MINISTRY OF INDUSTRY, MINES AND ENERGY
THE KINGDOM OF CAMBODIA

Data Collection Survey on Japanese Water Treatment Technology for Rural Area in the Kingdom of Cambodia

FINAL REPORT

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JAPAN INTERNATIONAL COOPERATION AGENCY

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STUDY AREAS


THAILAND
LAO PEOPLE'S DEMOCRATIC REPUBLIC
VIET NAM
VIET NAM
Gulf of Thailand
South China Sea
OTDAR MEAN CHEY
Svay Chek
Paoypet
BANTEAY MEAN CHEY
Sisophon
SIEM REAP
Siem Reap
BATTAMBANG
Battambang
PAILIN
Pailin
Lake Tonle Sap
Sangker
Sisophon
Pursat (Bpothisat)
PURSAT
Pursat
KAMPONG CHHNANG
Kampong Chhnang
KAMPONG SPEU
Koh Kong
KOH KONG
Kampong Speu
Sre Ambel
Kirirom
PREAH SIHANOUK
Preah Sihanouk
KAMPOT
Kampot
Kep
TAKEO
Takeo
PREAH VIHEAR
Tbeng Meancheay
KAMPONG THOM
Kampong Thum
Chinit
Tonle Sap
Kampong Chhnang
Kampong Cham
KAMPONG CHAM
Phnom Penh
Ta Khmau
KANDAL
Prey Veng
PREY VENG
Bassac
Mekong
STUENG TRENG
Stoeng Treng
Kratie
KRATIE
Kracheh
MONDULKIRI
Senmonorom
ROTANAKIRI
Lumphat
Ochum
Srepok
Sesan
Kong
SVAY RIENG
Svay Rieng
PHNOM PENH
Study Areas

PHOTOS（KAMPOT）


Kampot existing Water Treatment Plant (WTP)


Elevated tanks in Kampot WTP

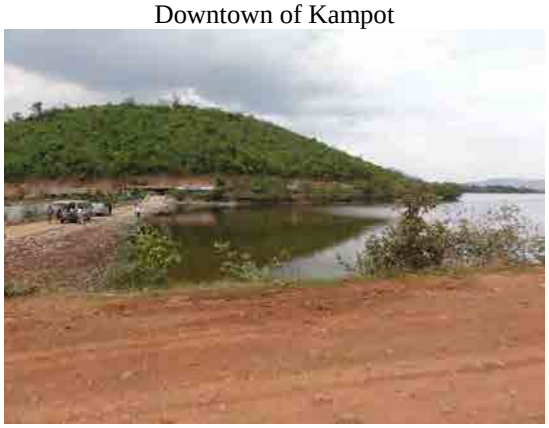

Kampot WTP


Downtown of Kampot


Kampot City


Downtown of Kampot


A Roundabout in Kampot City


Tak Krola Dam in Kampot

PHOTOS（KEP）

Tourist spot of Kep beach

Sea side

Pao Heng Dam

Meeting with O-Krasa commune

Interview with people in Kep

Sa La Khet Pond

Phnom Voil Dam

Veal Vong Dam

Executive Summary

1. Introduction

1) Background of the Survey

The National Strategic Development Plan (NSDP: 2006-2013) of the Kingdom of Cambodia (hereinafter referred to as Cambodia) aims to raise the rates of access to safe water to 80% in urban areas and 50% in rural areas by 2015. To achieve the target, the Ministry of Industry, Mines and Energy (hereinafter referred to as MIME) has set up an Action Plan for the water supply sector (2009-2013), one of the four major points of which is to promote cooperation with the private sector.

2) Objective of the Survey

The primary objective of the survey is to investigate the capability of advanced technologies possessed by Japanese private enterprises in local areas of Cambodia and promote safe water service in provincial cities and rural areas where the service ratio remains low. In parallel, the survey also collects basic information related to the commercialization by the Public-Private Partnership (hereinafter referred to as PPP).

3) Study Area

The Study areas are Kampot and Kep provinces.

2. Current status in the field of waterworks in Cambodia

1) Challenges in the water sector in Cambodia

Common challenges facing the regional town water supply in Cambodia include a lack of funding and inability to individually secure project funds to expand and develop facilities and to renew and improve decrepit facilities. The government's policy, therefore, is to utilize private funds and by official development assistance.

It is essential to improve water supply facilities in rural areas to protect people from waterborne diseases. However, as many rural areas are characterized by scattered dwellings, developing an urban-style water supply is very difficult. In the case of groundwater, there are shallow wells, which are either contaminated with arsenic or contain excessive iron. Accordingly, many rural residents have to buy substandard water from vendors at approximately 1.25 to 3.0 dollars per 1 m^3.

2) Water utilities in Cambodia

There were 16 public water suppliers in the 13 provincies of Cambodia in 2011. Of the 16 public water suppliers, 14, except the Phnom Penh Water Supply Authority (PPWSA) and Siem Reap Water Supply Authority (SRWSA), were directly administered by the Department of Potable Water Supply (DPWS) of MIME. However, due to lack of funding, the provincial capital water supply utilities of Kampong Chhnang, Prey Veng, Ratanak Kiri (Ban Lung), Kratie, Koh Kong, and Kampong Speu, which possess superannuated water facilities, have transferred the water utility licenses to private local companies in Cambodia, aiming to utilize the vitality of the private sector.

3. Current status of the PPP projects in the field of waterworks in Cambodia

Although Cambodia remains at an early stage of implementing its PPP project, some large-scale PPP projects have been implemented, especially in the power, communication and transport sectors. Regarding PPP as one of the key instruments to fill the financing gap by stimulating private sector investment in infrastructure, the Government of Cambodia has been seeking to improve the legal framework as well as the PPP transaction procedures.

There are 16 small-scale concessions as well as a bulk water supply BOT project. The World Bank is a major player in the field of donor-assisted PPP projects in the water sector; for instance, a loan has been given to the Government of Cambodia to help the country reach its Millennium Development Goals (CMDGs) in water supply and sanitation by 2015. Two approaches were piloted under the Cambodia Provincial and Peri-Urban Water and Sanitation Project.

4. Related laws and regulations

1) Concession and BOT

Laws on the PPP have not yet been formulated in Cambodia. To describe the laws related to the PPP, Law on Concession and Sub-Decree on Build-Operate-Transfer (BOT) Contract are mentioned in this section.

i. Law on Concession

The Law on Concession was established on 2007 to promote and facilitate the implementation of privately financed installations in Cambodia, which is divided into six chapters and the water supply sector is included in Article 5.

ii. Sub-Decree on Build-Operate-Transfer (BOT) Contracts

The Sub-Decree on Build-Operate-Transfer (BOT) Contract was established in 1998, applicable to 17 fields and including “clean water production plants”. The BOT period is determined not to exceed 30 years, except for the terms and conditions stipulated in the contract. Chapter 2 mentions the concessionaire selection procedures. The BOT contract is determined to be conducted through an international or national bidding process; however, the selection is to be conducted through a negotiation procedure in the case stated in Article 9. In addition, institutions which decide on the technical and financial selection of the concessionaire are mentioned in Article 10. If the investment project costs less than or equal to 5 million dollars, it is decided between the Minister in charge of the related project, the Ministry of Economy and Finance (MEF) and the Council for the Development of Cambodia (CDC).

2) Sub-Decree on the Water Licensing Draft

The Sub-Decree on Water Licensing Draft which is designed to establish conditions, formalities, and procedures for issuance, transfer, extension, modification, cancellation, suspension, and to specify valid periods for water licenses or permits in Cambodia is subject to the approval of the Council of Ministers. This Sub-Decree Draft comprises nine chapters and covers and governs all activities of water use, for either consumption or commercial purposes. It also covers the development of water resources within the context of Cambodia.

After the General Provision in Chapter 1, Chapter 2 determines that the Minisry of Water Resource and Meteorology (MOWRAM) shall be tasked with managing and registering water exploitation licenses or permits. Chapter 3 stipulates the following six types of licenses or permits: 1. License or

Permit to Make Use of Surface Water, 2. License or Permit to Make Use of Ground Water, 3. License or Permit for Drainage of Waste Water into Surface and groundwater, 4. License or Permit to Exploit Ore Deposits of rivers, streams, canals, ponds, lakes, water reservoirs, natural reservoirs or sea, 5. License or Permit to fill in rivers, streams, canals, ponds, lakes, dikes, water reservoirs, natural reservoirs or sea beach, and 6. License or Permit for Construction of Waterworks Structures. Furthermore, only one license or permit is determined to be valid per exploitation site.

5. Application of Japanese technologies and water supply planning

1) Planning of framework for water supply facilities in the Study area

This survey aims to pressure water supply project planes for aspecific local city and rural areas in Cambodia and then confirm applicability of water treatment leading–edge technologicalies which Japanese private firm have. In addition, the project is assumed to be implemented as a PPP project,

Study area

- A PPP project for the water supply will be planned.
- A bulk water supply project will be developed for Kampot Water Supply (KWS) and Water Supply projects covering Kep beach resort area and some rural areas will be developed for the Kep province.

Application of Japanese water treatment technologies

- Ceramic Membrane Filtration Equipment is employed as one of the Japanese water treatment technologies.

Bulk water supply to the Kampot provincial capital (KWS)

- The collective target for bulk water distribution in the Kampot province is the set of newly installed distributing areas. The PPP project will start on condition that the construction of the distribution network is completed separately within a short time, with financial assistance from overseas.
- Distribution from the existing water treatment plant of KWS will target communes, consisting mainly of existing distribution areas. While the disibution from the bulk water supply project will mainely target the communes with non-served areas.
- MIME expresses it is enough for the mutual business sustainability to employ take-or-pay agreement rather than the agreement of distribution zoning. At any rate, in order to maintain mutual business sustainability between Cambodian Government/MIME and water supplier of the special purpose company (SPC), take-or-pay agreement conclusion is imperative.

Water supply in the Kep provincial

- In the Kep beach (resort) area, piped distribution with a water treatment plant will be used as the means of supply. In rural areas, a Mobile Ceramic Membrane Filtration System (M-CMF) will be used. The treated water will be reserved in water tanks.
- A private water supply company has been granted a license by MIME to develop potable water in Kep province. However, due to bankruptcy, the enterprise was stopped in 2009, leaving a broken earth dam. The company, however, has obtained approval from MIME to postpone the license expiration for 6 months, until May 28, 2012.

PPP project

- The PPP project area combines Kampot provincial capital and Kep.
- The SPC will be set up in the new treatment facilities in Kampot and co-operated with the business in Kep province.

2) Survey on source water

Many dams and ponds were surveyed and the following water sources were selected for the water supply planning.

i. Kampot Province

Tak Krola Dam
This dam was constructed by MOWRAM in 1975, and has been used as a reservoir for agriculture, controlled by the ministry.

ii. Kep Province

Little Pond A (Near Provincial Office)
The pond is located in southern Kep National Park, and about 300 m of the north part of Kep Provincial Office. The water is used for the everyday needs of local residents, and its source is subsoil water from mountains and rainwater.

Kampong Tra Lach (O-Krasar) Dam
This dam is located in O-Krasar Commune, on the west border to Kampot. It was built by MOWRAM in 2008.

Phnom Prous Pond
This pond is located (Prey Thum Commune) on the north side of piedmont, in southern Kep province, and is used for the everyday needs of local residents. Some local residents fetch water with 30 liters (L) tanks during the survey, and according to them, the daily usage is about 40 L per person.

3) Optimal technology selection considering Japanese Technology

As the Japanese technologies – Ceramic Membrane Filtration System will be applied. In this technology, there are two types of system. One is a stationary type for water treatment plant. Another is a mobile type. The stationary type is able to be monitered and operated from a Remote Monitoring System in a base medium or large plant. The mobile type is able to be operated by the same system and in addition, it will be able to save the installation cost of distribution system for a convetional system. The Remote Monitoring System which will be used here is also recommendable technology.

The advantages and disadvantages of using a Ceramic Membrane Filtration System in this planning will be as follows:

＜Advantages when the technology is applied for a small-scale water treatment plant＞

- Since this system has no flocculation and sedimentation basin, the filtration process is simple. Also, unattended operation is possible, except for occasions involving addition of chemicals and maintenance, because it is automatically monitored and controlled by each measuring instrument and automatical chemical dosing system, etc.
- The backwash volume is negligible, resulting in increased sludge concentration in backwash water. Therefore the sludge disposing facility, such as the thickener and sun drying bed, can be simplified.

＜Disadvantages of a small-scale water treatment plant＞

- Initial cost tends to higher than conventional rapid sand filtration.
- The electricity in operation is possible to be higher than conventional rapid sand filtration.

＜Advantages of mobile water treatment equipment (M-CMF)＞

- The ceramic membrane is resistant to variations in raw water quality and physical vibrations. Therefore, the potential for membrane breakages, in the case of site relocations and treatment of highly turbid water during the rainy season, is low.
- Due to the low power consumption, a small diesel electrical generator can be installed, thus enabling a water filtration process in areas without mains electricity.
- Since the amount of backwash water is negligible, the environmental load is small.

＜Disadvantages of M-CMF＞

- Initial cost tends to be higher than conventional rapid sand filtration.
- When the equipment is broken, the cost of replacement is higher than conventional rapid sand filtration.

6. Preliminary design of the Kampot city water supply facilities

1) Concept of Bulk Water Supply by PPP Project

KWS targets increased water supply coverage up to about 92% in future, but the following two financial arrangements are required:

i. Construction of a distributing pipe to expand the water supply district (total extension of 62 km).
ii. Securing a new water source and construction of a new water treatment plant due to expansion of the water supply district (3,433 m³/day).

The water supply system in Kampot will be able to improve the coverage ratio to a very high level, funded both by ODA and the bulk water supply business by the private sector of Japan.

2) Present problem with the water supply

One of the key problems is a lack of funding to repair, replace and expand the facilities of treatment and distribution system. At the moment KWS is confident that users are satisfied with the quality of water, distribution service and reasonable price as overall conditions. However KWS has several basic problems.

As for the water treatment the following items are listed:

Sufficient capacity: The water production capacity remains low. KWS must build more treatment facilities as well as construct distribution systems.
Treated water quality: The quality of raw water (river water) changes rapidly, and treatment is difficult. Post-treated water is of a high standard, but the quality of water from taps still has quality issues, due to some old pipes still remaining.

As for the distribution system, KWS reported as follows:

Leakage: Old pipes largely remain, causing accidents, leakage and red water.
Old pipes: Replacement of old pipes and ACP is necessary. KWS lacks material to repair and replace pipelines.
ACP: Since allowable pressure of ACP is 2.5 bar or 0.25 MPa, farther extension after ACP is difficult.

3) Preliminary design of the bulk water supply facilities

The Bulk Water Supply will provide a volume of water to meet the demand of five Communes (Kampong Kraeng, Makprang, Trapeang Thum, Krang Ampil and Kampong Bay) of nine Communes in the area served and the existing water treatment facility will supply the remaining four Communes. In the next step, this matter should be discussed and reviewed with MIME.

4) Outlines of the water supply plan

- **Population served**

Population served by the KWS

Commune	2011	2015	2030
Kampong Kraeng	29	5,991	6,274
Makprang	372	4,007	4,036
Trapeang Thum	742	2,348	2,454
Krang Ampil	2,750	4,624	4,577
Kampong Bay	4,341	5,679	5,034
Sub-Total			22,375
Chum Kriel	1,685	4,796	5,068
Kampong Kandal	6,987	7,784	8,155
Andoung Khmer	3,626	11,639	12,223
Traeuy Kaoh	50	6,243	6,580
Sub-Total			32,026
Total	20,582	53,111	54,401

- **Water demand**

The planned water consumption of Cambodian tourists is 120 L per capita per day and 250 L per capita per day for foreign tourists.

Frame of the KWS in 2030

Items	Domestic	Tourists		Total
		Cambodian	Foreign	
Population	58,858	629	64	59,551
Population served	54,401	629	64	55,094
Unit Consumption (L/day)	120	120	250	
Water Consumption (m³/day)	6,528	75	16	6,619
Revenue ratio	90.0%	90.0%	90.0%	
Average Daily Supply (m³/day)	7,253	83	18	7,354
Loading ratio	0.80	0.80	0.80	
Maximum Daily Supply (m³/day)	9,066	104	23	9,193

＊ The maximum daily water supply from the existing water treatment plant is 5,760 m³/day and the maximum daily water supply from the Bulk Water Supply Business is 3,433 m³/day(=9,913-5,760).

The financial situation of KWS is unfavorable, including the depreciation expense of the existing facility. Therefore, to improve matters, it was decided to consider supplying the maximum capacity of water from existing water treatment plants in this study. The planned water supply capacity shall be as follows:

5) Outline of water supply facilities

Water resource
The water resource for the PPP project in Kampot : Tak Krola Dam.

Designed water supply
The design capacity of the new water treatment plant is 3,433 m³/day.

Process
Regarding the water treatment process for the new water treatment plant, when this survey started, a ceramic membrane filtration system was planned. However, a conventional coagulating sedimentation and rapid filtration system was ultimately adopted for the following reasons:

- This Kampot new water treatment facility will be a centralized monitoring base for the overall facility and M-CMF in Kep, so the required number of engineers will be unchanged as the number for the new water treatment facility of Kampot, even if it emploies the ceramic membrane filtration system which has big advantage in terms of saving man power, due to the ease of maintenance and operation.
- Unlike in the case of Kep province, there is a public water supply managed by KWS in Kampot, the tariff for which is 1,400 KHR/m³ as of 2012. Because the water supply area of KWS is located next to the new water supply area, the water tariff in the new water supply area should be the same as that of KWS. The construction cost of the ceramic membrane filtration system exceeds the conventional rapid filtration cost, so if the new water supply company adopts a ceramic membrane filtration system, the tariff will be higher due to depreciation.

Outline of the water treatment facility
The new water treatment plant consists of a coagulating flocculation basin, sedimentation basin, four sets of rapid filtration beds and clear water reservoir, thickener and two sets of sun drying beds. Because the new water treatment plant includes a central monitoring function for the new water treatment facility and M-CMF in Kep province, there is a central monitoring station and lounge for engineers and a workshop facility on-site.

6) Pre-condition of the Bulk Water Supply Business by the PPP project in Kampot

To establish a Bulk Water Supply Business, the water demand of Kampot city shall exceed the capability of the existing water treatment plant. To increase water demand, the installation of a water distribution pipe in areas lacking a water supply is crucial.

In conclusion, for Japanese firms to establish a Bulk Water Supply Business, the water supply district must be immediately expanded as a prerequisite.

7) Socioeconomic conditions

Occupations
Kampot Province is also characterized as an agricultural area by occupation data. Families mainly engaging in agriculture comprise 90% or more in most districts, except for Kampot District, where agricultural families occupy less than one third.

Present condition of water supply
Excluding Kampot District, few families can use pipe water and more than 50% use unsafe water sources during the dry season. Further development of safe water supply is required here.

Poor households

The results of the Identification of Poor Households Programme for Kampot Province were publicized by the Ministry of Planning. The percentages of poor households are summarized by District for 2009 in the following table.

Poor households by district in 2009

District	Poor 1 HHs (nos.)	Poor 2 HHs (nos.)	Poor 1 HHs (%)	Poor 2 HHs (%)	Total Poor HHs (%)	Total HH Nos.
Angkor Chey	1,321	1,113	7.8	6.6	14.4	16,949
Banteay Meas	1,903	2,064	10.3	11.1	21.4	18,560
Chhuk	2,462	2,023	11.6	9.6	21.2	21,164
Chum Kiri	936	891	9.9	9.4	19.4	9,438
Dang Tong	1,195	676	10.3	5.8	16.2	11,560
Kampong Trach	1,690	1,936	9.9	11.4	21.3	17,006
Tuek Chhou	1,910	1,373	9.8	7.0	16.8	19,553
Kampot*	139	231	6.1	10.2	16.3	2,270
Total/Average	11,556	10,307	9.9	8.8	18.8	116,500

Note: * Only Communes of Andoung Khmaer and Traeuy Kaoh are included.
Source: Ministry of Planning, Identification of Poor Households Programme

7. Preliminary design of the water supply facilities in Kep Province

1) Outline of water supply faccilities

The city of Kep is beautiful, with rich nature and surrounded by sea and mountains, therefore its future development as a tourist site is expected to be strong. However, one major hindrance to the development is the “Water” problem.

2) Service areas

The fixed water treatment plant will supply the following three districts:

- Tourist District: Districts where hotels and restaurants are concentrated, along the coastline (approximately 5.5 km).
- Main Water Source District: within a one km radius of Phnom Prous Pond (natural spring-fed pond), which is a selected water source for this water business project.
- Water Source for the Mobile Equipment District: within a one km radius of Little Pond A (natural spring-fed pond), which is a selected water source for M-CMF.

3) Planning of the water supply

This PPP Project focuses on the water problem of Kep city. Once Japanese firms have acquired the right to the water utilities business throughout the city of Kep, they will establish a water business utility (in 2015) and engage in business in the districts where profitability is expected, such as areas where hotels and restaurants are concentrated.

Most tourists to the city of Kep tend to visit over weekends or holidays and few people stay long. If we are to plan the water business assuming concentrations of tourists on a specific date, the facility will become excessive for normal demands. Accordingly, this cannot be considered an optimal approach in terms of resumption of investment. With this in mind, we plan to design a water facility and water transmission facility the same as the usual time (0.8 load factor) and during times of peak demand,

such as weekends etc., we chose to use M-CMF in addition to the main water treatment plant. On weekdays, mobile water treatment equipment will supply domestic water and drinking water to residents except for the Kep city area

Kep has considerable potential to be developed as a Kep Beach Resort Area. However, based on this assumption, planning and implementation for the target year of 2030 also involve considerable risk. Therefore this implementation plan currently assumes a plan for 2015. Although a plan for 2030 has been made, a future review will be required; hence the facilities to be implemented are based on the 2015 plan.

- **Population served**

Population served in Kep City, 2015

Commune	Domestic			Tourists (daily)	
	Population	Served	%	Cambodian	Foreign
Angkaol	8,044	0	0%	0	0
O-Krasar	7,400	0	0%	0	0
Pong Tuek	9,392	0	0%	0	0
Kep	5,039	2,362	46.9%	1,525	12
Prey Thum	8,648	3,098	35.8%	1,524	11
Total	38,523	5,460	14.2%	3,049	23

- **Water demand**

To calculate the planned water consumption, local residents' consumption is estimated at 80 L per capita per day. Moreover, planned consumption is estimated and calculated at 120 L per capita per day for Cambodian tourists and 250 L per capita per day for foreign tourists.

Frame of Kep water supply planning in 2015 (for WTP + M-CMF)

Items	Domestic	Tourists		Total
		Cambodian	Foreign	
Population	38,523	3,049	23	41,595
Population served	5,460	2,744	23	8,227
Unit Consumption (L/day)	80	120	250	
Water Consumption (m^3/day)	437	329	6	772
Revenue ratio	90.0%	90.0%	90.0%	
Average Daily Supply (m^3/day)	486	366	7	859
Loading ratio	0.8	0.8	0.8	
Maximum Daily Supply (m^3/day)	608	458	9	1,075

- **Water resource**

The main Water Source is Phnom Pros pond. In addition, Little Pond A (natural spring-fed pond), was chosen as the water source of M-CMF for weekend operation.

- **Designed water supply**

The new water treatment facility in Kep is planned to employ ceramic membrane filtration system to make unmanned control possible. Owing to this the manpower cost will be saved. Moreover, the planned daily maximum treatment is 900 m^3/day, including usage in the facility. In addition, for the steep increase of water demand on weekends and holidays when tourist increase, supporting by M-CMFs will make up the shortage.

The processes of new water treatment are as follows:

- Receiving water well
- Primary mixing basin
- Secondary mixing basin
- Ceramic membrane filtration equipment（7 elements/modules x 2 modules/unit x 1unit）
- Clear water reservoir（225 m³）.

- **Water transmission pipe**

Transmission pipe with length of 10,500 m will be installed between the water treatment plant (treating up to 852 m³/day) and the water distribution elevated tank (HWL 37.0 m，LWL 32,0 m), which will be installed in the tourist district:

Diameter, Material: φ250 to φ200 mm polyethylene pipe.

- **Distribution reservoir**

A distribution reservoir of 900 m³ (450 m³ x 2) will be installed next to the mobile water source of the tourist district. This will play a role, along with the demand for water, as a stock for tourists, focusing on weekends and holidays and also serve to purify water with the support of M-CMF.

In the study, we assumed the water demand of tourists to be 2/3 over the weekend (Saturday and Sunday), and 1/3 for the remaining five weekdays (Monday to Friday).

Moreover, the figure below indicates the result of the study on the distribution reservoir capacity by considering the water demand and water treatment capacity (50.3 m³/h) of the fixed water treatment plant and supporting the water treatment capacity (8.3 m³/h) of M-CMF.

4) Preliminary design of M-CMF

- **Service area**

O-Krasar, Pong Teuk and Prey Thum communes

- **Population served in 2015**

Frame of water supply by M-CMF by commune in 2015

Commune name	Domestic			Tourist (daily)	
	Population	Served	%	Cambodian	Foreign
O-Krasar	7,400	1,807	24%	0	0
Pong Teuk	9,392	1,066	11%	0	0
Prey Thum	8,648	1,325	30%	0	0

- **Water demand**

In calculating the water demand, the daily usage per resident is set at 80 L via piped water supply from the new water treatment facility, and 40 L for the unpiped water supply from M-CMF. This value is referred to as demand of “40 L/cap/day” as described in the “Design of the Community Tertiary Water Supply Project in the Kampong Cham Province, Cambodia (JICA report on 2009), etc.

Frame of Kep water supply by M-CMF in 2015

Items	Domestic	Tourists		Total
		Cambodian	Foreign	
Population	38,523	0	0	38,523
Population served	4,198	0	0	4,198
Unit Consumption (L/day)	40	0	0	40
Water Consumption (m^3/day)	168	0	0	161
Revenue ratio	90.0%	0	0	90.0%
Average Daily Supply (m^3/day)	187	0	0	187

Outline of water supply facilities

- **Water resources**

O-Krasar commune: Kampong Tra Lach (O-Krasar) dam
Pong Teuk commune: Phnom Voar Deer dam
Prey Thum commune: Phnom Prous pond

In Kep province three M-CMFs will be operated. On weekdays, they will operate in three communes, and on weekends in the Kep city area to support the water treratment plant capacity.

The rotation plan calculates the required volume of the clear water reservoirs at Prey Thum, O-Krasar and Pong Tuek communes as follows:

- Prey Thum commune: 160 m^3（RC）
- O-Krasar commune: 160 m^3（RC）
- Phong Tuek Commune: 160 m^3（RC）

5) Future plan for the target year 2030

As Kep city is expected to become a major tourist site, it is very difficult to draw up a future plan at this stage, as it will lack accuracy. Accordingly the figure of 2015 plan is extended and employed for 2030 planning.

6) Socioeconomic conditions

Occupations
According to the occupation data which NCDD compiled in Kep Data Book 2009, October 2009, Kep Province is characterized as an agricultural area.

Present condition of water supply
In Kep Province, no families use piped water and more than 80% use unsafe water sources during the dry season. The development of a safe water supply is thus necessary.

Poor households
The results of the “Identification of Poor Households Programme” for Kep Province were publicized by the Ministry of Planning. The percentages of poor households are summarized by Commune for 2009 and shown below.

Poor households by commune in Kep province in 2009

District	Commune	Poor 1 HHs (nos.)	Poor 2 HHs (nos.)	Poor 1 HHs (%)	Poor 2 HHs (%)	Total Poor HHs (%)	Total HH (nos.)
Damnak Chang Aer	SangkatAngkaol	154	236	9.5	14.6	24.1	1,621
Damnak Chang Aer	SangkatO-Krasar	149	184	9.9	12.2	22.1	1,504
Damnak Chang Aer	Pong Tuek	119	272	5.7	13.1	18.8	2,076
Kep	Kep	21	125	2.1	12.3	14.4	1,013
Kep	Prey Thum	23	154	1.4	9.6	11.0	1,612
	Total/Average	466	971	6.0	12.4	18.4	7,826

Source: Ministry of Planning, Identification of Poor Households Programme

8. Formulation of a PPP structure for the water supply service

1）Financing option to be selected

The following figure illustrates one of the financing options that appear viable based on the interview results. This financing option is set tentatively to determine whether the proposed financial structure would generate sufficient returns for the sponsors or not. Thus, depending on our simulation results, we will revisit and determine the final financial structure of the SPC, which can be acceptable to all stakeholders. It should also be noted that, in the following financing plan, we have assumed that the risks mentioned by those financial institutions will largely be mitigated by the risk mitigation measures.

Anticipated financing plan

		A'mt	%				A'mt	%	Currency	
Asset	Cash	30	0.3%	Debt	Private	Financial Institution A	3,670	35.0%	US$	#5
						Financial Institution B	0	0.0%		
	Kampot Capital Investment					Financial Institution C	0	0.0%		
		5,287	50.4%		Public	JICA	0	0.0%	JPY	#4
						JBIC	3,670	35.0%	US$	#6
	Kep Capital Investment (1)					ADB	0	0.0%	US$	
		3,793	36.2%			IFC	0	0.0%	US$	
						sub Total	7,339	70.0%		
	Kep Capital Investment (2)				Mezzanine	n/a	0	0.0%		
		1,376	13.1%			Japanese Entities	1,541	14.7%	JPY	#3
					Equity	Local Entities	1,604	15.3%	US$	#2
						sub Total	3,145	30.0%		#1
Total		10,485	100.0%	Total			10,485	100.0%		

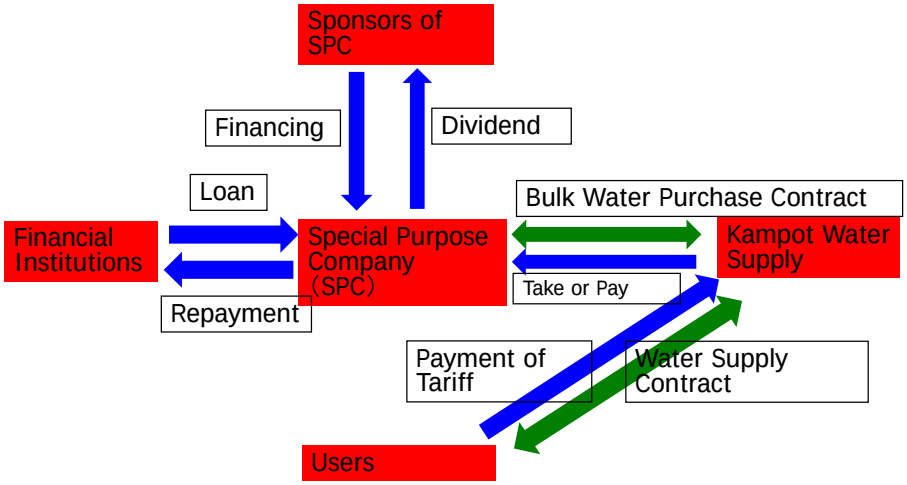
Business size(thousand US$)	10,485
Exchange rate(1US$=>4,040KHR）	4,040
Exchange rate(1US$=>78JPY）	78

	Items	Assumption	Constraints
#1	Debt-to-equity (D/E) ratio	70:30 (based on the general PPP scheme)	
#2	Local Entities	51% of share (=15.3% of project cost); expected to be involved as an EPC or O&M operator.	Required to subscribe a certain % of share to facilitate loans from financial institutions
#3	Japanese Entities	49% of share (=14.7% of project cost); expected to be involved as	Required to subscribe a certain % of share to facilitate loans from

		an EPC operator and a consultant.	financial institutions.
#4	JICA	No JICA loan is included in our initial financing plan to mitigate foreign currency risks (JICA provides JPY loans only).	Loan: up to 70% of project cost (within 25 years)
#5	Financial Institution A	50% of loan (=35% of project cost) denominated in US$	ECA support required to mitigate country risk -> need to have JICA investment/loan
#6	JBIC	50% of loan (=35% of project cost) syndicated with Financial Institution A	Syndicated loan with Japanese financial institutions (e.g. Financial Institution A)

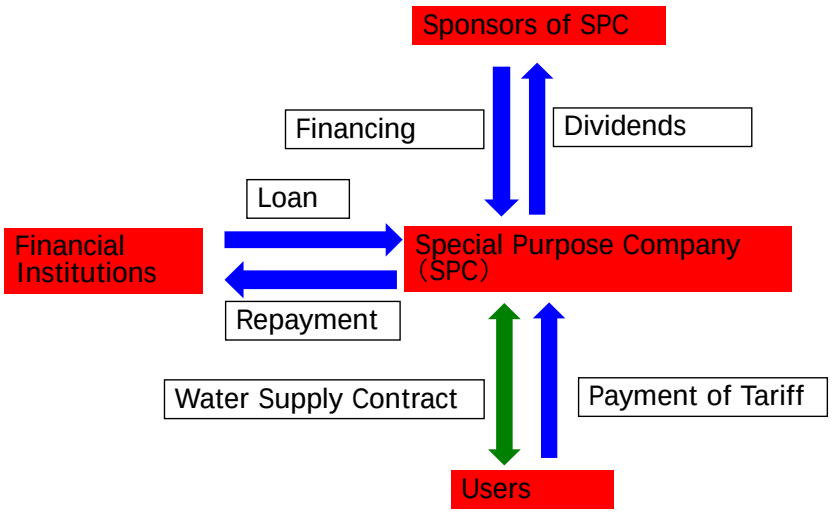
2) PPP structure to be selected

The selected PPP model for the Kampot project is illustrated in the following figure. The water treatment plant will be constructed under the DBOOT (Design-Build-Own-Operate-Transfer) with the 30-year project period, while a special purpose company will be established to conclude a bulk water purchase contract with the MIME/KWS. The off-taker of the bulk water would be MIME/KWS under the “take or pay agreement”.



Proposed PPP scheme for Kampot project

The selected PPP model for the Kep project is illustrated in the following figure. The water treatment plant as well as the mobile water supply equipment will be constructed and supplied under the DBOO T (Design-Build-Own-Operate-Transfe) with the 30-year project period, while a special purpose company will be established to provide the water supply services to end users as well as collect water charges from them. There is a possibility that water charges might be collected by the staff of KWS.



Proposed PPP scheme for Kep project

An SPC will be established to cover both Kampot and Kep projects. Possible sponsors for the SPC may include Japanese private investors and Cambodian private investors.

The functions of the SPC for the Kampot project include:

- Design, construction, and finance of the new water treatment plant at the preparatory stage;
- Ownership, operation, and maintenance of the new water treatment plant during the project period; and
- Transfer of the new water treatment plant to KWS at the end of the project period

Conversely, the functions of KWS include:

- Operation and maintenance of the distribution network;
- Countermeasures for non-revenue water;
- Collection of water charges from customers; and
- Provision of customer services

The SPC functions for the Kep project include:

- Design, construction, and finance of the new water treatment plant as well as the mobile water supply equipment at the preparatory stage;
- Ownership, operation, and maintenance of the new water treatment plant as well as the mobile water supply equipment during the project period;
- Transfer of the new water treatment plant and the distribution network as well as the mobile water supply equipment to the Government of Cambodia at the end of the project period;
- Operation and maintenance of the distribution network;
- Counter-measures for the non revenue water;
- Collection of water charges from customers; and
- Provision of customer services

3) Risk analysis of the selected PPP option

It is important that countermeasure against each project risk be allocated to the party best able to manage the risk at the lowest possible cost. Therefore, it must be assessed whether a particular risk can be managed better and more cheaply by the private developer or not. If a private developer would be

better able to handle the identified risk, they should handle such work.

The successful implementation of a PPP contract therefore depends on how the risks associated with the project are allocated among stakeholders. Before the risks are allocated, it is important to identify a wide range of the following risks.

The following table shows the risk sharing of a wide range of identified risks among various stakeholders. One of the most likely risks is that of demand, which could be covered by a "take or pay agreement" between the SPC and MIME/KWS, the off-taker of the bulk water in the DBOOT contract for the Kampot project.

Proposed risk sharing among stakeholders

Stage	Type of Risk		Responsibility of Risk Cover by Stakeholder (● : Main Responsibility, ▲ : Sub Responsibility)						
			Public	Private	Private				
					SPC	Sponsor	Financial Institutions	Insurance Company	Contractor
Common	Political Risk	Change in Law Risk	●						
		Political Risk	●						
		Regulation Risk	●						
		Tax Regime Change Risk	●						
		Public Support Risk	●						
	Economic Risk	Price Escalation Risk		●	●				
		Interest Rate Risk		●	●		●		
		Exchange Rate Risk		●	●		●		
		Financial Risk		●	●	●	●		
	Social Risk	AP (Affected People) Risk	●						
		Environmental Risk	●						
	Partner Risk	Partner Risk		●	●	●	▲		
	Force Majeure	Catastrophic Risk	●	▲	▲		▲	▲	▲
		War Risk	●						
Planning Stage	Planning Risk	Site Survey Risk		●	●				●
		Design Risk		●	●				●
		Plan Change and Delay Risk	●						
Construction Stage	Construction Risk	Land Acquisition Risk	●						
		Delay in Construction Risk		●	●	●		▲	●
		Cost Overrun Risk		●	●	●		▲	●
		Performance Risk		●	●				●
		Construction Damage Risk		●	●			▲	●
Operating Stage	Market Risk	Demand Risk		●	●		▲		
		Tariff Risk	●						
	Operating Risk	Operating Cost Risk		●	●				
		Operating Performance Risk		●	●				
	Default Risk	Default Risk		●	●	▲	▲	▲	

4) Constraints and challenges when Japanese firms enter the PPP business

The absence of the following seven pre-conditions will be critical barriers which might prevent a Japanese firm's smooth entry to the proposed PPP project. It is highly advisable to ensure these pre-conditions are satisfied:

- Government assistance
- A workable SPC selection process
- Clear-cut performance targets
- Realistic tariff setting and a proper tariff revision mechanism
- Quick procurement process through unsolicited proposals
- Compliance with QIP (Qualified Investment Project)
- Implementation of a Technical Assistance Program to SPC

9. Operation and maintenance

1) Operation and maintenance

SPC will operate and maintain the water facilities properly, observing related laws and regulations. Moreover, as well as promptly providing sufficient water of good quality to users, it will consistently maintain sound financial health by adopting economical methods of Operation & Maintenance (O&M). For the operation, it will be necessary to collect and analyze information concerning O&M in step with adjustment between monitoring operations and daily checkups and maintenance.

2) O&M management (Kampot WTP)

The Kampot Water Treatment Plant uses coagulation-sedimentation and a rapid filtration system and takes in raw water from a dam as a water resource. The quality of the water from the dam varies depending on the season and weather. Therefore the main plant operations will start with the monitoring of water quality, volume, level, and the quality of the treated water for each process. The plant will operate on a 24-hour 365-day basis.

3) O&M of the ceramic membrane facilities (Kep WTP)

The Kep Water Treatment Plant is a facility using a ceramic membrane filtration system. Facilities with the system can basically operate fully automatically, meaning no O&M operator is required in the plant for most of the time. Even though the M-CMF is mounted on a truck, the purification system is basically the same as the Kep Plant, so the work contents of O&M will also be the same.

The Kep Water Treatment plant will operate on a 24-hour 365-day basis except during maintenance and repair work. The three sets of M-CMF will target the three areas not supplied with water from water treatment plants. Moreover, since the equipment is mounted on a truck, they will meet demands that vary seasonally and according to the day.

4) Organization structure for O&M

To ensure appropriate operation and maintenance, it is necessary to establish an organization structure for O&M, which clarifies responsibility and authority.

5) Future considerations

It is preferable to provide OJT training focusing on practical operations by Japanese engineers during start up. After finishing the startup training, providing regular training by Cambodian staff trained in the JICA Project “The Project on Capacity Building for Water Supply System in Cambodia Phase-2” will be considered.

Directors and technical leaders will have opportunities to train in Japan. This is effective, not only to gain knowledge of Japanese waterworks, but also to deepen their understanding of Japanese waterworks and increase their sense of belonging, as well as enhancing the quality of work.

Also, since having Japanese engineers travel to and from Cambodia will incur considerable expense, it will be necessary to consider introducing an IT system, which enables Cambodian workers to be assisted and trained from Japan. This system should allow the Japanese engineers to determine the operating conditions of the equipment, water qualities, etc. For example, by utilizing web camera technology, it will allow Japanese engineers to communicate in real-time with pictures and voices, and facilitate detailed assistance and training at a relatively reasonable cost.

10. Cost estimate and implementation schedule

1) Cost estimate

The project cost is as estimated below. It comprises the construction cost, such as for water treatment facilities and equipment, while the O&M cost includes the SPC operating cost. As with the arrangement of land, it is expected to be provided from the Government for this Survey stage.

Initial and running costs

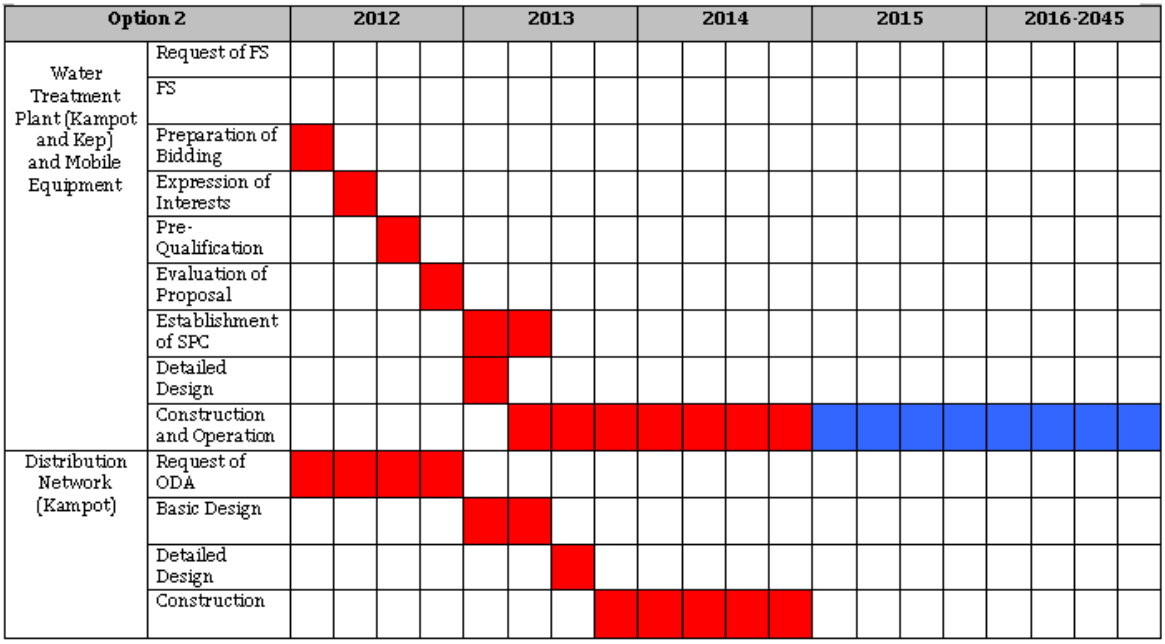
Items of Cost	Amount
Construction cost	10,453,000 US$
O&M cost and SPC operation cost(30 years)	24,414,000 US$(30years)

2) Implementation schedule

Since this survey is at the stage of data collection for the PPP project, two options are assumed for the tentative implementation plan.

Option 1 is based on the condition that the feasibility study is conducted on an unsolicited base, whereby a private investor carries out the feasibility study at its own costs and risks. An unsolicited method will be employed to conduct the feasibility study in advance of the SPC selection to shorten the total preparatory period for the proposed PPP projects. The party having submitted the results of the feasibility study will receive some advantages in terms of the SPC selection.

For Option 2, the duration, including both the preparatory period and the construction period, would be a total of three years as the quickest schedule, since the results of the pre-feasibility study in this Survey will be utilized for bidding at the selection of SPC. The construction is scheduled for completion by the end of 2014, and the operation will get underway at the beginning of 2015. Analysis is hereinafter employs this model as the Survey stage



Proposed implementation schedule (Option 2)

11 Financial analysis

We conducted interviews with various financial institutions to determine the potential and pre-conditions for them to provide financial support for this PPP project. Based on the results, we formulated a financial structure, consisting of a JPY loan from a public financial institution (50%), US$ loans from private financial institutions (25%), and equity (25%). However, with this financial structure, the Equity Internal Rate of Return (EIRR) was calculated as only 9.1%, which would most likely be lower than the acceptable rate of return required by most potential investors. Thus, in response to the initial simulation results, we reassessed the financial structure and formulated the following structure to be used in our financial analysis:

Summary of debt, mezzanine and equity underrevised scenario

(Amounts in thousand US$)

Type	Amount	Currency	Amount	Interest rate	Maturity	Grace period
Debt	7,339	JPY	7,339	2.5%	25 years	5 years
Mezzanine	1,573	KHR	1,573	0.0%	14 years	9 years
Equity	1,573	JPY	771	n/a	n/a	n/a
		US$	802	n/a	n/a	n/a
Total	10,485		10,485			

We assumed that the above funds would be injected over the initial 3-year period, which corresponds to the construction timing. In addition, we made the following key assumptions in performing our financial analysis (refer to the section '11.2 Assumptions for Financial Analysis' for further details and other assumptions):

Asumption of financial analysis

Area	Kampot	Kep		
End users	Residents	Hotels		Residents
Filtration equipment	Stationary	Stationary	Mobile	
Distribution system	Pipes		Pipes/Trucks	Trucks
Revenue				
Base tariff	1,390KHR	2.0US$		6,000KHR
Frequency of tariff change	5 years	1 year		3 years
Inflation rate	5%			
Inflation catch-up rate	80%	100%		80%
Max capacity (m^3/day)	3,440	900	215	
Utilization rate	Increased from 40% to 100% in 4 years.			100%
Revenue water %	89.3%	95.6%	100%	74.7%-91.7%
Costs/ Expenses	Significant portion of costs/expenses are assumed to increase annually at an anticipated inflation rate of 5%.			
Tax on profit	0% during the tax exemption period; 20% of profit before tax or 1% of revenue after the exemption period.			
Exchange rate	4,040 KHR/US$; 78 JPY/US$			

The following table summarizes the simulation results based on the assumptions described above. Annual Debt Service Coverage Ratio (ADSCR) exceeds the acceptable level of 1.3 throughout the concession period, which indicates the SPC would generate sufficient cash to service its debt obligation. EIRR is calculated to be 13.9% for the entire concession period of 30 years, which exceeds the original EIRR of 9.1%, yet is slightly lower than the expected market lending rate in Cambodia of 18-22%. Although equity investors cannot expect rates of return that exceed those of lenders from this project, we anticipate that the EIRR of 13.9% could be acceptable due to the following reasons: (1) the

cost of debt in Cambodia is very high and therefore, cost of equity is not expected to significantly differ from cost of debt in the premature financial market in Cambodia, and (2) the host country would realize social benefits with the increase in population having access to clean water and the sponsors would expect some further returns when they win an opportunity for participating in the the project as EPC or O&M contractors.

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Financial statements summary

(KHR in million)

PL	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
Revenue	15,881	31,242	39,211	49,241	63,208	79,864
Costs & operating expenses	-21,309	-22,927	-21,392	-22,088	-24,680	-28,825
Operating (loss)/income	-5,429	8,315	17,820	27,152	38,528	51,038
Other income	1,159	6,825	7,806	5,697	3,961	2,285
Other expenses	-2,867	-2,845	-2,642	-1,626	-610	-0
Ordinary (loss)/income	-7,137	10,502	22,984	31,223	41,879	53,323
Extraordinary income	0	0	0	0	0	0
Extraordinary loss	0	0	0	0	0	0
(Loss)/income before income	-7,137	10,502	22,984	31,223	41,879	53,323
Income taxes	-	(1,410)	(4,597)	(6,245)	(8,376)	(10,665)
Net (loss)/ income	-7,137	9,092	18,387	24,979	33,503	42,659

CF	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
Operating Cash Flow	8,886	22,032	25,789	29,303	35,437	42,455
Investing Cash Flow	-42,238	0	0	0	0	0
Financing Cash Flow	45,226	-12,335	-31,600	-33,108	-41,633	-42,659
Net Increase(Decrease) in CF	**11,874**	**9,697**	**-5,810**	**-3,805**	**-6,196**	**-204**
Cash at end of year	**11,874**	**21,571**	**15,760**	**11,956**	**5,760**	**5,556**
Free Cash Flow	**-33,351**	**22,032**	**25,789**	**29,303**	**35,437**	**42,455**

BS	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30
Current assets	12,317	22,145	16,507	12,847	6,924	7,082
Non-current assets	25,986	13,955	6,456	2,083	0	0
Total assets	38,304	36,100	22,963	14,930	6,924	7,082
Current liabilities	215	274	350	447	570	728
Non-current liabilities	32,518	24,389	16,259	8,130	-0	0
Total liabilities	32,733	24,663	16,609	8,576	570	728
Total equity	5,571	11,437	6,354	6,354	6,354	6,354
Total liabilities and equity	38,304	36,100	22,963	14,930	6,924	7,082

EBIT Margin	-34.2%	26.6%	45.4%	55.1%	61.0%	63.9%
ROA	-2.2%	8.0%	18.5%	36.3%	84.1%	152.7%
ROE	-20.4%	17.2%	46.7%	78.6%	105.5%	134.3%
EIRR (Dividends vs Equity)	n/a	-11.9%	7.2%	11.2%	13.0%	13.9%
ADSCR *2(5year average)	n/a	2.2	2.6	3.2	4.1	n/a

Note:EIRR includes repayments of preferred stock principal (hereinafter, the same for “EIRR”.)

Following our interviews with the financial institutions and financial simulation, we noted that the current PPP structure is considered barely feasible from a financial perspective. In addition, we have identified the following as prerequisites to sustain the project:

- Government guarantees to obtain financing from financial institutions
- Acceptance of take-or-pay supply terms by off-takers (i.e. local governmental bodies)

- The Cambodian government's support for proposed tariff setting
- Availability of debt financing from JICA.

12. Evaluation of feasibility

The feasibility of the Project is evaluated in terms of consistency with the national plans of Cambodia, applicability of Japanese technology to rural areas, consideration from the socio-economic section, profitability from the financial analysis, and sustainability of the PPP project. In conclusion, the Project is found to be feasible from a comprehensive standpoint.

1) Consistency with national plans of Cambodia

With regard to challenges faced by the Royal Government of Cambodia, the Rectangular Strategy which is a national development strategy in the coutry states in Phase II: September 26th, 2008 "The provision of quality public health services remains limited. … The progress in promoting health care services, sanitation and clean water in rural areas must be accelerated to meet the targets set in CMDGs." Point 68 also states that, "… The Royal Government will pay more attention to the rights of access of people to a clean water supply… in accordance with CMDGs …." In addition, Point 69 states, "… the Royal Government will encourage private sector participation in the development and the management of irrigation systems and clean water supply."

Accordingly, the result of this Survey is evaluated to be consistent with the national plans of Cambodia.

2) Applicability of Japanese technology to rural areas

As for the applicability of Japanese water treatment technology, feasibilities in terms of the technical aspects of the Study area and Cambodia are discussed. The technology used to study the applicability is M-CMF. While this study was underway, stationary-type Ceramic Membrane Filtration Equipment was employed for the proposed Kep new treatment plant.

The M-CMF and the stationary type are applicable to Cambodian rural areas due to the following features:

- Small villages are scattered and houses are also dotted around. Therefore, the piped distribution water supply type, which is both costly and time-consuming, is inefficient.
- It is difficult to employ and secure the required manpower for operation and maintenance in rural areas.
- Conventional water treatment technologies, such as the rapid sand filtration system, are not necessarily easy to maintain and capable of supplying safe water.

With these three points in mind, the adoption of a membrane filtration system is desirable.

In the case of the proposed Kep new treatment plant, as different conditions exist; it will not be desirable to employ the same treatment method as for Kampot, since the required method must involve easy adoption of a central monitoring system, user-friendly operation and guaranteed treatment results. From these perspectives, a stationary ceramic membrane filtration method is employed.

In addition, the technology of the M-MCF was verified through the test run in Kandal province from October to November 2011.

The technology of ceramic membrane filtration has attained a share of around 1/3 in membrane filtration facilities in terms of treated water volume in water treatment plants of Japan. As of June 2011, 103 water treatment plants employ a system which means the technology is operated and maintained in many rural areas. The operation and maintenance of the ceramic membrane filtration is easy. The oldest ceramic membrane facility went into operation 13 years ago, meaning the service life of the membrane is establishing a new record year by year.

As for the aforementioned reason, Ceramic Membrane Filtration technology is an established technology and one that is sufficiently appropriate.

3) Consideration from the socioeconomic section

Considering the fact that safe water is necessary, not only for preserving life but also improving public hygiene, unlike other products/services, it should be considered that the results of the project operation achieve equity and fairness.

Thus, if the burden on users is exacerbated, considerations should be made to ensure the socially vulnerable, especially the poor, can access the minimum required volume by easing the burden or exempting it completely. The following two items are generally considered for the reduction or exemption of the burden:

- Water consumption charge
- Connection fee

The water consumption charge is generally designed to be stepwise at a metered rate and with a lower unit price applied to smaller consumption volumes. The connection fee is generally discounted and/or paid by installments for targeted users, who are selected among applicants. It is only applied to new users due to its nature.

4) Profitability from financial analysis

It is reasonably expected that investors would generally not be interested in investing in a project if its EIRR is below the prevailing market interest rate in Cambodia (approx. 18%), plus certain premium. Nevertheless, we can assume that the EIRR that is slightly lower than the market interest rate could still be feasible for this PPP project for the following reasons: (1) the local cost of debt is very high and is not expected to differ significantly from cost of equity due to the premature financial market in Cambodia, and (2) the host country would realize public interests with the increase in population having access to clean water and the sponsors would expect some further returns when they win an opportunity for participating in the the project as EPC or O&M contractors.

5) Sustainability of the PPP Project

Of the wide-ranging PPP options which can be implemented to optimally exploit private sector involvement, the optimum PPP will be selected based on the site-specific conditions of Kampot and Kep. The involvement of the private sector can expand access to capital or financial resources for the investment/procurement of facilities/equipment as well as access to human capital for expertise and skills.

The Kampot project is designed to be implemented as a PPP option for the construction, operation and maintenance of the bulk water supply system, which is a typical PPP structure under the Design Build Own Operate and Transfer (DBOOT) model. Under this model, the water treatment plant will be constructed with a 30-year project period, while a SPC will be established to conclude a bulk water purchase contract with the MIME/KWS.

Meanwhile, both the WTP and M-CMFs will be constructed and supplied for the Kep project under the DBOOT with the 30-year project period, while the same SPC will provide water supply services to end users as well as collecting water charges from the same. Financial analysis verifies the sustainability of the above PPP option, subject to the necessary risk cover measures such as the take-or-pay contract being taken.

13. Conclusion and recommendations

1) Conclusion

Kampot city and Kep province are selected as the study areas. The water supply plans made by this Survey are: Bulk water supply planning developed for KWS and a new small-scale water supply project covering Kep beach areas and some rural areas of Kep. In the rural areas, a Mobile Membrane Filtration System (M-CMF) will be used.

The use of Ceramic Membrane Filtration Equipment, as one of the Japanese water treatment technologies in this survey, will be constrained in Kampot with the water charge in mind. Therefore, rapid sand filtration sysytem was selected as a suitable method for the plan of Kampot based on economic conditions.

In the planning of this survey, the distribution system plan was made by the concept of zone allocation-of-supply area. However, in a stage of full scale F/S, the study team should disscus with MIME and will review the method. MIME has the concept that “take or pay contacts” will be enough for the bulk water supply PPP project.

The results of financial analysis indicate that EIRR could be feasible for this PPP project for the following reasons, nevertheless, we can assume an EIRR slightly lower than the market interest rate:

(1) the cost of debt is very high and the cost of debt is not expected to differ significantly from the cost of equity due to the premature financial market in Cambodia, and
(2) the host country would realize public interests with the increase in population having access to clean water and the sponsors would expect some further returns when they win an opportunity for participating in the the project as EPC or O&M contractors.

The optimum PPP will be selected from various options based on the site-specific conditions of Kampot and Kep. Currently, DBOOT is recommended for both Kampot and Kep. The duration of the contract will be 30 years for both options.

2) Recommendations

(1) It is key to arrange international assistance such as grant aid for the short-term construction of the distribution network in Kampot.
(2) In readiness against PPP realization, appropriate contents of the future contract-draft shall be discussed form earlier stage with MIME. The discussion must include “take-or-pay clause for appropriate water quantity”.
(3) The movement of business rights of private water supplier in Kep must be carefully monitored.
(4) Preconditions to secure the sustainability of the PPP project are confirmed, with the necessary actions adopted swiftly and carefully.
(5) As fund procurement on a commercial basis requires a short repayment period and a high risk premium, the EIRR currently stands at 13.9%. Due to this level, the return might be sufficient to establish the PPP business. However there remains significant room to target securing market interest (18%) plus-something-extra of the investment return by comprehensively reviewing costs, negotiating the level of the water tariff, and exploring the potential for utilization in JICA’s investment program.

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ABBREVIATIONS

ACP	Asbestos Cement Pipe
ADB	Asian Development Bank
ADSCR	Annual Debt Service Coverage Ratio
AFD	Agence Francaise de Developpement
ATP	Affordability to Pay
BOT	Build Operate Transfer
CDC	The Council for the Development of Cambodia
CMDG	Cambodia Millennium Development Goals
CMF	Ceramic Membrane Filtration
CPI	consumer price index
DIME	Department of Industry, Mines and Energy
DPWS	Department of Potable Water Supply
ECA	Export Credit Agencies
EDC	Electricite Du Cambodge
EIRR	Equity Internal Rate of Return
EPC	Engineering, Procurement and Construction
FDI	Foreign Direct Invetment
FRB	the Federal Reserve Bank
GDP	Gross Domestic Product
IDPoor	Identification of Poor Households Programme
IFC	International Finance Corporation
IFRC	International Federation of Red Cross and Red Crescent Societies
IPP	Independent Power Producer
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
KHR	Khmer Riel (Cambodian currency)
KWS	Kampot Water Supply
L	Liters (unit)
LIBOR	London Inter-Bank Offered Rate
LMUPC	Land Management, Urban Planning and Construction
M-CMF	Mobile Ceramic Membrane Filtration Equipment
MEF	Ministry of Economy and Finance
MIME	Ministry of Industry, Mines, and Energy
MOLMUPC	Ministry of Land Management, Urban Planning and Construction
MOO	Modernize Own and Operate
MOWRAM	Ministry of Water Resource and Meteorology
MOT	Modernize Operate and Transfer
MRD	Ministry of Rural Development
NBC	National Bank of Cambodia
NCDD	National Committee for Sub-National Democratic Development
NCDM	National Committee for Disaster Management

NRW	Non Revenue Water
NSDP	National Strategic Development Plan
OJT	On the Job Training
O&M	Operation and Maintenance
PACl	poly-aluminum chloride
PPP	Public Private Partnership
PPWSA	Phnom Penh Water Supply Authority
QE	Quantitative Easing
QIP	Qualified Investment Project
SPC	Special Purpose Company
TCP	Technical Cooperation Program
WB	World Bank
WTP	Water Treatment Plant
WTP	Willingness to Pay

Chapter 1 Introduction

1.1 Background of the Survey

In the Kingdom of Cambodia (hereinafter referred to as Cambodia), the National Strategic Development Plan (NSDP: 2006-2013) aims to raise the rates of access to safe water in urban area by 80% and 50% in rural area by the year 2015. However, based on the result of various information and research, it resulted in 56.1% and 40.5% in 2008. MIME, which has jurisdiction over urban water supply services in the Capital of Phnom Penh and suburban cities, is promoting the development of city's waterworks facility with the support of donors, but water supply capabilities in other cities besides Phnom Penh is still low, therefore NSDP's implementation to achieve the targeted goal is needed urgently. In order to achieve the targeted goal, MIME is planning the action plan for water supply sector (in the year 2009-2013) and one of the four major points of the action plan is to promote cooperation with the private sector.

1.2 Objective of the Survey

Based on the circumstances above, this Survey investigates the capability of advanced technologies possessed by Japanese private enterprises in local areas of Cambodia, and to promote safe water service in provincial cities and rural areas of Cambodia where the service ratio still remains low. In parallel, the survey also collects basic information related to the commercialization by Public-Private Partnership (hereinafter referred to as PPP).

1.3 Study Area

The Study areas are the Kampot province and the Kep province.

1.4 Consistency of the Survey with Japanese Assistance Policy

Japan's aid policy toward Cambodia is stated in the document called "Country Assistance Program for Cambodia". Improvement/construction of water supply system is listed as one of the key issues of "Infrastructures for Social and Economic Development" in the document. The purpose of this Survey is consistent with the Japanese assistance policy for Cambodia.

Chapter 2 Current status in the field of waterworks in Cambodia

In this chapter current status of water sector in Cambodia is identified and based on the understanding, improvement for water supply of the local urban areas such as the Survey area are discussed.

2.1 Strategy of water sector in Cambodia

2.1.1 Rectangular Strategy

The National Assembly had enforced the Rectangular Strategy as a national development strategy. The four "growth rectangles" are (1) enhancement of agricultural sector; (2) continued rehabilitation and construction of physical infrastructure; (3) private sector growth and employment; (4) capacity building and human resource development; and "good governance" is placed at the core of the Rectangular Strategy.

"Good governance" focuses on anti-corruption, legal and judicial reform, public administrative and financial reform, and reform of the armed forces. In regards to the water supply field, Point 11 (14) of "1.2. Challenges faced by the Royal Government of Cambodia" of the Rectangular Strategy (Phase II: September 26th, 2008) states, "The provision of quality public health services is still limited. In spite of numerous achievements in the health sector, the maternal mortality rate is still high. The progress in promoting health care services, sanitation and clean water in rural areas needs to be speed up to meet the targets set in the Millennium Development Goals." Point 68 states "…The Royal Government will pay more attention to the rights of people to clean water supply access to ensure food safety and better livelihoods in accordance with the Cambodia Millennium Development Goals (CMDGs)...”In addition, Point 69 states "...the Royal Government will encourage private sector participation in the development and the management of irrigation systems and clean water supply."

2.1.2 National Strategic Development Plan Update (NSDP Update) 2009 to 2013

The MDGs of Cambodia was set in 2003. In its goals, the water sector was set to "halve the percentage of people without constant access to safe drinking water by 2015". Concrete target values are shown in Table 2.1.

Table 2-1 Cambodia Millennium Development Goals in the water sector

Sector performance indicators	Target		
	2005	2010	2015
Proportion of rural population with access to safe water	30%	40%	50%
Proportion of urban population with access to safe water	68%	74%	80%
Proportion of rural population with access to improved sanitation	12%	20%	30%
Proportion of urban population with access to improved sanitation	59%	67%	74%

Pursuing the reduction of poverty as a priority goal, the NSDP is a strategy that specifically sets out the target achievements of the CMDGs and the Rectangular Strategy. This development plan (NSDP) had determined the national strategy from 2006; however, the NSDP Update 2009-2013 was formulated in 2010 because of the global economic downturn and to synchronize the time period covered by the NSDP Update with the term of the Fourth Legislature of the Royal Government. The target values shown in Table 2.1 were altered to cut off at 2013 as per Table 2.2.

Table 2-2 NSDP update 2009-2013 (rural development and health goals)

Item	Target values			
	2010	2011	2012	2013
Access to improved drinking water in rural areas	43.49%	44.99%	46.49%	47.69%
Access to safe drinking water in urban areas	54%	55%	57%	60%

The goals of the NSDP Update are also detailed as follows.

- To improve access to sanitation and clean water in rural areas
- To utilize private water supply and private capital
- To control water supply costs set by public and private water supply companies

The targets to improve the access to safe water are as shown above; the results in the year of 2011 are reported as 60% in urban area by MIME and 69% in rural area by MRD.

2.2 Challenges in water sector in Cambodia

As described above sections, while all public water utilities in Cambodia are required to expand and improve water treatment facilities and distribution network in order to improve access ratios or achievement of CMDGs, they are also expected to renew and improve decrepit facilities.

Common challenges facing regional town water supply operations in Cambodia include lack of development funding, and inability to individually secure project funds to expand and develop facilities, renew and improve decrepit facilities. The government's policy, therefore, is to make use of private funds provided mainly by official development assistance. Further, water suppliers lack people to formulate basic designs and construction phase, so systematic training is required. In addition, water treatment plants using traditional rapid sand filtration methods are not operated and controlled appropriately, and rising power costs are placing pressure on the management of such plants. Therefore, when it comes to water supply operations in regional towns, introducing water treatment facilities that are easy to operate and/or are low-cost would be desirable.

