

8.2.7 Poor Access and its Problems

To provide a smooth access in the landfill to the users (collection vehicles) is the basic responsibility of the operator of a disposal site, i.e. PPWM. As for the SMCDS, PPWM often fails to provide this principal requirement of landfill operation. The users (collection vehicles) often have to wait for a considerable time, some time more than 6 hours, until they dump their wastes collected due to a vehicle stuck at mud and waste heap. A long queue of collection vehicles brings a considerable loss to the users and this is clearly caused by poor access to and at the working face (unloading area of the waste collected). This situation becomes more serious when it rains.

The Team summarizes the reasons why PPWM could not provide a good access as follows:

1. Lack of landfill equipment for a proper operation of the disposal site. Actually PPWM has no landfill equipment at all. As all landfill equipment belongs to the operation contractor, PPWM could not conduct any physical works to provide a good access without the consent of the contractor.
2. Insufficient budget for the operation of the SMCDS. In fact the current payment (US\$8,500) to the operation contractor is not enough to provide proper landfill operation. According to the calculation done by the Team the payment could only cover for a D7 class bulldozer rental fee and 12 hours continuous operation⁴ cost of it.
3. Improper operation of the operation contractor. This is due to lack of proper instruction and control of PPWM in addition to the insufficient knowledge of the contractor.
4. Lack of daily, weekly and monthly operation plans. Based on the plans, the operation contractor shall construct, maintain and repair of access; i.e. on-site roads and working faces.

8.2.8 Actions to be taken by MPP/PPWM

The Team recommends the PPWM to take the following actions to solve the current problems of the SMCDS:

a. Solution of Poor Access

Since provision of a good access to the users is the responsibility of PPWM not of private operation contractor, PPWM needs to take the following measures:

a.1 Increase of Income from Users and Raise Payment to the Contractor

For the provision of a good access to the collection vehicles, PPWM shall properly construct, maintain and repair on-site roads and working faces. PPWM shall understand that this work requires a considerable number of landfill equipment and inputs for their operation, i.e. fuel, lubricant, operators, etc.

The Team made a study for minimum requirement for a proper operation of SMCDS including shaping but excluding soil cover and estimated that it requires at least 25,300 US\$/month (This is equivalent to 1.20 US\$/ton if daily disposal amount is 700 ton/day.). PPWM, therefore, needs to negotiate the users, mainly CINTRI, to raise tipping fee to cover minimum cost for proper operation. At the same time PPWM shall make its best effort to provide a good access to users. Otherwise the users will not accept the increase of tipping fee. PPWM shall mind for negotiation that to improve the landfill and provide a good access will

⁴ Normally a bulldozer does not operate continuously. 12 hours continuous operation, therefore, means 24 hours normal operation.

bring a considerable benefits to the users. Because the provision of a good access improves the efficiency of the collection vehicles (e.g.: increase the number of trips) and avoids damages of them (e.g.: decrease the maintenance and repair costs).

If PPWM succeeds to increase the tipping fee, it shall increase the payment to the contractor and ask to increase the number of landfill equipment for proper operation.

a.2 Plan and Control of Landfill Operation

Even if PPWM secure the budget for proper operation, a good access could not be achieved without proper plan and control of landfill operation as far as PPWM entrusts the landfill operation to the private contractor. PPWM, therefore, needs to make a daily, weekly and monthly plan for proper operation to instruct and control the private contractor. Then based on the plans PPWM shall control and supervise its operation contractor considering the following aspects:

- Maintain the access (on-site roads and working faces) for collection vehicles higher than the surrounding area in order to avoid impact of the rain water
- Secure drainage of rain water for the on-site roads and working faces
- Conduct frequent maintenance and repair of the access according to the instruction of the Team

b. Control of SMCDS

The PPWM is the owner of the SMCDS and has responsibility for the following aspects:

- Overall management of the landfill
- Security of the landfill including measure to avoid theft of the property
- Landfill operation planning and instruction of operational works
- Control of the contractor on its landfill operation, the users of the landfill (incoming vehicles), waste pickers, visitors, etc.
- Supervision of landfill operation including watching from the watchtower
- Enforcement of the rule of the SMCDS such as control of open fires, improper operation and dumping, etc.
- Operation of weighbridge and leachate treatment facility
- Provision of electricity and water
- Provision of lights for night operation along the main road and working faces
- Maintenance of on-site roads, model block, enclosing bank, canal, etc.

In order to fulfill the above-mentioned responsibility, PPWM shall establish the Rule of the SMCDS based on the draft rule prepared by the Team. In addition, PPWM is suggested to revise the contract agreement with the operation contractor referring the Technical Specifications for the Operation Works of the SMCDS prepared by the Team.

c. Excavation and Taking Out of Aged Waste

There is a plan of taking out of disposed waste (aged waste) of at SMCDS to outside. The Team considered that the plan is very beneficial because it contributes to the extension of the use of SMCDS by providing extra landfill spaces and reduce the landfill operation cost by avoiding mounting up operation of waste. Therefore, the Team recommends PPWM to implement the plan but also request it to pay attentions on the following aspects:

- The excavation work shall be done in accordance with the order as shown in the Figure below. The first excavation area shall be number ① in the Figure. Then ② and ③. The number ④ shall be additional area in case it requires more aged wastes.

- The access road for the excavation site is recommended to apply the route as shown in the Figure. PPWM shall not allow the vehicle hauling aged wastes to use the main road to avoid mix traffic with collection vehicles. The route of the access road shall avoid the bank of leachate treatment ponds.
- PPWM shall not allow the excavation of aged wastes from the model block.

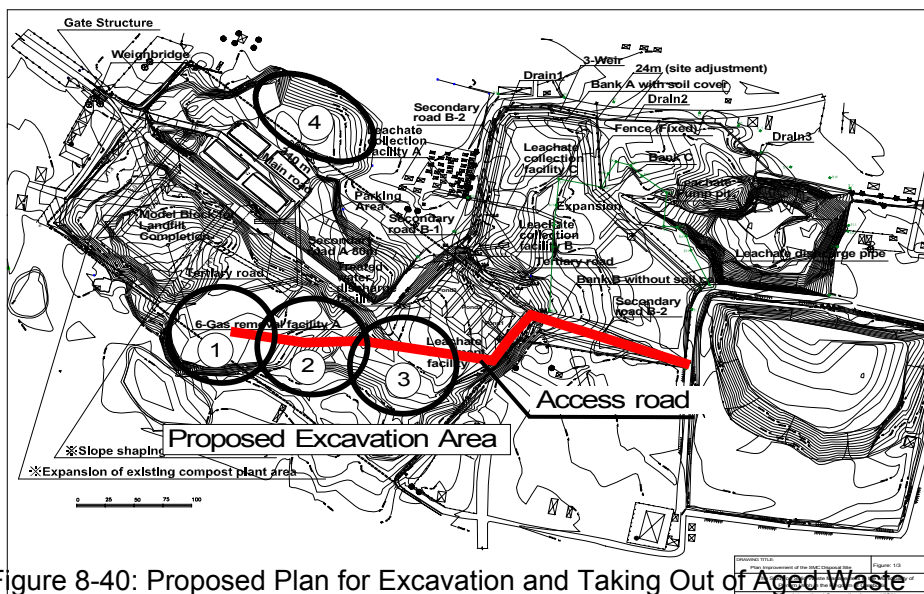


Figure 8-40: Proposed Plan for Excavation and Taking Out of Aged Waste

8.2.9 Technical Report for Improvement of Stung Mean Chey Disposal Site

The contents of the Technical Report for Improvement of SMCDS are following.

- Technical Specifications for the Operation Works of The Stung Mean Chey Disposal Site
- Rule of the Stung Mean Chey Disposal Site
- Estimation of Proper Operation Cost for SMCDS
- Technical Report for Problems Caused by the Big Hole

“1. Technical Specifications for Operation Works of the Stung Mean Chey Disposal”

It contains necessary technical specifications for the contract of landfill operation works at the SMCDS. Based on this, PPWM made the technical specifications for the contract of operation works at the SMCDS.

Technical Specifications For the Operation Works of the SMC Disposal Site (Draft)	
Article 1. General	This specification shall be applied to the “Operation Works of the SMC Disposal Site” in the Municipality of Phnom Penh in the Kingdom of Cambodia.
Article 2. Scope of Works	The Contractor shall fulfill the works stipulated in the Article 6 on its own account. The works shall include all works such as mobilization, materials, labor force, machinery, etc.
Article 3. Contractor’s Obligation	The Contractor shall follow the instruction given by PPWM (the Client) regarding the

method of works.

The Contractor shall be solely responsible for providing all materials, machinery, labor, fuel, etc. which are required for the operation works of the SMC Disposal Site (SMCDS) in accordance with the instructions made by PPWM (the Client).

The Contractor shall be responsible for maintaining/constructing the roads and working faces according to the instruction of the owner of the SMCDS, PPWM (within the boundary of the SMCDS) in order to avoid the following problems. If the problems occur, the Contractor shall solve them immediately on its own account. If the Contractor fails to solve the problems, it shall compensate the damages caused by the problems

1. Stagnation of the collection vehicles caused by improper maintenance of on-site roads and working faces; and
2. Damages of the collection vehicles caused by improper maintenance of on-site roads and working faces.

Article 4. Contract Period

The contractor has to commence the work as soon as the letter of intent is issued. The contract shall be valid by the end of xxx, 200x.

Article 5. Payment

The payment to the Contractor shall be 8,500US\$/month.

- Increase of the payment according to the disposal amount shall be examined.
- Penalty shall be examined.

Article 6. Description of Works

6.1 Maintenance and construction of on-site roads

The Contractor shall maintain on-site roads in order to assure the incoming collection vehicle to reach the working face (the area for waste dumping) for dumping its waste. The on-site roads shall include the main road, the secondary roads and tertiary roads. In order to maintain the roads, the Contractor shall conduct at least the following works:

1. Banking the on-site roads;
2. Constructing drains along the on-site roads;
3. Spreading soil and/or gravel on the roads if needed; and
4. Removing and placing steel plates.

In accordance with the change of the working faces, the Contractor shall extend and/or construct the secondary roads and tertiary roads. In order to construct roads the Contractor shall conduct at least the following works:

1. Pushing, banking, leveling and compacting wastes dumped;
2. Banking soil on the bank made by waste;
3. Spreading gravel on the soil if needed; and
4. Removing, transporting and placing steel plates.

6.2 Maintenance and construction of working face

The Contractor shall maintain the working faces in order to assure the incoming collection vehicle to smoothly dump its waste. In order to maintain the working faces, the Contractor shall conduct at least the following works:

1. Pushing, banking, leveling and compacting wastes dumped;
2. Banking soil on the working face if necessary;
3. Spreading gravel on the soil if needed; and
4. Removing, transporting and placing steel plates.

If a new working face needs to be constructed, the Contractor shall construct the working face. In order to construct the working face the Contractor shall conduct at least the following works:

1. Pushing, banking, leveling and compacting wastes dumped;
2. Banking soil on the waste banked if necessary;
3. Spreading gravel on the soil if needed; and
4. Removing, transporting and placing steel plates.

Article 7. Obligation of the User (Driver and Owner of Collection Vehicle)

The User (the driver of collection vehicle) shall follow the instruction made by the owner of the SMCDS, PPWM and be responsible for the following problems and shall solve them immediately on its own account. If the User (the owner of the collection vehicle) fails to solve the problems, it shall compensate the damages caused by the problems

1. Dumping waste at the designated area instructed by the PPWM; and
2. Keeping the rules of the SMCDS ordered by the PPWM

“2. Rule of the Stung Mean Chey Disposal Site”

This is a detailed rule of the SMCDS which was attached to the technical specifications as a reference material.

**Rule of the Stung Mean Chey Disposal Site
(Draft)**

Article 1. General

This rule shall be applied to the person (s) who control, operate, use, work and visit at the “Stung Mean Chey Disposal Site (SMCDS)” in the Municipality of Phnom Penh. The breach of the rule is subject to the penalty as stipulated in the Article 8.

Article 2. Common

Proper Use of Facilities and Equipment of the SMCDS

The following facilities and equipment are owned by the PPWM, the owner of the SMCDS and subject to the control of it. The person (s) who control, operate, use, work and visit at the “Stung Mean Chey Disposal Site (SMCDS) shall properly use the facilities and equipment in order not to cause any damages to them. If the person (s) causes damages to the facilities and equipment, she/he shall bear the recovery cost of the damages.

(1) Weighbridge and its Attached Equipment and Facilities

- ① Weighbridge and control building
- ② Indicator and personal computer
- ③ Electric poles and cables
- ④ Tap water and its equipment

(2) Leachate Treatment Facility and its Attached Equipment and Facilities

- ① Electric poles and cables
- ② Leachate treatment ponds
- ③ Leachate pumps and pits
- ④ Leachate transfer pipe
- ⑤ Generator
- ⑥ Pump station

(3) Site Office and its Attached Equipment and Facilities

- ① Site office and its furniture
- ② Electric poles and cables

- ③ Garage and toilet
- (4) Enclosing Bank/On-site Roads and Attached Equipment and Facilities
 - ① Steel plates
 - ② Electric poles and cables
 - ③ Lights
 - ④ Watching tower
- (5) Model Block and its Attached Equipment and Facilities
 - ① Gas collection facility and its equipment
 - ② Storage house
 - ③ Slope with turf
- (6) Others
 - ① Waste Pickers Develop Center
 - ② Drain and its attached equipment and facilities
 - ③ Septage sludge treatment facility
 - ④ Fence and gate

Prohibition of the Activities That Cause Adverse Environmental Impacts

The following activities that cause adverse environmental impacts shall be strictly prohibited at the SMCDS. If the person (s) conducts such activities, she/he shall be subject to the penalty as stipulated in the Article 8.

- Fire especially open burning of tires, electric cables, etc.
- Dump waste outside of the landfill

Article 3. Responsibility of DOE

The Department of Environment (DOE) shall be responsible for monitoring and control of the SMCDS and enforcement of laws and regulations on it.

Article 4. Responsibility of PPWM

The PPWM shall be the owner of the SMCDS and responsible for the following aspects:

1. Overall management of the landfill
2. Security of the landfill including measure to avoid theft of the property
3. Landfill operation planning and instruction of operational works
4. Control of the Contractor on its landfill operation, the users of the landfill (incoming vehicles), waste pickers, visitors, etc.
5. Supervision of landfill operation including watching from the watchtower
6. Enforcement of the rule of the SMCDS such as control of open fires, improper operation and dumping, etc.
7. Operation of weighbridge and leachate treatment facility
8. Provision of electricity and water
9. Provision of lights for night operation along the main road and working faces
10. Maintenance of on-site roads, model block, enclosing bank, canal, etc.

Article 5. Obligation of the Contractor of Landfill Operation

The contractor of the landfill operation shall be responsible for the following aspects:

1. Provision of sufficient landfill equipment for the operation of landfill including prompt replacement of the bulldozer when it has problems
2. Safe operation of landfill equipment such as lighting head and tail lamps in the night, paying attention to waste pickers, etc.
3. Provision of an extra working face for emergency
4. Daily maintenance of landfill equipment to avoid breakdown
5. Prompt rescue of collection vehicle stuck
6. Prohibition of doing a favor for specific collection vehicles and waste pickers

Article 6. Obligation of Users (CINTRI, etc.)

The users of the landfill operation (collection vehicles of CINTRI, etc.) shall be responsible for the following aspects:

1. Dump waste at the designated area instructed by the PPWM and get out there at once
2. Drive on on-site roads; main, secondary and tertiary roads
3. Keep driving speed less than 30km/hour
4. Take measurement at the weighbridge before entering the landfill
5. Prohibition of allowing waste pickers on the vehicle body and doing a favor for them
6. Inform the inspector of PPWM promptly when stuck at the landfill
7. Let the inspector of PPWM know about any problems on the landfill immediately
8. Conduct daily maintenance of the vehicle to avoid breakdown at the landfill
9. Do not cause harmful noise
10. Prohibition of dumping hazardous industrial wastes and infectious/hazardous medical wastes

Article 7. Obligation of the Waste Pickers

The waste pickers shall be responsible for the following aspects:

1. Register at the site office of PPWM and get ID card
2. Keep the ID card at the landfill
3. Work at the designated area instructed by the PPWM
4. Follow the instruction made by the inspector of PPWM
5. Prohibition of stealing waste, paying money to collection vehicle driver and bulldozer operator and riding on the back or top of the collection vehicle

Article 8. Penalty

The breach of this rule is subject to the following penalties:

For the Contractor of Landfill Operation:

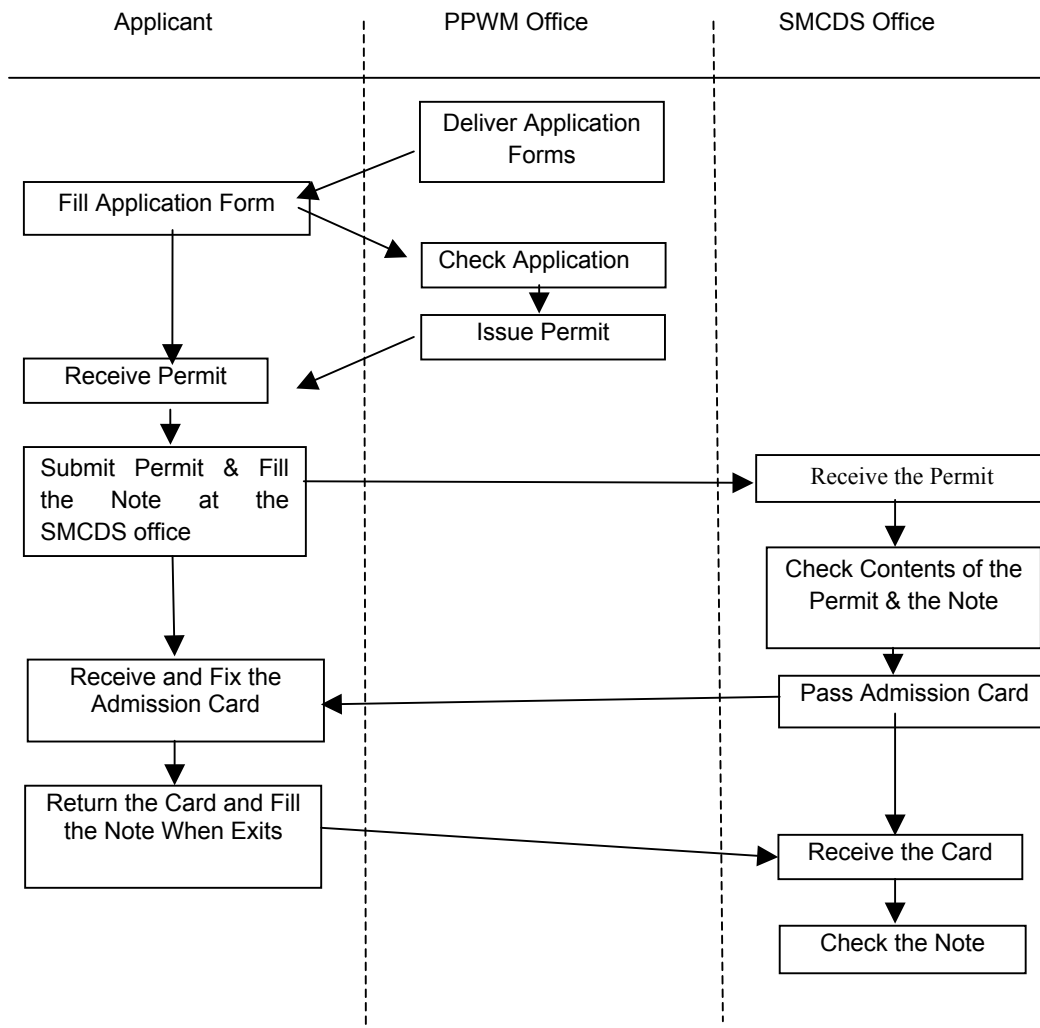
For the Users (CINTRI, etc.):

For the Waste Pickers:

Article 9. Admission system

Any person who enters the SMCDS shall get admission from the PPWM. The admission system is illustrated in the Figure below.

1. Any person who enters the SMCDS shall get an admission permit and for getting the permit he/she shall submit an application (the application form shall indicate purpose, organization, name of person, address, etc.) to PPWM and get the permit.
2. Then the person who gets the permit shall show it at the entrance (the control building at the weighbridge), write down the name and entering time on the note and get the admission card at the entrance.
3. The person who enters the SMCDS shall follow the instructions given by PPWM when he/she get the admission permit such as the area allowed to enter, time, etc.
4. The monitoring of the person shall be done by the guards (instructors) of waste pickers and he shall follow the instruction of them.
5. When the person exits the SMCDS, he/she shall write down the time of exit and return the admission card.
6. The person who will not follow such instruction shall be ejected from the SMCDS.
7. The admission shall be from 9:00 AM to 17:00 PM.



“3. Estimation of Proper Operation Cost for SMCDS”

This is the cost estimation calculated by the Team for proper operation of SMCDS. The Team explained PPWM the proper operation based on this cost estimation.

a. Introduction

a.1 Background

The “Technical Specifications for the Operation Works of the SMC Disposal Site” and the “Rule of the Stung Mean Chey Disposal Site (SMCDS)” were prepared by the Study Team. The cost for proper operation of the SMCDS, however, is not made. Since the SMCDS is the current disposal site and it receives more than 700 ton of waste a day, the shape of the site is changing day by day. Therefore, for the estimation of the cost for proper operation, it is necessary to establish requirements of proper operation.

a.2 Requirements of Proper Operation

The requirements of the proper operation for the SMCDS are established as follows:

1. Pushing, leveling, compacting and shaping the waste disposed of at the SMCDS in accordance with the Completion Plan of the SMCDS as shown in the Figure below.

2. Construction of at least **50 meters of on-site roads** as shown in the Figure below in accordance with the operation manual made by the Study Team.
3. Conduct of daily operation and maintenance works in accordance with the operation manual made by the Study Team.

The operator of the landfill, the operation contractor, shall at least fulfill the above-mentioned requirements.

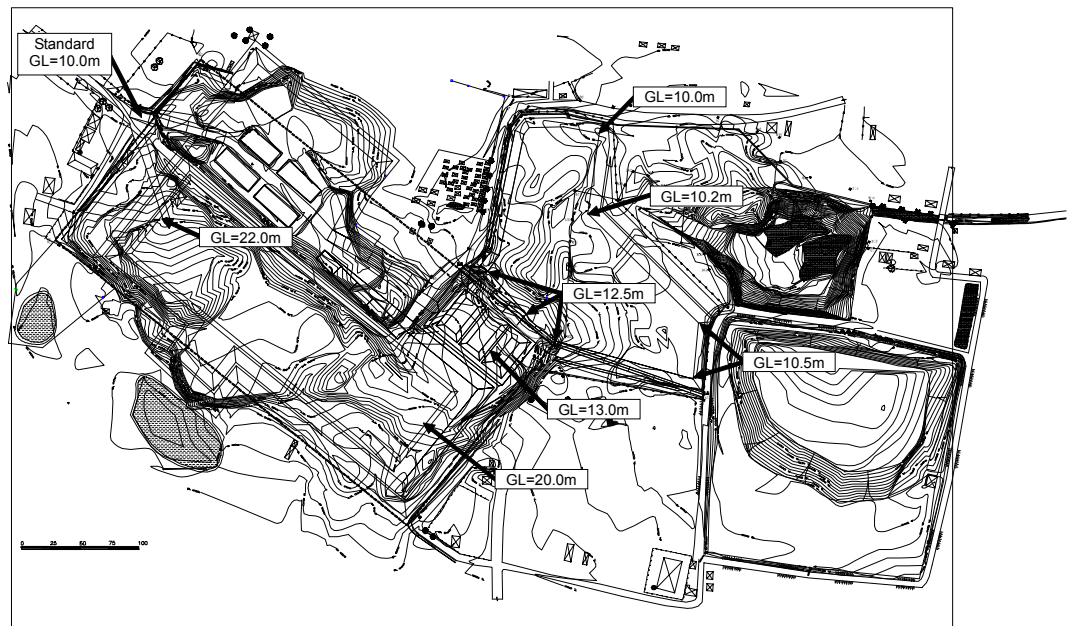


Figure 8-41: Completion Plan of the SMCDS

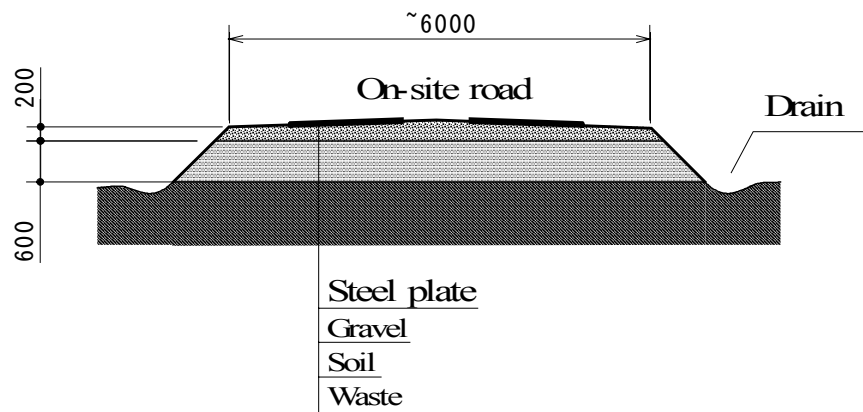


Figure 8-42: Typical Cross-Section Plan of On-site Road

b. Estimation of Proper Operation Cost

b.1 Requirements of the Heavy Equipment

The following heavy equipment is required:

1) A bulldozer for pushing and leveling waste:

This bulldozer shall be used for pushing wastes dumped at the working face and work for 24 hours. Therefore, the operation of it will be done by 3 shifts, three operators a day. Its net working rate is set as 50 %.

2) A bulldozer for compacting and shaping waste:

This bulldozer shall be used for compacting and shaping the wastes leveled by the above-mentioned bulldozer in accordance with the Completion Plan of the SMCDS. It will basically work for day time and 12 hours. Therefore, the operation of it will be done by 2 shifts, two operators a day. Its net working rate is set as 50 %.

3) An excavator:

The excavator shall be used for the following works:

- To construct on-site roads and working faces by moving and installing steel plates
- To maintain and repair on-site roads
- To constrict and maintain drains
- To fill and shape the wastes leveled by the above-mentioned bulldozer in accordance with the Completion Plan of the SMCDS

The excavator will be leased 10 days a month and work 8 hours a day. Its net working rate is set as 80 %.

4) A wheel loader:

The wheel loader shall be used for the following works:

- To move and get rid of wastes dumped on the steel plates
- To construct on-site roads and working faces by moving and installing steel plates
- To maintain and repair on-site roads
- To fill and shape the wastes leveled by the above-mentioned bulldozer in accordance with the Completion Plan of the SMCDS

The wheel loader will be leased 10 days a month and work 8 hours a day. Its net working rate is set as 80 %.

b.2 Requirement of Man Power

The following man powers are required:

1) For management

- A supervisor for the operation plan and control (permanent staff)
- Three permanent traffic controller (instructors for collection vehicles)

2) Operators for heavy equipment

- Three permanent operators for the bulldozer for pushing waste
- Two permanent operators for the bulldozer for compacting and shaping waste
- Three operators for excavator
- Three operators for wheel loader

3) Temporary labors for construction and repairing works

b.3 Bases of the Estimation

The operation cost was estimated based on the following data and conditions:

1) Labor cost table of RCC (Road Construction Center) below

No.	Position	Allowance		Remark
		Monthly	Daily	
1	Site manager	350	15	
2	Supervisor	300	10	
3	Accountant	250	8	
4	Foreman	250	8	
5	Mechanic	200	8	
6	Operator	150	6	

7	Driver	125	5	
8	Cooker	80	3	

2) Rental fee table of RCC

No.	Machinery		Rental price		Remark
			Monthly	Daily	
1.	Bulldozer	D7	3,550	244	Without allowance for operator
2.	Backhoe	0.7m ³	2,550	174	
3.	Wheel loader	16 ton	2,250	154	

(Note)

Fuel and lubricant will be supplied by the Client

All regular maintenance and repair cost will be paid by the Client.

