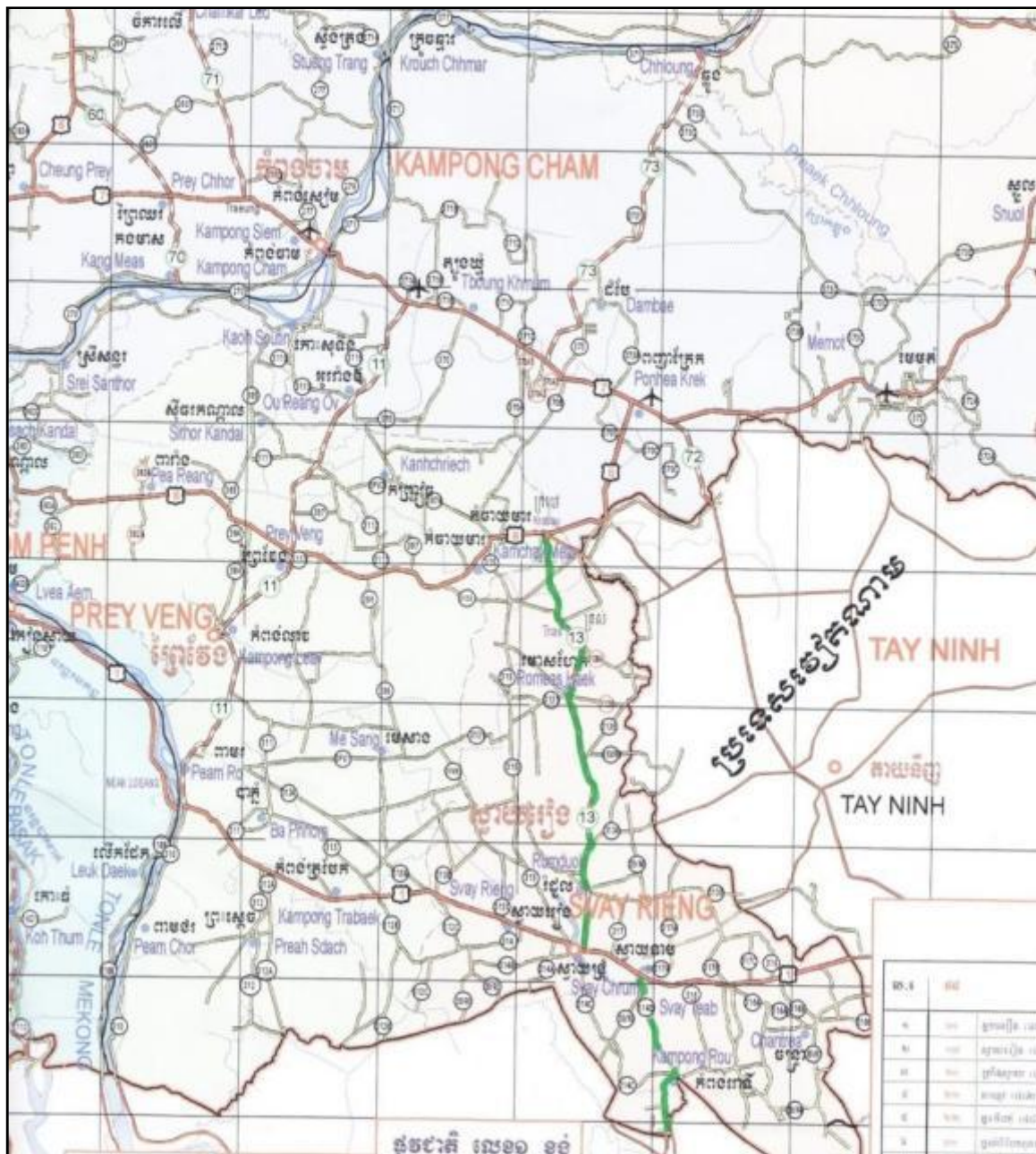


Figure III-1 Map of Project Roads NR13 and road 314D and CBF (marked in green)



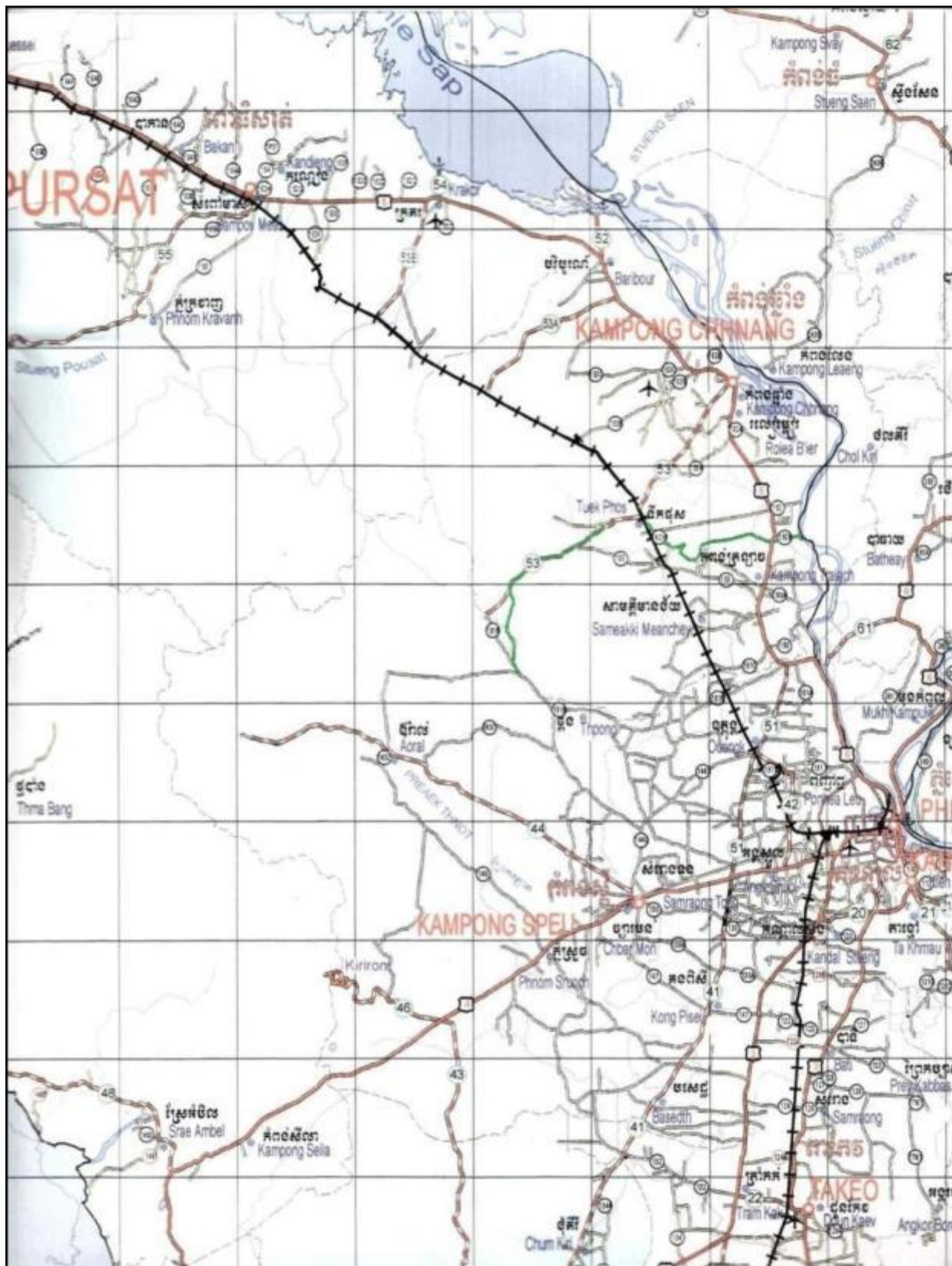


Figure III-2 Map of Project Roads 150B, NR53 and 151B (marked in green)

## **B. Road Design and Realignments**

64. The road design is intended to be within the existing construction limits, with no widening or realignment. However it will be seen below that one realignment is recommended.

65. Road 150Bwest will be realigned to the east to bypass the village of Anangkae. Within Taches market the road length maybe adjusted slightly (0.5 km) to provide paving within the town, without widening. Road 150B will be realigned just east of the village of Alangkae to pass directly to Tuek Phos. This will protect the village community. The length on the realigned route is 1.4 km shorter than the existing route through the village.

66. The existing alignment of road 150B through the village will be paved to ensure the community is not isolated. Minor road pavement works will be carried out and it will be surfaced, all within the existing width with no resettlement.

67. For NR53 the project begins where the ongoing DPWT improvements end. This is approximately 8.6 km southwest of Tuek Phos. The project road terminates at Thnal Bambaek in Amleang. The MPWT is planning other road improvements that will connect the end of the project roads to the important centre at Oudong, to the west on NR5 and to Aoral town to the east. Both connections are along continuations of road 151B. As mentioned above road 150B will be realigned at Alangkae village. The existing route (blue line) and the realigned route (red line) are shown in

Figure III-3. The existing route has 3 curves with very low radii, the first immediately in front of a school and the others as the road traverses the edge of the village. The approaches to the existing bridge donated by Japan in 2009 are extremely poor, suitable for a community road but unsuitable for an MPWT road where heavy traffic will pass in the future.

67. As well as providing a more direct route to Tuek Phos the realignment reduces the number of railway crossings from three to one. The railway is shown as a black line in the figure. The realignment is along existing local roads and near parallel and slightly (30m) to the east of the existing railway line.

68. Where it crosses the river a new bridge will be provided. The new bridge will be approximately parallel to the existing railway bridge. On the northern bank of the river the land is open and largely unused. This area may provide a suitable civil engineering construction camp. It is 0.6 km into Tuek Phos along an existing local road.

69. A minor realignment is under consideration within the town of Kampong Rou on road 314D. This will be a minor improvement to provide curvature at two right angled bends and protect access to a school. The realignment may take part of the land of a Government office.



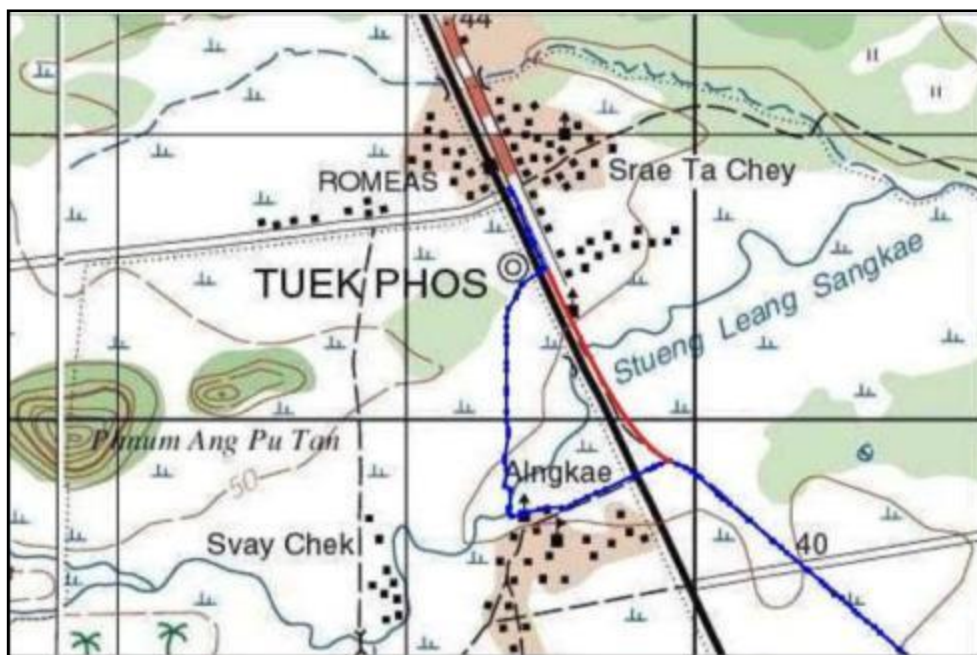


Figure III-3: Road 150B, Realignment at Alngkae Village

### C. Project Environmental Classification

70. The Project is classified as environment category B and an initial environmental examination (IEE) has been conducted as part of project preparation in accordance with ADB Safeguard Policy Statement of 2009 (ADB SPS).

### D. Current Conditions of Project Roads

#### 1. National Road NR 13

71. NR 13 has an alignment that is generally consistent throughout and has a 22km northern gravel section, a central section from km 22 to a road junction at km 48, which has a sealed surface that is in poor condition, and a southern section from km 48 to the junction with NR1 at km 62, which is sealed and is in generally fair condition. There are two significant settlements along the road at Kampong Trach and Rumduol, with a market area at Angk Prasrae.

#### 2. Road 314D

72. Road 314D is a gravel road with two very short sections of sealed surface. The whole length is in flat terrain. There is residential property and roadside activity along much of the length of the road, with one major settlement at Kampong Rou. There has clearly been recent establishment of commercial activity in the border area.

#### 3. CBF

73. Freight traffic on road 314D is believed to be seasonal, with heavier traffic during the rice harvesting period. The road ends at a border crossing into Vietnam. There is some international traffic but it is not yet significant. Some goods are transferred from road to barge at this location and carried into Vietnam by water transport. A new cross border

facility (CBF) will be constructed at Prey Var-Mocva to facilitate efficient cross border transport and trade between Cambodia and Vietnam.

#### **4. Road 150B**

74. Road 150B must be considered as two roads; the short section of approximately 5.5km to the east of NR5 and the longer section of about 28km to the west of NR5.

75. The eastern section is a gravel road to the village of Ta Ches, which is a major local market centre and from where there is a ferry taking vehicles across the Tonle Sap River. A road continues south from Ta Ches along the western bank of the Tonle Sap River.

76. The section of 150B to the west of NR5 is also a gravel road, which terminates at a junction with NR53 at Tuek Phos. It passes through flat terrain used for rice production, and connects with numerous local access roads. The road alignment changes direction sharply when passing south of Tuel Phos and a new section of approximately 1.5km is being considered. This will be a straighter section following the railway line. A new river crossing will be necessary.

#### **5. Road NR53 and 151B**

77. NR 53 connects the village of Tuek Phos northwards to Kampong Chhnang, and in the opposite direction westwards before turning in a southerly loop to give a connection to Udong. It is already being upgraded to a sealed standard (6m carriageway plus shoulders) to a point 8.7km to the west of Tuek Phos. The proposed project would continue this road westward for about 31km to the junction with road 151B just north of Amleang. This is a gravel road about 6m wide in generally good to fair condition. The first 17km to Kbal Tuek passes through flat terrain used for rice cultivation that is densely populated. Where rice paddies are prevalent on both sides of the road they tend to be inundated with water and consequently the road is on embankment. Beyond Kbal Tuek the land is undulating and much less intensively farmed. There are five single-lane bridges on this section of NR53.

78. It was proposed that the works to improve NR53 would be continued southwards along road 151B for 3.5km to Amleang, and then westwards via an unclassified road to Aural, a total distance of 40km. This road is currently a gravel road in mostly poor condition. The existing road traverses undulating country and in part passes through PAWS. However, this section of road is no longer included in this ADB-funded Project, and will not be considered further in this assessment.

#### **6. Condition Survey**

79. A condition survey was carried out to identify visually environmentally sensitive locations on the ground. These included: pedestrian crossing points; watercourses, lakes, ponds, rivers, streams; schools, kindergartens; hospitals, clinics, medical centres; pagodas, temples, churches, mosques; cemeteries and individual graves; high and low tension power lines; mobile phone towers; trees, orchards and vegetation. Details are given in Annex 1.

## **IV. WATER CAPTURE PROJECTS**

### **A. Rainwater Capture**

80. Most rural communities rely on wells, ponds, and canals. The project area experiences both very wet and very dry periods throughout the year. Very little infrastructure has been built to capture water and store it during the rainy season so that it can be available during extended dry periods. Where water storage exists in some areas, water appears to run out before the next rains.

81. Currently, when roads are being constructed, materials are being extracted from the roadside lands to be used for embankment construction. Local people ask for these ditches to remain so that rainwater can collect in them. However, these are not rehabilitated and some are eroding close to the road. In addition, they can pose a road safety problem if cars fall off the road in places where ditches are dug deep and close to the road.

82. Rainwater harvesting to improve water supply has been identified as an adaptation priority for the country (National Action Plan on Climate Change Adaptation, 2006) and this project will contribute to the supply of water sources primarily for agriculture and livestock along the project road.

### **B. Chiprong Dam, Tuek Phos District, Kampong Chhnang Province**

#### **1. Background**

83. Project Road NR53 exits Tuek Phos Village and runs west towards PAWS. It crosses the river 10 kms west of Tuek Phos Village on a JICA funded concrete bridge. Just upstream of this crossing point there is the remains of a wooden dam constructed in earlier regime and now destroyed. MPWT have been approached by local villagers and asked to assist in rehabilitation of the dam. The dam originally was intended to obstruct water flow and divert it to a concrete dam and spillway. The spillway then controlled the flow of the river into a primary canal which irrigated downstream fields. The dam has suffered extensive bomb damage. MOWRAM have been asked to repair it. The primary canal also needs rehabilitation.

#### **2. Links with Ministry of Water Resources**

84. The Kampong Chhnang Provincial Department of Water Resources have been contacted and discussions held with them. Meetings have taken place with Mr. Eng Daravuth, Deputy Director MOWRAM. (Mob 0975521000) He and his department have previous links with ADB. He was Project Manager on EFAP – Emergency Food Assistance Project – funded by ADB. MOWRAM are supportive of the activities of MPWT and endorse the construction of Chiprong dam.

#### **3. Location Chiprong Dam**

85. Chiprong is located 10 km West of Tuek Phos after the village of Khlong Popok. The future dam location is upstream of the main bridge of 72 m span. Flash floods can be very high and water level marks can be seen on the bridge abutments.

86. The downstream area is made of paddy fields covering about 1,000 ha both sides of the National Road. The previous dam was erected around 1977 during the Pol Pot regime. The dam was destroyed by successive flash floods and several times was rebuilt by the farmers with sand bags.

87. Since the river bed widens around the bridge location, the river velocity decreases and sand accumulates massively. It may become a threat to the future dam if no dredging is foreseen. On average, 50 m<sup>3</sup> of sand must be dredged everyday which makes 18,000 m<sup>3</sup> per year. That is five 20 tons trucks per day. Nowadays, existing local contractors are dredging this location for sand but the sand level will have to be closely monitored to avoid huge flooding of the surrounding area during flash floods. The figures below show the location of the dam and the existing condition. Note the second photo shows a man measuring the depth of the river.



Figure IV-1: Location of remains of temporary dam and depth being measured

88. Before construction, all the sand under the construction site will need to be removed to an estimated depth of 2m. Also a cut-off filled with clay is recommended to prevent water infiltration under the dam. The cut-off is 3 meter deep.

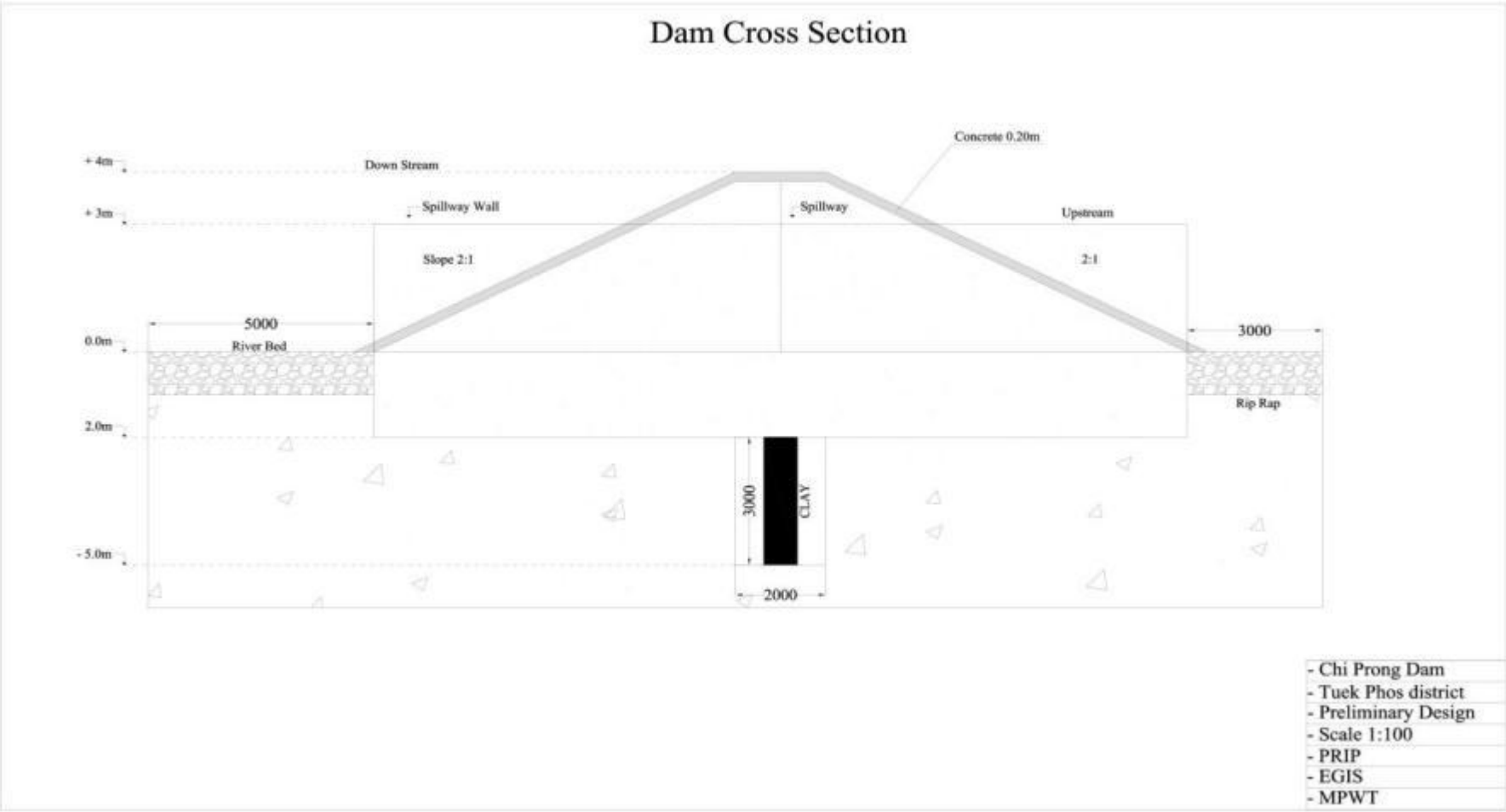
89. In total, with the sand dredging estimated at around two meters and the cut-off wall at 3m, and the spillway 4 metres, the total height of the dam will be 9 meters from base to top. This means the dam will be 4 meters higher than the river bed and stretch over a length of 120 m.

90. When the topo survey is finished, a detailed design can be prepared together with the bidding documents. It is possible that an NGO such as LWD be contacted to monitor the works and the maintenance of the dam and organise the farmers.

91. Following construction of the dam, a water offtake needs to be built alongside the river at the beginning of the primary irrigation canal and the canal itself need to be re-excavated. Here also the topo survey is needed to decide the positioning of the offtake.

92. Preliminary drawings have been prepared and are shown below.

Figure IV-2: Dam Cross Section



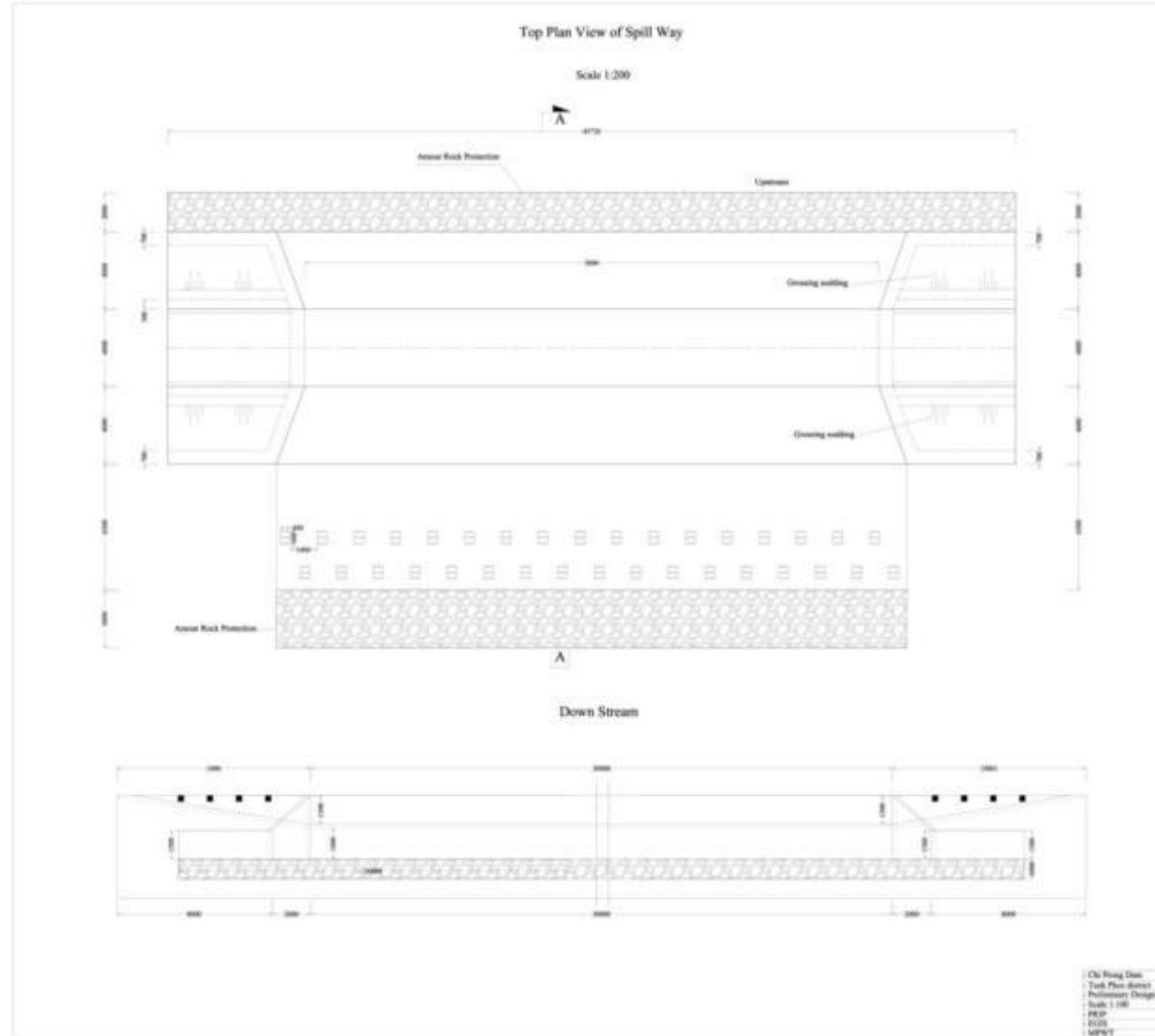


Figure IV-3: Dam Plan View

93. The slope of the embankment has been kept to 1: 2 and a concrete lining will be placed all over the dam.

94. The dam will be equipped with a spillway of 30 m long. In order to determine the exact location and height of the spillway crest, a topographic survey is needed showing cross-sections at the dam location 15 m before and after the dam site and up to the bridge. The site survey should show the elevation of the beginning of the primary canal which will allow one to determine the elevation of the spillway.

95. However a preliminary design has been prepared with a bill of quantities shown here under:

BILL OF QUANTITIES					
Item	Description	Unit	Quantity	Unit Price \$	TOTAL \$
<b>1 EARTH WORK</b>					
1.1	Soil excavation	m3	5040	1,7	8568
1.2	compacted backfilling	m3	9840	2,3	22632
<b>2.CONCRETE</b>					
2.1	Concrete Class C for embankment Lining	m3	480	75	36000
2.2	Concrete class B for Spillway ( foundation, crest)	m3	275	120	33000
2.3	Concrete Class B (wing wall and side walls)	m3	150	120	18000
2.4	reimforcement bars grade 400 deformed	Ton	63,75	960	61200
2.5	Wire Mesh reinforcement ø 6 mm	Ton	72	960	69120
<b>3. ROCK PROTECTION</b>					
3.1	Downstream & Upstream Rip Rap class B for spillway	m3	480	70	33600
3.2	Gabion for wing wall protection	m3	80	85	6800
			<b>TOTAL</b>		<b>288,920</b>

Figure IV-4: Dam Bill of Quantities

#### 4. Construction Works

96. The work should preferably start early January, at the end of the raining season, by the removal of the sand at the location of the dam and the building of the left bank cofferdam. Sand should be removed until the proper bottom of the river is met. That can be 2 or 3 meters.

97. Once finalised, water should be pumped out of the cofferdam immediately followed by filling and shaping the dam body.

98. The concrete lining of the dam can be started right after the final shape is obtained. The cofferdam can be removed and installed on the right bank out to the middle of the river. Water should be pumped out. Filling and shaping of the right side of the dam could be done leaving the middle of the dam slightly opened.

99. When finished, the space for the spillway should be dug over 30 meters and concrete for spillway poured. Then, the spillway body can be erected properly to the crest together with wingwalls. Backfilling can be gradually done around the spillway.

100. Once complete the upstream and downstream of the spillway should be protected with Rip Rap and on the sides with wingwalls from Gabions. Together with spillway construction, the concrete lining of the right side of the dam can be done.

101. The cofferdam can now be removed once the concrete works are older than 3 weeks. This is expected to be done by end of July during which time the high water level may be reached.

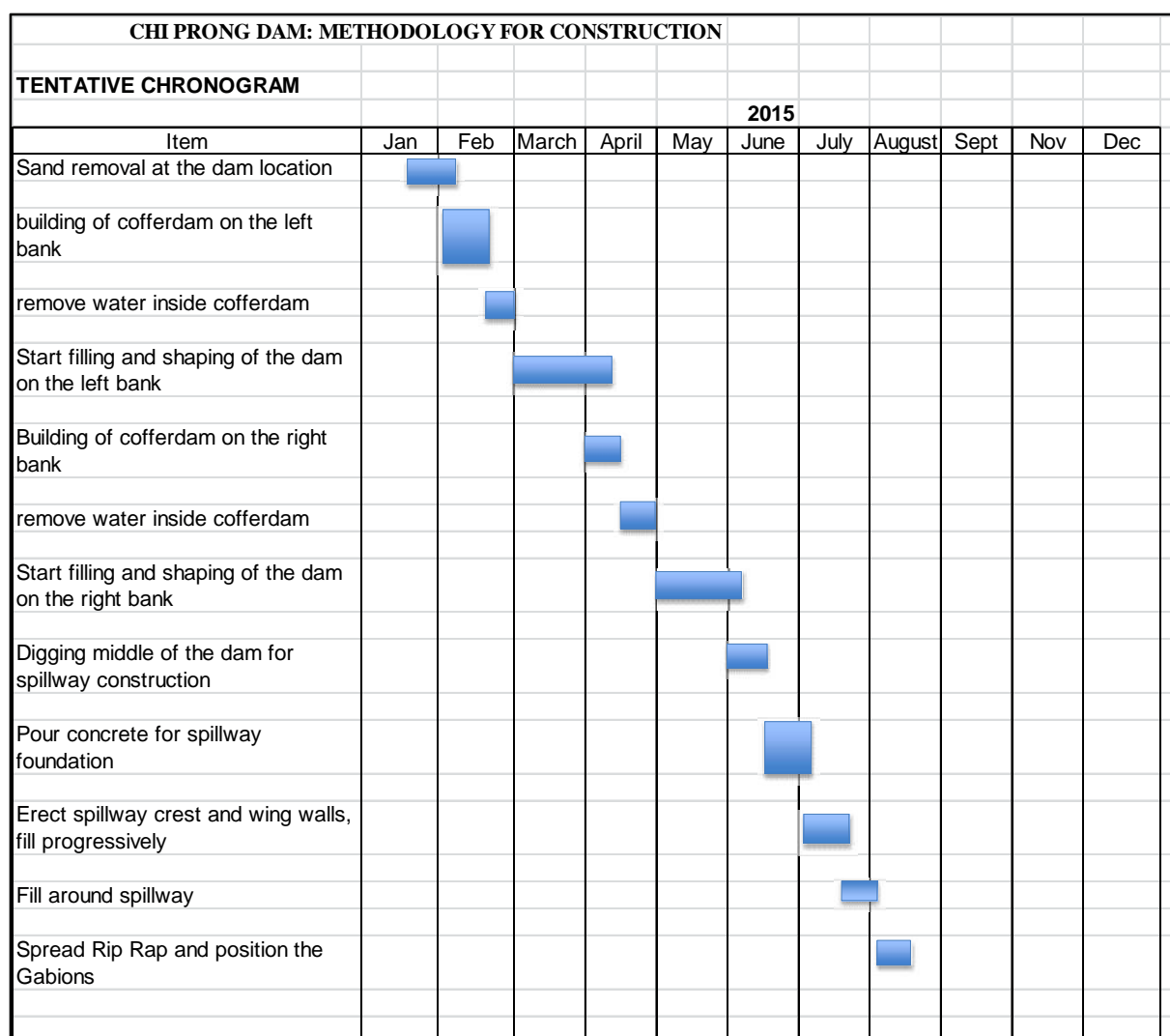


Figure IV-5: Timeline for Construction

## 5. Budget

102. The cost for the earth dam has been estimated at approximately US\$300,000. The upgrading of the primary irrigation canals has not yet been costed as it is beyond the scope of this project. It is anticipated that this will be undertaken by another third party.



## **6. Objectives**

103. The objectives of this project are :

- To provide water catchment facilities to farmers besides NR53
- To enable the farmers to grow 2 rice crops per year, possibly 3.
- To increase use of NR53 as the farmers will make more use of NR53 to take their rice crops to market in Teuk Phos and Kampong Chhnang

## **C. Water Capture Khset Lake, Kampong Chhnang Province**

### **1. Background**

104. To the south of Tuek Phos is Khset Lake. This was created artificially by the villagers who constructed a dam across a natural drainage basin into which a stream runs. A local road runs on top of the dam. Two sluice gates allow the captured water to overflow and be directed to the nearby rice fields.

The villagers wish to deepen the lake by excavating it further. This will increase the capacity of the lake and give water supplies during the dry season. Since the new water volume will be below the sluice gate base slab level, the new volume will need to be pumped out by the community.

The dredged material can be used to widen the road on the dam or other purposes.



Figure IV-6 Khset Lake, embankment and sluice gates

### **2. Location**

105. The lake is situated south of Tuek Phos as shown below.

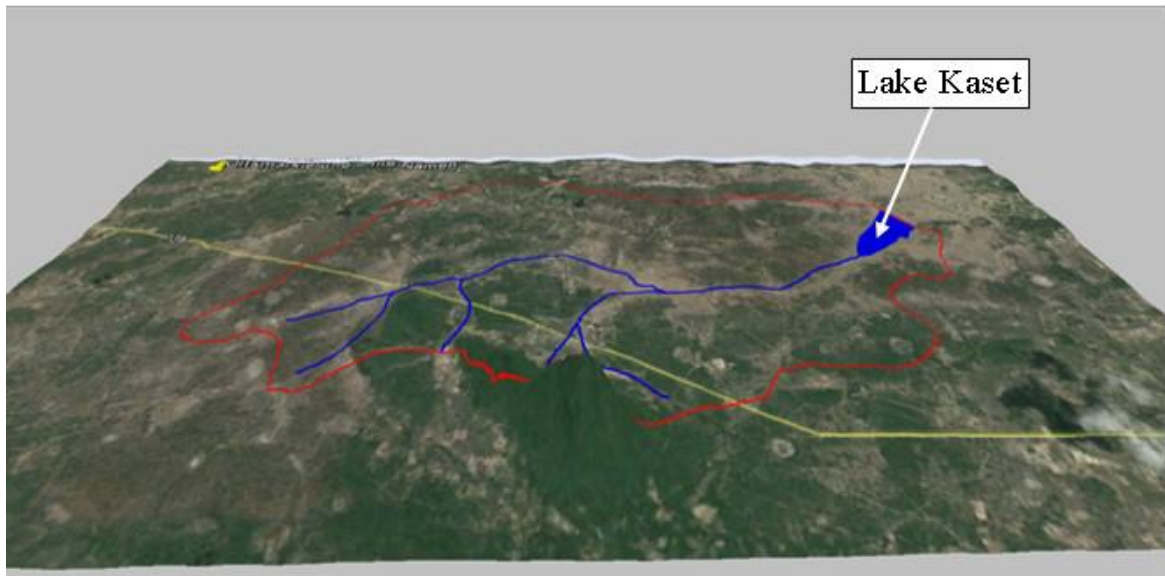


Figure IV-7: Lake Khset

### 3. Construction Works for Dredging of Lake Khset

106. The major items for the lake would be:

- Dredging
- Placing of dredged overburden

107. The dredging should be undertaken during the dry season with the lowest possible lake level. That means from March to July, maybe before March if the season was particularly dry.

108. The dredging should be done by excavators on tracks with a long neck with the minimum capacity of the Caterpillar 220 or the Komatsu 220. The dredging should start from the middle of the lake as close as possible to the existing dam. Trucks could be loaded as far as they can drive in the water. It is up to the contractor to estimate where excavator(s) and trucks can go.

109. The dredged materials can be used to widen the dam but must remain under the elevation of the existing dam, or disposed elsewhere in accordance with the local community requests.

110. If the dredged material is left around the lake, the dumping cannot be an unbroken continuous line but must allow rain water to pass through to reach the lake. Regular openings of 50 meters long should be kept throughout the lake contours.

111. The excavator should be equipped with a long neck and a bucket of minimum 1 to 1.44 m<sup>3</sup>. It should remove between 70 and 100 m<sup>3</sup> of material per hour. That is equal to between 600 and 800 m<sup>3</sup> per day.

112. At least 3 excavators should be used to achieve the work in 4 months. Some 10 to 15 all-wheel drive trucks should be used. The use of 4 excavators is advised. The operators should pay attention to not dig too deeply on the same area and try to maintain the bottom of the lake as flat as possible. An average depth of 1 meter should be maintained.

113. After dredging the contractor should do a topographic survey which will be compared to the before-works topo survey. This will provide the amount of dredged quantities which is to be paid.

DEEPENING OF LAKE KHSET: METHODOLOGY FOR CONSTRUCTION											
TENTATIVE CHRONOGRAM											
2015											
Item	Jan	Feb	March	April	May	June	July	August	Sept	Nov	Dec
DIGGING IN THE LAKE for deepening											
REPAIR minor cracks in the existing structures											

Figure IV-8: Timeline for Construction

#### 4. Budget

114. The cost of dredging the lake is estimated to be \$380,000.

#### 5. Objectives

115. The objectives of this project are:

- To provide a water source to local villagers and farming communities

### D. Kampong Leaeng Water Capture

#### 1. Background

116. Part of Kampong Leaeng district (948 km<sup>2</sup>) becomes an island at the mouth of Tonle Sap Lake during the flood season. It is the highest ground in the river and lake area and much of it does not flood. The project will work with communities to reduce vulnerability to climate change impacts.

117. There are several reservoirs and dikes constructed on Kampong Leaeng district which hold back flood water when the floods recede. That water is released gradually by farmers to irrigate their crops.

118. Despite the high flood levels, when the water recedes in December, dikes are often breached and not enough water remains for effective irrigation.

119. The project will design an improved water retention system based on three dikes using a combination of spillways and flood gates. The three water reservoirs created will cover more than 100ha and will irrigate over 1000ha allowing 2 crops per year so that rice production could double in these areas.

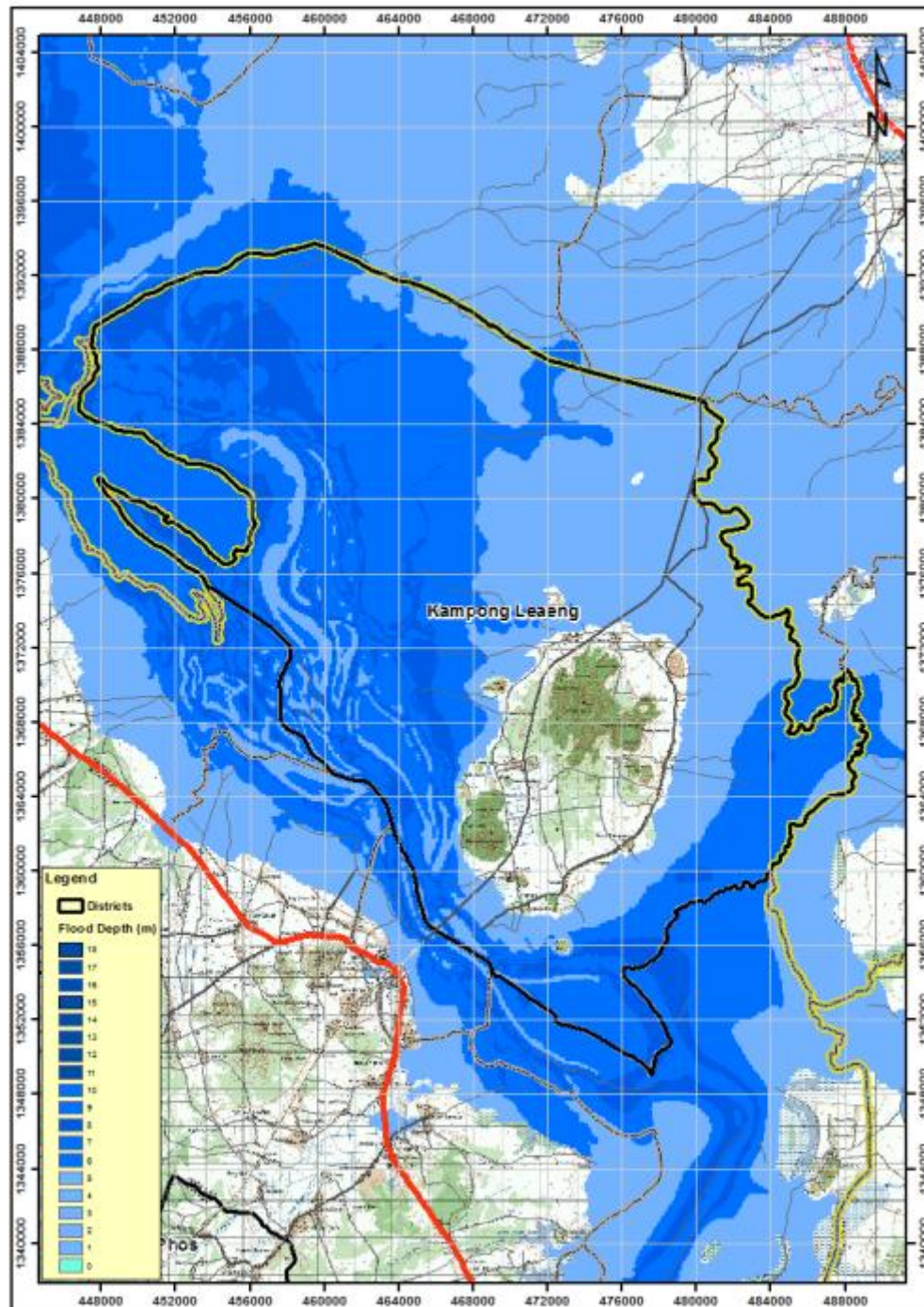


Figure IV-9: Kampong Leaeng showing 1 in 5 year flood depth.

## 2. Location

120. The location of the dikes in Kampong Leaeng are shown in Figure IV-10. The three dikes are discussed below.



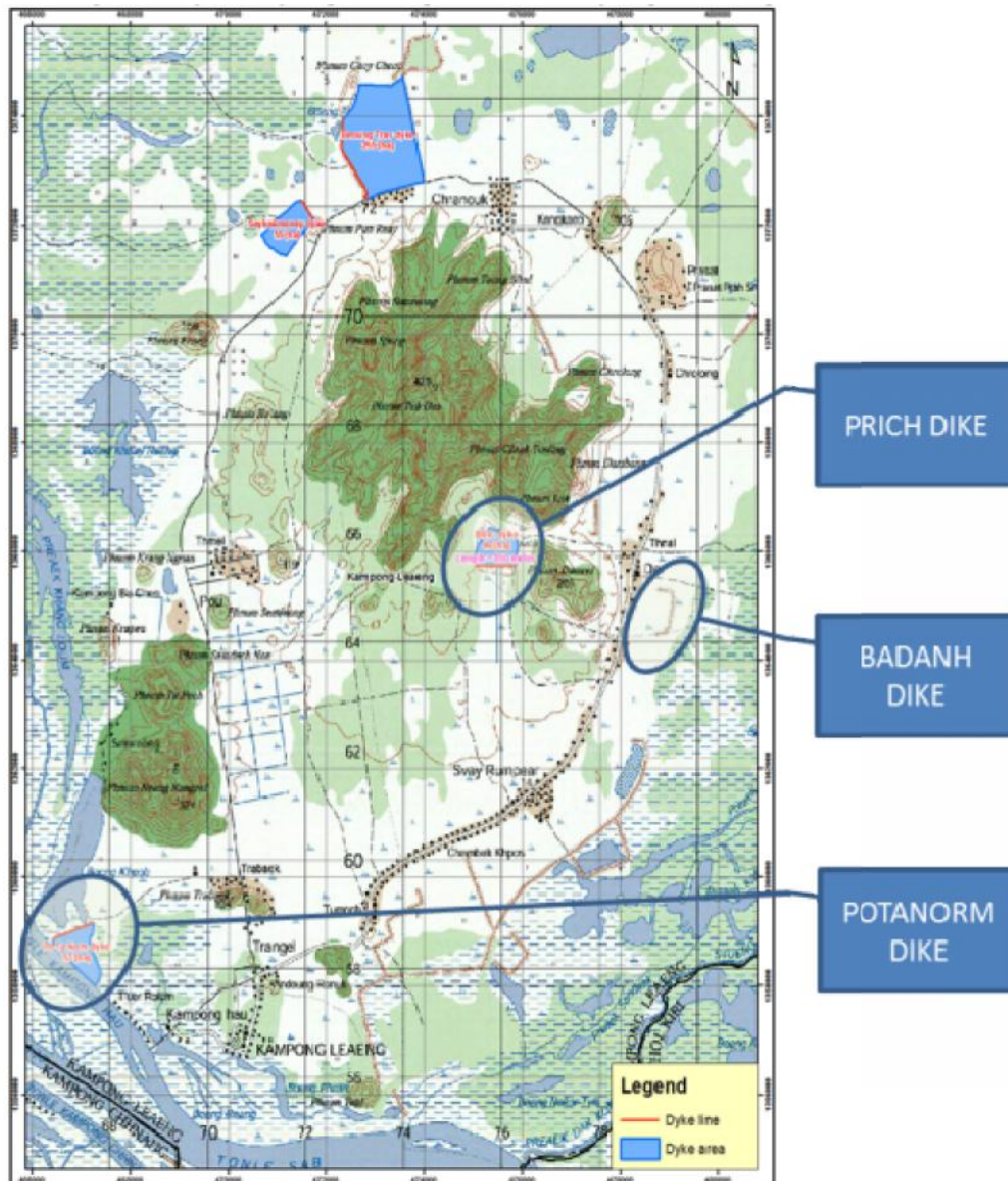


Figure IV-10: Map of dikes in the Kampong Leaeng area

### 3. Construction Works Po Ta Norn DiKE

121. Po Ta Norm is located 1.5 km North West of the ferry terminal in Kampong Hau, Kampong Leaeng district. The upstream irrigation field covers an area of about 156 ha and the downstream one 45 ha. During the dry season, they are irrigated with the water from the storage basin seen in the middle of the aerial photo given below.

