Materials for PR Activities

Presentation Material

For School Program

The ratio of the land and water

2. In this planet earth

3. Land area is 29%

5. Only fresh water is drinkable.

7. In 3% of fresh water, the ground water accounts for 29%, glaciers are 70% and 1% are from rivers, streams and lakes.

6. Among 71% of water, the sea water amount is 97% and only 3% is fresh water

4.Water is71%

ရေဘယ်ကရသလဲ?

Where do we get the water?

- ရေရရှိနိုင်သောနေရာများ:
  - မိုးရေများ
  - ဆီးနှင်းများ
  - ကန်ရေ
  - ရေအိုင်များ
  - စမ်းချောင်းများ
  - မြစ်ချောင်းများ
  - ပင်လယ်များ
  - အိုင်စိတွင်း
  - ရေလှောင်ကန်

Ocean Lakes
Ocean
Ocean

Glacier

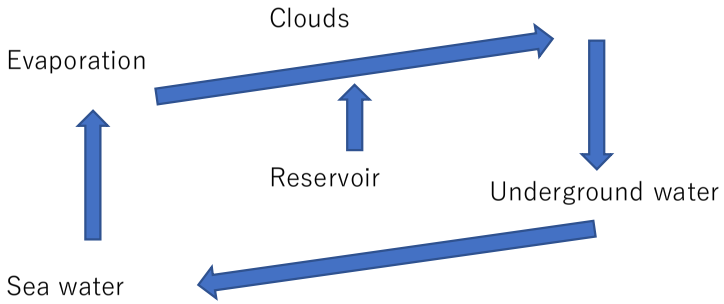
Natural sources of water

Naturally available sources of water

- **We can get the water from**
  - rain water
  - snows
  - lakes
  - ponds
  - streams
  - rivers
  - oceans

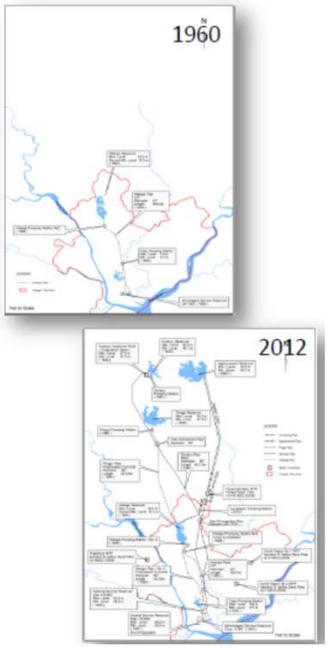
Water Cycle

It is rivers, seas & oceans where the water is collected.
The water is evaporated due to sun heat.
The water vapour are collected and formed the cloud.
And then it pours as the rain.
And the natural environment becomes greener when the rain comes
That is how water cycle operates
It's our duties to preserve the water to make this world beautiful.



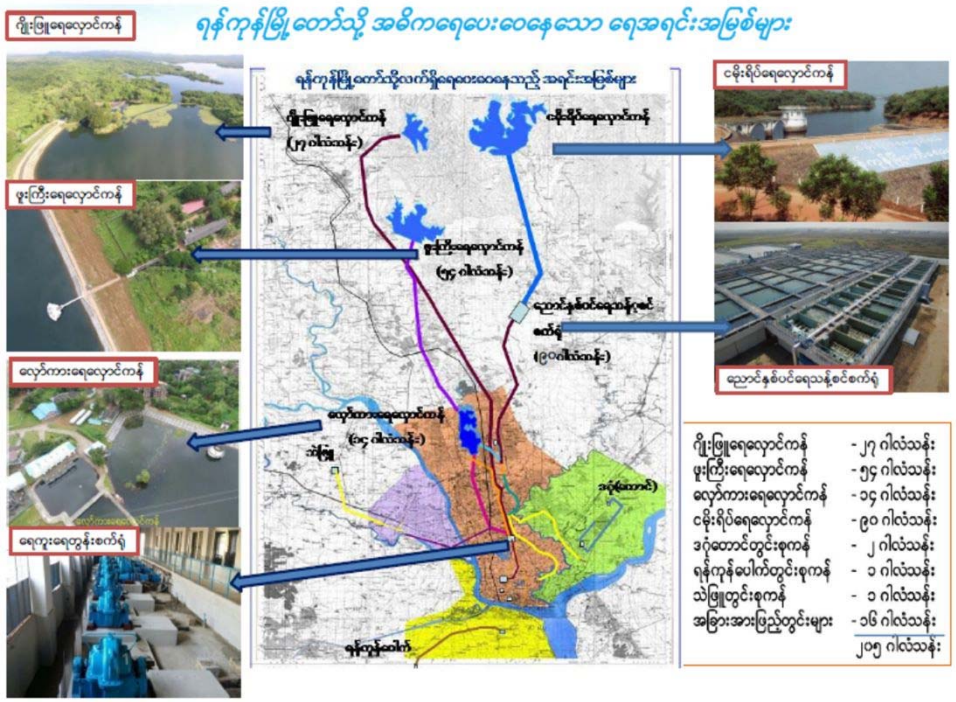
ရန်ကုန်မြို့တော်ရေပေးဝေရေးသမိုင်း

ရန်ကုန်မြို့ ရေပေးဝေမှုသမိုင်းကြောင်း	
၁၈၄၂	ရေတွင်းကြီး(၃၀)
၁၈၇၉	ကန်တော်ကြီးကန်
၁၈၈၄	အင်းလျားကန်
၁၉၀၄	လှော်ကားရေလှောင်ကန်
၁၉၄၀	ဂျိုးဖြူရေလှောင်ကန်
၁၉၉၂	ဖူးကြီးရေလှောင်ကန်
၁၉၉၅	ငမိုးရိပ်ရေလှောင်ကန်
၂၀၀၅	ငမိုးရိပ်ရေသန့်စင်စက်ရုံ(ပထမအဆင့်)
၂၀၁၄	ငမိုးရိပ်ရေသန့်စင်စက်ရုံ(ဒုတိယအဆင့်)



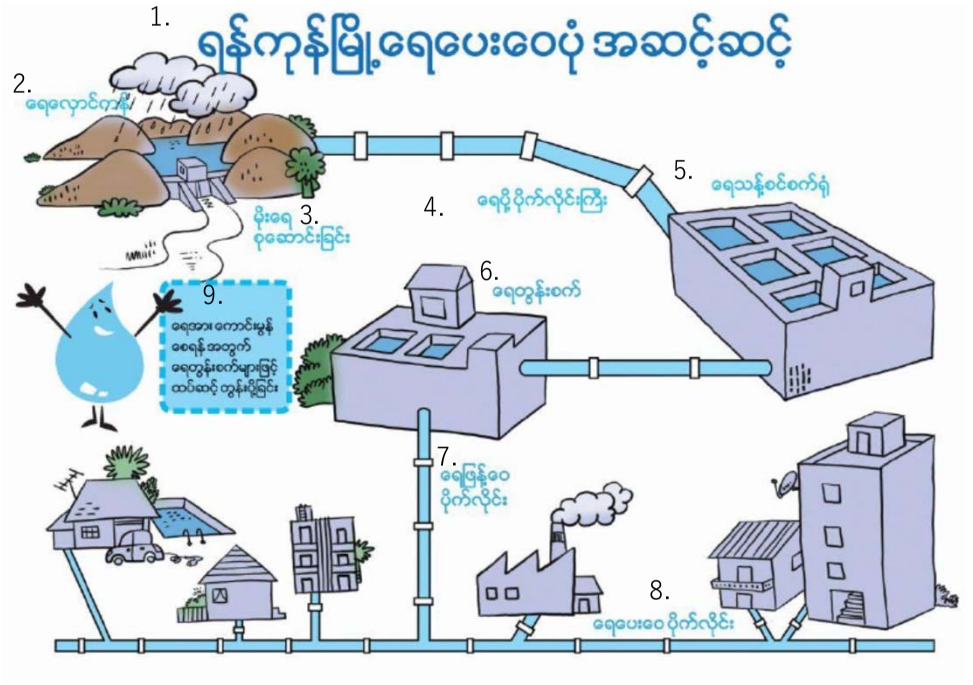
Yangon City Water Supply History

Yangon City Water Supply History	
1842	(30) Big wells
1879	Kandawgyi Lake
1884	Inya Lake
1904	Hlawga Reservoir
1940	Gyophyu Reservoir
1992	Phugyi Reservoir
1995	Ngamoeyeik Reservoir
2005	Ngamoeyeik Water Treatment Plant (First Phase)
2014	Ngamoeyeik Water Treatment Plant (Second Phase)



1. Gyophuy Reservoir - 27 MGD
2. Phugyi Reservoir - 54 MGD
3. Hlawga Reservoir - 14 MGD
4. Ngamoeyeik Reservoir - 90 MGD
5. Dagon (South) collecting well – 2 MGD
6. Yangon Pauk collecting well – 1 MGD
7. Thae Phyu collecting well – 1 MGD
8. Other reinforced wells – 16 MGD

In total = 205 MGD



Water Supply Steps/process in Yangon City

Reservoir

Water treatment plant

Collecting the rainwater

Transmission pipeline

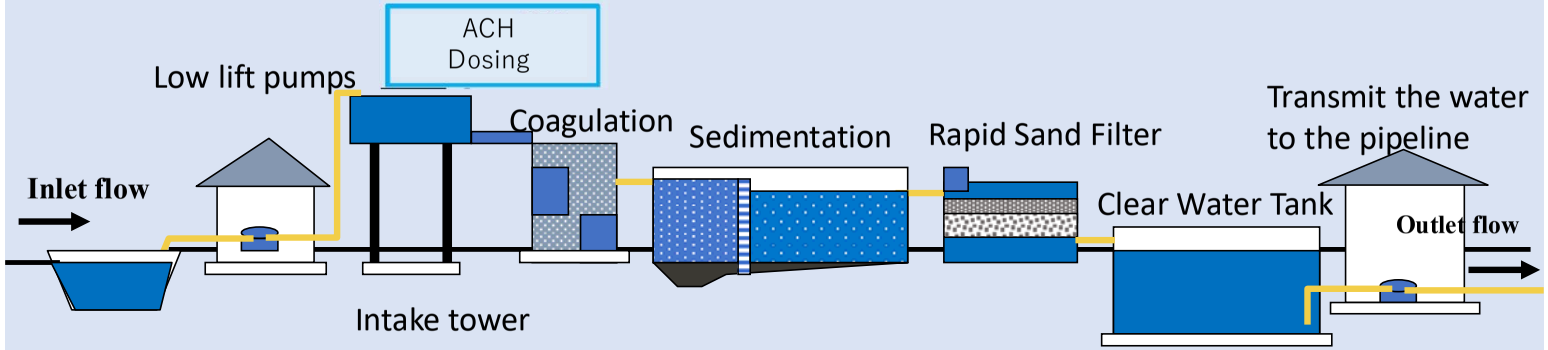
Booster pumping station

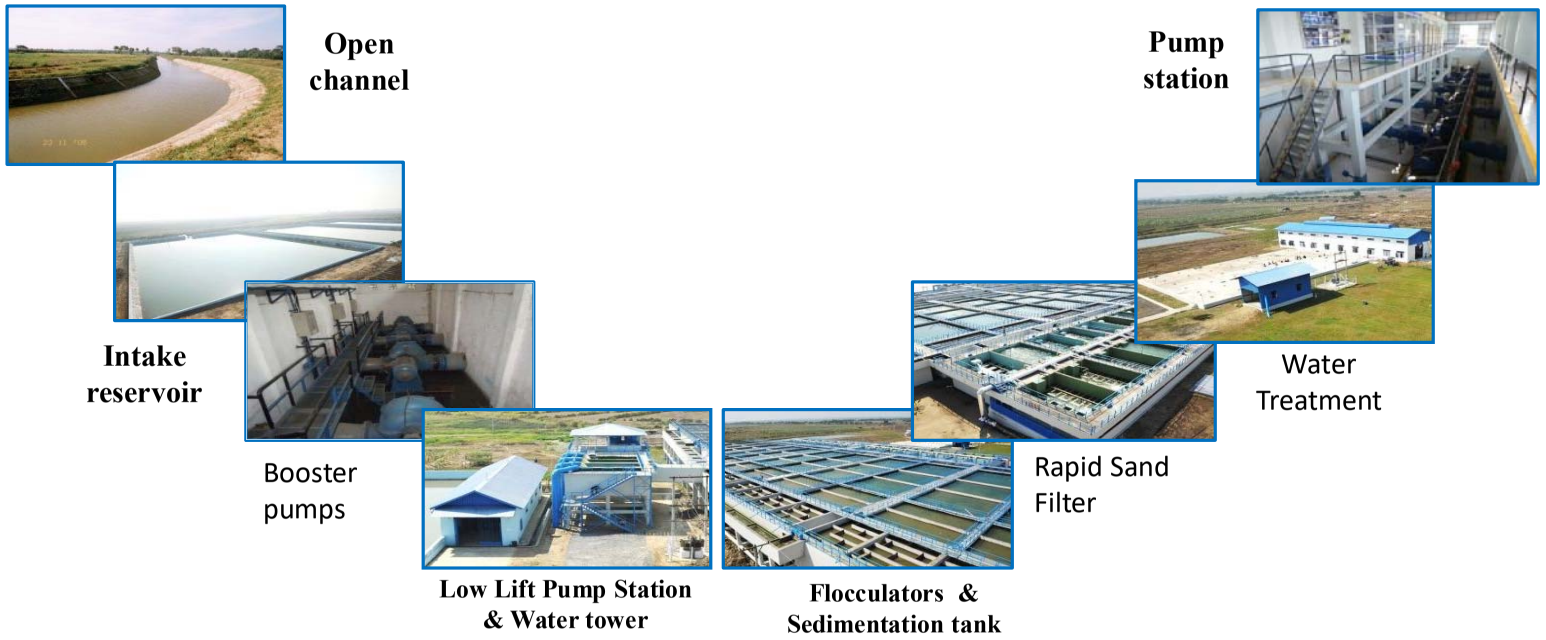
Pumping station

Distribution pipeline

Service pipeline

Water Treatment System at Ngamoeyeik Water Treatment Plant





Duties & Responsibilities of Engineering Department (Water & Sanitation)

Pipelines Maintenance

To be able to supply the sufficient/enough water to the people, it's to find the pipe leakages and repair it.

Water Quality Monitoring

To be able to supply clean and fresh water, it's to check/monitor the water quality regularly.

Issuing water permit

The customer can apply for the installing of water connection and construction of septic tank.

Checking water meter

By installing the water meter systematically, the water charges can be collected fully.

How can we use the water?

To drink

To prepare / cook the food

To clean
- Taking bath
- Washing the clothes
- Car washing
- Cleaning

To relax
- Swimming
- Fishing
- Riding the boat

To plant the trees

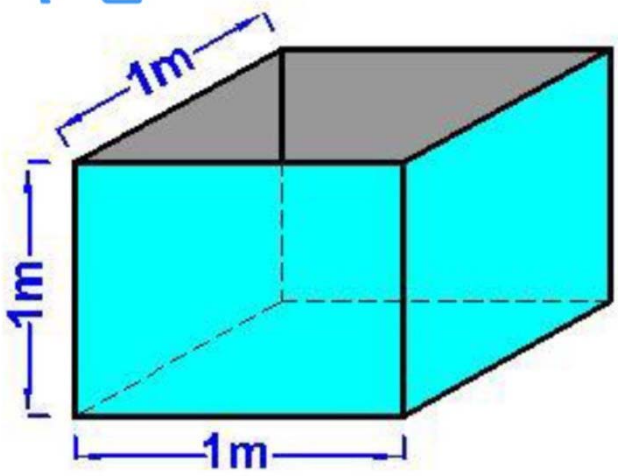
The amount of water
Used by per family is

150 gallons to 200 gallons per day

ရေတစ်ယူနစ်၏ ထုထည်

The volume of the water per unit

1 drum ~ 55 gallons



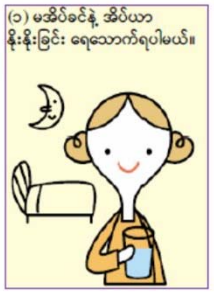
$1m^3 = 220$ gallons $= 1000$ litter

Why do we need water?

The water is the gift from the nature. We need water to survive

- We need water to plant the trees.
- The animals needs to consume water to survive.
- The fishes need the water.
- We need water to clean..
- The human need water to be healthy living.
- Water is needed for the children to play with.
- To be able to sustain the nature, the water is mainly important.
- To be healthy and happy as always, we need to thrift the water.

ဘယ်အချိန်မှာ ရေသောက် မလဲ?



ဘာကြောင့် ရေသောက် ရသလဲ?

❖ ခန္ဓာကိုယ်ရဲ့သုံးပုံနှစ်ပုံဟာ ရေတွေနဲ့ ဖွဲ့စည်းထား ပါတယ်။

❖ ခန္ဓာကိုယ်တွင် ရေဓာတ်နည်းပါးလျှင် အပူလျှပ်ခြင်း၊ နှလုံးရောဂါဖြစ်ပွားခြင်းများဖြစ်နိုင်မှု အခြေအနေများပြား ခြင်းကြောင့် သင့်ကျန်းမားရေးအတွက် ရေသောက်ခြင်း အလေ့အထကို ပြုလုပ်ပေးသင့်ပါတယ်။

❖ ရေဆာခြင်းဆိုတာ ရေဓါတ်ခန်းခြောက်ခြင်းရဲ့ ကနဦး လက္ခဏာတစ်ရပ်ဖြစ်ပါတယ်။

❖သင့်ခန္ဓာကိုယ်တွင် သကြားဓါတ် သို့မဟုတ် ဆားဓါတ် မြင့်မားနေလျှင် အစိုဓာတ်ကိုစုပ်ယူရန် အချိန်ပိုလိုအပ်ပါ သည်။

❖ထို့ကြောင့် ရေမဆာခင်ကတည်းက ရေသောက်ဖို့လိုအပ် ပါတယ်။

What time/when should we drink the water?

Before bed and after waking up, we need to drink the water immediately.

Before and after doing exercises, we need to drink the water.

Before and after taking shower, we need to drink the water.

Why should we drink water?

- ◆ The human body is made up two third of water.
- ◆ If the human feel dehydrated, it can happen heat stroke and heart attack. That's why the people need to practice the habit of drinking water.
- ◆ Feeling thirsty means the primary symptoms of dehydration.
- ◆ If the body is high in blood sugar level or sodium (salt level), it needs more time to absorb the moisture.
- ◆ That's why we need to drink water before we feel thirsty.

How to save the water

The leftover should be thrown into the dustbin. While washing the dishes with soap, turn off the water.

When showering, pour the water over the body gently.

Don't throw the used water from washing, use it again on watering the plant.

Collect the rain water.

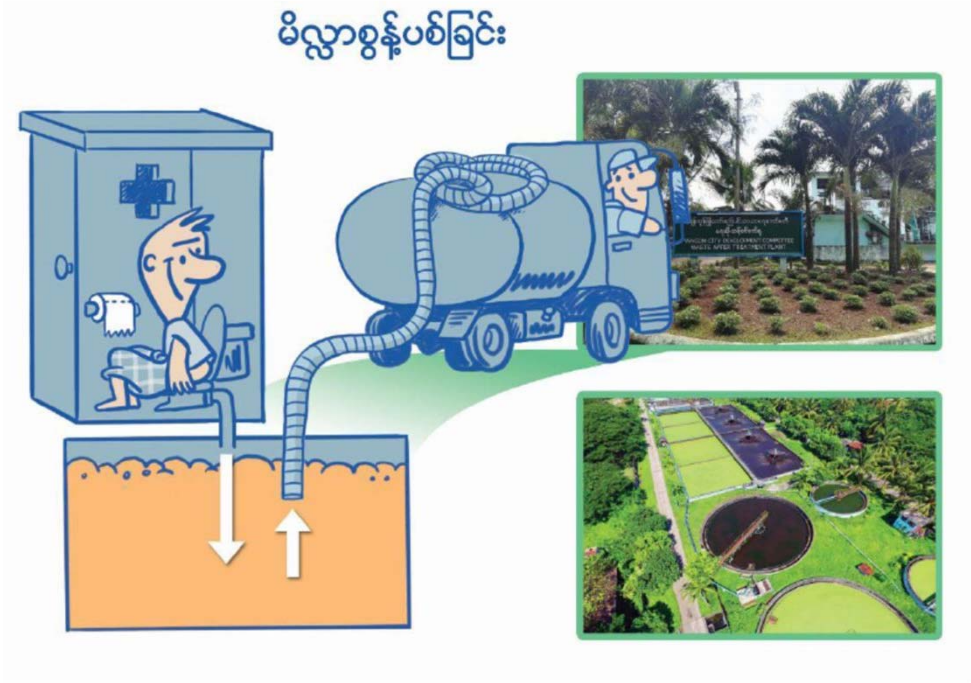
Water the plants when the sun is setting in.

While washing the car, used the bucket and sponge.

Do not wash the clothes one by one. Instead do it together.

While washing face and brushing teeth, turn of f the tap.

When the water leakage/ pipe break is found on the road, then immediately inform it to the respective EDWS offices.



Sewage Disposal

Assessment of understanding

ရေပိုက်ပေါက်လျှင် ရေသန့်ဌာနကို အကြောင်းကြားသင့်ပါသည်။

☐ မှန် ☐ မှား

မိသားစုတစ်စု၏ တစ်နေ့တာရေသုံးစွဲမှု ပမာဏမှာ ၅၀ ဂါလန်မှ ၁၀၀ ဂါလန် ကြား ရှိပါသည်။

☐ မှန် ☐ မှား

ရေဖိုးလာကောက်လျှင် ရေဖိုးပေးဆောင်ရပါမည်။

☐ မှန် ☐ မှား

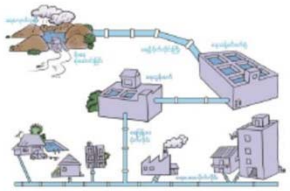
မျက်နှာသစ်၊ သွားတိုက်တဲ့အခါ ကျရင် ရေဘုံဘိုင်ကို တောက်လျှောက် ဖွင့်ထားရပါမည်။

☐ မှန် ☐ မှား

ပင်လယ်ရေကို သောက်သုံး၍ ရပါသည်။

☐ မှန် ☐ မှား

ရန်ကုန်မြို့ကို တစ်နေ့ရေဂါလန် (၂၀၅)သန်း ပေးဝေပါသည်။



☐ မှန် ☐ မှား

False

If the pipe break or water leak is found, it's to inform it to the EDWS Department.

The average water usage of a family per day is 50 gallons to 100 gallons.

It's to pay the water charges when the staff comes and collects it.

When washing face and brushing the teeth, it's to turn on the tap.

We can drink the sea water.

We can supply 205 MGD to Yangon City.

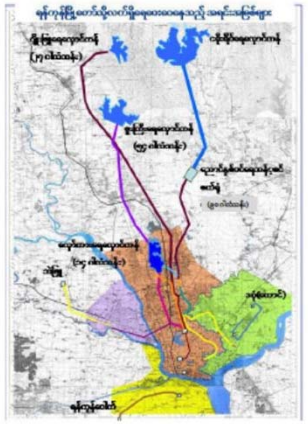
Assessment of understanding

ကမ္ဘာမြေကြီးမှာရေထု
ဘယ်နှစ်ရာခိုင်နှုန်းပါသလဲ?

ပင်လယ်ရေကို
ဘာကြောင့်သောက်၍မရ
သလဲ?

ဘာကြောင့်ရေသောက်
ရသလဲ?

ဘယ်အချိန်မှာ
ရေသောက်မလဲ?



ရန်ကုန်မြို့ကို ရေပေးဝေသော
ရေလှောင်ကန်ကြီး ဘယ်နှစ်ခု
ရှိသလဲ?

How much percentage of water in this planet?

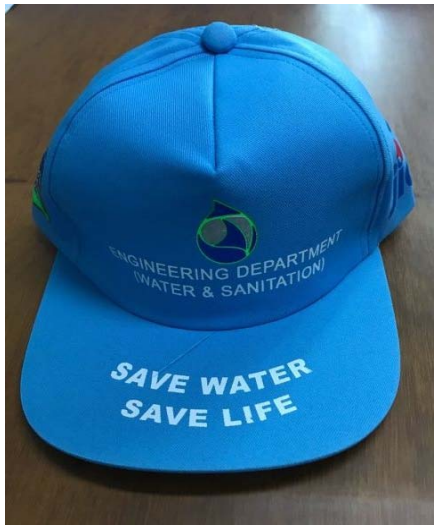
Why can't we drink sea water?

How many reservoirs in Yangon City Area?

Why should drink water?

When should we drink water?

Prepared Materials for School Program



Poster for the public

To explain about Chlorin

Facts on using Chlorine to purify the drinking water

- What is Chlorine injection?
- Chlorine injection means a method to eliminate/remove the bacteria and chemicals in the water that can be harmful to human bodies.

- What are the benefits of chlorine injection?
- Like the other countries in the world, by injecting the chlorine in the water, the city dwellers can use & drink the water safely and protect from water borne diseases.

- Where are the chlorine injection places?
- The chlorination facilities are constructed in Water Treatment Plant, Yegu Pumping Station and Hlawga Transmission pipe.

- How much of chlorine will be dosed?
- When dosing the chlorine, we will follow WHO guidelines and inject the chlorine according to guidelines.

- Can Residual Chlorine in drinking water harmful to human body?
- We have set Residual Chlorine percentage in tap water based on WHO guidelines and test/monitor the Residual Chlorine every day. The chlorinated water can be used for pets and the chlorinated water supply by YCDC can not be harmful for human bodies.

Facts on using Chlorine to purify the drinking water

Getting chlorine smells mean the water is chlorinated and eliminate the water borne disease and it's safe to use.

- How to remove Chlorine smells in water?
- There are (3) ways to remove the smell of chlorine.

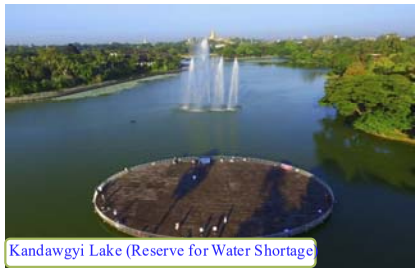
(1)The first one is by adding a small drop of lime juice in the water.
(2)The second way is by cooling the water in the fridge.
(3)The third way is by boiling the water.

- How many days can the water be used after removing the chlorine?
- The removed chlorine water can be used within 24 hours.

- Can chlorinated water be used for indoor home aquarium?
- To remove the chlorine in water, keep the water in sunlight for (24) hours and can be used for home aquarium after that.

Calendars of WRAWSA

Year 2017 to 2020



Kandawgyi Lake (Reserve for Water Shortage)

Joint Coordinating Committee (JICA & YCDC)

Engineering Department (Water & Sanitation), Yangon City Development Committee is the department which provides the services to distribute clean and fresh water adequately and systematic sewage disposal system to city dwellers.

JICA Project for Improvement of Water Supply Management of YCDC

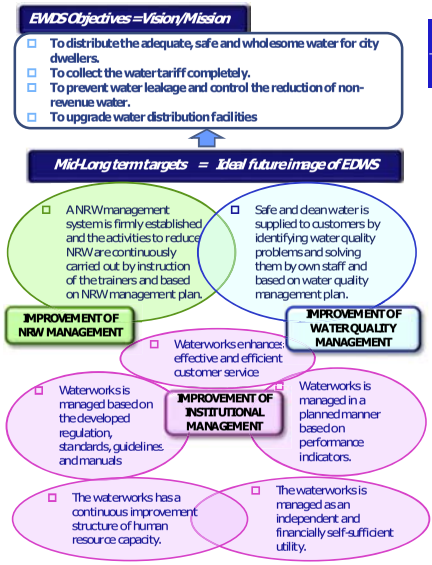
The Project started in July 2015 and will end in July 2020.

The objective of the Project is to improve the capacity of YCDC on the management of water supply service.

For this, the activities below are implemented with counterpart staff of EDWS.

- To improve the capacity on institutional management of water supply utility
- To improve the capacity on NRW (Non-Revenue Water*) management
- To improve the capacity on water quality management.

* NRW is the water that has been supplied without revenue.



Engineering Department (Water & Sanitation) has developed the ideal future images as a water service provider together with JICA Expert Team and is implementing the activities to achieve ideal future image assisted by JICA Expert Team.

Hlawgar Reservoir

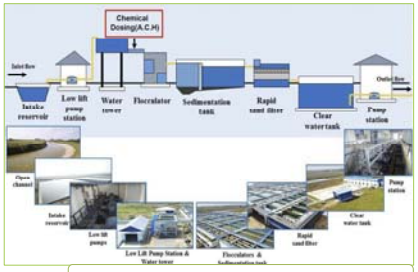
Gyobyu Reservoir

Daily Water Supply Amounts In Yangon City

Gyobyu Reservoir	- 27	MGD (122727 m³/day)
Phygyi Reservoir	- 54	MGD (245454 m³/day)
Hlawgha Reservoir	- 14	MGD (63637 m³/day)
Ngamoeyeik Reservoir	- 90	MGD (409090 m³/day)
YCDC Owned Tube Wells	- 20	MGD (90901 m³/day)

Total- 205 MGD (931809 m³/day)

Nyaunghnapin Water Treatment Plant



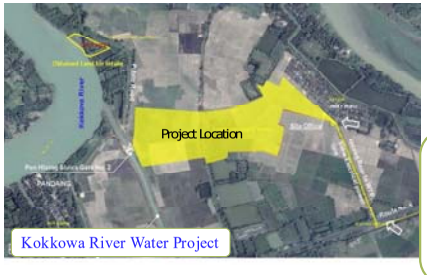
Process of Nyaunghanpin Water Treatment Plant

03 2017 March 1378ckESpf?

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Water is treated at water treatment plant through several processes and the clean water is delivered to Yangon City.

Lagunbyin Water Treatment Plant



Kokkowa River Water Project

04 2017 April 1378-1379ckESpf?

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

-A new water treatment plant at Lagunbyin is constructed by YCDC, to provide water to four T/S and Thilawa SEZ. Pumping Station, Control Center, Transmission & Distribution Pipeline, DMA & SCADA Systems are developed under JICA ODA Loan (1).
-Kokkowa River Water Project is being developed under JICA ODA Loan (2)as future water source for Yangon City.

Replacement of New Pipeline at Kabaraye Pagoda Road

New Pumping Station in Nyaunghnapin Water Treatment Plant

05 2017 May 1379ckESpf? wefcl;-

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Under the Japanese Grant Aid for Urgent Improvement of Water Supply System in Yangon City, the new pumping station at Nyaunghnapin WTP was constructed and transmission pipeline in Kabaraye Pagoda Road & distribution network in Yankin T/S were renewed.

56"ØM.S Transmission Pipe (Gyobyu)

40" Ø HDPE Transmission Pipe

06 2017 June 1379ckESpf? uqkef-

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

- 56"Ø M.S pipe is laid 43 miles long from Gyobyu Reservoir to Kokkine Service Reservoir.
-40" Ø HDPE pipe laying is completed 11.45 miles long from Nyaunghnapin WTP to Junction of No.4 Main Road to distribute water to Shwe Pyi Thar & Insein Townships.

Yegu Pumping Station

Disinfection Facility

07 2017 July 1379ckESpf? e,kef-

SUN	MON	TUE	WED	THU	FRI	SAT
			၁	၂	● ၃	၄
၅	၆	၇	၈	၉	၁၀	၁၁
၁၂	၁၃	၁၄	၁၅	၁၆	● ၁၇	၁၈
၁၉	၂၀	၂၁	၂၂	၂၃	၂၄	၂၅
၂၆	၂၇	၂၈	၂၉	၃၀		

At Yegu Pumping Station, disinfection facility has been replaced and re-started the operation to provide safe water to Yangon City.

World Water Day

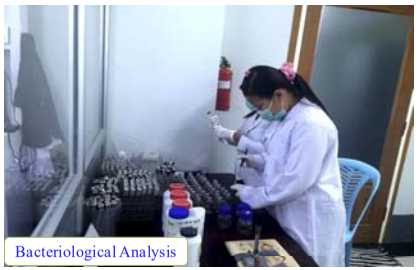
Myanmar Water -2016

08 2017 August 1379ckESpf? 0gqdk-

SUN	MON	TUE	WED	THU	FRI	SAT
			၁	၂	● ၃	၄
၅	၆	၇	၈	၉	၁၀	၁၁
၁၂	၁၃	၁၄	၁၅	၁၆	● ၁၇	၁၈
၁၉	၂၀	၂၁	၂၂	၂၃	၂၄	၂၅
၂၆	၂၇	၂၈	၂၉	၃၀		

Engineering Department of Water & Sanitation established the PR Section in Customer Service Division. PR activities for public relation have been started.

Chemical Analysis



Bacteriological Analysis

09 2017 September 1379ckESpf? 0gacgif-

SUN	MON	TUE	WED	THU	FRI	SAT
			၁	၂	● ၃	၄
၅	၆	၇	၈	၉	၁၀	၁၁
၁၂	၁၃	၁၄	၁၅	၁၆	● ၁၇	၁၈
၁၉	၂၀	၂၁	၂၂	၂၃	၂၄	၂၅
၂၆	၂၇	၂၈	၂၉	၃၀		

- Water quality in YCDC water distribution system is monitored by Central Water Quality Laboratory of EDWS, YCDC.
-To enhance the ability of water quality monitoring of YCDC, 4 small laboratories are installed in Hlawgar, Phugyi and Gyobyu Reservoirs and Yegu pumping station.

New Staff Training

Training in Laboratory

10 2017 October 1379ckESpf?awmfovif;-

SUN	MON	TUE	WED	THU	FRI	SAT
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၅	၆	၇	၈	၉	၁၀	၁၁
၁၂	၁၃	၁၄	၁၅	၁၆	● ၁၇	၁၈
၁၉	၂၀	၂၁	၂၂	၂၃	၂၄	၂၅
၂၆	၂၇	၂၈	၂၉	၃၀		

Engineering Department of Water & Sanitation has started the new training program to new staff (for engineers, clerks and workers). The training participants understood missions and works of EDWS and applied them in their work places. JICA expert gives training for water quality analysis to the laboratory staff.

Meter Accuracy Testing Training

Leak Detection Work Training

11 November
2017 1379ckESpf?wefaqmifrk

SUN	MON	TUE	WED	THU	FRI	SAT
			၁	၂	● ၃	၄
၅	၆	၇	၈	၉	၁၀	၁၁
၁၂	၁၃	၁၄	၁၅	၁၆	● ၁၇	၁၈
၁၉	၂၀	၂၁	၂၂	၂၃	၂၄	၂၅
၂၆	၂၇	၂၈	၂၉	၃၀		

66 % of produced water is wasted (it is called NRW (Non-Revenue water)). The actions for NRW reduction are implemented under the support of various donors. The photos show the activities against NRW: meter accuracy test, and leak detection survey by JICA experts. NRW Section is now established in EDWS of YCDC to implement NRW reduction activities and manage the NRW projects.

Main Air Compressor in Botahtaung Township

Operation & Maintenance of Sewerage System at Downtown Area

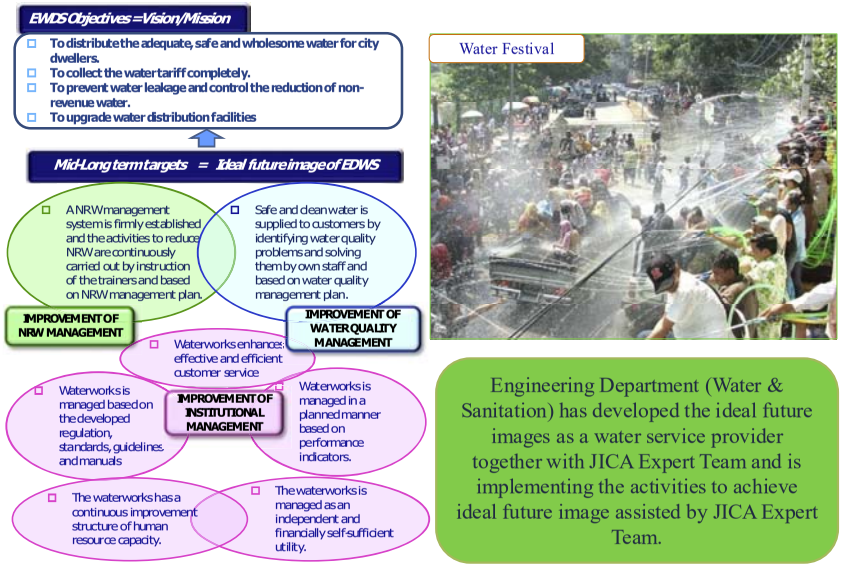
12 December
2017 1379ckESpf?

SUN	MON	TUE	WED	THU	FRI	SAT
			၁	၂	● ၃	၄
၅	၆	၇	၈	၉	၁၀	၁၁
၁၂	၁၃	၁၄	၁၅	၁၆	● ၁၇	၁၈
၁၉	၂၀	၂၁	၂၂	၂၃	၂၄	၂၅
၂၆	၂၇	၂၈	၂၉	၃၀		

-Conventional Sewerage system was installed in 1888. This system consists of Sewer pipes and Air Compressor Station. We regularly maintain these facilities.
-YCDC cooperates with Japanese private company and local government for proper maintenance of Sewerage system.

カレンダーの下の部分

This Calendar was published by EDWS, YCDC in cooperation with JICA Expert Team of the project for improvement of Water Supply Management of YCDC.



Water Festival

Engineering Department (Water & Sanitation) has developed the ideal future images as a water service provider together with JICA Expert Team and is implementing the activities to achieve ideal future image assisted by JICA Expert Team.


Phugyi Reservoir


Ngamoeyeik Reservoir

Daily Water Supply Amounts In Yangon City

Gyobyu Reservoir	– 27 MGD
Phugyi Reservoir	– 54MGD
Hlawga Reservoir	– 14MGD
Ngamoeyeik Reservoir	– 90 MGD
YCDC Owned Tube Wells	– 20 MGD
	205 MGD

Raw water from Ngamoeyeik reservoir is treated at Nyaunghnapin Water Treatment Plant.


Lagunbyin Water Treatment Plant


Pumping Station

A new water treatment plant (40 million gallons per day) at Lagunbyin near No. 2 Main Road is constructed by YCDC, to provide drinking water to four new satellite townships and Thilawa SEZ.

In this project, Pumping Station, Control Center, Transmission & Distribution Pipeline, DMA & SCADA Systems are developed under Greater Yangon Water Supply Improvement Project Phase I.

3.75 million gallons service reservoir

Steel works for pipe support

Concrete pipe support

3.75 million gallons service reservoir which stored treated water from Nyaunghnapin WTP to distribute water to Shwe Pyi Thar & Insein townships is completed in Hlawga Reservoir Compound.

03 2018 March 1379ckESpf?

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

For the maintenance of 76 years old aged 56”Ø Gyobyu MS pipe, pipe supports are replaced and covering premtape for anti-corrosion.

Pressure test of HDPE and PVC Pipes

Pressure test of HDPE and PVC Pipes

The actions for Non-revenue water (NRW) reduction have been implemented under the support of various donors.

04 2018 April 1379-1380ckESpf?

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

The activities against NRW: meter accuracy test, leak detection and leak repair by NRW team cooperation with JICA Experts.

Activities for Mini laboratories training

Water Quality Analysis

Water quality in YCDC water distribution system is monitored by Central Water Quality Laboratory and 4 small laboratories of our department.

05 2018 May 1380ckESpf? wefcl;-

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

To enhance the ability of water quality, residual chlorine in water distribution system is regularly surveyed.

Computer Training

On Site Training

Engineering Department (Water & Sanitation) makes the training programme to new staff (for engineers, clerks and workers) for the purpose of human resource development.

06 2018 June 1380ckESpf? uqkef-

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

The training participants understood missions and works of the department and applied them in their work places.

The 4th Joint Coordination Committee

MyanWater Exhibition

Mutual collaboration with Engineering Department (Water & Sanitation) and JICA expert team for technical corporation and improvement for water supply.

07
2018

July
1380ckESpf? e,kef-

SUN	MON	TUE	WED	THU	FRI	SAT
			၁ 1	၂ 2	● 3	၄ 4
၅ 5	၆ 6	၇ 7	၈ 8	၉ 9	၁၀ 10	၁၁ 11
၁၂ 12	၁၃ 13	၁၄ 14	၁၅ 15	၁၆ 16	● 17	၁၈ 18
၁၉ 19	၂၀ 20	၂၁ 21	၂၂ 22	၂၃ 23	၂၄ 24	၂၅ 25
၂၆ 26	၂၇ 27	၂၈ 28	၂၉ 29	၃၀ 30		

Our department established the Public Relation (PR) Section for public awareness such as exhibition related to water and sanitation.

School Activities in Tamwe Township

School activities in Tamwe Township

Public relation activities to primary school have been started for the very first time.

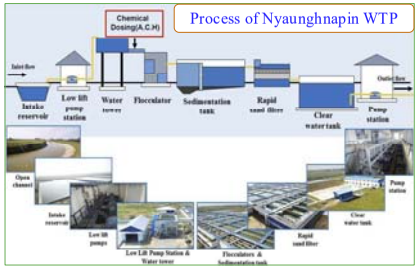
08
2018

August
1380 ckESpf? 0gqdk-

SUN	MON	TUE	WED	THU	FRI	SAT
			၁ 1	၂ 2	● 3	၄ 4
၅ 5	၆ 6	၇ 7	၈ 8	၉ 9	၁၀ 10	၁၁ 11
၁၂ 12	၁၃ 13	၁၄ 14	၁၅ 15	၁၆ 16	● 17	၁၈ 18
၁၉ 19	၂၀ 20	၂၁ 21	၂၂ 22	၂၃ 23	၂၄ 24	၂၅ 25
၂၆ 26	၂၇ 27	၂၈ 28	၂၉ 29	၃၀ 30		

Sharing knowledge and providing children to think how water is valuable for human and attract the public to coordinate with our staffs.

Nyaunghnapin Pumping Station



Process of Nyaunghnapin WTP

Students' site visit to Nyaunghnapin Water Treatment Plant to understand how water comes from very far distance to Yangon City and how many steps are done to get treated water.

09
2018

September
1380ckESpf? 0gacgif-

SUN	MON	TUE	WED	THU	FRI	SAT
			၁ 1	၂ 2	● 3	၄ 4
၅ 5	၆ 6	၇ 7	၈ 8	၉ 9	၁၀ 10	၁၁ 11
၁၂ 12	၁၃ 13	၁၄ 14	၁၅ 15	၁၆ 16	● 17	၁၈ 18
၁၉ 19	၂၀ 20	၂၁ 21	၂၂ 22	၂၃ 23	၂၄ 24	၂၅ 25
၂၆ 26	၂၇ 27	၂၈ 28	၂၉ 29	၃၀ 30		

Water is treated at water treatment plant through several processes and clean water is delivered to Yangon City.

Seminar organized by JICA

Cause and Effect Analysis

H.E Ek Sonn Chan (Secretary of State, Ministry of Industry and Handcraft, Cambodia) delivered the speech and discuss with officers and staffs to understand the importance of governance and sustainable management and issues for the enhancement .

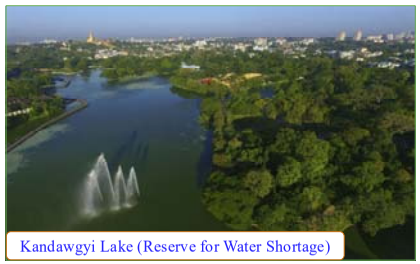
10
2018

October
1380ckESpf?awmfovif;-

SUN	MON	TUE	WED	THU	FRI	SAT
			၁ 1	၂ 2	● 3	၄ 4
၅ 5	၆ 6	၇ 7	၈ 8	၉ 9	၁၀ 10	၁၁ 11
၁၂ 12	၁၃ 13	၁၄ 14	၁၅ 15	၁၆ 16	● 17	၁၈ 18
၁၉ 19	၂၀ 20	၂၁ 21	၂၂ 22	၂၃ 23	၂၄ 24	၂၅ 25
၂၆ 26	၂၇ 27	၂၈ 28	၂၉ 29	၃၀ 30		

Continuous improvement (KAIZEN) for successful organization by implementation of 5S & elimination of 7 wastes.

Inya Lake (Reserve for Water Shortage)



Kandawgyi Lake (Reserve for Water Shortage)

Engineering Department (Water & Sanitation), Yangon City Development Committee is the department which provides the services to distribute clean and fresh water adequately and systematic sewage disposal system to city dwellers.

11 November
2018 1380ckESpf?wefaqmifrk

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

JICA Project for Improvement of Water Supply Management of YCDC

- The Project started in July 2015 and will end in July 2020.
-The objective of the Project is to improve the capacity of YCDC on the management of water supply service.

Wastewater Treatment Plant

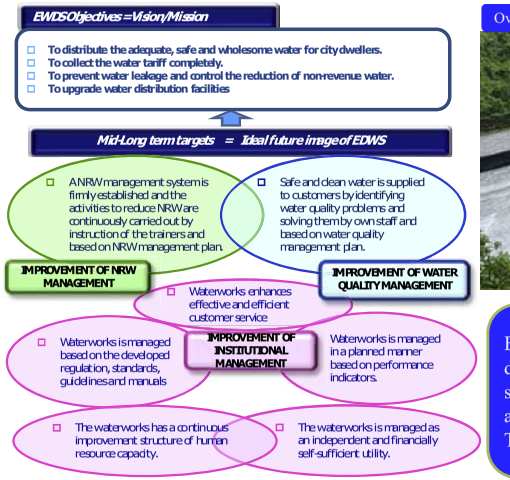
Wastewater Treatment Plant

Wastewater treatment plant was constructed in 2005 at Thanlyatsoon in Botahtaung township. Activated sludge process was installed and has treated wastewater ejected by air compressor from sewerage system.

12 December
2018 1380ckESpf?

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Engineering Department (Water & Sanitation) cooperates with JICA, Japanese private company and local government for proper maintenance of Sewerage system.



Overflow Water from Spill Way of Gyobyu Reservoir

Engineering Department (Water & Sanitation) has developed the ideal future images as a water service provider and implemented the activities to achieve ideal future image assisted by JICA Expert Team.

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

Kandawgyi Lake (Reserve for Water Shortage)

2019 January 1379 ckESpf? ewfawmf-jymoc

SUN	MON	TUE	WED	THU	FRI	SAT
			၁ 1	၂ 2	● 3	၄ 4
၅ 5	၆ 6	၇ 7	၈ 8	၉ 9	၁၀ 10	၁၁ 11
၁၂ 12	၁၃ 13	၁၄ 14	၁၅ 15	၁၆ 16	● 17	၁၈ 18
၁၉ 19	၂၀ 20	၂၁ 21	၂၂ 22	၂၃ 23	၂၄ 24	၂၅ 25
၂၆ 26	၂၇ 27	၂၈ 28	၂၉ 29	၃၀ 30		

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

Laying pipeline under Bago river to supply the water from Lagunbyin Water Treatment Plant to Thilawa SEZ.

2019 February 1379 ckESpf? ewfawmf-jymoc

SUN	MON	TUE	WED	THU	FRI	SAT
			၁ 1	၂ 2	● 3	၄ 4
၅ 5	၆ 6	၇ 7	၈ 8	၉ 9	၁၀ 10	၁၁ 11
၁၂ 12	၁၃ 13	၁၄ 14	၁၅ 15	၁၆ 16	● 17	၁၈ 18
၁၉ 19	၂၀ 20	၂၁ 21	၂၂ 22	၂၃ 23	၂၄ 24	၂၅ 25
၂၆ 26	၂၇ 27	၂၈ 28	၂၉ 29	၃၀ 30		

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

2019 March 1379 ckESpf? ewfawmf-jymoc

Replacing 36"Ø old concrete pipe with 1200 mm Ø HDPE pipe in No.3 Main Road.

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

2019 April 1379 ckESpf? ewfawmf-jymoc

Removing Sludge from Sedimentation basin of Water Treatment Plant to provide more purified water.

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

2019 May 1379 ckESpf? ewfawmf-jymoc

Discussions with JICA Experts about DMA System for NRW Reduction in Yankin

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

2019 June 1379 ckESpf? ewfawmf-jymoc

Research of Pilot Direct Filtration System for Hlawga Reservoir improvement.

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

2019 July 1379 ckESpf? ewfawmf-jymoc

Discussion of calculation for Financial Projection of Planning Section with JICA Expert.

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

2019 August 1379 ckESpf? ewfawmf-jymoc

House Connection Section and Customer Service Section discuss with experts for new Customer database.

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

2019 September 1379 ckESpf? ewfawmf-jymoc

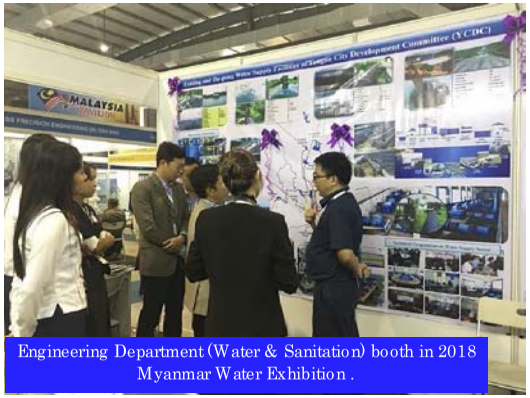
Jar Test in Central Lab to decide the appropriate amount of chemicals based on water quality.

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

2019 October 1379 ckESpf? ewfawmf-jymoc

Training course for Township engineers

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA



Engineering Department (Water & Sanitation) booth in 2018 Myanmar Water Exhibition .

2019 November 1379 ckESpf? ewfawmf-jymoc

SUN	MON	TUE	WED	THU	FRI	SAT
			၃ 1	၄ 2	● 3	၅ 4
၂ 5	၆ 6	၇ 7	၈ 8	၉ 9	၁၀ 10	၁၁ 11
၁၂ 12	၁၃ 13	၁၄ 14	၁၅ 15	၁၆ 16	● 17	၁၈ 18
၁၉ 19	၂၀ 20	၂၁ 21	၂၂ 22	၂၃ 23	၂၄ 24	၂၅ 25
၂၆ 26	၂၇ 27	၂၈ 28	၂၉ 29	၃၀ 30		

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

Installing of Sewage Treatment System with public toilets at Night Market, Strand Road.

2019 December 1379 ckESpf? ewfawmf-jymoc

SUN	MON	TUE	WED	THU	FRI	SAT
			၃ 1	၄ 2	● 3	၅ 4
၂ 5	၆ 6	၇ 7	၈ 8	၉ 9	၁၀ 10	၁၁ 11
၁၂ 12	၁၃ 13	၁၄ 14	၁၅ 15	၁၆ 16	● 17	၁၈ 18
၁၉ 19	၂၀ 20	၂၁ 21	၂၂ 22	၂၃ 23	၂၄ 24	၂၅ 25
၂၆ 26	၂၇ 27	၂၈ 28	၂၉ 29	၃၀ 30		

Engineering Department (Water & Sanitation),YCDC
In Cooperation with JICA

YCDC will continuously work on for better water quality and service.

2020

JANUARY	FEBRUARY	MARCH
APRIL	MAY	JUNE
JULY	AUGUST	SEPTEMBER
OCTOBER	NOVEMBER	DECEMBER

YANGON CITY DEVELOPMENT COMMITTEE
YANGON CITY

The Project for Improvement of Water Supply Management of YCDC.

Engineering Department (Water & Sanitation)

Water Resources and Water Supply Authority, YCDC

In cooperation with Japan International Cooperation Agency (JICA)

Intake Tower of Gyobyu Reservoir

Intake Tower of PhuGyi Reservoir

Lagunbyin Water Treatment Plant

Removal of weeds by Aquamarine to clean

Ngamoeyeik Water Treatment Plant(Nyaung Hna Pin)

Location Map of Kokkowa Water Supply Project

Conserve water to ensure its availability for future!

2020 CALENDAR

January - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

February - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

March - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

The Project for Improvement of Water Supply Management of YCDC.

Engineering Department (Water & Sanitation)

Water Resources and Water Supply Authority, YCDC

In cooperation with Japan International Cooperation Agency (JICA)

Purification Treatment of Gyobyu Reservoir

Service Reservoir for Zone (7) in Dagon Myothit (South) Township

Service Reservoir for Zone (8) in Dagon Myothit (East) Township

Iron Removal from the Groundwater by Aeration

710mmØ HDPE Pipe laying in Thaketa Township

Ground Tank under the Landscaping at Sehlaiathiri Park in Kyeemyindaing Township

Water is life treat it right!

