Kingdom of Cambodia

Nation Religion King

TA-8179 CAM MAINSTREAMING CLIMATE RESILIENCE INTO DEVELOPMENT PLANNING – PACAKGE A (45283-001)

Advanced Vulnerability Assessment and Adaptation Planning Training: Baseline Assessment for Climate Resilient Feasibility Studies in Urban, Transport and Rural Infrastructure

Date of training: September 26-28, 2016
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SUMMARY

The three-day "Advanced Vulnerability Assessment and Adaptation Planning Training: Baseline Assessment for Climate Resilient Feasibility Studies in Urban, Transport and Rural Infrastructure" workshop took place in Kampong Chhnang on 26-28 September 2016. The workshop was organized under TA 8179-CAM: Mainstreaming Climate Resilience into Development Planning, which is being executed by Cambodia's Ministry of Environment with assistance from International Centre for Environmental Management (ICEM).

Among other objectives, the TA seeks to strengthen the capacity of government officials to assess current and future vulnerabilities for selected investment projects (Activity 1.9), and to conduct feasibility studies for at least six pilot adaptation projects (Activity 2.2). The workshop was the last in a series of three field-level capacity-building workshops located at the pilot project sites. The aim of this workshop was to build capacity at local and national levels to conduct feasibility studies which incorporate climate-resilient and adaptation technologies into the project design, with focus on baseline data collection and assessment for feasibility studies for urban, transport and rural infrastructure projects.

The objectives for this workshop included:

1. To outline the feasibility study planning process for designing projects which incorporate climate change adaptations in urban, transport and rural infrastructure sectors;
2. To provide guidance on the feasibility study design, future planning and implementation process for the development of climate-resilient infrastructure in Kampong Chhnang Province;
3. To present concepts for the climate-resilient infrastructure sector adaptation development projects in Kampong Chhnang Province (Tonle Sap Lake ecozone) and in other provinces and ecozones of Cambodia (Tboung Khmum and Battambang), which will be subjected to feasibility studies under TA8179;
4. To build capacity at national and local levels to undertake vulnerability assessments for feasibility studies for adaptation projects in urban, transport and rural infrastructure; and
5. To conduct a field exercise on vulnerability assessment to enable participants to gain hands-on experience in procedures and methodologies required to develop and design climate-proofing urban, transport and rural infrastructure projects.

The workshop consisted of two days of presentations and desk exercises, and a one-day field visit to a site of a proposed project 'Enhanced Resilience of Rural Infrastructure and Community Livelihoods in Kampong Leng District'. It was attended by national, provincial and district officials from MOE, MPWT, MRD and other concerned ministries, who act as focal points for agriculture and water planning investment proposals.

The pre- and post-workshop questionnaires (Appendix 4) showed that the workshop improved the understanding of officials in what a vulnerability assessment consists of, and the data requirements. In their evaluation of the workshop (Appendix 4), the participants stated that the workshop provided them with a guideline and valuable field experience to assess impacts of climate change on infrastructure (road systems, reservoirs, and markets in Kampong Leaeng district). The workshop also helped participant able to establish links with NGO partners and local communities. Future workshops can be improved by increasing the length of the workshop (thus allowing for more time to be spent on each topic), and by improving a section for collecting comments from the community in the field survey.

The VA&AP methodology delivered in the workshop will be used to conduct VA&APs for the six feasibility studies under TA8179. The final design of the projects will be discussed with provincial and national officials, as well as local communities. Regarding the design of the Kampong Chhnang project, the overall objective is to provide farmers with greater access to markets via an improved port, market and road facilities. A number of alternatives exist for reducing the vulnerability of the port facility; while these will be evaluated in the coming months, there is a general consensus to have a year-round port facility to avoid moving ports during seasons. A decision also needs to be made on the location of the market to reduce its vulnerability to flooding. Many of the rural roads in the district are subject to flooding, and a decision on which of these will be rehabilitated as part of the project will be made in the coming months.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Ministry of Environment (MOE) is the executing agency of *TA 8179-CAM: Mainstreaming Climate Resilience into Development Planning*. The Technical Assistance (TA) is aimed at enhanced resilience to climate change in Cambodia through strengthening institutional and technical capacity of the government to mainstream climate resilience into development planning, as well as improving coordination among various sectoral line ministries, sub-national agencies, non-government organizations (NGOs) and the private sector.

The TA has four outputs: (i) SPCR coordination, technical support and capacity to mainstream climate resilience into development planning strengthened; (ii) detailed feasibility studies for selected National Adaptation Program of Action (NAPA) projects conducted; (iii) civil society support mechanism established and capacity of NGOs and civil society organisations (CSOs) to mainstream adaptation and disaster risk reduction (DRR) into their operations strengthened; and (iv) climate change adaptation knowledge products developed and disseminated. ICEM - International Centre for Environmental Management was contracted in February 2015 to support MOE for Package 1 of this TA, covering outputs (i), (ii) and (iv).

The project includes a series of capacity-building workshops at target sites to build capacity in vulnerability assessment and adaptation planning (VA&AP) and adaptation project development. The aim of the VA&AP training is to build capacity at local and national levels to conduct feasibility studies which incorporate climate-resilient and adaptation technologies into project design. These actions form an integral part of TA's Output (ii), namely conducting six feasibility studies for selected climate-resilient projects. The training program includes three field-level capacity-building workshops located at the pilot adaptation project sites, and will provide instruction materials for the development of the feasibility studies for submission to MOE, collaborating ministries and ADB.

The first three-day workshop in this series involved the Adaptation Working Group members from MOE, MPWT, MOWRAM, MRD and MAFF and provincial counterparts, and provided an introduction to the VA&AP methodology. It was held in Battambang in November 2015 and included field exercises and testing of the VA&AP tools. The second training workshop (*Baseline Assessment for Climate Resilient Feasibility Studies in Agriculture and Water Resource*), held in Prey Veng during 16-18 Aug 2016, focussed in greater detail on baseline data collection and assessment for feasibility studies for adaptation projects in agriculture and water management. The third three-day workshop – *Vulnerability Assessment for Climate Resilience in Urban, Transport and Rural Infrastructure* – focuses on baseline and vulnerability assessment as key steps in building climate resilience in urban, transport and rural infrastructure. The VA process is an essential part of conducting feasibility studies for projects in those sectors so that adaptation options which address climate change are integrated into project design.

In order to be eligible for global climate funds, a project proposal needs to show: (1) that a quality vulnerability assessment has been done; (2) adaptation measures that will be introduced; and (3) the comparative costs and benefits of introducing these measures have been assessed. This workshop is another step in addressing the first two aspects. This VA&AP process will continue to be the focus of further workshops and field activities linked to feasibility studies of six proposed adaptation projects. The third eligibility criteria – cost-benefit analysis – will be the subject of another training workshop.

The capacity-building efforts involved national, provincial and district officials from MOE, MPWT and MRD and other concerned ministries, who act as focal points for urban, transport and rural infrastructure planning investment proposals. These officials have been trained in the methods for climate vulnerability assessment.

In preparation for the workshop, the TA team made a visit to Kampong Chhnang on 15 – 16 September 2016 to work with the provincial officials and identify the sites to be visited during the workshop field exercises.

The training workshop was presided over by HE Prof Dr Sabo Ojano, Secretary of State and Program Coordinator of SPCR, Ministry of Environment; Lork Chhum Teav Pall Yoeun, Deputy Governor of Kampong Chhnang Province; and HE Pon Saroeun, Undersecretary of State and Deputy Program Coordinator of SPCR, Ministry of Environment.

1.2 WORKSHOP PURPOSE

The objectives for this training workshop included:

i. To outline the feasibility study planning process for designing projects which incorporate climate change adaptations in urban, transport and rural infrastructure sectors;
ii. To provide guidance on the feasibility study design, future planning and implementation process for the development of climate-resilient infrastructure in Kampong Chhnang Province;
iii. To present concepts for the climate-resilient infrastructure sector adaptation development projects in Kampong Chhnang Province (Tonle Sap Lake ecozone) and in other provinces and ecozones of Cambodia (Tboung Khmum and Battambang), which will be subjected to feasibility studies under TA8179;
iv. To build capacity at national and local levels to undertake vulnerability assessments for feasibility studies for adaptation projects in urban, transport and rural infrastructure; and
v. To conduct a field exercise on vulnerability assessment to enable participants to gain hands-on experience in procedures and methodologies required to develop and design climate-proofing urban, transport and rural infrastructure projects.

The workshop agenda and list of participants are provided in Appendix 1 and Appendix 2, respectively. The background information on Dar and Chronouk communes visited during field exercises is provided in Appendix 5.

2 SUMMARIES OF TECHNICAL PRESENTATIONS

The presentation slides are available in Appendix 6.

2.1 SESSION 1: OPENING AND INTRODUCTION

As indicated above, the training workshop was presided over by HE Pon Saroeun, Undersecretary of State and Deputy Program Coordinator of SPCR, Ministry of Environment; and Lork Chhum Teav Pall Yoeun, Deputy Governor of Kampong Chhnang Province.

Lork Chhum Teav addressed that Kampong Chhnang has achieved some outputs regarding environmental work such as adaptation and improving climate resilient in irrigations, rural roads, clean water and hygiene within communities. Also, provincial infrastructure improving such as drainages, roads, sidewalks, rubbish collection which is implemented under Climate proofing infrastructure in the Southern Economic Corridor towns as part of SPCR project.

H.E. Pon Saroeun made the opening speech of the training workshop that this was the third training of VA and AP to build capacity to AWG members. Through our 5-year SPCR program, we are contributing to achieve objectives of National Rectangular Strategy phase III and CCCSP in order to enhance Cambodia becomes more resilient to climate change especially to develop green infrastructure for roads, irrigations, drainages, canals, etc.

Before the training proceeding, all participants were requested to fill-in a pre-knowledge survey regarding their knowledge on the topic of the training.

Following the completion of opening session, Dr. Seak Sophat, Deputy Team Leader, briefed the objective of the workshop and agenda proceeding. The major objective of training workshop is to test the methodology of feasibility study's baseline assessment tool and build capacity of relevant government agencies with regard to vulnerability assessment and adaptation planning. The training agenda was divided into three days: the first day covered general issues about methodology, status and challenges for rural and urban infrastructure sectors with reference to flood, drought and wind storm and temperature; the second day was field visits to three communes: Dar, Chronouk and Kampong Hao; and the last day was on group report back of field work.

Dr. Lay Chanthy delivered a presentation on feasibility study methodology and process, and what the donors and funds required for the adaptation projects. The TA8179 will conduct six feasibility study projects, and in the end through comprehensive assessment and analysis based on results of feasibility studies, at least two project proposals will be formulated and submitted to Green Climate Fund.

He also gave the presentation on funding requirement for adaptation projects such as CC Financing Mechanism, Strategic Priorities, Access Modality, GCF Investment Criteria and Project eligibilities.

2.2 SESSION 2: KAMPONG CHHNANG URBAN AND TRANSPORT INFRASTRUCTURE SECTOR AND ADAPTATION PROJECT CONCEPT

2.2.1 Enhance resilience of rural infrastructure and community livelihoods in Kampong Leng district

This proposed adaptation project in Kampong Leng district is to 1) enhance resilience of Rural Infrastructure, and 2) enhance community livelihood responding to future climate extreme events (flood, drought, Storm, Temperature). The project will essentially concentrate on four key components namely: 1) Improvement of Road 50C where lines across six communes of Kampong Leng District, Road around the Touk Meas mountain about 36km length and Road section around Kang Rey mountain about 10Km length; 2) Improvement of Water Capture Dams/Dykes, Water Reservoirs and Irrigation Canals; 3) Improvement of submerged roads: line 1: Chronouk commune-Phlouv Touk

commune, 20km length, line2: Dar commune-Samrong Sen commune, 6km length, and line3: Kampong Hao downtown-Ferry Terminal, 0.50Km length; and 4) Installing Drainage Pipes & Improvement of Roads & Solid waste management site. Urban road (Kampong Hao Com.), Length: 11 Km and Solid waste management site (Kampong Hao Commune).

The proposed project will applied the following adaptation measures:

- Sub-Project 1: (Improvement of Road 50C): raising road elevation above high flood level (HFL), Embankment slopes upgrades (1:2-1:3) Embankment protection upgrades with green engineering, block sodding, rip rap, hedge on each side, mesh gabion, dry rock, Paving SBST, DBST, AC, RCC, Shoulders should be constructed as part of the road pavement to the full width of the embankment, and to be sealed with a bituminous treatment.
- Sub-Project 2: (Improvement of Water Capture Dams/Dykes, Water Reservoirs and Irrigation Canals): Rehabilitate the Dyke, by dredging, disposal and placing of dredged overburden, adding water gates at the necessary places, Protect the Dyke bank with green engineering, Paving Laterite, SBST, DBST, AC, RCC,
- Sub-Project 3: (Improvement of submerged roads): *Embankment:* low with soil-cement stabilized, *Sub-Base:* Cement stabilized sub-base used, *Base-Course:* Full width base design, *Shoulder:* Shall be constructed as the pavement structure & sealed with a bituminous treatment up to the edges of the embankment, *Side slope:* Rip Rap protection is to cover the full surface of embankments of roads at high risks of flash floods and of low land floods, *Hedge on side slope:* is subject to wave action, shall be established with an approved bio-engineering specification, *Pavement:* RCC, *Structure:* to mitigate the biodiversity, construct Spillway, Causeway, Drift, Bridge, Box culvert, etc.
- Sub-Project 4: (Installing Drainage Pipes & Improvement of Roads): Install bioengineered drainage system, Applying macadam for road base, Paving with SBST, DBST, RCC, Establish solid waste management site, Establish waste water treatment plant, Expand tree and vegetation cover.

2.2.2 Urban and transport infrastructure sector in Kampong Chhnang Province – status and trends as impacted by climate change, with the emphasis on floods, drought and other extreme weather events

Kampong Chhnang is one of the provinces located in Tonle Sap Great Lake area and it is about 91Km from Phnom Penh. The province is vulnerable to flood and drought every year after Battambang and Prey Veng provinces. Many road infrastructures are hit by flood annually. Like national classification of road transport, Kampong Chhnang province consists of several transport infrastructures: 1) water ways 110 Km length; 2) railways 73Km length; 3) national roads with one digit of 93.90 Km; 4) national roads with 2 digits of 225.95 Km with bituminous pavement 45.70 Km; 5) provincial roads with 3 digits 302.14 Km with bituminous pavement 24.38 Km; 6) provincial roads with 4 digits 84.27Km; 7) provincial roads without number 140.97Km with bituminous pavement 0.48Km; and 8) urban road networks 67.55Km with bituminous pavement 46.86Km, concrete paved 2.29Km, Laterite pavement 17.38Km, and unpaved roads 1.02Km.

Because of impacts from annual flood on infrastructure with extreme climate events in Kampong Leng district, the Provincial Department of Public Work and Transport has also proposed the projects to upgrade the flood prone infrastructure in Kampong Leng district, and the key infrastructure components are identical to the ones our proposed adaptation projects already mentioned in a section 2.2.1 above.

2.3 SESSION 3: SOCIO-ECONOMIC AND ENVIRONMENTAL PROFILE OF THE PROVINCE AND INTRODUCTION TO FIELD EXERCISE

2.3.1 Socio-economic and cultural contexts as impacted by climate change of the Kampong Chhnang Province – including traditional responses to extreme events (flood, drought and wind storms)

Kampong Chhnang Province is located in the central part of the Kingdom and to the north-east of capital city of Phnom Penh. It is situated on the banks of the Tonle Sap River. Kampong Chhnang Province is 91 Km far from Municipality of Phnom Penh on the national road number 5.

The total land area of the province is 5,521 km². The province consists of 8 Krong-districts covering 70 sankat/communes and 569 villages. The total population is 538,945 persons in 2015 while the population in 2010 was only 501,676 persons. Between 2010 and 2015, the population is increasing about 7.4% which is 37,269 persons increases (see table 2.3.1).

Table 2.3 1. Population statistics in Kampong Chhnang province from 2010 - 2015

Description	Year					
	2010	2011	2012	2013	2014	2015
No. of people	501,676	512,614	525,287	529,980	537,513	538,945
Annual increase rate (%)	2	2	2	1.28	1.42	0.27
No. of households	108,059	110,850	113,597	116,957	120,061	121,865
% of women head-household (%)	18.59	18.44	18.39	18.31	18.14	17.92
Average household size	4.64	4.62	4.62	4.53	4.48	4.42
No. of old age people (=>61 year old)	37,109	38,756	41,036	43,070	46,053	46,414

The economic activities of the Kampong Chhnang people are engaged in agricultural production (i.e., rice, orchard-long term crop and short-term crop production, vegetable, fishing, livestock husbandry, and Non-timber forest product (NTFP) collection).

And about 199,228 persons are mainly involved in agricultural production in year 2015 which is about 76.1% of total people in the province while around 37.8% of total population are women involved in agriculture production. About 0.2% of total Kampong Chhnang population has in 2015 served mainly in handicraft occupation while 23.3% served mainly in service provision such as trader, mentor/repairer, transportation provider, agricultural and construction laborer, factory worker, NGOs staff and government official. The government official is 2.6%.

Kampong Chhnang has suffered seriously from the climate extreme event such as storm, lightning, flood, drought, and, pest and insect outbreak. A number of family and people were severely affected by storm, flood and drought. 80 persons were killed by the climate extreme events, and statistically recorded from 2013 to 2015. Those 3 persons were killed by storm. 50 persons were killed flood while 27 persons were killed by the lightning (See table 2.3.2).