However, 80.5% of the Cambodian population lives in rural areas according to the Census of 2008, and only 40.49% of them have access to safe water. Although it is essential to improve water supply facilities in rural regions in order to protect many Cambodians from waterborne diseases, many rural areas are characterized by scattered dwellings, and therefore developing urban-style water supply is difficult. Furthermore, in the case of groundwater, there are many shallow wells in the Mekong and Tonle Sap basins that are contaminated with arsenic, and wells in other regions contain a lot of iron. Due to this, many residents of rural areas buy untreated river water conveyed trucks or treated water conveyed by trucks from relatively near treatment facilities at approximately 1.25 to 3.0 dollars per 1 m^3. This is a large expense considering that cash incomes in rural areas are as low as 200 to 900 US dollars per household. Therefore, developing water supply facilities that cater for small, scattered, low-population density villages and are economical and/or easy to operate are required in rural areas.

2.3 Water utilities in Cambodia

In this section, organizations, which are tackling aforementioned targets and challenges, are introduced.

2.3.1 Water utilities of MIME

MIME administers water supply operations that make use of water treatment equipment and a water supply distribution network. MIME also supervises water supply operations that are run commercially by public authorities and private companies. On the other hand, MRD administers rural water supply

facilities that are owned and run by the local community.

There are 16 public water suppliers in the 13 provinces of Cambodia in 2011. Two of the 16 public water suppliers, the PPWSA and SRWSA are managed independently and 14 of those suppliers are directly administered (through provincial DIME) by the Department of Potable Water Supply (DPWS) of the MIME. However due to lack of funding, the provincial capital water supply utilities of Kampong Chhnang, Prey Veng, Ratanak Kiri (Ban Lung), Kratie, Koh Kong, Kampong Speu, which possess superannuated water facilities, transferred the water utility licenses to private local companies in Cambodia from the year of 2011 aiming to utilize the vitality of the private sector. In addition to the privatization, there is a provincial capital water utility such as Sihanouk Ville which water supply capacity of bulk water largely exceeds the capacity of public water supply capacity. In addition, the future expansion of water treatment plant capacity depends on the private company. The capacity of Sihanouk Ville Water Supply is 8,000 m^3/day while the capacity of the private company is 20,000 m^3/day as of February 2012.

Number of public water supply utilities will be less than eleven after 2012, including PPWSA, SRWSA and Mondul Kiri Water Supply which is under planning. Refer to Table 2.3. The number of public water supply utilities as of February, 2012 is 14 utilities.

Table 2-3 Public water supply and the recent movement

No.	Name of City	2011-2012	Comments
1	Phnom Penh		Constructing Niroth WTP
2	Siem Reap	-JICA, -KTC Co., Ltd, - Capacity building	Need pipe expansion for KTC project.
3	Sihanouk Ville	-Started project of pipe replacement and expansion -Capacity building	Anco Brothers: 20,000 m3/day Public : 8,000 m3/day
4	Pursat	-Started project of pipe replacement and expansion -Capacity building	
5	Battambang	-Started project of pipe replacement and expansion -Capacity building	Need new treatment plant
6	Kampong Cham	Capacity building	Need more wells
7	Kampong Thom	Capacity building	Need pipes improvement
8	Svay Rieng	Capacity building	Need pipes improvement
9	Kampot	Capacity building	Need pipe improvement
10	Kampong Chhnang		Privatization
11	Prey Veng		Privatization, Need improvement
12	Ratanak Kiri(Ban Lung)		Privatization, Will develop
13	Kratie		Privatization, Need improvement
14	Stung Treng		ADB's improvement project starts
15	Kandal (Ta Khmau)		Under PPWSA
16	Kampong Speu		Private
17	Banteay Meanchey		Private
18	Ta Keo (DaunKeo)		Private
19	Koh Kong		Private
20	Oddor Meanchey		Private proposed
21	PreahVihear		Private
22	Kep		Private, Bankrupt, Extension of license
23	Pai Lin		Private

24	Mondul Kiri (Senmonorom)		Will develop till 2014

PPWSA and SRWSA are independent utilities financially and all of the other water utilities under direct control of MIME have to report and get approval for all organizational matters including financial matters. PPWSA has to report to MIME weekly and other utilities have to report monthly.

2.3.2 Phnom Penh Water Supply Authority (PPWSA)

PPWSA operations have developed gradually with the help of assistance from donors to date. It is under preparation to get into public stock market for 15% of total capital.

The operating areas of PPWSA cover the entire Phnom Penh City and includes congested areas that extended into Kandal Province's districts continuing from Phnom Penh City. In addition, the PPWSA entered into an agreement with MIME to provide the SRWSA with advisory services in management operations.

Looking at the management situation of the PPWSA, it is in a very good condition. In 2010, PPWSA supplied 102.169 million M^3 of water, 103% in respond to the basic daily needs. The number of network connection has increased up to 202.929 distribution networks. Furthermore, PPWSA has been able to maintain a reasonable price for water tariffs compared to provincial town water suppliers. The average tariff is approximately 1,019 KHR. The payment collection rate is a high as 99.22%.

The Phnom Penh Water Supply Authority is currently running three water treatment plants, and one other plant is currently being constructed (Niroth WTP). Refer to Table 2.4 for more details.

Table 2-4 Water treatment plants run by PPWSA

Water treatment plant	Capacity	Donor country
Chroy Chan War WTP	130,000 m^3/day	France, Japan, WB
Chumcar Mon WTP	20,000 m^3/day	France
PhumPrek WTP	150,000 m^3/day	Japan
Total capacity of existing facilities	300,000 m^3/day	
Niroth WTP (under construction)		Japanese and French co-financing

Source: PPWSA

2.3.3 Siem Reap Water Supply Authority (SRWSA)

A water treatment plant managed by the SRWSA was completed in January 2006 with grant aid from Japan. Supply capacity is currently 8,000 m^3/day and the SRWSA's operating area is limited to city centers. To meet the demands, which are greatly exceeding supply capacity due to the current growth of the tourism industry, expansion planning is advancing through two cities water supply programs and it is run by KTC (Korean company) and Japanese Yen Loan projects. When these facilities are completed (scheduled: 2017), they will have an overall supply capacity of 85,000 m^3/day. While the SRWSA is considered as a success authority in Cambodia on par with PPWSA, future issues facing the Authority include stabilizing management by switching from hotels' private wells etc. to water supplied by SRWSA, and complying with government instructions concerning groundwater regulations. The SRWSA is currently receiving management guidance and advice from the PPWSA under a consultant dispatch and assignment agreement. The SRWSA's management ability is sufficient for the project planned by this study.

2.3.4 Private water suppliers

MIME is promoting the increase of safe water access ratio to enhance the activities of private water suppliers due to the lack of fund. As of January 2012 the numbers of private water suppliers are: 114 organizations are under operation, 19 organizations are under construction, and 12 organizations are under application and total number of these organizations reaches 146. Water sources of the services are diverse such as wells, ponds, lakes, streams and rivers. The capacity varies from 300 to 9,600 m^3/day and majority of the area has around 700 m^3/day. Number of connections of these services is from 28 to 2000. Most of their water charges are 2,500 KHR/m^3or 0.63 US$/ m^3 and among them charges of 2,800 KHR/ m^3 or 0.70 US$/$m^3$ are found.

It seems that besides these registered private water suppliers, some non-license water suppliers exit.

2.3.5 Ministry of Rural Development (MRD)

Typical water supply operations under the jurisdiction of the MRD include communal tap operations by pumping groundwater. These are not privately managed, but are run by communities and NGOs. In recent years, there have been needs for water supply; therefore, MRD has been required to install water supply networks, even in a low-population or remote areas. Hence, MRD has to supervise the operation of water supply facilities run by communities.

The project planned by this study will not fall under the jurisdiction of the MRD. This is because maintaining the equipment will be difficult for communities and because the "MIME will administer water supply operations that are run commercially by public authorities and private companies", as stated in the “Memorandum of Understanding on Piped Water Supply System Between Ministry of Rural Development And Ministry of Industry, Mines and Energy” dated February 7th, 2005 between the MIME and MRD.

MRD announced the “Rural Water Supply, Sanitation and Hygiene Strategy 2010-2025, August 2010”, and promised that its new policy targets "100% water supply and 100% sanitation coverage for rural people by 2025."

2.4 Organization of MIME and its Action Plans

2.4.1 Organization of MIME

Water–related department of MIME is Department of Potable Water Supply (DPWS). Figure 2.1 shows the location of DPWS in MIME organization chart.

Major Roles and Functions of Ministry of Industry, Mines and Energy in water sector are as follows:

- Develop and implement water sector policy and strategy
- Develop urban water supply statistic and development plan
- Donors coordination
- Regulating and supporting the sector
- Develop water standards, procedures and guidelines
- Administration and monitoring public water utilities.
- Laboratory

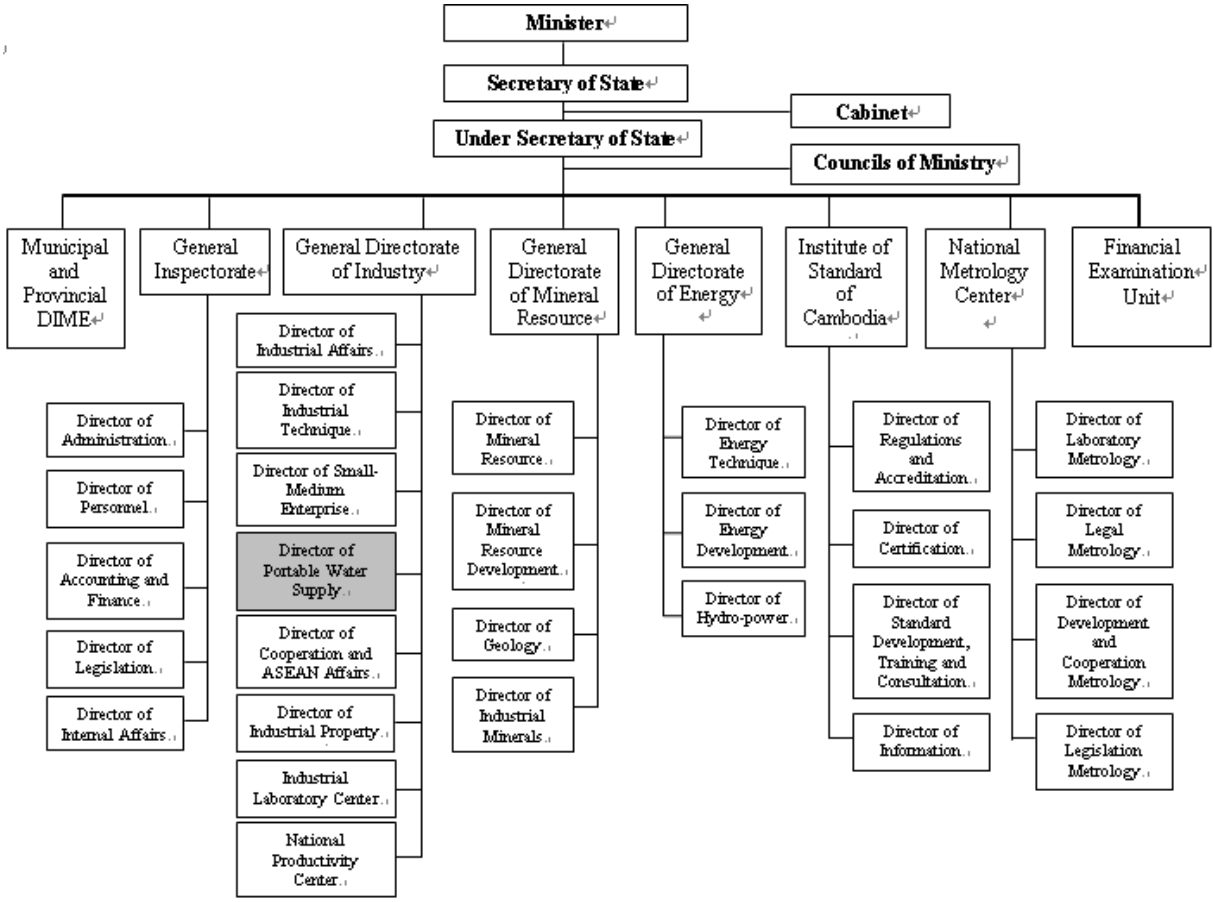


Figure 2-1 Location of DPWS in organization chart of MIME
(Source: MIME-DPWS)

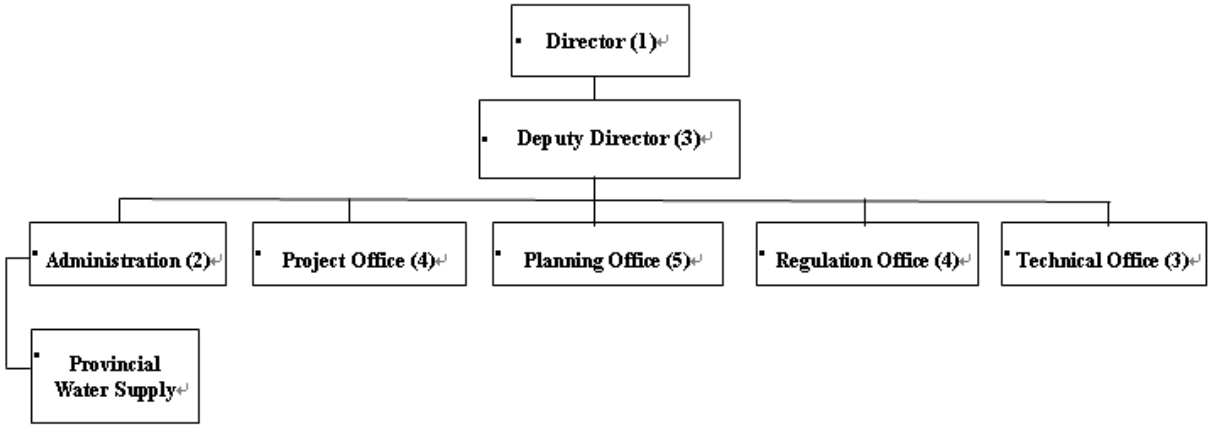


Figure 2-2 Organization of DPWS
(Source: MIME-DPWS)

The Department of Potable Water Supply is located under the General Director of Industry and has three Deputy Directors under the Department Director. And under those Deputy Directors are the Administrative Section, the Project Office, the Planning office, the Regulation Office, and the Technical Office. There are four to five permanent staffs in each section, and the total number of employees working in the Department of Potable Water Supply is 22. Water Supply Sections in each province are under the command of DIME. The Department of Potable Water Supply is made up of a total of six engineers, two civil engineers, one chemist, two electrical engineers, and one mining

professional. Features of the DPWS's responsibilities and authorities are well demonstrated by the three sections/offices listed below.

- Project Office: project administration, monitoring and assessment; administering public investment; collaborating with related parties and advisors domestically and abroad
- Planning Office: formulating strategic policies and planning of the Department of Potable Water Supply; monitoring and assessing ongoing strategies and policies; forming and promoting water supply projects; creating city and provincial water supply statistics and annual reports on water supply operations; and advising water suppliers
- Technical Office: formulating water quality standards; monitoring and assessing water quality; educational activities relating to safe water; creating standards and a legal system concerning water supply; water sector R&D; and technical advice

2.4.2 Action Plans etc. of MIME

The major challenge of the sector is the low access to clean and safe water. The reasons to this are low standard of living and shortage of financial resources.

Paying high attention to the poor, MIME sets their vision of utilities as a leading utility in supplying clean water supplier with safe, adequate and affordable tariff. To realize these MIME has been tackling the four efforts to:

1) Expand and improve service coverage
2) Improve level of service standards
3) Improve technical and economic efficiency and financial viability and
4) Address the specific need of the poor and protect the environment.

MIME's strategic long term goals were set as follows:

(1) Strategies for Implementing the Rectangular Strategy Phase II (2009-2013)

1) Promoting of the private sector participation
2) Improving public utilities
3) Protecting the poor and subsidy
4) Protecting environment and promote sanitation

(2) Action Plans for 2011-2013

1) Institutional Strengthening, Good Governance and Capacity Building

Action Plans:

- Prepare job description and Standard Operational Procedure (SOP) of each task of the five offices
- Review, re-assign the duties and strengthen the duty implementation and the responsibilities of officials of the department
- Review the roles and responsibilities of the municipal/provincial departments (DIME) related to urban water supply and strengthen the implementation
- Strengthen the implementation of the Common Statute for Civil Servants
- Continue strengthening and building the capacity of the officials in the fields of administration, technical and foreign language

2) Improving and Strengthening Regulations

Action Plans:

- Prepare the procedure and guideline for the investment in the water supply sector
- Develop a water tariff policy
- Prepare the policy on subsidy of the water connection for the poor
- Review and update the permit (Prakas) on the production-business of water supply
- Strengthen the implementation of the permit (Prakas) on the production-business of water supply
- Prepare the technical regulations and guidelines on the water quality improvement and production-business of water supply
- Strengthen the enforcement of the concession contracts
- Prepare database for water coverage areas (water coverage map)

3) Strengthening and Improvement of Public Waterworks

Action Plans:

- Strengthening and improving the efficiency of business and governance of the waterworks
- Continue administrating and follow up the progresses of the water works
- Continue building the human resources in management and technology
- Establishment of the Cambodia Water Works Association

4) Cooperation Projects with Develop Partners
Refer to 2.5.1, 2.5.2,

MIME is tackling aforementioned activities. For financial problems MIME gets supports from foreign assistances and NGO activities. Currently MIME has mainly received financial supports from two organizations: JICA and ADB. JICA is supporting in the Phase 2 of Capacity Building. As the name suggests, the project aims at building capacity of the eight Water Supply organizations in Pursat, Battambang, Siem Reap, Kampong Thom, Kampong Cham, Svay Rieng, Kampot, and Kampong Tom. This support will continue as Phase 3 from fiscal year 2012. ADB is financially supporting the Domestic Twining Program for Cambodia. The project provides technical assistance through PPWSA to develop network distribution in four provinces namely Kampot, Svay Rieng, Kampong Thom and Pursat. The project's length is 18 months, starting from February 1st.

2.5 Trends of other donor and ODA of Japan in relevant field

2.5.1 Trend of other donor other than Japan

Other international aids other than Japan are remarkable in the replacement and expansion of distribution system. That is to say, aging and shortage of distribution network has become remarkable nationwide. The related projects are listed on the action plan of "Cooperation Projects with Develop Partners" of MIME material.

Action Plans（Extract）:

- Network Expansion Project in urban areas (USAID)
- Water Supply Network Expansion and Sanitation at Kampot(UN-HABITAT)
- Water Supply Network Expansion at Pursat, Kampong Cham, Kampong Thom and Svay Rieng (UN-HABITAT)
- Pipe Expansion for Peri-Urban (WB)
- Pipe replacement in Kampot(GRET)
- Kampot Water Work improvement (GRET)

Table 2-5 shows recent assistance records of WB, UN-HABITAT and ADB.

Table 2-5 Recent assistance of WB, UN-HABITAT and ADB in water sector

No	Project Name	Project Areas/ Outline	Period	Budget
WB				
1	Urban Water Supply and Sanitation Sector Review	Country level	Apr. 2011-Feb. 2012	
2	Mekong Integrated Water Resource Management	-----	-----	32.5 M
3	*Urban Water Supply Project (IDA-30410)	The rehabilitation/extension of the Chruoy Chang Var treatment plant. Expansion of water supply in Sihanouk Ville. Development of a water supply and sanitation policy.	28 Sept. 1996	30.96 M
4	*Provincial and Peri-Urban Water Supply and Sanitation Project (IDA-H0340)	Output Base Aid (OBA) approach Svay Rieng, Prey Veng, Kompong Cham, Banteay Meanchey	Approval date: 22 Apr. 2003, closed now	19.9 M
5	*Provincial and Peri-Urban Water Supply and Sanitation Project (IDA-3746)	Design Build and Lease (DBL) Approach; Svay Rieng, Prey Veng Kampong Cham, Banteay Meanchey	-----	-----
6	*Pipe Expansion for Peri-Urban in Phnom Penh	-----	-----	-----
WSP				
7	Capacity Building for Small Scale Private Operator-Pilot Project	-----	-----	-----
8	Water and Sanitation Financing Strategy	-----	-----	-----
9.	Pilot project for aqua test kits with small scale private operators	-----	-----	-----
ADB				
10	Project on Regulatory Reform and Enforcement (negotiation to review of the regulatory framework in urban water supply 2011-12	-----	-----	-----
11	Twinning projects between WSA and 5 water works (Battambang, Kampong Chnnang, Kampong Speu, Kampot and Pursat)	-----	-----	-----
12	*Phnom Penh Water Supply & Drainage (With World Bank, supported PPWSA)	Expansion of water distribution system, Phnom Penh	1996-2003	-----
13	*Mekong Water Supply and Sanitation Project (Improvement Water Supply and Sanitation in Kratie and Stung Treng	Kratie and Stung Treng	May to Dec., 2009	1,2 M (TA)
14	*The Provincial Towns Improvement Project (1725/2013-CAM (SF))	Upgrading of the water supply systems in 6 towns: Battambang, Pursat, Kapong	Apr. 2000-Dec. 2006	16.3 M

No	Project Name	Project Areas/ Outline	Period	Budget
	(Continued)	Thom, Kampong Cham, Svay Rieng, Kampot		
15	The Water for Asian Municipalities (WAC)	-----	-----	-----
16	Provision of Water Supply and Sanitation Services with the Support from Mekong Region Water and Sanitation Initiative Programme	-----	2007-Now	-----
17	*Pipe Extension and Sanitation in Kompot	-----	-----	0.294 M Co-finance with Kampot utility (US$353, 500) and community (US$ 26,000)
18	*Pipe Extension in 4 Towns of Kampong Thom, Kampong Cham, Pursat and Svay Rieng	-----	-----	1.652 M Co-finance with 4 utilities (US$ 371,000) and communities.
19	*Project on Water Supply and Sanitation Expansion in Kampot Under Framework MEKWATSAN Phase I	Kampot	2008 to Apr, 2012	214, 300
20	*Project on Water Supply and Sanitation Expansion in Kampong Cham, Kampong Thom, Pursat and Svay Rieng Under Frame work MEKWATSAN Phase II	Pursat, Kampong Cham, Kampong Thom, Svay Rieng	December, 2009 to November 2012	1,065 M

Source: JICA

2.5.2 Trend of ODA from Japan

Present projects for improving infrastructure for water supply and sanitation promoted by JICA in Cambodia are shown in Table 2.6. “The Project on Capacity Building for Water Supply System Phase 3” is a technical cooperation continued from the same phase 2 project. During and before the Phase 2, emphasis was placed mainly on technical aspects, but Phase 3 focuses on the improvement of operation and management of water utilities. Targets for the phase 3 are planned; it includes eight provincial cities’ water utilities of the Phase 2 plus MIME, namely nine organizations. The phase will be started with detailed plans and is scheduled for five years including full-scale works to achieve technical transfer.

Table 2-6 Recent program for improving infrastructure for water supply and sanitation

Project	Scheme	Status
The Project on Capacity Building for Water Supply System Phase 2	TCP	Scheduled to end in March 2012
Niroth Water Supply Project （Phnom Penh）	Loan	JICA+AFD
Siem Rep Water Treatment Plant Expansion Project	Loan	Loan agreement in March 21012
The Project on Replacement and Expansion of Water Distribution System in Provincial Capitals	Grant	Bidding in February 2012
The Project for Flood Protect and Drainage Improvement in the Phnom Penh Capital City (Phase 3)	Grant	
Data Collection Survey on Japanese Water Treatment Technology for Rural Area	Data Collection	Dec. 2011 –Mar. 2012
The Project on Capacity Building for Water Supply System Phase 3	TCP	Fiscal year of 2012, the project will continue for approx. 5 years.

Source: JICA

For the forthcoming ODA schemes of water supply, etc. development issues will be set up based on policy consultations with host countries through program approach in order to conduct assistances more strategically. Hence Japan will pursue the ODA policy by tackling the ODA schemes as one development plan to organically combine loan aids, grant aids and technical cooperation programs.

Up to date, Japan has executed many loan assistances and grant aids; in addition, Japanese NGO aid and grassroots human security aid have been provided. Table 2.7 shows a record of recent Japanese grant aid and loans in the water supply field.

Table 2-7 Record of Japanese grant aid and loans

Year of arrangement	Investment type	Name of project	Ceiling amount ('00,000,000 yen)
2009	Grant	Project for Rural Drinking Water Supply in Memot District of Kampong Cham Province	3.69
2008	Loan	Niroth Water Supply Project	35.13
2006	Grant	Project for Rural Drinking Water Supply in Kampong Cham Province (Phase 2)	4.31
2005	Grant	Project for Rural Drinking Water Supply in Kampong Cham Province	4.34
2004	Grant	Project for Improvement of Water Supply System in Siem Reap Town	15.37
2003	Grant	The project for Improvement of Water Supply System in Siem Reap Town (Detailed Design)	0.74
2003	Grant	Project for Rural Drinking Water Supply in Peri-Urban of Phnom Penh City (Phase 2)	4.42
2002	Grant	Project for Rural Drinking Water Supply in Peri-Urban of Phnom Penh City (Phase 1)	7.84
2001	Grant	Project for Expansion of PhumPrek Water Treatment Plant	25.8
2000	Grant	Project for Expansion of PhumPrek Water Treatment Plant (Detailed Design)	0.6
1997	Grant	Project for Improvement of the Water Supply Facilities in Phnom Penh (Phase II)	21.12
1996	Grant	Project for Improvement of the Water Supply Facilities in Phnom Penh (Phase II Detailed Design)	0.42
1994	Grant	Project for Improvement of the Water Supply Facilities in	17.71

		Phnom Penh (Phase II)	
1993	Grant	Project for Improvement of the Water Supply Facilities in Phnom Penh (Phase I)	9.8

Source: Ministry of Foreign Affairs of Japan documents

2.6 Improvement for water supply and PPP project in local urban areas

As mentioned in the section of 2.3.1, number of public water supply in provincial capitals will be less than eleven including PPWSA and SRWSA. To discuss on the methodology of improvement for these water utilities the summary of the current movement of the eleven utilities is summarized in Table 2-8.

Table 2-8 Summary of current movement of the 11 utilities

Name	Recent conditions
PPWSA	-function in self-supporting accounting system - open 15% of capital in stock market in 2012
SRWSA	- function in self-supporting accounting system - start a project of JICA loan aid - bulk water supply plan of KTC Co. Ltd. -under capacity building
Sihanouk Ville Water Supply	- entrust expansion of water treatment facilities to Anco Brothers Co., Ltd. - start construction of distribution network expansion by JICA grant aid from Feb. 2012. - under capacity building
Pursat Water Supply	- start construction of distribution network expansion by JICA grant aid from Feb. 2012. - under capacity building
Battambang Water Supply	- start construction of distribution network expansion by JICA grant aid from Feb. 2012. - under request of water treatment expansion by JICA grant aid - under capacity building
Kampong Cham Water Supply	-under request of water treatment expansion by JICA grant aid - under capacity building
Kampong Thom Water Supply	- under capacity building
Svay Rieng Water Supply	- under capacity building
Kampot Water Supply	- under capacity building
Stung Treng Water Supply	- start rehabilitation work of a treatment plant by ADB fund
MondulKiri (Senmonorom)	- under planning of JAIF project, and start operation from 2014

As shown in the above table, Water Supply Utilities other than PPWSA are lacking of funds and are in need of capacity development. One of the ways to solve these problems is to introduce private sector participation in which MIME is promoting. Among the private sector participation, transferring of full privatization is one of the options; however, it is unclear ifthis option is able to maintainits the existing level of service. .

Public Private Partnership (PPP) is one of options, which the selection of private sector participation can be make use of. The purpose of PPP is to provide inexpensive and good quality of public services utilizing private sector vitality such as financial procurement, capacity, technical expertise and management know-how. As the result, public services can concentrate into higher function of public services such as quality control, and at the same time can decrease the level of financial expenditures. Also public services can realize more efficient and sound administrative function. While the populations or users can get high quality public services, the special purpose company (SPC), which is

a private company, can obtain appropriate profit and the possibility of rational risk sharing at the same time.

To ensure the appropriate profit, rational risk sharing becomes the major premise. It is required to burden many kinds of investment and to share risks such as tariff revision mechanism. By doing this, the basis of long-term relationship is being built and maintained.

From Table 2-8 water supply utilities, which seems appropriate to apply the future PPP projects from the view point of private company, will be SRWSA, Pursat Water Supply, Battambang Water Supply, Kampong Cham Water Supply, Kampong Thom Water Supply, Svay Rieng Water Supply and Kampot Water Supply, etc.

From these viewpoints, and from the applicability of Japanese water treatment technology, Kampot town and the vicinity of Kep province are selected as the study areas.

2.7 Influence of the 2011 flood to water sector in Cambodia

2.7.1 Situation overview of Cambodia – floods 2011

Heavy rains and overflow of Mekong River have brought floods to many parts of Cambodia since the second week of August. According to the Government of Cambodia, flooding has affected 18 of the 24 provinces/municipalities, which covered over 12 million Cambodians or 90% of the population (NIS 2008).

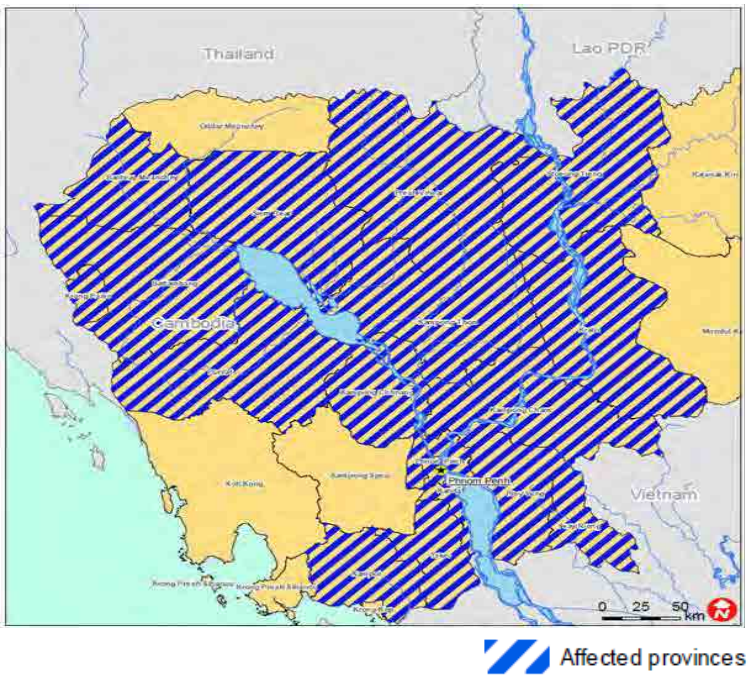


Figure 2-3 Areas affected by floods from August to October 2011 (1)

As of 28th October 2011, the National Committee for Disaster Management (NCDM) and Cambodian Red Cross has reported that:

- Kandal, Kampong Thom, Prey Veng and Kampong Cham were the most badly affected provinces.
- 1,640,000 people or 350,274 households have been affected, including 700,000 children and 51,594 households evacuated.

- 247 people killed and 23 people injured.

According to a report of UN organizations in Cambodia as of 18th November 2011,

- 423,449 hectares of rice fields have been affected with 265,804 hectares reported as damaged. (With the total area of planted rice at 2,466,429 hectares, this represents 10.7 per cent of total crops destroyed).

Table 2-9 Affected population figures

Ranked by Nber affected	Census (2008)	Affected population			Affected area	
		IFRC 10/10		NCDM 18/10		
Province Name	**Population**	**People**	**%**	**Households**	**Districts**	**Communes**
Prey Veng	947,372	312,879	33	40,615	8	86
Kandal	1,265,280	164,615	13	68,649	11	101
Kampong Cham	1,679,992	140,431	8.4	33,436	14	74
Kampong Thom	631,409	112,955	17.9	54,414	8	71
Siem Reap	896,443	74,705	8.3	23,198	12	78
Phnom Penh	1,327,615	66,562	5	17,150	3	22
Kratie	319,217	65,524	20.5	15,601	5	32
Svay Rieng	482,788	57,750	12	17,076	7	39
Takeo	844,906	33,050	3.9	7,869	7	32
Battambang	1,025,174	31,458	3.1	7,111	9	35
Kampong Chhnang	472,341	31,135	6.6	7,413	6	31
Pursat	397,161	30,689	7.7	12,158	4	12
PreahVihear	171,139	21,836	12.8	5,199	8	10
Kampot	585,850	15,792	2.7	5,509	2	6
Stung Treng	111,671	12,621	11.3	3,005	5	21
OtdarMeanchey	185,819	1,487	0.8	354	5	7
Banteay Meanchey	677,872			13,008	7	28
Pailin					1	2
Total	**12,022,049**	**1,173,489**	**10**	**331,765**	**122**	**687**

2.7.2 Effect on water supply in Cambodia

Flooding has affected many parts of the country; fortunately, it has not caused any damages to the water supply facilities in the urban areas of Cambodia. According to MIME, there is no effect on water supply facilities under its supervision; therefore, the Ministry has not collected any information about the damage-related issues. So far, no counter-measure for flooding has been taken into consideration.

To PPWSA, the 2011 flood did not affect their facilities and they do not have any standards to prevent the flood yet.

In Siem Reap, however, the damage caused by floods was quite severe. According to Mr. Channy, the Deputy Director of SRWSA, flood water leaked into some air valves, damaged some flow-meters, and softened the soil above some distributed pipes, leading to breaking of pipes when trucks ran on those softened areas.

Kampot was also slightly affected by the floods. The affected areas were Bantheay Meas commune and Kampong Trach commune, in particular the areas located along the borders of the two communes. In the interview with the Survey team on 16 January 2012, Mr. SOK Kimchoeun, the Deputy Director of Kampot DIME said that no facilities of KWS were affected by the floods. In Kep, on the other hand, since flooding was caused mainly by heavy rainfalls, the water flooded Kep town for only a few days.

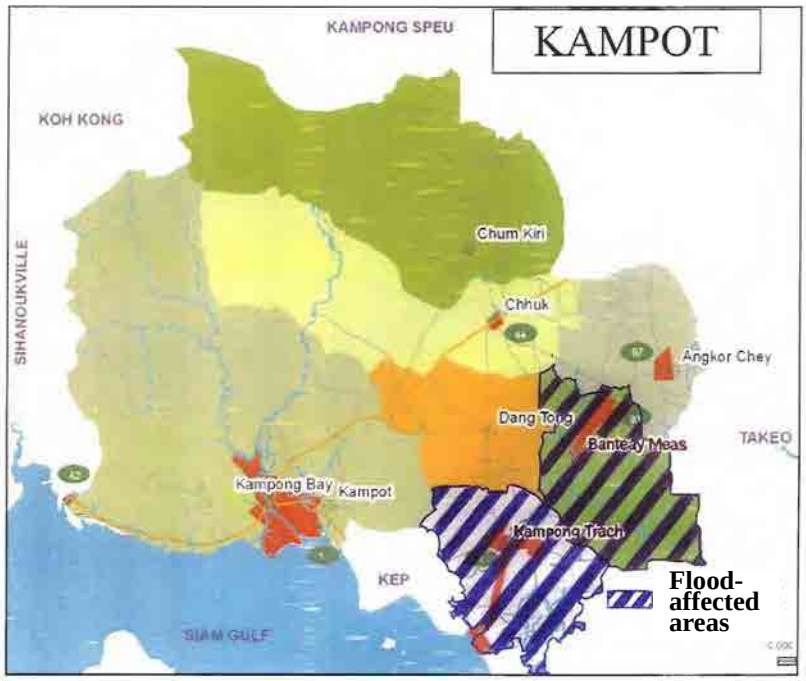


Figure 2-4 Areas affected by floods from August to October 2011 (2)

Chapter 3 Current status of PPP projects in the field of waterworks in Cambodia

3.1 Government's policies and current legal system in regards to PPP

Although Cambodia is still at an early stage of implementing its PPP project, some large-scale PPP projects especially in the power, communication and transport sectors have been implemented. The Government of Cambodia regards PPP as one of the important instruments to fill the financing gap by stimulating the private sector investment in infrastructure. Thus, the Government of Cambodia has been seeking for the improvement of the legal framework as well as the PPP transaction procedures.

In an attempt to significantly improve the service quality, the service coverage, and the efficient use of resources in Cambodia, the Government's policies in regards to PPP have been initiated when the Private Sector Development Committee (PSDC) was established in 2006. Following the establishment of the Committee, the National Assemble adopted the Law on Concession in 2007, providing a legal framework for the promotion of PPP projects. The Law on Concession provides an overview of how PPP concessions can be implemented in a competitive manner, but there are no uniformed operational guidelines for the implementations of PPP projects.

In response to these practical needs for the operation of PPP project, the draft sub-decree for the Law on Concession was prepared, and the main contents of the draft sub-decree are as follow. The draft sub-decree is the most important legal framework in terms of defining the regulatory and institutional framework of PPP projects, providing the operational guidelines to implement PPP projects.

- Establishment of prequalification, evaluation and award committees to oversee procurement using concessions
- Conformity with sectoral development plans
- Procurement with transparency, equality of treatment and efficient competition
- Bidding Procedures
- Technical Criteria for Bidding
- Financial Criteria for Bidding
- Post Award Obligations

In spite of the absence of a complete framework, a considerable number of PPP projects have been or are being carried out in Cambodia. Table 3-1 indicates the list of major PPP projects in Cambodia as of the end of 2011. In the water sector, 16 small rural distribution concessions and bulk water BOT were implemented apart from a lot of small-scale licensed water supply projects.

Table 3-1 Major PPP Projects in Cambodia (as of December, 2011)

Sector	Number and Form of PPP
Power	6 Hydro Power Generation BOTs 3 Coal Powered Generation BOTs 2 Transmission Leases/BOTs
Airports	3 Airport Concessions Air Navigation Services
Roads	National Route 4, Concession Various Rural Concessions
Rail	Operating and Maintenance Contract
Sea Ports	Oil Terminal and Dry Port Concession
Water	16 Small Rural Distribution Concessions 1 Bulk Water BOT
Solid Waste Management	2 Concessions

Source: Assessment of PPPs in Cambodia: Constraints and Opportunities, 2011

3.2 Current situation of PPP project

In the water sector of Cambodia, MIME and MRD govern controls over water sector policies and approval of water supply projects including PPP projects. A sector strategy for urban and rural water supply and sanitation (2010-2028) was prepared, estimating the required investment amount in Cambodia. Meanwhile, MIME also prepared its action plan to achieve the sector strategy. The action plan includes the programs of facilitating PPPs.

According to the database of MIME, the number of water supply projects to be implemented by the private sector, so far in Cambodia is 136. The majority of those projects are the license-based transactions. Licenses do not require any public sector investment without any risks for the government. Out of these projects, there are 16 small-scale concessions as well as a bulk water supply BOT project, which are PPP projects in the water sector. There have been no cases which Japanese firms joined any of PPP projects the water sector of Cambodia.

In addition to the above-mentioned PPP projects, the World Bank is a major player in the field of donor-assisted PPP projects in the water sector. The World Bank provided a loan to the Government of Cambodia to help the country reach the Millennium Development Goals in water supply and sanitation by 2015. Two approaches were piloted under the Cambodia Provincial and Peri-Urban Water and Sanitation Project.

The first approach is the Design-Build-Lease (DBL) scheme, which is similar to a construction contract. Payments are made to the winning contractor on the basis of inputs, and the same contractor is responsible for operating and managing the system over a 15-year period. In exchange, the contractor/operator pays the government a lease fee.

The second approach is the Output-based Aid (OBA) scheme using a Design-Build-Operate (DBO) contract. Under this scheme, the winning contractor is paid an agreed amount for every connection made to a pre-identified poor household. The bulk of the payment is made only after the connections have been validated as functioning by an independent engineer. The same contractor is made responsible for operating and managing the water supply system over a 15-year period but is not required to pay a lease fee to the government.

Table 3-2 World Bank assisted Design-Build-Lease (DBL) and Output-based Aid (OBA) Projects

Type	Province	Company	No. of Connections	Tariff (KHR per m^3)	Contract Year
DBL	Prey Veng	KIM MEX	3,208	1,560	2004
DBL	Svay Rieng	CCEC	466	2,100	2004
DBL	Svay Rieng	CCEC	364	2,100	2004
DBL	BanteayMeanchey	SAKOR	1,564	2,000	2005
DBL	BanteayMeanchey	SAKOR	1,313	2,000	2005
DBL	BanteayMeanchey	PHUM NIMITH	439	2,450	2005
DBL	BanteayMeanchey	PHUM NIMITH	1,310	2,000	2005
DBL	BanteayMeanchey	CCEC	885	2,350	2005
DBL	BanteayMeanchey	CCEC	980	2,400	2005
OBA	Kampong Cham	SINCAM	587	2,000	2005
OBA	Kampong Cham	SOPHORNRATANAK	1,006	2,000	2005

Source: MIME

Chapter 4 Related laws and regulations

4.1 General

4.1.1 Legal system

Legislator is composed of the National Assembly and the Senate. After the bill is adopted by the National Assembly, it is deliberated by the Senate. If the bill is passed, the King promulgates the law. The hierarchy of domestic Cambodia legal instruments is shown as Table 4-1.

Table 4-1 Hierarchy of domestic Cambodia legal instruments

No.	Domestic Cambodia legal instrument	Explanation
1	The Constitution	The Constitution is the supreme source of law in Cambodia.*1
2	Treaties and Convention	Treaties and Convention is signed and ratified by the King after a vote of approval by the National Assembly. *2
3	Chhbab: Law	A law is adopted by the National Assembly and the Senate, and promulgated by the King or the acting Head of State. A law must be in strict conformity with the Constitution. *1
4	Royal Kram: Preah Reach Kram and Royal Decree: Preah Reach Kret	A Royal decree is issued by the King in the exercise of his constitutional powers. A Royal decree must be in strict conformity with the Constitution. *1
5	Anu-Kret: Sub-Decree	A Sub-Decree is adopted by the Council of Ministers and signed by the Prime Minister. A Sub-Decree must be in strict conformity with the Constitution and conform to the Law to which it refers. *1
6	Prakas: Ministerial Order	A proclamation is a ministerial or inter-ministerial decision signed by the relevant Minister(s). A proclamation must conform to the Constitution and to the law or sub-decree to which it refers. *1
7	SechkdeiSamrech: Decision	Decision is issued by Prime Minister and Prakas-Deikais issued by the Governor based on the authority, which is stipulated in laws. *3
8	Sarachor: Circular	A circular is an instrument that a Ministry or higher authority use to clarify a point of law or to provide instructions. A circular is only advisory and does not have the force of law. *1
9	Arrete: Provincial Deka	Provincial Deka is issued by The State Governor and effective in the State. *3

*1 Office of the High commissioner for Human Rights Cambodia, United Nations Human Rights,http://cambodia.ohchr.org/klc_pages/klc_english.htm
*2 Articles 26, The Constitution of the Kingdom of Cambodia
*3 Cambodia Investment Guidebook, CDC, January 2010

4.1.2 Judicial system

In Cambodia, a three-tiered court system is adopted. Table 4-2 shows the abstract of the three-tiered court system in Cambodia.

Table 4-2 Cambodian judicial system

Court	Location	Explanation
Supreme Court	Phnom Penh	This is the highest appellate court which covers all cases except electoral and constitutional matters.
Appellate Court	Phnom Penh	This court hears all cases appealed from a court of first instance.
Court of First Instance	Municipal/Provincial (Military court is located in Phnom Penh.)	This is the lowest court which is composed of the Provincial, Municipal and Military courts, and covers all cases regardless of the nature or magnitude of the dispute.

4.2 Concession and BOT

Laws on the Private Public Partnership have not been formulated yet in Cambodia. Therefore, in order to describe the laws related to the Private Public Partnership, Law on Concession and Sub-Decree on Build-Operate-Transfer (BOT) Contract are mentioned in this section.

4.2.1 Law on concession

Law on Concession was established on 2007 in order to promote and facilitate the implementation of privately financed in the Kingdom of Cambodia, which is divided into six chapters and applies to the following sectors as specified in Article 5 of this law: 1. Power generation, Power transmission and Power distribution, 2. Facilities system, is included, but not limited to roads, bridges, airports, ports, railways, channel, 3. Water supply and Sanitation, 4. Telecommunication and Information Technology Infrastructure, 5. Supra-structure related to tourism projects, not limited to tourism resort museums, 6. Gas and Oil related infrastructure including oil and gas pipelines, 7. Sewerage, Drainage and Dredging, 8. Waste management and Treatment, 9. Hospitals and other infrastructure related to health, education and sport sectors, 10. Infrastructure related to special economic zones and social housing, 11. Irrigation and agricultural related infrastructure, and 12. other sectors for which a specific law allows for the granting of Concessions.

A concession contract which is defined the mutually binding agreement between the contracting institutions and the concessionaire, and which sets forth the terms and conditions for the implementation of an infrastructure project is provided by ten types of means. Table 4-3 shows these means stipulated in Article 6. According to MIME, there are no differences of responsibility between urban water supply concession and rural water supply concession.

Table 4-3 Concession means

Type		Asset	OM	Invest
BOT	Build Operate and Transfer	Pri→Pub (After period)	Pri	Pri (Construction)
BLT	Build Lease and Transfer	Pri→Pub (After period)	Pri (Lease)	Pri (Construction)
BTO	Build Transfer and Operate	Pri→Pub (After Construction)	Pri	Pri (Construction)
BOO	Build Own and Operate	Pri	Pri	Pri (Construction)
BOOT	Build Own Operate and Transfer	Pri→Pub (After period)	Pri	Pri (Construction)

BCT	Build Cooperate and Transfer	Pri→Pub (After period)	Pub+Pri	Pri (Construction)
EOT	Expand Operate and Transfer	Pri→Pub* (After period)	Pri	Pri (Expand)
MOT	Modernize Operate and Transfer	Pri→Pub (After period)	Pri	Pri (Modernize)
MOO	Modernize Own and Operate	Pri	Pri	Pri (Modernize)
-	Lease and Management Operation or Management Agreement	Pub*	Pub+Pri (Lease) Pri (Lease)	Pub*

* Not defined clearly in the law but confirmed with MIME

Selection and organization of the concessionaire is mainly determined in Chapter 3. Concession period is determined not to exceed 30 years; however, it can be extended in case of completion delay or interruption of operation due to the reason specified in Article 37 of this law.

Figure 4-1 shows the flow of selection and organization of the concessionaire. According to MIME, Infrastructure Project is approved as eligible if the field of the project is clear such as water supply or electricity and so on.

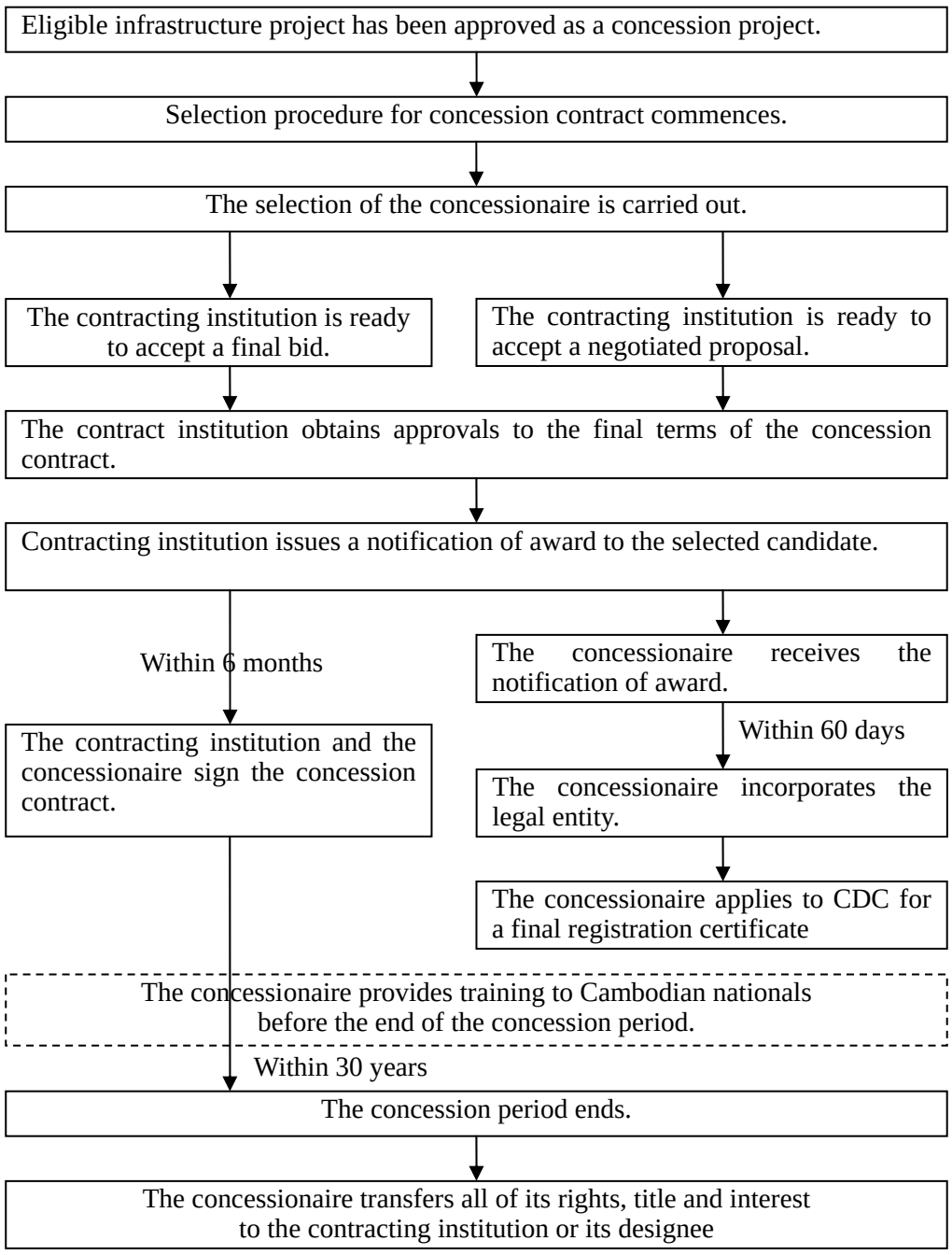


Figure 4-1 Concession flow

Article 11 mentions that the selection of the Concessionaire is determined to be carried out with the procedures provided for in the Sub-Decree; however, according to MIME, it is not regulated in the law. Other sample projects are mainly conducted by the following two types of procedures: proposal and bidding which are shown in Figure 4-2 and Figure 4-3.

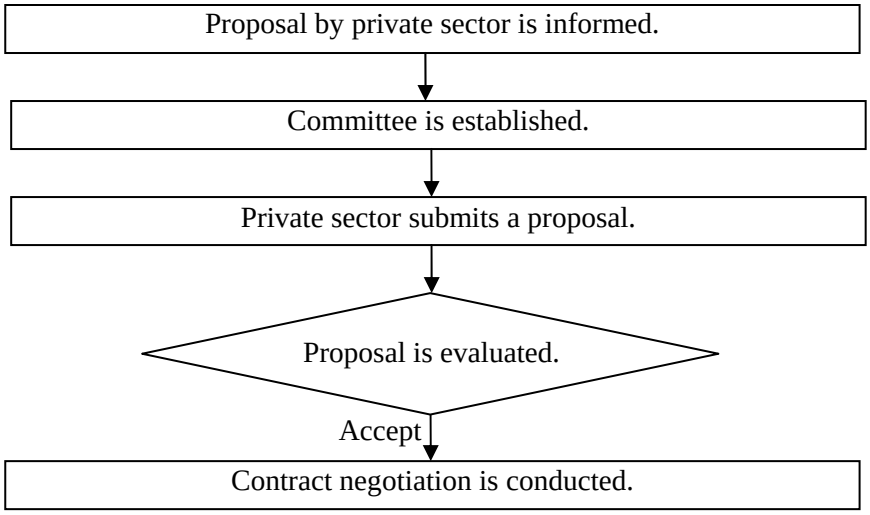


Figure 4-2 Proposal procedures

In proposal selection of the concessionaire, after the proposal by private sector is informed, committee which is organized by MIME, MEF and tax house is established. Then, private sector submits a proposal to the committee and it is evaluated by the committee based on the criteria such as water tariff, specification, technical, finance and so on. If the committee accepts the proposal, concession contract between the concession institution and the concessionaire is made through contract negotiation.

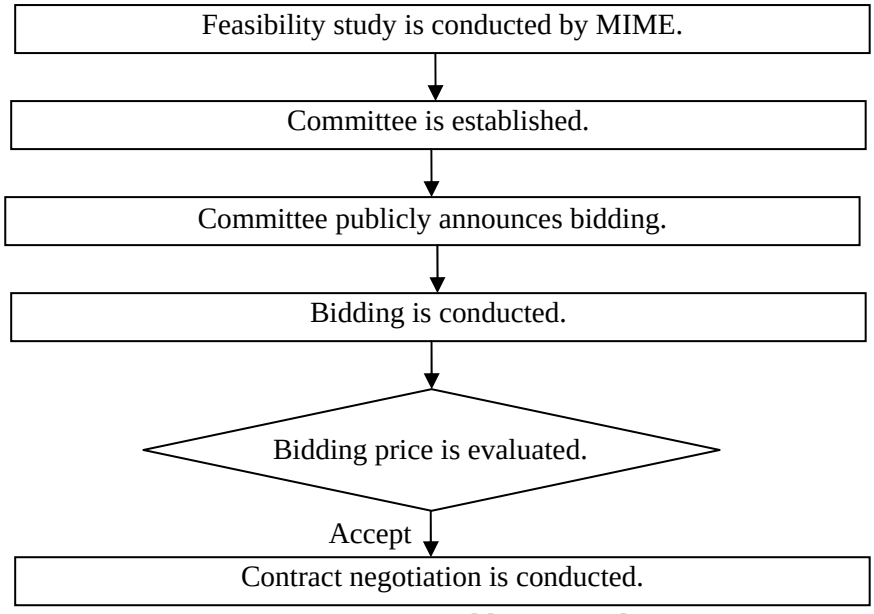


Figure 4-3 Bidding procedures

In bidding selection of the concessionaire, the committee is established after feasibility study by MIME. Then, the committee publicly announces bidding and the bidding is conducted. After the evaluation of bidding price, concession contract between the concession institution and the concessionaire is made through contract negotiation.

In financing for the implementation of the infrastructure project, Article 16 stipulates that a guarantee

can be granted in exceptional circumstances, however according to our investigation, it turned out that there is no government guarantee from MIME. In addition, Article 20 and 21 mention that the concessionaire should be responsible for the design, construction, operation and maintenance of the infrastructure facility at its own cost and risk except as provided in the concession contract.

4.2.2 Sub-Decree on Build-Operate-Transfer (BOT) Contract

Sub-Decree on Build-Operate-Transfer (BOT) Contract was established on 1998, which applies to the following seventeen fields: 1.electricity power plants, 2.roads and highways for vehicles, 3.ports, 4.telecommunication networks, 5.railroads, 6.residential development, 7.hospitals, 8.schools, 9.airports, 10.stadiums, 11.tourism resorts, 12.new cities, 13.hydropower stations, 14.dams, 15.factories, 16.clean water production plants, and 17.solid waste processing. This Sub-Decree is divided into four Chapters.

BOT period is determined not to exceed 30 years except for the terms and conditions which are stipulated in the contract. Chapter 2 mentions concessionaire selection procedures. BOT contract is determined to be conducted through international or national bidding process, however the selection is to be conducted through the negotiation procedure in the case which is stated in Article 9.

In addition, institution which decides the technical and financial selection of the concessionaire is mentioned in Article 10. If the investment project costs less than or equal to five million dollars, it is decided between the Minister in charge of the related project, MEF and CDC.

4.3 Laws and regulations regarding water supply operation

4.3.1 Water supply and sanitation regulation law draft

There are no laws related to water supply and sanitation in Cambodia. Water Supply and Sanitation Regulation Law Draft which is composed of nine chapters defines the Regulator and regulates its powers and functions. This draft law was submitted to the Council of Ministers as of 2006 already, however making it to the legislation have been paused now.

Furthermore, it is regulated in the draft that the Regulator shall approve or disapprove tariff and all amendment to any tariffs for water supply and sanitary sewerage services, but at present according to MIME, only MIME has the right for decision making.

4.3.2 Law on Environmental Protection and Natural Resource Management

Law on Environmental Protection and Natural Rescore Management, which was enforced in 1996, was established as a basic law on environmental protection in Cambodia. This law is a supreme legal instrument for governing environmental protection and natural resource management, which is divided into ten chapters. The purpose of this law is regulated as the following five points;

1) To protect and promote environmental quality and public health through the prevention, reduction, and control of pollution.
2) To assess the environmental impact of all proposed projects prior to the issuance of a decision by the Royal Government.
3) To ensure the rational and sustainable conservation, development, management, and use of the natural resources of the Kingdom of Cambodia.
4) To encourage and enable the public to participate in environmental protection and natural resource management.
5) To suppress any acts that cause harm to the environment.

In Chapter 3, environmental impact assessment which procedure is determined by Sub-Decree on Environment Impact Assessment Process is regulated to be done on every project and activity. Also environmental protection is mentioned significantly in Chapter 5, however the detail such as prevention, reduction, and control of airspace, water and land pollution, noise, vibration disturbances are determined by following Sub-Decree.

4.3.3 Sub-Decree on Environment Impact Assessment Process

Sub-Decree on Environment Impact Assessment Process was established on 1999 in compliance with Article 6 of the Law on Environmental Protection and Natural Rescore Management. This law applies to every proposed and ongoing project(s) and activities, either by private, joint-venture or state government, ministry institutions, except for a special case in which a project is approved by the Royal Government. The main purpose of this Sub-Decree is regulated as the following three points;

1) To determine an environmental impact assessment upon every private and public project or activity, and it must be reviewed by the MOE, prior to the submission for a decision from the Royal Government.
2) To determine the type and size of the proposed project(s) and activities, including existing and ongoing activities in both private and public prior to undertaking the process of environmental impact assessment.
3) To encourage public participation in the implementation of environment impact assessment process and take into account of their conceptual input and suggestion for re-consideration prior to the implementation of any project.

This Sub-Decree is divided into eight chapters. Chapter 4 mentions procedures of environmental impact assessment process for reviewing proposed project(s). On the other hand, Chapter 5 mentions procedures of environmental impact assessment process for reviewing existing project(s). Also the list of the projects requiresan initial environmental impact assessment to be included with the annex of this Sub-Decree, in which water supply project requires environmental impact assessment when the users of the project is over 10,000.

4.3.4 Sub-Decree on Water Pollution Control

Sub-Decree on Water Pollution Control was established on 1999 in compliance with Article 13 of the Law on Environmental Protection and Natural Rescore Management, which applies to all sources of pollution and all activities that cause pollution of the public water area. The supreme purpose of this Sub-Decree is to ensure the protection of human health and the conservation of bio-diversity. To archive this purpose, the water pollution control is regulated in this Sub-Decree.

This Sub-Decree is divided into six chapters. Chapter 2 mentions provisions on waste and hazardous discharge and standards for effluent discharge from any sources of pollution to public water areas or sewer which is specified in the annex 2. Table 4-4 shows the annex 2 of this sub-decree. Meanwhile any discharge standards by MIME has not been regulated yet, they have no plan to make a legislation related to discharge standards as of January 2012.

Table 4-4 Effluent standard for pollution sources discharging wastewater to public water areas or sewer

No.	Parameters	Unit	Allowable limits discharging to protected public water area	Allowable limits discharging to public water area and sewer
1	Temperature	˚C	<45	<45
2	pH		6-9	5-9
3	BOD_5(5 days at 20˚C)	mg/L	<30	<80
4	COD	mg/L	<50	<100
5	Total Suspended Solids	mg/L	<50	<80
6	Total Dissolved Solids	mg/L	<1000	<2000
7	Grease and Oil	mg/L	<5.0	<15
8	Detergents	mg/L	<5.0	<15
9	Phenols	mg/L	<0.1	<1.2
10	Nitrate(NO_3)	mg/L	<10	<20
11	Chlorine(free)	mg/L	<1.0	<2.0
12	Chloride(iron)	mg/L	<500	<700
13	Sulphate(as SO_4)	mg/L	<300	<500
14	Sulphide(as Sulphur)	mg/L	<0.2	<1.0
15	Phosphate(PO_4)	mg/L	<3.0	<6.0
16	Cyanide(CN)	mg/L	<0.2	<1.5
17	Barium(Ba)	mg/L	<4.0	<7.0
18	Arsenic(As)	mg/L	<0.10	<1.0
19	Tin(Sn)	mg/L	<2.0	<8.0
20	Iron(Fe)	mg/L	<1.0	<20
21	Boron(B)	mg/L	<1.0	<5.0
22	Manganese(Mn)	mg/L	<1.0	<5.0
23	Cadmium(Cd)	mg/L	<0.1	<0.5
24	Chromium(Cr^{+3})	mg/L	<0.2	<1.0
25	Chromium(Cr^{+6})	mg/L	<0.05	<0.5
26	Copper(Cu)	mg/L	<0.2	<1.0
27	Lead(Pb)	mg/L	<0.1	<1.0
28	Mercury(Hg)	mg/L	<0.002	<0.05
29	Nickel(Ni)	mg/L	<0.2	<1.0
30	Selenium(Se)	mg/L	<0.05	<0.5
31	Silver(Ag)	mg/L	<0.1	<0.5
32	Zinc(Zn)	mg/L	<1.0	<3.0
33	Molybdenum(Mo)	mg/L	<0.1	<1.0
34	Ammonia(NH_3)	mg/L	<5.0	<7.0
35	DO	mg/L	>2.0	>1.0
36	PolychlorinatedByphemyl	mg/L	<0.003	<0.003
37	Calcium	mg/L	<150	<200
38	Magnesium	mg/L	<150	<200
39	Carbon tetrachloride	mg/L	<3	<3
40	Hexachlorobenzene	mg/L	<2	<2
41	DTT	mg/L	<1.3	<1.3
42	Endrin	mg/L	<0.01	<0.01
43	Dieldrin	mg/L	<0.01	<0.01
44	Aldrin	mg/L	<0.01	<0.01
45	Isodrin	mg/L	<0.01	<0.01
46	Perchloro ethylene	mg/L	<2.5	<2.5
47	Hexachloro butadiene	mg/L	<3	<3
48	Chloroform	mg/L	<1	<1

No.	Parameters	Unit	Allowable limits discharging to protected public water area	Allowable limits discharging to public water area and sewer
49	1,2 Dichloro ethylene	mg/L	<2.5	<2.5
50	Trichloro ethylene	mg/L	<1	<1
51	Trichloro benzene	mg/L	<2	<2
52	Hexaxhloro cyclohexene	mg/L	<2	<2

(Quotation from the Sub-Decree on Water Pollution Control)

In addition, to the waste and hazardous discharge and standards for effluent discharge, any sources of pollution which is classified into two categories according to the annex 3 are required to have permission from MOE before discharging or transporting their effluent to other places. Pure drinking water manufacturing is classified into category I, which is subject to the prior permit when the amount of their effluent exceeds ten cubic meters per day but not including the amount of water volume used for cooling engine. As mentioned in Chapter 4, MOE is responsible for monitoring the pollution sources, and those who violate of this Sub-Decree is fined and punished as it is mentioned in Chapter 7.

4.3.5 Law on Water Resources Management

Law on Water Resources Management was established on 2007 in order to foster the effective and sustainable management of the water resources of the Kingdom of Cambodia, in which water resources means sea, river, tributary, stream, waterfalls, canal, lake and swamp, pond, reservoirs or storage. The following three things are determined in this law;

1) The rights and obligations of water users
2) The fundamental principles of water resources management
3) The participation of users and their associations in the sustainable development of water resources

This law is divided into eleven chapters and Article 7 mentions the Royal Government of Cambodia shall encourage the collaboration with and participation of the relevant agencies, private sectors, beneficially groups, NGOs, and international organizations.

In addition, water resources usage and development such as the conditions, modalities and procedures for granting, transfer, cancellation, time limitation, extension, suspension of water usage licenses and the water usage fee are to be determined by Government Sub-Decree in Article 13, however the Government Sub-Decree is not formulated yet. This means there are no laws or regulations related to procedures for granting water usage license or water usage fee. According to MIME, they are reported to MOWRAM as custom practice.