2020 CALENDAR

May - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
၃၀ 31					၀၁ 1	၀၂ 2
၀၃ 3	၀၄ 4	၀၅ 5	● 6	၀၆ 7	၀၇ 8	၀၈ 9
၀၉ 10	၀၁၀ 11	၀၁၁ 12	၀၁၂ 13	● 14	၀၁၃ 15	၀၁၄ 16
၀၁၅ 17	၀၁၆ 18	၀၁၇ 19	၀၁၈ 20	● 21	၀၁၉ 22	၀၂၀ 23
၀၂၁ 24	၀၂၂ 25	၀၂၃ 26	၀၂၄ 27	၀၂၅ 28	● 29	၀၂၆ 30

June - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	၀၂၇ 1	၀၂၈ 2	၀၂၉ 3	၀၃၀ 4	● 5	၀၁ 6
၀၂ 7	၀၃ 8	၀၄ 9	၀၅ 10	၀၆ 11	၀၇ 12	● 13
၀၈ 14	၀၉ 15	၀၁၀ 16	၀၁၁ 17	၀၁၂ 18	● 19	၀၁၃ 20
၀၁၄ 21	၀၁၅ 22	၀၁၆ 23	၀၁၇ 24	၀၁၈ 25	၀၁၉ 26	● 27
၀၂၀ 28	၀၂၁ 29	၀၂၂ 30				

July - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			၀၂၃ 1	၀၂၄ 2	၀၂၅ 3	● 4
● 5	၀၂၆ 6	၀၂၇ 7	၀၂၈ 8	၀၂၉ 9	၀၃၀ 10	၀၃၁ 11
● 12	၀၄ 13	၀၅ 14	၀၆ 15	၀၇ 16	၀၈ 17	၀၉ 18
● 19	● 20	၀၁၀ 21	၀၁၁ 22	၀၁၂ 23	၀၁၃ 24	၀၁၄ 25
၀၁၅ 26	● 27	၀၁၆ 28	၀၁၇ 29	၀၁၈ 30	၀၁၉ 31	

August - 2020

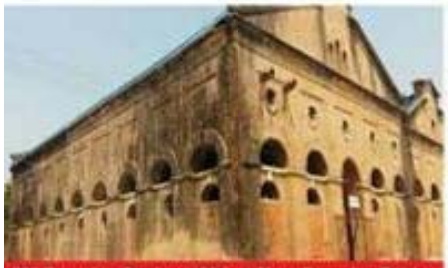
Sun	Mon	Tue	Wed	Thu	Fri	Sat
၀၁၉ 30	၀၂၀ 31					၀၂၁ 1
၀၂၂ 2	● 3	၀၄ 4	၀၅ 5	၀၆ 6	၀၇ 7	၀၈ 8
၀၉ 9	၀၁၀ 10	● 11	၀၁၂ 12	၀၁၃ 13	၀၁၄ 14	၀၁၅ 15
၀၁၆ 16	၀၁၇ 17	● 18	၀၁၉ 19	၀၂၀ 20	၀၂၁ 21	၀၂၂ 22
၀၂၃ 23	၀၂၄ 24	၀၂၅ 25	● 26	၀၂၇ 27	၀၂၈ 28	၀၂၉ 29

The Project for Improvement of Water Supply Management of YCDC.

Engineering Department (Water & Sanitation)

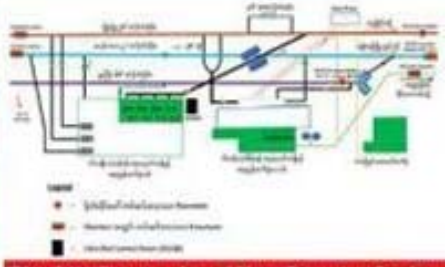
Water Resources and Water Supply Authority, YCDC

In cooperation with Japan International Cooperation Agency (JICA)



Old Pumping Station (1906) at Yegu Pumping Station

New Pumping Station (2007) at Yegu Pumping Station



Pipe Line Layout plan of Yegu Pumping Station

Training Yard at Yegu Pumping Station

New Chlorination Facility at Yegu Pumping Station

New Chlorine Dosing Facilities

Better water for better life!

2020 CALENDAR

September - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
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25	26	27	28	29	30	31

November - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
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22	23	24	25	26	27	28
29	30					

December - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

The Project for Improvement of Water Supply Management of YCDC.

Engineering Department (Water & Sanitation)

Water Resources and Water Supply Authority, YCDC

In cooperation with Japan International Cooperation Agency (JICA)

2020 CALENDAR

January - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
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February - 2020

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March - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

June - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

July - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
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August - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
30	31					1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
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23	24	25	26	27	28	29

September - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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20	21	22	23	24	25	26
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October - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

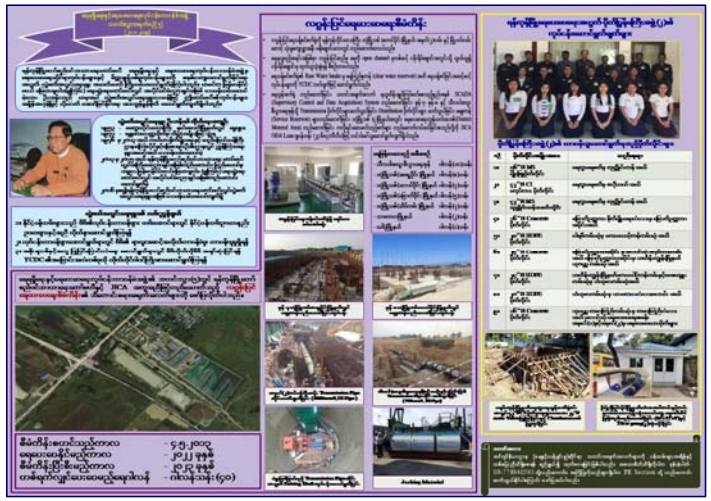
November - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

December - 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Newsletter for WRAWSA



Reference information when WRAWSA would like to prepare the animation video on water supply system

1. Mr. Water's trip! How to make tap water

မစၥတာ ေဝါတာ ရဲ့ ခရီးစဥ္ ။ Tap Water ကို ဘယ္လုိလုပ္ ကမလဲ

The animation video to explain the water supply system of Itami City

https://www.youtube.com/watch?v=NtNVlhloymM

 	Hello, my name is Mr. Water, I just become cleaned water at WTP. The water you use in the house is my friend, the tap water. Today, let's see how to make tap water in Itami city.	မဂၤလာပါ။ ကြ်ေနာ္ WTP မွာ သန္႕စင္ၿပီးသြားတဲ့ (ေဝါတာ) ပါ။ ေရသန္႕စင္စက္ရုံမွာပဲ ကြ်ေနာ္ဟာ သန္႕စင္ၿပီးသြားတဲ့ ေရျဖစ္ေနပါတယ္။ သင္တုိ႕အိမ္မွာ အသံုးျပဳေနတဲ့ Tap Water ေရဟာ ကြ်ေနာ္သူငယ္ခ်င္းပါပဲ။ ဒီေနရာမွာ Itami City မွာ Tap Water ကို ဘယ္လုိလုပ္သလဲဆိုတာကို ေလ့လာၾကည့္ေရအုပ္ပါ။
	Water system explanation. There are three systems (three rivers). The works of reservoir (control of water volume, settle down the large particulars)	ေရစနစ္ ရွင္းလင္းခ်က္။ စနစ္ (၃) ခု ရွိပါတယ္။(ျမစ္ ၃ခု) ေရလွ်ာ့ခ်ိန္ (ေရပမာဏကိုထိန္းခ်ဳပ္ျခင္း၊ ႀကီးမားတဲ့ အနယ္/အမႈန္ကိုအနည္ထိုင္ျခင္း)

	The water is delivered to WTP. 90,000 m3/day. Receiving wells, mixing tanks with Aluminum sulfate and sodium hydroxide, flocculation. How the floc is formulated? Water is mixed with aluminum sulfate and floc is formulated and settled down. Then Sedimentation basin.	ေရကိုေရသန္႕စက္႐ံုသို႔ ပို႔ပါတယ္။(၉၀,၀၀၀ m^3/day) ေရလက္ခံကန္၊ အလူမီနီယံ ဆာလ္ဖိတ္ႏွင့္ ဆိုဒီယမ္ ဟိုက္ဒေရာ့ဆိုဒ္ ေရာေမႊေပးတဲ့ကန္ ႏွင့္ flocculation. အမႈန္အမႊားအစုအခဲမ်ား ဘယ္လိုျဖစ္ေပၚလာသလဲ။ ေရဟာ အလူမီနီယံ ဆာလ္ဖိတ္ႏွင့္ ေရာၿပီးသြားတဲ့ခ်ိန္မွာ ေရထဲမွာ ပါတဲ့ အမႈန္အမႊားေလးေတြဟာ အႏွယ္အခဲေလးေတြျဖစ္လာၿပီး ေအာက္ေျခမွာ အႏွယ္ထိုင္သြားပါတယ္။
	The sedimented floc are collected to the sludge thickener. Sludge dewatering. Dewatered sludge is used as fertilizer	အႏွယ္ထိုင္သြားတဲ့အစုအခဲေတြကိုsludge thickener မွာ စုစည္းၿပီး ဖယ္ထုတ္ပါတယ္။ဖယ္ထုတ္လိုက္တဲ့အႏွယ္ေတြကို ေျမၾသဇာအျဖစ္ အသံုးျပဳႏိုင္ပါတယ္။
 	Advanced treatment (ozone, activated carbon) Filtration Disinfection Reservoir	အဆင့္ျမင့္သန္႔စင္မႈ (အိုဇုန္း activated carbon) စစ္ထုတ္ျခင္း ပိုးမႊားသန္႔စင္ျခင္း ေရစုကန္
	Control room	ထိန္းခ်ဳပ္ခန္း

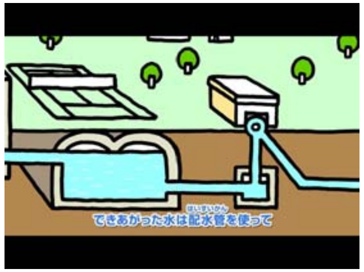
2. Osaka City

The animation video to explain the system of water treatment plant

https://www.youtube.com/watch?v=gYDv31IQFv0

	I am working to make clean water. You ask how the clean water is produced? Listen well that I will explain the process.	ေေရကို သန္ဒ၂စင္ေေစုဖိ ၂ ကြ်န္ေေတာ္ လု ပ္ေေနပါတယ္။ သန္ဒ၂ရွင္းတဲ့ ေေရကိုဘယ္လုိထုတ္မ လဲလို ၂သင္ေေမးမယ္ဆုိရင္ ာ်ား။ သန္ဒ၂စင္တဲ့ေေရကို ဘယ္လုိ ထုတ္သ လဲဆိုတာကို ရွင္းျပပါမယ္။ ေေသသခ်ာခ်နားေေထာင္ေေပးပါ။
	There are three WTP in Osaka. My work starts to receive water from Yodogawa.	အို ဆာကာၿမိဳ့မွာဆို ရင္ ေေရသန္ဒ၂စင္ စက္ရံုေ၃ ခု ရွိပါတယ္။ ကြ်န္ေေတာ့အလ ုပ္ကတာ့ Yodogawa ေကန ေေရကို လက္ခ ံရယ တာေတာ့ေနစပါတယ္။
	WTP is the factory to produce delicious and safe water. The garbage and sand is removed from the water received from Yodogawa in this place. But still the water cannot be drinkable. To make drinkable water, Osaka city makes all kinds of efforts.	ေေရသန္ဒ၂စင္ စက္ရံုဆို တာေကတာ့ အရသာရွိၿပီး စိတ္ခ ်ရတဲ့ ေေသသ္ကုထားေေရကိုထုတ္ေေ၀တဲ့စက္ရံုျဖစ္ ါတယ္။ဒီေေနရာမွာ Yodogawa မွရရွိတဲ့ ေေရမွာ ပါ၀င္တဲ့အမႈိက္သ ္ကို ဖယ္ရွာ်ားေေပးပါတယ္။အဲလို ဖယ္ရာ်ားလို က္ေေပမယ့္သည္း ေေရက ေေသသ္က ံုးလို ၂ရတဲ့ေအ်ခေအေနတာ့ မဟု တ္ေေသးပါဘ ား။ ဒါေေၾကာင့္မို့ ေေသသ္ကုထားလို ၂ရတဲ့ ေရ ဖ်ာ ိ ြအ ၀

		အို ဆာကာ မစိမ်းပြေကြတာ့်ညွှ အမ်ိဳးမ်ိဳးေသာအားထုတ္မႈေတြ တ ပါပီလုပ္ ပါတယ္
	From here, I (Aluminum sulfate) will explain. By getting into the water, catch the small particulars and settle down. The settled sand is recycled to be used in the construction.	ဒီေနရာမွာ ကြၽန္ေတာ္ (အလူမီနီယံဆာလ္ဖိတ္) ရွင္းျပပါမယ္။ ေရထဲကို အလူမီနီယံဆာလ္ဖိတ္ ထည့္လိုက္ျခင္းျဖင့္ ေသးငယ္တဲ့ အမႈန္အမႊားမ်ားကို စုစည္းေစၿပီး အနယ္ထိုင္ေစပါတယ္။ အနယ္ထိုင္တဲ့ အမႈန္အမႊားသဲေတြကို ေဆာက္လုပ္ေရးလုပ္ငန္းေတြမွာ ျပန္လည္အသုံးျပဳႏိုင္ပါတယ္
	But still water cannot be drinkable. This is our turn (Ozone, activated carbon). With her (Ozone, activated carbon), the safer and more delicious water can be delivered to citizens. Ozone disinfects bad odor and dissolve the invisible microorganism.	ဒါေပမယ့္လည္း ေရက ေသာက္လို႔ရတဲ့ အဆင့္မဟုတ္ေသးပါဘူး။ ဒီတစ္ခါ ရွင္းျပမွာက ကြၽန္ေတာ္တို႔ (အိုဇုန္း activated carbon) အလွည့္ျဖစ္ပါတယ္။ Ozone, Activated carbon ကို အသုံးျပဳၿပီး ပိုမိုစိတ္ခ်ရၿပီးအရသာရွိတဲ့ ေသာက္ေရကို ျပည္သူေတြကို ျဖန္႔ျဖဴးေပးႏိုင္မွာျဖစ္ပါတယ္။ အိုဇုန္းက ေရထဲမွာ ပါ၀င္တဲ့ အနံ႔ဆိုးေတြကိုပ်က္စီးေစၿပီး မ်က္စိနဲ႔ မျမင္ႏိုင္တဲ့ဇီ၀သက္ရွိေတြကို ဖယ္ရွားေပးပါတယ္
	Then this water is filtered by sand layers. Ozon works again and activated carbon catch the dissolved by ozone.	ၿပီးေနာက္ သဲမ်ားျဖင့္ ေရကို စစ္ထုတ္ပါမယ္။အိုဇုန္းက ျပန္လည္အလုပ္လုပ္ပါတယ္။ေနာက္ activated carbon က အိုဇုန္းေၾကာင့္ ေပ်ာ္၀င္သြားတဲ့ ဇီ၀သက္ရွိေတြကို ဖမ္းယူထားလိုက္ပါတယ္။

	We want to deliver the water as soon as possible, but water should be disinfected by chlorination and tested.	ရေကို မြန်နိုင်သမျှ မြန်မြန်လေး ဖြန့်ဖြူးချင်ပါတယ်။ ဒါပေမယ့်လည်း ကလိုရင်းဆေးခတ်ပြီး ပိုးမွှားသန့်ရှင်းပြီးမယ်။
	The cleaned water is delivered to your home through distribution pipes. Received the water, cleaned and delivered the water is the works of WTP.	သန့်စင်ထားတဲ့ရေကို ရေဖြန့်ဝေတဲ့ ပိုက်ကြီးများမှတဆင့် သင်တို့ရဲ့ နေအိမ်အထိရောက် ဖြန့်ဖြူးပေးပါတယ်။ သင်တို့အိမ်မှာ ရရှိတဲ့ သန့်စင်ထားတဲ့ရေဟာ ကျွန်တော်တို့ ရေသန့်စင်စက်ရုံရဲ့ လုပ်ဆောင်ချက်တွေပဲဖြစ်ပါတယ်။

Management of Water Utility in YCDC

Toward sustainable management

March 2021

Yoji Matsui

JICA Technical Assistant Expert Team

The Project for Improvement of Water Supply Management of YCDC

Contents

1. Some issues in YCDC

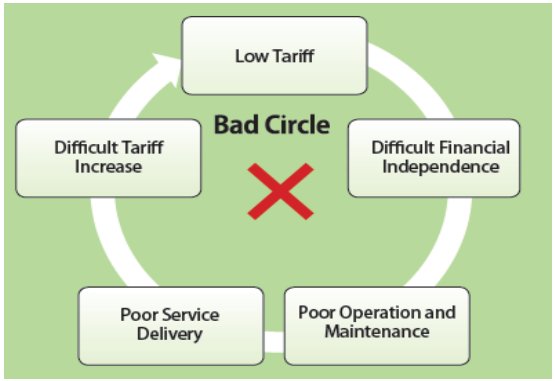
How to make a turn-around from bad circle to desirable circle

Still, water supply in Yangon city ……

- More than 60% of Yangon citizen cannot get piped water supply
- Even in the supply area, only 9 hours supply in a day (average)
- Even supplied water, quality is less than drinkable or WHO standards
- In addition, more than 60% of water is lost as non-revenue water (NRW)

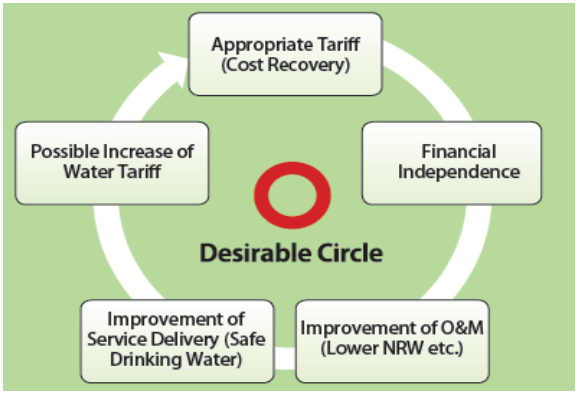
- There is no National Water Supply Law or no National Ministry/Department responsible for water supply in Union level

Bad Circle
of water supply management

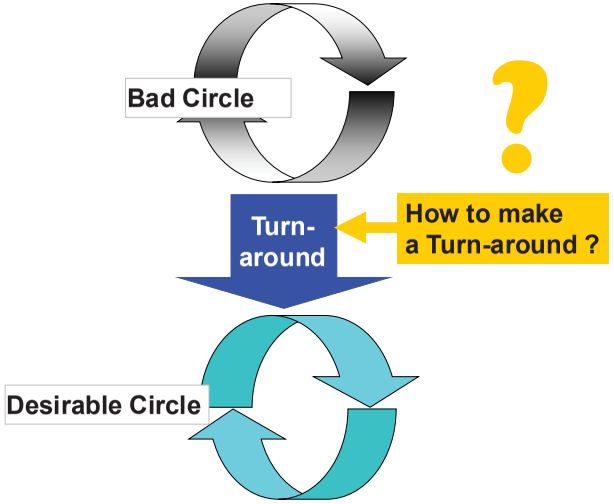


From "Facts about YCDC"

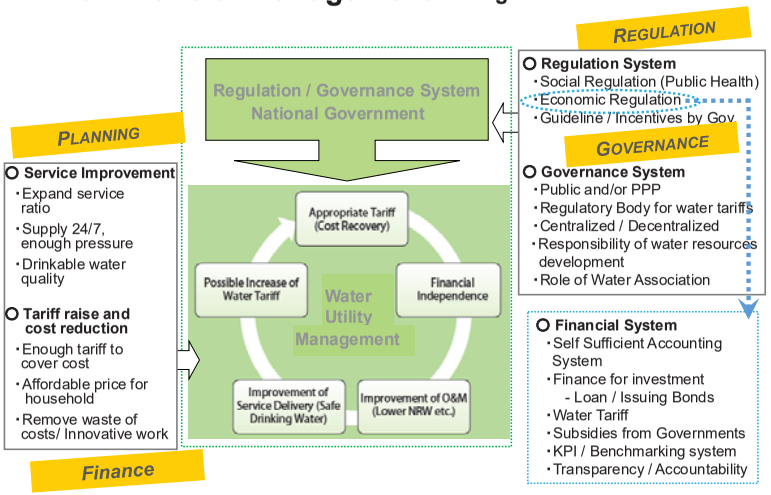
Desirable Circle
of water supply management



Turn-around for desirable circle



Importance of Regulation, Governance, Planning & Financial management -- to get a desirable circle



2. Characteristics of urban water supply management

Needs of regulation by government

9

Characteristics of water supply

2-1. Water supply?

10

Primitive water supply





A) Necessity of daily life

B) Beneficiary pay principle

11

Community water supply



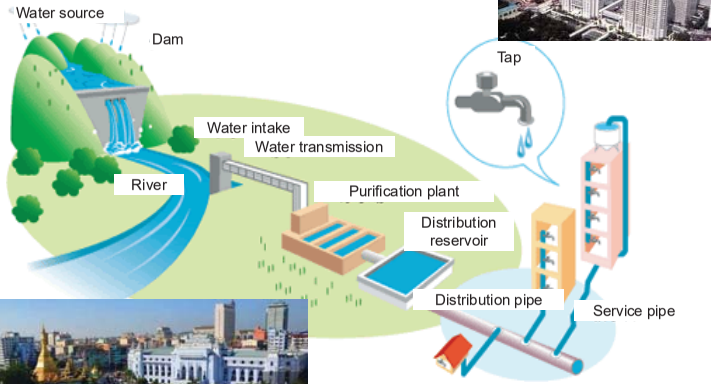

A) Necessity of daily life

B) Beneficiary pay principle

C) Community can afford initial investment

12

Urban water supply



Source: Yokohama Waterworks Bureau Website

A) Necessity of daily life
B) Beneficiary pay principle
C) Enormous initial investment
D) Natural monopoly

Characteristics of urban water supply management

A) Necessity of daily life
B) Beneficiary pay principle
C) Enormous initial investment
D) Natural monopoly

Characteristics of water supply

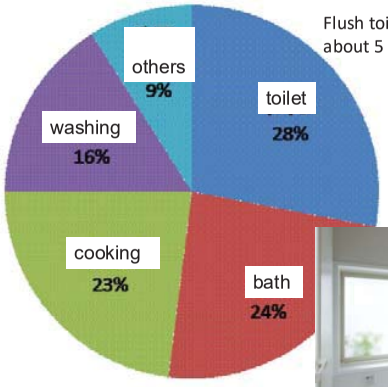
2-2. Necessity for daily life

Essential service

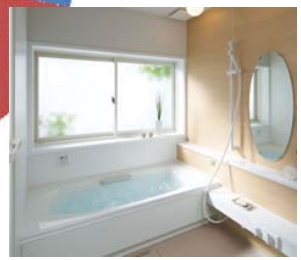
- Water utilities are engaged in the supply of water and services which are indispensable to the community. In the absence of these services, the normal life of the community is confused and messed up.
- For instance, any disruption in the supply of water would create a great inconvenience to the general public. Therefore, it is necessary that these services must be supplied regularly, adequately and efficiently.

Essential in house keeping

Washing machine:
about 100 Little



Flush toilet :
about 5 Little



Bath : about 200 Little

Source : TOKYO prefecture (2006)

Essential for city's daily activities

Office
Hotel
Hospital
Market store
University, Institution
Manufacturing factory

Inconvenience

- Drinking water, - Flushing Toilet, Bath / Shower, Landry (washing clothes)

Characteristics of water supply

2-3.Enormous initial investment

Dam, intake, conduit …..

More costly, considering society and environment

Water treatment plants

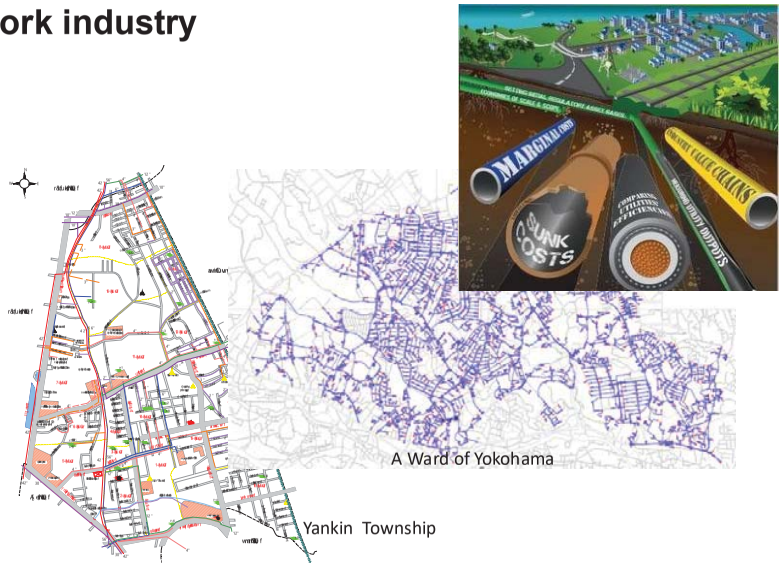
More costly, considering contamination and society's needs

Importance of underground facilities

A large portion of water supply assets are underground

Ostrich : (informal) someone who does not deal with difficult problems but tries to pretend that they do not exist, because ostrich were believed to bury their heads in sand so that their hunters could not see them

Network industry



A Ward of Yokohama

Yankin Township

Underground network

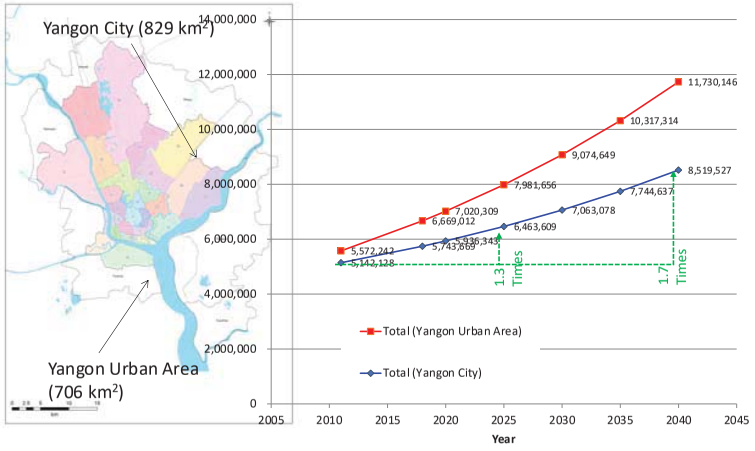
Component of Assets in Balance sheet

Huge investment to construct water supply system

Industry (JAPAN 1990)	Water	Elec-tricity	Gas	Manu-facture	Const-ruction	Retail
Tangible Asset (%)	89%	95%	77%	43%	19%	23%
Rotation rate (Annual sales/Tangible)	0.15	0.42	0.91	2.40	5.01	12.01

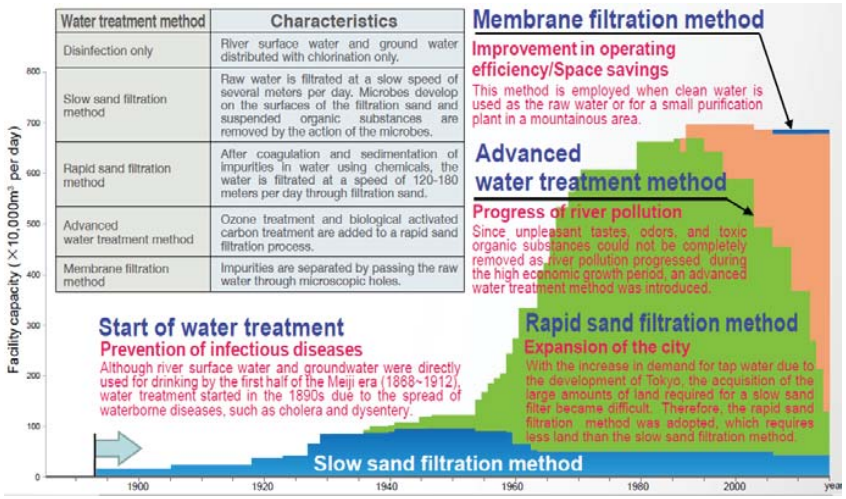
	Tokyo	Bangkok	Phnom Penh
Total Assets	2,677	60,634 (206 Billion yen)	1,166 (35 Billion yen)
Tangible Asset	2,383 (89%)	44,555 (73%)	874 (75%)
Network Asset	1,563 (65%)	30,413 (68%)	382 (44%)
Remarks	Billion yen 2014	Million Baht 2013	Billion KHR 2014

Huge investment required in Yangon



Huge investment in Tokyo

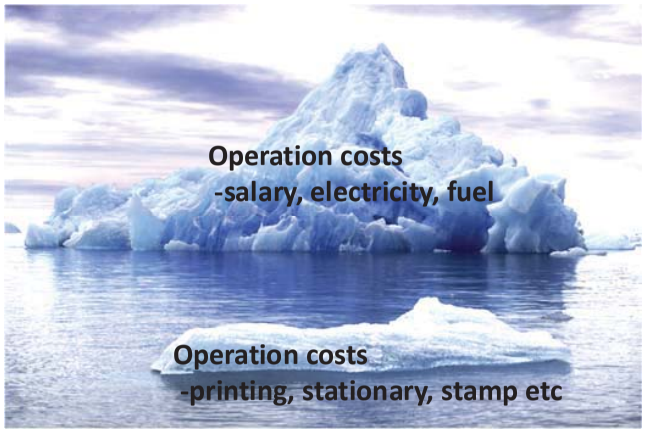
Water treatment method	Characteristics
Disinfection only	River surface water and ground water distributed with chlorination only.
Slow sand filtration method	Raw water is filtrated at a slow speed of several meters per day. Microbes develop on the surfaces of the filtration sand and suspended organic substances are removed by the action of the microbes.
Rapid sand filtration method	After coagulation and sedimentation of impurities in water using chemicals, the water is filtrated at a speed of 120-180 meters per day through filtration sand.
Advanced water treatment method	Ozone treatment and biological activated carbon treatment are added to a rapid sand filtration process.
Membrane filtration method	Impurities are separated by passing the raw water through microscopic holes.



Characteristics of water supply

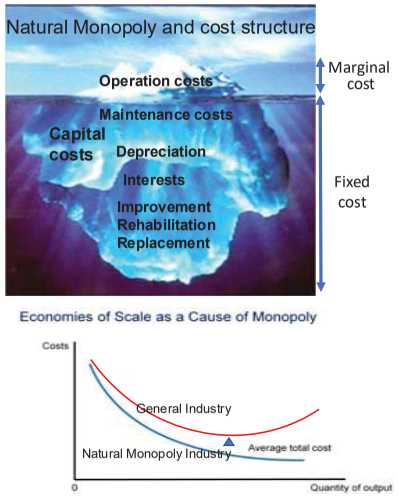
2-4. Natural monopoly

Superficial costs



Total cost structure

Natural monopoly and cost structure

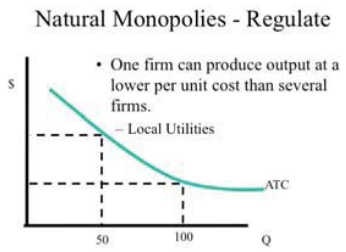


- In a general industry, the marginal cost decreases with economies of scale, then increases as the company has growing pains (overworking its employees, bureaucracy, inefficiencies, etc.). Along with this, the average cost of its products decreases, and then increases.
- However, a natural monopoly has a very different cost structure. A natural monopoly has a high fixed cost for a product that does not depend on output, but its marginal cost of producing one more good is roughly constant, and small.
- Then, only one company in the market can supply goods lower than other companies and be getting monopoly.

- This happen such industries as enormous initial investment required to build and maintain, that is, capital cost predominate and create high barriers to entry.
- Economies of scale continues and it has an overwhelming cost advantage over other potential competitor, that is, single company produce because most efficient in a society.
- Monopoly can lead to bad situation
  - higher than necessary price
  - inefficiency (higher average cost) would occur
  - bureaucracy

Cost curve in Natural monopoly

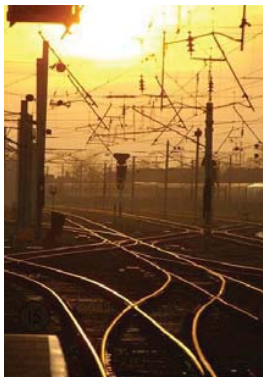
- Marginal cost is the cost to the company of serving one more product. (one more cubic meter of water).
- Usually in an industry the marginal cost decreases with economies of scale, then increases as the company has growing pains (overworking its employees, bureaucracy, inefficiencies, etc.). Along with this, the average cost of its products decreases and increases.



- **A natural monopoly has a very different cost structure. A natural monopoly has a high fixed cost for a product that does not depend on output, but its marginal cost of producing one more good is roughly constant, and small.**

Natural monopoly Industry

- Natural monopoly industry
  - electricity, natural gas, water, sewerage, railway, public transit, telecomunication, postal service, broadcast etc.
  - government manage or government regulate
  - Trend towards liberalization, deregulation and privatization but network infrastructure remained monopolistic
- This happen such industries as enormous initial investment required to build and maintain, that is, capital cost predominate and create high barriers to entry.
- Economies of scale continue and it has an overwhelming cost advantage over other potential competitor, that is, single firm produce because most efficient in a society.
- Monopoly can lead to bad situation
  - higher than necessary price
  - inefficient (at higher average cost) than would occur
  - bureaucracy



Water supply in market economy

Service
- Access
- Quantity (24/7, Pressure),- Quality

Cost/Price

	Rival multiple consumers cannot consume the same good	**Non-Rival** multiple consumers can consume the same good
Excludable consumption can be detected and prevented by producer	**Private Goods** (Efficiently produced and allocated by markets) Foods, Clothing, Electric Appliances, Cars, Furniture, Services,	**Natural Monopoly** (**High fixed costs, low marginal costs, inefficient competition**) **water supply, sewage**, gas, telecom, electricity, fire protection
Non-Excludable consumption cannot be detected or prevented	**Natural Resources** (negative externalities, overconsumption) **rivers, groundwater**, fisheries, ecosystems, unenclosed timber, underground oil/gas	**Public Goods** (Free riders, positive externalities, underproduction) national defense, prevention of flood, streets, parks (uncongested), lighthouses, knowledge

3. Regulation in water supply

How to regulate water utility

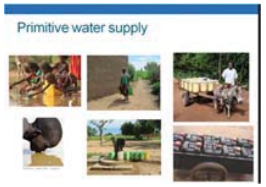
Regulation in water supply

3-1. Needs of regulation

Regulation and Characteristics of Urban Water Supply

- **Necessity of daily life and public health**
  >regulate to attain desirable social outcomes
  - supply good quality of drinking water
  - supply piped water regularly
  - supply water adequately
  - supply water by affordable price
- **Enormous initial investment**
  >regulate and support the utility to manage lots of facilities
  - approve "single" operator in designated area
  - support to get capital funds (provide subsidies)
- **Monopoly (it can lead to bad situations)**
  >regulate to remove the defect/fault of monopolistic operation
  - higher than necessary price
  - inefficient (at higher average cost) than would occur
  - bureaucracy

→ ***Regulation is vital for urban water supply***



Social regulation and Economic regulation

- Economic regulation
  - regulation of economic activities, i.e., government impose restrictions on corporation's activities over price, entry and exit, etc.
  - economic regulation centered on correcting for market failures or imperfections that reduce economic efficiency within a specific market
  - to increase investment to secure services

- Social regulation
  -regulation in social areas of health, safety, consumer protection and the environment
  - concept of social regulation is to correcting for the damaging effects of economic activity (market failures) such as pollution or risks to the health and safety of employees and consumers
  - attaining socially desirable outcomes

Water supply utility vs. Food industry

- **Water supply utility**
  > Economic regulation
  - monopoly
  > Social regulation
  - secure safe water

- **Food industry**
  > Economic regulation
  - compete each other
  > Social regulation
  - secure safe foods

Similarity and Difference

- **Similarity:**
  > Both industries produce goods to eat/drink
  - both industries need regulation to secure safe foods
    *license *facility registration
    *recordkeeping *reporting
    *good manufacturing practice requirement
    *labeling *inspections *preventive controls
- **Difference:**
  > Water supply utility distributes drinking water directly to customer using network of pipe and has the nature of monopoly.
  However, in the food industry there exist competition and no need of regulation
- **Learn other industry to improve**
  - Concept of HACCP →Water Safety Plan
  - ISO 22000

Regulation in water supply

3-2. Compare regulation: Japan and UK

41

Regulation in Japan

Waterworks Law and other regulations
License, Drinking Water Quality, Standards of Facilities, etc.
(Ministry of Health, Labour and Welfare)

Water Supply Law promotes public health and improvement of the living environment by supplying Clean, Ample and Inexpensive drinking water

Regarding sector governance, the Law stipulates water utilities shall be managed by municipality in principle

Water Utilities
(Operated by municipal government)

Local Public Enterprise Law is applied to municipal water supply utilities.

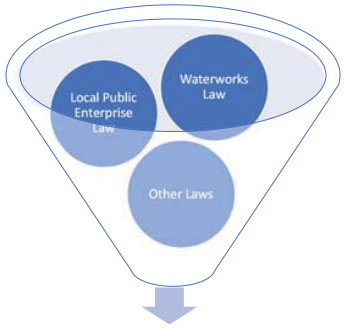
It enforces water utilities to manage like 'private company'.

- Its account shall be separated from the municipal's general account and introduce double-entry accounts.
- Its cost shall be covered by tariff (except for government subsidies).
- The Director General of it shall have the independent authority on personnel and expenses in principle.

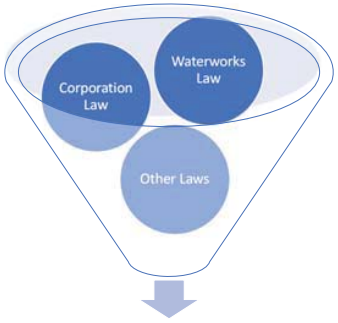
Local Public Enterprise Law and other regulations
Organizational and Financial Soundness of Municipal Water Utilities
(Ministry of Internal Affairs and Communications)

42

Regulation for municipal or private water utility in Japan



Municipal water utility
(Municipal government operate)



Private water utility
(Private company operate)

Very few case in Japan

43

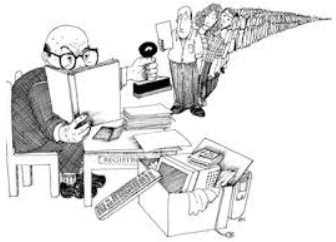
Waterworks Law in Japan

- The purpose of this law is to contribute to the development of adequate water sources and facilities, and rational management. To regulate and protect water supply utility, so as to have safe, adequate and reasonable water supply, and promote public health and improve the living environment to the people.
- In principle, water utility shall be operated by the municipal government. Private companies can also manage water utility if municipal government approve.
- Main responsibilities
  - approval of license
  - approval of rates of water tariff (private companies only)
  - setting standard design for construction of facilities
  - setting water quality standards
  - report, inspection

44

Local Public Enterprise Law in Japan

- This law stipulates the basics of the management of the local Public Enterprise and specifies the management of organization, finance, handling of the status of enterprise personnel, etc. And enhance efficiency of municipal enterprise introducing “corporation” style of management
- This law applies to utilities/public works operated by municipal governments
  - water supply, wastewater
  - railway, subway, bus
  - electricity, gas supply
  - port management,
  - hospital management ,
  - market facility management

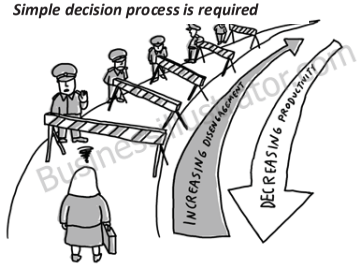


Remove bureaucracy

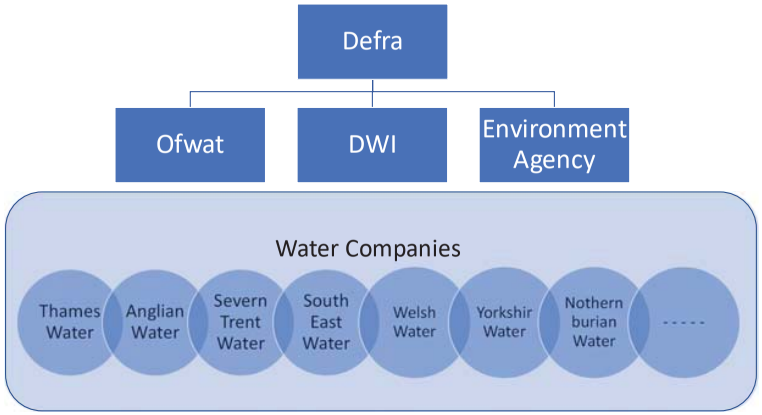
Main items stipulated in Local Public Enterprise Law in Japan

- Principle of management (enhance economic efficiency and social value)
- Independent authority of head of local enterprise (head of Tokyo Waterworks Bureau can manage personnel affairs, contract, expend money, etc, independent from Governor of Tokyo)
- Appointment of head of local enterprise (Governor of Tokyo appoint head of Tokyo Waterworks Bureau)
- Principle of water tariff rate-making
  - *cost of service principle
  - *efficient management (remove waste)
  - *secure sustainable management
- Accounting method (corporation accounting)
- Principle of personnel management
- Procedure of decision making (in the following cases, governor and local parliament concern: *budget setting, *financial report settling, *water tariff setting)

Simple decision process is required



Regulation in UK (England and Wales)



UK Ofwat: Office of Water Services

- Role is to ensure that the water companies give consumers a good-quality, efficient service at a fair price
- OFWAT has to protect consumers’ interests, but at the same time ensure that the water companies are able to finance the required improvement programmes
- OFWAT also compares company performance using performance measures and benchmarking
- Main responsibilities
  - Sets price limits
  - Promotes economy and efficiency
  - Protects consumers
  - Operates a guaranteed standards scheme
  - Sets and audits leakage targets

UK DWI: Drinking Water Inspectorate

- DWI check that water companies are complying with regulations, especially drinking water standards
- DWI takes enforcement action as necessary
- DWI investigate incidents and prosecuting if warranted
- DWI investigate consumer complaints
- DWI advise to Local Authorities on regulation of private water supplies

49

Japan vs. UK (England & Wales)

- Japan: Municipal body operate water utilities in all most all cases
  > Law/regulation
  - Waterworks Law →Water supply utility operator
  - Local Public Enterprise Law → Municipal operator

  > Regulator
  - Ministry of Health, Labour and Welfare
  - Ministry of Internal Affairs and Communication

- UK: Private company operate water utilities
  > Law/regulation
  - Water Act, Water Industry Act

  >Regulator
  - Defra: Department of Environment, Food and Rural affairs
  - Ofwat (Office for water services) ---Economic regulation
  - Drinking Water Inspectorate ---------Water quality regulation
  - Environment agency ----Wastewater discharge

50

Regulation system in Myanmar?

- Make clear in Laws/Regulations on how to regulate water utilities.
- Social regulation
  > Establishing responsible ministry in the central government
  > Responsible ministry shall establish "waterworks law" which stipulate both water utility and small community water supply
  - setting drinking water quality standards
  - setting standards of facilities that secure quality of water
  - setting responsibility of water utility on 24/7 supply and supply to all people live in service area
- Regulation for municipal government (in case of municipal operation)
  > Establishing responsible ministry in the central government
  > In order to establish efficient municipal operation, then, it required to establish "local public enterprise (corporation) law" which should include;
  - delegation of authority to head of municipal utility
  - guideline of rate making of water tariff
  - accounting method

51

4. Governance in water supply

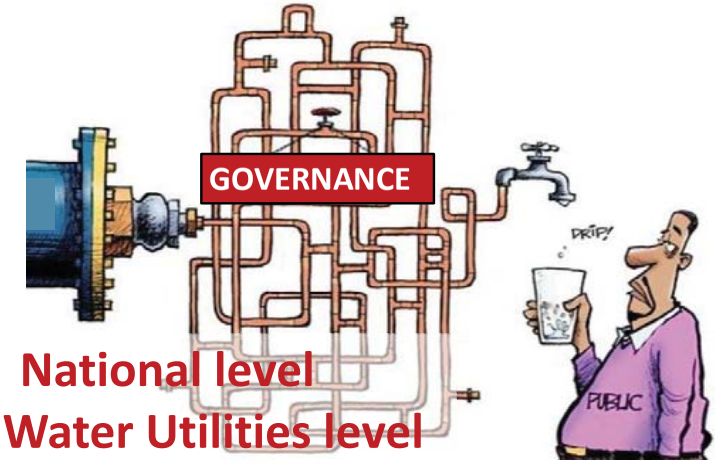
Governance: management framework

52

13

Governance in water supply

4-1. What is governance?



National level and Water Utilities level

Source: PPWSA

Governance in water supply

- The OECD defines water governance as;
  The range of political, institutional and administrative rules, practices and processes (formal and informal), through which decisions are taken and implemented. Stakeholders can articulate their interests and have their concerns considered. And decision makers are held accountable for water management (OECD, 2015).
- At JICA's 4th Executive Forum for Enhancing Sustainability of Urban Water Service in Asian Region (Yokohama, Aug 2017) defined as;
  Governance is "management system, environment system or framework"

Sector Governance = National Level Governance

- Governmental utility / Private utility, National utility / Local utility, Separation of Regulator / Operator

Public (Government) / Private (PPP)

Centralize / Decentralize

Separate functions (Policy, Regulation, Operation) / Integrate functions (Policy, Regulation, Operation)

Utility Governance = Utility Level Governance

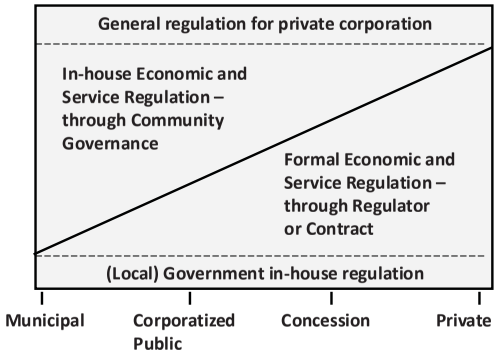
- Autonomous organization or dependent organization
- Who has power/authority to decide personnel, contract, expenditure in water utilities

Autonomous organization / Non-independent organization

Independent power / Non-independent power

Decision by Committee/ Council/ Board members / Decision by Elected/ Appointed Head

Sector Level Governance (Public / Private)



Separation from Gov't →	None ----------	More ---------- Complete
Asset Owner →	Public ----------	Private
Svc Provider →	Public ----------	Private ----------

Source: Paul Reiter, May 2004 Tokyo

Sector Level Governance (Centralized / Decentralized)

- Several type of centralized or decentralized water supply
  - ✓Central government operate as authority (Bangkok MWA/PWA, …)
  - ✓Central government operate as corporation (Yangon Electricity Supply Corporation, Japan post, Phnom Penh PPWSA)
  - ✓Municipal government operate as public works (Myanmar, most India, …..)
  - ✓Municipal government operate as local public enterprise (Japan, most USA, …….many countries)
  - ✓Municipal government operate as corporation (Netherlands, Sweden, ….)
- In water supply utilities, direct operation by (local) government is popular in the world.

57

Utility Level Governance
(Autonomous / Independent or Non-independent)

Water Supply as government's general services

Like public road, public park, flood prevention, etc.

- Water services are not based on costs of service and considerable part of costs are covered by tax revenue.
- Customers cannot realize correct value of water and may waste water.
- Customer may not request cost saving efforts to utility because they do not know its costs.
- Service price and costs are irrelevant which may cause irresponsible management.
  - Not customer-oriented service
  - Not transparent
  - Quick response for customer

Water Supply by autonomous/independent utility

- Water services are based on costs and be able to establish fair price.
- Customer realize correct costs which may lead them to efficient use of water.
- Customer request efficient management equivalent to they pay. It works as cost-center and utility shall have clear cost-consciousness.
- Service price are based on costs which may cause responsible management
  - Customer oriented services.
  - Transparency
  - Quick response for customer

58

Governance in water supply

4-2. Compare governance

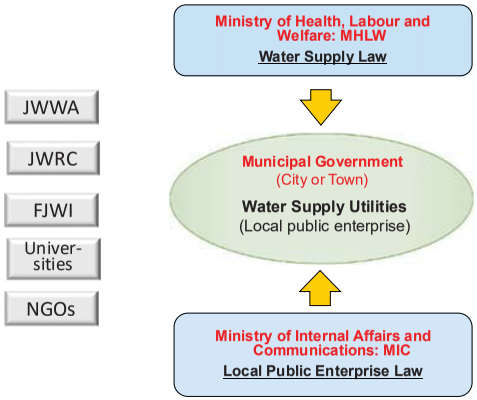
59

Alternatives of sector governance and utility governance

Sector Governance	Utility Governance	Remarks
Department style (Myanmar)	Utility Department is included in government organization, and not ring-fenced or has no autonomous management power in the government	Need autonomous style to be more effective and efficient utility.
Local public enterprise style (Japan, PDAM)	Utility is under local government, and ring-fenced and has mostly autonomous management power such as O&M, accounting, contract, personnel, except vital effect issues to citizens such as tariff revision	Need to introduce market economy concept to be more efficient utility.
Public Corporation Style (MWA, PPWSA)	Utility is corporatized and its share is owned by government or established as special statutory corporation (no share). Assets move to Corporation and all responsibility move to corporation. Board members manage the utility. They are appointed by Government.	Need a new law to establish public corporation. Government and Board has the role of regulator.
Concession style (MWSS and Manila Water & Maynilad)	Utility's most staff members move to concessionary company and some member remain in MWSS as regulator for the company. Assets owned by MWSS, and O&M and some construction move to private company. Utility's governance style is same as private company.	Need to consider carefully the concession contract between private company
Private Corporation (UK)	Utility is privatized and its share is open to public. Assets transfer to the company and all responsibilities move to the company.	Need new law to establish the system. Need to establish strong Regulators.

60

Sector Governance in Japan



Water Supply Law promotes public health and improvement of the living environment by supplying Clean, Ample and Inexpensive drinking water

Regarding sector governance, the Law stipulates water utilities shall be managed by municipality in principle

Water Supply Utilities are managed in principle by municipal government (city or town)

Utility's activities are ring-fenced and has mostly autonomous management power such as O&M, accounting, contract, personnel, except vital effect issues to citizens like tariff revision, according to Local Public Enterprise Law.

Local Public Enterprise Law is applied to municipal water supply utilities.

It enforces water utilities to manage like 'private company'.

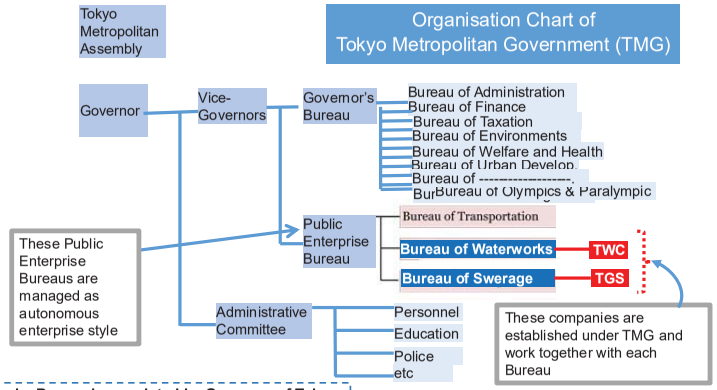
- Its account shall be separated from the municipal's general account and introduce double-entry accounts.
- Its cost shall be covered by tariff (except for government subsidies).
- The Director General of it shall have the independent authority on personnel and expenses in principle.

JWWA: Japan Water Works Association
JWRC: Japan Water Research Center
FJWI: Federation of Japan Water Industry

61

Utility Governance in Tokyo

Population served
13,640,448
Length of pipe
28,022 Km
Customer
7,816,724
Number of staff
3,623
Supply capacity
6,859,500 m3/d
Average supply
4,215,100 m3/d
(FY: 2019)



Head of Waterworks Bureau is appointed by Governor of Tokyo and has autonomous power on:
- Accounting - Finance - Personnel - Procurement
- O & M and Construction

Head has heavy responsibility:
- Water supply services *Water quality *24/7 *Pressure etc
- Financial sustainability - Sustainable management to the future

However, Head of Waterworks Bureau does not have power on;
- Annual Budget Decision - Water tariff revision,
- Create or amend Municipal Law (Ordinance)
(These matters are decided by Tokyo Metropolitan Parliament)

62

Myanmar vs Japan

Sector Governance in Myanmar

- National level governance →No national water supply law or no responsible ministry
- Region/State responsibility → No regional level water supply law. Responsible organization is *** in rural area and YCDC in urban area. Regional government made YCDC Law (or MCDC Law) which established a water supply organization and its responsibilities.

Utility Governance in YCDC

- YCDC is a municipal water supply entity.
- Water supply entity is named "Authority". But, actually, it is one of departments and it has not independent power at YCDC.
- Authority style which has five board members, but little power, such as limited decision power on personnel, contract, expenditure.
- Tariff and budget is under Regional government.

Sector Governance in Japan

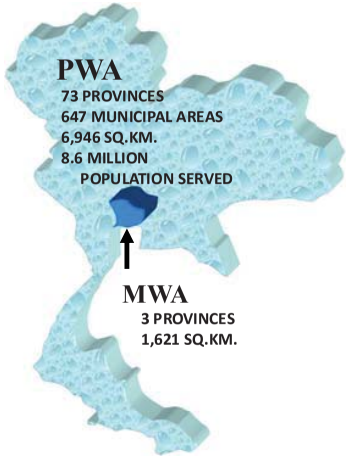
- National level governance →"Waterworks Law" and "Local Public Enterprise Law". Ministry of Health, Labor and Welfare, Ministry of Internal Affairs and Communication
- Prefecture→ According to the Laws, some responsibilities are entrusted to prefecture government from national government.

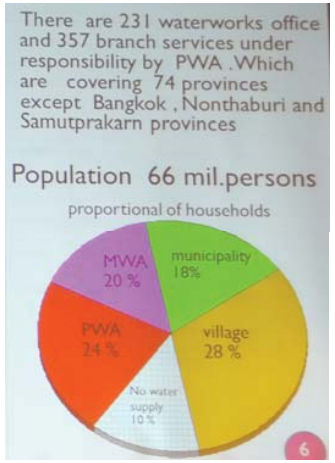
Utility Governance in Tokyo

- YCDC is a municipal water supply entity.
- Water supply entity is named "Authority". But, actually, it is one of departments and it has not independent power at YCDC.
- Authority style which has five board members, but little power, such as limited decision power on personnel, contract, expenditure.
- Tariff and budget is under Regional government.

63

Sector governance in Thailand





64

Sector governance in Thailand (MWA & PWA)

MWA (Metropolitan Waterworks Authority)
14 Nov. 1914 The water distribution of Bangkok started. This business was managed by a sanitary office bureau.
After World War II, Thai government established the board of directors that would improve the electric and water supply. Not long after, both of these organizations became the state enterprises.
16 Aug 1967 The government issued a legislative act to legally create the Metropolitan Waterworks Authority (MWA).