Table 2.3.2. Number of family and people impacted by extreme event of climate change from 2013-2015

No.	Description	Year		
		2013	2014	2015
I	**Impact by Storm**			
	No. of family severe effected by storm	566	531	604
	No. of people severe effected by storm	2,647	2,453	2,708
	No. of people killed by storm	1	2	0
II	**Impact by lightning**			
	No. of people killed by lightning	11	8	8
III	**Impact by flood**			
	No. of family severe effected by flood	2,792	1,477	412
	No. of people severe effected by flood	11,640	6,808	1,811
	No. of people killed by flood	24	8	18
IV	**Impact by drought**			
	No. of family severe effected by drought	1,593	5,335	4,158

Also the climate extreme events caused to lose and damage of agricultural production and infrastructure assets of the Kampong Chhnang province are shown in the table 2.3.3.

Table 2.3.3. Lose and damage of assets and production caused by climate extreme event from 2013-2015

No.	Description	Year		
		2013	2014	2015
I	**Impacted by flood**			
	Rice field damage by flood (Ha)	1,749	539	19
	Rice field damage by flood (%)	1.4	0.4	00
	Road length was damaged by flood (Km)	54,025	30,852	9,279
	Bridge & Box culvert were damaged by flood (Number)	19	10	6
II	**Drought**			
	Rice field was damaged by drought (Ha)	319	2,856	7,814
III	**Pest and Insect outbreak**			
	Rice field was damaged by pest and insect (Ha)	184	2,676	194

2.3.2 Rural infrastructure sector in Kampong Chhnang Province – status and trends as impacted by climate change, with the emphasis on floods, drought and other extreme weather events

The rural infrastructure sector in Kampong Chhnang covers small-scale infrastructure assets located in district or commune, and these are under responsibility of Department of Rural Development, which is managed by Ministry of Rural Development. These rural infrastructure assets in Kampong Chhnang province include: 1) Total rural roads of 474 lines with total length 1,587Km; 2) Bridges: 179 locations; 3) Culverts: 1,984 locations; 4) Community ponds: 173 locations; 5) Hand pump wells: 18,988 locations; 6) Ring wells: 11,049 locations; and 7) Reservoirs: 933 locations. Thus far, the rehabilitation of rural infrastructure received the fund from Royal Government of Cambodia and various development partners, including ADB. Due to climate change, the rural infrastructure systems in Kampong Chhnang have been impacted by extreme climate events like in Year 2000: Millennium flood, Year 2009: Ketsana storm disaster, Year 2011: Flood disaster, and Year 2016: Increasing of temperature and drought. In order to cope with these climate threats, a number of adaptation measures has been practiced. These are:

- Factors, measure and reasons to improve management at community level: providing and early warning of extreme climate events to local community, building safety hill, paved road by using concrete or bitumen, planting of tree along the road sides, digging of community ponds, construction of handpump/ring wells, providing community with filters, providing medicine (ABAT) for water purification, providing public sanitation, and providing food security.
- Measures responsive to climate threats have been applied in development for rural infrastructure in Kampong Chhnang: paved road by using concrete or bitumen, adding of structures at necessary locations, planting of tree along the road sides and grass at side slope, road shoulders paved by Laterite or Rubble stone, providing of DRIP system,

PDRD of Kampong Chhnang suggested the adaptation projects for rural infrastructure, which include construction of roads with resistance to disaster, construction of safety high land locations for evacuation during high flood, digging community ponds, Construction of wells and handpump, installing of drip irrigation system, and improvement of public sanitations.

2.3.3 Projected climate change in Kampong Chhnang and implications for development

Dr. Jeremy Carew-Raid, the Adaptation Project Development expert, presented the projected climate change in Kampong Chhnang province over a period of 2050. This projection would help the infrastructure and development planners to have concrete information on climate change and potential impacts so that they are able to adopt appropriate adaptation measures for their projects. Based on this projection, by 2050, Kampong Chhnang province's total rainfall in the wet season would increase by about 9.1 %, while total rainfall in the dry season would decrease by about -0.3%. At similar period, Kampong Chhnang's average daily maximum temperature during the wet season would increase by approximately 3.0 °C, whilst average daily maximum temperature during the dry season would increase by 2.5°C.

Due to changes in rainfall and temperature, the potential impacts of expected climate change in Kampong Chhnang province by 2050 will have:

- **For significantly hotter and wetter in the wet season**
  - Increased severity of pluvial flooding (where flooding already occurs)
  - Potentially new areas of pluvial flooding
  - Increased flows of the Mekong River
  - Floods would be deeper and longer duration
  - Heat-related stresses
    - ❖ increase pace of infrastructure degradation
    - ❖ crop failure and livestock losses
    - ❖ potential health problems
- **For significantly hotter and slightly dryer in the dry season**
  - Heat-related stress – infrastructure, agriculture, health
  - Higher evaporation, lower rainfall – increased incidence and duration of drought
  - Water stress for agriculture & domestic use

2.3.4 Introduction to the vulnerability assessment process and tools

The presentation briefly introduced the workshop participants about process of vulnerability assessment including baseline data collection and vulnerability assessment. This presentation is useful for participants to conduct field exercise on baseline data collection of training on 27 September 2016 and conducting vulnerability assessment on 28 September 2016. The presentation also provided basic knowledge especially for key ministries' AWG members for conducting feasibility study of their respective adaptation projects.

Vulnerability assessment is a process to assess vulnerability of system/assets to respective potential climate threats through assessing exposures, sensitivities, and adaptive capacity by using baseline data collected from the various sources of data collection. For detailed outline and information of the presentation, please refer to Appendix 6.

The presentation introduced some key concepts for vulnerability assessment, which include identifications of system/asset to assess, identification of potential climate change threat, screening projects to assess, scoping assets/area to cover in assessment, assessment of levels of exposures and sensitivities of system/assets to climate threats, identification of impacts of system/assets from potential climate threats, assessing adaptive capacity, and identification of adaptation options responsive to impacts.

2.3.5 Introduction to field exercise and templates for vulnerability assessment

As part of vulnerability assessment and adaptation planning, the field exercise is the integral part of the training workshop. This provided the participants with practical skills on how to collect data, including field arrangement, interview, focus group discussion and personal observation. The field templates are used as guiding questions and processes for participants to collect data on urban, transport and rural infrastructure necessary for conduction of vulnerability assessment. The template is divided into 7 sections, namely 1) Draw the existing infrastructure system and surrounding

landscape, 2) Provide a short description of the existing infrastructure system, 3) Identify the main components of the existing system *(e.g. rural roads, national roads, bridge culverts, canals, dykes, ponds and reservoirs and* drainage *channels), 4)* Describe the watershed context of the existing system, 5) Description of the specific location, and 6) Additional notes and diagrams (Appendix 6).

The trainees were divided into three groups who looked at specific components of the infrastructure projects in Kampong Leng district. Group 1 covers Main road (50C) around Touk Meas Mountain and associated infrastructure, group 2 does the Market, approach road and jetty, and group 3 Water storage reservoir and rural road. As part of the introduction of field exercise, the participants were given with the basic information about the communes (Appendix 5) so that they could read and understand each site prior to visits.

2.4 SESSIONS 4: DATA REQUIREMENTS FOR THE FEASIBILITY STUDY BASELINE ASSESSMENT – FIELD EXERCISE

The field exercise was carried out on 27 September 2016 to Kampong Leng district to look at the infrastructure projects as mentioned in section 2.2.1 above. The participants were subdivided into three groups as in the following, and each group was led by TA8179 experts.

Group 1 covers Main road (50C) around Touk Meas Mountain and associated infrastructure. By following the provided field baseline template, the participants held discussion with commune and district representatives together with local villagers in Dar commune office. Group 2 works on the Market, approach road and jetty, and held a meeting with local authorities and community members in Kampong Hao commune office. While, group 3 worked on Water storage reservoir and rural road, and held thorough discussion with local authorities and community members in Chronouk commune center. Following meeting, the trainees together with local authorities and community members made a short visit to each site of infrastructure for comprehensive understanding, and took photographs of each infrastructure asset for further analysis.

2.5 SESSIONS 5: DATA REQUIREMENTS FOR THE FEASIBILITY STUDY BASELINE ASSESSMENT – GROUP WORK

This session covers two presentations (Group work to complete the baseline assessment field template and Introduction to vulnerability assessment template, see Appendix 6). These are used as an instruction for trainees to summarize the baseline data collected from field on 27 September 2016 in Kampong Leng district, and for trainees to conduct the vulnerability assessment. Each respective group continued to work on summarizing data from the field by following the baseline data template, as each group member recorded the data on their template sheet. After completion, each group representative delivered the presentation on key findings from each site.

After the presentation, each group was guided to undertake the vulnerability assessment and scoring of each infrastructure component gathered from the field trip. By filling in the vulnerability assessment template, each group has to use the data recorded in baseline template by describing the climate threats to each infrastructure component. Through discussion with local stakeholders in the field and internal group discussion, we provided relative scores to each vulnerability criteria like exposure, sensitivity, impact, adaptive capacity and vulnerability level. Appendix 3 shows the results of vulnerability assessment and relative scoring.

3 SUMMARIES OF FIELD WORK AND GROUP DISCUSSION

3.1 FIELD WORK BASELINE ASSESSMENT FOR GROUP 1: MAIN ROAD (NO. 50C) AROUND TOUK MEAS MOUNTAIN AND ASSOCIATED INFRASTRUCTURE

The results of the field work baseline for Group 1 (Road 50C around Touk Meas mountain and associated infrastructure) are presented in the completed Templates in Appendix 3.1. Comprehensive responses were made to seven key sections of questions related to infrastructure components such as main road 50C, bale bridge, pipe culvert, burrow pit, submerged Samrong Seng road (connecting from road 50C to Samrong Sen commune), road side reservoirs, and rural market. Road 50C runs through 33 villages and 6 communes such as Kampong Hao, Svay Rompea, Dar, Chronouk, Po and Tra Ngel. It receives annual damage by flash flood from Touk Mea mountain due to lack of sufficient pipe culverts and bridges to drain rain water into the Tonle Sap floodplain. In some year, the road 50C is badly hit by high flood from Tonle Sap Lake, which it needs proper levelling responsive to flood.

With regard to vulnerability assessment and scoring of infrastructure components, each system component is ranked from high to very high in term of exposure, sensitivity, impact, and adaptive capacity of the system. For overall vulnerability score, the road 50C is rated to be high due to the fact that it is located floodplain of Tonle Sap lake and receives flash flood annually from Touk Meas mountain. For detail elaboration of vulnerability assessment for Group 1, please see Appendix 3.1.

3.2 FIELD WORK BASELINE ASSESSMENT FOR GROUP 2: MARKET, JETTY AND SUBMERGED ROAD

Field visit was done with the existing system of Kampong Leng district markets (Kampong Hoa market is the flooded market and Kampong Beoung market is the standing market), road connecting between these two markets (one is submerge road which is about 1km long, and dyke road about 2 Km long), and Jetty or ferry port in Kampong Leng district and at flooded market in Taour village.

Group 2 was assigned to collect baseline information and assessment of the components of the town infrastructure and rural road rehabilitation project in Kampong Laeng district, Kampong Chhnang province. Those components are such the market system, approach road and associated infrastructure. The baseline data collection and assessment was done at the specific project area by using the designed template for baseline assessment. The template designed to collect baseline data related to the existing system of structure/infrastructure, status and degradation of the system, causes of impact and responsive measure used to against the previous impact. Based on the template the team would attempt to collect the status and trend of the watershed and landscape surrounding the system.

Three specific components and locations were observed. Those are flooded Market, submerge road and dyke, and standing market. Adding to the landscape area surrounding this system was also observed. The data related to these areas were collected and discussed with commune council and local people including the sale/shop owner. These specific locations of the system would be discussed to identify and describe the geographical, natural and manmade features in the immediate vicinity of the system, include any slopes, vegetation, soil types proximity to water bodies, cultural features and environmental issues (e.g. pollution, erosion, solid waste, etc.)

The baseline data of the system was collected at field on 27th September 2016 and complied and assessed at class on 28th September 2016. That baseline data and assessment descripting about the existing system and impacted by extreme event of climate and regular climate event (rain fall and river flood) are detailed in the Appendix 3.2.

Beside of doing the baseline assessment, the group 2 has done the vulnerability assessment (VA) by using the template designed by TA-8179/ICEM specialist. As the time limited and too much information, the group 2 has selected three big components (flooded market, standing market, and submerge road) to discuss and assess. And the main climate treat is the extreme flood which was occurred in 2011. This intends to make the group (trainee) understand how to use the baseline data for vulnerability assessment (VA). And what important of (VA) exercise and assessment in planning of the climate change projects. Based on the group assessment, the system is vulnerable to the climate treats-extreme flood which is rating from medium vulnerability to very high vulnerability to extreme flood (2011). And it varies in according to the component of system for example, flooded market, submerged road and standing market. The result of VA assessment and template has been attached in the Appendix 3.2.

3.3 FIELD WORK BASELINE ASSESSMEENT FOR GROUP 3: RURAL ROADS (PART OF ROAD 50C), WATER STORAGE RESERVOIR AND SUBMERGED ROAD

Group 3 comprises of 14 training participants has been visited to Chronok Commune, Kampong Laeng District on 27 September 2016. There were 16 local people including district councillor, commune councillors, village chiefs and key villagers from Chronok commune and Phlov Touk commune have been arranged to meet with training participants of group 3 at Commune centre of Chronok commune. After a short meeting to introduce about purposes of visit, the whole team (Group 3 participants and local people) have been visited to three sites of proposed infrastructures including: (1) part of road 50C in Chronok commune, (2) submerged road connecting from Chronok commune to Phlov Touk commune, and (3) Dam-Reservoir of Damrei Hel. The whole team has been visited over all the three sites and took notes key information from field. After finishing field exercises, the team conducted meeting again in afternoon to discuss and ask for more detail information on what team members have found during field visit. Summary of field exercise is shown box below and with details as presented in Appendix 3.3.

(1) **Part of road 50C in Chronok commune**:

The purpose of upgrading part of road 50C is to enhance livelihood of community including improving: (i) accessibilities of children to school, people to health facilities, (ii) travel/communication and transport of agricultural products to market, and (iii) use as embankment of water storage from Cardamom Mountains of Touk Meas. Road 50C run through the commune. Villagers' houses locate along both sides of the road. This road is 11.8km long and equipped with 18 culverts (each is a single culvert with 0.8m diameter) and one bridge. The road is surfacing by laterite. This road has not sidewalk and its both slopes are not prepared to be resilient to flood. The road is threatened by flash flood from Touk Meas mountains and natural flood from Tonle Sap river. The road has been flooded over by occurred extreme floods in 2000, 2003, and 2013. Four sections (each section was flooded up to 1000m) of road in Chronok commune are recognized to be sensitive to flood. The road does not have enough number of culverts and existing culverts are also too small to release rain water during long and heavy rain.

(2) **Submerged road from Chronok commune to Phlov Touk commune**:

The purpose of intervention to improve this submerged road is to improve: (i) communication/travel of people and students from Phlov Touk commune to Kampong Laeng district, (ii) transport of agricultural products to market in Kampong Laeng, (iii) accessibility of people in Phlov Touk to health facilities in Kampong Laeng, (iv) effectiveness of administrative communication work, and (v) to be a dam for keeping water for using in dry season.

The existing road is not really a road but like an oxcart way that people can be used to travel by oxcart or motorbike during dry season. About 1 km long connecting to road 50C has already raised up and constructed as road during 1980s. This road is about 20km long that runs through

flooded forest land that flood during flooded season. This road is flooded during flooded season. People and students in Phlov Touk commune come to Kampong Laeng by boats. However, during water recession, travel by boat is also a big problem caused by floating water plant.

(3) Dam-Reservoir of Damrei Hel:

The purpose of rehabilitate of Damrei Hel Dam-Reservoir is to improve the existing dam-reservoir to be: (i) a fully irrigation reservoir for agriculture (crops, livestock, and wild animals), water supply, and feed water to ground water wells nearby.

Damrei Hel Dam-Reservoir is located at watershed of cardamom mountain of Touk Meas. It is located in between two mountains and one valley brings water from mountains to the reservoir. Size of reservoir is about 750m by 500m. The dam was constructed in 1975 till 1979. However, this dam had been collapsed in 1979 due to extreme flood and no maintenance at that time. The dam and reservoir has no function after that. Most of existing dam are at high level with covering by forest. A farmer is using part of bed of reservoir for growing vegetables and other crops. There are about 100 households live at downstream of the dam that these households would be put in consideration when the dam is decided for intervention.

In terms of existing watershed, Chronok commune contain mountains, forests, reservoir, rice field, residential area, road 50C, rice field, flooded forest, natural lakes, and lowland of Tonle Sap. Forest at mountains has been destructed, there are some erosions, loses of biodiversity (loss of wild life), Damrei Hel's canal is eroded and collapse. People also vulnerable to storm, wind gust, and lightening. Flooded forests and natural lake have been encroached to be lotus lakes and rice field. The forests are threatened by fires during dry season, natural lakes are getting shallow. For more detail information, please refer to Appendix 3.3.

4 KNOWLEDGE AND SKILL ASSESSMENT: PRE AND POST QUESTINNAIRES

There are 37 participants from MRD, MPWT, MoE, NCDM, Provincial officer, District governor, and NGOs workers. As high as 67% of participants reported that they knew the vulnerability assessment and only 35% of participant ever attended training on vulnerability assessment and adaptation planning. 26% of participants reported they have had experiences conducting vulnerability assessment. While, only 41% knew the type of data require for vulnerability assessment. Below is summary of results of Pre and Post test given by the trainees and detail results are placed in Annex 4.