4.3.6 Sub-Decree on River Basin Management Draft

Sub-Decree on River Basin Management Draft which is intended to set forth procedures of planning and its implementation for effective management, conservation and development of river basins within Kingdom of Cambodia is under approval of the Council of Ministers. This Sub-Decree composed of eight chapters covers all of the river systems existing in the Kingdom of Cambodia.
Chapter 2 defines river basin zoning. Table 4-5 shows the list of river basins with their size mentioned in Annex II, and Table 4-6 shows the distance of riparian and coastal strips from river basins determined in Article 5.

Table 4-5 Lists of river basins within Kingdom of Cambodia

No.	Code	Name of River Basin	Size (km^2)
I River Basins within Coastal Region			
1	1	Prek Kampong Bay	3,018
2	2	PrekToek Sap	1,529
3	3	PrekSreAmbel	2,653
4	4	PrekAndongToek	2,460
5	5	PrekTrapang Rung	2,615
6	6	PrekTatai	1,619
7	7	PrekKohPao	3,109
8	8	Stung Me Toek	1,043
		Sub-Total I:	18,045
II River Basins within Tonle Basac Region			
9	9	Stung Toan-han	1,765
10	10	Stung Slakou	2,485
11	11	Stung PrekThnot	7,055
		Sub-Total II:	11,305
III River Basins within Tonle Sap Region			
12	12	Stung KrangPonley	3,033
13	13	Stung Baribour	3,003
14	14	Stung Bamnak	1,116
15	15	Stung Pursat	5,964
16	16	Stung Svay Don Keo	2,228
17	17	Stung MoungRussei/Dauntry	1,468
18	18	Stung Sangker	6,052
19	19	Stung MongkolBorey	5,264
20	20	Stung Sisophon	5,593
21	21	Stung Sreng	9,931
22	22	Stung Siem Reap	3,619
23	23	Stung Chikreng	2,714
24	24	Stung Staung	4,357
25	25	Stung Sen	16,342
26	26	Stung Chinit	8,236
27	39	BoengTonle Sap	2,743
		Sub-Total III:	81,663
IV River Basins within Northeastern Region			
28	27	Tonle Se Kong	5,564
29	28	Tonle Se San	7,621
30	29	TonleSrepok	12,780
31	30	PrekPreah	2,399
32	31	PrekKrieng	3,331
33	32	PrekKampi	1,142
34	33	Prek Te	4,363
35	34	PrekChhlong	5,599
		Sub-Total IV:	42,800
V River Basins within Upper Mekong River Region			
36	35	Mekong Riverine	10,373
		Sub-Total V:	10,373
VI River Basins within Southeastern Region			
37	36	TonleVaico	6,618
		Sub-Total VI:	6,618

VII River Basins within Lower Mekong Delta Region			
38	37	Mekong Delta Cambodia	8,723
39	38	Mekong Tonle Sap flood plains(Spean Troas)	1,508
		Sub-Total VII:	10,231
		Total:	181,035

(Quotation from the Sub-Decree on River Basin Management Draft)

Table 4-6 Distance of riparian and coastal strips from river basins

River Basins	Distance of Riparian and Coastal Strips
Riparian	100 meters from the coastal bank
River	50 meters from its bank
Stream	30 meters form its bank
Canal	20 meters from its bank
Small stream	10 meters from its bank
Main channel	10 meters from the terrace of channel embankment
Distribution channel	5 meters from the terrace of channel embankment
Irrigation channel	3 meters from the terrace of channel embankment
Basin area	100 meters from the maximum water level from the basin water surface
Basin embankment	20 meters from the terrace beneath the basin embankment at which the water level ranges from 4 meters to 8 meters.

(Quotation from the Sub-Decree on River Basin Management Draft)

Chapter 3 defines MOWRAM as a competent body in charge of the management, conservation, and development of all river basins across the Kingdom of Cambodia. A National Basin River Committee is also determined to be established as a technical advisory body of the Royal Government. In addition, the establishment of a sub-national River Basin Committee is mentioned in Chapter 6, which is subject to develop plans for management, conservation, allocation, rehabilitation and development of river basins, to submit the plans to MOWRAM for review and decision, to conduct monitoring of all activities within the river basins and so on.

In line with NSDP and public investment program launched by the Royal Government, MOWRAM is required to formulate strategic plans, action pans and operational plans, which should be based on the eight considerations stipulated in Article 9.

4.3.7 Sub-Decree on Water Licensing Draft

Sub-Decree on Water Licensing Draft which is designed to establish conditions, formalities, and procedures for issuance, transfer, extension, modification, cancellation, suspension, and to specify valid periods for water licenses or permits in Kingdom of Cambodia is under approval of the Council of Ministers. This Sub-Decree Draft is composed of nine chapters, which covers and governs all activities of water use either for consumption or for commercial purpose and development of water resources within the context of Kingdom of Cambodia.

After the General Provision in Chapter 1, Chapter 2 determines that MOWRAM shall be tasked with managing and registering water exploitation licenses or permits. Chapter stipulates the following six types of licenses or permits: 1.License or Permit to Make Use of Surface Water, 2. License or Permit to Make Use of Ground Water, 3. License or Permit for Drainage of Waste Water into Surface and ground water, 4. License or Permit to Exploit Ore Deposits of rivers, streams, canals, ponds, lakes, water reservoirs, natural reservoirs or sea, 5. License or Permit to fill in rivers, streams, canals, ponds, lakes, dikes, water reservoirs, natural reservoirs or sea beach, and 6.License or Permit for Construction of Waterworks Structure. Furthermore, only one license or permit is determined to be valid per exploitation site.

Chapter 4 stipulates the formalities and procedures of issuance, transfer, extension, modification and cancellation of water exploitation licenses or permits. Any natural person or legal entity who wishes to exploit and develop water licenses should submit the application form and the following documents to MOWRAM or provincial department of water resources and meteorology.

A. For natural person:
    1) A copy of an application form with tax stamp
    2) A copy of family book record or ID card certified by concerned chief of commune. (For foreign natural, a copy of passport certified by his/her country embassy or consulate is needed.)
    3) A copy of the proposed exploitation site with legality
    4) A copy of the report of technical and environmental impact assessment
    5) A copy of business plan

B. For legal entity in addition to the foregoing:
    1) A copy of letter of assignment as representative
    2) A copy of certificate of business registration
    3) A copy of statute of the company
    4) A copy of patent

MOWRAM or provincial department of water resources and meteorology is determined to reply with its approval or rejection in writing of the application within 45 days from the submission.

In addition, procedures of water exploitation license or permit suspension and revocation are stipulated in Chapter 5, and those who have failed to commence the operation within two years form the issue date of the licenses or permits are subject to suspension.

License or Permit fee is required for any natural person or legal entity who has obtained any water exploitation license or permit for commercial purpose and development of water resources to pay to the government in accordance with Chapter 6, however the detail registration and business fees are determined in a joint Prakas issued by MOWRAM and MEF.

4.3.8 Drinking Water Quality Standards for Cambodia

Drinking Water Quality Standards for Cambodia inyear 2004 (the standards in year 2004) were prepared with guidance from World Health Organization and the Advisory Panel of specialists on January 2004. The standards in year 2004 were based on the WHO drinking water quality guidelines in 2003 and those of other countries with particular adaption to the water quality problems in Cambodia.

It is provided that the standards in year 2004 shall be reviewed every five years in order to accommodate changes in knowledge of the risk posed by various chemical and microbial constituents of water as well as the capacity to respond to water quality risks, however revised standards (the revised standards for year 2011) have not been issued as of January 2012. The revised standards for year 2011 are drafted and are now waiting for approval of Prime Minister of MIME.

Table 4-7 shows the comparison of the basic standards of drinking water quality among the standards in year 2004, the revised standards for year 2011 and Japanese standards. In the revised standards for year 2011, the parameters are divided into the following two standards: urban standards and rural standards. In order to accommodate actual circumstances in Cambodia, the maximum value of each parameter is mitigated and the number of parameter is diminished from the standards in year 2004.

Table 4-7 Comparison of the basic standards of drinking water quality

Parameter	2004	2011 Urban(Draft)	2011 Rural(Draft)	Japan***
Thermotolerant Coliform	0	0	0	0
Color	5 NTU	15 TCU		5 NTU
Turbidity	5 NTU	2 At treatment plant outlet 5 (in network)	10 NTU or acceptable	2 NTU
Residual Chlorine Cl_2	0.2-0.5 mg/L	0.1-1.0 mg/L	0.2-0.5 mg/L	1.0 mg/L
pH	6.5-8.5	6.5-8.5	6.5-8.5	5.8-8.6
Chloride Cl^-	250 mg/L	250 mg/L		200 mg/L
Hardness*	300 mg/L	300 mg/L or acceptable	500 mg/L or acceptable	300 mg/L
Iron (Fe)	0.3 mg/L	0.3 mg/L	3 mg/L or acceptable	0.3 mg/L
Manganese (Mn)	0.1 mg/L	0.1 mg/L	0.4 mg/L	0.05 mg/L
Sodium (Na)	200 mg/L	250 mg/L		200 mg/L
Total Dissolved Solids** (TDS)	800 mg/L	800 mg/L	800 mg/L or acceptable	500 mg/L

*Total hardness as $CaCO_3$

**Conductivity can also be measured and it is roughly equivalent to twice the TDS value.

***Drinking Water Quality Standards, May 30 2003, Ministry of Health, Labour and Welfare Japan. Residual Chlorine is included Complementary Items.

Monitoring of drinking water quality is also regulated in Drinking Water Quality Standards for Cambodia. Table 4-8 shows the frequency of monitoring stipulated in the standards in year 2004. When the water analysis shows values exceeding the standards, it is provided that effort should be made to find the source of the problem. However, according to MIME, the suspension of the water supply should be taken when it extremely exceeds the standards.

Table 4-8 Frequency of monitoring, 2004

Parameter	Frequency
Color, pH, residual chlorine, turbidity, total dissolved solids	Daily
Arsenic, iron, manganese, nitrates, chloride, sulfate, hardness, aluminum	Quarterly
Arsenic, barium, cadmium, chromium, cyanide, fluoride, lead, mercury, nickel, nitrate, nitrite, selenium	Once a year
Organic constitutions and pesticides	Every 3 years

(Quotation from the Drinking Water Quality Standards for Cambodia 2004)

Table 4-9 and Table 4-10 show the frequency of monitoring stipulated in the revised standards for year 2011. There is a few difference between the standards in year 2004 and the revised standards for 2011 (Urban), however the number of the parameter which needs daily monitoring or quarterly monitoring inconsiderably decreased compared with the standards in year 2004 and the draft of the revised standards for year 2011 (Rural).

Table 4-9 Frequency of monitoring, 2011(Urban)

Parameter	Frequency
Color, pH, residual chlorine, turbidity, total dissolved solids, taste and odor	Daily
Thermotolerant coliform, ammonia, iron, chloride, hardness, aluminum, sulfate ion	Quarterly
Manganese, sodium, arsenic, barium, cadmium, chromium, copper, fluoride, lead, mercury, nitrate, nitrite, zinc	Once a year

(Quotation from the revised standards 2011)

Table 4-10 Frequency of monitoring, 2011(Rural)

Parameter	Frequency
Thermotolerant coliform, residual chlorine*	Every 6 months
pH, turbidity, total dissolved solids, taste and odor, hardness, arsenic, fluoride, manganese, nitrate, nitrite	Once a year

*Where chlorine is added by community management or Water Sanitation Users Group, chlorine residual to be tested every week.

(Quotation from the revised standards 2011)

4.4 Other laws

4.4.1 Law on the Amendment to the Law on Investment

Law on Investment that is composed of nine chapters was established in August 1998, in which investment license system was stipulated. In order to make the system simpler, just, automatic, and non-arbitrary, the Law was greatly revised, and in 2003, Law on the Amendment to the Law on Investment was finally issued. This Law governs all QIP and defines procedures by which any person establishes a QIP.

Chapter 2 mentions CDC, which is the sole and One-Stop Service organization responsible for the rehabilitation, development and the oversight of investment activities. The organization and functioning of CDC is specified by Sub-Decree on the Organization and Functioning of the Council for the Development of Cambodia.

The project, which has already passed the investment procedures and obtains final registration certificate from CDC can be granted investment incentives such as tax exemption. Figure 4-4 shows the flow of investment procedures provided in Chapter 3.

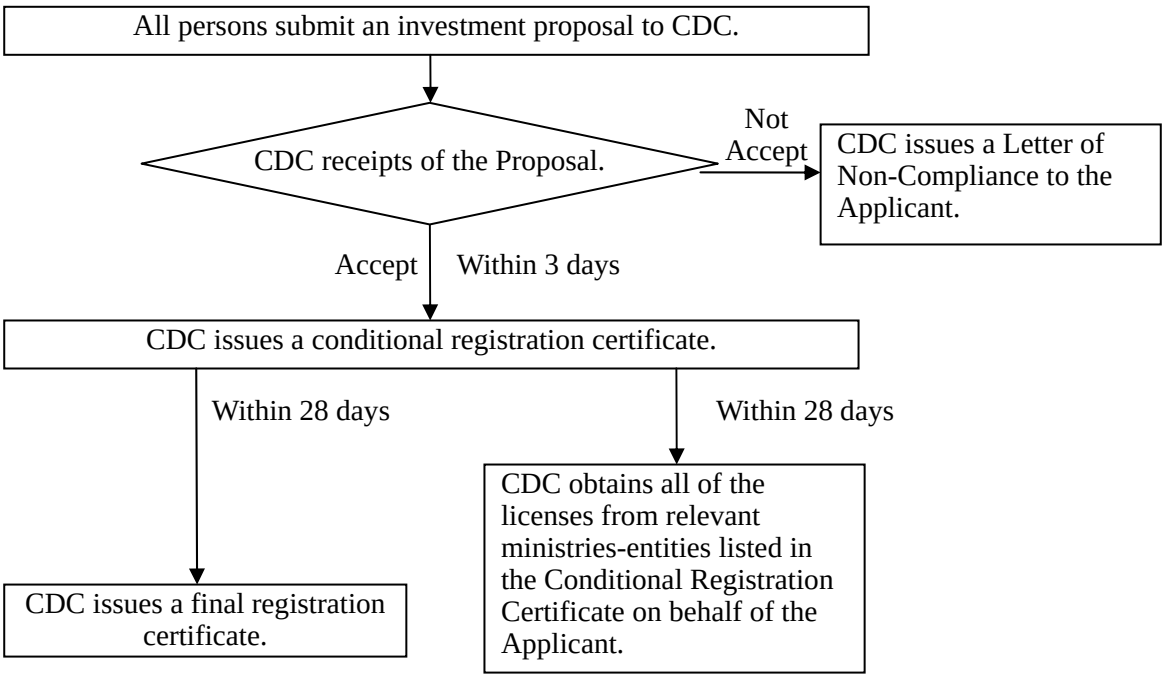


Figure 4-4 Flow of investment procedures

Chapter 5 mentions investment incentives. The incentives and privileges are determined to include the exemption, in whole or in part, of custom duties and taxes in Article 13. Article 14 states the period of the exemption and other related things so as to describe the detail.

4.4.2 Sub-Decree on the Organization and Functioning of the Council for the Development of Cambodia

Sub-Decree on the Organization and Functioning of the Council for the Development of Cambodia which is composed of four chapters was issued on 2008. In this Sub-Decree, roles and responsibilities of CDC is mentioned in Chapter 2 and it is also determined that CDC should submit for the approval of the Council of Ministers if the investment projects are included the conditions stipulated in Article 11.

4.4.3 Sub-Decree on the Implementation of the Law on the Amendment to the Law on Investment of the Kingdom of Cambodia

Sub-Decree on the Implementation of the Law on the Amendment to the Law on Investment of the Kingdom of Cambodia was established in 2005. This Sub-Decree aims to supplement and govern the application of the Law on Investment and is intended to encourage and regulate investments in the Kingdom of Cambodia by Cambodian entities and foreign entities. This Sub-Decree applies to every QIP registered at CDC and Provincial-Municipal Investment Sub-Committee (PMIS). Article 2 mentions scope of investment. All investment activities other than those activities which are set out in the Negative List in Schedule1, Part1 are applied to this Sub-Decree. In the case of water supply, the project with investment capital less than US$ 500,000 is stipulated not to be eligible for incentives. Investment incentives are provided to each project not to each investor.

4.4.4 Law on Commercial Enterprise

Law on Commercial Enterprise was adopted by the National Assembly of the Kingdom Cambodia on May 17th 2005 during the 2nd plenary session of the Third Legislature as a first comprehensive Law on Commercial Enterprise, which applies to partnership and company carrying on business in the Kingdom of Cambodia. As stipulated in Article 1, a partnership is composed of a general partnership and a limited partnership, while a company is composed of a private limited company, single member private limited company and public limited company. Chapter 4 states foreign business, which is divided by the following three types: 1. branch, 2. representative office, and 3. subsidiary. Table 4-11 and Table 4-12 show the feature of the partnership and the company which are mentioned in Chapter 2 and Chapter 3.

Table 4-11 Feature of partnership

Type	Legal Personality	Liability	Form of Contract
general partnership	Yes	Jointly and severelyliable for the debts of the partnership to third parties.	verbal or writing
limited partnership	NA	Liable only to the extent of the sum of money or value of the property he agreed to contribute.	verbal or writing

Table 4-12 Feature of company

Type	Legal Personality	Number of shareholders	Number of Directors	Issue securities to the public	Transfer Restriction of securities
private limited company	Yes	2-30	1 or more	No	Yes
single member private limited company	Yes	1	1 or more	No	Yes
public limited company	Yes	NA	at least 3	Yes	NA

Figure 4-5 shows procedures for formulation of a limited company, which is mentioned in Chapter 3.

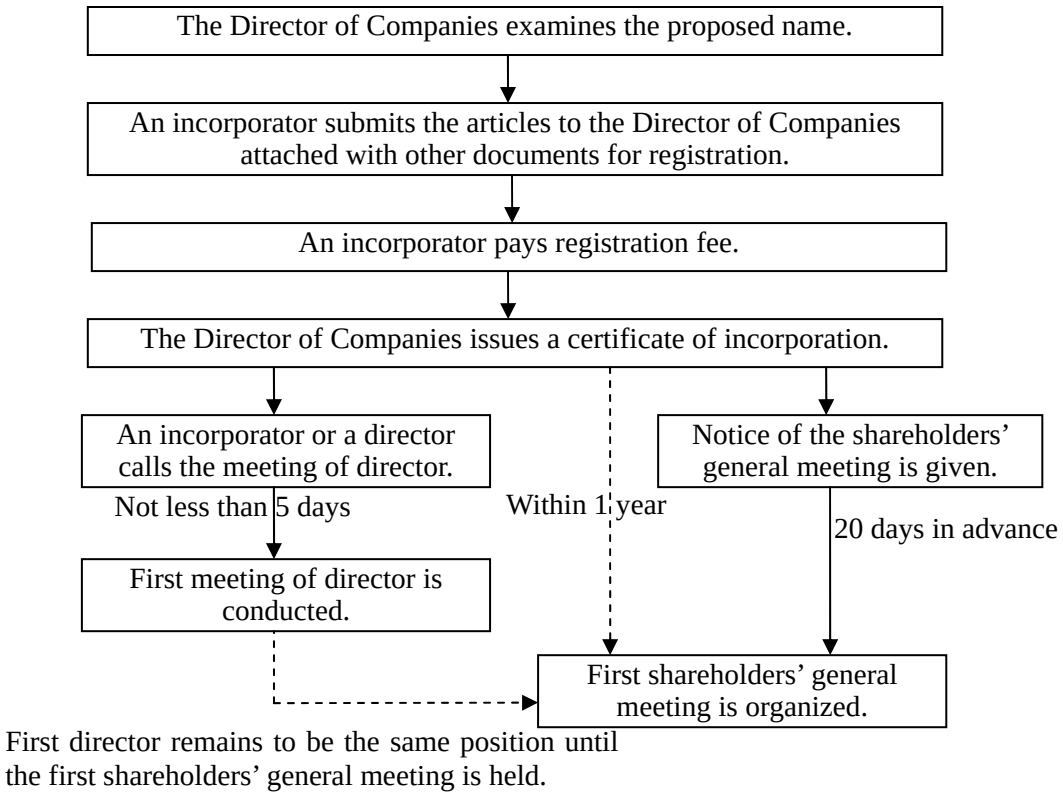


Figure 4-5 Procedure for formulation of a limited company

4.4.5 Prakas no. 679 MEF, dated 7 August 2007

Service charge for company registration is stipulated by Prakas no. 679 MEF, dated 7 August 2007. Table 4-13 shows service charge for company registration. Official registration fee is stipulated to be 420,000 KHR in total.

Table 4-13 Service charge for company registration

Detail	Official Registration Fee	Official Cancellation Fee	The Other Service Charge
1 Company ① Registration fee ② Registration procedure ③ Examination of the proposed company name ④ Registration of the company number	420,000 KHR 260,000 120,000 20,000 20,000	200,000 KHR	60,000 KHR
2 Registration as s Sole Proprietorship or those who pay tax for his profit	120,000KHR	60,000 KHR	20,000 KHR

(Reference from Prakas no. 679 MEF, dated 7 August 2007)

4.4.6 Law on Labour

Law on Labour was adopted by the National Assembly of the Kingdom of Cambodia on January 10th 1997 during the 7th session of the first legislature. Its purpose is to govern relations between employers

and workers from employment contracts, to the terms of labor and other related matters. Table 4-14 shows the terms of labor stipulated in this law.

Table 4-14 Terms of labor stipulated in Law on Labour

Item	Explanation
Forced Labor (Article 15)	Forced or compulsory labor is forbidden to everyone including domestics or household servants and all workers in agricultural enterprises or businesses.
Hiring or Dismissing (Article 21)	Every employer must make the declaration in writing to the ministry in charge of labor within fifteen days of hiring or dismissing a worker. Aagricultural enterprises has an exception to extend this period to thirty days.
Guaranteed Minimum Wages (Article 104 and Article 107)	The wage must be at least equal to the guaranteed minimum wage. The minimum wage is set by a Prakas of the Ministry in Charge of Labour, after receiving recommendations from the Labour Advisory Committee.
Working Hours (Article 137)	The number of hours worked by workers of either sex cannot exceed eight hours per day, or 48 hours per week.
Shift (Article 138)	When the work schedule consists of split shifts, the shifts are composed of the following two shifts: 1. in the morning and 2. in the afternoon.
Weekly Time Off (Article 146 and Article 147)	It is prohibited from using the same worker for more than six days per week. Weekly time off shall last for a minimum of 24 consecutive hours. In principle, all workers shall be given a day off on Sunday.
Paid Holidays (Article 166)	All workers are entitled to paid annual leave to be given by the employer at the rate of one and a half work days of paid leave per month of continuous service. The length of paid leave is increased at the rate of one day per three years of service.
Special Leave (Article 169 and Article 171)	All workers are entitled to a special leave up to maximum of seven days during any event directly affecting the worker's immediate family.
Maternity Leave (Article 182)	Woman is entitled to a maternity leave of nine days.
Child Labor (Article 177)	The allowable minimum age for wage employment is set at fifteen years.

(Reference from Law on Labour)

Article 266 provides workers and employers the right to form professional organizations which promote the interests and protects the rights, moral and material interests. Professional organizations of workers are called "worker unions", and those of employers are called "employers' associations". In the same Article, it is forbidden to form the trade unions or associations which include both employers and workers.

4.4.7 Law on the Amendments of article 139 and Article 144 of Labour Law

The Law on Amendment of Article 139 and Article 144 of Labour Law was adopted by the National Assembly of the Kingdom Cambodia on June 8th 2007 during the 6th plenary session of the third legislature and was fully adopted by the Senate on June 29th 2007 at its third plenary session of the second legislature. This law is composed of two Articles, in which overtime and night work are determined. Law on Labour stimulates that night work should be paid the same as overtime, however

in the Law on Amendment of Article 139 and Article 144 of Labour Law, it changed to be paid at a rate of 130% of the day time wage. Table 4-15 shows the provisions which is stipulated in this law.

Table 4-15 Provision which is stipulated in the Law on Amendment of Article 139 and Article 144 of Labour Law

Item	Explanation
Overtime (Article 139 New)	The overtime hours must be paid at an increased rate of 50%. Working overtime at night between 22:00h to 05:00h or weekly time off must be additionally paid at an increased rate of 100%.
Night Work (Article 144 New)	Night work must be paid at a rate of 130% of the day time wage.

(Reference from the Law on Amendment of Article 139 and Article 144 of Labour Law)

4.4.8 Law on the Amendment of the Law on Taxation

Law on The Amendment of The Law on Taxation was adopted by the National Assembly of the Kingdom Cambodia on February 4th 2003 and by the Senate on February 27th 2003, which amended Law on Taxation promulgated on February 24th 1997. This law is composed of the following six chapters: 1. Provisions for the Tax on Profit, 2. Provision for The Tax on Salary, 3. Provision for the Tax on Value Added, 4. Amendments to the Finance Act of 1994 and to the Amendments to the Finance Act of 1995, 5. Provisions on Tax Rules and Procedures, and 6. Closing Provisions. Table 4-16 shows main taxes and its rates stipulated in this law. Income exempt from tax, depreciation of tangible property, tax due, additional profit tax on dividends distributions and so on are added or revised.

Table 4-16 Taxes and its rates

Tax	Rate
Profit Tax (Article 20 New)	・ Legal person: 20% ・ Oil or natural gas production sharing contract and the exploitation of natural resources: 30% ・ QIP approved by CDC to be entitled to the 5 year transitional period commencing from the tax year: 9% ・ QIP during the tax exemption period as determined by CDC: 0%
Minimum Tax (Article 24 New)	・ Imposed at the rate of 1 % of the annual turnover inclusive of al taxes, except Value Added tax. ・ Except for QIP.
Withholding Tax (Article 25 New and Article 26 New)	Payment to residents; ・ Income received by a physical person from the performance of services: 15% ・ Royalties for intangibles and Interests in minerals: 15% ・ Interest: 15%(except Cambodian banks and saving institutions) ・ Interest paid by a Cambodian bank or savings institution to a resident taxpayer having a fixed term deposit account: 6% ・ Interest paid by a Cambodian bank or savings institution to a resident taxpayer having a non-fixed term deposit account: 4% ・ Income from the rental of movable and immovable property: 10% Payment to non-residents; ・ Interest: 14% ・ Royalties, rent and other income connected with the use of property: 14% ・ Compensation for management or technical service determined by

Tax	Rate
	・ Prakas of the MEF: 14% ・ Dividends: 14%
Tax on Salary (Article 47, Article 48, and Article 49 New)	・ (Resident) Monthly Salary is from 0 – 500,000 KHR: 0% ・ (Resident) Monthly Salary is from 500,001 – 1,250,000 KHR: 5% ・ (Resident) Monthly Salary is from 1,250,001 – 8,500,000 KHR: 10% ・ (Resident)Monthly Salary is from 8,5000,001 – 12,500,000 KHR: 15% ・ (Resident) Monthly Salary is from Over 12,5000,000 KHR: 20% ・ Non-resident: 20% ・ Fringe Benefits: 20%
Tax on Value Added (Article 64)	・ Taxable supply in the Kingdom of Cambodia: 10% ・ Service rendered outside of the Kingdom of Cambodia as stated in article 63:0% ・ Goods exported from the Kingdom of Cambodia: 0%

(Reference from the Law on the Amendment of the Law on Taxation)

4.4.9 Law on Corporate Accounting, Audit and Accounting Profession

Law on Corporate Accounting, Audit and Accounting Profession was adopted by the National Assembly on May 24th 2002 and was entirely approved by the Senate on June 21st 2002. This law determines the organization, management, and function of accounting system based on international accounting standards. This law is composed of the following eight chapters: 1. General provisions, 2. National Accounting Council, 3. Financial Statements, 4. Institute of Certified Public Accountants and Auditors, 5. Corporate Audit, 6. Accounting Profession, 7. Sanctions, and 8. Final Provisions.

Prakas no. 221 on the Implementation of Cambodian Accounting Standards and Cambodian Financial Reporting Standards adopted eighteen accounting standards and two financial report standards. In addition, Prakas no. 643. MEF on Obligation to Submit Financial Statements to be audited determines that all enterprise in Cambodia who fall in any two of the following three categories should submit their financial statements of respective year to independent auditors: 1. To have an annual turnover of 3,000,000,000 KHR upward, 2. To have total assets of 2,000,000,000 KHR upward pursuant to average price of assets available in the required year for audit, and 3. To have employees from 100 people upward pursuant to average price of assets available in the required year for audit.

4.4.10 Law on Insolvency

Law on Insolvency was issued in 2007 as a comprehensive law that stipulates insolvency in the Kingdom of Cambodia. The objectives of this law are to establish the rules, conditions, procedures, and proceedings governing the insolvency in the Kingdom of Cambodia and to provide collective, orderly and fair satisfaction of creditors' claims out of debtor's properties. This law is applied to all businessmen and legal entities that own assets in the Kingdom of Cambodia; howeveris not applicable to any debtor or creditor as they are covered under the following three laws: 1. Law on Banking and Financial Institutions, 2. Law on Insurance, and 3. Law on Non-Government Securities.

Figure 4-6 shows the flow of insolvency from petition to the assessment by administration which is mentioned in this law.

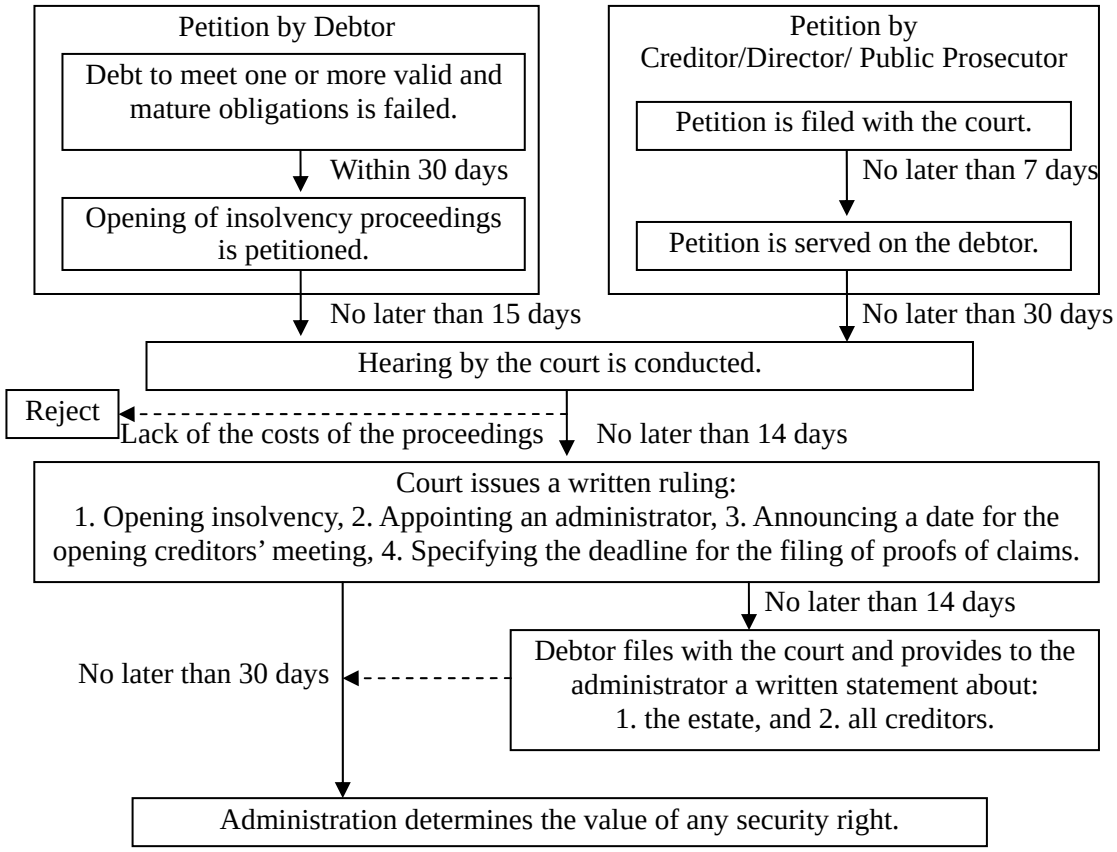


Figure 4-6 Flow from the petition to the assessment by administration

Figure 4-7 shows the flow of insolvency from proposal of compromise plan to implementation of the plan which is mentioned in this law.

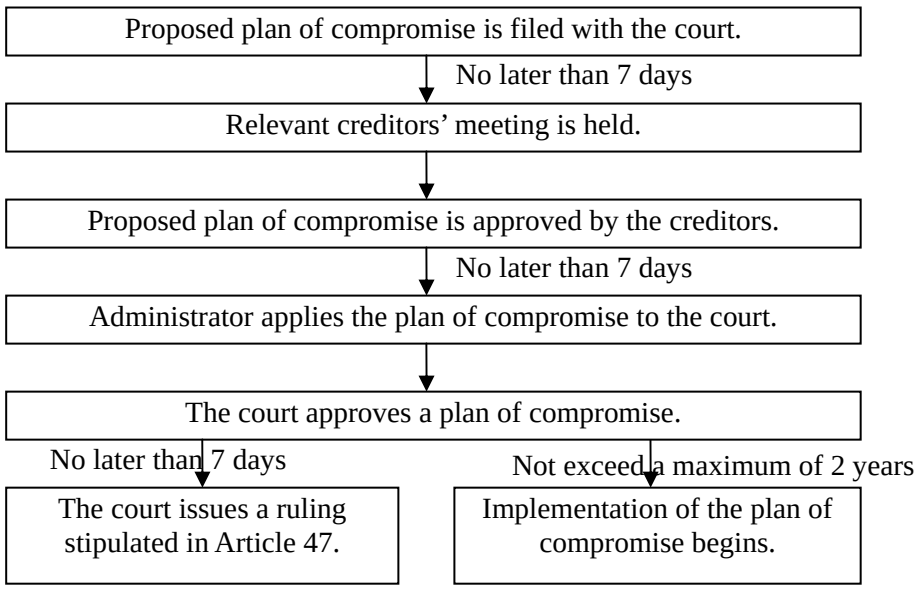


Figure 4-7 Flow from the proposal of compromise plan to implementation of the plan

4.4.11 The Commercial Arbitration Law

The Commercial Arbitration Law was enacted by the National Assembly of the Kingdom of Cambodia on the 6th of March 2006. This law aims to facilitate the impartial and prompt resolution of commercial disputes, to safeguard the legal rights and interests of the parties, and to promote the sound development of the economy. This law is divided into the following nine chapters: 1. General Provisions, 2. Arbitration Agreement, 3. National Center of Commercial Arbitration, 4. Composition of Arbitral Tribunal, 5. Jurisdiction of Arbitral Tribunal, 6. Conduct of Arbitral Proceedings, 7. Making of Award and Termination of Proceedings, 8. Resource, Recognition, and Enforcement of Arbitral Award, and 9. Final Provisions.

Article 17 mentions that the organization and functioning of National Center of Commercial Arbitration is determined in Sub-Decree.

4.4.12 Land Law

Land law was passed by the National Assembly on July 20th 2001 and was adopted completely by the Senate on August 13th 2001. The objective of this law is to determine the regime of ownership for immovable properties in the Kingdom of Cambodia according to Article 44 of the 1993 Constitution, which applies to all immovable properties within Kingdom of Cambodia. This law is composed of the following eight titles: 1. Private and public ownership, 2. Acquisition of ownership, 3. The regime of private ownership, 4. The forms of ownership, 5. Immovable property used as security, 6. Cadastre, 7. Penalty provisions, and 8. Final provisions.

Article 8 mentions that the right of ownership of land in Kingdom of Cambodia is limited to only local citizens or legal entities of Khmer nationality. The legal entity of Khmer nationality means an enterprise whose share is owned by local citizens of Cambodian nationality or by Cambodian legal entities 51% or more.

The acquisition of land is determined as the following four means: 1. sale, 2. exchange, 3. succession, and 4. gift. Table 4-17 shows each procedure to acquire the land stipulated in this law.

Table 4-17 Each procedure to acquire the land

Sale (Article 65 and Article 6)	1. Contract of sale of immovable property is made in writing in the authentic form drawn up by the competent authority. 2. Contract of sale of immovable property is registered with the Cadastral Registry Unit.
Exchange (Article 70)	1. Parties agree to exchange immovable properties with each other. 2. Contract of exchange of immovable property is made in writing in the authentic form drawn up by the competent authority. 3. Contract of exchange of immovable property is registered with the Cadastral Registry Unit.
Succession (Article 73)	None. (Immovable property that has actually been possessed only and has not been registered or recorded by governmental certificate, but was legally occupied may transferred by succession.)
Gift (Article 81)	1. A gift of immovable property is made in writing in the form of an authentic deed. 2. A gift of immovable property is registered with the Cadastral Registry Unit.

(Reference from the Land law)

4. 4.13 Sub-Decree on the Procedure to establish Cadastral Index Map and Land Register

Sub-Decree on the Procedure to establish Cadastral Index Map and Land Register was issued on March 22nd 2000 which determines the procedures through the systematic adjudication in areas declared as an adjudication area. Figure 4-8 shows the procedures stipulated in this Sub-Decree.

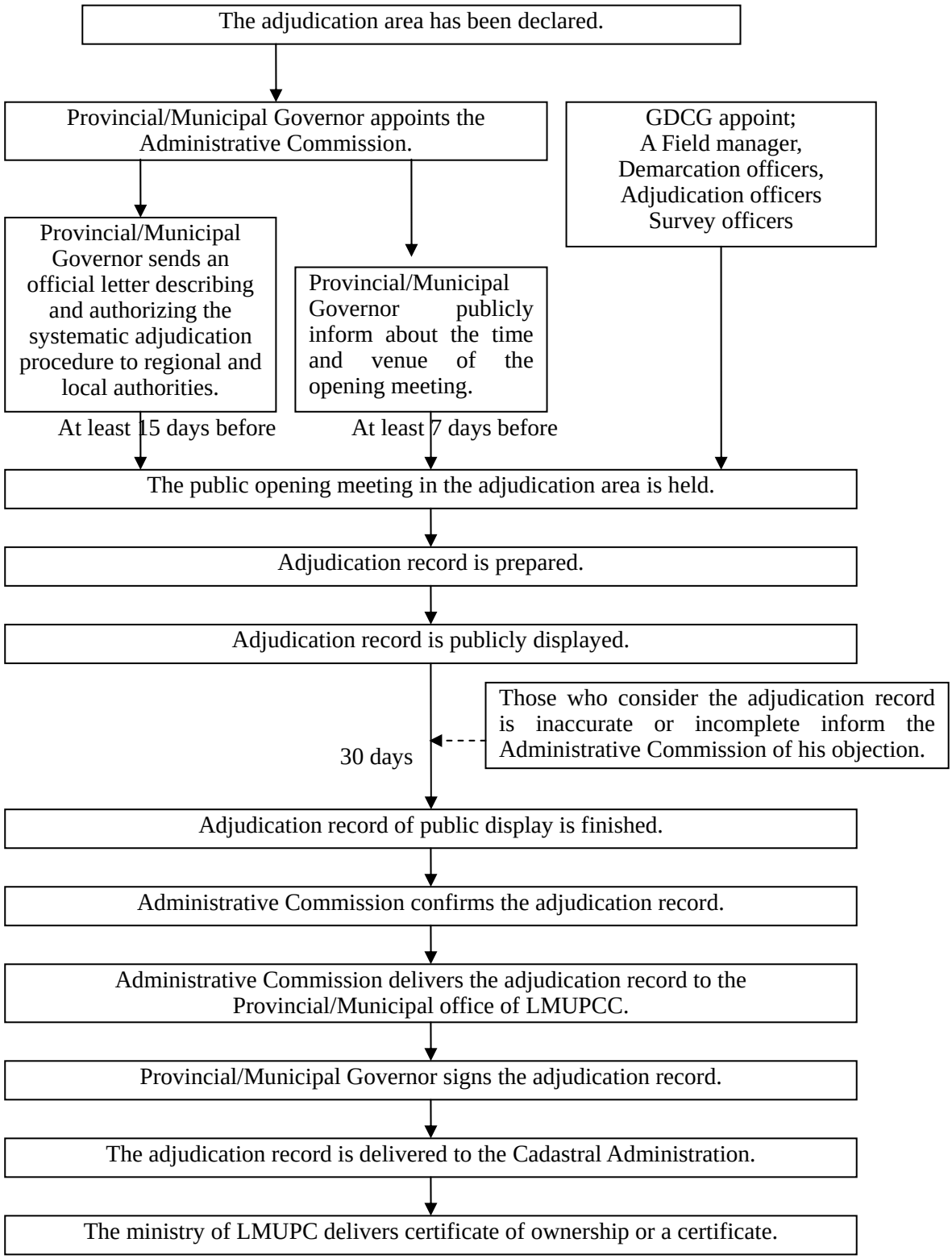


Figure 4-8 Procedures of establishing cadastral index map and land register

4.4.14 Law on Land Use Planning, Urbanization and Construction

Law on Land Use Planning, Urbanization and Construction was adopted by the National Assembly on May 24th 1994 and aims to promote the organization and embellishment of the urban and rural areas throughout the Kingdom of Cambodia with the purpose of assuring the development of this country.

Chapter 1 stimulates establishment of a National Committee for Country Planning, Urbanization and Construction whose membership, appointment proposals and administration is specified by a Sub-Decree. In Chapter 2, development master plan is determined to be prepared in the Municipality of Phnom Penh, each province and municipality. In addition, Chapter 3 mentions that each capital city, province and municipality should establish land use master plan which complies with the development master-plan stipulated the above and which indicates the area to be allocated for national defense, agriculture, commerce, industry, handicraft, culture, tourism, religion, and administrative and public facilities. Private entities and public authorities should adhere to this land use master plan during their construction works.

Furthermore, Chapter 4 determines that all individuals, private institutions, and public authority should not construct on the public yard-field as defined the following six zones: 1. water reservoir and water dams, 2. reserved mining fields and forest zones, archaeological and historical resort sites, 4. gardens and public parks and development zones, 5. reserved land for the road constructions or for the road sides, and for the construction of rail-road and airports, and 6. river, seas, streams including banks.

Chapter 5 Application of Japanese technologies and water supply planning

5.1 Planning of framework for water supply facilities in the Study area

This survey aims to presume water supply project plans for a specific local city and rural areas in Cambodia and then confirm applicability of water treatment leading-edge technologies which Japanese private firm have. In addition, the project is assumed to be implemented as a Public-Private Partnership project, which will include the collection of necessary information and analysis.

The outline of this planning is as follows:

Study area

1) The Study areas are the Kampot provincial capital and the Kep province. (As to the reason for the selection of study area, see the end of this section)
2) A PPP project for the water supply will be planned.
3) A bulk water supply project will be developed for Kampot Water Supply and a Water Supply project covering some rural areas will be developed for the Kep province.

Application of Japanese water treatment technologies

4) In this survey Ceramic Membrane Filtration Equipment is employed as one of the Japanese water treatment technologies. Since this technology is new to Kampot, a suitable method (rapid sand filtration system) will be selected on the basis of economic conditions.

Bulk water supply to the Kampot provincial capital (Kampot Water Supply)

5) The bulk water supply to the Kampot provincial capital consists of a water intake facility, raw water conveyance pipe, treatment plant, and water transmission pipe. The demarcation of responsibility between Kampot Water Supply and the bulk water supply will be the point of the flow meter on the inlet to the elevated tank.
6) The target distribution area of bulk water in the Kampot province are the newly installed distribution areas. The PPP project will start, subject to the construction of the distribution network being completed separately within a short period, with overseas financial assistance from such as JICA grant aid.
7) The distribution from the existing water treatment plant of Kampot Water Supply will target the communes, consisting mainly of existing distribution areas; while the distribution from the bulk water supply enterprise will mainly target the communes of new distribution areas. The distribution area for PPP is the major premise to conclude the agreement of distribution zoning between MIME and SPC, to secure mutual business sustainability.
8) MIME, Kampot Water Supply and SPC will build a long term, mutually cooperative and trusted relationship. With such strong relationship, the contractual basis can also be established.
9) The preliminary design for the new Kampot water supply facilities is described in Chapter 6.

Water supply in the Kep provincial

10) In the (resort) area of Kep beach, piped distribution with a water treatment plant will be used for the supply. In rural areas, a Mobile Membrane Filtration System will be used.
11) A private water supply company – Western Coastal Development Co., Ltd – has been licensed by MIME to develop portable water in Kep province. Due to bankruptcy, the enterprise ceased operations in 2009, leaving a broken dam. The company, however, has obtained approval from MIME to extend the license expiration for 6 months, until May 28, 2012.
12) The preliminary design for the Kep water supply facilities is described in Chapter 7.

PPP project

13) The area of the PPP project combines the Kampot provincial capital and the Kep.
14) The SPC will be set up within the new treatment facilities in Kampot and operated together with the business of the Kep province.
15) It is deemed rational if the SPC can obtain kind assistance from Kampot Water Supply in transactions involved in water charge collection of the Kep province.
16) The formation, risk analysis, and confirmation of the preconditions are described in Chapter 8.

The following figure shows the aforementioned schematic outline:

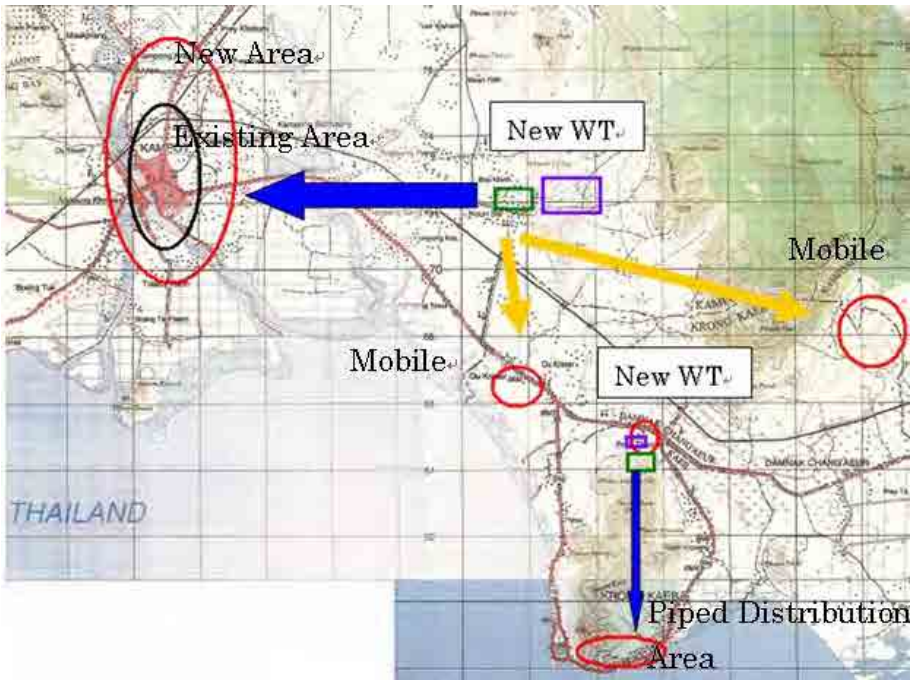


Figure 5-1 Framework for water supply facilities in the Study area

The reason for selecting the Study area：

1) Nine provinces were selected out of 24 provinces of Cambodia by excluding the provincial capiatals which have substantial master plans such as Phnom Penh and Siem Reap and those provinces where private water services exist. The nine provinces are Kampot, Battambang, Kampong Cham, Kampong Thom, Mondul Kiri, Pursat, Sihanouk Ville, Svay Rieng and Kep.
2) To exclude the areas of high potential water supply facilities which will be constructed within the next few years, from among the remaining provinces where a relatively large scale population, high development of settlements and to find suitable water sources were selected. The survey team selected the four areas that may satisfy the above conditions and those are namely Kampot, Kep, Sihanouk Ville and Kampong Cham.
3) The areas where there are ample groundwater and have another water related project were excluded from the study area as it will not meet the business concept of the plan.
4) Through these procedure Kampot provincial capital and Kep province were selected as the candidates of the Study Area.

5.2 Survey on the source of water and intake points

Based on the water supply area planned in Chapter 5.1, a field survey was conducted from 14-16 January, 2012. As for the water resource areas, study and sampling analysis of water qualities were conducted with regard to four sources in two places in Kampot province and 11 sources in 11 places in Kep province, based on information from DIME on each area. With regard to the parameters of water quality analysis, feasible analysis in Cambodia during the survey period was held based on the daily analysis of the Phnom Penh Water Supply Authority and Kampot Water Supply, which are managed referring to WHO guidelines. The analysis parameters and the result are shown in Table 5-1.

As to water rights in order to take water for water supply, the Team has not yet confirmed the existing water rights and the possibility to obtain new water right for the PPP project officially. However the officials of Kampot DIME and Kep DIME explained to us these water sources belong to the public and the PPP project will be able to use the water. In the next step such as the feasibility study stage, after resolving all preconditions, prior discussion or applications for water rights with MOWRAM to secure source water is necessary.

Table 5-1 The result of water analysis at Kampot and Kep on 14-16 January, 2012

No.	Parameters	Unit	Province/Sample name		Kampot	Kampot	Kampot	Kampot	Kampot	KEP	KEP	KEP	KEP	KEP	KEP
			Management Value of PPWSA	Management Value of KWS	Tom NopTak Krola Dam	Dei Eth Pond (Fish pond)Prey Khmum Commune	Dei Eth Pond (Fish pond)Prey Khmum Commune	Die Eth Pond (Left side) Prey Khmum Commune	River Water (Water resorce of existing WTP)	Little Pond	Kep Village Vipasana pagoda	Little Pond	Poa Heng Dam	Veal Vong dam (at Phnom Leave vil.)	Kampong Tra Lach(O-Krasar) Dam
1	pH	-	6.50-8.50	6.5-8.5	6.98	6.83	7.00	6.95	7.34	7.19	7.21	6.44	7.27	7.01	6.81
2	Turbidity	NTU	5	5	14.60	5.41	7.63	6.47	8.49	12.3	6.67	35.3	39.1	10.6	44.7
3	Conductivity	µS/cm	400	*	83	182	129	185	53	94	199	88	184	45	38
4	Suspended solids	mg/l	1		16	5	7	4	8	9	6	43	19	6	21
5	Total Dissolve Solids	mg/l	1000	800	42	91	65	93	27	47	99	44	92	23	19
6	Total coliform	cfu/100ml	0	0	2100	3200	1700	17700	6700	1400	6400	2400	11000	9900	4400
7	E. coli	cfu/100ml	0	0	100	0	200	300	400	100	0	0	0	100	200
8	Ca hardness	mg/l	70		12	12	20	28	18	14	50	10	48	3	2
9	Magesium hardness	mg/l	30		8	14	10	16	4	16	34	11	32	7	2
10	Alkalinity	mg/l	350	*	14	14	20	36	18	20	68	12	59	8	2
11	Organic sustances	mg/l		*	21.49	14.53	12.64	12.64	20.22	6.32	8.21	17.06	7.58	18.33	13.90
12	Dissolved Oxygen	mg/l			6.73	6.45	6.59	6.05	6.75	6.70	6.47	4.76	6.56	6.63	6.64
13	Color	TCU	15	5	11.25	5.97	9.36	6.00	13.35	4.14	3.62	45.21	12.80	28.45	64.42
14	UV,Absorbance	-			0.153	0.078	0.120	0.096	0.103	0.026	0.027	0.262	0.072	0.195	0.301
15	Ammonia	mg/l	0.05-0.50	1.8	0.134	0.183	0.219	0.012	0.292	0.122	0.195	0.158	0.158	0.073	0.097
16	Carbone Dioxide	mg/l			20	22	34	35	13	15	41	87	29	16	16
17	Copper	mg/l	0.02-1.0	1	0.000	0.002	0.001	0.001	0.002	0.000	0.001	0.005	0.002	0.005	0.026
18	Chloride	mg/l	25-250	250	29.0	58.5	34	44.5	16.5	26.5	30.5	29.0	28	20	25
19	Fluoride	mg/l	0.1-1.5		0	0.07	0.06	0.06	0	0.11	0.17	0.26	0.12	0.07	0
20	Iron	mg/l	0.1-0.3	0.3	0.140	0.09	0.08	0.05	0.31	0.03	0.05	1.97	0.23	0.72	1.36
21	Manganese	mg/l	0.05-0.50	0.1	0.009	0.000	0.000	0.000	0.002	0.000	0.001	0.009	0.010	0.005	0.030
22	Nitrate	mg/l	5.0-50		0	0	0	0.6	0.5	0	0	0	0.64	0	0
23	Zinc	mg/l	0.5-3.0		0	0	0	0	0	0	0	0	0	0	0
24	Phosphate	mg/l			0	0	0	0	0	0	0	0	0	0	0
25	Sulfide	mg/l	0.00	05(Hydroge	0.001	0.001	0.003	0.003	0.001	0.002	0.001	0.004	0.007	0.004	0.020
26	Sulfate	mg/l	25-250	3	0	6	4	2	0	6	0	0	4	0	0
27	Arsenic	mg/l	0.01		0	0	0	0	0	0	0	0	0	0	0

5.2.1 Kampot Province

5.2.1.1 Tak Krola Dam

This dam was constructed by MOWRAM 1975, and has been used as a reservoir for agriculture, under the control of the ministry. This dam (10°36'12.76"N, 104°17'18.50"E) is located almost 12.5 km in a straight line directly east of the existing water

Tak Krola Dam

treatment plant of Kampot. It mainly takes subsoil water from mountains nearby as its water resources. The area is about 4 km^2 (2×2 km), and the estimated water volume is approximately 8,000,000 m^3.

The aspects of the water quality analysis of this dam include the large amount of organic substance, which is considered attributable to contamination from villages around the dam, and the low alkalinity that was seen in overall water resources in this survey. Although no odor was detected based on interviews with neighborhood residents, it will be necessary to study the need to provide additives (such as including an activated carbon treatment in the filtration process) after obtaining long term fluctuation data on water quality in case this dam is used as a water resource in the next F/S. Also, as a provision for low alkalinity, adding alkaline agent should be considered.

5.2.1.2 Dei Eth Pond

This pond (10°39'18.22"N, 104°12'01.02"E) is located along a national highway, about 5 km northeast of the existing water treatment plant in Kampot. It is composed of three artificial ponds, and is used mainly for agricultural purposes.

Dei Eth Pond

There are no problematic figures for the water quality, and according to the neighborhood, fluctuation of water level depending on the season is rare. However, the water volume is about only 64,800 m^3 (W 60 m x L 180 m x D 2 m x 3 ponds) in the total of 3 ponds, which is too small for a water resource at a water treatment plant treating thousands of cubic meters of water a day. Moreover, one of the ponds is being used as a fish farm. Therefore, it is necessary to contact DIME and Prey Khmum Commune, who have authority over this pond, for information regarding the rights of use, in case this pond is selected as a water resource. In addition, the quality of water is similar to the source of 5.2.1.1.

5.2.2 Kep Province

5.2.2.1 Little Pond A (Near Provincial Office)

The pond (10°28'52.96"N, 104°18'10.64"E) is located in the south part of Kep National Park, and about 300 m from the north part of Kep Provincial Office. This water is used for the daily lives of the neighborhood residents, and its source is subsoil water from the mountains and rain water. The water quality is good enough to treat with conventional coagulation-sedimentation and rapid filtration systems. The water volume in the survey (dry season) was about 1,400 m^3 (φ 30 m x D 2 m), and even though hundreds of residents in the area use the raw water for daily life, there is little fluctuation in the water level. The water level rises by about 1 m during rainy season, therefore no major fluctuations are expected if the frequency of water intake remains a few times a week and about 100-200 m^3 per day

Little Pond A

5.2.2.2 Vipasana Pagoda Pond

This pond (10°29'56.45"N, 104°18'46.77"E) is located on the mountainside, about 2 km northeast of the pond referred to in 5.2.2.1. It is introduced by DIME of Kep.

Vipasana Pagoda Pond

A mountain stream flows into this pond, but the water is used by the nearby Pagoda and its volume is negligible. Therefore this is excluded from the options, even though the water quality is fine.

5.2.2.3 Little Pond B

This pond (10°29'25.20"N, 104°18'13.79"E) is located on the mountainside, between the water resources of 5.2.2.1 and 5.2.2.2. This is an artificial pond bringing water from a mountain stream and is used for the daily life of residents living at the foot of the mountain. The water volume is relatively small, only about 600 m³. Regarding the water quality, high levels of iron (1.97 mg/L) are found. This pond is positioned at a height of almost 80 meters and the roads leading there are narrow. Therefore, costs may be incurred for expanding the roads or laying water conduits, if the pond is to be used as the water source.

Little Pond B

5.2.2.4 Poa Heng Dam

This dam (10°30'42.96"N, 104°18'07.38"E) is located on the west side of the mountain crossing from the above water resource. It is constructed by the company named “Western Coastal Development Co., Ltd”, which currently holds the concession for private water work in Kep province. However, this company went bankrupt in 2009, and the dam has since been unused. The barrage (shoulder protection) has collapsed and it is not currently functioning as a dam, despite the huge water volume.

Poa Heng Dam

Poa Heng Dam

According to the survey, it is estimated that approximately 50,000 US$ will be needed for the restoration. Although the water source of this dam is subsoil water, a slightly high level of iron is found (0.23 mg/L); which is probably due to the fact that the water collected for this survey has remained in the bottom of the dam for an excessive period. Regardless of the good water quality, using this dam as a water source is considered difficult, as the risks and cost of restoration are huge. Also, there remain compensation issues for residents, who lost their property due to the construction, to be resolved.

5.2.2.5 Kampong Tralach (O-Krasar) Dam

This dam (10°33'31.23”N, 104°16'53. 42”E) is located in O-Krasar Commune, on the west border to Kampot and was built by MOWRAM in 2008. The water volume is estimated to be about 4,000,000 m³ (approx. W 2 km x L 1 km x H 2 m). This dam holds plenty of water, and regarding its quality, high levels of iron

Kampong TraLach Dam

(1.36 mg/L) are found, as well as other aspects, including a high level of organic substance and low alkalinity, both of which are also found elsewhere. Currently, the dam is used for agricultural purposes of the neighborhood. Negotiation with MOWRAM and MIME will be required if this dam is to be used as a water source.

5.2.2.6 Veal Vong Dam

This dam (10°32'01.21"N, 104°22'14.81"E) is located near the center of the Pong Teuk Commune, on the eastern side of Kep province, and is also under the control of MOWRAM. Its resource is subsoil water from the mountains, and it is used for agricultural purposes by the surrounding residents. The estimated water volume is 600,000 m³, and the water quality is similar to those of other dams – containing high CODMn, low alkalinity, and slightly high level of iron (0.72 mg/L). Since the altitude of this dam is only about 10m, there is concern at the potentially high cost of raw water transmission and water supply on the occasion of filtration plant construction.

Veal Vong Dam

5.2.2.7 Tuol Sra Ngan Dam

This dam (10°31'26.33"N, 104°24'04.42"E) is located about 3 km south west of the dam of 5.2.2.6, on the eastern border of Kep and Kampot provinces. Like the above two dams, it is also controlled by MOWRAM. It holds an estimated water volume of about 1,600,000 m³ (W 2 km x L 400 m x D 2 m) and is used for agriculture. This dam has the most suitable water quality to be used as water source for waterworks in Kep. However, the disadvantage is the cost of raw water transmission and water supply, as the altitude of this dam is low at only 7 m.

Tuol Sra Ngam Dam

5.2.2.8 Cham ka Bei Dam

This dam (10°33'41.02"N, 104°23'22.81"E) is located about 4 km north from the dam of 5.2.2.7, and holds 2,250,000 m³（W 1 km x L 300 m x D 1 m）of water. It is also under the control of MOWRAM and is mainly used for agriculture. Water is taken from the dam of 5.2.2.7, which is on the north side of this dam. Accordingly, the water quality is slightly worse than the dam in 5.2.2.9, and slightly higher levels of iron (0.56 mg/L) are found.

Cham Ka Bei Dam

5.2.2.9 Phnom Voar (Deer) Dam

Phnom Voar Dam

This dam (10°34'38.02"N, 104°23'04.38"E) is located about 2 km north west of the dam in 5.2.2.8, and holds approximately 6,000,000 m³ of water (W 2 km x L 1 km x D 3 m). It is also under the control of MOWRAM and mainly used for agriculture. Despite slightly high levels of CODMn and iron (0.57 mg/L), the water quality does not have problematic aspects hindering the usual coagulation-sedimentation process. The altitude is sufficient at about 37 m and the dam is also surrounded by fields and woods, making it the most suitable place for the construction of a water filtration plant.

However, it is almost 20 km away from the center of Kep Commune (City), which is the most populated area where the hotels are gathered. Therefore it is considered suitable as a water filtration plant to supply not only Kep Commune but the entire Kep province

5.2.2.10 Phnom Prous Pond

Phnom Prous Pond

This pond is located (Prey Thum Commune: 10°32'35.44"N, 104°18'50.19"E) on the north side of Piedmont, in southern Kep province. The estimated water volume is 12,000 m (W 300m x L 200 m x D 2 m) and it is used for the daily lives of neighboring residents. The water quality is similar to those of other sources –CODMn is slightly high and alkalinity is low. The water level changes about 50 cm between rainy season and dry season.

Some neighboring residents come to fetch water with 30 L tanks during the survey, and according to them, the water usage per day is about 40 L per person. The source of this pond is subsoil water from mountains and rain water, and the water quality is stable year-round. Also, the altitude is sufficient, at about 18 m, and the distance from the pond to Kep Commune is relatively close – 8 km. Therefore this is considered the most promising water source for Kep Commune.

5.2.2.11 Junior High School Pond

Junior High School Pond

This pond (10°29'43.01"N, 104°19'32.36"E) is located in a primary school in Kep Commune, about 1.3 km east of the source 5.2.2.1. It is a 10 square meter pond and it contains the largest amount of organic substances and coliform bacteria, compared to other water sources in Kep province. The water volume is also very small, thus it is also not included as a water source option in this survey.

5.3 Wrap-up

The following table shows the evaluation of the aforementioned sources: water volume, water quality, distance to supply areas, cost of filtration plant construction, and running cost regarding raw water transmission and water supply.

Table 5-2 Water Resources in Kampot City

No.	Name	Advantage	Disadvantage
5.2.1.1	Tak Krola Dam	・ Water Capacity is big. ・ Water Quality is mostly good. ・ Due to high attitude, it is available to use the water head.	・Here is far from the water supply area.
5.2.1.2	Dei Eth Pond	・ Here is near from the water supply area. ・ The cost of land creation is cheaper.	・ Small water capacity ・Due to use as aquaculture pond, the water quality is not good.

As for Kampot, Tak Krola Dam of 5.2.1.1 has an advantage due to the water quality, despite being far from the supply area.

Regarding Kep, Little Pond A of 5.2.2.1 has the biggest advantage in overall points. However the water volume is small, so it will be limited to a small-scale water source (approx. 100-200 m³/day) filtration plant.

For a larger-scale (thousands to ten thousands m³/day) water filtration plant, Phnom Voar (Deer) Dam of 5.2.2.9 has an advantage, but if the supply area is limited to Kep City, the length of pipes for the water supply or raw water transmission will be the longest. Therefore, it is necessary to consider the cost of the construction.

As for the source of middle scale water filtration plant (hundreds to thousands m³/day), Kampong Tra Lach Dam of 5.2.2.5 and Veal Vong Dam of 5.2.2.6, Tuol Sra Ngam Dam of 5.2.2.7, Phnom Prous Pond of 5.2.2.10 are lined up as candidates. With this in mind, in case the water supply area is restricted to within Kep City, Phnom Prous Pond is considered the most appropriate because it is the closest to the city.

Table 5-3 Water sources in Kep province

No.	Name	Advantage	Disadvantage
5.2.2.1	Little Pond A	・The water quality is mostly good. ・Due to high attitude, it is available to use the water head. ・Here is near from the water supply area (2015）.	・The water capacity is not big.（it is possible to use for 100-200 m^3/day usage.）
5.2.2.2	Vispasana Pagoda Pond	・The water quality is mostly good. ・Due to high attitude, it is available to use the water head.	・The water capacity is extremely small. ・There is a limit to use the water. ・The cost of land creation is high.