PWA (Provincial Waterworks Authority)
1966 The government had arranged a project on clean water across the kingdom, with 11 government agencies implementing it. During this period, the Department of Public Works (DOPW) and the Department of Health (DOH) were 2 main agencies providing clean water to rural people. Water supply services provided by DOPW and DOH, which had bureaucratic limitations, became inflexible.
28 Feb. 1979 Provincial Waterworks Authority (PWA), which was a new agency established, as a state enterprise under the jurisdiction of the Interior Ministry.

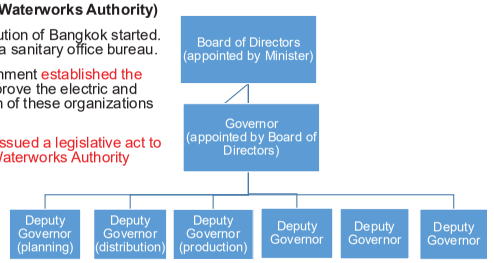
Sector governance in Thailand (MWA's case)

Bangkok's water supply is managed by Metropolitan Waterworks Authority (MWA) and independent and self-sufficient. The system is established by the MWA Act 1967 stipulated by Ministry of Interior.

- **The organization is lead by the Board of directors and the Governor of MWA is responsible for whole management of water supply.**

Organizational system and management principle is described in Special Law of MWA

- **History of MWA (Metropolitan Waterworks Authority)**
  - **14 Nov. 1914** The water distribution of Bangkok started. This business was managed by a sanitary office bureau.
  - **After World War II**, Thai government established the board of directors that would improve the electric and water supply. Not long after, both of these organizations became the state enterprises.
  - **16 Aug 1967** The government issued a legislative act to legally create the Metropolitan Waterworks Authority (MWA).



Sector governance in Cambodia (Phnom Penh's case)

Land:
181.035 km2
Population:
14.4 mil.

PHNOM PENH
375 km2
1.7 million inhabitants

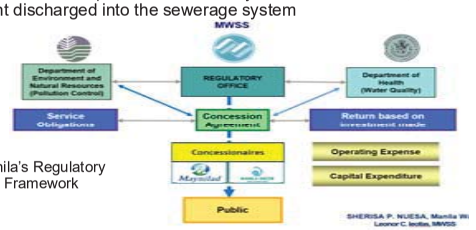
In 1895, Compagnie des Eaux et Electricité de l'Indochine ("CEEI"), a French water and electricity supply authority was authorized to operate as its own financial autonomy.
24 March 1960 (Royal Decree No. 164NS) PPWSA was officially established as a state and business unit under the direct supervision of the Phnom Penh Municipality, and was officially named "Phnom Penh Water Supply Authority". PPWSA ensuring the balance of income and expenses
In 1980-90's PPWSA returned to being an administrative unit relying on the national budget through the Phnom Penh Municipality for financing

19 Dec. 1996 PPWSA was a public enterprise with an economic and legal entity with administrative and financial autonomy. PPWSA was under the guardianship of the Phnom Penh Municipality whose representative was the Chairman of the BOD of PPWSA.
24 May, 2004 The guardianship of PPWSA was transferred to the MIME. The Representative of the MIME became the Chairman of the BOD.

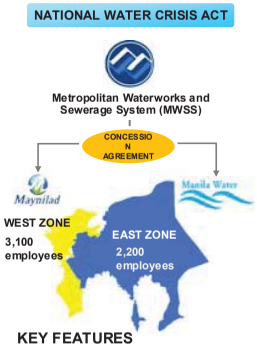
22 April 2011 PPWSA issue and offer its shares to the public provided that PPWSA is registered at the MOC and is recognized as a permitted entity by obtaining the necessary approvals from the SECC and the CSX.

Sector governance in Philippine (Manila's Case)

- Organization of water supply in Manila was established in 1878.
- It is re-organized as MWSS (Metropolitan Waterworks and Sewerage System) as state enterprise.
- Following the Water Crisis Act of 1995, the process **to allow for private sector participation** achieved on 1 August 1997.
  - The operational and investment functions of MWSS were transferred to Manila Water Company and Maynilad Water Services under two separate concession agreements.
  - The concession agreements transfer the followings to the concessionaires: the tenancy and operational fixed assets and exclusive rights to produce and treat raw water; transport, distribute, and market potable water; and collect, transport, treat, dispose, and eventually reutilize wastewater, including industrial effluent discharged into the sewerage system



Manila's Regulatory Framework



- **KEY FEATURES**
  - Two 25-year concessions (1977-2022)
  - Concessionaire is agent and operator of MWSS
  - Operators responsible for O&M, new investments and service of MWSS debt
  - Service coverage targets, performance-based
  - Regulation by contract; clear tariff setting mechanism
  - Absorb MWSS Employees
  - MWSS retains ownership of assets

IWA's "Lisbon Charter"

Guiding the public policy and regulation of drinking water supply, sanitation and wastewater management services.

Source: IWA (International Water Association), 2015

Responsibilities of governments and public administrations

1. Adopt strategic plans for the sector
2. Establish legal framework
3. Define governance models
4. Create institutional framework
5. Design regulatory frameworks
6. Define objectives of various bodies
7. Oversee and evaluate legal and regulatory frameworks
8. Define targets and standards
9. Ensure to access information
10. Ensure equality and non-discrimination in access to the service
11. Establish a fiscal framework
12. Promote tariff policies
13. Provide financial resources
14. Improve efficiency
15. Develop economy in the water sector
16. Promote awareness and participation
17. Support development of human resource
18. Provide the means the resolution of conflicts
19. Promote research

Responsibilities of regulatory authorities

1. Ensure to carry out in compliance with legislation or contract
2. Supervise tariff schemes
3. Oversee and promote quality of services
4. Ensure the protection of consumers
5. Help to clarify the operating rules
6. Facilitate innovative solution and technical progress
7. Disseminate information and enable a culture of transparency
8. Promote innovative research and development of human resources
9. Provide incentives and impose sanction

Responsibilities of service providers (water utilities)

1. Operate in accordance with policies and act in compliance with legal, contractual and regulatory frameworks
2. Improve operational efficiency (adopting optimal organization, staff management, administrative routine, planning, accounting…)
3. Contribute to improve efficiency using economic of scale, scope and process
4. Implement pricing policies
5. Contribute to human resources development and innovation in service delivery
6. Verify integrity by monitoring, reporting and auditing with reliable information
7. Aspire to operate "beyond compliance" to contribute conservation of resources

69

5.Financial management

Check water tariff, subsidy and loan to be sustainable finance

70

Financial management

5-1. Full cost recovery and Sustainable cost recovery

71

Full cost recovery and Sustainable cost recovery

Full Cost Recovery

All Costs = Tariff

All Costs include:
- O&M Costs (Recurrent Costs)
- Capital Investment Costs (Finance Costs)
  - Costs for expansion
  - Costs for improvement (modernization)
  - Costs for Renewing

Full Cost Recovery
- All costs covered solely by tariff
- Ideal long-term aim, but not feasible in reality

Sustainable Cost Recovery

All Costs = Tariff + Tax + Transfer (3T's)

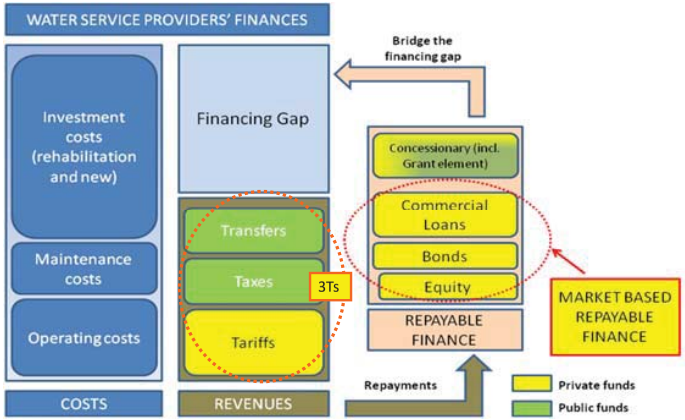
- Tariff: Consumer
- Tax: Subsidies from local or central government
- Transfer: Bilateral /Multilateral Assistance

Sustainable Cost Recovery
(Three Principles; OECD/ Camdessus Report)
- An appropriate mix of the 3Ts to finance recurrent and capital costs, and to leverage other forms of financing;
- Predictability of public subsidies to facilitate investment (planning),
-Tariff policies: affordable to all, including the poorest, while ensuring the financial sustainability of service providers

Camdessus Report: "Report of the world panel on financing water infrastructure", March 2003, Michel Camdessus, James Winpenny

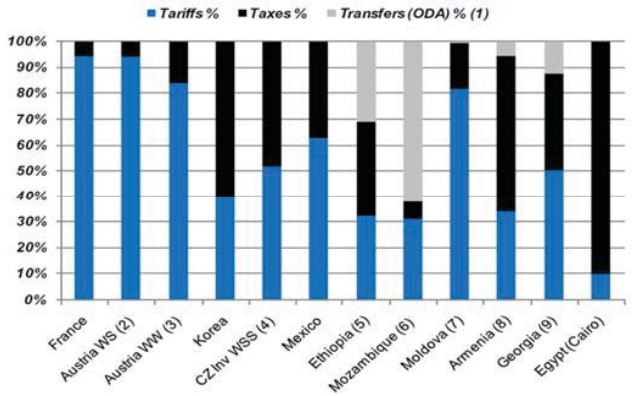
72

3Ts and Financing



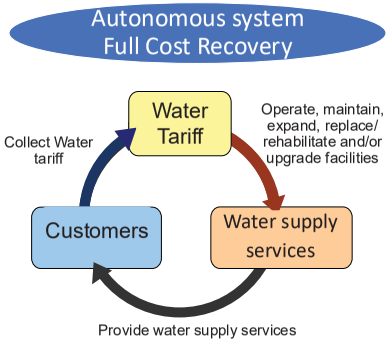
Source: OECD (2009b), "Strategic Financial Planning for Water Supply and Sanitation", OECD internal document, *www.oecd.org/water*

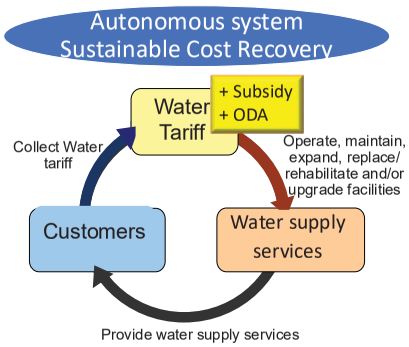
3Ts in Financing Water Supply and Sanitation



(1) Includes ODA grants as well as private grants, such as through non-governmental organisations. (2) WS = water supply. (3) WW = wastewater. (4) CZ Inv WSS = Czech Republic, composition of capital investment for water supply and sanitation. (5) 2005/06. (6) Rural WS, 2006. (7) 2006. (8) 2005. (9) 2007. ***Source*: OECD (2009b), "Strategic Financial Planning for Water Supply and Sanitation"**, OECD internal document, *www.oecd.org/water*.

How to ensure autonomous management Under Sustainable cost recovery

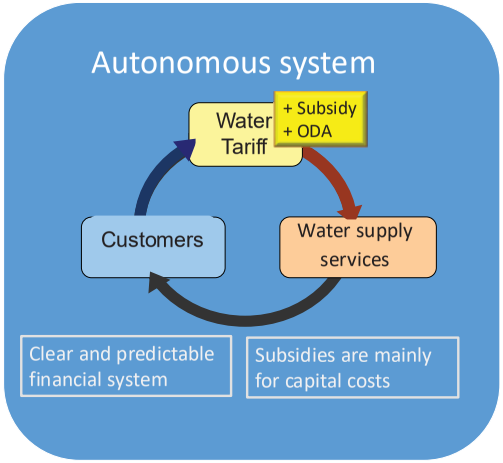




Subsidiary & ODA system described clearly on regulation which is predictable for operator of water supply

Subsidies are mainly for capital costs, not for operation & maintenance costs

Maintain autonomous management even under subsidized
-- Why autonomous is so important --



- **Efficient management**
  - ✓ Cost-consciousness, work as cost-center
  - ✓ Make efforts to obtain enough tariff revenues and to save costs in order to make ends meet
- **Transparency for customers (Compliance)**
  - ✓ Clear responsibility in supplying water services
  - ✓ Clear responsibility in financial management
- **Motivation for staff**
  - ✓ Performance shall be clearer for the staff of water utility
- **Customer-oriented service, closer to customer**
  - ✓ Establish fair price
  - ✓ Quick and fast correspondence and precise services

Financial management

5-2. Water tariff rate setting

77

5-2-1 Comparison of water tariff table

How to get sustainable tariff system?

78

Water Tariff Rate Table in Yangon and Mandalay

<Yangon>

	Category	1 Unit
1	Domestic (Meter)	88
2	Commercial (Meter)	110
3	FE (House) (Meter)	440
4	FE (Commercial) (Meter)	880
5	YCDC Staff (Meter)	88
6	Department (Domestic)(Meter)	88
7	Department (Commercial) (Meter)	110
8	Domestic (Flat)	1,800
9	Department (Flat)	3,000
10	FE (Flat)	270,000

<Mandalay>

Category	4/2015 - 3/2017	4/2017 -	Raise ratio
Domestic	85	200	135% up
Commercial (Medium)	110	260	136% up
Commercial (Industry/Factory)	440	660	50% up
FE (Commercial)	880	1,100	25% up

79

Electricity tariff in Myanmar

Residential settlements, temples and churches including the surrounding areas to such settlement pay electricity tariff. New tariff rates have been applied since July 2019.

< Before July 2019 > Electricity Consumption	Price per unit (Kyat/kWh)
1st 100 kWh (1-100 kWh)	35
2nd 100kWh (101-200 kWh)	40
3rd above 200 kWh	50
Meter service fee	500 kyat per month

Commercial sector and foreigners have the different tariff rates.

Commercial sector	Minimum	75 kyat/kWh
	Maximum	150 kyat/kWh.
Foreigners	12 cent/kWh (abut 140 kyat)	

Type of Consumers	New Rates (July 2019)		Former Rates		raise ratio
	Unit	Rate	Unit	Rate	
Domestic	1-30	35	1-100	35	----
	31-50	50			43%
	51-75	70			100%
	76-100	90			157%
	101-150	110	101-200	40	175%
	151-200	120			200%
	Over 201	125	Over 201	50	150%
Non-Domestic	1-500	125	1-5,000	75	67%
	501-5,000	135			80%
	5,001-10,000	145	5,001-10,000	100	45%
	10,001-20,000	155	10,001-50,000	125	24%
	20,001-50,000	165			32%
	50,001-100,000	175	50,001-200,000	150	17%
	Over 100,001	180	200,001-300,000	125	44%
			Over 300,001	100	80%

Water rate structure in Tokyo

Two part tariff system Fixed charges and Volume charges	• Fixed cost and customer cost shall be covered • Consideration to customer's usage
Diameter system (Meter size)	• Ensuring fair cost to each customer
Progress block rates system	• Demand control • Ensuring affordable price for domestic use

Class of charges		Fixed charges	Volume charges								
			1 ㎥～5 ㎥	6 ㎥～10㎥	11㎥～20㎥	21㎥～30㎥	31㎥～50㎥	51㎥～100㎥	101㎥～200㎥	201㎥～1000㎥	1001㎥～
General use	13㎜	860 yen	0 yen	22 yen per 1m³	128 yen per 1m³	163 yen per 1m³	202 yen per 1m³	213 yen per 1m³	298 yen per 1m³	372 yen per 1m³	404 yen per 1m³
	20㎜	1,170 yen									
	25㎜	1,460 yen									
	30㎜	3,435 yen	213 yen per 1m³						298 yen per 1m³	372 yen per 1m³	404 yen per 1m³
	40㎜	6,865 yen									
	50㎜	20,720 yen	372 yen per 1m³								404 yen per 1m³
	75㎜	45,623 yen									
	100㎜	94,568 yen	404 yen per 1m³								
	150㎜	159,094 yen									
	200㎜	349,434 yen									
	250㎜	480,135 yen									
	300㎜ or more	816,145 yen									
Public bath use		Same as the general use up to 30㎜, 6,865 yen for 40㎜ or more	0 yen	22 yen per 1m³	109 yen per 1m³						

Source: Tokyo Waterworks Bureau

Present Water Tariff Table in Yokohama
(to be abolished in July 2021)

- Usage categories is adopted such as for households and for business use.
- In unit price, progressive block system is adopted.
- One of meter size system is adopted, minimum charges are different based on the meter size and minimum consumption.

Category	Fixed charges	Volume charges							
	0～8㎥	9～10㎥	11～20㎥	21～30㎥	31～50㎥	51～100㎥	101～300㎥	301～1000㎥	1001㎥～
Household	790円	43円	158円	226円	269円	293円	320円	320円	320円
Business								369円	409円
Public-Bath		42円							

Diameter	Minimum Volume	Fixed charges for minimum volume	
40㎜～100㎜	50㎥	50㎥	10,096円
150㎜ and over	100㎥	100㎥	24,746円

New Water Tariff Table in Yokohama
(to be enacted from July 2021)

- Fairness: To introduce cost of service principle for fixed charges
- Stable: To get more stable water tariff revenue by more fixed charges (27%→ 29.5%)
- Conservation: Abolish minimum charges system. Progress system is maintained.
- Consideration for household use: average hike ratio for
  - small diameter (household use): less than 12%,
  - large diameter (Business use): 13% ~ 13.9%

Category	(Diameter)	Fixed charges	Volume charges								
			1～8㎥	9～10㎥	11～20㎥	21～30㎥	31～50㎥	51～100㎥	101～300㎥	301～1000㎥	1001㎥～
GENERAL USE	13㎜	840円	4円	48円	177円	253円	301円	327円	358円	413円	
	20㎜	845円									
	25㎜	850円									
	40㎜	10,150円	25円					329円	364円	419円	463円
	50㎜	10,500円	20円								
	75㎜	10,900円	15円								
	100㎜	12,000円	10円								
	150㎜	30,000円	30円								
	200㎜	42,000円	20円								
	250㎜	52,000円	10円								
Public-Bath		850円	4円	42円							

Water Tariff Rate in Fukuoka City

Water tariff charges in Fukuoka City are determined by the combination of a flat basic charge and a metered charge that varies depending on the volume of water consumed.

The basic rate rises according to the size of the diameter of the supply pipe and the metered rate varies depending on the type of use category – the rate for domestic use is less than the rate for commercial use.

Since water is a limited natural resource, the rate system is designed to promote water conservation: as the water consumption increases, the unit price per cubic meter also increases.

Diameter	Basic rate 2 month (1 month)
13mm	1,700 (850)
20	2,660 (1,330)
25	6,220 (3,110)
40	21,840 (10,920)
50	42,200 (21,100)
75	119,400 (59,700)
100	258,400 (129,200)
150	638,000 (319,000)
200	1,022,000 (511,000)
250	1,892,000 (946,000)

Category	Block of volume consumed	Metered rate (yen/m3)
Domestic use	1-20 (- 25mm)	17
	1-20 (40mm -)	120
	21-40	155
	41-60	243
	61-100	284
	101-200	335
	201-	387
Other than Domestic use	1-20 (-25mm)	17
	1-20 (40mm-)	175
	21-60	243
	61-200	335
	201-600	416
	601-2000	497
	2001-	542

Water rate in MWA, Bangkok

WATER TARIFFS
Effective December 1999

Type 1 Residence		Type 2 Commerce, Government Agency, State Enterprise and Industry	
Volume (cu.m.)	Baht/cu.m.	Volume(cu.m.)	Baht/cu.m.
1-30	8.50 Not less than 45.00 Baht	0-10	9.50 Not less than 90.00 Baht
31-40	10.03	11-20	10.70
41-50	10.35	21-30	10.95
51-60	10.68	31-40	13.21
61-70	11.00	41-50	13.54
71-80	11.33	51-60	13.86
81-90	12.50	61-80	14.19
91-100	12.82	81-100	14.51
101-120	13.15	101-120	14.84
121-160	13.47	121-160	15.16
161-200	13.80	161-200	15.49
over 200	14.45	over 200	15.81

MWA has been charged the untreated water at the rate of 0.15 baht or15 satang/cubic meter to the Royal Irrigation Department.

Source: MWA (Metropolitan Waterworks Authority, Bangkok)

85

Water rate in PPWSA, Phnom Penh

1984 : 1st Tariff – 166 Riel/m3

1993 : 166 Riel/m3 for Domestic, 515 Riel/m3 for Commercial

1996 : 250 Riel/m3 for Domestic, 700 Riel/m3 for Commercial

1997 : 1st Block Tariff

Consumer Category	Block (m3/month)	Tariff (Riels/m3)
Domestic	0 - 15	300
	16 - 30	620
	31 - 100	940
	>100	1260
Administra	flat rate	940
Commercial & Industrial	<100	940
	101 - 200	1260
	201 - 500	1580
	>500	1900

2001 : 1st Adjustment

Consumer Category	Block (m3/month)	Tariff (Riels/m3)	Tariff (USD/m3)
Domestic	0 - 7	550	0.14
	8 - 15	770	0.19
	16 - 50	1010	0.25
	> 50	1270	0.31
Admin.	flat rate	1030	0.25
Commer. & Industrial	<100	950	0.23
	101 - 200	1150	0.28
	201 - 500	1350	0.33
	> 500	1450	0.36

Source: PPWSA (Phnom Penh Water Supply Authority, Cambodia)

86

22

5-2-2 Process of water tariff rate setting

How to get sustainable tariff system?

87

Two steps on water tariff setting

First step
calculate Revenue Requirements

Second step
examine Tariff structure and make Tariff Table

Preparing a Financial Plan	➢ To determine plan-period (Test-year) ➢ To collect customer data and estimate their future tariff revenues ➢ To make various plans and put them to financial plan ➢ To estimate revenues and expenditures considering inflation and other factors
↓	
Calculating the revenue requirements	➢ To calculate the revenue requirements ➢ To consider the full cost principle or sustainable cost recovery principle
↓	
Allocate and Distribute Costs to customer classes	➢ To allocate and distribute the cost ➢ To consider the cost of service principle
↓	
Consider Rate Design and setting Tariff Rate Table	➢ To consider tariff policy and make rate Design ➢ Set tariff rate table

88

Important issues in water tariff setting process

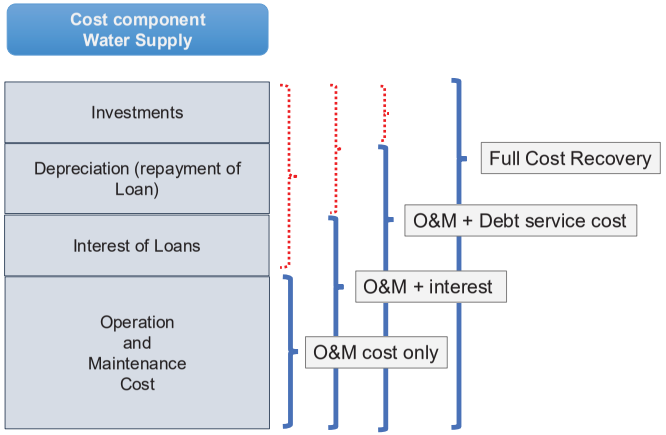
First step	Preparing a Financial Plan	Efficient management	➢ No redundant expenditure, no waste ➢ Under efficient management ➢ Include necessary investment & improvement
	Calculating the revenue requirements	How to set subsidy	➢ Cash need approach or Utility approach ➢ Full cost principle or Sustainable cost recovery principle (Subsidy from….)
Second step	Allocate and Distribute Costs to customer classes	Understand costs components	➢ To allocate and distribute the cost ➢ To consider the cost of service principle
	Consider Rate Design and setting Tariff Rate Table	Apply Policy	➢ To consider tariff policy and make rate Design ➢ Set tariff rate table

5-2-3 Calculating revenue requirements

Primary object of rate setting is to cover costs

90

To what extent costs are covered by water tariff?



91

Example: Cost Recovery Scenario in African case

	Scenario A	Scenario B	Scenario C
O&M cost	900.000	900,000	900,000
Depreciation	400,000	400,000	400,000
Capital cost	500,000	500,000	875,000
Total costs	1,800,000	1,800,000	2,175,000
Subsidy 1 (Capital cost)	500,000	125,000	0
Subsidy 2 (Capital maintenance cost)	400,000	0	0
Revenue requirement	900,000	1,675,000	2,175,000
Billed Water (m3)	3,120,000	3,600,000	4,080,000
Average Tariff	0.29	0.47	0.53
	Subsidy for Depreciation (capital maintenance cost) and capital cost	Subsidy only for capital cost	No subsidy

Source: "Guidelines for User Fees and Cost Recovery - for Urban Water and Sanitation- ", WPP, AfDB and International Cooperation Aid of Netherlands/Canada/Denmark

92

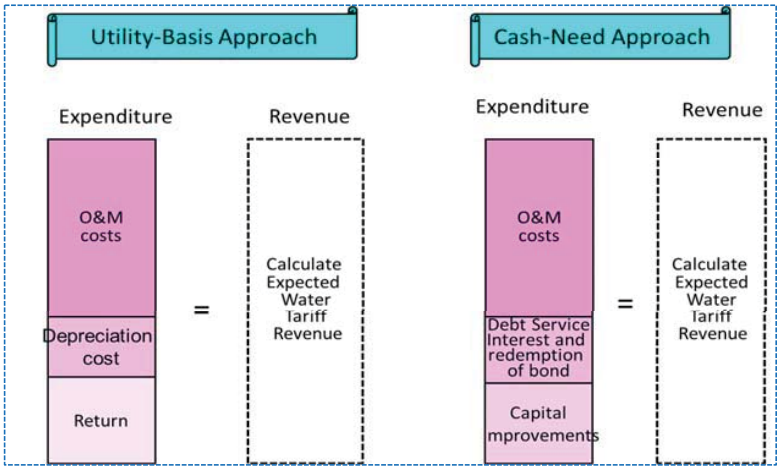
Cost recovery exercise based on YCDC mid-term plan

Items		Projection by fiscal year (mil. Kyat)			
		2018/19	2019/20	2020/21	3 year Total
Operating Income		12,000	19,598	26,375	57,973
	Water service charge	11,419	16,291	23,069	55,679
	Other income	581	857 (2,450)	856 (2,450)	7,194
Operation Expenditure		22,319	24,566	28,013	74,898
Operating Balance (A)		-10,319	-4,968	-1,638	-16,925

Items		Projection by fiscal year (mil. Kyat)			
		2018/19	2019/20	2020/21	3 year Total
ODA relating project		126,419	256,992	257,628	641,039
	Lagyunpyin WS Project	96,664	76,392	46,490	219,526
	Kokkowa River WSOther income	29,775	180,600	211,138	421,513
YCDC Activities		76,582	29,6858	33,543	89,783
Capital Expenditure		153,001	286,650	291,171	730,822
Capital Income (ODA Loan)		97,593	213,369	200,900	511,862
Capital Balance (B)		-55,408	-73,281	-90,271	-218,960

3 year Total Balance (Deficit)		Water Tariff Revenue	Need to tariff raise	Subsidy from YCDC or Region Government
Opex only	16,925	55,679	30% (88 →114)	All Capital expenditure
Opex + Capex / 2	16,925+(218,960/2) =126,405		127% (88 →200)	Half of capital expenditure
Opex + Capex	16,925+218,960=235,885		323% (88 →372)	No subsidy

Two approach to calculating total costs (revenue requirements)



Comparison of two approach

ADVANTAGES

Utility Approach	Cash-Needs Approach
• Is less subjective. • Better matches cost of service with beneficiary use (e.g., used and useful analysis). • Is more consistent with generally accepted accounting principles.	• Is consistent with governmental budget practices. • Can be easier to understand because it matches revenue with cash needs. • Is consistent with bond rating agencies' evaluation of revenue-producing capability. • Provides increased flexibility. • Bond covenants are predicated on cash needs. • Is generally accepted by governmental utility industry.

DISADVANTAGES

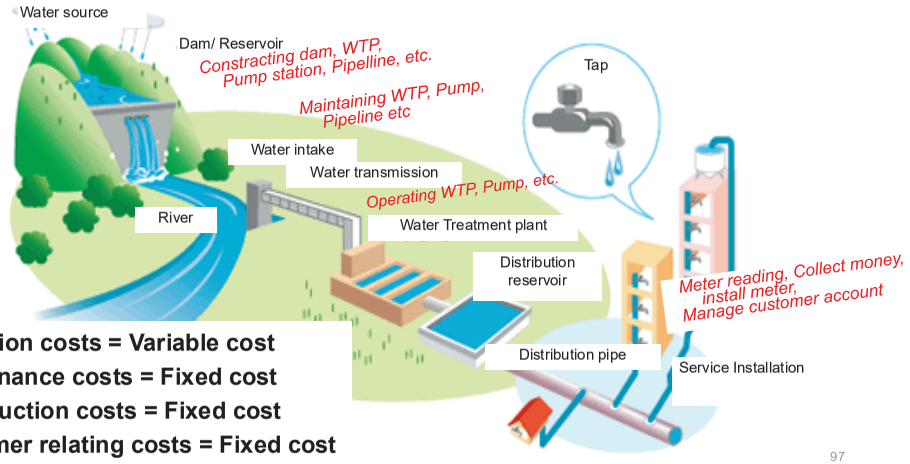
Utility Approach	Cash-Needs Approach
• May generate insufficient or excessive revenue for cash needs. • Is not generally accepted in governmental water and wastewater utility industry unless the utility is regulated. • Provides less flexibility. • Is more difficult to explain to customers/policy-makers.	• Could result in large net profits or *losses if financial statements are prepared* in accordance with generally-accepted accounting principles. • Can be more difficult to match the recovering capital costs in varying periods. • Is not usually accepted as a valid method by state public service commissions.

Source: The Arthur Young Guide to Water and Wastewater Finance and Pricing, George A. Raftelis, Lewis Publishers, 1989

5-2-4 Tariff structure

Revenue stability,
Consistency with cost-of-service principle,
Simplicity, Ease of administration,
Affordability, Resource efficiency, Legal, Fairness

Costs for water supply



Operation costs = Variable cost
Maintenance costs = Fixed cost
Construction costs = Fixed cost
Customer relating costs = Fixed cost

Categorize costs for water supply

Cost items	Capital or O&M	Fixed or Variable
Customer relating costs	Capital+ O&M	Fixed cost
Interest and Debt	Capital recovery	
Depreciation (construction and improvement)		
Maintenance cost (repair and periodical check)	Operation and Maintenance cost	
Labor cost (maintenance)		
Labor cost (operation)		Variable cost
Electricity & energy cost		
Chemical cost		
Other variable operating		

Tariff Structure

(Two Part Tariff)

Fixed charge
flat rate
for every month

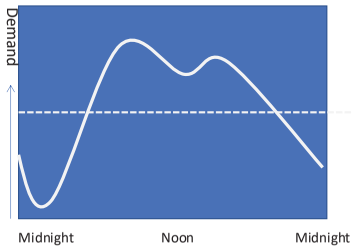
+

Volume charge
Metered charge
for every month

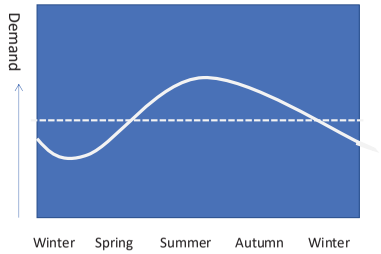
These costs are net costs which correspond with water tariff revenue and calculated as followings;
Net costs = Total expenditures – Total revenues except water tariff revenue

Fair allocation of fixed costs among customers

Considering "Water supply facilities shall be prepared (constructed) to cope with the maximum demand of customers."



Daily Maximum Demand

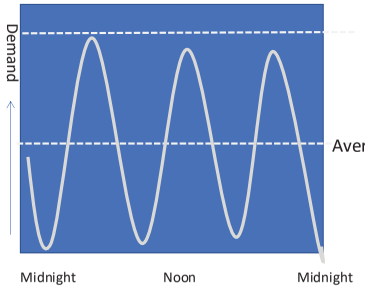


Yearly Maximum Demand

Fair allocation of fixed costs
among customers of different daily demand

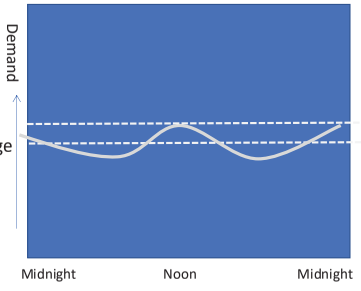
- Imagine such two customers as the average consumption in a day are the same, but maximum hourly demand are much different. (to compare customer A and B)
- They pay the same amount of water tariff according to "metered volumetric rate."
- But, water utility have to construct facilities such as larger water mains, big pump, big service reservoir in order to cope with high demand of customer A's .
- Do you think it is fare that A and B pay the same amount of water tariff.

Customer A's Daily Demand Curve



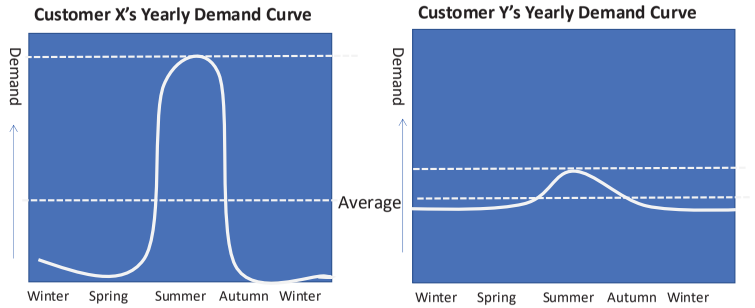
Average

Customer B's Daily Demand Curve



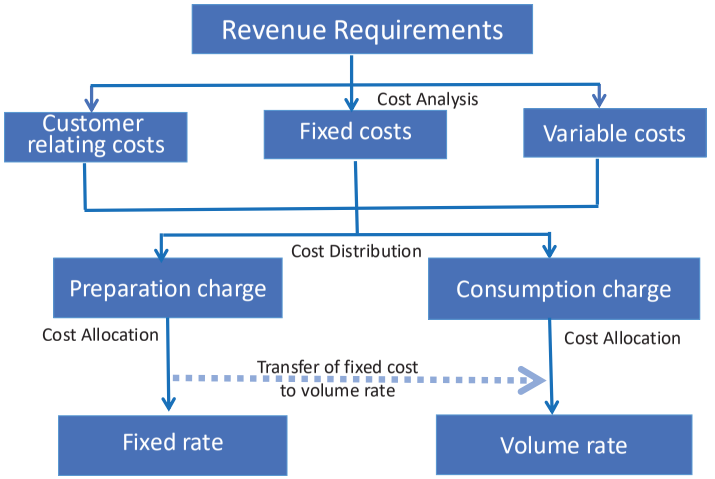
Fair allocation of fixed costs
among customers of different yearly demand

- Imagine such two customers as the average consumption in a year is the same, but maximum daily demand are much different. (to compare customer X and Y)
- They pay the same amount of water tariff according to “metered volumetric rate.”
- But, water utility have to construct facilities such as larger water resources, big water treatment plant in order to cope with high demand of customer X’s .
- Do you think it is fare that X and Y pay the same amount of water tariff.



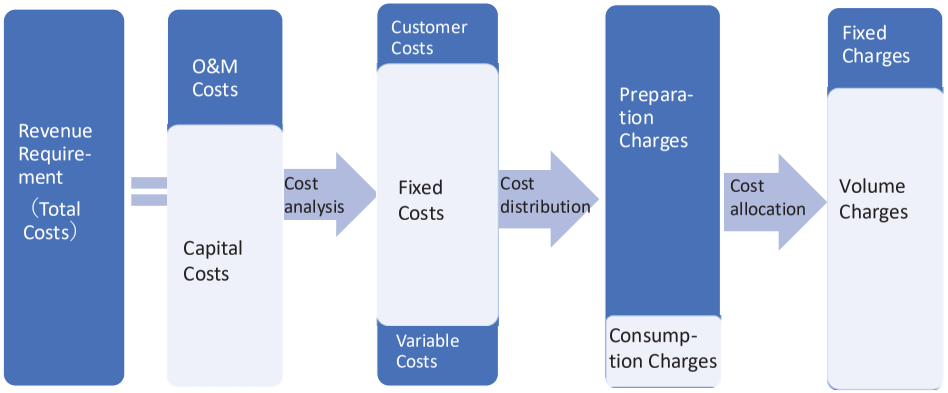
101

Costs analysis and costs distribution



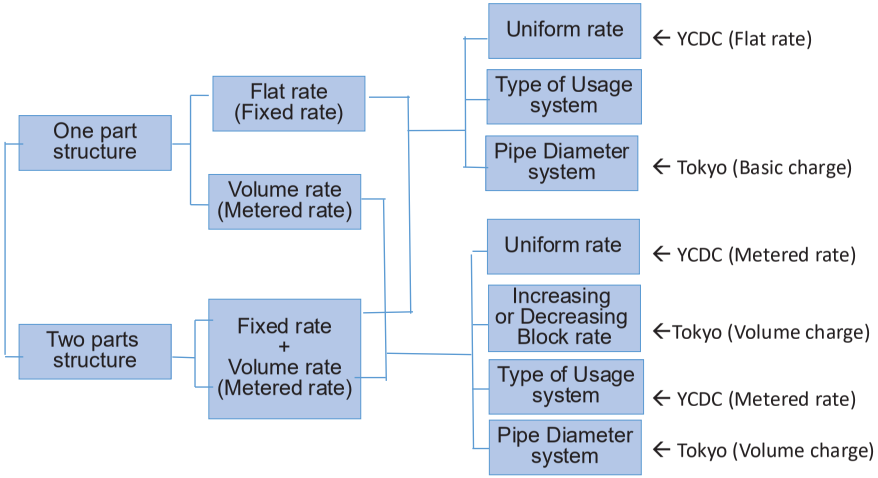
102

Cost structure and rate design



103

Tariff Rate Design



104

Water Tarif Setting Methods in Japan

(Source: Statistics of Water Tariff, JWWA)

Tariff Calculation Method (Full cost recovery with some subsidies)

- Utility-Basis Approach (86.2%)
- Cash-needs Approach (13.8%)

Two Part Tariff

- Fixed Charge + Variable Charge = 100%
  - 75% included Minimum Volume of Supply Water for Free.
    - From the Aspect of Public Health
  - Increasing Block: 67% ← Conserve the Demand
    Decreasing Block: 1%
    Uniform Rate and Others: 32%

Tariff Structure (Tariff Table)

- Classified by Meter Size 56.6%
  - Different charge rate are set depending on the diameter of the service pipe or meter size. Each customer's category is classified objectively, such as 13mm, 20mm, 100mm etc.
- Classified by Customer's Use (32.6%)
- Others 10.8%
  - Different charge rate are set depending on the type of water usage of the customer, such as household use or commercial use, industrial use, etc. In 1965 this system occupied 99.0%, however, it has decreased year by year, because in some cases classifying household and commercial use is not clear or indistinct.

105

- Step 1
  - Clear rule and predictable system of subsidy and water tariff setting to secure Autonomous management
  - Gradually to be "Full cost recovery"
- Step 2 (to change structure of tariff rate is rather challenging issues)
  - Analysis of cost, and fare cost to each customer
  - Policy : Affordable price for domestic and basic usage
  - Policy : Price system to enhance conservation and resource efficiency
  - Policy : Consider user category (Big user and domestic user)

106

5-2-5 Stakeholders' perspective on tariff

Utility, Customer, Society and Regulator

107

Water tariff and characteristics of water utility

Characteristics of water utility	Water tariff setting
Huge Investment	Water tariff shall ensure revenue of utility to recover huge investment
Monopoly	Water tariff shall not generate excessive profit for utility
Necessity for daily life	Water tariff shall be fare, reasonable and affordable for domestic use

108

27

Stakeholders' perspective on water rates

Utility's perspective
Higher rates looks happy, but at least …

- The rate shall meet revenue requirements
- The rate provide a fair rate of return
- The rate shall be enough to secure sustainable management

Customer's perspective
Lower rates looks happy, but at least …

- The process and the result shall be fair.
- The rate structure shall be understandable.
- The water bill shall be affordable.

Society's perspective

- The rate structure shall promote economic efficiency.
- Rates shall reflect proper valuation and priority uses.
- Rate shall encourage resource preservation.

Regulator's perspective

- Rates shall balance between utility and customer interests.
- The process shall be in accordance with accepted principles.
- The result shall be administratively feasible ?

Integrate all stakeholders' requests and make up principle

Principle in Japan

Water tariff shall be

- Appropriate and fair
- Based on the appropriate cost under the efficient management setup
- Able to ensure a sustainable management
- Clearly defined under a uniform rate and flat rate system
- No one incurs discriminatory treatment

(Waterworks Law, and Local Public Enterprise Law)

AWWA Principle

1. Every water utility should receive. sufficient revenues from water service and user charges to enable it to finance all operating and maintenance expenses and all capital costs
2. Water utilities should maintain their funds in separate accounts. Such funds should not be diverted to use unrelated to water utilities …
3. Every water utility should adopt a uniform system of accounts …
4. Water rate schedules should distribute the cost of water service equitably …

(American Water Works Association)

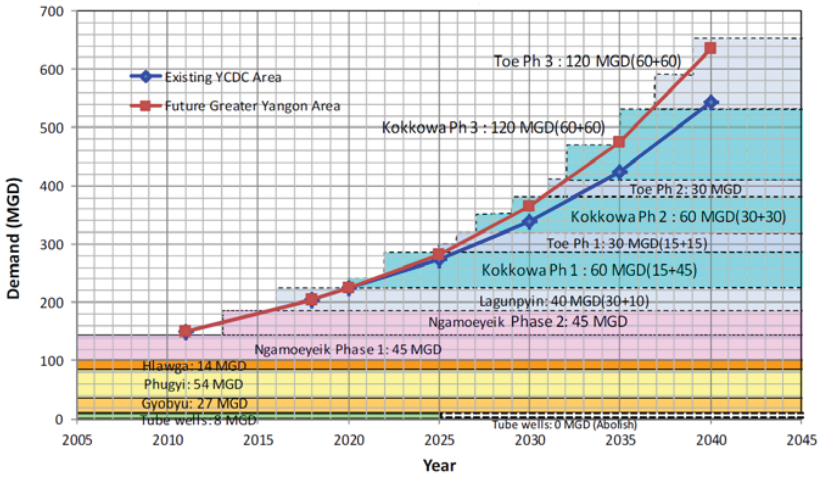
Key points for setting water tariff

- **Cost recovery**
  —the primary objective of any rate structure is to recover the revenue requirements or the costs of providing water service.
- **Revenue stability**
  —rate structures should provide revenue that matches changes in the costs of water service.
- **Consistency with cost-of-service principles**
  —rate structures consistent with cost- of- service principles are easier to defend and they make it easier to recognize that those who cause costs should pay for them.
- **Simplicity (understandable)**
  —simple rate structures are most generally preferred to complicated ones; customer understanding is important to achieving customer acceptance.
- **Ease of administration (implementation)**
  —feasibility and ease of administration are often important concerns. This objective might also include the capabilities of the billing system.
- **Affordability (consideration to domestic use)**
  —keeping water service affordable to customers enhances the collection of bills as well as revenue stability.
- **Resource efficiency (conservation)**
  —if customers face prices that reflect the costs of providing water service, they can make informed choices about efficient water use, and water waste is minimized.
- **Legal**
  —the rate structures should be consistent with applicable laws and regulations.
- **Fairness (defendable)**
  —rate structures viewed as fair are preferred from the standpoints of customer acceptance and legal defensibility.

Financial management

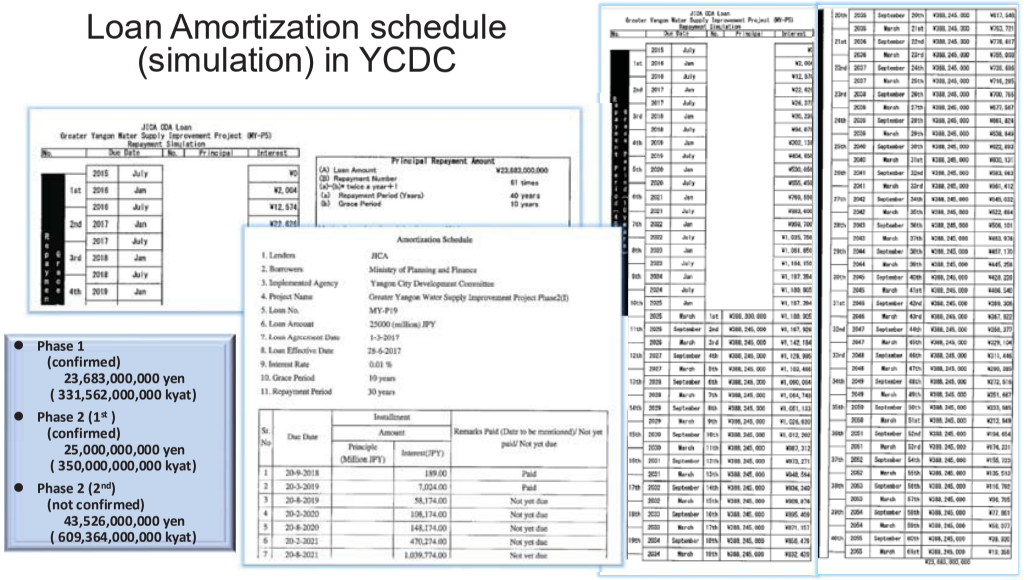
5-3. Loan and capital costs

Water Supply Development for Yangon City



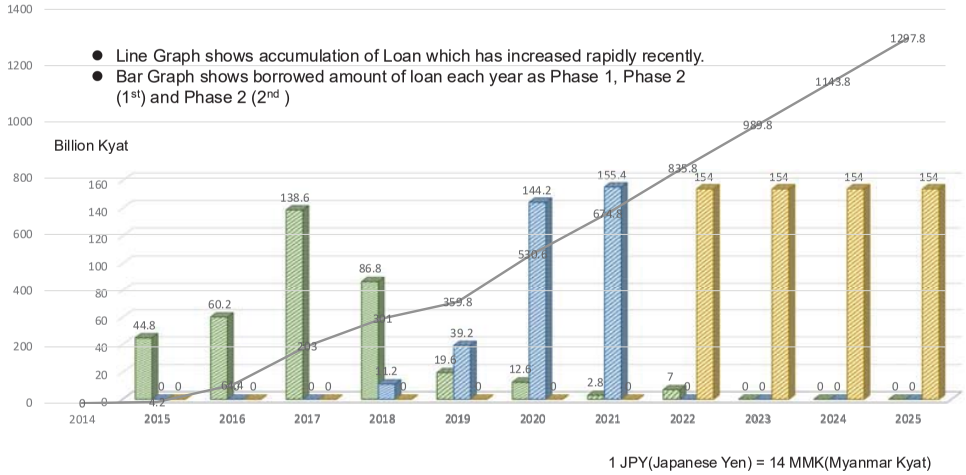
Source: JICA Study Team

Loan Amortization schedule (simulation) in YCDC



- Phase 1 (confirmed) 23,683,000,000 yen (331,562,000,000 kyat)
- Phase 2 (1st) (confirmed) 25,000,000,000 yen (350,000,000,000 kyat)
- Phase 2 (2nd) (not confirmed) 43,526,000,000 yen (609,364,000,000 kyat)

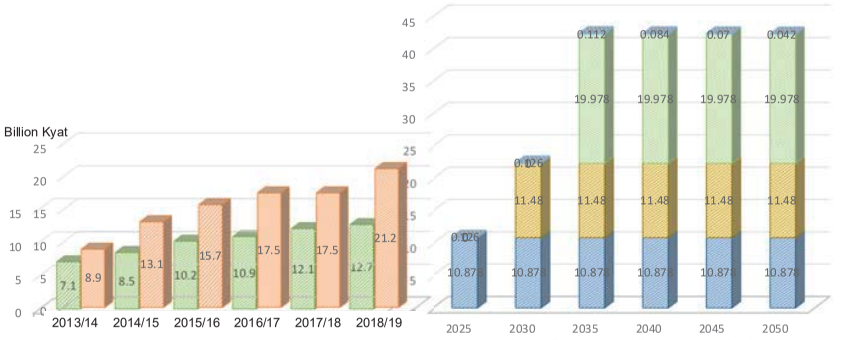
Accumulation of Loan (Phase 1 + Phase 2 (i) +(ii))



1 JPY(Japanese Yen) = 14 MMK(Myanmar Kyat)

Tariff revenue vs. O&M cost and Loan repayment

- At present, tariff revenue cannot cover O&M cost.
- In 2025 when repayment of principal (Phase 1) start, it will occupy 80% of the present tariff revenue. (not include currency exchange risk)
- In 2035, repayment of principal will accumulate as 4 times of the present tariff revenue. (not include currency exchange risk)

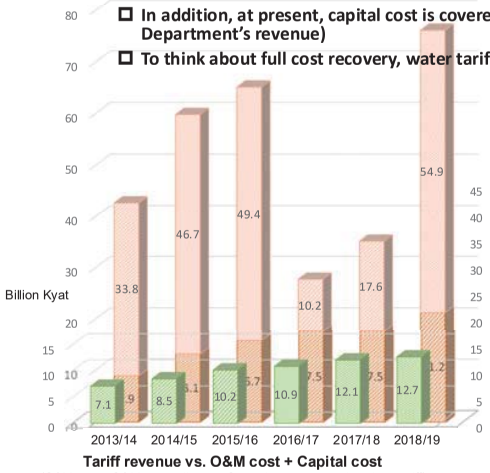


Tariff revenue vs. O&M cost
(O&M cost =O&M expenditure – Operating revenue other than tariff)

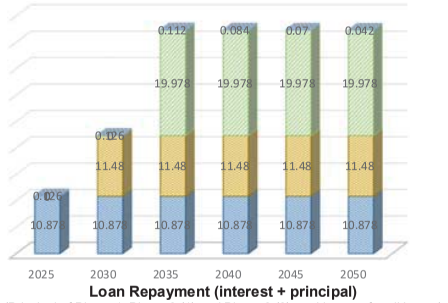
Loan Repayment (interest + principal)
(Principal of Phase 1, Phase 2 (1) and Phase 2 (2), and interest for all)

Tariff revenue vs. O&M cost, Capital cost and Loan repayment

- In addition, at present, capital cost is covered by YCDC general account. (other Department's revenue)
- To think about full cost recovery, water tariff shall be increased tremendously.