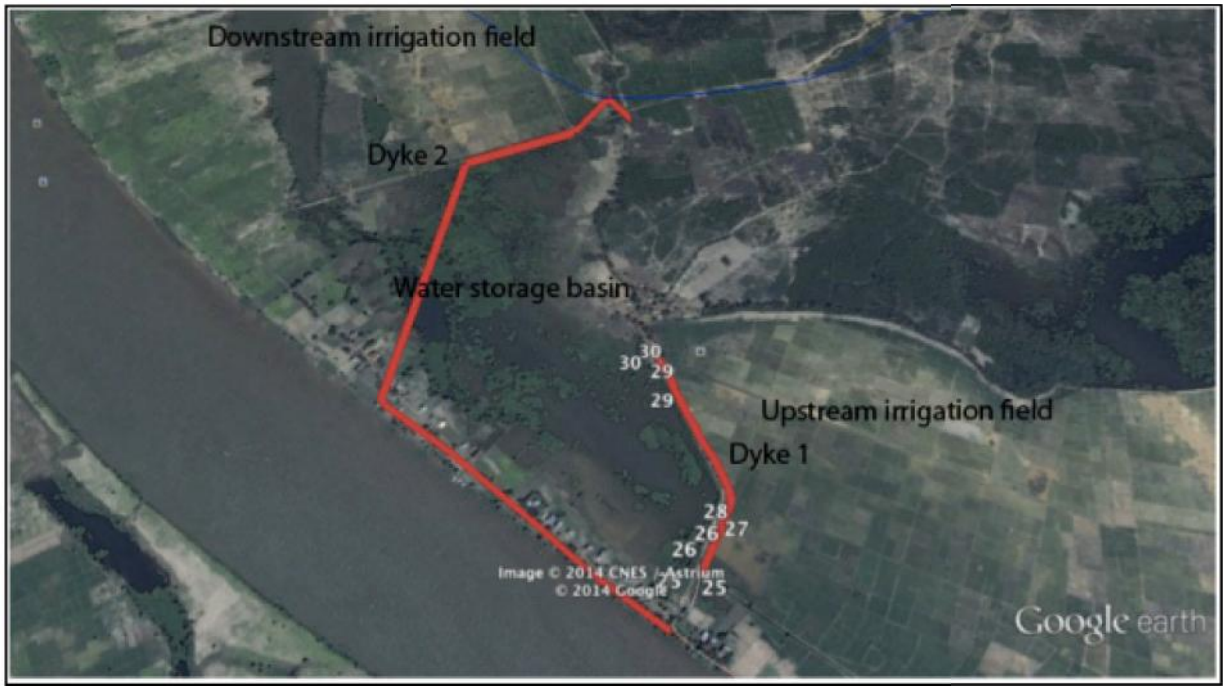


Figure IV-11: Irrigation Fields

122. The storage basin is natural and has not been human created. With the existing dike being 2 to 3 meter above ground level, it is estimated that 1 m of water is retained after the raining season which gives 400,000 m<sup>3</sup> storage.

123. With a need of 180 m<sup>3</sup> of water per day (2 L/sec/day) and per ha for rice fields, upstream irrigation field needs 156 x 180 m<sup>3</sup> per day while downstream area needs 45 x 180 m<sup>3</sup> per day. The total upstream plus downstream is 201 x 180 = 36,180 m<sup>3</sup>. This means that water for irrigation can be provided over 11 days of continuous irrigation. This is not enough and more water is required in the water storage basin.

124. Existing dykes are in a bad condition and have a lot of damaged places through which water is lost for irrigation at the due time.

125. It is therefore necessary to have the dikes fixed properly and equipped with the necessary regulating structures such as spillways and gates to regulate the flow from the storage area to the down and upstream irrigation fields. The spillway will look like the sample shown below.

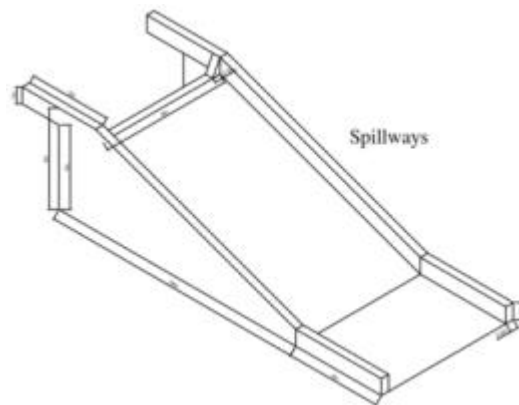


Figure IV-12: Typical Spillway

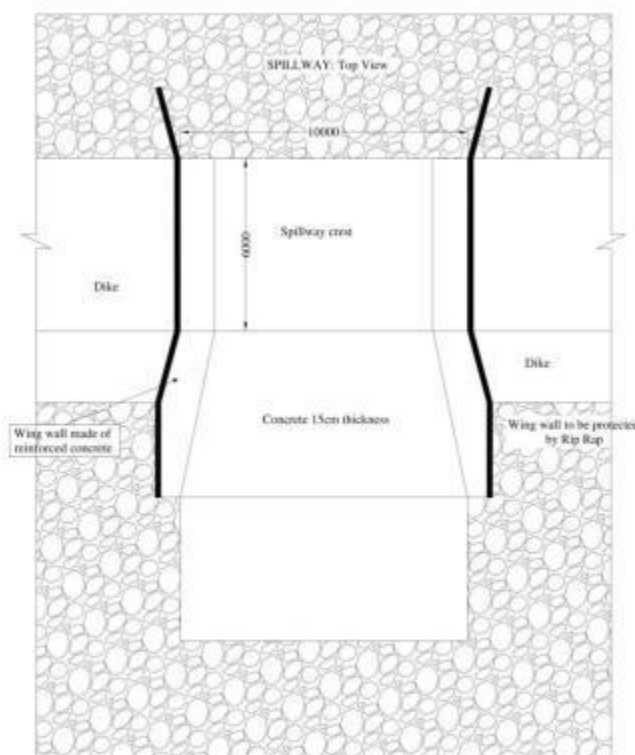
126. A field survey will be undertaken to provide a map of the area with elevation and necessary points to allow determining the size and location of spillways/flap gates. The rationale behind that is to keep as much water in the central water storage basin and avoid wasting water through flooding of both irrigation areas.

127. The existing dykes are overtopped each year from 0.5m up to 3m of water depending on the intensity of the flood. This water fills three plains and run from one plain to the downstream one. Each plain is cultivated in rice but also for eggplant and other vegetables, and also for fishing. When there is not enough water, farmers use the water from the downstream plain to irrigate the upstream plain by pumping. However, only one harvest can be done each year because of the flooding and the dry season. Seeding take place around December while harvesting is done in April. The inhabitants of the flooded areas take refuge in the Pagoda located in a high area of the village.

128. The dykes are damaged each year by overtopping but also by farmers who create openings to allow the water to flow from one place to the other. Gates should be more efficient without damaging the dykes. This suggests that the gaps are not as much infrastructural as they are management related. A more water efficient handling procedure is needed as well as the reshaping and improvement to the existing dikes.

129. A detailed survey will compute discharge and determine the size of the necessary gates. Dykes should also be slightly raised to avoid overtopping. According to the water users/farmers, the rise can be as much as 1 m. Water should be delivered in a controlled way and used without surplus. This can be achieved only by using spillways gates which will control and restrict the water consumption.

130. Manually operated gates can be used but the operation of the gate needs to be monitored and recorded to allow the computation of water needs against distribution. Farmer themselves cannot do that and they need support from a NGO or Government organisation. Dikes can be equipped with spillways to avoid overtopping. The spillway acts as a safety device and lets the water flow downstream before the water level overtops the dike.







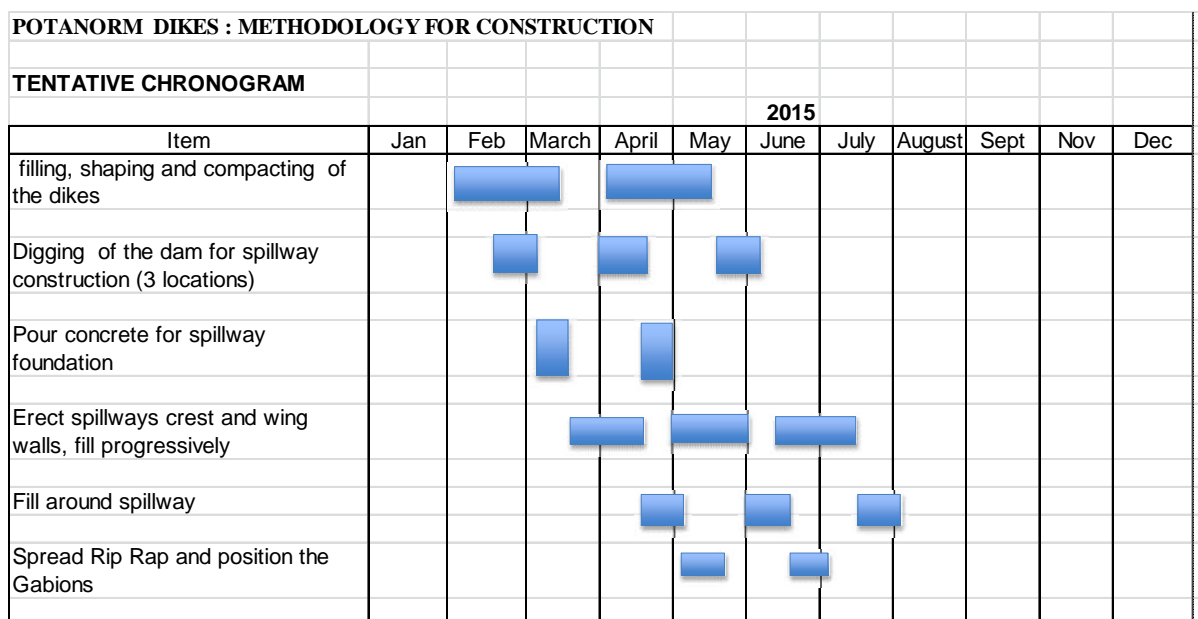


Figure IV-14: Timeline for Construction

136. Preliminary costing is given below.

Table IV-1 Preliminary Costing

item N°	Description	Unit	quantity	Rate USD	Amount
1.	Clearing and grubbing	Sq. m	12 000	0,22	2 640
2.	structural fill	Cu.m	21 000	2,25	47 250
3.	Riprap Class A	Cu.m	3 000	56,14	168 420
4.	Gabion boxes	Cu.m	450	76	34 200
					252 510
Spillways (3)					
5.	Wing wall	Number	30	1175	35 250
6.	Concrete Pipe ø 60	m	90	77	6 930
7.	Spillways	number	3	15000	45 000
					87 180
TOTAL					339,690

#### 4. Construction Works Preach Dike

137. Preach dike (also known as Prich or Bric dike) is located 17 km North of Kampong Hau District office. It lies on the foot of the highest mountains in the area which peak at an altitude of 429 m.

138. With a catchment area of 320 ha, the dike creates an artificial lake of about 30 ha and collects as much as 600,000 m<sup>3</sup> of water during the rainy season. The downstream irrigated area is as large as 2,000 ha but cannot be totally irrigated during the dry season due to lack of water.

The dimensions of the dike are:

- Length : 774 m

- Top width : 6 m
- Bottom width : 12 m
- Height : 3 m

It is equipped with three structures:

- 2 pipe culverts which can be closed by gates
- 1 sluice gate with 2 openings



Figure IV-15: Existing pipe culverts

139. The 3 structures are in good condition although they are dated from 1977.

140. The body of the dike is suffering from top surface and embankment erosion due to temporary overtopping. These overtoppings occur even though the gates of each structure are fully opened. They are limited to 20 to 50 cm of water passing over the top of the dike.



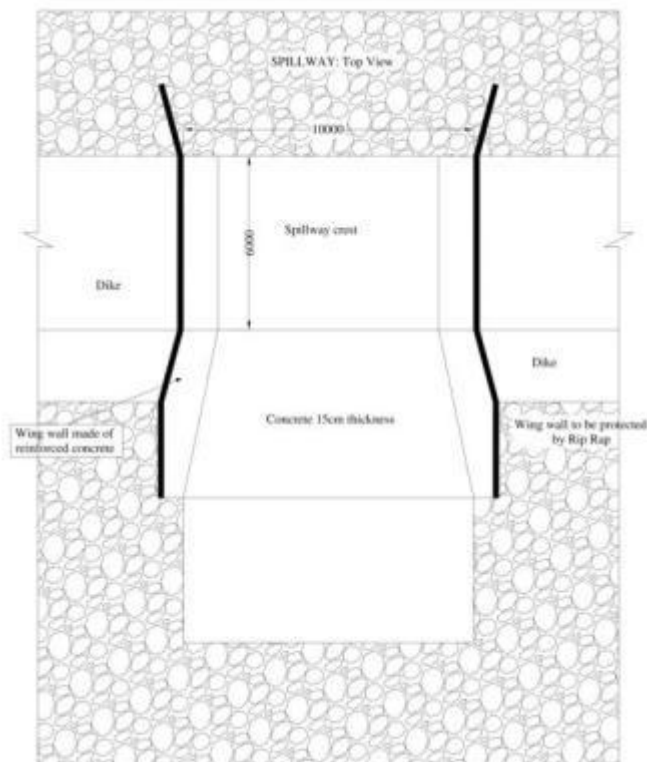
Figure IV-16: Surface and embankment slope damage

141. The dike has been rehabilitated in 2004 by the commune at a price of 18 millions Riels.



Figure IV-17: Commune Rehabilitation Works

142. The works will consist of:
- Dredging of the lake to get backfill material to raise the dam by one meter
  - Construct a spillway of 20 m near the center of the dike to avoid any overtopping.
143. A freeboard of 50 cm will be maintained by the spillway to limit the water level in heavy rains



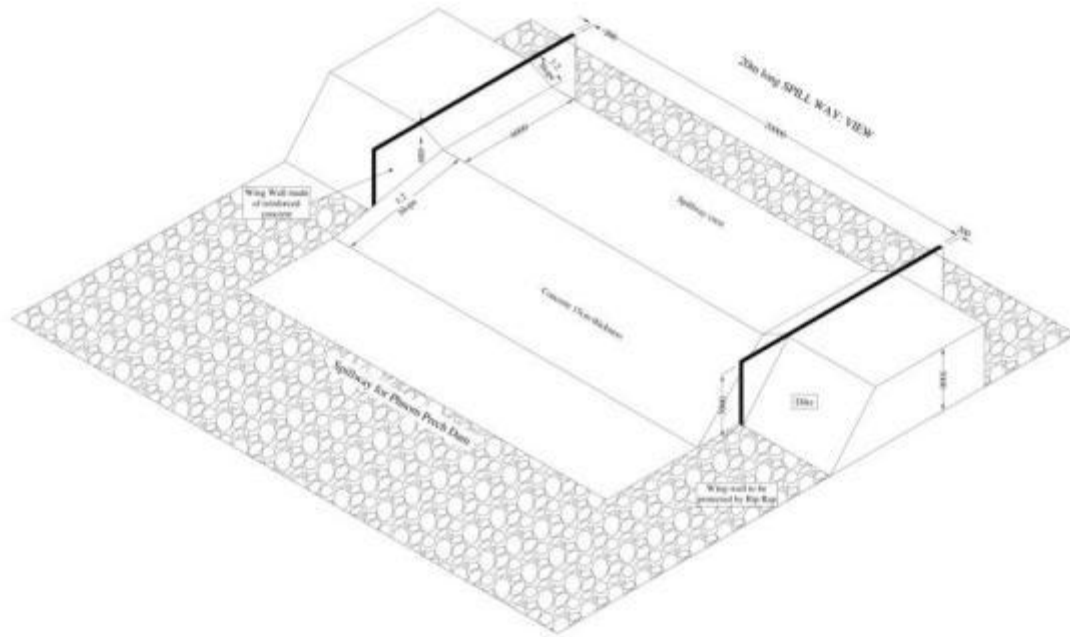


Figure IV-18: Spillway Design

144. The dike construction should be undertaken during the dry season with the lowest possible water level. That means from March to July, maybe before March if the season was particularly dry.

145. The fill for the dike should come from the storage area and not from the rice fields. The works have to start from the end of the dikes coming back to the track road. Compacting should be done as the reprofiling progresses. Vibrating rollers should be used to obtain good compaction as specified in the bidding documents.

146. Once the profiling and compaction have been done, the cuts can begin for the spillway. Once the cut is ready, the foundation of the spillway can be concreted followed by the elevation works which include the wing walls and the crest.

147. Upstream and downstream sides of the spillway have to be protected by rip rap and the wing walls by gabions cages. When that work is finished, the upstream side of the dam has to be covered with rip rap. Works have to be finished by July which is the beginning of the raining season in the area.

148. The timeline for construction is given below.

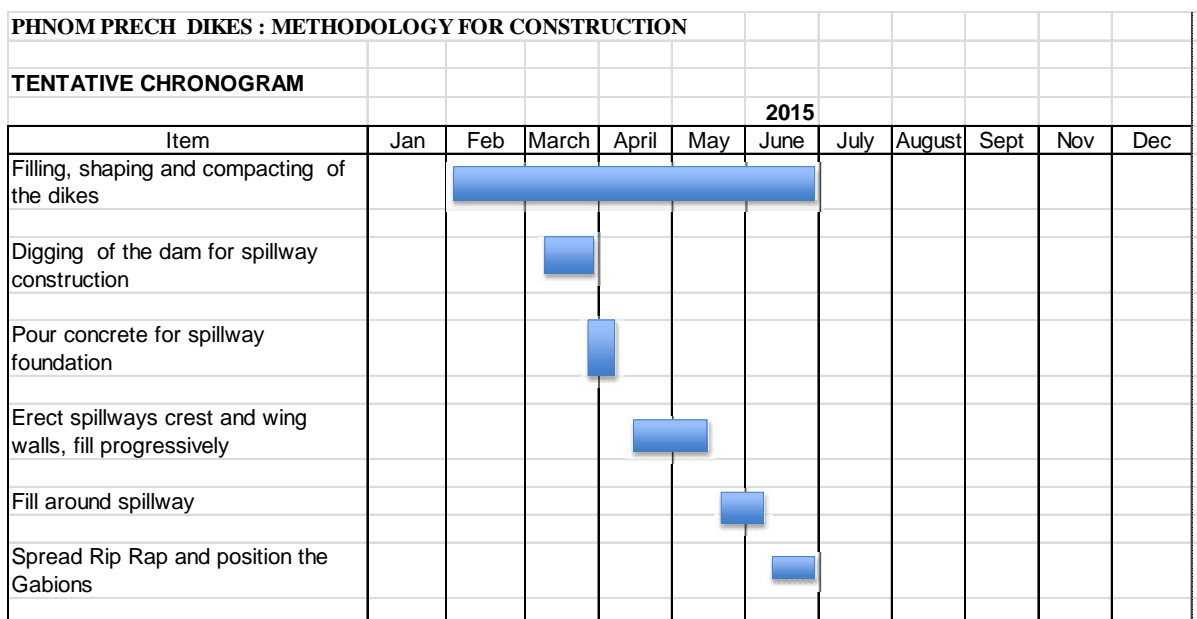


Figure IV-19: Timeline for Construction

149. Preliminary costing is given below.

Table IV-2 Preliminary Costing

Dam raising by 1m over 774 m

item N°	Description	Unit	quantity	Rate \$	Amount \$
	Clearing and grubbing				
1.		Sq. m	4 620	0.22	1 016
2.	structural fill	Cu.m	9 240	2.25	20 790
3.	Riprap Class A	Cu.m	3 850	56.14	216 139
4.	Spillway	Unit	1	50,000	50 000
					287,945

## 5. Construction Works Badanh Dike

150. Badanh dike is situated to the east of Svay Rumpae in Kampong Leaeng District. The downstream irrigation field covers an area of about 500 ha. During the dry season the area is irrigated with water from the storage basin created by the dike. The basin is fed with rain water and occasional flooding. The existing dike is in a bad condition and water is often lost which could be used at the proper time for irrigation.

151. The design and construction of the dike, which is rehabilitation of the existing structure, will be very similar to the other two dikes, Potanorm and Preach. However, at the moment, although initial surveys and reconnaissance have been carried out, detailed designs have not been prepared.

152. For evaluation purposes, it can be assumed all three dikes are basically the same design but varying in length and amount of repair needed to pre-existing structure.

## 6. Objectives

153. The objectives of this project are :

- To provide a water source to local villagers and farming communities

## **E. Water Supply Kampong Leaeng**

### **1. Background**

154. The project will also establish a water supply system in Kampong Leaeng, a small district limited to the circular road around the mountains consisting of 9 communes. An NGO (Lean Aid) has built a small water treatment plant and provides water to the people but without water supply distribution. The people have to come to the treatment plant and fill their jerricans on the spot. The plant pumps water directly from Tonle Sap.

155. In the other villages around the circular road, people are taking water from wells near their houses. Water is close to the ground (3 to 4 m) and is drinkable.

156. A water tank will be built with a capacity of 100 m<sup>3</sup> on an elevated ground.

### **2. Design Kampong Leaeng Water Supply**

157. Kampong Leaeng lies on the left bank of Tonle Sap in front of Kampong Chhnang. It is a small district limited to the circular road around the mountains consisting of 9 communes. Several options were investigated to provide water in the community center, including an intake from the Tonle Sap, with either a pontoon or a land based pumping station, and one intake from underground wells. The map below shows the location of the planned water supply, covering the communes of Kampong Hau and Trangil-Trabek which are the two main locations where 14,525 persons are living according to the 2014 census provided by the District.





Figure IV-20: Planned Water Supply

### River intake / pontoon option



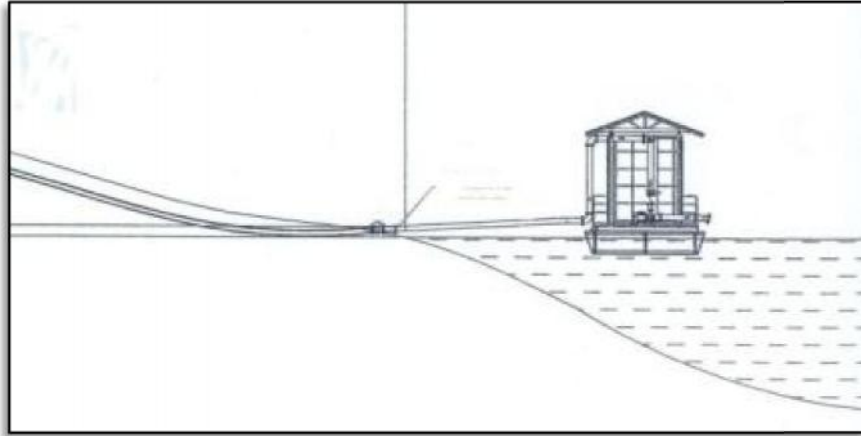


Figure IV-21: Water Supply Pontoon and Ultra-Filtration System

The pumping station should be at least 10 m x 6 m to allow the installation of the water treatment plant by ultrafiltration as shown above.

The preliminary dimensioning of the pumping station is 10 m x 6 m which should be enough to accommodate the ultrafiltration plant. The water treatment plant should be designed for 6 to 10 l/sec and be installed after the pump taking water from the lake. A nano-filtration unit can also be used in place of the ultrafiltration with the same results.

158. The pumping site and pumping station could be close to the boat/ferry terminal. From there a 125 mm HDPE will take the water to an elevated area close to the junction road to Trangel where the water tank should be built. From the water tank the water distribution will go through Kampung Hau, Trangil and Trabek Communes.

#### **Water Tank and distribution network**

159. The water supply network has been designed for 20,000 persons. The required flow is 25,000 persons x 25 liters per day = 500,000 l/day or 5.78 l/sec. The area is about 2.5 km x 3 km. A water tank has to be built with a capacity of 100 m<sup>3</sup> on an elevated ground close to the junction road to Trangel.





160. The general layout of the distribution network is shown below.

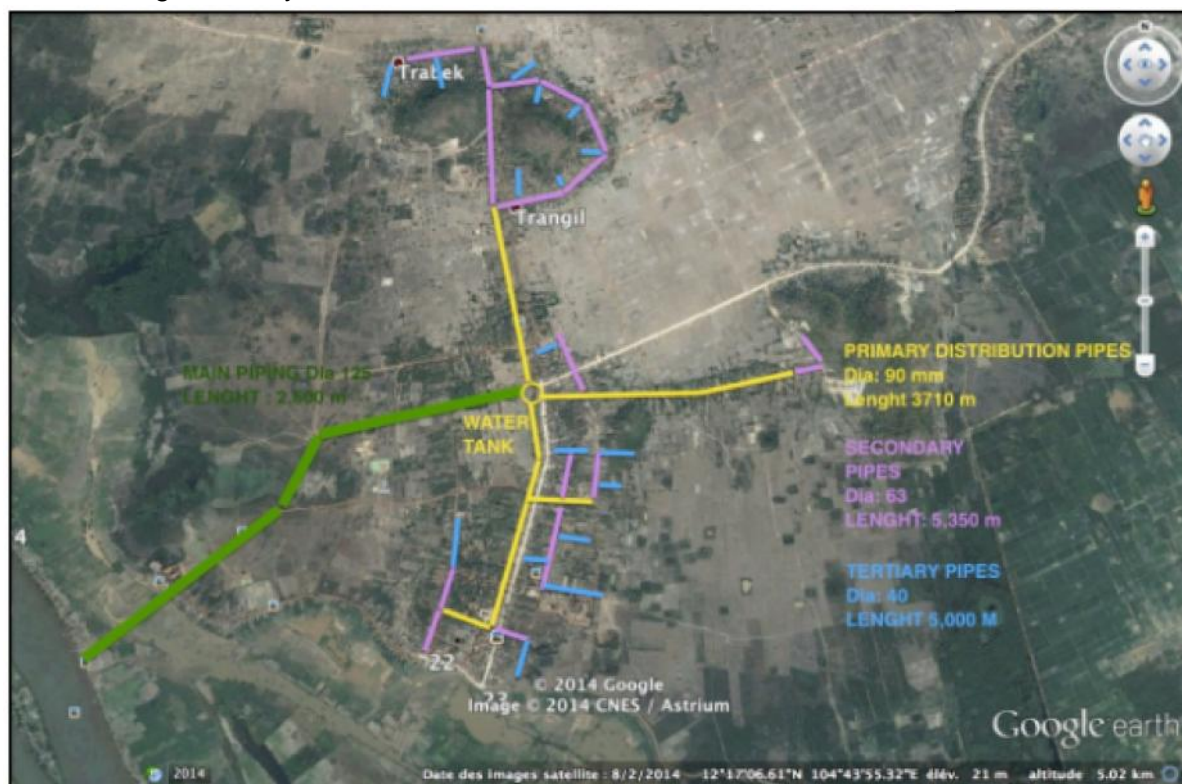


Figure IV-23: Distribution Network

161. From the water tank a primary pipe will take the water to Kampong Hau center and Trangil. The elevation of the water tank being 20 m we are assuming a pressure of 1.9 bar at the outlet of the water tank. The selected size of the primary piping is 90 mm to reduce the headlosses to a minimum.

162. When selecting the size and the discharge 6 l/sec, the headloss is only 0.01 m/m of pipe, leaving a pressure of 1.5 bar in the pipe at the end of the longest distance, near Trangel for instance located 1,000 m from the Tank.

163. At the end of the primary piping the size is reduced down to 63 mm and 40 mm in the streets. The connections to the houses are made in 32 or 25 mm pipes. Whatever their size, the pipes have to be buried at a depth of minimum 80 cm to avoid breakage, stealing or illegal private connection. Each connection will be equipped with a meter and customers will be registered for billing.

#### **Inland pumping station option with either fixed river intake or well intake**

164. The pumping station should be built on the Northern Bank of the Tonle Sap. It is a basic construction that does not require heavy foundation. The estimated elevation of the pumping station is 10 m ASL. With the Tonle Sap at the elevation of 5 m ASL at the end of the dry season, that gives a suction head of 5 meter plus headlosses which is quite acceptable.

165. The work should start with the electric resistivity tests to determine the exact location for drilling the well. The Contractor will start by selecting the location of the Water Tank and digging the tank foundation. The foundation concrete must be done as soon as possible because it is necessary to wait one month, 28 days, to obtain sufficient concrete hardness to

start building the pillars. The Engineer should pay particular attention to the quality of the foundation concrete and make sure the required hardness is obtained before starting the pillars.

166. At the same time, the contractor can start equipping the well (s) with pumps. Also, the primary piping system of the network can be installed. Trenches in which the pipes will be buried should be min 80 cm deep. The Engineer should check this at regular intervals. Trenches should remain opened for the final tests. In the meantime, the reinforcement bars for the water tank can be prepared and the formworks installed. After that the concrete can be poured immediately. Water sealant is applied inside the tank one week after the finish of the water tank reservoir.

167. Secondary and tertiary piping network should be started immediately after completion of the primary piping network. Connections to each house can be done also after completion of the tertiary network. The piping going from the well(s) to the water tank can be installed together with the outlet piping and connection to the primary pipe system can be made. When the water tank reservoir is dried up, auto switch on/off float can be installed inside the reservoir. When everything is ready tests should be done to check for leaks in the water tank and in the network. After that, trenches can be closed and filled. The timeline for construction is given below.

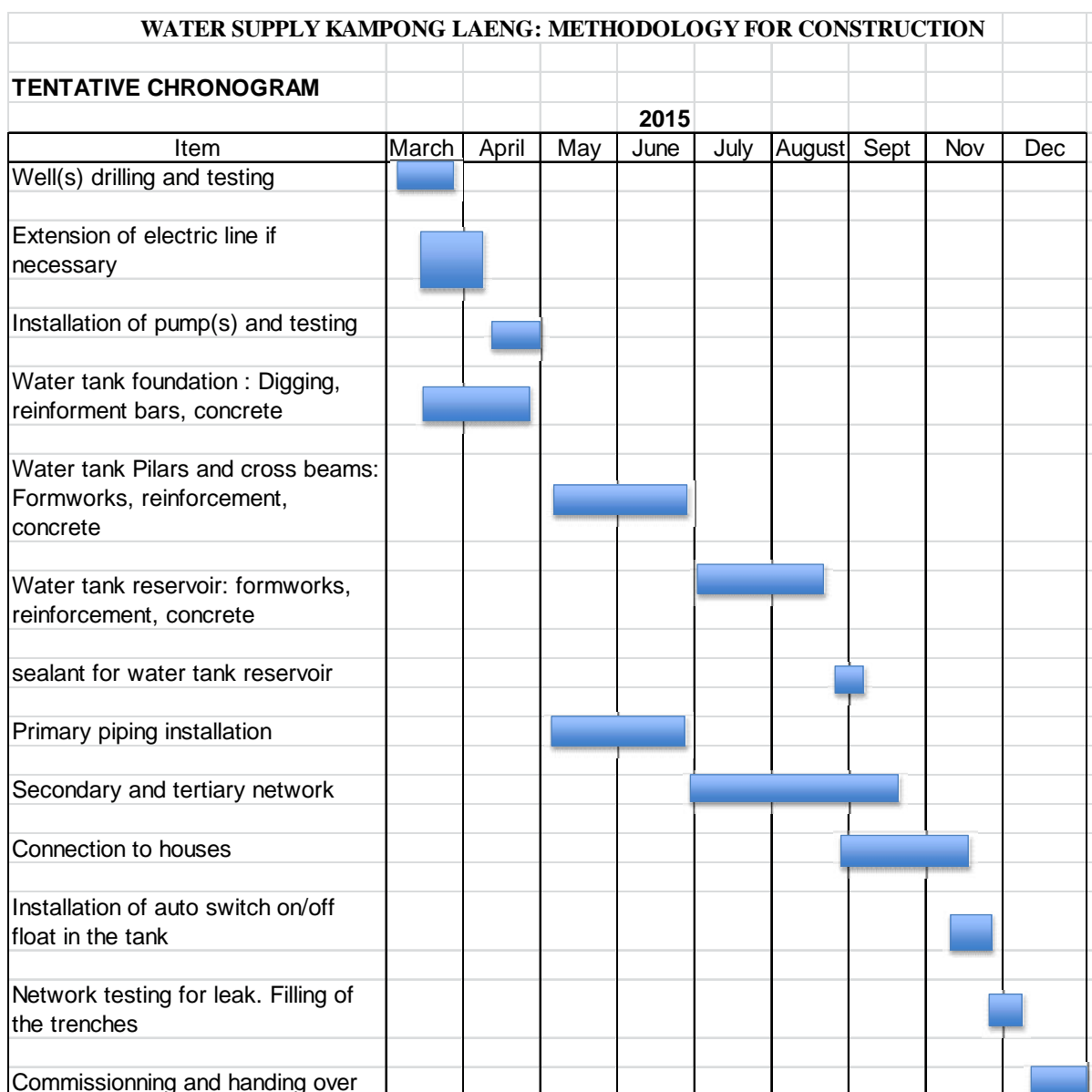


Figure IV-24: Timeline for Construction

168. Preliminary costing is given below.

Table IV-3 Preliminary Costing

Work description	Unit	qty	unit price	total
Construction of pumping station				
	LS	1	15 000	15 000
Construction of a 20 m high water tank, capacity 100m3	LS	1	40 000	40 000
Pumps set with controls	LS	1	9 000	9 000
Installation of NANO filtration device				
	LS	1	120 000	120 000
Water distribution network				
Dia 125	M	3550	17,24	61 207

Dia 90	M	3710	8,45	31 343
Dia 63	M	5350	3,80	20 330
Dia 40	M	5000	2,00	10 000
Dia 32	M	6000	0,90	5 400
Dia 25	M	8000	0,55	4 400
total network lenght		28060		
fiittings	LS	1	40 000,00	40 000,00
labour (trench opening/ closing)				
	M	28060	4,00	112 240,00
Sub total distribution network				152 240,00
Water meters	Unit	3000	15	45 000
		TOTAL		<b>513,920,00</b>

169. As shown here over, the total cost of building the water supply is nearing \$520,000. To this amount one has to consider the running cost for 3 years of operation which is estimated \$3,000 per month giving \$36,000 per year or \$108,000 for the 3 years.

### **3. Objectives**

170. In view of the available water resources of the Tonle Sap Lake and the long established practice of using dams for flood water retention it can be assumed that sufficient water for the proposed water retention schemes is almost guaranteed. The danger of investing into an unsustainable water scheme is low.

171. The investment into this scheme thus serves several purposes and increases adaptive capacities and resilience on more than one issue by diversifying water supply.

### **F. Emergency Response Management Centre, Kampong Leaeng**

172. The civil works under climate change will also include construction of an Emergency Response Management Centre. This will be located on Kampong Leaeng in a newly constructed building with communications equipment. No adverse environmental effects are associated with this new building. No IEIA is required by Cambodian MoE.

## **V. DESCRIPTION OF THE ENVIRONMENT**

### **A. Physical Resources**

#### **1. Geography**

173. Cambodia lies in the southwestern part of the Southeast Asian peninsula and has a land area of 181,035 km<sup>2</sup>. International borders are shared with Thailand to the west, the Lao People's Democratic Republic to the north, and the Socialist Republic of Vietnam on the east and southeast. The country is bounded on the southwest by the Gulf of Thailand and has a coastline of 440 km.

#### **2. Climate**

174. Cambodia's climate is dominated by the monsoon which causes distinct wet and dry seasons. The southwest monsoon typically brings the rainy season from May to October. The northeast monsoon brings drier and cooler air from early November to March, then hotter air prevails in April and early May. The southern part of the country typically has a two-month dry season whereas the northern areas have a four-month dry season although weather patterns have been changing and what is typical is now increasingly problematic.

#### **3. Rainfall**

175. The annual mean rainfall is 1,400 mm in the central lowland regions and can reach 5,000 mm in coastal areas. However, there are really no reliable rainfall databases for the Project zones and rainfall can vary from a low of less than 1,000 mm to a high of 2,000 mm. The relative humidity is high throughout the year, usually exceeding 90%, and even in the dry season rarely falls below 50%.

#### **4. Temperatures**

176. Temperatures are fairly uniform throughout the country, with only small variations from the average annual temperature of around 28°C. January is the coldest month where temperatures as low as 12°C have been recorded and April is the warmest where temperatures reach 42°C. Most of Cambodia's regions have an average wind velocity of less than 3 m/s. Maximum wind speeds can reach in excess of 20 m/s during the wet season. During the dry season the maximum wind velocities are lower and are commonly in the range of 6 - 8 m/s.

#### **5. Topography.**

177. Cambodia is divided into three distinct topographic regions: the central plains, the flat coastal areas, and the mountain ranges with high plateaus. The central plains form 75% of the country and consist of the alluvial plains of the Mekong River and the Tonle Sap basin where the project roads are located. These are Cambodia's two dominant topographical features and this is where over 90% of the population resides. The road sections are generally in flat terrain.

#### **6. Air Quality and Noise**

178. The Project roads traverse primarily agricultural areas and villages/residential areas in rural settings with no industrial development. Currently, main sources of air pollution are dust emission due to passage of vehicles along the unpaved project roads. Sources of

noise are community activities (especially near markets) and the existing traffic largely composed of motorcycles.

## **7. Surface Water**

179. The Project roads cross a number of rivers, streams and irrigation canals. Within the Project area, surface run-off on exposed soil and erosion of river embankments cause turbidity in some of the watercourses. Surface water pollution from domestic sewage along sections where densely populated villages are found as well as run-off from surrounding agricultural fields may also be expected.

## **8. Flooding**

180. Generally the southeast roads are not expected to flood. There is a greater risk over future years for midwest roads. The main issues for flooding are NR13 along Lake Vaico where it is planned to raise the road by up to 1m along a 1 km length and provide slope protection. The lake is not subject to high energy wave action, but might need some toe protection. The water level does vary seasonally, on occasion reaching up to the top of the shoulder, and at the moment clay dumping is taking place on the side slopes to try to prevent erosion.

181. PR150B east in Ta Ches market on Tonle Sap is intended to have a cement concrete road as a one way traffic system. Locals report the existing road is flooded by 300mm almost every other year. In the year 2000 floods the water marks on the walls are about 1.7m above the road level. This is very localized and as one exits the market the road is about 3m above the level of the usual flooding with locals saying it has never flooded.

## **9. Soil Types**

182. Cambodia has 27 different soil types but the main ones are either soils developed on the old alluvial terraces of the colluvial-alluvial plains. Four types – Prey Khmer, Prateah Lang, Bakan and Tuol Samroung – are where most of the agricultural production occurs although just one, the Toul Samroung, which occupies just 10% of the rice area is really suited to high yielding rice production. Soils developed on the active flood plains – Kabal Po and Krakor – are also highly suited for rice production and occupy approximately 30% of soils where rice production takes place. Such soils respond well to improved ditch and drainage irrigation and judicious application of fertilizers. Yields have increased over the past two decades with wet season yields averaging 2.4 tons per hectare and dry season yields (only 15% of rice produced) averaging almost 3.7 tons per hectare. These are below regional averages but the labor intensive system is currently recording average yields of 3.6 tons per hectare in the wet season. In 2008, Cambodia produced a surplus of 3 million tons although there are still food security problems for rice deficit households.

## **10. Minerals**

183. Cambodia's natural mineral resources include gem stones such as sapphires, ruby and zircon; coal, offshore gas and oil; basalt, granite, limestone, dolomite, quartzite; and phosphate deposits. There are no major mineral resources in the vicinity of the project roads, although there are white clay deposits in Kampong Chhnang.

## B. Localised Climate Change

### 1. Climate Assessment of Kampong Leaeng

184. This section presents a review of the current climate for Kampong Leaeng and presents a number of indicators that represent projected climate changes.

185. In 2013, the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) carried out high resolution climate modeling for Cambodia. The study, funded by AusAID, developed a 10 km grid regional climate model for South East Asia. This regional model, the Conformal Cubic Atmospheric Model (CCAM) used climate inputs from six of the latest generation Global Climate Models. Two emissions scenarios were considered: RCP 4.5 (lower greenhouse gas concentrations) and RCP 8.5 (higher greenhouse gas concentrations).

### 2. General climate parameters

186. The average annual mean temperature is 25°C +/- 3°C. Maximum temperatures of higher than 32°C are common, however, and just before the start of the rainy season, they may rise to more than 38°C. Minimum temperatures rarely fall below 10°C. January is the coolest month, and April is the warmest. Tropical cyclones that often devastate coastal Vietnam rarely cause damage in Cambodia but can form tropical depressions that result in high rainfall for a 3-4 day period.

187. Between 1960 and 2010 annual rainfall has ranged between 1200 and 2000 mm, concentrated between May and October. Over 80% of annual rainfall occurs in these six months, with peak rainfall occurring in September.

188. Relative humidity is lowest in March and highest in September. Daily evaporation values range from 3.1 mm in October to 6.7 mm in March, and the sunshine duration ranges from 6.0 hours a day in August to 9.3 hours a day in January.

### 3. Projected Temperature change

189. Projected temperature change for the short term and to 2055 are shown below. When considering changes over the next 10 to 15 years, changes are projected to be 0.5 to 1°C for the low CO<sub>2</sub> scenario and 0.6 to 1.4 for the higher CO<sub>2</sub> scenario with maximum temperatures expected to increase more than minimum temperatures. By midcentury, under the high emission scenario, maximum temperatures are projected to rise by up to 2.1°C during the early part of the dry season (December – March) but only by 1.6°C during the latter part of the dry season.

Figure V-1: Projected temperature change for the period 2025 to 2030 for two CO<sub>2</sub> scenarios.

Season	2025:RCP4.5			2025:RCP8.5		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum
April-May	0.5 – 1.1	0.5 – 1.0	0.4 – 1.1	0.7 – 1.3	0.7 – 1.3	0.65 – 1.3
June-September	0.5 – 1.1	0.5 – 1.1	0.6 – 1.1	0.7 – 1.4	0.8 – 1.4	0.9 – 1.4
October-November	0.5 – 1.0	0.6 – 1.0	0.7 – 1.2	0.6 – 1.4	0.8 – 1.4	0.8 – 1.4
December-March	0.6 – 1.1	0.6 – 1.1	0.7 – 1.2	0.8 – 1.3	0.9 – 1.3	0.95 – 1.4
Annual	0.5 – 1.1	0.6 – 1.1	0.8 – 1.2	0.7 – 1.3	0.8 – 1.4	0.9 – 1.4



Figure V-2: Maximum projected temperature rise for the high CO<sub>2</sub> scenario (RCP 8.5) for the 10-year period centered on 2055.

Season	Temperature increase °C
April-May	1.6
June-September	1.8
October-November	1.8
December-March	2.1

#### 4. Droughts

190. Droughts occur regularly in the region. The current values and projected values for the period centered on 2055 of two measures of drought are presented in the table below, the occurrence of dry periods and the maximum number of consecutive dry days. Both the average frequency (number of events in a 20 year period) and duration (months) of dry periods are expected to decrease by 2050. The number of consecutive dry days is also projected to decrease.

Figure V-3: Frequency (number of events in a 20 year period) and duration (months) of dry periods >3 months and number of consecutive dry days

	Current	2055
Frequency	8	6.5
Duration	6	5.5
Consecutive dry days	28	27

#### 5. Projected Rainfall change

191. The monthly rainfall for Kampong Chhnang for the two 20 year periods between 1960 and 2000 are shown below. The projected changes for the high CO<sub>2</sub> scenario (RCP 8.5) for 2055 are also shown. Rainfall is projected to decrease for the four wettest months of the wet season (June to September), resulting in a decrease in annual rainfall of 8%.

Figure V-4: Monthly rainfall for Kampong Leaeng for 20 year periods and projected rainfall for the high CO<sub>2</sub> scenario for the period centered on 2055 (Source: MOE 2010 and Katzfey et al 2013)

Month	1960-1979	1980-1999	2050-2060
Jan	0	0	0
Feb	10	2	2
Mar	30	30	30
Apr	70	80	80
May	150	160	160
Jun	180	170	140
Jul	180	170	140
Aug	210	200	170
Sep	250	300	270
Oct	150	290	290
Nov	10	90	90
Dec	2	2	2
Annual	1242	1494	1374
% annual change		20	-8

#### 6. Changes in extreme rainfall indicators

192. Current values of three measures of rainfall intensity and the projected changes for the high CO<sub>2</sub> scenario (RCP 8.5) for the period centered around 2055 are shown below. The

model indicates that the rainfall intensity during 5 day extreme events is projected to decrease and the average number of consecutive wet days is also projected to decrease.

Figure V-5: Current rainfall intensity indicator values and as projected for the high CO<sub>2</sub> scenario (RCP 8.5) for the period centered around 2055.

Indicator	Current (mm/day)	2050 (mm/day)
1 day extreme rainfall events	160	160
5 day extreme rainfall events	180	170
Consecutive wet days (wet day > 1mm)	37	32

## 7. Impacts of Climate Change

193. The climate of Kampong Leaeng is a typical monsoon climate with heavy rainfall confined to the six month wet season. The average annual mean temperature is 25°C with temperatures of up to 38°C towards the end of the dry season. Temperatures are projected to rise by 0.4 to 1.4°C by 2055. The frequency and duration of dry periods is projected to decrease by 2055 and the average number of consecutive dry days is also projected to decrease slightly.

194. Rainfall is projected to decrease over the four months when the heaviest falls occur (June to September), resulting in an 8% decrease in the annual rainfall compared to the average rainfall over the period 1980 to 1999. The amount of rainfall in 5-day events and the number of consecutive wet days is projected to decrease.

195. The projected rise in temperature will increase evapotranspiration. Potential problems caused by this increase will be offset to some extent by the decrease in the frequency and duration of dry periods. The decrease in rainfall will contribute to the reduction in the water budget but the overall effect is likely to be small given that the reduction is projected to occur in the wettest months and the annual rainfall is still projected to be over 1370 mm.

## C. Ecological Resources

### 1. Flora

196. Forests make up a major part of the country's natural resources. Hill evergreen, tropical rain and dry land evergreen forests are found in the humid coastal ranges, humid northeastern uplands, and the very humid to sub-humid low altitude areas. Freshwater inundated forests are found in the Tonle Sap Lake and in areas of the Mekong River. Mangrove forests are found along the coasts of Kaput and Kohl Kong provinces. In 1960 Cambodia's forests covered 73% of the total land area of the country. By 1998 the forest cover had decreased to 58% and at least until the mid-2000s it was estimated that Cambodia was losing forest cover at the rate of 2% per annum. The reduction has been attributed mainly to commercial logging, illegal logging (both large and small scale), large scale agricultural concessions, fuel wood collection, non-traditional shifting cultivation and the settlement of new villages. Secondary measures include forest fires and infrastructure development. Nevertheless, Cambodia still has substantial forest cover in comparison with other GMS countries with the exception of the Lao PDR.

197. Forests are divided into concession forests and protected forests. In the Project provinces, there are some protected forest areas and indigenous tree species (e.g. the *Dipterocarpus* species) that are protected by Cambodia's Forestry Law of 1995.

However, as the primary land use along the Project roads is agricultural and residential, these forests are not located in the vicinity of the roads proposed for upgrading. Community forests are managed by local residents who must abide by a management plan that is supervised by the Forestry Department. The community has access to the forest and may remove forest products and cut trees for their own use but they are prohibited from selling the trees. Timber harvesting for sale is only allowed from forest concessions. There are also non- timber forest products (NTFPs) that poorer households rely on such as bamboo, resins, wild fruits and vegetables, honey bees and other insects, and larger wildlife, although the collection of some NTFPs for commercial purposes are prohibited by Cambodian laws.