5.2.2.3	Little Pond B	・The water quality is mostly good. ・Due to high attitude, it is available to use the water head. ・Here is near from the water supply area (2015）.	・The water capacity is small.（it is possible to use for 50-100 m^3/day usage.） ・The cost of land creation is high.
5.2.2.4	Poa Heng Dam	・If the dam is repaired, the water capacity is big.	・The repair cost is high. ・The compensation to the residents is not solved.
5.2.2.5	Kampot Tra Lach Dam	・ The water capacity is big. ・ Here is near the water supply area by M-CMF.	・The concentration of Fe is higher.
5.2.2.6	Veal Vong Dam	・The water quality is mostly good. ・The water capacity is big.	・Here is far from the water supply area（2015）. ・Due to low attitude, it is difficult to use the water head.
5.2.2.7	Tuol Sra Ngan Dam	・The water quality is good. ・The water capacity is big.	・Here is far from the water supply area（2015）. ・Due to low attitude, it is difficult to use the water head.
5.2.2.8	Cham Ka Bei Dam	・The water capacity is bigger.	・The water quality is not good. ・Here is far from the water supply area（2015)
5.2.2.9	Phnom Voar Dam	・Due to high altitude, it is available to use the water head. ・The water quality is mostly good. ・There is a site for building big WTP.	・the water supply area (2015)
5.2.2.10	Phnom Prous Pond	・ Here is near the water supply area（2015）. ・ The cost of land creation is cheaper. ・ The water quality is mostly good.	・The water capacity is not big（It is possible to use about 1000 m^3/day WTP）.
5.2.2.11	Junior High School Pond	・Here is near the water supply area（2015）.	・The water capacity is extremely small. ・The water quality is bad.

5.4 Optimal technology selection considering Japanese technology

The following issues exist for waterworks projects in Kampot and Kep province, according to data on the water volume and the quality of each resource mentioned in Section 5.2, the estimated volume of water supplies in Section 6.4 and Section 7.3, and the management situation of the existing water filtration plant in Kampot stated in Chapter Section 6.2.

＜Kampot City＞
The current waterworks operated by Kampot Water Supply (KWS) consume a very high proportion of electricity cost (46%) and manpower cost (23%), therefore these proportions must be reduced. The current water tariff of KWS is 1,400 KHR/m³, and an similar level of tariff should be applied for the selling price for a private water supply project.

＜Kep Province＞

- The provinces development will henceforth proceed. Since the villages are widely dispersed and the water supply efficiency is low under current technology, the business is likely to be strained.
- There is a water source which has relatively stable water quality, but the volume is small.

Considering the aforementioned factorts, Japanese technologies – a Ceramic Membrane Filtration System and Remote Monitoring System – will be applied as water supply systems in this survey.

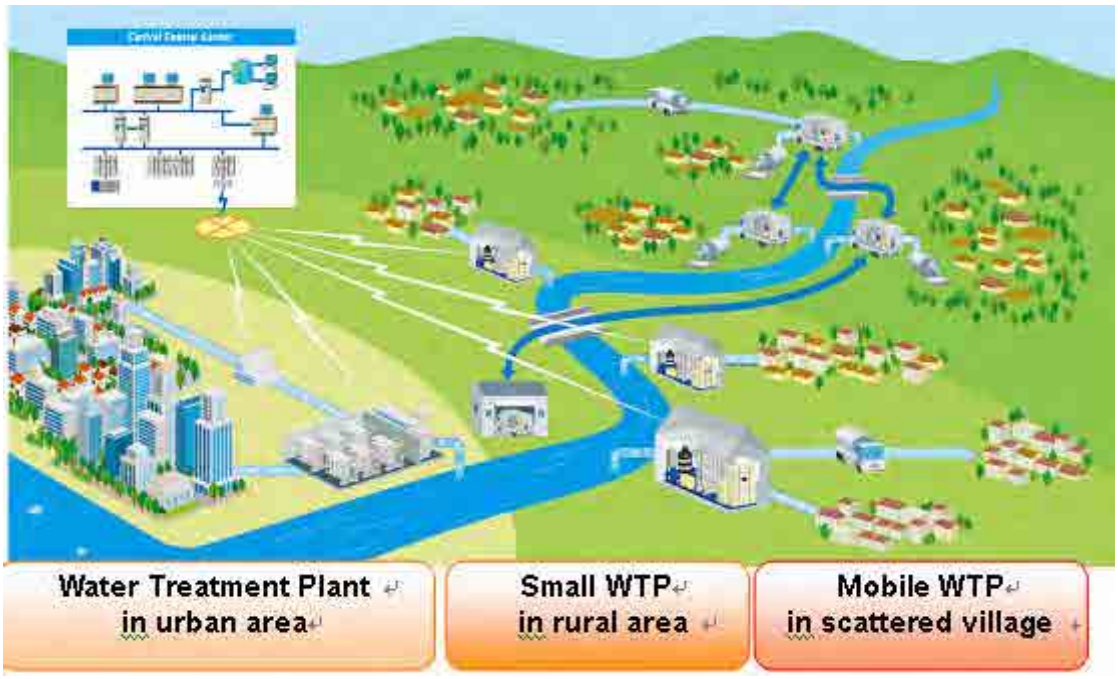


Figure 5-2 Concept of the water supply system for scattered areas

These systems boost the water supply rate and decrease the installation cost of water distribution pipelines, which consume much of the initial cost for waterworks facilities, by supplying water from Mobile Ceramic Membrane Filtration Equipment (M-CMF) for dispersed small villages, and from fixed small-scale ceramic membrane filtration plants for small and medium-sized settlements, using medium- or large-sized urban filtration plants as bases.

The advantages of using a Ceramic Membrane Filtration System in this system will be as follows:

＜Advantages of a small-scale water treatment plant＞

- As shown in figure 5-3, since this system lacks a flocculation basin or sedimentation basin, the filtration process is simple. Also, unattended operation is possible, except for occasions involving addition of chemicals and maintenance, because it is automatically monitored and controlled the chemical dosing rate by each measuring instrument.
- The volume of the backwash process is negligible, resulting in a higher concentration of sludge in the backwash water. Therefore it is possible to downsize the sludge disposing facility such as a thickener and sun drying bed.
- Due to the high water permeability of the ceramic membrane, power consumption is lower than with organic membrane filtration, which thus enables lower running costs.

＜Disadvantages of a small-scale water treatment plant＞

- The primary investment cost tends to be higher than conventional rapid sand filtration.
- The electricity in operation is possible to be higher than conventional rapid sand filtration.

＜Advantages in Mobile water treatment equipment＞

- The ceramic membrane, which is physically strong, resists variations in raw water quality and physical vibrations, meaning its potential for breakage is low in the case of site relocations and treatment of high turbidity water during the rainy season.
- Due to the low power consumption, a small diesel electrical generator can be installed, thus enabling the water filtration process to continue, even in the areas without public electrical supplies.
- Since the amount of backwash water is very small, it is small impact around the environment.

＜Disadvantages of Mobile water treatment equipment＞

- The primary investment cost tends to be higher than conventional rapid sand filtration.
- When the equipment is broken, the cost of replacement is higher than conventional rapid sand filtration.

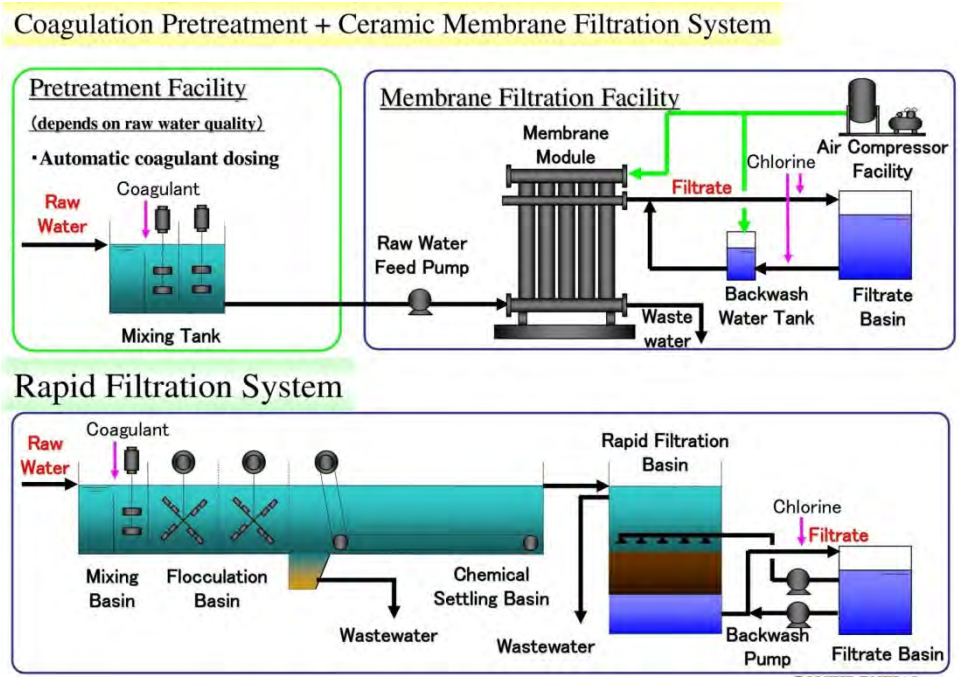


Figure 5-3 Comparison between conventional rapid filtration and ceramic membrane filtration

Figure 5-4 Small scale ceramic membrane water treatment system (240 m³/day)

Figure 5-5 Mobile ceramic membrane filtration equipment (M-CMF） (50 m³/day)

The operation data from small-scale water treatment plants and mobile treatment equipment will be constantly sent to the central monitoring system in large-scale water treatment plants via 3-Generation lines of data communication, which basically eliminates the need for skilled operators for mobile waste treatment equipment, except a truck driver. Issues regarding the survey areas described heretofore are thus almost resolved.

However, regarding the water treatment plant for Kampot province, there is a need to limit not only the O&M cost, but also the construction cost charged for depreciation and minimize it to keep the water tariff almost equal to the current price of KWS. Compared to conventional rapid filtration systems, the construction cost of the ceramic membrane filtration system may be higher. The final decision for a water filtration system concerning those matters will be made and mentioned in the “Outline of PPP project facilities” of Chapter 6 and thereafter.

Chapter 6 Preliminary design of the water supply facilities in Kampot city

6.1. Concept of bulk water supply by PPP project

In Kampot city, the water coverage at the end of 2011 was (10,893 households with regional water supply district, 4,026 of which with meter contracts) 37%, which is far from the target (Increasing the rate of access to safe drinking water to 80% in the city by 2015), specified by the National Strategy Development Plan (NSDP: 2009-2013), which was drawn up by the Cambodian government.

Kampot Water Supply (hereinafter referred to as KWS) shows the target value to raise the water supply coverage up to about 92% in future, however the financial arrangements for the following two projects remained to be specified:

1. Construction of a distributing pipe to expand the water supply district (total extension of 62 km).
2. Securing a new water source and construction of a new water treatment plant due to expansion of the water supply district (3,433 m³/day).

The water supply system in Kampot city will improve up to 92% in 2015 by funding from the government and private sector of Japan, etc. (a: Grant Aid within Official Development Assistance, plus b: Bulk water supply business of a PPP project by Japanese firms) and expand the capability to improve the public hygiene of the 33,800 citizens living outside the water supply coverage area in Kampot city and the living standard of the poor by allowing them to switch from buying water from water sellers to a public water service.

Moreover, the establishment of a water business overseas by Japanese firms in the city of Kampot, is a specific component of the new growth strategy of our government, which has been approved by the Cabinet. In the Asian region, water sector infrastructure is expanded and penetrated in package form, showing strength in the field. Moreover, Japanese technology and experience will serve as engines for sustainable growth in Asia, which is consistent with government policy.

6.2 Background to the bulk water supply PPP project

6.2.1 Outline of Kampot city

Kampot, one of 24 cities and provinces of Cambodia, is ideally situated close to Phnom Penh as well as the deep-sea port of Sihanouk Ville and also borders Vietnam. Linked to these locations by excellent transport infrastructure, the province forms part of the Southern Coastal Greater Mekong Sub-region Economic Corridor, which stretches for 893 km from Bangkok to Mau Nam Can in Vietnam.

Kampot covers an area of 4,873 km^2, consisting of eight districts, 92 communes and 482 villages. Kampot city is only 148 km from Phnom Penh along National Road #3. The province is served by four national roads, running for over 226 km (over 5% of Cambodia's total). The road to Sihanouk Ville, which is used by major transport, is part of the ASEAN highway network. The government of Cambodia is currently upgrading National Road #3 and other important roads such as those to the Vietnam border.

The population of Kampot was 627,884 in 2008 - see population data Table 6-1 and 6-2. Kampot citizens comprise Cambodians, Ethnic Khmer Chams, Chinese and Vietnamese. The main occupations are farming, fishing, manual labour, local and international business and an ever-growing tourism sector. Rice, cement, limestone, phosphate, salt, sea produce, forestry and sub-forestry products and fruits are produced in the province. The tourism sector is growing considerably.

Table 6-1 Population of Kampot Province

	2005	2006	2007	2008
Population (nos.)	584,367	608,740	619,559	627,884
Growth (%)	-	4.2	1.8	1.3
Families (nos.)	114,687	117,520	120,984	126,012
Average Family Size (nos.)	5.1	5.2	5.1	5.0

Source: NCDD, Kampot Data Book 2009, October 2009.

Table 6-2 Population by district in 2008

District	Nos.	Percentage (%)	Land Area (ha)	Pop. Density (nos./ha)
Angkor Chery	82,797	13.2	22,237	3.7
Banteay Meas	93,087	14.8	40,106	2.3
Chhuk	104,245	16.6	126,248	0.8
Chum Kiri	47,519	7.6	31,557	1.5
Dang Tong	57,255	9.1	34,500	1.7
Kampong Trach	98,065	15.6	35,300	2.8
Tuek Chhou	108,273	17.2	151,400	0.7
Kampot	36,643	5.8	5,400	6.8
Total	627,884	100.0	446,748	1.4

Source: NCDD, Kampot Data Book 2009, October 2009.

Agriculture and fishing

Rice is the major agricultural output of the province. Around 130,000 hectares are dedicated to paddy fields, with strong average yields of 2.6 and 3.3 t/ha in the wet and dry seasons respectively. Fruit crops are also important in Kampot, particularly durian (around 96,200 trees), mango (593,000 trees) and coconut (877,000 trees). The province is also famous for its peppers. Kampot pepper is prized internationally and has been designated with Geographical Indicator Status, helping brand the product and the province. Pepper plantations in Kampot yield on average around 2.5 t/ha. Vegetables are grown on around 2,500 hectares and supplied to Phnom Penh. Other crops include corn, sweet potato and peanuts. In 2007-08, Kampot produced over 15,000 tons of sugarcane. Fishing and seaweed cultivation are also important to the province's economy. The annual marine fish catch is around 5,170 tons – sold both fresh and for processing. Around one million liters of fish sauce are produced each year. The annual river fish catch is about one ton and there are also about 2,700 aquaculture ponds in the province. Kampot accounts for over 10% of Cambodia's total poultry stock.

Industry and services

Today, there are over 1,100 private enterprises operating in Kampot. Six cement factories have been approved in Kampot, one of which is active and produces over two million tons per year. Sea salt is another major product for Kampot, with 3,500 hectares devoted to production, averaging around 20 t/ha. Kampot can supply Cambodia's total salt requirements.

Tourism

Kampot has become an increasingly popular destination for foreign and local tourists, with numerous attractions including: Bokor National Park, Teuk Chou, Prek Ampal, Kep, Dong Mountain, Kampong Trach Mountain, Chor Gok Mountain, Kchang Mountain, Sor Mountain, Kampot Zoo, and Pepper and Fruit Plantations. The tourism trend is growing steadily, with an increase of 33.8% from 2010 to 2011. The total number of tourists in 2011 was 349,474, of whom 180,000 were foreigners.

Perspectives for industrial development

The province is home to the Kampot Special Economic Zone (SEZ). Located in the Koh Touch commune of Kampot district (currently Toek Chou district), this 1,000 hectare development offers

incredible business potential for Kampot. The SEZ is located on the coast, not far from Kampot city, and will include a very large international-standard port with the potential to compete with Sihanouk Ville.

Kampot is well-served with reliable electricity, and the supply is expected to increase over the next few years. The province's current source of electricity is the newly built hydro-electric plant at Kamchay Mountain, which came into use on 7 December, 2011. This 193 MW plant supplies Kampot, and has already expanded its coverage to surrounding regions namely Sihanouk Ville, Takeo and Phnom Penh. The electricity cost is expected to decrease to only 920 KHR per kWh.

6.2.2 Existing KWS facilities

The water supply facility was constructed in 1951 during the French colonial period. During 1975 to 1979, under the regime of Pol Pot, almost all facilities were destroyed. After the regime, the waterworks restarted and distributed non-treated water of 600 m³/day. At the time, the population served was 3,500. The SAWA project constructed a treatment facility providing a 2,800 m³/day capacity, and subsequently, in response to the increased water demand from the urban area, ADB provided a new plant in 2002. Pipe rehabilitation was conducted from 2002 to 2006. The official capacity (daily max.) of the plant was 5,760 m³/day in 2010.

The present situation of the facility is shown in Table 6-3.

Table 6-3 Situation of KWS (as of the end of 2010)

Items	Contents
Water supply area of 2010	Two districts and eight communes and 19 villages ● Kampot district (Communes of Kampong Kandal, Krang Ampil, Kampong bay, Troiy Koh and Andoung Khmer ● Toekchhou district (Communes of Chuum Kriel, Trapaing Thom and Makbrang)
Population of the provincial administrative area	585,110 based on the national census in 2008
Population in the water supply area	46,295
Served population	22,200
Service ratio	42%
Average daily water supply	3,712 m³/day
Daily maximum water supply	4,294 m³/day
Revenue water ratio	79%
Rate of loading	86%

Source: KWS

The current water production is approximately 4,300 m³/day. Of this total, 400 m³/month is sold wholesale to water vendors. The system of vendors might help increase the access ratio to safe water. According to a vendor, they sell five m³ of water at a price ranging from 7.5 to 10 US$, depending on the distance from the treatment plant. Outside the border of the distribution area, some people reportedly go to homes in the area to share the KWS water.

	
One of the treatment facilities	Water vendor

The water source is the river water of the Tec Chhou River, while the treatment method is rapid sand filtration. Sludge treatment facilities are not employed and the sludge is discharged into a river. Table 6-4, and Figures 6-1 and 6-2 show an outline of the facilities, a general Plot Plan of the treatment plant and the distribution network in Kampot city.

Table 6-4 Outline of facilities

Items	Contents
Capacity	5,760 m³/day
Water source	Tec Chhou River
Water conveyance	DI-Dia350 mm, L＝8,123 m
Treatment Plant	Receiving well 390 m³
	Sedimentation basin 885 m³
	Rapid sand filter 1,440 m³, 4 beds
	Clear water reservoir 2,000 m³
Transmission	DI-Dia350 mm, Pumped distribution system
Elevation tank	450 m³
Distribution pipe length (in 2010)	**Total 56,846 m** KWS 25,763 m ADB 11,062 m AIMF 11,674 m GRET 6,856 m JICA 1,491 m

Source: KWS

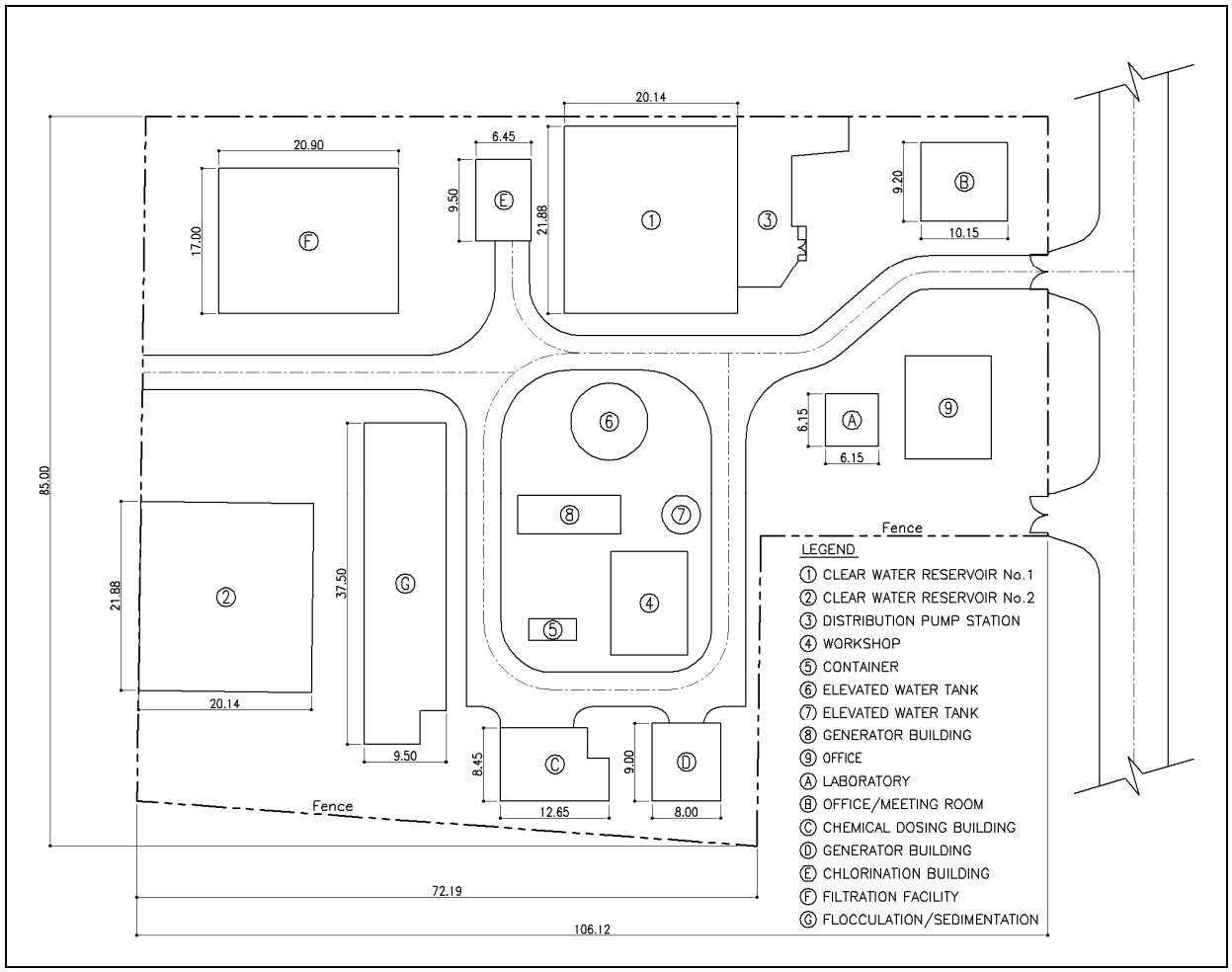


Figure 6-1 General plot plan of the Kampot Water Treatment Plant

The current distribution area mainly comprises four communes, namely Chum Kreil, Kampong Kandal, Andoung Khmer and Troiy Koh. The number of connections in 2011 was 4,026. Figure 6-2 shows the existing distribution system.

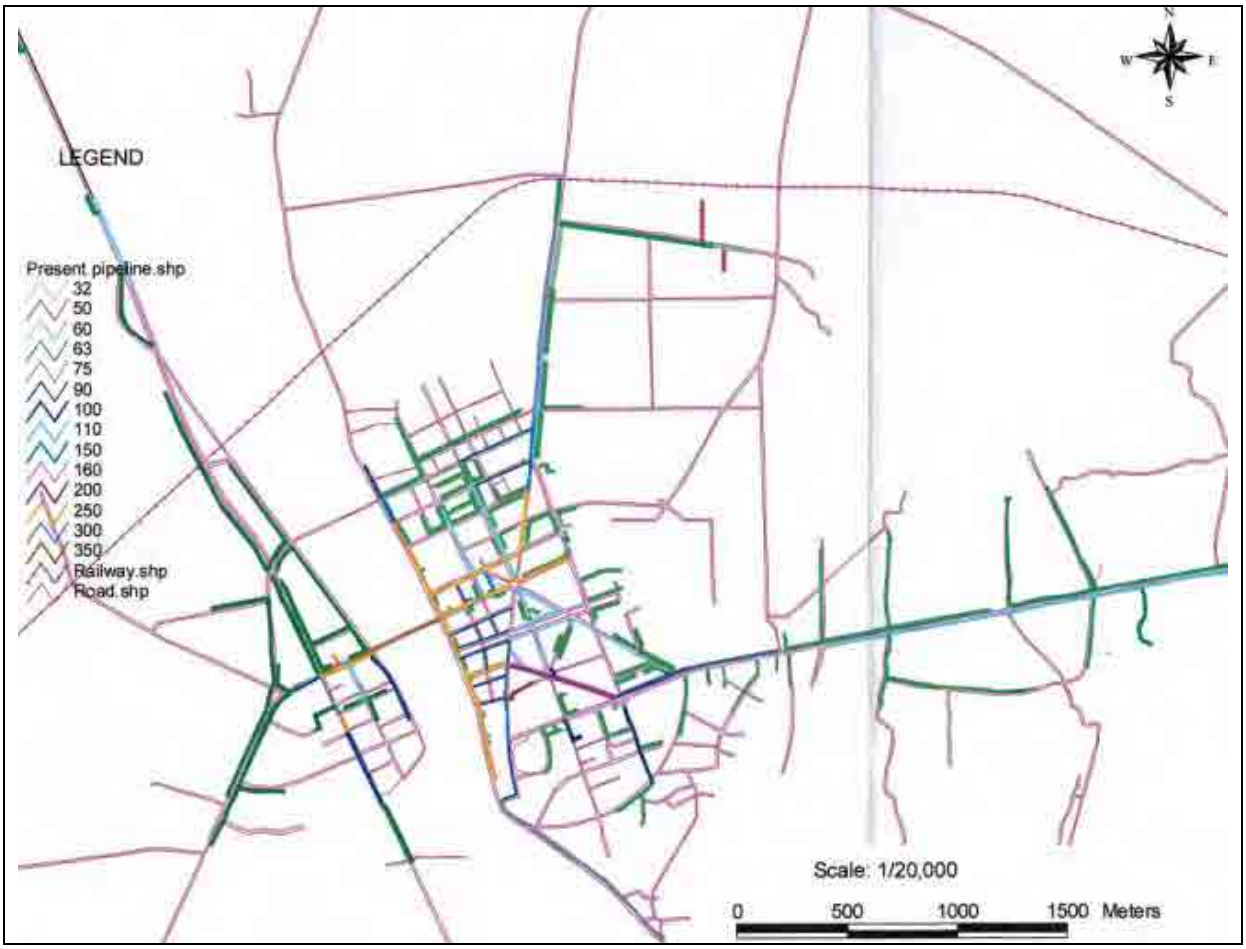


Figure 6-2 Existing distribution network

The distribution system has long stretches of asbestos cement pipes (ACP) and old pipes (14.525 m), which comprise 25.5% of the total network. Moreover, the total length of asbestos pipes is 10,700 m. ACP is weak and has an allowable design pressure is 2.5 bar, which hinders further extension after ACP.

Table 6-5 Existing distribution system (2011)

No.	Old Pipes			New Pipes		
	Diameter	Pipe Type	Length	Diameter	Pipe Type	Length
1	300mm	DI	190.00	350mm	DI	619.77
2	250mm	DI	95.00	250mm	DI	2,021.30
3	250mm	AC	5,220.00	160mm	HDPE	4,811.40
4	200mm	AC	540.00	150mm	DI	82.80
5	150mm	AC	755.00	110mm	HDPE	5,596.50
6	100mm	AC	4,185.00	100mm	PVC	300.00
7	100mm	GI	1,100.00	90mm	HDPE	1,550.00
8	100mm	PVC	1,400.00	60mm	PVC	1,660.00
9	75mm	GI	970.00	63mm	HDPE	23,510.00
10	50mm	GI	-	32mm	HDPE	2,370.00

11	60mm	PVC	70.00			
	Total		**14,525.00**	**Total**		**42,521.77**

Source: KWS

6.2.3 Present problems with the water supply

One of the big problems is a lack of funds to repair, replace and expand the treatment facilities and the distribution system. The system can continue to supply water on a 24 hour non-stop basis when the pipes are newly replaced and repaired. Currently, KWS is confident that users are satisfied with the quality of water, distribution service and reasonable price as overall conditions. However KWS still faces several basic problems and will be unable to respond to potential demand if the following problems remain unresolved:

As for water treatment the following are listed:

Sufficient capacity: The capacity to produce water remains low. KWS must build more treatment facilities as well as constructing a distribution system.

Treated water quality: The quality of raw water (river water) changes swiftly, which hampers treatment. Post-treated water is of good quality, but the quality of water from taps remains low as some old pipes still remain.

Residual chlorine: Residual chlorine is not secured at the point of the faucet because some old pipes remain.

Tidal reach: In dry season the level of water resources is low compared to sea level, meaning that when the tide is out, the salt water flows into the water source, which hampers treatment.

As for the distribution system, KWS reported the following:

Leakage: Old pipes have largely remained, resulting in accidents, leakage and red water. (See Table 6-6)

Old pipes: Replacement of old pipes and ACP is necessary. KWS lacks material for pipeline repairs and replacement.

ACP: Since the design allowable pressure of ACP is 0.25 MPa, farther extension after ACP is difficult.

Low pressure and house connection: The main complaint from users is based on the fact that despite the surprise increase in water demand, water pressure remains low due to the compact pipes and the fact that distributing networks are also far from households, which hinders the water connections. The complaint level is around 1%. KWS has urgently solved some, but not all of these problems. (See Table 6-7)

Condition: Kampot condition exacerbates DI pipe rust.

Difficult system: Currently, it is difficult to manage distribution networks because the block distribution system is not yet adopted.

Table 6-6 Number of leakages of repairs by year

	2007	2008	2009	2010	2012
Distribution pipe	38	65	40	62	21
Service pipe	30	38	62	88	70
Total	68	103	102	150	91

Table 6-7 Number of house connection by year

Code	District/Commune	New connections				Total (accumulated) connections				
		2008	2009	2010	2011	2007	2008	2009	2010	2011
0707_02	Chum Kriel	2	179	120	36	0	2	181	301	337
0707_03	Kampong Kraeng	0	0	0	3	3	3	3	3	6
0707_09	Makprang	1	2	0	0	65	66	68	73	73
0707_19	Trapeang Thum	2	60	68	28	0	2	62	130	158
0708_01	Kampong Kandal	103	99	62	45	985	1088	1187	1249	1294
0708_02	Krang Ampil	42	33	47	29	399	441	474	521	550
0708_03	Kampong Bay	54	53	50	60	669	723	776	826	886
0708_04	Andoung Khmer	43	73	56	66	473	516	589	645	711
0708_05	Traeuy Kaoh	2	1	1	0	7	9	10	11	11
Total		**249**	**500**	**404**	**267**	**2,601**	**2,850**	**3,350**	**3,759**	**4,026**

As for profitability, the water rate collection reportedly remains high and almost 100%. The water price is 1,400 KHR/ m^3 for all consumers without metering price classification. Other factors influencing the profitability of the water supply utility are as follows:

Profitability matters: The electricity fee is related to profitability. It is expensive. Also, the quantity of non-revenue water and the expense of repairing old pipes are high.

As for human resources the following are listed:

Operators' knowledge: From the management perspective, the operators' knowledge remains insufficient.

Capacity development: Around 60% of the staff are qualified and the remainder unqualified. Their capacity in terms of general education and English language remains limited.

6.2.4 Organization structure of KWS

The following chart (Figure 6-3) indicates the organization of KWS. KWS is supervised by Kampot DIME, which is the provincial office of MIME.

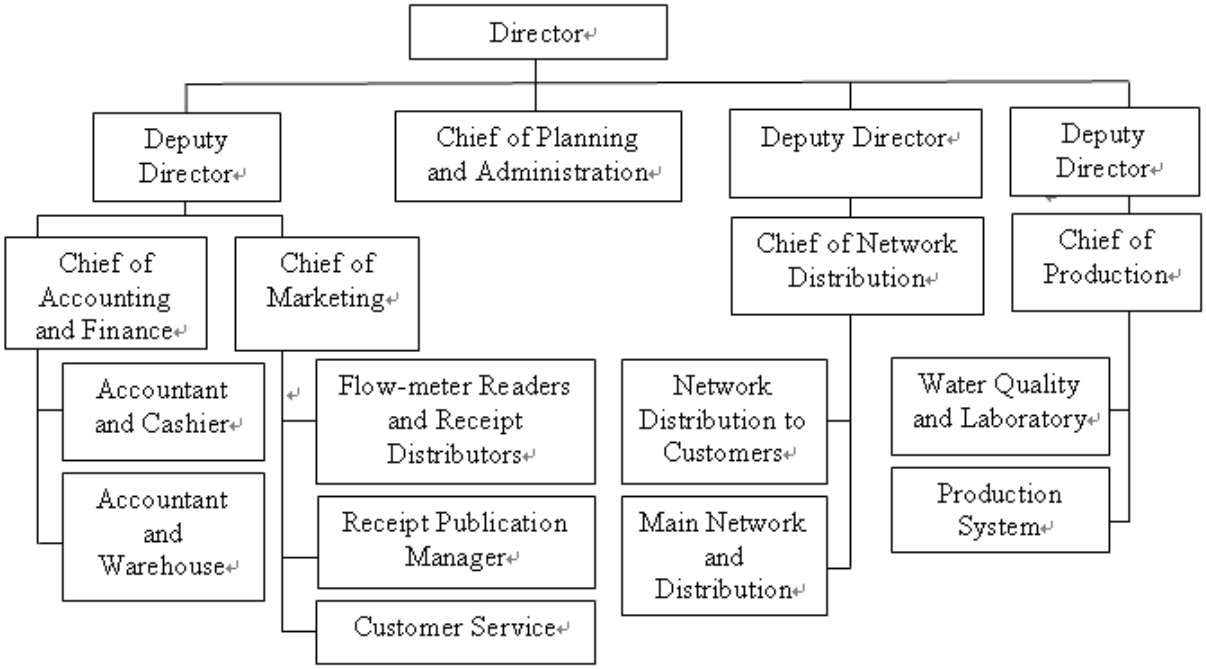


Figure 6-3 Organization chart of KWS
(Source: KWS)

KWS is headed by a Director, to whom the three Deputies report, consisting of a water production section, a distribution system section and an accounting and marketing section. The total number of personnel is 33. Per 1000 connections, 8.2 personnel were working in 2011. There are two other personnel under Chief of Accounting and Finance, five personnel under the Chief of Marketing, six personnel under the Chief of Network Distribution and seven personnel working under the Chief of Production.

6.3 Socioeconomic conditions

6.3.1 Population

The population of Kampot province is shown in Table 6-1. The growth rate is relatively low at less than 2%, except for 2006. The average family size is around 5.0.

Population by district for 2008 is shown in Table 6-2. Although Kampot District is the most urbanized, with the largest population density, its actual population is not necessarily the largest.

6.3.2 Occupations

Kampot Province is also characterized as an agricultural area by occupation data. Families mainly engaging in agriculture comprise 90% or more in most districts, except for Kampot District, where agricultural families occupy less than one third.

Table 6-8 Percentage of families by occupation for each district in 2008

District	Agriculture	Craft	Services	Others	Total
Angkor Chery	96.5	0.1	1.0	2.4	100.0
Banteay Meas	98.4	0.0	0.4	1.2	100.0
Chhuk	96.2	0.0	1.9	1.9	100.0
Chum Kiri	99.2	0.1	0.1	0.6	100.0
Dang Tong	99.0	0.0	0.1	0.9	100.0
Kampong Trach	94.9	0.0	1.6	3.5	100.0
Tuek Chhou	89.5	0.4	3.2	6.9	100.0
Kampot	32.8	1.2	18.7	47.3	100.0
Total	92.4	0.2	2.3	5.1	100.0

Source: NCDD, Kampot Data Book 2009, October 2009.

6.3.3 Water supply

Excluding Kampot District, few families can use pipe water and more than 50% use unsafe water sources during the dry season. Further development of safe water supply is required here.

Table 6-9 Percentage of families using different water sources by district in 2008

District	Pipe Water	Pump or Mixed Well	Ring Well
Angkor Chery	4.8	26.8	12.2
Banteay Meas	3.3	25.4	27.2
Chhuk	4.1	30.7	15.8
Chum Kiri	0.1	27.5	33.5
Dang Tong	0.7	40.6	31.0
Kampong Trach	10.0	14.6	18.6
Tuek Chhou	11.2	18.5	31.4
Kampot	84.1	3.5	6.2

Source: NCDD, Kampot Data Book 2009, October 2009.
Note: Calculated as a percentage of the total number of families in each district.

Table 6-10 Percentage of families using safe water sources in the dry season by district in 2008

District	Clean/Safe Water	Unsafe Sources	Total
Angkor Chery	31.5	68.5	100
Banteay Meas	23.1	76.9	100
Chhuk	42.5	57.5	100
Chum Kiri	36.3	63.7	100
Dang Tong	42.7	57.3	100
Kampong Trach	34.3	65.7	100
Tuek Chhou	34.2	65.8	100
Kampot	89.1	10.9	100

Source: NCDD, Kampot Data Book 2009, October 2009.

6.3.4 Poor households

In order to identify the poor households in rural villages, the Ministry of Planning (MOP) has been implementing the Identification of Poor Households Programme (IDPoor) since 2008 with technical assistance and coordination by the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ). IDPoor was scheduled to finish in 2011 but its termination has been postponed due to financial problems.

A standard questionnaire is used in all areas, to optimize the ease of comparison of the results of identification among households and geographical regions (village, commune, district, and province). The questionnaire consists of a set of commonsense proxy indicators, which are mainly based on easily observable and verifiable assets as well as other issues such as dependency ratio, school attendance and household composition.

Table 6-11 Identification criteria for the poor households of IDPoor

Scoring Criteria	Score
House situation	20
Means of production	8
Livestock	10
Food	8
Labor force	8
Communication	6
Transport	8
Total	68

Source: Ministry of Planning, Implementation Manual on the Procedures for Identification of Poor Households, October 2008.

The questions have weighted scores according to the perceived strength of their relationship to poverty. After the scores for each answer are added up, the final score is used to allocate households to different categories as follows:

Table 6-12 Categories of poor households and scores

Category	Score Range	Description
Poor Level 1	59 - 68 Points	The poorest or destitute category.
Poor Level 2	45 - 58 Points	The next poverty category after Poor Level 1.
Others	0 - 44 Points	Considered to have an average or better off living standard, and excluded from the List of Poor Households.

Source: Ministry of Planning, Implementation Manual on the Procedures for Identification of Poor Households, October 2008.

The results of the Identification of Poor Households Programme for Kampot Province were publicized by the Ministry of Planning. The percentages of poor households are summarized by District for 2009 in the following table:

Table 6-13 Poor households by district in 2009

District	Poor 1 HHs (nos.)	Poor 2 HHs (nos.)	Poor 1 HHs (%)	Poor 2 HHs (%)	Total Poor HHs (%)	Total HH Nos.
Angkor Chey	1,321	1,113	7.8	6.6	14.4	16,949
Banteay Meas	1,903	2,064	10.3	11.1	21.4	18,560
Chhuk	2,462	2,023	11.6	9.6	21.2	21,164
Chum Kiri	936	891	9.9	9.4	19.4	9,438
Dang Tong	1,195	676	10.3	5.8	16.2	11,560
Kampong Trach	1,690	1,936	9.9	11.4	21.3	17,006
Tuek Chhou	1,910	1,373	9.8	7.0	16.8	19,553
Kampot*	139	231	6.1	10.2	16.3	2,270
Total/Average	11,556	10,307	9.9	8.8	18.8	116,500

Note: * Only Communes of Andoung Khmaer and Traeuy Kaoh are included.
Source: Ministry of Planning, Identification of Poor Households Programme

6.4 Preliminary design of bulk water supply facilities

The main goal of this Bulk Water Supply Business is to take water that KWS will run short, from TAK KROLA dam (manmade lake), to purify and sell the water to Kampot Water Supply via a transmission pipe of about eight km.

6.4.1 Service area of KWS

The KWS is a water supply utility, which supplies water to nine communes. The water supply situation in 2011 is indicated in Table 6-14.

Table 6-14 Service areas and served connection of KWS

Code	Commune	Total Number of Family in Commune	Connection	Served
0707_02	Chum Kriel	1,058	337	31.9%
0707_03	Kampong Kraeng	1,387	6	0.4%
0707_09	Makprang	1,013	73	7.2%
0707_19	Trapeang Thum	615	158	25.7%
0708_01	Kampong Kandal	1,377	1,294	94.0%
0708_02	Krang Ampil	897	550	61.3%
0708_03	Kampong Bay	1,107	886	80.0%
0708_04	Andoung Khmer	2,083	711	34.1%
0708_05	Traeuy Kaoh	1,356	11	0.8%
Total		10,893	4,026	37.0%

This Business is to supply KWS with a volume of water capable of meeting the demand of five communes (Kampong Kraeng, Makprang, Trapeang Thum, Krang Ampil and Kampong Bay) of the nine communes indicated above and for the remaining four communes, the water will be supplied from an existing water treatment facility.

The reason for choosing this district is due to the height of the existing elevated tank (HWL 32 m, LWL 29 m), which was unsuitable for water distribution to very distant areas and comparatively high elevated regions (GL 15 m or more). Accordingly, the supply of water from new elevated tanks (HWL 40.0 m, LWL 35 m) to very distant areas and those of comparatively high elevation was planned in this Project.

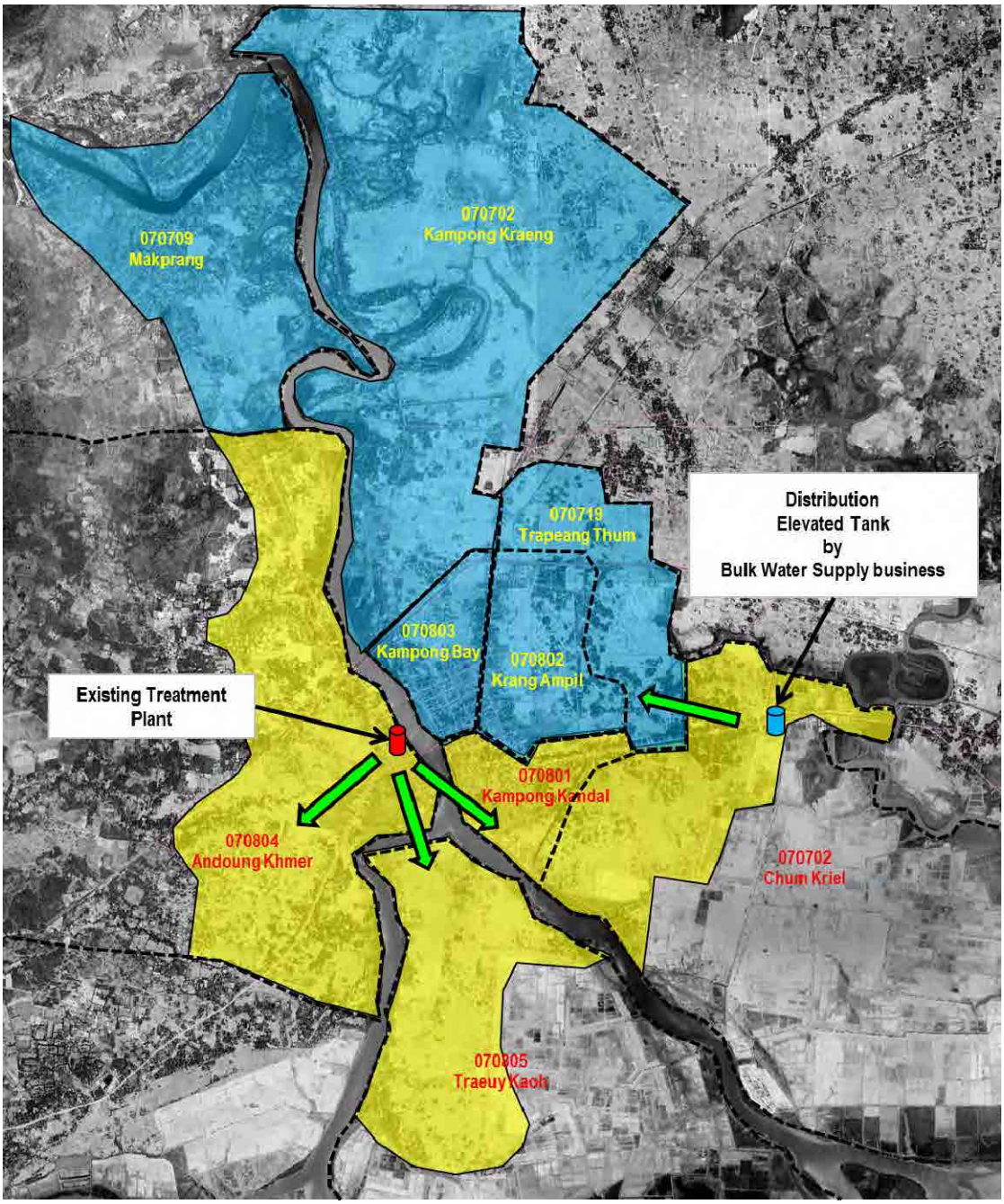


Figure 6-4 Map of Service Area

6.4.2 The population of the water supply area

The presumed population of nine communes, which is the water supply district of KWS between 2008 to 2011, is as follows:

As indicated below, there is fluctuation in the data until 2011, due to differences in data collection methods used each year.

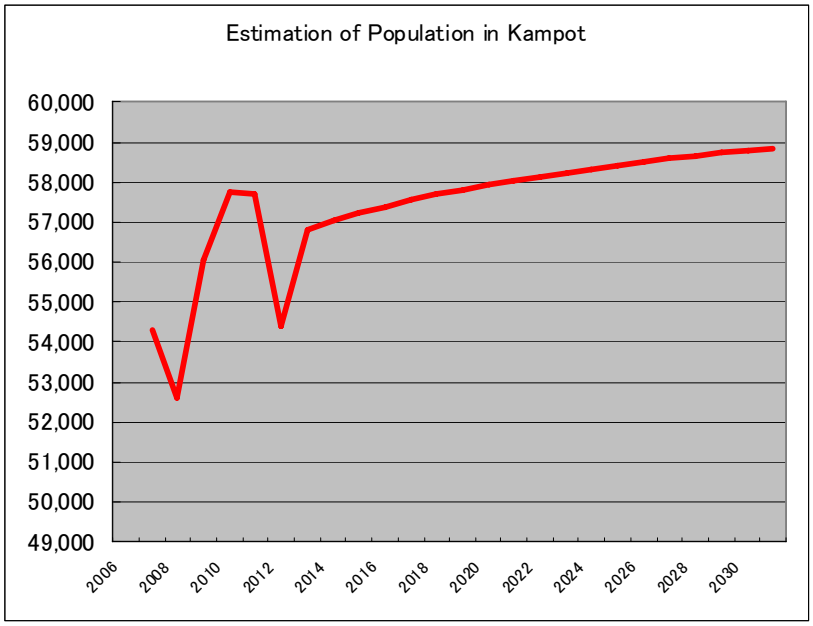


Figure 6-5 Estimation of population of Kampot

However, if the data shown above is presumed correct and a approximated curve of natural logarithm is drawn, the future population estimate will increase as shown in the graph above.

The population of the city of Kampot for 2012 is 56,828 and is expected to reach 58,858 in 2030, which represents an average population increase in a single fiscal year of 0.11%. The situation differs from the capital of Phnom Penh or the city of Siem Reap, where major population increases are expected.

Conversely, the estimated population of five communes (Kampong Kraeng, Makprang Trapeang Thum, Krang Ampil and Kampong Bay), which represents an area that serves a volume of water equivalent to the KWS, will be 25,803 in 2012 and 25,565 in 2030, which shows that the present population will be sustained.

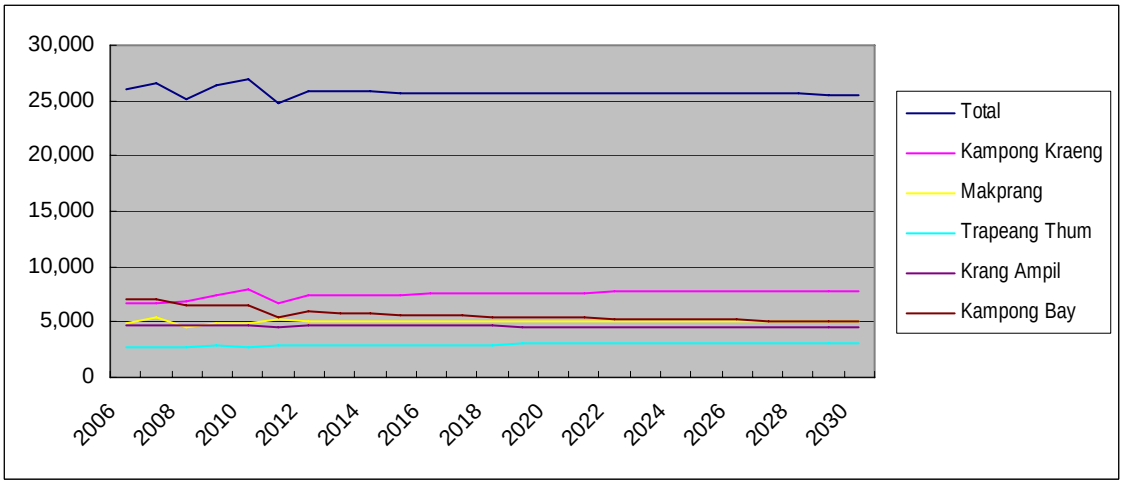


Figure 6-6 Prospective population by commune (designed areas)

Moreover, the estimated population of four communes (Chum Kriel, Kampong Kandal, Andoung Khmer and Traeuy Kaoh), which is the district that serves water from existing water treatment plant of

Kamot Water Supply, will be 31,025 for 2012 and 33,293 for 2030, while the average population increase per single fiscal year will be 0.22%. As shown in the graph below, there will be a gradual increase in population, but the growth rate will be very low.

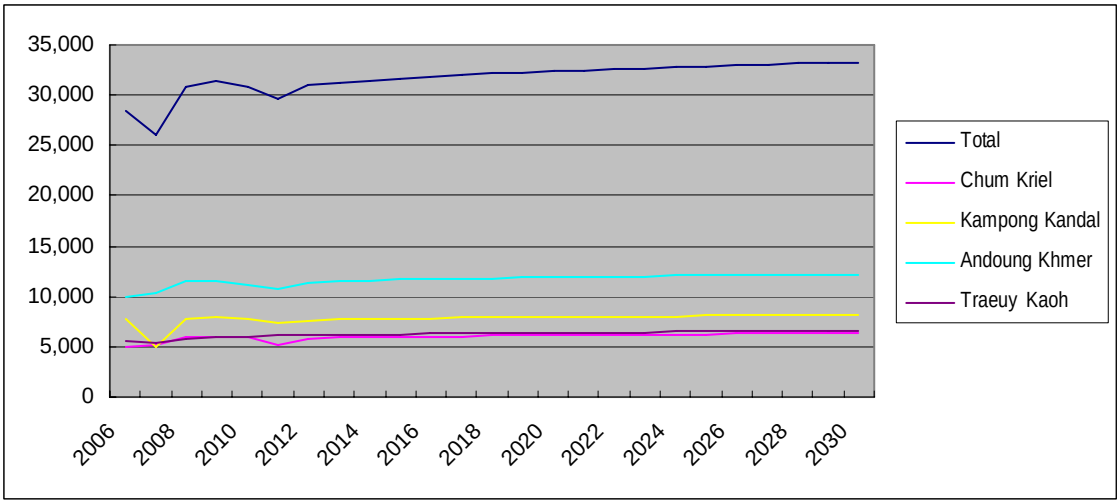


Figure 6-7 Prospective population by commune (existing areas)

This is because 80% of the water supply district of KWS is engaged in agriculture except for the central area. It is estimated that most people born in Kampot city will be transferred elsewhere except for heirs and spouses of farmers. Since this issue will have a major impact on the demand forecast in future, it is considered necessary to reestimate the population growth by using the "cohort method", which determines future population by studying age structure, birth rate and transfer situation etc., when conducting the feasibility study.

6.4.3 Served population

The planned population to be served by KWS was calculated on the assumption that all pipe laying works would finish by year 2015. Further details are shown in the table below.

Table 6-15 Population Served by KWS

Commune	2011	2015	2030
Chum Kriel	1,685	4,796	5,068
Kampong Kraeng	29	5,991	6,274
Makprang	372	4,007	4,036
Trapeang Thum	742	2,348	2,454
Kampong Kandal	6,987	7,784	8,155
Krang Ampil	2,750	4,624	4,577
Kampong Bay	4,341	5,679	5,034
Andoung Khmer	3,626	11,639	12,223
Traeuy Kaoh	50	6,243	6,580
Total	20,582	53,111	54,401

This development is expected to dramatically boost water penetration in the area of KWS to 37.0% in 2011, reaching about 92%.

6.4.4 Water demand

The calculation of planned water consumption is 120 L, which was determined as the water volume

used per capita per day. As to consumption value, it looked 135 L from Table 6-3 apparently but judging from the people around the current service area get tap water from people inside the service area and from the business of water venders who get water at Kampot WTP and convey to people outside the service area, the consumption value was determined as 120 L, employing planning value of PPWSA and SRWSA for reference. Moreover, as some tourist population was observed, the planned water consumption of Cambodian tourists was assumed to be 120 L per capita per day and 250 L per capita per day for foreign tourists. The tourist population was obtained from data treatment of Kampot Provincial Tourism Department.

Table 6-16 Frame of the KWS in 2015

Items	Domestic	Tourists		Total
		Cambodian	Foreign	
Population	57,397	673	50	58,120
Served Population	53,111	673	50	53,834
Unit Consumption (L/day)	120	120	250	
Water Consumption (m³/day)	6,373	81	13	6,467
Revenue ratio	90.0%	90.0%	90.0%	
Average Daily Supply (m³/day)	7,081	90	14	7,185
Loading ratio	0.80	0.80	0.80	
Maximum Daily Supply (m³//day)	8,851	113	18	8,982

＊ The maximum daily water supply from the existing water treatment plant is 5,183 m³/day and the maximum daily water supply from the Bulk Water Supply Business is 3,799 m³/day.

Table 6-17 Frame of KWS in 2030

Items	Domestic	Tourists		Total
		Cambodian	Foreign	
Population	58,858	629	64	59,551
Served Population	54,401	629	64	55,094
Unit Consumption (L/day)	120	120	250	
Water Consumption (m³/day)	6,528	75	16	6,619
Revenue ratio	90.0%	90.0%	90.0%	
Average Daily Supply (m³/day)	7,253	83	18	7,354
Loading ratio	0.80	0.80	0.80	
Maximum Daily Supply (me/day)	9,066	104	23	9,193

＊ The maximum daily water supply from the existing water treatment plant is 5,442 m³/day and the maximum daily water supply from the Bulk Water Supply Business is 3,751 m³/day.

It is possible to supply the water volume from Bulk Water Supply Business as shown in Tables 6-16 and 6-17. However, the financial situation of KWS is unfavorable, including the depreciation expense of the existing facility. Therefore, to improve matters, it was decided to consider supplying the maximum capacity of water from existing water treatment plants in this study. The planned water supply capacity shall be as follows:

Table 6-18 Planning of framework for the KWS in 2015
(Considered value in this Study)

	Expectation value	Considered value
Maximum daily water supply from the existing	5,183	5,760

WTP (m^3/day)		
Maxmum daily water supply from bulk water supply (m^3/day)	3,799	3,222
Total	8,982	8,982

Table 6-19 Planning of framework for the KWS in 2030 (Considered value in this Study)

	Expectation value	Considered value
Maximum daily water supply from the existing WTP (m^3/day)	5,442	5,760
Maximum daily water supply from bulk water supply (m^3/day)	3,751	3,433
Total	9,193	9,193

These values shall be considered along with the KWS and related organizations during the feasibility study.

6.4.5 Outline of PPP project facilities

1) Source of water

Based on the result of study on chapter 5.2, the water resource for the PPP project in Kampot province is selected as Tak Krola Dam. As described in chapter 5.2, on the day of the field survey, about 500 m³ /hour (12,000 m³/day) of water was discharged into an agricultural canal from the lake. During the dry season, even though it continues to discharge the water as is, over 80% of reservoir water was stored on the day of the survey. In case the Bulk Water Supply Business takes 3,500 m³/day of water from the lake, there will be no significant impact on the storage rate. However, further technical studies shall be conducted during the feasibility study.

Tak Krola Dam

2) Water treatment facility

2)-1 Water Intake/Transmission facility

The intake water point for the new water treatment facility is chosen as the area near the existing water gate (10°36’18.33”N, 17’06.92”E: The agricultural waterway to the west of Tak Krola Dam was chosen, because of the cheaper civil work in constructing transmission pipes due to a level road. In

this survey (it is the dry season on 16 and 18 January, 2012), the water level at the dam was located 19 m above sea level. Based on this and the result of interviews with neighborhood residents, the fluctuation of the water surface is set to plus or minus three meters.

The planned construction site for a new water treatment facility is decided as the crop land area (Figure 6.8) about 1.2 km southeast of the water gate. The elevation here is about 12 meters, so the water transmission uses the water head difference method without an intake pump. The piping for water transmission adopts the 300 mm diameter High Density Poly-Ethylene (HDPE) pipe that is widely used in Cambodia, and the pressure loss is about 1.4 m. Moreover, a coarse screen is installed at the intake point.

Existing water gate at Tak Krola dam

Figure 6-8 Piping plan between the Intake point and the new water treatment plant

2-)2 Water treatment plant

2)-2-1 Design water supply

The design water maximum daily supply in the new water treatment plant is 3,222 m³/day in 2015 and 3,433 m³/day in 2030, as described in chapter 6.4.4. Because the increase rate of water demand for 15 years is only 6%, in this plan, the capacity of the new water treatment plant is designed for 3,433 m³/day. Considering the water quantity required for chemical dissolution and toilets, the final flow quantity parameters are as follows:

- Design water maximum daily intake: 3,800 m³/day
- Design water maximum daily treatment: 3,700 m³/day

- Design water maximum daily supply: 3,433 m³/day

2)-2-2 Process

Regarding the water treatment process for new water treatment plants, at the beginning of this survey, a ceramic membrane filtration system was planned. However, a conventional coagulating sedimentation and rapid filtration system was ultimately adopted for the following reasons:

- This new water treatment facility will be a centralized monitoring base for the new water treatment facility and mobile water treatment equipment in Kep as hereinafter described, so will not achieve savings in terms of fewer engineers. It is of no merit for ceramic membrane filtration systems, because one of its advantages is reducing the number of operators required due to ease of maintenance and operation.

- Unlike in the case of Kep province, there is a public water supply managed by KWS (KWS) in Kampot, and the water tariff is 1,400 KHR/m³ in 2012. Because the water supply area of KWS is located next to the new water supply area in this survey, the water tariff in the new water supply area should be the same as that of KWS. The construction cost of the ceramic membrane filtration system also exceeds that of conventional rapid filtration, so if the new water supply company adopts a ceramic membrane filtration system, the tariff will be higher due to the charge for depreciation.

Considering these reasons, the processes for the new water treatment plant in Kampot will be conventional coagulating sedimentation and a rapid filtration system.

The main process in the existing KWS water treatment plant is a receiving well and flocculation basin, sedimentation basin and rapid filtration. From a construction perspective, and operation and maintenance costs, the process in the new water treatment plant is designed to be virtually equivalent to that of KWS, although the waste water treatment differs. In KWS's existing plant, sludge from the sedimentation basin and back wash waste water is directly discharged into the river without waste water treatment. In the new water treatment plant, a thickener and sun drying bed are planned for the waste water treatment system, considering the risk of polluting the river and the lack of a river near the new water treatment plant.

2)-2-3 Outline of the water treatment facility

The new water treatment plant consists of a coagulating flocculation basin, sedimentation basin, four series of rapid filtration basin and clear water reservoir and thickener and two series of sun drying beds. Because the new water treatment plant includes a central monitoring function for the new water treatment facility and mobile water treatment equipment in Kep province, there is also central monitoring, a lounge for the engineers' facility and a workshop facility in the area, as described in Tables 6-20 and 6-21.

The total area of the new water treatment facility is 4,485 m² (65×69 m).

Table 6-20 Building list in the Kampot new water treatment plant

Name	W (m)	L (m)	H (m)
Office + Laboratory building	11.6	8.6	4.0
Central supervisory building	5.6	8.6	3.0
Chemical storage + Workshop	11.6	8.7	3.0
Generator + Electric building	11.6	8.7	3.0

Table 6-21 Facility list in the Kampot new water treatment plant

Name	W (m)	L (m)	H (m)
Receiving water well + Sedimentation facility	31.9	9.7	4.0
Rapid filtration facility	12.8	14.8	3.0
Backwash waste water facility	9.2	5.6	3.0
Reservoir facility	15.1	15.6	2.0
Sun drying bed facility	21.0	21.2	2.0

Moreover, regarding the transmission method from clear water reservoir to elevated tank, it is designed to use the water head difference and a pump for shortfalls in pressure.