Questions	Pre	Post
Do you know what vulnerability assessment is?	67%	100%
Have you previously received training in vulnerability assessment and adaptation planning?	35%	82%
Have you conducted a vulnerability assessment for an existing or planned development?	26%	78%
Do you know what type of data is required for vulnerability assessment?	41%	86%

5 TRAINING WORKSHOP EVALUATION

37 participants filled in the workshop evaluation sheet among the total participants. They came from MOWA, MPWT, MRD, ICEM, MOE, Plan International's project partners (local NGOs) and from provincial line departments like Tboung Khmum, Pursat, and Battambang provinces, district officials from Kampong Leng district where the field exercise was taken place. Following are statement on how participants understand the workshop beneficial to their work.

The participants agreed that the workshop provides the basic knowledge and skill on vulnerability and risk assessment for infrastructure. The training course gave the participants' field work experience to assess such infrastructure components under condition of climate change. It provided an idea and guideline to use the evaluation tool for developing a climate adaptation change project. Participants received information about analysis methods for assessing climate change impacts on road systems, reservoirs, and markets in Kampong Leaeng district. The workshop materials are useful for participants' daily work, particularly water resource management in Kampong Laeang district. The workshop also helped participant able to establish links with NGO partners and local communities.

Among the participants who are filling the workshop evaluation sheet, as high as 81.3% reported that the workshop is of great benefit to their work, 9.4% was very satisfied, while only 9.4% reported neutral.

For future organization of the similar workshop, participants suggest the following points for improvement:

- The workshop has many topics in the same day, participants are hard to follow. The workshop organizer should extend to more days.
- Similar workshop should be organized again in the future because it is the first time that many trainees have participated. Participants have not yet deeply understood all the concept of climate change and adaptation and vulnerability assessment
- It's hard to understand the evaluation question "BA-CRFS", some questions difficult to divide. The questionnaire should be added up suggestion/comment from the community or authorities, regarding need of infrastructure buildings that are resilient to climate change.

6 CONCLUSIONS AND NEXT STEPS

6.1 WORKSHOP FINDINGS AND RECOMMENDATIONS

The pre- and post-workshop questionnaires showed that the workshop improved the understanding of officials in what a vulnerability assessment consists of, and the data requirements. In their evaluation of the workshop, the participants stated that the workshop provided them with a guideline and valuable field experience to assess impacts of climate change on infrastructure (road systems, reservoirs, and markets in Kampong Leaeng district). The workshop also helped participant able to establish links with NGO partners and local communities. Future workshops can be improved by increasing the length of the workshop (thus allowing for more time to be spent on each topic), and by improving a section for collecting comments from the community in the field survey.

Regarding the design of the Kampong Chhnang project, the overall objective is to provide farmers with greater access to markets via an improved port, market and road facilities. A number of alternatives exist for reducing the vulnerability of the port facility; while these will be evaluated in the coming months, there is a general consensus to have a year-round port facility to avoid moving ports during seasons. A decision also needs to be made on the location of the market to reduce its vulnerability to flooding. Many of the rural roads in the district are subject to flooding, and a decision on which of these will be rehabilitated as part of the project will be made in the coming months.

6.2 IMMEDIATE AND LONGER TERM NEXT STEPS FOR THE DEVELOPMENT OF FEASIBILITY STUDY PROJECT CONCEPT AND ACTION PLANS FOR KAMPONG CHHNANG

i. After completion of the Kampong Chhnang training workshop, incorporate the findings of that workshop and these MPWT comments to further refine the project concepts for Kampong Chhnang. These second drafts are to be completed by mid-October 2016 for submission to MPWT for further comment if deemed appropriate.

ii. Prepare with MPWT AWG and technical staff the first draft of the project design and field data collection, especially following the template outline of feasibility study report (suggested by ADB). This also includes the economic data on cost and benefit of the proposed project.

iii. From the project design and field data gathering, TA specialist in close cooperation with MPWT AWG members prepared the plan for additional data gleaning, including the baseline data collection survey design are to be completed by end of 2016.

iv. It is envisaged that the full feasibility study for the Kampong Chhnang project will be completed in mid-2017. If the study is shortlisted for full proposal preparation to be submitted to the global climate funds, such a proposal will be prepared in the second half of 2017.

7 PHOTOS

Day 1: Classroom training

Lok Chum Teav Pal Yoeun, Vice Governor of Kampong Chhnang province and H.E Pon Saroeun, Undersecretary of State of MoE are on board

H.E. Prof. Dr. Sabo Ojano, Secretary of State of the Ministry of Environment and SPCR Program Coordinator, chair the training workshop.

Dr. Seak Sophat, Deputy Team Leader of the SPCR project, provides an introduction to the training workshop

Dr. Lay Chanthy, NAPA Project Specialist, presents the vulnerability assessment to the meeting.

Participant reacts during the meeting

Participant reacts during the meeting

Dr. Jeremy, Adaptation Specialist, provides a prediction regarding to climate change in Kampong province

General view of the meeting

Participants pose for a group photo

Day 2. Field Visit: Baseline Data Collection

Heading to the shore of Kampong Laeng district

AWGs meet with Chronouk Commune Chief and relevant authorities

AWGs and authorities visit a submerged road in Da commune, Kampong Laeng District

Segment of submerged road in Da commune, Kampong Laeng District

A mean of transport during the flooded season

Local market submerged during the flooding season in Kampong Laeng district

Market moved to mainland during flooding season in Kampong Laeng district

AWGs and relevant authorities visit Damrei Hel highland reservoir Chronok commune, Kampong Laeng District

Water flows downstream from Damrei Hel highland reservoir Chronok commune, Kampong Laeng District

Water flows from Damrei Hel highland reservoir downstream across road 50C in Chronok commune, Kampong Laeng District

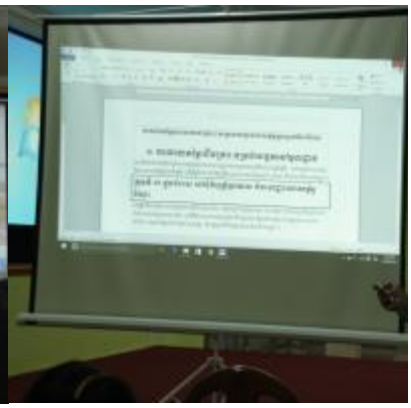
People raise cattle for income purpose and ploughing.

AWGs pose for a group photo

Day 3. Data Analysis and findings

Participants split into 3 different groups to analyse the collected data

Group Representative presents the key findings



Dr. Seak Sophat explains the participants about vulnerability assessment form

General view of the group discussions

Dr. Jeremy provides briefs of the purposes and data collection process and thank-you speech for the participants

H.E. Pon Saroeun provides closing remark of the training workshop

APPENDIX 1. AGENDA

ADVANCED VULNERABILITY ASSESSMENT AND ADAPTATION PLANNING TRAINING: (2) BASELINE ASSESSMENT FOR CLIMATE RESILIENT FEASIBILITY STUDIES IN URBAN, TRANSPORT AND RURAL INFRASTRUCTURE

Sok Thai San Hotel
KAMPONG CHHNANG, 26-28 SEPTEMBER 2016

Day/Session	Presentation/training activity	Presenter/facilitator
Day 0 – 25 September 2016 [Sunday]		
	Travel Phnom Penh to Kampong Chhnang	
Day 1 – 26 September 2016 [Monday]		
Session 1: Opening and introduction – the overall project and feasibility studies		
7:40 - 8:00	Registration	PMU Staff
8:00 - 8:25	Welcome Speech (TW/MCRDP/DOC1)	Provincial Governor
8:25 - 8:40	Opening Speech (TW/MCRDP/DOC2)	HE Prof Dr Sabo Ojano, Secretary of State, MOE, and SPCR Program Coordinator
8:40 - 9:00	Introduction to the training (TW/MCRDP/DOC3)	Dr Seak Sophat, Deputy Team Leader/ Water Resource Specialist
9:00 - 9:20	The structure and approach to feasibility studies, and what the donors and funds require (TW/MCRDP/DOC4A-B)	Dr Lay Chanthy, National Adaptation Project Development Specialist
9:20 - 9:40	An overview of six project concepts under consideration by SPCR/MCRDP and collaborating ministries (TW/MCRDP/DOC5)	Mr. Nom Sophearith, National Adaptation Project Development Specialist
Session 2: Kampong Chhnang Urban and Transport Infrastructure sector and adaptation project concept		
9:40 - 10:10	Detailed presentation of the Kampong Chhnang Infrastructure project concept "Enhance resilience of rural infrastructure and community livelihoods in Kampong Leng district" (TW/MCRDP/DOC6)	MPWT AWG member (assisted by Mr. Thai Vathara)
10:10 – 10:30	Coffee break	
10:30 - 11:15	Urban and transport infrastructure sector in Kampong Chhnang Province – status and trends as impacted by climate change, with the emphasis on floods, drought and other extreme weather events (TW/MCRDP/DOC7)	Kampong Chhnang Provincial Department of Public Work and Transport representative

Day/Session	Presentation/training activity	Presenter/facilitator
Session 3: Socio-economic and environmental profile of the province and Introduction to field exercise		
11:15 - 12:00	Socio-economic and cultural contexts as impacted by climate change of the Kampong Chhnang Province – including traditional responses to extreme events (flood, drought and wind storms) (TW/MCRDP/DOC8)	Kampong Chhnang Provincial Planning Department representative
12:00 – 13:30	Lunch break	
13:30 – 14:00	Rural infrastructure sector in Kampong Chhnang Province – status and trends as impacted by climate change, with the emphasis on floods, drought and other extreme weather events (TW/MCRDP/DOC9)	Kampong Chhnang Provincial Department of Rural Development representative
14:00 - 14:30	Projected climate change in Kampong Chhnang and implications for development (TW/MCRDP/DOC10)	Dr Jeremy Carew-Reid, International Adaptation Project Development Expert
14:30 – 15:00	Plenary discussion	Facilitated by Dr Jeremy Carew-Reid /Dr Seak Sophat
15:00 – 15:20	Coffee break	
15:20 - 16:30	Introduction to the vulnerability assessment process and tools (TW/MCRDP/DOC11)	Dr. Lay Chanthy
16:30 - 17:00	Introduction to field exercise and templates for vulnerability assessment. Participants divided into three groups for the field exercise. (TW/MCRDP/DOC12)	Dr Seak Sophat Mr. Thai Vathara
	Welcome dinner	
Day 2 – 27 September 2016 [Tuesday]		
Sessions 4: Data requirements for the feasibility study baseline assessment – field exercise		
8:00 – 17:00	Field trip – three groups are provided with the SPCR Baseline Assessment Field Template. During the field trip, they will consult with (i) local groups, (ii) district and commune government representatives, (iii) with other service providers and stakeholders (NGOs, private & others), and (iv) hold internal discussions to complete the baseline assessment field template.	Dr Jeremy Carew-Reid Dr Seak Sophat Dr. Lay Chanthy Mr. Thai Vathara Mr. Nom Sophearith (Support from MPWT and MRD AWG's)
Day 3 - 28 September 2016 [Wednesday]		
Sessions 5: Data requirements for the feasibility study baseline assessment – group work		
8:00 - 9:30	Group work to complete the baseline assessment field template	Facilitators – MRCDP team and MPWT/MRD AWG members
9.30-9.45	Introduction to vulnerability assessment template and scoring	Dr. Seak Sophat Dr. Lay Chanthy
09:45 – 10:05	Coffee (bring back to working group)	
10:05 -11:35	Group work to complete the vulnerability assessment template and scoring	Facilitators – MRCDP team and MPWT/MRD AWG members
11.35-12.30	Three working groups report back on baseline and vulnerability assessment – plenary session	Group representatives
12:30 -13:30	Lunch break	

Day/Session	Presentation/training activity	Presenter/facilitator
Session 6: Other project concepts and their data requirements		
13:30 – 14:00	Detailed presentation of the Tboung Khmum rural infrastructure project concept "Climate Resilience of Rural Roads and Small-Scale Irrigation Reservoir Improvement Project in Western Region of Tboung Khmum Province" (TW/MCRDP/DOC13)	Mr. Touch Siphat, MRD AWG member (Assisted by Dr Lay Chanthy)
14:00 – 14:30	Detailed presentation of the Integrated project concept in Battambang: Urban climate change adaptation: Rehabilitation of Irrigation and drainage system of Kampong Seima project-Battambang Municipality (TW/MCRDP/DOC14)	Mr. Ou Chanthearith, MOE AWG member, and MCRDP project manager (Assisted by Mr. Nom Sophearith and Dr Jeremy Carew-Reid)
14:30 – 15: 15	Group discussion (divided in two groups according to two concept notes above) - What have they learned from the vulnerability assessment exercises for climate resilient project design?	Facilitated by Dr. Seak Sophat, and MPWT / MRD AWG members
15:15 -15:35	Coffee break	
15:35 – 16:05	Group presentation and discussion	Facilitated by Dr. Seak Sophat, and MPWT / MRD AWG members
16:05 - 16:30	Workshop summary and next steps	Dr Jeremy Carew-Reid Mr. Thai Vathara
16:30 -17:00	Workshop close	MOE representative
	Travel from Kampong Chhnang to Phnom Penh	

Note:

The field exercise will be divided into three groups while focusing on climate extreme events like flood, drought, and wind storm/temperature:

1. Group 1: Main road (No. 50C) around Touk Meas mountain and associated infrastructure (submerged road connecting from Dar to Samrong Sen communes) to be led by Dr. Seak Sophat and Mr. Thai Vathara. Meeting location is in Dar commune
2. Group 2: Market, jetty and submerged road to be led by Mr. Sophearith and Dr. Jeremy Carew-Reid. The meeting location is in Kampong Hao commune in Kampong Leng district capital
3. Group 3: Rural roads (part of road 50C), water storage reservoir and submerged road (connecting from Chronouk to Plav Touk communes) to be led by Dr. Lay Chanthy. The meeting location is in Chronouk commune.

The field exercise will be to Kampong Leng district of Kampong Chhnang province where it is impacted by climate change events every year.

APPENDIX 2. PARTICIPANT LIST

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103	Muk Mern	Kampong Leng District	Residents	M	
104	Rem Ran	Kampong Leng District	Residents	M	071 667 2245
105	Tang Seng	Kampong Leng District	Chief Commune	M	
106	Chorn Chern	Kampong Leng District	Deputy Chief Commune	M	096 978 0281
107	Thourn Cha	Kampong Leng District	Residents	M	071 642 0832
108	Kon Phern	Kampong Leng District	Deputy Chief Commune	M	097 354 9349
109	Vong Hat	Kampong Leng District	Member of Commune	F	
110	Chem Sokhon	Kampong Leng District	Chief Commune	M	088 417 885
111	Moun Ty	Kampong Leng District	Fishery Community	M	

APPENDIX 3. SUMMARIES OF BASELINE ASSESSMENT IN KAMPONG LENG DISTRICT, KAMPONG CHHNANG PROVINCE

1.1 BASELINE ASSESSMENT FOR GROUP 1: MAIN ROAD (NO. 50C) AROUND TOUK MEAS MOUNTAIN AND ASSOCIATED INFRASTRUCTURE

Group 1: Main road (50C) around Touk Meas Mountain and associated infrastructure

The sub-components have been suggested – but the group can modify and add if they wish depending on what they find in the field and what local community members identify as important (take photos of each component and show location on your sketch map)

Date: 27 September 2016 **Name: Group-1**

Name of the target system	Kampong Leng District infrastructure
Location (District & GPS)	• Dar administrative commune centre • Using (UTM), Datum: WGS-84, Zone: 48P • Easting: 478291 • Northing: 1365501
Responsible authorities *Local and national agencies which need to be involved in the proposed adaptation project*	• Military Engineering Unit (Ministry of Defence) • Provincial Department of Rural Development (Kampong Chhnang/PDRD) • Provincial Department of Public Works and Transport (Kampong Chhnang/PDPWT) • Local authority

1. Draw the existing infrastructure system and surrounding landscape

This can be a rough sketch of the overall system showing key features and components. It can refer to photos you have taken, and show detail of any feature that you think is important. Use additional pages if needed.

Field Exercise Locations for Group-1

Kampong Leng District

Dar administrative commune center

2. Provide a short description of the existing infrastructure system

Groups 1, 2 and 3 will each be assessing the infrastructure in different parts of the project area. Looking at the infrastructure "system" in your area briefly state its main purpose and provide a short description. The purpose might be, for example, "to facilitate the transport of local agricultural products to market". The description could be, for example, "A one km section of rural road 50C, with three bridge culverts, and a junction leading onto a smaller rural road which is submerged during the wet season. The system also include a 1km section of borrow pit which acts as a water reservoir during the dry season."