198. Vegetation cover along the project roads largely consists of agricultural crops such as rice, while some sections traverse areas covered with shrubs, grasses and sparse trees. Lowland rice cropping is the main activity but other crops grown include soybean, cassava, and cashew. Fruit and vegetables crop are also cultivated although primarily for domestic consumption.

## **2. Fauna**

199. Cambodia has a rich biodiversity. The forests, wetlands and other habitats support many species of flora and fauna, including 212 species of mammals, 536 species of birds, 240 reptile species, 850 freshwater and 436 marine fish species and more than 2,300 plants (800 of these plants are used in for the local manufacture of traditional Khmer medicine).

200. Along the Project roads, fauna is mainly made up of the large and small livestock raised by some households. There are indigenous endangered species such as the Siamese Crocodile and a variety of monkeys (e.g. silvered leaf monkey) and birds (e.g. white-shouldered Ibis) within protected areas but as no project roads are located in protected areas adverse impacts to endangered species are not anticipated.

## **3. Fishery**

201. Fish is the most important source of animal protein in the diet of all Cambodians, constituting upwards of 75% of total animal protein input. Fish are also an important source of calcium and Vitamin A, especially for the rural poor. On average the countrywide consumption rate is 65.5 kg/capita/year. Each year, Cambodia's combination of subsistence, middle-scale and large- scale commercial fishing harvests produce 300,000 to 430,000 tons of freshwater fish. This production ranks fourth in the world and is worth approximately US\$300 million. However, there have been incremental declines in fish catches and it is now estimated that less than 250,000 tons of fish is being caught, consisting of approximately 105,000 tons of household fisheries, 75,000 tons of rice field fisheries and 68,000 tons of middle and large-scale fisheries (marine fisheries production account for an additional estimated 55,000 tons).

## **4. Ecologically Protected Areas**

### **a. Tonle Sap Biosphere Reserve**

202. The Tonle Sap Biosphere Reserve is protected by national legislation and is recognized by UNESCO under the MAB program. The Tonle Sap is the largest freshwater lake in the Greater Mekong Sub-Region with an area of 2,500-3,000 km<sup>2</sup> in the dry season and 10,000 – 15,000 km<sup>2</sup> in the wet season. The water depth ranges from 1 meter in the dry season to 10 meters in the wet season and it is home to nearly one-third of Cambodia's population. In 1997 it was nominated as a Biosphere Reserve under the Man and the

Biosphere Reserve Program of United Nations Education and Scientific Cooperation Organization (UNESCO). Biosphere reserves are nominated by governments and remain under their jurisdiction. Reserves are intended to fulfil three complementary functions: (i) a conservation function; (ii) a development function; and (iii) a logistic function.

203. The Tonle Sap Biosphere Reserve (TSBR) has the following zones: (i) *Core areas* are securely protected sites for conserving biodiversity, monitoring minimally disturbed ecosystems, and undertaking research and other low-impact uses such as education. The TSBR core areas cover a total of about 43,000 ha which are characterized by a flooded forest, streams and water bodies, and rich biodiversity. Nearly 100 water bird species are found there, a dozen of which are of global significance. The areas are also known for their fish, mammals, and reptiles. There are three core areas in TSBR.

(ii) The *buffer zone* covers about 541,482 ha and is used for cooperative activities compatible with sound ecological practices, including environmental education, recreation, ecotourism, and research. Its boundary corresponds to the outer boundary of the Tonle Sap Multiple-Use Area. The TSBR buffer zone surrounds the core areas up to the outer limit of the flooded forest.

(iii) The *transition area* is the outer zone which covers 899,600 ha. It is intended to be flexible and allows development in keeping with the needs of the local population. The transition area forms the interface between the TSBR and common land. The southern edge of TSBR transition zone forms a boundary with national road NR5. The flexible transition area is the integrated economic zone, which is managed for sustainable agriculture, human settlement and land uses, without having adverse effects on the flooded forest, water quality and soils of the region around the Tonle Sap Lake.

204. None of the project roads are located within the core, buffer zones and transition zones of TSBR.

## **b. Phnom Aural Wildlife Sanctuary**

205. The Phnom Aural wildlife sanctuary is located in western Cambodia and lies within the Cardamom Mountain range, covering parts of the three provinces of Kampong Chhnang, Kampong Speu and Pursat. (11°54 45 N 104°03 42 E) It was created by Royal Decree in 1993 and is one of the oldest protected areas in Cambodia. It covers a large area of 2,500 square kms (1,000 square miles) or 250,000 hectares.

206. The Phnom Aural wildlife sanctuary has been subject to a zoning process. Following consultation with local stakeholders and a series of ecological and socioeconomic surveys of the areas, a set of four zones was demarcated :

Core zone access only for research.

- Conservation zone small-scale community uses of Non Timber Forest Products (NTFP)
- Sustainable use zone community sustainable use of resources including NTFPs, fuel-wood collection, timber cutting, fisheries, ecotourism and agro-forestry (outside of community protected area)
- Community zone in addition to the above, small animal trapping for subsistence use, agriculture, and livestock grazing for both subsistence and commercial objectives

207. No consumptive use of resources is permitted in more than 60% of the land area.

208. The zones are shown below (

Figure V-6)



Agriculture and bare soil.	5,493.24	41.13	206.17	653.74	4,592.20
Evergreen hill forest on dacite and rhyolite.	17,509.36	17,390.28	119.07	0.01	
Evergreen hill forest on granite.	49,886.64	49,163.27	723.34	0.03	
Evergreen hill forest on sandstone.	13,220.91	12,457.99	732.58	29.17	1.17
High elevation woodland and grassland often with pine.	295.24	295.24			
Highly disturbed forest with abundant bamboo.	1,519.85	774.54	570.07	154.31	20.93
Low elevation of woodland and grassland.	126,953.25	46,711.81	51,573.18	19,835.31	8,832.95
Lowland forest: large crowned, low elevation forest with high proportion of deciduous tree species.	39,727.18	24,669.97	11,173.78	3,301.91	581.52
Montane forest.	428.54	428.54			
<b>Grand total:</b>	255,034.21	151,932.77	65,098.19	23,974.48	14,028.77

Figure V-7 PAWS Types of Forest Cover

210. PAWS contains an IBA which comprises all areas of evergreen and semi-evergreen forest above 400 m ASL, which is thought to be the lower altitudinal limit of the Chestnut-headed Partridge *Arborophila cambodiana*.

211. The IBA supports both restricted-range species found in the Cambodia-Thailand-Mountains Endemic Bird Area: Chestnut-headed Partridge and Cambodian Laughing thrush *Garrulax ferrarius*.

212. Within the IBA, hunting pressure on bird populations appears to be relatively low, and largely restricted to the snaring of ground birds for domestic consumption. Such snaring is mainly conducted by wood collectors. Another potential threat to biodiversity is selective logging, which can lead to habitat degradation and loss. This threat is, however, currently low, since no large-scale, commercial logging is taking place within the IBA, and small-scale, illegal logging is on the decline.

### c. Phnom Samkos Wildlife Sanctuary

213. The **Phnom Samkos Wildlife Sanctuary** was established in 1994 and is located in the Cardamom Mountains in western Cambodia, adjacent to the border with Thailand. (12°16'17" N 102°58'36" E) It is a mountainous area containing three peaks: Mount Samkos which is Cambodia's second highest mountain (1,717 m), Mount Khmaoch (1,496 m) and Mount Tumpor (1,250 m). The area includes an IBA.

### d. Cardamom Mountains Wildlife Sanctuaries Project

214. The Cardamom mountain range extends along a southeast-northwest axis from Koh Kong Province to Pursat Province. The highest elevation of the Cardamom Mountains is Phnom Aural. Dense tropical rain forest prevails on the wet western slopes, which annually

receive from 3,800–5,000 mm of rainfall. By contrast only 1,000 to 1,500 mm fall in Kirirom National Park on the wooded eastern slopes in the rain shadow facing the interior Cambodian plain.

215. Threats to the biological diversity of the Cardamom Mountain Range include habitat loss due to illegal logging, wildlife poaching, and forest fires caused by slash-and-burn agriculture. The government has been increasing support for protected area management but still relies extensively on donor and NGO assistance for implementing effective management. Many international conservation organizations are working in the area including Wildlife Alliance, Conservation International, Fauna and Flora International and WWF. Sections of the area have been designated as protected areas, including Phnom Samkos Wildlife Sanctuary and Phnom Aural Wildlife Sanctuary. The level of active protection in all parks in the mountains has been criticized as being too low.

216. The Cardamom Mountains are an emerging tourist destination, with the opening of Wildlife Alliance's Chi-Phat eco-tourism area in the southern Cardamoms in 2008 followed by their second Cardamom Mountains eco-tourism site in Trapeang Rong.

217. The Phnom Aural and Phnom Samkos wildlife sanctuaries were established in 1993 under the Royal Decree on the Creation and Defining of Natural Protected Areas. They are located at the south-eastern end and north-western end, respectively, of the Cardamom Mountains. The two sanctuaries combined cover nearly 600,000 ha. Surveys carried out since 2001 have shown the special importance of the two sanctuaries for biodiversity conservation and environmental services. They have diverse geography, extensive forests, and many endemic and globally threatened species. Evergreen hill forest covers most of the two sanctuaries and the area is listed among the World Wildlife Funds Global 2000 Ecoregions as a priority for biodiversity conservation

218. The two wildlife sanctuaries are home to about 30,000 people who rely on subsistence agriculture, cattle raising, and collection of non-timber forest products for their livelihoods. These communities are among the poorest in Cambodia. Under the Cardamom Mountains Wildlife Sanctuaries Project (CMWSP), a joint project of the Cambodian Ministry of Environment and Fauna and Flora International, zoning plans have been developed for both sanctuaries through participatory consultation with local stakeholders but the sanctuaries face threats from clearance of land by in-migrating settlers and the granting of economic concessions as in 2009 a decree was issued permitting limited economic development in PAWS.

#### **e. Kirirom National Park**

219. Kirirom National Park (11°18'37" N 104°03'04" E) is located mostly in Phnom Sruoch District, Kampong Speu Province, while a smaller section is in neighboring Koh Kong Province. It was established in 1993 and covers 350km<sup>2</sup>. The park extends over the eastern part of the Cardamom Mountains. It is located 112 km from Phnom Penh off National Highway 4 on the road to Sihanoukville. It is located at an altitude of 675m (2,215 ft) above sea level and was Cambodia's first officially designated national park. Among the animals in the park are Asian elephant, deer, Gaur, Banteng, leopard, Spotted Linsang, Pileated Gibbon and tiger.

#### **D. Economics**

220. The economic appraisal has been carried out for six road sections. NR 13 was analyzed as three sections, but the results have been combined for the whole road; all three sections are individually economically viable. The results for Road 314D are shown for two cases; one with only the cost of the road upgrading and one with the capital cost of the development of the CBF at Prey Vor included. No additional benefit for the CBF has been

calculated. Road 150B has been analyzed as two sections, east and west of NR 5, and the results are shown on this basis, as the two sections are distinct in terms of the road network. The sealing of the 3.1km of the western section of Road 150B in the village of Alnkae that will be bypassed by the proposed realignment has not been included. The analysis of the western section of Road 150B includes the new alignment and the distance saving obtained applied to all traffic. NR 53 and Road 151B were both analyzed as single sections. The results are shown in Table V-1 where they are summarized for the six road sections and for the project as a whole, with the total based on Road 314D including the CBF. In this Table the values of the main components of project costs and benefits are shown as discounted present values. The Net Present Value (NPV) shown is the sum of all savings minus the capital costs, discounted to base year values at 12%. The Economic Internal Rate of Return (EIRR) is shown in the final column.

Table V-1: Summary of Evaluation Results (US\$ mill)

	Capital Cost Increase	Maint. Cost Savings	VOC Savings	Pass. Time Savings	Non- Motorized Savings	NPV	IRR (%)
NR 13	12.72	0.52	15.66	3.67	0.20	7.33	16.8
314D: Road only	5.29	0.07	8.53	1.34	0.10	4.74	18.2
With CBF	7.90	0.07	8.53	1.34	0.10	2.13	14.2
150B East	1.00	0.01	1.23	0.27	0.01	0.52	15.9
150B West	3.55	0.05	3.93	0.55	0.09	1.07	14.6
NR 53	2.15	0.06	2.01	0.28	0.05	0.25	13.1
151B	0.27	0.01	0.64	0.08	0.00	0.46	22.7
<b>Total</b>	<b>27.59</b>	<b>0.71</b>	<b>32.01</b>	<b>6.19</b>	<b>0.45</b>	<b>11.77</b>	<b>15.5</b>

Note: Total includes option for Road 314D With CBF Source: Consultants

221. All of the road sections are shown to be viable, with positive NPVs and EIRRs above the target rate of 12%. Overall the project has an EIRR of 15.5%. The EIRRs are similar for all sections. The higher traffic levels on NR 13 and Road 314D produce higher benefits but the higher design standard results in much higher costs per km for the upgrading.

222. By far the largest source of benefits is VOC savings, being on average five times those of passenger time savings. Benefits to non-motorized traffic, almost entirely bicycles, are insignificant despite the large numbers on some road sections. There is a small net saving from routine road maintenance costs.

## E. Socio-economic Profile

223. During the baseline survey conducted in June 2011, 99.4% of respondents were in favor of the project while less than 1% are not in favor due to fear that their houses and shops might be affected during the construction. Overall, the key stakeholders are in favor of the project due to the following positive impacts: (i) greater access to basic facilities and services, specially for women/girls, children, elderly and disabled persons; (ii) improved roads will increase household's income; (iii) prices of commodities and transportation costs will be reduced due to improved roads; (iv) greater job opportunities for both unskilled women and men who would like to work during the road construction and maintenance; (v) children will be motivated to go to schools, and will increase enrollment and completion rates; (vi) faster and more convenient travel; (vii) the mothers will no longer be tired doing laundry for the uniform of their children daily (which is costly and time consuming), especially



during rainy season; (viii) easy to transport agricultural products (although there is a need to improve further roads in their communes/villages); and (ix) there will be more jobs that will be created in the future as more business investors will put up factories and other business establishments. Negative impacts raised by the key stakeholders include: (i) increase in road accidents; (ii) increase in number of individuals with HIV/AIDS/STDs, and human trafficking cases; (iii) possible increase in school drop-outs and child labor during the construction period; (iv) economic and physical displacement of some households (permanent and temporary); and (v) dust and noise during the construction, but this is only temporary.

224. During the baseline survey conducted in June 2011, less than 30% of the key informants mentioned that the project will result to spread of HIV/AIDS/STDs and will increase human trafficking cases. However, the community leaders have expressed that public awareness campaign on HIV/AIDS and human trafficking prevention program (HHTPP) will be of great help. There are NGOs that conduct HHTPP and road safety awareness in the communities. The teachers and the MoWA also mentioned the possibility for children who are enrolled in school (especially the girls) to work during the construction of the project. This could be mitigated by implementing the labor and gender action plan (LGAP) where the “no child labor policy” will be strictly enforced.

## **F. Poverty**

225. Cambodia is one of the least developed countries in Southeast Asia, and in the Asia-Pacific region, it ranks 131 of the 179 countries included in the UNDP's Human Development Index (HDI). It has a total population of 14.3 million as of 2010 with an annual population growth rate of 1.6%. The country's population in 2009 was 13.9 million and of this number, 51.23% are women. There were 2.9 million households with an average of 5 people and over 82% are in the rural areas. ADB mentioned in the Country Poverty Assessment for 2011 that based on the 2008 census, a quarter of Cambodian households (25.6%) are headed by women. The population is young, with more than half (56.1%) under the age of 25. The fertility rate has declined slightly but remains high. Rapid population growth from 1998–2008 at 1.54% per year is higher than the 1.3% average for Southeast Asia as a whole. Around 72% of the workforce is engaged in agriculture, forestry, and fishing. Urbanization is low, with just 19.5% of the population living in cities in 2008 and only a 1.3 percentage point increase over the previous decade (18.2% in 1998). While the annual growth rate of the rural population was 1.4% from 1998 to 2008, the urban population grew at 2.2% per year.

226. The country's national poverty incidence in 2008 was 30.1% but rural areas have higher poverty rate of 34.7%. Cambodia ranked 33 in the “alarming” countries with high level of hunger and under nutrition, where 12% of the households were classified as food insecure due to increase in food prices (UNDP Poverty Reduction Report, 21 March 2011). The UN-WFP Cambodia reported that although the poverty rate in the country fell by 4.7% from 2004 to 2007, the 30.1% poverty level among the country's total population was still high. The unemployment rate in Cambodia is projected to reach 20% by end of 2011. The poverty rate in Svay Rieng province was 24% and 35% in Kampong Chhnang province (2008 Census).

227. The total population in the project areas covering 10 districts in 4 provinces (Svay Rieng, Prey Veng, Kampong Chhnang and Kampong Speu) was 705,738 with 140,818 households in 2008. Of this number, 25,755 or 18% were female-headed households (2008 Census). Agriculture is the primary source of income and food for the households. In Svay Rieng province (with 5 out of 10 districts included in the project areas), only 5% of the farmers have access to irrigation and 33% owned less than 1 hectare of land, and 4% do not own land for rice cultivation. In Kampong Chhnang province (with 3 districts included in the project areas), 54% of the households owned less than 1 hectare of land and 8% do not own land for rice cultivation. Around 30% of the households in Kampong Chhnang have access to

irrigation. Based on the baseline survey conducted in June 2011, 26% of farmers who have land do not have legal land title. Absence of proof of land ownership makes the farmers vulnerable to losing land and inhibits them from investing long-term in agricultural production. Landless farmers and those with less than 1 hectare are included among the poor households in Cambodia. Based on the international poverty line (in 2006 purchasing parity terms), 40% of the population in Cambodia lived on less than \$1.25 a day, and 68% on less than \$2 a day (A. Bauer et. al. 2008, World Bank's New Poverty Data: Implications for ADB, Sustainable Working Development Working Paper Series No. 2. Manila).

## **G. Gender**

228. Women account for 52% of the population in the project areas. Female-headed households comprise 13% of the total households who were interviewed during the baseline survey conducted in June 2011. Of this number, 3% have children less than 5 years old. The country's child mortality rate in 2010 was 350 per 100,000 live births. Of the 4 provinces covered by the project, Kampong Chhnang has the highest maternal mortality rates with more than 500 mothers who died within 1 month after giving birth in 2008, followed by Kamchay Chay Mear district in Prey Veng with 305 and Svay Rieng with 350. Neonatal mortality rate per 1,000 live births in the country was 60 in 2010. Kamchay Mear district (Prey Veng province) has the highest neonatal mortality rate of 42 cases, followed by Svay Rieng with an average of 25 cases per 1,000 live births in 2008.

## VI. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION

### A. Impacts of Roads on Protected Areas due to Location

#### 1. National road NR 13

229. NR 13 will not pass in close proximity to any legally designated protected areas or sites of special ecological, cultural or religious interest. The only localised environmental concern at this time is the large water body through which the road passes on embankment which may be subject to periodic inundation in the short term, or extreme weather events in the long term.

#### 2. Road 314D and CBF

230. Road 314D will not pass in close proximity to any legally designated protected areas or sites of special ecological, cultural or religious interest.

231. The CBF site is already developed and in use by cross border traffic. No adverse environmental impacts are anticipated by further development and upgrading of this facility.

#### 3. Road 150B

232. Road 150B has an eastern section of 5.5 kms which connects NR5 to Tonle Sap river. It terminates at the village of Ta Ches at the ferry crossing point of the river. This point is the nearest that any project road approaches to the boundaries of Tonle Sap Biosphere Reserve. It is approximately 4.5 kms from the boundary of the outer zone, known as the Transition zone. There will be no impacts from the road on TLSBR. This is shown below.)

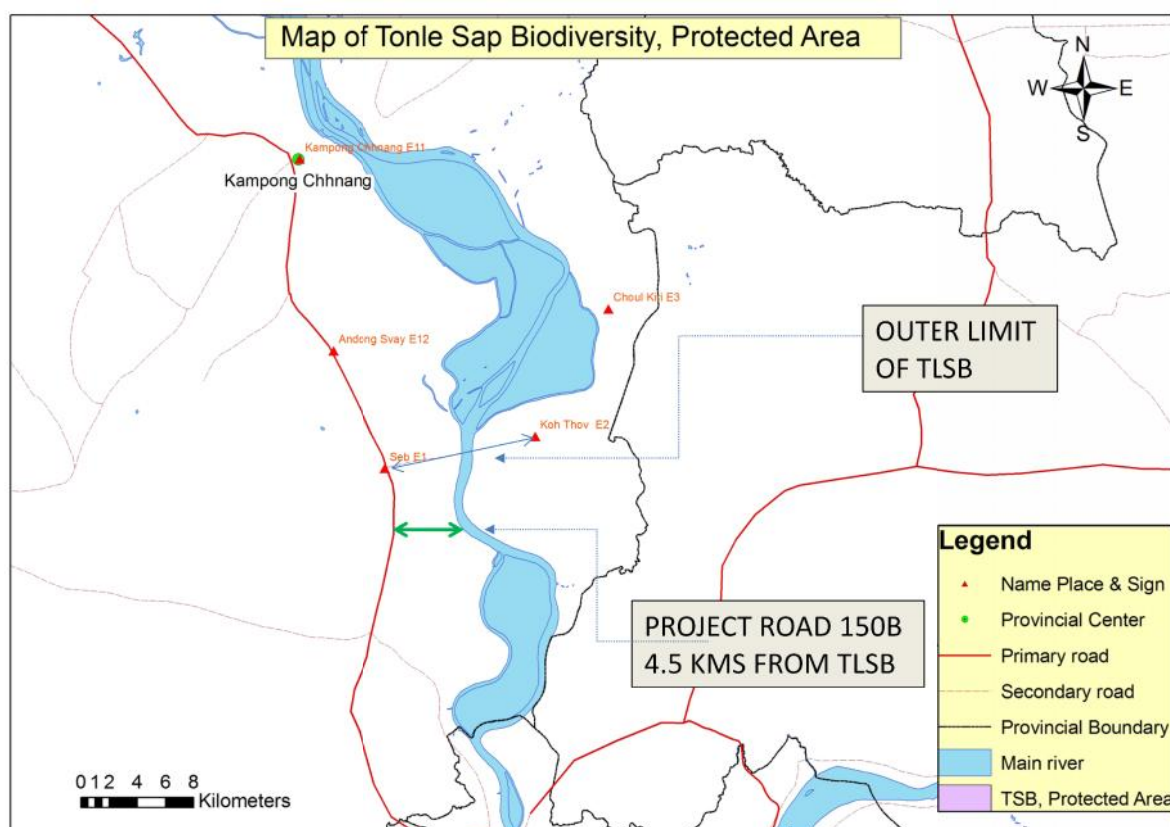


Figure VI-1 Road 150B in relation to Outer Zone of TLSBR

233. None of the project roads are located within the core, buffer zones and transition zones of TLSBR. The location of the project roads in relation to TLSBR are shown below. (Figure VI-2)

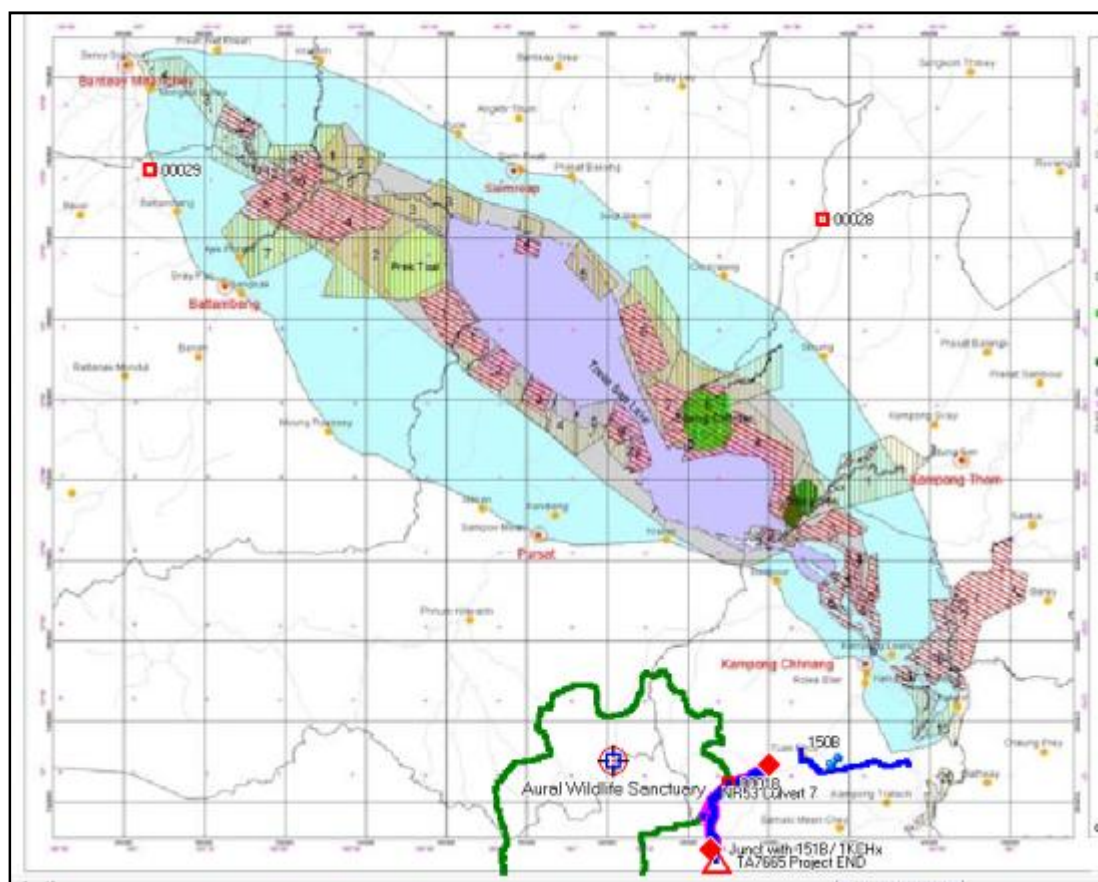


Figure VI-2 Road 150B, NR53 and 151B in relation to All Zones of TLSBR

#### 4. Road NR53

234. NR 53 runs alongside part of the eastern boundary of Phnom Aural Wildlife Sanctuary for a distance of approximately 6.5 kms.

235. The figure below depicts the location of PAWS based on public domain information with the project road superimposed. The road does not intrude into the PAWS but runs contiguous with the boundary. (Figure VI-3)

236. This has been confirmed by detailed investigations and “ground truthing” as described below.

237. Under the Royal Decree on the Protection of Natural Areas 1993 Article 3: Amendments “The protected natural areas may be modified or expanded in the future on the basis of scientific information involved in the conservation of ecology and the maintenance of the existing landscape in the Kingdom of Cambodia.” It is possible that the boundary may have been modified and yet still be completely in accordance with the law. However, site visits have established this has not occurred.

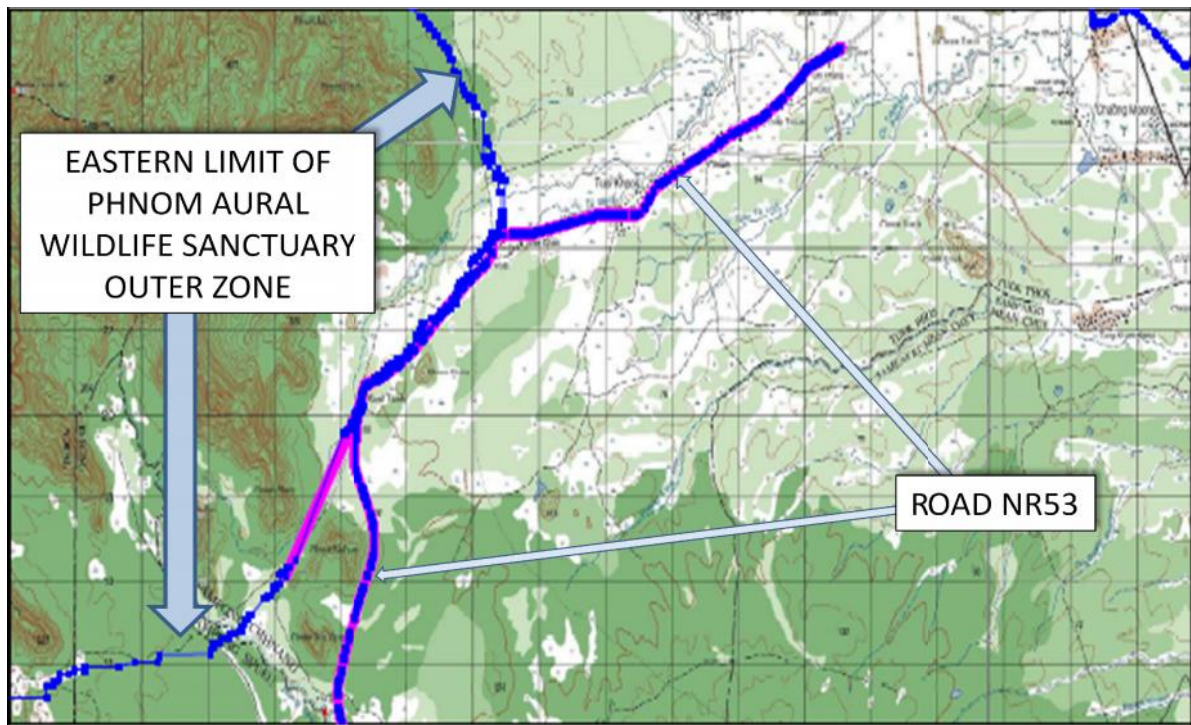


Figure VI-3 Road NR53 in relation to Outer Zone of PAWS

238. The boundary of PAWS was given in the Royal Decree of 1993 which showed a boundary line drawn on a map. The consultants obtained a copy of the original decree to confirm this. An NGO, FFI have recently been very active in PAWS with regards to the boundaries. They took coordinates off the original map and transformed these into cartographic coordinates using the UTM system. (The consultants have obtained these coordinates, called "Waypoints".) The waypoints were then used by FFI on a GPS system to identify locations on the ground where concrete posts could be erected to mark the boundary of the PAWS. In some cases the intended location was inaccessible and could not be used to locate a concrete marker. In this case discussions were held between FFI, MoE, Provincial officers and local villagers to agree on a location for the marker post. (see Figure VI-4)





Figure VI-4 The 80 Perimeter Marking Points of PAWS as marked by FFI and MoE

239. The boundary shown in the Royal Decree 1993, the estimated waypoints and the concrete marker posts could possibly be different. Site surveys were conducted to “ground truth” the data and confirm in reality exactly where the boundaries are, as indicated by the marker posts and agreed by local villagers.

240. Site surveys were carried out together with the PAWS Rangers from the Provincial Department of Environment, and the District Village Heads. A series of concrete posts were identified which mark the boundary of PAWS. Each post is numbered, states the Royal Decree and has the UTM Coordinates written on it. Some of these have been moved slightly at the request of the villagers to avoid natural features such as a drainage ditch (see Figure VI-5).



Figure VI-5 Concrete Marker Post showing Boundary of PAWS

241. The locations were checked with a GPS unit and the findings crossed checked with the UTM coordinates written on the post. All were found to be correct. Six posts mark the boundary of PAWS where it runs contiguous to NR53. (Figure VI-6)

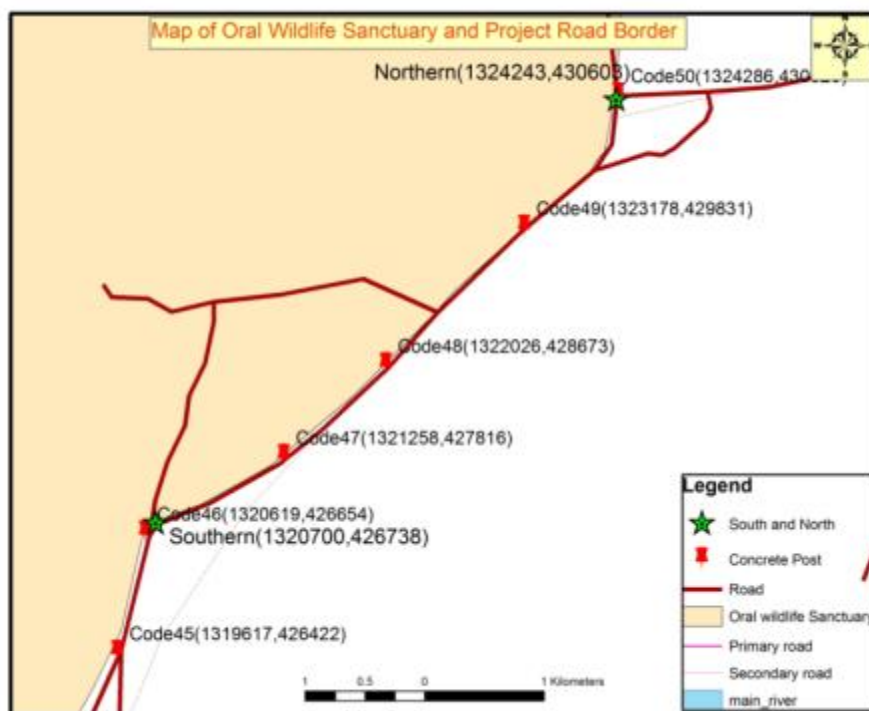
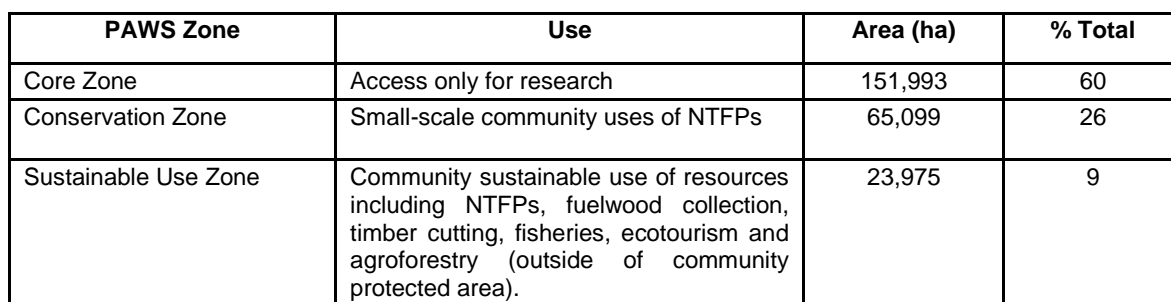


Figure VI-6 Concrete Marker Post 45, 46, 47, 48, 49 and 50 and UTM coordinates showing Boundary of PAWS contiguous with NR53

Figure VI-7 PAWS Zones in Vicinity of NR53





Community Zone	In addition to those activities above, small animal trapping for subsistence use, agriculture, and livestock grazing for both subsistence and commercial objectives.	14,029	6
<b>Total</b>		<b>255,036</b>	<b>100</b>

243. The location of the zones with respect to NR53 given below.

Table VI-1 Distance of NR53 from PAWS Internal Zones

NR53 runs contiguous to the outer boundary of PAWS for about 6.5 kms. The distances of NR53 to the nearest point of each zone are :	
Distance to Community Zone (Red)	10 metres (for approximately 3.5 kms)
Distance to Sustainable Use Zone (Blue)	10 metres (for approximately 3 kms)
Distance to Conservation Zone (Yellow)	2 kms (at nearest point)
Distance to Core Area (Green)	5kms (at nearest point)

244. It is intended to support activities to the villagers in PAWS to enhance their activities in line with sustainable development in locations adjacent to project roads. Discussions have been initiated with the stakeholders in PAWS to develop collaborative assistance in the future and these are reported in the public consultations sections. It can be seen that NR53 has no adverse impact on the activities designated by the zones of PAWS.

The distances of NR53 from the various zones are given in Table VI-1. It can be seen that NR53 has no adverse impact on the activities designated by the zones of PAWS.

Table VI-2 PAWS Internal Demarcation Zones

PAWS Zone	Use	Area (ha)	% Total
Core Zone	Access only for research	151,993	60
Conservation Zone	Small-scale community uses of NTFPs	65,099	26
Sustainable Use Zone	Community sustainable use of resources including NTFPs, fuelwood collection, timber cutting, fisheries, ecotourism and agroforestry (outside of community protected area).	23,975	9
Community Zone	In addition to those activities above, small animal trapping for subsistence use, agriculture, and livestock grazing for both subsistence and commercial objectives.	14,029	6
<b>Total</b>		<b>255,036</b>	<b>100</b>

Table VI-3 Distance of NR53 from PAWS Internal Zones

NR53 runs contiguous to the outer boundary of PAWS for about 6.5 kms. The distances of NR53 to the nearest point of each zone are :	
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Distance to Core Area (Green)	5kms (at nearest point)

245. It is intended to support activities to the villagers in PAWS to enhance their activities in line with sustainable development in locations adjacent to project roads. Discussions have been initiated with the stakeholders in PAWS to develop collaborative assistance in the future and these are reported in the public consultations sections.

## 5. Road 151B

246. Road 151B marks the most southern point of the project roads. This road is further away from PAWS than NR52 and more than 50 kms from Kirirom National Park. No adverse environmental impacts are anticipated from this section of the project road on these two protected areas.

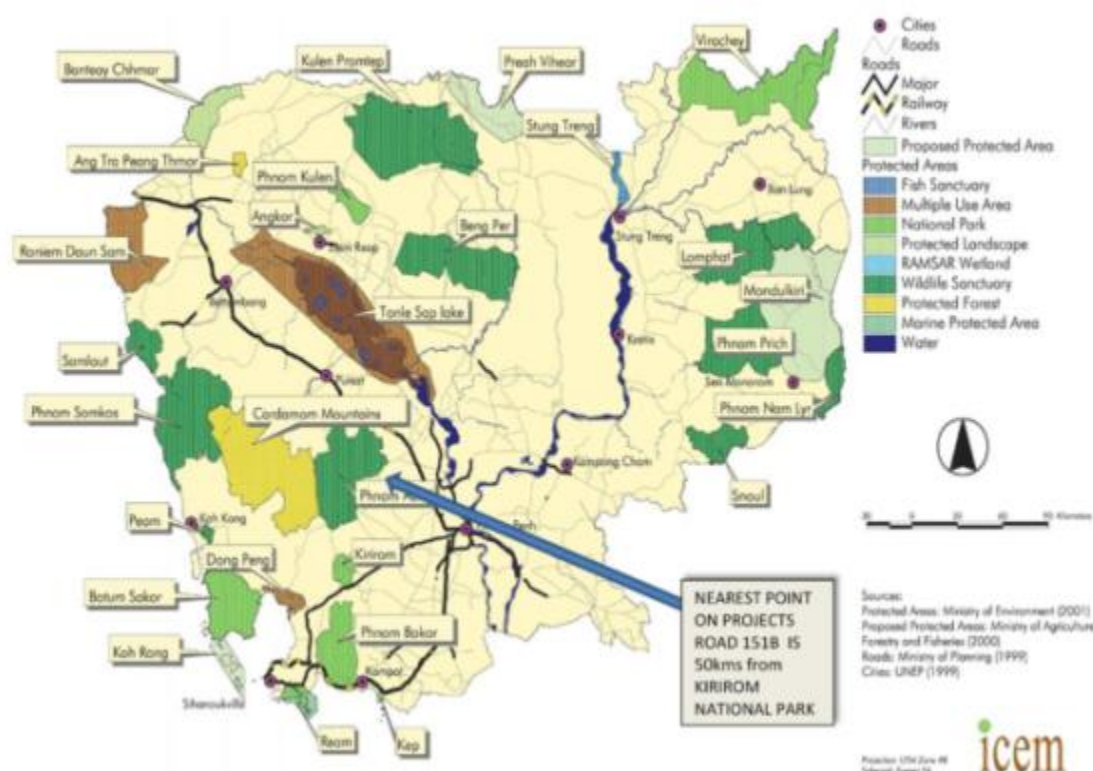


Figure VI-8 Road 151B in relation to Kirirom National Park

## **B. Impacts of Climate Change Sub Projects**

### **1. Chiprong Dam, Tuek Phos**

247. In order to enhance water capture several civil works sub projects have been included under a Climate Change Component of Loan 2839. Chiprong dam is one of these civil works which are not new projects but are rehabilitation of existing works. Chiprong dam already exists and has done for decades but has fallen into disrepair. The proposed works will return it to its former state and will not have any adverse environmental impacts.

### **2. Deepening of Lake Khset**

248. Deepening of Lake Khset will involve dredging of 350,000 m<sup>3</sup> of material. Under the Cambodian Ministry of Environment Sub-decree No 72 ANRK.BK. (1999) any dredging of more than 50,000 m<sup>3</sup> material must be approved by them. Therefore an abstract of this IEE will be submitted to them as an initial EIA (IEIA) in accordance with the regulations.

249. Samples of the material to be dredged have been taken and analysed for a range of environmental parameters including pesticides and heavy metals. This was carried out by an accredited laboratory in Cambodia. No adverse chemicals were detected and the results for NPK show the material would be a useful fertiliser. The full results are in Annex 2.

### **3. Water Retention Dikes in Kampong Leaeng**

250. These works are reconstruction of existing dikes and control gates. They will reinstate previous structures and use soil material from adjacent fields. None of these activities will have adverse environmental impacts.

### **4. Water Supply and Distribution in Kampong Leaeng**

251. None of the civil works associated with the water supply system for Kampong Leaeng will have adverse environmental impacts.

252. Water supply in Kampong Leaeng may involve groundwater abstraction. Some concerns have been raised over arsenic content in the groundwater.

253. Naturally occurring arsenic was first confirmed in drinking water in Cambodia during the Cambodia Drinking Water Quality Assessment, conducted jointly by the Ministry of Rural Development (MRD) and the Ministry of Industry, Mines and Energy (MIME) between 1999 and 2000. This assessment screened approximately 94 urban and rural drinking water sources in 13 provinces for chemically hazardous elements and found elevated arsenic levels in approximately 11 per cent of the groundwater samples from 5 of the 13 studied, exceeding the WHO guideline value of 10 ppb.

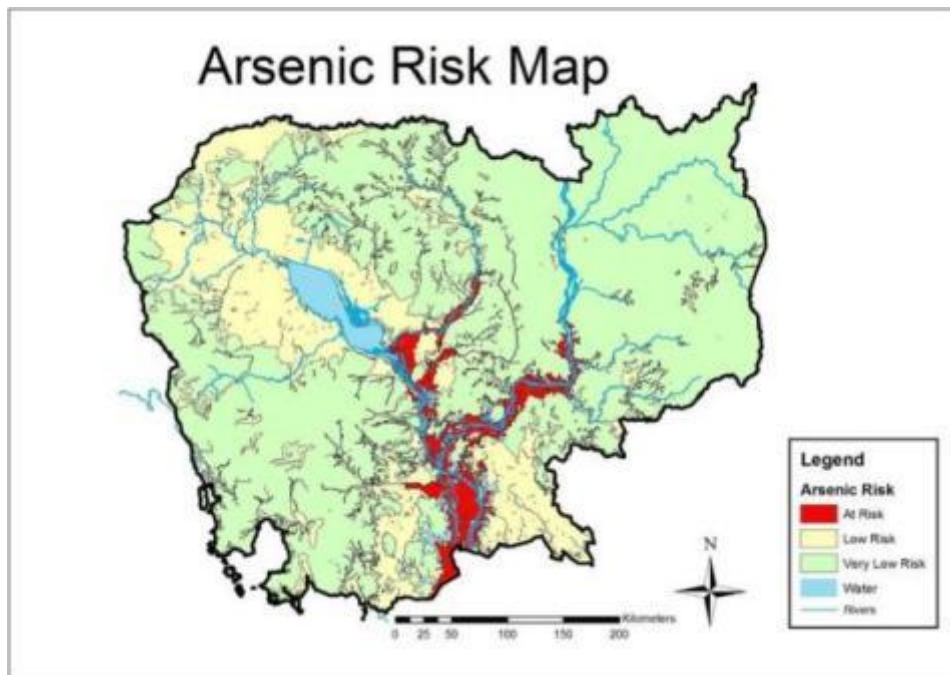


Figure VI-9 Arsenic Risk Map Cambodia MRD / MIME 1999

The arsenic risk map for Kampong Chhnang is given below. This was extracted from the MRD main study. It includes results for Kampong Leaeng. (see below)

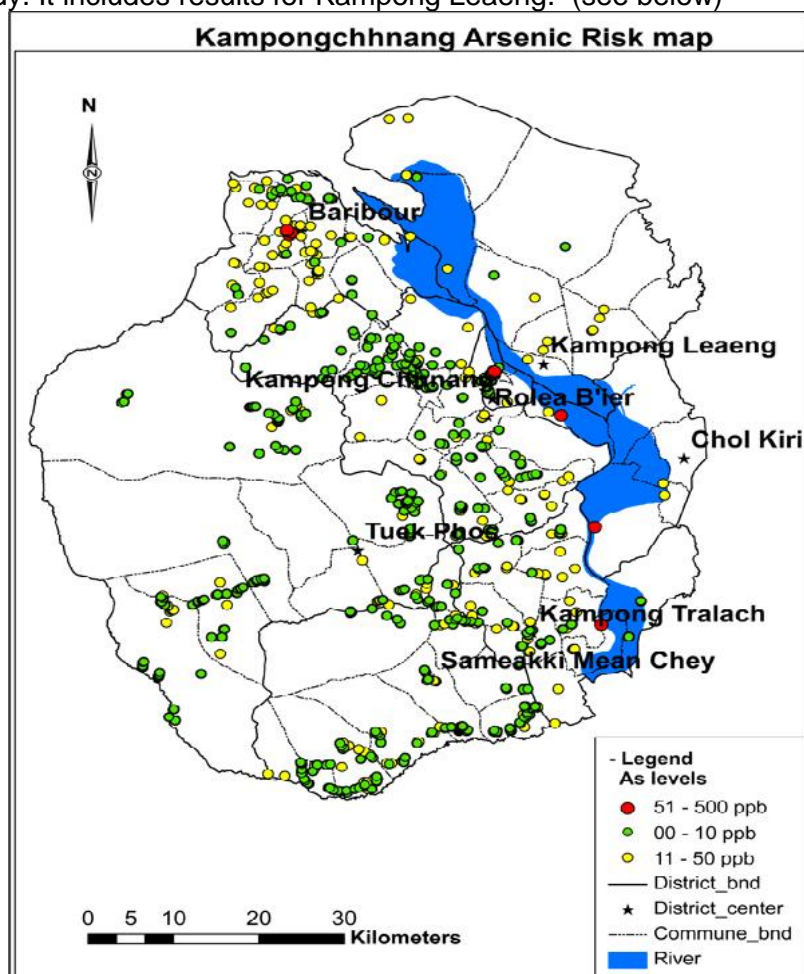


Figure VI-10 Arsenic Risk Map Kg Chhnang & Kg Leaeng

254. A standard of 50 ppb for arsenic in drinking water was set by USEPA in 1975. In 2001 the USEPA revised this to 10 ppb for the USA. The WHO Standard for arsenic in drinking water is 5 ppb

255. The Cambodian standard for arsenic in drinking water is 50 ppb. This is similar to many other countries outside USA. The MRD study shows arsenic levels in groundwater in Kampong Leaeng to be between 11 to 50 ppb which, according to the MRD study, is considered "low risk".