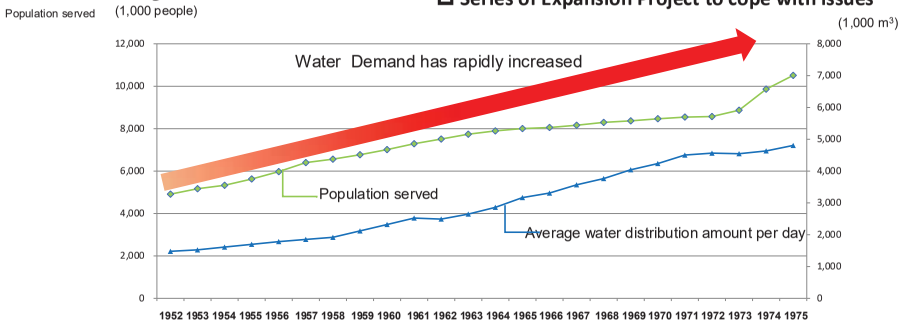
Tariff revenue vs. O&M cost + Capital cost
(O&M cost =O&M expenditure – Operating revenue other than tariff)
(Capital cost=Capital expenditure – ODA Grant & Loan)



Loan Repayment (interest + principal)
(Principal of Phase 1, Phase 2 (1) and Phase 2 (2), and interest for all Loans)

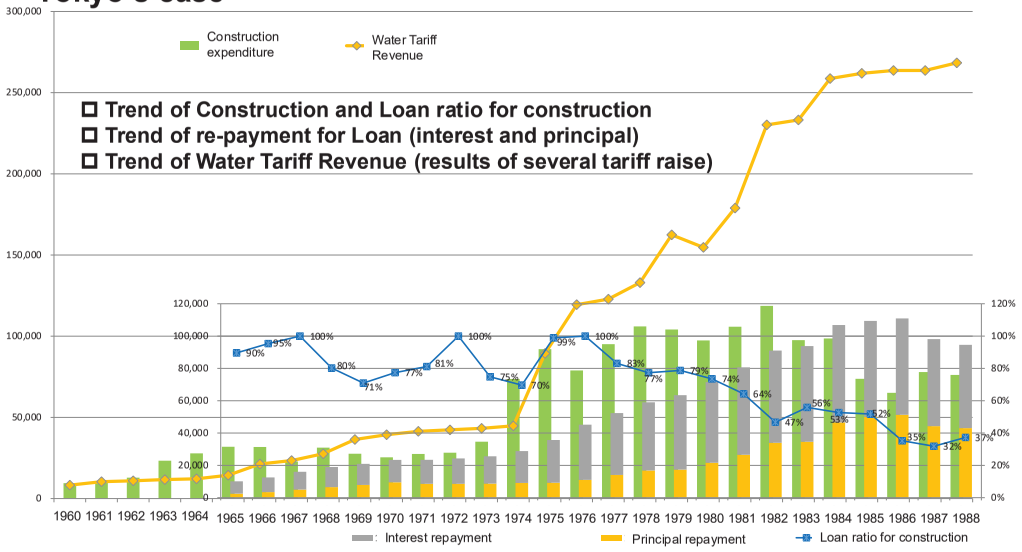
Tokyo's case

- High population growth and modernization of life-style
- Drastic increase in demand for water supply
- Series of Expansion Project to cope with issues



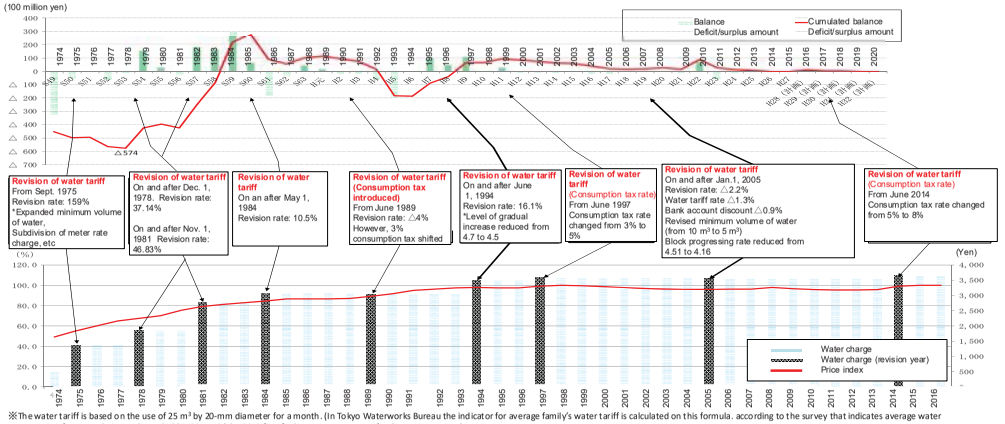
Expansion Project	Project year	Total project cost (million yen)
Edogawa River Water Supply Expansion Project	1960-1963	24,704
Nakagawa-Edogawa River Water Supply Expansion Project	1962-1965	75,179
The 1st Tone Ricer Water Supply Expansion Project	1959-1968	75,200
The 2nd Tone Ricer Water Supply Expansion Project	1965-1971	63,500
The 3rd Tone Ricer Water Supply Expansion Project	1969-1976	73,000
The 4th Tone Ricer Water Supply Expansion Project	1972-1985	527,500

Tokyo's case



Tokyo's case

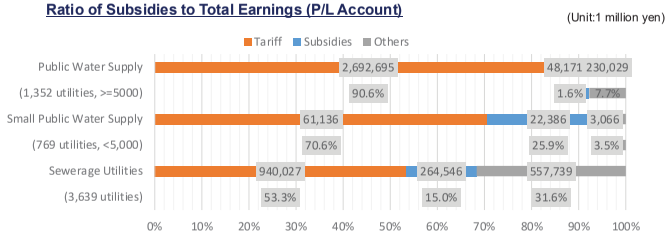
- History of Water Tariff Revision
- Trend of Water Tariff Level and Consumer Price Index
- Trend of Financial Balance of Cash Flow



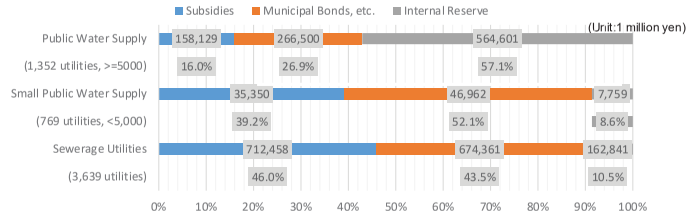
※The water tariff is based on the use of 25 m³ by 20-mm diameter for a month. (In Tokyo Waterworks Bureau the indicator for average family's water tariff is calculated on this formula. according to the survey that indicates average water consumption for 4 people in one household is 25.1 m3 (the 2012 fact-finding survey on water for domestic use, etc.)
※Revised charge recorded for the revision year
※The price index is expressed as relative values, with that of 2015 being 100% (general price index excluding imputed service of owner-occupied dwellings

Financial sources for capital costs in Japan

Ratio of Subsidies to Total Earnings (P/L Account)



Ratio of Subsidies to Investment in Construction (Capital Account)



Ministry of Internal Affairs and Communication FY2013

Central government's role for capital costs in Japan

Local Government Finance Program and Loan Program

- National government formulates the Local Government Financial Program (LGFP) each fiscal year based on forecasts of overall revenues and expenditures of all local governments.
- Under this Program, revenue sources for all local governments, such as bonds and loans, are secured.

		FY2017	FY2018	Share
1. Private Funds	Publicly Offered Bonds	USD 36 bn	USD 36 bn	33%
	Other Private Sectors	USD 30 bn	USD 31 bn	28%
2. Public Funds	JFM	USD 17 bn	USD 17 bn	15%
	National Government	USD 27 bn	USD 26 bn	24%
Total		USD 110 bn	USD 110 bn	100%

Source: Annual report 2018 JFM (Japan Finance Organization for Municipalities)

Subsidies for water supply in Japan

by Ministry of Health, Labour and Welfare

- **The Waterworks Law allows the national government to subsidize** Part of water utilities' facility construction costs are subsidized by Ministry of HLW
- **Subsidies are basically applied to investment for facility construction** Purpose of subsidies are to support utilities and promote national policy.
- **Category of Subsidies in Chronological order**
  - 1958: Subsidies for small public water supply (1/4)
  - 1967: Water resources development (1/3) (Construction of Dam, Water Channel, etc.)
  - 1967: Construction of facilities for regionalization (consolidation)of plural water utilities (1/4)
  - 1972: Sludge treatment facilities construction (1/4)
  - 1976: Regionalization (consolidation) construction under the approved plan (1/3)
  - 1988: Advanced water treatment facility construction (1/3)
  - 1991: Emergency water supply station construction (1/3)
  - 1995: Replacement of old pipelines (1/3, 1/4)
- **Subsidies at present (2020)**
  - Subsidies to make robust water system (include several items)
  - Subsidies for water resources development
  - Subsidies for advanced water treatment facility construction
  - Subsidies for small public water supply

Key points
Japan's Financial Management System

□To Secure Autonomous Management of Utilities by Clearly Prescribed Subsidies
The subsidy system shall be described clearly on regulations. That means the system shall be predictable and lasting for long-term, and transparent. Manager of utility counts on subsidies and make management plan independently. Although utility get subsidies, they can manage autonomously which enhances self-efforts. Managers do efforts to reduce costs, increase revenues, expand services, improve management and get good reputation of customers.

□To Consider Domestic Conditions for Subsidies
The situation of water utilities varies by its services. The government shall provide subsidies to fit their situation. Money from tax shall be put to specific purposes of government and get general public's supports. Generally, small water supply utility's management base is rather weak and require to support its financial conditions. Also, some incentives need to promote construction of waste water treatment plant.

□To Fill the Financing Gap by Government's Scheme
A special financing system for water utility is very effective to promote water services. To construct and maintain infrastructure system require big amount of money. The efficient and reliable system securing water utility to cover capital costs is essential.

Loan repayment a big financial burden

- In a growing mega city, loan repayment will be a big financial burden.
- Loan repayment is compulsory cost, not arbitrary cost.
- A long-term financial projection shall be prepared including loan repayment.
- To get sustainable management, appropriate and timely water tariff raise is necessary.

125

6. Planning in water supply

Check and develop plans to be desirable circle

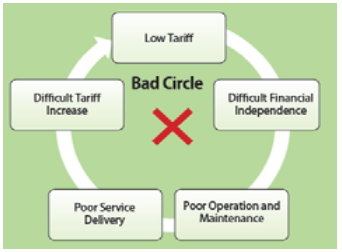
126

Planning in water supply

6-1. Plan to solve issues in water supply utility

127

Bad circle and its factors



- More than 60% of Yangon citizen cannot get piped water supply
- Even in the supply area, only 9 hours supply in a day (average)
- Even supplied water, quality is less than drinkable or WHO standards
- In addition, more than 60% of water is lost as non-revenue water (NRW)

- There is no National Water Supply Law or no National Ministry/Department responsible for water supply in Union level

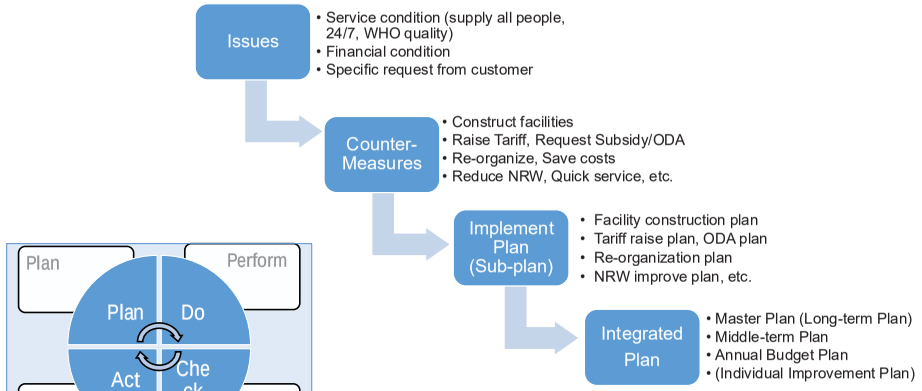
Source: "Characteristics of Well-performing Public Water Utilities", World Bank, May 2006

- ✓ Low tariff, low collection
- ✓ Consumers use water inefficiently
- ✓ High usage and system losses drive up costs
- ✓ Investment and/or maintenance are postponed
- ✓ Services deteriorates
- ✓ Customers are ever less willing to pay
- ✓ Utility lives off state subsidies
- ✓ Managers lose autonomy and incentives
- ✓ Efficiency decrease and dropping
- ✓ Subsidies often fall to materialize
- ✓ Utility can't pay wages, recurrent costs or extend system
- ✓ Motivation and service deteriorates further
- ✓ System assets go "down the drain"
- ✓ Crisis, huge rehabilitation costs

128

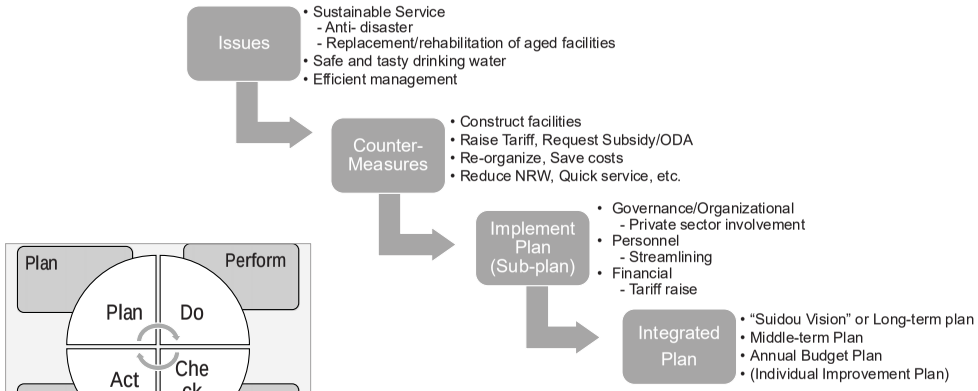
32

Plan shall include…



129

Plan shall include… (in Japan)



130

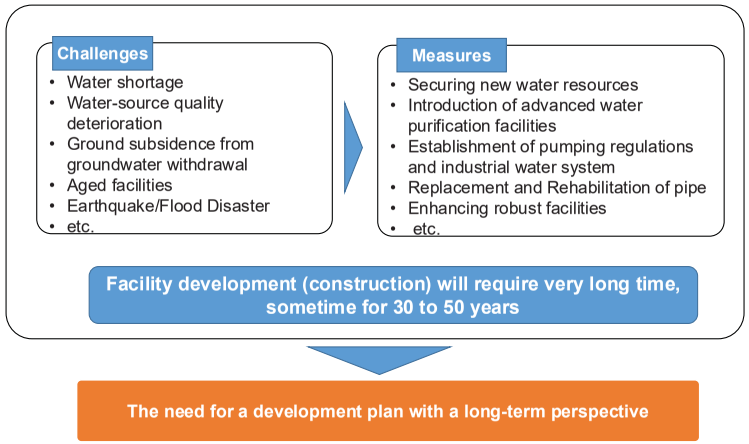
33

Planning in water supply

6-2. Long-term Plan, Mid-term Plan and annual Budget

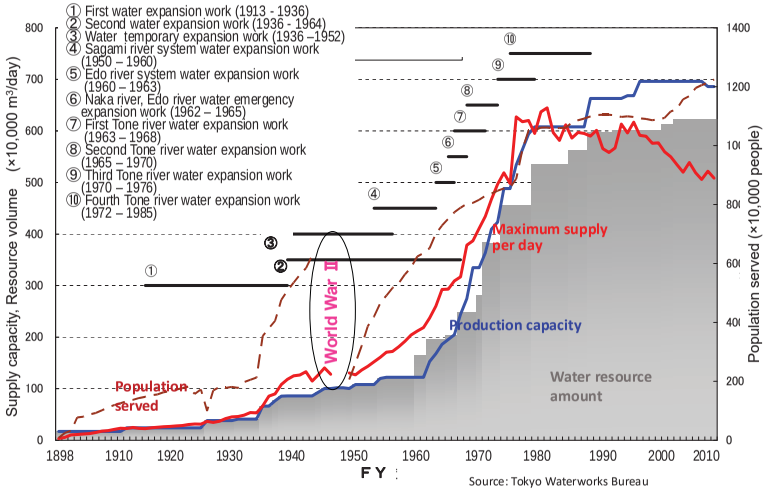
131

Needs of a Long-term Plan in water sector



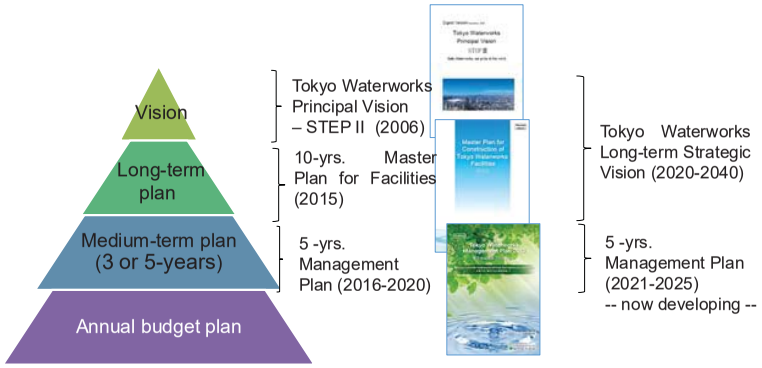
132

History of Tokyo Waterworks



Source: Tokyo Waterworks Bureau

Tokyo Waterworks' Vision & Plans

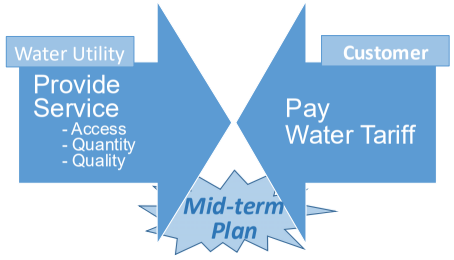


Source: Tokyo Waterworks Bureau

Mid-term Plan and Tariff revision

Mid-term Plan is like a contract or a promise between Utility and Customers.

- Usually, in Tokyo, a plan includes the decision of setting water tariff level for the planning period, even tariff is raised or reduced, or kept the same. This point attracts greater attention or interest of citizens when water tariff raise is announced at the same time the plan is published.
- There is a tension between the utility and customers regarding the plan. Customers think the utility should implement its management according to the plan and improve services because they pay water tariff which are enough o implement the plan.
- **Management cycle (PDCA)**
- **KPI**
- **Provide information (Transparency/Accountability)**



7. Conclusion

to be sustainable water utility

Find best practice, learn it, and implement it with PDCA cycle

PLANNING

Service Improvement
- Expand service ratio
- Supply 24/7, enough pressure
- Drinkable water quality

Tariff raise and cost reduction
- Enough tariff to cover cost
- Affordable price for household
- Remove waste of costs/ Innovative work

Regulation / Governance System
National Government

Appropriate Tariff (Cost Recovery)
Financial Independence
Improvement of O&M (Lower NRW etc.)
Improvement of Service Delivery (Safe Drinking Water)
Possible Increase of Water Tariff
Water Utility Management

REGULATION

Regulation System
- Social Regulation (Public Health)
- Economic Regulation
- Guideline / Incentives by Gov

GOVERNANCE

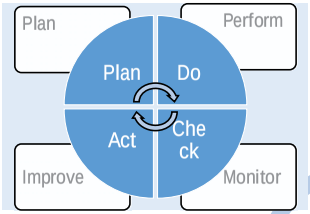
Governance System
- Public and/or PPP
- Regulatory Body for water tariffs
- Centralized / Decentralized
- Responsibility of water resources development
- Role of Water Association

Financial System
- Self Sufficient Accounting System
- Finance for investment
  - Loan / Issuing Bonds
- Water Tariff
- Subsidies from Governments
- KPI / Benchmarking system
- Transparency / Accountability

Finance

137

Implement each item systematically



138

How to make a turn-around by staff of WRAWSA

- Staff of WRAWSA shall understand the characteristics of water supply utility and the importance of regulation and governance of water utility management to get desirable circle.
- Need understanding and support of citizens and political persons regarding tariff raise and institutional reform such as establishing independent accounting system for water supply entity.
- Send message from staff of WRAWSA to citizens and political persons to get support towards the desirable circle.

139

Thank you for your attention

Inquiry (JICA Expert in Technical Cooperation Project)

The Project for Improvement of Water Supply Management of YCDC

Yoji Matsui (Mr.), Finance and Water Utility Management Expert

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gp7y-mti@asahi-net.or.jp

140

35

PPP and Organization Structure of Water Utility in YCDC

Toward sustainable management

March 2021

Yoji Matsui

JICA Technical Assistant Expert

The Project for Improvement of Water Supply Management of YCDC

Contents

1. Sustainable utility and private sector participation

How to enhance improvement of water supply utility by private sector participation

Re-organization in YCDC

1-1 Towards Sustainable Water Supply

Still, water supply in Yangon city ……

- More than 60% of Yangon citizen cannot get piped water supply
- Even in the supply area, only 9 hours supply in a day (average)
- Even supplied water, quality is less than drinkable or WHO standards
- In addition, more than 60% of water is lost as non-revenue water (NRW)

- There is no National Water Supply Law or no National Ministry/Department responsible for water supply in Union level

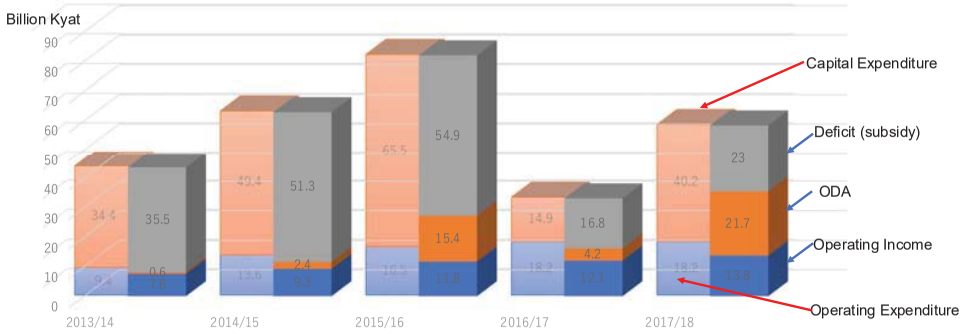
Financing Water Supply in Yangon

- Water tariff is not suffice to cover the cost of water supply
- No independent account for water supply exists, which makes YCDC difficult to understand the current status of their water supply and hinders efficient water supply operations

These prevent YCDC from considering/ implementing the appropriate PPP scheme

* See next pages of bar graph which illustrates financial balance of water supply in YCDC

Financial Balance of Water Supply in YCDC



Observations from the Financial Balance

-YCDC water supply faces significant loss and needs subsidy from the general account every year

-The level of water tariff revenue is not the cost-recovery level

-These financial balance is based on government accounting system which does not include costs of fixed assets (depreciation costs). In order to show accurate financial condition, corporate accounting system (Profit and Loss account (P/L) and Balance Sheet (B/S)) is essential in water supply management because it has enormous fixed assets.

Before implementing PPP, the more detailed financial analysis and future finance plan for YCDC water supply should be made

= Independent corporate accounting system for YCDC water supply entity needed

Implications from Technical Cooperation to PPP

Issues such as followings need to be tackled continuously, in order to establish the sustainable and autonomous water supply entity.

- Grasping the current asset of YCDC (ex: pipeline)
- Collecting necessary data for setting up Key Performance Indicators (ex: non-revenue water percentage, customer data, etc.)
- Ensuring sustainable financial position of water supply entity (ex: appropriate water tariff setting)
- Establishing independent financial management for water supply entity

JICA's Technical Cooperation continues assisting YCDC for these issues

Re-organization in other countries

1-2 Other countries' experiences

Other countries' experiences show the necessity of gradual approach to introduce the private sector in water supply

Water directly connects to People's Life

Overseas cases: Autonomous and private involvement (1)

Cases	Outline of case	Private involvement	What are requested when apply to YCDC
Japan's local public enterprise such as Fukuoka city	water utility manage under autonomous power on accounting, contract, personnel etc. following national Laws.	Most water utilities in Japan, like Fukuoka Waterworks Bureau, contract out some operating works to private companies	Authorities shall be more autonomous such as independent accounting, contract, personnel management. Even budget and tariff rate setting shall be drafted by authority.
Tokyo	Tokyo's water utility manage under the same system of Fukuoka, however it contract out most of operating work to its subsidiary corporations	Tokyo Waterworks Bureau keep core work and most works are contracted out to subsidiary companies whose most shares held by Tokyo Metropolitan Government.	Detail documents are necessary in contracting out to corporations. Subsidiary companies may be controlled not only by contract but also by share holder.

Overseas cases: Autonomous and private involvement (2)

Cases	Outline of case	Private involvement	What are requested when apply to YCDC
MWSS of Manila, Philippines	MWSS was formerly autonomous water supply entity and in 1997 it made concession contract with two private companies. Same scheme was applied to Pam-Jaya of Jakarta in 1997.	Most members of MWSS move to concessionaire and some member remain as regulator. Assets held by Authority, and O&M and some construction move to private concessionaires (corporations).	Standard/rule shall be strictly defined in contracting out to concessionaires. Financial rule shall be more strictly defined by contract. In Jakarta's case, financial rule invited failure.
MWA of Bangkok, Thailand and PPWSA of Phnom Penh, Cambodia	MWA and PPWSA are autonomous water supply utility. MWA is public corporation and PPWSA is corporatized whose most share is held by government.	Water supply Authority is corporatized or not, they are managed like private enterprise style under control of government. Assets are held by Authority.	They are Independent and autonomous, and are categorized as state enterprise. Need to establish financial rule and law/regulation for the authority
England & Wales of the United Kingdom	After 1989, public water authorities are wholly privatized and regulate by OFWAT and DWI.	Authorities are privatized and its share is open to public. Assets transfer to the companies and all responsibilities move to the private companies.	Need strong and powerful regulator which is supported by elaborated regulations and data/information.

MWSS: Metropolitan Waterworks and Sewerage System
MWA: Metropolitan Waterworks Authority
PPWSA: Phnom Penh Water Supply Authority
OFWAT: Water Services Regulation Authority
DWI: Drinking Water Inspectorate

Overseas cases: Re-municipalization and reasons

Cases	Outline of Cases	Reasons
Grenoble, France	In 2001 termination of private contract (lease contract and later joint venture contract), the municipal operator "Regie des Eaux de Grenoble" has re-municipalise water supply.	Corruption, lack of transparency, excessive pricing
Paris, France	In 2010 city of Paris re-municipalise after expiry of the two private contracts.	Lack of financial transparency (higher price, additional profit), accountability
Berlin, Germany	In2012/2013 shares owned by private companies (44%) are bought back by state of Berlin.	High return of 8% led to under-investment and soaring prices
Atlanta, USA	In 2003 the city terminated 20-year concession contract 16 years early by mismanagement.	Tariff continued to raise, water quality declined
Buenos Aires, Argentina	In 2006 the government cancelled the concession contract and create the public company to take responsibility of water services.	Fail to realize agreed investments, unexpected operational losses, long-lasting confrontation
Dar es Salam, Tanzania	In 2005, the contract was terminated by the government	Poor performance
Kuala Lumpur, Malaysia	In 2014 federal government and state government signed an agreement that three concessionaires will be taken over by new state owned company.	Lack of financial transparency
Jakarta, Indonesia	In 1997 concession contracts started, however, because of accumulated debt in the city, these contract seems to be unsustainable.	Concessionaire receive increased charge every 6 month, however, the city cannot increase water tariff

Findings from Other Countries' Experiences

Issues such as followings are necessary to establish the sustainable water supply through PPP

- Regulator's responsibility for selection negotiation, monitoring, and request to private water supply entity. Providing necessary information is also important
- Appropriate water tariff setting mechanism and concession fee
- Detailed decision making procedure for selecting the private water supply entity
- Estimate the impact of PPP to citizens' lives

Yangon needs to take PPP approach with well-planned, long-term vision

Which way should we move to ?

1-3 Considering Sustainable Scheme for Water Supply

Summary from Previous Sessions

Before contracting out to the private sector, YCDC needs to understand its water supply operations. More specifically, YCDC needs to

- Strengthen themselves to be the effective regulator for PPP
- Establish good asset and KPIs (Key Performance Indicators) management
- Capacity of regulator to set up and implement appropriate PPP mechanism

*Also, increase of water tariff is likely to be necessary when PPP will be introduced, which should requires wide understanding from citizen

- Thus, establishing the autonomous water supply management by public sector needs to be the first step.
- Private sector involvement needs gradual approach with well-planned long-term vision

Establishing autonomous management first is accepted globally in water supply sector.

Vision for Yangon Sustainable Water PPP

[Short-term]

Establish autonomous water supply in YCDC

[Mid-term]

Strengthen YCDC to be a good regulator

(Limited private sector out source to be considered)

[Long-term]

Larger private sector involvement in water supply

Requirements and Next step

Three Stages	How to proceed in YCDC	Requirements for next stage
[Shor-term] YCDC to be autonomous	- Necessary for effective and efficient water utility - Good opportunity in moving to the autonomous Authority - To be autonomous is the first things to do	- Establish independent accounting system - Establish financial rule between general account and the Authority's account - Design the subsidy system - More decision authority to the executives of the Authority to manage autonomously - Be accustomed to autonomous management

Requirements and Next step

Three Stages	How to proceed in YCDC	Requirements for next stage
[Mid-term] YCDC to be good regulator	- Keep strengthen the institutional arrangement as autonomous water supply entity - Start preparing for pilot-outsourcing	- Develop regulation/standards for water supply - Establish tariff setting principle based on clear cost recovery system - Start drafting a contract document for partial out-source
[Long-term] To involve private sector	- Including complicated things - Find appropriate style suitable for YCDC - Step by step	- Establish financial transparency - Establish financial self-sufficiency - Improve operational rule/regulation (detail contract documents) - Develop capacity more to manage and operate autonomously - Consider larger out-source to private

21

"Good governance" of Water supply
Not only for Yangon but also whole Myanmar,,,

■National level governance and institutional system in Myanmar shall be developed, such as:
- National "Water Supply Law"
- National Ministry or Department responsible for water supply
- Regulation/standards for water supply

G to G relation

Ministry of Health, Labour and Welfare(**MHLW**/Japan) held a conference in cooperation with Myanmar **NWRC** (National Water Resource Committee) in March 2019.

22

2. PPP project in water utilities

How to manage and utilize PPP project

23

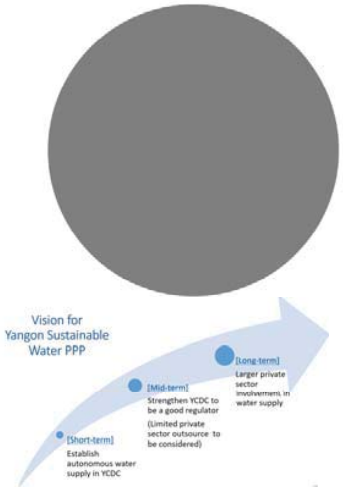
We are now at the start of PPP in YCDC

2-1 What the proposed PPP indicate?

24

We discussed with Mayor on 28th March 2019 and Chief Minister on 22nd May 2019 respectively about how to proceed to get sustainable water supply, especially how to proceed on PPP activities.

JICA TA team had recommended establishing the autonomous water supply management by public sector for the first step, and private sector involvement need a gradual approach with well-planned long-term vision



JICA TA team's concerns are;

Before contracting out to the private sector, YCDC needs to establish a firm water supply management system.

More specifically, YCDC needs to
- Strengthen themselves to be the effective regulator for PPP
- Establish good asset information (ex. pipeline)
- Collecting necessary data for setting up Key Performance Indicators (Ex: non-revenue water percentage, customer data, etc.)
- Ensuring sustainable financial position of water supply entity (ex: appropriate water tariff setting)
- Establishing firm financial management for water supply entity (independent account)

However,

TA team appreciate YCDC make a courageous step in August 2019 towards PPP.

The Government of the Republic of the Union of Myanmar
Yangon Region Government
Yangon City Development Committee (YCDC)

Request for Expression of Interest (EOI)

1. Applications/ Proposals for Expression of Interest (EOI) are invited from interested companies (local, international or joint venture) to carry out the works for the Project for the development of Zoning Water Distribution System (the Project) in Yangon City according to the master plan under Public-Private Partnership (PPP).
2. A complete set of the EOI documents may be purchased by the interested companies from the date of 28th August, 2019 at the address below during office hours:
   Water Resources and Water Supply Authority Office
   Yangon City Development Committee
   12-Storeyed New Office Building
   No. 390, Merchant Road, Botahtaung Township, Yangon, Myanmar.
3. Applications for EOI shall be delivered in sealed envelopes to the above address not later than 15:00 hours(local time) on 28th October, 2019 by hand. The EOI documents submitted later than the designated time and date will not be considered.
4. After the evaluation of EOIs, the Tender Committee will invite Proposal Bids from the Applicants that have been prequalified.
5. For further information, please contact Phone: +959-8627-992.

Tender Committee
Yangon City Development Committee

TA team hope to make the PPP project to be a big step towards sustainable water supply and would like to discuss the concerns/issues about it.

It is a good opportunity to discuss our concerns/issues for the next step.

The Project for the development of Zoning Water Distribution System under PPP basis

Concept Note will be submitted

စိတ်ပါဝင်စားမှုဖော်ပြခြင်း အဆိုပြုလွှာဖိတ်ခေါ်ခြင်း

Instruction of Application

1. The proposals for Expression of Interest (EOI) are invited from the interested local, international or joint venture companies (applicants) for the Project for the development of Zoning Water Distribution System (the Project) in Yangon City under Public-Private Partnership (PPP) basis.

   The Project shall include the following key components in integrated manner:

   A. Water Distributin Pipeline Network Management

   B. Water Meter Management

   C. Water Tariff Collection Management

   D. Non-Revenue Water Reduction Management

2. The Project aims at improving the water distribution services in the relevant zones through systematic construction of distribution networks and systematic installation of service pipelines and water meters, reducing the non-revenue water and also for receiving more revenue from water supply.

   In view of the existing water supply system and challenges faced by Yangon city, it is envisaged that the existing water distribution system has to be redesigned, repalced with a new distribution network for achieving the above objective.

From "Instruction of Application" of the YCDC PPP

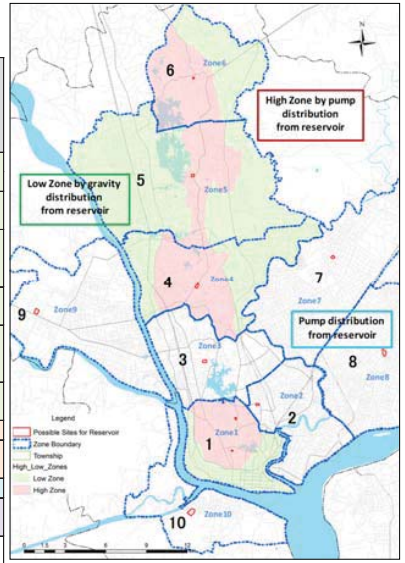
Scope of Works	Purpose	What works included in the scope ?		
		Management (O&M cost)	Operation and maintenance (O&M costs)	Construction and improvement (Capital costs)
Water Distribution Pipelines Networks Management	Systematic construction of distribution network	Management - Planning - Supervising	Distribute water Emergency & unforeseen works	Expand and construct new pipeline
Water Meter Management	Systematic installation of service lines and water meters	Management - Planning - Supervising	Check accuracy meter Repair damaged meter	Install new meter Replace meter
Water Tariff Collection Management	Receiving more revenue from water supply	Management - Planning - Supervising	Read meter, Collect tariff & non-payment Update customer data	Establish new customer data system
Non-Revenue Water Reduction Management	Reducing the non-revenue water	Management - Planning - Supervising	Detect leaks, Repair leaks Monitor and Manage DMA Identify illegal connection	Establish DMA Replace pipeline

- Existing water distribution system has to be redesigned, replaced with a new distribution networks

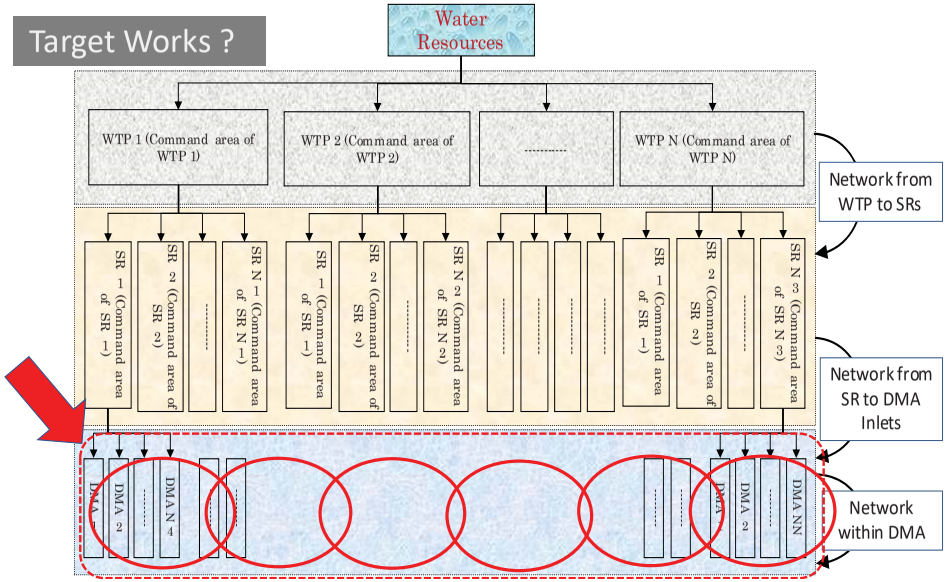
and request Concept Note.....

Target Zone ?

Zone number	Name of Distribution Zone (tentative name)	Supply Area (TS and TS Group's name)	Area of zone (km^2)	Location of S/R	Ground level at Site (m)	Total Area Required (m^2)	Water Demand in 2040 (MGD)
1	Central area	CBD, IUR	38.41	Kokine	22	Existing	83
				Central	30	Existing	
2	Tarmwe, Thaketa	Tarmwe, Thingangyun, Thaketa	35.06	Kyaikkasan Playground area	8	22,200	61
3	Hlaing	Mayangon , Yankin, Hlaing	54.16	Near Yangon University Hlaing Campus	17	24,200	67
4	Mayangon	(s)Mingaladon, North Okkalapa, (S)Insein	67.16	Near Airport	29	27,600	72
5	Mingaladon, Shwe Pyi Thar	(C)Mingaladon, (N)Insein, Shwe Pyi Thar	120.89	Near Survey Dept Benchmark	35	18,400	50
6	North side	(N)Mingaladon	53.84	Hlawga Road Side near Htauk Kyant	40	10,000	25
7	East side 1	East Dagon, North Dagon	82.62	East Dagon	5	24,800	69
8	East side 2	South Dagon, Dagon Seikkan	88.19	South Dagon	5	16,400	44
9	West side	Hlaing Thar Yar	81.54	Hlaing Thar Yar	5	15,100	40
10	South side	Dala, Seik gyi Kha Nanung To, (W)Kyeemyindaing	43.40	Dala	5	18,400	33
	Total		665.27			177,100	544



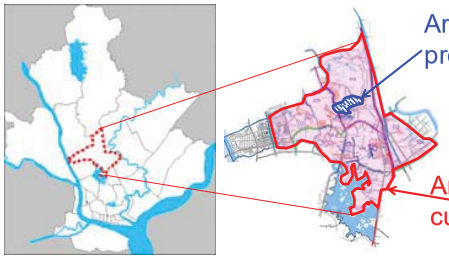
Target Works ?



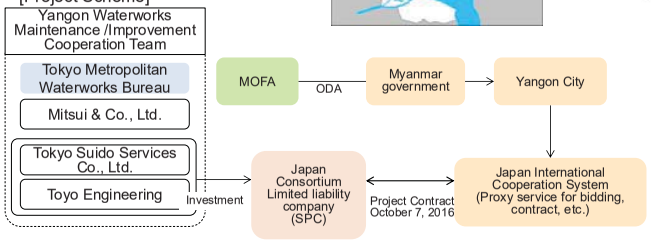
Scope, Target Results (Image) ?

NRW Reduction Project in Mayangon Township

Project Area: Mayangon Township
Project Scope: Water leakage survey, repair. Replacement and new construction of water pipes,
Replacement and new installation of water meters, etc
Term: 2016 - 2022
Project cost: Grant Aid by GoJ



[Project Scheme]



Previous Project by GoJ's Grassroots ODA Term: (Oct 2014- Mar 2015)

① NRW rate reduction
From approx. 77%
to **Approx. 32%**
② **24-hour water supply**
throughout the target areas
• Ensuring a certain water pressure and volume by reducing leakage volume
• ***Many residents voicing appreciation***

H. Taniguchi (Tokyo Waterworks) 19 March 2019, Conference by MHLW at YCDC

Scope, Target Results (Image) ?

PROJECT FRAMEWORK

Contract Price	15 M USD + contingency
Scope of Work	**Preliminary Works** •DMA Establishment •System Expansion Works •Emergency & Unforeseen Works **Leakage Reduction / Management** •Leak Detection •Leak Repair •DMA Control & Monitoring
Duration	**5 years – DMA Establishment / Leakage Reduction** **1 year – Maintenance Period**

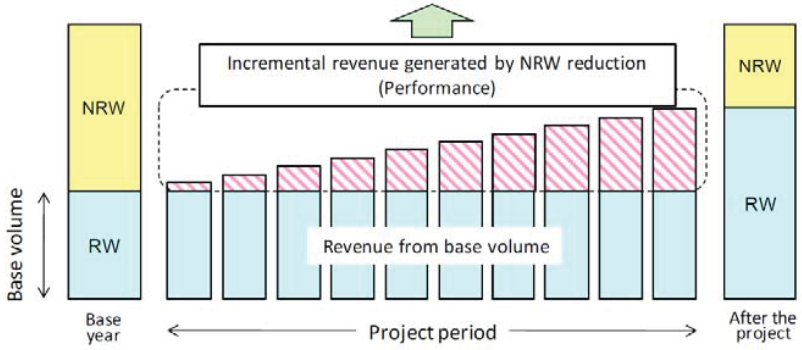
J.M.Rico (ManilaWater) Global Water Conference 17Aug 2016, Yangon

E.Largo, N.Catuoib (ManilaWater) IWA Water Loss Conference, February 2012, Manila

- The project aims to reduce water losses by 10 percentage points which can serve as additional supply to the city.

Scope, Target Results (Image) ?

Sharing the incremental revenue between a water utility and a private company



S. Takahashi, S. Kishida et al. (Kubota) IWA Water Loss Conference, February 2012, Manila

What scheme shall be applied in YCDC

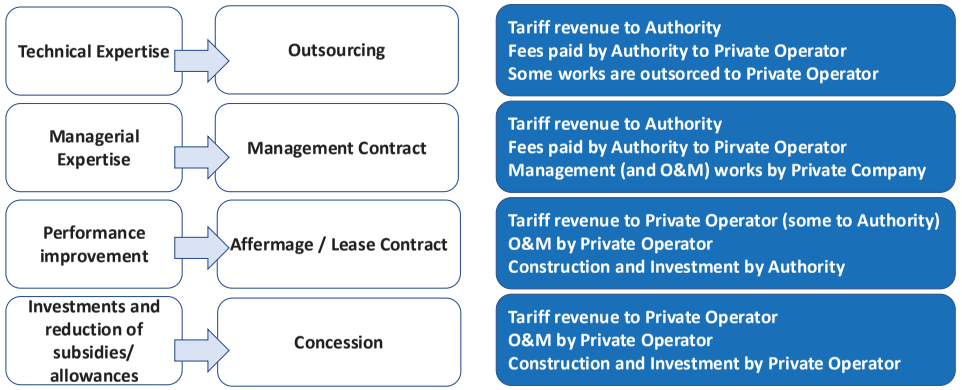
2-2 PPP Scheme in general

Is there a role for the private sector? What can the private sector bring?

- New technology and the know-how
- Better incentives for project performance
- Creative solutions for the design and implementation of the program
- Qualified human resources with flexibility for work
- Investment, under certain conditions

B. Kingdom, R. Liemberger et al, The Challenge of Reducing Non-Revenue Water (NRW) in Developing Countries –How the Private Sector Can Help: A look at Performance-Based Service Contracting, Dec 2006, World Bank Group

Selected PPP option as a function of effective need & demand



Jan G. Janssens, JJC Advisory Services (former World Bank), Seminar at Tirana (Albania), 13 May 2013

JJC Advisory Services

10

Concession, Affermage/Lease, Management, Outsourcing ?

✓ 'Concessions' are feasible, when:
- when investment can mostly be financed from cash generation; or
- in 'rich' countries or transition economies
- Governments and financiers (IFIs, bilateral) accept that public funds be on-lent to private concessionaires.

✓ When private equity and commercial debt are not available, *Affermage* /Lease is the next option to consider:
- combines public financing and attracts private efficiency
- preferred to 'Management' Contracts, because transfer of commercial risk is believed to create incentives to perform.
- If tariff level is not enough to cover the costs, it is not feasible.

Today, contracts almost always have a mixed nature in practice, part *'affermage,* part concession, subsidized concession, haybrid contract ……

We need a tailored/customized scheme to get Win-Win situation between Private company and YCDC

JJC Advisory Services

Design elements of NRW reduction contracts

☐Scoping:
- ✓what is the role of the private contractor? What are the NRW reduction targets?

☐Incentives:
- ✓how is the element of the contract structured?

☐Flexibility:
- ✓to what extent does the contract allow creativity in design and implementation of NRW reduction activities?

☐Performance indicators and measurement:
- ✓How is NRW reduction measured?

☐Procurement/Selection:
- ✓how is the private contractor selected?

☐Sustainability:
- ✓what happen after contract completion?

Some examples to be considered in each item

☐ **Scoping**
- physical and commercial loss reduction
- all cost included in the lump-sum price, like:
  - ✓ planning, design, engineering, mapping
  - ✓ selection, design and establishment of DMAs
  - ✓ supply of equipment, fittings, repair materials
  - ✓ leak detection and repair
  - ✓ customer meter replacement
  - ✓ transfer of technology - staff training

☐ **Incentives**
- ex. Target based contract with weak penalty formula

☐ **Flexibility**
- contract required physical and commercial loss reduction
- flexibility to establish DMAs anywhere in the distribution network ("cherry picking")
- flexibility to choose customers for meter replacement
- minimum number of DMAs and customer meters in the contract

B. Kingdom, R. Liemberger et al, The Challenge of Reducing Non-Revenue Water (NRW) in Developing Countries –How the Private Sector Can Help: A look at Performance-Based Service Contracting, Dec 2006, World Bank Group

How to proceed this PPP in YCDC

2-3 PPP process in general

PPP process in general

- Design of the PPP contract;
- Allocation of responsibilities and risks
- Selection of the operator; and
- Implementation and monitoring of the PPP contract.

European Bank, Public Private Partnerships and EBRD, February 2007

PPP contract Design

☐ **Design of a PPP contract:**
- ✓ 1. the clear output specification of the scope and
- ✓ 2. quality of the services to be delivered by the private operator and
- ✓ 3. the tariff that customers will have to pay for the service.

social reasons (e.g., affordability) that justify tariffs below cost for some services or group of customers. In these circumstances, tariff subsidies allow the private operator to recover costs

☐ **Define a set of service standards** (based on cost, willingness to pay and consumer preferences);
- ✓ tariff structure;
- ✓ subsidy arrangement (if necessary),
- ✓ cost of service should include operating and maintenance expenses, depreciation, and an agreed return on capital (i.e., the weighted average cost of debt/equity)

☐ **Tariff adjustment rules.**
- Use tariff resets especially for long duration contracts. Tariff resets involve a set of rules, principles and processes to adjust tariffs in a predictable way.
- the private operator has no control on the price of electricity for water supply.
- Consider tariff indexation formulas (adjusted at regular intervals)

European Bank, Public Private Partnerships and EBRD, February 2007

Allocation of responsibilities and risks

☐ **Allocation of responsibilities and risks**

➢ **Responsibilities:**
- ✓ management (employing and managing staff, implementing business plans);
- ✓ operations and maintenance (inventory management, asset maintenance, billing and collection); and
- ✓ investment and finance (planning capacity expansion, forecasting demand, preparing technical design, arranging finance, constructing assets).

➢ **Risks:**
- ✓ uncertain future development of demand and cost variables,
- ✓ including interest rates and foreign exchange rates.
- ✓ where a risk can be laid off for a commercially reasonable cost, then such risk may be borne by the private sector, (insurable risks)
- ✓ Exchange rate fluctuations can be influenced by governments through macroeconomic policies

➢ **Remarks:**
- ✓ the public authority should bear some of the exchange rate risk, or the operator may be allowed to share some risk with customers (e.g., some tariff component set in foreign currency), or the government may step in as the taker of risk of last resort.
- ✓ responsibility is allocated to the party best able to manage the risks associated with it.

European Bank, Public Private Partnerships and EBRD, February 2007

Operator selection

Best practice procurement process that is:
- clear and transparent (explicit contract objectives, understanding of the tender process);
- fair (level playing field where all bidders compete on equal terms); and
- cost-effective (cost and duration of the bidding corresponds to the potential rewards from winning).

Three basic approaches to select a private operator:
- competitive bidding,
- competitive negotiation (where the contracting authority engages in simultaneous negotiations with two or more bidders), and
- direct negotiation (e.g., when a private sponsor has a project idea and contacts the contracting authority).

Consider the following core criteria justifying an exception, when a formal competitive tendering procedure has not been used for the award of the concession:
- The process for selecting the Concessionaire has demonstrated sufficient fairness, transparency and competition;
- The process was free from corruption and in compliance with all applicable laws and regulations, and
- The outcome in terms of the concession agreement itself is fair and reasonable in terms of price, quality and risk sharing in relations to market practice.

European Bank, Public Private Partnerships and EBRD, February 2007

Contract implementation and monitoring

Institutional arrangements to manage a PPP contract needs functions:
- monitor the performance of each party's obligations under the contract;
- address poor performance;
- resolve disputes between parties;
- adjust tariff and service standards; and
- renegotiate the contract, if justified.

Managing and implementing the PPP contract needs capacities:
- Skills and capabilities necessaries to do the job;
- Incentives and independence to make decisions according to the governing rules;
- Flexibility to exercise discretion in the interest of customers and the operator;
- Moral and legal rights to take decisions (legitimacy);
- Access to all the information necessary to perform all the above tasks.

Other things to consider:
- To allocate responsibility for monitoring performance and ensuring compliance with the obligations set out in the contract.
- In monitoring the contract, key performance indicators are often used to ensure the achievement of adequate performance levels, not only financial ones (ex., reducing water leakages by a certain percentage).
- Renegotiation can be justified when it addresses the incomplete nature of the concession contract. (ex. capital investment needs following the discovery of the true state of the water pipes in municipal projects).
- However, consider a policy of no renegotiation except in the case of well-defined triggers, because not to secure additional benefits. It can undermine the economic benefits of the PPP contract.
- Substantial compensation to operators –including penalties-- in case of unilateral changes brought about.

European Bank, Public Private Partnerships and EBRD, February 2007

Allocation of Risk

- Operational
- Commercial
- Technical
- Financial
- Foreign exchange
- Regulatory

The Basic Process for Allocating Responsibilities

- Identify the main areas of **Responsibility** involved in delivering the services and the **Risks** associated with each Responsibility
- Allocate each area of Responsibility and Risk to the party best able to undertake and manage it, taking into account of the parties' ability to:
  - ✓Predict changes in the relevant factors
  - ✓Influence or control the risk factor
  - ✓Control the impact of the risk on the value of the business
  - ✓Diversify or absorb the risk
- Design the Arrangement to achieve the best allocation of risks and responsibilities

Checklist for defining responsibilities and risks

1. Define the major areas of responsibility (management, operations & maintenance, new investment)
2. Define specific responsibilities for each area
3. Identify the risks that are associated with each responsibility
4. Note the direct and indirect relationships between risks and responsibilities
5. Establish how the risks are inter-related
6. For each risk, identify which party (the operator, contracting authority or customers) is best able to bear the risk, and in particular who can:
   i. Predict the risk
   ii. Influence the risk
   iii. Control the impact of the risk
   iv. Diversify or absorb residual risk
7. Decide whether the risk should be fully allocated to one party or shared

Operator willing to take Operational/Technical Risk if…

- Existing assets are in good shape or rehabilitated
- Supply conditions (power, chemical) are acceptable
- Contractual performance targets are compatible with assets and supply conditions

Operator willing to take Commercial Risk if…

- Coercive measures for non payment are enforceable
- Tariff level and structure are adequate
- Substitutes (e.g. ground water) are regulated
- Proper budgeting and payments of Government water bills exist

Operator willing to take Financial Risk if…

- Commercial debt can be mobilized on the merits of the Project
- Strong reliance on cash generated by operations
  - ✓adequate tariff level
  - ✓low operating costs

Operator willing to take Regulatory Risk if…

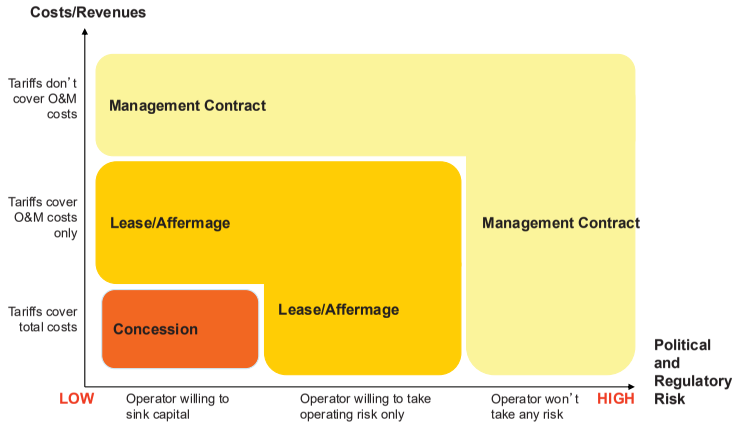
Confidence in Regulatory Framework

- Transparency
- Independence
- Arbitration
- Competence
- Predictability

Operator willing to take Foreign Exchange Risk if…

- Most expenses are in local currency
- Tariff is (partially) indexed on exchange rates variation

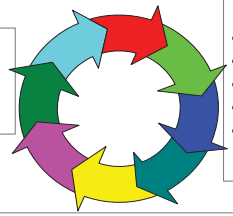
Choosing the 'best' model according to risk and tariff conditions



Source: Water Operators Round Table, Nov. 2004

Understanding participants goals

Customers want:
- dependable, quality service
- affordable tariffs
- tailored service for the poor



YCDC Water Authority wants:
- budget savings, no operating subsidies, minimal investment grants
- happy customers
- fast environmental cleanup
- happy public utility employees
- jobs for domestic firms
- private investment with reduced liabilities for the Government

Private Operator wants:
- steady, long-term returns
- market share, reputation, geographic presence
- mitigation of risks not under their control, or profits commensurate with risks
- spin-off benefits for parent supplier firms

Discuss and find solution

2-4 Concerns/Issues for the PPP project

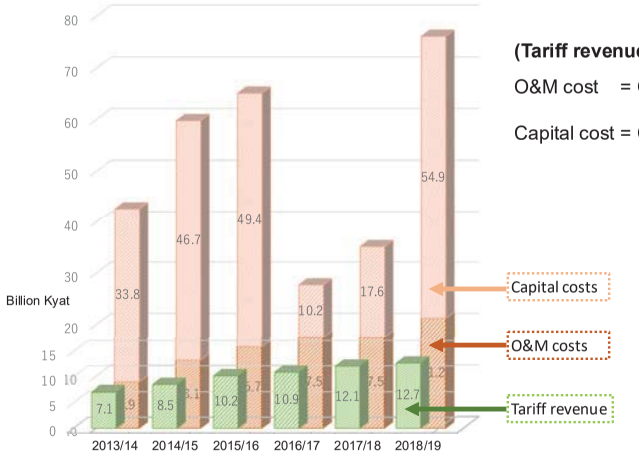
Concerns/Issues for the PPP

- YCDC is on the way to develop its capacity necessary for implementing PPP projects
  - ✓ Performance Indicators are necessary to supervise the private operator, but most of them are not available now.
  - ✓ Water Tariff covers only half of O&M costs. Capital costs are covered by YCDC general budget. When PPP contractor implement construction works, their investment shall be covered by YCDC general budget, not by tariff revenue.
  - ✓ DMAs are not established yet and volume of water supply in the zone cannot be measured.
  - ✓ Present service standards of the zone, such as water pressure, supply hours (24/7 or some hours) or water quality, cannot be figured out correctly yet.
  - ✓ YCDC staff members working for the PPP zone shall be treated rightly, but there is not clear regulation how to treat those members.
  - ✓ National Laws and Regulations regarding water supply are not made yet, the role of contract will be important
- Water supply shall be operated as integrated manner in the YCDC boundary
  - ✓ In case of accident, it become difficult to keep equal and fair supply
  - ✓ If tariff is different in zone by zone inside Yangon city. Is it acceptable for citizen?