Rental machinery shall be returned to RCC in reasonable condition.

3) Fuel consumption table of RCC

No.	Machinery		Consumption (liter/hour)
1.	Bulldozer	D7	28.50
2.	Backhoe	0.7m ³	17.00
3.	Wheel loader	16 ton	16.00

4) Maintenance/repair and lubricant cost is set as 20 % of rental fee

b.4 Proper Operation Cost

The proper operation cost is estimated as 25,300 US\$/month as shown in the table below.

Table 8-18: Proper Operation Cost

Item			Unit	Quantity	Unit Price (US\$)	Amount (US\$)
1 Labour cost						
Supervisor	8h/day x 30 day/month	MM	1.00	350.00	350.00	
Instructor	8h/day x 30 day/month	MM	3.00	125.00	375.00	
Labor	8h/day x 10 day/month (4 persons/day)	day	40.00	4.00	160.00	
Operator (Bulldozer)	8h/day x 30 day/month	MM	5.00	150.00	750.00	
Operator (Backhoe)	8h/day x 10 day/month	day	10.00	6.00	60.00	
Operator (Wheel loader)	8h/day x 10 day/month	day	10.00	6.00	60.00	
Sub-total						1,755.00
2 Machinery cost						
Bulldozer D7	D7	Month	2.00	3,550.00	7,100.00	
Backhoe	0.7m ³	day	10.00	174.00	1,740.00	
Wheel loader	16ton	day	10.00	154.00	1,540.00	
Sub-total						10,380.00
3 Fuel cost						
Bulldozer for pushing	D7	hour/month	360.00	14.25	5,130.00	
Bulldozer for filling/compaction	D7	hour/month	180.00	14.25	2,565.00	
Backhoe	0.7m ³	hour/month	64.00	8.50	544.00	
Wheel loader	16ton	hour/month	64.00	8.00	512.00	
Sub-total						8,751.00
4 Maintenance cost						
Bulldozer	D7	Month	2.00	710.00	1,420.00	

	Backhoe	0.7m ³	Month	1.00	35.00	35.00
	Wheel loader	16ton	Month	1.00	31.00	31.00
		Sub-total				1,486.00
5	Build of Tertiary road and Working face					
	Gravel & Soil	Gravel = 0.2m, Soil = Width = 6m	m	50.00	40.00	2,000.00
		Sub-total				2,000.00
6	Miscellaneous					
	Miscellaneous	---	%	3.8		978.00
Grand Total						25,300.00

“4. Technical Report for Problems Works of the Stung Mean Chey Disposal Site”

a. Background

a.1 Problems Caused by the Big Hole

The Big Hole, which is owned by Mr. Seng Sambo and being used as soil excavation pit, is causing the following problems on surrounding areas:

- Breakdown of the Drains: Drain 2 and Drain 3;
- Threat of collapse of Bank C;
- Danger of fallen down of the house; and
- Threat of landslide of the road of Mong Reththy Land

This report explains the background of the problems, studies causes of them and finally measures to be taken by the relevant authorities.

a.2 Rainwater Drainage System of SMCDS

a.2.1. Before the Excavation of Big Hole

The rainwater of the northern part of SMCDS (Stung Mean Chey Disposal Site) flowed down into the Boen Tompon canal passing through a natural stream existed on the Big Hole. However, the natural stream was cut down by the excavation of the Big Hole.

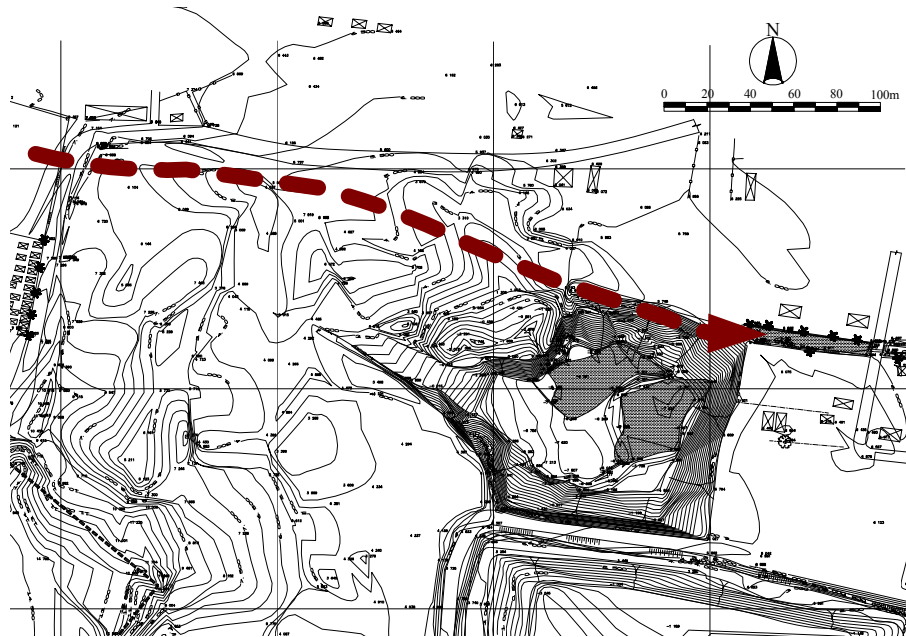


Figure 8-43: Rainwater Flow Before the Excavation of Big Hole

a.2.2. Before the Construction of Expansion Area; March 2003

The rainwater of the northern part of SMCDS and the surrounding area ran down into the Big Hole. The leachate generated in the northern part of SMCDS also flowed down into the Big Hole. As for the rainwater and leachate of the southern part of SMCDS was ran down into low land of the surrounding area and there is no discharge canal or stream existed.

The rainwater as well as leachate flows of the SMCDS before the construction of expansion area are illustrated in the Figure below.

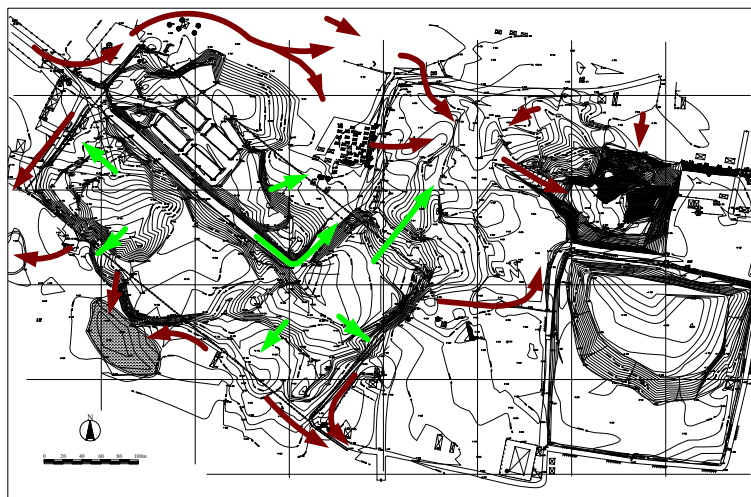


Figure 8-44: Rainwater and Leachate Drainage System of SMCDS Before the Construction of Expansion Area

a.3 Improvement Plan of SMCDS

a.3.1. First Improvement Plan of SMCDS; October 2003

Since large amount of rainwater and leachate flowed into the Big Hole, the Team prepared the first improvement plan of SMCDS as shown in the Figure below based on the rainwater drainage system before the construction of expansion area.

As shown in the plan, rainwater of the northern part of SMCDS and the surrounding area was planned to be discharged to an earth drain to be constructed along the enclosing bank of the expansion area. The earth drain was to be connected to the Boen Tompon canal. On the other hand, the leachate of the northern part of SMCDS was planned to be collected at the bottom of the Big Hole and pumped up from the pumping station to be constructed there to the leachate treatment ponds for treatment. After the treatment, the leachate is to be discharged into the earth drain mentioned above.

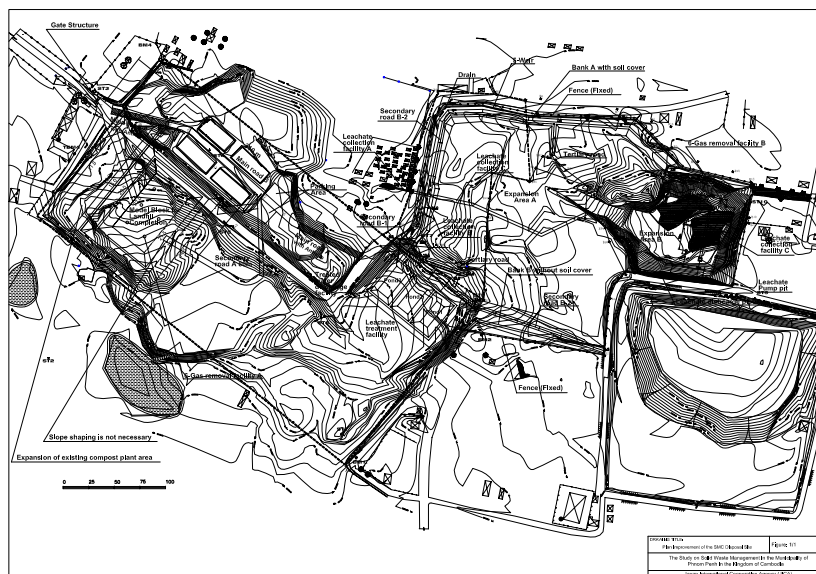


Figure 8-45: First Improvement Plan of SMCDS

a.3.2. Modification of First Improvement Plan of SMCDS; January 2004

(i) Dispute on the leased land for the expansion of the SMCDS

Based on the first improvement plan as shown in the above, the PPWM made lease agreement with the 10 landowners in total in the proposed expansion area. The PPWM made three land lease contracts on July 4 for the land of “A-1” and “A-2”, August 2 and August 20, 2003 for it of “B”, respectively (refer to Figure 8-46).

With the confirmation of three contracts, the Team completed the improvement plan including the development of the landfill expansion area and JICA approved and allocated a budget for the improvement of SMCDS.

Based on the improvement plan the Team made agreement with a local construction firm, SOM Corporation, Ltd. on October 13, 2003 and construction works commenced immediately after the agreement. However, from the commencement of the construction works, the Contractor received a lot of complains from the landowners, especially the owner of A-1 and A-2; Mr. Seng Sambo. In addition, the Contractor was often forced to stop his works by him with physical obstructions.

The Team often requested PPWM to solve the problems from the commencement of the work, i.e. mid-October, 2003. Although PPWM had many meetings with the landowners including boundary confirmation (the Team attended the boundary confirmation about ten

times), the obstructions by the landowner of A-1 and A-2 to the construction works were not ceased.

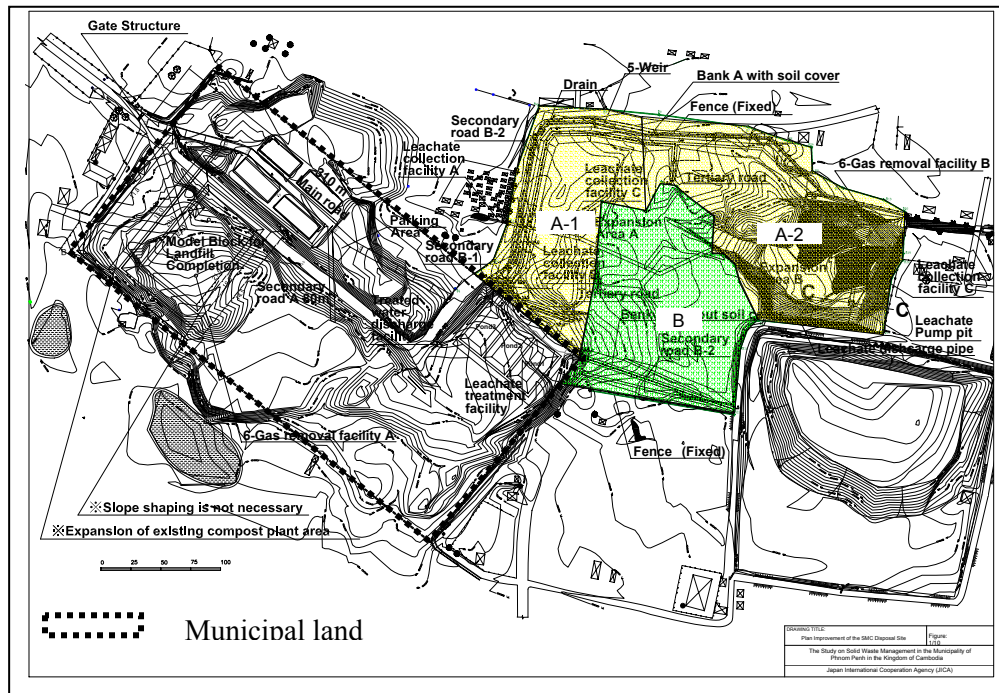


Figure 8-46: Land Ownership of the Expansion Area

Considering the above-mentioned background, the Team requested the Governor of Phnom Penh to finally solve the land dispute on December 31, 2003. Based on the order of the Governor, PPWM made meetings with the landowner of A-1 and A-2. Finally PPWM requested the Team to modify the improvement plan without the land of A-2 on January 5, 2004. Because it failed to get consent from the landowner for the use of the A-2 land.

In response to the request, the Team replied that if the following conditions were cleared it would make a modification plan for the improvement of SMCDS:

- All concerned parties (MPP, DPWT, PPWM, Khan, Sangkat and the landowner) make confirmation of boundary of leased land of PPWM; and
- The landowners confirm and agree the boundary of the leased land.

The above-mentioned conditions were cleared by the boundary confirmation meeting held at the site on January 8, 2004.

(ii) Cause of dispute

There seems to be many causes of the dispute and many of them the Team could not identify since the meetings and negotiations have been done by only concerned parties, MPP/PPWM and landowners. The Team, however, concludes that main cause of the dispute is unclear contract without a boundary map, especially regarding the clause I as below:

Clause I: “Party B” (the landowner, Mr. Seng Sambo) agreed to allow “Party A” (PPWM) to dispose waste in the pond land with the size of 200m x 100m until 4m high of waste heap, which is located: North is next to village road (Phlov Loum), South is next to waste heap, East is next to Oak’s land, and West is next to village road ((Phlov Loum).

Consequently, PPWM understands the leased land is A-1 and A-2 while the landowner allows only A-1.

(iii) Problems and countermeasures

The expansion of the SMCDS without A-2 land will cause serious problems as follows:

1. Discharge of treated leachate from the expanded landfill area
2. Discharge of rain water including waste water from surrounding area
A big excavated hole in the A-2 land, which is about 100 m width, 100 m length and 10 m depth, is not only the discharge point of the leachate from the SMCDS but also it of rain water as well as waste water from the following areas:
 - Some part of area along the access road to the SMCDS from the National Road; and
 - Some part of the residential area located in the north of the SMCDS
3. Need of an additional enclosing bank to clearly separate landfill area and the A-2.
4. Decrease of landfill volume

There are several options of countermeasures according to the problems. In order to set up the modification plan for the improvement of SMCDS, the Team provided a table below to discuss with MPP/DPWT/PPWM on January 12, 2004. With the discussion, MPP/DPWT/PPWM decided to take the following options:

Problem 1: Discharge of treated leachate and rain water

Alternative 1: To construct the drain in accordance with the improvement project plan

Problem 2: Need of an additional enclosing bank

Alternative 2: To construct a low bank by aged waste along the boundary of A-2 to prevent leachate intrusion into the A-2

Problem 3: Decrease of landfill volume

To use the emergency landfill area of MPP land. However the MPP/DPWT/PPWM will make continuous effort to get the permission of the A-2 landowner.

(iv) Modification plan for the improvement of the SMCDS

A modification plan for the improvement of the SMCDS is prepared as shown in the Figure 8-47. The implementation of the plan, however, is subject to the approval of the JICA Headquarters.

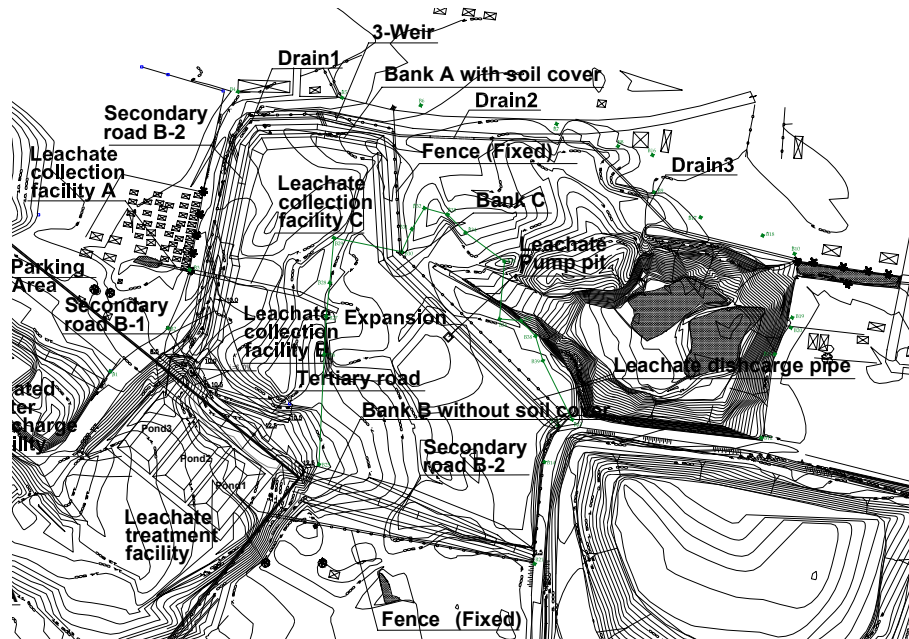


Figure 8-47: Modification Plan for the Improvement of the SMCDS

(v) Approval of JICA and Completion of the Improvement Plan

JICA was worried that the following problems may occur in the near future due to lack of A-2 site:

- Since the intrusion of leachate into A-2 land cannot be stopped by the implementation of the Modified Improvement Plan, especially through underground water, the landowner of A-2 land may oppose the MPP/PPWM.
- It is foreseen that in the rainy season the A-2 land will become a leachate and waste water (from surrounding area) pond as it was before the implementation of Improvement of SMCDS. This may also cause the A-2 landowner to oppose the plan.
- Although the expansion area with the A-2 land is estimated to dispose of 284,000 m³ of waste, without the A-2 land it is only 143,000 m³. Therefore, the SMCDS of the modified plan will not be able to receive waste until the end of 2007.

JICA, therefore, requested the MPP/PPWM to take the following measures:

- Deal with any complaints from the landowner by themselves using the evidence that shows the conditions of the site before the improvement. (Please refer to the attached photos; Change of A-2 Land Conditions)
- Heap up the municipal land of SMCDS (including the emergency landfill area) up to 8 m higher than the model block or facilitate the construction of the new disposal site.

The MPP responded to take necessary measures to overcome the problems that may occur without A-2 site as shown in [Appendix 1](#).

The modification plan for the improvement of the SMCDS was approved by JICA Headquarters in the beginning of February 2004. Then the plan has been implemented by the Contractor and completed on March 12, 2004.

b. Problems Caused by the Big Hole

Even after the leasing agreement made with PPWM on July 4, 2003, the landowner of A-2

continued to excavate soil at the Big Hole until mid-June 2004. The hole, therefore, has become bigger and deeper day by day. The excavation work was conducted even outside the land and over 15m deep. Due to such extraordinary excavation work the Big Hole is causing the following problems on surrounding areas:

- Breakdown of the Drains: Drain 2 and Drain 3;
- Threat of collapse of Bank C;
- Danger of fallen down of the house; and
- Threat of landslide of the road of Mong Reththy Land

b.1 Breakdown of the Drains

Drains, Drain 2 and Drain 3, which were constructed along the northern part of the Big Hole, were broken down as shown in the photos below.



Broken Drain 2



Broken Drain 3

b.1.1. Cause of Drain 2 breakdown

The causes of breakdown of Drain 2 are as follows:

- Land settlement; and
- Bulldozers of the landowner of A-2 land pushed the part of Drain 2.

b.1.2. Cause of Drain 3 breakdown

The land consists of **dispersive soil**, of which fine particle is easily flow out when the soil contains water and has place (in this case Big Hole) for flowing into. The dispersive soil flowed into the Big Hole and created small holes under Drain 3. Due to the emergence of the small holes part of Drain 3 sank and broke. This phenomenon also happened before the construction of Drain 3, causing part of the land collapse.

The same phenomenon is occurring at the opposite side of the Big Hole; i.e. the northern part of surrounding road of the land owned by Mong Reththy Group Ltd. This road is being threatened to land slide.

b.2 Collapse of Bank C

b.2.1. Situation of collapse

According to the extraordinary excavation by the land owner of A-2, collapse of the Enclosing Bank C was caused at around 12: 50 on the 30th of September, 2004.

The collapse broken out in an instant duration at the point approx. 70m form the north end of the Bank-C of which length is 200m. The waste used for bank and leachate flew into the Big Hole. Nobody is injured in this accident.

The drainage canal constructed along Bank-A was blocked off artificially at the north end of the Bank-C and there is a trench excavated on the top of Bank to lead the pooled leachate and

rain water to the expansion area.

The upper portion of Bank-C was fallen down just under the original position as if the bottom of bank was scooped out.

The pump installed in the expansion area was functioning.

There are many small collapses on the slope of the burrow pit.



Scene of the Bank-C collapse from inside of the expansion area



Scene of the Bank-C collapse from the Big Hole side



Edges of the collapse



Drainage canal was blocked off artificially



Trench on the Bank for leading water and leachate to the expansion area

b.2.2. Examination of the Cause of Collapse

JICA Study Team examined the cause of collapse of Bank-C as follows.

(1) Reduction of the stability by the excavation at the toe of the Bank-C

Construction of the Banc-C was commenced in January, 2004 and completed on the 8th of March, 2004. Bank-C was planned to be located in the land B keeping distance from the boundary of A-2 considering the followings.

- (1) To reduce an impact of excavation in the adjacent soil excavation pit
- (2) To avoid that Bank-c make the boundary obscure
- (3) To use the original ground being shaped a ridge on the boundary, as a support and impervious zone

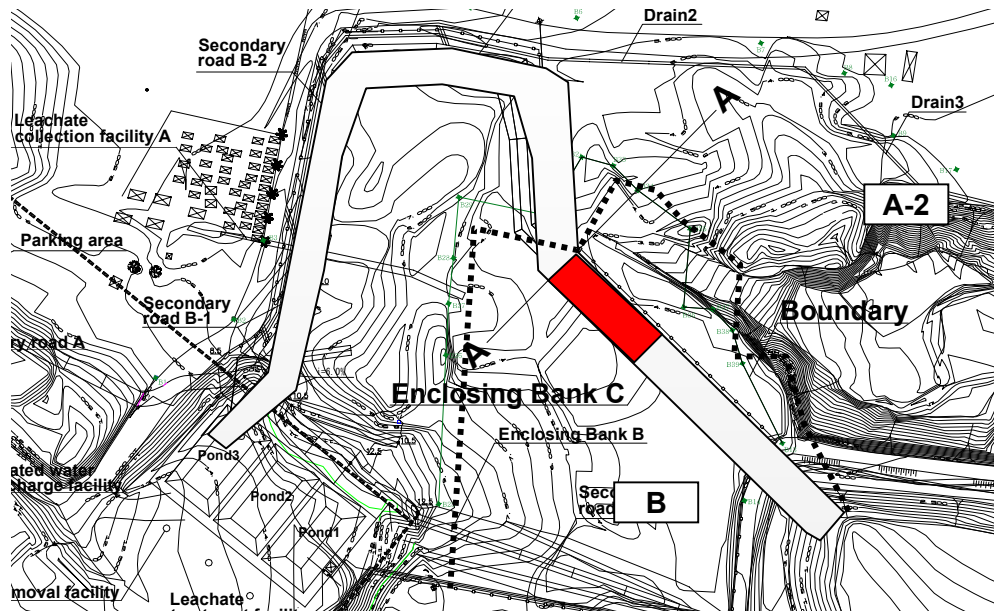



Figure 8-48: Location of the Collapse of Bank-C

At the beginning of the construction works, the pooled water in the Big Hole which was estimated as 200,000m³ was drained to construct the banks. Mr. Seng Sambo, the owner of the excavation pit, restarted to excavate the soil by the boundaries with the surroundings after the water had been drained. It excavation made a serious situation of the land collapse in everywhere along the boundaries. Especially, the house stands on the edge of the east side slope of Big Hole and the maintenance road of the burrow pit of Mong Rethy group are in face of danger of land collapses. He started to excavate the remaining soil which was kept as a support and impervious zone of Bank-C beyond the boundary of his property disregarding the notice given by PPWM.

Before Improvement (September 24,2003/10/05)	
	<p>Aerial photo of the Big hole before commencement of the pilot project for improvement of the SMC disposal site.</p> <p>Rain water and leachate pooled in the Big hole.</p>

After Improvement (March 8, 2004)	
	
	<p>Dike C just after completion of the construction There was an original ground beside of the embankment</p>
Before collapse (September 17, 2004)	
	
	<p>Half month before the collapse The original ground along the boundary between B and A-2 has been taken by the landowner of A-2.</p>

Accordingly, the bank structure, which the aged waste was filled up on the southern slope of the ground, lost a support so that the underneath might be pushed out by the raised water pressure in a moment of time. The vertical dropping of the top of Bank-C proofs this mechanism of collapse.

b.2.3. Conclusion

It is obvious that the weakening of the base of dike caused collapse of Bank-C. The following figure shows the mechanism of the collapse.

The source of weakening of the base is the abnormal excavation done by Mr. Seng Sambo disregarding the several notice given by PPWM. This abnormal excavation causes not only the collapse of Bank-C but also collapse of the north, east and south sides of borrow pit. These collapse damaged the drain had been installed by JICA ST and the brick wall of house located east side.

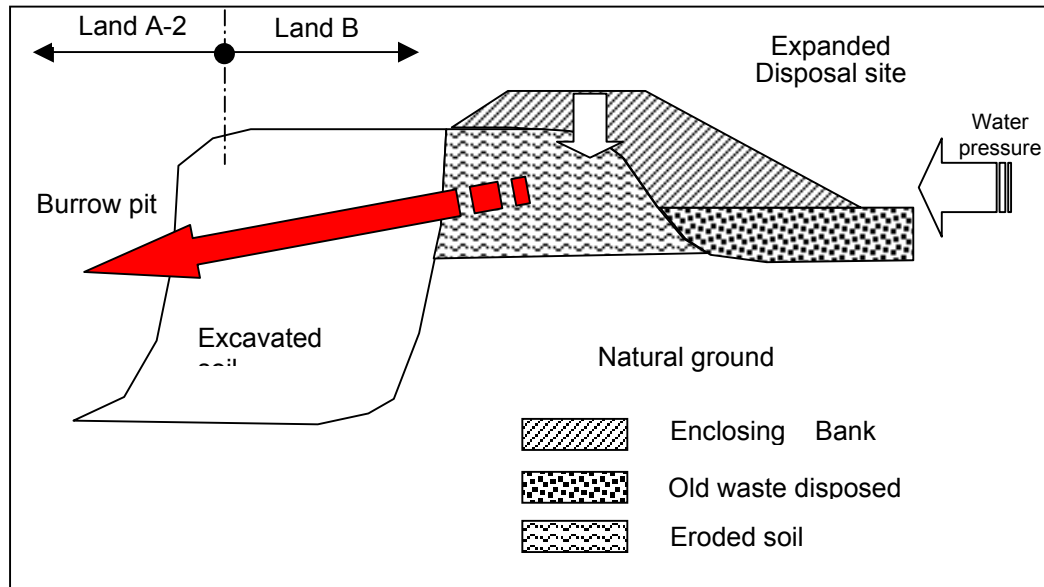


Figure 8-49: Mechanism of the collapse of Bank-C

b.3 Other Problems

b.3.1. Danger of Fallen Down of the House

As shown in the photos below, the house stands on the eastern edge of the Big Hole is in the Danger of fallen down. Apparently this is caused by the extraordinary excavation by the land owner of A-2 and rainfall increases the danger day by day.