Main purpose	• Improve the traveling, transportation and other service facilities, • Stock water at Chro Long village with 400m long in order to irrigate the rice field around 7ha, • Protect the community, livestock and infrastructure from flooding Tonle Sap Basin, • Transport the agricultural productivities to market, • Facilitate the travelling of students to the school, • Increase the security, • Safety hill for evacuation livestock and animals, • Increase access to health service, especially for the pregnancy woman • Increase the tourists to visit the history Touk Meas mountain, • Spot improvement and reduce dusty, • The road around Kang Rey mountain with total length 10km was rehabilitated between 2011 and 2013 by Laterite pavement through Po and Tra Ngel Communes by Commune fund and donors,
Overview *short description of existing system*	• Road 50C with total length 41.75Km and Bituminous paved in urban area 9.80Km by SBST • Road 50C: based on the villager's information, no Mine and Unexploded Ordnance (UXO) are located along right of way that remaining from civil war, • The remaining 31.95Km Laterite paved by Military engineering unit, Provincial department of rural development, Provincial department of public works and transport through 33 villages and 6 communes as Kampong Hao, Svay Rompea, Dar, Chro Nauk, Po and Tra Ngel, • Structures: pipe culvers with single rows 68 locations, pipe culvert with double rows 5 locations, pipe culvert with triple rows 9 locations, box culverts 2 locations and bridges 2 locations

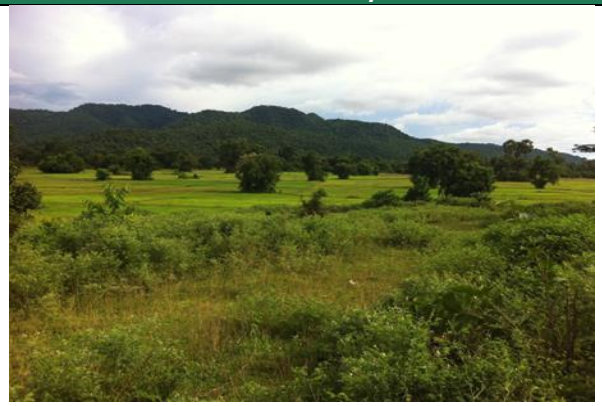
3. **Identify the main components of the existing system** *(e.g. rural roads, national roads, bridge culverts, canals, dykes, ponds and reservoirs and drainage channels)*

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
1. Main road (50C) around Touk Meas Mountain and associated infrastructure	Sub-components: E.g road surface, bridge culverts, ponds/reservoir, linked rural roads			
Sub-Component 1: Main Road 50C	• Total length: 41.75Km • Laterite paved: 31.95Km • Bituminous paved: 9.80Km 	• Damaged by runoff and was flowed over, • Critical damaged at Bale Bridge at Chronouk Commune, • Insufficient structures, • Road alignment is running around Touk Meas Mountain,	• by flash flowing from hill areas • by increasing level water from Tonle Sap Bank, • by group of castles crossing, • by branch of tree was grow over the road surface, • by insufficient structures to release discharge water, • Lack of maintenance	• Provide land for Ox-Cart and Castles, • Provide approach way at entrance or access roads, • Cut the branch of tree where grow over the road surface, • Add structure at necessary places, • Cooperate with institutional skilled departments, • Create the maintenance's communities,
Sub-Component 2: Bale Bridge	• Single span, • Total Length: 18m, • Width: 4m, • Location: Ch. 25+500, • Location: Chro Nauk Commune, • Built: Military Engineering Unit, • Year: 2003	• Flash flowing water from Domrey Hel reservoir, • Scouring of bridge bottom, • Erosion of the wingwalls,	• by flash flowing from mountainous area (Touk Meas), • by flowing water from	• Stone pitching at the bottom of bridge, • Extent wingwalls, • Backfill and turfing at abutment slopes,

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
		• Plenty of obstacle materials along the existing river, • Local truck with 4 axial load passing the bridge,	Domrey Hel reservoir due to no rehabilitation, • by plenty of bush grow along the existing river, • Direction of flowing water is not perpendicular to bridge alignment, • Lack of maintenance	• Plan the Reed, Romchek … to protect erosion, • Routine maintenance or emergency maintenance is necessary, • Issue information to skilled department in case of broken some part of bridge,
Sub-Component 3: Pipe culverts	Along the main road 50C, there are 86 places: • Single rows ϕ100: 68 • Double rows ϕ100: 05 • Triple rows ϕ100: 09 • Box culvert (4mx2Span): 02 • Bridge (Bale & RCC): 02	• Erosion at Up & Down streams, • Scorvering at Cut-off walls, • Pipe is filled by Silt & other obstacle materials, • A few pipes are unfunctional due to lack of maintenance, or by villagers fill soil at their land, • No clearing of existing canal at Up & Down streams,	• by flash flowing from mountainous area (Touk Meas), • by backing up of water from downstream (Tonle Sap bank), • by filling soil, plantation from villagers, • Lack of maintenance • Lack of fund,	• Back filling with proper compaction at erosions, • Using the stone pitching or Rip Rap to protect the flowing, • Extent wingwalls to protect side slope pressure, • Turfing at side slope to protect the erosion, • Clearing the silt or other obstacle item from pipe, • Repairing the cracking of concrete headwalls and wingwalls

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
				
Sub-Component 4: Borrow pit	• Side borrow pits and side drains are very important to drain the water out. • Side borrow pits are a land use involving the excavation or digging of soil material for use as road embankment. 	• Unfunctional due to block of water way by bush and other obstacle materials, • Silt up • No proper shape of borrow pit or side drains, • Type of soil is mostly sandy, • Many access roads was constructed, • Plenty of castles crossing the borrow pits,	• by flash flowing from mountainous area (Touk Meas), • Type of soil is easily to erode and damage the shape, • by group of castles crossing,	• Need to maintain by join from community, • Debris and waste removal from side borrow pits, • Using stone masonry at the critical erosion

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
Sub-Component 5: Samrong Sen Road	• Road name: Dra-Samrong Sen • Road length: is about 6Km • Condition: 250m isn't affected by flood, other is submerged road, it is floodplain and unpaved, earth road was developed by community fund on 2013, • HFL: max. 2.50m from rice field's elevation, • Traffic: 6 months dry, 6 months flood 	• Back up water from Tonle Sap bank, • Long time is under water (6 months), • It is located on flat terrain	• by low elevation and unpaved road, • by early traffic opening after water go down,	• Pave by using Concrete or Bitumen, • Raise up the elevation by consider HFL, • Adding structures with sufficient spans, • Plant any kind of green engineering as grass, reed… to protect the erosion, • Embankment and base use cement stabilizing,
Sub-Component 6: Reservoir	• Name: Pha Ae • Location: Chro Lorng Village, Dar Comm along the main road 50C, • Dimension: 70mx250m • Irrigate: 150Ha • Height: average 1.50m • Built: on Pol Pot regime, year 1977 • Benefit: stock water from Touk Meas mountain, • Using: Community and animals,	• Filled by silt, debris • Dam is total broken by erosion, • No maintenance, • No proper compaction during the construction, • No water gate,	• by flash flowing directly from mountainous area (Touk Meas), • by harmful from human and animal, • No renovation,	• Create the committee to manage and control • Build water gate or spillway • Paved by Laterite with proper compaction, • Turfing on the side slopes, • Plant the tree along the dam,

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
				• Using local recourse as rock, stone, aggregate, gravel…
Sub-Component 7: Rural Market	• Location: along both sides of road 50C, Dar Village, Dar Commune, • Number of Stalls: about 20 stalls permanently, • Number of Basket: about 100 baskets • Time: 3:00 AM – 7:00 AM • Facility: No infrastructure, no garbage cans, no sanitation, no committee, 	• Mud & water • Debris & waste • Smell, • Unpredictable accident by road users,	• by flowing water along road side drains, • by unproper management	• Move to the sufficient space with proper facility, • Create the committee market user group, • Find out the fund to develop the rural market

4. Describe the watershed context of the existing system

Describe the location of the existing system within the watershed, the condition of the watershed Document with photographs and sketches

Location within the watershed *(eg. what is upstream, midstream, downstream)*	• Road alignment is laid around Touk Meas mountain, • Its function like the dam, one part block flowing water from upstream (Touk Meas), and other from downstream (Tonle Sap bank), • It is affected by flowing water from Kang Rey about 3Km (Po & Tra Ngel), • Its alignment is crossing between Trabek , Tra Ngel mounatins and Vat Phnom about 300m with steep gradient, • Its alignment is also laid nearby other mountains such as Tumnub, Trapeang meas, Prasat, Kangkeb, Punreay, Trang
Watershed condition *(identify features – land use, human settlements, ecological assets and services – and trends in their condition)*	• Local people are living along the road alignment 50C, • Farming plantation and rice filed from upstream to downstream, • Community forest from top till toe of mountain, • Other agriculture production, • There are plenty of jungle with very tall tree, and thin forest, • There are plenty of wild animals, • Local people break the rock by hand and sell, • There are plenty of ancient temples, • That area has the potential for farm to feed the animals

5. Description of the specific location

Identify and describe the geographical, natural and manmade features in the immediate vicinity of the existing system, include any slopes, vegetation, soil types proximity to water bodies etc.

Landscape and natural features *(include slope, soil conditions, vegetation, water bodies)*	• The landscape is located on flat terrian and mountainous areas, • In Dar Commune, total land 8,788ha with 5 villages (Dar, Thnal, Chrolong Prasat, and Kuy) • Tourist areas (ancient temples, water falls, names: O Dar Seyla Touk Meas) • In Dar Commune, there are 17 water falls, 17 natural streams, • Tourist with internal and external) about 100K yearly, • There are total mountains with small and medium 28
Manmade features *(e.g. roads, housing, drainage infrastructure etc)*	This row is conducted the baseline assessment only in Dar Commune: • Main Road 50C: 7Km with Laterite pavement, • Rural Roads: 15.85Km with Laterite and Mountainous Sand pavement, • Earthen Roads: 10.68Km without pavement
Cultural and social features	This row is mentioned only in Dar Commune: • The people are living on Dar Commune mostly Khmer and adhere the region of Buddhist and Christian, • The total population: 7,360 people, (3,673 male and 3,687 Female) 1,701 families, • Farmer: 90% and other occupation 10%
Surrounding land uses *(e.g. agricultural fields, residences, commercial areas)*	• Samrong Sen Commune: 80% fishery occupation, • Kampong Hao: 50% fishery occupation, • Dar Commune: 90% farmers occupation,

Environmental issues *(e.g. pollution, erosion, solid waste)*	• Water that flows from hill areas to the stream mix with other materials is harmful to villages, • Flash flowing water from hill areas is eroded when the people cut the bush and tree, • Sometime, the forest was burning, • Increasing number of tourist was affected to environment situation, • Digging of construction materials was affected to environment situation,

6. **Past experience and response to extreme events –** *describe the occurrence and type of extreme events within the watershed affecting the system (eg. flood, droughts, wind storm, intensive rainfall). State if the flooding and drought are seasonal and occur annually. Also, describe extreme events which may have occurred in recent years – eg when the flood and drought was much worse than normal.*

Date of event	Nature of the event – describe (also note if it is a regular/seasonal event or one off)	Impact on system	Components affected	What was the response to the impact?	How effective was the response?
Year 2000	• Millennium flood	• Road was cut, • Flow over road surface • Erosion	• Four sections was cut at low terrain (Dar, Chronouk, Po, Tra Ngel)	• Using temporary wooden bridges, • Using local boat	• Short term
Year 2011	• Tonle Sap flood	• Cut of roads, • Damaged 13 culverts, • Broken bridge wingwall • House immersed in water, • Animal was affected by flood,	• Three sections was cut at low terrain (Chronouk, Po, Tra Ngel)	• Using temporary wooden bridges, • Using local boat	
Year 2004 2014 2015	• Drought	• Dusty of Laterite pavement, • Burned grass and tree along road side, • Dead rice and other vegetation, • Increasing disease, • Increasing insects, • Lack of water, • Forest fire	• Approximately, the rice was broken 90%, • School was closed, • Veterinary clinic is busy, • Grass on the side slope is dead and wilted, • Tree along the road side are dead and faded	• Dig pond to keep water, • Repair reservoir, • Drill well & Hand pump, • Rehabilitate irrigation system, • Make the basin to catch water, • Public sanitations announcement	

Date of event	**Nature of the event – describe** (also note if it is a regular/seasonal event or one off)	**Impact on system**	**Components affected**	**What was the response to the impact?**	**How effective was the response?**
Year 2014 2016	• Wind gust	• Break the branch of tree, • Fall down of tree, • Fall down residential people, • Rice fall down and lost the production, • Dangerous to people	• Broken 48 residents in Dar Commune, • Broken 09 residents in Samrong Commune • Broken 02 residents in Chronouk Commune	• Support from Red Cross, • Issue the money from other donors, • Issue education to vulnerability people,	
Year 2004	• Epidemic • Lightning • Forest fire	• Impact to people along the road alignment, • Scarcity of food, • Unsafety in areas,	• all people are living along the road buffer,	• Issue education to vulnerability people, • Issue emergency save in case of disaster,	

7. Additional notes and diagrams

Add any information which you may need when conducting the full vulnerability assessment.

- Quarry: need to investigate the environmental impact assessment, quality and quantity of construction materials,
- Access road: need to investigate the access road to mitigate negative impact to people are living along the access road alignment,
- Human resource: need to investigate the skilled and unskilled labour at project target areas,
- Mine/UXO detection and removal for identified critical sections if remaining from civil war

SPCR VA-AP VULNERABILITY ASSESSMENT TEMPLATE

Date: 27 September 2016 **Group: Number 01**

Complete this matrix using the baseline assessment information and expert judgement. Use the supporting scoring tables to score very low to very high for Exposure, Sensitivity, Impact and Adaptive Capacity – and give reasons in footnotes for the score you have given.

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure** [1]	**Sensitivity** [2]	**Impact**	**Description of Impact** *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity** [3]	**Vulnerability**
Whole System	Extreme flood						
	Extreme drought						
	Intensive rainfall						
	Storm with strong wind						

[1] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[2] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[3] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure**[4]	**Sensitivity**[5]	**Impact**	**Description of Impact** *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity**[6]	**Vulnerability**
Sub-Component 1: Main Road 50C	Extreme flood	**H**	**VH**	**VH**	• ***Direct impact:*** – Four sections were cut off at low terrain (Dar, Chronouk, Po, Trangel) – Damaged by runoff and flash water flowed over, – Structure was damaged by flowing water – Spoiled agriculture production • ***Indirect impact:*** – The traffic was cut off due to impassable travelling, – Inflation of products in local areas, – No market for agricultural production	**L**	**VH**
	Exposure: • Road alignment is laid around Touk Meas Mountain • Flash flowing from hill areas, especially from the top of Touk Meas Mountain • Increasing water level and back up water from Tonle Sap Bank, • Herd (cattle) crossing every day • Loosing of forest cover from the top to bottom of Touk Meas Mountain						

[4] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[5] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[6] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure**[7]	**Sensitivity**[8]	**Impact**	**Description of Impact** • *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity**[9]	**Vulnerability**
	Sensitivity: • Due to road embankment formed from earth or mountainous sand • Lack of maintenance and insufficient fund for maintenance • No technical standard to apply during the construction period • Insufficient structure to release discharge water • Poor quality of soil to form the road embankment **Adaptive Capacity:** • Limitation of fund for rehabilitation and maintenance • Limitation of technical standard and specific equipment for rehabilitation and maintenance • Not so good cooperation from local people and local authority • Quality of material construction is not complying or required to the technical standard • Lack of centralization or join from community						

[7] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[8] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[9] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure**[10]	**Sensitivity**[11]	**Impact**	**Description of Impact** – *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity**[12]	**Vulnerability**
	Exposure: • The bridge is constructed nearby Touk Meas Mountain toe, • The direction of flowing water isn't perpendicular to bridge alignment, • The stream form isn't properly shape, • Soil condition mostly type sandy, • On the stream, there are plenty of grass, bush and other obstacle items to against the flowing water, ***Sensitivity:*** • Wingwalls are not long enough to support slope pressure, • Bolts are rusted, • Bracing under slab are rusted, • As the bridge was built long time ago, so the serviceability is low, • No maintenance or remove the obstacle item from the stream, **Adaptive Capacity:** • Limitation of fund for renovation and maintenance, • Limitation of technical standard and specific equipment for renovation and maintenance, • Not so good cooperation from local people and local authority, • No frequency check or periodic maintenance for each item part of bridge, • Lack of centralization or join from community,						

[10] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[11] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[12] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure**[13]	**Sensitivity**[14]	**Impact**	**Description of Impact** *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity**[15]	**Vulnerability**
Sub-Component 3: Borrow pit	Extreme flood	**VH**	**VH**	**VH**	• ***Direct impact:*** – Damaged the pit shape, – Erosion and scouring at the critical flowing, – Damaged the side slopes, – Group of castles crossing regularly, • ***Indirect impact:*** – The passengers and road users are suffering or worried while travelled through that road, – The truck can't load the heavily good as usual	**L**	**VH**
	Exposure: • Flash flowing water from the top of Touk Meas Mountain, • Group of castles crossing regularly, • No extent the public entrance road with properly approaching way, • Some section of side borrow pit was filled the soil or plant vegetation by villagers, • Soil condition mostly type sandy, • On the borrow pit, there are plenty of grass, bush and other obstacle items to against the flowing water ***Sensitivity:*** • Soil condition mostly type sandy, • Borrow pit's slope are mostly steep, • Borrow pit isn't constructed by stone masonry or stone pitching,						

[13] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[14] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[15] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure**[16]	**Sensitivity**[17]	**Impact**	**Description of Impact** *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity**[18]	**Vulnerability**
	• The gradient of Borrow pit isn't properly, • There are not mitre drain to release water from Borrow pit, • No maintenance or remove the obstacle item from the borrow pit, **Adaptive Capacity:** • Limitation of fund for rehabilitation and maintenance, • Limitation of technical standard and specific form, • Not so good cooperation from local people and local authority,						

Summary vulnerability results – *transfer the vulnerability scores to this summary table and then colour each box according to the key*

		VL	L	M	H	VH
Whole System	Extreme flood					
	Extreme drought					
	Intensive rainfall					
	Storm with strong wind					

[16] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[17] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[18] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

		VL	L	M	H	VH
Sub-Component 1: Main Road 50C	Extreme flood					**VH**
	Extreme drought					
	Intensive rainfall					
	Storm with strong wind					
Sub-Component 2: Bale Bridge	Extreme flood				**H**	
	Extreme drought					
	Intensive rainfall					
	Storm with strong wind					
Sub-Component 3: Borrow pit	Extreme flood					**VH**
	Extreme drought					
	Intensive rainfall					
	Storm with strong wind					

1.2 BASELINE ASSESSMENT FOR GROUP 2: MARKET, JETTY AND SUBMERGED ROAD

Group 2: Markets, submerged and dyke road approach to both markets, and jetty

The sub-components have been suggested – but the group can modify and add if they wish depending on what they find in the field and what local community members identify as important (take photos of each component and show location on your sketch map)

Date: 26 September 2016 **Name: Group 2**

Name of the target system	Kampong Laeng district infrastructure
Location (District & GPS)	Taour Rolum village and Kampong Boeung village, Kampong Hoa commune, Kampong Laeng district, Kampong Chhnang province
Responsible authorities *Local and national agencies which need to be involved in the proposed adaptation project*	• MPWT and its line department • MOWRAM and its line department • Sub-national government (Province, District and Commune)

1. Draw the existing infrastructure system and surrounding landscape

This can be a rough sketch of the overall system showing key features and components. It can refer to photos you have taken, and show detail of any feature that you think is important. Use additional pages if needed.