Key Performance Indicators shall be prepared

- **Define a set of service standards by KPI**
- **Monitor the performance targets by KPI**
- **KPI such as;**
  - ✓ Supply indicators:
    - Service coverage (served population, number of customers)
    - Volume of water supply in the zone
    - Consumption/sales of water in the zone
    - Water pressure in the zone
    - Supply duration (24/7)
    - Water quality
    - NRW ratio in the zone (Non-Revenue Water volume, Leakage rate)
  - ✓ Assets condition indicators:
    - Pipeline: length, material, age and location
    - Wells: number, capacity and location (volume of ground water supplied)
    - Pump, service reservoir, etc.

To what extent Tariff revenue cover costs: Present situation



(Tariff revenue) vs. (O&M costs + Capital costs)

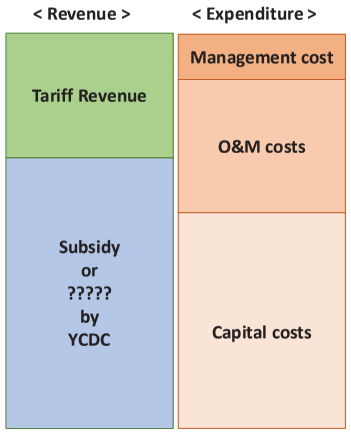
O&M cost = O&M expenditure
– Operating revenue other than tariff

Capital cost = Capital expenditure
– ODA Grant & Loan

- **At present, tariff revenue is not enough to cover O&M costs. Capital costs are covered by YCDC general account. (other Department's revenue)**

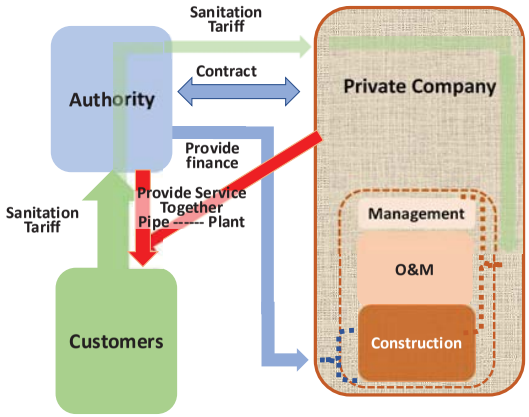
To what extent water tariff revenue cover costs of the Project

What works included in the scope ?		
Management (O&M cost)	Operation and maintenance (O&M costs)	Construction and improvement (Capital costs)
Management - Planning - Supervising	Distribute water Emergency & unforeseen works	Expand and construct new pipeline
Management - Planning - Supervising	Check accuracy meter Repair damaged meter	Install new meter Replace meter
Management - Planning - Supervising	Read meter, Collect tariff & non-payment Update customer data	Establish new customer data system
Management - Planning - Supervising	Detect leaks, Repair leaks Monitor and Manage DMA Identify illegal connection	Establish DMA Replace pipeline

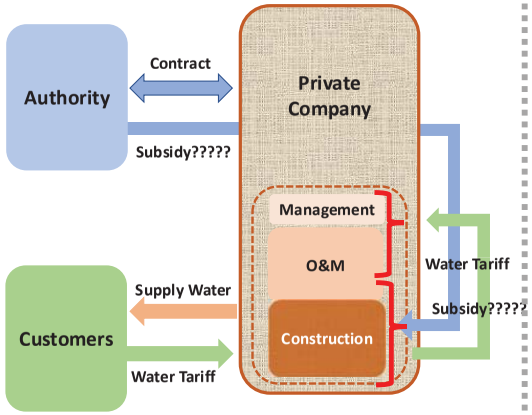


Example of Japan's case

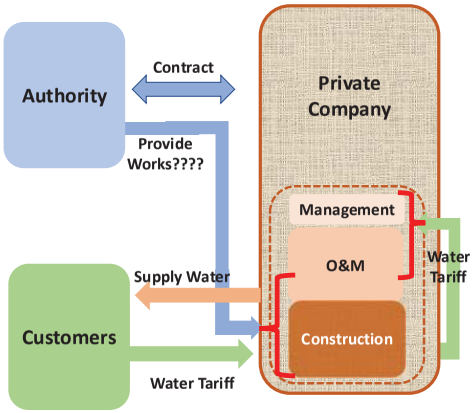
Concession Contract for Waste Water Treatment Plant and Pumping Station



Subsidized Contract?



Hybrid Contract ?



15

Just start and need more...

3.Conclusion

59

We need some profound ideas how to solve concerns/issues to be a successful PPP project.

We should utilize PPP system deliberately for the sustainable water supply in Yangon city

4

Thank you for your attention

Inquiry (JICA Expert in Technical Cooperation Project)

The Project for Improvement of Water Supply Management of YCDC

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61

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
YANGON CITY DEVELOPMENT COMMITTEE (YCDC)
THE REPUBLIC OF THE UNION OF MYANMAR

THE PROJECT FOR
IMPROVEMENT OF WATER SUPPLY MANAGEMENT OF YCDC

Technical Handouts by the Advisory Committee

April 2021

JICA Expert Team
TEC INTERNATIONAL Co., Ltd. (TECI)
TOKYO WATER Co., Ltd. (TSS)

Table of Contents

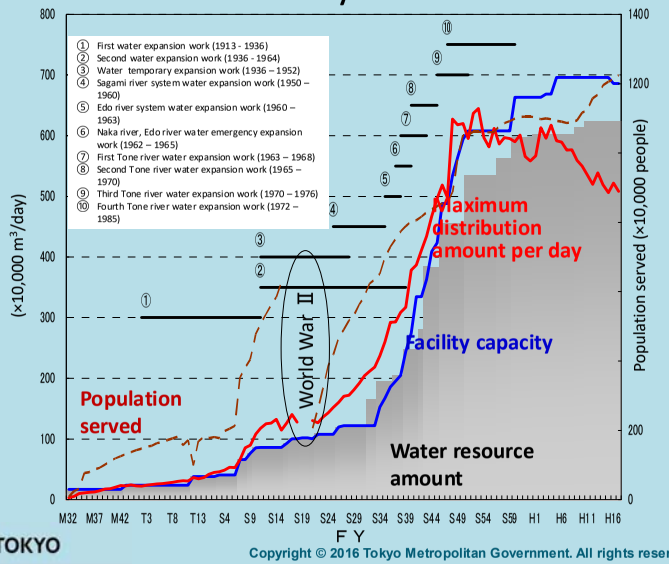
Tokyo Metropolitan Government, Waterworks Bureau

Table of Contents

Fukuoka City, Waterworks Bureau

1. MANAGEMENT PLAN OF TOKYO WATERWORKS

Transition of Tokyo Waterworks



WATER & TOKYO

Various Challenges Tokyo Has Faced

Water shortages caused by soaring demand

Water quality deterioration

Ground subsidence

WATER & TOKYO

Call for a Long-term Development Plan

Challenges

- Chronic water shortage
- Water-source quality deterioration
- Ground subsidence from excessive groundwater withdrawal etc.

Measures

- Securing new water resources
- Introduction of advanced water purification facilities
- Establishment of pumping regulations and industrial water system etc.

Facility development will require 30 to 50 years

The need for a development plan with a long-term perspective

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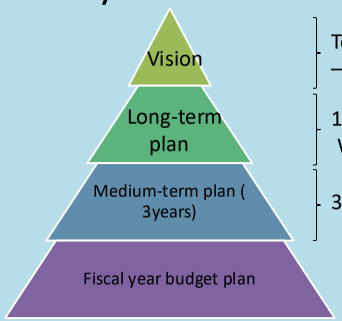
Tokyo Waterworks Vision & Plans



Tokyo Waterworks Principal Vision – STEP II (2006)

10 yrs. Master Plan for Construction of Waterworks Facilities (2015)

3 yrs. Waterworks Management Plan (2013)

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Tokyo Waterworks Principal Vision STEP Ⅱ

Waterworks to support the life of residents of Tokyo

Waterworks to support the urban functions of the capital city Tokyo

1 Waterworks to support comfortable life

2 Advanced waterworks for stable water supply

3 Building sustainable waterworks for next generation

4 Waterworks in a global environment

5 User-friendly waterworks

6 Leading role in the waterworks field

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Master Plan for Construction of Facilities

Direction

Stable water supply

Earthquake countermeasures

Safe, better tasting water suply

18 specific initiatives

Initiative 1: Secure water sources
Initiative 2: Update water treatment plants
Initiative 3: Update facility equipment
・・・
・・・
Initiative 17: Appropriate management of water supply facilities with receiving tanks
Initiative 18: Promote a switch to water service system without receiving tank

15 development targets

Index 1: Rate of water resources secured
Index 2: Rate of secured water supply in an accident
Index 3: Rate of updated purification plants
Index 4: Rate of earthquake-resistant filters
・・・
・・・
Initiative 14: Rate of guidance for improving water supply facilities with receiving tanks
Initiative 15: Rate of direct water supply from distribution main

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Master Plan for Construction of Facilities

Targets

We will steadily promote facility development in accordance with the 15 indexes.

	Index	FY2013 (Result)	FY2024 (Target)
Stable supply of water	Water resource availability for steady water supply at drought expected to happen once in every 10 years (%)	93	100 [FY2020]
	Rate of the water supply in an accident (%)	78	90
	Rate of Renewal of the Water Purification Plant (%)	0	19
Countermeasures of earthquake disaster	Rate of earthquake-resistant filters (%)	76	100 [FY2018]
	Rate of earthquake-resistant service reservoirs (%)	67	99
	Rate of the replacement of early ductile iron pipes (%)	47	100 [FY2021]
	Rate of earthquake-resistant pipeline joints (%)	35	59
	Rate of earthquake-resistant pipeline joints on supply routes serving capital's central agencies and emergency medical institutions, etc. (%)	70	100 [FY2019]
	Rate of earthquake-resistant pipeline joints used in supply routes serving priority evacuation centers and major stations (%)	35	100 [FY2022]
	Rate of earthquake-resistant service pipes supplying evacuation centers and major stations (%)	31	100 [FY2019]
	Rate of earthquake-resistant service pipes installed in private roads (%)	35	79
	Rate of water supply available during massive power outage (%)	58	100 [FY2021]
Safe, Potable delicious water	Achievement rate of residual chlorine decrease (%)	74	100 [FY2016]
	Rate of waterworks upgrade directives pertaining to water storage tanks (%)	37	100 [FY2015]
	Rate of direct water supply from distribution mains (%)	69	75

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Tokyo Waterworks Management Plan 2013

1 Stable supply of water

2 Countermeasure against earthquake

3 Safe, better tasting water

4 Wide-ranging business operation

5 Communicating with our customers

6 Energy/environment-related measures

7 International Contribution

8 Reinforcement of management base

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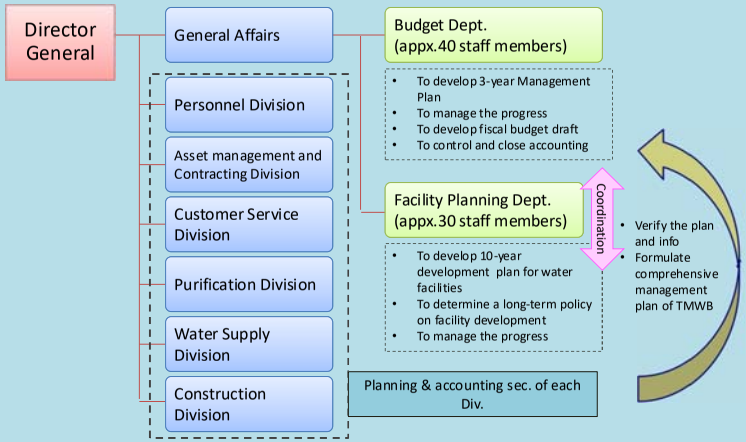
Planning Functions of Tokyo Waterworks



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2. HUMAN RESOURCES DEVELOPMENT OF TOKYO WATERWORKS

Business Operation Structure

- Maximize outsourcing to private operators
- Achieve business e fficiency while ensuring its public nature (Tokyo Waterworks maintains the core water business operations with its partner companies)

(Roles of each entity and task-examples)

Category	Description	Examples
Tokyo Waterworks	Core services for the water business operations	Formulation of its management policy & facility development plans, water quality control, operations & maintenance of important facilities, wide-area water supply operations, etc.
Partners (2companies)	Critical services for the business operations	Instruction & supervision of operations outsourced to private operators, general reception work, facility operation management, etc.
Private businesses	Outsourceable services (e.g. routine work)	Water meter reading, contract work (e.g. facility & piping work), etc.

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Changes in the Number of Employees

For greater efficiency, promotion of outsourcing and systemization have reduced the number of employees

Building a smaller, highly-skilled team

Response to increased outsourcing, etc.

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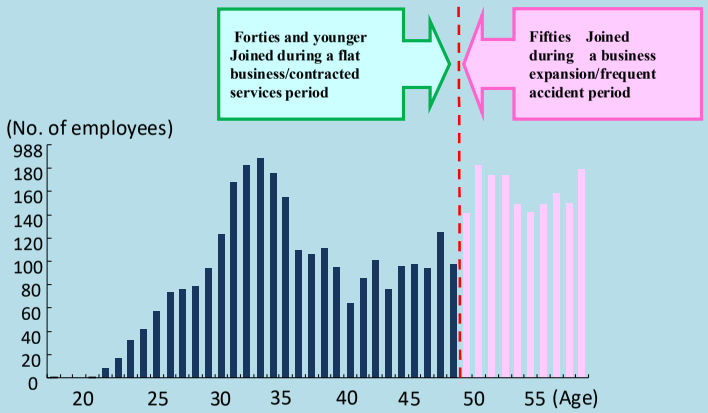
Employees by age



Passing down the technical and business know-how from a large group of retiring, experienced workers

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Personnel Training Department

1965: Tokyo Waterworks employee training department established.

- Training program unique to the Bureau has been developed.

Founded in 2005 **Training and Technical Development Center**

- Integrated previous employee training and technology development departments
- Many practical training facilities, field experiment sites provided

Human resource development to support business operation with a smaller number of employees

R&D that responds to changing needs and incorporates its results to actual work field

Synergy effect created through collaboration between training and R&D

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Training Principle / Training Plan

Training Plan 2005 –Stage 2-

Based on business environments surrounding Tokyo Waterworks, the Plan maps out the training target in view to the next 10 years.

- Training objectives
- Direction of training management
- Basic roles and skills required at each job level
- Practical training structure and goals

Training plan

- Developed annually
- Specific implementation planning for training (subject, object, trainee number, time, etc.)

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Training Objectives

a. HRD for the times requiring a small number of highly-skilled experts.

b. Handing-down and upgrading of operational know-how, as well as techniques and skills.

c. Cultivation of HR leading the water utility industry

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Key Points in Training Operation

a. HRD from a long-term perspective
b. Establishment of training PDCA, and effective HR cultivation
c. Improvement of experience-based training, and introduction of effective training approaches
d. HR cultivation in collaboration with the supervisory organization
e. Nurture of HR contributing to the water utility industry at home and abroad

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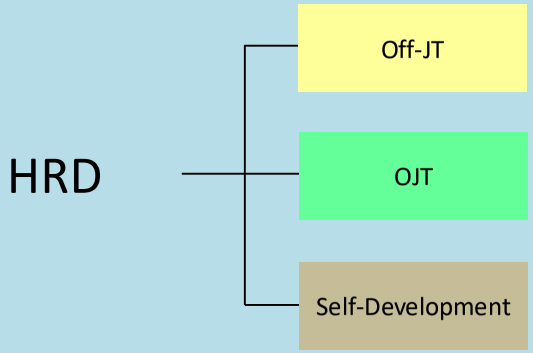
Structure of HRD



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Off-JT Personnel Training System

In-house training programs

1 Individual training for each job title

(Example) "Newly-hired," "Team leader," "Director/Manager"

2 Training on practical knowledge and know-how with specific, level-defined targets

(Example) "Legal work," "Pipework," "PowerPoint"

3 Training to understand and raise awareness on important issues that Tokyo waterworks faces

(Example) "IT security"

4 Training for in-house training instructors

5 Training at other training organizations including private companies for special knowledge and techniques

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Training sessions 1

Leakage prevention practice

Practice to connect large-diameter and small-diameter pipes

500 mm

100 mm

WATER & TOKYO

Training sessions 2

Water-purification practice

Water Purification Plant

Water quality laboratory

Electrical and mechanical training

Electrical training

Mechanical training

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Framework for OJT ①

Each section ← Support → Training and Technical Development Center

Manual

- Key-points to communicate
- Instruction points tailored to each experience level
- How to prepare an OJT planning sheet

Planning & report sheet

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Framework for OJT ②

Tutorial System

- ◆ Conducted at departments with first-year employees
- ◆ Assigns a senior employee who is close in age, as a tutor to a new employee
- ◆ Provides OJT for new-recruits in collaboration with senior supervisors.

- Create a yearly development plan
- Provide instruction/advise on daily work assignments
- Provide instruction/advise on workplace etiquette and working relationships
- Become a role model as a Tokyo Metropolitan Government employee

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Support for self-training

Support Menu	No of items	Cost to be supported	Coverage		Condition
			Portion	Maximum	
License Examination 【Example】 ・Professional Engineer, ・bookkeeping, ・TOEIC etc.	62	Examination Fee	100% of Expenses	None	Passing the exam
		Mandatory Lectures Fee		None	
		Other LectureFor Examinees		¥60，000	
Taking a course 【Example】 ・Business management, ・PC handling etc.	100	Fee for the course	50% of Expenses	None	Completing the course

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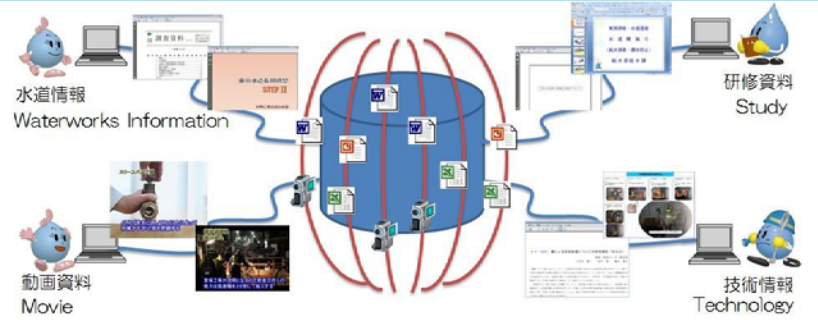
Knowledge Bank

- ◆A database of information, the knowhow and extensive knowledge of Tokyo Waterworks
- ◆The staff can refer to the information on own PC.



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3. MAIN LAWS AND STANDARDS RELATED TO TOKYO WATERWORKS

Major Related Laws and Regulations

- Waterworks Law
- The Local Public Enterprise Law
- The Local Autonomy Law
- River Law
- Basic Environment Law
- Water Pollution Control Law
- Water Supply ordinance of the Tokyo Waterworks

etc

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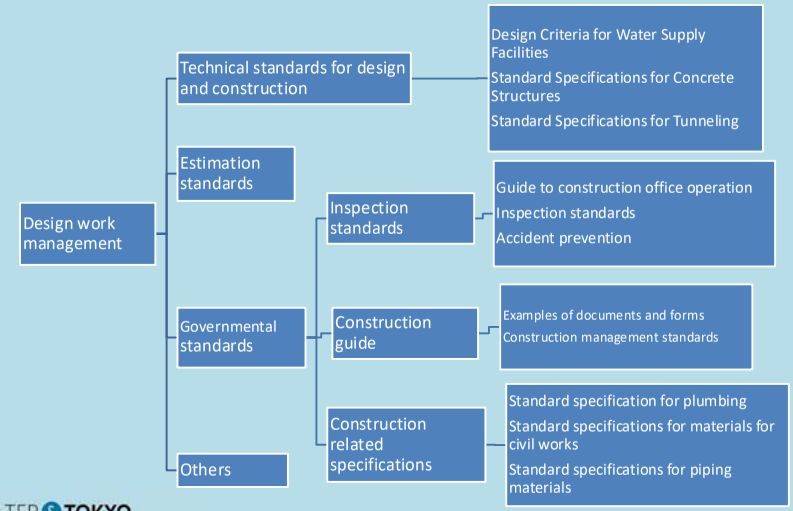
Structure of facility development standards



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Standard specification for plumbing

- Aims to attain uniform interpretation and operation, for proper contract fulfillment
- Describes routine, technical requirements and construction details (work order, material quality, quantity, finishing, and construction methods)

Sample description in plumbing work (excerpt)

- Transport and handling of materials : use cushioning material to prevent damage
- Pipe installation : install pipe in low-to-high order
- Pipe cutting : use special low-noise tools
- Pipe protection : obtain permission from supervisor before installation
- Water pressure test : apply pressure of 0.5 MPa, and check for 0.4 MPa or higher pressure after 5 min.
- Preparation for water-flow : inspect everything, disinfect inside the pipe etc.

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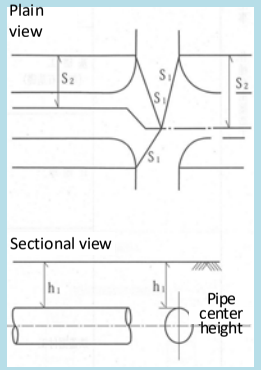
Management standards for completed civil construction work

- Specifies the item details related to finished work in the standard specification for plumbing

Sample description in plumbing work (excerpt)

- Gaps with pipe extension...
  - less than 500 m ⇒ ± 10 cm
  - 500 m or more ⇒ ± 20 cm
- Offset (S_1)... ± 3 cm
- Occupied location (S_2): ± 3 cm
- Earth-covering (h_1): ± 3 cm
- Pipe center height... ± 3 cm etc.



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Conclusion

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Achieving Sound Water Management Operation

- As waterworks development takes substantial time and massive expense to carry out, it requires a plan from a middle to long term perspective.
- It is essential to have a department to formulate such plans.
- Based on the plan developed, work has to move forward steadily while examining ways to secure its budget.
- By outsourcing wherever reasonably possible to private companies, we will secure public nature of the business, by running our operation more efficiently with a small group of highly-skilled workers.
- Through various training programs, we will encourage each employee in professional development.
- Develop standards and manuals to compensate gaps in knowledge and experience among employees.

WATER & TOKYO

4. WATERWORKS MANAGEMENT SYSTEM IN JAPAN

Corporate Financial Accounting of Waterworks

WATER & TOKYO

Difference between General Administrative Services and Water Supply Services①

General Administrative Services e.g.. National Defense, Road Services, etc.

- **Available** for concurrent use by multiple number of users

- Possible to be served without bearing any costs
- Impossible to bear service charges corresponding exactly to volumes of services received
- Possible only to cover service costs by revenue of compulsory taxes

Water Supply Services

- **Not available** for concurrent use by multiple number of users

- Clear relationship between receiving services and cost bearing
- Possible to bear service charges corresponding exactly to volumes of services received
- Possible to pursue economic efficiency of business operation

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Difference between General Administrative Services and Water Supply Services②

General Administrative Services

Collection of taxes, etc.

Public Administration

Order/Compulsion

Citizens

Water Supply Services

Water Utilities ⇔ Citizens

Equal contractual partnership

WATER & TOKYO

Relationship between Waterworks and Government①

Central Government

・General legislative control

Formulation of rules and reference materials on business operation

JWWA

・Guidelines on business operation and management

Guidelines for setting of water charge rates,
Standards for water quality related instruments, etc.

Water Utilities

・Rule setting and business operation in due consideration of actual status of the entity

・In case of no government controls, the utities may set up their own targets and standards.

・Also, the utities are allowed to impose on themselves their own regulations that are stricter than government's ones.

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Relationship between Waterworks and Government ②

Laws and regulations on institutional system and operation

Central Government

General laws and regulations on public administration:

・Local Autonomy Act, Local Public Service Act, Local Finance Act, etc.

Mechanism of such organizational systems that are of more efficient than those of general public administration:

・Local Public Enterprise Act, etc.

Water Utilities

Various rules and regulations related to organizational system and operation and management on the following:

・Internal organizational structure, division of duties, decision making authority;

・Salaries for employees, working hours, disciplinary punishment;

・Documentation management;

・Accounting, etc.

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Government Subsidiary for Operating Expenditures (Water Supply Law)

・Government must concern to provide water utities with technical assistances and financial aids required.

・According to the relevant Acts, Government shall subsidize a part of their operational expenses.

・The subsidies shall be within the relevant government budget.

⇨ No subsidies are given in case when the budget is used up.

・Projects that are subject to the subsidy, in case of waterworks:

Water source development projects
Water supply area expansion projects
Wastewater treatment facilities in water purification plants, etc.

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Management Body of Waterworks

Essentiality | Intensive locality | Huge funds

Monopolistic management by public bodies such as cities, towns and villages, authorized by Government

Furthermore, ・・

Local Public Enterprise Act

In order to pursue economic efficiency in enterprise operation, it is required to be managed in a form of local public enterprises, established in local governments.

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Outline of Local Public Enterprise System

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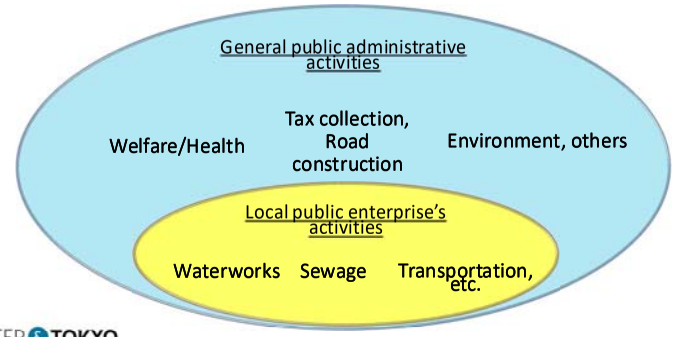
What is “Local Public Enterprise”?

- Enterprises established and managed by local governments
- Entities for: Enhancement of citizen’s welfare + Attainment of business efficiency



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Setting Up of Separate Accounts (Local Public Enterprise Act)

- Setting up of individual accounts for each project, in principle, separately from general administrative accounts
- Accounting data processing in corporate accounting method

Accounts of Tokyo Metropolitan Government （Unit: 0. 1 billion yen）

Item	FY 2015 budget (expenses)	Details
General account	69,520	General administrative sectors, such as: Welfare/Health, Road Construction
Special account	47,045	Municipality-owned housing development, debt service expenditure, etc.
Public enterprise account	22,140	Water, sewerage, transportation, etc.
Waterworks account	4,554	
Total	138,706	

Set up separately from general administrative sectors

Purpose: to clarify exactly relationship between business operational performance and financial status

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Self-Support Accounting and Costs Burden by General Public Administrative Sector (Local Public Enterprise Act)

Self-support Accounting	Business operating costs must be compensated by business revenues
Cost burden by General Public Administrative Sector	A part of expenditures, such as costs related to general public administrative services and unprofitable investment costs, may be borne by general public administrative sector

Ensure fair costs bearing

Ensure financial autonomy

Ensure efficient business operations

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Costs Burden by General Public Administrative Sector（Local Public Enterprise Act）

Clarifying, in advance, costs and expenses not to be covered by water charges, make the enterprise be responsible for those other than such costs and expenses.

Expenses to be borne by general administrative sectors

(1) Expenses having natures that are not qualified to be covered by water charge income
e.g. costs required for installation and O&M of fire hydrants

(2) Expenses that are difficult to be compensated only by water charge income despite of efficient business operation
e.g. costs required for operation of hospitals located in mountainous regions or remote islands

Expenses to which subsidies from general administrative sectors are authorized

- Expenses required for highly public projects
  e.g. expenses required for disaster restoration, costs of water resource development projects

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Financial Accounting in Local Public Enterprise

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Accounting Method (Local Public Enterprise Act)

Processing under Corporate Accounting ⇒ In order to assess actual status of enterprise

Characteristics of public corporate accounting

(1) Processing under accrual basis , not cash basis
(2) Dual budgeting systems: “operating revenue and expenditure” and “capital revenue and expenditure”
(3) Balance Sheet to be prepared
(4) Accounting under a concept of periodical calculation (allocation of cost by terms)
(5) Emphasis both on Budget and Closing

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(1) Accrual Basis, not Cash Basis

(1) Government accounting ⇒ ”Cash Basis”:
Accounting processing under bookkeeping based on actual cash revenues and cash expenditures

(2) Public corporate accounting ⇒ ”Accrual Basis”
Regardless cash revenue/expenditure,
based on actual accrual of specific economic activities,
accounting processing under recording of incomes and expenditures to be accrue in each time of such accruals

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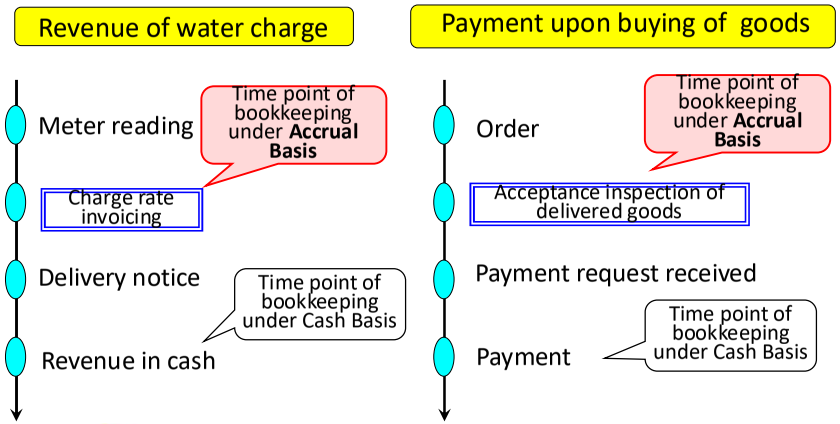
Comparison of timings of bookkeeping



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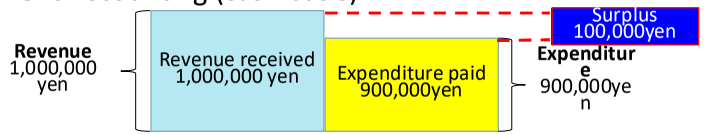
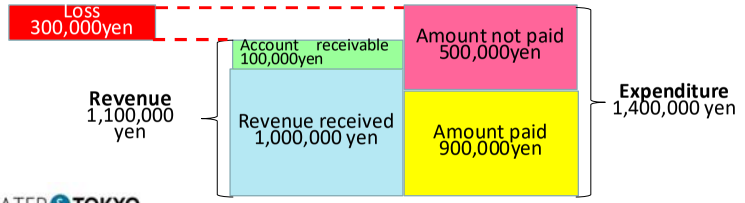
[Example] A case that black figure (surplus) and red figure (loss) become reversed each other because of difference of bookkeeping timings

Government Accounting (cash basis)



Corporate Accounting (accrual basis)



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(2) Budgeting in dual systems: “operating revenue and expenditure” and “capital revenue and expenditure”

In corporate accounting, periodically calculated profit and loss shall be identified in classification of income and expenditure Into the following:

1) Those based on profit & loss transaction in the current fiscal year
2) Those in transaction related to rise or fall of investment amount (capital transaction)

Dual budgeting systems:

- Operating revenue and expenditure
- Capital revenue and expenditure

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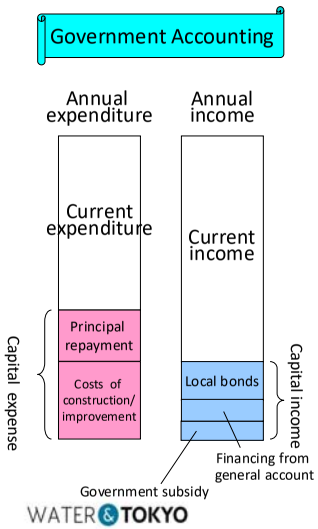

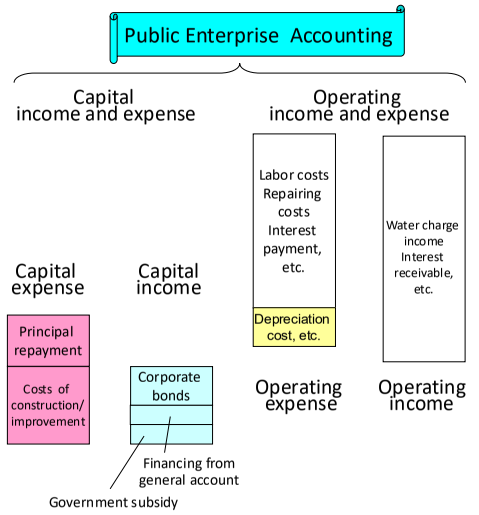

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Capital Revenue and Expenditure

In this system: Capital Revenue and Expenditure,

- Expenditures in the current year are carried over to book later after next accounting period, and are balanced with future revenue

Capital income

- Corporate bonds/loans
- Government subsidiary
- Money transferred from general account

Capital expenditure

- Costs of construction/facility improvement (construction of water purification plant, installation of water distribution pipes, etc.)
- Repayment of corporate bonds/loans

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Operating Revenue and Expenditure

In this system: Operating Revenue and Expenditure,

- Expenditures are booked in the current year, and are balanced with revenues in the same current year.
- Profit & Loss Calculation is made based on this Operating Revenue and Expenditure accounting

Operating Income

- Operating income (water charge revenue, etc.)
- Non-operating income (interest received, etc.)
- Extraordinary profit

Operating Expense

- Operating expense (costs of repairing works, energy and chemicals, depreciation costs, etc.9
- Non-operating expense (interest paid, etc.)
- Extraordinary loss

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(3) Balance Sheet
(Concepts of assets, liabilities and equity)

Assets – Liabilities = Equity

(Assets = Liabilities + Equity)

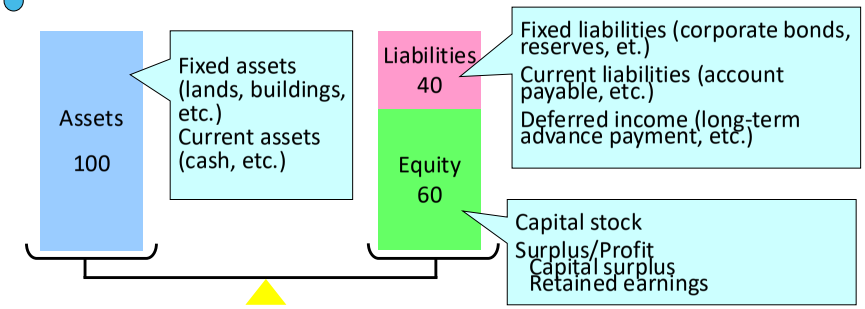
"Assets " and "Liabilities + Equity "

shall be always balanced.

Financial position statement
= Balance Sheet (BS)

WATER TOKYO

[image]
BS shows that "Assets" ,including cash, buildings, etc., are obtained and accumulated depending on the amount of "liabilities", including corporate bonds, etc., and "equity", Including capital, reserved funds, etc.



Always balanced

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(4) Concept of Periodical Accounting (cost allocation)

In corporate accounting practice,

・Among expenditures in a current year, only portions that are deemed to contribute to bring about some incomes in the current accounting year shall be booked as expenditures, or shall be expensed, in the current year, and

・Other portion of expenditures that are corresponded to revenues accrued later after the next accounting year shall be carried over to be booked in the later accounting year.

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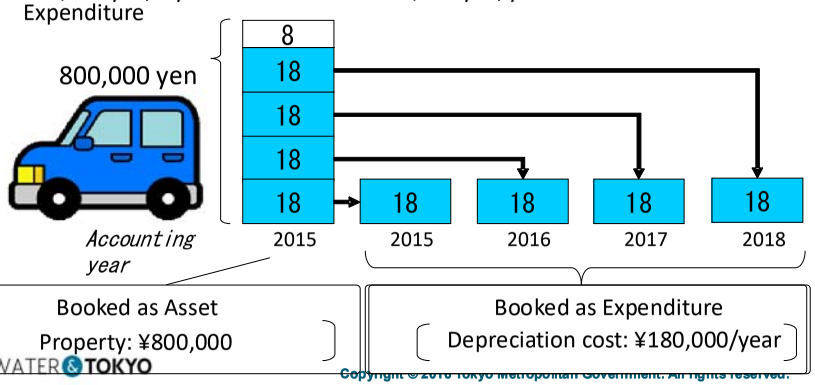
Periodical Accounting (cost allocation)

[Example] Purchase a vehicle priced at 800,000 yen and of 4 years' durable year →Effects of expenditure of 800,000 yen will continue for 4 years

800,000 yen - 80,000 yen of statutory residual value (10%) = 720,000 yen
720,000 yen/4 years' durable life = 180,000 yen/year shall be booked as Expenditure



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(5) Emphasis both on Budget and Closing

Budget in Gov't Accounting

- Major emphasis on control of annual expenditures
  (Unclear on relationship between income (taxes) and expenditure)

Budget in Public Enterprise

- Budget is prepared paying attention to maximization of economic efficiency.
- Expenditures are estimated in due consideration of revenue maximization
  (Very clear on relationship between income (charges) and expenditure)
- While budget control is pursued, management places importance on financial results that show how much of revenues are obtained.

Budget in Private Entity

- While budget is prepared as a target of business operation, financial results is absolutely important.
  (Nothing important than "financial results" represented by profit earnings and dividend to shareholders)

Conclusion (1)

Merits of Local Public Enterprise System

1 It enables to formulate appropriate business management strategies owing to accessible information on profit-loss and stock.

2 It enables to make comparison among business management situations of enterprises.

3 It enables to attain business management efficiency and service quality improvement owing to improvement of flexibility of business management.

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Conclusion (2)

How Japan's System works well

1 Independent, Corporate Account System
- Clearly understood financial situation
- Compare other water utilities by financial PIs
- Comparison of PIs enforce own efforts
- Clearly identify costs for tariff rate setting

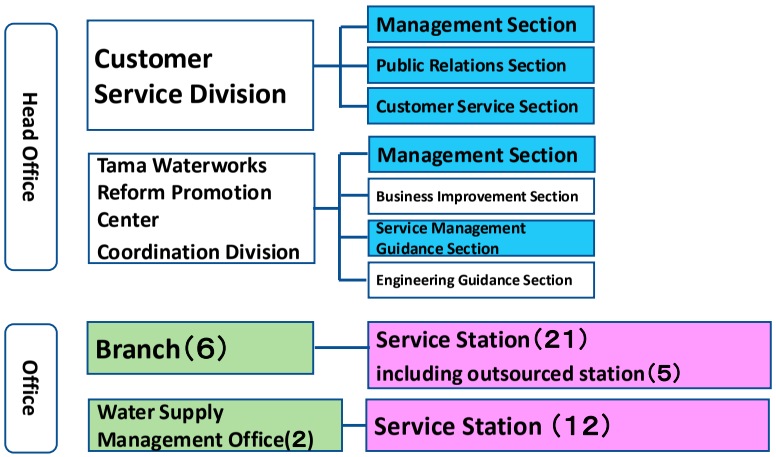
2 Independent Authority for Head of Bureau
- Decision on fast and professional manner like private company (Head has all most all authority on expenditure, contract, personnel, etc.)
- Clear responsibility of water supply services of Head of Bureau
- Clear financial responsibility of Head of Bureau

3 Balance between Public Interest and Company Efficiency
- Decision of critical issues such as tariff setting, budget are decided by local government parliament which represents public opinion
- Mayor (Governor) has the authority to appoint Head of Bureau which means if a Head fail to implement his responsibility he will be fired.

WATER & TOKYO

5. CUSTOMER SERVICE

Organization of Customer Service Post



Customer Service Division - Management Section

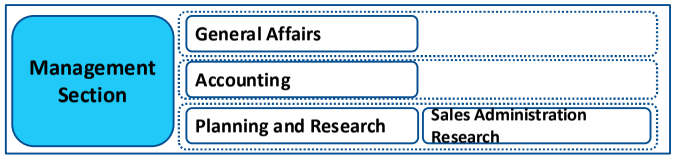
Division of Duties

1 Planning and Research for Customer service

2 Coordination of Emergency Water supply

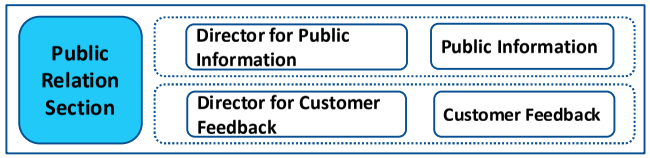
3 Bureau's Credit Management

4 Issues that do not belong to other sections in the division



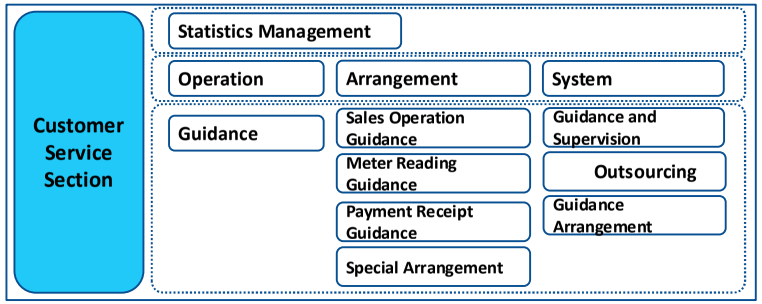
Customer Service Division – Public Relation Section
Division of Duties

1 Bureau's Public Information and Public Hearing (Except Press Release)
2 Customer Service
3 Liaison, Coordination and Implementation of Information Disclosure
4 Liaison, Coordination and Implementation of Protection of Personal Information, etc.



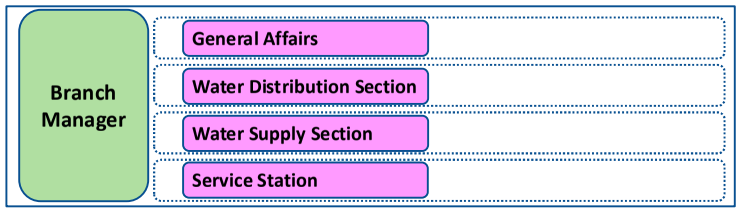
Customer Service Division - Customer Service Section
Division of Duties

1 Guidance of Sales Operation
2 Water Charge, Water Charge for Industrial Use, Sewerage Charge and Commission Charge
3 Arrangement of Accounts Receivable
4 General Reception



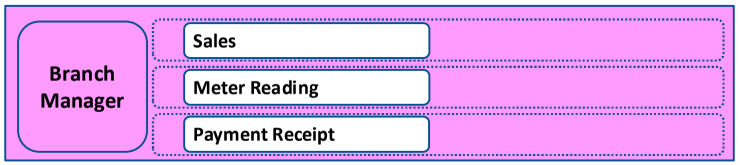
Branch Office Division of Duties

1 Maintenance and Supply Adjustment of Distribution Facilities for Tap water/Industrial Water
2 Leakage Prevention of Tap Water/Industrial Water
3 Emergent Measures in case of Suspension/Reduction, etc. of Tap Water/Industrial Water Supply
4 Collection of Water Charges, etc.
5 Water Supply System for Tap Water/Industrial Water



Service Station Division of Duties

1 Approval of Water Use（Beginning/Suspension of Use, etc.）
2 Calculation of Water/Sewage Charge
Collection and Reception of Water/Sewage Charges, Commission Charges, Construction Cost, etc.
3 Service Station's Public Information and Public Hearing



Relations between Head Office and Service Station①

73

Customer Service Division-Management Section → Service Station

Organization Management, Government Building Management, Notification of disaster countermeasure, etc.

Service Station → Customer Service Division-Management Section

Various Reports, inquiry and consultation

Relations between Head Office and Service Station②

74

Customer Service Division-Customer Service Section → Service Station

Notification such as Public Information and Public Hearing, Inquiry

Service Station → Customer Service Division-Customer Service Section

Various Reports, inquiry and consultation

Relations between Head Office and Service Station③

75

Customer Service Division-Customer Service Section → Service Station

Operation Guidance（Service Station Visit for Guidance, etc.), Notification Concerning Charges, Operation Information Meeting

Service Station → Customer Service Division-Customer Service Section

Various Reports Concerning Charges, inquiry and consultation

Meeting and Training

76

Meeting

Service Station Managers' Meeting (Including All Sections of Customer Service Division), Acting Directors' Meeting (Sales, Meter Reading, Payment Receipt)

Training(Held by Training Center or Head Office)

Training for Newly Assigned, Practical Training

（Service Station Managers, Acting Directors, Sort by management levels or by duties, etc.）

Comments and Advices about Public Relation

Tokyo Metropolitan Government
Bureau of Waterworks

◆ Tokyowaterworks Caravan

Seminar for School Kids

Seminar for Adults

◆ Communication with customers at community events

Water Service Consultation

Introducing important projects by the Tokyo Waterworks

◆ Publishing community bulletins

PR to an unlimited number of customers

- By press releases, websites, social media

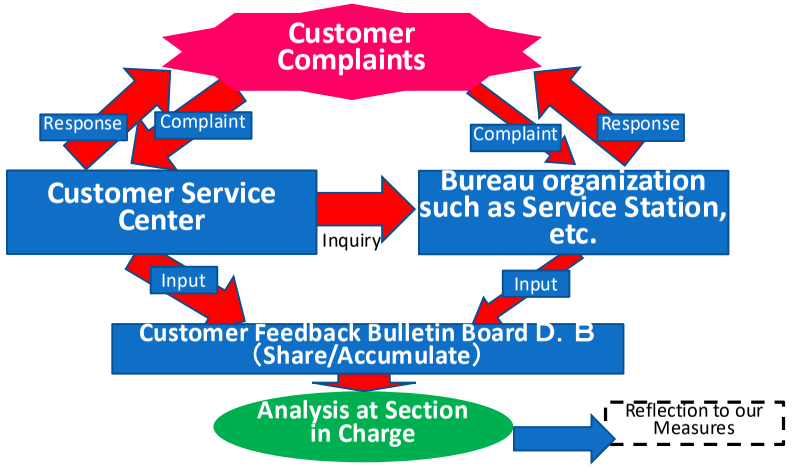
PR to customers in specific communities

- Participation in community events, disaster prevention training
- Publishing community bulletins

Target	Residents and companies in the community
Format	A4 two side color printed leaflets
Locations	Hospitals, Subway Stations, Ward Offices, Public Libraries, Resident's Associations
Content	Events in the community, Emergency water supply training, Important projects by the Tokyo Waterworks

◆ Publishing community bulletins

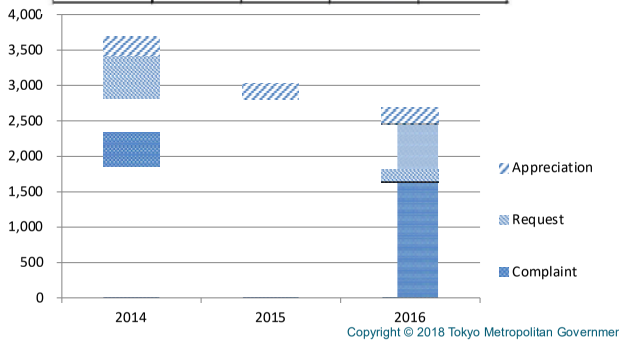
Complaint Response System



Customer Feedback

Annual number of feedback received (Unit: comment)

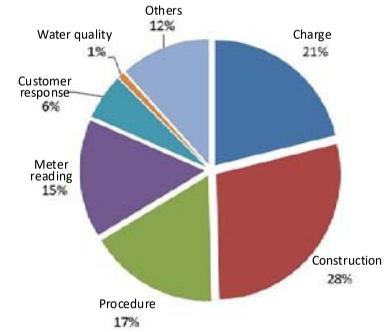
	Complaint	Request	Appreciation	Total
FY 2014	2,340	1,084	263	3,687
FY 2015	1,834	976	216	3,026
FY 2016	1,640	811	228	2,679



Customer Feedback

Number of feedback by content (Unit: comment)

	Charge	Construction	Procedure	Meter reading	Customer response	Water quality	Others	Total
Complaint	300	702	179	241	102	13	103	1,640
Request	257	44	171	157	3	6	173	811
Appreciation	9	15	102	8	53	3	38	228
Total	566	761	452	406	158	22	314	2,679



Cause of Complaints

- Construction
  （Construction Noise, Poor Water Flow, Suspension of Water Supply, Turbid Water, etc.）
- Organization, System
  （Charge, Meter Reading, Procedure, etc.）
- Individual
  （Response, etc.）
- Water Quality

Number of feedback by content (Unit: comment)

	Charge	Construction	Procedure	Meter reading	Customer response	Water quality	Others	Total
Complaint	300	702	179	241	102	13	103	1,640

Reception Training, Case-based Training

- Reception Training

Every staff member gets Reception Training every three years

- Case Based Training

At training sessions sorted by management levels (Service Station Managers, Acting Directors, etc.), training based on cases such as difficult cases are conducted.

(Utilization of Group debate)

Important Points in Customer Response

- Speedy and Sincere Response

Late response lead to even bigger complaint
Face to face explanations with customers are effective

- Be a Good Listener, Explain Politely

Instead of telling Bureau's points one-sidedly, listen to the customers from their point of view.
Avoiding to use technical terms as much as possible, try to make an easy to understand, clear and logical explanation

- Impression

Your impression can be influenced by your facial expression, the way you talk and your appearance.