House under the Threat of Fallen Down (1) House under the Threat of Fallen Down (2)

b.3.2. Threat of Landslide of the Road

As mentioned in the Section 2.1.2, the dispersive soil (of the northern part of surrounding road of the land owned by Mong Reththy Group Ltd.) flowed into the Big Hole and created

small holes under it. There are many holes emerged on the surface of the road and under it bigger holes are being created by rainwater. Absolutely the road is under the threat of landslide. In fact the part of the edge of the road has been collapsed already.



Holes Emerged on the Road Surface



Edge of the Road Collapsed

b.4 Conclusions

The Team concludes the cause of the problems as follows:

1. Extraordinary excavation of the land A-2 directly or indirectly caused all problems. The excavation work not only violated the safety regulation but also beyond the ownership of the A-2 land.
2. The **dispersive soil**, of which the surrounding area contains in its part of geological profile, makes the problems more serious.
3. The urgent measures, to stop excavation, caution to the surrounding residents and protect the slopes of the Big Hole, shall be taken by the relevant Authorities.

8.3 Improvement of Waste Collection System

An improvement of the waste collection needed to realize the M/P is to establish the collection system for unserved or insufficient service area and to strengthen the collection capacity of the MPP/PPWM.

Most of the unserved area and insufficient service area is inaccessible area. The team conducted the pilot project to verify the practicability of the container collection system investing one skip loader truck and 10 of 5 m³ containers and the fee collection system involving sangkat and phum offices in the 2nd phase study.

In the 3rd phase study, PPWM has conducted the pilot project to expand collection service to the unserved and insufficient service area by using the existing vehicles. Through his pilot project, PPWM practiced doing every kind of activities required for the service provider instead of CINTRI and continues now.

8.3.1 Introduction of Container Collection System

c. Outline of improvement plan

c.1 Expansion of waste collection service using containers

Kongkea Pos and Boeung Salang (1 and 2 in Figure 8-50) are typical low income areas in Phnom Penh. There, the collection method combining primary collection by pushcart and secondary collection by container was attempted.

The NIP area in Khan Chamkar Mon is 800m east-west and 200m north-south. The northern half is part of Sangkat Bengkengkong 1 and the southern half is part of Bengkengkong 2. In the NIP area where primary collection is established, waste is collected by SHGs and brought to the recycling center for separation. However, as the recycling center is located near the northern end of the NIP area, the hauling distance from the southern end is long, approximately 1 km, and low collection efficiency is a problem. Therefore, the study team tried to increase work efficiency by placing containers in the southern section, Bengkengkong 2 to reduce the haulage time of the SHGs. The team also placed containers along the canal running north-south in the eastern part of the NIP area in an attempt to reduce waste heaps and the dumping of waste in the canal.

c.2 Separate collection

A trial of separate collection dividing compostable waste from non-compostable waste was carried out targeting the 200 households in Bengkengkong 2.

c.3 Establishment of fee collection system

A fee collection system by Sangkat was introduced in the Kongkea Pos and Boeung Salang areas where the waste collection service was newly provided.

Table 8-19: Outline of Target Areas of Trials

Target Area	Introduced Collection System	Description of Target Area
Konkea Pos, Sangkat Toul Sangke, Khan Toul Kork	Primary collection + container collection	Part of Sangkat Toul Sangke located on the outskirts of the northwestern part of the four urban khans. The households along route 598 receive CINTRI's waste collection service but the 263 households targeted in this improvement do not receive the service.
Village 14 in Boeung Salang, Khan Toul Kork	Primary collection + container collection	This village is part of Sangkat Boeung Salang adjacent to the new drainage canal. It is necessary to improve the narrow roads in order to carry out primary collection. There are approximately 113 household within the area.
Bengkengkong 1, 2 Khan Chamkar Mon	Primary collection + container collection	About half of the NIP area collection area under control of PPWM is targeted. 2,000 households are targeted.
Bengkengkong 2 Khan Chamkar Mon	Separate collection	One section of the NIP area collection area under PPWM's control. 200 households are targeted.

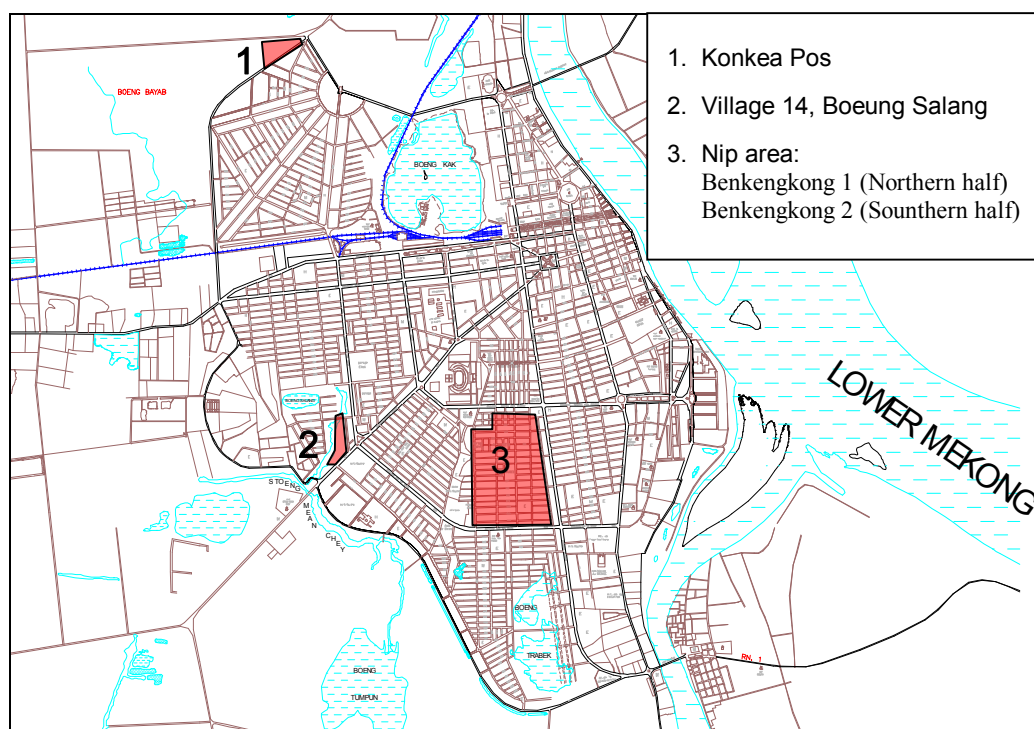


Figure 8-50: Location Map of target Area for Collection Trial

d. Findings

d.1 Establishment of primary collection

In the Kongkea Pos and Boeung Salang areas, as in many of the unserved areas, the alleyways and passages are narrow and unpaved, which make waste collection by pushcart difficult or impossible. The study team first conducted a survey in the area to measure the layout and width of the alleyways. They then carried out paving work including widening of some of the roads so that pushcarts could pass. The study provided material for the work, such as aggregate and cement, and the residents provided man power.

Table 8-20: Road improvement in the PP area

Target Area	Length of paving(m)
1. Kongkea Pos	884
2. Boeung Salang	528

For primary collection, three former waster pickers were organized into a Self Help Group (SHG) with the cooperation of CSARO, and they provided the collection service to the Kongkea Pos and Boeung Salang areas at a rate of 0.3US\$/household/month by direct contract with PPWM.

According to the questionnaire survey targeting the residents after the start of the trial, a large number of residents were satisfied. The payment rate of the fee, described later, in the first collection was 89% in Kongkea Pos and 82% in Boeung Salang, which is proof of their satisfaction.

d.2 Effectiveness of Container Collection

By placing containers in the unserved area, the waste heaps disappeared and the view and foul odor in the surrounding area were improved. There was also a drastic decline in illegal

dumping in the area. Furthermore, in addition to primary collection, there were also residents who directly brought their waste to the containers. Container collection proved to be an effective system for expanding the collection service to unserved areas that are difficult to access.

By placing containers in the NIP area, the hauling distance from the southern area was shortened, thereby reducing the work time of the SHGs. As for recycling, although the SHGs tried to recover valuable materials before loading waste into the containers and gather them at the recycling center, the amount of recovered valuables at the center decreased.

d.3 Placement of containers

As for the placement of containers(5m³), based on the discharge rate of 487g/person/day and in consideration of the income level in the target area, one container per 340~440 households was planned. Soon after the collection began, the amount of waste discharged in both Kongkea Pos and Boeung Salang was greater than originally estimated. In Kongkea Pos in particular, one container was not sufficient so a second container was placed as an emergency measure. Three days later it went back to one container. The initial excess of waste was thought to be due to the fact that when the proper discharge site was provided nearby, the residents disposed of all the waste that had collected in their homes at once.

In the NIP area, at first the waste amount was as expected and the container system was going smoothly. However, a couple of weeks after the start of the trial, the waste amount increased and the containers were overflowing. The reason is thought to be because in the areas surrounding the NIP area, waste is not collected by CINTRI three days a week, on Saturday, Sunday and Monday, and the uncollected waste is brought to the containers in the NIP area by small size trucks and bike carts.

d.4 Problems with the container system and measures

About two weeks after the start of the trial, the area surrounding the containers was littered with waste. This was due to the fact that the amount of waste transported from outside the target area was greater than expected and some of the residents did not properly place their waste in the container. As an emergency measure, the study team, through PPWM, requested the SHGs to keep the container area clean and requested the Sangkat to try to stop waste from being brought in from outside the target area. As a permanent measure, it is necessary to teach proper discharge practices through public education. Furthermore, container ownership is a problem, and it is necessary to examine community based activities to clean up the container area.

d.5 Effectiveness of separate collection

The discharged waste was assorted into two kinds, wet and dry. By introducing separate collection, the amount of compostable waste recovered per person per hour at the recycling centre was 7.6 times greater, and the amount of valuables recovered from the dry waste was 6.8 times greater. However, some of the households that used to give all their waste to the SHGs are now selling the valuable materials directly to recycling companies. Although this not desirable for the SHGs, in view of solid waste management as a whole, it can be said that citizens are now taking part in recycling activities.

e. Fee collection system

Regarding the fee collection system that was introduced, PPWM prepares the bills and the Sangkat collects the fees and pays PPWM. PPWM gives back 10% of the fees collected to the Sangkat to as a service charge.

In order to get the fee collection system started, the study team held a meeting for the Sangkat and community representatives to explain the system and the basis of the fee.

Before starting the collection trial, an explanatory meeting was held for the residents, and the residents understood that those who would receive the service had to make a service agreement with PPWM and pay the fee every month.

The first collection of fees was conducted in January 2004. As seen in the results shown in the table below, it appears that the consensus of most residents has been obtained.

Table 8-21: Results of Fee Collection (January 2004)

Target area	No. of households	Expected amount collected (US\$)	No. of households that paid	Actual amount collected (US\$)
Kongkea Pos	263	294	261(99.2%)	261.0(88.7%)
Boeung Salang	113	125	101(89.3%)	101.6(81.3%)

The average fee collection rate in subsequent half year was 82% as shown in the below figure. Therefore, this verified that the fee collection system with Sangkat was feasible.

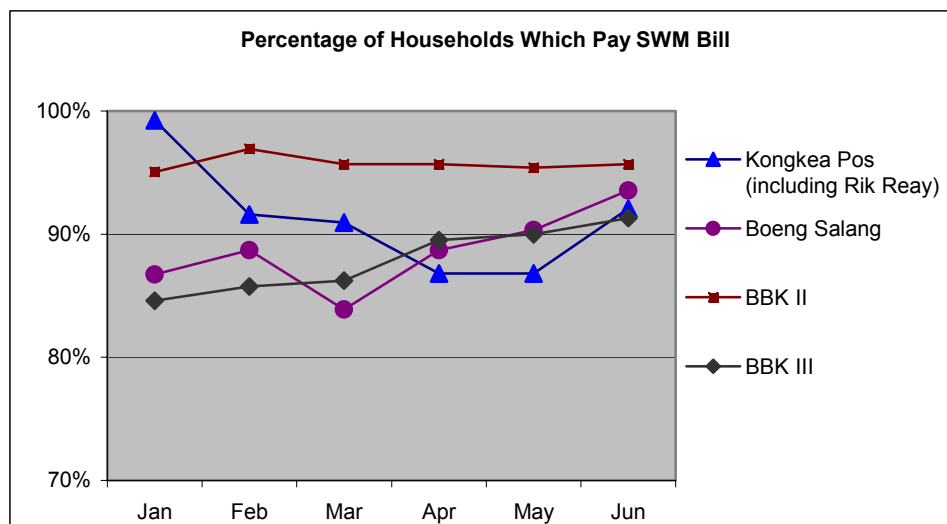


Figure 8-51: Fee collection rate

8.3.2 Collection Service Expansion

a. Outline of the Pilot Project

PPWM and the team selected 4 candidate sites in which unservices and insufficient service areas were located for the pilot project expanding the service based on the results of the pilot project conducted within the rural 3 Khans in the 2nd phase study. Subsequently, PPWM requested CINTRI to agree to conduct the pilot project in these three sites. But CINTRI proposed to exchange 4 Sangkats, where the selected candidates sites were located, for NIP area and Boeung salang area in which PPWM was continuing the pilot project from the 2nd phase study. Accordingly, MPP/PPWM agreed the CINTRI's proposal and could implement the pilot project to expanding service area.

a.1 Plan of Collection

(1) Pilot project area and customers targeted

The area of the pilot project, of which population is 88,902 in 2003 (75% of total population) is shown in the Figure 8-51.

The targeted customers will be the one who are receiving CINTRI's collection service as of now. PPWM and the Team collected the customer's data in the 4 Sangkats in cooperate with Sangkat office and Phum. According to the data collected, the targeted number of the customers is 6,314 as shown in the table below. Therefore, it is not confirmed whether these number of customers received the service given by CINTRI as of now.

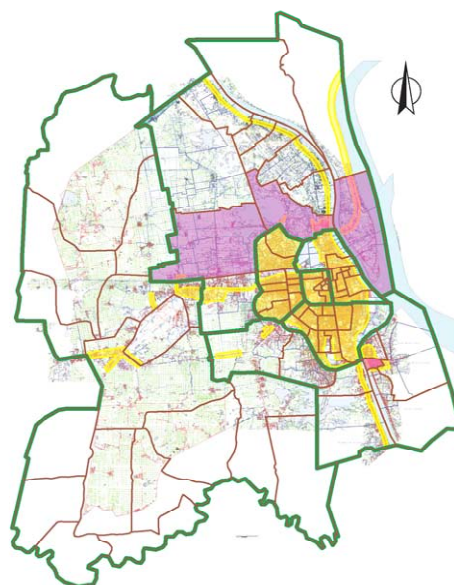


Figure 8-51: Pilot Project Area

Table 8-22: Area and Population of the Project area (in 2003)

Local Authority		Area	Population
Khan	Sangkat	(Km ²)	(Person)
Mean Chey	Chbar Ampov Muoy	0.49	12,053
Russey Keo	Toul Sankae	2.76	30,773
Russey Keo	Phnom Penh Thmei	20.55	25,844
Russey Keo	Chrouy Changva	9.62	20,232
Total		33.42	88,902

Table 8-23: Number of Customers informed by Sangkats

		Chba Ampov 1	Chroy Changva	Phnom Penh Thmey	Toul Sangke	Total
Households	Total	1245	2465	3168	4159	11037
	Within Service Area	1150	1849	345	2074	5418
Restaurants	Total	9	49	7	17	82
	Within Service Area	9	24	3	10	46
Shops	Total	113	127	59	624	923
	Within Service Area	113	69	20	400	602
Offices	Total	4	2	9	1	16
	Within Service Area	4	2	3	1	10
Accommodation Facilities	Total		50	24	651	725
	Within Service Area		21	10	194	225
Factories	Total		2	18	33	53
	Within Service Area			3	4	7
Markets	Total		2	1	2	5
	Within Service Area			1	1	2
Medical Facilities	Total		1			1
	Within Service Area					-
Schools	Total		13	5	4	22
	Within Service Area			2		2

Public Facilities	Total		3	1	4
	Within Service Area				-
TOTAL	Total				
	Within Service Area				6,314

Upper: Whole sum, Lower: CINTRI service receiver

(2) Targeted collection amount

Targeted collection amount was estimated based on the number and kind of customers informed by Sangkats.

Table 8-24: Targeted Collection Amount in the Service Area

Customer Type	Chba Ampov I	Chroy Changva	Phnom Penh Thmey	Toul Sangke	4 Sangkats Total
Household	3.22	5.18	0.97	5.81	15.17
Restaurant	0.14	0.77	0.05	0.32	1.28
Shop	0.51	0.31	0.09	1.80	2.71
Office	0.01	0.01	0.01	0.00	0.04
Accommodation Facility	0.00	0.07	0.04	0.68	0.79
Factory	0.06		1.50	2.72	4.28
Market			0.60	3.00	3.60
Medical Facility					
School			0.15		0.15
Public Facility					
Total	3.95	6.34	3.40	14.33	28.02

(3) Collection vehicles owned by PPWM

PPWM has four types of collection vehicles, 4 Compacter trucks, 1 skip loader and 10 communal containers (5m³).



Skip loader truck with 5m³ container



Compacter truck 4m³



Compacter truck 18m³



Compacter truck 4.5m³

Figure 8-52: Collection Vehicles owned by PPWM

(4) 1st Collection plan

A frequency of collection service is planned as 3 days a week for residential area and everyday for commercial area basically. Assuming the type of vehicles and number of trips, PPWM and the team estimated the maximum collection capacity as Table 8-25. However, the targeted collection amount is comparatively smaller than this capacity, it considered the breakdown, traffic accident, increased waste in the festival, new customers and expansion of the service area.

Table 8-25: Collection Capacity of PPWM

Area	Vehicle	Vehicle Capacity	Collection Plan	Collection Capacity
		Ton/trip	trip/day	ton/day
Tuol Sangke	Compactor Daewoo (01)	9.6	2	19.2
	Skip Loader (05)	1.2	6	7.2
Chbar Ampov I	Compactor hiroshima (03)	2	3	6
Chroy Changwar	Compactor Laterday (02)	2.7	2	5.4
	Compactor hiroshima (03)	2	1	2
Phnom Penh Thmey	Compactor hiroshima (04)	2	2	4
TOTAL			16	43.8

(5) Implementation Schedule

According to the agreement with CINTRI, commencement of the service for 4 Sangkats was set on the 15th of September, 2004. PPWM had a explanatory meeting with Sangkat and its people, made the service agreement with the customers, employed new driver and workers and trained them before the commencement.

Table 8-26: Implementation Schedule

Items	Jul.	Aug.	Sep.	Oct.
Agreement between MPP and CINTRI		■		
Customer Data Collection	■■■■■■■■■■			
Detail Collection Planning		■■■■■■■■■■		
Agreement with Sangkat		■■■■■■■■■■		
Service agreement with Customers		■■■■■■■■■■	■■■■■■■■■■	
Preparation of the vehicle depot		■■■■■■■■■■		
Preparation of the maintenance facility		■■■■■■■■■■		
Recruit new staffs		■■■■■■■■■■		
Purchase tools and materials		■■■■■■■■■■	■■■■■■■■■■	
Training staff			■■■■■■■■■■	
Implementation of the collection service			■■■■■■■■■■	■■■■■■■■■■

a.2 Action taken by MPP/PPWM

(1) Secure the initial fund

PPWM and the team estimated 13,000 US dollar as a initial budget necessary for the first 6 weeks management to provide collection service to the 4 Sangkats. This amount included personnel expenses including new employees, training fee, maintenance cost and fuel etc. PPWM requested to allocate this budget, and MPP supplied this fund by September, 2004.

(2) Secure the land for vehicle maintenance and depot

PPWM has 5 units of collection vehicles but does not have the maintenance facilities and depot. To provide a reliable collection service, these are indispensable.

Therefore, MPP/PPWM decided to park the collection vehicles in the Waste Pickers Multi Purpose Center (WPMPC) constructed by the JFPR project in the SMC disposal site temporarily for the moment and prepare the facilities in the open space next to the SMC disposal site office.

b. Findings

b.1 Collection amount

PPWM has collected waste as shown in the below table within 2.5 month from September 15, 2004. The reason why the waste collected in Toul Sankea in September was large amount in spite of half month operation, illegal waste heaps were removed through the cleansing campaign conducted at the beginning of the service. And the collection amount in Chroy Changvar and Toul Sangkae facing to the river in November was large because of the water festival.

Collection amount in October was 32.2 ton per day, which exceeds the planned amount by 4 ton and this was equal to 74% of the current collection capacity of PPWM.

Table 8-27: Waste Amount Collected in 4 Sangkats (Weighbridge data)

Sangkat	September, 2004			October, 2004			November, 2004		
	trips	ton/m	ton/day	trips	ton/m	ton/day	trips	ton/m	ton/day
Toul Sangke	121	543.7	36.2	171	649.2	21.6	196	708.8	23.6
Chroy Changvar	38	99.4	6.6	58	158.2	5.3	58	597.7	19.9
Phnom Penh Thmey	14	34.3	2.3	28	65.2	2.2	15	57.5	1.9
Chbar Ampov 1	15	36.5	2.4	33	94.0	3.1	42	108.6	3.6
Total	188	713.9	47.6	290	966.6	32.2	311	1,472.6	49.1

Note: Collection service was started from the 15th of September

b.2 Management of collection equipment

2 compacter trucks out of 5, which are 18 m³ and 4.5m³ compacter trucks, broke down so frequent that the remaining 2 units of 4m³ compacter trucks covered these troubles. However, it was expected situation because these two compacter trucks were old, but PPWM has been managing the vehicles well without stopping the service.

PPWM equipped all the vehicles with radio for emergency such as breakdown and accident, and established the communication system to give the instruction to change the collection route anytime.

However, the overage vehicles are big size, covering by small vehicle is not effective. Replacement of the collection vehicles is required urgently.

b.3 Number of customers and fee collection

The number of customers agreed with PPWM, contracted amount and the fee collected as of the end of November, 2004 are shown in the below table. PPWM explained the cause of low fee collection rate, which was about 58%, why the teamwork between PPWM and Sangkats

was not working smoothly and some customers did not pay the fee. PPWM will launch a public education campaign to raise the fee collection rate in cooperation with Sangkat office in December, 2004.

Table 8-28: Number of Customers, Contract Amount and Collected Amount (End of Nov. 2004)

	Agreement		Fee collected	
	Customers	US\$	Customers	US\$
Toul Sangke	2,301	4,338.50	1,334	2,094.90
Chroy Changvar	305	892.20	65	418.80
Phnom Penh Thmey	193	362.50	22	151.00
Chbar Ampov 1	1,052	1,471.25	811	1,192.50
Total	3,851	7,064.45	2,232	3,857.20

Data source: PPWM record issued on 8 Dec., 2004

b.4 Emergency measures

One traffic accident occurred within these 2.5 month operation. 18 m³ compactor truck touched with a trailer truck on the 16th of November, 2004. However, 2 workers got a scratch, the compactor truck was not necessary to be repaired.

In this accident, the driver sent the workers to the hospital according to the emergency manual prepared by the team. Therefore, PPWM warned this driver to fire if he would cause an accident again.

8.4 Public Education Campaign

8.4.1 Background

In the center of Phnom Penh, the population density is considerably high and a large amount of waste is generated and discharged every day. On the other hand, public awareness of solid waste management is low and discharge manners in many areas are not appropriate, while neither a collection service provider nor MPP provide enough instruction on when, where and how waste should be discharged to local residents. In addition, the collection efficiency is low due to old equipment and inappropriate discharge manners. As a result, there are various problems such as scattered waste left on the street after waste is collected, waste heaps in many parts of the city and offensive odor caused by waste.

The improvement of the collection service by a collection service provider is essential. It is, however, impossible to realize improvement of the whole collection system without increasing public awareness and improving their discharge manners. Therefore, it is important for MPP to increase public awareness and to promote public participation in solid waste management systems in order to solve the above mentioned problems.

In MPP, DOE is the organization responsible for increasing public awareness and promoting public participation, but so far DOE has had no experience but a public campaign. In carrying out the campaign, DOE urged people to clean the city but did not provide specific instructions on how to discharge waste, consider how to promote public participation, or examine modifying the collection system. As a result, the campaign ended without a significant achievement.

In the proposed master plan, the JICA study team proposed discharge rules. In order to examine the effect and applicability of these rules, the study team decided to initiate an experimental project to introduce the discharge rules as a pilot project in the third phase of the study, in consultation with MPP.

Since DOE has little experience in promoting public awareness of solid waste management systems, the team decided to introduce the discharge rules in a small area, rather than in the whole city, selecting a typical place mixed with residential and commercial areas in the center of the city.

8.4.2 Outline

a. Goals of the project

The project aims at cleaning up the city, in particular the waste heaps in a typical residential area mixed with a commercial area with a high population density, by introducing waste discharge rules in cooperation with local authorities and residents. It was imperative for DOE to increase public awareness and promote public participation in order to introduce the discharge rules smoothly. Therefore, enhancing the capabilities of DOE to increase public awareness through PP was also an important purpose of the project.

b. Project Sites

Since the center of the city with a high population density has more serious problems, possible target areas were (1) a large-scale housing complex with a few hundred households or a group of apartments which share a common space as waste discharge points, (2) an area mixed with residences and small shops, and (3) a market area.

Based on these criteria, DOE selected several candidate sites, and the team chose a building block in Sangkat Monorom shown below.

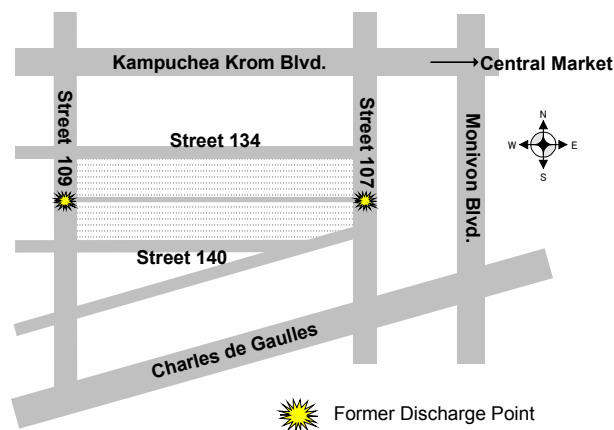


Figure 8-53: Project Site in Sangkat Monorom

Inside the building block, there is an alleyway connecting Street 107 and 109, and along the alleyway there are more than three hundred households and business establishments as well as dozens of street vendors. Before the pilot project, the discharge points for those who live along the alleyway were at the intersections with Street 107 and 109. There were always large waste heaps at these discharge points, as shown in pictures below.



On Street 107



On Street 109

In addition, based on a request by CINTRI, an area in Sangkat Boeung Trabek, a typical residential area with one or two story houses in the suburb of Phnom Penh, was selected as another project site. Before the pilot project, CINTRI collection workers faced problems caused by large waste heaps at the both sides of the bridge over the canal.

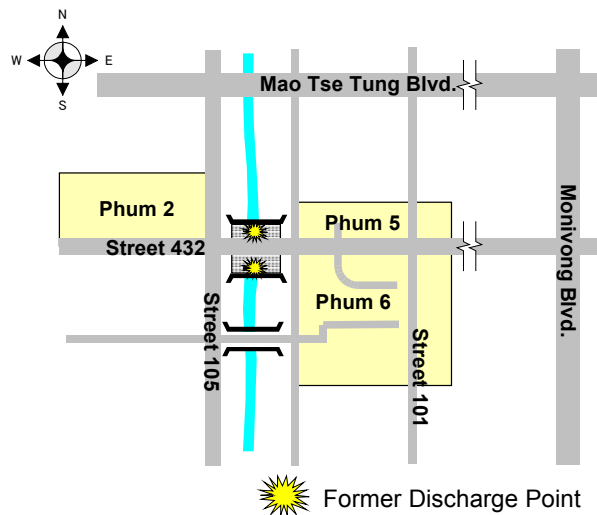


Figure 8-54: Project Site in Sangkat Boeung Trabek

In the first plan, the target area was only Phum 6 in Sangkat Boeung Trabek. However, the results of the observation survey revealed that other people living along Street 105 and Street 432 also discharged their waste at the waste heaps. Therefore, the target area was expanded to Phum 2 and 5 along the Street 432 and 105.



c. Consensus Building (Establishment of Working Group)

Ordinary Cambodian people are not familiar with basic social rules in general. Therefore, in order to introduce discharge rule smoothly it is necessary to build a broad consensus about

discharge rules with local residents and business establishments and to spend enough time to make them understand the discharge rules clearly.