2. Provide a short description of the existing infrastructure system

Groups 1, 2 and 3 will each be assessing the infrastructure in different parts of the project area. Looking at the infrastructure "system" in your area briefly state its main purpose and provide a short description. The purpose might be, for example, "to facilitate the transport of local agricultural products to market". The description could be, for example, "A one km section of rural road 50C, with three bridge culverts, and a junction leading onto a smaller rural road which is submerged during the wet season. The system also include a 1km section of borrow pit which acts as a water reservoir during the dry season."

Main purpose	Makes people better off in livelihood and resilience to climate change , and particularly to alleviate the poverty of people in Kampong Leng district.
Overview *short description of existing system*	The system is under the sub-catchment of Tonle Sap River where is connecting to the Tonle Sap Lake. To the west the system closes to the Tonle Sap tributary river, and to earth it is the hill area. Most part of the system (west and north of the system) is bounded by water in the wet-season. The system consists of two sites of district market, one is the seasonal flooded market (Kampong Hoa market) and standing market (Kampong Boeung village), and connecting roads (submerge road and dyke road), and natural lakes.

3. Identify the main components of the existing system (e.g. rural roads, national roads, bridge culverts, canals, dykes, buildings, solid waste facility, jetty, ponds and reservoirs and drainage sewers)

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
1. Flooded market (Kampong Hao market) in Taour Rolum village	Man-made structure			
Sub-component 1: Shops	Man-made and temporary structure. It is easy to remove and resettle. The shop made from wood, and cover with a thatch roof and zinc roof.	• Broken and torn out • The shops were absolutely flooded if they were not moved out on time as the market area are frequently flooded starting by July through December yearly.	• Flood and wind/storm • Removal, transport and re-construction	• Removing the structure before flood coming and • Re-constructing after flood receding.

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
Sub-component 2: Shop and market floor	It is the man-made floor. The floor was smoothening by people (owner). Some shop floors were concreted while shop floors were smoothening by laterite soil or earth.	• Broken • Dirty by muddy and garbage	• Flood and wind/storm • Removal, transport and re-construction	• Re-building and cleaning up after flood receding.
Sub-component 3: Road around market	Man-made earthen road.	• Broken and dirty by muddy and garbage	• Flood and wind/storm • Removal, transport and re-construction	• Re-building and cleaning up after flood receding.
Sub-component 4: Jetty and loading zone	N/A	N/A	N/A	N/A
2. Submerge road from flooded market to Dyke				
Sub-component 1: Road embankment	• This road is man-made laterite road. Its length is about 1km starting from river bank (at flooded market-Kampong Hao market) to Dyke at Wat Pothi Sakda Ram. • The road embankment is around 7 metre wide. • This road is frequently around 6 months flooded starting by July through December. In 2011, the road was flooded, and under water 4-5 metres.	• Broken or eroded slightly every year • Dirty by muddy and garbage	• Surface water runoff and raining-yearly • Extreme flood	• Repair and maintain every year after flooding. • Responsible by the district authority with supporting from local people and local businessman in Kampong Laeng district.
Sub-component 2: Road slop	• The road slope is gradual and shallow-not a steep slope. It has been grown flooded trees on the road slope as well.	• Broken or eroded slightly every year	• Surface water runoff and raining-yearly • Extreme flood	• Repair and maintain every year after flooding.

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
4. Standing market (Kampong Boeung market) in Kampong Boeung village				
Sub-component 1: Market structures and Shops	• This market situates at hill area, and behind the district hall. The market is surrounding by residential, government buildings, school and pagoda. • Land area of market is around 1 hectare (ha) • The floor of market is smoothen by laterite soil • Structures of market and shops-constructing with wood, roofing by zinc, thatch, and plastic. There are around 120 shops where the shop is not a hard structure (i.e., not concrete or hard wooden structure).	• The roof of shop is damage (i.e. broken or torn) by wind and rain • The market ground is wet and water flows across since the market road is higher than market ground	• wind and rain	• Repair and maintain by shop owner
Sub-component 2: Road around market	• Road around the market is man-made laterite road. Its level is higher than the market ground.	• The road was holed or eroded by heavy rain and water runoff	• Heavy rain and water runoff	• Repair and maintain by local authority with supporting by shop owner
Sub-component 3: Solid waste collection system	N/A	N/A	N/A	N/A
5. Jetty	• The jetty made of concrete cement with 40 metres in length. And jetty slope is about 12 metres in width.	• Eroded and cracked mark at some area	• Water runoff	• Repair and maintain when it damage. The contractor for ferry port would response for

4. Describe the watershed context of the existing system

Describe the location of the existing system within the watershed, the condition of the watershed Document with photographs and sketches

Location within the watershed *(eg. what is upstream, midstream, downstream)*	• This existing system is in Tonle Sap Lake watershed area where locates in the sub-catchment of Tonle Sap River connecting between the Tonle Sap to the Tonle Sap Great Lake. • The existing system where have been considered consists of two sites of district market, one is the seasonal flooded market (Kampong Hoa market) and standing market (Kampong Boeung village), and connecting roads (submerge road and dyke road), and natural lakes. • The Kampong Hoa flooded market is at the west of the system built on the bank of Tonle Sap tributary river called Kampong Hoa River, and lays along to earth at hill area of Highland of Kampong Laeng district where is the another linked market, Kampong Boeung standing market located. • Most part of the system (west and north of the system) is bounded by water in the wet-season.
Watershed condition *(identify features – land use, human settlements, ecological assets and services – and trends in their condition)*	• Natural resource: there are a tributary river connecting to the Tonle Sap River, and two natural lakes (namely Boeung Rang and Boeung Kros), and floodplain area of Tonle Sap, and mountain area (called Tepi mountain). There are flooded forest (flooded shrub and flooded tree), and aquatic resources. Most land area of the system is covering by water during the wet-season. • Land use within the existing system: there are rice field (dry rice field area around the system), and other cropping land (orchard) and home gardening land. Beside of the system consists of road and residential land. • Economic activities: there active economic activities are such ferry transportation, fishing, rice and other crop cultivation during the dry season, and trading at these two district markets. • House structure and housing condition: Houses of the local people are resettled surrounding the markets, and, dyke road and commune/district road. Most of houses is structured by wooden or bamboo floor, wooden or thatch/leaf wall, and thatch or zinc or tile roof. Few houses or public buildings are structured by concrete wall, tile roof, and concrete floor.

5. Description of the specific location

Identify and describe the geographical, natural and manmade features in the immediate vicinity of the existing system, include any slopes, vegetation, soil types proximity to water bodies etc.

Landscape and natural features *(include slope, soil conditions, vegetation, water bodies)*	• The landscape of the system is likely to be an island of Tonle Sap Great Lake. It is the low-land. It is that area situated at sub-catchment of Tonle Sap river. Within the landscape there are a tributary river connecting to the Tonle Sap River, and two natural lakes (namely Boeung Rang and Boeung Kros), and floodplain area of Tonle Sap, and mountain area (called Tepi mountain). • There are flooded forest (flooded shrub and flooded tree), and aquatic resources. • The soil condition of the landscape is laterite soil and fertile soil, and it is likely to be acid soil condition since it is frequently flooded 6 months during the wet-season.

Manmade features *(e.g. roads, housing, drainage infrastructure etc)*	• Road structure: the road is man-made structure. Most of road structure within the system is laterite road, and approximately 1km of road is flooded during the wet-season where is the submerge road. • Drainage system: there no sewage drainage system exists within the area. There are digging canal is the man-made canal connected from the tributary river of Tonle Sap river to the hill area of Kampong Laeng district. • House structure and housing condition: Houses of the local people are resettled surrounding the markets, and, dyke road and commune/district road. Most of houses is structured by wooden or bamboo floor, wooden or thatch/leaf wall, and thatch or zinc or tile roof. Few houses or public buildings are structured by concrete wall, tile roof, and concrete floor. • Dumping site. One dumping site was built at place supporting by Provincial Environmental Department. • Jetty and ferry port, it was made with concrete, and repaired frequently while it is caused to damage
Cultural and social features	• Housing style is Khmer traditional style • There are two Buddhist Pagodas, one closes to the tributary river and one is at upland area closes to standing market.
Surrounding land uses *(e.g. agricultural fields, residences, commercial areas)*	• Agricultural production: there are rice field (dry rice field area around the system), and other cropping land (orchard) and home gardening land. • Fishing activities: traditional fishing practices are such long-line /hook and line, gillnet, and fishing trap, etc. • Transportation: there are active business service in transportation such as ferry transporting from/to Kampong Chhnang town to/from Kampong Laeng district, and motor taxi transporting around the district • Two district markets: one market is frequently and seasonally flooded 6 months during the wet and another market is non-flooded market. There are around 120 shops. • Residential structure: most abandon surrounding the dyke and road. And surrounding the market.
Environmental issues *(e.g. pollution, erosion, solid waste)*	• There are road/dyke slope eroded causes by water runoff and heavy raining. And some road area was flooded by river flood and rain. • The laterite soil was extracted for rural road and dyke road construction, and market floor building. The digging ponds at floodplain and behind the Kampong Hoa commune hall were not in use. It was kept unsafety for human and animal • Although there are dumping site and solid waste collection system was set up the management and function of this system was not functioning well. The garbage or solid waste was unmanageably abandoned throughout the system, and water bodies. • There are no sewage drainage system exists within the system. • Chemical feticide and herbicide/pesticide were commonly used by local farmers for their crop production (rice, crop and vegetable cultivation)

6. **Past experience and response to extreme events –** *describe the occurrence and type of extreme events within the watershed affecting the system (eg. flood, droughts, wind storm, intensive rainfall)). State if the flooding and drought are seasonal and occur annually. Also, describe extreme events which may have occurred in recent years – eg when the flood and drought was much worse than normal.*

Date of event	Nature of the event – describe (also note if it is a regular/seasonal event or one off)	Impact on system	Components affected	What was the response to the impact?	How effective was the response?
2000/01	**Ponding-flood:** or river flood is flood some part of the system	• Impact on Kampong Hoa market and Taour Rolum village. Shops and houses were damage. • Submerge road connecting to Kampong Hoa commune, and some part of district road. Slope and embankment of road were eroded.	• Floor of market and shop • Roof of shop and house within the market and surrounding market in Taour village • Road embankment and slop	• Traditional repair and maintenance after flood receded. • They fill in the laterite on where the area damage	• Normally it can be used after repairing
09/10-2011	**Ponding-flood:** The flood occurred fast and depth. It was above 5 metres in depth. It could flood most areas of the system but not standing market area (i.e., Kampong Boeung market in Kampong Boeung village)	• Impact on Kampong Hoa market and Taour Rolum village. Shops and houses were damage. • Submerge road connecting to Kampong Hoa commune, and some part of district road. Slope and embankment of road were eroded.	• Floor of market and shop • Roof of shop and house within the market and surrounding market in Taour village • Road embankment and slop	• Traditional repair and maintenance after flood receded. • They fill in the laterite on where the area damage. • But the dyke road connecting from submerge road to standing market was pave to be a bituminous pave road.	• Normally it can be used after repairing. • Dyke road has no flood while fix and repairing after flood in 2011
Yearly	**River flood:** the flood is regularly occurred yearly. The river flood is starting July through December.	• Impact on Kampong Hoa market and Taour Rolum	• Market and shop (floor and structure)	• Traditional repair and maintenance after flood receded.	• Normally it can be used after repairing, and

Date of event	Nature of the event – describe (also note if it is a regular/seasonal event or one off)	Impact on system	Components affected	What was the response to the impact?	How effective was the response?
	The water depth is deep or shallow in according to the rainy and river water. However the flood depth is very from 2 to 3 metres	village. Shops and houses were damage. • Submerge road connecting to Kampong Hoa commune, and some part of district road. Slope and embankment of road were eroded.	• Road embankment and slop of submerge road	• They fill in the laterite on where the area damage. • Move the shop before river flood coming and restructuring after flood receded	rebuilding the shop
Yearly	**Wind/storm:** monsoon wind storm it is occurring every year. This wind storm is frequently taken place 5-7times/year within the period from May through August.	• Impact on Kampong Hoa market and Taour Rolum village. Shops and houses were damage.	• Roof and structure of shop and house surrounding the market	• Traditional repair and maintenance	• Normally it can be used after repairing, and rebuilding the shop

SPCR VA-AP VULNERABILITY ASSESSMENT TEMPLATE

Date: 28-September-2016 **Group: 2**

Complete this matrix using the baseline assessment information and expert judgement. Use the supporting scoring tables to score very low to very high for Exposure, Sensitivity, Impact and Adaptive Capacity – and give reasons in footnotes for the score you have given.

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure**[19]	**Sensitivity**[20]	**Impact**	**Description of Impact** *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity**[21]	**Vulnerability**
Whole System	Extreme flood (flood event in 2011)						
Component 1 : Kampong Hoa Market or flooded market	Extreme flood (flood event in 2011)	**VH**	**H**	**VH**	The area of market and shop standing is easy to impact by flood. The structure of shop caused to damage by flood and floor of market and shop is dirty by flood brought the waste and mud in. However, the damage and lose is not much as the structure of market and shop is soft and flexible tools which is easy to remove and rebuild. The cost of damage is taking time to restructure and cleaning up the floor of market and shop.	**M**	**VH**

[19] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[20] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[21] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure**[22]	**Sensitivity**[23]	**Impact**	**Description of Impact** *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity**[24]	**Vulnerability**
	Note: - (Exposure): the market and shop area locates at low land area and closes to river. Normally the area is flooded 6 months in wet-season. The depth of flood is varies 2 to 3 metres according to the river flood and raining period. In the year 2011, the flood depth is above 5 metres. - (Sensitivity): the shop made of non-hard wood (i.e., small stick) roofing by thatch or zinc, and floored by plastic or laterite (local soil), and the market floor is laterite soil or local soil/land. (Adaptive capacity): small structure of the shop and market, it invest with local product and material to build, and easy to remove and rebuild. The people is aware of the area condition and be ready to move their own shop and property.						
	Storm with strong wind	**H**	**H**	**H**	- The area of market and shop standing is easy to impact by wind or storm. - The shop structure, particularly the roof is easy to damage and lose by wind	**M**	**H**
	Note: - (Exposure): the area closes to bank of river, no wind shelter to protect the structure where it locates in the floodplain area of Tonle Sap river. - (Sensitivity): the shop made from wood, and roof by thatch and zinc. It is easy to damage - (Adaptive Capacity): small and flexible structure. It is built with the local resource and less investment.						

[22] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[23] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[24] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	**Threat** *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	**Exposure**[25]	**Sensitivity**[26]	**Impact**	**Description of Impact** *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	**Adaptive Capacity**[27]	**Vulnerability**
Component 2: Kampong Boeung Market or standing market	Extreme flood (flood event in 2011)	**M**	**M**	**M**	- The water flows over the road and floor of market. It causes to erode, and ponding the water on the road embankment and market ground. - No sewage drainage system, thus the solid and liquid waste discharges out and runoff the road and market ground	**M**	**M**
	Note: - (Exposure): the market location is far from the river and situates in hill area. This area was not flooded even if the extreme flood event in 2011 thought there are some part of market area is wet by water runoff. There are many strong or hard structured buildings (i.e., concrete buildings) surrounding the market area. - (Adaptive capacity): small and flexible structure. It is easy to remove and rebuild. The investment on the structure is less and use of local materials and household's labour force.						
Component 3: Submerge road where the road connecting the flooded market (Kampong Hoa market) to Dyke road.	Extreme flood (flood event in 2011)	**H**	**M**	**H**	Eroded some slope and embankment of the road. But it was not much damage since this road is blocked of transportation during flood period.	**M**	**H**
	Note: - (Exposure): the road is laying in the low land and floodplain area. It situates at bank of river. Normally the read flooded 6 months seasonally a year. The depth of flood is around 2 to 3 metres. In 2011 when the extreme flood occurred in the area, the depth of flood was about 5 metres deep. - (Sensitivity): The road is built by local and laterite soil. It can resistant to the water. After flood receding, this laterite road can be used and transporting as normal though there about 2 million riels spent for fixation or repairing the damage of the road about 1km. (Adaptive capacity): the road is regularly maintained. They use the local material (i.e. laterite soil) and local labour force.						