256. The safe yield rate of ground water pumping will be established by yield tests in the near future. According to the tests previously conducted by MRD arsenic levels in groundwater in Kampong Leaeng are low risk and within the Cambodian Standard for drinking water. It is recommended that this be confirmed by taking a water sample during the yield test and having a laboratory analysis conducted.

257. It should be noted that the above data applies to groundwater. If river water is extracted for use in the water supply then tests on river water should be carried out. As arsenic is carried by river water before entering the groundwater there is a distinct correlation between results and standards for each, if both are to be ultimately used for raw water purposes.

## **5. Emergency Response Management Centre.**

258. The civil works under climate change will include construction of an Emergency Response Management Centre. This will be located on Kampong Leaeng in a newly constructed building with communications equipment. No adverse environmental effects are associated with this new building.

259. Proposed civil works for utilisation of a water tower in Tuek Phos for water supply has been dropped from the previous program as these works have already been undertaken by Ministry of Energy. The budget for this subproject has been reassigned to another subproject.

## **6. All Civil Works Packages**

260. Temporary environmental impacts caused by the civil works have been identified and mitigation measures are given in the environmental management plan (EMP). The EMP (and EMMP) is included in the IEE.

## **C. Potential Impacts Pre-construction Phase**

### **1. Unexploded Ordnance**

261. A land mine or unexploded ordnance (UXO) risk is widespread in Cambodia including the provinces in which the proposed project will be conducted. The works are to upgrade existing roads without widening. Nevertheless, a risk remains since there may be deep seated mines that could be exploded by heavy construction equipment and shallow ordnance may be uncovered during the works. The detailed design and implementation supervision consultant (DDIS) shall engage a UXO specialist to determine

the level of risk of all project roads and advise on the need for clearance. Any clearance that is required will be undertaken through the civil works contracts, by the engagement of qualified local UXO clearance firms. The contractor shall only commence site works after the UXO clearance firm has certified that areas are already cleared.

## **2. Climate Change and Hydrological Impacts**

262. Existing climate change projections supported by field observations highlight two major concerns related to current and future climate changes. Specifically, there appears to be an overall increase in average total annual rainfall and, this increase is poorly distributed over seasons, resulting in increased floods during the rainy season and increased drought during the dry season. Droughts are significant especially for unpaved roads as dust levels increase and reduce visibility and create poor local air quality. Flooding and soil moisture content is a primary concern for protecting investments in roadworks and will be addressed as a priority in the climate change adaptation strategy to be implemented under the Project. The strategy will seek to strengthen the overall objective of the Project to improve rural road mobility. It will do so by:

- Protecting the road infrastructure from the impacts of climate change and,
- Ensuring that the road infrastructure does not increase the vulnerability of the surrounding area to climate change.

263. The adaptation activities fall under two outcomes: outcome i): Improved planning for rural road infrastructure development to accommodate climate changes and, outcome; ii) Increased resilience of road infrastructure to climate changes. In particular, outcome 2 will involve design and implementation of ecosystem-based adaptation strategies focusing on environmental/green planning for project roads to improve flood and drought management i.e. increasing ground cover and infiltration of floods and water retention during droughts, which has the added co-benefits of improving rural livelihoods by improving the soil structure for agriculture.

264. In selecting species of trees and other vegetation for the ecosystem-based adaptation, the consultants for the climate change adaptation component of the Project shall ensure new species (i.e., species not currently established in the country or region of the project) shall not be intentionally introduced unless carried out in accordance with the existing regulatory framework for such introduction, if such framework is present, or unless the introduction is subject to a risk assessment. Under no circumstances must species known to be invasive be introduced into new environments.

265. To address hydrological impacts, the project shall provide for appropriate design of roadside and cross drainage systems, where necessary, to avoid flooding on project roads as well as in areas surrounding the road embankment. The road embankment, bridges and drainage facilities shall be designed based on the historical flood data and flood forecasting. Erosion control and slope stabilization measures shall be included in the design, as appropriate, such as side ditches and berms, rock lining and slope walls along the road, shrub buffer strips sites in areas of high erosion risk, cross drainage to accommodate floodwater/run-off in case road sections are on elevated fills that will obstruct natural drainage.

## **D. Potential Impacts Due to Construction Works**

### **1. Potential Impacts from Operating Outside Agreed Areas**

266. Contractors must be instructed as to where construction works, materials storage, workers camps, fabrication yards and borrow areas may be located. Operating outside these areas may intrude into protected areas or lead to conflict with local residents.

### **2. Borrow Areas**

267. Widening and raising of embankments will use a variety of earth, laterite and rock materials. Soil will be obtained from borrow pits or excavated material taken from trenches running lateral to the road. Temporary roads may be needed to access borrow pits. After work is completed borrow areas (borrow pits and borrow roads) must be reinstated to their original condition.

### **3. Rock Extraction**

268. Where rock extraction is by explosives, blasting noise and vibration impacts may occur. The blasting method statement must be submitted to the RE in advance for his approval.

### **4. Fabrication Sites**

269. Construction of bridges and culverts will be by the use of pre-cast concrete structures, which will be transported to site and installed. The location of fabrication sites and their operation may have impacts on surrounding areas.

### **5. Transport of Construction Materials**

270. Construction materials such as earth, gravel and rock will be hauled by trucks to the project sites. Concrete beams will be pre-cast in a fabrication yard and then transported to site and erected. If contractors' haulage trucks exceed weight limits there may be damage to bridges.

### **6. Fuel and Oils**

271. Vehicles will require fuel and lubrication oils which may leak into watercourses. Vehicle wash down water may cause contamination.

### **7. Bitumen Use for Asphalt**

272. Bitumen for asphalt and batching plants will be stored on site. Storage areas must be strictly controlled and not located near watercourses. Bitumen will need a fuel source for heating. Wood should not be used as an alternative fuel. Asphalt applied during rain can be washed into watercourses.

### **8. Noise and Vibration**

273. During construction, noise and vibration may be generated by construction equipment, vehicles, pile driving, demolition and blasting.

### **9. Dust**

274. Dust from unpaved roads is a major nuisance for roadside residents, especially those in built-up areas. During construction, fabrication sites and access roads, material stockpiles, crushers and batching plants may generate dust.

### **10. Construction Waste Materials**

275. Demolition of old structures may give rise to waste construction materials. These may comprise waste concrete rubble, wood, nails and old steel re-bars. These can be sharp and pose a threat to grazing animals.

#### **11. Erosion and Sedimentation**

276. Borrow pits, quarries, road embankments, culverts and bridge abutments and road diversions will expose bare soils where material can be eroded. Work within channels and dumping of excavated material into flowing channels can cause blockage of drainage channels.

#### **12. Damage to Services**

277. Services within the RoW may include electrical cable, fibre optic telephone cables, mobile telephone transmission towers and underground water pipelines. Damage to such utilities must be avoided.

#### **13. Road Diversions**

278. It may be necessary to divert traffic around certain areas. Drivers must be forewarned of changed road conditions. Old signage may be misleading if not removed.

#### **14. Forest and Roadside Trees**

279. In order to allow widening large numbers of roadside trees will be removed. These must be disposed of adequately. These are discussed in detail under "Mitigation".

#### **15. Discovery of Relics**

280. No ancient monuments have been located along the project roads, but contractors must exercise care as historic artifacts may be discovered as "chance finds" during excavation.

#### **16. Accidents and Injuries**

281. The Contractor must have a stated policy and clear program for Occupational Health and Labor Safety. Trained first aid personnel and emergency response facilities are required.

### **E. Potential Impacts Due to Workers Camps**

#### **1. Location of Camps and Works**

282. The conceptual layout of the construction camps, workers quarters and quarries has not yet been proposed. In addition to permanent camps there may be temporary camps for teams of workers who move around the project roads. Their exact locations are not yet specified. More details will become available as the works progress.

#### **2. Camp Amenities for Fixed Teams**

283. Workers living in camps will need adequate facilities for food preparation and cooking facilities, laundry, personal hygiene and waste removal. Contractors must provide these to avoid unsanitary impacts on nearby residents.

#### **3. Construction Camps for Mobile Teams**

284. If teams move around the route as works progress contractors may try to use temporary camps with containers for sleeping and temporary latrines on rented land. This is considered too disruptive to local villagers and renting houses as temporary quarters is preferred.

#### **4. Stagnant Water Areas**

285. Stagnant water can gather in borrow pits, discarded solid waste such as plastics, old tires and metal containers and provide temporary breeding habitats for mosquitoes. Malaria and dengue fever are prevalent. Contractors should provide preventive control measures.



## **5. Health and Safety**

286. Risks may arise during the construction stage from (i) inadequate sanitation facilities in work camps (ii) lack of preparation for accidents and injuries (iii) introduction of contagious diseases by immigrant workers (iv) outbreaks of malaria in the labor force. Contractors must take steps to avoid these.

## **6. Social Issues - STIs**

287. The introduction of sexually transmitted diseases or other infections by immigrant workers is a concern. These issues should be addressed.

## **7. Cleanup of the Construction Site**

288. When construction is completed, the contractors must clean up the construction sites by removing all equipment and buildings and carrying out site remediation work, unless the site and buildings are to be left intact and handed over to the local authorities.

## **F. Potential Impacts Due to Operation**

### **1. Road Accidents**

289. As a result of the improved road and with long straight stretches and relatively long distances between the villages, it will be possible for vehicle speeds to increase. This may increase road accidents. Traffic safety is an issue and a road safety program will be implemented.

### **2. Community Based Road Safety Program**

290. Cambodia experiences an extremely high accident rate that is three times that of other countries in the ASEAN region, and accidents, casualties and fatalities have all increased proportionally faster than the growth in road traffic and the population. Consequently the government has committed to a national target of reducing road crash fatalities by 30% in 2010. This project will improve selected provincial roads and the rural communities are aware that paving the roads is likely to lead to an increase in traffic speeds, and have expressed concern over road safety. The project includes a component to address the Road Safety problem through the provision of road safety experts who will, in concert with existing programs in Cambodia, support the NRSAP and deliver practical solutions including public awareness of the road law, road user competence and education and vulnerability awareness.

291. The National Road Safety Committee supports and coordinates road safety action plans throughout Cambodia such as the Cambodia Road Safety Week before Khmer New Year. The 2011-2020 National Road Safety Action Plan (NRSAP) is aligned to the UN Global Decade of Action for Road Safety and consists of 7 pillars : Pillar 1 Road Safety Management; Pillar 2 Infrastructure; Pillar 3 Safe Vehicles; Pillar 4 Safe Road User Behaviour; Pillar 5 Post Crash Care; Pillar 6 Legislation and Enforcement; Pillar 7 Driver Licensing. Under the ADB funded Provincial Roads improvement Project TA 7665-CAM baseline studies have been carried out in August 2011 on selected roads. These included helmet surveys, road user surveys, school surveys, hospital surveys and road safety consciousness surveys. Drawing on these results the 7 pillars of NRSAP are to be applied to Community Based Road Safety (CBRS) through a Technical Assistance Project.

292. The CBRS program aims to :

- Raise awareness of road safety for all road users in target areas
- Work with local communities, in particular youth and women, to promote road safety
- Support communities in developing road safety planning based on accurate and relevant information

293. The CBRS project will focus on districts, communes and villages adjacent to project roads. It will be coordinated by the CBRS Management Team at MPWT; District Level facilitators of whom 30% will be female; Commune level facilitators (30% female); and Village level volunteers of whom 40% will be female and the majority youth. A fundamental aim is to ensure long term sustainability at grass roots level.

The CBRS activities will include :

- Road safety seminars
- Volunteer training
- Road Safety Training for teachers
- Road Safety show
- Road Safety information for farmers
- Local Road Safety Information
- Annual Road Safety week
- Road Safety Information Boards
- Road Safety Focal points at Schools
- Road Safety School program
- Helmets on Our Heads Program
- Driver training of farm tractors
- Headlight on in Daytime Program
- Mentor Program for women
- Enhancing pedestrian safety

These will comprise annual and weekly events, school events, exhibitions and ground breaking events. Consultants will be hired who will be responsible for facilitating all of these actions and for monitoring and evaluation of progress.

### **3. Noise**

294. Noise from road traffic is a nuisance for roadside residents. As traffic grows, with more heavy goods vehicles, noise levels will increase. However smoother road surfaces can reduce road / wheel interaction noise.

### **4. Air Pollution**

295. Air pollution from vehicle operation, especially heavy diesel powered vehicles will increase. However, higher speeds give more engine efficiency which reduces air pollution.

### **5. Toxic Spills**

296. Currently transport operators face a poor road system with the attendant risks of a high proportion of accidents attributable to these poorly maintained roads. With the new road and better road conditions transport accidents attributable to poor road conditions will decrease but accidents attributable to speed are likely to be several times greater. Thus as traffic densities and speeds increase there is increased likelihood of accidents and toxic materials being released into the air, ground and aquatic systems. To date there do not appear to have been any major accidental spills.

### **6. Illegal Settlement**

297. Illegal dwellings should be discouraged as encroachments and squatters can effectively reduce the road width and contribute to accidents.

### **7. Loss of Forests**

298. Improved access to an area can sometimes result in accelerated loss of forests due to illegal logging. Illegal logging is controlled by MoE Rangers and they reported that is not a major activity in PAWS, the main protected area near to any project roads.

## **8. Loss of Wildlife**

299. A concern with increased access is the possibility of an increase in illegal wildlife hunting and threats to endangered species. As stated above MoE Rangers patrol to control such illegal activities.

## **9. Positive Operational Impacts - Social Enhancement**

300. Not all impacts are adverse. The project will have several positive benefits which include:

- Hiring of Local Communities for construction work
- Reduce Transport Costs
- Improved Public Access
- Improved Transport of Goods for Rural Communities
- Tourism Benefits

These will enhance the quality of life and living standards of the local population.

## **G. Mitigation of Impacts Due to Location**

### **1. Avoidance of Impacts outside Agreed Areas**

301. Contractors must follow instructions as to location of construction works, materials storage, workers camps, fabrication yards, and borrow areas. They must not work in protected reserves without prior permission from the relevant authorities.

### **2. Ancient Bridges and Temple**

302. There are no ancient bridges or old temples adjacent to the project roads.

### **3. Religious Edifices**

303. There are no religious edifices in the immediate vicinity of the project roads. There are several pagodas and graves located near some of the roads. Contractors must employ normal care when working near these. Details are given in the Conditions Surveys. (Annex1)

## **H. Mitigation of Impacts Due to Construction Works**

### **1. Intrusion into Protected Areas**

304. All of the construction activities, including structural work and laydown yards, quarries, borrow pits, fabrication yards and workers camps must be located outside any protected areas.

### **2. Borrow Areas**

305. The borrow areas are still to be identified and finalized. Details of location, excavation and rehabilitation are still to be decided. Many villagers stated during consultations that they wished borrow pits to be left open so that they could be used for water reservoirs, duck ponds or fish ponds. As borrow areas will be subject to a private contract between the villagers and the contractor, the decision as to rehabilitation will be made on a case by case basis. However, should the villagers specify rehabilitation the contractor must comply with this request. Otherwise all borrow pits must be filled in after project completion, and resurfaced with topsoil and revegetation, as indicated in the borrow pit excavation plan, to such a condition that they do not pose a hazard to local residents. Temporary roads will be needed to access borrow pits. After work is completed these must be removed. This includes breaking up compaction and reinstating the original ground surface.

### **3. Quarry and Borrow Sites Operation**

306. The following measures should be implemented at quarry and borrow sites to minimize impacts on water quality, reduce dust emission during transport, minimize erosion and siltation of nearby water courses and avoid damage to productive land and ecologically sensitive areas:

- (i) Sourcing of quarry and borrow materials from existing sites shall be preferred over establishment of new sites, as much as possible.
- (ii) Quarries and borrow pits shall not be established in national, provincial, district and village conservation forests and other ecologically sensitive and protected areas.
- (iii) Borrow/quarry sites shall not be located in productive land.
- (iv) In case the Project will involve new quarry/borrow sites, necessary approvals from environmental authorities shall be obtained prior to operation of such sites. Such sites shall be located over 300 m away from residential, school, hospital and other sensitive receptors.
- (v) Prior to extraction, topsoil (about 15 cm) shall be stockpiled, preserved and then refilled after completion of quarry/borrow pit operation for rehabilitation purposes after excavation is over.
- (vi) Dust control during excavation and transport e.g. water spraying on access roads and covering of truck loads with tarpaulins shall be undertaken in areas where there are sensitive receptors such as residential areas, school, hospital, etc.
- (vii) Long-term material stockpiles shall be covered to prevent wind erosion.
- (viii) During quarry and borrow site operation, provide adequate drainage to avoid accumulation of stagnant water.
- (ix) The use of river bed sources shall be avoided, as much as possible, however if this is unavoidable the contractor shall minimize use of river bed for construction materials and sources of fill and quarry materials lying on small rivers and streams shall be avoided. Alluvial terraces or alluvial deposits which lie on the river beds but are not covered by water in normal hydrological conditions shall be preferred.
- (x) 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 full safety measures must be observed to prevent drowning. Such agreements would be formalized in writing between the contractors and the villagers after full discussion with all concerned parties.

#### **4. Rock Extraction**

307. Where rock extraction is to be by explosives blasting, normal industry standards and safety practices must be followed to minimize noise and vibration impacts. The blasting method statement must be submitted to the RE in advance for his approval.

308. The contractor, or his appointed blasting subcontractor, must advise on location of drilled holes, depth of drilling, diameter of hole and charge per hole. The total number of holes and the total maximum quantity of explosive to be used must be given. If pattern blasting is to be utilized, then 10-20 millisecond delays between holes must be used to minimize vibrations. Stemming to holes must be used to minimize noise and projection of "flyrock."

309. If explosives are to be stored on site, a licensed magazine must be used. This must have strict security and restricted access. An inventory of explosives transported in, used and stored must be kept and reported monthly to the R.E.

310. Details of the type of explosive must be given, whether it proprietary or prepared on site (e.g. ANFO). The type of initiation must be stated, whether electrical, cortex, etc. Local residents must be made aware of blasting taking place and warned in advance. If possible blasting must take place at some regular prearranged time so that residents become accustomed to it and are not alarmed. Audible (siren) and visual (red flag) signals must be used to warn passersby of an imminent blast.

311. Charges and hole spacing must be selected to minimise any subsequent “bouldering” blasting. All intended blasting of quarries or for demolition of structures must be notified to the UXO officer to ensure that any related areas have been cleared, in order to avoid secondary detonations. Blasting for demolition of structures must be notified to local residents at least 7 days in advance. Written notices (in Khmer) must be distributed or attached to notice boards, trees and the like in the area. Audible and visual warnings must be given in advance of the blast.

## **5. Fabrication Sites**

312. Concrete beams and culverts will be pre-cast in a fabrication yard and then transported to site and erected. Cement and aggregate must be kept on the yard and not transported to site.

## **6. Transport of Construction Materials**

313. Materials such as earth, gravel and rock will be required for the road construction. Borrow pits may be located along the roads. Gravel and crushed stone will be hauled by trucks to the project sites. If contractors’ haulage trucks exceed weight limits there may be damage to bridges and road surfaces. Weight restrictions must be imposed on contractor’s vehicles to prevent damage to structures. Wheel washing facilities must be provided at roadside camps to prevent mud being carried over onto roads.

## **7. Fuel Storage and Vehicle Maintenance**

314. It is expected that vehicles will be stored at construction sites. Fuel stored on site must follow good industry practice. Fuel suppliers must provide skid mounted tanks with a metered off take and pump, mounted on a concrete hard standing. The concrete base must have a perimeter kerb to catch and retain any minor leaks or spills from the main tank manifold. Some vehicle maintenance may take place at commercial garages. This will have no impact on the project area. If maintenance takes place on site, measures must be implemented to control oily water runoff.

## **8. Waste Oil**

315. Waste oil can be sold to local waste contractors. This process is endorsed. The project contractor is at liberty to subcontract with any one he chooses. This approach has several advantages:

- It allows the contractor to avoid a cost of disposal
- It brings in some revenue to the contractor
- It is believed that the waste oil is used as a fuel additive in the scrap metal recovery business, which currently uses wood. This disposal route may, to a limited extent, assist in reducing deforestation.
- The subcontractor will have paid for the waste oil. It is now a valuable commodity to him. Therefore he is extremely unlikely to illegally dump the waste oil or allow any spillage on the road.

Any waste oil must be stored in drums which are clearly marked “waste material”. The drums must be of sound structural integrity and not leak, or be covered on the outside with dirty oil.

Drums must be stored on a concrete hard standing with a perimeter kerb to catch and retain any minor leaks or spills from the drums. The base must be covered with a lightweight rain proof shelter. Simple inclined corrugated lightweight material is sufficient. This must stop rain falling on the drums. (See figure below)

#### **9. Bitumen Use for Asphalt**

316. Bitumen will be heated by kerosene or gas. Fuel wood must not be used or as an alternative cold mix bitumen can be employed. Asphalt must not be applied during rain so as to avoid it being washed into watercourses.

#### **10. Noise Impacts**

317. Pile driving, improper silencing of vehicles and equipment used on the road construction site may impact on communities. The Contractor must ensure that machinery is adequately silenced and operations are restricted to normal daylight hours. Blasting noise must also be controlled as described above.

#### **11. Dust Impacts**

318. The Contractor must maintain dust abatement procedures where roads, construction sites and access areas pass through villages and at sites where workers are employed. In rock quarries which are privately owned dust abatement will be owner's responsibility, unless the crusher, screens and storage are owned by the contractor. Abatement measures can include covering piles of raw material with tarpaulins to prevent dust being blown away, and water spraying of roads and construction areas.

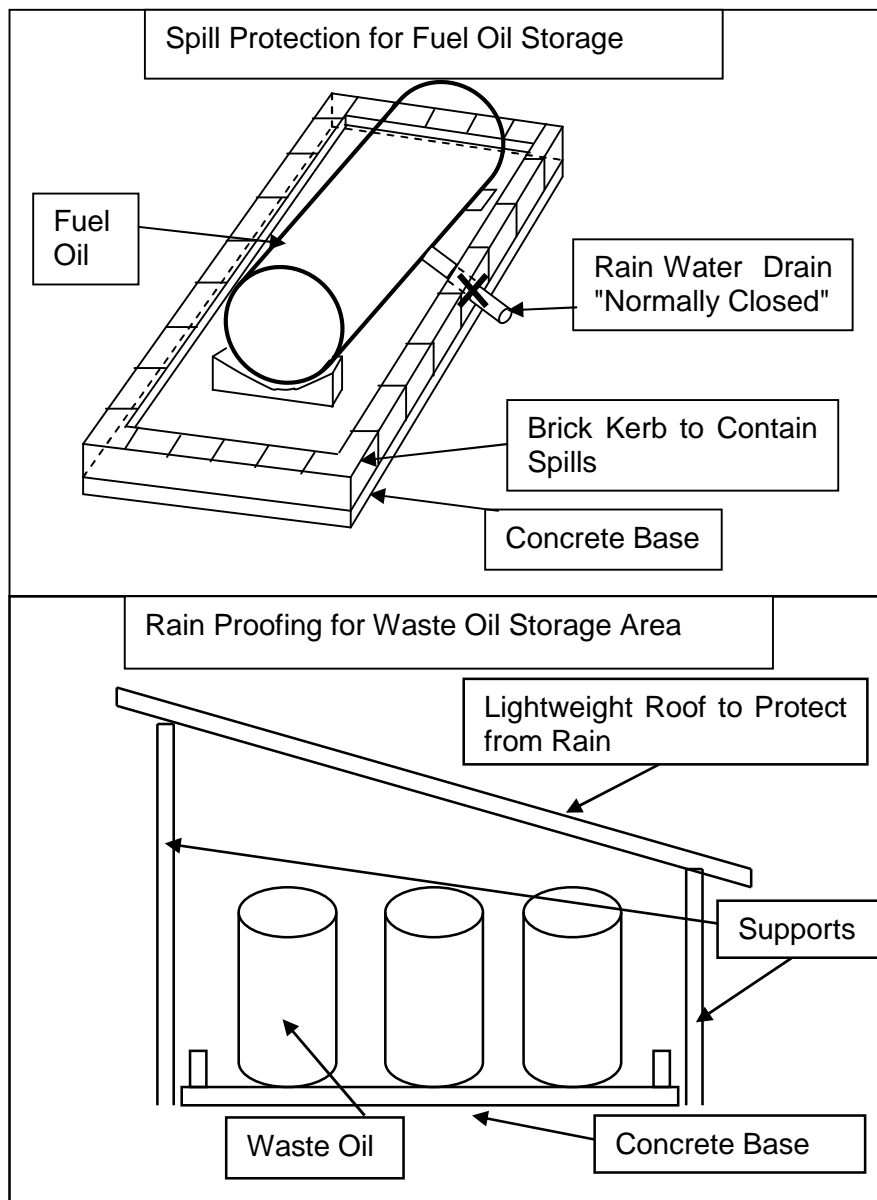


Figure VI-11 Spill Protection for Fuel Oil Storage / Rain Proofing for Waste Oil Storage

## 12. Construction Waste Materials

319. Demolition of old structures may give rise to waste construction materials. These may comprise waste concrete rubble, wood, nails and old steel re-bars. These can be sharp and pose a threat to grazing animals. They must be disposed of at an agreed location approved by the local authorities. This must be reported to the RE.

## 13. Erosion and Sedimentation

320. Borrow pits, quarries, road embankments, culverts and bridge abutments and road diversions will expose bare soils where material can be eroded. Areas must be re-vegetated as soon as possible after disturbance. Depending on the season this may require watering to ensure establishment of vegetation until the wet season arrives. Re-vegetation work may be carried out by project affected people within the Resettlement Plan as a form of income generation. Re-vegetation specifications will be included in the Detailed Design. The contractor must take care to avoid unnecessary work within channels and avoid dumping of

excavated material into flowing channels. If possible, work which could affect water channels must take place during the dry season, before heavy rainfall flows occur.

#### **14. Damage to Services**

321. The Contractor must liaise with the relevant utility companies to check location of services and avoid damage.

#### **15. Road Diversions**

322. It may be required to divert traffic around certain areas. Warning signs and flagging must be displayed at the commencement of any road construction or diversion so as to forewarn drivers of changed road conditions. Old signage must be removed by the Contractor.

#### **16. Forest and Roadside Trees**

323. Trees to be cut down are on 314D are 2,234 and NR13 it is 9,906. On NR53 there are 3,010 and 2,612 on the other western roads. For road 150B the trees on the shoulders are 15m high and along NR 13 planting on the shoulder/ sideslope must be removed as will the short section in Prey Veng province where they are 10m high. Where they are under the new road it will be necessary to remove the roots where widening from 4m to 8m as the tap root is thought to be about 5m long. Replacement of trees is discussed under Resettlement.

#### **17. Discovery of Relics**

324. If during excavation relics are discovered, under the Law on Cultural Heritage, 1996, the "chance find" discovery must be reported to the responsible agency.

#### **18. Accidents and Injuries**

325. The Contractor shall have a Safety Officer trained in first aid and the contractor must check the response time of emergency facilities such as fire and ambulance. All workers must be issued with PPE – Personal Protective Equipment – such as safety boots, helmets, goggles and gloves. Workers must be trained in their use and reminded daily at morning "Toolbox Briefings" when the day's tasks are assigned. Records must be kept of accidents, lost time due to fatalities, injury or medical attention. Workers should be offered incentives to report "near misses" and correct carelessness. Extra efforts must be made to prevent children injuring themselves on site after working hours. Emergency telephone numbers must be displayed prominently on site.

#### **19. Dislocation of People**

326. The road is being built within an established ROW but minor dislocations such as temporary bypasses around structures must be agreed by the contractor and local people.

### **I. Mitigation of Impacts Due to Workers Camps**

#### **1. Camp Amenities for Fixed Teams**

327. Potable water must be supplied for cooking and washing but it is not intended for drinking. If wells are drilled on sites the supply must be 100 L / man / day. It must be stored in overhead storage tanks for gravity distribution. If no wells are planned water for personal washing, laundry, cooking and toilets must be supplied to the camp by road tanker. The supply must be 100 L / man / day.

#### **2. Drinking Water**

328. Adequate drinking water must be supplied. Between 1-4 litres per day bottled water must be supplied per worker.

#### **3. Sanitation**



329. Toilets must be flushed by water which connects to septic tanks. Prefabricated septic tanks must be used which have internal baffles and connect to underground soakaways. These are readily available in the local market. It is recommended that local subcontractors / builders be used to install them as they have local knowledge of soil conditions, water table depth and are low cost.

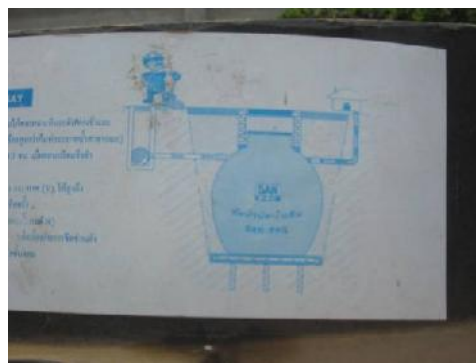


Figure VI-12 Septic Tanks Locally Available with Installation Instructions

Septic tanks must be covered with concrete slabs to control odour and must have vent pipes. They must be accessible by manhole covers with grease seals to allow emptying when needed. Soakaways must be constructed below the ground surface to allow dissipation of liquid effluents and be subsurface.

#### **4. Food Preparation**

330. Food must be prepared by offsite local contractors to provide 3 meals per day. Food waste must be collected daily and removed regularly to discourage vermin.

#### **5. Camp Fuel Needs**

331. If the labor force is not supplied with adequate rations they may exert demands on local supplies of fuelwood, fruit and wildlife. The Contractor must provide gas, kerosene or similar for cooking and heating, and regular meals three times a day.

#### **6. Washwater**

332. Potable water must be used for personal hygiene washing, laundry and washing cooking utensils. Such wash waters must be kept in a separate waste stream and not mixed with sanitary waste. If discharged to water courses the waste water must first pass through a grease trap to retain detergents and oil / grease. This must be cleaned regularly and the grease waste buried.

#### **7. Solid Waste Disposal**

333. Biodegradable waste must be buried in pits and covered with soil on a daily basis. Non biodegradable wastes such as paper, plastics, cans bottles and the like must be collected and removed from the site by a subcontractor.

#### **8. Mobile Teams**

334. If mobile teams are used they may move around the route as the works progress. The contractors must rent houses as temporary quarters, with full water supply, sanitation and cooking facilities for each team of workers. These locations must be determined through the approval of the Engineer.

#### **9. Stagnant Water Areas**

335. Contractors must check borrow pits, discarded plastic sacks, old tires and metal containers for stagnant water to avoid temporary breeding habitats for mosquitoes. This must be at least every 7 days to interrupt the breeding cycle of the mosquito which is 12

days. Contractors must implement regular pesticide sprays and provide mosquito nets for workers during sleeping.

#### **10. Health and Safety**

336. The contractors must implement a pre-employment health screening, employ a safety officer skilled in first aid, and carry out regular sanitary checks. They must also liaise with the local emergency services (fire, police, ambulance) to check the response time of emergency facilities.

#### **11. Social Issues - STIs**

337. Workers from outside the community must be given pre-employment HIV screening. Work camps should be sited away from local communities. An HIV/AIDS awareness program has been developed and should be implemented by a specialist subcontractor.

#### **12. Cleanup of the Construction Site**

338. When construction is completed, the contractors must clean up the construction sites by removing all equipment and buildings and carrying out site remediation work.

### **J. Mitigation of Impacts Due to Operation**

#### **1. Alignments**

339. A short section of NR53 will have its alignment adjusted slightly on the opposite side to PAWS to avoid a concrete marker post of PAWS which has been placed actually outside the PAWS boundary close to the shoulder of the road.

#### **2. Embankments**

The raising of the embankment to a flood free height will avoid flooding of the road. It may cause runoff to be held behind the embankment and so additional cross drainage has been included. Some slopes on NR13 will be eased from 1:2 to 1:3 to improve slope stability.

#### **3. Noise**

340. Noise from road traffic can be a nuisance for roadside residents. The project will have positive impacts on the quality of life of roadside residents as paved roads will be less noisy, but as traffic grows with more heavy goods vehicles noise levels will increase. The paved road will assist in reducing noise. Other controls include; prohibition on the use of air horns at night and fining drivers who operate vehicles without adequate silencers.

#### **4. Air Pollution**

341. Air pollution from vehicle operation, especially heavy diesel powered vehicles will increase. The project will pave roads reducing dust which will have a major immediate beneficial impact on those people living alongside the road. Road 314D will be improved by filling in of old roadside narrow rectangular borrow pits which are a source of vector breeding. Provision of a concrete road on 150B at the approach to Taches market will reduce airborne dust and improve muddy conditions during rain and flooding.

#### **5. Religious Edifices**

342. There are no religious artefacts located near the roads. Graves will be avoided.

#### **6. Road Accidents**

343. Control of speeding and overloaded vehicles is the responsibility of the police. A community based road safety program will be implemented.

#### **7. Toxic Spills**

Control of vehicles carrying hazardous materials is the responsibility of the police. Vehicles in Cambodia do carry HAZCHEM warning signs. To date there do not appear to have been any major accidental spills.

## 8. Illegal Settlement

344. MPWT will discourage illegal dwellings, encroachments and squatters within the RoW.

## 9. Loss of Forests

345. While the Project will improve access to PAWS protected area it is not expected to increase any forest loss beyond that taking place at the moment. The Departments of Agriculture, Forestry and Fisheries are active in controlling illegal logging and impound vehicles if caught involved in such activities.

## 10. Loss of Roadside Trees

### a. Policy

346. All standing annual crops will be allowed to be harvested before the start of civil works in a particular section of the Project roads. This can be achieved with the synchronization of the start of civil works and the cropping schedule of DPs cultivating plots of land in the ROW. This is shown below.

Crops and trees	Loss of, or damage to, assets	Owners regardless of tenure status	<ul style="list-style-type: none"> <li>• DPs to be <b>notified at least 3 months in advance</b> of the start of civil works in the locality.</li> <li>• To the extent possible, DPs will be <b>allowed to harvest</b> their annual and perennial crops prior to construction.</li> <li>• Perennial and timber trees will be compensated in cash as per replacement cost study.</li> </ul>
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Table VI-4 Policy on Crops and Trees Removal

### b. PR 314D, CBF, and NR13

#### i. Affected crops and trees

347. All standing annual crops will be allowed to be harvested before the start of civil works in a particular section of the Project road. This can be achieved with the synchronization of the start of civil works and the cropping schedule of DPs cultivating plots of land in the ROW.

348. **PR314D:** A total of 584 perennials of various species and age will be cleared from the COI in PR314D. These trees are not commercially grown but sporadically planted inside the ROW. Of this number, 82 are not yet bearing fruits. In addition, some 1,650 of timber trees of commercial value will also be cleared from the COI.

Table VI-5 Quantities of Affected Perennials PR314D

Type of Perennial	Categories			Total
	1*	2	3	
Mango	14	124	10	148
Jackfruit	12	25	3	40
Teuk Doh Kor	2	14	0	16
Coconut	2	18	0	20

Betel nut	1	5	5	11
Palm tree	3	145	31	179
Kampungreah	9	0	6	15
Guava	4	0	17	21
Papaya	2	2	3	7
Tamarind	1	3	11	15
Cashew	0	4	2	6
Others	32	36	38	106
Total	82	376	126	584

\*Not yet bearing fruits

Table VI-6 Quantities of Affected Timber Trees PR314D

Type of Timber Trees	Categories			Total
	1	2	3	
Pine tree	0	10	0	10
Chankiry	0	0	30	30
Bamboo	8	100	270	378
Cassia	10	246	612	868
Eucalyptus	0	1	44	45
Chhat	0	1	4	5
Flamboyant tree	0	1	13	14
Loeung Reach	0	0	3	3
Rubber tree	0	1	0	1
Smach	0	0	148	148
Other trees	0	13	135	148
Total	18	373	1,259	1,650

349. **CBF**: A total of 583 timber trees and 15 fruit trees on private and government land will be acquire in the expansion and development of the CBF.

Table VI-7 Quantities of Affected Fruit and Timber Trees CBF

Type of Trees	Categories			Total
	1	2	3	
Coconut	0	3	0	3
Palm	0	5	7	12
Shade tree (Chankiri)	0	0	9	9
Acacia	344	230	0	574

350. **NR13**: A total of 966 perennials of various species and age will be cleared from the COI in NR13. These trees are not commercially grown but sporadically planted inside the ROW. Of this number, 195 are not yet bearing fruits. In addition, some 8,940 of timber trees of commercial value will also be cleared from the COI.

Table VI-8 Quantities of Affected Perennials NR13

Type of Perennial	Categories			Total
	1*	2	3	
Mango	86	333	29	448
Coconut	21	12	2	35
Betel nut	8	0	6	14
Tamarind	1	8	0	9
Jackfruit	18	30	3	51
Palm tree	13	85	1	99
Teuk Doh Kor	0	4	0	4
Papaya	2	15	0	17
Guava	9	4	19	32
Cashew	37	8	0	45

Type of Perennial	Categories			Total
	1*	2	3	
Other tree	0	163	49	212
<b>Total</b>	<b>195</b>	<b>662</b>	<b>109</b>	<b>966</b>

\*Not yet bearing fruits

Table VI-9 Quantities of Affected Timber Trees NR13

Type of Timber Trees	Categories			Total
	1	2	3	
Pine Tree	2	0	0	2
Chankiry	38	0	1	39
Bamboo	3,188	1	8	3,197
Cassia	5,140	15	0	5,155
Eucalyptus	39	2	21	62
Chhat	0	18	2	20
Flamboya	0	9	0	9
Loeungreach	0	4	0	4
Other tree	0	452	0	452
<b>Total</b>	<b>8,407</b>	<b>501</b>	<b>32</b>	<b>8,940</b>

Compensation for removed trees is shown below.

Table VI-10 Compensation for Perennials PR314D

Type of Perennial	Unit Rate (\$)	Categories					
		1* Count	Amount	2 Count	Amount	3 Count	Amount
Mango	55.84	14	781.76	124	6,924.16	10	558.4
Jackfruit	49.71	12	596.52	25	1,242.75	3	149.13
Teuk Doh Kor	31.25	2	62.5	14	437.5	0	0
Coconut	46.41	2	92.82	18	835.38	0	0
Betel nut	17.5	1	17.51	5	87.55	5	87.55
Palm tree	51.5	3	154.5	145	7,467.5	31	1,596.5
Kampingreah	17.0	9	153.0	0	0	6	102.0
Guava	7.18	4	28.72	0	0	17	122.06
Papaya	5.33	2	10.66	2	10.66	3	15.99
Tamarind	39.17	1	39.17	3	117.51	11	430.87
Cashew	18.84	0	0	4	75.36	2	37.68
Others	15.0	32	480.0	36	540.0	38	570
<b>Total</b>		<b>82</b>	<b>2,417.16</b>	<b>376</b>	<b>17,738.37</b>	<b>126</b>	<b>3,670.18</b>

\*Not yet bearing fruits

Table VI-11 Compensation for Timber Trees PR314D

Type of Timber Trees	Unit Rate (\$)	Categories					
		1 Count	Amount	2 Count	Amount	3 Count	Amount
Pine tree	12.0	0	0	10	120.0	0	0
Chankiry	12.33	0	0	0	0	30	369.9
Bamboo	0.96	8	7.68	100	96.0	270	259.2
Acacia	6.50	10	65.0	246	1,599.0	612	3,978.0
Eucalyptus	6.50	0	0	1	6.5	44	286.0
Chhat	4.0	0	0	1	4.0	4	16.0
Flamboyant tree	7.5	0	0	1	7.5	13	97.5
Loeung Reach	5.0	0	0	0	5.0	3	15.0
Rubber tree	15.0	0	0	1	15.0	0	0
Smach	6.0	0	0	0	0	148	888.0
Other trees	15.0	0	0	13	195.0	135	2,025.0
<b>Total</b>		<b>18</b>	<b>72.68</b>	<b>373</b>	<b>2,048</b>	<b>1,259</b>	<b>7,934.6</b>

Table VI-12 Compensation for Assorted Trees CBF

Type of Trees	Unit Rate (\$)	Categories					
		1 Count	Amount	2 Count	Amount	3 Count	Amount
Coconut	46.41	0	0	3	139.23	0	0
Palm	51.5	0	0	5	257.5	7	360.5
Shade tree (Chankiri)	12.33	0	0	0	0	9	110.97
Acacia	6.50	344	2,236.0	230	1,495.0	0	0

<b>Total</b>	<b>344</b>	<b>2,236</b>	<b>238</b>	<b>1,891.73</b>	<b>16</b>	<b>471.47</b>
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Table VI-13 Compensation for Perennials NR13

Type of Perennial	Unit Rate (\$)	Categories					
		1* Count	Amount	2 Count	Amount	3 Count	Amount
Mango	55.84	86	4,802.24	333	18,594.72	29	1,619.36
Coconut	46.41	21	974.61	12	556.92	2	92.82
Betel nut	17.5	8	140.0	0	0	6	105.0
Tamarind	39.17	1	39.17	8	313.36	0	0
Jackfruit	49.71	18	894.78	30	1,491.3	3	149.13
Palm tree	51.5	13	669.5	85	4,377.5	1	51.5
Teuk Doh Kor	31.25	0	0	4	125.0	0	0
Papaya	5.33	2	10.66	15	79.95	0	0
Guava	7.18	9	64.62	4	28.72	19	136.42
Cashew	18.84	37	697.08	8	150.72	0	0
Other tree	15.0	0	0	163	2,445.0	49	735.0
<b>Total</b>		<b>195</b>	<b>8,292.66</b>	<b>662</b>	<b>28,163.19</b>	<b>109</b>	<b>2,889.23</b>

\*Not yet bearing fruits

Table VI-14 Compensation for Timber Trees NR13

Type of Timber Trees	Unit Rate (\$)	Categories					
		1 Count	Amount	2 Count	Amount	3 Count	Amount
Pine Tree	12.0	2	24.0	0	0	0	0
Chankiry	12.33	38	468.54	0	0	1	12.33
Bamboo	0.96	3,188	3,060.48	1	.96	8	7.68
Acacia	6.50	5,140	33,410.0	15	97.5	0	0
Eucalyptus	6.50	39	253.5	2	13.0	21	136.5
Chhat	4.0	0	4	18	72.0	2	8.0
Flamboyant tree	7.5	0	0	9	67.5	0	0
Loeungreach	5.0	0	0	4	20.0	0	0
Other tree	15.0	0	0	452	6,780.0	0	0
<b>Total</b>		<b>8,407</b>	<b>37,220.52</b>	<b>501</b>	<b>7,050.96</b>	<b>32</b>	<b>164.51</b>

Table VI-15 Summary of Impacts PR 314D and NR13

Items	Unit	Quantity		
		PR314D*	CBF+	NR13*
<b>Perennial trees</b>	<b>no.</b>	<b>584</b>	<b>15</b>	<b>966</b>
Not yet bearing fruit	No.	82	0	195
Fruit bearing class A	No.	208	0	513
Fruit bearing class B	No.	168	8	149
Fruit bearing class C	No.	46	7	60
Fruit bearing class D	No.	80	0	49
<b>Timber trees</b>	<b>no.</b>	<b>1,650</b>	<b>583</b>	<b>8,940</b>
Class A	No.	18	344	8,407
Class B	No.	373	230	501
Class C	No.	1,098	0	26

351. The replacement cost of 584 perennials in PR314D is estimated to be \$23,825.71, while the 1,650 timber trees in said section are estimated to be \$10,055.28. At the CBF, the replacement cost of 598 perennials and timbers trees thereat is estimated to be \$4,599.2. In NR13, the replacement cost of 966 perennials is estimated to be \$39,345.08, while the 8,940 timber trees in said section are estimated to be \$44,435.99.

352. The estimated cost of resettlement for the rehabilitation of PR314D, CBF, NR13 is **US\$1,676,977.00** Table VI-30 provides a breakdown of these costs. As can be seen from the summary of resettlement costs replacement costs for trees along PR314D, CBF, NR13 represents 7.3% of total resettlement costs.

**c. PR150B, NR53, and PR151B**

**i. Affected crops and trees**

353. **PR150B:** A total of 2,278 perennials of various species and age will be cleared from the COI in PR150B. These trees are not commercially grown but sporadically planted inside the ROW. Of this number, 224 are not yet bearing fruits. In addition, some 1,912 timber trees of commercial value will also be cleared from the COI.

Table VI-16 Quantities of Affected Perennials PR150B

Type of Perennial	Categories			Total
	1*	2	3	
Mango	45	172	35	252
Jackfruit	9	18	5	32
Teuk Doh Kor	10	38	15	63
Coconut	46	295	29	370
Betel nut	0	5	0	5
Palm tree	30	397	4	431
Guava	1	31	6	38
Papaya	1	4	3	8
Tamarind	4	27	1	32
Cashew	48	848	0	896
Lemon	1	3	0	4
Longan	1	1	3	5
Custard Apple	4	58	31	93
Others	24	21	4	49
<b>Total</b>	<b>224</b>	<b>1,918</b>	<b>136</b>	<b>2,278</b>

\*Not yet bearing fruits

Category 1 (1-3 years), Category 2 (4-5 years) and Category 3 (5-10 years)

Table VI-17 Quantities of Affected Timber Trees PR150B

Type of Timber Trees	Categories			Total
	1	2	3	
Chankiry	0	7	1	8
Bamboo	3	106	13	122
Cassia	17	1,131	20	1,168
Eucalyptus	15	139	19	173
Other trees	1	412	28	441
<b>Total</b>	<b>36</b>	<b>1,795</b>	<b>81</b>	<b>1,912</b>

Category 1 (1-3 years), Category 2 (4-5 years) and Category 3 (5-10 years)

354. **NR53:** A total of 637 perennials of various species and age will be cleared from the COI in NR53. These trees are not commercially grown but sporadically planted inside the ROW. Of this number, 28 are not yet bearing fruits. In addition, some 687 timber trees of commercial value will also be cleared from the COI.

Table VI-18 Quantities of Affected Perennials NR53

Type of Perennial	Categories			Total
	1*	2	3	
Mango	2	33	4	39
Jackfruit	1	7	1	9
Teuk Doh Kor	1	5	0	6
Coconut	3	24	0	27
Palm tree	0	121	1	122
Guava	0	22	0	22
Tamarind	0	63	2	65
Cashew	21	57	2	80
Custard Apple	0	5	4	9
Others	0	207	51	258
<b>Total</b>	<b>28</b>	<b>544</b>	<b>65</b>	<b>637</b>

\*Not yet bearing fruits

Category 1 (1-3 years), Category 2 (4-5 years) and Category 3 (5-10 years)

Table VI-19 Quantities of Affected Timber Trees NR53

Type of Timber Trees	Categories			Total
	1	2	3	
Chankiry	0	5	4	9
Bamboo	0	16	0	16
Cassia	9	519	5	533
Eucalyptus	3	23	0	26
Loeung Reach	0	3	0	3
Others	0	96	4	100
<b>Total</b>	<b>12</b>	<b>662</b>	<b>13</b>	<b>687</b>

Category 1 (1-3 years), Category 2 ( 4-5 years) and Category 3 (5-10 years)

355. **PR151B:** A total of 95 perennials of various species and age will be cleared from the COI in PR151B. These trees are not commercially grown but sporadically planted inside the ROW. Of this number, 44 are not yet bearing fruits. In addition, 13 timber trees of commercial value will also be cleared from the COI.