For the establishment of a broad consensus and close cooperation among all stakeholders, the team proposed to establish a working group including representatives of local residents and business as well as local authorities and CINTRI, so that all the stakeholders can meet regularly to exchange opinions and reflect their opinions in the discharge rules. The team asked environmental NGOs to participate in the process as observers.

Participants of the working group:

- JICA study team
- DOE (MPP)
- Collection service company (CINTRI)
- Local authorities of project sites
- Representatives of local residents and business establishments in the project sites
- Environmental NGOs

All the important issues such as the content of discharge rules were finalized at the working group meetings.

8.4.3 Procedures

The procedures of the pilot project are summarized below.

a. Baseline survey

In order to find an appropriate approach, it is necessary to grasp the level of public awareness of solid waste management, current solid waste management exercised by local residents (e.g. how to store and discharge waste), family structure, and lifestyle, as well as the total number of households, population density, share of residences/business establishments, and so on. The team conducted an interview and observation survey, as well as a documentary search, in order to obtain the following information:

- Number of residents, households and business establishments
- Average discharge amount per household or business establishment
- Actual conditions of storing and discharging waste by average households
- Current conditions of collection system

a.1 Interview Survey

To obtain information on awareness level and waste storage and discharge manners, a simple interview survey with questionnaire was conducted. The questionnaire was divided into six parts: 1) public awareness, 2) waste generation and storage, 3) waste discharge manners, 4) recycling activities, 5) public cooperation, and 6) about the interviewees. Samples were selected randomly. In some cases, the interviewees were asked to see their kitchens and how they store their waste.

The same interview survey was conducted about two months after the start of the discharge rules so that the results of both surveys could be used to assess the effect of the project.

a.2 Observation Survey

At the former discharge points, the team observed who discharged waste and how they discharged waste, while shooting videos and photos, in order to understand the details of current conditions. The videos and photos were utilized later in the educational materials both for environment authorities and local residents.

b. Establishment of Working Group

In order to build a broad consensus among all stakeholders, a working group was established to discuss the discharge rules and to reflect their opinions in the discharge rules. Working group meetings were arranged regularly every week or second week, and the contents of discharge rules as well as the leaflets and posters were decided on at the meetings.

c. Modification of collection systems and establishment of waste discharge rules

At the working group meetings, local authorities and representatives of local residents complained about CINTRI's collection systems and requested that they be changed. The team recognized the necessity of modifying the collection systems, and the team and CINTRI discussed how the collection systems were to be modified, considering the requests from local authorities and residents.

Based on the discharge rules proposed in the master plan and the result of the baseline survey, a draft of waste discharge rules was formulated by the team, and finalized through discussions at the working group meeting.

The final discharge rules were decided on after meeting with CINTRI and DOE.

Contents of the discharge rules

- to designate discharge points
- to designate the discharge time
- to instruct how to store and discharge waste
- to put a ban on bringing waste to outside area (all the households should discharge their waste in their residential area)

d. Organizing Community Meetings

Before finalizing the discharge rules, community meetings were arranged to explain the draft discharge rules to local residents and to exchange opinions about the proposed rules, in particular discharge points. Since the most difficult issue in the discharge rules was the location of discharge points, at a community meeting in Monorom, the team showed three possible ideas and selected one based on the opinion of participants.

e. Preparation of public education materials

In order to realize the waste discharge rules, all the stakeholders should share a basic idea of why discharge rules are necessary and understand the contents of the rules clearly. Therefore, the team prepared educational materials such as a series of three leaflets and posters.

Since the baseline data revealed that a lot of people living outside the project site regularly dump their waste at former discharge points in the project sites, an additional leaflet targeting these people was prepared in order to encourage them to stop this behavior.

f. Implementation of discharge rules

One of key elements for the smooth implementation of discharge rules was how to prevent outside people from dumping waste at former discharge points, while controlling local residents to discharge their waste at designated places and time.

Sangkat and Phum officers stood at former discharge points for one week after starting the discharge rules, and DOE staff patrolled the project site for three days to give instruction to local residents and business establishments on how to discharge waste.

A team assistant continued to conduct regular monitoring in the project site until the end of December.

g. Project Assessment

The same interview survey as the preliminary survey was conducted in September to check if there were any changes in the behavior of local residents and how their behavior changed. In addition, the conditions of waste discharge points before and after the project were compared. Based on the results of these surveys, the effect of the pilot project was evaluated.

8.4.4 Implementation of the project

a. Preparation Work

a.1 Baseline surveys

a.1.1. Outline of the survey

The following surveys were conducted in project sites in Sangkat Monorom and Sangkat Boeung Trabek.

(1) Interview Survey

Monorom (June 12 and 13)

- ◆ 108 households (out of 111 samples)
- ◆ 9 business establishments
- ◆ 14 vendors

Boeung Trabek (June 12 and 13)

- ◆ 42 households
- ◆ 2 business establishments
- ◆ 3 vendors

(2) Observation Survey

Monorom (June 15, Tuesday)

- ◆ at the current discharge point on Street 107
- ◆ at the current discharge point on Street 109

Boeung Trabek (June 16, Wednesday)

- ◆ Both sides of the bridge on Street 243

a.1.2. Findings of the survey

In the project sites, there are always big waste-heaps. The team tried to analyze the main causes of these big waste-heaps based on the results of the interview survey and observation survey. The results of the interview survey before and after the pilot project are shown in the Databook.

The results of the interview and observation survey show that many residents discharge waste at the wrong time. In the case of BTB, many people discharge waste on days when it is not collected. This is partly because many of them did not know the collection days and times well. Before the pilot project, CINTRI did not inform the collection days and times to either the Sangkat office or local residents. In addition, irregularity of collection services by CINTRI confused local residents about the collection time further. As a result, soon after waste is collected, a small waste heap is created.

Discharge points in the projects sites are located on the street. Even a small waste heap on the street could make people less hesitant to discharge waste there and attract more waste from

outside. The observation survey in Monorom revealed that waste heaps there became regular dumping sites for passersby and a large part of the waste of these waste heaps were brought by passersby on their way to the office and shops.

Waste heaps also attracted waste pickers. They scatter waste and this makes the situation in the project sites worse. Moreover, several push carts were stationed at the discharge point on Street 109 in the evening and this caused a serious traffic jam every night.

To solve the problems of waste heaps, it is imperative to stop small waste heaps from emerging by improving the discharge manners of local residents. In addition, it is indispensable to prevent passersby from dumping their waste in the project sites. Local residents need to realize that they all the community members need to cooperate in order to prevent outside people from dumping waste in their community.

a.2 Modification of collection system and formulation of discharge rules

a.2.1. Modified collection system

In Monorom, the team initially proposed to arrange a common discharge place on the sidewalk of Street 107 and 109. However, due to the limited space on the sidewalk, objections from house owners living along Street 107 and 109, and a strong request from authorities and residents, a primary collection system was introduced along the alleyway. CINTRI prepared one pushcart, and Sangkat Monorom is in charge of its safekeeping. Waste along the alleyway is collected by manual collection workers with the pushcart and transferred to a collection vehicle at the intersection of the alleyway and Street 107.

The current collection system in Monorom is shown below.

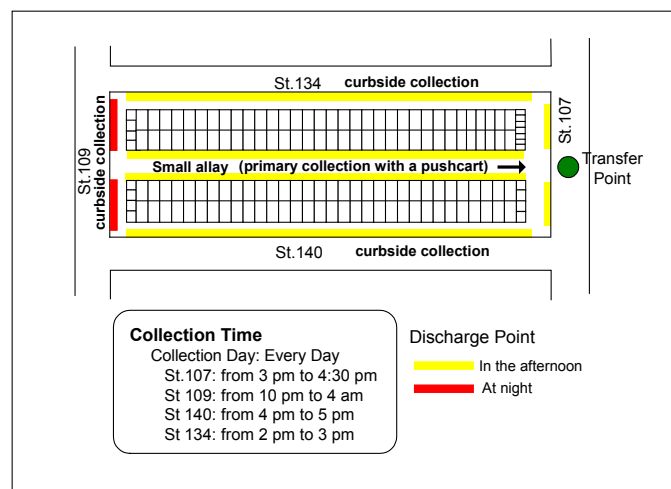


Figure 8-55: Modified collection system in Monorom

In BTB, CINTRI decided to collect the waste along an alleyway in Phum 6 separately from other areas using a smaller type of collection vehicle.

a.2.2. Established discharge rules

The result of the baseline survey shows the importance of improving the discharge manners of local residents in order to remove waste heaps. The team proposed the following discharge rules, which consist of four parts, in order to give instruction to local residents on how to discharge their waste. The draft discharge rules were finalized at the working group meeting and the final discharge rules were determined after the community meetings.

Discharge Rule 1: about the day and time of discharging waste.

Waste can only be discharged on a designated day and time.

- Waste can only be discharged on the collection day
- Waste can only be discharged shortly before the collection time
(from a few hours before the collection time until the collection vehicle comes)

In Monorom, many people come home for lunch, and those who live along Street 107 and the alleyway were required to discharge waste after lunch.

Discharge Rule 2: about the discharge place.

Waste can only be discharged at the following designated places.

- Along the main street with a collection service
In front of houses and stairs on the sidewalk
- Along the alleyway with a collection service
In front of houses and stairs along the alleyway
- Along the alleyway without a collection service
At a discharge point along the street with a collection service

Discharge Rule 3: about the way of discharging waste.

Waste should be discharged in the following ways.

- Waste should be discharged in a container, basket or plastic bag.
Along the alleyway with a primary collection service, waste should be discharged in a plastic bag.
- The plastic bag should be bound tightly.
- Don't dump waste directly on the ground.

Discharge Rule 4: about prohibiting the dumping of waste in other areas.

- Waste should be discharged in your own residential area. Don't bring waste to other areas for dumping.

a.3 Preparation of Educational Tools

In order to make local residents understand the discharge rules and their importance, the team prepared the following educational tools.

- Leaflets (series of 3)
 - 1) Introduction of the project
 - 2) Contents of discharge rules
 - 3) Result of the project
- Additional Leaflets
 - 1) Announcement of the project
 - 2) Notice of project to people in neighboring areas
- Posters (distributed to each household, giving instructions on how to store and discharge waste)
- Signboards (showing the discharge day and time)
- Bulletin board (to be used by the Sangkat for community organization)

Village officers visited each household and distributed the leaflets and poster, explaining the discharge rules.

Let's help clean our city!

Discharge Rules
 In order to keep our area clean, we introduced the following discharge rules which consist of four parts. We appreciate your cooperation. Let's help clean our city!

Discharge way

Waste should be discharged in the following ways

- Waste should be discharged in a container, basket or a plastic bag.
- A plastic bag should be bound tightly.
- Don't dump waste directly on the ground.

Discharge Point

Waste should be discharged at a designated place.

- Along the main street
In front of houses and stairs on the sidewalk.
- Along the alleyway with a collection service
In front of houses and stairs along the alleyway.
- Along the alleyway without a collection service
At a discharge point along the street with a collection service.

Discharge Day & Time

- Waste can be discharged only on the collection day.
- Waste can be discharged only shortly before the collection time (from 1 hour before the collection time until a collection vehicle come).

Prohibition

- Waste should be discharged only in your living area. Please don't bring your waste to other areas for dumping.

Storage of Waste

Let's keep waste in a container, basket or plastic bag at home.

In order to mitigate problems such as odor....

- To try to keep water content low as much as possible.
- To separate solid waste from liquid. Don't put liquid in a container.
- To keep the waste container in a well ventilated place and to shut the container to prevent maggots.
- odor caused by offal could be mitigated by wrapping with used newspaper.

If you miss the chance to discharge waste at a designated time, please keep it until the next discharge time in stead of discharging waste at a wrong time.

Please write the collection day and time in your area

Collection Day	
Collection Time	

Figure 8-56: Introduction of Waste Discharge Rules in Educational Materials

a.4 Dissemination of Information

a.4.1. Working Group Meetings

Almost all important issues such as the draft discharge rules were decided at working group meetings. Representatives of local residents and business establishments were asked to discuss the topics of each meeting with their neighbors.

a.4.2. Community Meetings

After the draft discharge rules were decided at the working group meetings, the draft was explained to local residents at community meetings in each project site. The discharge rules were finalized based on the opinions and comments from local residents.

a.4.3. Educational Tools

Leaflets and posters were distributed by Phum officers to all the households in the project site. They explained the importance of discharge rules, while visiting households, shops and restaurants to distribute leaflets and posters. In addition, signboards were installed to show the discharge places and discharge time.

a.4.4. Street Cleansing Event

One day before the start of the discharge rules, a street cleansing event was organized in Monorom in order to ensure that all the residents knew that the discharge rules would start the next day. Waste left at former discharge points and scattered along the alleyway was removed. After the event, a ban was imposed on dumping waste at former discharge points on Street 107 and 109.

b. Implementation

The discharge rules started on July 26 in Sangkat Monorom and on July 28 in Sangkat Boeung Trabek. The implementation schedule in Monorom is shown below.

Table 8-29: Implementation Schedule in Monorom

	July	August	September
Preparation			
Distribution of leaflets and posters	←————→		
Install signboard	←————→		
Street cleansing event	▲		
Implementation (starting on July 28)			
Continuous monitoring	▲		
Hourly monitoring	←————→		
Daily monitoring	←————→		
Weekly monitoring	←————→		
			←————→ continuing until Dec.
Follow-up survey			↔

For the first three days after the start of the discharge rules, Phum/Sangkat officers conducted continuous monitoring at discharge points to prevent outsiders from dumping waste at former discharge points, while DOE staff toured the project site and gave instructions on how to discharge waste to local residents. For these three days, police joined the monitoring unit in case that outsiders who used to dump waste at waste heaps in the project sites made an objection to the rules. Village officers continued to monitor the former discharge points for another two days.

A team assistant visited the project site every second day in August to check the discharge manners. When serious problems were observed, the assistant was accompanied by DOE staff to give instruction to those who often violated the discharge rules.

The follow-up interview survey was conducted both in Monorom and BT in September to evaluate the effect of the pilot project. Weekly monitoring by a team assistant continued until the end of December, 2004.

8.4.5 Evaluation of the pilot project

For almost two months after the start of the discharge rules, the team conducted regular monitoring. In addition, a follow-up interview survey was conducted on September 20 and 21 in order to grasp how much the awareness of waste management had increased, how much people's behaviors had changed, and how local residents evaluated the educational materials. The number of samples in Monorom and BTB are 31 and 20 respectively.

a. Result of the observation survey

a.1 Discharge manners and waste heaps

Both in Monorom and BTB, almost all local residents stopped discharging waste at former discharge points on the streets. Even though some people still discharge waste at the wrong time and do not bind the plastic bags tightly, their discharge manners had considerably improved. As a result, waste heaps there disappeared as shown in the pictures below.

In the neighboring block in Monorom, however, waste heaps became larger than before, since passersby that used to dump their waste in the project site on the way to the office or shops did not stop bringing waste from their houses to outside areas, but continued to dump waste

at waste heaps in the neighboring blocks. In addition, street vendors such as coconut and sugar cane sellers who move around the city continued to dump their waste at waste heaps there.



Monorom



Boeng Trabek

a.2 Efficiency of collection systems

In Monorom, the efficiency of curbside collection along Street 107 and 109 had improved. The pushcart usually made three rounds between the alleyway and transfer points, and the total length of collection time was not shortened much.

In BTB, the current collection system is the same as the previous one, curbside collection, but the collection efficiency was significantly improved because big waste heaps disappeared.



Primary collection in Monorom



Transfer point on Street 107



Curbside collection in BTB

b. Result of interview survey

The change in public awareness and waste storage/discharge manners was assessed from the results of the interview survey before and after the pilot project in order to evaluate the effect of the pilot project.

b.1 Awareness of waste management and behavior

b.1.1. Before PP

Before the pilot project, 76.9% and 93.2% of respondents in Monorom and BTB recognized there were problems caused by bad waste management in their area. Even though it seemed

that Monorom had more serious problems, the level of awareness there was lower than that in BTB. Only 22 respondents chose waste heaps as a problem in their area. In BTB, local authorities and NGO gave hygiene education to local residents, and this probably resulted in the relatively high public awareness.

The interview survey before PP revealed that a lot of people did not understand the collection day and time properly, due to a lack of information from CINTRI. In BTB, the collection service is provided three times per week, on Tuesdays, Thursdays and Saturdays; however, most of the respondents discharged waste more often than the collection service frequency, as shown in Table 8-30.

Table 8-30: When do you discharge waste? (Before PP in BTB)

Discharge Day	Discharge Point		
	St 432	St 105	St 101
Monday	95.7%	100.0%	100.0%
Tuesday	60.9%	77.8%	
Wednesday	82.6%	83.3%	50.0%
Thursday	73.9%	94.4%	50.0%
Friday	82.6%	83.3%	50.0%
Saturday	60.9%	72.2%	
Sunday	100.0%	100.0%	100.0%

Base: 23 (St. 432), 19 (St. 105), and 2 (St. 101)

This inappropriate behavior can be attributed to limited information and low awareness. The survey revealed that around 30% of respondents in BTB did not know the collection day. Even those who replied that they knew the collection day did not understand it correctly, as shown in Table 8-31. Moreover, most of the respondents discharged waste on Mondays and Sundays, regardless of knowing there was no collection service on these days.

Table 8-31: Is there collection service on the following day?

		St 432	St 105	St 101
Monday	Yes	5.9%		
	No	94.1%	100.0%	100.0%
Tuesday	Yes	64.7%	69.2%	100.0%
	No	35.3%	30.8%	
Wednesday	Yes	52.9%	30.8%	50.0%
	No	47.1%	69.2%	50.0%
Thursday	Yes	35.3%	46.2%	50.0%
	No	64.7%	53.8%	50.0%
Friday	Yes	52.9%	30.8%	50.0%
	No	47.1%	69.2%	50.0%
Saturday	Yes	64.7%	69.2%	100.0%
	No	35.3%	30.8%	
Sunday	Yes	11.8%		
	No	88.2%	100.0%	100.0%

Base: 17 (St. 432), 13 (St. 105), and 2 (St. 101)

Table 8-32 shows the discharge time in the project site (the colored cells indicate appropriate discharge time). In total, almost 70% of respondents discharged waste at the wrong time. Irregularity in the collection time along with limited information and misunderstanding of the collection time resulted in this behavior.

Table 8-32: What time do you discharge waste? (multi-answer question)

Discharge Point Discharge Time	Monorom					BTB		
	St 107	St 109	St 134	St 140	undecided	St 432	St 105	St 101
3:00 – 6:00	2.3%	1.8%				13.0%	5.6%	
6:00 – 9:00	11.4%	5.3%	25.0%		16.7%	4.3%	27.8%	
9:00 – 12:00		1.8%	12.5%	66.7%				
12:00 – 15:00	22.7%	5.3%	50.0%	100.0%		4.3%		
15:00 – 18:00	56.8%	31.6%	12.5%		16.7%	43.5%	50.0%	100.0%
18:00 – 21:00	15.9%	50.9%			83.3%	43.5%		
21:00 – 3:00 next day		8.8%				4.3%		
Whenever waste is generated							11.1%	

Base: 44 (St. 107), 57 (St. 109), 8 (St. 134), 3 (St. 140), 6 (undecided)23 (St. 432), 19 (St. 105), and 2 (St. 101)

b.1.2. After PP

The results of the follow-up survey revealed that more than 95% of respondents understood the collection day and more than 90% understood the collection time correctly. Regarding the discharge rules, more than 80% of the respondents recognized their discharge places correctly, while around half of them could not describe the required discharge ways properly (e.g. binding the plastic bag tightly).

To the questions concerning how much discharge manners had changed, almost all respondents replied that they changed the discharge places, while only 5.9% of them changed the discharge way.

More than 90% of the respondents replied that they followed the discharge rules because they wanted to keep their area clean and recognized the situations in their area had improved a lot or to some extent.

b.2 Evaluation of educational tools

The follow-up survey also asked respondents to evaluate the educational tools such as the leaflets, posters, and signboards in terms of the content, layout, illustrations and pictures, and size. A part of the results is shown in the table below.

Table 8-33: Evaluation of Educational Tools

	Leaflet			Poster		
	Monorom	BTB	total	Monorom	BTB	total
Content						
Easiness to understand						
easy to understand	100%	100%	100%	100%	100%	100%
neither easy nor difficult	0%	0%	0%	0%	0%	0%
difficult to understand	0%	0%	0%	0%	0%	0%
Necessary information						
all the necessary information was included	100%	100%	100%	100%	100%	100%
some was not included	0%	0%	0%	0%	0%	0%
there was a lot of unnecessary information	0%	0%	0%	0%	0%	0%
Layout						
easy to understand	100%	100%	100%	100%	100%	100%
neither easy nor difficult	0%	0%	0%	0%	0%	0%
difficult to understand	0%	0%	0%	0%	0%	0%
Illustration and Pictures						
easy to understand	96.8%	100%	98%	96.8%	100%	98%
neither easy nor difficult	3.2%		2%	3.2%	0%	2%
difficult to understand	0%	0%	0%	0%	0%	0%
Size						

	Leaflet			Poster		
	Monorom	BTB	total	Monorom	BTB	total
too big	0%	0%	0%	6.5%	5%	5.9%
appropriate size	100%	100%	100%	90.3%	95%	92.2%
too small	0%	0%	0%	3.2%	0%	2.0%

8.4.6 Expansion of PP to neighboring building blocks

As mentioned above, waste heaps in the project sites disappeared. However, waste that used to be dumped by passersby was just moved to waste heaps in the neighboring blocks. In consequence, waste heaps at the next building block became extremely large, and local authorities and residents need to take necessary measures.

Due to the strong request of Sangkat and Phum, the pilot project was expanded to two adjacent building blocks (Phum 3, 4 and 7) at the end of October. Since there was not enough time to discuss the discharge rules with local residents, some of them did not understand the rules well at the start and discharged waste at the wrong time and in the wrong manner. It took more time to put the modified collection system and discharge rules on the right track.

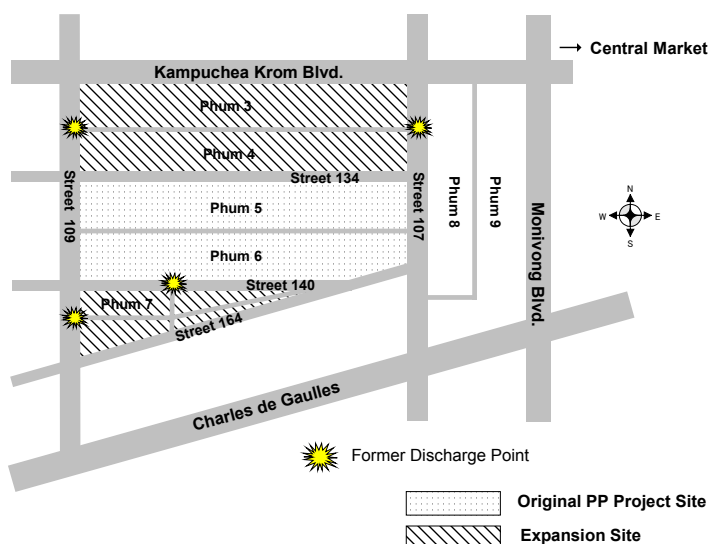


Figure 8-57: Expansion Project Site

8.4.7 Findings

Many of the residents in the center of Phnom Penh, where waste is scattered and large waste heaps are often observed, want to clean their areas. Even though many of the local residents do not respect basic social rules such as traffic rules, it is possible to introduce discharge rules and to promote public participation in solid waste management if the benefit as well as the content of discharge rules can be shown clearly to local residents.

Key elements for successful results are examined in this section. Problems to be solved for the expansion of discharge rules to the whole city are also summarized.

a. Key elements

(1) Common awareness of problems

It is important for all the stakeholders to have common awareness of the problems caused by bad waste management in order to introduce waste discharge rules smoothly. In the pilot project, through working group meetings and community meetings, DEO and the team could

build a common awareness of solid waste management with local authorities and residents as well as CINTRI. Common awareness contributed to active participation and cooperation of local authorities and residents.

Visual presentation materials made based on video files shot during the observation survey had a significant effect on making local authorities and resident have common awareness.

(2) Strong leadership of local authorities

In Monorom, the strong leadership of the Sangkat chief played an important role in the successful result. Under his leadership, Phum officials were actively involved in disseminating information on the newly established discharge rules to local residents and persuading them to participate in solid waste management. As a result, local residents were confident that other people would follow the rules and were therefore willing to follow the rules themselves.

It is imperative for DOE to establish close cooperation with Khans and Sangkats for expanding discharge rules to the whole city.

(3) Clear benefit

For smooth implementation, it is very important for DOE to show the benefits of discharge rules clearly, as well as the concrete instructions on how to store and discharge waste.

The successful result of the pilot project could be utilized as an example to show the benefit of discharge rules when DOE expands the application of discharge rules to other parts of the city.

b. Issues to be solved for the expansion of discharge rules

(1) Disseminate information to the whole city

In the pilot project, one of the criteria for selecting project sites was the willingness of local authorities to clean their districts. For the expansion of discharge rules, it is necessary for DOE to disseminate information about the pilot project at the Khan and Sangkat level, so that more Sangkats are willing to work with DOE to clean their areas.

DOE also has to make newly established waste discharge rules widely known in the whole city by active public relations activities through such media as TV, radio and newspaper.

(2) Ban on bringing waste out from the block of residence to other areas

The results of the observation survey revealed that a lot of people regularly dumped waste at waste heaps, some distant from their houses, on their way to the office or shops. Even though the conditions of the pilot project sites were significantly improved, those who used to dump their waste probably continued to dump waste in the neighboring areas.

Therefore, it is necessary for DOE to prevent them from bringing waste to other areas outside of their block of residences. DOE should impose a ban on bringing waste from the location of their residence to other areas and make the ban known widely in the whole city.

(3) Dealing with street vendors

The observation survey also revealed that street vendors such as coconut and sugar cane sellers which move around the city discharged large amounts of waste at the waste heaps. At present, they discharge waste anyplace they want. Moreover, they dump waste directly on the ground. It is critical for DOE to control these street vendors for the expansion of waste discharge rules to the whole city.

8.5 Development of the Data Management System for SWM

8.5.1 Objectives

In the first phase of the JICA study, a weighbridge was installed at the gate of the existing disposal site, which makes it possible for PPWM to weigh the waste that is brought to the disposal site. It is, however, necessary to process and analyze the compiled data in order to utilize the weighed waste amounts for the improvement of waste management.

The M/P proposes that PPWM should start to provide waste collection and public cleansing services in the area of the three rural Khans from 2008. Its sustainability largely depends on adequate fee collection, which in turn necessitates the development of a customer database.

The Japanese side and the Cambodian side agreed to open the information of the progress of the study to the public on proper occasions to raise people's awareness in the first steering committee meeting held from the 25th of February to the 10th of March, 2003. According to this agreement, the ST developed a Website on MPP's Home Page.