[25] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[26] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[27] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Summary vulnerability results – *transfer the vulnerability scores to this summary table and then colour each box according to the key*

		VL	L	M	H	VH
Whole System	Extreme flood (2001)					VH
	Storm with strong wind					
Component 1 : Kampong Hoa Market or flooded market in Taour village	Extreme flood (2011)					VH
	Storm with strong wind				H	
Component 2 : Kampong Boeung Market or standing market in Kampong Boeung village	Extreme flood (2011)			M		
Component 3: Submerge road where the road connecting the flooded market (Kampong Hoa market) to Dyke road.	Extreme flood				H	

1.3 BASELINE ASSESSMENT FOR GROUP 3: RURAL ROADS (PART OF ROAD 50C), WATER STORAGE RESERVOIR AND SUBMERGED ROAD

Group 3: Rural road and water storage reservoir

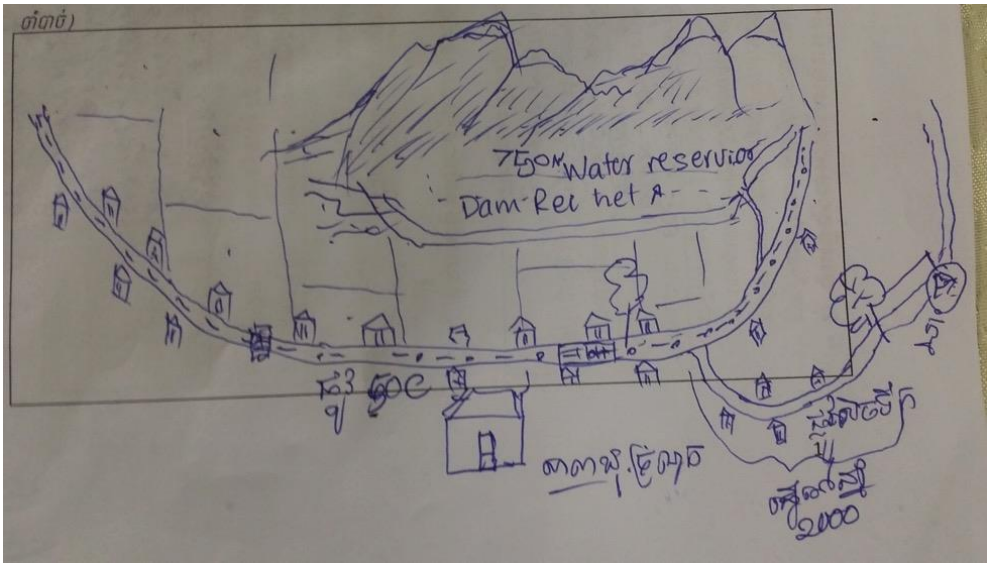
The sub-components have been suggested – but the group can modify and add if they wish depending on what they find in the field and what local community members identify as important (take photos of each component and show location on your sketch map)

Date: 28 September 2016 **Name: Group 3**

Name of the target system	Kampong Laeng district infrastructure (1) Part of road 50C in Chronok Commune; (2) Submerged road from Chronok commune to Phlov Touk Commune; (3) Dam and Reservoir of Damrei Hel..
Location (District & GPS)	Chronok Commune, Kampong Laeng District
Responsible authorities *Local and national agencies which need to be involved in the proposed adaptation project*	• Chairman of District councillors of Kampong Laeng District • Commune chiefs of Chronok and Phlov Touk communes • Commune councils of Chronok and Phlov Touk communes • Selected key villagers from Chronokand Phlov Touk communes Total local people: **18**

1. Draw the existing infrastructure system and surrounding landscape

This can be a rough sketch of the overall system showing key features and components. It can refer to photos you have taken, and show detail of any feature that you think is important. Use additional pages if needed.



This drawing picture indicate geographical picture Chronok commune, connection between villagers' houses, road, mountains, agricultural field in commune. In direction from Da commune, Chronok commune is bear by cardamom mountain of Touk Meas at the left hand side of road 50C and low land/rice field at right hand side. Most of houses are located along both sides of main road 50C. This picture also presents connection between road 50C and Dam-Reservoir of Damrei Hel and submerged road from Chronok commune to Phlov Touk.

2. Provide a short description of the existing infrastructure system

Groups 1, 2 and 3 will each be assessing the infrastructure in different parts of the project area. Looking at the infrastructure "system" in your area briefly state its main purpose and provide a short description. The purpose might be, for example, "to facilitate the transport of local agricultural products to market". The description could be, for example, "A one km section of rural road 50C, with three bridge culverts, and a junction leading onto a smaller rural road which is submerged during the wet season. The system also include a 1km section of borrow pit which acts as a water reservoir during the dry season."

Main purpose	(1) **Part of road 50C:** to enhance livelihood of community people including improving: (i) accessibilities of children to school, people to health facilities, (ii) travel/communication and transport of agricultural products to market, and (iii) the embankment of water storage from Cardamom Mountains of Touk Meas. (2) **Submerged road from Chronok commune to Phlov Touk communes:** to improve: (i) communication/travel of people and students from Phlov Touk commune to Kampong Laeng district, (ii) transport of agricultural products to market in Kampong Laeng, (iii) accessibility of people in Phlov Touk to health facilities in Kampong Laeng, (iv) effectiveness of administrative communication work, and (v) to be a dam for blocking of water for using in dry season (3) **Dam-Reservoir Damrei Hel**: to improve the existing dam-reservoir to be: (i) a fully irrigation reservoir for agriculture (crops, livestock, and wild animals), water supply, and feed water to ground water wells nearby.
Overview *short description of existing system*	**Cardamom mountain, rice field, residential area, rice field, livestock (cow and buffaloes), family crops (rice, cucumber, potato, corn, sugar can, and vegetable) flooded forest, natural lakes, temples, schools, health center, commune center, police post.**

3. Identify the main components of the existing system *(e.g. rural roads, national roads, bridge culverts, canals, dykes, ponds and reservoirs and drainage channels)*

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
3. Rural road and water storage reservoir				
Sub-component 1: Section of Road 50C	• Cross through the communes with villagers' houses located in both sides of road. • One side of road is flat land connect to mountains of Touk Meas and another side also flat land connect to lowland of Tonle Sap. • The road comprise of culverts, bridge.	• The road is threatened by rain water flow from cardamom mountains of Touk Meas and water from Tonle Sap.	• Does not have enough culverts and existing is single culvert with diameter of 0.8m. • There are so many cows and buffaloes walk on the road	Depend on Provincial Department of Public Work and Transportation of Kampong Chhnang to maintenance

System components	Description of natural and manmade features and assets of the system	Condition Signs of degradation	Causes of degradation	Existing approaches to maintenance
		• This is laterite road at low level at few section of the road.	• The existing height of road is low at some section • Does not have a good prepared of slope (no side walk)	
Sub-component 2: Phlov Touk road (Now submerged)	• Across lowland that flood from Tonle Sap during rainy season (flooded forest area) • Length of road is about 20km • It is an oxcart road • The accessed road of about 1km have been raised up in 1980s.	Flooded lowland that flood during rainy season	• Not exact a road • Now water releasing system • Rich of wild life and animals • Rich water plants can be a big obstacle for travelling by boat during water recession.	There is only a water releasing committee for managing the use of water for rice field during dry season.
Sub-component 3: Culverts	• Length of road 50C in Chronok commune is 11.8km • There are 18 places of culvert with a single culvert of 0.8m diameter and one bridge.	• Two of culverts are blocked by garbages • Poor maintenance of culverts • The distant from one culvert to another is long.	• Two of culverts are blocked by garbages • Poor maintenance of culverts • The distant between culverts is long	
Sub-component 4: Reservoir	Located at watershed of cardamom mountain of Touk Meas. It is locate in between two mountains and one valley brings water from mountains to the reservoir. There is a small land use for vegetable field and rice field in bed of the reservoir. There 100 households located at down-stream of the dam. The existing access road to reservoir is cow road.	The dam was built in 1975 and finished in 1979. Without maintenance this dam had been collapsed in 1979 and local people also took away water gate.	The dam was built in 1975 and finished in 1979. Without maintenance this dam had been collapsed in 1979 and local people also took away water gate.	No (There were some studies conducted by NGOs but due to huge infrastructure need big money to rehabilitate)

4. Describe the watershed context of the existing system

Describe the location of the existing system within the watershed, the condition of the watershed Document with photographs and sketches

Location within the watershed *(e.g. what is upstream, midstream, downstream)*	Mountains, forest, reservoir, rice fields, residential area, road 50C, rice fields, flooded forests, lowland of Tonle Sap.
Watershed condition *(identify features – land use, human settlements, ecological assets and services – and trends in their condition)*	Forest/trees at mountain has been destructed, there are some erosions, lose of biodiversity (loss of wild life, there are remaining little of wild pig and monkey), canal of Damrei Hel is eroded and collapse. Most of people live on both sides of road 50C. People also vulnerable to storm, wind gust, and lightening), flood forests has been encroached to lotus lake and rice field. The forests is threatened by fires during dry season, natural lakes are getter shallow (silt brought from highland and water plants)

5. Description of the specific location

Identify and describe the geographical, natural and manmade features in the immediate vicinity of the existing system, include any slopes, vegetation, soil types proximity to water bodies etc.

Landscape and natural features *(include slope, soil conditions, vegetation, water bodies)*	Water flow from mountain to lowland is flowed as natural through natural water way with any intervened water infrastructure.
Manmade features *(e.g. roads, housing, drainage infrastructure etc.)*	Roads, culverts, temples, social buildings, water infrastructures
Cultural and social features	• Good security, good conservation of tradition, and no problem for drug issue • Availability of sanitary toilet is 60%, but • In debt of micro-finance is 50% • Migration out for work is 30%
Surrounding land uses *(e.g. agricultural fields, residences, commercial areas)*	• Mountains, forests/trees, residential land, agricultural land, lowland and flooded land, • Low yield of agricultural land (poor agricultural technique and pests) • Small business (low price of agricultural products)
Environmental issues *(e.g. pollution, erosion, solid waste)*	• Not much use of pesticide and herbicide except some herbicide for killing grass • Garbage management household by household through: burning and through away in open space • Poor management of animal wastes, cow and buffaloes manure. • Poor sanitation due to spreading out of cow and buffaloes manure in yard.

6. **Past experience and response to extreme events –** *describe the occurrence and type of extreme events within the watershed affecting the system (e.g. flood, droughts, wind storm, intensive rainfall). State if the flooding and drought are seasonal and occur annually. Also, describe extreme events which may have occurred in recent years – e.g. when the flood and drought was much worse than normal.*

Date of event	Nature of the event – **describe** (also note if it is a regular/seasonal event or one off)	Impact on system	Components affected	What was the response to the impact?	How effective was the response?
	Extreme floods (flood from Tonle Sap river and from Touk Meas mountains) 2000, 2003, and 2013	• Four sections of road 50C in Chronok commune have been flooded • Most of houses along both sides of road 50C have been flooded • Flood agricultural land and damage rice production • Caused animal disease • Closed of schools	• Roads • Agricultural land • Residential land • Human health and animal • Some of social services have been cut up.	• Distributed seeds • Distributed food • Moved flood people and animal to safer place • Provided early warning information • Plan trees • Protect trees • Establish forest communities • Availability of Emergency Preparedness and Response Plan • Raise up of house	Limited
	Extreme droughts 2004, 2015, and 2016	• No irrigated water • Dramatically drop of agricultural yield (100kg/ha) • Ecosystem has been deteriorated by fires • Lack of water supply for human and animals	• No irrigated water • Dramatically drop of agricultural yield (100kg/ha) • Ecosystem has been deteriorated by fires Lack of water supply for human and animals	• Distributed drinking water • Repair ground water wells (but still no water) • There are 8 community ponds but only 2 are in good function	Limited

7. Additional notes and diagrams

Add any information which you may need when conducting the full vulnerability assessment.

SPCR VA-AP VULNERABILITY ASSESSMENT TEMPLATE

Date: 28 September 2016 **Group: Group 3**

Complete this matrix using the baseline assessment information and expert judgement. Use the supporting scoring tables to score very low to very high for Exposure, Sensitivity, Impact and Adaptive Capacity – and give reasons in footnotes for the score you have given.

Asset *(Name the system and its components)*	Threat *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	Exposure [28]	Sensitivity[29]	Impact	Description of Impact *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	Adaptive Capacity[30]	Vulnerability
Whole System	*1.* Road 50C (part in Chronok Commune)-Extreme flood	**H**	**H**	**H**	Detail of reasons are shown in tables below	**L**	**H**
	2. Submerged road from Chronok commune to Phlov Touk commune-Extreme flood	**VH**	**VH**	**VH**	Detail of reasons are shown in tables below	**VL**	**VH**
	3. Dam-Reservoir of Damrei Hel-Extreme flood	**VH**	**VH**	**VH**	Detail of reasons are shown in tables below	**M**	**VH**

[28] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[29] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[30] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	Threat *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	Exposure [31]	Sensitivity[32]	Impact	Description of Impact *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	Adaptive Capacity[33]	Vulnerability
1.1 Road 50C (part in Chronok Commune)	Extreme flood	**H**	**H**	**H**	**Exposures:** there are many animal walk on the road, slopes of road are not in good prepared for climate change, no side walk, located very close to cardamom of Touk Meas mountains, road cross plain (lowland that easy to expose to floods), not enough water infrastructure for protecting road from flood, loses of forest from mountain area, parts of road surface contain of water (there are four section of road that always exposed to flood during extreme flood occurred) **Sensitivities:** poor/lack of maintenance, it is laterite road that is easy to erode when water flow through, height of road is still low, slope preparation is not suitable to protect with flood, no side walk, no water releasing infrastructure along the both side of road. **Impacts:** four sections of road 50C in Chronok commune have been always flooded during extreme flood occurred (1000m/section), loosed of people life, parts of road 50C that didn't flood had been used to be safer place for affected people and animal to move to during flood, almost crops have been destroyed, flood normally took for last longer at about 2 months to stay. **Adaptive capacity:** No local maintenance committee has been set yet, lack of supported technical staffs, lack of resources and budget for repairing work.	**L**	**H**

[31] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[32] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[33] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	Threat *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	Exposure [34]	Sensitivity[35]	Impact	Description of Impact *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	Adaptive Capacity[36]	Vulnerability
1.2 Culverts and bridge of road 50C	Extreme floods	**H**	**H**	**H**	**Exposures:** there is not enough number of culverts; existing culverts are too small to release water from mountain; huge amount of water is released at one side of road during long and heavy rains, a serious erosion at slope of culverts and bridge, **Sensitivities:** poor/lack of maintenance, not proper placing of culvert (put in a wrong location), culvert quality is not good (easy to break) **Impacts:** Block culverts, the capacity of culvert is limited, can't release rain water on time and caused flood at residential areas **Adaptive capacity:** No local maintenance committee available, limited number of culverts, lack of supported technical staff, resources and budget for repairing works.	**L**	**H**
					Exposures: located in lowland area, long distance, long period of expose to flood (4-6months), water floating plants create big problem for Phlov Touk commune people to travel, esp. in water recession. **Sensitivities:** it is a oxcart road - an earth road that very easy to erode when water flows over, it acrosses lowland and flooded forest area. **Impacts:** not being used, it is always flooded in rainy season **Adaptive capacity:** No local maintenance committee available, lack of supported technical staff, resources and budget for repairing works.		

[34] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[35] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[36] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

Asset *(Name the system and its components)*	Threat *Describe the climate change threat – eg extreme flood, drought, intensive rainfall, high temperatures, storms*	Exposure[37]	Sensitivity[38]	Impact	Description of Impact *The information on impacts is very important because adaptation measures will need to address the impacts. List the direct impacts (eg road is overtopped and sections washed away) and indirect impacts (eg farmers cannot get produce to market)*	Adaptive Capacity[39]	Vulnerability
3.1 Dam-Reservoir of Damrei Hel	Extreme flood	**VH**	**VH**	**VH**	**Exposures:** Dam is long and covered by forest, it locates very close and exposes to rainwater flow from part of Touk Meas mountains, the dam and reservoir beds are in poor condition (erosion). **Sensitivities:** no maintenance, no water gate, not being used for long time, easy to erode and have been serous eroded. **Impacts:** the dams is broken, serious eroded, can't block water, **Adaptive capacity:** there many trees that can protect part of dam from erosion, height of dam is still high	**M**	**VH**
3.2 Bed of Damrei Hel reservoir	Extreme flood	**H**	**H**	**H**	**Exposures:** there small forest at bed of reservoir, the bed in shallow, one farmer is using a part of bed for cropping. **Sensitivities:** soil condition is not godd for holding water (high infiltration), high evaporation, capacity of store water is 450,000m^3 **Impacts:** erosion, small forests **Adaptive capacity**: no maintenance	**M**	**H**

Summary vulnerability results – *transfer the vulnerability scores to this summary table and then colour each box according to the key*

Infrastructure		VL	L	M	H	VH
1. Road 50C (part in Chronok Commune)-Extreme flood	Extreme flood				✓	
2. Submerged road from Chronok commune to Phlov Touk commune-Extreme flood	Extreme flood					✓
3- Dam-Reservoir of Damrei Hel-Extreme flood	Extreme flood					✓

[37] Exposure criteria: eg Duration (e.g. hours or days of flooding); Location (e.g. distance from flood); Intensity (e.g. strength of rainfall, speed of flood); Volume or Flow (e.g. size of event); Aspect (orientation to the threat). **Give reasons for score in footnotes**

[38] Sensitivity criteria: eg Materials, Construction quality, Levels of maintenance, Protective systems (e.g. river walls, dykes), Location, Design. **Give reasons for score in footnotes**

[39] Adaptive capacity criteria: eg Cross cutting Factors: The range of available adaptation technologies; Availability and distribution of financial resources; Skills, knowledge and information; Management and response systems; Relevant policies and programs; Availability of material resources (construction and maintenance). **Give reasons for score in footnotes**

APPENDIX 4. RESULTS OF PRE AND POST TEST OF TRAINEES AND EVALUATION

1. PRE AND POST-TEST REPORT

1.1 Participant profile

There are 37 participants from MRD, MPWT, MoE, NCDM, Provincial officer, District governor, and NGOs worker. The attendant list is in attachment. 67% of participant reported that they knew the vulnerability assessment and only 35% of participant ever attended training on vulnerability assessment and adaptation planning. 26% participants reported experience conducting vulnerability assessment; addition, only 41% knew the type of data require for vulnerability assessment.