To improve customer satisfaction

- Listen carefully to the customers from their point of view, and explain respectfully
- After grasping needs or problems, important point is to reflect them in making improvement

6. NON-REVENUE WATER COUNTERMEASURES OF TOKYO WATERWORKS

Flow of the Presentation

①Works of leakage-prevention-related sections in Tokyo
- ●What is leakage prevention?
- ●Organizations engaged in leakage prevention

②Outline of the leakage prevention works in Tokyo
- ●Planned replacement of water pipes and improvement of materials for pipes
- ●Leak detection technology and early repairs

③Trainings regarding leakage prevention
- ●Training and Technical Development Center (handing-down of techniques/improvement of capabilities)
- ●Certification of Tokyo Waterworks Technology Experts/super plumbers
- ●Knowledge bank

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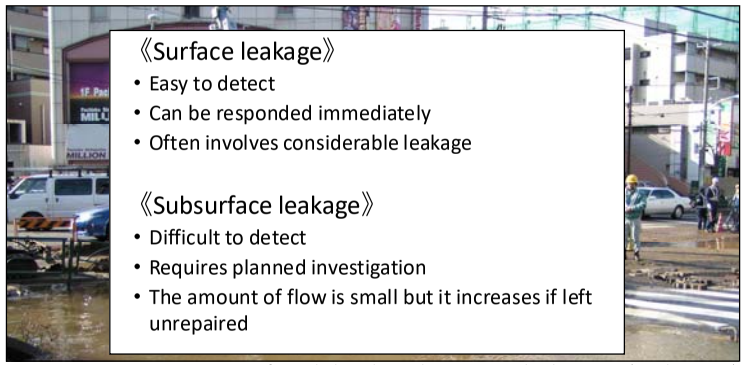
What is Leakage Prevention?①

About water leakage

Water leakage: water which leaks from water pipes in the course that tap water is transmitted.
(Damaged part of pipeline, loose joint part of pipeline)



Circumstance of water leak accident with 500mm main distribution pipe (March 30, 2015)

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What is Leakage Prevention?②

Occurrence factors of leakage

Internal factors	External factors
Those attributed to pipe/material	Those attributed to installation environment
• Those with originally flawed material/structure of pipe, joint or attached equipment • Strength degradation due to corrosion • Aged deterioration of material	• Increase in traffic volume • Hollowing-out around pipes due to overlooked leakage • Ground movement • Rupture due to freezing pipe interior • Difference between design and actual conditions • Excess external stress • Soil pollution due to industrial effluent, etc.
Those attributed to design/construction technology	Those attributed to other construction works/disasters
• Design error • Joining defect of joints, etc. • Inappropriate backfill • Contact with other structure (lack of protection) • Flaw in corrosion prevention method • Potential difference corrosion due to dissimilar metal	• Surface wound due to other companies' construction works • Change in installation environment due to other companies' construction works • Ground/road deformation due to disasters such as earthquakes
Those attributed to factors in pipes	
• Water pressure, water quality (internal corrosion) • Water hammer • Temperature change	
Others	
• Complex causes	

Know the causes of leakage and the weakness of pipelines

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What is Leakage Prevention? ③

a） Corporate management

- ●Dispose of expensive purified tap water

Precipitation/filtration⇒Membrane treatment, ozonation, biological activated carbon treatment

- ●Cost for leakage prevention measures

Lots of leakage cases⇒Requires personnel and project budget for leakage prevention measures

b） Accident prevention

- ●Secondary disasters such as caving roads
- ●Disturbs stable water supply (Decreased feed-water pressure/defective water flow)
- ●Water pollution in pipelines

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What is Leakage Prevention? ④

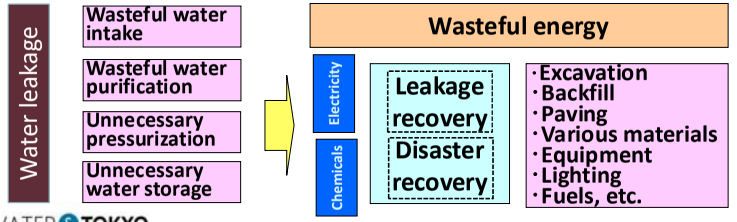
C） Water resource situation

Water resource situation

- Have good-quality and abundant water resources
- Abundant but having problems with water resource quality
- Water resources are limited

⇒Leakage prevention measures are as effective as new water resource development

d） Environmental measures



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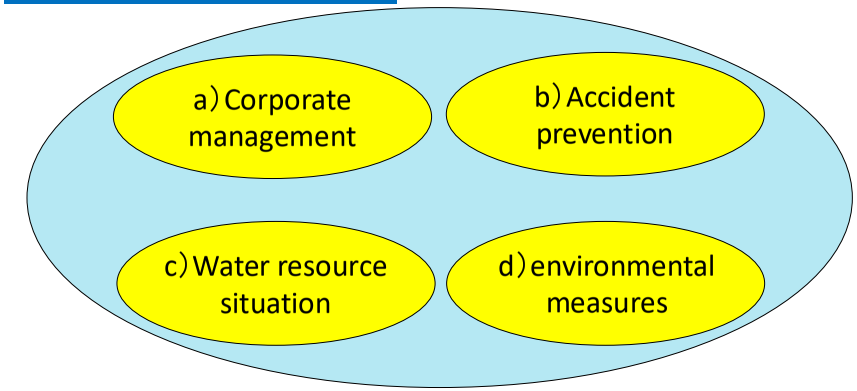
What is Leakage Prevention? ⑤

The necessity of leakage prevention



Positioning leakage prevention as one of main measures

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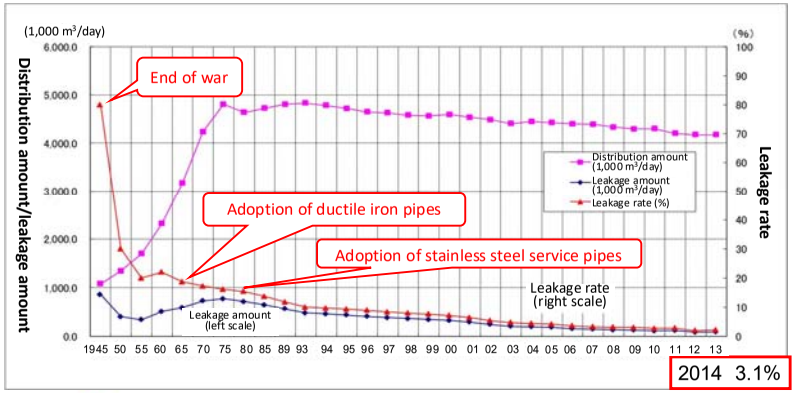
What is Leakage Prevention? ⑥

Transition of leakage rate

Changes of distribution amount/leakage amount/leakage rate in Tokyo



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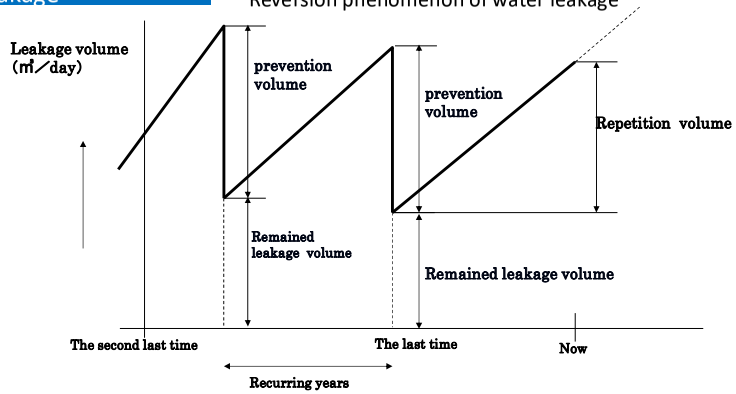
What is Leakage Prevention? ⑦

Reversion phenomenon of water leakage

Reversion phenomenon of water leakage

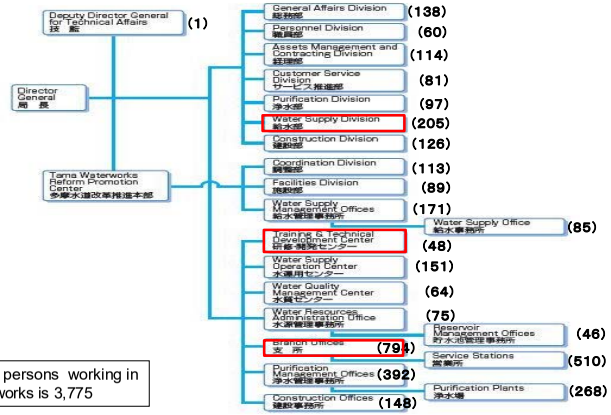


Continuous efforts are required as leakage reverts

Organizations Engaged in Leakage Prevention ①

The whole organization of Tokyo Waterworks

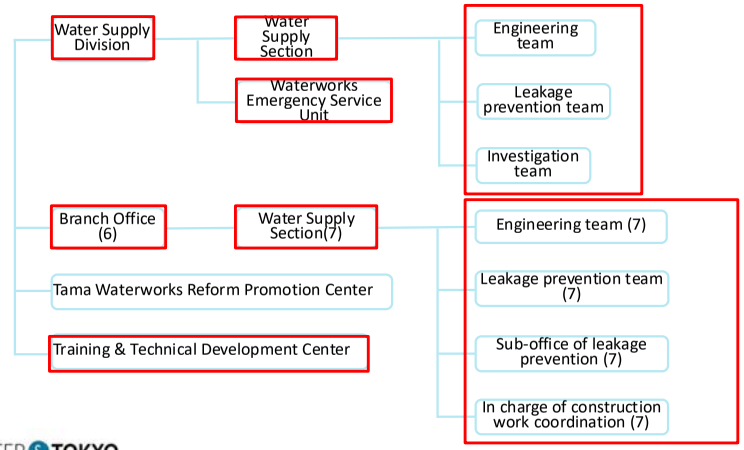
Organization chart of Tokyo Waterworks (As of July 2015)



Number of persons working in the Waterworks is 3,775

Organizations Engaged in Leakage Prevention ②

Organizations engaged in leakage prevention



Organizations Engaged in Leakage Prevention ③

Water Supply Division, Water Supply Section

Engineering team (6 people)	• Administration
Leakage prevention team (5 people)	• Execution management (administration of the leakage prevention of branch offices) • Instruction and coordination regarding leakage prevention • Project implementation plan • Preparation of budget proposal • Clerical works for agreements with contractors
Investigation team (6 people)	• Statistical processing • Affairs concerning basic plans

※Excerpted works regarding leakage prevention only

Organizations Engaged in Leakage Prevention ④

Water Supply Division, Waterworks Emergency Service Unit

Engineering team (9 people)	• Planning/formulation of various trainings • Inspection/management of vehicles and instrumentation to be deployed
1st to 5th sub-team (12 people/team)	• Initial response at the time of sudden accident • Secures a supply route to the capital's central agencies at the time of disaster

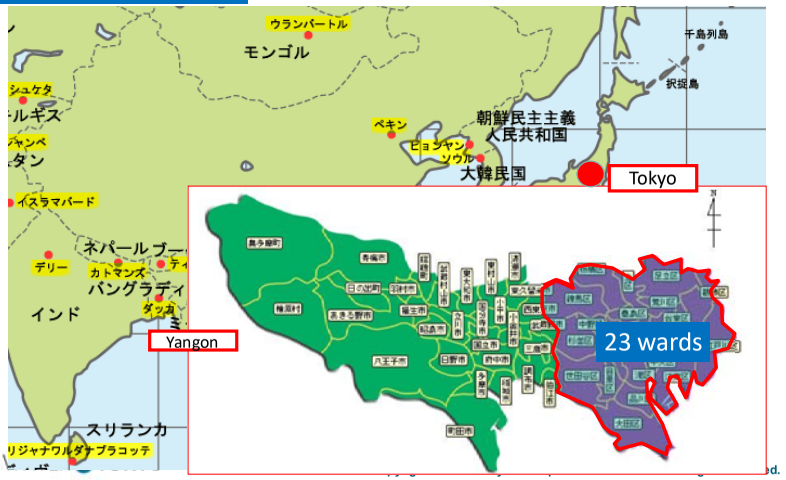
Branch Office, Water Supply Section

※Excerpted works regarding leakage prevention only

Engineering team	• Commencement and settlement of construction works • Research on petitions
Leakage prevention team	• Planning and implementation of leakage prevention works • Field investigations and repair works • Coordination and implementation of service pipe development works, etc.
Sub-office of leakage prevention	
In charge of Construction work coordinators	• Communication and coordination for road occupancy works

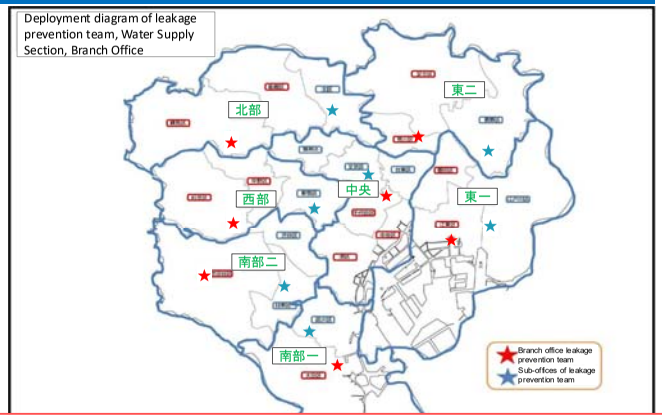
Organizations Engaged in Leakage Prevention ⑤

Location of Tokyo



Organizations Engaged in Leakage Prevention ⑥

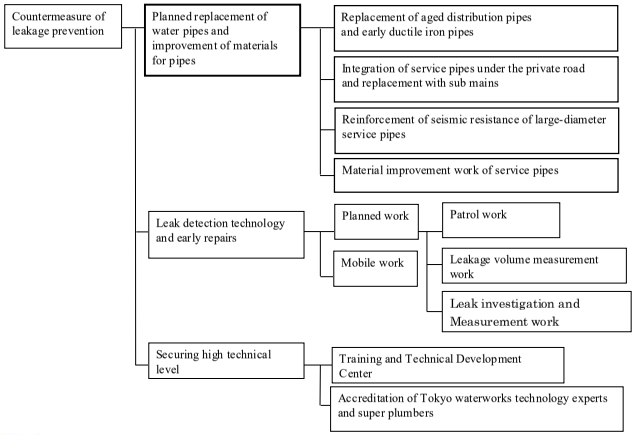
Bases in the 23 wards of Tokyo (6 branch offices, 7 sections and 14 teams)



Allocation of roles between the main office and outpost agencies

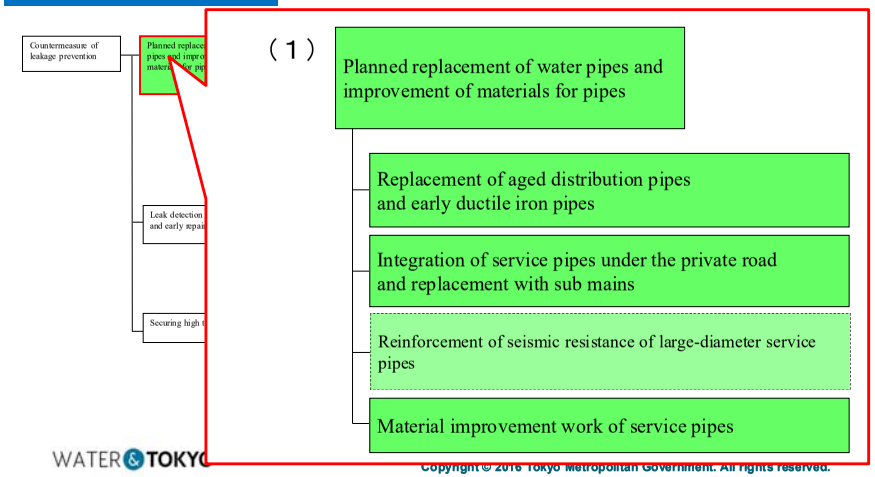
Outline of the leakage prevention works in Tokyo

System of leakage prevention measures



Planned replacement of water pipes and improvement of materials for pipes ①

4 measures



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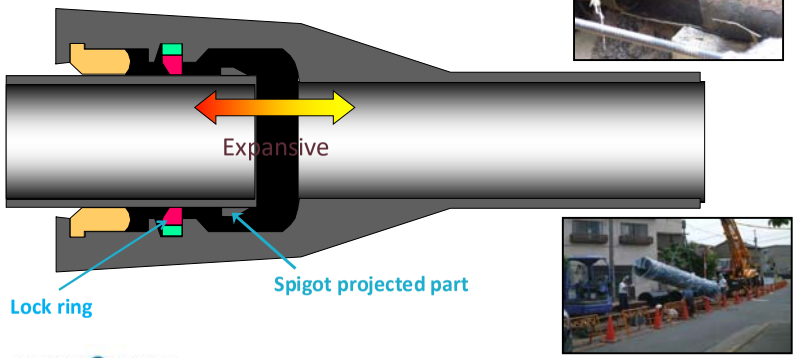
Planned replacement of water pipes and improvement of materials for pipes ②

Replacement of aged distribution pipes and early ductile iron pipes

Structure of pipe with earthquake-resistant joints

(NS-form joint of ductile cast iron pipe)



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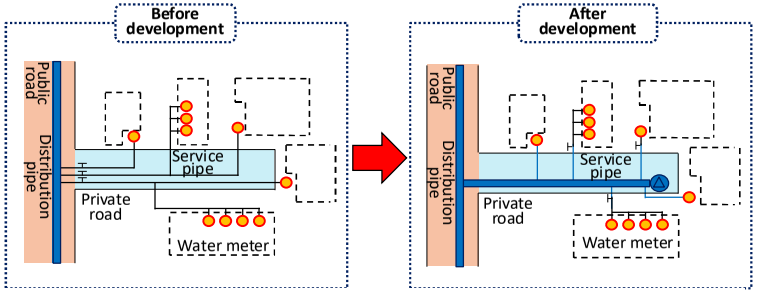
Planned replacement of water pipes and improvement of materials for pipes ③

Development of service pipes under private road

Install distribution pipes under private road and lay stainless service pipes again from the closest point.
⇒Reduced risk of leakage, improvement of materials for service pipes, ensuring stable water pressure



※In cases when there are 3 or more water plugs under the private road

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Planned replacement of water pipes and improvement of materials for pipes ④

Improvement works of materials for service pipes (1)

●Problems with lead pipes
- **Subject to damage from the vibration and impact of road excavating**
- **Subject to crack from external force and water hammer pressure due to the low intensity of material**
- **Subject to soil corrosion (particularly considerable corrosion to alkali soil)**
- **The intensity of junction is greatly affected by the degree of techniques**
- **As service pipes are private property, they are not re-installed or removed even if they are aging.**

Lead pipe

Corrugated stainless steel pipe

Number of leak repair cases 75,403 cases (1978) ⇒9,206 cases (2014)

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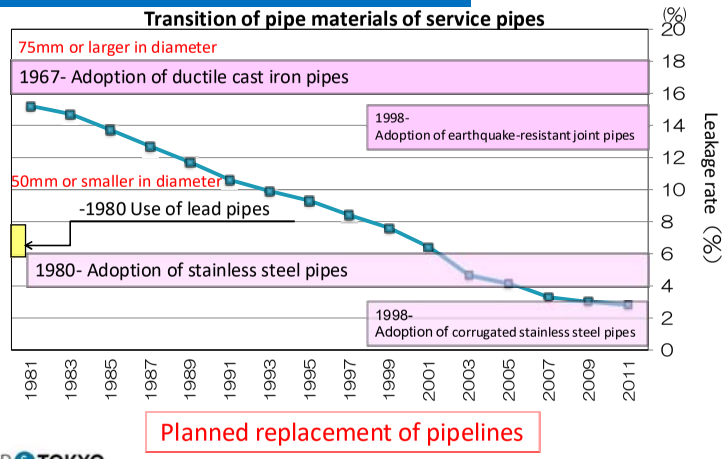
Planned replacement of water pipes and improvement of materials for pipes ⑤

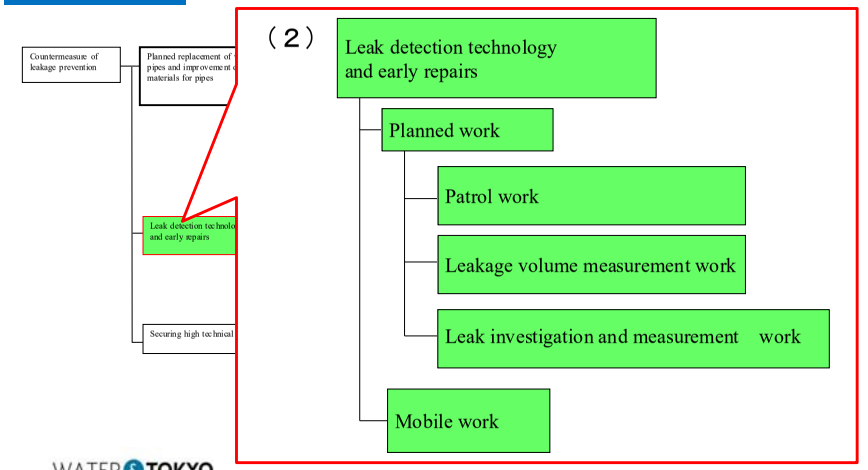
Improvement works of materials for service pipes (2)



Planned replacement of pipelines

Leak detection technology and early repairs①

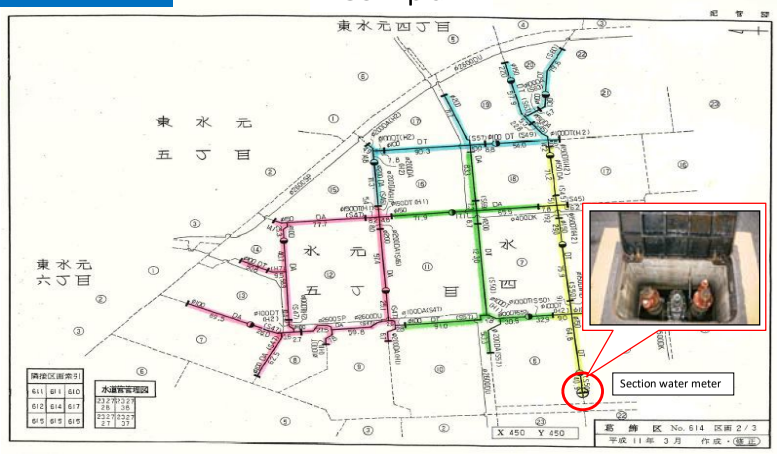
2 measures



Leak detection technology and early repairs ②

Planned work

Block plan



Leak detection technology and early repairs ③

Patrol work

Mainly targeted at subsurface leakage!

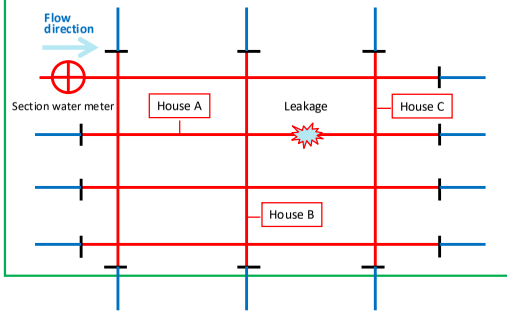
Acoustic rod

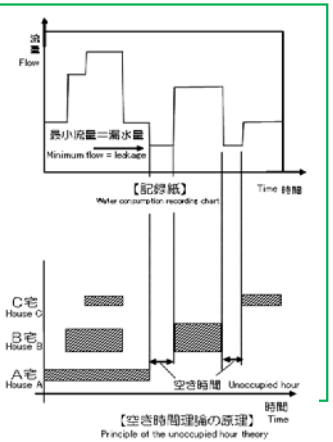
Electronic leakage detector

Leak detection technology and early repairs ④

Leakage volume measurement work (1)

Work to **measure leakage volume** within a certain section by turning off the outer gate valve and making the section water meter the only entrance of water.





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Leak detection technology and early repairs ⑤

Leakage volume measurement work (2)

Minimum flow meter

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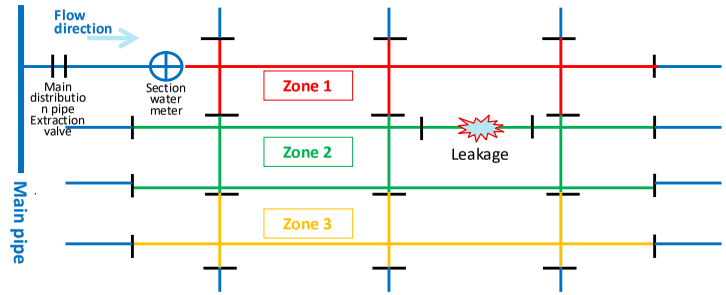
Leak detection technology and early repairs ⑥

Leak investigation and measurement work

Work aimed at function check for the extraction valve of distribution main /practical training to secure water flow route at the time of earthquake disaster/leakage volume measurement

Water flow will be expanded sequentially as follows: Zone 1 ⇒Zone 1 • 2⇒Zone 1 • 2 • 3



Develop compartments in pipe network and carry out measurement in a planned manner

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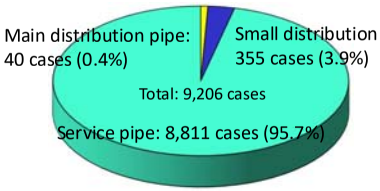
Leak detection technology and early repairs ⑦

Mobile work (1)

- Sent out in response to reports from residents, ward offices, police, etc., investigate water leakage, defective water flow, abnormal water quality, etc., identify the cause and repair.
  （Work on accrual basis）
- Response to sudden accidents and the front line of crisis management
  (Immediate and appropriate decision and instruction make them repaired on the same day in principle)
- Requires handing-down of techniques
  (Accumulation of flexible responses including the identification of leakage points and the handling of water stoppage)

Breakdown of leakage causes by pipe types (FY2014)



Many leakage cases are attributable to service pipes

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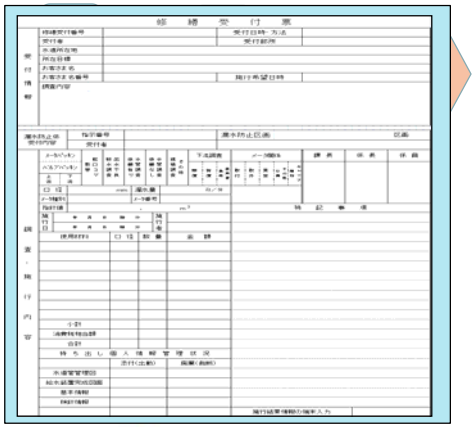
Leak detection technology and early repairs ⑧

Mobile work(2)

Flow of mobile work



Go to the site to conduct leakage investigation

Arrange contractors to repair the leakage

Input the result in statistics system

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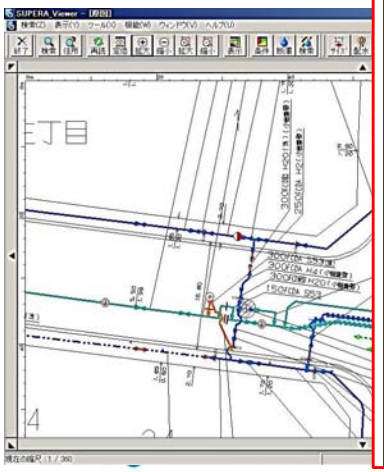
Leak detection technology and early repairs ⑨

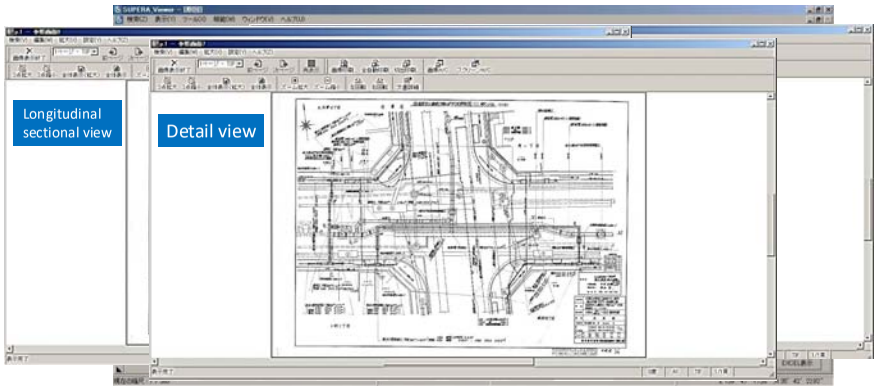
Waterworks mapping chart (1)



Name	Attribute value
Drawing number	262599
System key number	2150727
Completion drawing classificatic	Completion drawing available
Micro number	P0741700021
Construction work number	302
Installed year	H04 (1992)
Diameter unit classification	Millimeter
Diameter (millimeter)	800
Diameter (inch)	
Material joint	SP
Special part	Inverted siphon (underground installa
Small-scale construction work fla	No construction work
Polyethylene sleeve	No coating
Registered length	0m
Tama Index number	
Construction work number (SUB1	
Important line classification	Normal
Shallow layer pipe classification	Normal
Distribution pipe serial number	170
Calculated length	48.527m

Leak detection technology and early repairs ⑩

Waterworks mapping chart (2)



Requires development of drawings which show the conditions of pipeline

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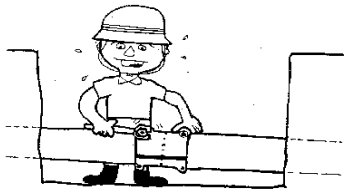
Leak detection technology and early repairs ⑪

Leak repair method (1)

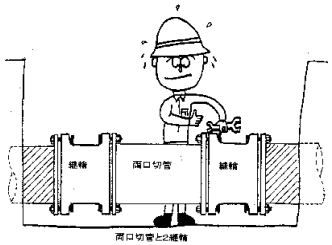
Leak repair construction method (external surface)

No-water suspended construction method



Swivel joint ring splitting construction method

Water suspended construction method



Pipe-cutting construction method

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Leak detection technology and early repairs ⑫

Leak repair method (2)

【Repair by splitting swivel joint ring】

【Repair by cutting pipe 】

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Leak detection technology and early repairs ⑬

Leak repair method (3)

Repair by band-formed tape

※It's used by emergency repairing of a service pipe.

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Necessary Procedures to Administrator ①

Road occupancy permission

Occupancy is the act of setting up a certain object or facility and using the road continuously (Installation of waterworks/gas pipes, installation of a sign of roadside building, etc.)

- Road administrator's permission is required for occupancy
- Permitted in cases where it will not cause obstruction to conservation of road structure, safety of road traffic, etc.
- Use for a purpose other than passage of people or cars requires the road usage permission of the police chief in charge
- Also requires coordination with other lifeline administrators

<Road administrator>

- Administrator differs by the degree of importance (regulated by the Road Act)
- Divided into national road, prefectural road and ward road

※Total length of roads in Tokyo: 24,467km (ward area: 11,875km)
(As of April 1, 2014)

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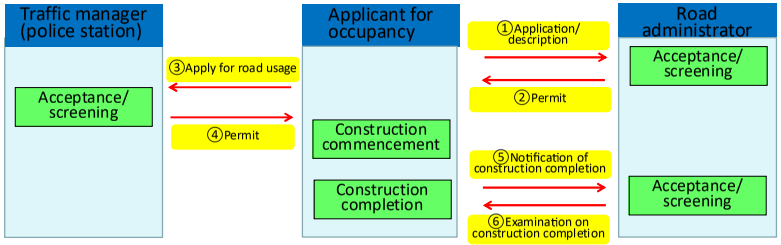
Necessary Procedures to Administrator ②

Flow from permit application to construction completion



<Emergency response>

- In the event of an emergency, such as leak repair, call the police station and road administrator in charge first to inform of the place and the time it takes. Report the completion at the time of repair completion.
- Fill out paperwork after the repair completion.

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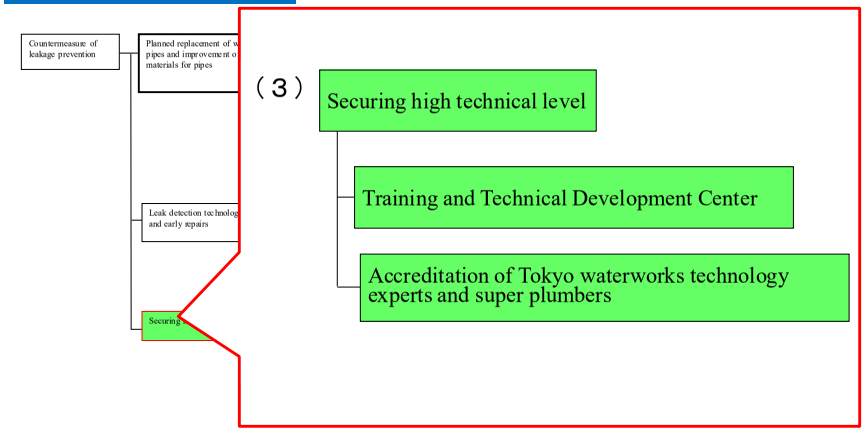
Necessary Procedures to Administrator ③

Road occupancy permission

Road usage permission

Securing high technical level①

2 measures



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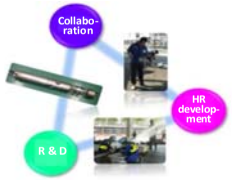
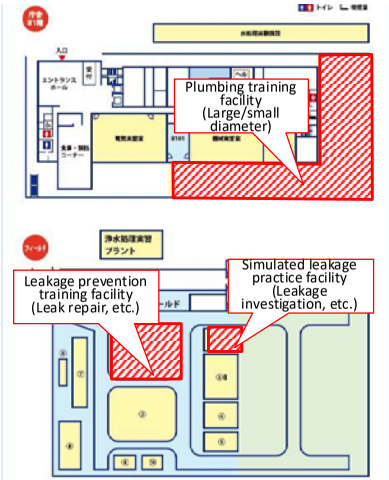
Securing high technical level ②

Training and Technical Development Center(1)



Government office building B1 Field



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Securing high technical level ③

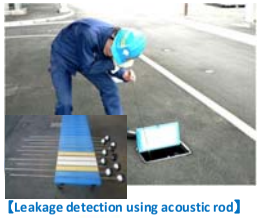
Training and Technical Development Center(2)

Training scenes and facilities

【Plumbing training for large bore diameter distribution pipes（φ500）】

【Plumbing training for small bore diameter distribution pipes（φ100）】

【Temporary repair by splitting the swivel joint ring of leak point】



【Leakage detection using acoustic rod】

【Minimum flow measuring method】

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Securing high technical level ④

Training system

- Bureau training
  - Stratified training — Acquire commonly-required knowledge, etc.
  - Practical training — Acquire knowledge/techniques and skills required for the set target level
  - Topic-based training — Understanding of important issues in the metropolitan government/bureau projects
  - Instructor training — Acquisition of skills necessary for instructors and highly professional training
  - Dispatch training — Conducted by dispatching trainees to private training institutions, etc. in acquiring expertise, techniques, etc.
- Workplace training — Conducted by supervisors, etc. at workplace
- Self-training — Conducted during off-duty hours by staff to improve their job performance skills
- Commissioned training
  - Central training — Consigned to the General Affairs Bureau to conduct
  - Other bureaus' training — Consigned to other bureaus to conduct

Practical training

Category		Training name
Newly-appointed	Common	Basic waterworks
		· · ·
	Water quality	Basic water quality control
Elementary	Facility development	Practical pipeline designing
		Practical structure designing
		· · ·
	Maintenance	Water distribution adjustment Ⅰ
		Pipeline maintenance Ⅰ
		· · ·
	Water purification	Water treatment technique
		Practical water treatment training Ⅰ
		· · ·
		· · ·
	Leakage prevention	Leakage prevention Ⅰ
		Leakage prevention planning work (process management)
		Response to sudden accident (pipeline)
	Water supply	Outline of Water Supply Section
		Water supply equipment Ⅰ
Intermediate	Facility development	Water facility planning
	Maintenance	Practical construction supervision
		Pipeline maintenance Ⅱ
		· · ·
		· · ·
	Leakage prevention	Leakage prevention Ⅱ
	Water supply equipment	

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Securing high technical level ⑤

Trainings regarding leakage prevention

Category		Training name	Training objectives	Training subjects	Targets	Days
Elementary	Leakage prevention	Leakage prevention Ⅰ	・Learn the techniques of work and repair relating to water leakage ・Learn the handling of equipment	Leakage detection technique Meter replacement and opening Buried pipe detecting technique Leakage repair technique Minimum flow measurement method and simple water quality inspection method	Newly-appointed/transferred staff	2
		Leakage prevention planning work	The efficient operation of leakage prevention planning work and the advancement in knowledge	Leakage detection technique Meter replacement and opening Buried pipe detecting technique Leakage repair technique Minimum flow measurement method and simple water quality inspection method	Staff engaged in planning work	0.5
		Response to sudden accident (pipeline)	Learn the techniques needed for appropriate response at the time of sudden accident	Initial response Information communication Case study How to prepare reports Accident response rules	Newly-appointed/transferred staff	0.5
	Water supply equipment	Outline of Water Supply Section	Acquire the knowledge necessary for the services of Water Supply Section to improve practical capability	Outline of water supply equipment Outline of water supply equipment construction work Basic knowledge on waterworks meter Outline of leakage prevention	Newly-appointed/transferred staff	0.5
Intermediate	Leakage prevention	Leakage prevention Ⅱ	Conduct exercises of voluntary leakage detection works (presupposing the understanding of the structure and principle of leakage prevention equipment)	Minimum flow measurement Buried pipe detecting technique Correlated leakage detection technique Leakage detection technique (sound listening rod/electronic type) Air valve leakage repair Main valve packing replacement	Those who completed Leakage prevention Ⅰ	1

Acquisition of different knowledge/techniques depending on training targets

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Securing high technical level ⑥

Tokyo Waterworks Technology Experts/super plumbers

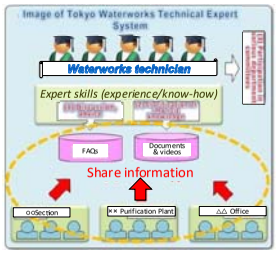
～Activities of Experts～

① Instructions and advices to staff
In response to the job-related consultations by staff including those of other divisions, give instructions and advices.

② Implicit knowledge to explicit knowledge
Transform implicit knowledge including experiences/knowhow to explicit knowledge so that staff can utilize it.

③ Participation in various investigative commissions
Responding to requests from various divisions, participate in various investigative commissions as an advisor.

Area	Main topics	Job type	No. of certified persons
Design and construction management	Techniques regarding the design/construction management, etc. of purification plants/water supply stations/pipelines, etc.	Civil engineering	10
		Electrical	3
		Mechanical	3
Water purification	Techniques regarding maintenance, etc. of purification plants	Civil engineering	4
		Electrical	2
		Mechanical	3
Water distribution	Techniques regarding water distribution adjustment and maintenance, etc. of pipelines	Civil engineering	14
Water supply	Techniques regarding leakage prevention and water supply equipment, etc.	Civil engineering	10
		Mechanical	1
Water operation	Techniques regarding wide-range water operation plan and local water operation plans in wards/Tama, etc.	Civil engineering	5
Water quality	Techniques regarding water quality control and water quality inspection, etc.	Environmental	7
Water resource management	Techniques regarding maintenance, etc. of dams and water resource forest	Civil engineering	2
		Forestry	2
Building and repairs	Techniques regarding design/construction management, etc. of architecture/facilities incidental to the architecture	Mechanical	1
		Architecture	1
Total			68



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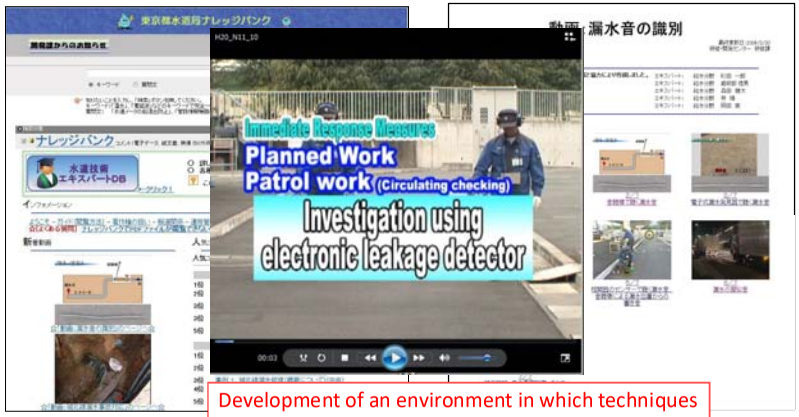
Securing high technical level ⑦

Knowledge bank



Development of an environment in which techniques can be easily passed on from veteran staff

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In Advancing the Non-Revenue Water Countermeasures

● **About the outline of leakage prevention and the works of relevant departments**
- Know the causes of leakage and the weakness of pipelines
- Continuous efforts are required as leakage reverts
- Allocation of roles between the main office and outpost agencies

● **About the leakage prevention works**
- Planned replacement of pipelines
- Develop compartments in pipe network and carry out measurement in a planned manner
- Many leakage cases are attributable to service pipes
- Requires development of drawings which show the conditions of pipeline

● **About the handing-down of techniques**
- Acquisition of different knowledge/techniques depending on training targets
- Development of an environment in which techniques can be easily passed on from veteran staff

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Reference data
（The method of leakage investigation）

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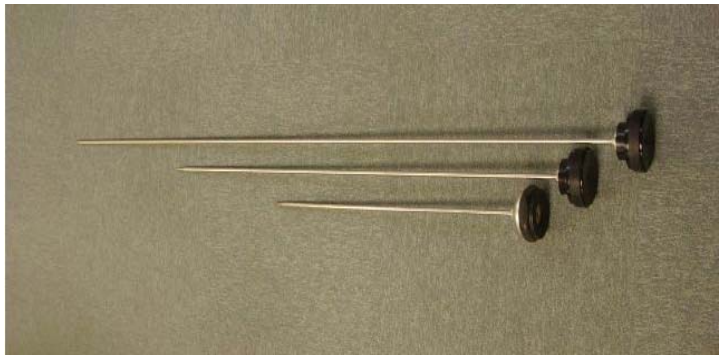
Leakage Detection Measures①

Acoustic rod



Acoustic rod

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Leakage Detection Measures ②

Electronic leakage detector

Electronic leakage detector

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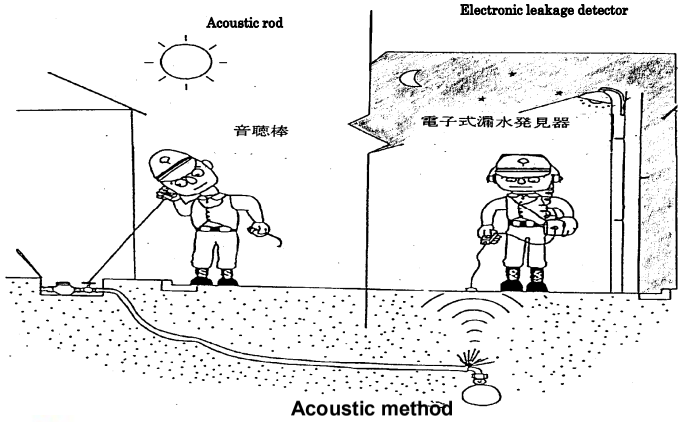
Leakage Detection Measures ③

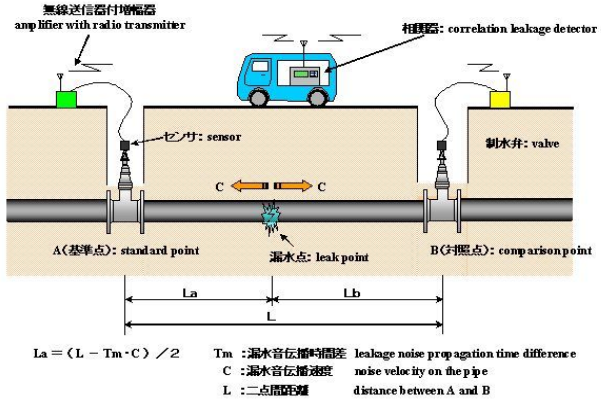
Acoustic method



Acoustic method

Leakage Detection Measures ④

Correlation method(1)



La＝(L − Tm･C) ／2　Tm ：漏水音伝播時間差 leakage noise propagation time difference
C ：漏水音伝播速度 noise velocity on the pipe
L ：二点間距離 distance between A and B

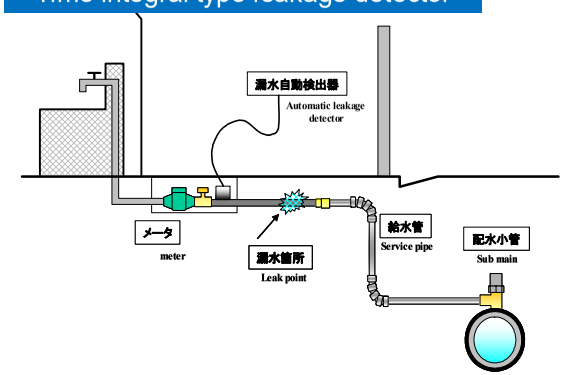
Leakage Detection Measures ⑤

Correlation method(2)

Correlation type leakage detector

Leakage Detection Measures ⑥

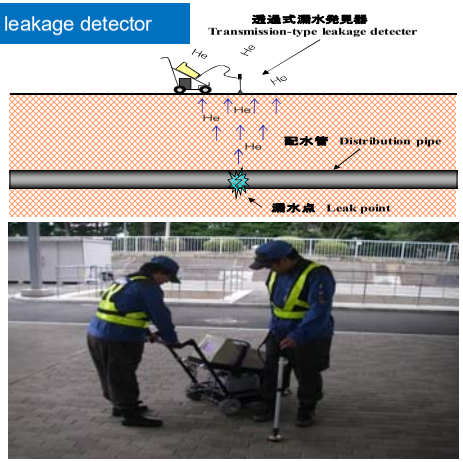
Time integral type leakage detector



Time integral type leakage detector

Leakage Detection Measures ⑦

Transmission type leakage detector



Transmission type leakage detector

Leakage Detection Measures ⑧

Metal pipe locator

Metal pipe locator

Leakage Detection Measures ⑨

Water hammer Generator

Water hammer Generator

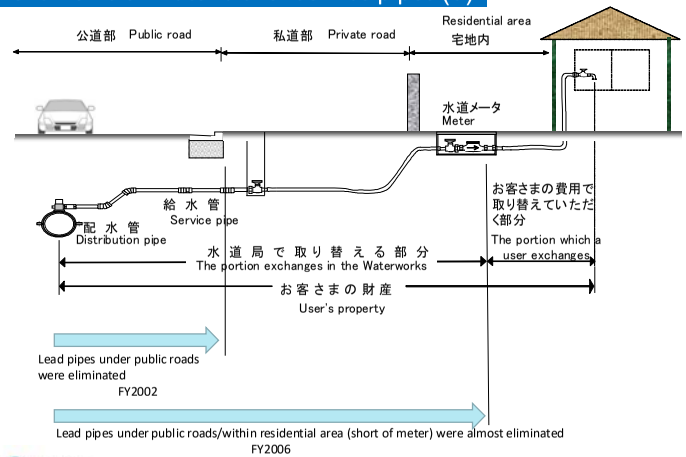
Effect of Leakage Prevention

Year	Leakage rate	Distribution reduction amount (m^3/year)	CO_2 emission reduction amount (m^3/year)	CO_2 Conversion into number of vehicles
1980 ↓ 2011	15% ↓ 3 %	240,800,000	53,700	22,900

Distribution reduction amount : Difference between actual distribution amount and hypothetical distribution amount in case the leakage rate was set as 15 % in 2011

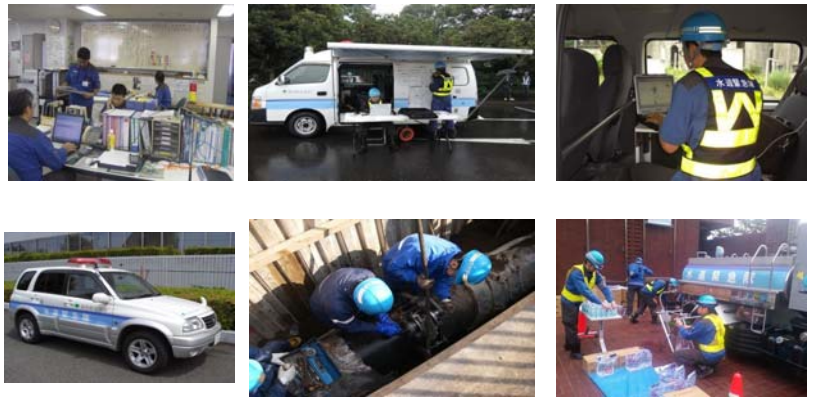
Planned replacement of water pipes and improvement of materials for pipes ⑥

Improvement works of materials for service pipes (3)



Organizations Engaged in Leakage Prevention

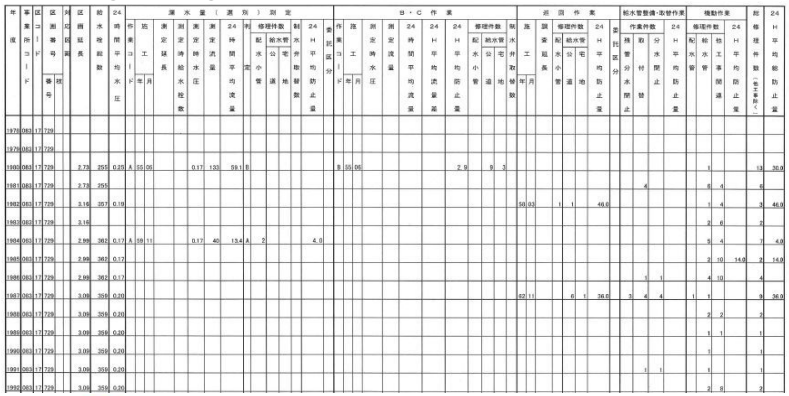
Waterworks Emergency Service Unit



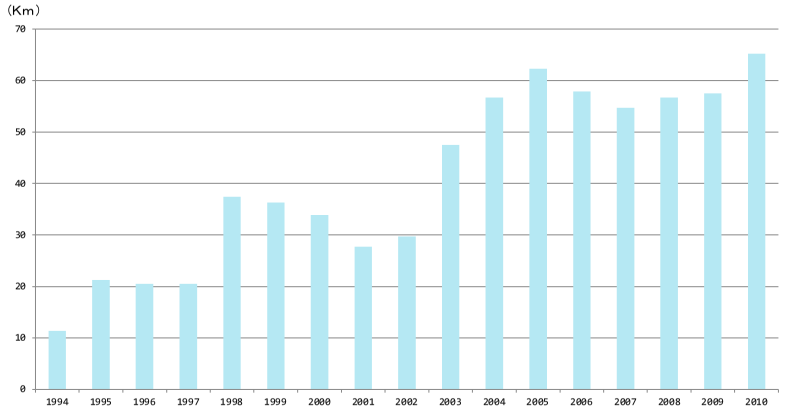
Skill of leakage detection / Early repair work

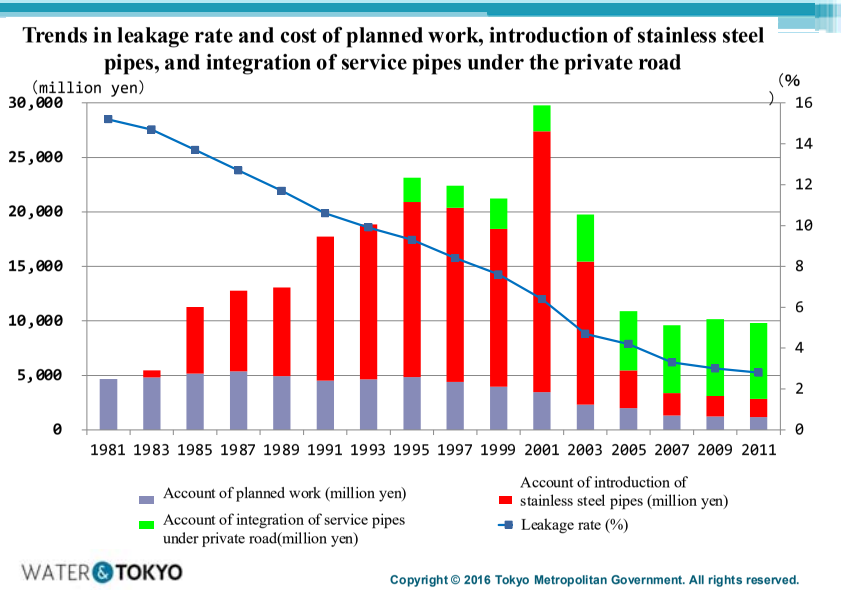
Planned work

Area management ledger



Total Length of integration of service pipes under the private road

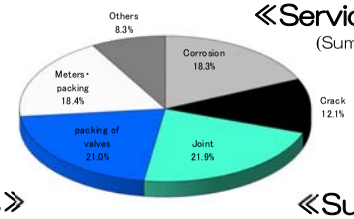




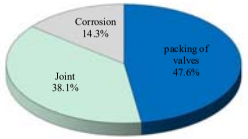
Breakdown of leakage cause

【By cause】

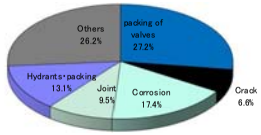
≪Service Pipe≫
(Sum:8,811)



≪Mains≫
(Sum：40)



≪Submains≫
(Sum:355)



7. MEASURES AGAINST LEAKAGE

~DISTRIBUTION PIPES & WATER SUPPLY EQUIPMENT~

Contents

153

LEAKAGE CASES

on distribution pipe
on water supply equipment

154

Leakage on distribution pipes

Other construction works

Φ500mm DIP on flexible pipe

Φ200mm DIP on pipe

155

Leakage on distribution pipes

Improper work

Φ250mm MLDP at joint

Corrosion

Φ500mm DIP on pipe

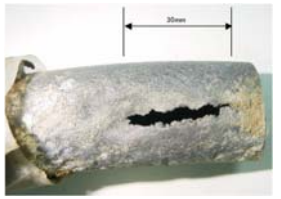
156

Leakage on water supply equipment

Φ25mm PP

Valve gland

Φ20mm LP



Meter union

Leakage on water supply equipment

Φ150mm DIP

Polyvinyl chloride pipe

What do you think about causes of leakage?

Causes of leakage

Other construction works	• Informed other constructor about pipe location?
Improper work	• Taught workers right joint method? • Selected diameter & materials properly?
Aging & corrosion	• Considered prioritization of pipe replacement?
Unsystematic development	• Implemented projects based on plans? • Designed based on criteria, guideline and standard?
Not implemented maintenance works	• Managed pipe information? • Adjusted water pressure? • Implemented leak detection systematically? • Found leakage immediately? • Prepared repair materials?