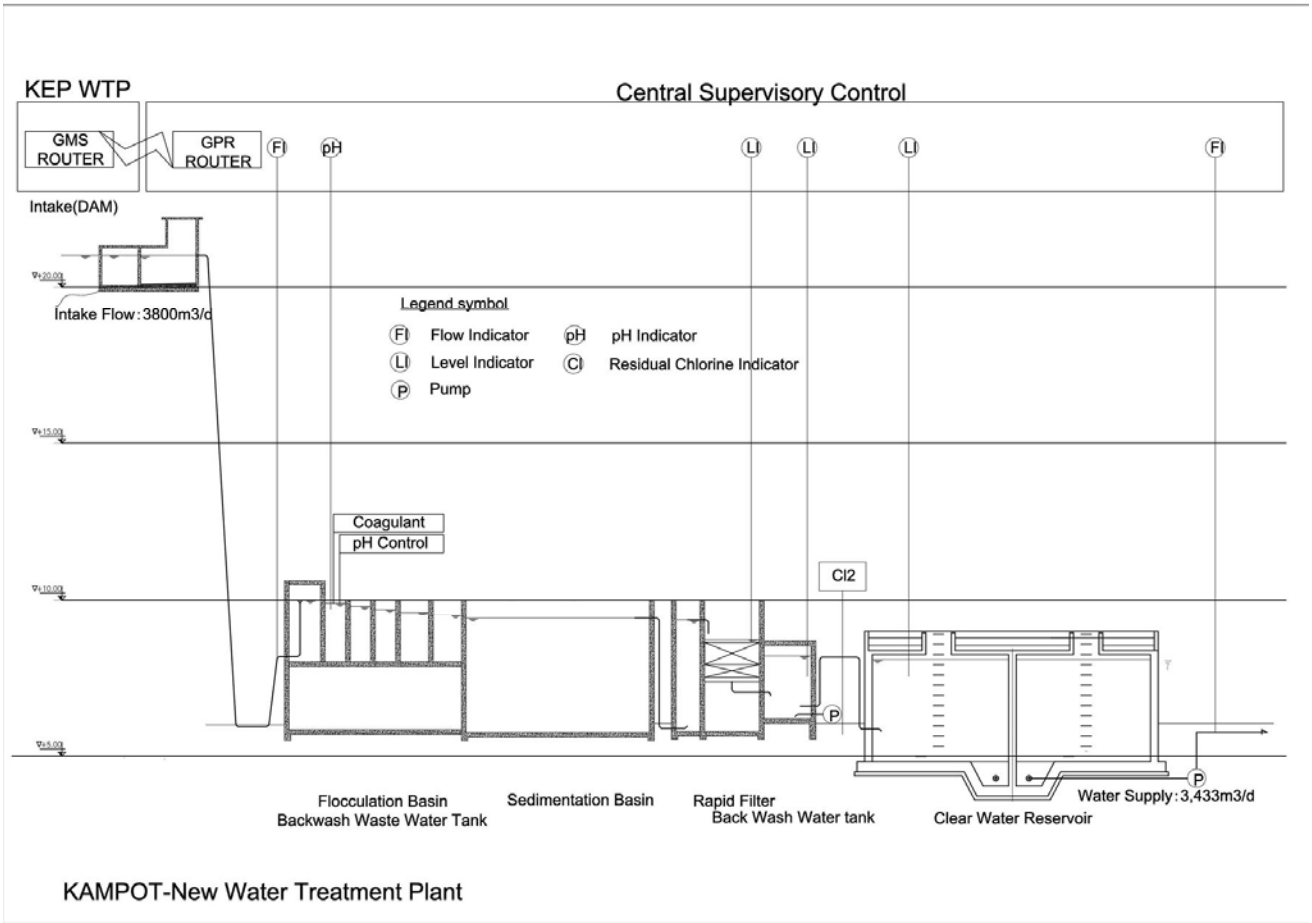


Figure 6-9 Water level relationship drawing

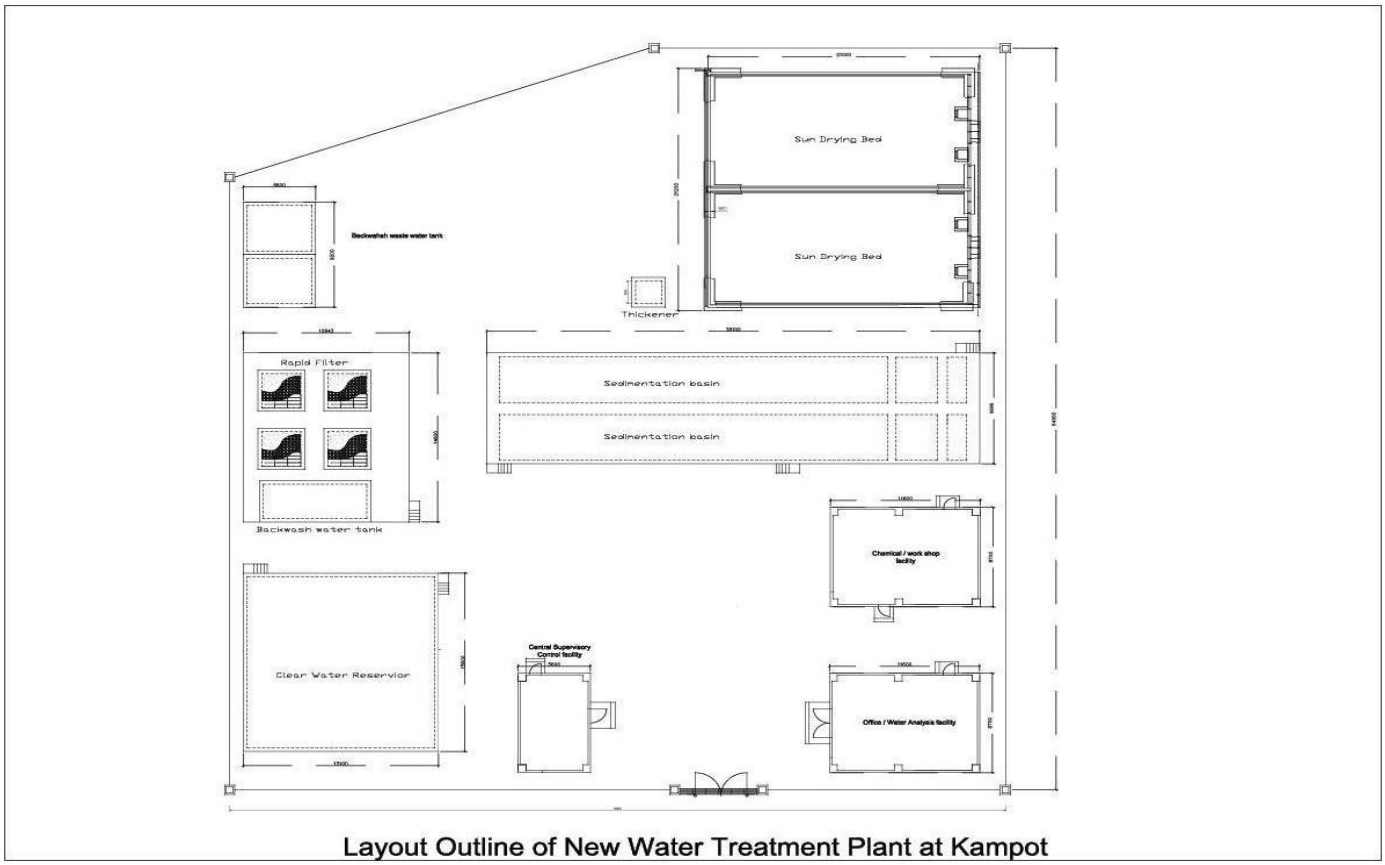


Figure 6-10 New water treatment plant layout plan

2)-2-4 Central monitoring system

One of the benefits of adopting a ceramic membrane filtration water treatment plant is unattended operation using a central monitoring and control system. To reduce the number of operators and engineers required for the operation and maintenance of the new water treatment plant in Kep province, a centralized controlling system is planned for the new water treatment plant in Kampot and described in Figure 6-11

The operational data of the water treatment plant in Kampot and Kep is transferred by wired Internet, while the operational data of mobile water treatment equipment is transferred by 3G wireless LAN that is widespread in Cambodia to a central monitoring system.

The contents of the data from each water treatment facility are as follows:

- Water treatment facility in Kep: Raw water turbidity, raw water flow rate, differential pressure of membrane (Trans-Membrane-Pressure: TMP), treated water turbidity, residual chlorine of treated water, distributed water flow rate, alarm of system
- Mobile water treatment facility in Kep: Raw water flow quantity, TMP, alarm of system
- Distribution area in Kampot and Kep: Flow rate, pressure, water level in distribution tank

Adopting this system, a new water treatment facility in Kep can operate unattended, except for maintenance involving the addition of chemicals once a week. Moreover, the mobile water treatment facility can be operated without specialized engineers, basically, trained truck drivers can fulfill this role.

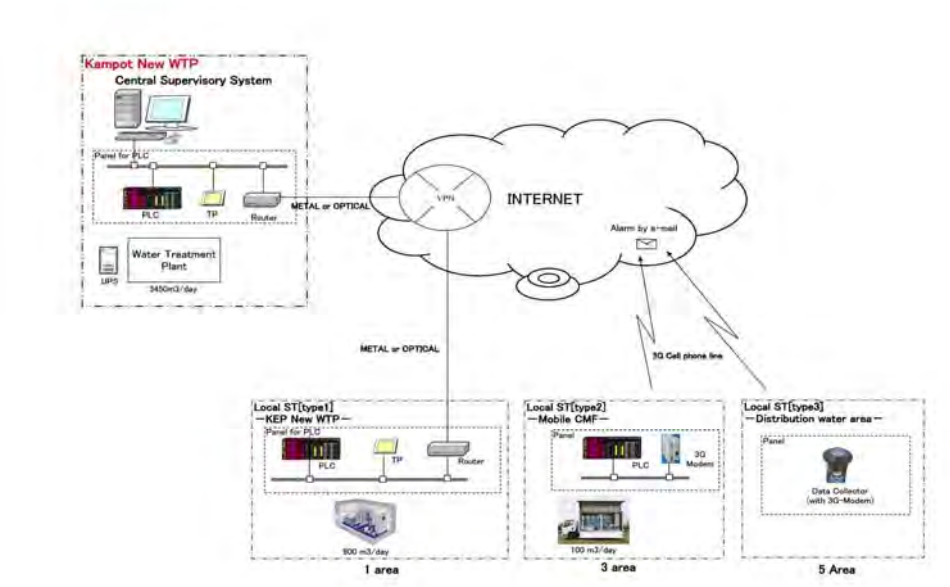


Figure 6-11 Structure of the central supervisory system in 2 WTPs and 3 M-CMFs

2)-2-5 The planned construction site for the new water treatment plant and electricity facility

The planned construction site for the new water treatment plant in Kampot is situated in a farmland area 1.2 km southwest of the intake point (Figure 6-12). The required area of farmland can be secured, however, the scope of this survey involves several dozen residents in the vicinity. The issue of compensation to residents will be solved by a future feasibility study. In addition, the required electricity for the new water treatment facility is about 84 kVA. However, there are no high voltage electrical power lines in this area. The nearest electrical power line in this area is located near national road number 33, four kilometers south of the planned construction area. In this survey, the estimated cost is calculated; however, regarding the purchase of land and the extension of electrical power lines, the potential must be determined in a future feasibility study.

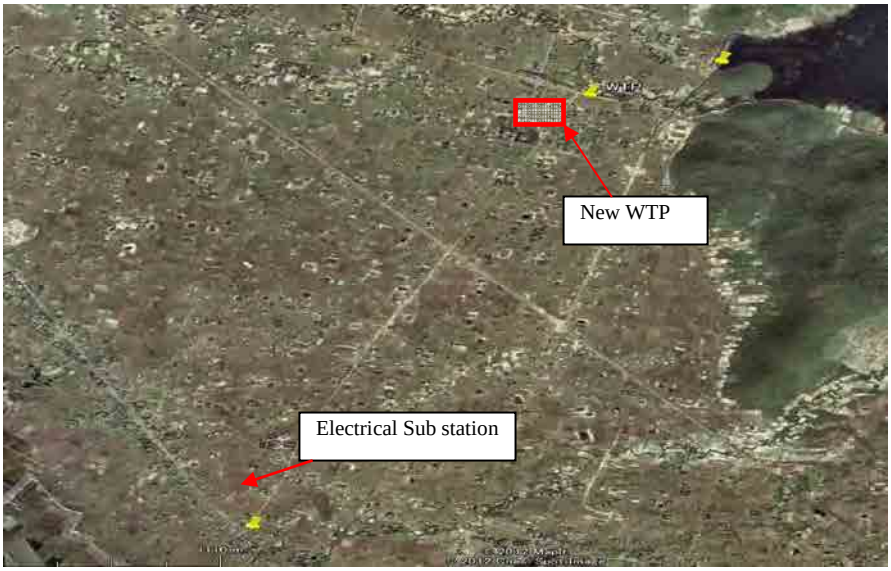


Figure 6-12 Position of the new WTP and electrical substation

3) Water transmission pipe

Between the new treatment plant and a elevated tank (HWL 40.0 m, LWL 35 m) (distance 7,960 m), which will be constructed to the east of the water supply district of KWS, a φ250 mm water pipe lined in two, will be installed by Bulk Water Supply Business.

The type of water pipe used shall be a polyethylene pipe, which is a commonly used material in Cambodia, as it is considered suitable from procurement, construction and economic perspectives.

Figure 6-13 Water transmission pipe

Moreover, the demarcation point between the Bulk Water Supply Business and KWS is the meter, which will be installed upstream of the water distribution elevated tank by the Bulk Water Supply Business. However, the quality of the water supply from influent water to the elevated tank shall be managed by Bulk Water Supply Business, whereupon.

6.5 Pre-conditions of the bulk water supply business by the PPP project in Kampot

In order to establish the Bulk Water Supply Business, the water demand of Kampot city shall exceed the capability of the existing water treatment plant. To increase water demand, it is a must to install a water distribution pipe on roads, where there is no water supply.

KWS understands this and is constructing water pipes under a limited budget. Moreover, to establish new connections to each household, they are gradually expanding the scope of the water supply.

Figure 6-14 below indicates the total connection value from 2007 onward. If the future expansion of the water supply district at the current pace is assumed, the value of the maximum daily water supply might shift to the graph shown below.

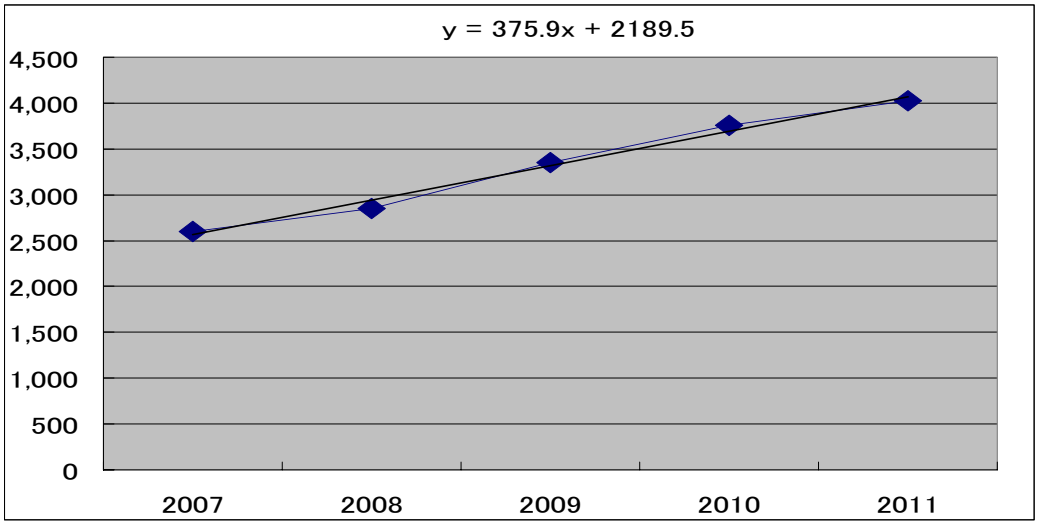


Figure 6-14 Total connection value from 2007

As indicated in Figure 6-15 below, if the water supply district expands at the current pace, the present treatment capacity (5,760 m³/day) will be exceeded in 2018. Moreover, in 2028, the maximum daily water supply capacity of 9,000 m³/day will be attained, which is the maximum capacity that the Bulk Water Supply Business can operate.

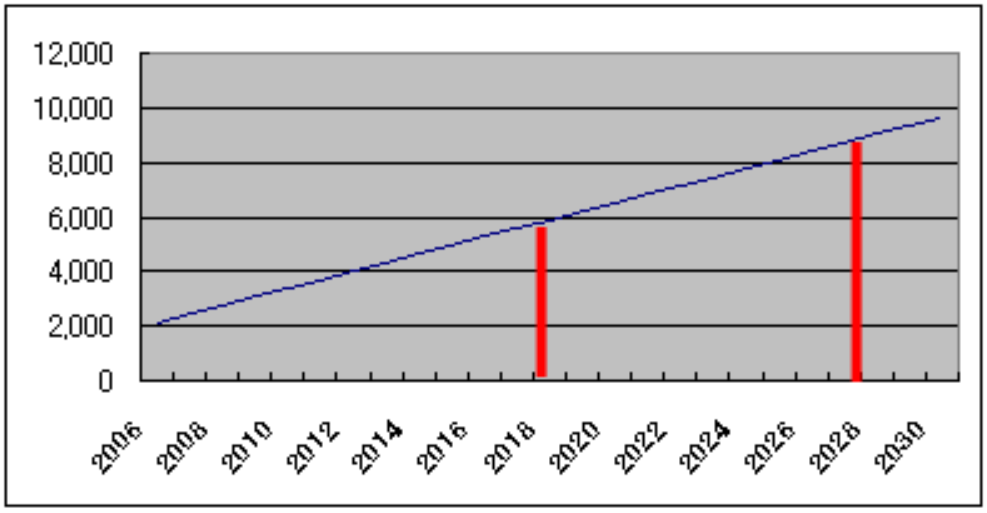


Figure 6-15 Future trend of water demand in Kampot

However, the incline of the graph will be smaller as no financial assistance has been secured to expand the water supply district. Moreover, as it moves towards the suburban area, the number of customer houses per one kilometers of water pipes will decline.

In order to establish the Bulk Water Supply Business, earnings must be anticipated. At this stage, it is extremely risky to expect increased water demand as shown in the graph, as financial proof to expand the water supply district remains pending.

Moreover, as expected in 2018, if the treatment capability of the existing plant can be exceeded and the Bulk Water Supply Business has launched, the maximum daily water supply capacity will only be realized in 2028 and an extremely difficult situation will be expected in terms of recovering investment.

In conclusion, in order for Japanese firms to establish the Bulk Water Supply Business, the water supply district must be immediately expanded, as this is a prerequisite to establish business. International cooperation such as grant aid is thus desirable. A summary of the related expansion of water supply areas is shown below.

Table: 6-22 Estimation for newly recommended distribution pipelines

Category	Material	Diameter (mm)	Length (m)	Unit cost (yen/m)	Construction cost (yen)
Main	DCIP	450	60	---	---
Main	DCIP	400	2,124	---	---
Main	DCIP	350	1,343	---	---
Main	DCIP	300	3,209	---	---
Sub-main	PE	250	4,500	---	---
Sub-main	PE	200	8,635	---	---
Sub-main	PE	150	5,397	---	---
Branch in	PE	100	17,214	---	---
Branch	PE	80	13,055	---	---
Distribution elevated tank					---
Total					1,740,000,000 JPY

Chapter 7 Preliminary design of the water supply facilities in Kep Province

7.1. Concept of water supply by PPP project

The Kep city in the Kep province is a beautiful, nature-rich city, surrounded by sea and mountains, hence its future development into a major tourist venue is confidently expected. However, a major hindrance to this development is the WATER issue. The lack of water utilities established in this city, means existing hotels draw water from ponds or wells. During the dry season, water from the ponds and wells either deplete or declines in quality.

With the water problem in mind, there is a lack of adequate customer service. Via a combination of fixed water treatment plants and Mobile Membrane Filtration Equipment (hereinafter referred to as M-CMF), the problem will be settled. Moreover, the belief that "Japanese tap water can be used safely" can boost the rapid development of Kep as a tourist venue.

7.1.1 Outline of Kep province

Kep is a seaside tourist province located 173 km south-west of Phnom Penh. Visitors from Phnom Penh take National Road 3 via Kampot province or National Road 2 via Takeo province. In addition, the train from Phnom Penh to Sihanoukville stops at Damnak Chang Aer Station, which is about seven kilometers from the Kep city.

Kep is a province outside Cambodia's 24 cities/provinces, with a total land area of 158.63 km^2. It is located in the south of the country; bordering Kampot to the North, East and West and the Gulf of Thailand to the south. The province has relatively few typical plain wet areas, like other provinces, as there are some foothills from the Elephant Mountains from Kampot province. Land administration is divided into one city (Kep), one district (Damnak Chang Aer), five communes, and 16 villages. The total number of families is 7,779, housing a total population of 36,742 (August 2011).

Table 7-1 Population of Kep province

	2005	2006	2007	2008	2009	2010
Total population	34,660	33,306	35,206	35,854	36,738	36,742
Total families	6,869	6,958	7,103	7,517	7,404	7,779

Source: Population Statistic (2005-2010)

Note:
While the total number of households (6,958) in 2006 increased, the population (33,306) decreased. There are two reasons:

1. Some family members got married and moved out to form their own families.
2. During 2006, there was considerable migration to other provinces and overseas. Those people's names were therefore removed from the provincial population list.

Provincial climate

- Cool season: November-March (Temperature 20-26 °C)
- Hot season: March- May (Temperature 29-34 °C)
- Rainy season: May - October (Temperature 22-30 °C, with humidity up to 90%)

Tourism capacity

The total number of tourists was counted based on the registration list distributed by the Kep Department of Tourism (hereinafter referred to as KDT) to the hotels and guesthouses. The owners are asked to hand the lists to the guests during room registration. Counting is per head. Once they check out and/or return next time and must re-register, the number will be recounted and updated as part of

the tourism data.

The following table shows the tourism capacity and total number of tourists in Kep.

Table 7-2 Tourism capacity

Description by types	Number by years		
	2008	2009	2010
Total tourists	296,967	346,183	475,375
Resorts	10	11	11
Bungalows	3	4	4
Restaurants	19	24	25
Hotels	4	5	6
Guesthouses	11	16	17
Canteens	3	5	6

Source: Data of Department of Tourism (2011)

According to newly-updated information (2011) from KDT, the situation of tourism in Kep is as follows:

1. International tourists (very few)
2. Regional tourists such as people from Viet Nam, Laos and Thailand (average rate)
3. Cambodian tourists: city & provincial tourists + local tourists (larger number than regional tourists)

Kep's tourism has improved since 2011, after the Bay of Cambodia, including Kep, was integrated in "**the Club of the Most Beautiful Beaches in the World"** which is held by a French organization. Recently, the number of hotels, guesthouses and other tourist sites in the province has increased. There are 38 guesthouses (427 rooms), seven bungalows (66 rooms), seven hotels (190 rooms), 35 restaurants, six canteens, and 11 resorts. In 2011, the total number of tourists visiting Kep was 748,076, of which 8,763 were foreigners.

History of Kep

The city was founded in 1908 during the French colonial time and renovated into a beautiful seaside resort in the 1960s, during the then-Prince Norodom Sihanouk's Sangkum Reastr Niyum Regime. The name Kep comes from the French term *le cap*, or cape in English. A cape is a point of land that juts into water, especially a headland significant for navigation. Kep was a city until 1979, whereupon it was classified as a commune under Kampot district, Kampot province. In 1992, the Council of Ministers decided to establish Kep-Bokor city and a ceremony of city establishment was held on 23 March, 1993 in the honored presence of Prime Minister Hun Sen, Head of the Council of Ministers of Cambodia[1]. On 19 March, 1994, the Kep city changed its administrative structures from city to district level by retaining the name 'Kep city'[2], and on 7 October, 1994, changed its administrative structure again from district level to city level. The administration continued until 2009. Later, on 24 May, 2009, a Royal decree number 0.509/542 was issued, ordering the nomination of Kep city to Kep province until the present.

Reason for the change from City to Province

Kep is a small province with a small population and few households, yet a tourism capacity that has seen it nominated as city of the country on a few occasions, making it an attractive place for tourists.

[1] Sub-degree number 29 issued in 1992
[2] Sub-degree number 59

Due to its low population and low economic growth, however, it is a major expense for administrative management to run it at the level of a city. In short, the provincial capacity cannot be considered to be at a city level.

Target rural areas for M-CMF

The target rural areas and their outlines are followings below. As to their locations, see Figure 7-7.

Rural area 1:

1. Kep village, Kep commune (Kep City)
2. (North) KompongTrolach village, Prey Thum commune (Kep City)
3. (South) Thmei village, Prey Thum commune (Kep City)
4. Damnak Chang Aer village, Prey Thum commune (Kep City)

Table 7-3 Population and households of rural area 1 (2010)

Areas	Population	Households
1. KEP village	2,649	556
2. KompongTrolach village	2,043	423
3. Thmey village	2,335	541
4. Dam Nak Chung Aer village	3,458	669

In these areas, the standard of living is higher than elsewhere. Around 50% of the population are farmers, mainly producing rice and seasonal crops such as corn, bean, sweet potato and some tropical fruits. Kep has the largest number of officials (around 30%) because it is the main business and administrative area of the province. The remaining 20% of the population are business people, workers and fishermen.

Rural area 2:

1. ChamkarBei village, Pong Tuek commune (Dam Nak Aer District)
2. ChamkarJek village, Pong Tuek commune (Dam Nak Aer District)
3. AngtongSar village, Pong Tuek commune (Dam Nak Aer District)

Table 7-4 Population and households of rural area 2 (2011)

Areas	Population	Households
1. ChamkarBei village	1,261	257
2. AntongSar village	953	212
3. ChamkarJek village	1, 082	233

The standard of living of the residents around these areas is quite low. Based on the report from Mr. Ly Hort, Leader of Pong Teuk commune where the three villages are located, most people in these three villages may not be able to buy water at 4,000 KHR = 1 US$ per one m^3. They may also be unable to install their own pipes, given a distance between the dam and villages of around 1.5 to two kilometers (the dam is located in the middle of the three villages). Almost all the residents are farmers, living mainly on rice and crop plantation. They do not have annual and monthly, or even regular daily incomes.

Rural area 3:

1. O-Krasar village, O-Krasar commune (Kep City)
2. DamnakChambak village, O-Krasar commune (Kep City)

Table 7-5 Population and households of rural area 3 (2010)

Southern Part of the Area (40% of total)

Areas	Population (40%)	Households (40%)
1. O-Krasar village and 2. DamnakChambak	2,880	599

According to the O-Krasar leader, residents living close to the national road are divided into two: the upper part of the road (on the land area, close to Kampot), and the lower part (close to the sea area). The upper part accounts for 60% of the total population, with the remainder in the lower part. Residents in the upper part can access water much more easily than those living lower down and since they can obtain water from wells, ponds and dams, they might not buy the water of this project. However, those living in the lower part of the road urgently need water because the groundwater is salty and inadequate for daily usage. A study is therefore proposed for the lower part. Residents of the lower part mainly exist through fishing (as they live near the sea). Some residents are business people and workers, and only a few are government officials.

7.1.2. Planning of the water supply

In this PPP Project, the focus is on Kep city's water problem. After Japanese firms have acquired the right to start a water utilities business in the entire city of Kep, where hotels and restaurants are located and thus profitability is expected, a water business utility will be established (2015) and business operations conducted. At the same time, by using M-CMF, awareness of water safety will be enhanced. As a future goal, if Kep city can become a major tourist site, a water supply business for the entire city of Kep will be planned.

In terms of business operations, by gaining cooperation from Kampot Water Supply (KWS), which is one of the targeted city of JICA's "Project on Capacity Building for Water Supply System in Cambodia Phase-2", it is expedient to ensure the technical level and reduce the budget for this Project.

Regarding the tourism aspect of Kep, most tourists tend to visit over weekends or holidays and not many people stay long. If planning a water business assuming tourists will be concentrated on a specific date, the facility becomes too large with normal demand in mind; hence this cannot be considered an optimal approach in terms of recovering the investment. Accordingly, the design of the water facility and water transmission facility is planned to cover the normal demand (0.8 load factor), while at times of peak demand, e.g. weekends, M-CMF will be used alongside the main water treatment plant. On weekdays, mobile water treatment equipment supplies domestic water and drinking water to residents outside the city of Kep.

7.2 Socioeconomic conditions

7.2.1 Population

The population of Kep province is shown in Table 7-1. Its growth rate fluctuated widely, from negative to positive, between 2006 and 2007. The average family size is around 5.0.

The following table shows the 2008 population by district, with similarly low population densities for both districts.

Table 7-6 Population by district in 2008

District	Nos.	Percent	Land Area (ha)	Pop. Density (nos./ha)
Damnak Chang Aer	23,101	64.4	16,517	1.4
Kep	12,753	35.6	8,096	1.6
Total	35,854	100.0	24,613	1.5

Source: NCDD, Kep Data Book 2009, October 2009.

7.2.2 Occupations

Kep province is characterized as an agricultural area according to the occupation data. In total, families mainly engaging in agriculture account for more than 90%.

Table 7-7 Percentage of families by occupation for each district in 2008

District	Agriculture	Craft	Services	Others	Total
Damnak Chang Aer	97.1	0.1	2.4	0.4	100.0
Kep	82.5	0.0	2.3	15.1	100.0
Total	91.8	0.1	2.4	5.8	100.0

Source: NCDD, Kep Data Book 2009, October 2009.

7.2.3 Water supply

In Kep Province, no families have access to piped water, and around 80% of the population use water from unsafe sources during the dry season. The development of a safe water supply is urgently required here.

Table 7-8 Percentage of families using different water sources by district in 2008

District	Pipe Water	Pump or Mixed Well	Ring Well
Damnak Chang Aer	0.0	28.8	38.6
Kep	0.0	40.3	37.2

Source: NCDD, Kep Data Book 2009, October 2009.
Note: Calculated as a percentage of the total number of families in each district.

Table 7-9 Percentage of families using safe water sources in dry season by district in 2008

District	Clean/Safe Water	Unsafe Sources	Total
Damnak Chang Aer	23.1	76.9	100
Kep	18.1	80.9	100

Source: NCDD, Kep Data Book 2009, October 2009.

7.2.4 Poor households

The results of the Identification of Poor Households Programme for Kep Province were publicized by the Ministry of Planning. Details of the programme are described in 6.3.4. The percentages of poor households are summarized by District in 2009, as shown below. Data by Communes in 2009 is shown in Table 7-10.

Table7-10 Poor households by commune in Kep province in 2009

District	Commune	Poor 1 HHs (nos.)	Poor 2 HHs (nos.)	Poor 1 HHs (%)	Poor 2 HHs (%)	Total Poor HHs (%)	Total HH (nos.)
Damnak Chang Aer	SangkatAngkaol	154	236	9.5	14.6	24.1	1,621
Damnak Chang Aer	SangkatO-Krasar	149	184	9.9	12.2	22.1	1,504
Damnak Chang Aer	Pong Tuek	119	272	5.7	13.1	18.8	2,076
Kep	Kep	21	125	2.1	12.3	14.4	1,013
Kep	Prey Thum	23	154	1.4	9.6	11.0	1,612
	Total/Average	466	971	6.0	12.4	18.4	7,826

Source: Ministry of Planning, Identification of Poor Households Programme

7.3. Preliminary design of conventional water supply system (piped distribution)

7.3.1. Service areas

A fixed water treatment plant will be set up and water supplied through distribution pipes to the following three districts:

1) Tourists District: Districts where hotels and restaurants are concentrated, along the coastline (approximately 5.5 km).
2) Main Water Source District: Within a one-km radius of Phnom Prous Pond (natural spring-fed pond), which is chosen as a water source for this water business project.
3) Water Source for Mobile Equipment District: Within a one-km radius of Little Pond A (natural spring-fed pond), which is chosen as a water source for M-CMF.

See Figure 7-1.

The above 2) and 3) are selected as ponds secured by local residents for their precious daily lives. When selecting water sources for this Project, the team wanted to avoid rapid drawdown of the water table or change in quality and also anticipated troubles with surrounding residents. Therefore, to avoid such problems, the team included them in the coverage area of the plan.

In the Survey, it was assumed that inhabitants lived within one kilometer of the water source. When conducting the next feasibility study, it will be necessary to interview or negotiate with residents and after specifying stakeholders, the final coverage area should be determined.

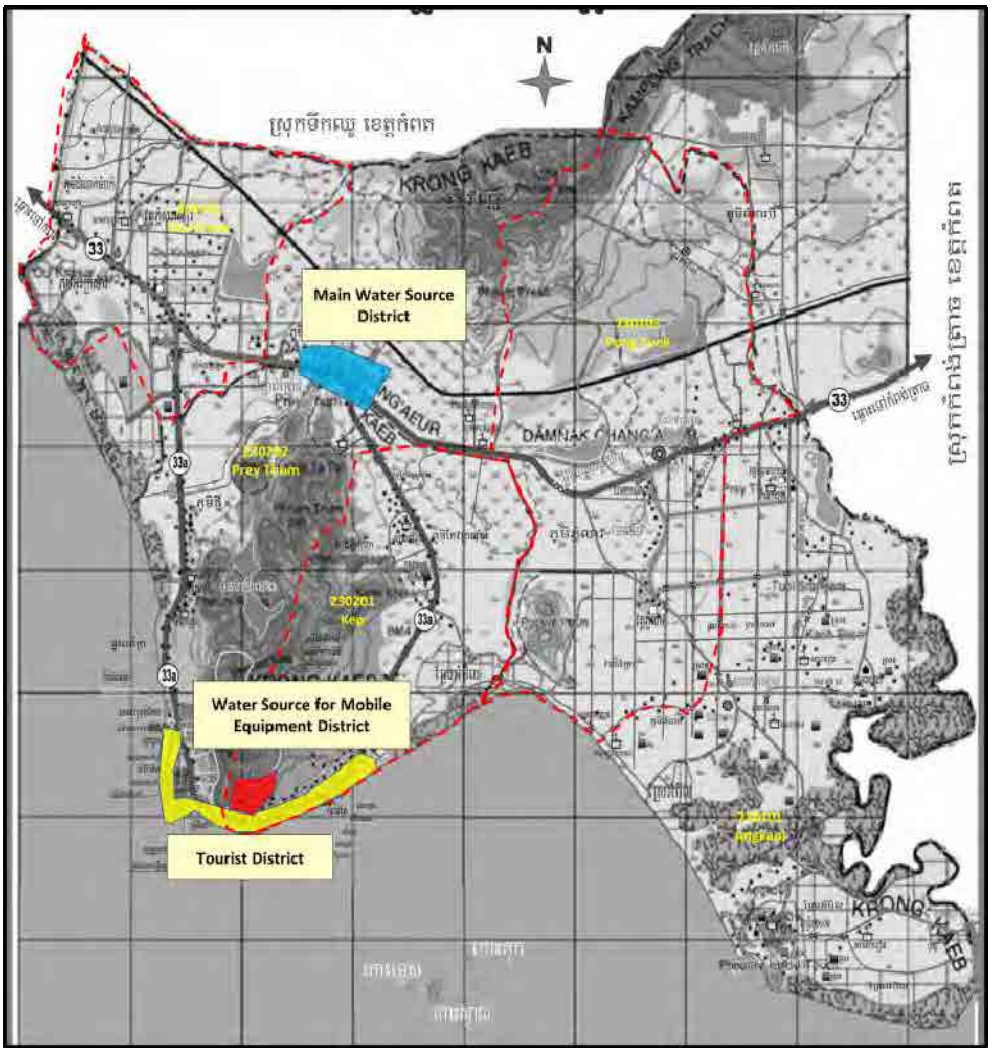


Figure 7-1 Map of service areas

7.3.2. Served population

Table 7-11 shows details of the served population in Kep province. In addition to 90% of Cambodian tourists and 100% of foreign tourists, 922 Kep residents and 1,098 Prey Thum residents living in the tourist district, 2,000 Prey Thum residents living in the main water resource district, and 1,440 Kep residents living around the water source for the mobile equipment district shall be the subject matter.

Table 7-11 Served population via pipe distribution system in Kep province, 2015

Commune	Domestic			Tourists (daily)	
	Population	Served	%	Cambodian	Foreign
Angkaol	8,044	0	0%	0	0
O-Krasar	7,400	0	0%	0	0
Pong Tuek	9,392	0	0%	0	0
Kep	5,039	2,362	46.9%	1,525	12
Prey Thum	8,648	3,098	35.8%	1,524	11
Total	38,523	5,460	14.2%	3,049	23

7.3.3 Water demand

To calculate the planned water consumption, that of local residents is estimated at 80 L per capita per day. Moreover, the planned consumption is estimated and calculated at 120 L per capita per day for Cambodian tourists and 250 L per capita per day for foreign tourists.

The reason for estimating local residents' water consumption as low is because according to the poor living conditions of the people, for instance, the present water volume used daily is only 20 L per capita per day. Therefore, it is very dangerous to select a much higher volume of water consumption. The water consumption is, accordingly, assumed to be 80 L per capita per day, referring to the value at the time when PPWSA restarted the 24 hour water supply in around 2002.

Table 7-12 Frame of the Kep water supply (pipe distribution system) in 2015

Items	Domestic	Tourists		Total
		Cambodian	Foreign	
Population	38,523	3,049	23	41,595
Served Population	5,460	2,744	23	8,227
Unit Consumption (L/day)	80	120	250	
Water Consumption (m³/day)	437	329	6	772
Revenue ratio	90.0%	90.0%	90.0%	
Average Daily Supply (m³/day)	486	366	7	859
Loading ratio	0.8	0.8	0.8	
Maximum Daily Supply (m³/day)	608	458	9	1,075

7.3.4 Outline of the water supply facilities

7.3.4.1 Water source

The Phnom Prous Pond, which is the source of water for this Project, is located 7.6km (10°32'35.34"N, 104°18'51.33"E) linearly north of the tourist district on the coastline and is used to secure daily water for local residents. Considerable spring water can be expected, as the water level does not fluctuate a lot year-round. However, during the next feasibility study, it is necessary to conduct a production test and determine whether this pond will become a stable water source for the Project.

Phnom Prous Pond

7.3.4.2 Water treatment facility

A new water treatment facility in Kep is managed by new water treatment facility in Kampot to save on manpower. The Ceramic Membrane Filtration System (hereinafter referred to as CMF) – one of Japanese technologies – is adopted as a treatment facility, with planned daily maximum treatment of 900 m³/day, including usage inside the facility. In addition, for the steep increase of water demand on weekends and holidays when tourists increase, supporting by M-CMFs will make up for the shortage.

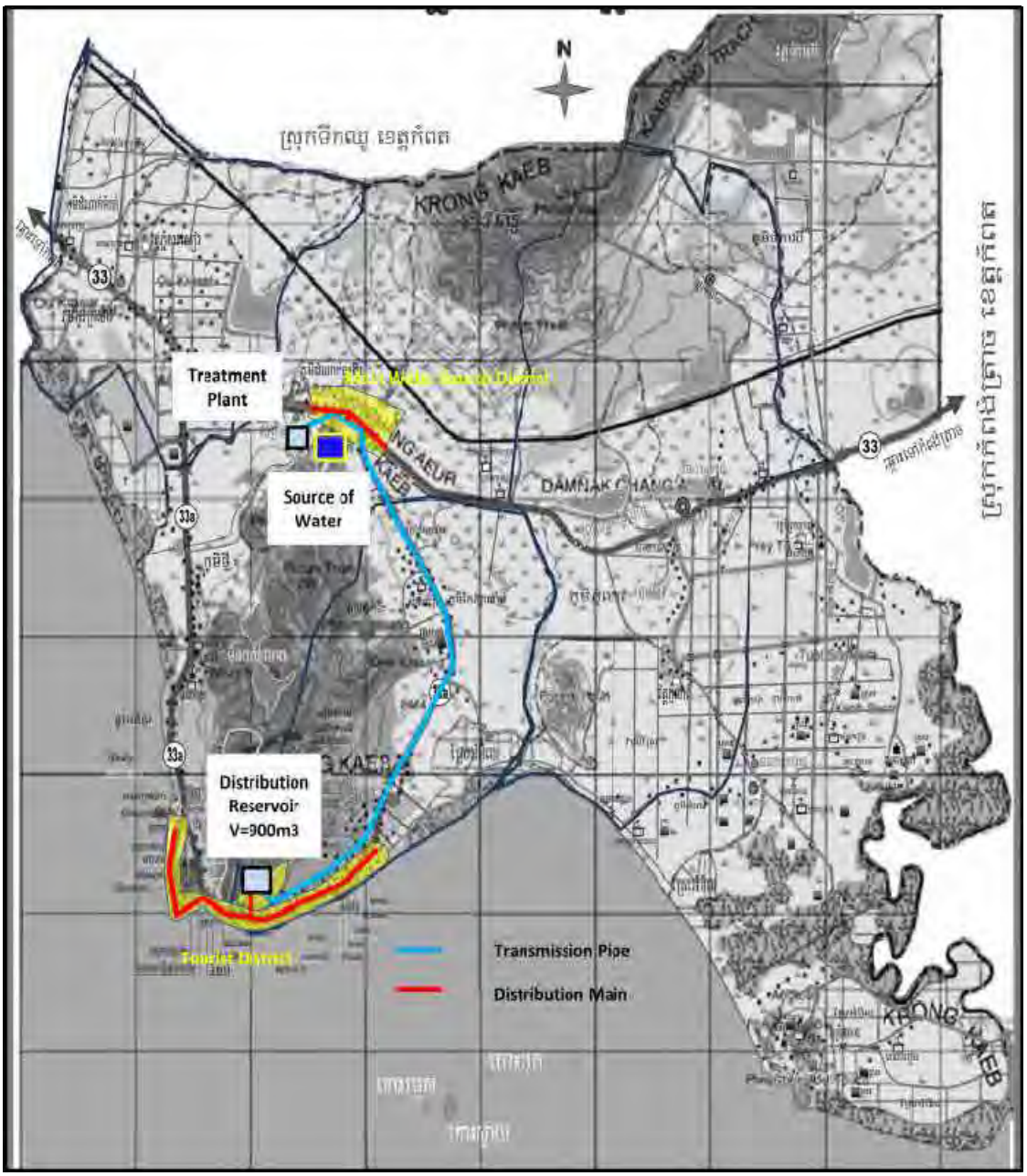


Figure 7-2 Map of the Water Treatment Facility

The process of new water treatment is as follows:

- Receiving water well
- Primary mixing basin
- Secondary mixing basin
- Ceramic membrane filtration equipment (7 elements/modules x 2 modules/unit x 1unit)
- Clear water reservoir (225 m^3)

The required area for this water treatment facility is about 590 m^2 (33×18 m). The drawing flow sheet and plan layout are shown in Figure 7-3 and 7-4.

The outline of the RC tank and building specification are as follows:

Table 7-13 Outline of the RC tank

Facilities	W (m)	L (m)	H (m)
Clear water reservoir	8.6	7.0	4.0
Sun drying bed	7.2	5.0	2.0
Membrane filtration facility	16.6	8.7	4.0

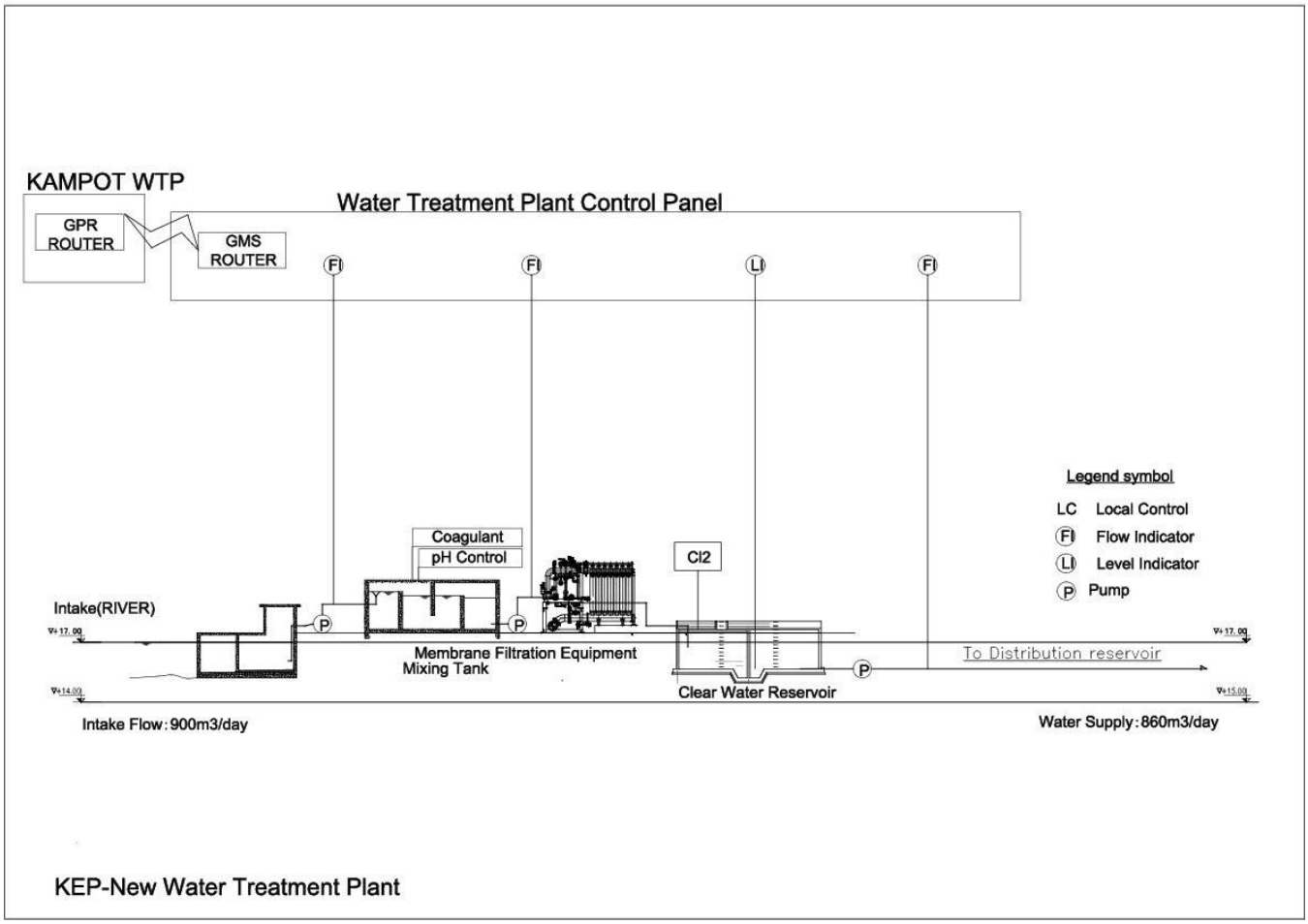


Figure 7-3 Water level relationship drawing

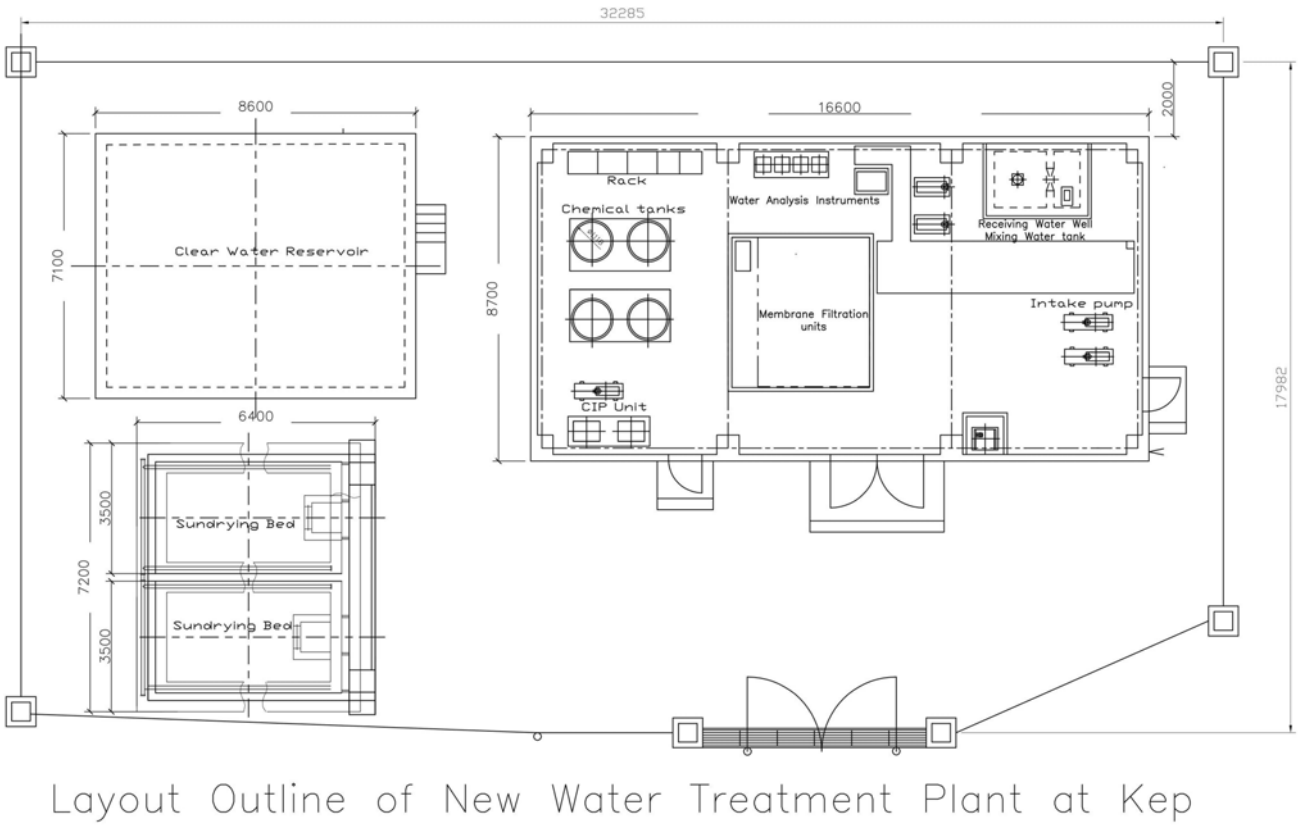


Figure 7-4 New water treatment plant layout plan

7.3.4.3 Water transmission pipe

Between the water treatment plant (treating up to 852 m³/day) to the elevated water distribution tank (HWL 37.0 m, LWL 32.0 m) (distance 10,500 m), which will be constructed in the tourist district, a water pipe of φ250 to φ200 mm will be installed.

The material pipe shall be made of polyethylene, which is commonly used in Cambodia. This material is considered suitable from procurement, construction and economic perspectives. Moreover, a branch distribution pipe from the transmission pipe is required, to supply up to 223 m³/day to residents in the main water source district (2,000). The maximum flow rate at the outlet of the treatment plant will be 1,075 m³ (852 + 223 m³). However, as the water supplied directly to the main water source district takes hourly factor of 1.6, the flow rate at the outlet of the treatment plant is calculated at 50.3 m³/hour.

7.3.4.4 Distribution reservoir

Next to the mobile water source of the tourist district, a distribution reservoir of 900 m³ (450 m³ x 2) will be placed, which will play the role of meeting the major water demand at weekends and holidays. It also purifies water with the support of M-CMF.

In the study, 2/3 of the water demand of tourists is assumed to come at weekends (Saturday and Sunday), equaling a week of normal water demand. The consumption during the remaining five weekdays (from Monday to Friday) will be 1/3. Details are shown in the following table:

Table 7-14 Amount of water consumed on weekdays and weekends

Day	Water consumption (m^3/day)			Revenue ratio	Average daily supply (m^3/day)	Loading ratio	Max. daily (m^3/day)
	Domestic	Tourist	Total				
Thu	437.0	156.3	593.3	90%	660	0.8	825
Fri	437.0	156.4	593.4	90%	663	0.8	837
Sat	437.0	781.7	1,218.7	90%	1,355	0.8	1,694
Sun	437.0	781.7	1,218.7	90%	1,355	0.8	1,694
Mon	437.0	156.3	593.3	90%	660	0.8	825
Tue	437.0	156.3	593.3	90%	660	0.8	825
Wed	437.0	156.3	593.3	90%	660	0.8	825
Total	3,059.0	2,345.0	5,404.0		6,013		7,525

Figure 7-5 below indicates the result of the study on distribution reservoir capacity by considering the water demand and transmission pump capacity (50.3 m³/h) from the fixed water treatment plant and support water treatment capacity (8.3 m³/h) from M-CMF.

In addition, the daily flow rate trend is measured based on the Phnom Penh Water Supply Authority distribution data of 2 February, 2012. If there is no support water treatment capacity from M-CMF, daily capacity (300 m³), which is equivalent, shall be added to the distribution reservoir capacity, whereupon the capacity will be 1,200 m³.

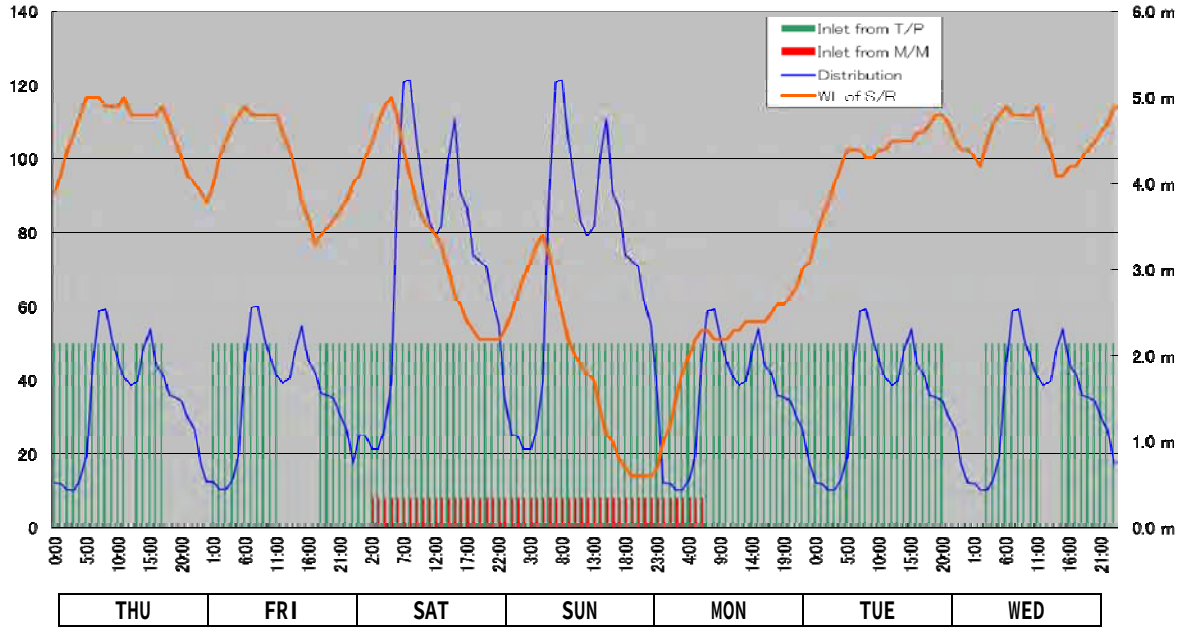


Figure 7-5 Capacity estimation of distribution reservoir

7.3.4.5 Distribution pipes

The distribution pipes shall be installed along the 5.5 km coastline, where hotels and restaurants are concentrated, and the area close to the main water source and the water source for mobiles. Details of the plan are shown in the following table and figure:

Table 7-15 Distribution pipes

Category	Material	Diameter (mm)	Length (m)
Main	PE	200	590
Sub-main	PE	150	1,040
Sub-main	PE	100	4,490
Branch	PE	80	1,060
Branch	PE	50	3,000
Total			10,180

Supply Area (Refer to 3) of Section "7.3.1")

Figure 7-6 Map of distribution pipes

7.4. Preliminary design of the water supply by Mobile Ceramic Membrane Filtration System

7.4.1. Service area

The use of a mobile water treatment facility assists in supplying water on weekends as in 7.3. Accordingly, the mobile water treatment facility (M-CMF) must have a minimum capacity of 200 m³/day. Moreover, on weekdays, the mobile water treatment facility is used to supply clean water to residents living near the water treatment facility in Prey Thum commune. At the beginning of this planning drinking water of two L/people/day throughout Kep province had been consider to provide. However, the planned capacity of 200 m³/day and 100,000 people/day cannot be applied to the area estimated to be only 38,523 from the business profitability. In addition, considering the quality management and sales method for two-liter bottles, the cost is thus excessive for this business.

For the above-mentioned reason, M-CMF is extracted from areas in which residents cannot access safe water sources, despite the high population density and a distance to water source of within one to two km. The survey result is as follows:

Table 7-16 Population in each village, water sources and water vendors in Kep province

Province	City/ district	Commune Name	Village Name	Population (2010)	Water resource around 1km	private water vendor	Sales price of water vendor (US$/m^3)	Remarks
Kep	Kep City	Kep	Kep	2,649	Presence	Presence	1-2	(New water supply area)
			Keo Krosung	436	No	Presence	1.5	
		Prey Thum	Dam Nak Chung Aer	3,458	Presence	unclear	unclear	(New water supply area)
			Kompong Trolach	2,043	Presence	unclear	unclear	
			Thmey	2,335	Presence	unclear	unclear	
		O-Krasar	O-krasar	3,928	Presence	(North)Yes (South)No	2-6	
			Dam Nak Cham Bak	3,271	Presence			Brackish water area
	Dam Nak Chung Aer District	Ang Koal	Aum Peng	3,190	unclear	unclear	unclear	Brackish water area
			Toul Kro Sung	1,246	unclear	unclear	unclear	Brackish water area
			Koh Sam	1,133	unclear	unclear	unclear	Brackish water area
			Ang Koal	1,923	unclear	unclear	unclear	Brackish water area
		Pong Tuek	O-Dong	1,302	Presence	Presence	0.6	
			Prey Ta Koy	1,029	Presence	Presence	0.6	
			Phnom Liv	3,082	Presence	Presence	0.6	
			Ro Nes	963	Presence	Presence	0.6	
			Cham Kar Bei	1,261(2011)	Presence	No	-	
			Antong Sar	953(2011)	Presence	No	-	
			Cham Ka Jek	1,082(2011)	Presence	No	-	

Based on the Table, the sites suitable for new water treatment facilities are:

- AngKoal commune: water is brackish and no private water vendors exist
- O-Krasar commune
- Cham KarBei/AntongSar/Cham KaJek villages in Pong Tuek commune
- Kampong Trolach/Thmey villages in Prey Thum commune

7.4.2 Served population

7.4.2.1 O-Krasar commune

The O-Krasar commune consists of Damnak Chambak Village to the west and O-Krasar village in the east. According to the O-Krasar commune leader, the population ratio of the northern and southern areas is about 60:40. Based on this information, the population in the southern area of O-Krasar commune is estimated to be 3,012. This southern area covers three km^2 (2×1.5 km), with most residents centered around the O-Krasar Commune Office, along National Road 33.

In the northern part of O-Krasar commune, there are some private water vendors. The vendors take in water from TakKrola dam in Kampot province and sell it to local citizens. The water is stored in two to four m³ tanks and delivered to citizens by truck. The Kampong Tralach (O-Krasar) dam is also located in the northern area, but is not targeted for new business in this survey.

In the southern part of O-Krasar commune, where water sources are either inadequate or brackish, residents urgently need water. Domestic and drinkable water are bought from a few private water vendors, hence this area is selected as one for targeted service. Although it is relatively large, due to

the concept of M-CMF "saving on distribution piping construction cost by using removable water treatment equipment", a clear water reservoir will be installed near the commune office, but no distribution pipes will be installed.

According to the survey, the residents who live around one kilometer from the water reservoir are willing to install the distribution pipes by themselves. Even though the opinions are reliable, the possibility will be discussed in a future feasibility study. Considering the no-distribution pipe concept, the population of supply water is determined at 60% in this area, based on which, the population of water supply by M-CMF is as follows:

Table 7-17 Frame of the O-Krasar commune water supply by M-CMF in 2015

Commune name	Domestic			Tourists (daily)	
	Population	Served	%	Cambodian	Foreign
O-Krasar	7,400	1,807	24%	0	0

7.4.2.2 Pong Tuek commune

Pong Tuek commune is located to the east of Kep province, consisting of Chamkar Bei/Antong Sar/Chamkar Jek villages to the northwest, Ror Nes/O-Dong/Phnom Leav villages in the center and Prey Ta Koy village to the northeast. The three villages in the center of the commune buy water from a private water vendor named "Bun Yorng", while intake water is taken from Veal Vong Dam. It is said that "Bun Yorng" has received an informal temporary license from Kep DIME, but the company treats the dam water by simple system, the quality cannot assure safety.

Regarding the three villages in the northeast of the commune (four km^2: 4×1 km), the water supply business shows potential, given the lack of private water vendors to date. However, given the scarcity of residents in this area, not all will be able to pay the higher water tariff. However, since around a quarter of residents (25% = estimated 4,264 people in 2015) are anticipated as being able to afford the high tariff, this area is targeted for the M-CMF business.

Table 7-18 Frame of the Pong Tuek Communes water supply by M-CMF in 2015

Commune name	Domestic			Tourists (daily)	
	Population	Served	%	Cambodian	Foreign
Pong Teuk	9,392	1,066	11.3%	0	0

7.4.2.3 Prey Thum commune

Located to the north of Kep province, the Prey Thum commune consists of the Damnak Chang Aer village (3,458 people in 2010) to the north, Kampong Trolach village (2,043 people in 2010) at the center, and Thmei village (2,335 people in 2010) to the south. The eastern part of DamnakChang Aer village and the eastern part of Kampong Trolach village are selected for a new water treatment facility in Kep province.

The western area of Kampong Trolach village and the northern area of Thmei village collectively cover eight km^2 (2 x 4 km) of land, with the northern part conspicuous for the many Cambodian and foreign villas. The area was also targeted by a private company – Western Coastal Development Co., Ltd – who failed to proceed with their business due to bankruptcy. Since higher water tariffs may be set here, the area is also chosen for the M-CMF business. However, because this area is twice as big as the other two, the water supply rate is set to 30%.

Table 7-19 Frame of the Prey Thum commune water supply by M-CMF in 2015

Commune name	Domestic			Tourists (daily)	
	Population	Served	%	Cambodian	Foreign
Prey Thum	8,648	1,325	15%	0	0

7.4.3 Water demand

In the calculation of water demand, the daily usage per resident is set at 80 L for the piped water supply from the new water treatment facility, and 40 L for the un-piped water supply from the M-CMF. This value is referred to as the "40 L/person/day" water demand described in the "Design of the Community Tertiary Water Supply Project in Kampong Cham Province, Cambodia (JICA report in 2009). It is possible for the water demand to decrease in accordance with the life level of residents. In target areas like the Ang Koal commune (7,492 people in 2010) and Kep Krosung village (1,981 people in 2009), the set water demand (161 m³/day) will be achieved.

Table 7-20 Frame of the Kep water supply by M-CMF in 2015

Items	Domestic	Tourists		Total
		Cambodian	Foreign	
Population	38,523	0	0	38,523
Served Population	4,198	0	0	4,198
Unit Consumption (L/day)	40	0	0	40
Water Consumption (m³/day)	161	0	0	161
Revenue ratio	90.0%	0	0	90.0%
Average Daily Supply (m³/day)	179	0	0	179

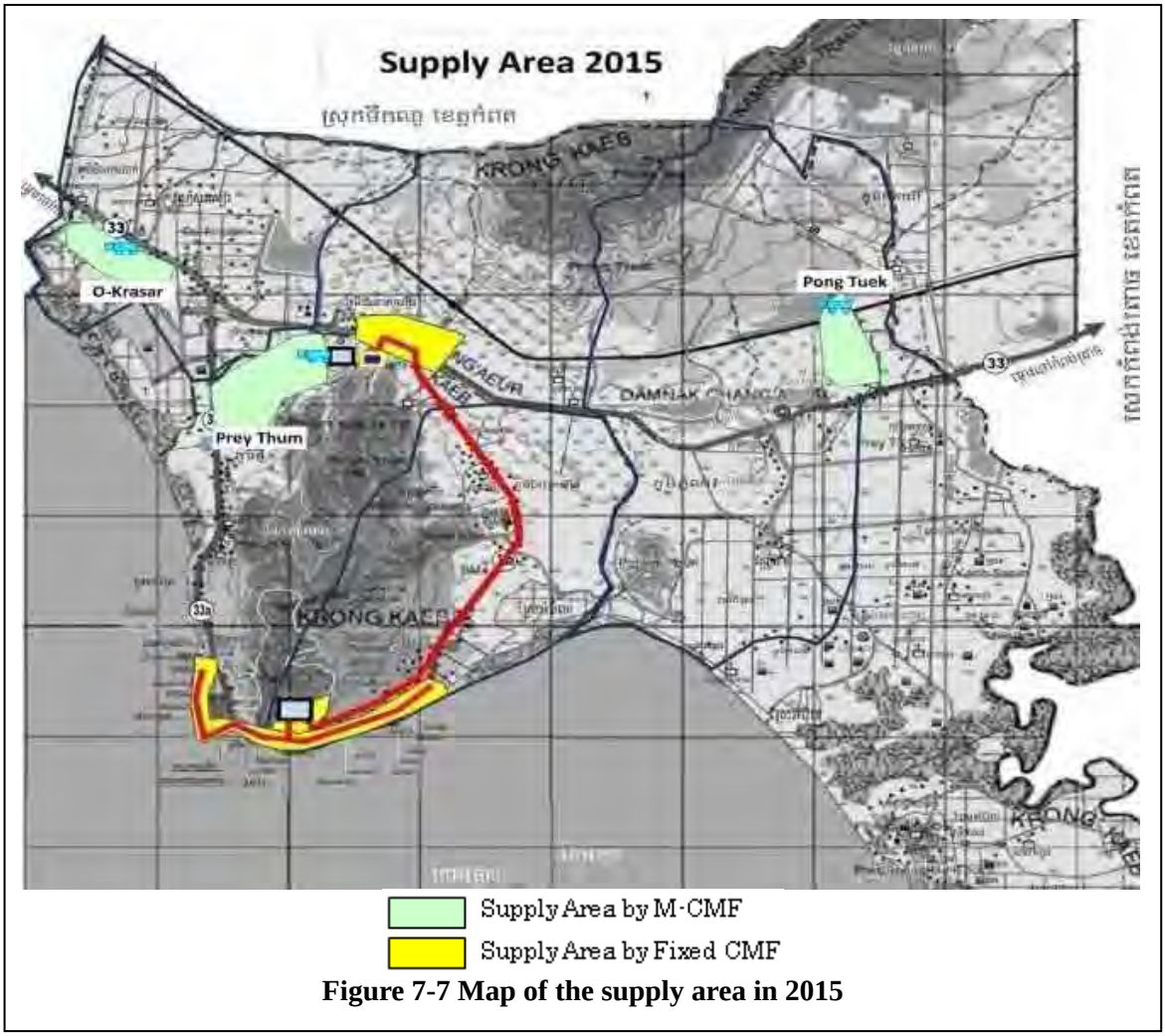


Figure 7-7 Map of the supply area in 2015

The total number of households in this area is 2,365 (2010). When the average daily supply 161 m³/day is divided by the number of households, the water demand is 68 L/household/day. According to an interview with the residents, this value is less than their water consumption (70-80 L/household/ day) and can thus be considered reasonable.

Kampong Trolach Dam

7.4.4 Outline of water supply facilities

7.4.4.1 Water sources

The water source in the O-Krasar commune is located in the Kampong Trolach (O-Krasar) dam, east of O-Krasar commune (10°33'31.23"N, 104°16'53.42"E). The distance from the dam to the water supply is around 1.2 km, hence a transmission pipe (100 mm diameter HDPE pipe) must be installed.

This dam has sufficient capacity for 96 m³/day supply by M-CMF, meaning no fluctuation in the water level.

Phnom Voar Dam

The water source in Pong Teuk commune is the Phnom Voar (Deer) Dam (10°34'38.02"N, 104°23'04.38"E), located to the west of ChamkarBei Village. Intake from this water source will also be via the transmission pipe (600 m distance, 100 mm diameter, HDPE).