Table VI-20 Quantities of Affected Perennials PR151B

Type of Perennial	Categories			Total
	1*	2	3	
Mango	31	5	5	41
Jackfruit	1	0	0	1
Teuk Doh Kor	2	2	0	4
Coconut	7	10	3	20
Palm tree	2	9	0	11
Guava	0	4	2	6
Tamarind	0	5	0	5
Lemon	0	1	0	1
Custard Apple	1	1	2	4
Others	0	2	0	2
<b>Total</b>	<b>44</b>	<b>39</b>	<b>12</b>	<b>95</b>

\*Not yet bearing fruits

Category 1 (1-3 years), Category 2 ( 4-5 years) and Category 3 (5-10 years)

Table VI-21 Quantities of Affected Timber Trees PR151B

Type of Timber Trees	Categories			Total
	1	2	3	
Chhat	3	0	10	13
<b>Total</b>	<b>3</b>	<b>0</b>	<b>10</b>	<b>13</b>

Category 1 (1-3 years), Category 2 ( 4-5 years) and Category 3 (5-10 years)

Compensation for removed trees is shown below.

Table VI-22 Compensation for Perennials PR150B

Type of Perennial	Full Unit Rate (\$)	Categories					
		1* Count	Amount	2 Count	Amount	3 Count	Amount
Mango	48.81	45	732.15	172	5,596.88	35	1,708.35
Jackfruit	42.5	9	127.5	18	510	5	212.5
Teuk Doh Kor	31.25	10	104.17	38	791.67	15	468.75
Coconut	44.37	46	680.34	295	8,726.1	29	1,286.73
Betel nut	17.5	0	0	5	58.33	0	0
Sugar palm tree	46.75	30	467.5	397	12,373.17	4	187
Guava	7.75	1	2.58	31	160.17	6	46.5
Papaya	5.0	1	1.67	4	13.33	3	15
Tamarind	38.33	4	51.11	27	689.94	1	38.33
Cashew	21.75	48	348	848	12,296	0	0
Lemon	36.66	1	12.22	3	73.32	0	0
Longan	30	1	10	1	20	3	90
Custard Apple	13.58	4	18.11	58	525.09	31	420.98
Others	15.00	24	120	21	210	4	60



<b>Total</b>	<b>224</b>	<b>2,675.35</b>	<b>1,918</b>	<b>42,044</b>	<b>136</b>	<b>4,534.14</b>
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\*Not yet bearing fruits (1/3 of full unit rate); Cat 2 = 2/3 of full unit rate; Cat 3 = full unit rate

**Table VI-23 Compensation for Timber Trees PR150B**

Type of Timber Trees	Full Unit Rate (\$)	Categories*					
		1 Count	Amount	2 Count	Amount	3 Count	Amount
Chankiry (Ampil Teuk)	12.6	0	0	7	58.8	1	12.6
Bamboo	0.3	3	.3	106	21.2	13	3.90
Cassia	6.25	17	35.42	1,131	4,712.5	20	125
Eucalyptus	6.25	15	31.25	139	579.17	19	118.75
Others	15	1	5	412	4,120	28	420
<b>Total</b>		<b>36</b>	<b>71.97</b>	<b>1,795</b>	<b>9,491.67</b>	<b>81</b>	<b>680.25</b>

\*Cat 1 = 1/3 of full unit rate; Cat 2 = 2/3 of full unit rate; Cat 3 = full unit rate

**Table VI-24 Compensation for Perennials NR53**

Type of Trees	Full Unit Rate (\$)	Categories					
		1* Count	Amount	2 Count	Amount	3 Count	Amount
Mango	48.81	2	32.54	33	1,073.82	4	195.24
Jackfruit	42.5	1	14.17	7	198.33	1	42.5
Teuk Doh Kor	31.25	1	10.42	5	104.17	0	0
Coconut	44.37	3	44.37	24	709.92	0	0
Palm tree	46.75	0	0	121	3,771.17	1	46.75
Guava	7.75	0	0	22	113.67	0	0
Tamarind	38.33	0	0	63	1,609.86	2	76.66
Cashew	21.75	21	152.25	57	826.5	2	43.5
Custard Apple	13.58	0	0	5	45.27	4	54.32
Others	15	0	0	207	2,070	51	765
<b>Total</b>		<b>28</b>	<b>253.75</b>	<b>544</b>	<b>10,522.71</b>	<b>65</b>	<b>1,223.97</b>

\*\*Not yet bearing fruits (1/3 of full unit rate); Cat 2 = 2/3 of full unit rate; Cat 3 = full unit rate

**Table VI-25 Compensation for Timber Trees NR53**

Type of Perennial	Full Unit Rate (\$)	Categories*					
		1* Count	Amount	2 Count	Amount	3 Count	Amount
Chankiry	12.6	0	0	5	42	4	50.4
Bamboo	0.3	0	0	16	3.2	0	0
Cassia	6.25	9	18.75	519	2,162.5	5	31.25
Eucalyptus	6.25	3	6.25	23	95.83	0	0
Loeung Reach	5	0	0	3	10	0	0
Others	15	0	0	96	96	4	60
<b>Total</b>		<b>12</b>	<b>25</b>	<b>662</b>	<b>2,409.53</b>	<b>13</b>	<b>141.65</b>

\*Cat 1 = 1/3 of full unit rate; Cat 2 = 2/3 of full unit rate; Cat 3 = full unit rate

**Table VI-26 Compensation for Perennials PR151B**

Type of Trees	Full Unit Rate (\$)	Categories					
		1* Count	Amount	2 Count	Amount	3 Count	Amount
Mango	48.81	31	504.37	5	162.7	5	244.05
Jackfruit	42.50	1	14.17	0	0	0	0
Teuk Doh Kor	31.25	2	20.83	2	41.67	0	0
Coconut	44.37	7	103.53	10	295.8	3	133.11
Palm tree	46.75	2	31.17	9	280.5	0	0
Guava	7.75	0	0	4	20.67	2	15.5
Tamarind	38.33	0	0	5	127.77	0	0
Lemon	36.66	0	0	1	24.44	0	0
Custard Apple	13.58	1	4.53	1	9.05	2	27.16
Others	15	0	0	2	10	0	0
<b>Total</b>		<b>44</b>	<b>678.6</b>	<b>39</b>	<b>972.6</b>	<b>12</b>	<b>419.82</b>

\*Not yet bearing fruits (1/3 of full unit rate); Cat 2 = 2/3 of full unit rate; Cat 3 = full unit rate

Table VI-27 Compensation for Timber Trees PR151B

Type of Timber Trees	Full Unit Rate (\$)	Categories*					
		1 Count	Amount	2 Count	Amount	3 Count	Amount
Chhat	5	3	5	0	0	10	50
<b>Total</b>		<b>3</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>50</b>

\*Cat 1 = 1/3 of full unit rate; Cat 2 = 2/3 of full unit rate; Cat 3 = full unit rate

Table VI-28 Summary of Tree Removal

Items	Unit	Quantity		
		PR150B	NR53	PR151B
<b>Perennial trees</b>	<b>no.</b>	<b>2,278</b>	<b>637</b>	<b>95</b>
Not yet bearing fruit	No.	224	28	44
Fruit bearing class A	No.	1,918	544	39
Fruit bearing class B	No.	136	65	12
<b>Timber trees</b>	<b>no.</b>	<b>1,912</b>	<b>687</b>	<b>13</b>
Class A	No.	36	12	3
Class B	No.	1,795	662	0
Class C	No.	81	13	10

356. The replacement cost of 2,278 perennials in PR150B is estimated to be \$49,253.49, while the 1,912 timber trees in said section are estimated to cost \$10,243.87. In NR53, the replacement cost of 637 perennials is estimated to be \$12,000.43, while the 687 timber trees in said section are estimated to cost \$2,576.18. The 95 perennials in PR151B are estimated to cost \$2,071.02, while the 13 timber trees in said section are estimated to cost \$55.

357. The estimated cost of resettlement for the rehabilitation of PR150B, NR53 and PR151B **US\$773,779.12** Table VI-31 provides a breakdown of these costs. As can be seen from the summary of resettlement costs replacement costs for trees along PR150B, NR53, and PR151B represents 10% of total resettlement costs.

#### 11. Loss of Wildlife

358. There are no wildlife-protected areas within the immediate project area and there are considerable numbers of rangers deployed to protect wildlife.

#### 12. Positive Operational Impacts - Social Enhancement

359. The project will have several positive benefits which will enhance the quality of life and living standards of the local population. No mitigation is required but efforts must be made to maximize these benefits.

#### 13. Consultations and Liaison

360. The contractors must maintain contact on a working level with the local authorities :

- Provincial DoE
- Provincial DoCF
- Provincial DoAFF

In addition liaison with community heads, local village representatives, individual landowners and utility companies must be maintained.

### K. Climate Change

#### 1. Adaptation Strategy

361. In Cambodia, there appears to be an overall increase in average total annual rainfall and, this increase is poorly distributed over seasons, resulting in increased floods during the rainy season as well as increased drought incidence during the dry season.

362. Some of the ways in which climate change can impact on road infrastructure is damage due to land-slides and mud-slides, increased moisture in the subsurface causing failure to the structure, increased erosion to unpaved shoulders from rapid water runoff, increased winds erosion of unpaved roads, and penetration of rainwater through poor surface treatment. Increased wind and reduced moisture on unpaved roads can increase dust levels and reduce visibility. These issues are of concern to the infrastructure itself as well as pose a safety issues for drivers and other road and roadside users.

363. Flooding and soil moisture content is a primary concern for protecting investments in road works and will be addressed as a priority in the adaptation strategy of this project. There is no evidence of major landslides damaging the road in what is a relatively flat topography. However, ditches alongside the road, created when materials are extracted for construction of the embankments, are increasingly eroded and cause safety problems to people, livestock and infrastructure.

364. The proposed project roads experience regular flooding both from surface runoff during the rainy season and stream overflows each year in the rainy season. The most recent high intensity event were the 2000/2001 floods. Experts recollect this to have been the only major flood in the last 60 years in the project area (other parts of the country were affected by typhoon Ketsana in 2009). With high likelihood of increasing intensity of rainfalls causing stronger floods than usual, the roads need to be strengthened structurally to withstand intensified climate events.

365. The proposed adaptation strategy therefore includes a combination of engineering, non-engineering and planning activities to manage the changes observed and predicted in the project area. The engineering changes have been mainstreamed in the project design itself for mainstreaming adaptation into core development planning activities. These include elevation of the road in areas where major flooding is becoming increasingly common and changing the selection of sub-grade materials to withstand higher moisture contents.

Table VI-29 Treatment of Adaptation to Climate Change and Notional Budget

	Notes	Budget from PPCR (TBC)
<b>Output 1.</b> Project road and CBF rehabilitated	Civil engineering adjustments are made to make roads more climate resilient under current and future conditions	USD 12M
<b>Output 4.</b> Reduced vulnerability of project road area to climate change	"Non"-civil works	USD 5.5M
Policy and Planning (300,000)		
4.1 MPWT completes and uses the detailed vulnerability map for climate change for project provinces: by 2016.	Coordinate with NDF activities with MRD	150,000
4.2 Review the sustainability and capacity of MPWT current engineering designs, standards and guidelines to withstand climate change and propose amendments	Coordinate with NDF activities with MRD	50,000
4.3 Design and implement a training program for MPWT SEO, in coordination with NDF-MRD activities being planned	Coordinate with NDF activities with MRD, little additional budget required	100,000
Ecosystem-based measures (3,000,000)		
4.4 MPWT completes a green infrastructure planning strategy to reduce vulnerability to climate change by 2016		200,000
4.5 2 temporary nurseries are constructed and produce locally available species for land-cover extension affecting project area		300,000
4.4 Planting program engaging communities and women is implemented to reduce flooding and water from damaging roads and surrounding areas		1,000,000
4.5 Completion and piloting of a plan for water capture and storage systems integrated in road construction features for the project province by 2016		1,500,000
Others TBC		
Emergency Management Systems (1,550,000)		
4.3 MPWT completes a pilot climate monitoring system-based road maintenance and management program: by 2016	Review of road maintenance and management system and budget to anticipate changes to needs due to the impacts of climate change  MPWT can also integrate disaster risk management and reduction in its planning.	50,000
4.4 MPWT establishes a pilot emergency management system in selected project area and operates it: by 2016 /4.5 MPWT installs the pilot early warning system the project province (of 4.4): by 2016	Coordination with gendarmerie, the National Disaster Management Committee and the Department of Meteorology	1,500,000

## 2. Impacts of Water Capture Projects

366. All the water capture projects are rehabilitation and repair of existing structures. The planned works will simply return them to their original state or improve them. No additional impacts on the environment will be generated by these works.

367. In view of the absence of impacts no major mitigation measures are required.

## L. Land Acquisition and Resettlement

## **1. PR314D and NR13**

368. The major impacts caused by the project in the rehabilitation of PR314D and NR13 include demolition of structures used for residence and business, and acquisition of occupied land in the road right-of-way (ROW). According to the inventory of losses (IOL) conducted on 20 May 2011 – 2 June 2011, around 697 households (215 in PR 314D and 482 in NR13) in 20 communes (7 PR314D and 11 in NR13) are affected by the loss of fixed assets and sources of incomes or livelihoods.<sup>1</sup> 45 households in PR314D and 108 households in NR13 are affected by impacts on their homes and house-and-shops, of which 20 households in PR314D and 26 households in NR13 will lose entirely their homes and house-and-shops and will need to reconstruct behind the construction corridor.

369. Moreover, 62 households in PR314D and 114 households in NR13 are affected by impacts on their independent shops (i.e., detached from other buildings), of which 45 households in PR314D and 57 households will have to relocate their business behind the construction corridor. In PR314D, some 27,936 m<sup>2</sup> of land in the ROW are used or occupied by private households (12,004 m<sup>2</sup> for agriculture and 15,932 m<sup>2</sup> for residence and business), while in NR13, around 47,398.3 m<sup>2</sup> of land in the ROW are used or occupied by private households (44,681 m<sup>2</sup> for agriculture and 2,717 m<sup>2</sup> for residence and business).

370. Other fixed structures affected include fences, concrete pavements, extended eaves, pipe culverts and sign boards. In addition, 96 electric and telecommunication posts (75 in PR314D and 21 in NR13) need to be relocated behind the COI. Around 12,140 perennials and timber trees (2,234 in PR314D and 9,906 in NR13) need to be removed from the COI.

371. In the expansion of the CBF at Prey Var, an aggregate of 24,945.12 m<sup>2</sup> of private land will be acquired, in addition to 2 houses and 1 store with a combined floor area of 90 m<sup>2</sup>. Some 15 perennial and 583 timber trees owned by these private individuals will likewise be acquired. Two absentee (i.e., living abroad or in Phnom Penh) and one landed local farmer own the affected plots of land. Two other households have built structures on the land of two of the landowners to oversee the properties. The existing CBF facilities are standing on a 10,982 m<sup>2</sup> government land.

## **2. PR150B, NR53, and PR151B**

372. The major impacts caused by the Project in the rehabilitation of PR150B, NR53, and PR151B include demolition of structures used for residence and business, and acquisition of occupied land in the road right-of-way (ROW). According to the inventory of losses (IOL) conducted on 6 – 21 June 2011, a total of 39 houses, 34 house-and-stores, and 89 shops in PR150B; 17 houses, and 43 shops in NR53; and 2 houses and 10 shops in PR151B are adversely affected by the rehabilitation of the Project roads; 38 houses and house-and-stores in PR150B; 12 houses in NR 53; and 1 house in PR151B are entirely affected and must shift behind the corridor of impact.

373. Moreover, 67 independent shops in PR150B, 29 shops in NR53, and 3 shops in PR151B are entirely affected. Some 150,290.5 m<sup>2</sup> of ROW land in PR150B are used or occupied by private households for farming, for residence and business; while 18,228.5 m<sup>2</sup> of ROW land is occupied by private persons in NR53; and 2,485 m<sup>2</sup> in PR151B.

374. Other fixed structures affected include fences, concrete pavements, extended eaves, pipe culverts and sign boards. In addition, 41 electric and telecommunication posts (39 in

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<sup>1</sup> This number excludes the 14 houses and shops in PR314D and the 44 houses and shops in NR13 whose owners could not be determined at the time of the IOL because said structures were unattended or locked.

PR150B and 2 in PR151B) need to be relocated behind the COI. Around 3,010 of perennials and 2,612 timber trees need to be removed from the COI of the Project roads.

### 3. Measures to Minimize Impacts and Resettlement

375. In order to avoid or minimize displacement of people from assets and livelihoods, the existing road alignment will be followed and construction works will be confined within a corridor of impact (COI) of 10 meters measured either way from the road centerline. In addition, as part of the Project's resettlement strategy, project displaced persons (DPs) will be provided sufficient time to rebuild their homes and shops prior to the commencement of civil works and that they are able to continue with their present livelihood activities even during Project implementation. Also, all standing annual crops, including privately-owned trees, will be allowed to be harvested before the start of civil works in a particular section of the Project roads. The MPWT, through its Project Management Unit 3 (PMU3) and the Inter-ministerial Resettlement Committee (IRC), through the Resettlement Department at the Ministry of Finance (RD-MEF), will ensure that this resettlement strategy is followed diligently.

### 4. Resettlement and Compensation Costs

376. The project will acquire approximately 24.4ha of land within the existing right of way (ROW) of various roads and 2.5ha of privately owned land at the site of the Prey Vor cross border facility (CBF). Land acquisition will cause temporary and permanent displacement of an estimated 936 households. Of the 566 households experiencing impacts on structures (houses and/or shops) most will be partially affected and will be able to remain on remaining unaffected land. There will 4 households that are expected to require relocation in Akphi Vot commune in Tuek Phos district. The other affected households are expected to lose use of productive land within the right of way only and/or secondary structures or trees/crops.

377. The total costs of resettlement for provincial roads 314D and 13 is US\$1,676,977. The total costs of resettlement for PR150B, NR 53, and PR151B is estimated at US\$773,779.12.

Table VI-30 Summary of Resettlement Costs (PR314D, CBF, NR13)

Items	Unit	Quantity	Rate (\$/Unit)	AMOUNT (US\$)
<b>LAND</b>				<b>103,113.74</b>
Cultivated ROW land (loss of land use)	m <sup>2</sup>	55,685.3	0.75	103,113.74
Private residential land (CBF)	m <sup>2</sup>	2,250.6	11.80	26,557.08
Private agriculture/grazing land (CBF)	m <sup>2</sup>	57,935.9	1.5	232,784.56
<b>MAIN STRUCTURES</b>				<b>108,918.21</b>
Partially affected houses and independent shops	m <sup>2</sup>	2,162.9	varied	50,018.26
Repair cost of partially affected main structures	\$	50,018.26	20%	10,003.65
Entirely affected houses and independent shops	m <sup>2</sup>	3,846.80	varied	48,896.30
<b>SECONDARY STRUCTURES</b>				<b>487,304.41</b>
Extended eaves	m <sup>2</sup>	10,011.90	varied	352,481.47
Fence	LM	35,152.80	varied	59,754.95
Shed	m <sup>2</sup>	240.0	varied	3,996.20
Assorted other structures	-	-	varied	71,071.79
<b>TREES (Perennials and timber)</b>	No	12,738	9.60	<b>122,261.26</b>
<b>Sub-Total 1</b>				<b>821,597.62</b>
<b>ALLOWANCES AND OTHER ENTITLEMENTS</b>				
Moving allowance for relocating house and shops	no.	151	\$50	7,550.0
Moving allowance for 6 relocating house/shop renters	no.	6	\$50	300.0
Living allowance for relocating house	no.	48		5,400.0

Items	Unit	Quantity	Rate (\$/Unit)	AMOUNT (US\$)
Living allowance for relocating independent shops	no.	103		3,862.5
Income loss allowance for relocating shop, house/shop	no.	106	\$50	5,300.0
Rental allowance for relocating renters of house/store	2 mo	6	\$25	300.0
Living allowance for vulnerable Ahs	3 mo	385	100 kg	43,312.
Income restoration program (IRP) block fund			lump sum	322,800
Hiring of IRP specialists/consultants		322,800	20%	64,560.0
<b>Sub-Total 2</b>				<b>453,385.0</b>
External Monitoring/Evaluation			Lump sum	15,000.00
<b>TOTAL DIRECT COSTS</b>				<b>1,289,982.62</b>
Administrative Cost (15%)				<b>193,497.39</b>
Costs contingencies (15%)				<b>193,497.39</b>
<b>GRAND TOTAL (rounded)</b>				<b>1,676,977.0</b>

Table VI-31 Summary of Resettlement Costs (PR150B, NR53, and PR151B)

Items	Unit	Quantity	Rate (\$/Unit)	AMOUNT (US\$)
<b>LAND</b>				<b>45,175.5</b>
Cultivated ROW land (loss of land use)	m²	60,234	0.75	45,175.5
<b>MAIN STRUCTURES</b>				<b>121,774.48</b>
Partially affected houses and independent shops	m²	1,146	varied	45,618.06
Repair cost of partially affected main structures	\$	45,618.06	20%	9,123.61
Entirely affected houses and independent shops	m²	3,740	varied	67,032.81
<b>SECONDARY STRUCTURES</b>				<b>111,989.73</b>
Extended eaves	m²	1,630	varied	26,219.76
Fence	LM	12,527	varied	41,153.54
Assorted other structures	-		varied	44,616.43
<b>TREES (Perennials and timber)</b>	No	5,622	varied	<b>76,200.</b>
<b>Sub-Total 1</b>				<b>355,139.70</b>
<b>ALLOWANCES AND OTHER ENTITLEMENTS</b>				
Moving allowance for relocating houses and shops	no.	150	\$50	7,500
Moving allowance for 1relocating shop renter	no.	1	\$50	50
Living allowance for relocating house and house-and-store	no.	51	\$112.5	5,737.5
Living allowance for relocating independent shops	no.	99	\$37.5	3,712.5
Income loss allowance for relocating shop, house/shop	no.	115	\$50	5,750
Rental allowance for relocating renters of shop	2 mo	1	\$25	50
Living allowance for vulnerable Ahs	No	134	\$112.5	15,075
Income restoration program (IRP) block fund		260	\$600	156,000
Hiring of IRP specialists/consultants		156,000	20%	31,200
<b>Sub-Total 2</b>				<b>225,075</b>
External Monitoring/Evaluation			Lump sum	15,000.00
<b>TOTAL DIRECT COSTS</b>				<b>595,214.70</b>
Administrative Cost (15%)				<b>89,282.21</b>
Costs contingencies (15%)				<b>89,282.21</b>
<b>GRAND TOTAL (rounded)</b>				<b>773,779.12</b>

## M. Social and Labor Impacts

378. Bidding documents and civil works contracts will require implementation of appropriate labor standards and basic occupational/health and safety measures. Civil works contracts will also require unskilled men and women to be given priority for employment using LBES, and that no child labor nor trafficked individuals be hired for the construction or maintenance works.

379. Monitoring tools with sex-disaggregated data will be developed and used for monitoring project impacts (social benefits, employment and other economic opportunities, cases of HIV/AIDS/STDs, human trafficking, etc.). These indicators will be included in the baseline survey with sex-disaggregated and will be used for project impact monitoring. Actual inspection and meeting/consultation with the laborers will be done at the project sites during road construction and maintenance. Other monitoring tools will be designed. Monthly and quarterly progress reports will also be prepared, in addition to the mid-term and final reports. The local communities (CC/VDC) and the commune/district women and children's consultative committee) will be trained and encouraged them to participate in monitoring and evaluation activities during and after project implementation.

## **N. Poverty Impacts**

380. The project has 5 outputs: (1) civil works/road rehabilitation and construction of a cross border facility at Prey Vor –Mocva; (2) improved road asset management; (3) increased road safety (RS) and safeguards by implementing: a) a community-based RS awareness program in line with the national program; b) an HIV-AIDS and human trafficking prevention program; and c) a sex-disaggregated baseline socio-economic survey of beneficiaries; (4) climate change adaptation to assess vulnerability to climate; develop emergency management planning; and (5) efficient project management support to MPWT. During the road construction, unskilled men and women will be given job opportunities using labor-based equipment support (LBES). Around 30% of women will be hired during the construction and 30% during road maintenance and in climate change adaptation and other community-based climate change activities. A labor and gender action plan (LGAP) was prepared to serve as guide to ensure gender mainstreaming before and during project implementation.

## **O. Gender Issues**

381. The project will have significant positive impacts to women particularly female-headed households. Majority of the houses are located more than 3km away from urban centers, where hospitals, markets, banks and agencies are located. Lack of access to basic health facilities affects women and children's health as oftentimes they will just resort to self-medication instead of going to the health center/hospitals for medical check-up. The schools are also located far with 53% of households located 2-3 km from schools and 27% located more than 3km from schools. Around 56% of the children go to school using bicycles while 37% go to school by foot.

382. The mothers also mentioned that their children's health is at risk due to dust which they inhale everyday when they go to school. There is a high rate of school drop-outs, especially among girls in lower secondary levels due to the distance of schools from their houses and poor economic conditions of households. Livelihood opportunities for women are even less than for men. Agricultural production is low due to farmers' limited access to irrigation facilities with the majority being limited to planting rice only once a year. There are also few job opportunities in rural areas, and low educational levels among girls would limit their capacity to compete with others with higher educational attainment for waged employment. Lack of job opportunities in the area push men and women to migrate to other areas. Migration rate in the project areas is high (7.2%) and female migrants comprised 6% (2008 census). There are risks involved in working in areas away from their families, e.g. engaging in risky behavior such as unprotected sex with casual partners and sex workers, and drug use.

## **P. Indigenous Peoples**

383. There will be improved access to markets, education, health, banks, and government agencies. One hundred percent of the Cham and Vietnamese in Kampong Tralach and



Tuek Phos districts are highly in favor of the road project. For the Cham, they could go to mosques faster, and the Vietnamese in Ta Ches market expressed that better roads will improve their profit. There are over 10,000 IPs in the projects areas with more than 3,000 households.

384. An estimated 33 IP households will be affected by land acquisition and resettlement, comprising 2 ethnic Cham and 31 ethnic Vietnamese. Most of the resettlement impacts will be temporary in nature and will not cause relocation. Otherwise IPs in the project areas will not be adversely affected other than the generalized potential risks of HIV/AIDS, human trafficking and road safety.

## **VII. ANALYSIS OF ALTERNATIVES**

385. This project was originally classified as Category B and this has been confirmed by this IEE. No Analysis of Alternatives is required.

## **VIII. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION**

### **A. General Public Consultation on Environmental Issues**

386. A total of 40 public information meetings/ consultations with various stakeholders were conducted in 25 communes from May-July 2011. A total of 319 people attended (50%) were women. The meetings provided information on the project, anticipated impacts (environmental, involuntary resettlement and social risks) and mitigation measures. Participants were provided opportunities to raise questions, clarify information and express their opinions. There were also 7 separate consultations with the IPs/ethnic groups (i.e. Cham and the Vietnamese) conducted in the districts of Kampong Tralach and Tuek Phos in Kampong Chhnang province from June-July 2011. In addition to stakeholder consultations, a total of 700 households also participated in the socio-economic baseline survey conducted in June 2011 and 437 (62%) of the respondents were women.

### **B. Perception towards the Project NR13, 314D and CBF**

387. Most of the male-headed (92.0% or 47 respondents) and women-headed (81.0% or 21 respondents) AHs in PR314D are supportive of the Project. Percentage-wise, the sample AHs in NR13 are not as supportive as those in PR314. Only 61.0% (44 respondents) of the 72 male-headed AHs and only 50.0% (7 respondents) of the 14 women-headed AHs in NR13 expressed support for the Project. It implies that the surveyed AHs in NR13 are satisfied with the present condition of their paved (asphalt) road and are apprehensive of the disruption the rehabilitation of the road will bring about to their existing activities.

### **C. Perception about the Project PR150B, NR53, and PR151B**

388. Majority (69% or 42 respondents) of the male-headed and all 4 of the women-headed AHs in PR150B are supportive of the Project. Similarly, most (82.76% or 24 respondents) and all 8 of the women-headed AHs in NR53 are supportive of the Project. Also, most (77% or 10 respondents) of the male-headed and the 2 women-headed AHs in PR151B are supportive of the Project. Among the reasons cited for their support of the Project are (a) good road will facilitate the development of the villages, communes, and districts; (b) better access to health care; (c) cheaper transport cost; and (c) cleaner environment. Reasons for the negative view about the Project are (a) income loss due to disruption in business operation during construction; (b) damage to or loss of houses and other structures; and (c) the need to rebuild public structures, such as Pagoda gates, wells, and drainage system. Full details are given in Annex 3.

## **D. Public Consultation on Water Capture Projects**

389. Under the Climate Change Mitigation Measures component of TA 7665 Project, a series of five water capture projects have been identified in Kampong Chhnang Province. Each of these projects must be described in the IEE and an essential component of this evaluation is Public Consultation. Public Consultation Meetings were conducted on 7-8 September 2011 in Tuek Phos District, Kampong Chhnang Province

The public consultations were organized with the assistance of the Commune Chiefs in each locality. Potentially Affected Persons from the villages were invited verbally, relevant provincial government officers invited in writing by MPWT, and suitable locations organized in pagodas. The venues were :

- Roleang Ke Pagoda, Chaong Maong Commune, Tuek Phos District, Kampong Chhnang Province
- Keo Buthearam Pagoda, Akphivodth Commune, Tuek Phos District, Kampong Chhnang Province
- Vihear Beth Meas Pagoda, Kbal Tuek Commune, Tuek Phos District, Kampong Chhnang Province

There were 3 venues for 4 meetings covering 5 communes, all in Tuek Phos District, Kampong Chhnang Province. The 4 meetings took 2 days in total.

In order to demonstrate Gender Equity in the meetings and ensure a correct record of comments from villagers the services of a female rapporteur were retained. A “break out group” to hold discussions among females only was offered but proved not necessary.

It was estimated that 150 people might attend the 4 meetings over 2 days and refreshments were offered to attendees. No other incentives were offered to any persons. The budget was US\$550. In the event 109 villagers attended plus provincial government staff and consultants.

No disputes or conflicts were raised. Competing needs were described but in general all the villagers were very supportive of the plan to provide more irrigation water for generating two rice crops a year instead of one. Some pertinent points were :

- A dam across the river was needed but it would raise the water level upstream where people currently wade across the river because the water level is low. Could a crossing be provided on top of the dam ?
- One lady was concerned that she was so poor she could not afford the money for a connection to a piped water supply and asked if she could offer her labor in exchange for a connection?
- The use of the ex-railway water tank to provide water was enthusiastically supported. Local residents asked for drinking water not general garden irrigation water. They were willing to pay for the water if it was cheaper than commercially available bottled water. They were concerned over who would manage the water supply, would it be taken over by private operators, and would the raise the price of the water.
- A villager offered use of his land for free to show his support for the projects

Government officers from MOE, MRD and MOWRAM also concurred with the proposals and endorsed inter ministry cooperation.



Figure VIII-1 Public Consultations on Water Capture Projects, Kampong Chhnang

Full details are given in Annex 4.

## IX. GRIEVANCE REDRESS MECHANISM

### A. Grievance Redress

390. 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, MPWT 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 MPWT and contractors are placed on the notice boards outside the construction site and at local government offices (e.g., provincial and commune levels)

391. Through a Grievance Redress Committee (GRC), MPWT shall 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 be chaired by PMU to be assisted by the SEO. The GRC shall have members from the PDRD, 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.

392. PMU, through the PDRDs, shall make public the existence of this grievance redress mechanism through public awareness campaigns. PMU shall also 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 levels). Locally affected people will still be able to express grievances through the commune councils and these would be referred to PMU through the usual channels in those committees.

393. The GRC, through the SEO, 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 SEO will develop and

maintain a database of complaints received related to the Project. 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.

## **X. ENVIRONMENTAL MANAGEMENT PLAN (EMP)**

### **A. Environmental Management Plan**

394. The general Environmental Management Plan (EMP) gives guidance on how to mitigate the environmental concerns identified in connection with this project. The EMP deals with mitigation and management measures to be taken during Project implementation to avoid, reduce, and mitigate adverse environmental impacts.

395. MPWT will ensure that the EMP is included in the tender documents for civil works. It will form part of the contract between MPWT and the selected contractor and the requirements of the EMP will be contractually binding on the contractor. The conformity of contractors with environmental contract procedures and specifications shall be regularly monitored by the project management unit (PMU) through the Social and Environmental Office (SEO) during Project implementation. PMU/SEO shall be assisted by the detailed design and implementation supervision consultant (DDIS) to undertake EMP monitoring and to prepare corresponding semi-annual reports for submission to ADB.

### **B. Contractors Environmental Management Plan (CEMP)**

396. After appointment and mobilization the contractor must prepare his own version of the EMP known as the Contractors EMP (CEMP). This must give specific details of locations of borrow areas, borrow roads, workers camps and other facilities. This must be submitted to the Supervising Consultant for their approval before physical works commence.

### **C. Guidance on Environmental Issues**

397. A document has been produced jointly by MPWT and MRD entitled "Guidance on the Implementation of Environmental Safeguards". This was produced under the "Provincial and Rural Infrastructure Project (PRIP) PHRD Grant No. TF056974.(May 2010)". It is a guidance document and has no regulatory authority but the contractor should obtain a copy and follow its recommendations.

### **D. Social and Environment Office (SEO)**

#### **1. Social and Environmental Office**

398. SEO is a team in MPWT who have responsibilities in : socio-economics; resettlement; environment and HIV/ female trafficking. Their current duty is to implement "The Resettlement Plan (RP)". SEO works in close cooperation with the Inter-Ministerial Resettlement Committee and liaises on a regular basis with :

- Team of Working Group MPWT
- Provincial Sub-Committees
- Representative of District, Commune and Village authority

399. SEO staff with environmental knowledge will respond to complaints during the construction phase, and support the DDIS environmental inspectors in the field.

## **2. Organisation of Social and Environmental Division (now SEO/ ESO)**

400. On 20<sup>th</sup> October 2005 MPWT engaged the services of an Independent Consultant under the Cambodia Road Improvement Project, ADB Loan 1945. His duties were to assist in the reorganizing of MPWT. The reorganized structure was to be submitted to the Council of Ministers within 24 months of loan effectiveness.

401. The Consultants responsibilities included assisting Department of Planning in preparation of the duties and job descriptions of the Social and Environmental Division, assist in its establishment and train SED staff so that they could effectively carry out their mandate.

402. In December 2006 the consultant recommended the staff needed for Social and Environmental Impact Evaluation were :

- Chief of Division
- Social specialist
- Environmental specialist
- Land / property surveying supervisor

403. Job descriptions were provided. In February 2007 the SED was reviewed again and the need for further training noted. This review was repeated in October 2007. The SED staff were involved in the resettlement and land acquisition issues associated with NR5, NR6 and NR56.

404. Currently the SED is located in the Ministry of Public Works and Transport under the Department of Planning and Investment. The Director of the Department of Planning and Investment has the additional duties of being Head of SED. He reports to the General Directorate of Planning and Administration who in turn reports to the Undersecretary of State, Secretary of State and Minister. He has three staff who have a background in legal studies and the social sciences. There is a strong need for more technical skills. Their mandate is oversight, monitoring and evaluation.

## **3. Duties of SEO Environmental Staff**

405. SEO Environmental Staff must coordinate the site assessment procedures undertaken by the consultants site inspectors. They will be involved in the finalization of the EMP, the familiarization of the inspectors with the check lists and reporting procedures and the interaction of the inspectors with the contractors.

406. They must review the monthly reports of the inspectors and comment on them before submitting to the Project Manager for discussion at the monthly progress meetings. Where issues are identified and remedial measures proposed by the contractors, the SEO must check before the next monthly meeting if these measures have in fact been implemented, and if they proved effective. If not, the issues must be raised at the next progress meeting.

407. If the DoE or MoE are needed for environmental monitoring, or analysis, using equipment that is not available to consultants' inspectors, the SEO must coordinate with MoE in Phnom Penh to arrange the necessary support. SEO will be responsible for receiving any analytical data from the MoE and interpreting it in terms of the legislation, and the obligations it places on the contractors of MPWT. The duties and responsibilities of SEO must include ensuring that the contractors comply with the relevant legislation.

## **E. EMMP**

408. The Environmental Monitoring Program is included in the Environmental Management Plan and so the EMP can be considered as an EMMP - Environmental Management and Monitoring Plan.

### **1. Environmental Monitoring**

409. The essence of monitoring is to ensure Compliance with Environmental Legislation. The contractors have a duty to comply with the relevant legislation. The supervising consultant must check their activities and report to MPWT. In the event of noncompliance MPWT can exert pressure on the contractor to comply.

### **2. Measurements**

410. It will be necessary to carry out measurements to establish if the regulations are being met. In fact, simple compliance with the standards is not necessarily the final objective. There is no harm in the contractor “going beyond compliance” and running an operation better than that required by the standard. The measurements to be made and standards to be met are given below. There will be a “hierarchy” of monitoring and measurements. This would be based on :

- Contractors
- Consultants inspectors
- SEO environmental staff
- Ministry of Environment

411. Initially, contractors should check daily that all operations are being conducted correctly. In general “good housekeeping” must be employed. Overflowing of septic tanks must be checked by visual inspection. Dust must be controlled by covering of stockpiles and water sprays. Solid waste, engine oil and grease, must be taken away by waste removal contractors and records kept.

412. Construction supervision inspectors must make daily spot checks and weekly formal checks on site operations. They must cross check all of the above and view records for waste disposal. They must also investigate any pollution incidents or complaints. They must use the checklists for record purposes and make sure that the complaint or incident is brought to the notice of the contractor immediately, verbally and with a follow up written notice.

413. SEO staff will have access to noise and water quality monitoring equipment. This will be kept at a central location and made available as necessary. SEO staff will be responsible for care and maintenance of the equipment and regular calibration. When requested by inspectors SEO staff must visit the site and make measurements. The equipment for noise and water will give direct results so data will be available immediately. In the event that more detailed information is required on water quality SEO staff must take samples of water and deliver them to a commercial laboratory for analysis. This may be MOE or other labs which are available. In addition SEO staff should make monthly visits to site to check the veracity of reporting. They should also review the reports submitted by the consultants to the MPWT and report to the MPWT project manager.

414. If vibration measurements or dust measurements are required then specialized equipment will be needed. The responsibility for requesting the measurements will be the contractor's. SEO must liaise with MOE and DOE to arrange the measurements. MOE have vibration equipment for measurement of traffic and blasting vibrations.

415. If dust measurements are needed than a two stage process must be adopted. A high volume sampler (HVS) will be deployed by MOE. After a suitable period, usually 24 hours, the filter in the HVS will be retrieved by MOE staff and transported to the laboratory for the second stage which is analysis. This requires highly specialized equipment which MOE possess in Phnom Penh. The MOE will charge for this service. These charges must be covered by the contractor.

416. The results must be submitted to SEO who will interpret them with respect to the relevant regulations. Discussions must then be held with SEO, the consultants' inspectors and the contractor to determine how to resolve any problems.

417. After extraction from borrow areas is finished, revegetation and reinstatement must be carried out. Warning signs must be erected to avoid drowning if deep ponds are left. Inspectors and SEO staff must make regular checks by visual inspection.

### **3. Timing of Monitoring**

418. The timing of the monitoring is important. The following list is for guidance and is indicative only.

- Liquid emissions from sites must be checked every three months or after heavy rain if overflowing is reported. Measurements in streams and water courses must be made.
- Dust emissions on site must be checked weekly by visual inspection and monthly by examining records of water spraying. Ambient air quality must be checked over a 24 hour continuous period at sensitive receptors in the event of complaints.
- Noise levels must be checked every three months at site perimeters, or in the event of a complaint, at night as well as during the daytime.
- Correct removal and disposal of food waste and waste engine oil and grease must be checked weekly by visual inspection of the camps and checking of records from the waste disposal contractors.
- Noise and vibration must be checked at sensitive receptors when blasting first occurs or in the event of complaint. Before blasting commences warning notices must be posted to local residents.
- Reinstatement of borrow pits and quarries must be checked after closure of the facility.

419. In addition to regular monitoring, unannounced spot checks must be made by SEO on contractors operations. All of the above procedures should be carried out by the site inspectors, in conjunction with SEO, and where appropriate MOE/ DOE. The results should be formally recorded every week and compiled into a monthly report. This should be submitted to the Engineer, the Chief Resident Engineer and discussed with SEO and the contractors as necessary but at a minimum on a monthly basis. Monthly reports should be compiled into quarterly and annual reports to be submitted to ADB.



Table X-1 Measurement of Environmental Parameters

Regulation	Environmental Issue	Parameter	Standard	Timing	Equipment	Institutional Responsibilities
Sub-decree on Water Pollution Control	Water Quality	BOD	< 50mg/L	every 3 months or after heavy rain	Water Sampler	Inspector, SEO
		SS	< 50mg/L			
		Temperature	<45 <sup>0</sup> C			
		pH	6-9			
		Oil & Grease	< 5mg/L			
		Dissolved Oxygen	> 4mg/L			
Sub-decree on Air and Noise Pollution Control	Air Quality	TSP	< 0.33 mg/m <sup>3</sup>	24 hours	H.V.S + Lab	MoE
	Noise Quality	Leq	75dB(A)	(daytime 07-19)	Noise Meter	SEO
		Leq	65dB(A)	(nighttime, 19-07)		
No Regulation	Vibration	PPV	< 1mm/sec	During blasting	Vibration meter	MoE
Sub-decree on Solid Waste Management	Solid Waste	Food Waste	Properly Removed	Daily	Visual Inspection	Contractor
	Liquid Waste	Waste Oil, Grease	Properly Controlled After Removed by Subcontractor	Weekly	Visual Inspection	Contractor
No Regulation	Septic Tank	Smell, Sewage	No Smell, No Overflowing	During Operation	Visual Inspection	Inspector
No Regulation	Borrow Pits	Condition of Borrow Pits	Filled after Project Completion, Topsoil resurfaced	After Closure	Visual Inspection	Inspector
No Regulation	Borrow Pits	Depth of Borrow pits	No Drowning Hazard	After Closure	Visual Inspection	Inspector
No Regulation	Borrow Road	Location for Borrow Road	Meet the Engineer Demand	After Closure	Visual Inspection	Inspector
No Regulation	Quarries	Condition of Quarries	Quarries reinstated	After Closure	Visual Inspection	Inspector
No Regulation	Tree if Cut	Tree	Tree Replanted	After Removal	Visual Inspection	FA

#### **4. Review Procedures**

420. Successful implementation of the EMP will require combined efforts from contractors, consultants, MPWT and local authorities. The CEMP is a dynamic document and may be subject to change as the project progresses. Periodic reviews may be necessary and these should in fact be encouraged. These changes should be driven by the SEO in MPWT.

#### **5. Staffing for Monitoring**

421. The contractors should have an environmental specialist on their staff who will advise on meeting the conditions of the EMP, by writing their own CEMP, and implementing it. MPWT will retain supervision consultants. They will maintain a Resident Engineer (RE) on site and a team of inspectors. The inspector's responsibilities will include environmental issues and they must check activities and progress against environmental checklists. (See Annex 5) The inspectors must report to the RE who in turn submits reports to the Consultants. Environmental results must be reported to the SEO which has been established in the Department of Planning, MPWT. The results must also be incorporated in the progress reports submitted to ADB.

#### **6. Response to Complaints**

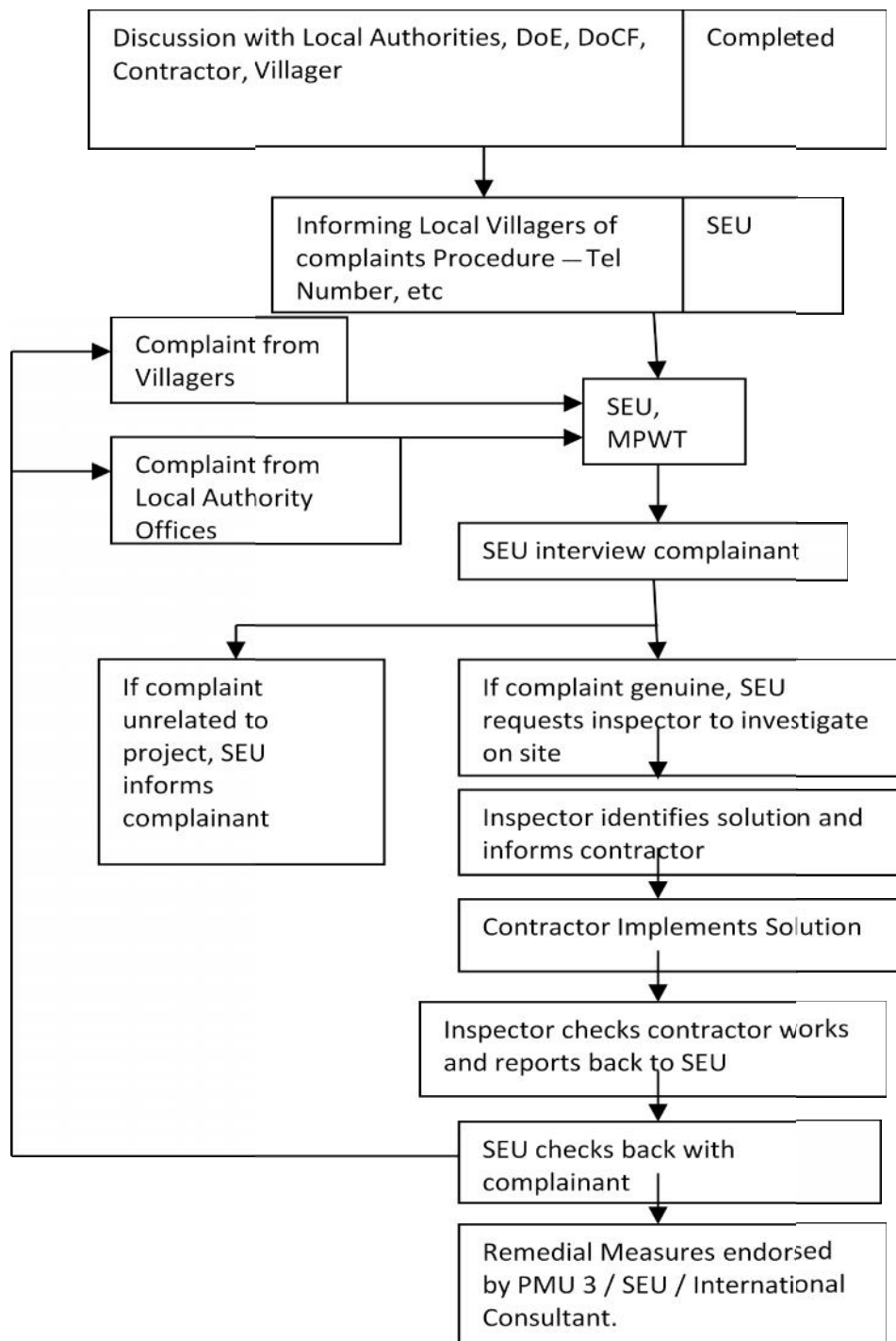
422. Villagers and APs are encouraged to voice complaints and these are to be duly investigated and reported through the contractor to SEO and so to MPWT. As a complaints procedure exists for resettlement issues it is recommended that this procedure be maintained and extended to include environmental issues.

423. Environmental monitoring must be carried out by the construction supervision inspectors, all of whom have previous experience of environmental issues on similar projects. 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 National Environmental Specialist, accompanied by SEO, and regular oversight checks by International Environmental Specialist.
- Checks with complainants that they are satisfied

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. The procedure is shown below.