MEASURES AGAINST LEAKAGE

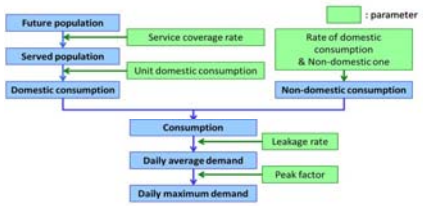
Planning stage
Design stage
Procurement stage
Construction stage
Maintenance stage

Planning stage

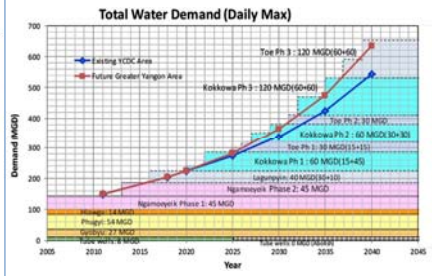
Water demand & source development plan

(source: JICA M/P in 2014)

Procedure of water demand estimation



Staged water source development plan

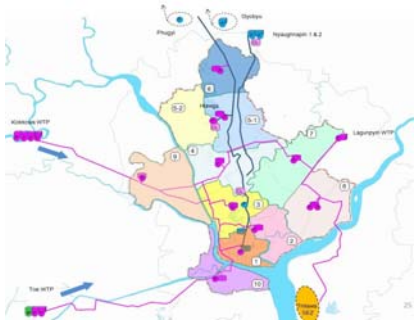


Planning stage

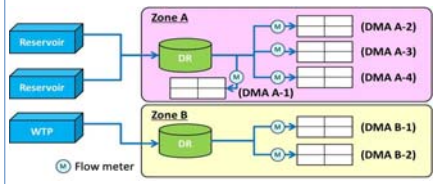
Systematic facility development plan

(source: JICA M/P in 2014)

Water supply system in 2040



Zoning & DMA system

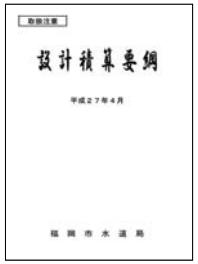


Design stage

Criteria, Guideline and Standard

Criteria
(for facilities design)
(for operation & maintenance)

Guideline of
design & estimation
(for distribution pipeline)

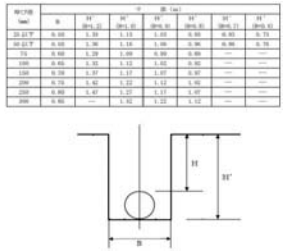


Standard of design &
construction management
(for water service equipment)

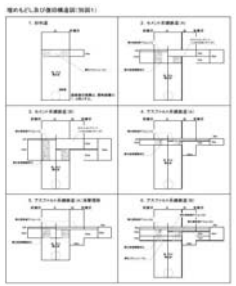
Design stage

Unified design

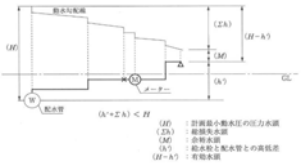
Excavation measurements
without sheet piles



Road structures



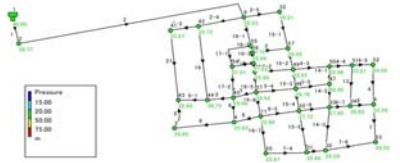
Meter size
(considering with head loss)



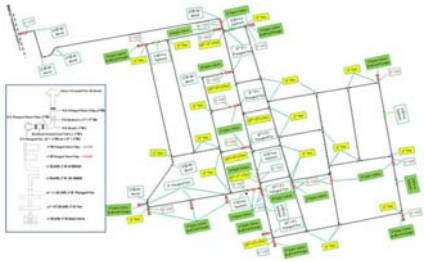
Design stage

Systematic design within DMA

Simulation with EPANET



Design drawing

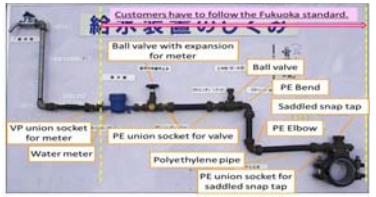


Valve installation plan

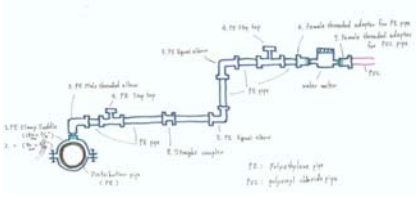
Design stage

Plumbing model of water service equipment

Fukuoka case



Proposal for YCDC



Plumbing route from saddle snap tap to meter

< Case 1 >

< Case 2 >

Procurement stage

Selection of materials

Materials used in YCDC

Specifications of water meter
(ISO 4064:2005)

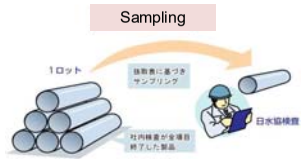
Specifications of HDPE pipe
(ISO 4427)

Procurement stage

Inspection of ordered materials

JWWA inspection

Sampling



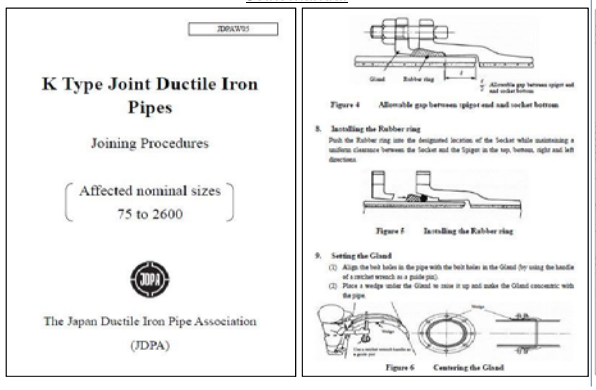
All process

Waterworks inspection

Construction stage

Construction manuals

Joint manual



Check sheet

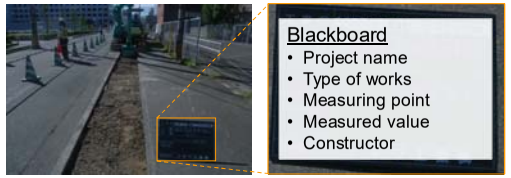
Construction stage

Construction supervision

Standard of construction supervision

Progress control management

Photo management



Construction stage

Tools

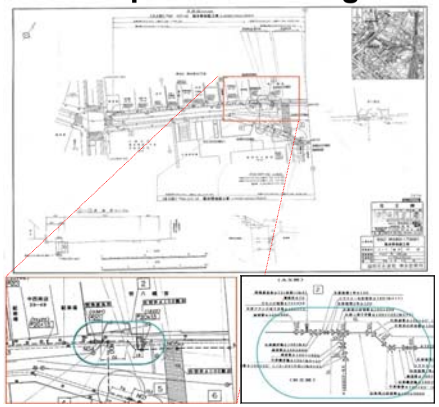
Licensed plumber

- Jointing distribution pipes
- Plumbing water service equipment

Construction stage

Pressure test

Completion drawing



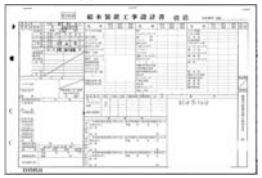
Maintenance stage

Mapping system

Main information
(diameter, type, installed year)

Completion drawing

Application form



Water suspension area

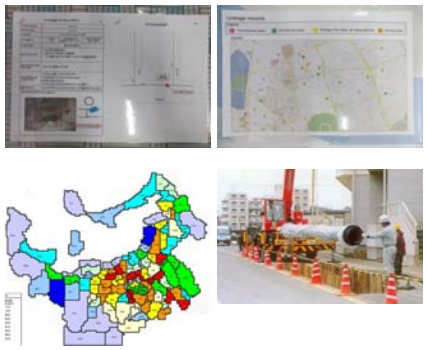
Maintenance stage

Leak detection

Repair of leakage

Maintenance stage

Aging pipe replacement

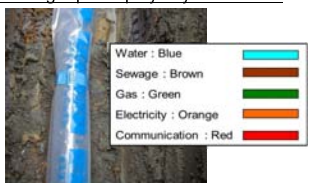


Inspection & cleaning

Others

Announcement

Marking tape on polyethylene sleeve



Sign sheet

Pamphlet for preventing accidents
by other constructors

Others

Capacity development

Fukuoka City Waterworks
Technical training institute

Measures against leakage

Stage	Measures
Planning	• Water demand & source development plan • Systematic facility development plan
Design	• Criteria, Guideline and Standard • Unified design • Systematic design within DMA • Plumbing model of water service equipment
Procurement	• Selection of materials • Inspection of ordered materials
Construction	• Construction manuals • Construction supervision • Tools & Licensed plumber • Pressure test & Completion drawing
Maintenance	• Mapping system • Leak detection & repair • Aging pipe replacement and Inspection & cleaning
Others	• Announcement • Capacity development

CONCLUSION

Conclusion
Implementation

Conclusion

V: Measures of each stage will solve the cause.

Stage \ Causes	Unsystematic development	Improper work	Not implemented maintenance works	Aging & corrosion	Other construction works
Planning	V				
Design	V	V	V	V	
Procurement		V	V		
Construction		V	V	V	
Maintenance			V	V	V
Others	V	V	V	V	V

အတူတူကြိုးစားမယ်။

Implementation

Stage	Measures
Planning	• Water demand & source development plan
D	
Procurement	• Selection of materials • Inspection of ordered materials
C	
M	• Aging pipe replacement and inspection & cleaning
Others	• Announcement • Capacity development

- **Which measures can you implement by yourselves?**
- **And which ones do you request assistance from JICA team?**

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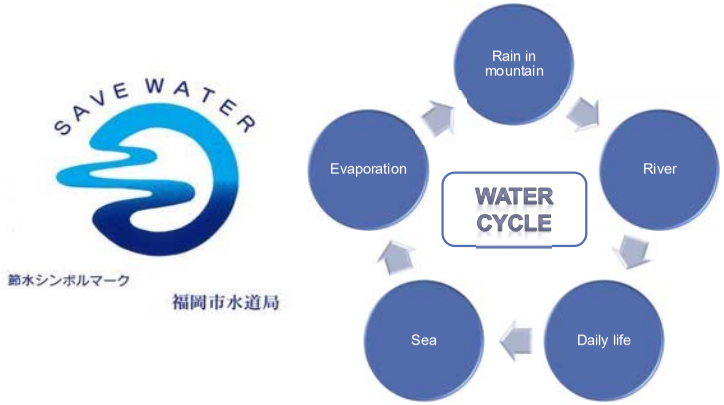
8. MEASURES AGAINST NON-PHYSICAL LOSSES IN FUKUOKA CITY

SYMBOL MARK



FUKU-CHAN

Mascot character of Fukuoka City Waterworks Bureau from 1995

- The 4th grader of elementary school (10 years old)
- It is used for public relations.

185

CONTENTS

186

1. CURRENT STATE IN FUKUOKA

1) Water charge collection system
2) Billing methods
3) License of service installation works
4) Customer call center

187

1) WATER CHARGE COLLECTION SYSTEM

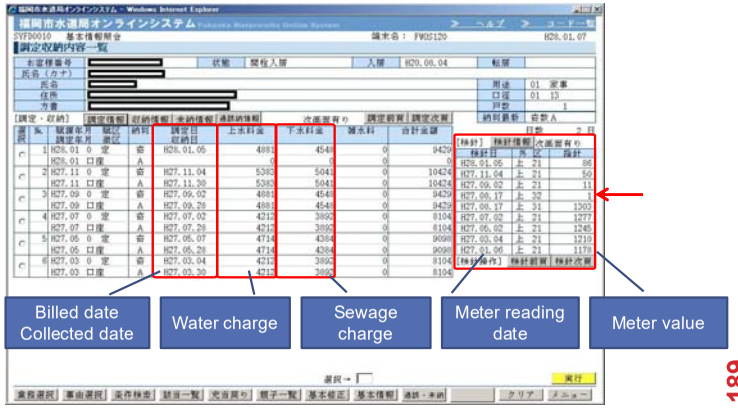
Handy terminal

- The system was installed in 1988 and handy terminals were also started using.
- The number of metering per staff a month has increased from 2,800 to 3,500.

188

1) WATER CHARGE COLLECTION SYSTEM

Contents



189

2) BILLING METHODS

3 billing methods

(1) Payment notification

(2) Account transfer

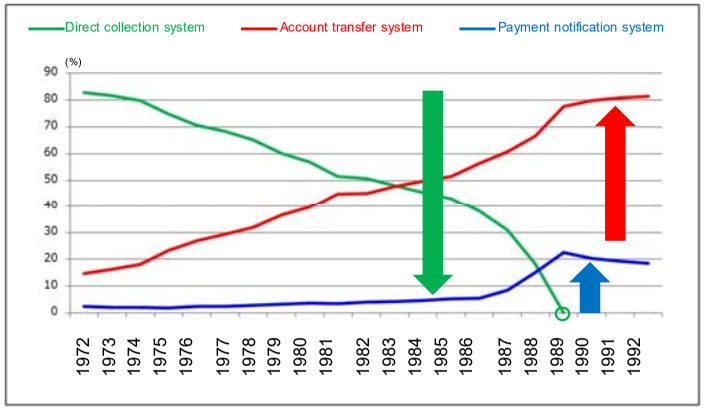
(3) Credit card

We promote (2) Account transfer system in terms of receipts rate and billing cost.

190

2) BILLING METHODS

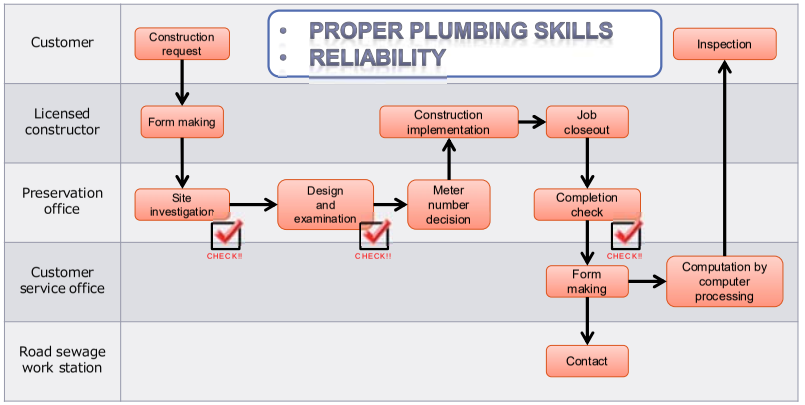
Ratio among billing methods



191

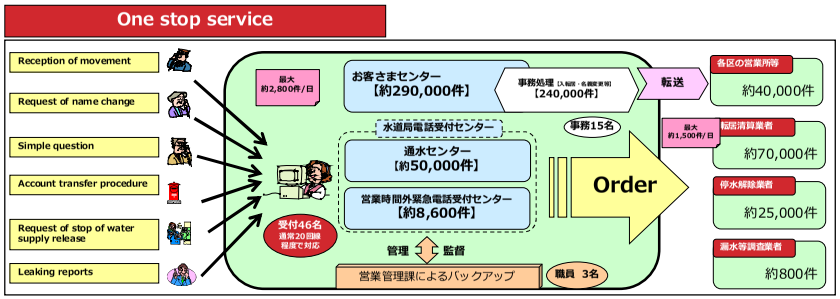
3) LICENSE OF SERVICE INSTALLATION WORKS

Procedure of new customer application



192

4) CUSTOMER CALL CENTER



The purpose of installation

Efficiency
① Clerical employee's concentration
② Operation by people
③ Systematization
④ Cost reduction

Service improvement
① One-stop-ization
② Improvement of the reply rate
③ Reception in a holiday

受付時間

お客さまセンター	平　日 土曜日	08：45～17：30 09：00～17：00
通水センター	平　日 土日祝	09：00～20：00 09：00～17：00
営業時間外緊急電話受付センター	平　日 土日祝	17：30～08：45 08：45～08：45

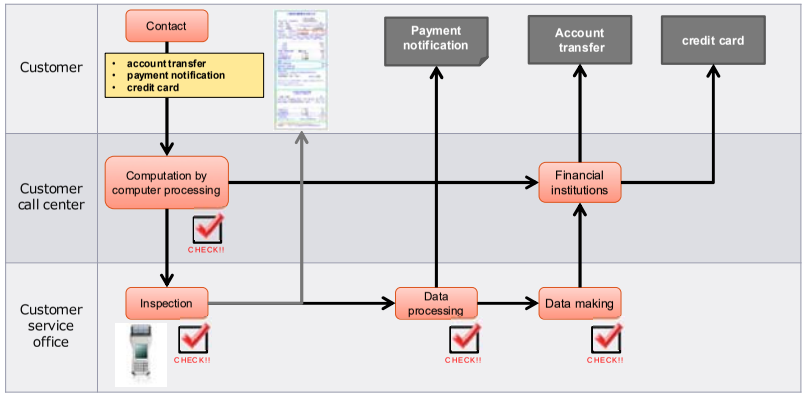
※　最大40回線で電話受付可能。　着信状況により回線数を調整。

2. IMPORTANCE OF WATER CHARGE COLLECTION

1) **Procedure of water charge collection**
2) **Intervals & metering errors**
3) **Water suspension for nonpayment customers**
4) **Manuals**

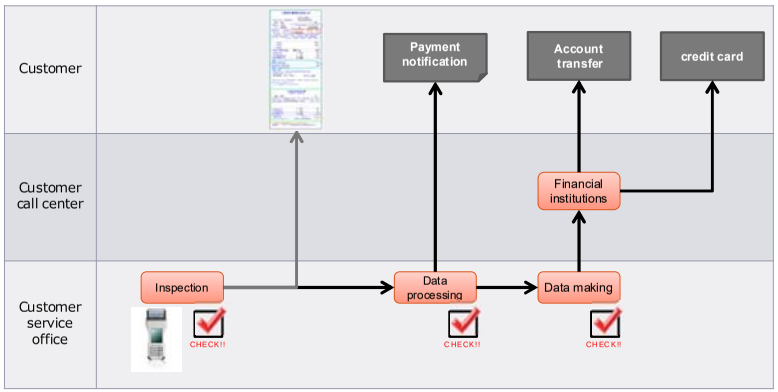
1) PROCEDURE OF WATER CHARGE COLLECTION

At the first time



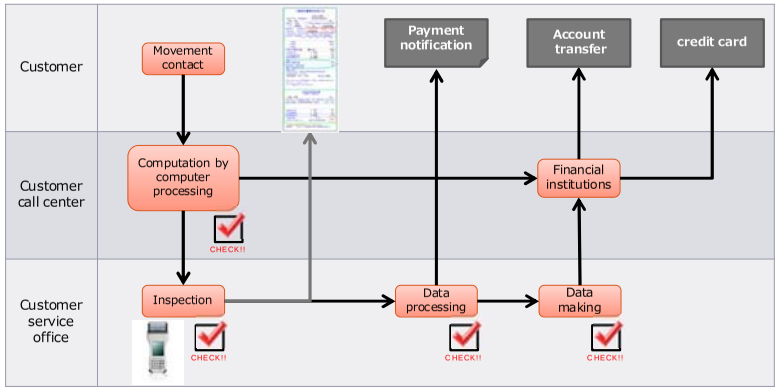
1) PROCEDURE OF WATER CHARGE COLLECTION

After 2nd time



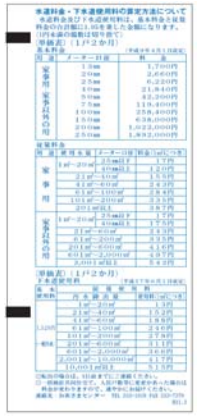
1) PROCEDURE OF WATER CHARGE COLLECTION

At the last time (when customer moves)



1) PROCEDURE OF WATER CHARGE COLLECTION

Handy terminal & notification of water consumption



Customer number

Metering day (Previous / Current)

Billing method / Deadline

Interval of metering days/ Water consumption

Water charge / Sewage charge

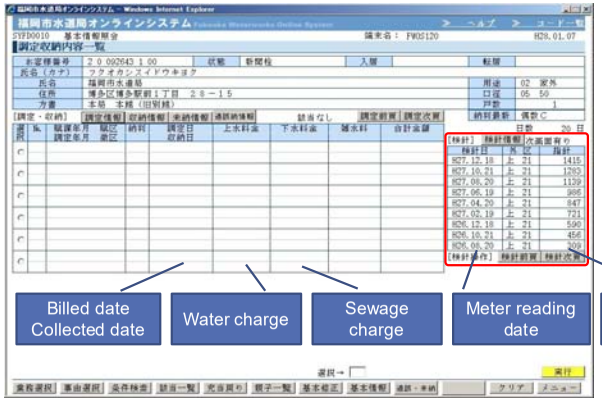
Previous water consumption
(Last time / Same month last year)

Service office phone number/Staff number

Receipt of last time

1) PROCEDURE OF WATER CHARGE COLLECTION

Sample: Head office of waterworks bureau

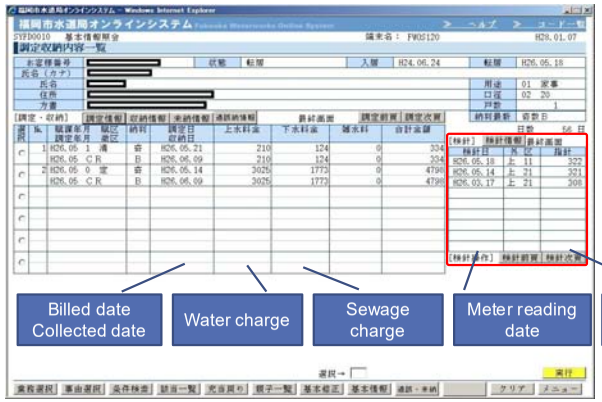


Meters are installed on all connections including ones for the waterworks bureau.

1) PROCEDURE OF WATER CHARGE COLLECTION

Sample of customer move

It is necessary to settle the charges when customers move.



201

2) INTERVALS & METERING ERRORS

Intervals of metering

Frequency	Customers
Once 2 months	Basically all customers
Monthly	Customers who have 50mm and over, and who ask the bureau to bill once a month
Anytime	For settlement of move

202

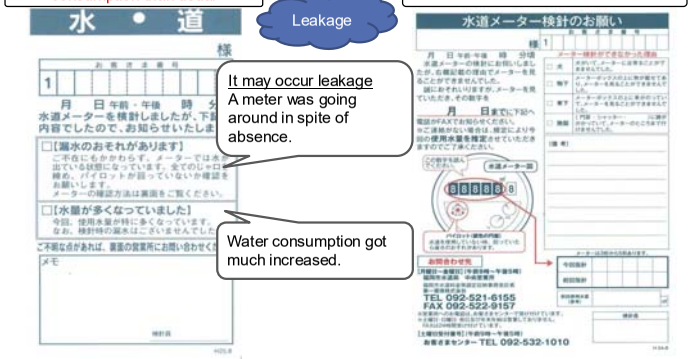
2) INTERVALS & METERING ERRORS

Announcement to customers

In case of much more water consumption than usual

Leakage

In case of impossible metering



It may occur leakage
A meter was going around in spite of absence.

Water consumption got much increased.

203

2) INTERVALS & METERING ERRORS

Standard of investigation

Why can we notice possibilities of leakages?

(a) Too big

current consumption
>= **150%** x one on same month in last year

(b) Too small

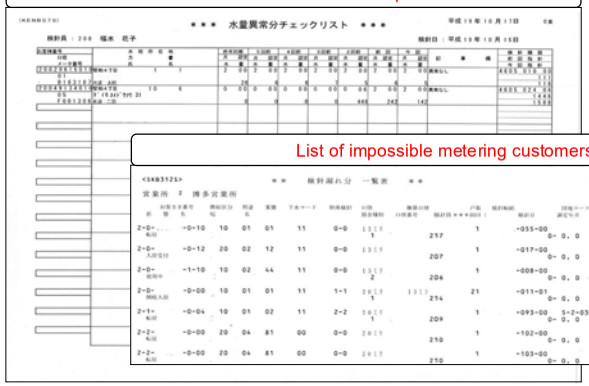
current consumption
<= **50%** x one on same month in last year

204

2) INTERVALS & METERING ERRORS

Lists of the customers

List of abnormal water consumption



List of impossible metering customers

3) WATER SUSPENSION FOR NONPAYMENT CUSTOMERS

Procedure

Notification → Deadline → Pressing → Deadline → Notification of suspension → Water suspension

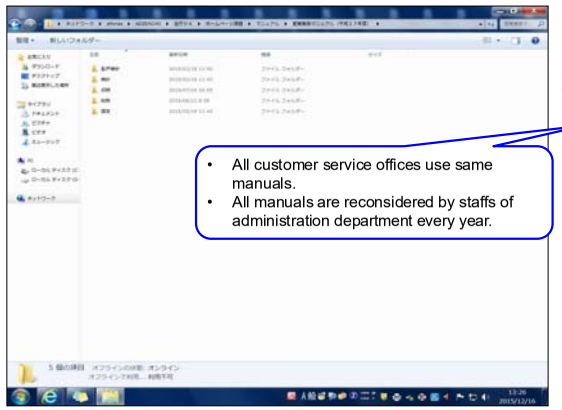
Customer	Settlement	Payment notification	Deadline	Pressing notification	Deadline of pressing	Suspension notification	Deadline of suspension notification	Suspended date	Date of finished suspension
A		04/13	04/28	05/10	05/18	05/28	06/07		
B		04/23	05/08	05/20	05/28	06/08	06/17		
C		05/01	05/18	05/29	06/08	06/18	06/27		

3) WATER SUSPENSION FOR NONPAYMENT CUSTOMERS

Record of payment

4) MANUALS

Manuals for water charge collection

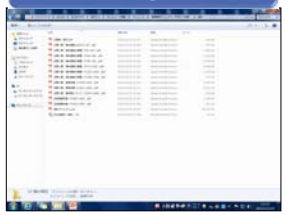


- All customer service offices use same manuals.
- All manuals are reconsidered by staffs of administration department every year.

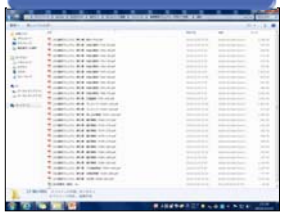
4) MANUALS

A lot of pages on our manuals

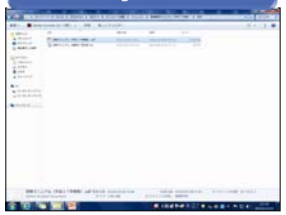
330 pages
on the metering manual



300 pages
on the settlement manual



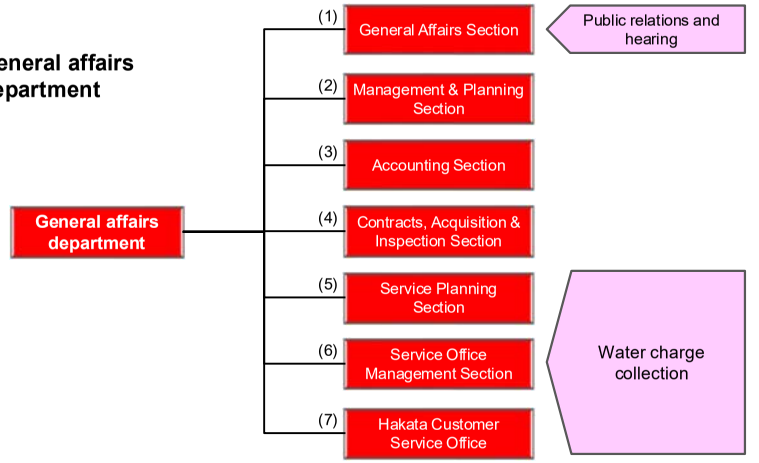
177 pages
on the billing manual



209

4) MANUALS

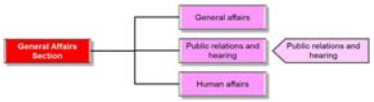
General affairs department



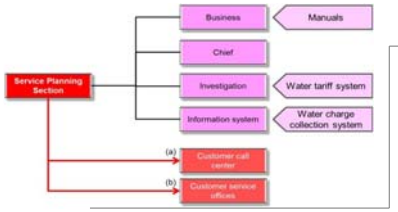
210

4) MANUALS

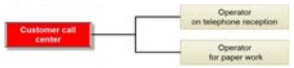
(1) General Affairs Section



(5) Service Planning Section

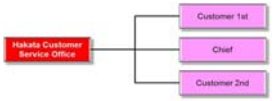


(5) (a) Customer call center

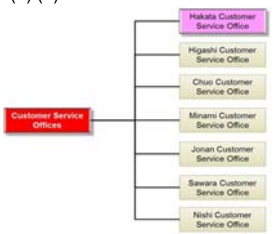


(6) Service Office Management Section

(7) Hakata Customer Service Office



(5) (b) Customer Service Offices



211

3. IMPORTANCE OF PUBLIC RELATIONS

1) **Experience of a failure**
2) **Public relations**

212

1) EXPERIENCE OF A FAILURE

Metering cycle

Intervals	Cost of metering	Investigated leak amount	Water charge payment for customers
1 month	High	Little	Easy
2 months			
6 months	Low	Much	Difficult

213

2) PUBLIC RELATIONS

Homepage

214

2) PUBLIC RELATIONS

Public relations paper

215

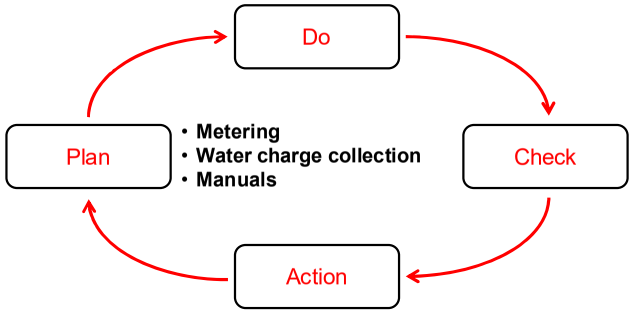
4. CONCLUSIONS

1) **Uniform works**
2) **Relationship with customers**

216

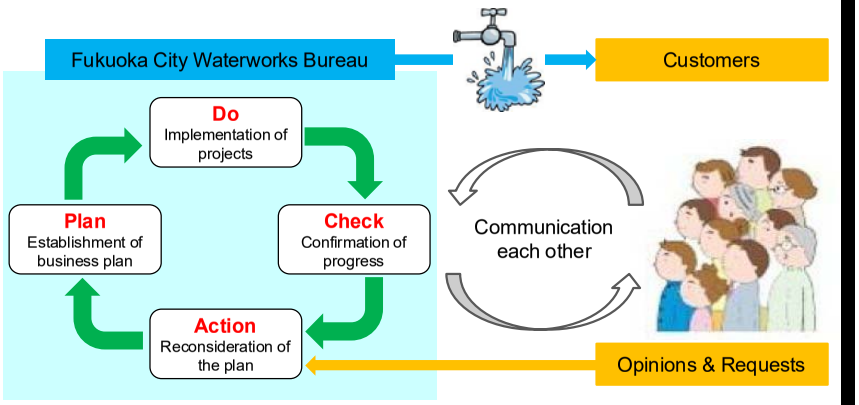
1) UNIFORM WORKS

I recommend that all township offices in YCDC should work uniformly.



217

2) RELATIONSHIP WITH CUSTOMERS



218

THANK YOU FOR YOUR KIND ATTENTION.

I believe YCDC will reduce Non-physical losses positively.

219

220

9. TRANSITION OF WATER QUALITY CONTROL & WATER PURIFICATION PROCESS

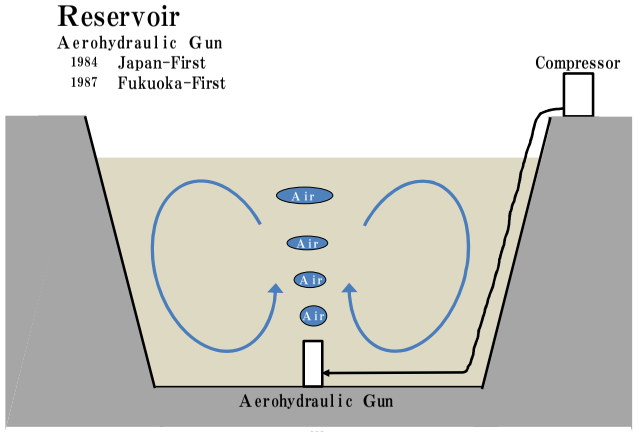
1 Deterioration of Water Source

- Drinking Water was Mainly Well Water
- Rapid Population Growth due to the Development of Civilization
- Sewage Contamination which led to the Deterioration of Water Source

Item	The World	Japan	Fukouka City
Cholera	1817 Cholera Outbreak (7 Times)	1858 Cholera Outbreak 1879 100,000 People or More Died of Cholera 1886 〃	1890 Cholera Outbreak
Modern Waterworks	1829 The First Modern Waterworks (Slow Sand Filter System)	1887 The First Modern Waterworks (Slow Sand Filter System)	1923 The First Water Purification Plant (Slow Sand Filter System)

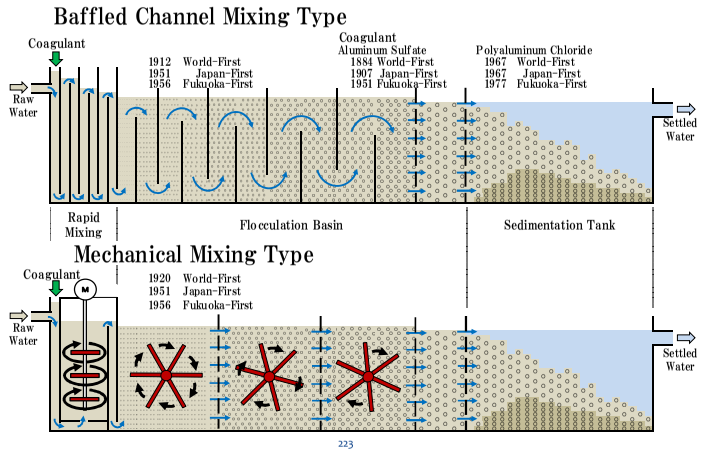
221

2 Water Resource



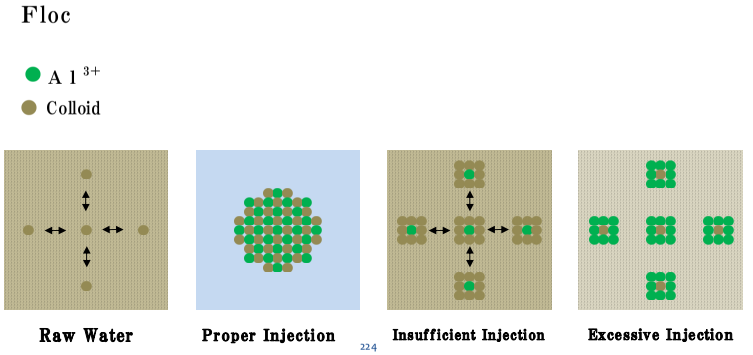
222

3 Mixing System & Sedimentation Tank



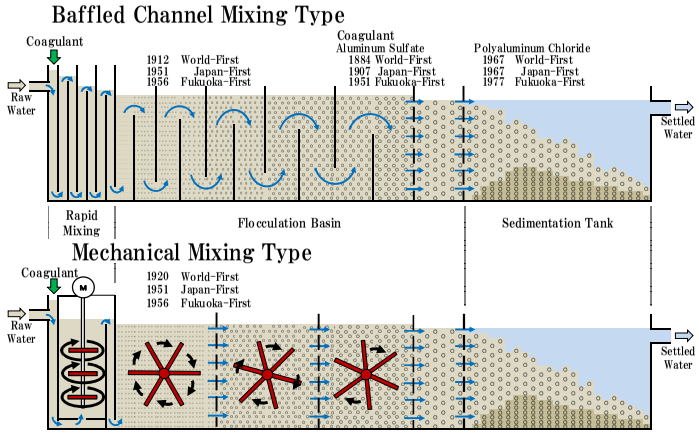
223

3 Mixing System & Sedimentation Tank



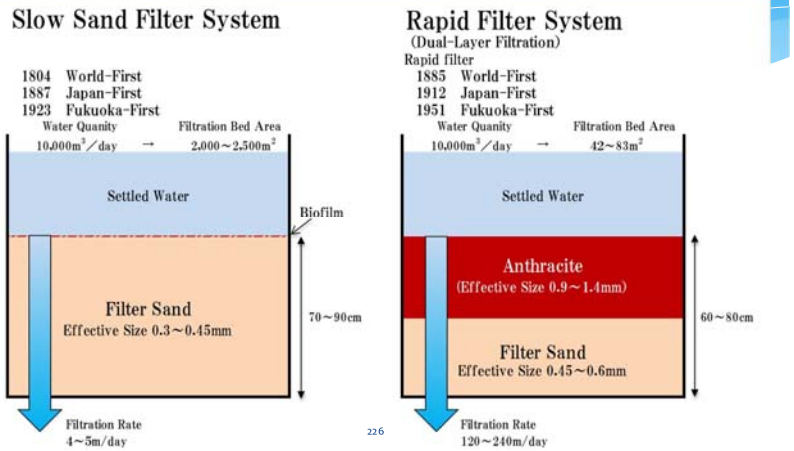
224

3 Mixing System & Sedimentation Tank



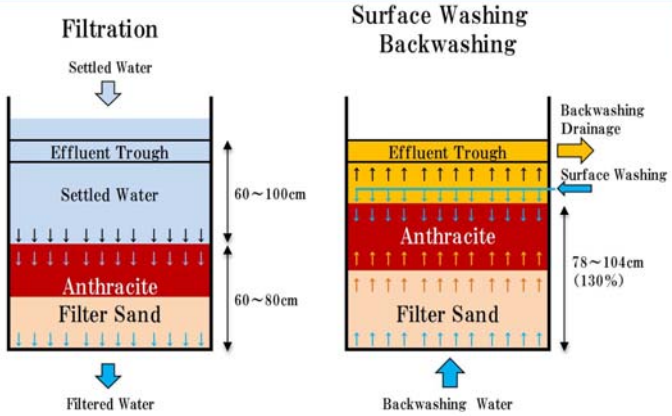
225

4 Filter System



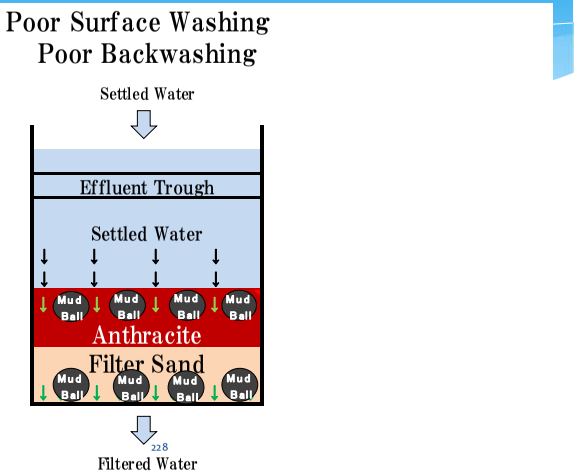
226

5 Dual-Layer Filtration System



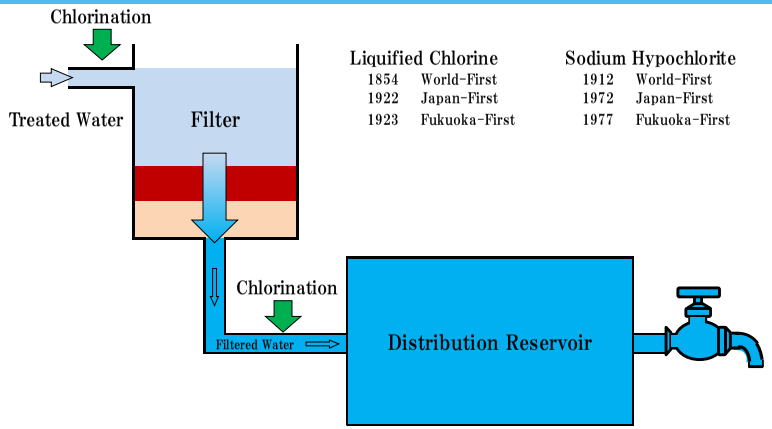
227

5 Dual-Layer Filtration System



228

6 Disinfection & Water Distribution



Liquified Chlorine		Sodium Hypochlorite	
1854	World-First	1912	World-First
1922	Japan-First	1972	Japan-First
1923	Fukuoka-First	1977	Fukuoka-First

229

7 Importance of Disinfection

To Supply Safe Drinking Water

- Make Sure to use Chlorine with Antimicrobial Property to Kill Disease-Causing Bacteria.
- Residual Chlorine Concentration prevents Bacterial Pollution during the Delivery and Distribution of Water, and inside the Water Pipe.

Chlorine Consumed in 1mg/l

- Iron → 0.64 mg/l
- Manganese → 1.29 mg/l
- Hydrogen Sulfide → 8.85 mg/l
- Ammonium Nitrogen → 7.6 mg/l
- Virus → more than 0.5 mg/l

※ Much More Consumed at High Temperature.

230

231

10. IMPORTANCE OF OPERATION & MAINTENANCE (O&M)

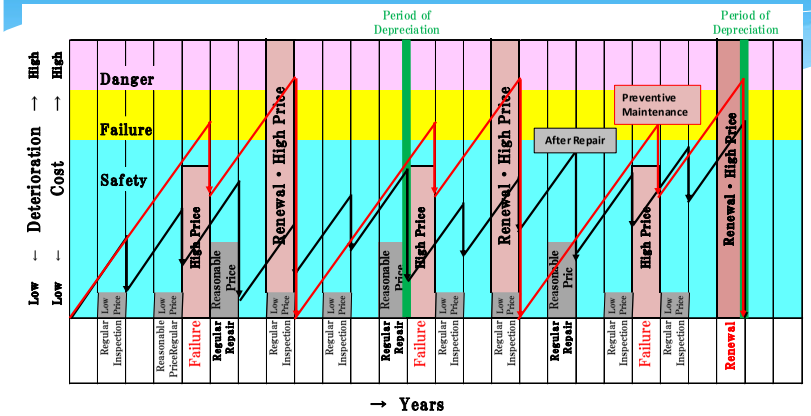
1 What is Preventive Maintenance?

Planned Inspection and Repair Prevent the Sudden Failure of Machinery. Preventive Maintenance also reduces Deterioration of Machinery, which lead to the Cut-Down of Operation and Maintenance cost.

Item	Contents	Stable Supply		Cost	
		Safety Factor	Repairperiod of Term	Life of a Machine	Repair Cost
Preventive Maintenance	Daily Inspection Regular Inspection Regular Repair ↓ Less Trouble	High	Short Term		Low Price ・ Reasonable Price
After Repair	Trouble ↓ Repair	Low	Long Term	Short Term	High Price

232

2 Importance of Preventive Maintenance



3 Contents of Preventive Maintenance

Item	Contents
Daily Inspection	Appearance, Vibration, Abnormal Sound , Abnormal Odor, Temperature, Damage, Water Leakage, Oil Leakage, Current Value, Pressure,etc
Regular Inspection	Cleaning , Function Test, Performance Test , Voltag Value, Insulation Resistance, Change of The Consumable Parts,etc
Regular Repair	Overhaul

4 Preventive Maintenance Cycle of Fukuoka City

Item	Regular Inspection	Regular Repair
Pumping Facility	As Necessary	8 years
Water Treatment Facilities	As Necessary	6 years
Disinfection Facilities	As Necessary	8 years
Chemical Feeding Facility	As Necessary	8 years
Non-Utility Generation Facility	2 Times a Year	14 years
Erectrical Facilities	3 Times a Year	12 years
Water Quality Meters	2 Times a Year	8 years

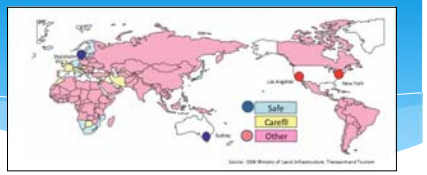
5 Period of Depreciation of Japan and Fukuoka City

Item	Period of Depreciation		B／A
	A Japan (Legal※)	B Fukuoka City (Target)	
Pumping Facility	15 years	30 years	**2.0**
Water Treatment Facilities	17 years	30 years	**1.8**
Disinfection Facilities	10 years	20 years	**2.0**
Chemical Feeding Facility	15 years	20～25 years	**1.3～1.7**
Non-Utility Generation Facility	15 years	25 years	**1.7**
Erectrical Facilities	20 years	23 years	**1.2**
Water Quality Meters	10 years	15 years	**1.5**

※from Ordinance for enforcement of the local public enterprise law

6 Summary

6 Summary



Water Purification Process Technology, Originally developed in the United States, United Kingdom and other Western Countries, is more or less well- established.

To ensure a stable supply of water, it is important to master techniques for Water Purification Process, Water Quality Control as well as Plant Maintenance.

It is said that throughout the World, there are only 15 Countries where people can drink safe tap water.

To work toward becoming the 16 th, let us sort out the problems together, work them out one by one.

11. DESIGN AND O&M OF WATER PURIFICATION FACILITY

Outline

Next

1 Design of Water purification

Next 241

1-1 Design Criteria & Case of Fukuoka city

Next 242

The Water Supply Law, that is the basic law for water supply

Water Supply Law（facility standards）

Article 5 The technological standards for water supply facilities shall be provided for by Ordinance of the Ministry of Health, Labour, and Welfare

⇩

The ministerial ordinance that establishes technical standards of water supply facilities

⇩ As an alternative to standards of waterworks facility

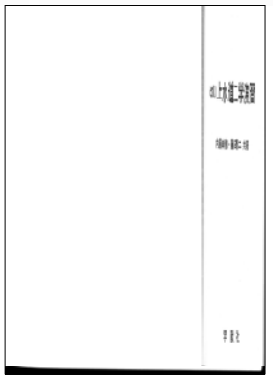
The Design Criteria for Water Supply Facilities

Next 243

other

Water supply engineering

Engineering exercises of Water supply



Next 244

Contents of The Design Criteria for Water Supply Facilities

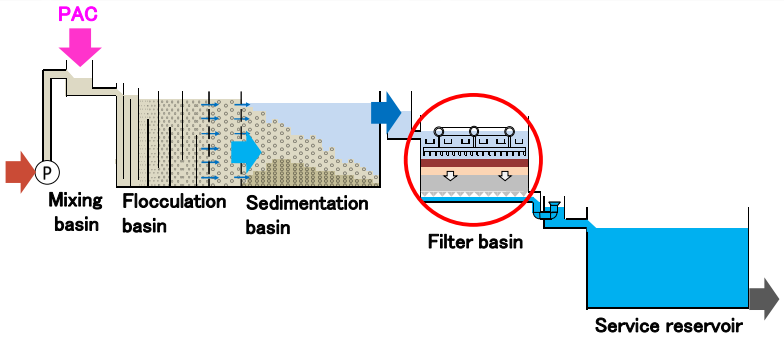
Next 245

Chapter 5. Water Treatment Facilities

Next 246

Rapid sand filters

Facilities flow



Next 247

Rapid sand filters

Filter basin (Double-layer)

items	Design Criteria	A WPP	B WPP	C WPP
number of units	more than two including the standby unit as the minimum	12	16	12
standby unit	one standby filter shall be provided for every 10 units	2	2	1
filter bed area per filte	150m2	100	73.44	120
filtration rate	120～240m/day	122	194	132

Next 248

Rapid sand filters

Filter basin (Double-layer)

items		Design Criteria	A WPP	B WPP	C WPP
anthracite	The standard depth	200～500mm	200	190	250
	density	1.4～1.6g/cm^3	1.47	1.43	—
	effective diameter	0.9～1.4mm	1.2	1.2	1.2
	uniformity coefficient	less than1.5	≦1.5	1.39	≦1.4
Filter sand	The standard depth of the sand bed	300～500mm	400	480	500
	density	2.57～2.67g/cm^3	2.63	2.64	—
	effective diameter	0.45～0.6mm	0.6	0.6	0.6
	uniformity coefficient	less than1.70 (1.3～1.6)	1.34	1.37	≦1.4
The total standard depth of the multi-media		600～800mm	600	670	750

Next 249

Rapid sand filters

Filter basin（Perforated block)

items		Design Criteria	A WPP	B WPP	C WPP
Filter grave	its depth	200mm	200	490	200
	density	not less than 2.50g/cm^3	2.62 ～2.67	2.53 ～2.65	—
	The standard depth of 1st layer	50mm	50	100	50
	The standard depth of 2st layer	50mm	50	100	50
	The standard depth of 3st layer	50mm	50	100	50
	The standard depth of 4st layer	50mm	50	100	50
	The standard depth of 5st layer			90	

Next 250

Rapid sand filters

Filter basin（Perforated block)

items		Design Criteria	A WPP	B WPP	C WPP
filter gravel	diameter of 1st layer	2～3.5mm	2～5	2～4	2～3.5
	diameter of 2st layer	3.5～7mm	5～10	5～10	3.5～7
	diameter of 3st layer	7～13mm	10～15	12～20	7～13
	diameter of 4st layer	13～20mm	15～20	20～30	13～20
	diameter of 5st layer			30～42	

Next 251

Rapid sand filters

Standard Wash water quantity etc.(fixed type)

items	Design Criteria	A WPP	B WPP	C WPP
water quantity of surface wash nozzles	0.15～0.2m^3/min•m^2	0.20	0.17	0.17
water quantity of backwash	0.6～0.9m^3/min•m^2	0.60	0.91	0.58
water duration of surface wash nozzles	4～6min	5	8	6
water duration of backwash	4～6min	5	6	8
washing duplication time	—	3	6	4

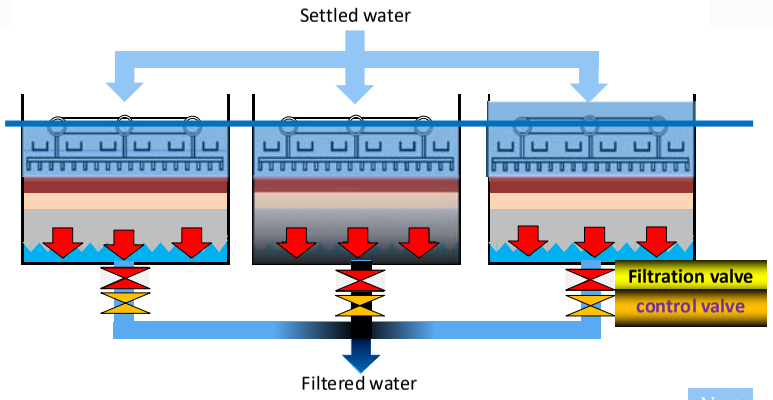
Next 252

1-2 An idea for problem & Improvement

Next

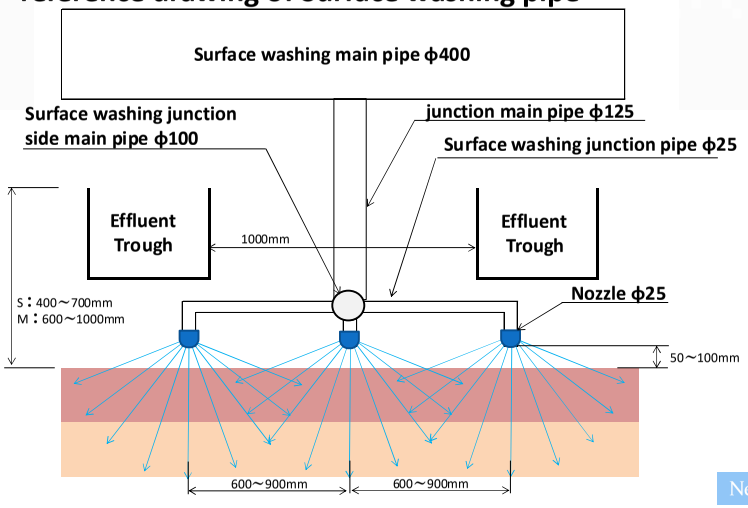
Rapid sand filters

Not adjusted of Filter basin water level



Next

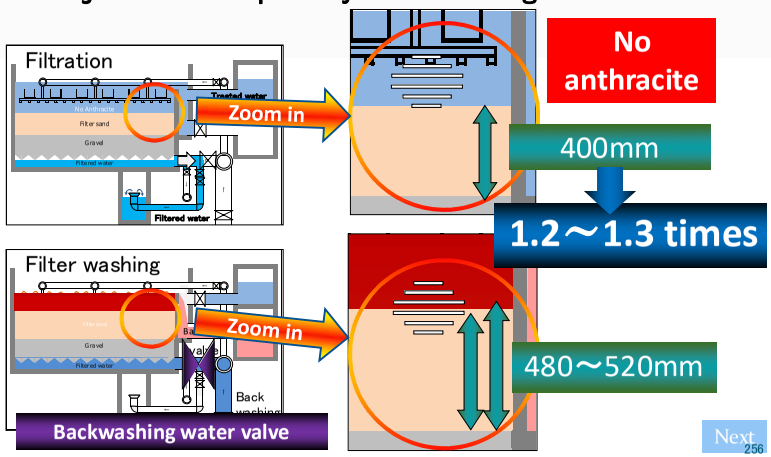
reference drawing of Surface washing pipe



Next

Rapid sand filters

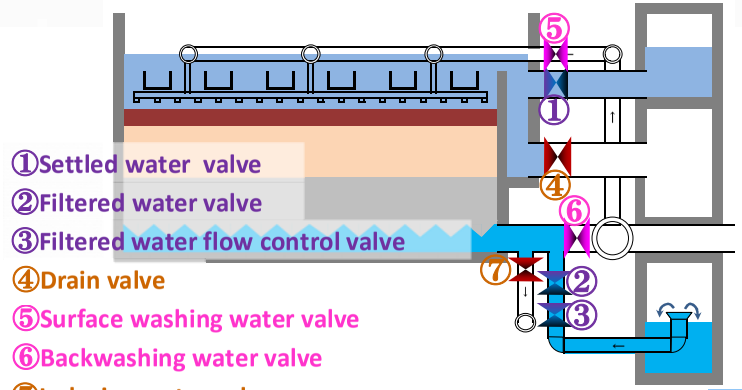
No adjustment of quantity Backwashing water



Next

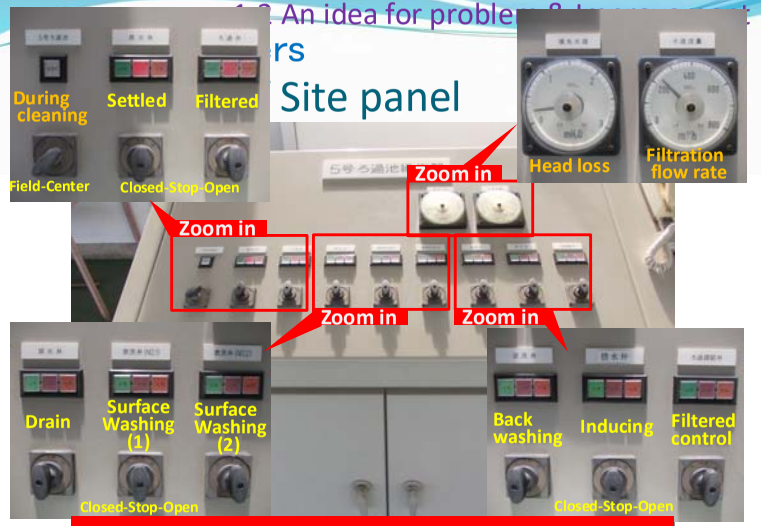
Rapid sand filters

Washing by manual operation



Next 257

Site panel



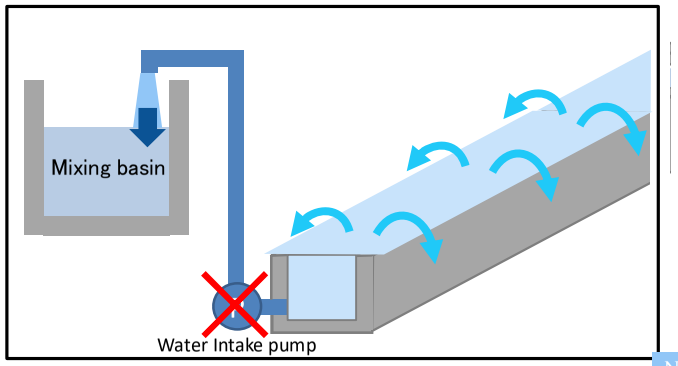
Inspect & Maintenance & system established