This dam also has sufficient capacity for a 51 m³/day supply by M-CMF, meaning no fluctuation in the water level.

The water source for water supply to the Prey Thum commune is Phnom Prous Pond, which is the same as the new water treatment plant.

7.4.4.2 Water treatment facility and clear water reservoir and distribution pipe

The M-CMF for this area adopts the dual element type, with a treatment capacity of about 100 m³/day. This equipment consists of an intake pump, mixing tank and ceramic membrane module. If the flux is set at 3.5 m/day, it has a water treatment capacity of about 100 m³/day.

Regarding the value of the membrane flux, reference is made to the result of the demonstration test in Kandal province from October to December 2011. During the demonstration test, filtrating high turbidity raw water (200 to 300 NTU), the membrane flux achieved was four m/day. The turbidity of this water was about 10 to 30 NTU, and even during rainy season, the turbidity will not exceed 200NTU.

The M-CMF can be powered by a diesel generator or public electricity supply; therefore, if there is a public electricity supply in the vicinity of the M-CMF parking area, public electricity should be used with the operational cost in mind.

The truck mounted water treatment equipment is four ton light duty trucks, which can be driven on narrow roads and mountain corridors. This equipment has been verified that it could travel even on unpaved road in rainy season without any trouble. In the event of getting stuck a mounted electric winch is exploited. Figure 7-8 shows the outline of the M-CMF.

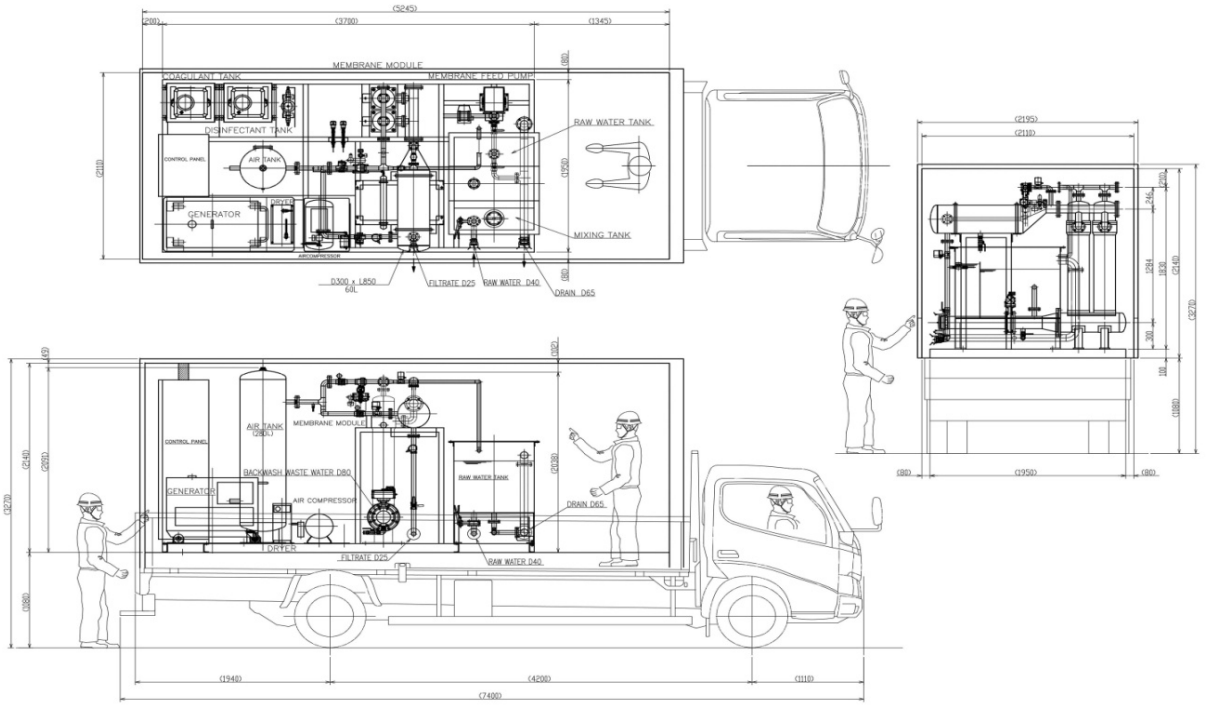


Figure 7-8 Outline of the M-CMF

In Kep province, three M-CMFs will be operated for areas shown in Figure 7-7. On weekdays they distribute water in the three communes, and on weekends they supply water to the Kep city area to assist the new water treatment plant. The operational rotation plan is indicated in Table 7-21. For the provisional calculation, the year 2017 is the time when the house connection ratio of the new WTP supply area is assumed to become 100%.

Table 7-21 M-CMF rotation plan (2017)

	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
M-CMF_A	O-Krasar	O-Krasar	O-Krasar	O-Krasar	Prey Thum	KEP	Maintenance
Feed Quantity (m³)	96.6	96.6	96.6	92.4	92.4	96.6	0.0
M-CMF_B	Phong Tuek	Phong Tuek	Phong Tuek	Ph/Pr	Prey Thum	KEP	KEP
Feed Quantity (m³)	96.6	96.6	96.6	92.4	92.4	96.6	71.4
M-CMF_C	O-Krasar	O-Krasar	O-/Ph	Prey Thum	Prey Thum	KEP	KEP
Feed Quantity (m³)	96.6	96.6	92.4	96.6	92.4	96.6	71.4

The rotation plan calculates the required volume of the clear water reservoir at Prey Thum, O-Krasar, Pong Tuek communes as follows:

- Prey Thum commune: 160 m³(RC)
- O-Krasar commune: 160 m³ (RC)
- Pong Tuek Commune: 160 m³ (RC)

7.5 Future plan for the target year 2030

As Kep province is expected to become a major tourist site, it is very difficult to draw up a future plan at this stage. However, it is possible to assume the water business plan for 2030 as follows:

7.5.1 Service area

Of all the public roads in Kep province obtained through this study, except for the figures shown in the planning, which was obtained from the Kep Provincial Planning Department, the agricultural land and the roads conforming to this shall be considered as the coverage area of the water supply.

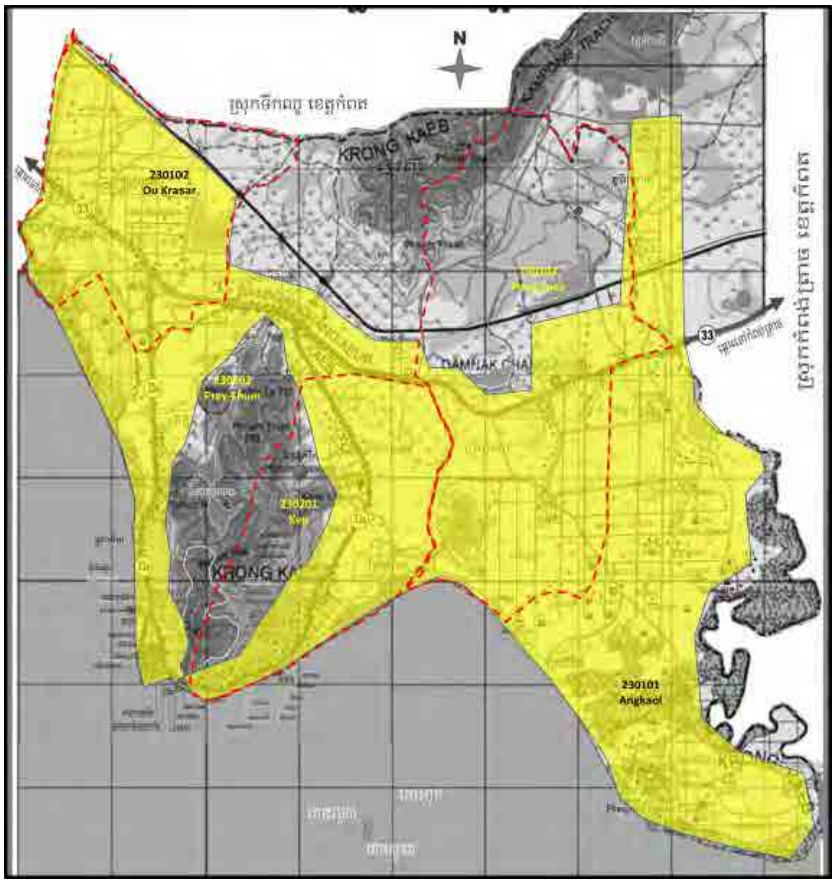


Figure 7-9 Map of the service area for 2030

7.5.2 Served population

The population of Kep province in 2030 is estimated by determining an approximate value from the 2007-2010 statistical data. As for the served population, the local residents are predicted to live uniformly around all roads, excluding the area reserved as agricultural land.

The tourist population is estimated from the 2009-2010 statistical data by determining an approximate

value and adding 100% of this tourist population to the served population. Further details are shown in the table below.

Table 7-22 Served population in Kep province, 2030

Commune	Domestic			Tourists (daily)	
	Population	Served	%	Cambodian	Foreign
Angkaol	9,370	9,370	100%	1,664	12
O-Krasar	8,620	8,620	100%	0	0
Pong Tuek	10,940	5,426	49.6%	832	6
Kep	5,870	5,870	100%	2,913	22
Prey Thum	10,074	10,074	100%	2,912	22
Total	44,874	39,360	87.7%	8,319	62

7.5.3 Water demand

As for the calculation of planned water consumption, the water volume used per capita per day for local residents is 120 L. Cambodian tourists' water consumption per capita per day is 120 L, and the consumption for foreign tourists is 250 L per capita per day.

Table 7-23 Frame of the Kep water supply in 2030

Items	Domestic	Tourists		Total
		Cambodian	Foreign	
Population	44,874	8,319	62	53,255
Served Population	39,360	8,319	62	47,741
Unit Consumption (L/day)	120	120	250	
Water Consumption (m^3/day)	4,723	998	16	5,737
Revenue ratio	90.0%	90.0%	90.0%	
Average Daily Supply (m^3/day)	5,248	1,109	18	6,375
Loading ratio	0.8	0.8	0.8	
Maximum Daily Supply (m^3/day)	6,560	1,386	23	7,969

7.5.4 Outline of the water supply facilities

7.5.4.1 Water Source

The Phnom Voar (Deer) Dam (man-made lake), which is the source of water for 2030, was constructed by the Ministry of Water Resources and Meteorology (MOWRAM) since before the Pol Pot Regime (1975). The dam has been used as an agricultural water lake under the jurisdiction of the Ministry. This man-made lake is located 14 km (10°34'37.35"N, 104°23'5.00"E) linear northeast of the tourist district along the coastline.

Phnom Voar (Deer) Dam

The field study was conducted in the dry season; however, the dam was filled to around 80% or more of capacity. In case the Water Supply Service Business takes 7,200 m^3/day (including the loss of the water treatment plant) of water from the lake, there will be no significant impact on the storage rate. Further technical studies will be conducted during a future feasibility studyS.

7.5.4.2 Water treatment facility and process

The new water treatment plant will be center of facilities for 2030. As the water supply area will extend to whole Kep province, the water tariff in Kep will be subject to the influence the tariff level of Kampot province. From this view point construction cost-saving will be required and the system was studied to employ same rapid sand filtration system as Kampot. The preceding facilities which consist of stationary type of membrane filtration system and M-CMFs operation from 2015 (the bodies of vehicles themselves will be abolished). The new water treatment capacity of the rapid sand filtration will be 6,810 m³/day in 2030 after the calculation: daily maximum water supply of 7,909 m³/day minus 859 m³/day of treatment capacity and 300 m³/day of M-CMF total capacity. The flow quantity parameters are as follows:

- Design water maximum daily intake: 8,000 m³/day
- Design water maximum daily treatment: 7,500 m³/day
- Design water maximum daily supply: 6,810 m³/day

The process of the new treatment plant employs receiving water well, flocculation basin, sedimentation basin and rapid sand filter. The sludge treatment employs sun drying bed system.

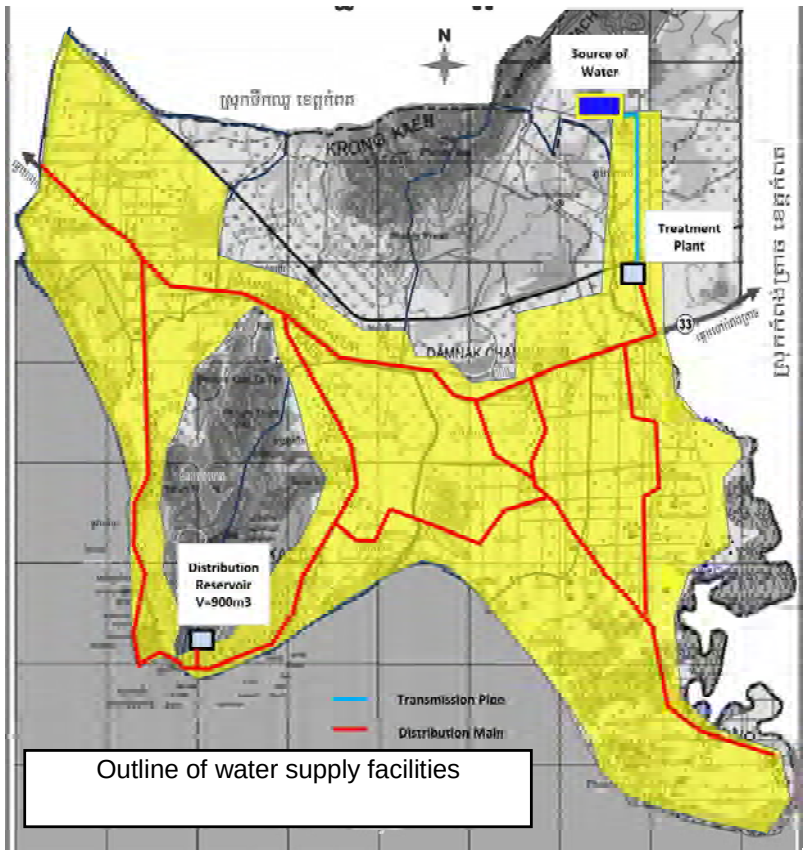


Figure 7-10 Outline of the water supply facilities in 2030

7.5.4.3 Outline of the water treatment facility

The new water treatment plant will consist of a coagulating flocculation basin, sedimentation basin, four series of rapid filtration basin, clear water reservoir and thickener, and two series of sun drying beds. Since the 2030 water treatment plant will also include a central monitoring function for a new

water treatment facility and mobile water treatment equipment in Kep province, a central monitoring station, and lounge for an engineering facility and workshop facility in the area will also be established. The total area of the new water treatment facility is 6,000 m^2 (65×69 m).

7.5.4.4 Distribution pipe

It is planned to transmit 7,110 m^3/day directly from the new water treatment plant to Kep province, using a distribution pump. The distribution elevated tank (HWL 37.0 m, LWL 32.0 m), the construction of which is scheduled for 2015, will play a role as a surge tank and is expected to ease the water hammer pressure.

In all public roads of Kep province (except for agricultural land and roads conforming to the same), distribution pipes will be constructed. The total extension will be 94 km and the maximum diameter is φ500 mm.

Table 7-24 Details of the distribution pipes for 2030

Category	Material	Diameter (mm)	Length (m)
Main	DCIP	500	5,021
Main	DCIP	450	4,551
Main	DCIP	400	4,733
Main	DCIP	350	3,423
Main	DCIP	300	1,807
Sub-main	PE	250	13,452
Sub-main	PE	200	9,597
Sub-main	PE	150	14,577
Branch	PE	100	7,819
Branch	PE	80	9,967
Branch	PE	50	19,053
Total			94,000

Chapter 8 Formulation of PPP structure for water supply services

8.1 Applying scheme regarding project form and financing

8.1.1 Financial scheme for PPP

PPPs provide governments with the ability to develop infrastructure by tapping into private sector resources in both local and international markets. When the government has only limited borrowing capacity and is having difficulties mobilizing additional tax revenues and user fees, PPPs can help the government meet a financing gap by stimulating private sector investment in infrastructure.

This section gives brief explanations about the parties, which provide financial support in a typical PPP setting.

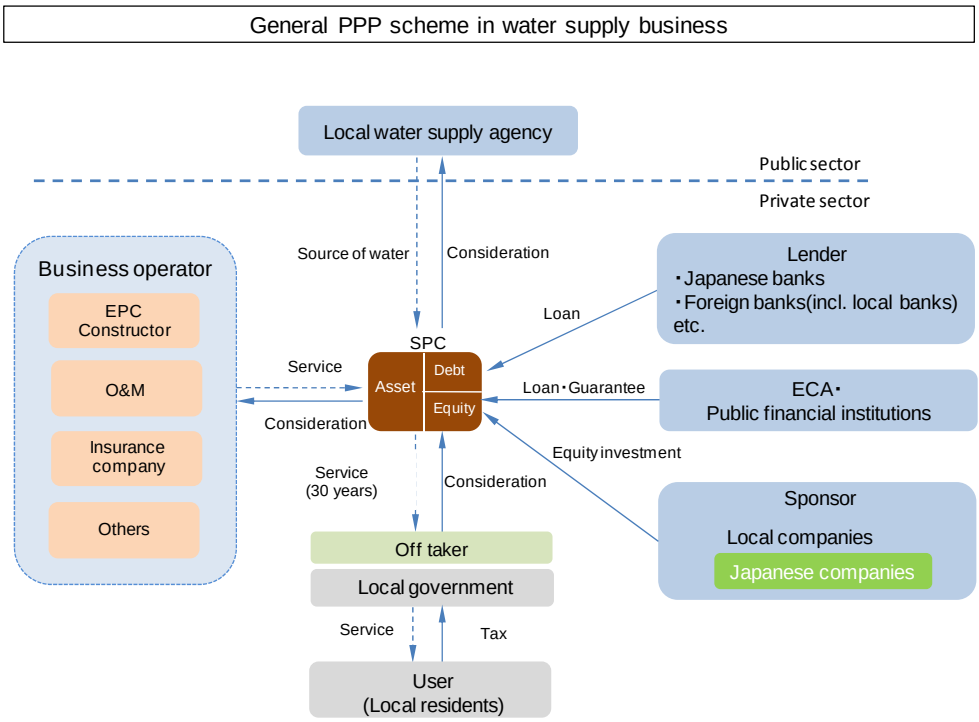


Figure 8-1 Financial scheme for PPPs in water supply business

SPC and Sponsors

In implementing PPPs, a party called 'sponsor' establishes a SPC. This SPC conducts business operations after obtaining proper approvals and business rights (concession) from the government of the host country. Being newly established, the SPC does not have enough capability or capacity to carry out the project by itself. Therefore, sponsors not only provide funds, but also support the SPC by providing technical expertise, human resources, and/or shareholder's loans etc. In establishing the SPC, sponsors enter into an agreement such as joint venture agreement or shareholders' agreement, which stipulates the provisions related to the ownership and voting rights, control and management of the SPC, and resolution of any future disputes among sponsors etc. The following parties could potentially be the sponsors:

- EPC contractor/operator* ,
- local business enterprises,
- domestic or foreign infrastructure funds,
- multilateral development banks/public financial institutions, and

- the government or governmental agencies of the host country.

Note: EPC contractor/operator means firms which join engineering, procurement, construction and/or operating related facilities.

Lenders

Funds required for carrying out the project can be sourced from outside parties in the form of debt in addition to the equity that the sponsors contribute. These debts are procured mainly from private financial institutions, credit investors, and public financial institutions such as multilateral development banks and export credit agencies (ECA). Determination of debt/equity ratio depends on the relationship between EPC contractor/sponsors and lenders as well as the nature of the project. Loan/facility agreement is entered between the SPC (borrower) and the lenders, which stipulates loan amount, terms such as principal, interest rate, and processing fees; duration; conditions; representations and warranties; covenants; and events of default.

Mezzanine Finance

Mezzanine finance refers to financing through subordinate debt or preferred equity instrument. Subordinate debt is inferior to ordinary debt in terms of the order of receiving repayment and security. On the other hand, although there are certain limitations in terms of voting rights etc., preferred share has priority over ordinary share in the payment of dividends and upon liquidation.

As mentioned in the section '4.4.4 Law on Commercial Enterprise,' there are several forms of business entities that are available in Cambodia. The most common form of investment vehicle (an entity used as a means of investment) is limited liability company. A limited liability company must issue a minimum of 1,000 shares with a par value of not less than 4,000 KHR per share and generally has only one class of shares unless the articles specify other classes of shares. If the articles provide for more than one class of shares, the rights of each class of shares may be absolute, relative, or contingent, and the rights, privileges, restrictions, and conditions attaching to the shares of each class must be detailed in the articles. In other words, as long as the rights and restrictions are stipulated in the articles, it appears that the Cambodian law allows a company to issue different classes of shares, including but not limited to redeemable preferred shares. Even if preferred shares cannot be issued, other forms of financial instruments such as subordinate debt should be available as mezzanine instrument.

8.1.2 Conditions for financing arrangements

8.1.2.1 Interviews with financial institutions

We conducted interviews with various financial institutions to understand the possibility and conditions for financial support for the PPP project, which provides clean water supply services in rural and suburban areas of Cambodia. We targeted two types of financial institutions for interview. One is public financial institutions and ECAs, which typically provide financing for certain causes and/or political purposes regardless of the maturity of the financial market of the host country and/or profitability of the project. The other is private financial institutions, which are more profit-oriented, compared to public financial institutions and could provide financing to various types of businesses.

Financial institutions we conducted interview with are as follows:

■ Public financial institutions & ECAs
- Japan International Cooperation Agency (JICA)
- Asian Development Bank (ADB)

- Japan Bank for International Cooperation (JBIC)
- International Finance Corporation (IFC)

■ Private financial institutions
- Japanese bank covering Cambodia – Financial Institution A
- Japanese bank covering Cambodia – Financial Institution B
- Japanese owned Cambodian bank – Financial Institution C
- Financial Institution D

Note: In the subsequent sections, no further consideration is made in relation to the following three financial institutions as we noted, based on our interviews, that these institutions currently have no plan on providing loans to a public-sector business operating in Cambodia.

1) IFC: IFC does not currently provide any loans to Cambodian projects for fear of unclear land titling system in Cambodia.
2) Financial Institution B: The size of this Project is too small for Financial Institution B to provide financing.
3) Financial Institution D: Financial Institution D has no plan on providing loans in Cambodia due to lack of lending experience in Cambodia.

8.1.2.2 Summary of interview results

The summary of interview results with the aforementioned financial intuitions is illustrated in the table below.

Table 8-1 Summary of interview results

	Public			Private	
Items	JICA	ADB	JBIC	Financial Institution A	Financial Institution C
General strategy in opportunities for investment and loan in clean water supply business	✓ JICA would invest in or provide loans to the businesses/ projects operating in certain countries where Yen loans are allowed based on JICA's lending criteria. Cambodia is one of those target countries.	✓ Only 2 projects (non-water business) in Cambodia, whose project sizes are $7M and $15M respectively. ✓ Water business is still in study phase and the scale is small. Probably need to wait a couple more years.	✓ No prior experience of providing loans to water supply business. ✓ Expectation for future water business is high though it is not backed by sufficient research.	✓ Water business can be the target of A's financing. ✓ Key points are how to mitigate country risk and political risk.	✓ No prior experience with providing loans to water supply business. ✓ Priority of water supply business is low because there are many other good opportunities in Cambodia. ✓ Country credit rating is below the C's investment criteria (BBB) ✓ Long-term financing is not likely. Most loans made so far are working capital loans up to 1 year.
Common issues and challenges recognized for investments and loan in clean water supply business	✓ Foreign currency risk ✓ Inflation risk ✓ Country risk ✓ Off-take risk ✓ Demand risk	✓ Political risk (especially corruption)	✓ Foreign currency risk ✓ Off-take risk ✓ Scope of PPP (i.e. whether the project is construction of water treatment	✓ Demand risk (Price) ✓ Off-take risk ✓ Foreign currency risk	✓ Capital market risk ✓ Funding risk ✓ Project completion risk ✓ Restriction on foreign investment in equity ✓ Ownership of land

	Public			Private	
Items	JICA	ADB	JBIC	Financial Institution A	Financial Institution C
			facilities only or also includes distribution and/or O&M). ✓ Demand risk (sustainability of profitable tariff level) ✓ Country risk		is limited to the Cambodian residents.
Principal criteria for investment and loan in clean water supply business	✓ Hurdle rate is either local risk-free rate or JICA's borrowing rate on the fiscal investment and loan program (FILP) fund. ✓ Qualitative criteria • Project with high contribution to the development of host country • Japanese companies expanding into new region.	✓ Refer to the section '8.1.3 Possible Financing Options' below.	✓ Qualitative criteria • Business plan backed by robust demand forecast • Prefer to have exit conditions defined.	✓ Qualitative criteria • Member of sponsors • Importance of the project for the government of host country • Policy change risk • Transparency of price setting	✓ Qualitative criteria • Comparison between plan and results • Prior experience with the similar projects (project experience in Cambodia is not necessarily required)
Financial instruments which your institute has used or will use in opportunities for	✓ Refer to the section '8.1.3 Possible Financing Options' below.	✓ Refer to the section '8.1.3 Possible Financing Options' below.	✓ JBIC generally provides recourse financing (**defined below), but non-recourse	✓ Generally, project finance is possible. ✓ Guarantee, insurance and collateral are obtained through a	✓ Providing non-recourse loan is difficult (loans are normally secured by collateral (typically

	Public			Private	
Items	JICA	ADB	JBIC	Financial Institution A	Financial Institution C
investment and loan in infrastructure businesses			finance (**defined below) or project finance is also possible. ✓ Guarantee from the host country's government is required at minimum.	full or limited-recourse loan (**defined below).	real property)). ✓ Bond market does not exist in Cambodia.
Investment or borrowing terms and exit strategy for infrastructure businesses	✓ Case by case	✓ Case by case	✓ Loan period needs to be matched with the fund procurement period of JBIC. ✓ JBIC will exit when Japanese companies exit.	✓ Dividends to sponsors are allowed as long as repayment of loans is certain.	✓ Property-backed loan with below 40% of loan-to-value (LTV) is required.
Policies to take or mitigate risks such as foreign currency, capital market, country, political, and natural disaster risk.	✓ Foreign currency Risk should be borne by the SPC, host country or public entity etc.. ✓ Interest rate risk: JICA's borrowing rate is fixed – thus, JICA can avoid the risk if lending rate is also fixed. ✓ Generally, 2-step loan (defined in section 8.1.4) is preferred.	✓ Case by case	✓ Capital market risk (Restriction on foreign investment, cash transfer, opening bank account by non-residents, and drawing cash from bank accounts) ✓ Consideration on public nature of the business ✓ Participation of	✓ Risks such as country, political, and natural disaster risk should be taken by the host country's government or other parties. To mitigate political risk, especially policy change risk, supports from adequate public financial institutions that have influence over the Cambodian government are necessary.	✓ Not mentioned

	Public			Private	
Items	JICA	ADB	JBIC	Financial Institution A	Financial Institution C
	✓ Country, political, natural disaster risk etc. need to be borne by other parties, mainly host country.		Japanese companies		
Governance and monitoring	✓ Not mentioned	✓ Not mentioned	✓ Monitoring Japanese companies' interest percentage in the SPC as compared to foreign investors' and exit conditions.	✓ Monitoring Japanese companies' interest percentage in the SPC as compared to foreign investors' and exit conditions.	✓ Not mentioned
Any co-investment/syndicated loan arrangements	✓ Targeting mainly those projects with a large viability gap; thus, independent financing is possible. ✓ Syndicate loan with other development banks may be possible.	✓ Not mentioned	✓ Syndicate loan with Japanese financial institutions is required.	✓ Japanese public financial institution (JICA & JBIC/NEXI) is required. ✓ Independent financing is possible with guarantees from Japanese sponsors.	✓ Not mentioned

Source: Interview

**) Recource loan represents a type of loan, which allows the lender to collect from the debtor and/or debtor's guarantor without limiting to the value of the collateral. On the other hand, non-recourse loan does not allow the lender to go after the personal assets of the debtor beyond any collateral that was used to secure the loan. Limited recourse loan represents a loan, in which the lender has limited claims on the loan in the event of default.

8.1.3 Possible financing options

According to the interview results as discussed in section 'Summary of Interview Results' above, possible financing options are as follows (Note: The likelihood of occurring the event in question is higher if noted as 'probable' than 'possible'):

Table 8-2 Possible financing options

			Public Financial Institutions			Private Financial Institutions	
			JICA	ADB	JBIC	Financial Institution A	Financial Institution C
Tranche	Loan		Probable	Probable	Probable	Probable	Probable
	Mezzanine		n/a	Not mentioned	Possible	n/a	Possible (If EPC)
	Equity		Probable	Probable	Possible	n/a	n/a
Duration	Period	Loan	20 years (max 25 years)	30-40 years	10-12,13 years	10-15 years	1 year (max 2 years)
		Equity	10 years	30-40 years	Under 20 years (cannot be too short)	n/a	n/a
	Terms		Amortization	Not mentioned	Amortization, balloon, bullet	Amortization	Not mentioned
Required interests or dividend	Interests rate		Procurement interest rate + risk premium, but, not exceeding grant element of 25% (2-3%) Grant element represnets a measure of concessionality of a loan (commercial loan: GE=0%; grant: GE=100%)	LIBOR±1~1.5% (Hurdle rate for the project 12%)	Lending cost +α (α is determined based on significance of the meaning of the project & country risk)	LIBOR±1~1.5%	Secured loan with 13-14% (spread ~10%) (internal rate of return (IRR) ~20%)
Majority /minority (investment/ loan ratio)	Loan		Max 70% (80% in special cases)	Minority (max 25%, could be around 40%). Total is around $50M.	Majority is possible	Independent financing is possible if sponsors guarantee loan	Not mentioned

	Equity	Minority (max 25%, not to be majority)	n/a	Minority	n/a	n/a
Currency		JPY	US$	JPY/US$	US$	Not mentioned

Source: Interview

While assurance of repayment is obviously important from lenders' point of view, during our interviews with the aforementioned financial institutions, we were also reminded the importance of having the measures to mitigate anticipated risks ("○" represents the risks mentioned in the interview with each financial institution.).

Table 8-3 Summary of anticipated risks and mitigation measures

	Risk	JICA	ADB	JBIC	Financial institution A	Financial institution C
1	Country risk	○	○	○	○	○
2	Off-take risk	○		○	○	
3	Demand risk	○			○	
4	Foreign currency risk	○		○	○	
5	Project completion risk			○		
6	Policy change risk					
7	Capital market risk			○		○

Source: Interview

	Risk	Risk mitigation measure
1	Country risk	Difficult to mitigate completely, but partially mitigated by participation of public financial institutions/ECAs.
2	Off-take risk	Can be mitigated with guarantees from Cambodian government
3	Demand risk	Assuming stable growth of demand.
4	Foreign currency risk	Consider whether tariff can be collected in US$ from off-taker (i.e. local governmental body) or adjusted based on the fluctuation in US$ rate.
5	Project completion risk	Mitigated by using combination of lump sum contract with EPC and M-CMF* whose completion risk is low.
6	Policy change risk	Difficult to mitigate completely, but partially mitigated by participation of public financial institutions/ECAs.
7	Capital market risk	Difficult to mitigate.

Note: M-CMF stands for the Mobile Ceramic Membrane Filtration Equipment.

8.1.4 Anticipated financial plans

The following table illustrates one of the financing options that appear viable based on the interview results. This financing option is set tentatively to see whether the proposed financial structure would generate sufficient returns for the sponsors or not. Thus, depending on our simulation results, we will revisit and determine the final financial structure of the SPC, which can be acceptable to all stakeholders. It should be also noted that, in the below financing plan, we have assumed that the risks mentioned by those financial institutions would be largely mitigated by the risk mitigation measures (e.g. government guarantees, participation of public financial institutions/ECAs etc.) as discussed in the section '8.1.3 Possible Financing Options'.

Table 8-4 Anticipated financing plan

		A'mt	%				A'mt	%	Currency	
Asset	Cash	30	0.3%	Debt	Private	Financial Institution A	3,670	35.0%	US$	#5
						Financial Institution B	0	0.0%		
	Kampot Capital Investment					Financial Institution C	0	0.0%		
		5,287	50.4%		Public	JICA	0	0.0%	JPY	#4
						JBIC	3,670	35.0%	US$	#6
	Kep Capital Investment (1)					ADB	0	0.0%	US$	
		3,793	36.2%			IFC	0	0.0%	US$	
						sub Total	7,339	70.0%		
	Kep Capital Investment (2)			Mezzanine		n/a	0	0.0%		
		1,376	13.1%	Equity		Japanese Entities	1,541	14.7%	JPY	#3
						Local Entities	1,604	15.3%	US$	#2
						sub Total	3,145	30.0%		#1
Total		10,485	100.0%	Total			10,485	100.0%		

Business size(thousand US$)	10,485
Exchange rate(1US$=>4,040KHR)	4,040
Exchange rate(1US$=>78JPY)	78

	Items	Assumption	Constraints
#1	D/E ratio	70:30 (based on the general PPP scheme)	
#2	Local Entities	51% of share (=15.3% of project cost); expected to be involved as an EPC or O&M operator.	Required to subscribe certain % of share to induce loans from financial institutions
#3	Japanese Entities	49% of share (=14.7% of project cost); expected to be involved as an EPC operator and a Consultant.	Required to subscribe certain % of share to induce loans from financial institutions
#4	JICA	No JICA loan is included in our initial financing plan to mitigate foreign currency risks (JICA provides JPY loans only).	Loan: up to 70% of project cost (within 25 years)
#5	Financial Institution A	50.0% of loan (=35% of project cost) denominated in US$	ECA support required to mitigate country risk → need to have JICA investment/loan
#6	JBIC	50% of loan (=35% of project cost) syndicated with Financial Institution A	Syndicated loan with Japanese financial institutions (e.g. Financial Institution A)

Under the current proposed financial structure, the equity is held 51% by Cambodian entities. Thus, the SPC is considered to have Cambodian nationality.

We have excluded, from the above-anticipated financial structure, certain financial institutions and/or financial instruments due to the following reasons.

■ Senior debt

- ADB is interested in clean water supply project, yet ADB's target investment/loan size (~$50M) is much larger than the current financial needs (~$10M). If we have multiple lots and the overall project size becomes larger, it may be easier to receive financial support from ADB.
- Financial Institution C can provide working capital loans with a maturity of less than one year. Thus, it is not matched with the planned SPC scheme; however, it can be considered as a potential source of short-term financing once the SPC is up and running.

■ Mezzanine

- It is assumed that obtaining mezzanine loan from JICA would mitigate credit risk of the project taken by private financial institution. However, by interview with JICA, it cannot provide mezzanine finance.

■ 2-Step loan

- JICA indicated that 2-step loan* is strongly preferred. However, we anticipate that it is difficult to obtain 2-step loans in Cambodia because there are no local financial institutions that can provide long-term financing (based on our interview results, they only provide short-term loans due within one year). Thus, under the above financing option, we assumed JICA would provide 1-step loan to the SPC (i.e. direct loan from JICA to the SPC).
  * Represents the lending system where a loan is provided to a local bank in a different county (Step 1) and the bank then provides a loan to the project/business that operates locally (Step 2).

8.2 Implementation structure of PPP

8.2.1 Possible PPP options

There are a wide variety of Public-Private-Partnership (PPP) options, which can be implemented to make maximum use of the private sector involvement scheme. Out of the following various options, the optimum PPP will be selected based on the site-specific conditions of Kampot and Kep.

- **Service contracts:** Service contract is a finite-term contract to a private firm to provide water supply services, and a local water utility pays the firm for charges in response to the services to be delivered. Part of water supply services can be contracted out to a private operator for a certain period.

- **Management Contracts:** Management contract is a contract entrusting specific water supply services under private management for a certain period of time, for which a management fee is paid to the management contractor. The management fee could be paid in accordance with the performance of the management contractor. Although management contract could be an attractive first step to the full-scale private sector involvement, it does not directly lead to the investment on the improvement of water supply services due to the relatively shorter contract term. A management contractor is required to mainly focus on improving its services to existing customers rather than on enlarging the service coverage such as delivering the services to the lower-income area.

- **Lease Contracts:** Lease contract grants a private operator full control over delivering water supply services in exchange for use of the fixed assets whose ownership and responsibilities belong to the authority. Under an enhanced lease, while partial improvements of the leased facilities are the responsibility of the private operator, major investments remain the responsibility of the authority.

- **Concession:** Concession is a long-term contractual arrangement in which a private operator is awarded an official license to provide water supply services over a longer period of time in exchange for a negotiated fee. A concession agreement stipulates the rights and obligations of the awarded concessionaire who retains ownership of the principle assets. Normally, during an average period of 25-30 years, the concession contract transfers all responsibilities for capital investment and operation and maintenance to a private concessionaire. While the fixed assets legally remain the property of the authority, the concessionaire might pay a fee to use them.

- **Build-Operate-Transfer (BOT) Contract:** Build-Operate-Transfer (BOT) contract and its variations are options, which are similar to concession and are primarily suitable for large-scale investments on facilities. During a relatively longer period up to 30 years, depending upon the size of the investment which has to be amortized, a BOT operator provides a wide range of water supply services in exchange for guaranteed service fees in the contract, although the operator accepts the risk to design, build and operate the facilities at the agreed standards of services in exchange for a guaranteed cash flow.

- **Full Privatization:** Full privatization is the most radical form of private sector involvement in which existing operations and assets for water supply services are sold to the private sector, in some cases, with a limited term license.

Table 8-5 Shows a varieties of possible PPP options with the comparison of asset ownership, operations and maintenance, capital investment, commercial risks and duration of contract.

Table 8-5 Comparisons of possible PPP options

Option	Asset Ownership	Operations and Maintenance	Capital Investment	Commercial Risks	Duration of Contract
Service Contract	Public	Public and Private	Public	Public	1-2 Years
Franchising	Public	Public and Private	Public	Public	1-5 Years
Management Contract	Public	Private	Public	Public	3-5 Years
Leasing Contract	Public	Private	Public	Public and Private	8-15 Years
Concession	Public	Private	Private	Private	25-30 Years
BOT and Its Variations	Public and Private	Private	Private	Private	20-30Years
Full Privatization	Private or Private and Public	Private	Private	Private	Indefinite

Out of the above possible options, the BOT-related PPP options has a wide range of varieties and can be applied in different type of projects. **Table 8-5** shows possible BOT-related PPP options with the comparison of asset ownership, operations and maintenance, capital investment, commercial risks and duration of contract.

Table 8-6 Comparisons of options for BOT and its variations

DB	Design-Build	One entity enters a contract with the owner to provide both architectural/engineering design services and construction services.
BOT	Build-Operate-Transfer	A concession is granted to a contractor to design, finance, maintain, and operate a facility for a period of time. The constructor recoups the cost of the project by collecting tolls during the life of the concession period.
BTO	Build-Transfer-Operate	A private developer finances and builds a facility and, upon completion, transfers legal ownership to the sponsoring government agency. The agency then leases the facility back to the developer under a long-term lease. During the lease, the developer operates the facility and earns a reasonable return from user charges.
BOOT	Build-Own-Operate-Transfer	Ownership of the facility rests with the contractor until the end of the concession period, at which point ownership and operating rights are transferred to the host government.
BOO	Build-Own-Operate	Resembles outright privatization. Projects of this type are often let with no provision for the return of ownership to government.
DBO	Design-Build-Operate	The contractor is responsible for the design and construction of a facility. Upon completion transfer of legal ownership to the sponsoring government agency. The contractor is also responsible for operating and maintaining of the facility for the stipulated period.
DBFO	Design-Build-Finance-Operate	A contractor is responsible for the design, construction, maintenance, and financing. The contractor is compensated by specific service payments from government during the life of the project.
BLTM	Build-Lease-Transfer-Maintain	In this type of arrangement, a facility is typically designed, financed, and constructed by the private sector and is then leased back to government for some predetermined period of time at a pre-agreed rental.
LROT	Lease-Renovate-Operate-Transfer	This model is for facilities that need to be modernized. The private sector contractor pays a rental to government and agrees to renovate the facility. In exchange, the contractor is granted a concession to operate the facility for a fixed period of time and to charge a fee for the service.

8.2.2 Criteria for selecting optimum PPP schemes

The following criteria are employed in an attempt to select the best and optimum option for the private sector involvement scheme in providing the water supply services. However, when applying these criteria, the current site-specific conditions of the project sites should be carefully taken into account. Choosing the optimum PPP option is one of the most crucial decisions. A broad range of the past experiences indicate that a mere copying of approaches that have been successful in other projects will tend to fail when they are not properly adapted to the local and site-specific situation.

- **Effectiveness:** Effectiveness is the quantitative degree of increasing the service coverage and qualitative significance of improving the quality of services through involving the private sector.

- **Competition and Efficiency:** By using the private sector's cost-saving expertise, the private sector involvement will significantly reduce the financial burden on the authority. The efficiency will be normally measured by the value for money analysis. If the efficiency of water supply services through competition is significantly improved, the tariff level will eventually be reduced due to the further rationalized private sector,

thereby benefitting the whole society. In order to improve the efficiency, the technical transfer of the management and technical skills from the private sector to the public sector is the key to the success.

- **On-Time Provision of Capital Investment to Infrastructure:** The involvement of the private sector can enlarge the access to capital or financial resources for investment/procurement of facilities/equipment as well as the access to human capital for expertise and skills. The degree of the accessibility to those financial and human capital by the public sector is one of the important motivation for the private sector involvement.

- **Accountability and Transparency:**
  Accountability and transparency under the private sector involvement depends on the degree to which the procurement process is open to competitive market forces and the extent to which corruption distorts the process. On the other hand, accountability and transparency in the implementation phase depends on the performance monitoring.

- **Risks and Sustainability:** The risks in the private sector involvement are important factors for sustainably providing water supply services. By sharing the risk factors between the public sector and the private sector, the regulatory framework which removes the risk factors will protect the private sector, thereby making the private sector involvement for water supply services functions sustainably.

- **Duration of Contract:** The duration of a contract is a cardinal issue for the access to capital investment by the private sector to be taken into account. If the duration of a contract is relatively short, a private service provider would not have sufficient time to repay a loan for the construction of facilities.

8.2.3 Outline of selected PPP options

The PPP model for the Kampot and Kep projects will be selected from the following candidate models specially selected from the possible PPP options.

1. **Concession/BOT Model for developing bulk water supply system and O&M of the Entire System**

The concession model for the development of the bulk water supply system including the operation and maintenance of the entire water supply system is a PPP structure developed on a BOT basis. As per the concession agreement, the private developer is required to undertake the construction of the bulk water supply system including the raw water off-take system, raw water transmission lines and water treatment plant. The private developer will also be responsible for the operation and management of the water supply system from source to the end consumer. The private developer is given the right to levy and collect revenues from the consumers for the activities undertaken.

2. **Concession/BOT Model for construction, O&M of bulk water supply system**

The concession model for the construction, operation and maintenance of the bulk water supply system is a typical PPP structure under the Design Build Own Operate and Transfer (DBOOT) model. Under this model, the private operator is required to construct the bulk supply facilities so as to provide treated water up to the service reservoir. The capital investment required for the augmentation works needs to be borne by the private operator. The operation and management of these assets during the concession period rests with the local government.

3. Concession/BOT Model for construction, O&M of distribution system

As per this form of concession model, the design and finance of the identified augmentation works would be undertaken through a 100% capital grant from the government. As per the contract, the private developer is required to first undertake the construction/rehabilitation works for the identified section of the water system, and further to the construction activity, undertake the operation and maintenance of the entire water supply system. Once the construction activity is complete, the private developer alone is responsible for the operation and maintenance of the entire water supply system, including the supply of treated water to all the connections, installation of meters, generation of bills, and collection of revenues. Any major expansion activities which may be required to the existing infrastructure would have to be borne by the government.

a. Kampot Project

The selected PPP model for the Kampot project is the Model 2 of the above candidates, and the outline of the model is illustrated in the following figure. The water treatment plant will be constructed under the DBOOT (Design-Build-Own-Operate-Transfer) with the 30-year project period, while the SPC will be established to make the bulk water purchase contract with the Kampot Water Supply (KWS). The off-taker of the bulk water would be KWS under “the take or pay agreement”.

Note: “take or pay agreement” is a provision, written into a contract such as PPP contract, whereby one party or purchaser has the obligation of paying a specified amount of product over long term. Furthermore, up to an agreed-upon ceiling, the purchaser has to pay the supplier even for products they do not take. This provision reduces market risk which the supplier originally has the obligation.

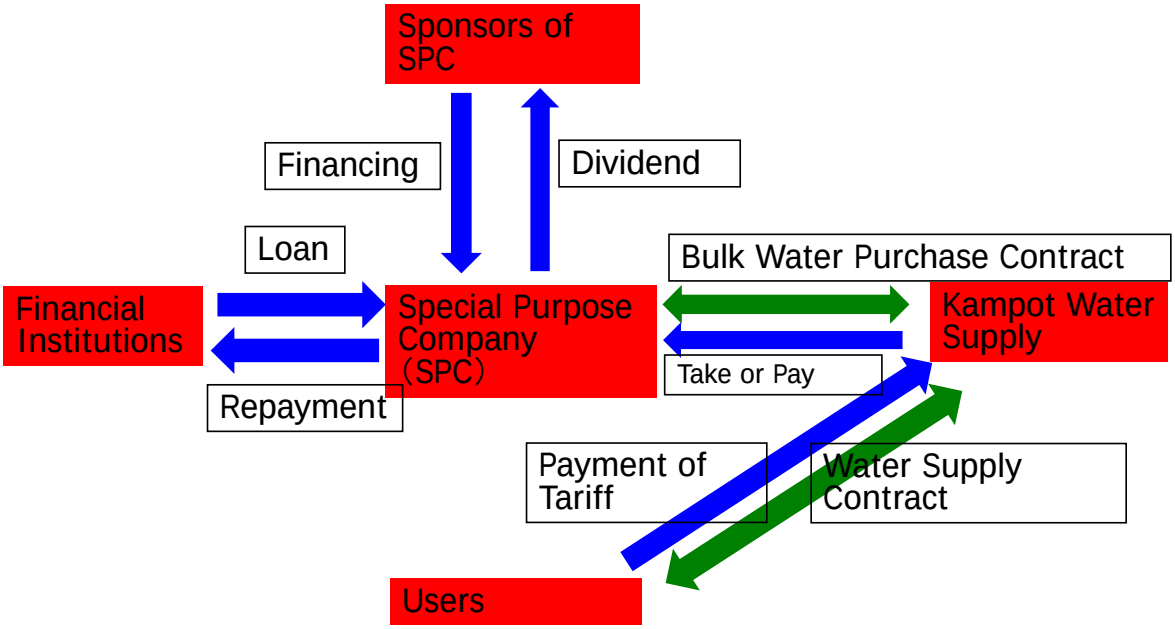


Figure 8-2 Proposed PPP scheme for Kampot project

b. Kep Project

The selected PPP model for the Kep project is the Model 1 of the above candidates, and the outline of the model is illustrated in the following figure. The water treatment plant as well as the mobile water supply equipment will be constructed and supplied under the DBOOT (Design-Build-Own-Operate) with the 30-year project period, while the same SPC as the Kampot project will be responsible for providing the water supply services to end users as well as to collect water charges from them. There is a possibility that water charges might be collected by the staff of KWS.

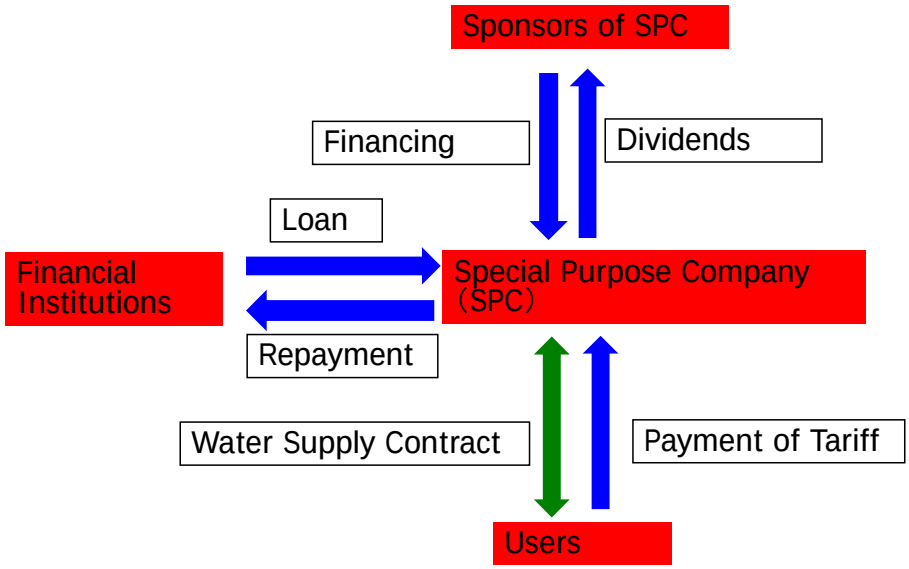


Figure 8-3 Proposed PPP scheme for Kep project

The SPC will be established to cover the both Kampot and Kep projects. The possible sponsors for the SPC would be the Japanese private investors and Cambodian private investors. Phnom Penh Water Supply Authority (PPWSA) would also be one of the sponsors for the SPC on the condition that the investment would be carried out through its subsidiary company, if established, and the profitability of the SPC meets its expectations.

The functions of the SPC for the Kampot project includes:

- design, construction, and finance of the new water treatment plant at the preparatory stage;
- ownership, operation, and maintenance of the new water treatment plant during the project period; and
- transfer of the new water treatment plant to the Government of Cambodia at the end of the project period

On the other hand, the functions of KWS includes:

- operation and maintenance of the distribution network;
- counter-measures for the non revenue water;
- collection of water charges from customers; and
- provision of customer services

The functions of the SPC for the Kep project includes:

- design, construction, and finance of the new water treatment plant and the distribution network as well as the Mobile Ceramic Membrane Filtration Equipment (M-CMFs) at

the preparatory stage;
- ownership, operation, and maintenance of the new water treatment plant and the distribution network as well as the M-CMFs during the project period;
- transfer of the new water treatment plant and the distribution network as well as the M-CMFs to the Government of Cambodia at the end of the project period;
- operation and maintenance of the distribution network;
- counter-measures for the non revenue water;
- collection of water charges from customers; and
- provision of customer services

8.3 Risk analysis on selected PPP model

Risk is an unavoidable factor in the provision of water supply services. The contracting authority and operator know that the value of certain variables, such as demand, interest rates, and foreign exchange rates, is important for the project. But while they may know the past and present values of the variables, they cannot predict future values with certainty.

It is important that each risk in a project be allocated to that party which is best able to manage the risk at least possible cost. Therefore, it needs to be assessed as to whether a particular risk can be managed better by the private developer at a lesser cost or not. If the case is that the private developer would be able to handle the identified risk better, it is recommended that the same be handed over to it.

Successful implementation of a PPP contract therefore depends on how the risks associated with the project are allocated. Before the risks are allocated, it is important that a wide range of the following risks be identified.

Table 8-7 Identified risks for the PPP Projects

Stage	Type of Risk		Description of Risks
Common	Political Risk	Change in Law Risk	Possibility of change of PPP legal structure
		Political Risk	Possibility of unstable political conditions
		Regulation Risk	Possibility of change of relevant regulations
		Tax Regime Change Risk	New tax and change of tax rates
		Public Support Risk	Failure of public support to projects
	Economic Risk	Price Escalation Risk	Inflation/deflation
		Interest Rate Risk	Unexpected increase in interest rates
		Exchange Rate Risk	Fluctuation of exchange rates
		Financial Risk	Varieties of financial arrangement risks
	Social Risk	AP (Affected People) Risk	Objective movement by affected people
		Environmental Risk	Negative environmental impacts
	Partner Risk	Partner Risk	Lack of reliability in SPC partners
	Force Majeure	Catastrophic Risk	Force majeure (natural calamities)
		War Risk	Force majeure (war and riots)
Planning Stage	Planning Risk	Site Survey Risk	Lack of ample preparatory site survey
		Design Risk	Specification change due to design mistakes
		Plan Change and Delay	Plan change and delay due to EIA and

		Risk	stakeholder meetings
Construction Stage	Construction Risk	Land Acquisition Risk	Possibility of failure of land acquisition
		Delay in Construction Risk	Possibility of delay in construction due to various reasons
		Cost Overrun Risk	Possibility of cost overrun due to various reasons
		Performance Risk	Underperformance by construction mistakes
		Construction Damage Risk	Delay in operation due to construction damage
Operating Stage	Market Risk	Demand Risk	SPC's revenue reduction due to unexpected demand decrease
		Tariff Risk	SPC's revenue reduction due to difficulties in tariff setting and tariff revision
	Operating Risk	Operating Cost Risk	Unexpected increase of operating costs
		Operating Performance Risk	Unexpected underperformance of operation
	Default Risk	Default Risk	Possibility of default of SPC

Table 8-8 shows possibilities of risks and risk cover measures for PPP projects. One of the most likely risks is the demand risk which could be covered by "take or pay agreement" between the SPC and MIME/KWS, the off-taker of the bulk water in the DBOOT contract for the Kampot project.

Table 8-8 Possibilities of risks and risk cover measures for PPP Projects

Stage	Type of Risk		Possibilities of Risks and Risk Cover Measures
Common	Political Risk	Change in Law Risk	The possibility of the change of PPP legal structure is extremely low, since the government promotes the policies on PPP.
		Political Risk	Political conditions are stable.
		Regulation Risk	The possibility of the change of relevant regulations is relatively low.
		Tax Regime Change Risk	Monitoring of new taxes and change of tax rates
		Public Support Risk	The possibility of the failure of public support is extremely low.
	Economic Risk	Price Escalation Risk	To be properly shared by stakeholders
		Interest Rate Risk	To be properly shared by stakeholders
		Exchange Rate Risk	To be properly shared by stakeholders
		Financial Risk	To be properly shared by stakeholders
	Social Risk	AP (Affected People) Risk	The number of the affected people is negligible.
		Environmental Risk	Negative environmental impacts are negligible.
	Partner Risk	Partner Risk	There would be good partnership among SPC sponsors.
	Force Majeure	Catastrophic Risk	Catastrophic risks are extremely low.
		War Risk	War risks are extremely low.

Planning Stage	Planning Risk	Site Survey Risk	The ample site survey has been conducted during this Survey stage.
		Design Risk	The result of this Survey will be well utilized to avoid the design risk.
		Plan Change and Delay Risk	The possibility of the plan change is relatively low.
Construction Stage	Construction Risk	Land Acquisition Risk	The location of facilities can flexibly be changed.
		Delay in Construction Risk	The selection of reliable contractors and the monitoring of the construction process
		Cost Overrun Risk	The selection of reliable contractors and the monitoring of the construction process
		Performance Risk	The selection of reliable contractors and the monitoring of the construction process
		Construction Damage Risk	The selection of reliable contractors and the monitoring of the construction process
Operating Stage	Market Risk	Demand Risk	Take or pay agreement in the contract
		Tariff Risk	The tariff setting and the tariff revision schedule should be incorporated into the contract.
	Operating Risk	Operating Cost Risk	Selection of reliable SPC and monitoring of operating process
		Operating Performance Risk	Selection of reliable SPC and monitoring of operating process
	Default Risk	Default Risk	The default of SPC is relatively low, and the management of SPC should be properly monitored.

Table 8-9 shows the risk sharing of a wide range of the identified risks among various stakeholders. Once the risks have been identified, and allocated appropriately, the next activity to be undertaken is developing the probable risk mitigation strategies. Risk mitigation strategies will be developed with the intention of reducing each party's exposure to the risk.

Table 8-9 Proposed risk sharing among stakeholders

Stage	Type of Risk		Responsibility of Risk Cover by Stakeholder (● : Main Responsibility, ▲ : Sub Responsibility)						
			Public	Private	Private				
					SPC	Sponsor	Financial Institutions	Insurance Company	Contractor
Common	Political Risk	Change in Law Risk	●						
		Political Risk	●						
		Regulation Risk	●						
		Tax Regime Change Risk	●						
		Public Support Risk	●						
	Economic Risk	Price Escalation Risk		●	●				
		Interest Rate Risk		●	●		●		
		Exchange Rate Risk		●	●		●		
		Financial Risk		●	●	●	●		
	Social Risk	AP (Affected People) Risk	●						
		Environmental Risk	●						
	Partner Risk	Partner Risk		●	●	●	▲		
	Force Majeure	Catastrophic Risk	●	▲	▲		▲	▲	▲
		War Risk	●						
Planning Stage	Planning Risk	Site Survey Risk		●	●				●
		Design Risk		●	●				●
		Plan Change and Delay Risk	●						
Construction Stage	Construction Risk	Land Acquisition Risk	●						
		Delay in Construction Risk		●	●	●		▲	●
		Cost Overrun Risk		●	●	●		▲	●
		Performance Risk		●	●				●
		Construction Damage Risk		●	●			▲	●
Operating Stage	Market Risk	Demand Risk		●	●		▲		
		Tariff Risk	●						
	Operating Risk	Operating Cost Risk		●	●				
		Operating Performance Risk		●	●				
	Default Risk	Default Risk		●	●	▲	▲	▲	

8.4 Constraints and challenges when Japanese firms enter the PPP business

The absence of the following seven pre-conditions will be the critical barriers which might prevent the smooth implementation of the proposed PPP project. It is highly recommended that those pre-conditions would be satisfied.

8.4.1 Assistance from the Government

In general, it is required that the government provides a wide range of "government supports" to a PPP project to help attract private investment on the said PPP project. The government supports include the following various activities.

- Upfront Procurement of Land
- Contractual Abilities
- Contract Extensions
- Protection from Competition
- Political Risk Guarantees
- Exchange Rate Guarantees on Project Revenues
- Output and Capital
- Tax and Customs Benefits
- Profit and Cost Sharing Arrangements
- Public Loans

- Public Equity Participation

The risk cover measures to mitigate a series of risks are closely related to the government supports. The risk cover measures which are currently expected from the government include the followings:

- The take or pay agreement which guarantees the minimum purchase of the bulk water from the SPC should be included in the PPP contract;
- The setting up on the escrow account* for the SPC should be supported.
- Tax and customs exemptions or privileges should be sought for the SPC by obtaining "QIP (Qualified Investment Project)".

Note: "escrow account" is one kind of a trust account that is established in trust bank or the like to hold separate funds for the purpose of paying bills such as repairs, paying the interest and principal by the set various account. When the bill comes due, the trust bank has the funds available to pay it for SPC, since the money has been collected through the target Project finance.

8.4.2 Workable selection process of SPC

After the identification of the PPP structure, it is required to finalize the procurement process of the SPC. For initiating the procurement process, transaction structures should be established which would cover the following aspects.

- The parties involved in the contract
- The contractual relationship between the parties
- The nature of the agreement
- The key risks and their allocation
- Government commitment
- Duration of contract
- Performance indicators
- Payment terms
- Award criteria
- Contract management strategy

The preparation for selecting the SPC is the final phase in implementing a water supply project on a PPP basis. A detailed implementation plan for the contractual structure needs to be prepared. The DBOOT contract for the Kampot project and DBOOT contract for the Kep project put the implementation structure into legal documents that can be enforced. Those contract agreements define the rights and obligations of the contracting parties and the terms and conditions under which the obligations would be discharged. Both DBOOT contract for the Kampot project and DBOOT contract for the Kep project would need to be drafted before it initiates the procurement process of the selected PPP structure.

8.4.3 Clear-cut performance targets

The preparation of a PPP requires the clear definition of the performance targets of the SPC. A wide range of performance monitoring indicators which are categorized into 11 groups (service coverage, water consumption and production, unaccounted for water, metering practices, water quality, operational performance, cost and staffing, quality of service, billings and collections, financial performance and capital investment) should be incorporated into the business plan of the SPC to monitor its performance. The clear-cut and quantitative target figures of these performance indicators should be also incorporated into the contractual documents.

8.4.4 Realistic tariff setting and proper tariff revision mechanism

The realistic tariff setting and the proper tariff revision mechanism are keys to the long-term sustainability of the proposed PPP project. The tariff setting and the tariff revision mechanism will be included in the proposed DBOOT contract for the Kampot project as well as the proposed DBOOT contract for the Kep project with the following basic principles.

- Water tariffs should cover at least the operating cost and the depreciation for replacement cost of existing facilities, desirably part of the debt service obligations for the future investment cost. The tariff based on financial terms should be accurately calculated readily by making use of the latest financial data and information available.

- Water tariffs should not be discriminatory among users. The price per unit of consumption should be basically the same for all users. Price differentials are acceptable, when the corresponding costs to provide services for different users vary.

- The tariff level should send a clear signal to water conservation by users as well as efficiency improvement. Users will adjust their consumptions to price variations if they are metered, and the tariff would be a function of the consumed volume. At the same time, the tariff should be periodically readjusted to maintain their real value.

- The demand side such as users' affordability and willingness to pay for water supply and sanitation services should be properly taken into account, when the tariff level is revised.

8.4.5 Quick procurement process through unsolicited proposal

In order to shorten the duration required for the feasibility study, thereby achieving the fastest establishment of the SPC, the proposal on the unsolicited basis should be adopted for the feasibility study process. The complicated and slower bidding process of the feasibility study should be avoided on the following conditions.

- When results of the pre-feasibility study or the equivalent are available they should be utilized for the private investors who will conduct feasibility study on the unsolicited base.
- The selection of the SPC would be based on the normal bidding process.
- The company who submitted the feasibility study report would have some advantages

8.4.6 Compliance with QIP (Qualified Investment Project)

CIB (Cambodia Investment Board) stipulates QIP (Qualified Investment Project) as a project which is entitled to enjoy the exemption of import duties as well as a wide range of tax privileges, contributing to the cash flow of the SPC. The type of QIP is divided into "export-oriented QIP" and "domestic type" QIP. According to the definition of the Investment Law, a water supply project is reportedly to be categorized into "domestic type QIP".

8.4.7 Implementation of technical assistance program to SPC

A wide range of the technical assistance program should be rendered through the staff of KWS which might be dispatched to the SPC. The technical assistance program includes a wide range of expertise in the field of (a) operation and maintenance, (b) customers' satisfaction, (c) financial management, (d) human resources and staff deployment, and (e) organizational restructuring.

- To study the current situation of:
  - operation and maintenance efficiency including non revenue water reduction

  - degree of customers' satisfaction
  - financial conditions of SPC
  - human resources and staff deployment of SPC
  - organizational restructuring of SPC
- To set the quantitative target for:
  - Improvement of operation and maintenance efficiency including non revenue water reduction
  - degree of customers' satisfaction
  - efficiency of financial management of SPC
  - capacities and efficiency of human resources and staff deployment of SPC
  - organizational efficiency of SPC
- To make the strategies for
  - improvement in operation and maintenance efficiency including non revenue water reduction
  - improvement in customers' satisfaction
  - financial improvement of SPC
  - improvement in capacities and efficiency of human resources and staff deployment of SPC
  - organizational restructuring of SPC
- To make the detailed implementation plan for:
  - Improvement in operation and maintenance efficiency including non revenue water reduction
  - improvement in customers' satisfaction
  - financial improvement of SPC
  - improvement in capacities and efficiency of human resources and staff deployment of SPC
  - organizational restructuring of SPC
- To monitor the performance indicators of:
  - Improvement in operation and maintenance efficiency including non revenue water reduction
  - improvement in customers' satisfaction
  - financial improvement of SPC
  - improvement in capacities and efficiency of human resources and staff deployment of SPC
  - organizational restructuring of SPC

Chapter 9 Operation and maintenance

9.1 Operation and maintenance

Special Purpose Company (SPC) will operate and maintain the water treatment/distribution facilities properly observing related laws and regulations. And along with providing sufficient amount of good quality water to users without delay, it will always maintain a sound financial condition on a consistent basis by taking economical ways of operation & maintenance (O&M). To conduct the management like those above, it will be necessary to hold and analyze the information concerning O&M in step with adjustment among monitoring, daily checkups and maintenance.

9.1.1 Targeted area of SPC management

Targeted area of SPC management will be shown below.