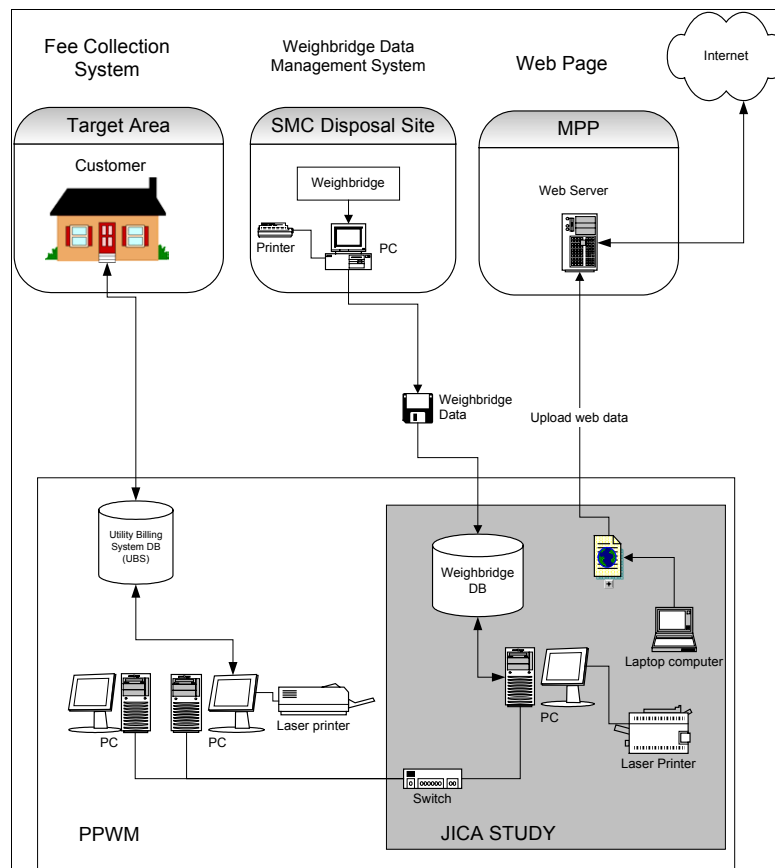


Figure 8-58: Concept of the Data Management System Development

8.5.2 Weighbridge Data Management System

All the incoming vehicles are weighed in the weighbridge at the entrance of the disposal site, where the weight it is transmitted from the weighbridge to the connected computer. The connected computer is installed with the “Truck Scale Software T-3000 Ver. 7.0x” developed by the weighbridge supplier. All the data obtained by this system are transferred to the

PPWM office by floppy disk, where the data it is imported to the system developed by the team as shown in the following figure.

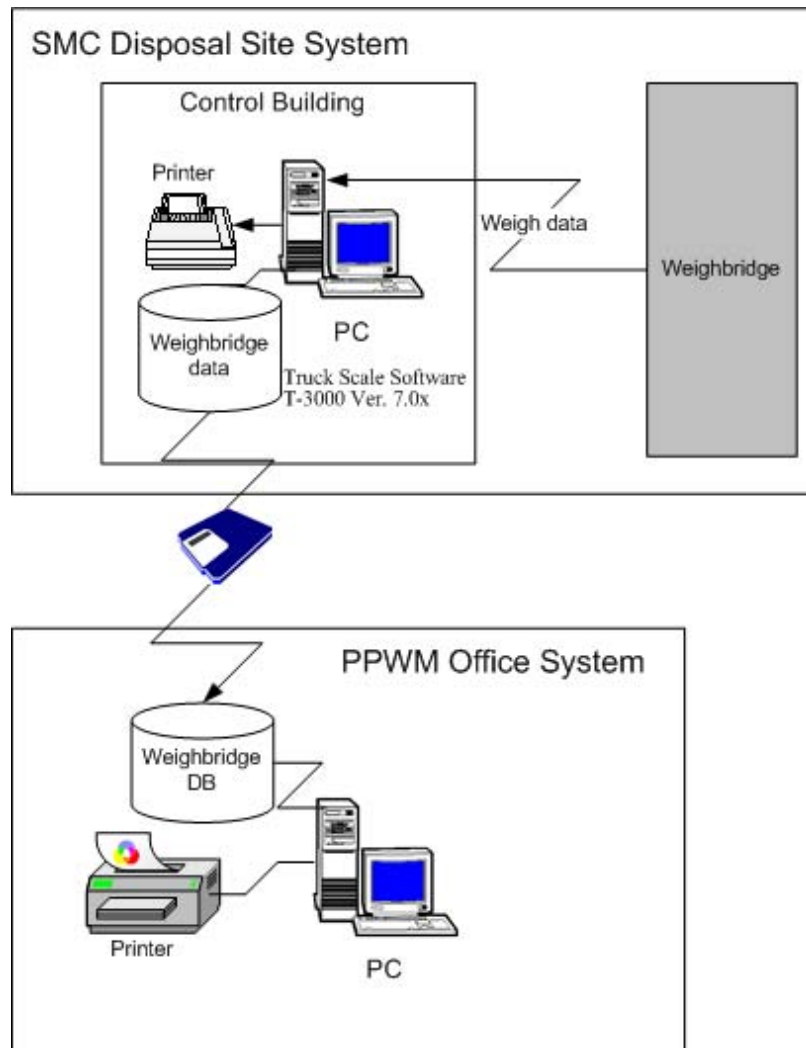


Figure 8-59: Weighbridge Data Management System

a. Development

a.1 SMC Disposal Site System (Truck Scale Software T-3000 Ver. 7.0x)

The "Truck Scale Software T-3000 to Ver. 7.0x" developed by the weighbridge supplier receives the weight data automatically from the weighbridge, and then saves it with the truck information.

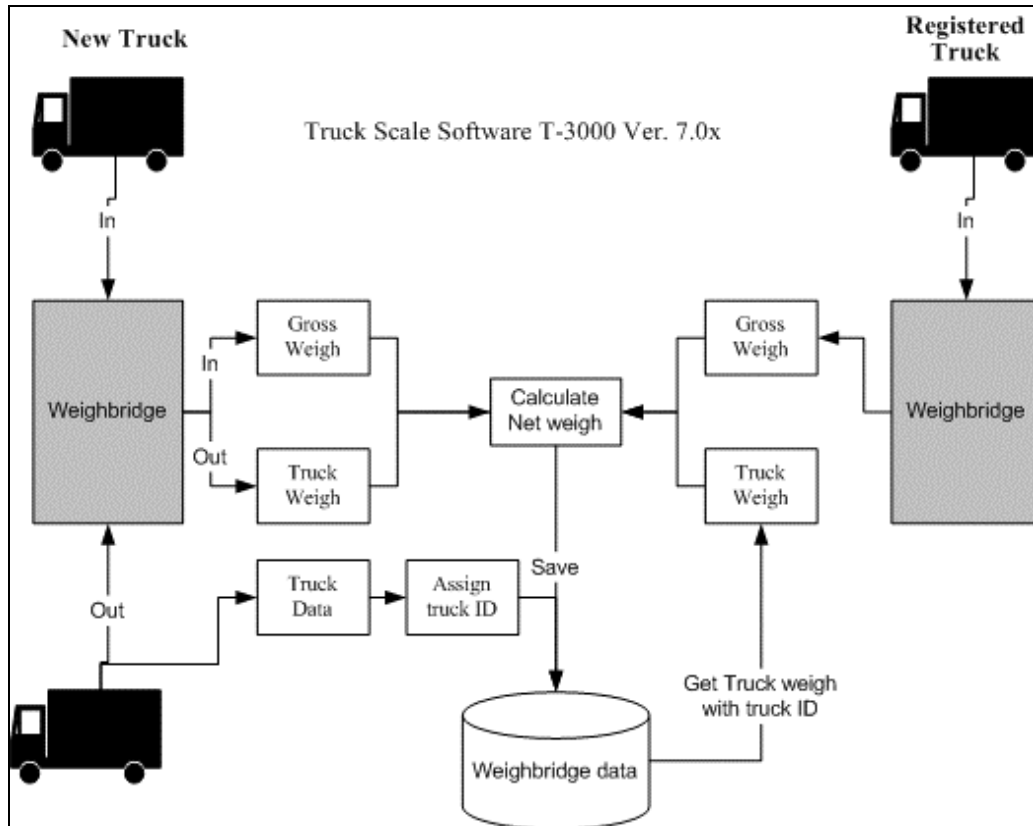


Figure 8-60: System Scheme of Weighbridge Data Management

As shown in the previous figure, the vehicles that are not registered are weighed at the entrance to obtain the gross weight, and then weighed again on the way out to obtain the weight of the empty truck (net weight). Once the weight of the truck is obtained, an identification code is assigned to the truck, other additional data of the truck is obtained, and the truck is registered.

As for the vehicles that are registered, they are weighed at the entrance, the assigned code of the truck is entered, and the net weight is saved to the database. The type of waste and the location code of where the waste comes from are also entered.

Table 8-34: Weighbridge Data

Weighbridge data		Data store in the weighbridge		
Name	Type	Size	Property	
ID	Long Integer	4	Running number ID	
SeqIn	Double	8	Sequential truck registration number	
TicketNo	Long Integer	4	Sequential Weighbridge ticket number	
TruckID	Text	12	Truck ID	
CustomerId	Text	16	Customer ID	
Wasteld	Text	16	Waste Category ID	
LocationId	Text	16	Location ID (Phum ID)	
InDate	Date/Time	8	Truck enter date	
InTime	Date/Time	8	Truck enter time	
GrossTon	Double	8	Gross ton	
OutDate	Date/Time	8	Truck out date	
OutTime	Date/Time	8	Truck in date	
TruckWTON	Double	8	Truck registered weigh	
NetWTON	Double	8	Waste net ton	
F14	Long Integer	4	Not use	
F15	Long Integer	4	Not use	
F16	Long Integer	4	Not use	
F17	Double	8	Not use	
F18	Double	8	Not use	
F19	Long Integer	4	Not use	
F20	Text	10	Not use	
Trade	Text	1	Not use	

a.2 Backup and restore system

Due to the importance of the weighbridge data, several backup systems have been introduced as shown in the following figure.

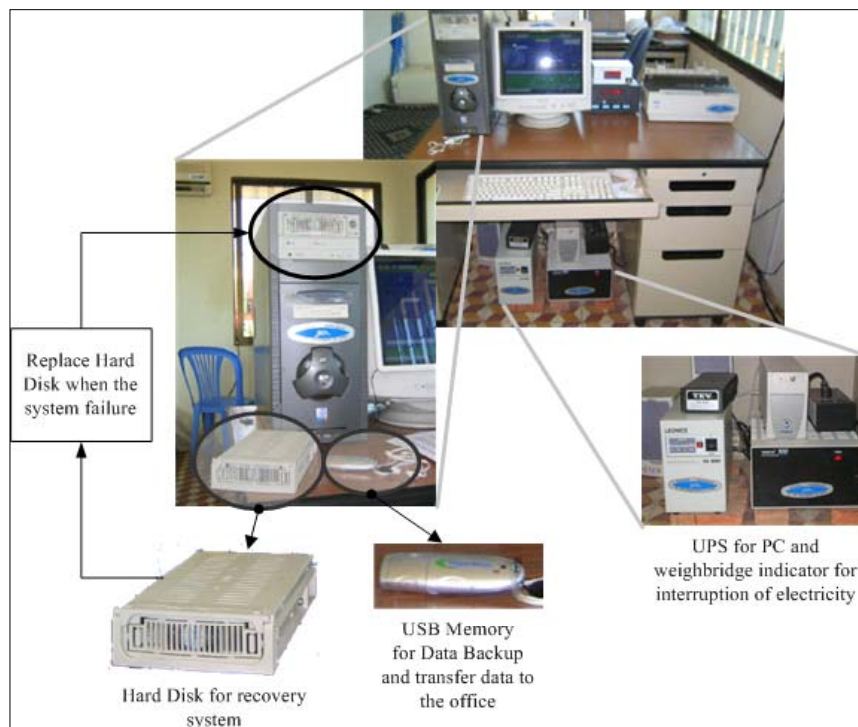


Figure 8-61: Backup and Restore System

(1) UPS in case of electricity interruption

As shown in the previous figure, the system has an electricity stabilizer and two UPS in case of an interruption to the electricity supply. One UPS is connected to the computer and in the event of an electricity interruption the computer can work for a period of 20 minutes, which is enough time to shut down the system normally. The second UPS is connected to the weighbridge indicator, and the indicator can work for approximately 8 to 10 hours and can weigh normally all the trucks coming to the disposal site. In this period of time, the weight, truck ID, date and time are recorded in a notebook and then updated to the computer.

(2) Backup of the weighbridge data

Data is backed up daily with the “T-3000” system, and the data of the previous day is sent daily by diskette to the office of PPWM. There is also “USB Memory” for the transfer of large data weekly, monthly, etc.

(3) System recovery

The most common cause of data loss is failure of the computer’s hard disk. The Study Team prepared a system recovery “hard disk” which is installed with the complete system, as shown in the previous figure. If the current hard disk fails, it can be replaced with the other hard disk and the system can continue to be used normally. In this way, the loss of data will be minimized.

a.3 PPWM Office System (WeighBridge Database)

The Study Team developed a Database System called WeighBridge Database (WBDB). This database system will receive the data from the “T-3000” system by diskette and will import it to the DB and manage the data to obtain different reports. The WBDB has been developed with Microsoft Access 2000 because it is an application that is widely used and known all over the world. For that reason, it will be easy to manage and maintain.

(1) System structure

The “T-3000” system has an option to export weighbridge data to “txt” format, which is a format that can be read in any operating system. On a daily basis, the weighbridge data of the previous day are exported to the “txt” format and sent to the office by diskette.

In the office, the WBDB system reads the file in “txt” format and converts it to DB format. Once the data is converted, the system verifies the duplication of data. Any error in the source data will be verified and then it will proceed again to be imported to the WBDB system.

Once the data are imported to the WBDB, the system can print diverse reports and export the data to other file formats, in which the data can be manipulated in other applications.

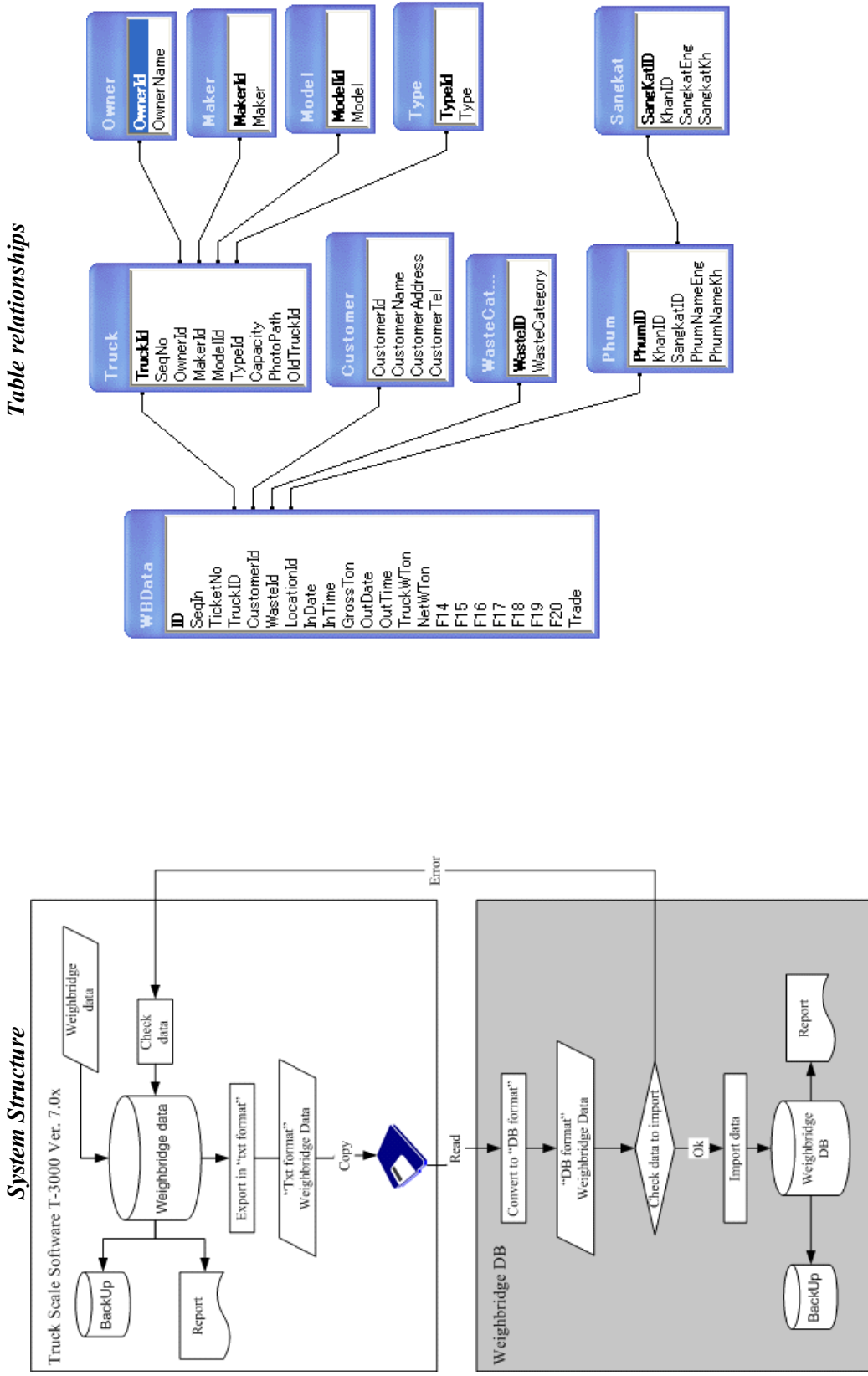


Figure 8-62: System Structure and Table Relations

(2) Table structure

<i>WBTmpTxt</i>		<i>Temporary WB data to import to the WeighbridgeDB</i>	
Name	Type	Size	Property
F1	Text	255	
F2	Text	255	
F3	Text	255	
F4	Text	255	
F5	Text	255	
F6	Text	255	
F7	Text	255	
F8	Text	255	
F9	Long Integer	4	
F10	Text	255	
F11	Text	255	
F12	Long Integer	4	
F13	Long Integer	4	
F14	Long Integer	4	
F15	Long Integer	4	
F16	Long Integer	4	
F17	Double	8	
F18	Double	8	
F19	Long Integer	4	
F20	Text	255	
F21	Text	255	

<i>WBData</i>		<i>Imported WB data</i>	
Name	Type	Size	Property
ID	Long Integer	4	Running number ID
SeqIn	Double	8	Sequential truck registration number
TicketNo	Long Integer	4	Sequential Weighbridge ticket number
TruckID	Text	12	Truck ID
CustomerID	Text	16	Customer ID
Wasteld	Text	16	Waste Category ID
LocationID	Text	16	Location ID (Phum ID)
InDate	Date/Time	8	Truck enter date
InTime	Date/Time	8	Truck enter time
GrossTon	Double	8	Gross ton
OutDate	Date/Time	8	Truck out date
OutTime	Date/Time	8	Truck in date
TruckWTON	Double	8	Truck registered weigh
NetWTON	Double	8	Waste net ton
F14	Long Integer	4	Not use
F15	Long Integer	4	Not use
F16	Long Integer	4	Not use
F17	Double	8	Not use
F18	Double	8	Not use
F19	Long Integer	4	Not use
F20	Text	10	Not use
Trade	Text	1	Not use

<i>Truck</i>		<i>Truck type</i>	
Name	Type	Size	Property
TruckID	Text	12	Truck ID
SeqNo	Double	8	Sequential truck registration number
OwnerID	Long Integer	4	
MakerID	Long Integer	4	
ModelID	Long Integer	4	
TypeID	Long Integer	4	
Capacity	Double	8	Capacity of the truck
PhotoPath	Text	50	Truck picture file path
OldTruckID	Text	12	

Table		Truck owner		
Name	Type	Size	Property	
OwnerId	Long Integer	4		
OwnerName	Text	30		

Maker		Truck maker		
Name	Type	Size	Property	
MakerId	Long Integer	4		
Maker	Text	30		

Model		Truck model		
Name	Type	Size	Property	
ModelId	Long Integer	4		
Model	Text	30		

Type		Truck type		
Name	Type	Size	Property	
TypeId	Long Integer	4		
Type	Text	255		

Customer		Waste transporter owner		
Name	Type	Size	Property	
CustomerId	Text	16		
CustomerName	Text	30		
CustomerAddress	Text	50		
CustomerTel	Text	50		

Waste		Waste type		
Name	Type	Size	Property	
WasteID	Text	16		
WasteCategory	Text	50		

Khan		Khan		
Name	Type	Size	Property	
KhanID	Text	2		
KhanNameEng	Text	30		
KhanNameKh	Text	30		
Area	Text	15		

Phum		Phum		
Name	Type	Size	Property	
PhumID	Text	255		
KhanID	Text	2		
SangkatID	Text	4		
PhumNameEng	Text	30		
PhumNameKh	Text	30		
Sangkat		Sangkat		
Name	Type	Size	Property	
SangKatID	Text	4		
KhanID	Text	2		
SangkatEng	Text	30		
SangkatKh	Text	30		

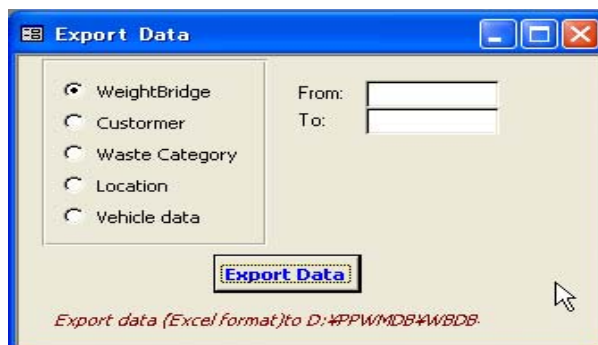
a.4 Reports

The reports that can be obtained directly from the system are shown in the following figure.

Enter the time period and then select the type of report. For details, refer to the WBDB user manual



The data can be exported from WBDB to Microsoft Excel for preparation of the report.



b. Training in System Operation

Training in how to operate the system was carried out with PPWM for the three operators at the SMC disposal site and the system administrator in the PPWM office who will be in charge of working of the overall system.

Training in operation of the “T-3000” system was carried out previously by the supplier of the weighbridge, and in this phase the Study Team carried out training in the following items

- Data export from the “T-3000” system
- Data backup with “T’3000” system
- Full system recovery
- Data import from “T-3000” to WBDB
- WBDB operation
- Management and preparation of reports from WBDB data with Microsoft Excel.
- Backup of WBDB data

A very important point in the operation of the system is the assignment of a truck code. This is because most of the waste collection trucks do not have plate numbers and they have a vehicle number assigned by the owner that is not exclusive for each vehicle.

Given this situation, some vehicles are very difficult to identify by number and for the system, the most important part is to identify the vehicle with a unique code. The Study Team agreed with PPWM to code the vehicles with the following format.

Table 8-35: Code of the Vehicles

CINTRI	-	001
First 6 digit to identify the owner		Last 3 digits for the vehicle number

Then, the Study Team verified and modified all the previous data and trained the weighbridge operator to correctly register a new vehicle with the new code format.

PPWM will have to contact the truck owners to explain this code format and ask them to assign numbers to the trucks according to this format.

c. Plan for system management

To ensure that the system runs smoothly, the system administrator will do the following:

- Check the truck code, especially when registering a new truck
- Back up the data
- Carry out computer maintenance, especially for the computer installed in the SMC disposal site because there is a lot of dust
- Check the data entered into the “T-3000” manually

In the near future, it is recommended to consider some kind of online communication system to connect the computers at the disposal site and the PPEM office, so that the data will always be up-to-dated correctly. The system also has to be upgraded according to new demands.

8.5.3 Customers Database Management System for Fee Collection

The customer database management system, which records all the customers receiving the waste collection service in the pilot project site, is to support fee collection. The general work flow for fee collection is shown in the following figure.

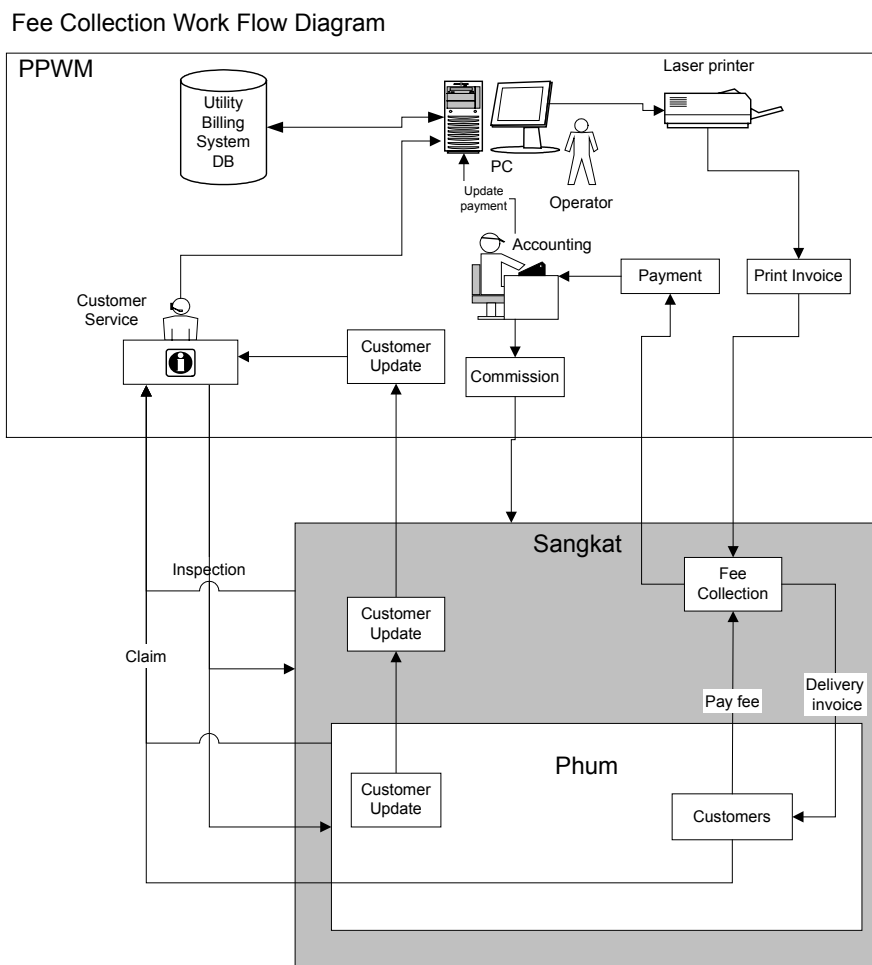


Figure 8-63: Customers Database Management System

a. Billing System

At the present time, PPWM is using the UBS “Utility Billing System”, developed with the “Clarion” application, and with this system the invoice of about 3540 clients is controlled.

For the implementation of the pilot project in the new areas, about 400 new customers are to be introduced. Before developing a new billing system, the Study Team carried out a thorough study of the current UBS. They found that with the application installed, “Clarion”, it was not possible to export the data to be used with the program Access XP. For that reason, if a new system is developed, it would be necessary to enter all the data of the existing customers manually or use two different billing systems.

The Study Team and PPWM analyzed this problem and decided to continue using the UBS because most of the customers are in this system and the operators are already very familiar with the system. The Study Team is carrying out the following modifications in the utilization of the UBS to adapt it to the new billing system.

a.1 Current billing system

As shown in the following figure, with the current billing system, the invoices are printed monthly according to a collection zone and the fee collectors deliver the invoices and receive the invoice payments from the customers according to the collection zone.

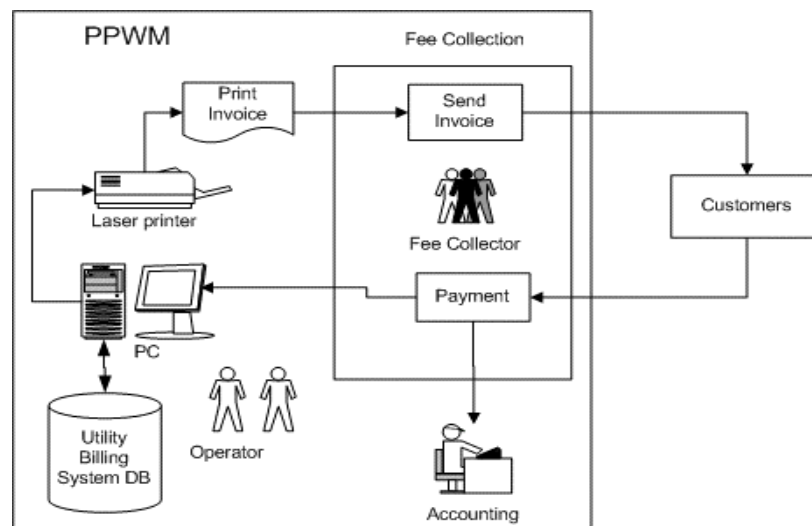


Figure 8-64: Current Billing System

a.2 New billing system

For the implementation of the P/P and the new billing system, the Sangkat offices will participate and will be responsible for delivering the invoices and receiving the payments from the customer and then sending the payments to PPWM.