Questions	Pre	Post
Do you know what is vulnerability assessment	67%	100%
Have you previously received training in vulnerability assessment and adaptation planning?	35%	82%
Have you conducted a vulnerability assessment for an existing or planned development?	26%	78%
Do you know what type of data is required for vulnerability assessment?	41%	86%

1.2 Participant familiar with the condition of infrastructure assets

Among 37 participants were assessed in pre and post workshop for whether they are familiar with the condition of infrastructure in Kampong Chhnang province. The assessment result rating in five categorize (1 - No knowledge, 2 - Very little knowledge, 3 - Somewhat familiar, 4- Familiar, 5- Very familiar). Chart 1 indicates result change between pre and post-test. The participants acknowledged that they increase knowledge of understanding infrastructure in Kampong Chhnang province.

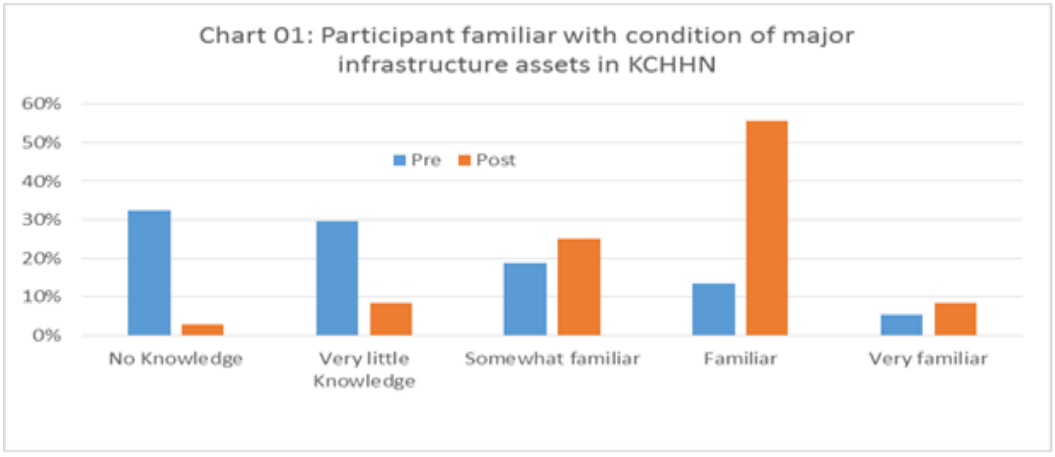
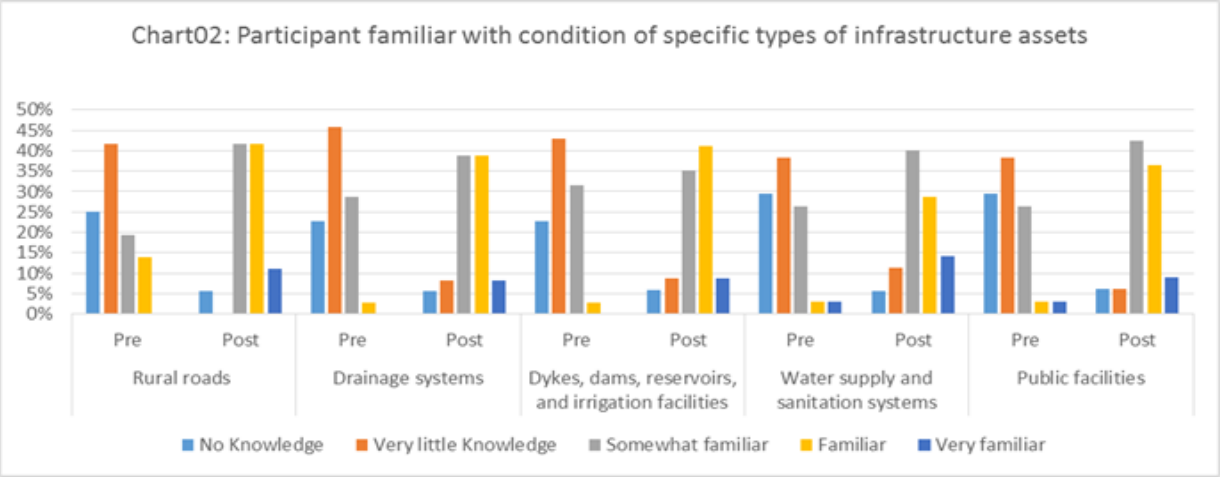
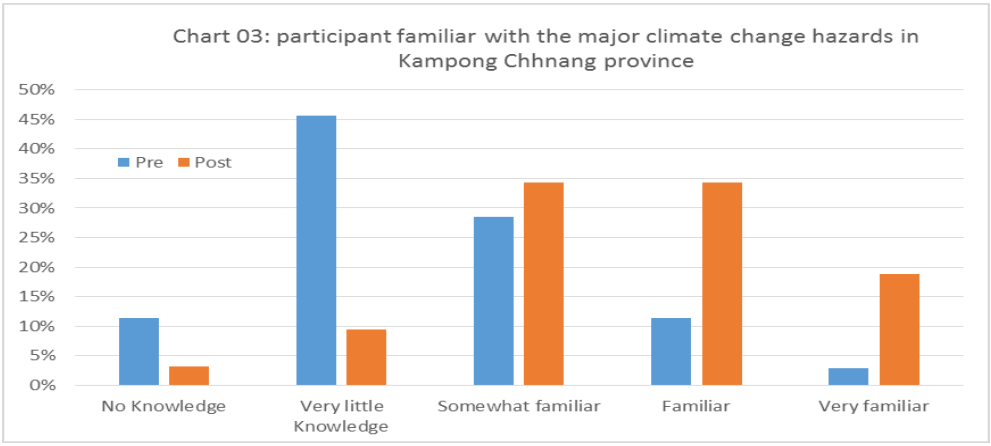


Chart number 02 indicates the increased of number of participant who familiar with difference type of major infrastructure assets compare between pre and post-test. Participant reported increased knowledge on major infrastructure such as rural road, drainage system, dam reservoir, water supply, and public facilities etc.

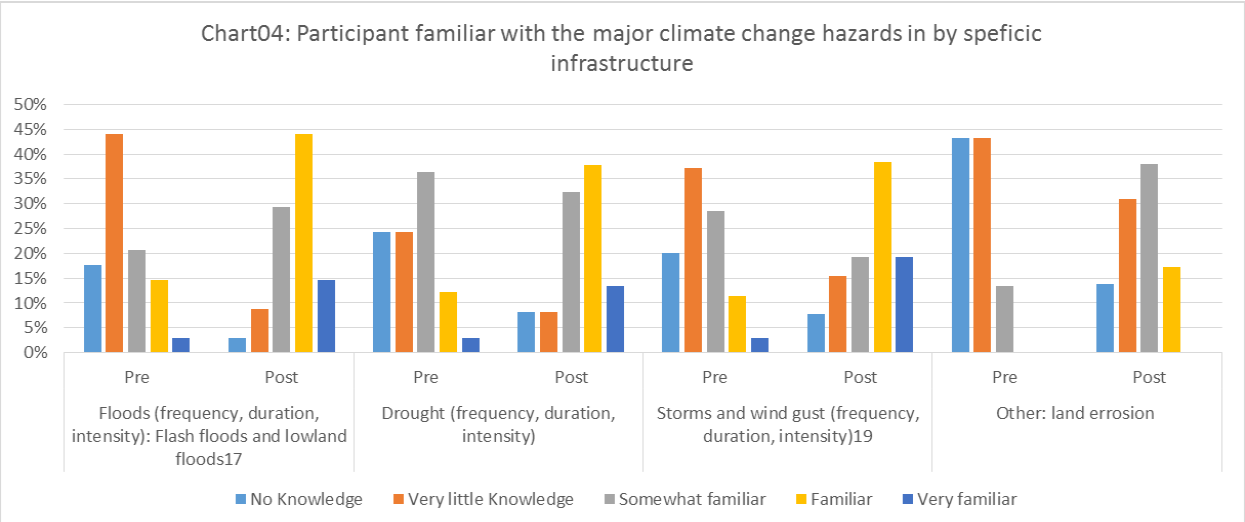


1.3 Climate change hazard

Regarding to the exposure to current climate hazards, participant were increase their understanding through the workshop. Chart 03 shows the participant were familiar with the major climate change hazards in Kampong Chhnang province were change by comparing between pre and post-test. Participants increased their understanding on impact of climate change on infrastructure assets.

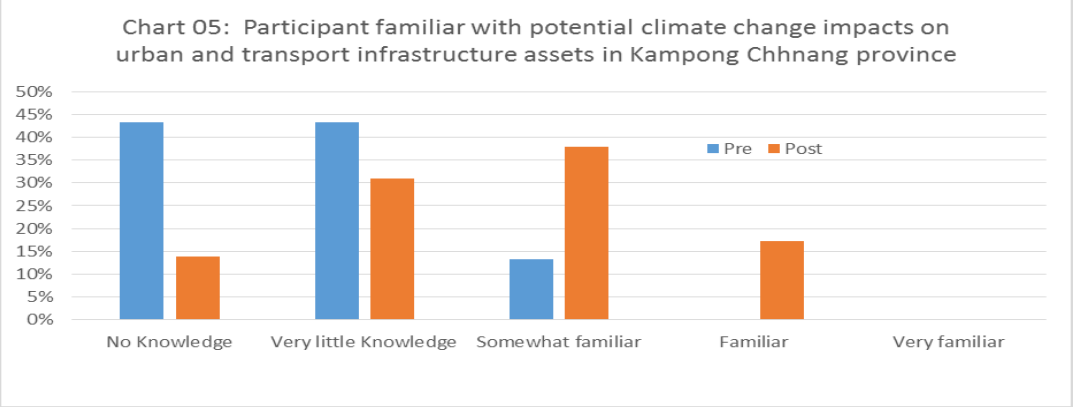


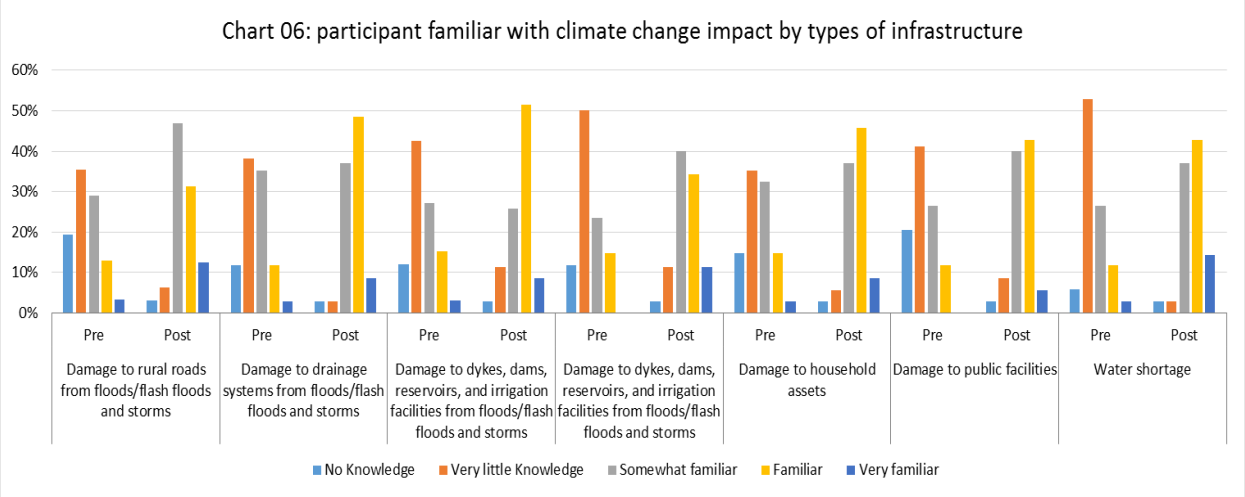
Specifically, participant increased knowledge on climate change impact on specific type of assets such as flooding, drought, storms and other natural phenomenon. Participant familiar with potential climate change impacts on urban and transport infrastructure assets in Kampong Chhnang province were increased.



1.4 Climate change impact on urban and transportation infrastructure

On another hand, participants also increase their understanding on sensitivity of potential climate change impact on major infrastructure assets. Chart 05 presents the increase number of participants understanding the potential climate change impacts (few people knew climate change impacts before the workshop conducted, most people became familiar with potential climate change impacts after the workshop). Specifically, chart 06 indicates that after the workshop, the number of participants familiar with potential climate change impacts on specific urban and transport infrastructure assets increased (on damage of rural roads, drainage, dam reservoirs, irrigation, household infrastructures, public facilities and water supplies.





1.5 Climate change adaptive Capacity

The workshop has also provides concept of climate change adaptation knowledge to participation. The pre-test were shown low understanding on how they determine on climate change adaptation capacity. Chart 09 presents the increase of number of participants understood the concept of climate change adaptive capacity at post-test.

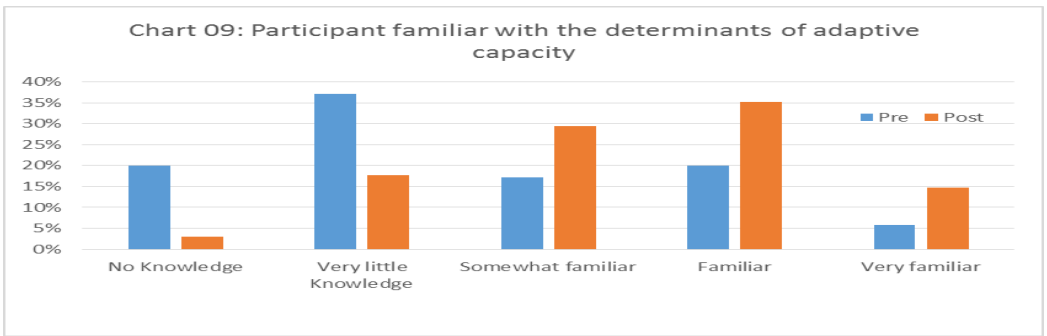
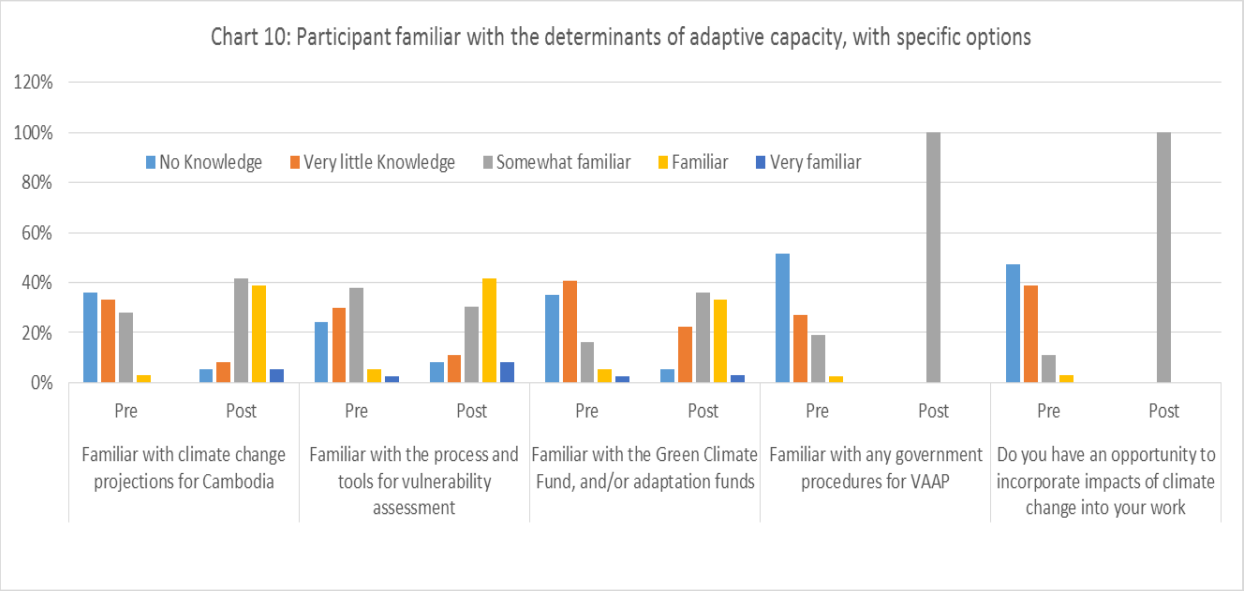


Chart 10 presents the workshop participant understand the climate change adaptive capacity by specific options. Number of participants reports knowing the project climate change in Cambodia were increased, they familiar with the process and tools of vulnerability assessment. Furthermore, participants gain knowledge on green climate fund/adaptation find, and government procedure for vulnerability assessment and adaptation planning. Addition, participant also reported on being increase opportunities incorporate impacts of climate change into their place.



2. WORKSHOP EVALUATION

In general, participant reported that they satisfy with the workshop. Following are detail on the feedback to the workshop.

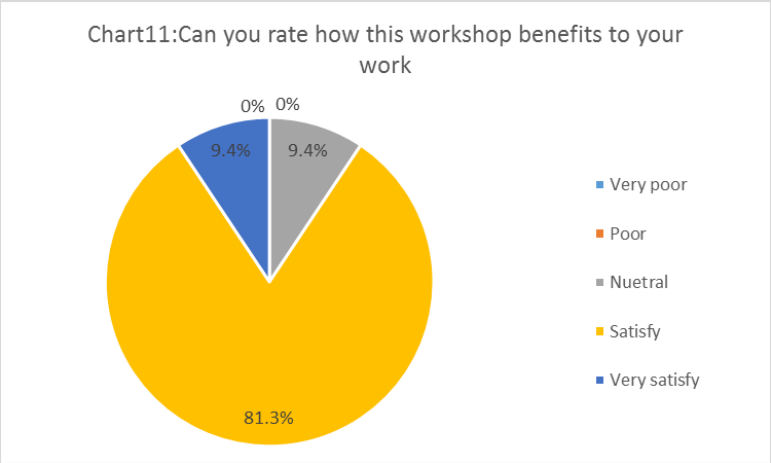
2.1 How this workshop benefits to participant?