- Kampot Water Treatment Plant (WTP)（3,500 m^3/day）
- Kampot city water pipe lines（The pipe line between the plant and the elevated tank）
- Kep WTP (900 m^3/day）
- Kep city transmission pipeline and distribution network
- Mobile Ceramic Membrane Filtration Equipment (M-CMF)（three mobiles）

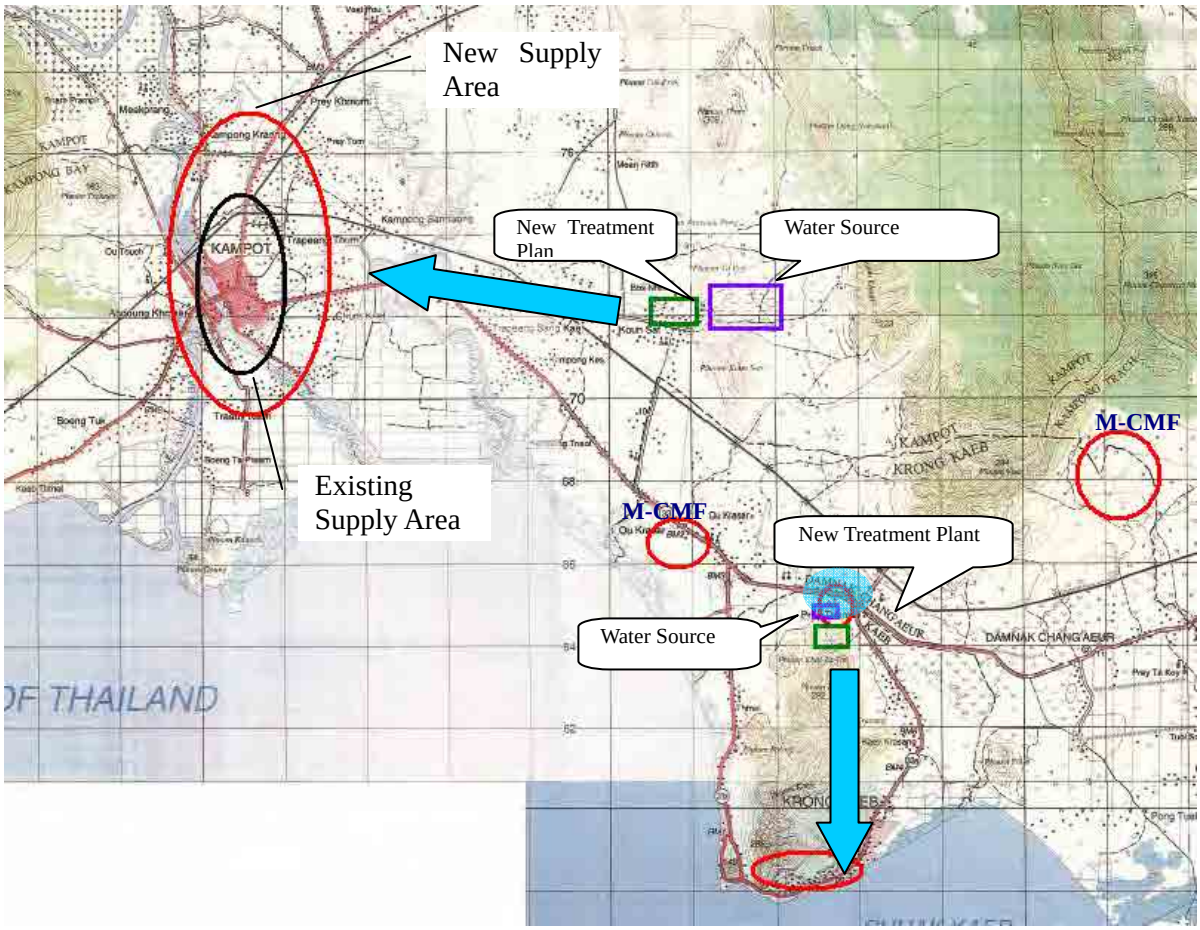


Figure 9-1 Targeted area of SPC management

9.1.2 O&M and management policy

This project proposes to maintain the level of technologies and reduce cost while observing relevant laws and regulations with the cooperation of Kampot Water Supply (KWS) which is one of the selected cities of the technology transfer project “The Project on Capacity Building for Water Supply System in Cambodia Phase-2” by JICA

9.1.3 O&M and management

The management of the facilities on a daily basis will be classified roughly into operation management and maintenance management. Of these, operation management aims to have an efficient operation of the whole system, as well as secure and right operation of each facility and equipment.

The maintenance management aims to maintain the functions of those facilities and equipments to be used in good order all the time. It is important to have regular inspections and replacement of parts and consumables to keep original functions and extend life of those. Basically the method recommended by manufacturers will be applied for the types of repairing works and time, and then considering actual degree of consumption and problem frequency, realistic work plan will be made and carried out properly.

The knowledge and data acquired through O&M will be filed, analyzed, and utilized for objective assessment and criterion towards facility improvements. This will improve the stability and manageability, and contribute to the improvement of the whole system and efficient business operation.

9.1.3.1 O&M of coagulation-sedimentation and rapid filtration facility (Kampot WTP)

Kampot WTP is a plant using coagulation-sedimentation and rapid filtration system and taking water from a dam as a water source. The water source from a dam changes its qualities depending on the season and the weather. Therefore the main operations for the water plant will start from managing water quality, water volume, water level, and quality of treated water for each process. Thus, it is necessary to consider controlling methods, features and capacity of the equipment, and to proceed appropriately.

Table 9-1 Example of process control item

Process	Examples of items to be managed
Water intake	Source water quality Intake water volume
Coagulation and sedimentation	pH of treated water Coagulation state (flock formation state)
Sand filtration	Flow rate to reservoir Filtration flow volume Head loss Backwash frequency
Water conveyance	Volume of water conveyance Pressure of water conveyance Water level of filtration pond Quality of treated water
Sludge treatment	Sludge interface Drying period
Others	Residual of each chemicals Injection ratio/amount of each chemicals Operating status and time of each equipment

9.1.3.2 O&M of ceramic membrane facilities

Kep WTP is a purification facility using a pond as a water source and ceramic membrane filtration system. WTP with this system are basically capable for full automatic operation, therefore O&M administrator is not required to be in the plant most of the time.

As to M-CMF, although it is installed in a truck, the purification system is basically same as Kep WTP. Therefore work contents of O&M are the same as Kep WTP.

Table 9-2 Examples of O&M for Ceramic Membrane Filtration Equipment

Works	Estimated frequency	Notes
Operation-halt control	everyday	
Backwashing	4-6 times/day	Performed when trans membrane pressure get increased
Rupture Test (PDT)	2-3 times/week (After driving)	PDT (Pressure Decay Test)
Patrol inspection	Once/day	Checkups with five senses
Chemical cleaning	Once/6-12 months	Approx. 2 days for cleaning
Maintenance of water quality measurement instrument	Once/month	Refill the reagent, etc.

Note: Operation-halt control, backwashing operation and PDT are full automatic operation.

Kep WTP will be operated for 24 hours /365 days except during maintenance and repair works. The three M-CMFs (No.1-3) will target the three areas where there are no water supplies from WTPs. And since the equipment is installed in a truck, they will flexibly meet the demands that vary with seasons and days. The following is an example of operation pattern of M-CMFs.

Table 9-3 Example of operation pattern of M-CMF

	Days and water supply area (commune)						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
№1	O-Krasar	O-Krasar	O-Krasar	O-Krasar	Prey Thum	KEP	Maintenance
№2	Phong Tuek	Phong Tuek	Phong Tuek	Ph/Pr	Prey Thum	KEP	KEP
№3	O-Krasar	O-Krasar	O-/Ph	Prey Thum	Prey Thum	KEP	KEP

9.1.3.3 O&M of mechanical equipment

Waterworks facilities are composed of many types of equipments like pumps, motor installations, valves and agitators and so on, and problems to these equipments can cause reduction and cutoff of water supply, as well as abnormal water qualities. Therefore the appropriate daily maintenance and checkups will reduce the likelihood of equipments facing problmes, and will lead to an enhancement of credibility for waterworks system.

To check the hardware, it is important to concentrate on one’s senses in order to find the possible problems of the machines in operation. Possible problems include unusual odor, vibrations, overheat, water leakage, oil leakage, etc. And it is important to judge the problem with knowledge acquired from past experiences, so that it will lead to an early detection of the possible problems.

9.1.3.4 O&M of electrical equipment

In Japan, installation personnel of electrical facilities must register the installations including maintenance codes to the regulatory authorities pursuant to Paragraph 1, Article 42 of the Electricity Enterprises Law. There are specifications for daily inspection tours, regular inspections, and precision inspections for the purpose of O&M securities. However, there are no relevant regulations found in Cambodia, therefore Japanese regulations and inspection stipulations of the equipment manufacturer shall be applied.

Also, it is essential to have a secure and stable electrical supply to maintain the credibility of waterworks system. Daily checkups, regular inspections, and precision inspections are necessary for the system to work appropriately.

9.1.3.5 O&M of pipe lines

Most of the pipes are buried underground so it will be difficult to have a visual inspection. Therefore, the main work of O&M will be to find water leakages by checking valves installed in the piping and monitoring the changes of differences between water supply quantity and revenue ratio. On regular basis, it is necessary to keep the best conditions of pipelines by having water leakage inspection with a special measuring machine conducted by engineers.

9.1.4 Water quality management

The quality of treated water will be tested and managed using the Water Control Management Standard of Kampot and Phnom Penh Water Supply Authority (PPWSA) as a reference. Test devices will be set up in a water testing laboratory placed in Kampot WTP and working staff will conduct the tests. But, the Water Control Management Standard will be potentially revised in 2012. Also, private water quality testing companies will conduct the tests regularly to carry out thorough water quality control. Examples of Standard Values of water quality control by are shown below.

Table 9-4 The water quality test in PPWSA

	Test		Standard Value	
No	Parameters	Unit	PPWSA	Kampot
1	pH		6.50-8.50	6.5-8.5
2	Turbidity	NTU	5	5
3	Conductivity	µS/cm	400	*
4	Suspended solids	mg/L	1	
5	Total dissolve solids	mg/L	1000	800
6	Free available chlorine	mg/L	0.1-1.0	0.2-0.5
7	Total available chlorine	mg/L	2	
8	Total coliform	cfu/100mL	0	0
9	E. coli	cfu/100mL	0	0
10	Ca hardness	mg/L	70	
11	Total hardness	mg/L	100	300
12	Magnesium hardness	mg/L	30	
13	Alkalinity	mg/L	350	*
14	Organic substances	mg/L		*
15	Dissolved oxygen	mg/L		
16	Color	TCU	15	5
17	UV, absorbance			
18	Aluminum	mg/L	0.05-0.20	0.2
19	Ammonia nitrogen	mg/L		1.5
20	Ammonia	mg/L	0.05-0.50	
21	Carbone dioxide	mg/L		
22	Copper	mg/L	0.02-1.0	1
23	Chloride	mg/L	25-250	250
24	Cyanide	mg/L	0.07-1.0	
25	Fluoride	mg/L	0.1-1.5	
26	Iron	mg/L	0.1-0.3	0.3
27	Manganese	mg/L	0.05-0.50	0.1
28	Nitrate nitrogen	mg/L		
29	Nitrate	mg/L	5.0-50	
30	Nitrite nitrogen	mg/L		
31	Nitrite	mg/L	1.0-3.0	
32	Zinc	mg/L	0.5-3.0	
33	Phosphate	mg/L		
34	Sulfide	mg/L	0.00	0.05 (hydrogen)
35	Sulfate	mg/L	25-250	3
36	Arsenic	mg/L	0.01	

Note: * denotes items measured as references without standard values

9.1.5 Sludge disposal

Apparently, in Kampot WTP, sludge created through filtration process is released into a river which also serves as the water source. However it is considered to be difficult to release the sludge because ponds or lakes will be the water sources in this project. Thus the sludge created from filtration process in this project will be moved to sun drying beds, and get dried for about two months until it becomes a dehydrated sludge, and will be handled by a sludge disposal vendor. The following will be the estimated amount of sludge created from each filtration plant of Kamport and Kep.

Table 9-5 Amount of produced sludge and dehydrated sludge

	Amount of sludge production Water content ratio 60% (kg-DS/day)	Amount of dehydrated Sludge (ton /two months)
Kampot WTP	116	12
Kep WTP	11	1.2

In the case of outsourcing sludge disposal to a waste disposer, about 2.5 ton once of carriage will be possible. If pick-up points (filtration plant) are within 10 km from the center of Kampot or Kep, the cost for pick-ups will be about 30-40 US$/time.

9.1.6 Visions for renewal of equipment

In this project, life extension of equipment and functions is proposed by implementing O&M management using Japanese technologies andknowledge. Since the deterioration rate of ceramic membranes are low, they are considered to be not in need of having a renewal within the project period. However, the pumps and the valves are expected to be functionally defective due to aging degradation, so functional maintenance by daily maintenance and appropriate replacements timing based on equipment will be implemented.

9.2 Organization structure for O&M

To have an appropriate O&M of waterworks systems, it is necessary to establish an organization structure for O&M, which clarifies the command-structure, roles, and responsibilities. The following shows the organization structure of O&M and works (roles and responsibilities) in this project.

9.2.1 Organization structure for O&M

Organization structure for O&M is shown below.

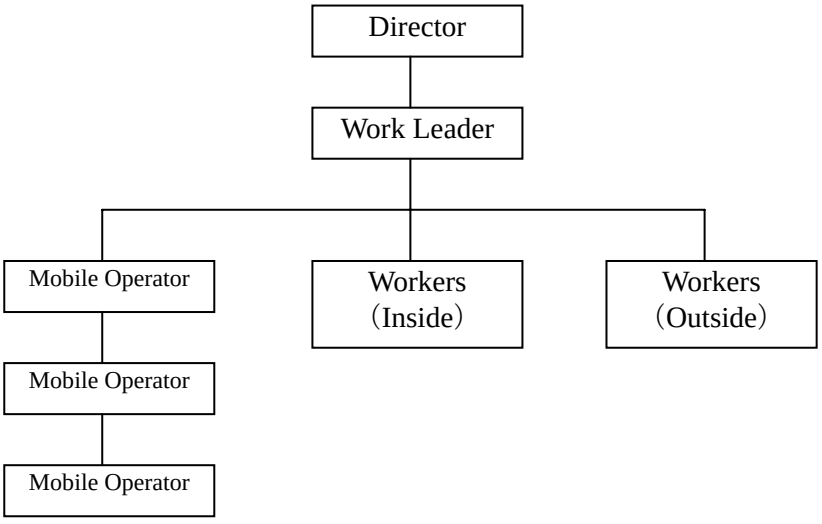


Figure 9-2 Organization structure for O&M

Table 9-6 Organization structure for O&M

	Weekdays		Holidays	
	Daytime	Nighttime	Daytime	Nighttime
	8:00～17:00	17:00～8:00	8:00～17:00	17:00～8:00
Director	1	0	0	0
Work leader	1	1	1	1
Mobile operators	3	3	3	3
Workers	2	2	2	2
Total	7	6	6	6

Respective works and roles are shown below

Table 9-7 Works and roles

Roles	Works	Working places
Director	Coordination with SPC Contacts for outwards Coordination of O&M management Assistance of monitoring operations	Monitoring room of Kampot new WTP
Work leader	Monitoring operations Water quality test Deputy director	Monitoring room of Kampot new WTP
Mobile operators	Operation of M-CMF, maintenance, monitoring Truck operation	Around Veal Bong Dam Around O-Krasar Commune
Workers（Inside）	Equipment inspection/ repair and maintenance Assistance of water quality test Assistance of monitoring Maintenance of the premise	Kampot WTP Kep WTP (water sampling and inspection)
Workers（Outside）	O&M of piping system and Kep WTP and so on. Water collection for water quality test Inspection of pipe lines (Kampot, Kep) Assistance of mobiles	Kampot Kep

9.2.2 Calculations for the numbers of workers

According to the conditions below, the numbers of workers needed for O&M will be calculated.

Conditions:

1. The Water Filtration Plant will be operated for 365 days, 24 hours in principle, and has to be always controlled by a director or a work leader.
2. A director basically works for daytime of weekdays, and a work leader takes the director’s duty during night time and in the time of absence of the director.
3. Mobile operators drive the M-CMF trucks.
4. Work Systems：Irregular two shift system（exclude director）
5. Holidays in Cambodia shall be 125 days in a year
6. Standard working hours shall be 48 hours in a week
7. Positioning of personnel shall be according to the table below

As a result of calculation based on the conditions above, the numbers of workers needed is 24. The following is the numbers of workers in need of each work.

Table 9-8 Work position and number

Position	Number
Director	1
Work leaders	4
Mobile operators	8
Workers	11
Total	**24**

9.2.3 The number of workers per 1000 connections

Number of workers is tried to compare with the performance index of WB that around five workers are desirable for 1,000 connections. The connection of Kampot and Kep is estimated as 5,600. On the other hand, the numbers of SPC workers (planned number) engaged in operations and O&M of the filtration plant out of SPC workers is 26. This 26 figure comprises WTP worker 24 minus mobile operators 8, and the plus the SPC administrative manager, engineers and clerks 10.

From these numbers, the number of workers per 1000 connections becomes 4.7. The most suitable numbers of workers per 1000 connection is described as five according to the WB indexes. Therefore, the manpower planning is considered appropriate.

9.3 Procurement

9.3.1 Electricity

In Feb 2012, Electricity in Kampot is mainly provided from EDC (Electricite Du Cambodge), and from an Independent Power Producers (IPP) which is affiliated with EDC for Kep. In a part of the area, electricity is provided by a private company, but large amount of electricity will be needed in this project and it will be purchased from EDC and IPP affiliated with EDC. The price of electricity differs between Kampot and Kep. Kampot rate is 1,100 KHR/kWh and Kep rate is 800 KHR. However, a construction of hydraulic power plant has been in progress in Kampot, and it is said that the price will be 920 KHR when the hydraulic power plant starts running.

9.3.2 Chemicals

As a disinfectant, chlorine gas (liquid chlorine) which is mainstreaming in Cambodian water treatment plants will be used. However chlorine gas is extremely poisonous and care should be taken for handling. It will also be used as a disinfectant and ceramic membrane chemical cleaning for M-CMF.

As a disinfectant and as a cleaner, Calcium Hypochlorite is used for M-CMF.

On the other hand PACl has mainstreaming in Japan and lately it is becoming available in Cambodia as well. Therefore the use of PACl that is relatively easy to handle should also be considered in the future.

As a pH adjuster, Calcium Hydrateis used, and as an acid adjuster, sulfuric acid is used. In addition, most of the unavailable chemicals will be imported from China or Vietnam. Examples of types of chemicals used for waterworks available in Cambodia are shown below.

Table 9-9 Example of quotation from chemical vender (NARY CHHEAN THONG CO., LTD.)

(unit: US$)

No.	Name	Unit price (Per ton)	VAT 10%	Transportation fee (Per ton)		Total price (Per ton)
				Kampot	Kep	
1	Lime	246.00	24.60	10.00	10.00	280.60
2	Alum	355.00	35.50	10.00	10.00	400.50
3	Liquid chlorine	1,400.00	140.00	10.00	10.00	1,550.00
4	Sulfuric acid 50%	200.00	20.00	10.00	10.00	230.00
5	Sulfuric acid 98%	310.00	31.00	10.00	10.00	351.00

9.3.3 Telecommunication

Central Monitoring System will be set up in Kampot WTP and monitor the intake point and the elevated tank, Kep WTP and M-CMFs. They will be controlled by central control system via communication lines. The cost of communication is difficult to be specified in this stage because it will depend on the types of lines that will be used as well as the type of communication companies. According the records of PPWSA which has set up many flow meters in their city and been performing centralized monitoring via telecommunication lines, the cost of communications for such functions will be approximately 80 US$/year for one spot.

9.3.4 Diesel fuel（for M-CMF）

M-CMF is installed in a 4 ton truck and diesel fuel is used for trucks. In Cambodia, petrol and diesel fuel are sold in not only in chained petrol stations, but also in small shops like a general store or street stalls beside roads. The results of the study shows that relatively large-sized petrol stations are available and two are in Kampot, one is in Kep and they make feeding trucks possible. The price of diesel fuel differs in shops and is changing day by day. In the survey of Feb 2012, the price of diesel fuel was about 5,000 KHR (approx. 1.25 US$). Also the price of petrol was 6,500 KHR for high-octane petrol, and 6,000 KHR for regular petrol. However, diesel fuel costs high so common electricity shall be considered to be used as well.

9.3.5 Manpower expenses

According to the result of the hearing survey in Kampot and Kep, monthly wage for factory workers is about 50 US$, and 100 US$ in general. Meanwhile, there is a case of the wages becoming more than 1000 US$ for graduates in cities like Phnom Penh. Generally, there is a big wage gap depending on educational qualifications, place of work, and companies to work for.

9.3.6 Purchasing of materials and equipment for maintenance

There is a need for grease and consumables, materials like industrial tools for O&M and it is preferable to be able to purchase them near the work area. Besides there is a special store for electric tools in Kampot, lower-capacity breakers and electrical wires, etc. are available in the shops selling lightings. And although small stores dealing materials like grease and pipes were found in and around a market, the variety of materials and equipments dealt with are limited. Therefore it will be necessary to purchase gland packing or bearings from trading companies in Phnom Penh.

9.3.7 Water quality test

The possible item of water quality test in Cambodia and the example expense for those tests are below.

Table 9-10 Water quality test item and price

	Test		Price(US$)
No	Parameters	Unit	
1	pH	-	1.5
2	Turbidity	NTU	1.5
3	Conductivity	µS/cm	1.5
4	Suspended solids	mg/L	1.5
5	Total dissolve solids	mg/L	1.5
6	Free available chlorine	mg/L	3
7	Total available chlorine	mg/L	3
8	Total coliform	cfu/100mL	5.5
9	E. coli	cfu/100mL	5.5
10	Ca hardness	mg/L	3
11	Total hardness	mg/L	3
12	Magnesium hardness	mg/L	3
13	Alkalinity	mg/L	3
14	Organic substances	mg/L	3
15	Dissolved oxygen	mg/L	3
16	Color	TCU	3
17	UV, absorbance	-	3
18	Aluminum	mg/L	3
19	Ammonia nitrogen	mg/L	3
20	Ammonia	mg/L	3
21	Carbone dioxide	mg/L	3
22	Copper	mg/L	3
23	Chloride	mg/L	3
24	Cyanide	mg/L	3
25	Fluoride	mg/L	3
26	Iron	mg/L	3
27	Manganese	mg/L	3
28	Nitrate nitrogen	mg/L	3
29	Nitrate	mg/L	3
30	Nitrite nitrogen	mg/L	3
31	Nitrite	mg/L	3
32	Zinc	mg/L	3
33	Phosphate	mg/L	3
34	Sulfide	mg/L	3
35	Sulfate	mg/L	3
36	Arsenic	mg/L	3

9.4 Considerations for the future

9.4.1 Training and monitoring of quality of works

It is preferable to provide an OJT training focusing on practical operations by Japanese engineers at the time of start up. After finishing the start up training, providing regular training by Cambodian staff trained in JICA Project “The Project on Capacity Building for Water Supply System in Cambodia Phase-2” will be considered.

For the directors and technical leaders, they will have opportunities for training in Japan. This is effective not only for gaining knowledge about Japanese waterworks, but deepening their understanding for Japanese waterworks and increasing their sense of belongings, as well as increasing the quality of works.

Also, since having Japanese engineers travel to and from Cambodia will create a large amount of expense, it is necessary to consider introducing an IT system which makes assisting and training Cambodian workers from Japan possible. This system should allow the Japanese engineers to figure out the operating conditions of the equipment, water qualities, etc. For example, by utilizing the technology of web cameras, it will allow the Japanese engineers to have communications in real time with pictures and voices, and it will lead to a relatively reasonable detailed assistance and training.

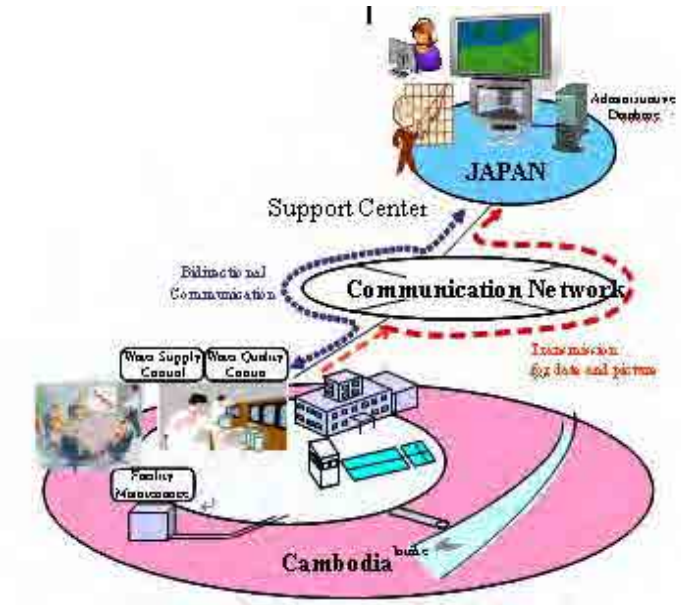


Figure 9-3 Image of remote monitoring and supporting system utilizing IT

Chapter 10 Cost estimate and implementation schedule

10.1 Cost estimate

Project cost is estimated below. It comprises construction cost such as for water treatment facilities and equipments, and O&M cost including SPC operating cost. As with the arrangement of land, it is expected to be provided from the Government for this stage.

Table 10-1 Initial and running costs

Items of Cost	Amount
Construction cost （Water treatment plants, distribution systems and M-CMFs）	10,453,000US$
O&M cost and SPC operation cost (30years)	24,414,000US$(30years)

10.2 Implementation schedule

Since this survey is at the stage of data collection for the PPP project, the following two options are assumed for the tentative implementation plan of the proposed PPP projects. Option 1 is based on the condition that the feasibility study will be conducted on an unsolicited base where a private investor carries out the feasibility study at its own costs and risks. An unsolicited method will be employed for conducting the feasibility study in advance to the selection of SPC in order to shorten the total preparatory period of the proposed PPP projects. The party who submitted the results of the feasibility study will receive some advantages over the selection of the SPC.

For Option 1, the duration including the preparatory period as well as the construction period would be totally four years, since the unsolicited method will be employed for conducting the feasibility study. The construction is subject to be completed by the end of 2015, and the operation will be started at the beginning of 2016. In parallel with the construction of the water treatment plants for the Kampot and Kep projects, it is assumed that the distribution network for the Kampot project will be completed by the middle of 2015.

For Option 2, the duration including the preparatory period as well as the construction period would be totally three years which is the quickest schedule, since the results of the pre-feasibility study in this survey will be utilized for bidding at the selection of SPC. The construction is subject to be completed by the end of 2014, and the operation will be started at the beginning of 2015.

In addition, the construction schedule of the new distribution network in Kampot was not set to assume a specific donor. Accordingly it is necessary to keep in mind to reset the plan meeting the scheme of the specific donor after the donor will be determined.

The financial analysis in Chapter 11 is based on the implementation schedule of Option 2.

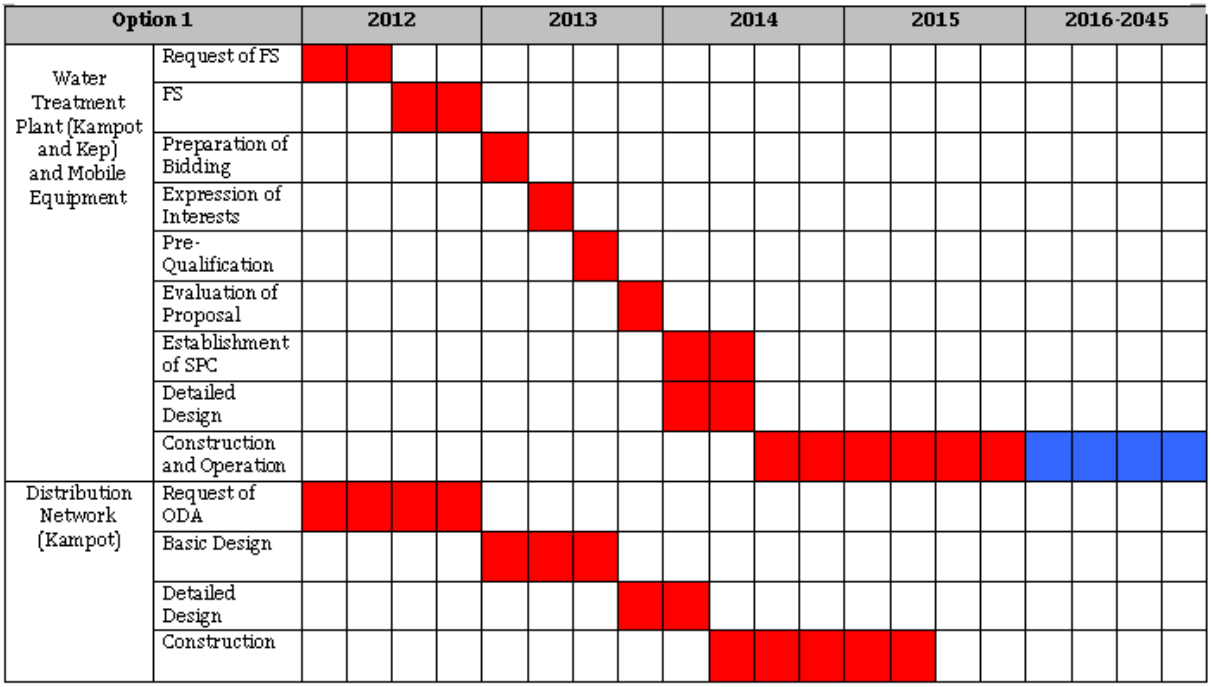


Figure 10-1 Proposed implementation schedule (Option 1)
(Feasibility study is conducted on an unsolicited base)

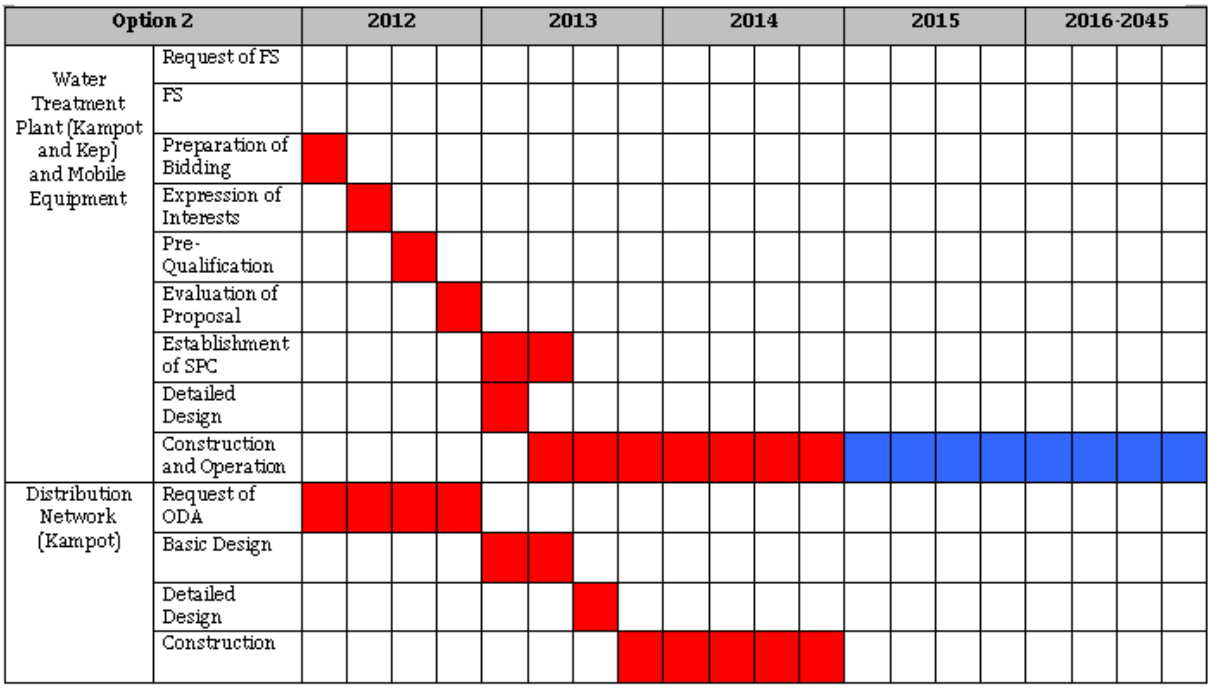


Figure 10-2 Proposed implementation schedule (Option 2)
(The project will be implemented based on this Survey without a feasibility study, and be conducted on an unsolicited base)

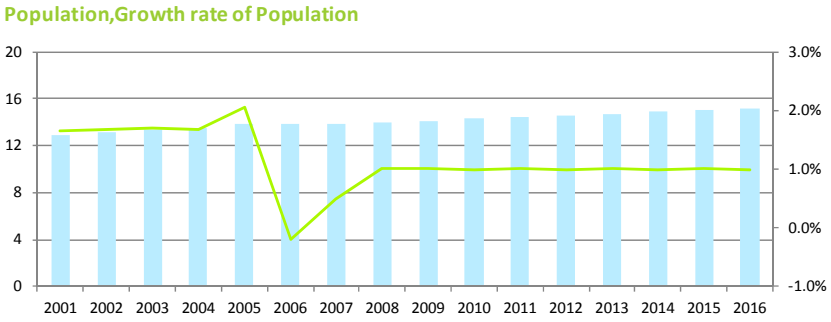
Chapter 11 Financial analysis

11.1 Business environment

11.1.1 Economic environment

Population

The population in Cambodia has increased at a steady rate of approximately 1-2% from 2001 through 2008 except for 2006 when the population growth has temporarily slowed. From 2009 through 2016, the annual growth rate is projected to be 1.0%, which will bring the population up to 15 million by 2015. (See Figure 11-1)



Population,Growth rate of Population — Million Persons

Actual	2001	2002	2003	2004	2005	2006	2007	2008
Population	12.89	13.10	13.33	13.55	13.83	13.80	13.87	14.01
Growth rate of population	1.6%	1.7%	1.7%	1.7%	2.1%	-0.2%	0.5%	1.0%

Estimate	2009	2010	2011	2012	2013	2014	2015	2016
Population	14.15	14.29	14.43	14.58	14.72	14.87	15.02	15.17
Growth rate of population	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Source:IMF

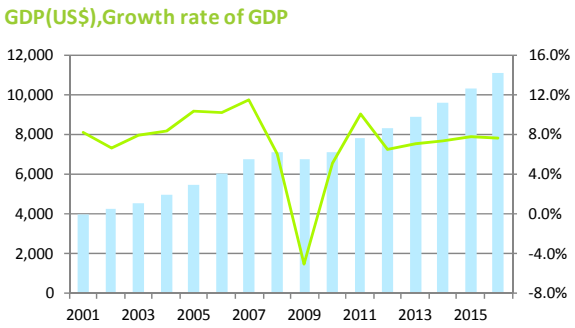
Figure 11-1 Population

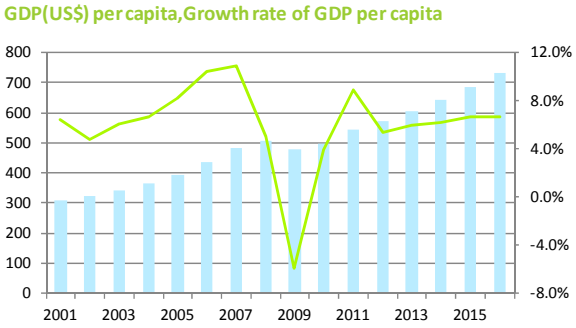
GDP/ GDP per capita

After continuous annual economic growth at around 10 percent, Cambodia saw a negative GDP growth in 2009 during the worst of the recent global financial crisis. Cambodia, however, is recovering well with estimated economic growth returning to around 5.1% in 2010 and this is expected to accelerate going forward, according to the projections by the International Monetary Fund (IMF).

The three main driving powers of growth are exports of garments, tourism, and agriculture. Cambodia's garment exports have been increasing as demand rebound in the key markets of North America and Europe. Exporters also diversified their markets, particularly to Russia and Japan. Tourism surged in 2010 as total arrivals climbed, leading to total receipts of nearly US$ 1.8 billion, the highest in the country's history. Agriculture maintained steady growth in 2010 regardless of the global crisis as investment led to a rise in rice exports in particular and the country's first export of sugar during the post-Pol Pot regime.

The trends in GDP per capita are similar to those in GDP from 2001 through 2016 with a relatively steady population over the same period.





GDP,Growth rate of GDP

Million US$

Actual	2001	2002	2003	2004	2005	2006	2007	2008	2009
GDP(constant prices)	3,972	4,233	4,567	4,951	5,465	6,022	6,714	7,124	6,768
Growth rate of GDP	8.1%	6.6%	7.9%	8.4%	10.4%	10.2%	11.5%	6.1%	-5.0%

Estimate	2010	2011	2012	2013	2014	2015	2016
GDP(constant prices)	7,110	7,823	8,328	8,911	9,561	10,303	11,094
Growth rate of GDP	5.1%	10.0%	6.5%	7.0%	7.3%	7.8%	7.7%

Source:IMF

GDP per capita,Growth rate of GDP per capita

US$

Actual	2001	2002	2003	2004	2005	2006	2007	2008
GDP(constant prices) per cap	308	323	343	365	395	436	484	509
Growth rate of GDP per capita	6.4%	4.8%	6.1%	6.6%	8.2%	10.4%	10.9%	5.1%

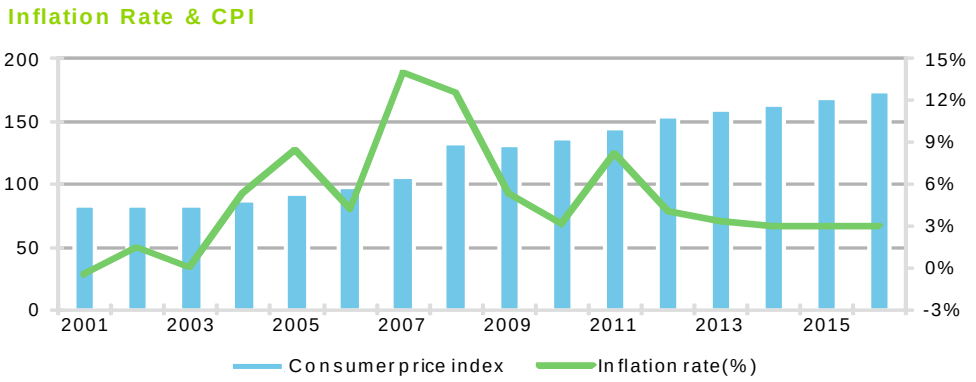
Estimate	2009	2010	2011	2012	2013	2014	2015	2016
GDP(constant prices) per cap	478	498	542	571	605	643	686	731
Growth rate of GDP per capita	-5.9%	4.0%	8.9%	5.4%	5.9%	6.2%	6.7%	6.6%

Source:IMF

Figure 11-2 GDP/ GDP per capita

Inflation rate

Although upward pressure on prices increased by the end of 2010, inflation in Cambodia remained well below the rates experienced in 2007-2008 prior to the economic crisis. Following a year of deflation in 2009, consumer price index inflation returned in 2010 as prices of key commodities including rice and fuel climbed at an average of 4%. The inflation rate continued to accelerate at the beginning of 2011, with prices for fuel in particular surging on the back of high oil prices in the international markets, leading the IMF to forecast an inflation of 8.2% for the year. In the long run, IMF is forecasting that the inflation rate will be stabilized at around 3.0%, which appears reasonable based on the historical rates excluding the impact from the economic crisis. (See Figure 11-3)



Inflation rate

Actual	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Inflation rate	-0.4%	1.4%	0.0%	5.3%	8.4%	4.2%	14.0%	12.5%	5.3%	3.1%
Consumer price index	82.7	82.8	83.6	86.9	92.4	98.1	105.6	132.0	131.1	136.4

Estimate	2011	2012	2013	2014	2015	2016
Inflation rate	8.2%	4.1%	3.4%	3.0%	3.0%	3.0%
Consumer price index	145.1	153.2	158.7	163.7	168.6	173.6

Source:IMF

Figure 11-3 Inflation rate

Currency and foreign exchange

Cambodia is primarily a cash-based economy with checks and credit cards infrequently accepted commercially. The national currency of Cambodia is the riel, which has remained fairly stable since 2001 at around 4,000 to the US dollar. In spite of a 1992 sub-decree prohibiting transactions denominated in foreign currencies, the US dollar is still freely traded throughout the country occupying over 90% of transactions.

The strong inward flow of dollars related to garment exports, tourism receipts, FDI and official development assistance (ODA), will benefit the dollar based urban economy. The National Bank of Cambodia (NBC) intervenes from time to time to keep the exchange rate within a target range. Since the NBC maintains a fairly stable exchange rate, and the economy is highly dollarized, a sharp depreciation of Cambodian riel is not generally expected against US$.

The trend in Cambodian riel to Japanese yen is relatively similar to the one in US dollar to Japanese yen. Since 2001, Cambodian riel has been moderately depreciating compared to Japanese yen.

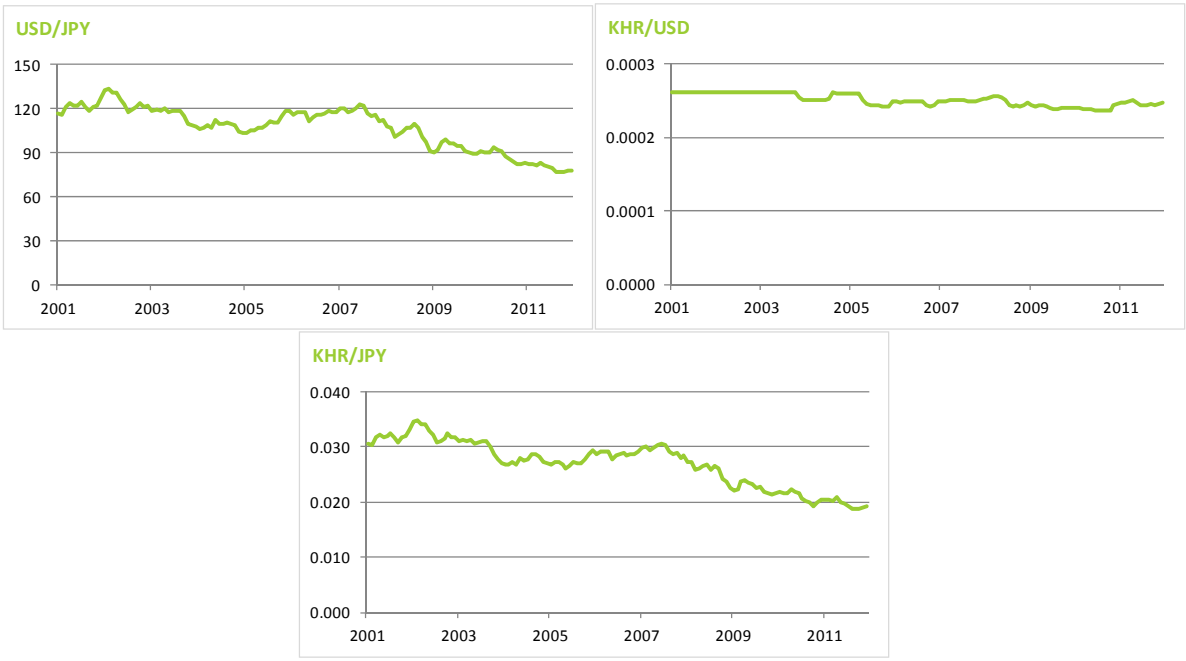
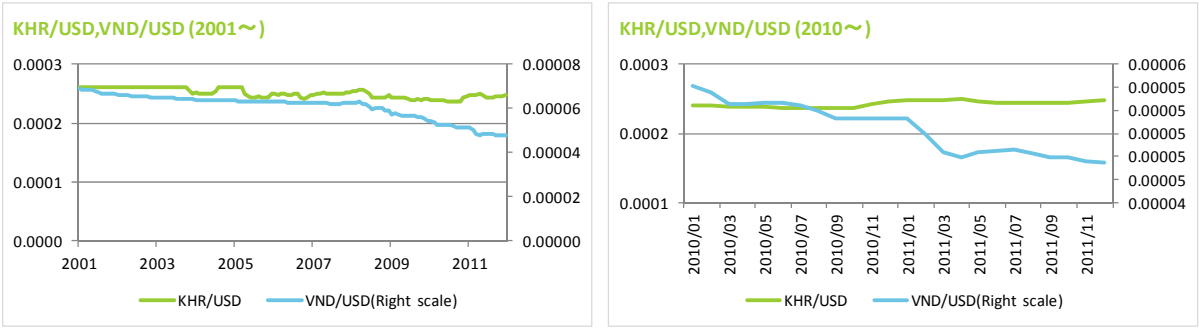


Figure 11-4 Currency and foreign exchange

To further analyze the trend in Cambodian riel, we have presented below the comparison between Cambodian riel and Vietnamese dong. The national currency of Vietnam is used in this analysis as Vietnam is located in the same South-East Asia region and historically has comparable GDPs per capita.



GDP billion US$

	2011	2012	2013	2014	2015	2016
Usa	15,227	15,880	16,522	17,224	17,993	18,808
Japan	5,822	5,921	6,058	6,218	6,380	6,540
Cambodia	13	14	16	17	19	21
Vietnam	119	129	143	159	176	194

Source: IMF, World Bank

GDP per cap thousand US$

	2011	2012	2013	2014	2015	2016
Usa	48.7	50.3	51.8	53.5	55.4	57.3
Japan	45.7	46.5	47.7	49.0	50.4	51.9
Cambodia	0.9	1.0	1.1	1.2	1.3	1.4
Vietnam	1.3	1.4	1.6	1.7	1.9	2.0

Source: IMF, World Bank

Figure 11-5 Currency and foreign exchange

As discussed above, Cambodian riel has been fairly stable to US dollar since 2001 mainly due to the highly dollarized Cambodian economy along with the intervention from NBC using affluent foreign reserves. In recent years, Cambodian riel became slightly stronger especially after October 2010 due mainly to the announcement of a large-scale quantitative easing (QE2) by the US Federal Reserve Bank. However, this appreciation of Cambodian riel should be temporary and expected to be stabilized in the near future.

On the other hand, Vietnamese dong has been steadily depreciating since 2008. This trend appears to be attributable to the continued current-account deficit in Vietnam while it is moving away from the dollarized economy.

Lending rate

Over 2007 to 2010, interest rate on loans in Cambodian riel was around 20% and in US dollar was around 16%. However, interest rate in both Cambodian riel and US dollar sharply dropped to the same level of approx. 15% in June 2011 and still remained in August 2011. It means that interest difference between Cambodian riel and US dollar has narrowed.

It should be also noted that the Cambodian financial market is not mature enough to have interest rates that correspond to the term of the debt.

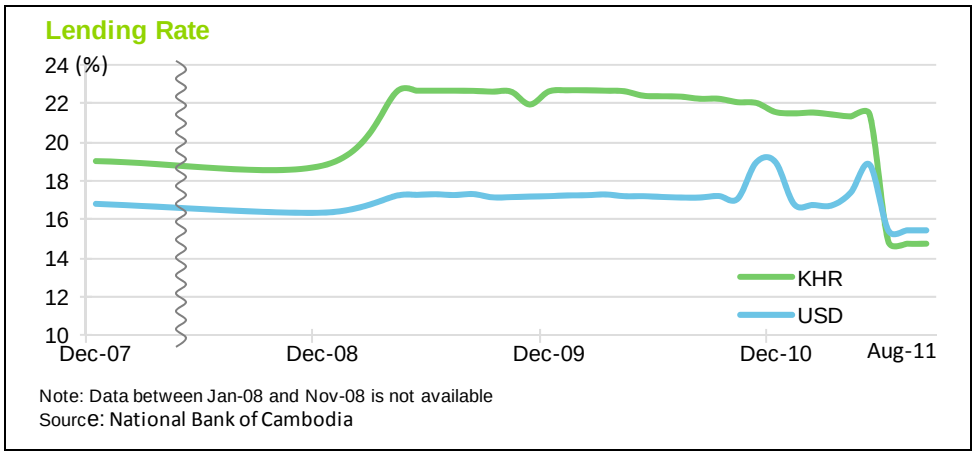
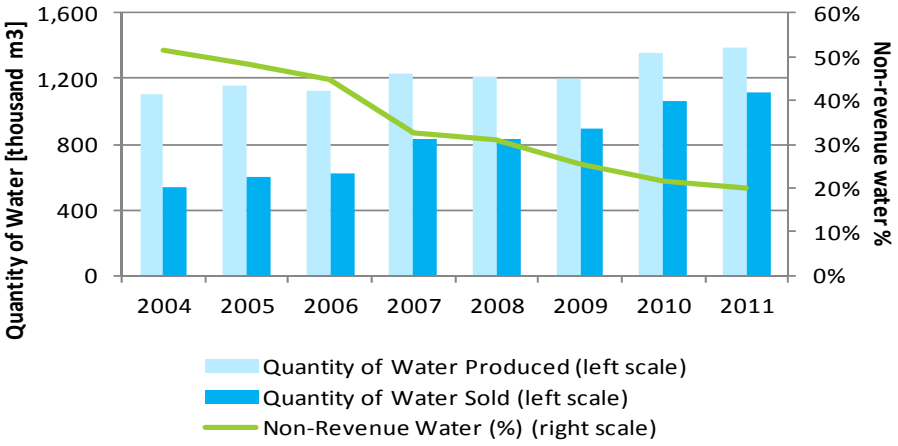


Figure 11-6 History of lending interest rate movement

Water supply and revenue in Kampot

The volume of water produced in Kampot has been consistently increasing from 1.1 million m^3 in 2004 to 1.4 million m^3 in 2011, while the volume of accounted-for water (i.e. water sold) has significantly increased by 108% from 536 thousand m^3 to 1,114 thousand m^3 over the same period. This has resulted in a gradually lowered non-revenue water percentage of nearly 20% in 2011. According to the information provided by Kampot Water Supply (KWS), the unit price (or tariff) per m^3 was raised from KHR 1,200 to KHR 1,400 in September 2007.

The following figure and table summarize the data related to clean water supply in Kampot since 2004.



Balance Sheet of Kampot Water Supply thousand m³

year	2004	2005	2006	2007	2008	2009	2010	2011
Quantity of Water Produced	1,107	1,157	1,129	1,230	1,211	1,197	1,355	1,390
Quantity of Water Sold	536	596	624	831	836	894	1,066	1,114
Non-Revenue Water	571	561	504	399	375	303	289	276
Non-Revenue Water (%)	51.6%	48.5%	44.7%	32.5%	30.9%	25.3%	21.4%	19.9%

Source: Kampot Water Supply

Figure 11-7 Kampot Water Supply

11.1.2 Socioeconomic benefit analysis

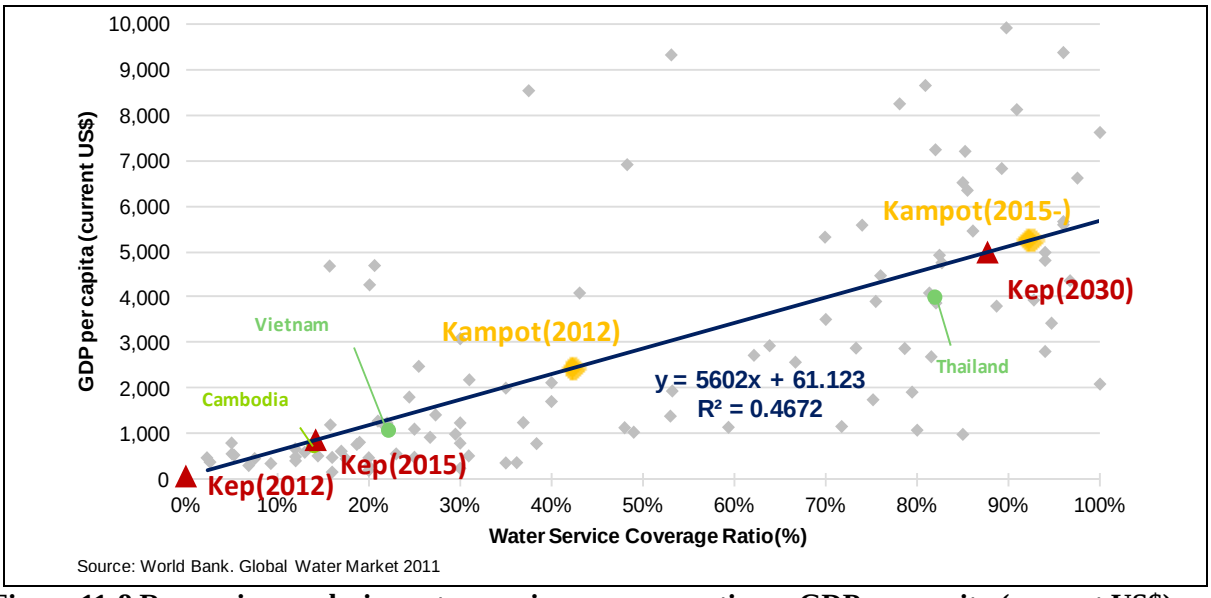


Figure 11-8 Regression analysis: water service coverage ratio vs. GDP per capita (current US$) in 2008

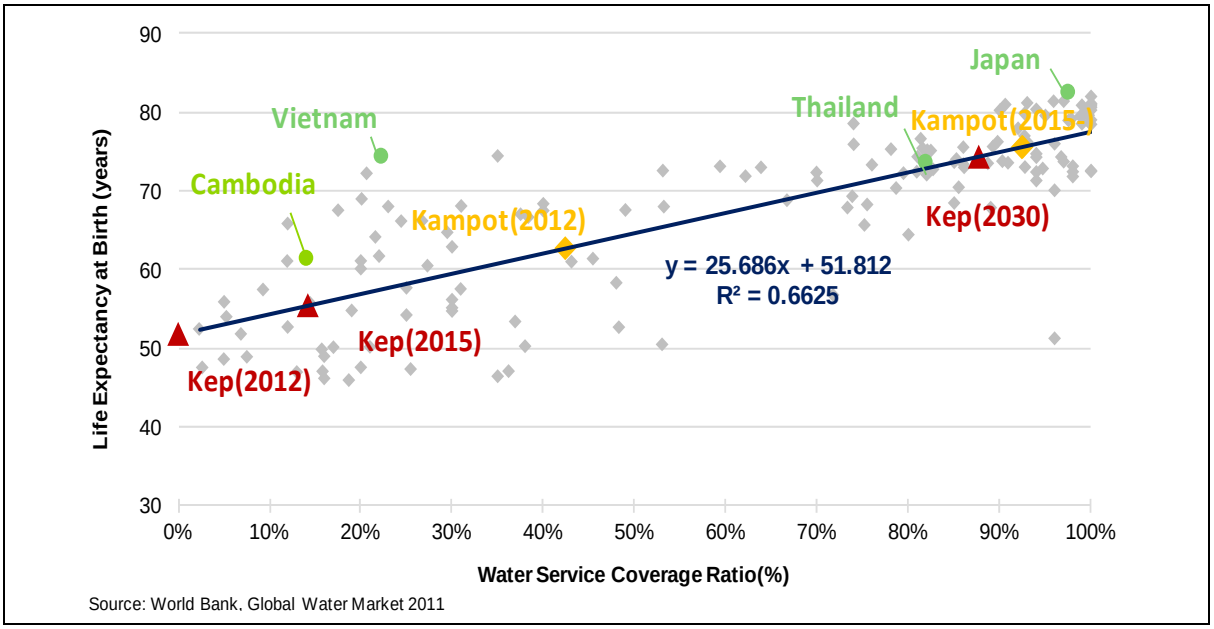


Figure 11-9 Regression analysis: water service coverage ratio vs. life expectancy at birth (years) in 2008

The two figures above show regression analysis for "Water Service Coverage Ratio" to each "GDP per capita (current US$)" and "Life Expectancy at Birth (years)". The analysis indicates that improving water service coverage has a meaningful correlation with increasing GDP per capita and lengthening life expectancy.

The following table summarizes the high-level estimates of expected impact of the increased water service coverage provided by the SPC on the life expectancy and GDP per capita in the project areas – Kampot and Kep.

In Kampot, the average life expectancy at birth and GDP per capita are anticipated to increase by 13 years and US$ 2,807 after the SPC starts supplying the planned volume of clean water. On the other hand, the average life expectancy at birth and GDP per capita in Kep are anticipated to increase by three years and US$ 796, respectively.

However, it should be noted that the impact on the GDP per capita for the entire Cambodia nation will be much lower and calculated as +US$ 123 (= US$ 2,807 x 4.4%) for Kampot and +US$ 2.4 (= US$ 796 x 0.3%) for Kep, given that the population in Kampot and Kep accounts for only 4.4% and 0.3% of total population in Cambodia, respectively. Also, the effect of additional clean water supply in Kampot and Kep on overall life expectancy at birth in Cambodia is minimal and calculated as +0.6 year and +0.01 year, respectively.

Table 11-1 Anticipated socio-economic benefits

Area	Ratio	Current	With planned water supply from the project	Effect
Kampot	Water service coverage ratio	42%	93%	+51%
	Life expectancy at birth (Year)	63	76	+13
	GDP per capita (US$)	2,436	5,243	+2,807
Kep	Water service coverage ratio (Year)	0%	14%	+14%
	Life expectancy at birth	52	55	+3
	GDP per capita (US$)	61	857	+796

Consideration of possible future expansion

We note that the mobile filtration equipment can be used not only in Kep, but also in other large rural areas in Cambodia. Excluding Kampot and Kep covered by this project, we assume, herein, that the mobile technology can be applied in other areas than five main provinces (Phnom Penh, Kandal, Kampong Cham, Battambang, and Siem Reap). We further make the assumption that 50% of the population in this target area (i.e. 50% of population of 'Others' in the Table below, or 3,287 K people (= 50% x 6,575 K people)) is served by the expanded mobile filtration system. This represents approximately 24.5% of total population in Cambodia. Under these assumptions, the anticipated impact is calculated to be 81 times as much as that in Kep (81 = target population of 3,287K/ Kep population of 36K). Accordingly, the impact on overall Cambodian GDP per capita is estimated to be +US$ 195 (= US$ 2.4 x 81) assuming the same increase in GDP per capita as in Kep in the entire Others area.

Table 11-2 Summary of population in Cambodia

Province	Population (in '000)		%	
Phnom Penh	1,326		9.9	
Kandal	1,265		9.5	
Kampong Cham	1,681		12.5	
Battambang	1,025		7.6	
Siem Reap	896		6.7	
5 Area subtotal		6,193	46.2	
Kampot	585		4.4	
Kep	36		0.3	
Others	6,575		49.1	→50% = 3,287 (24.5%)
Other Area subtotal		7,196	53.8	
Cambodia		**13,389**	**100.0**	

Source: Statistical Year of Cambodia 2008 ,4.4 population density by region,1998-2008

11.1.3 Financial market

Taxation

In addition to the taxes discussed in Section '4.4.8 Law on the Amendment of the Law on Taxation,' a business in Cambodia may also incur the following taxes:

Table 11-3 Other taxes imposed on businesses in Cambodia

Tax	Rate	Application to this project
Import and Export Duties	Import Duties: Imposed on all goods crossing the border at a rate variable from 7-35%, except for those specifically exempted from import duties by law or relevant authorities. Export Duties: No export duties applied other than those levied on restricted export products.	Import Duties: Major imported item will be filtration membranes; however, the SPC is expected to be qualified as a QIP which will receive customs duty exemptions as discussed in the 'Investment Incentives' section below).
Specific Tax on Certain Goods and Services	3-45% depending on the goods and services in question (listed in Customs Tariff Schedule).	Per the Customs Tariff Schedule, diesel fuel is the only item that is subject to specific tax (4.35%) and is used in this project. The specific tax, however, is

		assumed to be incorporated in the purchase price in our financial analysis.
Property Tax	0.1% on all immovable property exceeding KHR 1billion. Roads, bridges, infrastructure for producing clean water or producing electricity, airports, ports, railway stations including buildings and offices serving directly for the activities of those infrastructures are exempt from the Property Tax.	No property tax is expected to be imposed as the project should be categorized as an infrastructure project for producing clean water.
Unused Land Tax	2% paid by registered owner of the land if a plot is determined to be 'unused' by the Committee for Evaluation of Undeveloped Land.	N/A as the land is expected to be owned by the government. Even if owned by the SPC, no unused land tax is expected to be imposed as the land will be fully utilized.
Registration Tax	4% of transfer value upon transfer (sale, exchange, gift, or share capital contribution) of ownership of immovable property and certain vehicles.	Applicable registration tax is assumed to be built in the purchase price in our financial analysis.

Cambodia does not have double taxation agreements (DTAs) with any country, but treaty negotiations are soon to start based on a model DTA prepared by the General Department of Taxation (GDT) in cooperation with a foreign expert.

Investment Incentives

Investment incentives are available for Qualified Investment Projects (QIPs). As discussed in Section '4.4.3 Sub-Decree on the Implementation of the Law on the Amendment to the Law on Investment of the Kingdom of Cambodia' water supply project with a capital amount exceeding US$ 500 thousand is considered a QIP. QIPs are entitled to the following investment incentives, and may elect to have either a profit tax exemption or use special depreciation allowances. In addition, QIPs also enjoy customs duty exemptions on the import of production equipment, construction materials, and projection inputs.

Profit tax exemption – QIPs electing to utilize a tax "holiday" will enjoy a profit tax exemption during the "trigger period," the "three-year period" following the trigger period, and the "priority period". The "trigger period" is the period commencing on the date of registration of the QIP and ending on the last day of the tax year immediately preceding the earlier of: i) the tax year that the profit is first derived; or ii) the third tax year after the tax year in which the revenue is first derived. The three-year period commences from the tax year immediately following the above trigger period. The "priority period" (as defined by the Financial Management Law 2006) commences from the tax year immediately succeeding the third year of the three-year period. In case of a clean water supply business with an investment capital amount of less than US$ 10 million, the priority period is determined to be one year per the Financial Management Law. If the investment capital amount is between US$ 10 million and US$ 30 million, the priority period of two years is given. In addition, it is deemed that QIPs are no longer required to pay minimum tax, nor are they subject to the prepayment of minimum tax on a permanent basis.

Special depreciation – For QIPs not electing to utilize the profit tax exemption, they are entitled to a special depreciation allowance of forty percent of the value of the new or used tangible properties used in production or processing. The special depreciation allowance can be deducted in the first year of the purchase of the tangible property or the first year of use of the property in question.

Custom duty exemption – Export-oriented and supporting industry QIPs enjoy customs duty exemptions for imports of production equipment, construction materials, and production inputs. Domestically oriented QIPs generally receive customs duty exemptions for the import of production equipment and construction materials only. Export duty exemptions, meanwhile, are provided to all QIPs except for some exports that are specifically stated in Cambodian law as subject to export duties.

Value Added Tax (VAT) refunds – QIPs may receive VAT refunds for VAT paid in relation to their investment projects during the setting up of their business in Cambodia. To be entitled to this VAT refund, QIPs must undertake VAT registration which is specially designated for QIPs and which is valid for two years with the Tax Department.

In addition to the above incentives, both foreign and Cambodian QIPs enjoy the following investment guarantees:

- Equal treatment of all investors regardless of their nationality (except for land ownership and some investment activities);
- No nationalization adversely affecting investors' properties;
- No price control on investors' products or services; and
- Remittance of foreign currencies abroad.

Regulations on foreign investment

Use of land – Land may be privately owned by individuals with Cambodian citizenship, or legal entities having Cambodian nationality, without limitation by time or interest. A legal entity is considered to have Cambodian nationality if 51% or more of the voting shares of the entity are held by Cambodian citizens or a Cambodian entity. However, land concessions, indefinite-term leases, and renewable definite-term leases are permitted to all investors. For foreign investors, therefore, use of land is usually achieved through a long-term lease (15 years or more), a concession from the public sector, or a minority interest (up to 49%) in a Cambodian-owned company that owns the land, coupled with secured lending against the land.

In case of this project, the SPC is considered to have Cambodian nationality as 51% of interest in the SPC is expected to be owned by Cambodian entities; therefore, no significant issue is anticipated in relation to the ownership of land.

(NOTE: As to foreign ownership of co-owned buildings, a major step forward was achieved with the promulgation of the Law on the Provision of Ownership Rights over Private Units of Co-Owned Buildings to Foreigners, on May 24, 2010, which allows foreigners to own up to 70% of private units in co-owned buildings or condominiums, excluding ground and underground floors.)

Restriction on foreign shareholdings – Unlike many countries in the Asian region, Cambodia places restrictions on the level of foreign participation in only a few business sectors. As a result, a greater proportion of investors choose to establish 100% foreign-owned companies in Cambodia than in many other developing nations.

Transfer of funds – There are currently no restrictions on the repatriation of profits or capital derived from investments made in Cambodia, nor on most transfers of funds abroad. The 2003 Investment Law guarantees that investors may freely remit foreign currencies abroad for the purposes of:

- Payment for imports and repayment of principal and interest on international loans;
- Payment of royalties and management fees;
- Remittance of profits; and
- Repatriation of invested capital on dissolution of an investment project.