Figure X-1 Complaints Investigations Procedure



## 7. Costs for EMP

424. The estimated costs for implementing the EMP are provided below:

Table X-2 Estimated Costs for EMP Implementation (4 years)

Item	Estimated Total Cost (US\$)
1. Environmental monitoring to be undertaken by DDIS environment specialists	
a. International (1 person for 4 months US\$20,000/month)	80,000
b. National (1 person for 4 months @ US\$2,500/month)	10,000
2. Environmental management capacity building program/training to be undertaken by DDIS for ESO (SEO) staff (estimates only, to be determined during Project implementation)	20,000
3. Environmental effects monitoring for noise, dust and surface water quality at US\$5,000 / year	20,000
4. Construction phase mitigation measures (included in project costs)	N/A
5. Transportation for environmental monitoring (@ US\$5,000 year for 4 years)	20,000
Sub-total	150,000
6. Contingency (10%)	15,000
<b>Total</b>	<b>165,000</b>

## 8. Table of Environmental Management Plan

The EMP is given in tabular form below.

Table X-3 SUMMARISED POTENTIAL NEGATIVE IMPACTS, MITIGATION MEASURES AND RESPONSIBILITIES

Activities	Potential Negative Impacts	Mitigation Measures	Implementing Organisation	Supervising Organisation
(a) Road alignment	Damage to marker posts showing boundary of PAWS.	<ul style="list-style-type: none"> <li>Road alignment was changed slightly widen road on opposite side to PAWS.</li> </ul>	Consultant	MoCF, MPWT
(b) Raising Road Affecting Hydrology or Drainage.	Increase erosion, possible road failure due to impoundment of flood waters.	<ul style="list-style-type: none"> <li>All bridges stream flow area increased, extra cross drainage provided. Included in detailed design.</li> </ul>	Consultant	MPWT
(c) Road Widening	Loss of infrastructure	<ul style="list-style-type: none"> <li>Minimal Impacts, alignment changed to change number of railway crossings from 3 to 1. No mitigation required.</li> </ul>	Consultant	N/A
(d) Need for fill material	Loss of livehood, Loss of Agricultural Land for Borrow Pits.	<ul style="list-style-type: none"> <li>Develop alternative uses for borrow pit areas with agreement of farmers and villagers. Some villagers request borrow pits to be left as water ponds for use by village.</li> </ul>	Contractor	SEO, MPWT
(e) Cutting of roadside trees	Loss of roadside trees, loss of shade and utility.	<ul style="list-style-type: none"> <li>Compensation to be paid under Resettlement Plan. No replanting is required by contractor.</li> </ul>	IMRC	MPWT
(f) Cut faces and borrow pits	Erosion and instability of cut faces and borrow pits	<ul style="list-style-type: none"> <li>Design cut slope to minimize instability.</li> <li>Use structural stabilization measures such as retaining walls and gabions, if necessary.</li> <li>Use adequate design, siting, and sizes of drainage structures.</li> </ul> <p>All included in detailed design.</p>	Consultant	MPWT
(g) Outflow from drainage structures	Erosion of Lands below the roadbed receiving concentrated outflow carried by drainage structures— in contravention of Draft Sub-Decree on Water Quality.	<ul style="list-style-type: none"> <li>Position drainage structures to avoid a cascade effect and to ensure that runoff is conveyed into natural drainage lines at controlled velocities.</li> <li>Line receiving areas with stones or concrete to protect soils at outflow areas</li> <li>Incorporate sufficient number of drainage outlets such that flow from any individual outlet is not excessive.</li> </ul> <p>Included in detailed design.</p>	Consultant	MPWT
(h) Road alignment across river	Loss of riverside vegetation, disturbance river flow.	<ul style="list-style-type: none"> <li>Minimise areas of bridge abutments</li> <li>Minimise area of bridge pillars.</li> </ul>	Consultant	MPWT
(i) Road widening for hard shoulders	Loss of vegetation and habitat through road widening, and hard shoulders	Shoulders will be approx 1 metre. No mitigation necessary.	Contractor	Consultant
(j) Road alignment	Impacts on wildlife through	No impacts.	Consultant	Consultant,

	interruption of migratory routes and other habitat disturbances– in contravention of Law on Environmental Protection and Natural Resource Management (1996)			MPWT, DoE
(k) Road alignment	Encroachment on irrigation structures from road widening and realignment	<ul style="list-style-type: none"> <li>▪ Use appropriate drainage structures to replace those presently used in irrigation systems.</li> <li>▪ Avoid encroachment on irrigation systems in use.</li> <li>▪ Consult with relevant government offices and villagers.</li> </ul> <p>Already included in detailed design</p>	Contractor	Consultant, SEO, MAFF
(l) Road Construction	Encroachment on water supply systems from road construction activities	<ul style="list-style-type: none"> <li>▪ Identify places where there are existing and planned water pipes and make appropriate arrangement avoid water pipes.</li> <li>▪ Detailed design must include plans for avoidance of damage to water systems and replacement/repair of water systems where avoidance is not possible. Coordination should be exercised through the Inter-Ministerial Resettlement Committee, as well as normal inter-ministry liaison.</li> </ul>	Contractor	Consultant, MPWT, MoWM
(m) Road widening onto agricultural land	Destruction of agricultural land through road widening and realignment	<ul style="list-style-type: none"> <li>▪ Minimize realignment through agricultural land.</li> <li>▪ Ensure appropriate compensation for loss of agricultural lands.</li> </ul>	Consultant	MAFF, SEO
(n) Road shoulder widening	Encroachment on previously unidentified cultural sites– in contravention of Law on Protection of Cultural and National Heritage (1996)	<ul style="list-style-type: none"> <li>▪ Consult with villagers during detailed design to avoid encroachment on graveyard, and other unidentified sites of cultural importance.</li> </ul>	Consultant	, MPWT, MoCF
(a) Mobilization of equipment and workforce	Accident risk from mobilizing construction equipment	<ul style="list-style-type: none"> <li>▪ Minimize the mobilization of heavy equipment to nighttime.</li> <li>▪ Over-width and over-length vehicles should display adequate warnings such as flashing lights, signs, and flags on extending parts of equipment.</li> </ul>	Contractor, Police	SEO
(b) Mobilizing workforce	The introduction of an outside workforce can have a negative impact on the health and social well-being of local people	<ul style="list-style-type: none"> <li>▪ Conduct special briefing or on-site training on environmental requirement of the project to workers.</li> <li>▪ Strictly supervise workers not to interference</li> </ul>	Contractor	SEO

		<p>with local affairs or quarrel with local people.</p> <ul style="list-style-type: none"> <li>▪ In case of complaints from local people on the issues caused by workers, the complaints should be solved as soon as possible, by collaboration of contractor and village representatives.</li> </ul>		
(c) Behaviour of workers	Impacts on local wildlife by workforce— in contravention of Joint Prakas of the Ministry of Environment and the Ministry of Agriculture on Prohibition of Hunting and Catching of Wildlife Animals (1996)	<ul style="list-style-type: none"> <li>▪ Carry out awareness-raising campaigns on wildlife value for workers.</li> <li>▪ Any worker conduct hunting, or buying wildlife from local people, will be dismissed from job.</li> <li>▪ Supply workers with sufficient food from outside the project.</li> </ul>	Contractor	SEO, MoE, MAFF
(d) Protecting workers safety	Accident risk from mobilizing	<p>The following safety precautions should be provided to workers.</p> <ul style="list-style-type: none"> <li>▪ Warning and/or Precaution Signs on safety.</li> <li>▪ Provide full PPE; Helmets, boots, warning jackets etc.</li> <li>▪ Instruction on health and safety.</li> <li>▪ Establishment of all relevant safety measures required by law and good engineering practices.</li> </ul>	Contractor	SEO, MPWT
(e) Health Aspects	Outbreak of disease	<ul style="list-style-type: none"> <li>▪ The contractor shall have all his workers undergo a medical screening prior to their arrival on site, to check for HIV/AIDS, sexually transmitted diseases, and to provide an awareness program. Any workers screening positive for such diseases shall not be allow on the site.</li> <li>▪ Site construction camps far away from local communities and rivers.</li> <li>▪ Keep camps from becoming blight on the local environment.</li> <li>▪ Provide enough water supplies for workers, and ensure sufficient sanitation for the camp: the proper location for solid waste disposal.</li> <li>▪ Make medical treatment available for workers. Provide workers mosquito nets and malaria-prevention medication, if needed, spray around camp area with chemicals against mosquitoes.</li> </ul>	Contractor	SEO, MoH
(f) Providing fuel for workers	Depletion of natural resources through demand for building	<ul style="list-style-type: none"> <li>▪ Do not harvest wood resources within protected area.</li> </ul>	Contractor	SEO, MoE, FA

	materials, fuel and food for workers– in contravention of Royal Decree on the Creation and Designation of Protected Areas (1993)	<ul style="list-style-type: none"> <li>▪ Where local materials must be used, make agreements with local communities about the areas or the volume that can be harvested without significant impact.</li> <li>▪ Support community development by paying an adequate price for any local resources used.</li> <li>▪ All supplies for building camps should be brought from outside area.</li> </ul>		
(i) Construction work area	Loss of water quality– in contravention of Sub-Decree on Water Quality	<ul style="list-style-type: none"> <li>▪ Revegetation of construction area. This relates to grass seeding of slopes of new embankments for soil stabilisation and control of sediment run off.</li> </ul>	Contractor	MPWT
(ii) Work in stream channels	Loss of water quality– in contravention of Sub-Decree on Water Quality	<ul style="list-style-type: none"> <li>▪ Limit work in channels to low flows. Diversionary works to be completed in dry season.</li> </ul>	Contractor	MPWT
(iii) Fuel, lubricants and asphalt	Loss of soil and water quality – in contravention of MOE Praka No. 992 on the Regulation of Industrial Solid and Liquid Waste Management (1994)	<ul style="list-style-type: none"> <li>▪ Fuel storage in properly designed facilities, careful refueling systems</li> </ul>	Contractor	MPWT, DoE
(iv) Solid waste disposal	Loss of soil and water quality– in contravention of Sub-Decree on Waste Management	<ul style="list-style-type: none"> <li>▪ Solid waste management procedures</li> </ul>	Contractor	MPWT, DoE
(v) Dust impacts	Loss of quality of life values– in contravention of Draft Sub-Decree on Air Pollution Prevention	<ul style="list-style-type: none"> <li>▪ Road watering, cover stock piles</li> </ul>	Contractor	MPWT
(vi) Noise impacts	Loss of quality of life values– in contravention of Draft Sub-Decree on Noise Prevention	<ul style="list-style-type: none"> <li>▪ Vehicle noise control, Timing of work, Give advance notice of time of blasting</li> </ul>	Contractor	MPWT
(vii) Vibration impacts	Loss of quality of life values– in contravention of Draft Sub-Decree on Noise Prevention	<ul style="list-style-type: none"> <li>▪ Schedule work to minimize nuisance</li> </ul>	Contractor	MPWT
(viii) Damage to services	Loss of services	<ul style="list-style-type: none"> <li>▪ Contractor liaise with utility company on location of services</li> </ul>	Contractor	MPWT
(ix) Damage to bridges and pavements	Loss of access	<ul style="list-style-type: none"> <li>▪ Truck overloading must be controlled</li> </ul>	Contractor	MPWT/Police
(x) Altered road conditions	Driver hazards	<ul style="list-style-type: none"> <li>▪ Reduce waiting time delays; signage</li> </ul>	Contractor	MPWT/Police
(xi) Inadequate sanitation	Increased disease– in contravention of Law on Environmental Protection and	<ul style="list-style-type: none"> <li>▪ Provide sanitation through septic tanks; potable water, by wells and tankers. Well to be sunk on permanent campsites. Septic</li> </ul>	Contractor	MPWT



	Natural Resource Management (1996)	tanks to be installed on permanent campsites. Temporary camps to be in rented accommodation with existing sanitation, and extra water provided by tanker if needed.		
(xii) Being ready for accidents and injuries	Slow response to injury, no treatment for illness	<ul style="list-style-type: none"> <li>Worker Health and Safety Plan, First Aid officer on site identifying nearest medical facilities.</li> </ul>	Contractor	Contractor, Consultant, MPWT
(xiii) Transmission of sexually communicable diseases	Spread of diseases to communities	<ul style="list-style-type: none"> <li>Pre-employment worker screening, Public education program.</li> </ul>	Separate study and program implemented	MPWT/ Contractor
(xiv) Stagnant water areas	Breeding habitats for mosquito vector	<ul style="list-style-type: none"> <li>Siting camps distant to communities. Removal of stagnant water areas.</li> </ul>	Contractor	Consultant
(xv) Dislocation of people within RoW	Loss of livelihood and assets	<ul style="list-style-type: none"> <li>Resettlement and compensation plan</li> </ul>	SEO	MPWT/ IRC
(xvi) Discovery of artifacts and relics	Permanent loss of cultural items– in contravention of Law on Protection of Cultural and National Heritage (1996)	<ul style="list-style-type: none"> <li>Contractor awareness; inform MoCF</li> </ul>	Contractor	MoCF
(xvii) Earthworks and operating of quarries and borrow pits	Erosion and instability of cut faces and borrow pits	<ul style="list-style-type: none"> <li>No new side roads should be permitted in areas with steep slopes.</li> <li>Minimize major earthworks during the rainy season, to the extent feasible.</li> <li>Pile topsoil from digging of borrow pits carefully to one side, where it can be later used for reclamation.</li> <li>During construction, employ erosion prevention measures such as the use of hay bales.</li> <li>At the end of the construction phase, recontour borrow pit walls, replace topsoil, and revegetate.</li> <li>At the end of the construction phase, revegetate cut slopes where feasible.</li> </ul>	Contractor	SEO
(xviii) Disposal of overburden	Erosion from disposal of cut spoil	<ul style="list-style-type: none"> <li>Dispose of spoil only where there is vegetated strip at least 50m wide between the disposal site and the nearest water body. To the extent feasible, avoid disposal on slopes greater than 30%.</li> <li>Where spoil disposal in vegetated sites cannot be avoided, select areas with scrub growth over areas of healthy forest.</li> <li>No disposal in protected areas such as PAWS</li> </ul>	Contractor	SEO

		<ul style="list-style-type: none"> <li>▪ No disposal into gullies or watercourses.</li> <li>▪ No disposal in or adjacent to cultivated areas, unless such areas lie within the road reserve width, in which case owner will be compensated under the Resettlement Plan.</li> <li>▪ No disposal by direct tipping of spoil down slope.</li> <li>▪ Revegetate spoil dumps to maintain the soil stability.</li> </ul>		
(xix) Construction near riverside	Loss of riverside vegetation	<ul style="list-style-type: none"> <li>▪ Avoid clearing riverside vegetation during road construction except where absolutely necessary. Revegetate riverbanks where clearing is unavoidable.</li> </ul>	Contractor	SEO
(xx) Construction of detour	Loss of vegetation from detour construction	<ul style="list-style-type: none"> <li>▪ In flat areas, leave enough of a roadside edge for vehicle to pass on the other half of the roadway.</li> <li>▪ Remove the base soil of any necessary detours and revegetate after road construction.</li> <li>▪ Avoid use of detour where at all possible.</li> <li>▪ Where realignments are being built, use the existing roadway for traffic to pass.</li> <li>▪ Where detour are unavoidable, as in areas where bridges are being built, limit the length and impact of each detour to the degree possible.</li> <li>▪ Limit the width of any necessary detours to a minimum.</li> </ul>	Contractor	SEO
(xxi) Construction near forests	Loss of vegetation and habitat through road widening, realignment of right-of-way, quarries and borrow pits— in contravention of Royal Decree on the Creation and Designation of Protected Areas (1993)	<ul style="list-style-type: none"> <li>▪ Do not allow side roads in forested area.</li> <li>▪ There must be no new quarries within the PAWS nor in any of the provincial or district prohibited areas.</li> <li>▪ Do not cut any trees outside of the construction zone.</li> <li>▪ In case of new quarries operation, the environmental authorities – DoE - must approve the quarries.</li> <li>▪ Where possible, avoid cutting trees along the edge of the construction zone.</li> <li>▪ Quarrying activity should be limited to a minimum of necessary sites, with previously used sites preferred.</li> </ul>	Contractor	SEO, DoE
(xxii) Construction near	Impacts on wildlife through	<ul style="list-style-type: none"> <li>▪ Strict monitoring in this area should be used</li> </ul>	Contractor	SEO, DoE

Areas Protected by Royal Decree	interruption of migratory routes and other habitat disturbances– in contravention of Royal Decree on the Creation and Designation of Protected Areas (1993)	<p>to prevent opportunistic "salvage" logging or illegal timber harvest. If observed, notify relevant authorities or police.</p> <ul style="list-style-type: none"> <li>▪ No side roads should be built in the PAWS, as may encourage poaching of wildlife. If observed, notify PAWS rangers or police.</li> </ul>		
(xxiii) Construction near village water supplies	Encroachment on water supply systems from road construction activities	<ul style="list-style-type: none"> <li>▪ Contractors should pay a fee to villagers for damage to water system, perhaps based on number of days without water until the system is fixed. Fees might be specifically targeted toward women's groups, since they are usually the ones who will have the main burden of carrying water when the system is down.</li> </ul>	Contractor	SEO
(xxiv) Construction near cultural sites	Encroachment on previously unidentified cultural heritage sites– in contravention of Law on Protection of Cultural and National Heritage (1996)	<ul style="list-style-type: none"> <li>▪ Alert local authority upon discovery of any objects of possible archaeological significance that may be uncovered during construction.</li> <li>▪ Construction activity affecting the area of the find should stop until qualified site assessment has been made and contractors have been given permission to proceed.</li> <li>▪ Bring in a qualified archaeologist as needed.</li> </ul>	Contractor	SEO, MoCF
(xxv) Construction Causing Air Pollution	Dust / Air pollution– in contravention of Draft Sub-Decree on Air Pollution Prevention	<ul style="list-style-type: none"> <li>▪ Use water bowsters to water the road when dust occurs, particularly in the dry season.</li> <li>▪ Maintain all construction vehicles to minimize vehicle emission.</li> </ul>	Contractor	SEO, DoE
(xxvi) Construction Causing Noise	Noise and Vibration– in contravention of Draft Sub-Decree on Noise Prevention	<ul style="list-style-type: none"> <li>▪ All road construction vehicles must have working mufflers and be properly maintained.</li> <li>▪ Time blasting activities so as not to disrupt local people.</li> <li>▪ Avoid working at night near settled areas</li> <li>▪ Inform people of possible damage from vibration before using Vibration Rollers near to settled area.</li> <li>▪ Avoid, as much as possible, using Vibration Rollers for soil compaction in settled areas</li> </ul>	Contractor	SEO, DoE
(xxvii) Excavation of Borrow pits	Creation of stagnant water bodies in borrow pits, quarries	<ul style="list-style-type: none"> <li>▪ Incorporate adequate drainage and fill in borrow pits and quarries.</li> <li>▪ Maintain borrow pits and quarries by landscaping and revegetating after operation.</li> </ul>	Contractor	SEO

(xxviii) Construction of by-pass	Accidental risks by traffic disruption during construction. Interference with railway line	<ul style="list-style-type: none"> <li>▪ Employ "flag men" to regulate the traffic flow.</li> <li>▪ Where new alignments are being built, allow traffic to continue on old alignments.</li> <li>▪ Where possible, as in flat areas, provide enough edge space for one-way traffic flow.</li> </ul>	Contractor	SEO
(xxix) Visual impact of construction	Visual Impact of road cut, spoil disposal, borrow pits, and quarries.	<ul style="list-style-type: none"> <li>▪ Where feasible, quarries should be sited away from the road.</li> <li>▪ In sites where quarries must be close to the road, trees and other vegetation should be left between the quarry/crushing plant sites and the road.</li> </ul>	Contractor	SEO
(xxx) Removal of unused structures and pavement	Construction waste– in contravention of Draft Sub-Decree on Waste Management	<ul style="list-style-type: none"> <li>▪ Dispose only on sites approved by DoE. No disposal in the area of the PAWS.</li> <li>▪ No disposal into gullies or watercourses.</li> <li>▪ No disposal in or adjacent to cultivated and settled area.</li> </ul>	Contractor, Consultant	SEO
(xxxi) Setting up and operating an asphalt plants, bitumen operation area.	Water pollution by oil, grease, and fuel around gas stations and parking areas– in contravention of Draft Sub-Decree on Hazardous Substances	<ul style="list-style-type: none"> <li>▪ Locate storage areas for diesel and bitumen at least 500 meters from watercourses.</li> <li>▪ Employ safe practices in filling bitumen distributor tanks and in heating bitumen. Do not allow smoking or fire of any kind in the vicinity of bitumen and kerosene blending tanks. Provide a carbon dioxide fire extinguisher at the bitumen tank site for fire-fighting.</li> <li>▪ Collect and recycle all lubricants and take precautions to prevent accidental spills.</li> <li>▪ Prohibit road asphaltting activities during rainfall.</li> <li>▪ Develop and implement plans for safe storage of all toxic and potentially toxic materials into construction planning and design.</li> </ul>	Contractor	Consultants, SEO
(xxxii) Construction activities near prime agricultural lands	Destruction of agricultural land through spoil and construction waste disposal– in contravention of Draft Sub-Decree on Waste Management	<ul style="list-style-type: none"> <li>▪ Do not dispose cut spoil and construction waste at agricultural land.</li> </ul>	Contractor	SEO, MAFF
(xxxiii) Construction Camps Operation	Solid waste– in contravention of Draft Sub-Decree on Waste Management	<ul style="list-style-type: none"> <li>▪ Provide garbage bins &amp; sanitary facilities for workers. Waste in the bins should be cleared periodically.</li> <li>▪ Special attention should be paid to the</li> </ul>	Contractor	SEO

		sanitary condition of camps.		
(xxxiv) Residual Effects from Construction Camps	Depletion of natural resources through demand for building materials, fuel and food for workers– in contravention of Law on Environmental Protection and Natural Resource Management (1996)	<ul style="list-style-type: none"> <li>▪ Do not harvest wood resources within the PAWS</li> <li>▪ Do not allow construction camps to become permanent settlements. Remove camps prior to project completion.</li> <li>▪ Use non-wood fuels such as Liquid Propane Gas or kerosene for cooking food and heating bitumen.</li> <li>▪ Where local materials must be used, make agreements with local communities about the areas or the volume that can be harvested without significant impact.</li> <li>▪ Support community development by paying an adequate prices for any local resources used.</li> <li>▪ All supplies for building camps should be brought from outside the area.</li> <li>▪ Upon close of construction, consider transferring camp structures to local people for community or government use.</li> </ul>	Contractor	SEO
(xxxv) Health Effect from Construction Camps	Creation of a new pathway for disease vectors affecting humans	<ul style="list-style-type: none"> <li>▪ All workers will have a medical screening conducted by "Cambodian Red Cross", to check for HIV/AIDS, sexually transmitted diseases, etc.</li> <li>▪ Keep camps from becoming blight on the local environment.</li> <li>▪ Provide enough water supplies for workers, and ensure sufficient sanitation for the camp: the proper drainage systems and the proper location for solid waste disposal.</li> <li>▪ Make medical treatment available for workers. Provide workers mosquito nets and malaria-prevention medication. If needed, spray around camp area with chemical against mosquitoes.</li> <li>▪ Plan post-construction clean-up activities to assure no unsanitary or otherwise hazardous debris are left behind at camp sites.</li> </ul>	Contractor	SEO, MoH
(a) Better quality road and higher speeds	Increase in road accidents to people and livestock	<ul style="list-style-type: none"> <li>▪ Speed limits enforced. Driver and community awareness; road signs</li> </ul>	Police	Police
(b) More traffic volume	Increased air pollution and noise	<ul style="list-style-type: none"> <li>▪ Control of vehicle air and noise emissions</li> </ul>	DoE	MoE, Police

	– in contravention of Draft Sub-Decree on Noise and Air Pollution Prevention	from vehicles. Paved road will decrease noise and dust.		
(c) Poor control of increased traffic volume with more vehicles carrying hazardous chemicals.	Accidental Risk of Toxic Spills – in contravention of Draft Sub-Decree on Hazardous Substances	▪ Enforcement of transport regulations and HAZCHEM procedures	Police	DoE, Police
(d) Increased access	Illegal Settlement along RoW	▪ Restriction of development within RoW; offer of alternative sites for activities.	Provincial Government	SEO, MPWT
(e) Increased access	Accelerated Loss of Forests and Wildlives – in contravention of Joint Prakas of the Ministry of Environment and the Ministry of Agriculture on Prohibition of Hunting and Catching of Wildlife Animals (1996)	▪ Not anticipated as no wildlife conservation areas near to project roads.	DoE	MoE, MAFF
(f) Increased vehicular traffic	Overexploitation of forest resources through illegal and unsustainable harvesting– in contravention of Royal Decree on the Creation and Designation of Protected Areas (1993)	<ul style="list-style-type: none"> <li>▪ Strengthen enforcement of existing laws regulating timber harvest, achieved through inputs in training, staffing, resources and regulatory powers of Forestry officials at all levels.</li> <li>▪ Improve border area controls on all sides with increased staffing, training, and resources.</li> <li>▪ Support community forestry initiatives.</li> </ul>	FA, MAFF, DoE Rangers,	MAFF, MoE
(g) Increased vehicular traffic	Impacts of wildlife through increased pressure from illegal trade– in contravention of Joint Prakas of the Ministry of Environment and the Ministry of Agriculture on Prohibition of Hunting and Catching of Wildlife Animals (1996)	<ul style="list-style-type: none"> <li>▪ Enforce of existing wildlife regulations prohibiting trade in endangered species.</li> <li>▪ Build Cambodia government capacity for enforcement of wildlife laws through training resources, and increased staffing.</li> <li>▪ Improved border area controls on all sides (Vietnam and Cambodia) with increased staffing, training and resources.</li> </ul>	FA, DoE	MAFF, MoE
(h) Increased vehicular traffic	Loss of cultural resources and tradition – in contravention of Law on Protection of Cultural and National Heritage (1996)	<ul style="list-style-type: none"> <li>▪ Support well-planned eco-tourism that involves solicitation of continuous feedback from both local residents and travelers.</li> <li>▪ Support the development of village cultural preservation groups, as already occur in several villages along the Project Road.</li> </ul>	DoCF	MoCF

➤ Note:

G = Gabion

M = Mattress

Geo. = Geo Textile

RP = Resettlement Plan

DoE = Department of Environment, MoE = Ministry of Environment

FA = Forestry Administration, MAFF

MAFF = Ministry of Agriculture, Forestry and Fisheries

DoCF = Department of Culture and Fine Arts, MoCF = Ministry of Culture and Fine Arts

SEO = Social and Environment Unit

MPWT = Ministry of Public Works and Transport

IRC = Inter-Ministerial Resettlement Committee

MoH = Ministry of Health

MoWM = Ministry of Water Resource and Meteorology

## **XI. CONCLUSION AND RECOMMENDATION**

425. All potential environmental impacts have been identified. The project is confirmed as being Category B according to ADB guidelines.

426. Only minor environmental impacts are anticipated. Such impacts will be experienced during site works mainly due to dust and noise emissions as well as potential occupational and community health and safety risks, but can be mitigated. Some minor mitigation measures will be specified but no major impacts have been identified.

427. Some slopes on NR13 will be eased from 1:2 to 1:3 to improve slope stability. Road 314D will be improved by filling in of old roadside narrow rectangular borrow pits which are a source of vector breeding.

428. Provision of a concrete road on 150B at the approach to Taches market will reduce airborne dust and improve muddy conditions during rain and flooding.

429. A short section of NR53 will have its alignment adjusted slightly on the opposite side to PAWS to avoid a concrete marker post of PAWS which has been placed actually outside the PAWS boundary close to the shoulder of the road.

430. None of the eastern project roads (NR13, 314D and the CBF) are in close proximity to any protected areas of ecological significance.

431. For the western roads, none traverses the transition, buffer or core zones of ecologically protected areas.

432. Road 150B has an eastern section of 5.5 kms which connects NR5 to Tonle Sap river. It terminates at the village of Ta Ches at the ferry crossing point of the river. This point is the nearest that any project road approaches to the boundaries of Tonle Sap Biosphere Reserve. Road 150B is approximately 4.5 kms from the boundary of the outer zone, known as the Transition zone. There will be no impacts from the road on TLSBR.

433. NR 53 runs alongside part of the eastern boundary of Phnom Aural Wildlife Sanctuary for a distance of approximately 6.5 kms. The boundary is defined in the Royal Decree 1993 and is indicated by concrete marker posts. Site surveys have been conducted to confirm the exact location of the boundary markers, and these have agreed by local villagers and the Provincial Department of Environment officers. The PDE officers confirmed that NR53 does not intrude into the PAWS.

434. Road 151B marks the most southern point of the western project roads. This road is further away from PAWS than NR53 and more than 50 kms from Kirirom National Park. No adverse environmental impacts are anticipated from this section of the project road on protected areas.

435. The Sub-decree No 72 ANRK.BK. Date 11, August 1999 contains an annex "List of the projects that require an Initial Environmental Impact Assessment". This stipulates that an IEE is required for "National Road Construction 100 Kilometers and bridges 30 tonnes". As this project is rehabilitation of existing roads, and the only bridge will be 25 tonnes capacity, then according to MOE Legislation an IEE will not be required.



436. To avoid or mitigate negative impacts arising from the project, an environmental management plan (EMP) detailing mitigation measures and monitoring activities has been prepared as part of the IEE.

437. Public consultations involving affected people and local officials have been conducted during the preparation of the IEE in compliance with ADB information disclosure and consultation requirements through focus group discussions and individual interviews in all project affected provinces. Environment was not seen as a major issue by those persons interviewed.

438. Climate change adaptation was included in the project. The residents knowledge of climate change induced affects, and adaptation strategies, was limited. However, they were strongly in favor of water capture projects.

439. In order to enhance water capture several sub projects have been included under a Climate Change Component of Loan 2839. These include a consultancy and civil works for :

A dam at Chiprong near Tuek Phos

Deepening of Lake Khset

Water retention dikes in Kampong Leaeng

Water supply and distribution in Kampong Leaeng

None of these civil works are new projects but are rehabilitation of existing works or improvement projects. None of them will have adverse environmental impacts.

440. Deepening of Lake Khset will involve dredging of 350,000 m<sup>3</sup> of material. Under the Cambodian Ministry of Environment Sub-decree No 72 ANRK.BK. (1999) any dredging of more than 50,000 m<sup>3</sup> material must be approved by them. Therefore an abstract of this IEE will be submitted to them as an initial EIA (IEIA) in accordance with the regulations.

441. Samples of the material to be dredged have been taken and analysed for a range of environmental parameters including pesticides and heavy metals. This was carried out by an accredited laboratory in Cambodia. No adverse chemicals were detected and the results for NPK show the material would be a useful fertiliser.

442. Water supply in Kampong Leaeng may involve groundwater abstraction. The safe yield rate of water pumping will be established by tests in the future. Some concerns have been raised over arsenic content in the groundwater. According to test previously conducted by MOWRAM (see main report for reference) arsenic levels in groundwater in Kampong Leaeng are low and within the Cambodian Standard for drinking water. However, it is recommended that this be confirmed by taking a water sample during the yield test and having a laboratory analysis conducted.

443. The civil works under climate change will also include construction of an Emergency Response Management Centre. This will be located on Kampong Leaeng in a newly constructed building with communications equipment. No adverse environmental effects are associated with this new building.

444. Proposed civil works for utilisation of a water tower in Tuek Phos for water supply has been dropped from the previous program as these works have already been undertaken by Ministry of Energy. The budget for this subproject has been reassigned to another subproject.

445. Temporary environmental impacts caused by the civil works have been identified and mitigation measures are given in the environmental management plan (EMP). The EMP (and EMMP) will be included in the IEE and will form part of the tender documents which becomes legally binding on the selected contractor.

446. To ensure that the project is carried out in accordance with the EMP requirements, MPWT will specify details of the implementation of the EMP in the tender documents and civil works contracts.

447. ESO (previously SEO) is operational but needs capacity building. The detailed design and implementation supervision consultant will provide on-the-job training to the field personnel of the ESO of MPWT to build their capacity in environmental management and monitoring.

448. No environmental impacts were identified that would warrant the conduct of an environmental due diligence study.

## XII. ANNEX 1 CONDITION SURVEYS

### A. Condition Survey Road NR13

ROAD SECTION	FROM	TO	Date of Survey			
NR13	BEGINNING POINT KRABAU 122 kms from PHNOM PENH	NR1	17.3.2011			
#	Measured distance	Marked Chainage	LHS / RHS	Feature	Start / End	Reference
1	0	0	LHS	Electricity post; Low Tension	0954	
2	0		RHS	Electricity post; Low Tension		
3	0.4		LHS / RHS	Electricity post; Low Tension crossing, culvert		
4	1.0		RHS	Mature trees		
5	1.4		LHS / RHS	Trees		
6	1.5		LHS	Electricity post; Low Tension, lateral borrow areas both sides		
7	2.3		LHS/ RHS	Close trees		
8	2.9		LHS	Electricity post; Low Tension, no trees, road very dusty		
9	3.9		LHS	Electricity post; Low Tension, cross drainage		
10	4.6		LHS	Andong Trabek school		
11	4.8		Both	Open Padi		
12	6.5		LHS/RHS	Excavations, Electricity post; Low Tension, LHS		
13	7.4		LHS	Low shrubs		
14	9.6		LHS	Andong Trabek Police Station		
15	10.2		LHS	Temple		
16	13.1		LHS/RHS	Open Padi		
17	14.4		RHS	School		
18	14.5		LHS	Commune Building		
19	15.3		LHS	Pagoda		
20	16.8		Both RHS	Bushes Mobile Tour		
21	17.6		RHS	EU FAO Food Program		
22	17.7		RHS	Svay Rien province		

				boundary, road dusty		
23	19.7		Both	Crossroads, Commune office, police station, EU/FAO signs. Roads dusty		
24	22.3		LHS	Electricity post; Low Tension		
25	23.5		Both	Tarmac surface begins		
26	23.7		Both	15Tonne bridge over river. Built 2001, needs replacing		
27	23.8		LHS	Electricity post; Low Tension		
28	24.0		Both	High school. Small town, market, Kampong Trach		
29	24.7		LHS	Kampong Trach health centre		
30	24.8		Both	Romeashek Referral Hospital (LHS); District office (LHS); School (LHS); Pagoda (RHS)		
31	25.9		LHS	High school		
32	28.0		Both	16T bridge, Culvert		
33	31.1		LHS	Pagoda entrance; primary school		
34	32.9		LHS	Electricity post; Low Tension		
35	36.2		LHS / RHS	Mobile phone towers; Hospital, pagoda (RHS)		
36	38.2	38+200	Both	Bridge Built 2003 no weight limit		
37	38.9		LHS / RHS	Pagoda (RHS), High school (LHS)		
38	40.0		LHS	Electricity post; Low Tension; Mobile phone towers		
39	41.1		RHS	Pagoda		
40	42.7		LHS	Primary school		
41	43.5		LHS	Electricity post; Low Tension		
42	44.1	44+100	LHS / RHS	Mobile phone tower (LHS); primary school (RHS); mature houses		
43	45.6		RHS	Pagoda		
44	46.0		Both	Pagoda (RHS); Police station, primary school (LHS)		
45	46.8		Both	T-junction road to Vietnam, NR1		
46	47.0		LHS	Electricity post; Low Tension		
47	47.6		LHS	Pagoda		
48	47.9		Both	Grave (LHS); Mobile tower		
49	48.8		RHS	Police station		
50	50.3		Both	Bridge no weight sign		
51	51.4		RHS	Dry well		

52	52.3		RHS	School. Lots of electrical cables		
53	53.2		Both	Pagoda (LHS); District office, primary school, mobile phone tower (RHS)		
54	53.6		Both	Bridge 15T, Tax office (RHS)		
55	53.8		LHS / RHS	Pagoda (LHS); Electricity post, High Tension (RHS)		
56	54.3		Both	Culvert; Electricity post, High Tension (RHS)		
57	55.7		RHS	Primary school; Electricity post, High Tension (RHS)		
58	56.7		RHS	Graves 100m from road		
59	57.2		RHS	Pagoda; Electricity post, High Tension (RHS)		
60	58.7		Both	Electricity post, High Tension and step down transformers (RHS); Pagoda (LHS)		
61	59.7		Both	Bridge over Lake Vigo; lake both sides, some birds, some fishermen		
62	60.0		LHS	Pagoda		
63	60.8		Both	Box culvert		
64	61.1		Both	Primary schools		
65	61.3		Both	Highway 1	1135	

## B. Condition Survey Road 314D and CBF

ROAD SECTION	FROM	TO	Date of Survey			
NR13	BEGINNING POINT Highway 1	CBF	17.3.2011			
#	Measured distance	Marked Chainage	LHS / RHS	Feature	Start / End	Reference
1	0	0		Rasot, T-junction Highway 1. Height restriction Max 16T axle 2, 20T axle 3	1200	
2	0.5		RHS	Hospital		
3	1.0		RHS	Electricity post; Low Tension, gravel road		
4	2.3		Both	Electricity lines crossing		
5	2.4		RHS	Electricity from Vietnam		
6	2.9		LHS	Pagoda		
7	3.4		LHS	Primary school		
8	5.3		RHS	Electricity posts High Tension		
9	6.0		LHS	Pagoda		
10	6.4		LHS	Christian church		
11	6.7		RHS	Pagoda		
12	7.3		LHS	Mobile Phone tower		
13	7.4		LHS/RHS	Electricity post High Tension		
14	10.1		LHS	Electricity post; Low Tension		
15	11.4		RHS	Pagoda; electric poles crossing		
16	13.6		RHS	Pagoda		
17	14.7		Both	Road very dusty		
18	15.0		Both	Road changes from gravel to blacktop		
19	15.2		LHS	Kampomg Gro high school		
20	15.5		Both	Roundabout, dual carriageway		
21	15.6		Both	Blacktop ends, gravel resumes		
22	15.8		LHS	Market		
23	16.3		LHS	Mobile phone tower, high tension electricity poles		
24	17.8		RHS	Primary school		
25	19.3		Both	Water gate and water channel crossing road		
26	21.1		LHS	Pagoda		
27	21.4		LHS	Mobile phone tower		
28	22.9		Both	Bridge 16T. Viet Nam border markers		

29	24.5		LHS	Boats loading rice to Viet Nam		
30	25.0		Both	Viet Nam border crossing	1400	

### C. Condition Survey Section 150B

ROAD SECTION	FROM	TO	Date of Survey			
150B and NR53	BEGINNING POINT Tonle Sap River	Crossing NR5 to Tuek Phos Village	16.6.2011			
#	Measured distance	Marked Chainage	LHS / RHS	Feature	Start / End	Reference
1	0	0	LHS	Tak Ches Village Market; very narrow road	0900	
2	1.1		RHS	Pagoda, school		
3	1.3		LHS	Rice padi		
4	1.7		LHS	Rice padi		
5	2.6		LHS	Mosque		
6	3.5		LHS	School		
7	4.7		LHS/RHS	School; Health centre		
8	5.1		RHS	Mobile phone tower		
9	5.3		Both	NR5 intersection		
10	5.7		RHS	School setback 200m		
11	6.2		LHS	Commune office		
12	6.7		Both	Rice paddies		
13	7.5		LHS	Mobile phone tower		
14	8.4		Both	Road on embankment, rice padis		
15	9.0		LHS	Sharp left hand bend		
16	9.6		LHS/RHS	Mobile phone tower/School		
17	12.7		Both	Embankments		
18	13.3		RHS	School		
19	13.5		LHS	Mosque		
20	15.7		Both	Rice padis		
21	17.5		LHS	Old sign Primary school		
22	19.1		LHS	Road to school		
23	19.6		RHS	Mobile phone tower		
24	20.2		LHS	Grave setback 100m		
25	21.7		Both	HT Electric poles crossing		
26	22.9		RHS	Sharp right hand bend, rice padis both sides		
27	23.5		LHS	Left hand bend		
28	23.8-24.2		LHS	Grave, school, many mature trees		
29	25.1-25.3		LHS	Dense stands of trees		
30	26.9		Both	Rice padis		
31	28.5		Both	Railway line crossing		



32	29.3		LHS	Pagoda		
33	29.6		Both	Bridge 15T, river		
34	30.9		Both	Bridge		
35	31.1		LHS	Water tower, railway line		
36	31.6		LHS	Pagoda		
37	31.9		LHS RHS	/ Tuek Phos village	1100	

**D. Condition Survey Section NR53 and 151B**

ROAD SECTION	FROM	TO	Date of Survey			
NR13	BEGINNING POINT Tuek Phos Village	End 151B	17.3.2011			
#	Measured distance	Marked Chainage	LHS / RHS	Feature	Start / End	Reference
1	0	0		Culvert #7	0954	
2	2.5		LHS	LT Electric poles		
3	3.6		LHS	School		
4	3.7		RHS	Pagoda		
5	3.8		LHS	Mobile phone tower		
6	5.2		Both sides	Mobile phone towers		
7	5.9		LHS	School, LT Electric poles		
8	6.2		LHS	Pagoda entrance		
9	7.8		LHS/RHS	LT Electric poles/ Mobile phone tower		
10	8.4		LHS	Private school		
11	9.2		LHS	Mobile phone towers		
12	10.7		LHS	Pagoda		
13	11.6		RHS	School		
14	14.0		RHS	Pagoda		
15	16.1		LHS	Mobile phone tower		
16	16.8		RHS	Mobile phone tower, school, pagoda		
17	16.9		RHS	School, waterfall		
18	18.7		Both	Rice padi both sides		
19	20.4		Both	Mature trees		
20	22.2		LHS	LT Electric poles		
21	23.8		RHS	School		
22	26.7		LHS	LT Electric poles		
23	28.9		LHS	Fishponds		
24	29.3		LHS	Watergate		
25	30.3		RHS	Y-junction		
26	306		Both	River		
27	31.2		Both	Y-junction 151B	1500	

**E. Condition Survey Section 151B**

ROAD SECTION	FROM	TO	Date of Survey			
151B	BEGINNING POINT NR53	Chinese Road	09.07.2011			
#	Measured distance	Marked Chainage	LHS / RHS	Feature	Start / End	Reference
1	0	0	LHS	LT Electric poles	1330	
2	0.4		LHS	Borrow pits full of water		
3	1.7		LHS	Private school		
4	1.8		LHS	Pagoda		
5	3.3		RHS	Mobile phone tower		
6	3.7		LHS	Oblique junction; end of 151B section; junction with "Chinese road".	1400	

### **XIII. ANNEX 2 SOIL ANALYSIS RESULTS KHET LAKE**



## Food and Chemical Services

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Ref.: AS2014-328

### RESULT OF ANALYSIS

Organization / company	KCL Tel: 011 855042
Type of sample	Mud
Sample submitted date	15 August, 2014

N	Parameter	Unit	Testing Result	Testing Methods
1	pH	-	6.90	pH meter
2	Dried Weight (DW)	g/100g	63.5	Gravimetry, AOAC
3	Total Nitrogen (N)	g/Kg DW	0.59	Kjeldahl, AOAC
4	Total Phosphorus (P)	g/Kg DW	0.11	Spectrophotometry, AOAC
5	Potassium (K)	g/Kg DW	0.52	Spectrophotometry, AOAC
6	Total Organic Carbon (TOC)	g/Kg DW	16.8	Walkley and Black
7	Nitrite (NO <sub>2</sub> )	g/Kg DW	0.03	Spectrophotometry
8	Nitrate (NO <sub>3</sub> )	g/Kg DW	0.44	Spectrophotometry
9	Total Iron (Fe)	g/Kg DW	6.70	Spectrophotometry, AOAC
10	Zinc (Zn)	g/Kg DW	0.58	Spectrophotometry
11	Arsenic (As)	mg/Kg DW	2.47	Metalizer, WagTech, UK
12	Mercury (Hg)	mg/Kg DW	2.83	Metalizer, WagTech, UK
13	Lead (Pb)	mg/Kg DW	3.22	Metalizer, WagTech, UK
14	Cadmium (Cd)	mg/Kg DW	ND (<0.003)	Metalizer, WagTech, UK
15	Copper (Cu)	mg/Kg DW	32.9	Spectrophotometry, AOAC
16	Hexavalence Chromium (Cr <sup>6+</sup> )	mg/Kg DW	0.42	Spectrophotometry, AOAC
17	Total Chromium (Cr)	mg/Kg DW	1.84	Spectrophotometry, AOAC
18	Cyanide (CN)	mg/Kg DW	25.5	Distillation, AOAC
19	Biological Oxygen Demand (BOD <sub>5</sub> )	mg/Kg DW	708	Standard method for wastewater testing
20	Chemical Oxygen Demand (COD)	mg/Kg DW	1990	Standard method for wastewater testing
<b>Polychloro Biphenyl (PCB)</b>				
21	2,2'-Dichlorobiphenyl (PCB 4)	µg/Kg DW	ND (< 10)	GC-MS
22	2,4,4'-Trichlorobiphenyl (PCB 28)	µg/Kg DW	ND (< 10)	GC-MS
23	2,2',5,5'-Tetrachlorobiphenyl (PCB 52)	µg/Kg DW	ND (< 10)	GC-MS
24	2,2',4,5,5'-Pentachlorobiphenyl	µg/Kg DW	ND (< 10)	GC-MS



	(PCB 101)			
25	2,2',3,4,4',5'-Hexachlorobiphenyl (PCB 138)	µg/Kg DW	ND (< 10)	GC-MS
26	2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)	µg/Kg DW	ND (< 10)	GC-MS
27	2,2',3,4,4',5,5'-Hepta chlorobiphenyl (PCB 180)	µg/Kg DW	ND (< 10)	GC-MS
<b>Pyrethroid Pesticides</b>				
28	Acrinathrin	µg/Kg DW	ND (< 10)	GC-MS/MS
29	Bifenthrin	µg/Kg DW	ND (< 10)	GC-MS/MS
30	Δ-Cyhalothrin	µg/Kg DW	ND (< 10)	GC-MS/MS
31	Cyfluthrin	µg/Kg DW	ND (< 10)	GC-MS/MS
32	Cypermethrin (isomers)	µg/Kg DW	ND (< 10)	GC-MS/MS
33	α-Cypermethrin	µg/Kg DW	ND (< 10)	GC-MS/MS
34	Deltamethrin	µg/Kg DW	ND (< 10)	GC-MS/MS
35	Fenpropathrin	µg/Kg DW	ND (< 10)	GC-MS/MS
36	Esfenvalerate	µg/Kg DW	ND (< 10)	GC-MS/MS
37	Fenvalerate	µg/Kg DW	ND (< 10)	GC-MS/MS
38	Flucythrinate	µg/Kg DW	ND (< 10)	GC-MS/MS
39	Flumethrin	µg/Kg DW	ND (< 10)	GC-MS/MS
40	Halfenprox	µg/Kg DW	ND (< 10)	GC-MS/MS
41	Permethrin (cis, trans isomer)	µg/Kg DW	ND (< 10)	GC-MS/MS
42	Tefluthrin	µg/Kg DW	ND (< 10)	GC-MS/MS
<b>Organochlorine Pesticides</b>				
43	4,4'-DDD	µg/Kg DW	ND (< 10)	GC-MS/MS
44	4,4'-DDE	µg/Kg DW	ND (< 10)	GC-MS/MS
45	2,4'-DDE	µg/Kg DW	ND (< 10)	GC-MS/MS
46	2,4'-DDT	µg/Kg DW	ND (< 10)	GC-MS/MS
47	4,4'-DDT	µg/Kg DW	ND (< 10)	GC-MS/MS
48	Aldrin	µg/Kg DW	ND (< 10)	GC-MS/MS
49	α-BHC	µg/Kg DW	ND (< 10)	GC-MS/MS
50	β-BHC	µg/Kg DW	ND (< 10)	GC-MS/MS
51	γ-BHC (Lindane)	µg/Kg DW	ND (< 10)	GC-MS/MS
52	δ-BHC	µg/Kg DW	ND (< 10)	GC-MS/MS
53	Chlordane	µg/Kg DW	ND (< 10)	GC-MS/MS
54	Dieldrin	µg/Kg DW	ND (< 10)	GC-MS/MS
55	α-Endosulfan	µg/Kg DW	ND (< 10)	GC-MS/MS
56	β-Endosulfan	µg/Kg DW	ND (< 10)	GC-MS/MS
57	Endosulfan Sulfate	µg/Kg DW	ND (< 10)	GC-MS/MS
58	Endrin	µg/Kg DW	ND (< 10)	GC-MS/MS
59	Endrin Aldehyde	µg/Kg DW	ND (< 10)	GC-MS/MS
60	HCb (Hexachlorobenzene)	µg/Kg DW	ND (< 10)	GC-MS/MS
61	Heptachlor	µg/Kg DW	ND (< 10)	GC-MS/MS
62	Heptachlor epoxide (isomer B)	µg/Kg DW	ND (< 10)	GC-MS/MS
63	Pentachloroaniline	µg/Kg DW	ND (< 10)	GC-MS/MS
<b>Carbamate Pesticides</b>				