- The workshop provides the basic knowledge on the risk evaluation for infrastructures. Participant get more information about others analysis regarding on the evaluation of climate change impact to road system in Kampong Leaeng district
- This is useful training and understand more about adaptation of climate change method. It's useful for participant's daily work. Specifically, it's very useful on water resource in Kampong Laeang district, KCH. Participant know Kompong Hao market location during study tours. It is good knowledge for implementing current and new project.
- This training cause is useful for participant's work such infrastructure office and tourism on climate change. It provides an idea and guideline to use the evaluation tool for developing an adaptation of climate change project
- This course helps participant able to facilitate with NGO partners and communities, and they can share with NGO partners and communities
- Participant learned about baseline assessment for climate change facility infrastructure and its tools, practice, process of situation of a feasibility study in KCH province especially in Kg. Leaeng district, such as learning on challenge and impact of climate change, adaptation and scoring, vulnerability evaluation in community Know how to score to vulnerability of climate change.
- Participant learned the process of evaluation and guideline on vulnerability and adaptation of climate change, more detail on transportation infrastructure in urban and rural as well as study tours about the infrastructure in Kampong Leaeng district

- This course benefits to my work such as: group collecting data in the community, group presentation and forms are easy to understand and practice. This training course benefits to develop work plan for developing, investment plan in commune/sangkat and lesson learn for providing training to community, development at sub national level, study on infrastructure projects, working in group and working with authorities at sub national level
- Project implementation which response to the adaptation on climate change and gender

2.2 Rate of satisfaction of participant to the work shop

This to present how the participant rate their satisfaction with the workshop. The majority of participant reported that they were satisfied with the topics and benefits to their work place (chart 11). Only very few people reported very satisfy and neutral.



2.3 What are the specific areas of the workshop benefit to participant?

- The evaluation on environmental impact, vulnerability and adaption on climate change
- Evaluation tools on community vulnerability the resource in community. Eg. The vulnerability of road in Kompong Leaeng district
- Evaluation tool of vulnerability for implementing the infrastructure between urban and rural area
- Analyze the area, evaluation project and know the real affect area and real practice on group discussion on how to practice on the evaluation of vulnerability, Tool and approach for BA-CRFS, understanding about climate change resilient facility infrastructures
- Threaten factors of climate change, challenge, impact and adaptation (flood, draught, raining, storm and weather increase)
- Study tours about village situation and evaluation on the impact
- Making us think about the safety and climate change
- The presentation during training by technical person, study tours and leadership skills
- The guideline on vulnerability evaluation
- Study about the vulnerability, adaptation and the climate change benefits to my work
- The important topic is adaptation of the climate change that people will face with such as storm, flood and draught… etc.
- Communication in group and plenary, method of adaptation weather, strategy for feasibility study on adaptation of climate change project, Conceptual framework on adaptation project
- The guideline on the vulnerability evaluation
- Collecting data at community
- Infrastructure and adaptation of climate change
- Evaluation tools on the vulnerability of environment change

2.4 What are the specific areas does not benefit to participant?

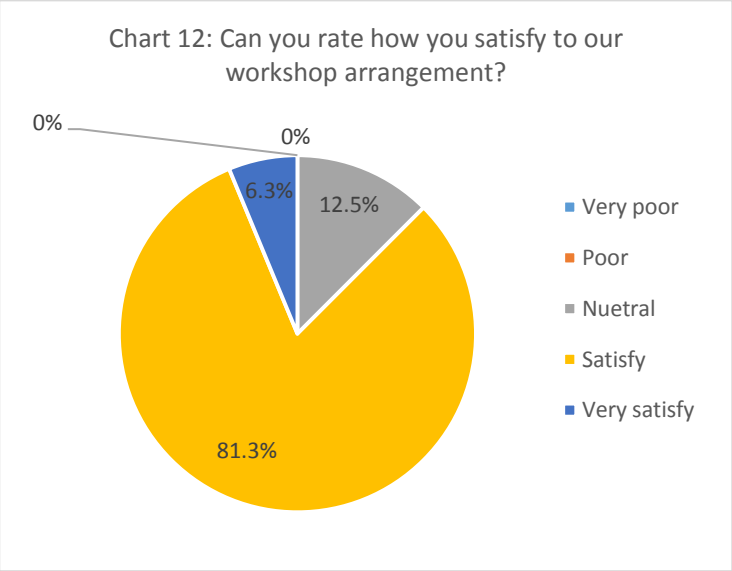
- Participant satisfy with this course but I am not clear for the content of this course, if possible should organize this
- Participant comment on snack, were not appropriate.
- The toilet is not hygiene, training time does not strict,
- Time for group discussion not clear, not time management and out of topic during group discussion

2.5 Could you please let us know how your satisfaction with our workshop arrangement?

- If possible reduce lesson, more group discussion and energizer game
- Please distribute documents in advance and reduce the agenda
- Please provide refresher course
- Should use LCD screen for group discussion or flip chat and makers
- If it's available, next training should share more detail on guideline or note on climate resilient infrastructure which recognized by gov't or other experience countries
- Add more days and documents for reference. Should be considered between expectation and training duration be equal, if no the facilitating follow the schedule will affect the training quality
- Looking for enough fund to support provincial officer
- The facilitator should respect to the time of topics and add up time for the break
- There is shortage of some material
- The training course is too short and the important topics that presentation is short too. Should add up more days because there are a lot of topics and need to be cleared before implement the project. Should consider on the training duration and topics (too short but a lot of topics)
- Please organize more course with study tours
- That's enough
- Should consider to the agenda and time
- Please add up more days for the next training session at least a week
- In order to make better of adaptation of climate change, the project owner ADB should provide budget package to those vulnerable provinces
- If possible organize the next training in Tboung Khum province
- Should add up more days for training session and study tours as well as allowing more participants from the community
- Please sent clear invitation letter to participant both national and sub-national level
- I hope that the project implementing will be progressed and benefit to people livelihood who are living in that area, having job and there are a lot of tourists.
- More practice on the theory and presentation. Should provide on how to create questionnaire that would benefit to the collecting data and transforming data to effective proposal writing
- Next training should make sure the participant from each institutions and at least notice 3 days in advance for the invitation letter
- Time management for lunch time -/+ 10 mn it could be affect to participant health as well as the participant does not caught up the session if the time is over. For training evaluation should not put participant's name and detail personal information because they will not give much information

2.6 Workshop arrangement

Regarding to the workshop arrangement, participate rate their satisfaction in chart 12. The majority satisfy to the workshop arrangement. Only very few people reported satisfy.



2.7 There was few additional comment on the workshop provided by TA8179

- The workshop has many topics at the same day, participant are hard to follow. The workshop organizer should extend to more days.
- Should organize the same as this training course next time because it is the first time to participate. Participants are not deeply understand the concept of climate change and adaptation and vulnerability assessment
- It's hard to understand the evaluation question "BA-CRFS", some questions difficult to divide. In questionnaire should add up suggestion/comment from the community or authorities, regarding to infrastructure building's need that adaptation to climate change?
- Anyway, participant positively comment that they got knowledge of climate change adaptation, after participated 3 days training, gained more knowledge and be able to train to the officers and colleagues, participated MCRDP course, it makes me understand clearly on vulnerability of adaptation and climate change especially in Kompong Leaeng district, Kampong Chhnang.

APPENDIX 5. BASIC INFORMATION ON COMMUNES FOR FIELD EXERCISE FOR VA&AP TRAINING WORKSHOP (26-28 SEPTEMBER 2016) IN KAMPONG CHHNANG

INTRODUCTION

As part of the training, we have selected three different site location (communes) for field exercise that will teach the participants on how to make the (i) Baseline Assessment: Field Survey Template, and (ii) Vulnerability Assessment Template and make analysis the data on Advanced Vulnerability Assessment and Adaptation Planning Training: (2) Baseline Assessment for Climate Resilient Feasibility Studies in Urban, Transport and Rural Infrastructure. Site locations for field exercise are located in Kampong Leng District as bellow:

(i)- Dar Commune,

(ii)- Chro Nouk Commune,

(iii)- Kampong Hao Commune,

Vulnerability Assessment - Field Exercise Locations

Dar Administrative Commune

Chronouk Administrative Commune

The participants will meet and discuss with local authorities, people living along the road alignment, road user community, and relevant people about the flood, drought, and wind storm that have caused tremendous impacts on their locations. For efficient time management of the field exercise on 27 September 2016, the participants (Group-I) will visit Dar Commune, (Group-II) will be in Chro Nouk Commune, and (Group-III) will be in Kampong Hao Commune at same time of three locations around 8:30 AM. Below are brief profile of proposed visit sites.

DAR COMMUNE (GROUP-I)

This commune is located in Kampong Leng District which borders with Chronouk commune, distance about 25Km from District center along Laterite road 50C. It has a land area about 8,788 ha and has five villages (Dar, Thnal, Chro long, Prasat, Kuy). This commune is generally flat terrain and mountainous. Site location for field exercise is located in Dar Commune center with approximately participants 15 people (2 people from each communes and other 5 people from elder people). Group-(I) focus of Road 50C around the Touk Meas Mountain and of a road section around Kang Rey Mountain.

Demography: Total population is 7,360 people (F: 3,673 and M: 3,687) statistic data 2015 with 1,701 families. More than 90.30% of population is engaged in rice farming, and the rest in other occupations like animal husbandry, fishing, cultivations, collection of non-timber forest product, migration, etc.

Issues and constraints related to climate change (flood, drought, and wind storm): year of 2000 and 2011 are the biggest flood in the commune. This commune is severely affected by Tonle Sap water rising and flash floods from the Touk Meas mountains. Some section of road 50C was flowed over by flood. The rural road from Dar to Samrong Sen Commune about 6Km was totally flood.

Road networks: based on the statistic data 2015,

Road Networks	Length (m)	Remarks
Provincial Road-50C	7,000	Paved Laterite
Rural Road-Paved Laterite	15,848	Paved Laterite & Mountainous Sand
Earth Road-Unpaved	10,685	Unpaved surface

Community based Organization: refer to the statistic data year 2015, this commune had formed many communities such as forest, management and user irrigation system, tourist by participated from villagers, local authority, other development partnership, and other skilled institutional provincial departments.

CHRONOUK COMMUNE (GROUP-II)

It is located in Kampong Leng District, and the distance is about 6Km from Dar administrative commune center, it is easily accessible by DBST about 7Km and Laterite roads from District Center. The commune has four villages (Kang Kep, Thlork, Lech, Kandal) with a total land area of 28,663 ha.

Type of land	Hectare	Remarks
Residential land	298 ha	
Rice field	3,031 ha	
Cropping field	65 ha	
Other land	25,269 ha	Forest, Lake,

The planned schedule of visit is around 8:30 AM date on 27 September 2016. We really expect that 5 communes with around 10 people (Chronouk, Plov Touk, Dar, Samrong Sen, Kampong Hao) will join the group discussion during our field exercise. Group-(II) focus of Submerged Roads and Urban Market (Drainage system + Solid waste management).

Demography: Total population is 8,351 people (1,890 families), while female population is 4,286 and male is 4,065. More than 93.70% of commune population is farmer, and the rest in other occupations like animal husbandry, fishing, cultivations, collection of non-timber forest product, migration, etc.

Issues and constraints related to climate change (flood, drought, and wind storm): as it is located in the Tonle Sap Ecozone. Almost every year, Chronouk Commune is severely affected by Tonle Sap water rising and flash floods from the Touk Meas mountains. Big flood was also recorded in 2000 and 2011 across the whole commune.

Road networks: based on the statistic data 2015,

Road Networks	Length (m)	Remarks
Provincial Road-50C	11,000	Paved Laterite
Rural Road-Paved Laterite	5,518	Paved Laterite & Mountainous Sand
Earth Road-Unpaved	1,250	Unpaved surface

Community based Organization: refer to the statistic data year 2015, this commune had formed many communities such as forest, management and user irrigation system, tourist by participated from villagers, local authority, other development partnership, and other skilled institutional provincial departments.

KAMPONG HAO COMMUNE (GROUP-III)

This commune is currently located in Kampong Leng District and borders with Por Commune, and it is not far from District center, it is easily accessible by Ferry from KCH provincial town about 30minutes and DBST road to reach the location. The commune has six villages (Kampong Beung, Keng Tasok, Thaour Rolum, Steung Sandek, Koh Kaek, Don Viet) with a total land area of 4,580 ha.

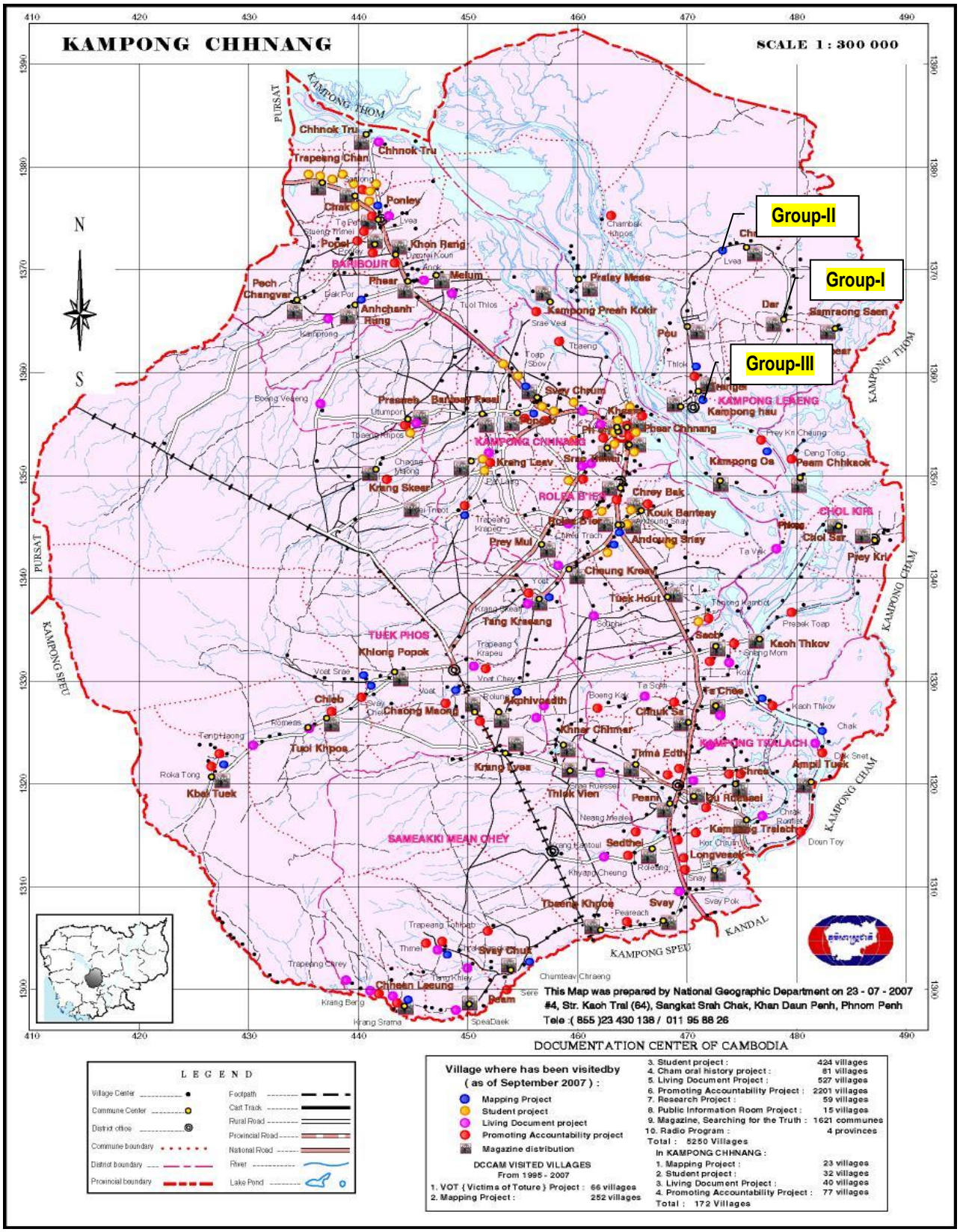
Type of land	Hectare	Remarks
Residential land	120 ha	
Rice field	1,032 ha	
Cropping field	744 ha	
Other land	2,683 ha	Forest, Lake,

The same as other locations, the planned schedule of visit is around 8:30 AM date on 17 September 2016. We really expect that at least five communes with around 20 participants (3 people from each commune plus 5 elder people) will join the group discussion during our field exercise. Group-(III) focus of Dykes and Reservoirs.

Demography: Based on statistic data 2015, the total population is 8,775 people (1,713 families), while female population is 4,444 and male is 4,331. More than 90% of commune population is farmer, and the rest in other occupations like animal husbandry, fishing, cultivations, collection of non-timber forest product, migration, etc.

Issues and constraints related to climate change (flood, drought, and wind storm): Big flood was also recorded in 2000 and 2011 across almost everywhere and High Flood Level was the same the DBST's camber elevation of Road 50C. As it is located in the Tonle Sap Ecozone, Tonle Sap River separates the Kampong Chhnang town and the Kampong Leng District. Almost every year, especially 2011 was severely affected by Tonle Sap water rising and flash floods from the Touk Meas mountains. During the wet season, the commune center becomes an island and people are evacuated from the Tonle Sap river bank to a mountainous area and other safety hill. Kampong Hao Rural Market was moved to Kampong Beung from July to December every year due to be impacted by Tonle Sap water rising.

Map of Field Exercise Locations



APPENDIX 6. WORKSHOP PRESENTATIONS