Under the Foreign Exchange Law of 1997, foreign currencies may be freely purchased through the banking system. The law specifically states that there shall be no restrictions on foreign exchange operations, including the purchase and sale of foreign exchange, transfers, and all types of international settlements as long as these transactions are performed solely by authorized intermediaries (i.e. lawfully established banks).

It is important to note that while foreign exchange transfers are not currently restricted, the law does allow the NBC to implement currency exchange controls in a foreign exchange crisis. The events that would constitute such a "crisis" are not specified.

Banking and financing

The banking and financial sector saw a major overhaul of its regulatory framework under the Law on Banking and Financial Institutions (the "Banking Law"), passed on November 18, 1999, the Insurance Law, passed on July 25, 2000, and various regulations issued by the National Bank and the Ministry of Economy and Finance since 2000-2001.

NBC is the central bank and is charged with the responsibility of supervising and regulating financial institutions in Cambodia. It has the power to manage money transactions, credit, domestic and international settlements and foreign exchange, and precious metals and stones.

The Banking Law divides banks into commercial banks, specialized banks, specialized financial institutions, and micro-finance institutions. Only licensed banks may engage in the activities set out in the Banking Law. While many new banks have been licensed in recent years, the system is dominated by five large banks (two of which are foreign owned), which account for nearly 80% of credit. Rural areas are primarily served by micro-finance institutions, representing less than 10% of financial system assets.

Banks may carry out all types of banking operations; in practice, however, the activities conducted by commercial banks in Cambodia are limited. Savings and current accounts are available, and terms deposits are generally offered, in US dollars or Cambodian riels (Over 95% of banking system deposits are denominated in US dollars.). Most banks will perform overseas wire transfers, foreign exchange services, and will issue letters of credit secured by cash deposits.

Domestic financing in Cambodia has historically been difficult to obtain on commercially acceptable terms. When loans are extended, the term is short and interest rates tend to be high (approximately 8-18% per annum) because of the difficulties that lenders face in securing their loans in the local market. However, improvements have been made since 2007, upon which time the Law on Secured Transactions was adopted, which enhanced the rights of creditors to take security over locally-based collateral.

11.2 Assumptions for financial analysis

11.2.1 General

As discussed in section '4.2.1 Law on concession' concession/BOT period should not exceed 30 years under the current Cambodian regulation. With this restriction, we set the concession period to be 30 years. Construction periods for the water supply facilities in Kampot, Kep (stationary), and Kep (mobile) are expected to be three years, 0.5 years, and 0.25 years, respectively.
The operations related to clean water supply business are largely divided into two major tasks – production of clean water by operating a waterworks facility and distribution of clean water to the end users through pipes or some other means. The following table summarizes the separation of roles and

responsibilities expected by the sponsors in this project.

Table 11-4 PPP business model

Area		Kampot	Kep		
End-Users		Residents	Hotels		Residents
Filtration Equipment		Stationary	Stationary	Mobile	
Distribution System		Pipes		Pipes/Trucks	Trucks
Production	Assets	SPC	SPC	SPC	
	Operation	SPC	SPC	SPC	
Distribution	Assets	KWS	SPC		N/A
	Operation	KWS	SPC		SPC

In this business model, we assumed that the SPC would produce clean water and KWS would take the responsibility of distributing clean water to the users in Kampot.

11.2.2 Assumptions related to business plan

Revenue

Kampot

Price/Tariff – We have developed the sales price forecast by considering the current market price to the end users in the neighborhood area (i.e. current tariff for existing piped water supply collected by KWS - approximately KHR 1,400/m^3 in 2011) with the assumption of increase in price based on the anticipated 5% inflation rate as opposed to IMF's forecast at 3% on a constant basis (5% approximates the average inflation rate for the past seven years, excluding 2007 and 2008 when the inflation rates were abnormally high presumably due to the world economic turmoil (i.e. inflation rates in 2004-2006, 2009, and 2010 (total five years) were used in this calculation). Refer to section '11.1.1 Economic Environment - Inflation Rate' for the historical inflation rates in Cambodia).

The following represents the comparative income statements of KWS for the past five years, along with the data related to non-revenue water percentage. KWS earns revenue by producing clean water and distributing the produced water to the end-users. As the non-revenue water percentage decreased from ~30% to ~20% over the past five years, the profitability of KWS improved significantly. However, KWS still cannot generate a net income with the current tariff level billed to the end users.

Table 11-5 Income statements of KWS for 2007- 2011

(in KHR million)	2007	2008	2009	2010	2011
Revenue					
Water sales revenue	1,053	1,141	1,251	1,482	1,560
Service revenue	8	9	4	12	17
Asset pipe network	56	73	20	83	69
Others	2	8	5	2	0
Total revenue	**1,119**	**1,230**	**1,280**	**1,578**	**1,646**
Non-revenue water %	*32.5%*	*30.9%*	*25.3%*	*21.4%*	*19.9%*
Costs/ expenses	1,493	1,669	1,644	1,889	1,858
Operating loss	**374**	**438**	**364**	**312**	**212**
Minimum tax	11	11	13	15	16
Net loss	**384**	**450**	**377**	**327**	**228**

Source: Department of Industry, Mines and Energy - Kamport Water Supply

While it is theoretical to deduct a certain margin percentage from the current tariff in determining a tariff level used in our analysis, given that the SPC will sell the bulk water to local government without incurring piping and distribution costs, we assume the same price level as the current tariff as the local government (or KWS) does not appear to be fully recovering the costs at the current tariff level.

In this model, this base sales price is raised every five years up to the price level calculated with the annual growth rate of 5% resulting from the anticipated inflation, reduced by 20% assuming that it is not realistic to reflect full impact of inflation on the tariff of public water supply. Specifically, as discussed in the section '12.3 Considerations from the socio-economic section,' it is one of the most important issues to protect the poor in the implementation of a new project. In the section 12.3, we examine the actual guidelines followed by PPWSA to protect the poor in detail and application of such guidelines in Kampot and Kep by segmenting total population into different poor levels and setting up varying connection fees for each poor category. In our financial analysis, however, we do not apply differentiated pricing system based on such segmentation; instead, we assumed, herein, that the inflation catch-up rate of less than 100% is used as a means of protecting the poor. Use of 80% as a catch-up rate is considered sufficient given that the percentage of households categorized in Poor Level 1 & 2 (as defined in the section '6.3.4 Poor households') accounts for approximately 18% in Kampot. As a result, the trend in tariff will draw a step-like pattern as shown in the Figure 11-10 below. Catch-up period of five years is considered reasonable given that changing tariff every year is not practical and the last tariff increase in Kampot occurred in 2007 (4-5 years ago).

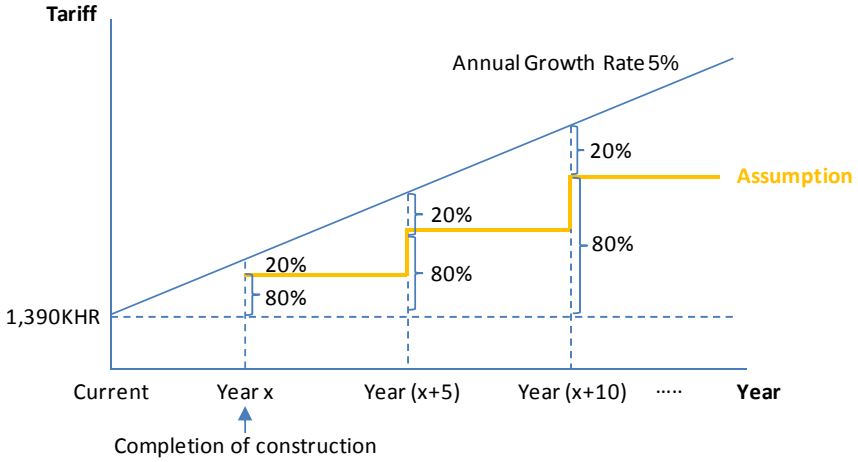


Figure 11-10 Assumption on Kampot tariff

Volume – We use supply volume rather than demand volume in calculating revenue assuming either 1) off-takers will accept take-or-pay supply terms, or 2) the SPC will be given preferred distribution rights over the existing water suppliers in the neighborhood areas. The production capacity of the water treatment facility is designed to be 3,433 m^3/day (see '6.4.5 Outline of PPP project facilities) and revenue water percentage is assumed to be 89.3% for the entire period. Utilization rate will start from around 40% and go up to 100% within four years after the completion of the construction of water treatment facility, assuming that the full capacity supply will not be expected during the period of piping construction. Two main factors affecting the revenue water percentage is possible leakage/waste at the production facility and the risk of tariff going uncollectible. With the current Japanese clean water supply technology, leakage/waste is minimal (This can be also supported by the historical single-digit leakage rate by PPWSA in Phnom Penh). In addition, tariff collection risk is close to nil under the assumption that the local government will be responsible for the operation of clean water distribution, including collection of tariff from the end-users. No increase in volume is assumed during the entire concession period as the SPC does not expect to make additional capital investments to increase the production capacity.

Kep

Price/Tariff – We developed two price settings depending on user – 1) hotels and 2) local residents.

1) **Hotels:** Hotels located in the target area in Kep are currently using groundwater from wells (i.e. no costs incurred by hotels). Therefore, we have no base price which we can make reference to in setting our initial sales price to the hotels. Given the fact that the well water is soon to be unavailable due to emerging salt damage (i.e. the price can be negotiable with no other easily accessible alternatives) and that the hotels are considered to have sufficient ability to pay, we set the initial sales price of the clean water provided to the hotels at US$ 2.0/m^3, which is equivalent to the market price of clean water in this region. We further assumed that the price can be revised annually based on the anticipated inflation rate of 5%.

2) **Local residents:** Local residents living in the target area in Kep are currently paying ~US$ 2.0/m^3 for clean water. With reference to this current sales price, we have decided to use KHR 6,000/m^3 ($1.5-1.75/$m^3$) as initial sales price to the local residents. In this model, this base sales price is raised every three years up to the price level with the annual growth rate of 5% resulting from the anticipated inflation, reduced by 20% assuming that it is not

realistic to pass the 100% impact from the increasing CPI onto the end users, especially considering the poor in the project area.

As a result, the trend in sales price to both hotels and the local residents in Kep will be similar to the one depicted in the Figure 11-10 above, with narrower steps resulting from more frequent price revision.

Volume – Similar to Kampot, we use supply volume rather than demand in calculating revenue with an assumption that the demand (from both hotels and local residents) will exceed supply throughout the concession period.

3) **Hotels:** Hotels will have access to clean water through piped distribution system connected to the stationary filtration equipment located near the water source seven days a week, which has a planned maximum daily treatment of 900 m^3/day (see '7.3.4.2 Water treatment facility) with anticipated revenue water rate of 95.6%. With a higher water demand from increased number of tourists during the weekends, this regular water supply from stationary filtration equipment need to be supplemented by additional water supply from mobile filtration system, which has a maximum production capacity of 215 m^3/day with anticipated revenue water rate of 100%. The revenue water rate for stationary filtration equipment is lower than that for mobile filtration equipment. This is mainly because clean water from stationary waterworks facility is distributed through pipes whereas mobile filtration equipment delivers clean water right outside of the hotels. Utilization rate will start from around 40% and go up to 100% within four years after the completion of the construction of water treatment facility, assuming that full capacity supply will not be expected during the period of piping construction (more specifically, set-up of adequate water distribution environment near the hotels that impacts water supply from both stationary equipment and mobile equipment (i.e. each hotel's connection to the main pipe etc.)).

4) **Local residents:** Local residents are provided clean water that is produced by mobile filtration equipment during weekdays (i.e. five days a week). The maximum capacity is set at 215 m^3/day with anticipated revenue rate being gradually increased from 74.7% in the year subsequent to the completion of construction to 91.7% in the last year of concession period as a result of expected increase in the population in the project area.

No other volume increase is anticipated in this model, as there is no plan to expand the water supply facility or increase in the number of trucks with the mobile filtration system.

Costs/Expenses

The following table summarizes major costs/expenses the SPC is expected to incur during the concession period. We assume, in our financial model, that all of the costs described below, except for one-time registration fee, will increase every year at an anticipated inflation rate of 5%.

Table 11-6 Summary of costs/expenses

Type of costs/expenses	Assumptions
Electricity, chemicals, fuels, communication (e.g. telephone, internet), sludge disposal costs, production supplies	These costs are considered variable with production volume being the main cost driver. However, no change is expected except for the increase from inflation factor as we set the production volume almost constant for the entire concession period for both Kampot and Kep. These costs are expected to be first incurred in the year the SPC starts the operation and denominated in US$.

Repair & maintenance expenses	Repair & maintenance expenses for the water filtration equipment (both Kampot and Kep, including mobile filtration equipment) are expected to gradually increase over the period of 5 years as the equipment expects wear and tear as time goes by. After every 5-year period, however, the repair & maintenance expenses are forecasted to be back to the level of Year 1 with improved condition resulting from the major repair & maintenance performed toward the end of 5-year period. These costs are expected to be incurred mainly in US$.
Payroll-related expenses	Payroll-related expenses include salaries & employee benefit etc. for the employees working on-site (i.e. direct labor). Therefore, these costs are expected to be incurred after the construction period and in KHR. We do not expect change in headcount after the construction period as there will be no significant change in the SPC's level of activity.
Audit fees, administrative costs (outsourcing costs)	These costs are expected to be incurred irrespective of the level of production volume. In our financial model, these costs are set to be incurred from the beginning of the concession period and remains constant throughout the period and incurred in US$.
Registration fee	The SPC is expected to incur one-time registration fee of 42 million KHR payable to the government when it is established in Year 1.

In addition, the SPC is expected to lease the lands required for stationary water filtration facilities in Kampot and Kep. The rent expense, however, is not incorporated in our financial analysis as we assume that the lands will be made available by the government free of charge.

Capital investment

The following capital investment is planned to be made over the construction period (i.e. three years for Kampot and one year for Kep). Depreciation is calculated based on the depreciation methods and rates in Cambodia and starts when the construction is complete.

Table 11-7 Capital investment & depreciation rate

(in thousand US$)

	Kampot	Kep (1)	Kep (2)	Total	Depreciation
Building & structures	3,277	872	178	4,327	5% depreciation rate based on straight-line method.
Computers & software	-	-	-	-	50% depreciation rate based on declining balance method.
Automobiles	-	-	1,196	1,196	25% depreciation rate based on declining balance method.
Office furniture & equipment	-	-	-	-	
All other tangible property	2,008	2,920	-	4,928	20% depreciation rate based on declining balance method.
Total	**5,286**	**3,792**	**1,375**	**10,453**	

The timing of the capital investment is summarized as follows.

Table 11-8 Timing of capital investment

(in thousand US$)

	Year 1		Year 2		Year 3		Total
Kampot	1,057	20% initial installment	2,643	50% 2nd installment	1,586	30% upon completion	5,285
Kep (1)	3,792	100% upon completion	-		-		3,792
Kep (2)	1,375	100% upon completion	-		-		1,375
Total	6,224		2,643		1,586		10,453

Although we assume, herein, that additional capital investment will not be required for the remainder of the concession period (i.e. Year four through Year 30), if such additional investment actually becomes necessary for the SPC to continue its operations, our simulation results could end up being significantly different from the ones shown in the section ’11.3 Simulation results.’ In particular, it should be noted that, although each mobile equipment is given a down time of one day every three weeks, the mobile equipment is assumed to operate at a maximum capacity and last for 30 years, which is much longer than the useful life of eight years calculated based on the tax depreciation rate. Thus, more detailed analysis may need to be performed in terms of the economic useful lives of the production equipment.

In the Table 11-8 above, we assumed installment payments for Kampot project; however, no significant project completion risk and/or project delay risk are anticipated as the SPC would retain the contractor with secured capability of completing the construction on schedule or may require the contractor to indemnify losses resulting from possible delay in construction.

Working capital

We projected the receivable and payable turnover to be 30 days and 40 days, respectively, for both locations and for the entire period. In addition, we forecasted the minimum cash required for the SPC operations to be 5% of revenue for the year. Those working capitals are assumed to be mostly denominated in US$.

Tax on profit/ Minimum tax

Assuming that the entire project is qualified as a single QIP and that SPC elects to have a profit tax exemption rather than a special depreciation allowance, tax rate of 0% is used during the tax exemption period. Tax exemption period is calculated as described in the section ’11.1.3 Financial market – Investment incentives – Profit tax exemption.’ After the tax exemption period, SPC will pay tax on profit calculated as 20% of income before tax. Although QIP may be exempt from paying minimum tax on a permanent basis, we conservatively assume, in our financial analysis, that the SPC would pay minimum tax after the tax exemption period as we have not been able to obtain clarification on QIPs’ permanent minimum tax exemption status with the relevant authorities. Under the Cambodian tax law, net operating loss can be carried forward up to five years. The SPC is assumed to utilize the net operating loss carry forward, if any, by offsetting the taxable income it generates.

VAT

As described in the section ‘4.4.8 Law on the Amendment on the Law on Taxation’, under the VAT system, a business pays tax on the value that it adds in the supply chain. It should be noted, however,

that our financial analysis is conducted net of VAT.

11.2.3 Formulating feasible financial structure

Our base scenario assumed the following financial plan, discussed in the section '11.2.3.1 Simulation results based on the tentative financial structure.'

Table 11-9 Summary of debt and equity based on the tentative financial structure

Type	Currency	Amounts (thousand US$)	Interest rate	Maturity (years)	Grace Period (years)
Debt	US$	7,339	18.0%**	15 years	-
	Debt total	7,339			
Equity	JPY	1,541			
	US$	1,604			
	Equity total	3,145			
	Total	10,485			

** Approximates US$ lending rate for 2010 estimated by NBC/Phnom Penh Securities Plc. (PPS) of 17.12%.

The above funds totaling US$ 10,485 thousand (loans and equity) are injected at the timing as illustrated in Table 11-8 to finance the required capital investment over the construction period (NOTE: The difference between total capital investment of US$ 10,453 thousand and total cash injection of US$ 10,485 thousand will be used as initial operating capital.). Under our assumption, capital investment is funded 70% by US$ loans, and the remaining 30% by equity when the construction is complete (Note, however, that during the construction period (i.e. 1st and 2nd installments for Kampot in Table 11-8) funding is provided 50% by US$ loan and 50% by equity).

Insurance and guarantees are recognized as prerequisite by lenders; however, we assume that premiums for those credit facilities would be included in the contractual interest rate set out above. Additionally, we do not anticipate any upfront fees or origination costs for those financial arrangements, assuming that they are reflected in the contractual interest rates.

It should be also noted that if the cash on-hand balance becomes lower than the minimum cash required for the SPC operations (as defined in the Working Capital section under '11.2.2 Assumptions Related to Business Plan'), we assumed that the shortfall would be automatically funded by a revolving loan from a local bank at an interest rate of 22.0%. Conversely, if the cash balance exceeds the minimum cash balance, the excess is assumed to be deposited and earn interest rate of 8.0%. The interest rate for revolving loan of 22.0% and deposit rate of 8.0% are determined based on the deposit rate of 8.1% and the spread of 13.8% (i.e. lending rate ~ 21.9%) as published in 'Country Report – Cambodia (February 2012)' by Economist Intelligence Unit (EIU).

Exchange rates

The financial model has been prepared in KHR. When there are transactions or balances denominated in foreign currencies (JPY or US$ in this project), conversion was calculated at the end of each period using the exchange rate of 4,040 KHR/US$ and 78 JPY/US$ (conversion between JPY and KHR is calculated based on these two rates), which represent the rate as of December 31, 2011. We assumed constant exchange rates throughout the concession period of 30 years as it is not practical to make reasonable estimates of the future exchange rates. Nevertheless, we believe using the fixed rate for KHR vs. US$ to be reasonable given that the exchange rate of KHR to US$ has historically been stable based on our analysis in the section '11.1.1 Economic Environment – Currency and Foreign Exchange.'

11.2.3.1 Simulation Results based on the tentative financial structure

Profitability and efficiency measures that are typically used in a financial analysis include, but not limited to, EBIT margin, ROA, and ROE, whose definitions are indicated below:

EBIT margin: A profitability measure, which equals to EBIT (earnings before interest and taxes) divided by net revenue.

ROA (Return on Assets): A ratio measuring an entity's profitability and efficiency in using the entity's assets to generate earnings; calculated as net income divided by total assets.

ROE (Return on Equity): A ratio measuring an entity's profitability by revealing how much profit an entity generates with the money shareholders have invested; calculated as net income divided by total shareholders' equity.

We use EIRR and ADSCR as evaluation criteria for sponsors and lenders, respectively. EIRR and ADSCR are defined as follows:

EIRR: An internal rate of return calculated using the amount of equity injected as the initial investment and the series of dividends (and repayments of principal, in case of redeemable preferred stock or subordinate debt) paid as returns

ADSCR: A ratio measuring an entity's ability to produce enough cash to cover its debt payments; calculated as average ratio of cash available for debt servicing against interest and principal payments, where cash available for debt servicing is free cash flow with add-back interest paid.

(Note) In the interviews conducted in Section "8.1.2.1 Interviews with financial institutions" and the guideline for finance that JICA has made publicly available, it was noted that JICA uses Financial IRR or/and Economic IRR in evaluating the projects for financing. However, we have adopted the above indicators in our simulations to generalize lenders and equity investors in our model.

As a result of our simulation based on the financial structure tentatively set in the section 'Table 11-9 Summary of debt and equity based on the tentative financial structure,' EIRR and ADSCR are calculated as follows:

Table 11-10 Summary of simulation results based on the tentative financial structure

	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
EBIT Margin	-34.2%	26.6%	45.4%	55.1%	61.0%	63.9%
ROA	-2.7%	9.0%	29.8%	51.6%	65.3%	83.8%
ROE	-217.8%	3.2%	-43.3%	44.7%	54.2%	70.3%
EIRR (Dividends vs Equity)	n/a	n/a	n/a	-0.6%	6.3%	9.1%
ADSCR *2(5year average)	(2.6)	0.5	0.6	1.3	n/a	n/a

Sponsors assume greater risk as compared to lenders due to subordinated nature of equity and therefore, generally require a higher rate of returns. However, EIRR for this project under the tentative assumptions has been calculated as 9.1%, which is much lower than the interest rate on US$ loans of 18.0%. Consequently, we believe few sponsors would be interested in investing in this project based on this financial structure.

According to the simulation results based on the tentative financial structure, free cash flow is turned positive a few years after the completion of construction (i.e. from Year 6) and cash will steadily build up from Year 6. However, due to a large amounts of depreciation and interest expenses, the SPC is not expected to generate a net profit until Year 10 and as a result, accumulated deficit will not be cleared up until Year 13. In other words, dividends can be paid only after Year 18 as a form of returns to the sponsors.

In order to improve the return for the sponsors, we propose the following financial structure as an alternative scenario:

(1) To reduce significant burden of interest payments from private financial institutions, the SPC will obtain loans from JICA only at an interest rate of 2.5% (we assume that working capital loan in KHR at interest rate of 22.0% will still be available and utilized in case of cash shortfall). As a result, JICA's portion to total cash injection will increase to 70%.
(2) To increase the financial efficiency by moving forward the timing of cash repatriation, equity investors will also acquire preferred shares, which can be redeemable after nine years but before 15 years (i.e. during 5-year period from Year 10 through Year 14).

In the following section '11.2.4 Assumptions Related to Finance,' we summarize the assumptions that have been revised in response to the initial financial simulation results. Unless otherwise noted hereafter, the other assumptions used in our final simulation will be the same as the original base assumptions used in our initial simulation.

11.2.4 Assumptions related to finance

Our original financial structure proposed in the section '11.2.3.1 Assumptions Related to Finance based on the Tentative Financial Structure' resulted in the EIRR that appears to be unacceptable to most of the potential equity investors. In this section, we summarize the assumptions related to financing based on the alternative scenario described in the preceding section '11.2.3.2 Simulation Results based on the Tentative Financial Structure.'

Table 11-11 Summary of debt, mezzanine, and equity under the revised scenario

(in thousand US$)

Type	Currency	Amounts	Interest rate	Maturity (years)	Grace Period (years)
Debt	JPY	7,339	2.5%*	25 years	5 years
Mezzanine	KHR	1,573	0.0%	14 years	9 years
Equity	JPY	771	49% of share (Japanese Entities)		
	US$	802	51% of share (Local Entities)		
Equity Total		1,573			
Total		10,485			

* Mid-point of JICA's benchmark rate of 2-3%. Refer to Table 8-2.

Timing of funding

Table 11-12 below indicates the timing of funding. Funds are injected to correspond with the timing of required capital investments as illustrated in Table 11-8.

Table 11-12 Timing of funding

(in thousand US$)

	Sponsor/Lender	Year 1	Year 2	Year 3	Total
Debt	JICA	4,161	1,329	1,850	7,339
Mezzanine	Japanese entities	775	4	793	1,572
Equity	Japanese entities	646	643	(519)	771
	Local entities	672	669	(539)	802
	Sub total	1,318	1,312	(1,058)	1,573
	Total	6,255	2,643	1,586	10,485
	% to Total	60%	25%	15%	100%

11.3 Simulation results

The following table summarizes the simulation results based on the assumptions described in the section ’11.2.4 Assumptions related to finance’ above.

Under the revised assumptions described in the section ‘11.2.4 Assumptions Related to Finance,’ the SPC is expected to generate EIRR of 13.9%. Although the resulting EIRR is still below the market lending rate of 18-22% in Cambodia, we can assume that the PPP project, which earns EIRR that is slightly lower than the market interest rate, could be feasible due to the following reasons: (1) the cost of debt in Cambodia is very high and therefore, cost of equity is not expected to significantly differ from cost of debt in the premature financial market in Cambodia, and (2) the host country would realize social benefits with the increase in population having access to safe water and the sponsors would expect some further returns when they win an opportunity for participating in the project as EPC or O&M contractors.

Table 11-13 Financial statements summary

(KHR in million)

PL	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
Revenue	15,881	31,242	39,211	49,241	63,208	79,864
Costs & operating expenses	-21,309	-22,927	-21,392	-22,088	-24,680	-28,825
Operating (loss)/income	-5,429	8,315	17,820	27,152	38,528	51,038
Other income	1,159	6,825	7,806	5,697	3,961	2,285
Other expenses	-2,867	-2,845	-2,642	-1,626	-610	-0
Ordinary (loss)/income	-7,137	10,502	22,984	31,223	41,879	53,323
Extraordinary income	0	0	0	0	0	0
Extraordinary loss	0	0	0	0	0	0
(Loss)/income before income	-7,137	10,502	22,984	31,223	41,879	53,323
Income taxes	-	(1,410)	(4,597)	(6,245)	(8,376)	(10,665)
Net (loss)/ income	-7,137	9,092	18,387	24,979	33,503	42,659

CF	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
Operating Cash Flow	8,886	22,032	25,789	29,303	35,437	42,455
Investing Cash Flow	-42,238	0	0	0	0	0
Financing Cash Flow	45,226	-12,335	-31,600	-33,108	-41,633	-42,659
Net Increase(Decrease) in CF	**11,874**	**9,697**	**-5,810**	**-3,805**	**-6,196**	**-204**
Cash at end of year	**11,874**	**21,571**	**15,760**	**11,956**	**5,760**	**5,556**
Free Cash Flow	**-33,351**	**22,032**	**25,789**	**29,303**	**35,437**	**42,455**

BS	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30
Current assets	12,317	22,145	16,507	12,847	6,924	7,082
Non-current assets	25,986	13,955	6,456	2,083	0	0
Total assets	38,304	36,100	22,963	14,930	6,924	7,082
Current liabilities	215	274	350	447	570	728
Non-current liabilities	32,518	24,389	16,259	8,130	-0	0
Total liabilities	32,733	24,663	16,609	8,576	570	728
Total equity	5,571	11,437	6,354	6,354	6,354	6,354
Total liabilities and equity	38,304	36,100	22,963	14,930	6,924	7,082

EBIT Margin	-34.2%	26.6%	45.4%	55.1%	61.0%	63.9%
ROA	-2.2%	8.0%	18.5%	36.3%	84.1%	152.7%
ROE	-20.4%	17.2%	46.7%	78.6%	105.5%	134.3%
EIRR (Dividends vs Equity)	n/a	-11.9%	7.2%	11.2%	13.0%	13.9%
ADSCR *2(5year average)	n/a	2.2	2.6	3.2	4.1	n/a

Note: EIRR includes repayments of preferred stock principal (hereinafter, the same for “EIRR”).

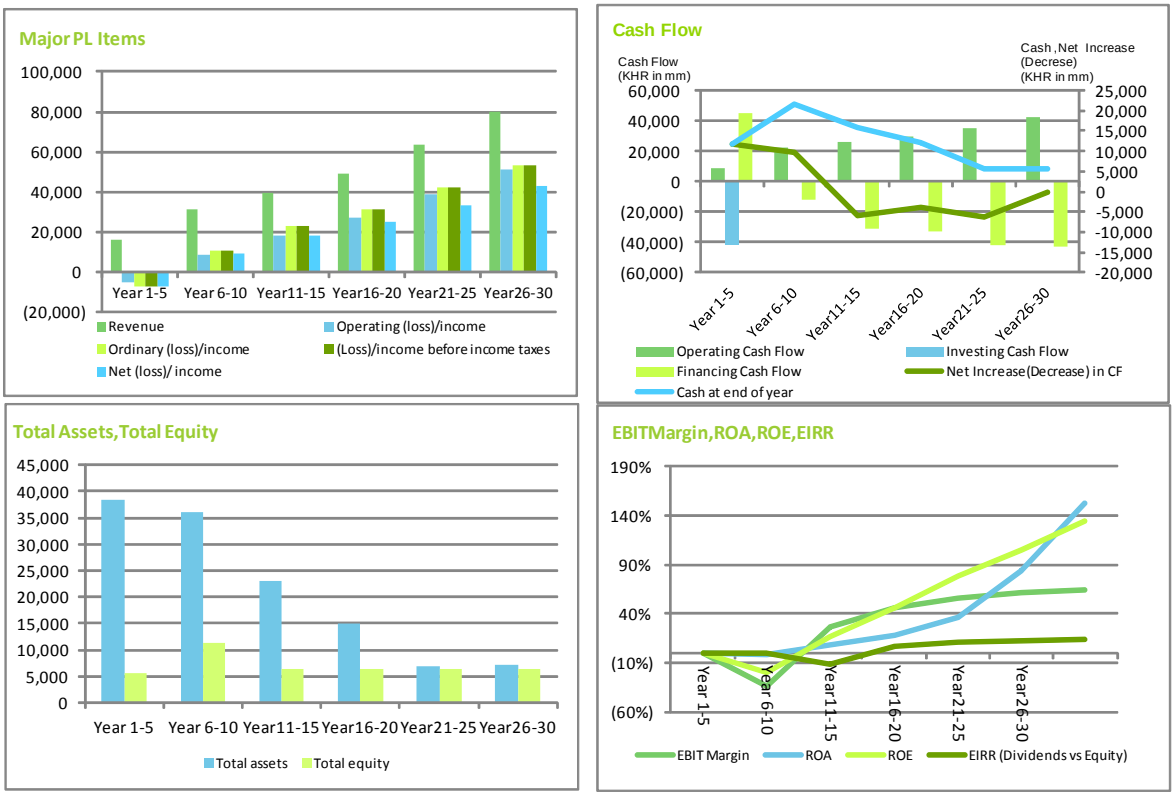


Figure 11-11 Financial statement summary

11.4 Management benchmarks for PPP

To have sustainable clean water supply business, there are certain management benchmarks that need to be set and upheld. The following table summarizes such benchmarks that are typically considered essential in carrying out the water supply project.

Table 11-14 Summary of management benchmark

No	Management benchmarks	Definition	Target Level	Actual parameters in the financial analysis
1	Water supply coverage rate (%)	(Served population/ Total population) x 100	100%	42%
2	Quality of water	Cambodia standards	WHO guidelines	Good condition
3	Operation hours (hours)	Number of hours of operation per day	24 hours	Good condition
4	Water pressure (kPa)	100-150 kPa	Minimum 200 kPa	250 kPa
5	Non-revenue water rate (%)	((Physical loss + commercial loss)/ total supply volume) x 100	Developing countries – 30%; Developed countries – approx. 10%	Kampot – 6.3% Kep (hotels) – 4.6% Kep (residents) – 6.3%
6	Employee rate	No. of employees working in the clean water supply facilities/ (no. of	World Bank guidelines – 5 employees	8.2 (2011)

		households with clean water access/1,000)		
7	Running cost rate (%)	(Running costs/ revenue) x 100 Running costs = O&M costs less depreciation expense	100% or less (preferably at 70% or less)	Year1 - 37.5% Year15 - 35.2% Year30 - 35.8%
8	Operating cost rate (%)	(Operating costs/ revenue) x 100 Operating costs = O&M costs + interest expense + other administrative expenses	120% or less (preferably at 100% or less)	Year1 - 367.8% Year15 - 49.8% Year30 - 35.8%
9	Collection rate (%)	(Actual cash collection/ revenue) x 100	90% (preferably 100%)	90-100%
10	Tariff (KHR or US$)	Within users' WTP *and ATP**		Year 1: Kampot - 1,390 KHR/m^3 Kep (hotels) - 2 US$/$m^3$ Kep(residents) - 6,000 KHR/m^3 Succeeding years: Assumed to increase at a certain rate as discussed in the section 11.2.2.

Notes：***** WTP stands for Willingness to Pay
****** ATP stands for Affordability to Pay which bases on total household income.

11.5 Various scenarios and sensitivity

While the results described in the section '11.3 Simulation results' were derived from our base scenario, actual results would be affected by the risks including those indicated by the financial institutions in our interviews, which were depicted in the section '8.1.3 Possible financing options.' In order to assess magnitude of the risks by factor, this section considers several risk scenarios and analyzes their implication to the financial model.

11.5.1 Risk scenario 1: Risk of local currency depreciation

This risk scenario analyzes a situation where the local currency depreciates against foreign currencies, resulting in a downturn in profitability in foreign currencies, as the SPC's revenue is partially denominated in local currency. This would, in turn, lead to higher burden to repay its debt denominated in JPY.

As the section '11.1.1 Economic environment – Currency and foreign exchange' analyzed, KHR has remained fairly stable against the US dollar. Therefore, the Risk Scenario 1 assumes that Cambodian riel depreciates by 20 % against Japanese yen in the following 10 years on the same rate and then stabilized.

Table 11-15 Results of the risk scenario 1

Risk Scenario1	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
EIRR (Dividends vs Equity)	n/a	-23.1%	5.2%	10.0%	12.0%	13.1%
ADSCR (5year average)	n/a	2.0	2.4	2.8	3.6	n/a

The table above shows that, in the Risk Scenario 1, the project would generate less cash inflow to cover cash outflow for debt servicing. Consequently, sponsors and the SPC would experience deterioration in profitability.

11.5.2 Risk scenario 2: Risk of delay in construction schedule

This risk scenario analyzes a situation where the construction of waterworks facilities is not completed within the assumed construction period and the SPC cannot start its operations as scheduled. More specifically, the Risk Scenario 2 assumes three-year delay in completion of the Kampot water treatment facility.

Table 11-16 Results of the risk scenario 2

Risk Scenario2	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
EIRR (Dividends vs Equity)	n/a	-13.5%	4.1%	8.9%	11.0%	12.3%
ADSCR (5year average)	n/a	2.4	3.1	3.8	5.0	n/a

From the table above, we see the project cash inflow will be reduced by three years, resulting in lower ADSCRs throughout the period. Consequently, sponsors and the SPC would experience deterioration in profitability.

11.5.3 Risk scenario 3: Risk of increase in O&M costs

This risk scenario analyzes a situation where the project incurs higher O&M costs compared to those assumed in our base scenario. Specifically, the Risk Scenario 3 assumes an inflation rate of 8% in Cambodia, which is higher than the expected inflation rate of 5% originally assumed, based on past figures, in our base scenario. While costs increase at the higher inflation rate in the Risk Scenario 3, we assumed that the SPC cannot raise tariff at the similar rate.

Table 11-17 Results of the risk scenario 3

Risk Scenario3	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
EIRR (Dividends vs Equity)	n/a	-23.1%	3.5%	7.6%	9.4%	10.3%
ADSCR (5year average)	n/a	1.9	2.2	2.2	2.2	n/a

In the Risk Scenario 3, the project will generate less cash inflow to cover the debt servicing, resulting in lower ADSCRs. In addition, sponsors and the SPC would experience deterioration in profitability.

11.5.4 Risk scenario 4: Risk of decrease in inflation catch-up rate

This risk scenario analyzes a situation where the sales price/ tariff cannot be increased as planned, specifically due to the drop in inflation catch-up rate that is currently set as 80% for both Kampot and Kep (local residents) as discussed in the section ‘11.2.2’. This Risk Scenario 4 assumes that the tariff catch-up rate would be 50% instead of 80% due to possible resistance from the users and/or intervention from the government. It should be noted that the inflation catch-up rate for the Kep hotels

is kept at 100%, which is consistent with the base scenario.

Table 11-18 Results of the risk scenario 4

Risk Scenario4	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
EIRR (Dividends vs Equity)	n/a	-15.5%	6.0%	10.1%	12.0%	13.0%
ADSCR (5year average)	n/a	2.1	2.5	2.9	3.7	n/a

The table above shows that, in the Risk Scenario 4, the project would generate less cash inflow to cover cash outflow for debt servicing. Also, sponsors and the SPC would experience deterioration in profitability.

11.5.5 Risk scenario 5: Risk of decline in sales price/tariff level

In our current base scenario, the sales price/tariff is set, assuming that the distribution costs (i.e. piping and administrative costs incurred by off-takers) are minimal and therefore, off-takers would take zero margin on the current market price. In this Risk Scenario 5, we assume that the margin of 20% would be taken by the off-takers, effectively reducing the sales price/ tariff earned by the SPC.

Table 11-19 Results of the risk scenario 5

Risk Scenario5	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
EIRR (Dividends vs Equity)	n/a	-23.1%	-3.4%	4.8%	8.0%	9.7%
ADSCR (5year average)	n/a	1.5	1.9	2.4	3.0	n/a

From the table above, we see the project cash inflow will be reduced due to lower sales price/tariff, resulting in lower ADSCRs. Also, sponsors and the SPC would experience deterioration in profitability.

11.5.6 Risk scenario 6: Risk of higher construction costs

This risk scenario analyzes a situation where the SPC incurs higher construction costs compared to the ones assumed in our base scenario. Specifically, we assume that the construction costs end up being 20% higher than the current assumption.

Table 11-20 Results of the risk scenario 6

Risk Scenario6	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
EIRR (Dividends vs Equity)	n/a	-23.1%	2.9%	8.1%	10.4%	11.7%
ADSCR (5year average)	n/a	1.8	2.3	2.7	3.5	n/a

The table above shows that, in the Risk scenario 6, the sponsors and the SPC would experience deterioration in profitability and the lenders would experience lower ADSCRs due to the increased cash outflow associated with the cost overrun on initial investments.

11.5.7 Risk scenario 7: Risk of higher interest rate

In our base scenario, we assumed that JICA would provide the loan at an interest rate of 2.5%. While JICA stated, during the interview session with us, that the benchmarking interest rate is 2-3%, we

anticipate that the impact of change in the interest rate to the SPC's financial results would be significant with the JICA loan being the only source of debt financing. Thus, this risk scenario analyzes a situation where the interest rate on the JICA loan goes up by 2.5% to 5.0%.

Table 11-21 Results of the risk scenario 7

Risk Scenario7	Year 1-5	Year 6-10	Year11-15	Year16-20	Year21-25	Year26-30
EIRR (Dividends vs Equity)	n/a	-23.1%	2.8%	8.5%	11.0%	12.3%
ADSCR (5year average)	n/a	1.5	2.0	2.6	3.6	n/a

The table above shows that, in the Risk scenario 7, the project would generate lower net cash flow resulting from a higher interest rate on the JICA loan. Consequently, sponsors and the SPC would suffer from deterioration in profitability and the lender would experience lower ADSCRs.

11.6 Profitability analysis and valuation

According to the results of our sensitivity analysis performed in the section '11.5 Various Scenarios and Sensitivity' above, the scenarios that had a significant impact on the SPC's profitability were 5) allowance of 20% margin to off-takers, 3) Increase in O&M costs at an annual growth rate of 8%, and 6) increase in the construction costs, in the order of magnitude.

Table 11-22 Summary of the profitability analysis result

figures in parentheses mean minus

		Yr 1-5	Yr 6-10	Yr 11-15	Yr 16-20	Yr 21-25	Yr 26-30
Base scenario	EIRR	N/A	(11.9)%	7.2%	11.2%	13.0%	13.9%
	ADSCR	N/A	2.2	2.6	3.2	4.1	N/A
1. Depreciation of KHR against JPY by 20% for 10 years	EIRR	N/A	(23.1)%	5.2%	10.0%	12.0%	13.1%
	ADSCR	N/A	2.0	2.4	2.8	3.6	N/A
2. Delay in the construction schedule in Kampot by three years	EIRR	N/A	(13.5)%	4.1%	8.9%	11.0%	12.3%
	ADSCR	N/A	2.4	3.1	3.8	5.0	N/A
3. Increase in O&M costs at an annual growth rate of 8%	EIRR	N/A	(23.1)	3.5%	7.6%	9.4%	10.3%
	ADSCR	N/A	1.9	2.2	2.2	2.2	N/A
4. Decline in inflation catch-up rate from 80% to 50%	EIRR	N/A	(15.5)	6.0%	10.1%	12.0%	13.0%
	ADSCR	N/A	2.1	2.5	2.9	3.7	N/A
5. Allowance of 20% margin to off-takers	EIRR	N/A	(23.1)	(3.4)%	4.8%	8.0%	9.7%
	ADSCR	N/A	1.5	1.9	2.4	3.0	N/A
6. Increase in the construction costs by 20%	EIRR	N/A	(23.1)%	2.9%	8.1%	10.4%	11.7%
	ADSCR	N/A	1.8	2.3	2.7	3.5	N/A
7. Increase in the interest rate on JPY loan from 2.5% to 5.0%	EIRR	N/A	(23.1)%	2.8%	8.5%	11.0%	12.3%
	ADSCR	N/A	1.5	2.0	2.6	3.6	N/A

Chapter 12 Evaluation of feasibility

12.1 Consistency with the national plans of Cambodia

This feasibility is evaluated by consulting the Rectangular Strategy, the National Strategic Development Plan (NSDP) and the Action Plan of MIME.

The Rectangular Strategy is a national development strategy in Cambodia. In regard to the water supply field, challenges faced by the Royal Government of Cambodia as stated in the Rectangular Strategy (Phase II: September 26th, 2008) concern, "The provision of quality public health services is still limited. … The progress in promoting health care services, sanitation and clean water in rural areas needs to be speeded up to meet the targets set in the Millennium Development Goals." Point 68 also states that, "… The Royal Government will pay more attention to the rights of access of people to clean water supply… in accordance with the Cambodia Millennium Development Goals (CMDGs) …." In addition, Point 69 states, "… the Royal Government will encourage private sector participation in the development and the management of irrigation systems and clean water supply."

The National Strategic Development Plan (NSDP) is a strategy that specifically sets out the target achievements of the CMDGs and the Rectangular Strategy. It was updated in 2010. In this plan, the target values of access ratio to safe water: rural area 50% and urban area 80% until 2015 were revised as shown in Table 12-1 as targets until 2013.

Table 12-1 NSDP update 2009-2013

Item	Target values			
	2010	2011	2012	2013
Access to improved drinking water in rural areas	43.49%	44.99%	46.49%	47.69%
Access to safe drinking water in urban areas	54%	55%	57%	60%

The goals of the NSDP Update are also detailed as follows.

- To improve access to sanitation and clean water in rural areas
- To utilize private water supply and private capital

The action plans of MIME are to realize the Rectangular Strategy. They are formulated as "Action Plans for 2009-2013". The constituent are the four points below:

1) Institutional Strengthening, Good Governance and Capacity Building
2) Improving and Strengthening Regulations
3) Strengthening and Improving Public Waterworks
4) Facilitating Cooperation Projects and Developing Partners

Out of theses the "2) Improving and Strengthening Regulations" specifies the following two points as its ***Strategic Objectives***.

1) Promoting Private Sector
2) Providing Protection and Subsidy to the poor

Accordingly, the result of this Survey is evaluated to be consistent with the national plans of Cambodia.

12.2 Applicability to rural area of Japanese technology

As to the applicability of Japanese Water Treatment Technology, the feasibilities in technical aspect in the Study area and in Cambodia are discussed. The technology used to study the applicability is

Mobile Ceramic Membrane Filtration Equipment (M-CMF). However, in the process of this study, the stationary type of Ceramic Membrane Filtration Equipment was employed for the proposed Kep new treatment plant. The applicability of this proposed method is also studied.

The M-CMF and the stationary type are applicable to Cambodian rural areas due to the following features:

- Small villages are scattered and houses are also dotted. Therefore, piped distribution water supply type, which is both costly and time-consuming, is inefficient.
- It is difficult to employ and to secure necessary manpower for the operation and maintenance in rural areas.
- Conventional water treatments technologies such as the rapid sand filtration system are not necessarily easy for maintenance and able for supplying water.

To consider these three points the adoption of the membrane system is desirable.

In case of the proposed Kep new treatment plant, as there exist different conditions; it will not be desirable to employ the same treatment method as for Kampot. As it is necessary to select the method which central monitoring system can be easily adopted, the operation is easy and the treatment is very certain.

From these viewpoints stationary ceramic membrane filtration method is employed.

In addition, the technology of M-CMF was verified through the test run in Kandal province from October to November 2011. The test was completed under the cooperation of MIME and PPWSA. The result verifies that the equipment functions as microfiltration treatment method and also is very durable to the road condition in Cambodia.

The technology of ceramic membrane filtration has attained approximately 1/3 of share in membrane filtration facilities in treated water volume in Japan. As of June 2011, the ceramic membrane technology is adopted in 103 water treatment plants, which means the technology is operated and maintained in many rural areas. The operation and maintenance of the ceramic membrane filtration is easy. The oldest facility with the ceramic membrane elapsed 13 years from the start of the operation, meaning the service life of the membrane is establishing new record year by year.

As for the aforementioned reason, the Ceramic Membrane Filtration technology is a really established technology and sufficiently appropriate technology, which has been verified by the pilot test in Kandal province.

12.3 Considerations from the socio-economic section

Development of water supply system not only improves the sanitation situations in the project area but also eases the water drawing work, which is usually the job of children and/or women in developing countries. Considering the water drawing work is often keeping them away from education and other social activities, it is expected that the project will surely improve the social environment.

On the other hand, the new water supply system also imposes a new cost burden on the people in the project area. From the socio-economic viewpoint, it is one of the most important issues how to protect the poor people in the implementation of the new project. In this sub-section, the mechanism is examined for providing subsidies to the poor people in order to access the minimum necessary amount of the safe and clean water in the water supply project based on the PPP scheme.

12.3.1 Typology of subsidies

Types and examples of the subsidies are summarized below.

Table 12-2 Subsidies types and examples

Subsidy Subject	Untargeted	Targeted		
		Self-Selection		Administrative Selection
		Quantity Targeting	Service-Level Targeting	
Consumption	*Across-the-board price subsidies* ⇒ all consumers	*Increasing block tariffs* ⇒ low-volume consumers with meters	*Free water at public water taps* ⇒ households using public taps	*Geographically differentiated tariff* ⇒ customers who live in certain areas *"Social tariffs"* ⇒ customers classified as poor
Connection	*No connection fee* ⇒ all new customers	-	*Reduced connection fee for lower service level* ⇒ households that chose this service level	*"Social connections"* ⇒ households classified as poor

Source: World Bank, Water, Electricity, and the Poor: Who Benefits from Utility Subsidies?, 2005

12.3.2 Guidelines of protecting the poor

National Policy on Water Supply and Sanitation approved by the Council of Ministers in 2003 contains the guidelines of PROTECTING THE POOR AND SUBSIDIES (Chapter 4) with the objective that "Provide good quality and adequate quantities of water to consumers at appropriate prices that they are able and willing to pay for." In addition, it emphasizes that the critical issue is usually not so much the tariff for water consumption but the high connection costs, which act the barrier.

12.3.3 The case of PPWSA

From 1999 till the end of December 2011, PPWSA had installed 26,877 connections for the poor families. It is 14% of total connections. Of the 26,877 poor connections, 16,118 connections (1,463 urban and 14,655 suburban) are subsidized with the total amount of 4,029,904,080 KHR or US$ 982,904. The breakdown of the subsidies is shown below.

Table 12-3 Breakdown of subsidies for connection fee

Subsidy	Connections in		Total	Subsidy Amount (KHR)
	City Center	Suburb		
100%	236	6,123	6,359	2,151,885,600
70%	594	4,090	4,684	1,109,545,920
50%	490	3,252	3,742	633,146,400
30%	143	1,190	1,333	135,326,160
Total	1,463	14,655	16,118	4,029,904,080

Source: PPWSA

PPWSA's tariff employs the increasing block tariff and user categories. It is shown below.

Table 12-4 Tariff of PPWSA

Domestic		Administrative		Commercial	
Volume (m^3/month)	Tariff Rate (KHR/m^3)	Volume (m^3/month)	Tariff Rate (KHR/m^3)	Volume (m^3/month)	Tariff Rate (KHR/m^3)
0 - 7	550	-	1,030	0 - 100	950
8 - 15	770			101 - 200	1,150
16 - 50	1,010			201 - 500	1,350
>50	1,270			>500	1,450

Source: PPWSA

12.3.4 Examined scheme for the Plan

Presently, Kampot Water Supply (KWS) has no scheme for the poor. Connection fee is US$100 and the water price is 1,400 KHR per cubic meter, which is flat for any amount of consumption. In addition, new user has to pay US$13 for the deposit at the beginning of connection.

As the subsidy from the government is not expected in the PPP project scheme, reduction of the burden on the poor people should be offset by the increase in the cost of others, or cross-subsidy under the full cost recovery policy. The obstacles for the poor to prevent accessing the water supply are mainly 1) connection fee which should be paid at once at the time of beginning, and 2) higher water charge for every day use with considering with the income. So, the two matters shall be considered for the protection of the poor as follows.

- Connection fee is discounted and/or paid by installment on the targeted users, who are selected among applicants. It is applied only to new users due to its nature; and
- Water consumption charge is designed to be stepwise at metered rate with lower unit price applied to smaller consumption volume.

12.3.5 The applicability of the plan

Development of water supply system ease the water drawing work by children and women and protect the health of residence from waterborne infectious disease and the plan will improve social environment. In addition, to the poorest segment of the population, by discussing the topic indicated in Clause 12.3.4 with KWS, the applicability of the plan will be evaluated.

12.4 Consideration from financial analysis

It is reasonably expected that investors generally would not be interested in investing in a project if EIRR of the project is below the market interest rate prevailing in Cambodia (~ approx. 20%), plus certain premium. Nevertheless, we can assume that the PPP project, which earns EIRR that is slightly lower than the market interest rate could be feasible due to the following reasons: (1) the cost of debt in Cambodia is very high and therefore, the cost of equity is not expected to significantly differ from cost of debt in the premature financial market in Cambodia, and (2) the host country would realize social benefits with the increase in population having access to clean water and the sponsors would expect some further returns when they win an opportunity for participating in the project as EPC or O&M contractors..

12.5 Sustainability of the PPP project

Out of a wide range of PPP options which can be implemented to make maximum use of the private sector involvement, the optimum PPP will be selected based on the site-specific conditions of Kampot and Kep. The involvement of the private sector can enlarge the access to capital or financial resources for investment/procurement of facilities/equipment as well as the access to human capital for expertise and skills.

The Kampot project is designed to be implemented as the PPP option for the construction, operation and maintenance of the bulk water supply system which is a typical PPP structure under the Design Build Own Operate and Transfer (DBOOT) model. Under this model, the water treatment plant will be constructed with the 30-year project period, while the special purpose company (SPC) will be established to make the bulk water purchase contract with KWS.

Meanwhile, the water treatment plant as well as M-CMF will be constructed and supplied for the Kep project under the DBOOT with the 30-year project period, while the same SPC will provide the water supply services to end users as well as to collect water charges from end users. The financial analysis verifies the sustainability of the above PPP option on the conditions that the necessary risk cover measures such as the take-or-pay contract will be taken.

Chapter 13 Conclusion and recommendation

13.1 Conclusion

The National Strategic Development Plan (NSDP) aims to raise the rates of access to safe water in urban and rural areas by 80 and 50% respectively by 2015. However, information from MIME and MRD suggests the figures achieved were 60 and 41% in 2011. MIME has jurisdiction over urban water supply services in the capital of Phnom Penh and suburban cities. It is also promoting the development of the city's waterworks facility with the support of donors, but water supply capabilities in cities besides Phnom Penh remain low. There is therefore an urgent need to implement NSDP to achieve the target goal, hence MIME has drawn up the Action Plans for 2009-2013 for the water supply sector. According to these Plans, MIME is conducting various improvements under the policies and has recently transferred its four suburban water supply business rights to local companies. Other than this privatization, the total number of private water supplier registrations in Cambodia is up to 146.

Based on the above circumstances, this Survey, under JICA supervision, is intended to investigate the applicability of Japanese Water Treatment Technologies possessed by Japanese private enterprises in local areas of Cambodia and establish a safe water service plan in provincial towns and rural areas where the service ratio remains low. In parallel, the survey also collected basic information related to commercialization by the formation of a PPP. As privatization is progressing, suitable water utilities for future PPP projects are limited to only several utilities such as SRWSA, Pursat Water Supply, Battambang Water Supply, Kampong Cham Water Supply, Kampong Thom Water Supply, Svay Rieng Water Supply and Kampot Water Supply, etc.

Kampot city and Kep province are selected as the study areas. The water supply plans established under this Survey are:

(1) A bulk water supply planning developed for Kampot Water Supply and a new small scale water supply project covering Kep beach areas and some rural areas planned for Kep province.
(2) In Kampot, a bulk water supply project will supply a daily maximum water supply of 3,433 m^3/day in 2030, while the equivalent figure for the water treatment plant capacity in Kep is 859 m^3/day.
(3) The daily water supply capacity of the Mobile Ceramic Membrane Filtration Equipment used in Kep province is 220 m^3/day.
(4) In the resort area of Kep beach, piped distribution with a water treatment plant is the planned means of supply. In rural areas, a Mobile Membrane Filtration System will be used.

As one of the Japanese water treatment technologies used in this survey, the mobile type of Ceramic Membrane Filtration Equipment and the stationary type of Ceramic Membrane Filtration Equipment are employed for the plan. The new facilities and technologies of Kampot will be subject to constraints on water charges, and a suitable method will be selected with economic conditions in mind.

The distribution planning of Kampot in this Survey was made based on zone-allocation of supply area in order to secure water treatment volume and mutual business sustainability. As MIME has another vision such as take-or-pay system regarding the method to secure water treatment volume and mutual business sustainability, the planning should be reconsidered in the next stage between MIME and SPC candidate.

The result of the financial analysis indicates that EIRR is 9.1% with the tentative finance structure and have a possibility to increase it to reach 13.9% with a proposed alternative scenario. It is still lower than the market interest rate and not quite enough but could have a good chance to make it feasible as a PPP project after further detailed study. Besides reviewing costs, financial structure and so on, the following factor might be factors to be duly considered by the investors:

(1) the local cost of debt is very high and the cost of debt is not expected to significantly differ from cost of equity due to the premature financial market in Cambodia, and
(2) the host country would realize public interests with the increase in population having access to clean water and the sponsors receives business interests as EPC or O&M operators.

The optimum PPP will be selected from various options based on the site-specific conditions of Kampot and Kep. At the moment DBOOT is recommended to both Kampot and Kep. The contract duration will be 30 years for both sites.

The areas of the PPP project are those combined with the Kampot provincial capital and Kep. The SPC will be set up and located in the new treatment facilities in Kampot and operated alongside the business in Kep province.

The bulk water supply contract will include a “take-or-pay clause for appropriate water quantity” and “zone allocation-of-supply area cause”. However, “zone allocation-of-supply area cause” should be reviewed based on a discussion with MIME in more detailed survey of the future. To start the PPP business in these areas, the short-term construction of a distribution network via international assistance such as grant aid will be a prerequisite.

13.2 Recommendations

1) It is important to arrange international assistance such as grant aid for the short-term construction of a distribution network in Kampot.

2) In readiness for PPP realization, appropriate contents of the future contract-draft include a “take-or-pay clause for appropriate water quantity”. These clauses will establish a win-win relationship for both sides.

   As prerequisites for our analysis, we assume such off-take risk is mitigated by :
   - guarantees from the Cambodian government, and
   - acceptance of take-or-pay supply terms by local governments (off-takers), leaving the demand risk with the off-takers. If these are not applicable, however, the SPC will be directly exposed to the demand risk, which may, in turn, result in a higher premium requirement by SPC sponsors.

3) A private water supply company – Western Coastal Development Co., Ltd – has been granted a license by MIME to develop potable water in Kep province. Due to bankruptcy, the private water supply enterprise went out of business in 2009, leaving behind a broken earth dam. The company, however, has obtained approval from MIME to extend the license expiration date for six months, until May 28, 2012. This new extension must be carefully monitored.

4) The following prerequisites apply to ensure the sustainability of the PPP project. The related persons and institutions must confirm and construct the procedures and execute the necessary actions carefully and swiftly:
   - Determining and obtaining effective support from the government of Cambodia.
   - Preparation of bidding to set up the SPC
   - Pinpointed Performance Targets
   - Realistic tariff standards for original setting and a realistic mechanism for resetting
   - Efficient procurement procedure through an unsolicited process
   - Securing the benefit of eligibility to be recognized as a QIP
   - Provision of technical assistance to SPC

5) In terms of the finance structure, funding via commercial bases would make the project unfeasible given the high interest rate (currently around 20%/year) and short repayment period. It is imperative to obtain loans from JICA for the long term & at a low interest rate to make the project feasible and sustainable. In addition, we assume that the SPC would be given a repayment grace period of five years by JICA. Since subsidies from the government of Cambodia are not available (i.e. MIME only supports a full-cost recovery system), without this grace period, the SPC will suffer a significant loss during the early stage of the concession period and will become insolvent.

6) In the next step such as the feasibility study stage, after resolving all preconditions, prior discussion or prior applications for water rights with MOWRAM to secure source water (the regulation concerning water rights is currently at the DRAFT stage) is necessary. It is also necessary to hold stakeholders' meetings, including the populace.

7) The cost to be taken into consideration for the poor should be financed on an internal basis or via a Cross-Subsidy. The degree and extent to which consideration should be made while retaining appropriate profit and sustainability of the operation requires the consensus of related stakeholders. Some water utilities operate their businesses with consideration for the poor via a Cross-Subsidy. A detailed case study will be useful and necessary in the future feasibility study.

ANNEXES

MINUTES OF MEETING

INCEPTION REPORT FOR DATA COLLECTION SURVEY ON JAPANESE WATER TREATMENT TECHNOLOGY FOR RURAL AREA IN THE KINGDOM OF CAMBODIA

BETWEEN
MINISTRY OF INDUSTRY, MINES AND ENERGY
AND
JAPAN INTERNATIONAL COOPERATION AGENCY SURVEY TEAM

Phnom Penh, January 13th, 2012

Satoshi Kachi
Satoshi Kachi
Team Leader,
JICA Survey Team
Japan

Phork Sovanrith
Secretary of State,
Ministry of Industry, Mines and Energy
(MIME)
Kingdom of Cambodia

(As a witness)

植木雅浩

Masahiro Ueki
Advisor,
Water Resources Management Division 1
Global Environment Department, JICA
Japan

1. Introduction

The JICA Survey Team (hereinafter referred to as "the Team") organized by the consortium of METAWATER Co., Ltd., CTI Engineering International Co., Ltd., Deloitte Touche Tohmatsu LLC., discussed with the Ministry of Industry, Mines and Energy (hereinafter referred to as "MIME") regarding the Inception Report (hereinafter referred to as "IC/R") for the Data Collection Survey on Japanese Water Treatment Technology for Rural Area in the Kingdom of Cambodia (hereinafter referred to as "the Survey") on January10th and 13th, 2012.

As the result of the discussion on IC/R, MIME accepted IC/R and agreed on its contents in principle.

2. Main points discussed

The main issues discussed and agreed in the discussion were as follows:

(1) Stand Point of the Survey

JICA explained that the Survey would be conducted to aim only at basic data collection and the implementation of the proposed project would be considered later by the related parties based on the result of the Survey. MIME agreed on that.

(2) Request to MIME from the Team

In conjunction with the Chapter 6 of IC/R (Request for Cooperation,) the Team requested MIME to assign counterpart personnel in order to conduct smooth execution of the Survey.
In response to this, MIME agreed to assign two counterparts personnel (as follow) and the Director of Kampot waterworks.

- Mr. Prom Sokunnarith in charge of the PPP, legal, socio-economical and financial matters.
- Mr. Pich Sambatt Rattanak in charge of the technical matter.

The Team requested MIME to provide the Team with the present status of registration and ongoing application of licenses of private water supplier operations in Kampot and Kep provinces. MIME agreed to provide necessary information by January 13th, 2012.
MIME pointed out that "(6) To provide measures to ensure the safety of the survey team" in Chapter 6 of IC/R was beyond the control of MIME.

(3) Title of the Survey

The Team reported the result of visit to Department of Rural Water Supply, Ministry of

Rural Development for the presentation of IC/R. MRD suggested that the title of the Survey shall be changed the title from "Japanese Technology for Rural Water Supply" to "Japanese Water Treatment Technology for Rural Area". Both sides agreed to change it as MRD suggested.

(4) Permission Letter to the Team and DIMEs

The Team reported the result of visits to DIMEs in Kampot and Kep provinces for the presentation of IC/R. DIME suggested that the permission letters are necessary to support the Team for the coordination with local authorities and the stakeholders and to keep them in DIMEs for record purpose. MIME promised to issue the permission letters both to the Team and DIMEs.

(5) Suggestions from MIME

a. MIME explained that the Cambodian government might face difficulty to allocate budget for the PPP project which would be proposed as the result of the Survey.
b. MIME suggested that the Team would contact Ministry of Economy and Finance (MEF) if the proposed PPP project would be implemented as BOT (Build Operate and Transfer).

MINUTES OF MEETING

INCEPTION REPORT FOR DATA COLLECTION SURVEY ON JAPANESE WATER TREATMENT TECHNOLOGY FOR RURAL AREA IN THE KINGDOM OF CAMBODIA

BETWEEN

MINISTRY OF INDUSTRY, MINES AND ENERGY

AND

JAPAN INTERNATIONAL COOPERATION AGENCY SURVEY TEAM

Phnom Penh, February 29th, 2012

Satoshi Kachi

Satoshi Kachi
Team Leader,
JICA Survey Team
Japan

Phork Sovanrith
Secretary of State,
Ministry of Industry, Mines and Energy
(MIME)
Kingdom of Cambodia

1. Introduction

The JICA Survey Team (hereinafter referred to as "the Team") organized by the consortium of METAWATER Co., Ltd., CTI Engineering International Co., Ltd., Deloitte Touche Tohmatsu LLC., discussed with the Ministry of Industry, Mines and Energy (hereinafter referred to as "MIME") regarding the result of the Data Collection Survey on Japanese Water Treatment Technology for Rural Area in the Kingdom of Cambodia (hereinafter referred to as "the Survey") on February 29th, 2012.

2. Main points discussed:

(1) Request by the Survey Team

- The team submitted two copies of Draft Final Report to MIME and asked for comments from MIME by 7th March.

In response to this, MIME mentioned that the comments to the draft final report are only as follows:

(2) Comments from MIME:

A. KEP

1. The PPP scheme in KEP should be changed from DBOO to DBOOT, like that in Kampot. The transfer can be made by the SPC to the Cambodian Government; and the Government (via MIME) will manage it.

2. After the concession period, the SPC must ensure the good condition of the Mobile-CMF when transferring them to the Government.

B. Kampot

1. In the planned bulk water supply to KWS, the separation of coverage areas between KWS and SPC is not necessary. It is KWS' responsibility to manage its distribution. To ensure the financial sustainability of the SPC, the contract between the two parties could mention the minimum amount of bulk water supply by the SPC to the KWS as "take or pay contract". So even during the season in which the demand of water is low, KWS has to adjust its capacity and purchase that amount of bulk water supply from the SPC. In the meantime, the SPC has to ensure: quantity, quality, and water pressure.

(3) MIME reserves the right to develop water supply in both towns with other development partners.

S. K.