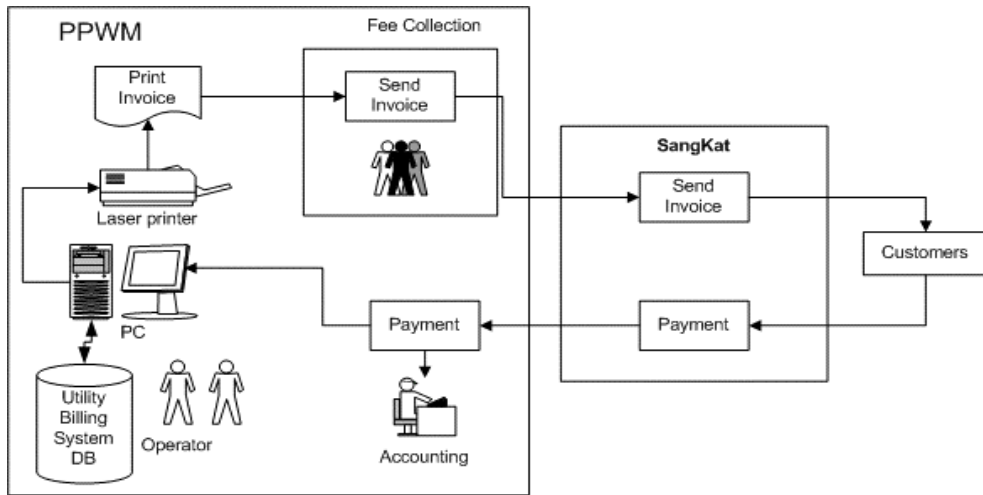


Figure 8-65: New Billing System

To implement this new billing system with the UBS, the collection zones will be modified to Sangkats. This way the invoices will be printed monthly according to the customers of each Sangkat, and the invoices will be sent to the offices of the respective Sangkat.

The code for all the sangkats were defined as follows:

Table 8-36: Sangkat Code

KhanName	SangkatId	Sangkat Name	Household	Population	Code
01Chamkar Mon	0101	Tonle Basak	8,823	44,513	A
	0102	Boeng Keng Kang Muoy	2,408	14,405	
	0103	Boeng Keng Kang Pir	2,049	12,055	
	0104	Boeng Keng Kang Bei	3,841	22,700	
	0105	Oulampik	1,549	9,799	
	0106	Tuol Svay Prey Muoy	2,208	13,575	
	0107	Tuol Svay Prey Pir	1,793	11,589	
	0108	Tumnob Tuek	2,334	13,720	
	0109	Tuol Tumpung Pir	1,371	8,594	
	0110	Tuol Tumpung Muoy	1,672	10,422	
	0111	Boeng Traback	1,558	9,452	
	0112	Phsar Daem Thkov	2,760	16,258	
Chamkar Mon Total			32,366	187,082	
02Daun Penh	0201	Phsar Thmei Muoy	1,234	7,447	B
	0202	Phsar Thmei Pir	1,305	7,771	
	0203	Phsar Thmei Bei	2,275	13,154	
	0204	Boeng Reang	1,272	7,714	
	0205	Phsar Kandal Muoy	1,817	11,223	
	0206	Phsar Kandal Pir	1,352	7,954	
	0207	Chakto Mukh	2,171	12,501	
	0208	Chey Chumneah	2,004	12,980	
	0209	Phsar Chas	1,387	8,287	
	0210	Srah Chak	5,945	34,115	
	0211	Voat Phnom	1,441	8,767	
Daun Penh Total			22,203	131,913	
03Prampir Makara	0301	Ou Ruessei Muoy	1,621	9,120	C
	0302	Ou Ruessei Pir	1,874	10,722	
	0303	Ou Ruessei Bei	1,498	8,519	
	0304	Ou Ruessei Buon	1,569	9,123	
	0305	Monourom	2,212	12,981	
	0306	Mittakpheap	2,170	12,323	
	0307	Veal Vong	3,684	21,394	

KhanName	SangkatId	Sangkat Name	Household	Population	Code	
	0308	Boeng Prolit	1,901	12,010		
Prampir Makara Total			16,529	96,192		
04Tuoll Kork	0401	Phsar Depou Muoy	1,645	10,398	D	
	0402	Phsar Depou Pir	1,798	10,236		
	0403	Phsar Depou Bei	1,699	10,038		
	0404	Tue L'ak Muoy	2,362	13,401		
	0405	Tue L'ak Pir	1,718	11,247		
	0406	Tue L'ak Bei	2,936	17,282		
	0407	Boeng Kak Muoy	2,587	16,423		
	0408	Boeng Kak Pir	4,260	25,177		
	0409	Phsar Daeum Kor	2,658	15,998		
	0410	Boeng Salang	4,535	24,768		
Tuoll Kork Total			26,198	154,968		
05Dang Kor	0501	Dang Kor	2,035	10,547	E	A
	0502	Trapeang Krasang	554	3,013	E	B
	0503	Kouk Roka	1,068	5,153	E	C
	0504	Phleung Chheh Rotch	695	3,640	E	D
	0505	Chaom Chau	3,395	19,740	E	E
	0506	Kakab	3,184	17,679	E	F
	0507	Pong Tuck	1,053	5,561	E	G
	0508	Prey Veang	563	3,013	E	H
	0509	Samraong Kraom	810	4,211	E	I
	0510	Prey Sar	892	4,221	E	J
	0511	Krang Thnong	564	2,983	E	K
	0512	Krang Pongro	461	2,016	E	L
	0513	Prateah Lang	765	3,594	E	M
	0514	Sak Sampov	412	1,920	E	N
	0515	Cheung Ack	1,114	5,170	E	O
Dang Kor Total			17,565	92,461		
06Mean Chey	0601	Stueng Mean Chey	5,552	31,740	F	A
	0602	Boeng Tumpun	5,150	29,037	F	B
	0603	Preack Pra	1,969	11,346	F	C
	0604	Chbar Ampov Muoy	1,754	10,378	F	D
	0605	Chbar Ampov Pir	4,428	24,227	F	E
	0606	Chak Angra Leu	2,913	16,599	F	F
	0607	Chak Angra Kraom	3,151	19,814	F	G
	0608	Nirouth	2,526	13,971	F	H
	Mean Chey Total			27,443	157,112	
07Ruessey Kaev	0701	Khmuonh	1,120	5,987	G	A
	0702	Toul Sangkae	4,691	27,244	G	B
	0703	Svay Pak	2,160	12,197	G	C
	0704	Kiloumaetr Lekh Prammuoy	2,366	13,372	G	D
	0705	Phnom Penh Thmei	3,191	17,731	G	E
	0706	Ruessei Kaev	3,309	18,742	G	F
	0707	Tuek Thla	5,494	33,139	G	G
	0708	Praek Lieab	1,733	10,617	G	H
	0709	Praek Ta Sek	914	4,936	G	I
	0710	Chrouy Changva	2,974	16,427	G	J
	0711	Chrang Chamreh Muoy	1,308	7,233	G	K
	0712	Chrang Chamreh Pir	2,114	12,451	G	L
Ruessey Kaev Total			31,374	180,076		
			173,678	999,804		

b. Procedure to input customer list for pilot project

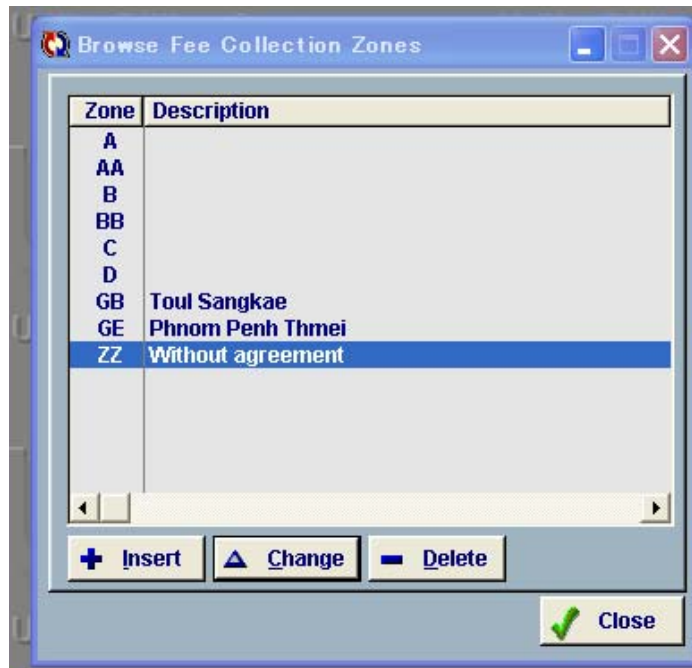
In the UBS, add the Khan, Sangkats and Phums as follows:



Then input the information of the customer in the next windows, from the list.

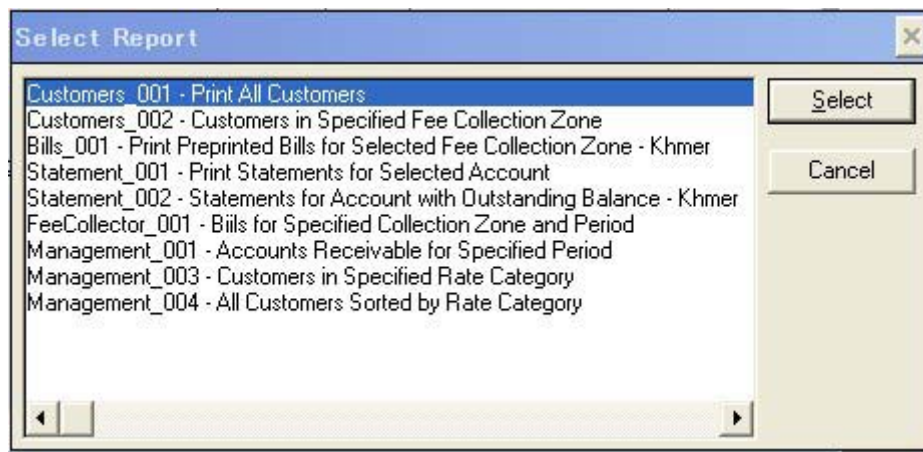
Each Sangkat is identified by a collection zone. Add the next two Sangkats.

Sangkat	Fee Collection Zone
Toul Sangkae	GB
Phnom Penh Thmei	GE



Use (ZZ) for customers that do not agree yet with the collection fee.

c. Reports



- Monthly bill
- List of customers with fee paid, rate category
- Customer in specified fee collection zone (Sangkat)
- Statement for selected account
- Statement for account with outstanding balance

d. Training in System Operation

The Study Team conducted training for the two operators with experience in operation of the UBS and the administrator of the billing section, in regard to the following:

- Explanation of the new billing system involving Sangkats
- Changes introduced to the UBS
- Definition of the codes for each Sangkat

The team developed a web page using the web server of the PPM. This Web site publishes information on (1) the current situation of SWM in Phnom Penh (2) relevant laws and regulations, and (3) the JICA Study, and provides an e-mail address to contact the PPWM. The general schema is shown in the following figure.

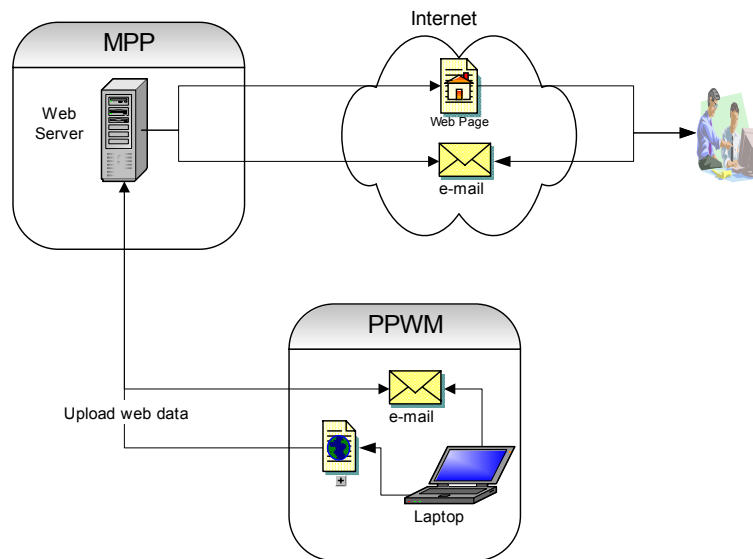


Figure 8-67: General Structure of Web Site on MPP's Home Page

b. SWM Home Page structure

The “SWM Home Page”, which is linked to MPP’s home page, has three main sections as shown in the following figure.

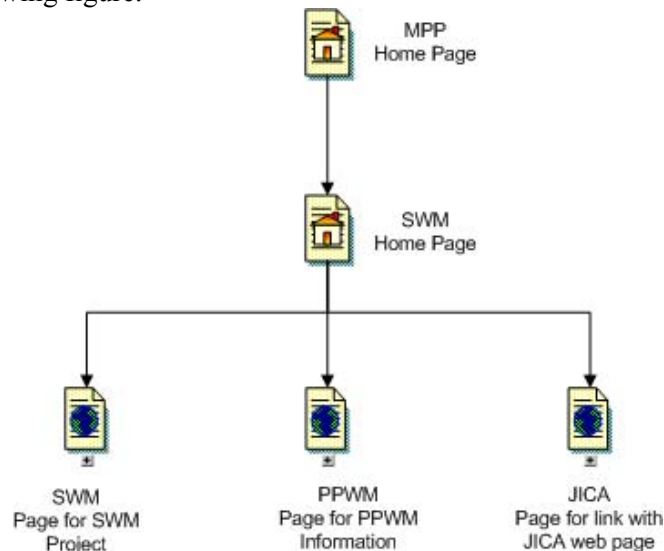


Figure 8-68: Structure of SWM Home Page

- The SWM Page will show all the information related to the SWM project
- The PPWM Page will show all the information from PPWM
- The JICA Page has links to JICA web sites.

b.1 SWM Home Page

To access the “Solid Waste Management” Home Page go to <http://www.phnompenh.gov.kh/> using the Internet and the following screen will appear.



Figure 8-69: Top of MPP Home Page

If you click “Solid Waste Management” in the screen above, the following web page will appear.



Figure 8-70: Top Page of SWM Home Page

Visitors can contact PPWM at ppswm@phnompenh.gov.kh.

b.2 Operation, maintenance and training

MPP’s IT Center will be in charge of maintaining the web site, and PPWM will have to upload data as shown in the following figure.

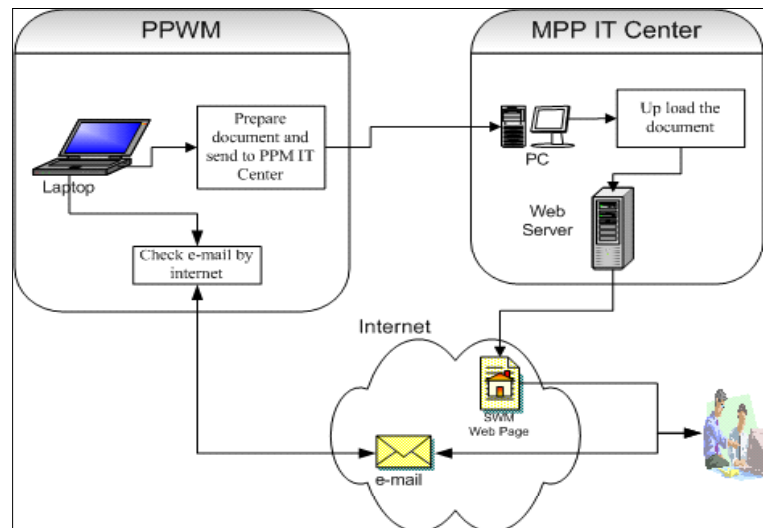


Figure 8-71: Update of the Data

PPWM prepares the documents to be presented on its web page and then sends it to MPP's IT Center, where the personnel in charge of the web site will upload the data.

At the present time, the PPWM office does not have a telephone line or access to the Internet. Therefore, to check its web page or send e-mails, PPWM personnel will have to go to the IT Center office of MPP.

Training was carried out for personnel from PPWM, the web master and the manager of MPP's IT Center.

8.6 Development and Promotion of the Urban Waste Compost Market

8.6.1 Background

In Phnom Penh, compostable organic waste such as kitchen waste and grass/wood waste is approximately 70% of the total waste generated. The disposal of such waste is an increasingly difficult problem. Landfill disposal is done at SMCDS; however, the site has almost reached its full capacity. Even though a new disposal site will be developed in Dang Kor in the future, it is very important to discover treatment methods which reduce the volume of such waste to accommodate the limited space at the landfill site. One possibility is the conversion of urban waste into compost.

If composting is operated successfully, it can have the following benefits.

- Conserve resources by recycling
- Support nature's cycle by returning organic waste to the earth
- Reduce the landfill space requirement of the Dang Kor disposal site

This pilot project aims to develop a market for the urban waste compost as a soil conditioner by demonstrating its effectiveness to farmers and investigating the marketability of urban waste compost. The main components of the pilot project are as follows:

- Physical/chemical analysis of urban waste compost
- A market survey of the urban waste compost

- A PR field trial using the urban waste compost
- Field trips to PR field trial farmland
- Production of promotional material

8.6.2 Physical/Chemical analysis of urban waste compost

Table 8-37: Physical/compost standard in Thailand and analysis results of composts

Parameters	Standard	Analysis results	
		COMPED	SCARO
C/N ratio	less than 20	16.6	9.8
pH	5.5-8.5	9.08	9.18
N content	1.0% or more	1.32	1.98
P ₂ O ₅	0.5% or more	1.2	1.8
K ₂ O	0.5% or more	0.8	2.7
Contamination	10% or less	27	7.9
Glass and Metals	None	Glass0.3% Metal0.1%	Glass0.4% Metal0.2%
As	50ppm	1.9	0.7
Cd	5ppm	1.3	2.2
Cr	300ppm	14	0
Cu	500ppm	44	108
Pb	500ppm	132	132
Hg	2ppm	0.1	0.4

- The content of N, P, and K and the C/N ratio clear the Thai standard. Though COMPED's results for K₂O are different from CSARO's, it seems to be due to the difference in raw materials. COMPED uses market waste as raw materials, and CSARO uses household waste.
- The pH results exceeded the standard. Ammonia may be generated from the compost because both composts are not aged enough. Further aging can improve it.
- COMPED compost exceeded the standard of contamination. This is because the compost is stored in an open yard. The contamination may occur when it is turned.
- Both composts exceeded the standard for "Glass and Metal". The raw material should be sorted more thoroughly.
- Other parameters such as heavy metals clear the Thai standard.

8.6.3 A market survey of urban waste compost

a. Objectives of the Survey

Once the solid waste is been converted to humus, it is ready for the final step of the composting operation, marketing. The study team, therefore, investigated the end-users of the compost product and the price to determine the feasibility of the new compost plant. As for the compost market survey, a questionnaire was given to the farmers in and around Phnom Penh in order to:

- identify potential users and their location
- find out the seasonal variation of the compost demand, the total estimated demand in the area, and the expected price of the compost
- identify the existing compost users and the possibility of expansion

b. Method of the Survey

b.1 Selection of villages and farmers

The study team planned to select ten villages from the targeted area. Nine villages were selected within a 20 km range of the border of Phnom Penh at random, and one was selected in Phnom Penh. From each village, five farmers were selected at random for the questionnaire survey. In total 50 farmers were selected for the survey.

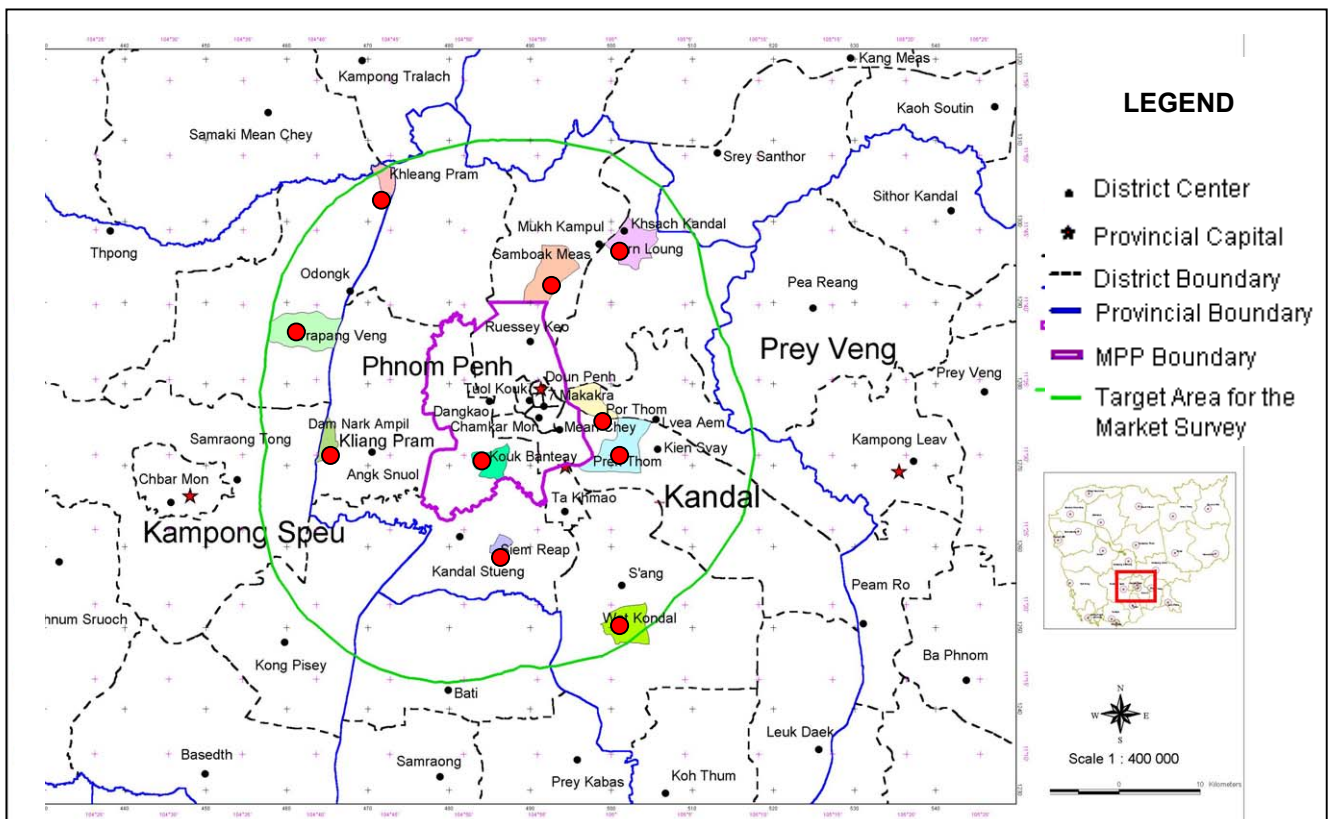
The list of villages surveyed is shown in the tables below. All the results in the tables were obtained by the questionnaire survey given to the farmers. The location map of the selected villages in targeted area was shown in the figure below.

Table 8-38: List of Surveyed Villages in Targeted Area

No.	Villages	Communes	Districts	Province and Municipality
01.	Prek Thom	Kbal Koah	Kien Svay	Kandal
02.	Por Thom	Arey Ksart	Lvea Em	Kandal
03.	Orn Loung	Prek Tameak	Ksarch Kondal	Kandal
04.	Sambork Meas	Bak Kheng	Mork Kampol	Kandal
05.	Dam Nark Ampil	Dam Nark Ampil	Ang Snoul	Kandal
06.	Siem Reap	Siem Ream	Kandal Steung	Kandal
07.	Wat Kondal	Teak Vil	S'Ang	Kandal
08.	Trapang Veng	Trapang Korng	Samrong Tong	Kampong Speu
09.	Kliang Pram	Viang Chas	Oudong	Kampong Speu
10.	Kork Bontey	Prey Sar	Dang Kor	Phnom Penh

A total of 347,962 households were estimated in the targeted area. The number of village households interviewed was 50. Therefore, the sample size was 0.014% of the total.

Map of Selected Surveyed Villages in Three Different Provinces



b.2 Questionnaire Survey

The survey was conducted from the 3rd to the 19th of November, 2003 by visiting farmers in the targeted area.

c. Results of Survey

c.1 Agricultural situation

Based on the 1992 Landsat survey of Cambodia, approximately 58% of land use was forest. Farmland was 22%, and rice fields accounted for 14% of the 22%. The rice fields are distributed in the central area of Cambodia like the target area of the marketing survey. Agriculture is the main industry and approximately 70% of workers are farmers. It can be said that the main crop in the target area is rice, followed by vegetables.

c.2 Rice fields

Almost all the farmers interviewed were rice farmers. Many of them cultivate vegetables but it is for side work. Normally, farmers can cultivate rice two times per year, in the rainy and the dry season. Based on the results of the marketing survey, the rice yield was less than 3 tons/ha. All interviewees used chemical fertilizer, the prime reason being that the supply of chemical fertilizer is stable. On the other hand, the interviewees answered that they know the problems caused by the overuse of chemical fertilizers (i.e. soil hardening) and they want to apply organic fertilizer such as compost. The chemical fertilizers used are DAP, 15 15 15, Urea, and 16 20 00, and the prices range from 45,000 to 60,000 riel/50kg. In the case of rice farming, the application rate of those chemical fertilizers is 202kg/ha on average.

About half (26 of the 50 farmers) of the farmers use organic fertilizer with chemical fertilizers. Cow manure is normally used. However, it is not always available because there are few cattle farmers. As a result, rice farmers have to rely on the chemical fertilizers more and more. The prices range from 20 to 60 riel/kg. In the case of rice farming, the application rate of organic fertilizers is 250 to 7,500kg/ha. The application rates varied according to the supply condition. The average application rate is 2,800kg/ha in total.

c.3 Vegetable fields

Thirty-one of the 50 farmers cultivate vegetables. As with rice, chemical fertilizers are normally used. Usually vegetable cultivation is side work to help pay daily living expenses. However, there were no vegetable farmers of the interviewees from the two villages, Dam Nark Ampil and Kliang Pram, both located in the west of Phnom Penh.

As with rice farmers, vegetable farmers use chemical fertilizer because the supply of chemical fertilizer is stable. This is the prime reason for use of it. They vegetable farmers also answered that they know the problems caused by the overuse of chemical fertilizers (i.e. soil hardening) and they want apply organic fertilizer such as compost. The chemical fertilizers used are DAP, 15 15 15, Urea, and 16 20 00 and the prices range from 45,000 to 60,000 riel/50kg. In the case of vegetable farming, it is notable that the application rate of those chemical fertilizers is 410kg/ha on average.

Fifteen of the 31 vegetable farmers use organic fertilizer with chemical fertilizer. Cow manure is normally used. However, it is not always available because there are few cattle farmers. Organic fertilizer is used in only three villages, Orn Long, Wat Kandal and Kork Bontey. However, 93% of the vegetable farmers in the three villages are using them. It can be said that vegetable farmers would like to apply organic fertilizer if it were available. The price of the organic fertilizer ranges from 20 to 60 riel/kg. In the case of vegetable farming, the application rate of those organic fertilizers is 250 to 7,500kg/ha. The application rates

varied according to the supply condition. It is notable that the average application rate is 3,100kg/ha in total, which is higher than that of rice cultivation.

c.4 Compost Producers

In Cambodia, there are two NGOs, COMPED and CSCARO, which process waste into compost fertilizer, but it not well-known that urban waste compost fertilizer is available in Phnom Penh. COMPED has been supported by German funding, and it sells somewhere around six tons of compost fertilizer per month. The price is 200 riel per kilogram. COMPED’s customers are vegetable and fruit farmers and the number of customers is limited. The consumers of these products are mainly high-class restaurants or hotels for foreigners.