64	Aldicarb	µg/Kg DW	ND (< 10)	GC-MS/MS
65	Aldicarb sulfone	µg/Kg DW	ND (< 10)	GC-MS/MS
66	Aldicarb sulfoxide	µg/Kg DW	ND (< 10)	GC-MS/MS
67	Bendiocarb	µg/Kg DW	ND (< 10)	GC-MS/MS
68	Butocarboxim	µg/Kg DW	ND (< 10)	GC-MS/MS
69	Carbaryl	µg/Kg DW	ND (< 10)	GC-MS/MS
70	Carbofuran	µg/Kg DW	ND (< 10)	GC-MS/MS
71	3-hydroxy carbofuran	µg/Kg DW	ND (< 10)	GC-MS/MS
72	3-keto carbofuran	µg/Kg DW	ND (< 10)	GC-MS/MS
73	Fenobucarb	µg/Kg DW	ND (< 10)	GC-MS/MS
74	Fenoxycarb	µg/Kg DW	ND (< 10)	GC-MS/MS
75	Isoprocab	µg/Kg DW	ND (< 10)	GC-MS/MS
76	Macbal(XMC)	µg/Kg DW	ND (< 10)	GC-MS/MS
77	Methiocarb	µg/Kg DW	ND (< 10)	GC-MS/MS
78	Methomyl	µg/Kg DW	ND (< 10)	GC-MS/MS
79	Metolcarb	µg/Kg DW	ND (< 10)	GC-MS/MS
80	Oxamyl	µg/Kg DW	ND (< 10)	GC-MS/MS
81	Pirimicarb	µg/Kg DW	ND (< 10)	GC-MS/MS
82	Promecarb	µg/Kg DW	ND (< 10)	GC-MS/MS
83	Propham	µg/Kg DW	ND (< 10)	GC-MS/MS
84	Propoxur	µg/Kg DW	ND (< 10)	GC-MS/MS
85	Thiodicarb	µg/Kg DW	ND (< 10)	GC-MS/MS
<b>Organophosphorous Pesticides</b>				
86	Acephate	µg/Kg DW	ND (< 10)	GC-MS/MS
87	Azinphos methyl	µg/Kg DW	ND (< 10)	GC-MS/MS
88	Bromophos ethyl	µg/Kg DW	ND (< 10)	GC-MS/MS
89	Bromophos methyl	µg/Kg DW	ND (< 10)	GC-MS/MS
90	Carbophenothion	µg/Kg DW	ND (< 10)	GC-MS/MS
91	Chlorfenvinphos	µg/Kg DW	ND (< 10)	GC-MS/MS
92	Chlorpyrifos	µg/Kg DW	ND (< 10)	GC-MS/MS
93	Chlorpyrifos Methyl	µg/Kg DW	ND (< 10)	GC-MS/MS
94	Coumaphos	µg/Kg DW	ND (< 10)	GC-MS/MS
95	Cyanofenphos	µg/Kg DW	ND (< 10)	GC-MS/MS
96	Demeton-S-methyl	µg/Kg DW	ND (< 10)	GC-MS/MS
97	Diazinon	µg/Kg DW	ND (< 10)	GC-MS/MS
98	Dichlorvos	µg/Kg DW	ND (< 10)	GC-MS/MS
99	Disulfoton	µg/Kg DW	ND (< 10)	GC-MS/MS
100	Ditalimfos	µg/Kg DW	ND (< 10)	GC-MS/MS
101	Edifenphos	µg/Kg DW	ND (< 10)	GC-MS/MS
102	EPN	µg/Kg DW	ND (< 10)	GC-MS/MS
103	Ethion	µg/Kg DW	ND (< 10)	GC-MS/MS
104	Ethoprophos	µg/Kg DW	ND (< 10)	GC-MS/MS
105	Ethoxyquin	µg/Kg DW	ND (< 10)	GC-MS/MS





106	Famphur	µg/Kg DW	ND (< 10)	GC-MS/MS
107	Fenamiphos	µg/Kg DW	ND (< 10)	GC-MS/MS
108	Fenthion	µg/Kg DW	ND (< 10)	GC-MS/MS
109	Heptenophos	µg/Kg DW	ND (< 10)	GC-MS/MS
110	Iprobenfos	µg/Kg DW	ND (< 10)	GC-MS/MS
111	Isoxathion	µg/Kg DW	ND (< 10)	GC-MS/MS
112	Malathion	µg/Kg DW	ND (< 10)	GC-MS/MS
113	Mecarbam	µg/Kg DW	ND (< 10)	GC-MS/MS
114	Methacrifos	µg/Kg DW	ND (< 10)	GC-MS/MS
115	Methamidophos	µg/Kg DW	ND (< 10)	GC-MS/MS
116	Methidathion	µg/Kg DW	ND (< 10)	GC-MS/MS
117	Mevinphos	µg/Kg DW	ND (< 10)	GC-MS/MS
118	Monocrotophos	µg/Kg DW	ND (< 10)	GC-MS/MS
119	Omethoate	µg/Kg DW	ND (< 10)	GC-MS/MS
120	Parathion	µg/Kg DW	ND (< 10)	GC-MS/MS
121	Parathion-ethyl	µg/Kg DW	ND (< 10)	GC-MS/MS
122	Phenthoate	µg/Kg DW	ND (< 10)	GC-MS/MS
123	Phorate	µg/Kg DW	ND (< 10)	GC-MS/MS
124	Phosalone	µg/Kg DW	ND (< 10)	GC-MS/MS
125	Phosmet	µg/Kg DW	ND (< 10)	GC-MS/MS
126	Phosphamidon	µg/Kg DW	ND (< 10)	GC-MS/MS
127	Pirimiphos ethyl	µg/Kg DW	ND (< 10)	GC-MS/MS
128	Pirimiphos methyl	µg/Kg DW	ND (< 10)	GC-MS/MS
129	Propaphos	µg/Kg DW	ND (< 10)	GC-MS/MS
130	Prothiofos	µg/Kg DW	ND (< 10)	GC-MS/MS
131	Pyrazophos	µg/Kg DW	ND (< 10)	GC-MS/MS
132	Quinalphos	µg/Kg DW	ND (< 10)	GC-MS/MS
133	Terbufos	µg/Kg DW	ND (< 10)	GC-MS/MS
134	Tocofos methyl	µg/Kg DW	ND (< 10)	GC-MS/MS
135	Triazophos	µg/Kg DW	ND (< 10)	GC-MS/MS
136	Tribufos	µg/Kg DW	ND (< 10)	GC-MS/MS
137	Trichlorfon	µg/Kg DW	ND (< 10)	GC-MS/MS
138	Vamidothion	µg/Kg DW	ND (< 10)	GC-MS/MS

DW: Dried Weight. ND: Not Detected.

Phnom Penh, 27 August, 2014  
Head of Laboratory



DR. DAVIN UY



#### XIV. ANNEX 3 BASELINE COMMUNITY LEVEL SURVEY ABSTRACTED FROM SOCIO-ECONOMIC STUDY JULY 2011

(N.B. Original Table Numbers retained to allow cross reference to SES)

Table 9. Data on Wet Season Rice Irrigation and Farmers' Access to Irrigation

Province	Description	2007	2008
Svay Rieng Province	Total area of wet season rain fed rice land	98%	597,452 ha
	Percentage of wet season rice land that is irrigated & are in hectares (2008):	2%	3,001 ha (1%)
	(i) Area irrigated from canal/dam	75%	2,364 ha (78%)
	(ii) Area irrigated from river, stream, etc.	7%	11 ha (0%)
	(iii) Area irrigated from drilled well	11%	370 ha (12%)
	(iv) Area irrigated from dug pond	8%	266 ha (9%)
	Families who have access to irrigation water	5%	5,826 families (5%)
	Families who have irrigation wells	1%	1,532 families (1%)
	Number of irrigation wells in the province	1,029 wells	1,272 wells
	Percentage of families per district (with access to (supplemental) irrigation for wet season cultivation	No Data in 2007	2008
Project Areas (Svay Rieng)	(i) Kampong Rou District	-	11.0% (access to irrigation); 4.8% (access to supplemental irrigation); 478 families owned irrigation; wells-429 number of irrigation wells.
	(ii) Rumduol District	-	0.0% (access to irrigation); 0.1% (access to supplemental irrigation); 53 families owned irrigation; wells - 47 number of irrigation wells .
	(iii) Romeas Haek District	-	0.9% (access to irrigation); 0.2% (access to supplemental irrigation); 493 families owned irrigation; wells 378 number of irrigation wells.
	(iv) S vay Teab District	-	0.7% (access to irrigation); 0.0 (access to supplemental irrigation); 26 families owned irrigation; wells 25 number irrigation wells .
Prey Veng Province	Total area of wet season rain fed rice land	88%	180,744 ha (87%)
	Percentage of wet season rice land that is irrigated & are in hectares (2008):	12%	25,928 ha (13%)
	(i) Area irrigated from canal/dam	56%	15,847 ha (61%)
	(ii) Area irrigated from river, stream, etc.	26%	5,451 ha (21%)
	(iii) Area irrigated from drilled well	17%	4,455 ha (17%)
	(iv) Area irrigated from dug pond	0%	175 ha (1%)
	Families with access to irrigation	22%	47,278 families (21%)
	Families who have irrigation wells	7%	15,554 families (7%)
	Number of irrigation wells in the province	14,649 wells	14,467 wells
	Percentage of families per district with access to irrigation for wet season cultivation	No Data 2007	2008
Project Area	(i) Kamchay Mear District	-	8.7% (access to irrigation); 3.6% (access to supplemental irrigation); 892 families owned irrigation; wells- 681 number of irrigation wells (dist.)

Kampong Chhnang Province	Total area of wet season rainfed rice land	78%	84,905 ha (83%)
	Percentage of wet season rice land that is irrigated & are in hectares (2008):	22%	16,988 ha (17%)
	(i) Area irrigated from canal/dam	22%	16,988 ha (17%)
	(ii) Area irrigated from river, stream, etc.	70%	10,435 ha (22%)
	(iii) Area irrigated from drilled well	24%	5,242 ha (31%)
	(iv) Area irrigated from dug pond	0%	25 ha (0%)
	Families who have access to irrigation water	30%	25,099 families (31%)
	Families who have irrigation wells	1%	447 families (1%)
	Number of irrigation wells in the province	357 wells	255 wells
	Percentage of families per district (project area only) with access to irrigation for wet season cultivation (2008 data):	No Data 2007	2008
Project Areas	(i) Kampong Tralach District	-	38.5% (access to irrigation); 7.4% (access to supplemental irrigation); 39% number of families owned wells; 39% number of irrig.
	(ii) Tuek Phos District	-	22.1% (access to irrigation); 24.2% rice land with supplemental irrigation.
	(iii) Sameakki Mean Chey	-	27.3 (access to irrigation); 38% - rice land with supplemental irrigation.
Kampong Speu Province	Total area of wet season rain fed rice land	87%	267,089 ha (87%)
	Percentage of wet season rice land that is irrigated & are in hectares (2008):	13%	13,037 ha (5%)
	(i) Area irrigated from canal/dam	80%	11,253 ha (86%)
	(ii) Area irrigated from river, stream, etc.	19%	1,760 ha (14%)
	(iii) Area irrigated from drilled well	0%	0 ha (0%)
	(iv) Area irrigated from dug pond	0%	24 ha (0%)
	Families who have access to irrigation water	17%	21,632 families (16%)
	Families who have irrigation wells	0%	0 families (0%)
	Number of irrigation wells in the province	68 wells	0 wells
Project Area	Percentage of families per district with access to irrigation for wet season cultivation	No Data	2008
	(i) Thpong District	-	4.4% (access to irrigation); 18.6% (access to supplemental irrigation); 0 irrigation wells

Table 28. Overall assessment on the impacts of road project by Sex and Province

Province	In Favor of the Road Project		Not in Favor of the Road Project	
	F (N)	M (N)	F (N)	M (N)
Svay Rieng	233	152	0	2
Prey Veng	30	20	0	0
Kampong Chhnang	152	77	1	0
Kampong Speu	21	12	0	0
Total	436 (62%)	261 (37%)	1 (1%)	2 (3%)
Grand Total	697 (99.6%)		3 (0.4%)	

Source: HSES, June 2010.

Table 29. Perceptions on the Positive Impacts of the Road Project

Positive Impacts	Svay Rieng	Prey Veng	Kampong Chhnang	Kampong Speu	Rank per Province
	N	N	N	N	
Faster travel time and convenient	387	50	230	33	1st
Beneficial to children (no more dust, favorable in going to school, no more mud)	210	50	203	32	2nd

Improve income/revenues of the government (will facilitate economic growth within the project areas)	6	1	9	0	4th
Will provide employment/greater job opportunities to the people/local communities	245	40	82	6	3rd
Prices of land will increase	20	0	7	3	5th

\*Multiple responses

\*100% of the perceive impacts will have long-term impacts

Source: HSES, June 2010.

#### Negative Impacts of the Project

Table 30. Perceptions on the Negative and Level of Impacts of the Project

Negative Impacts	Svay Rieng	Prey Veng	Kg Chhnang	Kg Speu	Total & Rank (All provinces)	Level of Impacts		
	N	N	N	N	N	High	Med.	Low
Dust during construction	49	20	62	3	134 (4rd)	12	22	100
Noise during construction	50	5	51	3	109 (5th)	12	79	18
Some houses/lot will be affected (families will be displaced), loss of jobs and source of income	183	18	130	18	349 (2nd)	24	80	245
Increase number of migrants/ increase of human trafficking cases	72	0	2	0	74 (7th)	52	14	8
Increase in number of women/girls who will work in casinos/hotels and other business centers	82	0	0	0	82 (6th)	39	12	31
Increase in HIV/AIDS/STDs cases	10	0	2	0	12 (9th)	1	6	5
Increase in number of child labor cases	13	0	0	0	13 (8th)		0	1
Increase road accidents; over-speeding vehicles dangerous to children and old people	250	15	130	5	400 (1st)	196	170	34
No negative Impacts what's important is to have improved roads)	190	35	76	15	316 (3rd)	-	-	-
Total	790	93	453	44	1,380*	196	383	442

\*Multiple responses

Source: HSES, June 2011

Ethnicity/Ethnic Group	Female		Male		Both Gender (Total N %)	
	N	%	N	%	N	%
Cham	35	49	10	14	45	63
Vietnamese	11	15	9	13	20	28
Chinese	6	8	1	1	7	9
Total	52	72%	20	28%	72	100%

Table IPs' Ethnic Origin by Gender Source: HSEBS, June 2011

Table Breakdown of the Baseline Respondents by Gender

Province/District	Total Number of Respondents by Gender		Total Number and Percentage (Both F/M)	
	Female	Male	N	%
Svay Rieng Province				
(i) Kampong Rou	57	44	101	14
(ii) Svay Teab	58	28	86	12

(iii) Romeas Haek	72	34	106	15
(iv) Rumduol	37	37	74	11
(v) Svay Rieng City	8	12	20	3
Total:	232 (33%)	155 (22%)	387	55%
Prey Veng Province:				
(i) Kamchay Mear	31	19	50	7
Total:	31 (4%)	19 (3%)	50	7
Kampong Chhnang Province:				
(i) Kampong Tralach	85	41	126	18
(ii) Tuek Phos	48	22	70	10
(iii) Sameakki Mean Chey	20	14	34	5
Total:	153 (22%)	77 (11%)	230	33%
Kampong Speu Province:	21	12	33	5
(i) Thpong	21 (3%)	12 (2%)	33	5%
Total:	437 (62%)	263 (38%)	700	100%

Table Age Breakdown of the Respondents by Gender

Age Bracket	Svay Rieng		Prey Veng		Kampong Chhnang		Kampong Speu		Total of the Number and Percentage (per age bracket)			
	F	M	F	M	F	M	F	M	F (N)	F (%)	M (N)	M (%)
Below 18 years old	6	0	0	0	1	0	0	0	7	1	0	0
18 - 30 years old	54	14	5	2	33	23	6	1	98	14	40	6
31 - 40 years old	44	54	11	6	37	12	8	3	100	14	75	11
41 -50 years old	71	48	7	5	33	15	4	3	115	16	71	10
51- 60 years old	37	25	4	6	33	13	1	5	75	11	49	7
61 -70 years old	12	9	4	0	12	10	2	0	30	4	19	3
71 years old and above	8	5	0	0	4	4	0	0	12	2	9	1
Total Per Province	232	155	31	19	153	77	21	12	437	62%	263	38%
Grand Total	387 (55%)		50 (7%)		230 (33%)		33 ( 5%)		700 (100%)			

Source: HSES, June 2011

Table Marital Status of the Respondents by Gender

Civil Status	Svay Rieng		Prey Veng		Kampong Chhnang		Kampong Speu		Total Number and Percentage (per civil status)			
	F (N)	M (N)	F (N)	M (N)	F (N)	M (N)	F (N)	M (N)	F (N)	F (%)	M (N)	M (%)
Single/Never Married/Never Lived with a Partner	16	5	1	1	13	6	3	0	33	5	12	1
Married/Living Together	170	153	22	18	101	68	15	11	308	44	250	36
Female Headed Household	40	0	8	0	39	0	3	0	90	13	0	0
Male Headed Household	0	3	0	0	0	3	0	1	0	0	7	1
Total Per Province	232	155	31	19	153	77	21	12	431	62%	269	38%
Grand Total	387 (55%)		50 (7%)		230 (33%)		33 (5%)		700 (100%)			

Table Respondents' Ethnic Origin by Gender

Province	Khmer		Cham		Vietnamese		Chinese		Total Number and Percentage (Combined both F/M)			
	F	M (N)	F (N)	M	F (N)	M	F	M	F	F	M	M

	(N)			(N)		(N)	(N)	(N)	(N)	(%)	(N)	(%)
Svay Rieng	226	152	0	1	2	1	4	1	232	33	155	22
Prey Veng	31	19	0	0	0	0	0	0	31	4	19	3
Kampong Chhnang	109	60	35	9	9	8	0	0	153	22	77	11
Kampong Speu	19	12	0	0	0	0	2	0	21	3	12	2
Total per Ethnic Goup	385 (55%)	243 (35%)	35 (5%)	10 (1%)	11 (16%)	9 (1%)	6 (1%)	1 (0.01%)	437	62%	263	38%
Grand Total	628 (90%)		45 (6%)		20 (3%)		7 (1%)		700 (100%)			

Source: HSES, June 2011

Table 42. Occupation of Household Heads in the Project Areas

Occupation	Svay Rieng		Prey Veng		Kampong Chhnang		Kampong Speu		Total Number and Percentage (per occupation)				Total Both Sex (%)
	F	M	F	M	F	M	F	M	F (N)	F (%)	M (N)	M (%)	
Farming	146	128	25	13	101	51	18	11	290	41	203	29	70
Fishing	0	0	0	0	4	7	0	0	4	1	7	1	2
Selling/Owned a Shop/Store	60	10	3	4	37	15	2	0	101	15	29	4	19
Carpenter	0	1	0	0	0	0	0	1	0	0	2	0.01	0.01
Construction Worker/Laborer	1	3	0	1	0	1	1	0	2	0.01	5	1	1.01
Driver	0	2	0	0	0	0	0	0	0	0	2	0.01	0.01
Casino Worker	1	1	0	0	0	0	0	0	1	0.01	1	0.01	0.02
Factory Worker	5	0	0	0	1	0	0	0	6	1	0	0	1
Handicraft Making	2	0	0	0	1	0	0	0	3	0.01	0	0	0.02
Mechanic/Repair Vehicles	0	4	0	0	0	1	0	1	0	0	6	1	1
Teacher	2	4	0	0	0	1	0	0	2	0.01	5	1	1.01
Making Palm Sugar/Wine	3	2	3	1	2	1	0	0	7	1	4	0.01	1.01
Dressmaker/Tailor	8	0	0	0	1	0	0	0	9	1	0	0	1
No Job	6	0	0	0	6	2	0	0	12	2	2	0	2
Total per province	232	155	31	19	153	77	21	12	437	62%	263	38%	100%

Source: HSES, June 2011

Table Primary Source of Water for Drinking

Province	Faucet inside the house (with water pipes connected to the water source)	Water Pump	Ring Well/ Open Well	Rain Water (with jars or water container)	Stream, River or Lake
	N	N	N	N	N
Svay Rieng	35	287	32	33	0
Prey Veng	5	35	8	2	0
Kampong Chhnang	3	60	120	12	35
Kampong Speu	0	0	6	16	11
Total (N)	43	382	166	63	46
% (by Water Source)	6%	55%	24%	9%	6%

Source: HSES, June 2011

Table Households' Monthly Income

Monthly Income	Svay Rieng		Prey Veng		Kg Chhnang		Kampong Speu		Total Number and Percentage (per income bracket)				Total N & % (both Sex)	Rank (by Income)
	F	M	F	M	F	M	F	M	F (N)	F (%)	M (N)	M (%)		
\$50.00 and below	82	55	13	5	58	31	10	3	163	23	94	13	257 (36%)	1st
\$51.00 to	60	40	9	7	35	22	10	7	114	16	76	11	190	2nd

\$100.00													(27%)	
\$101 - \$150.00 monthly	40	38	9	4	43	18	0	1	92	13	61	9	153 (22%)	3rd
\$151.00 - \$200.00	32	15	0	2	14	3	0	0	46	7	20	3	66 (10%)	4th
\$201.00 to \$250.00	14	5	0	1	0	0	0	0	14	2	6	1	20 (3%)	5th
\$251.00 and more	4	2	0	0	3	3	1	1	8	1	6	1	14 (2%)	6th
Total (N) Per Province	232	155	31	19	153	77	21	12	437	62%	263	38%	700 (100%)	

Source: HSES, June 2011

Table Households' Status of Land Ownership and Size of Farm Land

Province	Size of Farm Land					Total (N & %) Households Who Owned Land
	Do not own Land	Less than 1 ha.	1-2 ha.	3-4 ha.	More than 4 ha.	
	N	N		N	N	
Svay Rieng	124	138	95	25	5	263 (54%)
Prey Veng	8	26	14	1	1	42 (9%)
Kampong Chhnang	77	92	45	11	5	153 (31%)
Kampong Speu	4	15	12	2	0	29 (6%)
Total (size of land)	213 (30%)	271 (38%)	166 (24%)	39 (6%)	11 (2%)	487 (70%)

Source: HSES, June 2011

Table Households' Type of Toilet Facilities

Province	Open Defecation (No Toilet)	Use of public shared latrine (communal)	Use of unimproved (but not shared), i.e. open pit, no flush type	Improved toilet facility (water sealed with flush)	Close pit (no automatic flush but use water)
	N	N	N	N	N
Svay Rieng	221	3	15	3	145
Prey Veng	45	1	1	0	3
Kampong Chhnang	168	2	2	0	58
Kampong Speu	24	0	0	0	9
Total (N)	458	6	18	3	215
(%)	65%	0.07%	3%	0.02	31%

Source: HSES, June 2011

Table Other Health/Nutrition Projects Suggested by the Respondents

Province	Provide Additional Food Supplies	Provide Clean water Source	Provide Sanitary Toilets	Provide Free Medicines & Vitamins, etc.	Feeding Center	Health & Nutrition Education
	N	N	N	N	N	N
Svay Rieng	56	89	98	112	25	7
Prey Veng	10	12	10	7	4	7
Kampong Chhnang	50	45	60	18	19	38
Kampong Speu	10	8	9	0	0	6
Total (N)	126	154	177	130	48	58
% & Rank	18% 4th Rank	22% 2nd Rank	25% 1st Rank	20% 3rd Rank	7% 6th Rank	8% 5th Rank

Source: HSES, June 2011

Table Respondents Recommendations to Improve the Health Condition by Gender and per Province \*

Recommendations and Rank	Svay Rieng			Prey Veng			Kampong Chhnang			Kampong Speu		
	F	M	Both F/M	F	M	Both F/M	F	M	Both F/M	F	M	Both F/M

Improve health facilities (hospitals/health centers should have complete facilities and hire additional qualified health personnel) (6th Rank)	30	11	41	2	3	5	4	8	12	1	0	1
Provide free medical check-up & medicines to poor households (1st Rank)	75	45	120	13	8	21	48	19	67	7	3	10
Provide sanitary toilets (toilet bowls) (4th Rank)	26	20	46	2	2	4	15	8	23	0	0	0
Provide safe drinking water (construct more water pumps in villages and schools without clean drinking water) (5th Rank)	20	18	38	4	2	6	13	7	20	4	1	5
Construct health center in the commune in every commune (2nd Rank)	17	15	32	4	3	7	44	19	63	2	2	4
Implement a feeding program for undernourished children in every commune/village (8th Rank)	16	11	27	2	0	2	1	2	3	1	0	1
Improve roads (provincial, rural and farm to market roads) (3rd Rank)	31	26	57	1	1	2	16	9	25	3	3	6
Health education seminars/trainings on (HHTPP/reproductive health, etc. (7th Rank)	17	9	26	3	0	3	12	5	17	2	3	5
Total per Province	232	155	387	31	19	50	153	77	230	21	12	33

Source: HSES, June 2011 \* Multiple Responses

Table 54. Primary Source of Water for Drinking

Province	Faucet inside the house (with water pipes connected to the water source)	Water Pump	Ring Well/Open Well	Rain Water (with jars or water container)	Stream, River or Lake
	N	N	N	N	N
Svay Rieng	35	287	32	33	0
Prey Veng	5	35	8	2	0
Kampong Chhnang	3	60	120	12	35
Kampong Speu	0	0	6	16	11
Total (N)	43	382	166	63	46
(%)	6%	55%	24%	9%	6%

Additional Data: Majority of the respondents' water source is just beside the house. The rest are located within 5-10 meters.

Table 57. Source of Power or Lighting Facilities

Province	Electricity	Re-chargeable Battery	Lamp (using oil or gas)	Total Number and Percentage per province
	N	N	N	N
Svay Rieng	191	115	81	387
Prey Veng	24	24	1	50
Kampong Chhnang	3	178	49	230
Kampong Speu	0	23	10	33
Total (N)	219	340	141	700
(%)	31%	49%	21%	100%

Table 84. Respondent's Answer to the Question, Have you experience flood or drought?

Province and District	Yes	No	Total Number and Percentage (per province)	
	N	%	N	%
Svey Rieng Province				
(i) Kampong Rou	42	59	101	14%

(ii) Svey Teab	40	46	86	12%
(iii) Romeas Haek	34	72	106	15%
(iv) Rumduol	32	42	74	11%
(v) Svey Rieng City	10	10	20	3%
Prey Veng Province:				
(i) Kamchay Mear	12	38	50	7%
Kampong Chhnang Province:				
(i) Kampong Tralach	56	70	126	18%
(ii) Tuek Phos	21	49	70	10%
(iii) Sameakki Mean Chey	10	24	34	5%
Kampong Speu Province:				
(i) Thpong	8	25	33	5%
Total	265 (37.86%)	435 (62.14%)	700	100%

Table 85. Information Received by the Respondents on Flood/Drought per Province/District

Province and District	Heard from Others that a big flood is coming	Need to Protect Environment to Protect Flood	No information received, no training yet on climate change or disaster preparedness	Total Number and Percentage per province/district	
	N	N	N	N	%
Svey Rieng Province					
(i) Kampong Rou	10	5	86	101	14%
(ii) Svey Teab	18	5	63	86	12%
(iii) Romeas Haek	8	6	92	106	15%
(iv) Rumduol	5	5	64	74	11%
(v) Svey Rieng City	3	2	15	20	3%
Prey Veng Province:					
(i) Kamchay Mear	4	3	43	50	7%
Kampong Chhnang Province:					
(i) Kampong Tralach	8	14	104	126	18%
(ii) Tuek Phos	0	0	70	70	10%
(iii) Sameakki Mean Chey	0	0	34	34	5%
Kampong Speu Province:					
(i) Thpong	0	0	33	33	5%
Total Per Response	56 (8%)	40 (6%)	604 (86%)	700	100%

Table 86. Specific Information Received on Climate Change

Province and District	Conserve forest, do not cut trees, plant more trees and take care of nature	Be prepared always for disaster, and what to do before and during disasters, prepare all things,	Conduct disaster preparedness training for the local communities with emergency drills	No Idea/No Training attended yet on climate change/disaster preparedness	Total Number and Percentage per province/district	
	N	N	N	N	N	%
Svey Rieng Province						
(i) Kampong Rou	5	5	7	84	101	14%
(ii) Svey Teab	2	8	1	75	86	12%
(iii) Romeas Haek	3	7	5	91	106	15%
(iv) Rumduol	4	5	6	59	74	11%
(v) Svey Rieng City	1	5	1	13	20	3%
Prey Veng Province:						
(i) Kamchay Mear	1	9	1	39	50	7%
Kampong Chhnang Province:						
(i) Kampong Tralach	4	5	5	112	126	18%
(ii) Tuek Phos	1	1	1	67	70	10%
(iii) Sameakki	0	1	1	32	34	5%



Mean Chey						
Kampong Speu Province:						
(i) Thpong	0	0	1	32	33	5%
Total Per Response	21 (3%)	46 (7%)	29 (4%)	604 (86%)	700	100%

Table 87. Specific Information Received on What to Do in Case of Flood

Province and District	Evacuate or leave house and go to higher grounds; don't stay close to rivers	Open spillway in areas with big rivers / irrigation structures	Always watch TV, listen to radio and information from the commune / village chief	Just stay at home (it is still safer at home)	No Idea / Not experience d flood yet	Total Number and Percentage per province/district	
	N	N	N	N	N	N	%
Svey Rieng Province							
(i) Kampong Rou	3	3	8	22	65	101	14%
(ii) Svey Teab	2	3	7	30	44	86	12%
(iii) Romeas Haek	2	3	6	20	75	106	15%
(iv) Rumduol	2	7	5	24	36	74	11%
(v) Svey Rieng City	3	1	2	10	4	20	3%
Prey Veng Province:							
(i) Kamchay Mear	1	1	5	22	21	50	7%
Kampong Chhnang Province:							
(i) Kampong Tralach	9	7	5	10	95	126	18%
(ii) Tuek Phos	1	1	0	0	68	70	10%
(iii) Sameakki Mean Chey	0	1	0	0	33	34	5%
Kampong Speu Province:							
(i) Thpong	0	0	0	0	33	33	5%
Total Per Response	23 (3%)	27 (4%)	38 (4%)	138 (20%)	474 (68%)	700	100%

Table 88. Information Received on What to Do During Drought (all provinces)

Information Received	N	%
Dig canal or have water reservoir	60	9
Plant more trees (to prevent drought)	48	7
No Idea	592	84
Total:	700	100%

Table 89. Respondents' Answers to the Question, "Have you attended any training on climate change/disaster preparedness?"

Province and District	Attended	Not Yet Attended	Total Number and Percentage per province/district	
	N	F	N	%
Svey Rieng Province				
(i) Kampong Rou	16	85	101	14%
(ii) Svey Teab	18	68	86	12%
(iii) Romeas Haek	16	90	106	15%
(iv) Rumduol	8	66	74	11%
(v) Svey Rieng City	7	13	20	3%
Prey Veng Province:				
(i) Kamchay Mear	10	40	50	7%
Kampong Chhnang Province:				
(i) Kampong Tralach	5	121	126	18%
(ii) Tuek Phos	14	56	70	10%
(iii) Sameakki Mean Chey	1	33	34	5%
Kampong Speu Province:				

(i) Thpong	1	32	33	5%
Total Per Response	96 (14%)	604 (86%)	700	100%

Table 90. Early Warning Systems Known by the Respondents (all provinces)

Province and District	Use bells in school and pagoda during emergency	Information from the Commune/Village Chiefs ; neighbors and other local people	Making noise by knocking on some objects made of wood, and other indigenous materials	Personal experience, just observe the weather; and watch TV/listen to radio; just do whatever is safe for the family during typhoon	No Idea / No Response	Total Number and Percentage per province/district	
	N	N	N	N	N	N	%
Svey Rieng Province							
(i) Kampong Rou	2	1	2	72	24	101	14%
(ii) Svey Teab	2	1	3	44	36	86	12%
(iii) Romeas Haek	4	1	1	54	46	106	15%
(iv) Rumduol	2	4	3	45	20	74	11%
(v) Svey Rieng City	2	1	2	10	5	20	3%
Prey Veng Province:							
(i) Kamchay Mear	1	1	1	35	12	50	7%
Kampong Chhnang Province:							
(i)Kampong Tralach	3	14	4	26	79	126	18%
(ii) Tuek Phos	0	9	0	2	59	70	10%
(iii) Sameakki Mean Chey	0	3	0	1	30	34	5%
Kampong Speu Province:							
(i) Thpong	0	0	0	0	33	33	5%
Total Per Response	16	35	16	289	344	700	100%

Table 91. Source of Information During Floods/Typhoons

Province and District	Commune/Village Chiefs	Neighbors /local villagers	TV/Radio	Personal observation/strategy/Just do what is best based on observation of the weather/climate No idea/ No answer	Total Number and Percentage per province/district	
	N	N	N	N	N	%
Svey Rieng Province						
(i) Kampong Rou	4	2	12	83	101	14%
(ii) Svey Teab	3	1	10	72	86	12%
(iii) Romeas Haek	6	9	15	76	106	15%
(iv)Rumduol	3	1	17	53	74	11%
(v) Svey Rieng City	4	1	2	13	20	3%
Prey Veng Province:						
(i) Kamchay Mear	5	10	12	23	50	7%
Kampong Chhnang Province:						
(i)Kampong Tralach	8	10	21	87	126	18%
(ii) Tuek Phos	10	1	0	59	70	10%
(iii) Sameakki Mean Chey	5	0	0	29	34	5%
Kampong Speu Province:						
(i) Thpong	0	0	0	33	33	5%
Total Per Response	48	35	89	528	700	100%

Table 92. Strategies Used by Households During Flood/Typhoon

Province and District	Just stay at home (it's	If flood is high,	No Idea	Total Number and Percentage
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	safe than staying outside the house)	go to a higher level		per province/district	
	N	N	N	N	%
Svey Rieng Province					
(i) Kampong Rou	36	20	45	101	14%
(ii) Svey Teab	28	19	39	86	12%
(iii) Romeas Haek	32	24	50	106	15%
(iv) Rumduol	35	19	20	74	11%
(v) Svey Rieng City	7	10	3	20	3%
Prey Veng Province:					
(i) Kamchay Mear	15	10	25	50	7%
Kampong Chhnang Province:					
(i) Kampong Tralach	33	18	75	126	18%
(ii) Tuek Phos	19	5	46	70	10%
(iii) Sameakki Mean Chey	9	5	20	34	5%
Kampong Speu Province:					
(i) Thpong	2	5	26	33	5%
Total Per Response	216 (31%)	135 (19%)	349 (50%)	700	100%

Table 93. Place Where Households Bring their Livestock During Floods by Province

Province and District	Near the House	Near the Road (Higher Grounds)	Have not experienced any flood yet (just leave animals where they will be safe)	Pagoda	Total Number and Percentage per province/district	
	N	N	N	N	N	%
Svey Rieng Province						
(i) Kampong Rou	8	6	85	2	101	14%
(ii) Svey Teab	11	5	69	1	86	12%
(iii) Romeas Haek	12	4	88	2	106	15%
(iv) Rumduol	13	10	50	1	74	11%
(v) Svey Rieng City	3	5	11	1	20	3%
Prey Veng Province:						
(i) Kamchay Mear	6	5	36	3	50	7%
Kampong Chhnang Province:						
(i) Kampong Tralach	4	13	109	0	126	18%
(ii) Tuek Phos	8	2	60	0	70	10%
(iii) Sameakki Mean Chey	6	1	27	0	34	5%
Kampong Speu Province:						
(i) Thpong	1	0	32	0	33	5%
Total Per Response	72 (10%)	51 (7%)	567 (82%)	10 (1%)	700	100%

Table 94. Suggestions on what else is needed by the commune/village to best respond during disasters

Province and District	Conduct public awareness / training on disaster preparedness with drills	Organize disaster preparedness team (with medical team, trained volunteers, etc. who will help the people during disasters)	The govt. should raise funds, have money/resources (relief goods/foods, medicines and other supplies ready always) for distribution to the people or could be used anytime	Construct irrigation facilities – it can provide water for rice fields any season	Improve roads and canals	Total Number and Percentage per province/district	
	N	N	N	N	N	N	%
Svey Rieng Province							
(i) Kampong Rou	14	22	16	20	29	101	14%
(ii) Svey Teab	26	13	12	3	32	86	12%
(iii) Romeas Haek	37	23	20	6	20	106	15%
(iv) Rumduol	15	15	14	4	26	74	11%
(v) Svey Rieng City	3	4	3	1	9	20	3%

Prey Veng Province:							
(i) Kamchay Mear	14	9	5	4	18	50	7%
Kampong Chhnang Province:							
(i) Kampong Tralach	21	27	28	27	23	126	18%
(ii) Tuek Phos	10	17	12	9	22	70	10%
(iii) Sameakki Mean Chey	9	9	7	0	9	34	5%
Kampong Speu Province:							
(i) Thpong	7	11	3	0	12	33	5%
Total Per Response	156 (22%)	150 (21%)	120 (17%)	74 (11%)	20(29%)	700	100%

Table 95. Respondents' Answer to the Question, "Do you run out of Water During Dry Season?" (per province)

Province and District	Yes N	No N	Total Number and Percentage (Per province)	
			N	%
Svey Rieng Province				
(i) Kampong Rou	29	72	101	14%
(ii) Svey Teab	26	60	86	12%
(iii) Romeas Haek	23	83	106	15%
(iv) Rumduol	24	50	74	11%
(v) Svey Rieng City	3	17	20	3%
Prey Veng Province:				
(i) Kamchay Mear	14	36	50	7%
Kampong Chhnang Province:				
(i) Kampong Tralach	52	74	126	18%
(ii) Tuek Phos	16	54	70	10%
(iii) Sameakki Mean Chey	15	19	34	5%
Kampong Speu				
(i) Thpong	0	33	33	5%
Total:	202 (29%)	498 (71%)	700	100%

Table 96. Respondents' answer to the question, "Do you Need the Borrow Pits?" (by province)

Province and District	Yes N	No N	Total Number and Percentage (Per province)	
			N	%
Svey Rieng Province				
(i) Kampong Rou	38	63	101	14%
(ii) Svey Teab	27	59	86	12%
(iii) Romeas Haek	22	84	106	15%
(iv) Rumduol	27	47	74	11%
(v) Svey Rieng City	8	12	20	3%
Prey Veng Province:				
(i) Kamchay Mear	12	38	50	7%
Kampong Chhnang Province:				
(i) Kampong Tralach	42	84	126	18%
(ii) Tuek Phos	15	55	70	10%
(iii) Sameakki Mean Chey	10	24	34	5%
Kampong Speu				
(i) Thpong	14	19	33	5%
Total:	215	485	700	100%

Table 97. Purpose of borrow pits as perceived by the respondents (per province)

Province and District	Source of Water for Livestock	Source of Irrigation During Dry Season	Serve Fish Ponds as	No Benefits	Total Number and Percentage per province/district	
	N	N	N	N	N	%
Svey Rieng Province						
(i) Kampong Rou	15	8	12	66	101	14%
(ii) Svey Teab	11	5	8	62	86	12%
(iii) Romeas Haek	8	8	10	80	106	15%

(iv) Rumduol	12	5	9	48	74	11%
(v) Svey Rieng City	5	3	1	11	20	3%
Prey Veng Province:						
(i) Kamchay Mear	21	5	14	10	50	7%
Kampong Chhnang Province:						
(i) Kampong Tralach	5	29	8	84	126	18%
(ii) Tuek Phos	2	9	4	55	70	10%
(iii) Sameakki Mean Chey	2	7	1	24	34	5%
Kampong Speu Province:						
(i) Thpong	0	12	2	19	33	5%
Total Per Response	81 (11%)	91 (13%)	69 (10%)	459(66%)	700	100%

Table 98. Respondents' reasons why they do not like borrow pits (per Province)

Province and District	Possible Negative Effects on People's Health	Risky to Children (might get drowned)	Land used for Borrow Pits could still be Used as Farm Land	No Idea / Answer	Total Number and Percentage per province/district	
	N	N	N	N	N	%
Svey Rieng Province						
(i) Kampong Rou	24	10	4	63	101	14%
(ii) Svey Teab	15	8	5	58	84	12%
(iii) Romeas Haek	14	7	2	83	106	15%
(iv) Rumduol	14	9	1	50	74	11%
(v) Svey Rieng City	12	6	1	1	20	3%
Prey Veng Province:						
(i) Kamchay Mear	32	8	3	7	50	7%
Kampong Chhnang Province:						
(i) Kampong Tralach	26	8	28	64	126	18%
(ii) Tuek Phos	4	1	8	57	70	10%
(iii) Sameakki Mean Chey	1	1	2	30	34	5%
Kampong Speu Province:						
(i) Thpong	8	1	17	7	33	5%
Total Per Response	150 (21%)	59 (9%)	71 (10%)	420 (60%)	700	100%

Table 99. Respondents' Answer to the Question, "Do you Need More Water Capture?" (per Sex and Province/District)

Province	Yes		No		No Answer/No Idea		Total (both sexes)	
	F (N)	M (N)	F (N)	M (N)	F (N)	M (N)	N	%
Svey Rieng	44	51	26	34	143	89	387	55%
(i) Kampong Rou	10	10	8	6	50	17	101	14%
(ii) Svey Teab	10	11	5	11	36	13	86	12%
(iii) Romeas Haek	13	15	4	7	33	34	106	15%
(iv) Rumdoul	9	10	5	6	22	22	74	11%
(v) Svey Rieng City	2	5	4	4	2	3	20	3%
Prey Veng	8	1	15	17	7	2	50	7%
(i) Kamchay Mear								
Kampong Chhnang	18	24	44	21	91	32	230	33%
(i) Kampong Tralach	12	17	19	10	54	14	126	18%
(ii) Tuek Phos	5	7	17	7	26	8	70	10%
(iii) Sameakki Mean Chey	1	0	8	4	11	10	34	5%
Kampong Speu	0	1	16	7	5	4	33	5%
(i) Thpong								
Total:	70	77	101	79	246	127	700	100%

Table 100. Purpose of Water Capture as Perceived by the Respondents

(per sex and province)

Province and District	Source of Clean Water for Drinking / Household Use	Use as Fish Ponds	Could be used for Irrigating Farm During Dry Season	No Idea	Total Number and Percentage per province/district	
	N	N	N	N	N	%
Svey Rieng Province	36	9	31	17	292	
(i) Kampong Rou	12	3	10	76	101	
(ii) Svey Teab	8	3	5	70	86	
(iii) Romeas Haek	10	1	7	88	106	
(iv) Rumduol	4	1	5	64	74	
(v) Svey Rieng City	2	1	4	13	20	
Prey Veng Province:						
(i) Kamchay Mear	3	5	1	41	50	
Kampong Chhnang Province:						
(i) Kampong Tralach	15	9	5	97	126	18%
(ii) Tuek Phos	11	1	0	58	70	10%
(iii) Sameakki Mean Chey	1	0	0	33	34	5%
Kampong Speu Province:						
(i) Thpong	0	1	0	32	33	5%
Total Per Response	49 (7%)	26 (3%)	25 (3%)	3(1%)	700	100%

Table 101. Respondents' Answer to the Question, "Do you Need More Planting to Reduce Damage to Erosion?" (all provinces)

Respondents' Answer	N	%
Yes	593	85%
No	56	8%
No idea	51	7%
Total	700	100%

Table 102. Respondents' Perceptions on the Usage/Purpose of Planting Trees (all provinces)

Usage/Purpose of Planting Trees	N	Rank
Livestock Fodder	37	5th rank
Source of food (fruits)	408	2nd rank
Fuel wood/firewood and fiber	73	4th rank
Shade from the un	534	1st rank
Stabilize soil	84	3rd rank

Note: \* Multiple Responses

Table 103. Respondents' Perception on Who are Usually Involved in Planting Trees in the Communes

Province and District	Commune / Village leaders	Father (Men)	Mothers (Women)	Youth (both Sexes)
	N	N	N	N
Svey Rieng Province				
(i) Kampong Rou	11	50	13	27
(ii) Svey Teab	7	40	20	19
(iii) Romeas Haek	9	33	33	31
(iv) Rumduol	6	41	11	16
(v) Svey Rieng City	5	27	18	20
Prey Veng Province:				
(i) Kamchay Mear	5	27	15	15
Kampong Chhnang Province:				
(i) Kampong Tralach	24	56	50	42
(ii) Tuek Phos	27	45	29	20
(iii) Sameakki Mean Chey	6	24	18	1
Kampong Speu Province:				
(i) Thpong	2	27	18	2
Total/Rank	102 (4th rank)	370 (1st rank)	225 (2nd rank)	193 (3rd rank)

Note: Multiple responses.

## **XV. ANNEX 4 PUBLIC CONSULTATION ON WATER CAPTURE SEPTEMBER 2011**

Under the Climate Change Mitigation Measures component of TA 7665 Project, a series of five water capture projects have been identified in Kampong Chhnang Province. Each of these projects must be described in the IEE and an essential component of this evaluation is Public Consultation. Public Consultation Meetings were conducted on 7-8 September 2011 in Tuek Phos District, Kampong Chhnang Province. The public consultations were organized with the assistance of the Commune Chiefs in each locality. Potentially Affected Persons from the villages were invited verbally, relevant provincial government officers invited in writing by MPWT, and suitable locations organized in pagodas. The venues were :

Roleang Ke Pagoda, Chaong Maong Commune, Tuek Phos District, Kampong Chhnang Province

Keo Buthearam Pagoda, Akphivodth Commune, Tuek Phos District, Kampong Chhnang Province

Vihear Beth Meas Pagoda, Kbal Tuek Commune, Tuek Phos District, Kampong Chhnang Province

There were 3 venues for 4 meetings covering 5 communes, all in Tuek Phos District, Kampong Chhnang Province. The 4 meetings took 2 days in total.

In order to demonstrate Gender Equity in the meetings and ensure a correct record of comments from villagers the services of a female rapporteur were retained. A “break out group” to hold discussions among females only was offered but proved not necessary.