As for CSARO, it is supported by the NORAD organization in cooperation with MPP. CSARO can produce from one to two tons of compost per month and the price is 350 riel per kilogram, which is higher than the compost fertilizer produced by COMPED.

8.6.4 A PR field trial using the urban waste compost

a. Background

The field trial to verify the effect of urban waste compost application was conducted on farmland in Svay Rieng by International Volunteers of Yamagata (IVY), and the farmers under the instruction of IVY. In the trial, the yields of rice on farmland with and without compost were reported to the team via IVY and compared. The implementation structure of the field trial is shown in the figure below. The results of the experiment will be utilized for the development of the urban waste compost market and the wide use of compost for rice cultivation.

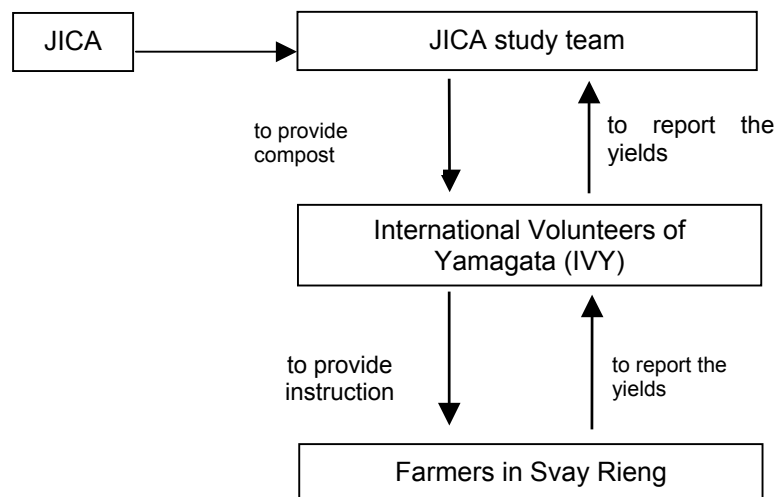


Figure 8-72: System to Conduct the Field Trial

b. Method of the Field Trial

The field trial was done in five sites. Sites 1 to 3 were the farmers’ farmland and compost was applied with chemical fertilizer. Sites 4 and 5 were in the IVY pilot farm and compost was applied without chemical fertilizer. In each site, three types of trials were done, one without compost, one with 10t/ha of compost and one with 30t/ha of compost.

c. Results of the Field Trial

The following table shows the results of the field trial:

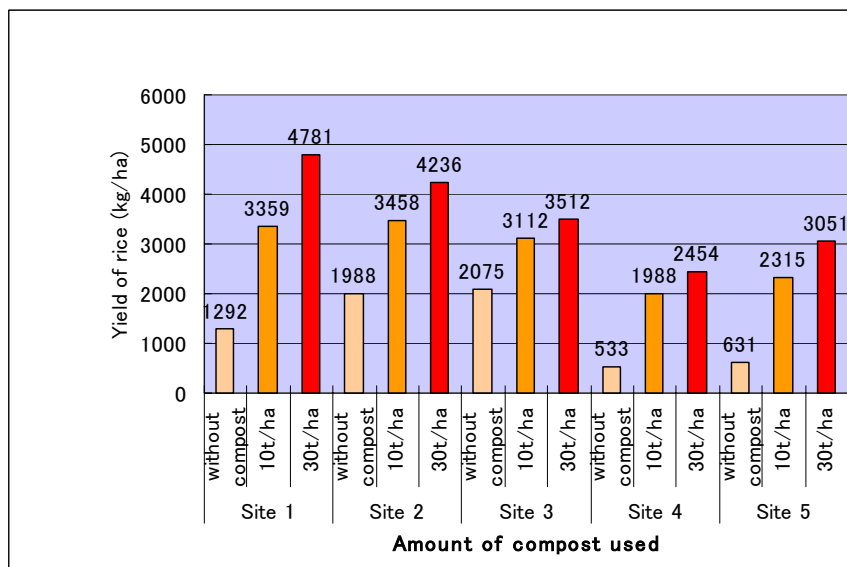


Figure 8-73: Effectiveness of urban waste compost

All the sites show that the urban waste compost is effective both with and without chemical fertilizer. In particular, sites 4 and 5 showed a 3.4 to 3.7 times increase in yield with the use of 10t/ha of compost compared to without compost.

Comparing the application rate of compost, all sites show that the yields of rice with 30t/ha of compost were higher than those with 10t/ha of compost but the increase was less than 3 times the amount. Therefore, from the viewpoint of cost effectiveness, the most suitable application rate for compost can be said to be under 10t/ha. For example, based on the analysis results mentioned before, the nitrogen content of the compost was 1.3 to 2%. As the nitrogen application rate is 50kg/ha on average in Cambodia, the compost application rate must be between 2.5 to 3.8t/ha to satisfy the nitrogen application rate.

8.6.5 Field trips to PR field trial farmland

Two field trips were arranged, once during the growing period and once at harvesting time, targeting farmers in Svay Rieng to demonstrate the effect of compost. Another field trip was arranged at harvesting time targeting related persons in Phnom Penh for the same purpose. In addition, a promotional video, panels and leaflet, showing the production process of urban waste compost, how to use compost and the cultivation process of rice, were made.

a. Field trip targeting farmers in Svay Rieng

Date: November 12, 2003
 Attendants: 50 farmers from Svay Rieng
 Time: 10:00 ~ 15:00 am
 Venue: Agricultural hall in Svay Rieng experimental farmland of IVY and farmers

1. Workshop for urban waste compost
2. Field visit to observe the growing condition of the rice

b. Second trip targeting farmers in Svay Rieng

Date: December 9, 2003
Attendants: 50 farmers from Svay Rieng
Time: 10:00 ~ 15:00 am
Venue: Agricultural hall in Svay Rieng experimental farmland of IVY and farmers

1. Workshop for urban waste compost
2. field visit to observe the rice at harvesting time, and demonstrate the compost production

c. Field trip targeting farmers in Phnom Penh

Date: 26th of November 2003
Attendants: 44 attendants (16 farmers in Phnom Penh, 2 NGO, 23 MPP/local officers and 3 PPWM)
Time: 8:00 ~ 19:00 am
Venue: Experimental farmland of IVY and farmers in Svay Rieng

1. Workshop for urban waste compost
2. Field visit to observe the growing condition of the rice

8.6.6 Findings

Regarding the results of the compositional analysis of the urban waste compost produced by COMPED and CSARO in Phnom Penh, pH and contamination exceeded the Thai standard of compost quality. However, these can be cleared by improving composting process.

The results of the field trials conducted in Svay Rieng demonstrated that the use of urban compost can increase rice yields. The study team made a promotional video showing the production process of compost and the field trials that were conducted. At the second seminar, the video will be shown to the participants along with a presentation of compost using panels in order to demonstrate the effectiveness of urban waste compost. The videos were also lent out to NGOs producing urban waste compost to further promote its use.

In the marketing survey conducted in the villages, the farmers were found to fully appreciate the importance of organic farming. However, the supply of compost is not steady so they have to rely on chemical fertilizers. This shows that if a system for providing a steady supply of compost at a reasonable price is established, there will be an increase in demand.

In the field trial, in order to produce 2000 kg of rice, 50kg of chemical fertilizer and 10,000 kg of urban waste compost were required. The chemical fertilizer costs 900~1,200 riel/kg while the compost costs 200~500 riel/kg. Therefore, the investment to produce the same yield is 45 to 80 times greater for compost. Even taking into account the effect of soil improvement, if cost is not reduced to one tenth of the current amount, the farmers will have no choice but to rely on chemical fertilizers.

COMPED sells compost at 200 riel/kg to fruit farms and farmers who grow vegetables in the suburbs of Phnom Penh, while CSARO sells compost at 350 riel/kg for home gardens and horticulture. Although both are small scale markets, for limited purposes there is a demand. Therefore, although urban waste compost cannot compete with chemical fertilizers in terms of cost, a demand for high value crops can be expected.

Chapter 9

Capacity Building

9 Capacity Building

9.1 Capacity Building through Pilot Projects

9.1.1 Objective

In the ICB/NIP by NORAD conducted from May 1997 to March 2002, organizations were formed and offices were set up for the operation and management of SWM services in Phnom Penh. However, DPWT and PPWM, the executing bodies, lack the capability to operate and manage such services and have not formulated an operational plan.

In order to smoothly implement the M/P, the institutional capacity building (ICB) of the implementing agencies, i.e. PPWM, DPWT and DOE, for the management and operation of SWM services in Phnom Penh is essential.

Accordingly, the JICA study team implemented the above-mentioned ICB as described below.

9.1.2 Method

The SWM system in MPP is basically divided into a collection system (including public area cleaning) and a final disposal system. The management and operation of such SWM activities in MPP are the responsibility of DPWT, DOE, and PPWM. However, the majority of collection and street cleaning services and the collection of fees for such services are conducted exclusively by a single private contractor.

Given such conditions, in order to strengthen the management and operational capabilities of DPWT, DOE, and PPWM, the Study implemented the following ICB program:

1. ICB through the implementation of pilot projects (PP) :
In order to provide OJT (on-the job training) through the actual improvement of SWM services, PPs to improve the collection system and final disposal system were implemented in collaboration with the C/P.
2. ICB through seminars, workshops, etc :
ICB was implemented through meetings to explain the various reports, weekly meetings, seminars and workshops, and C/P training.

9.2 ICB through the Implementation of PP

9.2.1 Improvement of the SMC Disposal Site

a. Contents of ICB

Planning for the improvement of SMC disposal site commenced in April 2003, and the improvement work was completed in February 2004. Through this PP, ICB was conducted for the planning, operation and management of a final disposal system, as shown in the table below.

Table 9-1: ICB through PP for the Improvement of SMC Disposal Site

Category	Item	Description
Planning	Formulation of an improvement plan	<ul style="list-style-type: none"> • Training in planning methodology through weekly meetings
	Preparations for implementation of the improvement plan	<ul style="list-style-type: none"> • Negotiations to secure land for expansion of the disposal site • Supervision of construction work • Introduction of WP registration system
Operation	Formulation of an operational plan	<ul style="list-style-type: none"> • Training in planning methodology through weekly meetings
	Implementation of the operational plan	<ul style="list-style-type: none"> • Preparation of Daily Landfill Operation Plan • Instruction to collection vehicle drivers, heavy equipment operators and WP on the working face rules, and thorough enforcement
Management	Control of waste brought to the site	<ul style="list-style-type: none"> • Confirmation and management of incoming vehicles and incoming waste • Weighing of incoming vehicles by weighbridge and compilation of the data • Operation and maintenance of on-site roads.
	Operational control	<ul style="list-style-type: none"> • Control of WPs. • Operation and maintenance of the working face.

b. Outcome and problems

b.1 Outcome

The main outcome was that PPWM established a management system (operation and maintenance of the working face, setting of site boundaries, registration and control of WP, etc.) to some degree for the SMC disposal site, which before the PP was simply an open dump with no rules or order.

In addition, a system for monitoring the incoming vehicles and waste using the weighbridge installed at the entrance was established. The type and amount of waste that is disposed of at the site as well as where it comes from and who brings it is recorded.

The management system was also strengthened in physical terms. The number of PPWM staff members operating the SMC disposal site was increased from one person before the PP to four people. Moreover, one of the two Deputy Governors of PPWM also took responsibility of the site operation. PPWM also assigned a staff member to its head office in order to manage the weighbridge data that it receives daily.

b.2 Issues to be solved

Although a management system was established by PPWM to some degree, further ICB in regard to the following is needed to establish a final disposal system.

1. The further building up of human resources to establish a system for proper disposal, control of WP and environmental monitoring.
2. The strengthening of the operation and maintenance system of equipment and vehicles in order to realize proper disposal.
3. The establishment of an environmental monitoring system such as leachate control, etc.

9.2.2 Improvement of the Waste Collection System

a. Contents of ICB

Improvement of the waste collection system was conducted with the primary aim of eliminating the areas in MPP where waste is not collected and/or the collection service is inadequate in the Phase 2 study. The study team and PPWM conducted the pilot project providing the collection service to the 4 Sangkats by using the equipment PPWM owned presently to establish the integrated waste collection system including from finding customers, collection service and fee collection. Therefore, PPWM is now continuing this activities.

Table 9-2: ICB through PP for the Improvement of Waste Collection System

Category	Item	Description
Planning	Formulation of an improvement plan	<ul style="list-style-type: none"> • Training in planning methodology through weekly meetings. • Public meetings were held, and the improvement plan was formulated reflecting the requests and comments of the residents. • A waste collection fee system was planned.
	Preparation for implementation of the improvement plan	<ul style="list-style-type: none"> • Primary collection workers were organized and contracts were negotiated. • Negotiations were held with Sangkat. • Beneficiaries of the collection service were registered and controlled. • A service agreement was signed with the beneficiaries of the collection service. • Public cleansing campaign was planned and held
Operation	Formulation of operational plan	<ul style="list-style-type: none"> • Training in planning methodology through weekly meetings. • Preparation and explanation of the action manual in an emergency
	Implementation of operational plan	<ul style="list-style-type: none"> • Preparation of collection route plan for collection vehicles and workers • Instructions were given to collection vehicle drivers and collection workers and strictly enforced. • An explanatory meeting on the collection routes and practical training were given to the drivers. • Collection and management of waste fee
Management	Customer management (beneficiaries of collection service)	<ul style="list-style-type: none"> • Establishment of the customer relation section and education and training of the stuffs. • Signing and management of collection service agreements • Deal will public complaints • Preparation and update of customer lists
	Operation and management	<ul style="list-style-type: none"> • Operation and maintenance of collection vehicles and containers • Operation and maintenance of container site • Control of primary collection workers

b. Outcome and problems

b.1 Outcome

The main outcome was that a system for collecting fees from the beneficiaries, a prerequisite to the provision of the collection service, was developed to a certain degree. In the fee

collection system, PPWM makes a contract with the residents and prepares bills, and the Sangkat collects fees based on that.

In addition, the collection service by PPWM, which prior to the implementation of the PP was simply collecting waste and dumping it at the disposal site, extends to service quality; PPWN now deals with customer complaints, operates and maintains the container sites, manages the primary collection work, etc.

PPWM drivers and collection workers also maintain the vehicles and equipment (i.e. they inspect the equipment before starting work, wash the vehicles and containers, etc.), which was rarely done prior to the implementation of the PP.

b.2 Problems

Although PPWM has established a management system to some degree, in order to develop a collection system that will eliminate unserved and inadequately serviced areas, further ICB is required in respect to the following:

1. Further capacity building of PPWM staff in order to realize the expansion of the collection service proposed in the M/P
2. Strengthening of coordination with concerned persons (Sangkats, primary collection workers) required for the expansion of the collection service; that is, to expand and strengthen coordination among PPWM, DOE, Sangkats, and residents in order to carry out fee collection, update customer lists, and monitor the collection service.
3. Establishment of cooperation with the residents, the customers, in order to prevent the scattering of waste, operate and maintain the container sites, and eliminate free riders.
4. Urgent preparation of the maintenance facility for the equipment

9.2.3 Public Education Campaign

a. Content of ICB

As mentioned in the chapter of pilot project, DOE is the organization responsible for increasing public awareness and promoting public participation in MPP, but so far DOE has had no experience but a public campaign. In carrying out the campaign, DOE urged people to clean the city but did not provide specific instructions on how to discharge waste, consider how to promote public participation, or examine modifying the collection system. As a result, the campaign ended without a significant achievement.

Through the pilot project, DOE was expected to gain the knowledge and skills to solve such problems as scattered waste on the street and odor caused by waste by introducing the simple waste discharge rules. The outline of the pilot project from the ICB point of view is shown below.

Table 9-3: ICB through PP for Public Education Campaign

Category	Item	Description
Planning	Formulation of a basic strategy and a plan	<ul style="list-style-type: none"> • To conduct baseline surveys and analyze causes of problems • To organize meetings with other stakeholders and make a broad consensus with them • To decide basic strategies and approaches in cooperation with other stakeholders (making clear roles and responsibilities of each stakeholder) • To formulate the waste discharge rules while examining the appropriateness of current collection systems
	Preparations for implementation of the plan	<ul style="list-style-type: none"> • To prepare educational materials in cooperation with local authorities and collection service providers • To disseminate information • To give an instruction on how to store and discharge waste both to local authorities and residents • to give an instruction to collection service providers if necessary
Implementation in the project sites	Implementation of discharge rules	<ul style="list-style-type: none"> • To monitor the behaviors of residents and passersby • to monitor the activities of waste collection service providers • to give an instruction if necessary • to modified discharge rules if necessary

b. Outcome and issues to be solved

b.1 Outcome

Through the pilot project, DOE realized the importance of the waste discharge rules, though the discharge rules applied in the pilot project were minimum rules for the proper solid waste management. DOE obtained the know-how to formulate simple discharge rules in cooperation with other stakeholders, disseminate information, and educate local residents and business establishments.

DOE initiated the similar project in other areas in Phnom Penh, referring to this pilot project, with funding from ADB and UNDP. In addition, DOE sought the budget from the SEILA program to expand the waste discharge rules.

b.2 Issues to be solved

(1) Further cooperation with local authorities and collection service providers

It is urgent for DOE to expand the discharge rules to the whole city. However, the budget and staff of DOE is limited, and it is very difficult to realize it by itself. The close cooperation with local authorities is one of key elements for the successful implementation of the waste discharge rules. DOE staffs, who are assigned to each Khan office, are expected to take a leading role in expanding the discharge rules to the whole city.

In addition, the result of PP showed that the waste discharge rules improved the collection efficiency to a considerable degree. Before the pilot project, there had been little cooperation between DOE and CINTRI. Even though they started discussion about the discharge rules during the pilot project, it is preferable that CINTRI be involved in the waste education activities further. It is necessary for MPP to clarify the roles and responsibilities of collection service providers in the waste education program.

(2) Disseminate information to the whole city

The result of pilot project showed that it was not difficult to ask local residents for their cooperation to implement discharge rules. It is, however, very difficult to control the activities of passersby and street vendors that are moving around the city. It is necessary for DOE to make newly established waste discharge rules widely known in the whole city by active public relations activities through such media as TV, radio and newspaper.

(3) Necessity for more sophisticated waste discharge rules

As mentioned above, the waste discharge rules applied in the pilot project were the minimum rules necessary to keep their houses and surrounding area clean. At present, it seems difficult to keep a communal collection system properly because there is no guarantee to keep the communal discharge points clean and local residents near the communal discharge points are strongly against this collection system. As a result, at the pilot project the door to door collection system was introduced where there is no access of the collection vehicles.

In addition, the separate collection system will be necessary in the future. DOE has to take an effort to arrange further budget and staff for the implementation of the more sophisticated discharge rules.

9.2.4 Establishment of Regular Monitoring System (Under PP for Improvement of SMC Disposal Site)

Before the pilot project, MOE/DOE had never conducted the environmental monitoring at the SMC disposal site. The regular environment monitoring by the regulatory organizations is indispensable for the proper pollution control.

On the other hand, in the development plan of the DK disposal site, the team proposed to organize the monitoring committee to control the operation of PPWM. In order to guarantee the regular monitoring by the monitoring committee at the DK disposal site, MOE/DOE should start to prepare for the regular monitoring system now. Therefore, under the pilot project, the team decided to support MOE/DOE to initiate the regular monitoring system at the SMC disposal site.

Due to the lack of the budget, it is almost impossible for MOE/DOE to start the same regular monitoring system as the development plan proposed. The team decided to exclude some monitoring items which are not affordable for MOE and DOE. Even though the newly established regular monitoring system is primitive, MOE and DOE could accumulate knowledge and experience through the regular monitoring which includes such tasks as sampling, analysis, data compiling, and data analysis.

9.3 ICB through seminars, workshops, etc.

The ICB through seminars, workshops and other activities is summarized in the table below.

Table 9-4: ICB through seminars, workshops, etc.

Item	Sub-item	Period	Contents	Participants
Group training	C/P Training in Laos (Vientiane)	29/09/03 - 03/10/03	Understanding of the valuable recommendations made in the M/P (public container collection system, fee collection and customer management system, system for operation of final disposal site and management of incoming waste, etc.)	A total of 9 participants from MOE, MPP, DPWT, DOE, and PPWM
	Group Training Workshop in Cambodia	29/12/03 - 02/01/04	A workshop was held to disseminate the results of the study throughout the country. The aim was to help the concerned persons from local government to obtain the knowledge and information required to formulate a SWM M/P	29 participants from provincial cities, 16 from MPP, and 6 from central government agencies
		13/09/04 - 17/09/04	A workshop was held to disseminate the results of the study throughout the country. The aim was to help the concerned persons from local government to obtain the knowledge and information for the proper operation of SWM services	31 participants from provincial cities, 14 from MPP, and 4 from central government agencies
Technology transfer seminars/workshops	Technology transfer seminar	06/10/03	Explanation of the contents of the SWM Master Plan (Draft). Confirmation of the priority projects. Confirmation of the contents of the pilot projects.	A total of 55 participants, 38 related to MPP, 2 from central government agencies, 1 from an NGO, 4 from international organizations, 2 from the private sector, and 8 from the media.
		26/05/04	Explanation of the contents of the SWM Master Plan and the results of the F/S.	A total of 66 participants, 38 related to MPP, 9 from central government agencies, 12 from NGOs, 1 from the private sector, and 6 from the media.
		18/01/05	Dissemination of the results of the Study and formulation of a consensus among the stakeholders regarding smooth implementation of the M/P	A total of 97 participants, 31 related to MPP, 9 from central government agencies, 23 from NGO, 14 from the private sector, and 20 from the media.
	Workshop to promote the 3Rs	08/01/04 - 09/01/04	As a first step in raising public awareness of the 3Rs, knowledge and information on SWM and the 3Rs are provided to NGOs and government organizations which will play a leading role.	A total of 41 participants, 14 from NGOs, 8 from central government agencies, and 19 from MPP.
	Explanation/discussions	IC/R	25/02/03 - 10/03/03	Explanation and discussions of the objectives, methodology, etc. of the study
P/R (1)		03/07/02	Explanation and discussions of the concept of the M/P, F/S, and PP.	A total of 41 participants.
IT/R		23/09/03	Explanation and discussions of the M/P (Draft) and PP (Draft).	A total of 33 participants.

Item	Sub-item	Period	Contents	Participants
	P/R (2)	13/01/04	Explanation and discussions of the method for continuing the F/S (Draft) and PP.	A total of 30 participants
	DF/R (1)	25/05/04	Explanation and discussions of the contents of the SWM M/P and the results of the F/S.	A total of 40 participants
	P/R (3)	27/07/04	Explanation and discussions of the contents of modified SWM M/P and F/S.	A total of 35 participants
	Overall weekly meetings	28/02/03 - 27/06/03 - 03/10/03 - 16/01/04 - 21/05/04 - 23/07/04 - 06/09/04 - 08/10/04 -	Explanation and discussions of the schedule, work, objectives and contents of the study.	5-10 C/P staff (DPWT, PPWM, DOE)
	SMCDS weekly meetings	12/10/03 - 12/01/04 - 24/05/04 - 26/07/04 - 06/09/04 - 04/10/04 -	Explanation and discussions of the schedule, work, objectives and contents of the study.	2-8 C/P staff
Surveys of existing conditions	Waste amount and composition survey	23/03/03 - 30/03/03 - 21/10/03 - 28/10/03 -	Explanation and discussions of the schedule, work, objectives and contents of the survey; implementation of field survey (sampling method, analysis method); data management/analysis.	2-3 C/P staff
	T&M survey	24/03/03 - 06/04/03 - 12/11/03 - 16/11/03 - 01/12/03 - 08/12/03 -	Preparations for survey (arrangement of collection vehicles data, classification of collection systems), implementation of survey, arrangement/analysis of survey results	2 C/P staff
	Water quality survey	23/04/03 28/11/03	Explanation and discussions of the schedule, work, objectives and contents of the survey, field survey (training in sampling method)	1-2 C/P staff
Explanatory meetings for residents	1 st public hearing	20/10/03	Explanation of the Dang Kor Disposal Site Development Project (Draft 1) and the EIA survey followed by a Q&A session,	Approx. 96 participants including C/P, MPP, PPWM, Khans, Sangkats, and local residents
	2 nd public hearing	25/12/03	Explanation of the Dang Kor Disposal Site Development Project (Draft 2) and the results of the EIA survey followed by a Q&A session.	Approx. 379 participants including C/P, MPP, PPWM, MOE, Khans, Sangkats, and local residents
	3 rd public hearing	15/07/04	Explanation of the Dang Kor Disposal Site Development Project (Draft 3) and the results of the EIA survey followed by a Q&A session.	Approx. 352 participants including C/P, MPP, PPWM, MOE, Khans, Sangkats, and local residents

9.3.1 C/P Training in Laos (Vientiane)

a. Objective

The objective of the training is to facilitate the C/P (DPWT/PPWM of MPP) to understand and obtain sufficient knowledge to implement the SWM master plan (M/P) to be proposed by the Team.

Specifically, the training program will provide the following opportunities:

- Vientiane differs from Phnom Penh in its natural, social and economic conditions. The C/P members will be able to inspect similar SWM systems of some important system components to be recommended in the M/P, such as the communal container collection system, the waste collection fee and costumer management system, the operation and incoming waste control system of the final disposal site, etc. Some of the systems are planned to be implemented as pilot project components.
- The C/P will receive some lectures on how the improvement plan proposed by the JICA SWM Study was implemented by responsible persons in Vientiane Municipality and how to overcome the several issues and problems encountered in the implementation stage.
- The C/P will inquire about several issues and problems in SWM and exchange opinions on such issues with relevant personnel in Vientiane Municipality.

b. Results of Training

b.1 Collection and Street Cleaning System

b.1.1. Items pointed out to the C/P (MPP/PPWM)

In general, Vientiane Municipality has adopted a collection and street cleaning system based on the M/P formulated in the JICA development study.

(1) Collection system

1. For small quantity generators such as general households, etc:

Waste is disposed of in bamboo baskets and collected by skip loader truck or dump truck. The collection frequency and quantity is generally one basket per household per week, or determined by customer request.

2. For large quantity generators such a markets, etc:

Five m³ containers are collected by skip loader truck. The collection frequency and quantity (no. of containers) is determined by customer request.

(2) Street cleaning system

Street cleaning is done manually using cheap labor.

b.1.2. Situation in Vientiane and the C/P's response

(1) Collection system

- In contrast to Phnom Penh, scattered waste is rarely seen in Vientiane. The C/P understood that this was basically a result of to the discharge and collection system mentioned above and public cooperation.
- The C/P also found the collection service to be very efficient compared to Phnom Penh (In bamboo basket collection, only a small amount of time was required for loading and hardly any time for container collection).



Waste discharged in bamboo baskets



Waste collection by skip loader truck

(2) Street cleaning system

- Street cleaning work is generally done manually. A few years ago a street cleaning vehicle was provided through grant aid. However, after being in operation for one year, the part shown below wore out and the vehicle could no longer be used. The problem is that the part costs 3,500 dollars and is difficult to purchase. Moreover, with that money it is possible to hire 120 street cleaners for a month.
- The C/P, MPP, understood the importance of continuing to carry out street cleaning manually as proposed by the Study Team in the M/P.



Broken part costing 3,500US\$



Street cleaning vehicle

b.2 Fee Collection System

b.2.1. Items pointed out to the C/P (MPP/PPWM)

(1) Waste collection fee

The collection service in Vientiane Municipality (VM) is covered by the fees collected from residents and businesses, the beneficiaries of the service. An agreement is made with the customer before the collection service is provided. As inflation is severe, the contract is for a period of three months. In general, the collection service fee is established based on the proposal in the JICA development study from 12 years ago.

- Small quantity generators are generally charged 8,000 kips/month (1US\$ = 10,800 kips) for the collection of one bamboo basket per week. (At the time of the JICA study it was 500 kips/month (1US\$ = 730 kips).).
- There are three methods for collecting fees: 1) direct collection by VM staff, 2) indirect collection by Bans (the smallest unit of government), and 3) the lending out of collection vehicles to CBOs (Community Based Organizations) or CBEs (Community Based Enterprises) in Bans (In this case, vehicles are lent out at a price). Of these methods, 1) was proposed in the JICA study but 2) is the most common at present. The fee collection work includes supervision and monitoring (hearing of complaints, prosecuting of violators, and management of sanitary conditions in the districts) and 10% of the amount collected is paid to the Bans.
- VM currently has 20 staff members responsible for fee collection but it is mostly done centering on collection contracts.
- For large quantity generators, an agreement is made to lease containers and the fee varies depending on the collection frequency. The container fee is currently the most important source of revenue for the Cleansing Department of Vientiane. Therefore, the department manufactures the containers by itself.

(2) Disposal fee

- At present, 10 kips/kg (10,000 kips/ton, about 1US\$/ton) is charged for waste disposed of at the disposal site, excluding waste from VM collection vehicles.

(3) Others

As for other sources of revenue, the biggest is the funding provided by VM for the public area cleansing service and beautification of the city. There is also a small amount of revenue from fees collected for the collection and disposal of sludge from septic tanks.

b.2.2. Situation in Vientiane and the C/P's response

(1) Waste collection fee

- The collection fee for small quantity generators is based on the number of bamboo baskets. The C/P found this to be a rational system as the fee is determined by the generation amount.
- Of the fee collection methods, the C/P was very interested in Method 2, where the fee is indirectly collected by Bans (the smallest unit of government). The reason was because the fee collection work includes supervision and monitoring work such as the hearing of complaints, prosecuting of violators, and the management of

sanitary conditions of districts, which are troublesome tasks that should be carried out by the Cleansing Department.

- During the training, the C/P visited the Nasai Ban office to obtain information on the situation from the Ban Chief and Ban fee collectors. They found that of the 334 households in the Ban, there is a collection agreement with 229 households and a total of 3,290,000 kips is collected per month. As for those who do not have an agreement or cannot afford to pay the fee, they are cooperating by placing their waste in bamboo baskets at collection sites in front of their homes. Of the 329,000 kips collected per month, only 50,000 kips is paid to the Ban office and what's left of that goes to the fee collectors. The revenue collected by the Ban office from issuing marriage licenses, etc. is small.
- The collection fee for large quantity generators is based on a container leasing agreement, and varies depending on the collection frequency, etc. The C/P found this to be a rational system as the fee is generally determined by the generation amount.

(2) Disposal fee

- As the disposal fee is charged based on the weight of waste measured at the disposal site, the C/P recognized the importance of operating the weighbridge installed in the Study.
- At first, the C/P thought a fee of 1US\$/ton was quite sufficient. The study team, therefore, explained how this was not adequate to cover the operation of a sanitary landfill, which requires 5US\$/ton. However, as raising the fee leads to illegal dumping, the C/P realized the importance of subsidizing the cost to some degree from the city budget in order to set a fair fee.

(3) Other

- The C/P understood the importance of VM's covering the cost of the public area cleansing service and providing funds for activities to beautify the city. With waste collection, there is a direct benefit and as the waste generator (beneficiary) can be identified, it is possible to charge a fee (share the burden). However, with public services such as the cleaning of public areas and beautification of the city, the beneficiary cannot be identified so it should be shouldered by the city. The C/P recognized that the situation in Phnom Penh, where this burden is left to CINTRI with hardly any assistance from the city, is an issue that needs to be addressed.



Interview with Ban staff on the waste collection fee system



Management of measurement data at the final disposal site

b.3 O&M of Equipment and Vehicles

b.3.1. Items pointed out to the C/P (MPP/PPWM)

- The method for daily inspection, O&M of spare parts and vehicles, etc. of the maintenance shop constructed through grant aid were explained, and the actual management situation was inspected.
- At the final disposal site, the C/P happened to observe the driver of a skip loader truck rinsing the containers using the pump from the road sprinkler.
- It was explained that in order to reduce the amount spent on purchasing containers, the containers were manufactured at the maintenance shop.

b.3.2. Situation in Vientiane and the C/P's response

- The waste collection dump trucks used in the 1991 JICA study were still in operation, which made the C/P understand the importance of daily inspections.
- In the Study, the construction of maintenance shops is targeted for the F/S. The C/P fully understands the importance of this.



Washing of container at disposal site



Construction of container at maintenance shop

b.4 Final Disposal System

b.4.1. Items pointed out to the C/P (MPP/PPWM)

According to the M/P established in the JICA study, the sanitary landfill constructed by grant aid was a Level 2 (sanitary landfill where leachate is not treated but daily soil covering is carried out), and was to be upgraded to a Level 3 (leachate is treated by recirculation system) in the year 2000.

However, the landfill has been downgraded to a Level 1, where soil covering is only carried out occasionally (controlled tipping). This is due to the fact that there is a shortage in fuel required for the daily operation of heavy equipment.

b.4.2. Situation in Vientiane and the C/P's response

- In general, the operation of heavy equipment (typically a bulldozer) at a sanitary landfill for eight hours a day requires 200 liters of fuel. At the disposal site in Vientiane, although two of the three dump trucks provided through grant aid are still in operation, it would require 800 liters of fuel a day to operate both for a full eight hours, which would cost 240/day or 1,200 dollars/month. With that money, it would be possible to hire 240 laborers for one month.

- It became clear that one of the main reasons for the shortage of fuel is because the city does not allocate enough funds. As mentioned above, it is difficult to raise the disposal fee as it will lead to illegal dumping. Furthermore, even if the sanitary conditions of the dumpsite worsen, the number of residents affected by it is small. As a result, the politicians who in charge of the budget do not consider it a high priority.
- As a result of the visit by the personnel from Phnom Penh, funds were quickly allocated for improvement of the disposal site. Compared to the time of Mr. Shimura's visit on September 17, the conditions had clearly improved. Both VM and MPP personnel recognize that making politicians understand that continuing a sanitary landfill operation at disposal sites will cost money and that there is a need for improvement are major issues.



Disposal site prior to training (September 17)



Disposal site during training (October 2)

b.5 Other

b.5.1. Promotion of working level exchange between MPP and VM

MPP and VM have very similar socio-economic conditions. From this standpoint, they face many common problems with regard waste management. This training allowed working level officials from MPP and VM to exchange views on these common problems, and they recognized this to be a good opportunity for them to work hard together to improve their respective waste disposal services in the future.

b.5.2. Impact on VM

As mentioned above, the reason why UCSD/VM is not able to maintain the KM-18 disposal site as a sanitary landfill (Level 2) is largely due to the reduced budget from the city. Despite the fact that the Mayor and Vice Mayor, the head of the municipal government in charge of policy making, have a great interest in making the city beautiful and eliminating garbage from the city, they have a very low interest in the disposal site. This had led to the reduction in funding from the city.

The C/P's visit to Vientiane to study the waste management conditions there is thought to have had a great impact on the heads of the municipal government. As a result, funds were quickly allocated for the improvement of the disposal site. This shows that this training has not only had a favorable impact on MPP/PPWM but also on the solid waste management service of UCSD/VM.

9.3.2 Report of Group Training in Phnom Penh

a. Objectives

The Sub-decree on Solid Waste Management (the Sub-decree on SWM) stipulates Municipal SWM (Non-Hazardous Waste Management or Household Waste Management) is the responsibility of local governments. The Sub-decree also stipulates that each local government should promptly formulate a short, medium and long-term plan on MSWM for the proper management of its waste. Although Phnom Penh, the capital city, is formulating the MSWM M/P by this study, none of the local governments in Cambodia have formulated a MSWM plan.

Taking the above-mentioned situation into consideration, the group training in Phnom Penh will be conducted with the following objectives: Sub-decree on Solid Waste Management

- To support main local governments (i.e. the four municipalities and 20 provincial towns) to facilitate formulation of their respective MSWM M/Ps;
- To provide necessary information and knowledge to key personnel of main local governments so that they are able to formulate their respective MSWM M/Ps by themselves; and
- To guide main local governments to prepare action plans (A/Ps) for MSWM, which will identify what they have to do to formulate an M/P.

In order to achieve the above objectives, the group training will invite key personnel of main local governments to Phnom Penh and provide them with the necessary information and knowledge, which are obtained through the conduct of the Study on SWM in the MPP; i.e. the field surveys, the process of the formulation of M/P, the contents of Feasibility Study, and pilot projects.

b. Results of Training

b.1 Master Plan (M/P) and Action Plan (A/P)

Master Plan

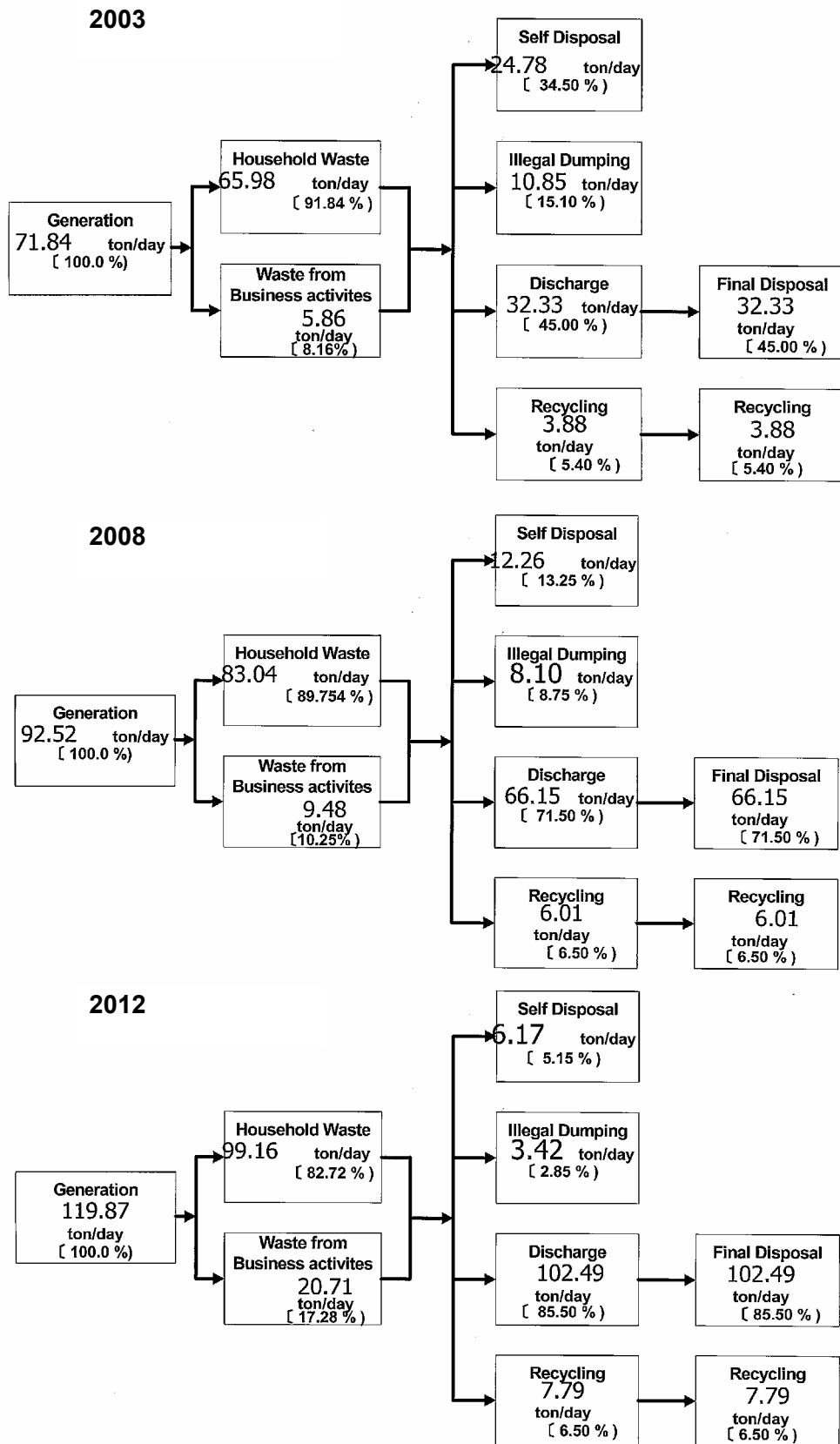
Table 0-1: The SWM Master Plan for Battambang

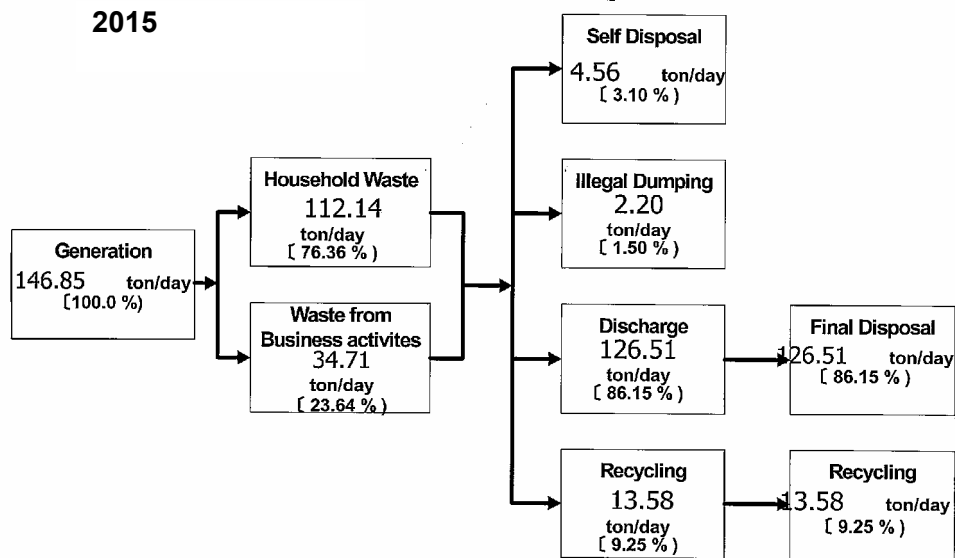
Components	Phase Present (2003)	Phase 1 (2006)	Phase 2 (2012)	Phase 3 (2015)
1. MSW Generation				
Population in '07	136,478	163,656	169,650	180,232
MSW Amount (ton/day)				
Generation	71.84	98.52	116.67	146.25
Discharge	32.33	46.15	102.49	129.51
Collection	32.33	46.15	102.49	129.51
MSW Composition (%)	100			
Non-compostable	-	40.50	29.85	37.49
Compostable	-	59.50	66.16	62.50
2. Refuse Collection & Transportation				
Collection rate	45.00	71.50	85.50	86.15
Ratio of improper disposal to generation	15.10	8.75	2.85	1.5
Separate collection rate to refuse collection	-	1.1	1.3	1.4
Collection system	In front household	In front household		
Major type of vehicles (unit)	4	5	7	7
Transportation system	Push cart, Tractor	Tractor, Container, Compactor	Tractor, Container, Compactor	Buildover, Compactor
Executing organization	Everyday	Everyday	Everyday	Everyday
Unit cost (US\$/ton)	-	4.25	7.20	9.50
3. Public Area Cleaning				
Method of sweeping	Manual	Manual	Manual	Manual
Length of served road (km)	5	8	12	15
Operated by	Private company	Private company	Private and Gov't	Private and Gov't
Unit cost (US\$/ton)	10	125	17.75	20.25
4. Recycling/Intermediate Treatment				
Compost plant	0	0	Chrey Kaeng 200	Chrey Kaeng 300
Site	No	No	No	No
Unit cost (US\$/ton)	No	No	No	No
Recycling at generation	Market waste	Market waste	Market waste	Market waste
Overall recycling rate	No	No	6.8	1.3
Recycling system	Dig a hole	Dig a hole	Dig a hole	Dig a hole
5. Final Disposal				
Method of operation	Open dumpsite	Landfill No.4	Landfill No.4	Landfill No.4
Final disposal site	Andaing Chagn	Andaing Chagn	Chrey Kaeng	Chrey Kaeng
Distance from city (km)	4	4	10	10
Operation by	Private company	Private company	Private and Gov't	Private and Gov't
No. of workers	20	20	24	30
Tipping fee (US\$/ton)	0.75	1.20	3.45	3.45
Unit cost (US\$/ton)	0.43	3.66	2.78	2.78
Main equipment	Push cart, Tractor	Tractor, Container, Compactor	Tractor, Container, Compactor	Buildover, Compactor
6. Maintenance & Repair				
Preventive Maintenance	Private company	Private company	Private and Gov't	Private and Gov't
Major repair	Private company	Private company	Private and Gov't	Private and Gov't

Components	Phase Present (2003)	Phase 1 (2006)	Phase 2 (2012)	Phase 3 (2015)
7. Public Organizations Responsible on SWM				
Operation by	Private company	Private company	Private and Gov't	Private and Gov't
Battambang District Hall				
8. Financial Matters				
Unit SWM Cost (US\$/ton)	-	7.15	10.27	8.45
Revenue Source	-	570	726	815
Collection rate of waste collection fee (%)	-	80.00	85.00	90.00
Coverage rate of waste collection fee to SWM	-	25	35	40
Total revenue (US\$ 1,000)	-	570	726	815
Budget allocation from general finance (%)	-	1.00	1.20	1.50
Share of recyclables and compost (%)	-	-	0	70
Tipping fee (%)	-	-	0	70
Total revenue per capita (US\$)	-	-	3.18	3.62
Municipal Budget (thousand US\$)	-	10	15	22
Share of SWM budget	-	0.8	0.7	0.8
8. Public and Private Partnership	Private company	Private company	Private and Gov't	Private and Gov't
10. Public Co-operation				
Local authorities at province, district, commune, and DoE will conduct educational outreach to public as well as to local communities so they can get involved with the us, especially from NGOs.				
11. Medical SWM				
Generation (ton/day)	0.1	0.2	0.35	0.5
Treatment at generation	Discharge, burn	Discharge	Discharge, burn	Discharge, burn
Final disposal	Open	Only after treatment	Only after treatment	Only after treatment
Final disposal operation	Private company	Private company	Private and Gov't	Private and Gov't
12. Industrial SWM				
Generation of HW (ton/day)	1.5	1.74	2.01	2.35
HW treatment	None	FDS	FDS	FDS
Final disposal	Open	Monitoring and controlling	Monitoring and controlling	Monitoring and controlling

Of the nine M/Ps and A/Ps prepared and presented by the participants in the training, the presentation on Battambang is shown below.

b.1.1. Waste Flow





ផែនការសកម្មភាពសំរាប់បង្កើតផែនការមេ (១)

ឈ្មោះសកម្មភាព	កាលបរិច្ឆេទធ្វើ	អ្នកទទួលខុសត្រូវធ្វើ	តំណក់សំគាល់
១. ប្រជុំផ្សព្វផ្សាយការងាររៀបចំផែនការមេ	សប្តាហ៍ទី ១ ខែ មករា ២០០៤	លោក អ៊ុក វង្ស	
២. ចុះស្រង់ទិន្នន័យសំនុំតាមផ្ទះ	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក សេង ហួរ	
៣. ស្រង់ទិន្នន័យតាមភោជនីយដ្ឋាន	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក អ៊ុន ព្រាជ្ញ	
៤. ស្រង់ស្ថិតិហាងទំនិញ	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោកស្រី ព្រី វណ្ណា	
៥. ស្រង់ទិន្នន័យតូបលក់ដូរតាមផ្សារ	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក វង់ កាអុន	
៦. ស្រង់ទិន្នន័យសិស្សតាមសាលា	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក ភឹម ផុន	
៧. ស្រង់ស្ថិតិសំនុំតាមផង្គូរ	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក ម៉ុក សារីវណ្ណា	
៨. ស្រង់ស្ថិតិបន្ទប់តាមផ្ទះសំណាក់ និងសណ្ឋាគារ	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក អ៊ុន ព្រាជ្ញ	

ផែនការសកម្មភាពសំរាប់បង្កើតផែនការមេ (២)

ឈ្មោះសកម្មភាព	កាលបរិច្ឆេទធ្វើ	អ្នកទទួលខុសត្រូវធ្វើ	តំណក់សំគាល់
៩. ស្រង់ស្ថិតិកងឈ្មោះរដ្ឋបាល អង្គការរដ្ឋបាល - ក្រុមហ៊ុនឯកជន	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក សួន សារុន	
១០. ស្រង់ទិន្នន័យសំនុំចាក់ ដោយខ្លួនឯង	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក សេង ហួរ លោក ម៉ុក សារីវណ្ណា	
១១. ស្រង់ទិន្នន័យសំនុំចាក់ ដោយខ្លួនឯង	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក សេង ហួរ	
១២. ស្រង់ទិន្នន័យសំនុំចាក់សេវា ទឹកយក	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក ម៉ុក សារីវណ្ណា លោក សេង ហួរ លោក ម៉ុក សារីវណ្ណា	
១៣. ស្រង់ទិន្នន័យសំនុំចាក់កែច្នៃ	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក សេង ហួរ លោក ម៉ុក សារីវណ្ណា	
១៤. ត្រួតពិនិត្យសំនុំចាក់ចោល ចុងក្រោយ	សប្តាហ៍ទី ២ ខែ មករា ២០០៤	លោក សេង ហួរ លោក ម៉ុក សារីវណ្ណា	
១៥. ប្រជុំត្រួតពិនិត្យសរុបលទ្ធផល	លើសខែ កុម្ភៈ ឆ្នាំ ២០០៤	លោក ម៉ុក សារីវណ្ណា លោក អ៊ុក វង្ស	

b.2 Feedback from the Participants

1. Each day after the lectures, the participants were asked to complete a questionnaire. The questions and responses were as follows:

(December 29)

Total number of respondents: 37

“Did you understand all parts of today’s program?” : < Y : 19, N : 18 >

“Please describe the parts that you did not understand below.”

- Formulation of M/P for SWM : 8
- Water quality parameters, i.e. PCB : 2
- Other : 8

(December 30)

Total number of respondents: 32

“Did you understand all parts of today’s program?” : < Y : 15, N : 17 >

“Please describe the parts that you did not understand below.”

- Leachate treatment : 3
- Management of final disposal site : 5
- Other : 9

(December 31)

Total number of respondents: 38

“Did you understand all parts of today’s program?” : < Y : 14, N : 24 >

“Please describe the parts that you did not understand below.”

- Acquisitions of data, i.e. waste generation amount : 5
- Formulation of M/P for SWM : 5
- Other : 14

2. On the final day of training, the participants were asked to complete a questionnaire concerning the overall training program. The questions and responses were as follows:

(January 2)

Total number of respondents: 47

Q1 “Your organization’s department”

(Response) Central Government : 3, MPP : 14, Local Authority : 27

Q2 “Do you think the group training workshop in Phnom Penh is useful for your job?”

(Response) Y : 47, N : 0

Q3 “Did you know joint PRAKAS on Municipal Solid Waste Management before the group training?”

(Response) Y : 36, N : 11

Q5-1 “What did you want to learn through the group training workshop?”

(Response)

- About formulating A/Ps and M/Ps : 19
- About final disposal sites : 8
- About SWM in communities : 7

Q5-2 “Were you able to obtain such knowledge through the group training workshop?”

(Response) Y : 23, Partly : 24, N : 0

Q6 “Do you have some ideas to improve this group training workshop in Phnom Penh?”

“What did you want to see and know more about?”

(Response)

- The training period was too short. It should be longer. : 17
- Group discussions : 7

- The training should include lectures on hazardous and medical wastes : 2
- Q7 “What is the most important issue on solid waste management in your cities?”
(Response)
- | | |
|-----------------------------------|------|
| Waste collection and disposal | : 18 |
| Management of final disposal site | : 15 |
| Resident participation | : 12 |
- Q8 “What kind of support do you need to improve solid waste management in your cities?”
(Response)
- | | |
|---|------|
| Technical support and financial support (JICA, Government of Japan) | : 21 |
| | : 42 |
| Support for final disposal sites | : 8 |

(General assessment of questionnaire results and attitude of participants)

The training covered topics and issues that the participants were interested in learning about and they seemed to have understood most of them. However, due to the limited time, they were not able to understand all the topics and issues. It was surprising to find that although the participants were key personnel responsible for SWM in Cambodia, close to one fourth of them were not familiar with the PRAKAS on Municipal Solid Waste Management.

Regarding administrative support to local governments, many of the participants were expecting to make improvements through assistance from JICA.

According to the initial training schedule, January 1 was to be a day off. However, due to the strong request by the participants, the study team used that day to give guidance on the preparation of A/P.

As shown above, the participants were very serious about the training. The personnel responsible for SWM from local governments showed they were enthusiastic and earnest about improving solid waste administration.

b.3 Others

b.3.1. Acquisition of required knowledge/information for the formulation of M/P

The relevant personnel from local authorities (LAs) that participated in the training obtained the basic knowledge and information required for the formulation of a MSWM M/P, which was the primary objective of the training. In order to determine the degree of understanding, the participating LAs were asked to prepare waste flows of their respective cities. In regard to this, the LAs had to have an understanding of what the Phnom Penh M/P was, and use it as an example to prepare the waste flow of their cities by themselves. At the end of the training, the waste flows of nine cities were presented, which confirms their understanding. Although the preparation of M/Ps on their own is unlikely, several of the participants from LAs would be able to formulate an outline of an M/P (formulation of an equipment and facility plan in accordance with the generation amount, discharge amount, collection amount, and final disposal amount) provided they had a certain amount of expert support.

b.3.2. Building of a network among persons relevant to SWM

All the local authorities (LAs) that participated in the training, including MPP, are faced with many problems concerning SWM. In this training, key personnel confronting these problems were able to consult with each other and exchange views on how to cope with such problems. Moreover, MOE played an active role in preparing for the training program by

contacting the relevant personnel from local towns and municipalities by letter and by phone to invite them to attend. In the training, there was interaction between personnel from the central government and SWM personnel from local towns and municipalities. In such a way, the training was used as an opportunity to lay the groundwork for a network to facilitate information exchange on SWM among local governments and between the central and local governments. This will enable LAs to work hard together to improve their respective waste disposal services in the future. This network is also expected to be very effective in filtering in the central government's policies on SWM to the local towns and municipalities.

b.3.3. Impact on the central government

The participants from the central government, including the MOE, frequently receive support from abroad, and have obtained the latest knowledge and information on SWM in advanced nations through seminars, workshops, and overseas training. There is a great disparity between this latest knowledge and information and the existing MSWM situation of local authorities (LAs) responsible for such work. In this group training, the participants from the central government became well aware of this disparity through the work done jointly with LA personnel, such as the formulation of A/Ps. As a result, it is expected that the central government will set forth more realistic policies in the actual improvement of SWM.

b.3.4. Leadership of MPP/DPWT/PPWM

Until now, DPWT/PPWM of MPP, the counterparts (C/P) in this study, have been passively learning about the formulation of M/P from the study team. In the training, however, DPWT/MPP played an active role in conveying the information and knowledge they acquired to other local towns and municipalities.

From this standpoint, in this training DPWT/PPWM made a positive effort to fulfill their roles as leaders of the other local authorities in Cambodia. Not only the C/P, DPWT/PPWM, but also a number of personnel from the Mayor's Office including the Mayor, participated in the training. They actively carried out work such as computer operation, etc. for the participants from other LAs in the lectures and group works they were in charge of, and supported the overall work.

c. Conclusion

This group training included 51 participants from Cambodia and cost about 3.6 million yen in total. (Travel and lecture room expenses accounted for 1.2 million yen and personnel and accommodation expenses of consultants 2.4 million yen.) The cost per C/P was 70,000 yen, which is much cheaper than past C/P training in Japan.

Even so, as mentioned above, the training was effective and the LAs were able to obtain the basic knowledge and information required for the formulation of their respective MSWM M/Ps in the future. The training also had considerable secondary effects, such as the fact that many people were able to gain an understanding of this JICA study, interaction at the working level, etc.

The C/P training conducted in JICA studies in the past targeted the C/P personnel. As a result, it did not provide adequate opportunity to convey the study results to key personnel from other relevant organizations. This training was very significant in that it provided not only the MPP personnel who are carrying out the SWM improvement with assistance from Japan, but also many SWM personnel from other LAs throughout Cambodia with the chance to learn measures for improving SWM and acquire other relevant knowledge and information using the results of the Study. The study team sincerely hopes that this kind of opportunity can be created through JICA studies in the future.