It was estimated that 150 people might attend the 4 meetings over 2 days and refreshments were offered to attendees. No other incentives were offered to any persons. The budget was US\$550. In the event 109 villagers attended plus provincial government staff and consultants.

No disputes or conflicts were raised. Competing needs were described but in general all the villagers were very supportive of the plan to provide more irrigation water for generating two rice crops a year instead of one. Some pertinent points were :

A dam across the river was needed but it would raise the water level upstream where people currently wade across the river because the water level is low. Could a crossing be provided on top of the dam ?

One lady was concerned that she was so poor she could not afford the money for a connection to a piped water supply and asked if she could offer her labor in exchange for a connection?

The use of the ex-railway water tank to provide water was enthusiastically supported. Local residents asked for drinking water not general garden irrigation water. They were willing to pay for the water if it was cheaper than commercially available bottled water. They were concerned over who would manage the water supply, would it be taken over by private operators, and would the raise the price of the water.

A villager offered use of his land for free to show his support for the projects

Government officers from MOE, MRD and MOWRAM also concurred with the proposals and endorsed inter ministry cooperation.

Public Consultation Meeting Report  
Tuek Phos District, Kampong Chhnang Province

XXXXXXXXXXXXXXXXXX

Subject: Boeung Khset and Svay Chek Dam Chaong Maong and Akphivodth Commune	
Personnel Information	Suggestion, Opinion, Question, Recommendation
Mr. Ung Vong Doeun, Deputy of Tuek Phos District Governor	<p>“First of all, I would like to pay the great gratitude to all his/her excellence, official and non-officials part, and all the participants being present here this morning. I have the honor to inform you that this morning we are going to talk about the new project on the infrastructure in this district. We would like to get all the possible suggestion and recommendation from all of you to start the project. At the end, I do hope you all say out your ideas without hesitation.” Thanks You!</p> <p>The purposes of the topic/project today are: First to examine what are the needs of the resident <b>Question:</b> To examine what the residents do not need? <b>Question:</b> What are the effects of its both negative and positive on the local residents? <b>Request:</b> The local want us to drain water up, need bigger road to strengthen the people’s health. I do eager you all say out loud of what you want or not? How do they affect to all of you? Or any opposed ideas or suggestions. If there is enough water, bridges, and road, we need to preserve it before and after draining up. Some family are even poorer and poorer due to borrowing money from banks to prepare their son or daughter reception, to buy new materials and at the end they will have lost their land of having no money to repay the debt. In order to gain the higher living standard, the villagers should increase the crops on free space. Delay the planting period to gain the higher yield and price rather than plant half a hectare and borrow half a hectare. The villagers should expose themselves to the market information and plant those crops upon needs annually, as this year: peas cost two million riels per ton or 2300 riel per kilogram, and rice cost more than one million riel per ton. Welcome speech from the minister of the Ministry of Agriculture on how to get high yield of doing farming and spend less.</p> <p>All in all, I am to show my sincere thank for your actively participation. After the examination, if it responds to the development of people, ADB will start doing it. The topic raised on dams are: <b>Review the pass:</b> Boeung Khset Svay Chek dam: since 1989, eight open streams were demolished by the thieves and its location was full of sand caused soil eroded into the</p>



	marsh.
Mr. Dork Bunthun, Director of PDWRAM, Kampong Chhnang Province	<p><b>Review the pass:</b> He has been working and development of irrigation system for Akphivodth commune, Teuk Phos district since 2006. This project was spend \$USD8 million (including buy the land and pay for affected area, construct).</p> <p>Svay Chek dam: nearby Svay Chek dam, there was shallow and need to drain it deeper up, which will be used for irrigating 1800 ha rice field. It was built in 1980 in which supported by AFFC. Up to now, there had been guarded by Mr Chan Sim, for more than 24 years. Additionally, he has added that this irrigation system study has been conducted for years including examining the geographical area and our budget to see how much water it could store. At the end he concluded that Provincial Department of Water Resource and Meteorology will try to develop the irrigation system for the villagers and support this project wholeheartedly (100%).</p>
Mrs. Ngim Bunra, First Vice Chief of Akphivodth commune	<p><b>Request:</b></p> <p>Want the project to rehabilitation the irrigation system in order to cultivate the rice field for two crops per year, fishing and improve the villagers' life.</p> <p>Want nice and bigger road which will be easy for travelling and transport goods</p>
Mr. Tun Chhern, Village Chief, Thmey village, Chaong Maong commune	<p><b>Request:</b></p> <p>Want the project to rehabilitation the irrigation system in order to cultivate the rice field for two crops per year, fishing and improve the villagers' life.</p>
Mrs. Chhub Vern, Villager, Khset village, Chaong Maong commune	<p><b>Request:</b></p> <p>Want the project to rehabilitation the irrigation system in order to cultivate the rice field for two crops per year, fishing and improve the villagers' life.</p>
Mrs. Chhub Hein, villager, Khset village, Chaong Maong commune	<p><b>Request:</b></p> <p>Want the project to rehabilitation the irrigation system in order to cultivate the rice field for two crops per year, fishing and improve the villagers' life.</p>
Mr. Ker Lin, villager, Thmey village, Chaong Maong commune	<p><b>Request:</b></p> <p>Need to have water and agreed to provide piece of his land along/nearby the project.</p>
Mr. Un Sokhom, villager, Chong Mong village, Chaong Maong commune	<p><b>Difficulties:</b></p> <p>His villagers affected by the lack of water to do the farming because their fields are beyond and away from canal.</p>
Mr. Chan Yan, First commune chief, Chaong Maong Commune	<p><b>Request:</b></p> <p>Want to have the water level up in the canal in order to be able to irrigate the lower fields</p>
Svay Chek village	<p><b>Perception:</b> All villagers who are living within project areas very happy and welcome to have a big bridge in Svay Chek village.</p>
Mr. Mao Key, village chief, Trapaing Chum village, Chaong Maong commune	<p>The government always develops new irrigation system; the quality of water gate must be good and reliable unlike the previous one has been damage some part already.</p>

Mr. Som Kim, Village development, Trapaing Raing village	Very happy and welcome to have Svay Chek dam and rehabilitation the canal that will make his life even better.
Mr. Bun Phan, Villager, Ralaing Ker village	Need to have bridge with box culvert because it is too weak to support heavy weight trucks etc., and the old one has been damaged
Mrs. Phoeuk Vy, Villager, Srae Prich, Akphivodth commune	Want to have the automatic water gate in order easily to control the inlet and out-let of water for irrigating into the rice field. It should be better to clearly study the canal location before construct.
Mrs. Phong Yeit, Villager, Trapaing Chum village, Chaong Maong commune	Want to have canal and small dike to irrigate water into the rice field.
Mr. Lay Phal, village chief, Pea Raing, Chaong Maong commune	On behalf of the villager, he very happy and welcome to have these projects because his villagers will be gotten benefit from the dam and there is no problem of construct.
<b>Subject: Water Tower Akphivodth Commune</b>	
<b>Personnel Information</b>	<b>Suggestion, Opinion, Question, Recommendation</b>
Mr. Ung Vong Doeun, position: Deputy-district chief	Opening Remark: "This is the precious chance for our villagers that will receive the pure water, bridge, and road. New bridge is going to born here too. In the recent day, we lack of toilet, health care center, and surrounding environment. There are more than 4000 villagers benefited from this project and in Taing commune, there are 267 families and 1980 villagers. Inevitably, water is precious for life such as drinking, washing, irrigating, and cooking and so on so forth. However, there is a problem of liquid waste, the villagers should control carefully, because it can cause health problems. In the final statement, I am sincerely wishing you all healthy, wealthy, success, prosperity, happiness and noble. Thanks You!
Mr. Kuy Leng, Commune chief, Akphivat commune	There are now 2053 families, 300 increases compare to 2010. The population in SreTachey village increase to 877 families, but in 2009 the total family is only 500. Thus, the total population in this commune is 9587 families and 5000 is female (2009) including 18-year population be able to get married is 3050. So how much land should be prepared for them? What are the possible problems can be take place unexpectedly.
Mr. Huy Sovannara, villager, SreTachey village, Akphivodth commune.	<b>Recommendation:</b> He thinks that right now, there are existing some of tube wells within this areas, therefore, if the water supply fee is higher, it may be difficult for local villager to use it. Should be negotiation with the affect people prior construction on water pipe network.
Mr. Maen Kaing, villager, SreTachey village, Akphivodth commune	Water and electricity is government property, can it be handed to the private counterpart? If it is handed to the private counterparts, does government have any program or regulation to help the villagers? "I do agree with this project"
Mr. Uon BunThoeun, Vender, Srea Tachey village, Akphivodth	<b>Question:</b> He wants to clearly know about the alignment of the project road construction?

commune	<p>When will the construction start?</p> <p>If it is handed to the private counterparts, does government have any program or regulation to help the villagers?</p>
Mr. Men Sopheap, Former Health Center Staff, Sre Ta Chey Vallage, Akphivodth Commune	<p><b>Suggestion:</b></p> <p>The provider water supply should determine clearly conditions and follow those conditions to the customers and vice versa; and what is the parameter should be stated within the condition or contract between receiver and provider.</p> <p><b>Question:</b></p> <p>How much does utility service (water supply fee)?</p> <p>“Totally, I am wholeheartedly agree and welcome to this project”</p> <p>What are the problems of this utility set up?</p> <p>What are the problems of studying project?</p>
<p><b>Subject: Chiprong Dam</b>  <b>Chaong Maong, Akphivodth and Klong Porpok Commune</b></p>	
<b>Personnel Information</b>	<b>Suggestion, Opinion, Question, Recommendation</b>
Mr. UngVongDoeun Deputy District Chief	<p>Welcome Speech: “Welcome to all staff and participants for the public consultation meeting, and the villagers.</p> <p><b>Question:</b> Do you want a dam in our area?</p> <p>Looking at Chiprong dam, it was first established in 1973 and had been damaged in war age. So at to our road lies from Ta Ches village nearby riverside to Armlaing commune (NR 52). Having seen the difficulties of all villagers including road condition, water and electricity supply; the Ministry of Public and Transport Pregame is seeking fund from ADB to help us and we will have the accessible road, water and utilities supply sooner or later. So I eager you all please to share your own ideas and this is the significance chance for you.</p> <p>What do you want from this project? Do not want from the project? Any affect? Any question? Please do not hesitate to answer with all questions. Our life is prosperous depending on available road for travelling or transporting goods and services, stable water and electricity supply as we can plant crop, rice and feeding the fish raising as commercial one.</p> <p><b>Question:</b></p> <p>Where can our dam be located?</p> <p>What the techniques in construct this dam are?</p> <p>What are the possible effects from this dam?</p> <p>How many families will be affected? How much land will be affected?</p> <p>How many people will be benefited from this dam?</p> <p>We cannot escape from the natural forces, but we do have to find way to protect ourselves in advance. I do hope and happy to hear this project and it would be succeeded in the near future.</p>
Mr. Tep Bern, village chief, Klung Porpok village, Klong Porpok commune	<p><b>Problem:</b></p> <p>We always lack of water annually even though there is some water supplying from the other sources or dam. It cannot be reached his village.</p> <p>Please our villagers share idea and opinion about this project?</p> <p><b>Question:</b></p>

	How many areas will be flooded if the water gate of Chiprong dam is closed?
Mr. TepChea, village, Klung Porpork village, Klong Porpok commune	<p>I am very happy and welcome to have this project</p> <p><b>Recommendation:</b> To establish the Dam Maintenance Committee and Canal Repairing. Improve the canal in which connecting from the river for irrigation to the rice fields, Establishing dam will affect those who use waterwheel due to the water level in the river will be up and local people can not pass through the river, so they request to have a small bridge.</p>
Mr. Sem Sat, villager, Sre Ta Chey Village, Akphivodth commune	<p>I am very happy and welcome to have this project</p> <p><b>Problem:</b> Related to this matter, there have problem for long time (more than ten years) the upstream user can be flooded whereas downstream user lack of water for using.</p> <p><b>Recommendation:</b> To establish the Dam Maintenance Committee and Canal Repairing in order to manage the water using and avoid to have conflict between the upstream and downstream users.</p>
Mr. Taon Sel, village chief, Ta Kam village, Klong Porpok commune	<p><b>Suggestion:</b> Is that possible to have secondary irrigation canal and water gate, and possible to have water gate of small canal located along the rice field?</p> <p><b>Question:</b> Who is responsible for managing water use?</p>
Mr. Men Sot, village chief, Boeung Steng village, Klong Porpok Commune	<p><b>Suggestion:</b> Create small water gate for water sharing to all village along the canal, and rehabilitation the damaged canal.</p>
Mr. Chan Yann, first commune chief, Chong Mong commune	<p>"I do welcome this project of construct dam from 100% to 200%. This project will not affect me at all and those small water gates must have built. Our commune one-year fund can contribute for two small water gates.</p>
Mr. Keo Chamroeun, vender, Sre Ta Cher village, Akphivodth commune	<p><b>Questions:</b> After construct the irrigation system, what will you do next? Create automatic water gate to allocate to all villages along the channel when the height of water reaches the peak level.</p> <p><b>Suggestion:</b> Provide training course on how to feed the fish or plant any suitable crop during the flooding time. The upstream should plant crop depend on the season when it is the flooding time, they should feed the fish instead of planting rice, establish resort or part and so on so forth.</p>
Mr. Chhim Van, villager, Kraoy Wat, Akphivodth commune	<p><b>Suggestion:</b> There is needed to be managing the water for both seasons (wet and dry season). Create automatic water gate to allocate to all villages along the canal.</p>
<b>Subject: Water Capture for using within Communities Kbal Tuek Commune</b>	
Mrs. Sim Run, First commune chief, Chipouk village	<p>"Welcome, Ladies and gentlemen! Our topic today is going to talk about water capture for using within communities and pipe line system for distributed to local communities within the Kbal Tuek Commune.</p>

Mrs. Ngorm Sary, Villager, Taing Ksach village	<b>Request:</b> The quality of pipe lines system, especially primary and secondary pine lines must be good in order to keep for long time.
Mr. Louch Touch, Vice village chief, Mong village	<b>Request:</b> Want to have a water storage and water tank in his village (Mong village)
Mr. Ngim Leng, Pagoda committee	<b>Request:</b> Want to have a water tank in his pagoda (the Vihear Beth Meas) and in each village. Want to have water tap which have 4-5 m from the house in order to avoid dirty place, so the villagers will not contaminated.
Mrs. Prak Lun, Village member, Mong village	<b>Request:</b> Her house is a little bit far away from the primary pipe line, so she wanted to know whether the ADB can distribute the water for her or just a well is better. Want to have water user committee and she want to share water fee for sustainable used.
Mrs. Kong Din, villager, Taing Ksach village	<b>Request:</b> She cannot afford to connect the water for using and ask the ADB whether it can pay for her of connecting water in which regarding to the equipment and she can contribute with labor. <b>Opinion:</b> she could pay some money for the water usage committee
Mrs. Ol Sreyvuth, village assistant, Taing Sya village	<b>Request:</b> she want to have water tank, but it is not big in Buddhist structure want to have a water storage in her village
Mr. Has Nom, village development committee, Doung village	<b>Request:</b> Want to have water storage in his village.
Mr. Yim Narith, Director of Wildlife Conservation Kampong Chhnang,	<b>Request:</b> The primary pipe line should be laid on the ground which have over height about 1.50 m above the land. Want to access the water use in Sleng village, Toul Kposh commune due to this village is also located within PAWS. There is needs to establish by-law and water user committee in order to manage the water using
Mr. Ma Him, Chief of Kbal Teuk commune, Krasaing Dos Lerng village	<b>Request:</b> Thanks you for your participation in this discussion to let the ADB direct it project properly. I do welcome this project wholeheartedly. The discussion is ended now!

List of Participants invited within Public Consultation Meeting for  
Tuek Phos District, Kampong Chhnang Province

~~~~~

Date: 7 – 8 September, 2011

| No                                                                                                                                                                                                        | Participants                              | Person Number | Remark |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------|--------|
| <b>I.</b>                                                                                                                                                                                                 | <b>Provincial Department</b>              |               |        |
|                                                                                                                                                                                                           | 1.1 Provincial DoPWT                      | 1             |        |
|                                                                                                                                                                                                           | 1.2 Provincial DoWRM                      | 1             |        |
|                                                                                                                                                                                                           | 1.3 Provincial DoE                        | 1             |        |
|                                                                                                                                                                                                           | 1.4 Provincial DoRD                       | 1             |        |
|                                                                                                                                                                                                           | 1.5 Provincial DoAFF                      | 1             |        |
|                                                                                                                                                                                                           | 1.6 Social-Environmental Unit (SEO)       | 3             |        |
|                                                                                                                                                                                                           | 1.7 Director of PAWS                      | 2             |        |
|                                                                                                                                                                                                           | <b>Sub-total (People)</b>                 | <b>10</b>     |        |
| <b>II</b>                                                                                                                                                                                                 | <b>District</b>                           |               |        |
|                                                                                                                                                                                                           | 2.1 Tuek Phos Governor                    | 1             |        |
| <b>III</b>                                                                                                                                                                                                | <b>Commune and Village</b>                |               |        |
| <i>Date: 7 September, 2011; at 9:30 AM,<br/>The Public Consultation Meeting will be held in Roleang Ke Pagoda (Wat Ekly Phal),<br/>Chaong Maong Commune, Tuek Phos District, Kampong Chhnang Province</i> |                                           |               |        |
| <b>3.1 The Public Consultation for Boeung Khset and Svay Chek Dam Project</b>                                                                                                                             |                                           |               |        |
| <b>A</b>                                                                                                                                                                                                  | <b>Chaong Maong Commune Chief/Council</b> | 2             |        |
|                                                                                                                                                                                                           | Thmey Village                             | 3             |        |
|                                                                                                                                                                                                           | Chaong Maong Village                      | 3             |        |
|                                                                                                                                                                                                           | Roleang Kèr Village                       | 3             |        |
|                                                                                                                                                                                                           | Trapaing Chrum Village                    | 3             |        |
|                                                                                                                                                                                                           | Khset Village                             | 3             |        |
|                                                                                                                                                                                                           | Pea Raing Village                         | 3             |        |
| <b>B</b>                                                                                                                                                                                                  | <b>Akphiwadth Commune Chief/Council</b>   | 2             |        |
|                                                                                                                                                                                                           | Trapaing Prinh village                    | 4             |        |
|                                                                                                                                                                                                           | Srae Prich village                        | 4             |        |
|                                                                                                                                                                                                           | Trapaing Raing village                    | 4             |        |
|                                                                                                                                                                                                           | <b>Sub-Total</b>                          | <b>35</b>     |        |
| <i>Date: 7 September, 2011; At 13:00 PM<br/>The Public Consultation Meeting will be held in Keo Buthearam Pagoda, Akphivodth<br/>Commune, Tuek Phos District, Kampong Chhnang Province</i>                |                                           |               |        |
| <b>3.2 The Public Consultation for Water Tower Project</b>                                                                                                                                                |                                           |               |        |
| <b>C</b>                                                                                                                                                                                                  | <b>Akphiwadth Commune Chief/Council</b>   | 2             |        |
|                                                                                                                                                                                                           | Srae Ta Chey Village                      | 15            |        |
|                                                                                                                                                                                                           | Romeas Village                            | 15            |        |
|                                                                                                                                                                                                           | <b>Sub-Total</b>                          | <b>32</b>     |        |
| <i>Date: 8 September, 2011; At 9:30 AM,<br/>The Public Consultation Meeting will be held in Keo Buthearam Pagoda, Akphivodth<br/>Commune, Tuek Phos District, Kampong Chhnang Province.</i>               |                                           |               |        |
| <b>3.3 The Public Consultation for Chiprong Dam Project</b>                                                                                                                                               |                                           |               |        |
| <b>D</b>                                                                                                                                                                                                  | <b>Klong Popok Commune Chief/Council</b>  | 2             |        |

|                                                                                                                                                                                           |                                          |            |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------|--|
|                                                                                                                                                                                           | Boeng Steng Village                      | 4          |  |
|                                                                                                                                                                                           | Kroy Wat Village                         | 4          |  |
|                                                                                                                                                                                           | Klong Popok village                      | 4          |  |
|                                                                                                                                                                                           | Tropang Chrey village                    | 4          |  |
|                                                                                                                                                                                           | Krobao village                           | 4          |  |
| <b>E</b>                                                                                                                                                                                  | <b>Choang Mong Commune Chief/Council</b> | 2          |  |
|                                                                                                                                                                                           | Rolaing Ker village                      | 5          |  |
|                                                                                                                                                                                           | Svay Chek village                        | 5          |  |
| <b>F</b>                                                                                                                                                                                  | <b>Akphivodth Commune Chief/Council</b>  | 2          |  |
|                                                                                                                                                                                           | Srae Ta Chey Village                     | 5          |  |
| <b>Sub-Total</b>                                                                                                                                                                          |                                          | <b>41</b>  |  |
| <i>Date 8 September, 2011; At 13:00 PM,<br/> The Public Consultation Meeting will be held in Vihear Beth Meas Pagoda, Kbal Tuek Commune, Tuek Phos District, Kampong Chhnang Province</i> |                                          |            |  |
| <b>3.4 The Public Consultation for Water Pipe Project</b>                                                                                                                                 |                                          |            |  |
| <b>G</b>                                                                                                                                                                                  | <b>Kbal Tuek Commune Chief/Council</b>   | 2          |  |
|                                                                                                                                                                                           | Moang villagel                           | 5          |  |
|                                                                                                                                                                                           | Doung village                            | 5          |  |
|                                                                                                                                                                                           | Tang Khsach village                      | 5          |  |
|                                                                                                                                                                                           | Ngoy village                             | 5          |  |
|                                                                                                                                                                                           | Taing Tya villagel                       | 5          |  |
|                                                                                                                                                                                           | Chi Pouk villagel                        | 5          |  |
|                                                                                                                                                                                           | Krasang Dos Loeung village               | 5          |  |
|                                                                                                                                                                                           | Representative of Water User Community   | 1          |  |
| <b>Sub-total</b>                                                                                                                                                                          |                                          | <b>38</b>  |  |
| <b>Total (people)</b>                                                                                                                                                                     |                                          | <b>156</b> |  |

## 07-08 September 2011

លេខ: ២២២/២០២២ រ.ក.ក. ចុះថ្ងៃទី ២២ ខែ កក្កដា ឆ្នាំ ២០២២ ទំព័រ ២០៩៩

[illegible]

Explain the following:

| Sl | Time  | Topic | Sl | Time  | Topic | Sl | Time  | Topic |
|----|-------|-------|----|-------|-------|----|-------|-------|
| 1  | 2:00  | Math  | 2  | 2:15  | Math  | 3  | 2:30  | Math  |
| 2  | 2:45  | Math  | 4  | 2:55  | Math  | 5  | 3:10  | Math  |
| 3  | 3:25  | Math  | 6  | 3:40  | Math  | 7  | 3:55  | Math  |
| 4  | 4:10  | Math  | 8  | 4:25  | Math  | 9  | 4:40  | Math  |
| 5  | 4:55  | Math  | 10 | 5:10  | Math  | 11 | 5:25  | Math  |
| 6  | 5:40  | Math  | 12 | 5:55  | Math  | 13 | 6:10  | Math  |
| 7  | 6:25  | Math  | 14 | 6:40  | Math  | 15 | 6:55  | Math  |
| 8  | 7:10  | Math  | 16 | 7:25  | Math  | 17 | 7:40  | Math  |
| 9  | 7:55  | Math  | 18 | 8:10  | Math  | 19 | 8:25  | Math  |
| 10 | 8:40  | Math  | 20 | 8:55  | Math  | 21 | 9:10  | Math  |
| 11 | 9:25  | Math  | 22 | 9:40  | Math  | 23 | 9:55  | Math  |
| 12 | 10:10 | Math  | 24 | 10:25 | Math  | 25 | 10:40 | Math  |
| 13 | 10:55 | Math  | 26 | 11:10 | Math  | 27 | 11:25 | Math  |
| 14 | 11:40 | Math  | 28 | 11:55 | Math  | 29 | 12:10 | Math  |
| 15 | 12:25 | Math  | 30 | 12:40 | Math  | 31 | 12:55 | Math  |
| 16 | 1:10  | Math  | 32 | 1:25  | Math  | 33 | 1:40  | Math  |
| 17 | 1:55  | Math  | 34 | 2:10  | Math  | 35 | 2:25  | Math  |
| 18 | 2:40  | Math  | 36 | 2:55  | Math  | 37 | 3:10  | Math  |
| 19 | 3:25  | Math  | 38 | 3:40  | Math  | 39 | 3:55  | Math  |
| 20 | 4:10  | Math  | 40 | 4:25  | Math  | 41 | 4:40  | Math  |

[illegible][illegible][illegible]





**Pictures of Public Consultation meeting  
Tuek Phos District, Kampong Chhnang Province  
(7-8 September, 2011)**

NO PHOTO TAKEN FOR THE MEETING

**Public Participation for Boerg Khse and Sray Chet Dam,  
Ekallpal Pagoda, Chong Moung Commune  
07 September, 2011, at 09:30 AM to 12 AM**



Local Authorities and Provincial Departments

Local Authorities and District Departments



Local Villages



Local Villages



Local Community were supported the project  
100%



Local Community were supported the project  
100%

Public Participation for Water Tower,  
Keo Puthea Ram Pagoda, Akphiwodth Commune,  
07 September, 2011, at 13:00 PM to 17:00 PM



Local Authorities and district Departments



Local Authorities and district Departments



Local Community



Local Community



Discuss for Supporting the Project



Local Community were supported the project  
100%



Public Participation for Chipromg Dam Project  
 Keo Puthea Ram Pagoda, Alphivodth Commune,  
 08 September, 2011, at 09:30 AM to 12:00 AM



**Public Participation for System Water User Community Project,  
Vihear Bet Meas Pagoda, Kbal Tusk Commune,  
08 September, 2011, at 13:00 PM to 16:00 PM**



Local Authorities



Local Authorities and Director for PAMS and his staff



Local Communities



Local Communities



Local Communities and Stakeholders Supported the Project 100%



Local Communities and Stakeholders Supported the Project 100%

**XVI. ANNEX 5 CHECK LISTS FOR EMP**

## CHECKLIST 1 Construction Camps

(N.B. There is no specific regulation for this activity.  
"Good Housekeeping" must be observed and "General Industry Practice" followed)

|                                                                                                                         |              |
|-------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                                                                                    |              |
| <b>Observer:</b>                                                                                                        |              |
| <b>Frequency:</b> Check weekly during preparation of camp, at opening of camp, then weekly or in response to complaint. |              |
| <b>Date:</b>                                                                                                            | <b>Time:</b> |
| <b>Location / Road Distance:</b>                                                                                        |              |
| <b>Weather Condition:</b>                                                                                               |              |

| Checklist Question                                                                                                                         | Yes                      | No                       | Additional Data needs    |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 1. Is the camp / yard located in a protected area, next to a community water source or any other ecologically or otherwise sensitive area? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, comment on the adverse impacts on the environment:                                                                                 |                          |                          |                          |
| 2. Is the camp / yard being properly maintained?                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, list what is not being done properly:                                                                                               |                          |                          |                          |
| 3. Is the wastewater being disposed of properly?                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on how it is being disposed and what are the impacts:                                                                       |                          |                          |                          |
| If no, comment on.<br>Have septic tanks been installed?<br>Are they working correctly, that is not overflowing, or emitting smell?         |                          |                          |                          |
| 4. Is the solid waste being disposed off properly?                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on how it is being disposed and the impacts of such disposal:                                                               |                          |                          |                          |
| 5. Is attention being paid to "Good housekeeping"?                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on what is not being done:                                                                                                  |                          |                          |                          |

| Checklist Question                                                                  | Yes                      | No                       | Additional Data needs    |
|-------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 6. Are the contractor's vehicles being maintained at the campsite / yard?           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, are appropriate precaution taken to avoid water and land contamination?     |                          |                          |                          |
|                                                                                     |                          |                          |                          |
| 7. Is the waste from vehicle maintenance being disposed off properly?               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on how it is being disposed:                                         |                          |                          |                          |
|                                                                                     |                          |                          |                          |
| 8. Is the fuel storage area properly surfaced and has a containment kerb around it? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on how the surrounding area is being affected:                       |                          |                          |                          |
|                                                                                     |                          |                          |                          |
| 9. Are occupational health and hygiene precautions being taken?                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on where they are being neglected:                                   |                          |                          |                          |
|                                                                                     |                          |                          |                          |
| 10. Does the community have any issues with the camp?                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, what are the issues?                                                        |                          |                          |                          |
|                                                                                     |                          |                          |                          |
| Any additional comments:                                                            |                          |                          |                          |
|                                                                                     |                          |                          |                          |



## CHECKLIST 2 Borrow Pits / Quarries

(N.B. There is no specific regulation for this activity)

|                                                                                                                       |              |
|-----------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                                                                                  |              |
| <b>Observer:</b>                                                                                                      |              |
| <b>Frequency:</b> Check weekly during preparation of borrow pit, at opening, then weekly or in response to complaint. |              |
| <b>Date:</b>                                                                                                          | <b>Time:</b> |
| <b>Location / Road Distance:</b>                                                                                      |              |
| <b>Weather Condition:</b>                                                                                             |              |

| Checklist Question                                                                                                                                    | Yes                      | No                       | Additional Data needs    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 11. Is the borrow pit / quarry located in a protected area, next to a community water source or any other ecologically or otherwise sensitive area?   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, comment on the adverse impacts on the environment:                                                                                            |                          |                          |                          |
| 12. Is the borrow pit / quarry being properly maintained?                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, state what is not being done :                                                                                                                 |                          |                          |                          |
| 13. Is there adverse visual impact due to the borrow pit?                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, comment how:                                                                                                                                  |                          |                          |                          |
| 14. Is borrow pits / quarries excavation / mining adequately employing drainage and fill methodology to avoid any water pools formation during rains? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment:                                                                                                                                       |                          |                          |                          |
| 15. Is the borrow pits / quarry properly rehabilitated at least partially before the start of the rainy season?                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on what needs to be done:                                                                                                              |                          |                          |                          |

| Checklist Question                                                                                            | Yes                      | No                       | Additional Data needs    |
|---------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 16. Are there any signs of erosion and instability?                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, what seems to be the reason?                                                                          |                          |                          |                          |
| 17. Are the cut faces stabilized with appropriate materials and methods?                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, what are the impacts?                                                                                  |                          |                          |                          |
| 18. Is the borrow pit / quarry to be closed and rehabilitated?                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, Is there a closure plan?                                                                              |                          |                          |                          |
| 19. Are the borrow pit / quarry operations creating excessive dust / noise?                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, are any measures being taken to minimize dust and noise?                                              |                          |                          |                          |
| 20. Do the communities have any concerns / issues with borrow pit / quarry during operation or after closure? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, what are those concerns / issues?                                                                     |                          |                          |                          |
| Any additional comments:                                                                                      |                          |                          |                          |

**CHECKLIST 3    Erosion of Slopes**  
(N.B. There is no specific regulation for this activity)

|                                                             |              |
|-------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                        |              |
| <b>Observer:</b>                                            |              |
| <b>Frequency:</b> Check weekly or in response to complaint. |              |
| <b>Date:</b>                                                | <b>Time:</b> |
| <b>Location / Road Distance:</b>                            |              |
| <b>Weather Condition:</b>                                   |              |

| Checklist Question                                                                                                                           | Yes                      | No                       | Additional Data needs    |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 1. What is / are the reason(s) for erosion / landslides / instability?                                                                       |                          |                          |                          |
| a. Improper design / stripping of cut faces                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Improper drainage                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Clearing of vegetation / lack of gabions, geotextiles                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Improper leveling after earth removal                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Are the slopes properly stabilized before the start of the rainy season?                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Inadequate water channel diversion, or                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| g. A combination of some of the reasons above                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Is remedial action required?                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, comment:                                                                                                                             |                          |                          |                          |
|                                                                                                                                              |                          |                          |                          |
| 3. Did the erosion / landslide / instability cause any damage?                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, what was the nature of the damage?                                                                                                   |                          |                          |                          |
|                                                                                                                                              |                          |                          |                          |
| 4. Did the contractor take appropriate mitigatory measures, pre and post erosion / instability / landslides, to avoid / counter the problem? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, why did the contractor not consider it necessary to take appropriate mitigatory measures?                                             |                          |                          |                          |
|                                                                                                                                              |                          |                          |                          |
| 5. Was the erosion brought to the notice of appropriate authorities by the communities?                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, was there any action taken?                                                                                                          |                          |                          |                          |
|                                                                                                                                              |                          |                          |                          |
| If no, why was action not taken?                                                                                                             |                          |                          |                          |
|                                                                                                                                              |                          |                          |                          |

Any additional comments:

#### CHECKLIST 4 Air Pollution

(N.B. The contractor must carry out his activities to ensure compliance with the regulations stated in draft Sub Decree on Air and Noise Pollution Control)

|                                                             |              |
|-------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                        |              |
| <b>Observer:</b>                                            |              |
| <b>Frequency:</b> Check weekly or in response to complaint. |              |
| <b>Date:</b>                                                | <b>Time:</b> |
| <b>Location / Road Distance:</b>                            |              |
| <b>Weather Condition:</b>                                   |              |

| Checklist Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                          |                          |                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 21. What is the nature of air pollution? <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;">                         a. Dust from road<br/>                         b. Dust from stock piled materials<br/>                         c. Generator, batching plant emissions<br/>                         d. Vehicular emissions                     </div> <div style="width: 50%;"> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/> </div> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                          |                          |                          |
| Checklist Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Yes                      | No                       | Additional Data needs    |
| 22. Is the problem significant enough to warrant attention?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, did the contractor take appropriate measure to mitigate the problem?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                          |                          |                          |
| What is / are the measures taken? <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 75%;">                         a. Periodic water sprays on road surface / borrow pits<br/>                         b. Vehicle tire washing facilities at borrow pits and other locations<br/>                         c. Speed limit enforced on project vehicles<br/>                         d. Vehicles speeding checked by posting signs on roads, and awareness raising of staff and local communities<br/>                         e. Covering of stock piled materials<br/>                         f. Vehicles regularly maintained<br/>                         g. Equipment regularly maintained                     </div> <div style="width: 20%;"> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/> </div> </div> |                          |                          |                          |
| 3. Is air pollution creating problems for the surrounding communities?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

If yes, what type of problems?

## CHECKLIST 5 Water Pollution

(N.B. The contractor must carry out his activities to ensure compliance with the regulations stated in Sub Decree on Water Pollution Control, No. 27 ANRK.BK, April 06, 1999)

|                                                             |              |
|-------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                        |              |
| <b>Observer:</b>                                            |              |
| <b>Frequency:</b> Check weekly or in response to complaint. |              |
| <b>Date:</b>                                                | <b>Time:</b> |
| <b>Location / Road Distance:</b>                            |              |
| <b>Weather Condition:</b>                                   |              |

| Checklist Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                      |                                                                                      |                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <p>23. What is the nature of water contamination?</p> <p>1.1 Surface Water (stream, pond etc.)</p> <div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="width: 80%;"> <p>a. disposal of cut spoil into water body or on slope leading to water body</p> <p>b. discharge of wastewater from camp into fresh water body</p> <p>c. road run-off into water body</p> <p>d. discharge of used oil, fuel, grease, etc. into water body</p> </div> <div style="width: 15%; text-align: center;"> <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/><br/><br/> <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/><br/><br/> <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/><br/><br/> <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> </div> </div> <p>1.2 Groundwater</p> <div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="width: 80%;"> <p>e. leakage of oil, fuel, wells, etc. on land resulting in contamination of ground water and wells</p> <p>f. any other reason</p> </div> <div style="width: 15%; text-align: center;"> <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/><br/><br/> <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> </div> </div> |                                                                                      |                                                                                      |                                                                                      |
| Checklist Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Yes                                                                                  | No                                                                                   | Additional Data needs                                                                |
| 1. Is the impact significant enough to warrant mitigatory measures?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> |
| If yes, provide necessary details:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                      |                                                                                      |                                                                                      |
| 4. Is the impact long term?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> |
| If yes, comment:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                      |                                                                                      |                                                                                      |
| 4. Can it be ratified by mitigatory measures?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> |
| If yes, what type of mitigatory measures should be taken?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                      |                                                                                      |                                                                                      |
| Did community bring the problem to the notice of authorities?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> | <input style="width: 30px; height: 30px; border: 1px solid black;" type="checkbox"/> |
| Has action been taken to counter the problem? Is it effective?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                      |                                                                                      |                                                                                      |

Additional comments:



## CHECKLIST 6    Agriculture

(N.B. The contractor must carry out his activities to ensure compliance with the regulations stated in draft Law on Agriculture made by MAFF)

|                                                             |              |
|-------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                        |              |
| <b>Observer:</b>                                            |              |
| <b>Frequency:</b> Check weekly or in response to complaint. |              |
| <b>Date:</b>                                                | <b>Time:</b> |
| <b>Location / Road Distance:</b>                            |              |
| <b>Weather Condition:</b>                                   |              |

| Checklist Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |                          |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <p>24. What is the impact of project activities on agriculture activities?</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 80%;"> <p>a. road encroachment on paddy / agricultural land</p> <p>b. borrow pit located on agricultural land</p> <p>c. spoil dump located on agricultural land</p> <p>d. diversion of water channels and road construction resulting in inundation of agricultural land</p> <p>e. irrigation channels broken / diverted due to project activities</p> <p>f. oil, grease and fuel road run-off contaminating agricultural fields</p> <p>g. any other project activities resulted in destruction of agricultural land</p> </div> <div style="width: 15%; text-align: center;"> <input type="checkbox"/><br/><input type="checkbox"/><br/><input type="checkbox"/><br/><input type="checkbox"/><br/><input type="checkbox"/><br/><input type="checkbox"/><br/><input type="checkbox"/> </div> </div> |                          |                          |                          |
| Checklist Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Yes                      | No                       | Additional Data needs    |
| 25. Is the impact significant enough to warrant mitigatory measures?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, provide necessary details:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |                          |                          |
| 5. Is the impact permanent?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. If permanent, could it have been avoided by taking appropriate mitigatory measures?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, how?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                          |                          |                          |
| 6. Is the impact temporary?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, when and how could it be corrected?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                          |                          |                          |

| Checklist Question                                                                                      | Yes                      | No                       | Additional Data needs    |
|---------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 7. Is the contractor using any insecticides on the site which adversely affect farmland?                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, comment:                                                                                        |                          |                          |                          |
| 8. Is the community satisfied with the measures taken by the contractor to protect farmland?            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, how and with what measures can it be improved?                                                   |                          |                          |                          |
| 9. Is the local administration satisfied with the measures taken by the contractor to protect farmland? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, what is being suggested by the local administration?                                             |                          |                          |                          |
| Any additional comments:                                                                                |                          |                          |                          |

# CHECKLIST 7 Land Contamination

(N.B. There is no specific regulation for this activity)

|                                                             |              |
|-------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                        |              |
| <b>Observer:</b>                                            |              |
| <b>Frequency:</b> Check weekly or in response to complaint. |              |
| <b>Date:</b>                                                | <b>Time:</b> |
| <b>Location / Road Distance:</b>                            |              |
| <b>Weather Condition:</b>                                   |              |

| Checklist Question                                                                      |                          |                          |                          |
|-----------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 26. What are the impacts of project activities on land?                                 |                          |                          |                          |
| a. road run-off of oil, grease and fuel contaminating land                              |                          |                          | <input type="checkbox"/> |
| b. fuel oil / used oil / grease spill on land in equipment yards / camps sites          |                          |                          | <input type="checkbox"/> |
| c. indiscriminate discharge of waste water on land                                      |                          |                          | <input type="checkbox"/> |
| d. indiscriminate disposal of solid waste                                               |                          |                          | <input type="checkbox"/> |
| e. any other project activities resulting in land contamination                         |                          |                          | <input type="checkbox"/> |
| Checklist Question                                                                      | Yes                      | No                       | Additional Data needs    |
| 27. Is the impact significant enough to warrant mitigatory measures?                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, provide necessary details:                                                      |                          |                          |                          |
|                                                                                         |                          |                          |                          |
| 6. Is the impact permanent?                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. If permanent, could it have been avoided by taking appropriate mitigatory measures? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, what type pf mitigatory measures should have been taken?                        |                          |                          |                          |
|                                                                                         |                          |                          |                          |
| 11. Is the impact temporary?                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, when and how could it be corrected?                                             |                          |                          |                          |
|                                                                                         |                          |                          |                          |

|  |
|--|
|  |
|--|

| Checklist Question                                                                                                      | Yes                      | No                       | Additional Data needs    |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 12. Is the community satisfied with the measures taken by the contractor to protect agricultural activities?            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, how and with what measures can it be improved?                                                                   |                          |                          |                          |
| 13. Is the local administration satisfied with the measures taken by the contractor to protect agricultural activities? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, what is being suggested by the local administration?                                                             |                          |                          |                          |
| 14. Did the community allow the use of their land for borrow pit or any other purpose?                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, what was the motivation behind it?                                                                              |                          |                          |                          |
| If no, did the contractor take permission from the land owner and local administration for the specific use?            |                          |                          |                          |
| Any additional comments:                                                                                                |                          |                          |                          |

## CHECKLIST 8 Cultural Heritage

(N.B. The contractor must carry out his activities to ensure compliance with the regulations stated in "Law on Protection of Cultural and National Heritage", (1996)

|                                                             |              |
|-------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                        |              |
| <b>Observer:</b>                                            |              |
| <b>Frequency:</b> Check weekly or in response to complaint. |              |
| <b>Date:</b>                                                | <b>Time:</b> |
| <b>Location / Road Distance:</b>                            |              |
| <b>Weather Condition:</b>                                   |              |

| Checklist Question                                                                                     | Yes                      | No                       | Additional Data needs    |
|--------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 28. Does the project area have any cultural heritage, archaeological, historical or religious sites?   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. If yes, are they affected in any way by the project activities?                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, how?                                                                                           |                          |                          |                          |
| 3. Did the concerned authorities and the contractor take any appropriate measures to protect the site? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, what are the measures taken?                                                                   |                          |                          |                          |
| 4. Are the communities satisfied with the measures taken?                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Is the community satisfied with the measures taken by the contractor to protect land?               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, how and with what measures can it be improved?                                                  |                          |                          |                          |
| 6. Is the local administration satisfied with the measures taken by the contractor to protect land?    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, what is being suggested by the local administration?                                            |                          |                          |                          |
| Any additional comments:                                                                               |                          |                          |                          |

## CHECKLIST 9 Noise Pollution

(N.B. The contractor must carry out his activities to ensure compliance with the regulations stated in draft Sub Decree on Air and Noise Pollution Control)

|                                                             |              |
|-------------------------------------------------------------|--------------|
| <b>Project Site:</b>                                        |              |
| <b>Observer:</b>                                            |              |
| <b>Frequency:</b> Check weekly or in response to complaint. |              |
| <b>Date:</b>                                                | <b>Time:</b> |
| <b>Location / Road Distance:</b>                            |              |
| <b>Weather Condition:</b>                                   |              |

| Checklist Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                          |                          |                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 29. What is the nature of noise pollution? <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;">                         a. vehicles on road<br/>                         b. Generators, construction plant<br/>                         c. Construction vehicles<br/>                         d. vibration from equipment<br/>                         e. vibration from road vehicles<br/>                         f. vibration from explosive blasting                     </div> <div style="width: 50%;"> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/> </div> </div>                                                                                                                                                                                                                                                                                                                 |                          |                          |                          |
| Checklist Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Yes                      | No                       | Additional Data needs    |
| 30. Is the problem significant enough to warrant attention?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, did the contractor / consultant take appropriate measure to mitigate the problem?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                          |                          |                          |
| What is / are the measures taken? <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 75%;">                         e. vehicles regularly maintained and silencers checked<br/>                         f. speed limit enforced on project vehicles<br/>                         g. construction equipment maintained and silenced<br/>                         h. compressors and generators operated with silencing panels closed<br/>                         h. awareness raising of staff over causing nuisance to local communities<br/>                         i. blasting at fixed times and communities notified<br/>                         j. Avoid undertaking construction activities and blasting close to communities at night                     </div> <div style="width: 20%;"> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/><br/> <input type="checkbox"/> </div> </div> |                          |                          |                          |
| 7. Is noise pollution creating problems (health, aesthetic & nuisance) for the surrounding communities?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

If yes, what type of problems?

# CHECKLIST 10 Drainage and Flooding

(N.B. There is no specific regulation for this activity)

|                                  |              |
|----------------------------------|--------------|
| <b>Project Site:</b>             |              |
| <b>Observer:</b>                 |              |
| <b>Frequency:</b> As required    |              |
| <b>Date:</b>                     | <b>Time:</b> |
| <b>Location / Road Distance:</b> |              |
| <b>Weather Condition:</b>        |              |

| Checklist Question                                                                      | Yes                      | No                       | Additional Data needs    |
|-----------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 31. Is the flooding extensive or not?                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, give details:                                                                   |                          |                          |                          |
| 32. Have contractors activities caused flooding or blocked drains?                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, give details:                                                                   |                          |                          |                          |
| 33. Have cross drainage structures been built in correct location as shown in contract? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, give details:                                                                    |                          |                          |                          |
| 34. Are cross drainage structures "as built" same as in "detailed design"?              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, give details:                                                                    |                          |                          |                          |
| 35. Any other issues                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, give details                                                                    |                          |                          |                          |



CHECKLIST 11 Construction Camps Closure  
(N.B. There is no specific regulation for this activity)

|                                             |              |
|---------------------------------------------|--------------|
| <b>Project Site:</b>                        |              |
| <b>Observer:</b>                            |              |
| <b>Frequency:</b> Check at closure of camp. |              |
| <b>Date:</b>                                | <b>Time:</b> |
| <b>Location / Road Distance:</b>            |              |
| <b>Weather Condition:</b>                   |              |

| Checklist Question                                                                                                                          | Yes                      | No                       | Additional Data needs    |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 36. Is the camp / yard located in a protected area, next to a community water source or any other ecologically or otherwise sensitive area? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, comment on the adverse impacts on the environment:                                                                                  |                          |                          |                          |
| 37. Has the camp / yard been properly cleared of all debris and revegetated?                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, list what was not done properly:                                                                                                     |                          |                          |                          |
| 38. Was the wastewater disposed of properly?                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on how it was being disposed and what were the impacts:                                                                      |                          |                          |                          |
| 39. Were septic tanks installed? Have they been removed?                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, why not?                                                                                                                             |                          |                          |                          |
| 40. Was solid waste disposed of properly?                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on how it was being disposed and the impacts of such disposal:                                                               |                          |                          |                          |
| 41. Was attention being paid to housekeeping?                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on what was not being done:                                                                                                  |                          |                          |                          |

| Checklist Question                                                                         | Yes                      | No                       | Additional Data needs    |
|--------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| 42. Have all the contractor equipments being removed from the campsite / yard?             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, have all appropriate precautions been taken to avoid water and land contamination? |                          |                          |                          |
| 43. Has the scrap metal from vehicle maintenance being disposed of properly?               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on how it is to be disposed:                                                |                          |                          |                          |
| 44. Has all fuel storage been removed from the site?                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on how the surrounding area is being affected:                              |                          |                          |                          |
|                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 45. Have all general offices and staff dwellings been removed?                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If no, comment on if they are to be handed over to new owner or other plans:               |                          |                          |                          |
| 46. Does the community have any issues with the camp closure?                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If yes, what are the issues?                                                               |                          |                          |                          |
| Any additional comments:                                                                   |                          |                          |                          |