Next 258

An idea the Improved of Other facility

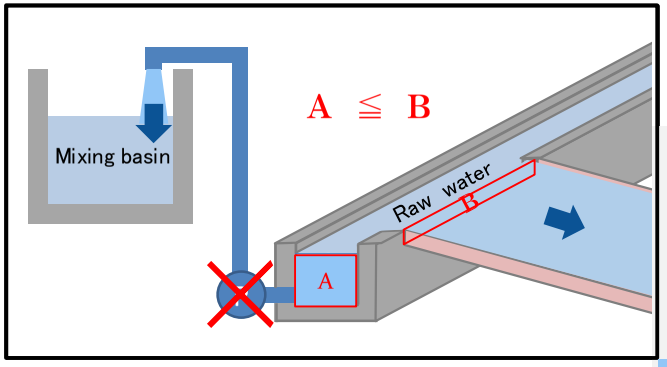
Next 259

Water Intake of raw water



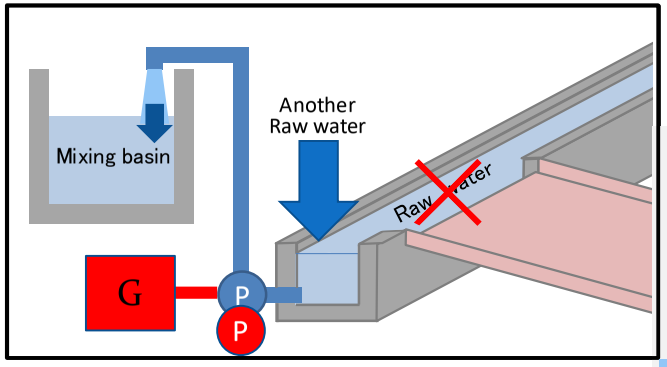
Next 260

Water Intake of raw water



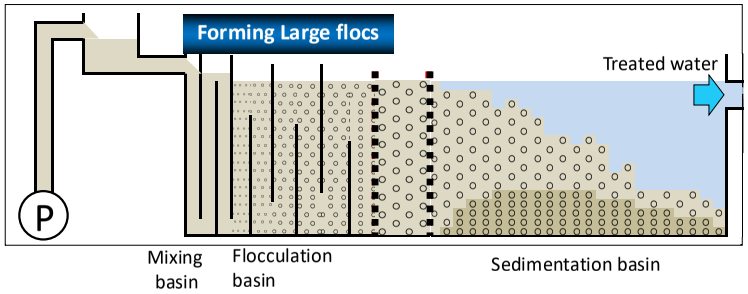
Next 261

Water Intake of raw water



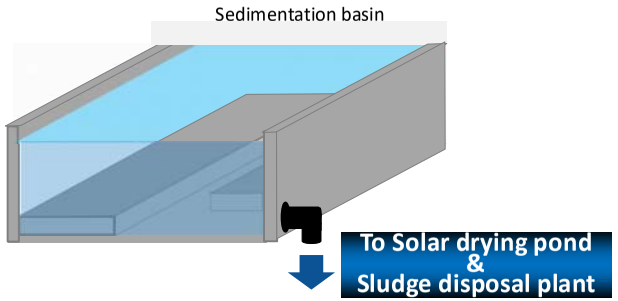
Next 262

Flocculation basin outlet



Next 263

Desludging of Sedimentation basin



Next 264

2 Operation and Maintenance

Next 265

2-1 Case of Water Supply Facilities Maintenance Manual

Next 266

Contents of The Water Supply Facilities Maintenance Manual

Chapter 1. Introduction
Chapter 2. Management for safety and health
Chapter 3. Disaster and Accident measures
Chapter 4. Water Intake Facilities
Chapter 5. Water Storage Facilities
Chapter 6. Raw Water Transmission Facilities

Next 267

Contents of The Water Supply Facilities Maintenance Manual

Chapter 7. Water Treatment Facilities
Chapter 8. Membrane filtration equipment and Seawater desalination facilities
Chapter 9. Treated Water Transmission and Distribution Facilities
Chapter 10. Water Service Fittings
Chapter 11. Mechanical and Electrical Equipment
Chapter 12. Instrumentation Equipment
Chapter 13. Water Quality Management

Next 268

Chapter 7. Water Treatment Facilities

Chapter 7. Water Treatment Facilities

7.6. Rapid sand filtration

Table 7.6.2 Examples of points of inspection of the filter

Daily inspection		Periodic inspection		Detailed inspection	
Cycle	Inspection contents	Cycle	Inspection contents	Cycle	Inspection contents
As needed	1.To confirm water level in the filter	2 to 6 months.	1.Inspection, cleaning of accretion on walls, troughs, wash waste water gutter	Situation as expanded filter layer does not Reach surface wash nozzles	1.Replenishment of filter sand (in the case of the filter with only sand)
Daily	2.To confirm filtration flow, filtration rate, head loss, filter run time	2 to 3 years	2.If there are cracks, impairment and leak from water-proof layer	20 – 50% reduction in filter layer thickness	2.Refilling of anthracite (in the case of multi-media filter)
Daily	3.To confirm filtered water Quality (turbidity,pH,alkalinity,residual chlorine etc.)	1 to 3 years	3.Study on filter layer (contamination of filter media, occurrence of mud balls, effective diameter, uniformity coefficient, filter layer thickness etc.)	10 to 15 years or effective diameter > 0.7 mm	3.Replacement of filter media

7.6. Rapid sand filtration

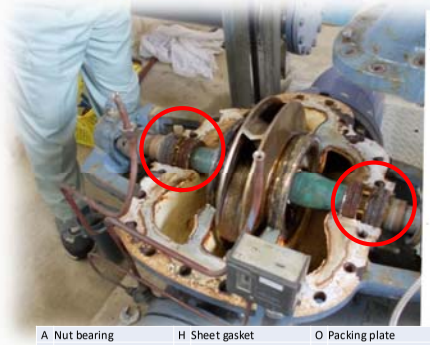
Table 7.6.3 Measures in abnormal cases in rapid sand filters

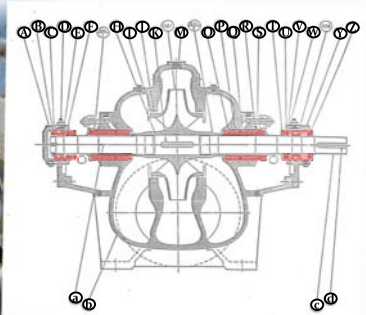
Abnormal event	Cause	Measure
Abnormal filtered water Quality Leak of turbidity matters	Insufficient coagulant	Additional dose of coagulant
	Improper cleaning	Improvement of cleaning method
	Filtration under negative head loss	Shortening of interval of cleaning
	Abnormal filter	Upkeep of filter layer, repair of underdrain system
During cleaning Abnormal local gushing of filter sand during backwash	Gravel layer largely undulates and heaves up to near filter layer surface, and backwash water concentrates there.	To study on undulation of filter layer, and replace it.
Filter layer Occurrence of mud balls in filter layer, crack on filter layer surface, and opening between filter layer and filter walls	Insufficient cleaning effect resulting in residual turbidity matters in filter layer	(1) Reexamination of cleaning condition (surface wash, air wash, optimization of expansion rate, shortening of cleaning interval) (2) Improvement of filter layer

2-2 A plan for regular maintenance

Next

Pump





A Nut bearing	H Sheet gasket	O Packing plate	V Oil seal	c Main shaft
B Washer bearing	I Liner ring	P Gland packing	W Sheet gasket	d Shaft coupling key
C Casing bearing	J Dowel pins	Q Seal water ring	X Ball bearing	
D Grease nipple	K Impeller key	R Holding gland	Y Bearing casing	
E Distance piece	L Impeller	S Holding gland bolt	Z Oil seal	
F Bearing cover	M Upper casing	T Draining spit	a Sheet gasket	
G Shaft sleeve	N Shaft sleeve	U Bearing cover	b Lower casing	

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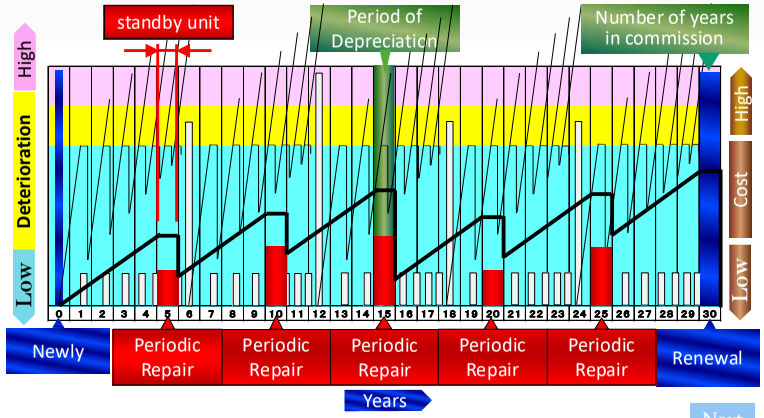
Periodic inspection

Inspect & Maintenance system established ⇨ You can purchase of good equipment



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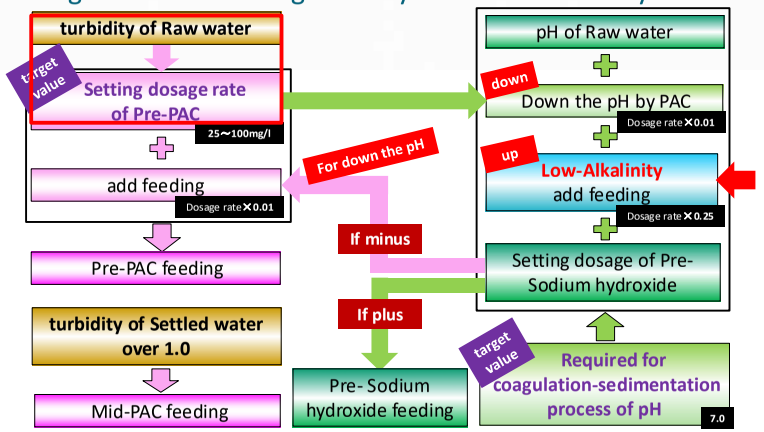
2-3 Water quality control

Next

Setting of chemical dosage rate by PAC and Sodium hydroxide



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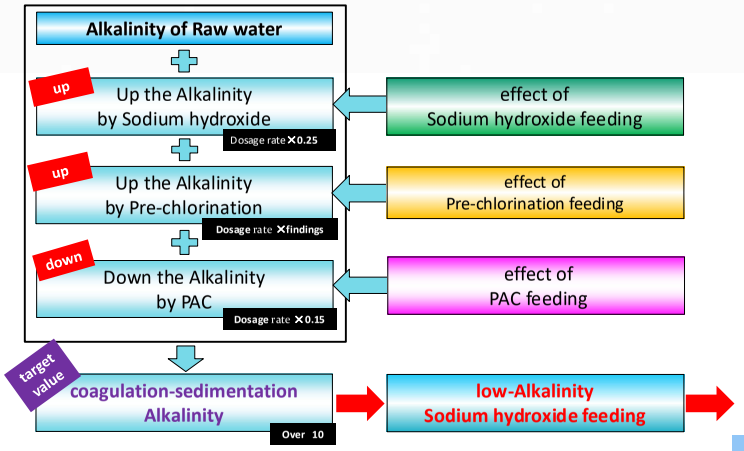
Effect of Alkalinity



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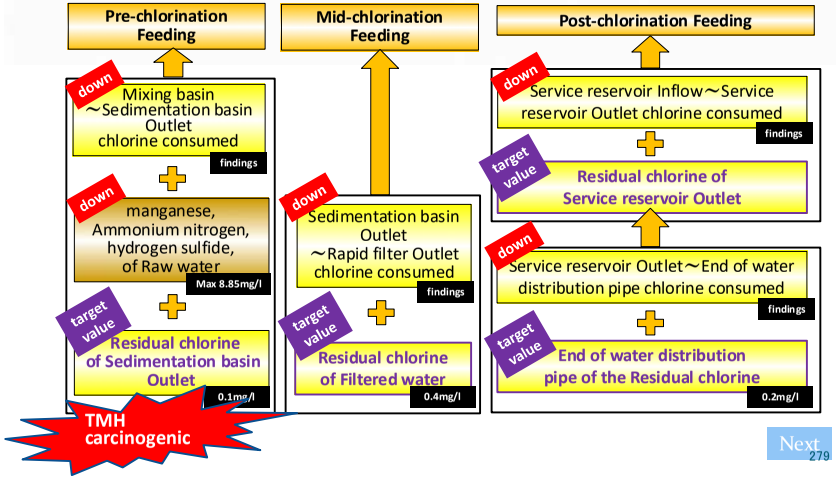
Setting of chemical dosage rate by Sodium hypochlorite



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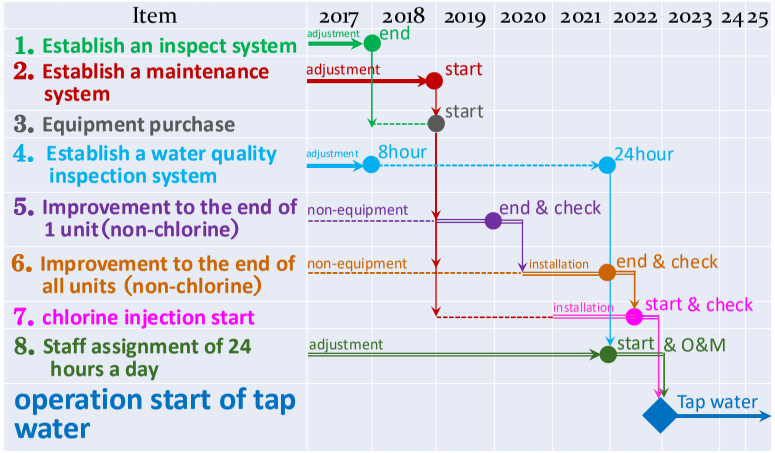
3 Improved facilities of step-by-step

Next

3 -1 An idea the main improvements schedule

Next

Major Improvement Schedule



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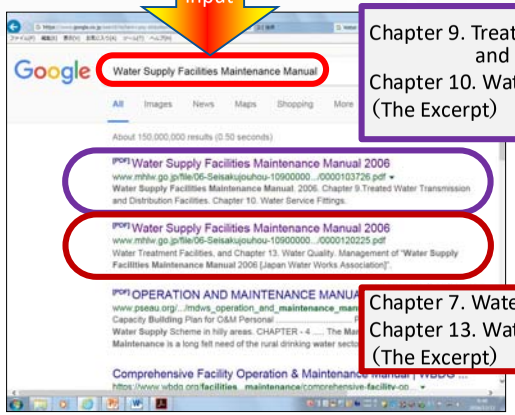
Water Supply Facilities Maintenance Manual

input



Chapter 9. Treated Water Transmission and Distribution Facilities
Chapter 10. Water Service Fittings
(The Excerpt)

Chapter 7. Water Treatment Facilities
Chapter 13. Water Quality Management
(The Excerpt)

Next

4 Download method method of Guidelines

The Design Criteria for Water Supply Facilities

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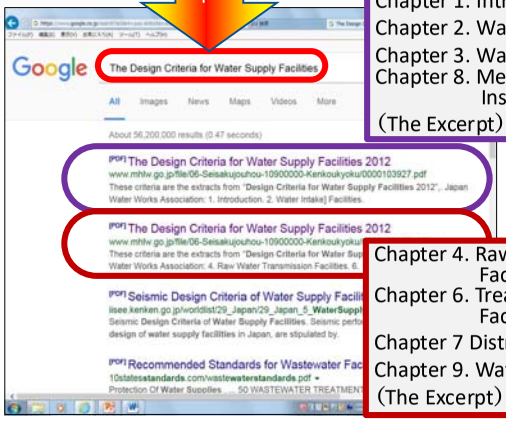

Chapter 1. Introduction
Chapter 2. Water Intake Facilities
Chapter 3. Water Storage Facilities
Chapter 8. Mechanical, Electrical and Instrumentation Equipment
(The Excerpt)

Chapter 4. Raw Water Transmission Facilities
Chapter 6. Treated Water Transmission Facilities
Chapter 7 Distribution Facilities
Chapter 9. Water Service Fittings
(The Excerpt)

Next
285

4 Download method method of Guidelines

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①input

②Click

Japanese

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286

4 Download method of Guidelines

Next
287

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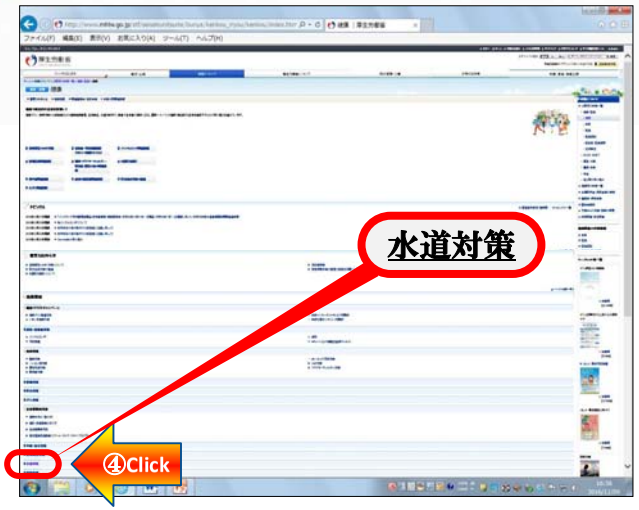

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288

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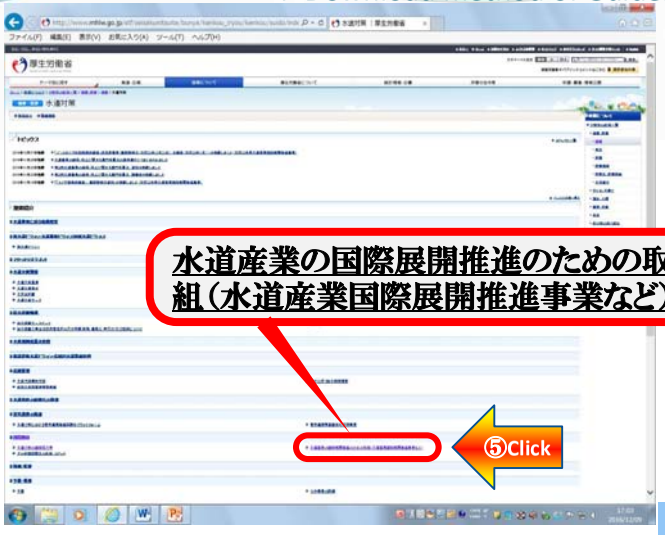

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289

4 Download method of Guidelines

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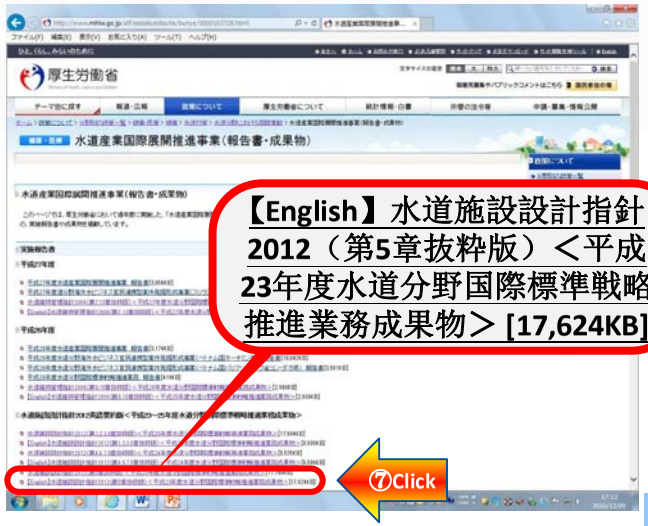
290

4 Download method of Guidelines



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291

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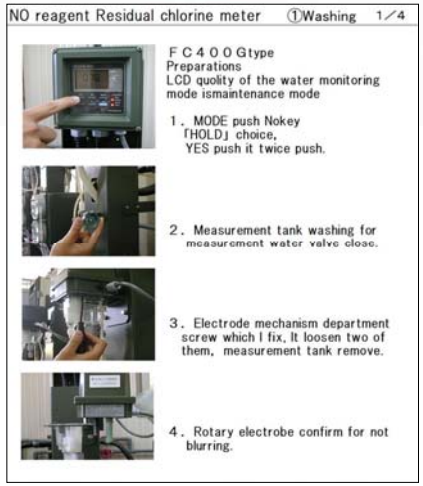
make a manual



Next
292

5 Summary

Next 293

Summary

Before starting the operation of tap water

Guideline

- Read the guidelines carefully.
- Draw up improvement plans.

In parallel

- Establish an inspect system.
- Establish a maintenance system.
- Draw up an equipment purchase plan.
- Establish a water quality management plan.

After having these improved (and established), implant Chlorine at the end

Next 294

Facility design

The contents of water supply facility standards are defined by waterworks law and ministerial ordinance.

(1) Waterworks law (Water supply facility standards)

Have facilities according to
- Quality and quantity of raw water
- Geographical condition
- Water supply form

・Position and sequence of facilities

Laying & Maintenance ⇒ Economic & easy

(2) Technical standard of water facilities

(Ministerial ordinance Ministry of Health and Welfare)

・Facilities structure & material

Enough proof strength (Water pressure, Earth pressure, Seismic force)

・Requirement

Facilities of ①Intake, ②Water storage, ③Water conveyance, ④Purification, ⑤Water transmission, ⑥Water distribution

Reference book

▪ Design criteria for waterworks facilities (Japan waterworks association : JWWA)

295

Operating & Maintenance of Purification

Reference book

▪ Guidelines for waterworks technical management (Japan waterworks association : JWWA)

【Facility equipment & Operation】 Operation & maintenance guideline of purification plant

(1) Operation management (SOP)

- ・Water quality meter check
- ・Intake change operation
- ・Chemical acceptance & feeding machine
- ・Sludge pump operation
- ・Sampling pump operation
- ・Rapid sand filter operation ・・・and so on

(2) Accident response manual

- ・Oil pollution accident
- ・Chemical feeding machine accident
- ・At power failure accident
- ・Power receiving equipment accident
- ・Water quality meter accident ・・・and so on

296

Operating & Maintenance of Purification

(3) Use of SOP (manual)
- ①Daily operation
- ②OJT : getting operation skills
- ③Accident
- ④Freshman training

(4) Review
- ①Once a year(WSP review)
- ②Suitability

〔※If the freshman use it, the defection part will be known〕

297

12 WATER SAFETY PLAN

Table of contents

299

Ⅰ Demand to the water supply

300

Ⅰ-1 Demand of user ≒ Target of supplier

Water supply system ・・・ Faucet open ⇒ out water

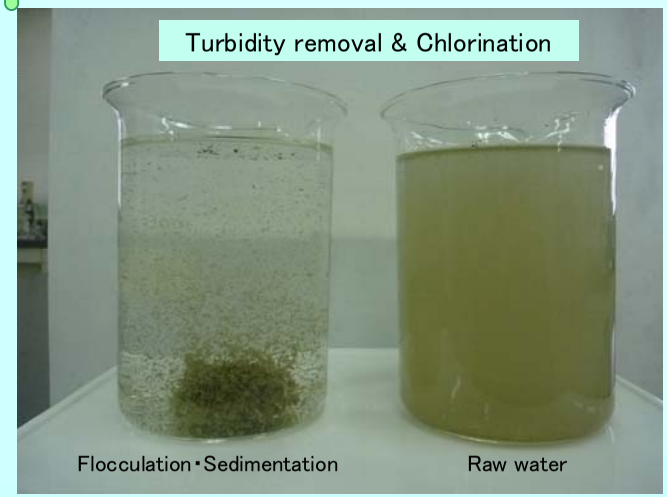
①You can drink tap water: Safe water
②You can use at any time: Stable supply
③You can use low-priced water: Low-price

Safety
Stability
Low price
User satisfy trust

301

Ⅰ-2 Raw Water quality & Purification (Basis of water treatment)

Turbidity removal & Chlorination



302

Ⅰ-2 Raw water quality & Purification (Reality of water treatment)

【Rapid sand filtration method】

Raw water → **Coagulation sedimentation** → **Rapid sand filtration** → Chlorination → Treated water

★Water treatment conditions will depend on the quality of raw water.

◇If: Raw water quality and quantity is stable(no change).
⇒Water treatment conditions are constant (Easier management).

◇Reality: Raw water quality and quantity is always changing.
(Sometimes upheaval)
(Factor: rainfall, temp., season, external contamination etc.)

⇒Always required to have control of the water treatment conditions.

The user receives a disadvantage by mistake

303

Ⅱ Water Safety Plans (WSP)

304

Ⅱ-1 What is WSP？

－Risk management system of tap water quality－

- Proposal for WHO
  （Guidelines for drinking-water quality 3rd edition 2004.09）
- Introduced HACCP to water quality management
- Comprehensive plan to ensure water safety
  It analyzes evaluate the weakness from the water source to the faucet ⇒ Formulate how to manage
- Health authorities in Japan have recommended WSP or similar hazard management

305

Ⅱ-2 Effect of WSP

- Improve of safety
- Improve of maintenance level
- Inheritance of skills
- Accountability of safety to the user
- Uniform management from water resource to water tap
- Reinforcement of the cooperation between staff

306

Ⅱ-3 HACCP

Hazard Analysis and Critical Control Point

Method to check all of the hygiene and quality in the work process leading to the final product from raw material in the manufacturing and processing of food.

Analyzed the hazard that may occur to each process.
Evaluate the hazard from about impact and frequency of occurrence.

↓

Critical control point can prevent the occurrence of hazard.
To continually manage and record the point.

↓

Ensuring more of product safety.

307

HACCP？:（Example）Retort-pouched cuurry （1）

Process

Foodstuffs

↓

Preparation

↓

Cook・packed-pouch

↓

Retort sterilization

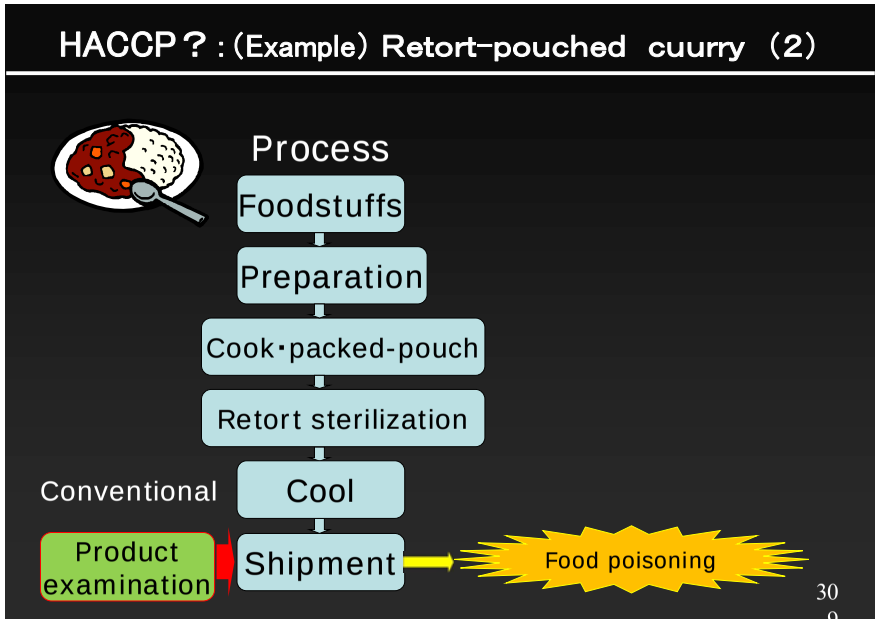
↓

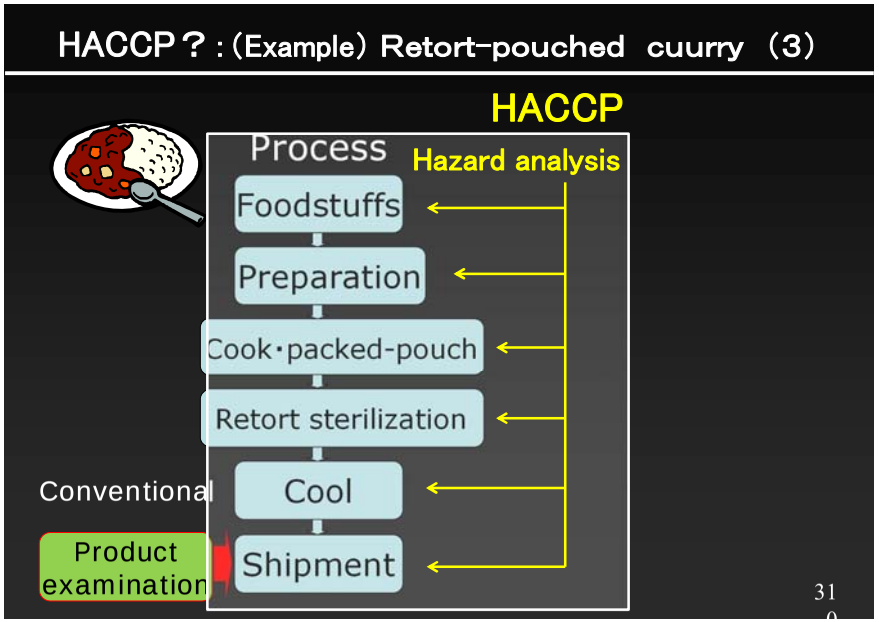
Conventional Cool

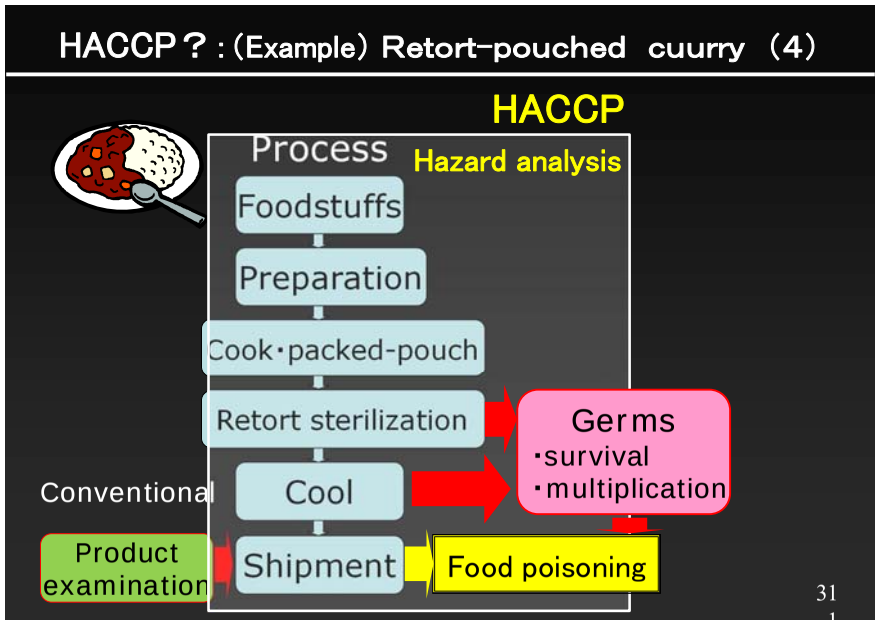
↓

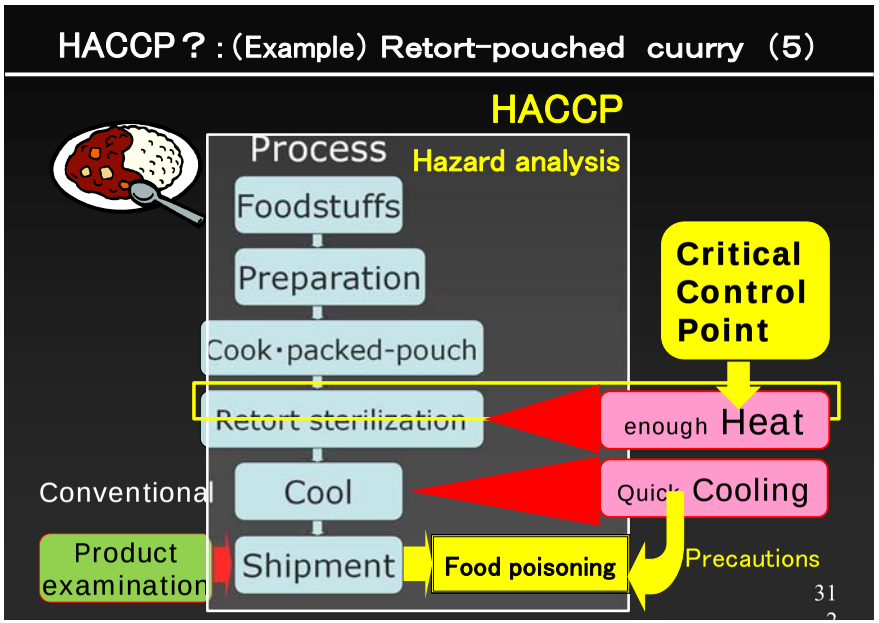
Product examination Shipment

308

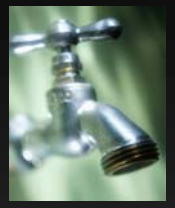

HACCP？:(Example) Retort-pouched cuurry （2）
Process
Foodstuffs
Preparation
Cook・packed-pouch
Retort sterilization
Conventional
Cool
Product examination
Shipment
Food poisoning
30


HACCP？:(Example) Retort-pouched cuurry （3）
HACCP
Process
Hazard analysis
Foodstuffs
Preparation
Cook・packed-pouch
Retort sterilization
Conventional
Cool
Product examination
Shipment
31


HACCP？:(Example) Retort-pouched cuurry （4）
HACCP
Process
Hazard analysis
Foodstuffs
Preparation
Cook・packed-pouch
Retort sterilization
Germs
・survival
・multiplication
Conventional
Cool
Product examination
Shipment
Food poisoning
31


HACCP？:(Example) Retort-pouched cuurry （5）
HACCP
Process
Hazard analysis
Foodstuffs
Preparation
Cook・packed-pouch
Retort sterilization
Critical Control Point
enough Heat
Quick Cooling
Conventional
Cool
Product examination
Shipment
Food poisoning
Precautions
31

(Example) Application to the water quality management （1）



Process

Water resource

Water intake

Coagulation sedimentation

Sand filtration

Water distribution

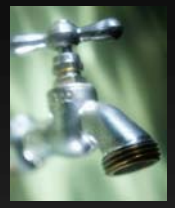
Water supply

Conventional

Water examination

31
3

(Example) Application to the water quality management （2）



Process

Water resource

Water intake

Coagulation sedimentation

Sand filtration

Water distribution

Water supply

Waterborne disease

Conventional

Water examination

31
4

(Example) Application to the water quality management （3）

Process

Hazard analysis

HACCP

Water resource

Water intake

Coagulation sedimentation

Sand filtration

Water distribution

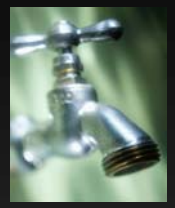
Water supply

Conventional

Water examination

31
5

(Example) Application to the water quality management （4）



Process

Hazard analysis

HACCP

Water resource

Water intake

Coagulation sedimentation

Sand filtration

Water distribution

Water supply

Germs
・survival
・multiplication

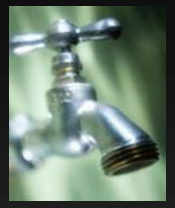
Waterborne disease

Conventional

Water examination

31
6

(Example) Application to the water quality management (5)



Process — Hazard analysis — HACCP

- Water resource
- Water intake
- Coagulation sedimentation
- Sand filtration
- Water distribution
- Water supply

Critical Control Point

- Turbidity control
- Residual chlorine

Conventional: Water examination

Waterborne disease → Precautions

31
7

Ⅱ-4 WSP way of thinking

- The ba
  - Safety check in water quality examination at the faucet
- More advanced water quality management
  - Water quality examination at the water source and purification plant
  - The water quality monitoring by measuring instrument at the water treatment plant and water tap
  - Improvement of water quality examination accuracy

- 「WSP」: Systematic water quality management
  - The emphasis on process management
  - Set how to respond to the hazard in advance

31
8

80

Ⅱ-5 Flow chart decision and apply WSP

- Assemble the team to the WSP
- Grasp the water supply system
- Hazard analysis・Set of management method
- Creating response manual
- Setting the recording and storage method
- Apply and review(verification, validation)

Supporting programs

319

Ⅲ WSP of Fukuoka City

320

Ⅲ－1　Formulate Policy

【Actual situation of Fukuoka city 】

①Five water treatment plants includes a plurality of water sources.
Have water treatment to adjust the water intake amount in accordance with the demand.

②We are doing an efficient water operation.
The flow rate adjustment between by controlling the flow and water pressure each water purification plant by the water distribution adjustment system.

321

Ⅲ－1　Formulate Policy

【Common Edition】
Generic content such as the flow of investment to the purpose and development.

【Water purification Edition】
Water sources and water intake of the situation and edit in each water purification plant by the different management and monitoring in water treatment.

【Feed water distribution Edition】
It showed how to manage on feed distribution process until the faucet from distributing reservoir.

322

Ⅲ－2　Overview of planning

Hazard extraction

Dam, Rivers	Outflow of Oil Water quality deterioration by drought Pollution of hazardous substances　etc.
Purification plant	Increase of turbidity Failure of drug injection equipment　etc.
Feed water distribution	Leakage of water pipe Lowering of residual chlorine　etc.

It was extracted 296 kinds of hazards that is assumed at each step to supply water distribution from the water source.

323

Risk analysis

Likelihood and severity categories that can be used in risk scoring

Item	Rating	Definition
Likelihood categories		
Rare	A	Once／10yeara or more
Unlikely	B	Once／3～10years
Moderately likely	C	Once／1～3years
Likely	D	Once/a few month
Almost certain	E	Once/month
Severity categories		
Insignificant	a	No impact or not detectable
Minor	b	Compliance impact
Moderate	c	Aesthetic impact
Major	d	Regulatory impact
Catastrophic	e	Public health impact

324

Risk analysis

Risk level setting

Matrix for ranking risks

Likelihood categories			Severity of consequences				
			Insignificant	Minor	Moderate	Major	Catastrophic
			a	b	c	d	e
Almost certain	Once/month	E	1	4	4	5	5
Likely	Once/a few month	D	1	3	4	5	5
Moderately likely	Once／1～3 years	C	1	1	3	4	5
Unlikely	Once／3～10years	B	1	1	2	3	5
Rare	Once／10years or more	A	1	1	1	2	5

325

Point	Kind	Hazard cause accident	Items Water quality	Frequency of occurrence	About influence	Risk level
Water resource	Surface water	Traffic accident	Mineral oil	C	c	3
Water intake	Intake	Illegal dumping	Cyanide ion And cyanogen chloride	A	e	5
Treated water	Receiving well	Leakage due to a large volume of powdered activated carbon	Turbidity	A	a	1
Treated water	Flocculation basin	Mixing machine breakdown	Turbidity	A	a	1
Treated water	Sedimentation tank	Coagulant injection shortage	Turbidity	A	a	1
Treated water	Finished water reservoir	Sodium hypochlorite injection shortage	Residual chlorine	B	c	2
Chemic	Poly	Clogged injection				

Ⅲ-2 Overview of planning

Management method

Risk level	Frequency of occurrence ・Degree of influence	Response Manual
≦2 （1，2）	Range during normal	Normal time manual
≧3 （3、4，5）	Case of abnormal	Fault response manual

【Examples of monitoring method and control criteria】

Monitoring item	Point	Monitoring method	Control criteria (degree)
Turbidity	Receiving well	Turbidimeter (continuous)	≦50
	Sedimentation tank		≦0.6
	Sand filter		≦0.05
	Distribution pipe		＜0.1

7

Ⅲ-3 Apply of the plan

Record and keeping

・Risk level 3 or more cases：Report on a case-by-case basis
・Risk level 2 or less：The described in business diary

Review

・Verification：observance of the manual
・Validation：check the manual
・Once a year, check with the people related to the WSP.
・To improve if necessary.

Education and training

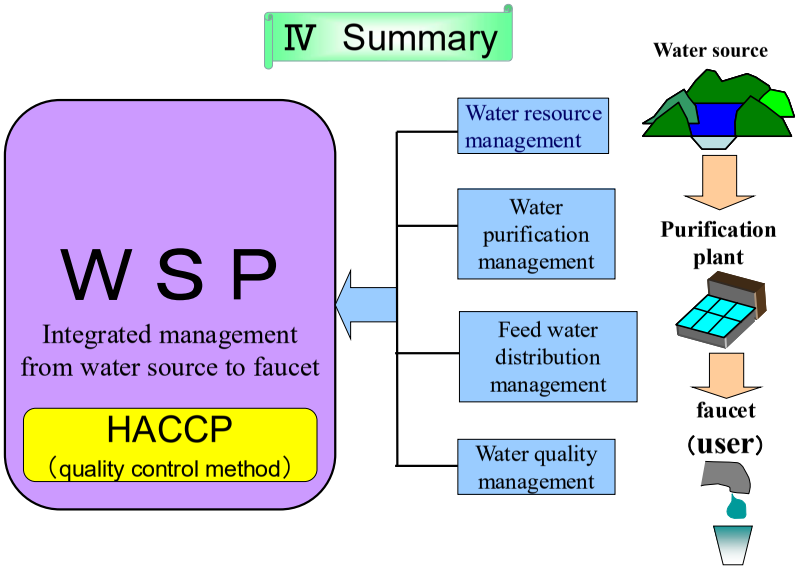
・The entire training　・On the job training

328

Ⅳ Summary & Advice

329

Ⅳ Summary



330

Ⅳ-2 Advice

【Recommendation of formulating】

①WSP is a system for continuously supplying a safe tap water.

②The purpose of the WSP is utilized rather then formulate.

③You do not need to seek perfection from the start. Inevitably contents repeated operations and review will continue enhance.

④The first step is the team organization. And grasp the water supply system.

331

332

13 WATER QUALITY MONITORING PLAN

Table of contents

333

（Ⅰ）Water Quality Management

334

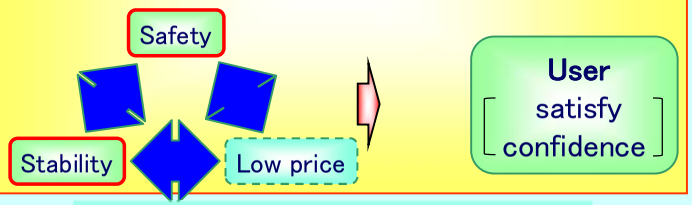
Ⅰ-1 Water Quality Management

Water supply system ・・・ Faucet open ⇒ out water

①You can drink tap water：Safe water

②You can use at any time：Stable supply

③You can use low-priced water：Low-price



【Demand of user ≒ Target of supplier】

335

Ⅰ-2 Water Quality Management

Safe water Supply ⇒ **It is necessary to properly manage water quality**

★Purpose of water quality management.

◇Keep tap water in a faucet always available in a safe and clean state.
⇒(Safe and good quality conforming to water quality standards.)

336

Ⅰ-3 Water Quality management

【How to manage of water quality】

Confirmation that tap water is safe

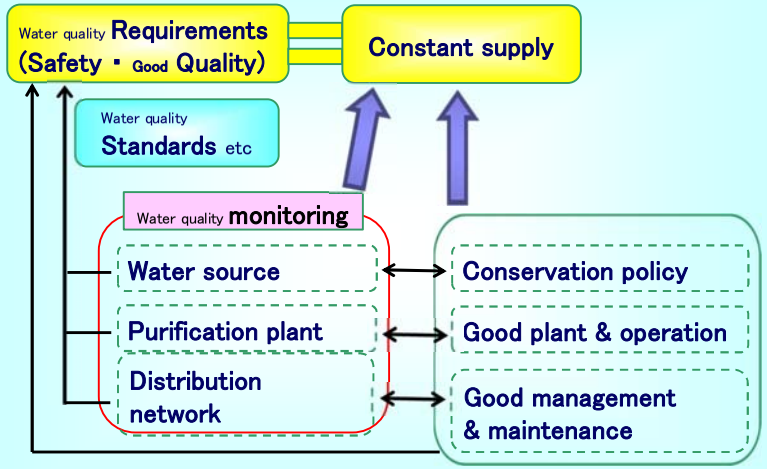
Regularly check by examination
(can not be examined at all times)

Evaluation & utilization of examined date

Construction and operation of highly reliable system that can always supply

337

Ⅰ-4 Water Quality management



【Concept of water quality management】

338

（Ⅱ） Monitoring Plan

339

Ⅱ-1 Monitoring plan

The contents of water quality examination and monitoring plan are defined by waterworks law and ministerial ordinance.

(1) Waterworks law
- Setting water quality standards [51 items, Residual chlorine]
- Implementation of water quality examination

(2) Ministerial ordinance (Ministry of Health and Welfare)
- Types of examination
  - Regular water examination
  - Temporary water examination
- Formulate and implement monitoring plan

340

Ⅱ－2 Monitoring plan

〔Regular water examination〕

（1）Examination of tap water

1)Frequency of examination of standard items

①More then once examination per day
(Color, Turbidity, Residual chlorine(3items))

②More then once examination per month
In addition to ① [General bacteria, E.coli, Cl−, TOC, pH, Taste, Odor, Geosmin, 2−MIB, (9items)]

③More then once examination per three month
In addition to ①&② (other standard items(40items))

2) Water sampling point

①In principle a water faucet

②Select one or more points for each distribution area

③Do not change the water faucet for each examination item

341

Ⅱ－3 Monitoring plan

〔Regular water examination〕

（2）Examination of raw water

・More then once examination per year
(Including when the water quality is worst)

（3）Other necessary examination ・・・Key points

・The necessary examination must be carried out according to the situation of each water utility

the situation of [the water source / the purification plant / the distribution]

【Each water utility's own monitoring plan】

342

Ⅱ－4 Monitoring plan

〔Temporary water examination〕・・・Quick response

・More In case of abnormality in water source or Water treatment.
・When there is a possibility that the water supply facilities has been remarkably contaminated.

〔Other water examination〕

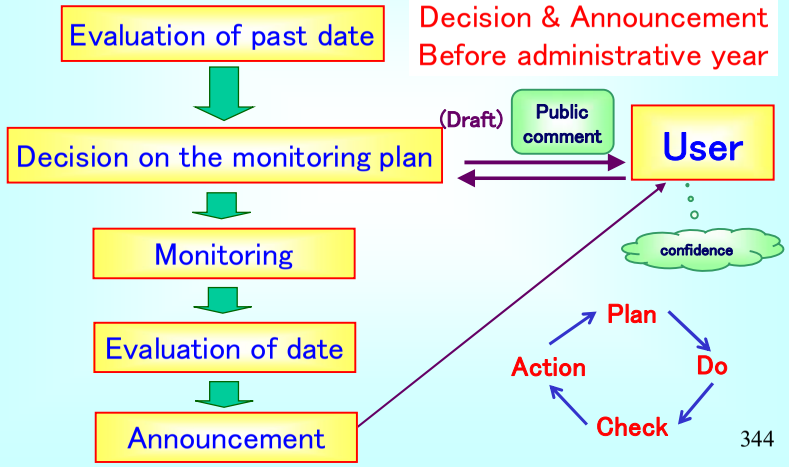
1) Examination before starting water supply
・In case of newly constructed or modified water facilities.
〔Water (intake, storage, conveyance, treatment, transmission, distribution) facilities〕

2) Request examination from users
・When a water user got an abnormality in tap water and requested a water quality examination.

343

Ⅱ－5 Monitoring plan

〔Decision & operation procedure〕



344

Ⅱ-6 Monitoring plan

〔Contents of the plan〕

① Basic policy
② Outline of waterworks
③ Water resource conditions, raw and treated water of quality
④ Regular water quality examination (point, items, frequency)
⑤ Temporary water quality examination
⑥ Method of water quality examination
⑦ Announcement of water quality examination results
⑧ Evaluation and review
⑨ Assurance for accuracy and reliability of examination
⑩ Collaboration with relevant organizations

345

Ⅱ-7 Monitoring plan

①〔Basic Policy〕

・Describe the purpose and monitoring policy of the water quality monitoring plan

(Example)
・Purpose: **We will conduct planned monitoring to ensure safe and high quality tap water.**
・Policy: **We will examine from the water resource to the faucet based on the monitoring plan.**
・・・and so on

346

Ⅱ-8 Monitoring plan

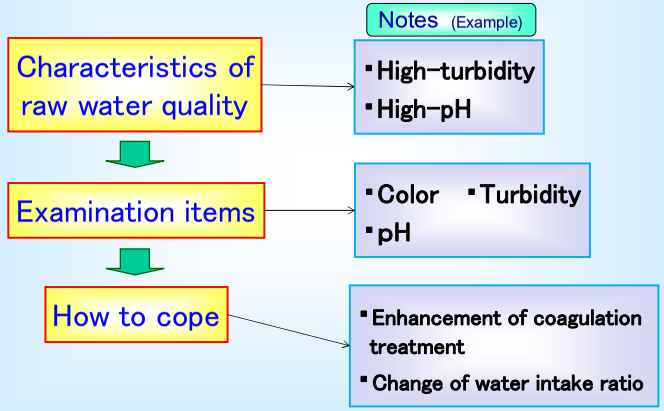
②〔Outline of Waterworks〕

・Outline of water resource
Well , Dam , River , Reservoir
・Facility overview of water treatment plant
Mechanism of water treatment
Tap water treatment capacity
・Outline of water supply
Service Area
Population Supplied
Number of Water Supply Units
Annual Water Supply Volume
Average Daily Supply
・・・and so on

347

Ⅱ-9 Monitoring plan

③〔Water Resource Conditions, Raw and Treated Water of Quality〕



Describe by water resource and water treatment plant separately

348

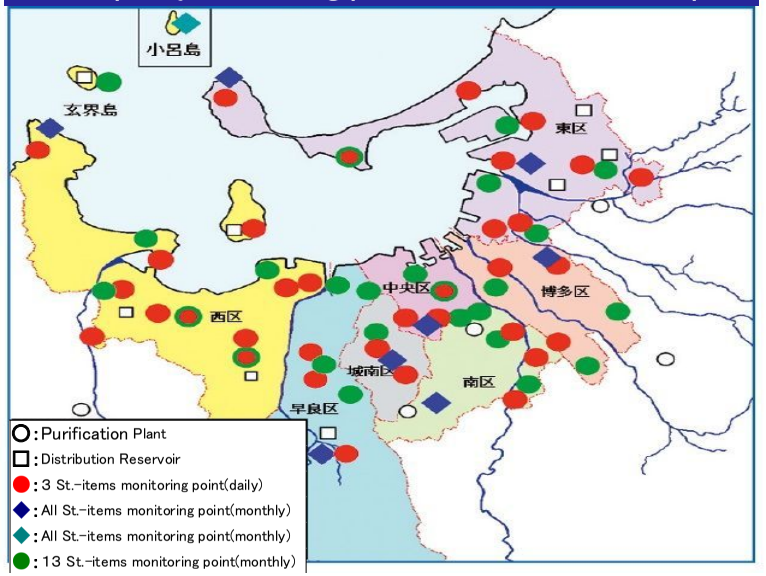
Ⅱ－10　Monitoring plan

④〔Regular water quality examination〕

- Sampling Point
- Examination Items
- Monitoring Frequency

・・・and so on

Water quality Monitoring points of faucet　(Example)



Summary of Monitoring Plan (Fukuoka city)　(Example)

Category	Sampling Location	Number of sampling point	Monitoring frequency	Water quality examination items		
				number of Standards	number of Other items	total items
Water resource	Dam (8 Dams)	8	Monthly	12	16	28
			Once a year	29	22	51
	Intake (4 river)	5	Monthly	12	16	28
			4 times a year	32	21	53
Water treatment plant (5 Plants)	Raw water	5	Daily	4	6	10
			Monthly	15	13	28
			4 times a year	39	23	62
	Settled Water	5	Daily	4	5	9
	Filtered water	5	Daily	5	5	10
	Treated water	6	Daily	5	5	10
			Monthly	27	14	41
			4 times a year	51	18	69
Distribution reservoir	Receiving of water	1	Monthly	18	8	26
			4 times a year	19	–	19
	Water distribution	1	Monthly	27	14	41
			4 times a year	51	17	68
Water supply	Faucet	34	Daily	3	–	3
		8	Monthly	51	14	65
			4 times a year	51	23	74
		25	Monthly	13	6	19

Ⅱ－11　Monitoring plan

⑤〔Temporary water quality examination〕

Already explained ⇨ Ⅱ－4

Ⅱ－12 Monitoring plan

⑥〔Method of water quality examination〕

Water quality standards	・Ministerial Ordinance (Ministry of Health and Welfare)
Examination method	・Notice (Ministry of Health and Welfare)
Reference book	・Standard methods for examination of water (Japan waterworks association：JWWA)

※ Make the standard operating procedure from method of notice (A own procedure manual in the laboratory)

353

Ⅱ－13 Monitoring plan

⑨〔Accuracy and reliability of examination〕

・The water quality examination value is accurate and requires reliability

・The examination value always has variations

- Difference in skill
- Equipment accuracy
- Reagent quality
- Degradation of sample ・・・and so on

・Confirm the variation beforehand and to grasp the accuracy of examination

One tenth of the reference value

- Organic matter ≦CV20%
- Inorganic matter ≦CV10%

(CV%：Coefficient of variation)

354

Ⅱ－14 Monitoring plan

Standard Operating Procedure list

(Example)

① Each Examination Items
② Maintenance of each Analytical Equipment
③ Operation of each Analytical Equipment
④ Management of Reagents
⑤ Management of Samples
⑥ Sampling
⑦ Report Preparation

355

Ⅱ－15 Monitoring plan

⑦〔Announcement of water quality examination results〕

⑧〔Evaluation and review〕

Next Contents

356

（Ⅲ） Evaluation & Utilization

357

Ⅲ-1 Evaluation & Utilization

〔Evaluation of examination results〕

Comparison with standard value → ▪Safety verification

Comparison with past data

- → ▪Within the detection range of the past data ⇒Water quality management is appropriate
- → ▪Out of the detection range of the past data ⇒Possibility of water pollution ⇒Inappropriate water treatment ⇒Examination error
  - → ▪Investigate the cause ▪Re-examination

We compares with the data of the past five years

358

Ⅲ-2 Evaluation & Utilization

〔Make a report and sharing〕

Examination frequency is daily or monthly

Daily data → ▪Shared by water quality personnel and purification plant staff ⇒Use for daily water quality management

Monthly data → ▪Shared across the organization ⇒The result of the faucet is posted on the website and returned to the user → Verification

▪Make a annual report book ⇒Data file is posted on website

▪Long-term results will reveal the strengths and weaknesses of facilities and management methods ⇒It is effective for improvement and management

359

Monitoring data of faucet (point name) (Example)

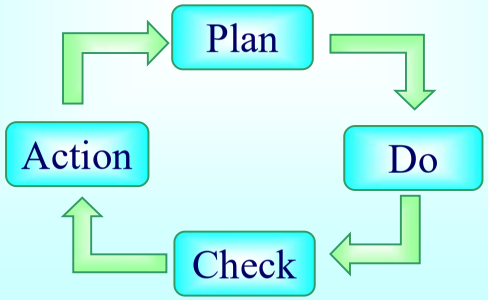
No.	Items	Unit	mean	max.	min.	number of times	Apr.	May	Jun.		Jan.	Feb.	Mar.
	Temperature	℃	18.5	30.6	7.1	12	13.4	15.9	26.8		11.4	7.1	10.8
	Water temperature	℃	18.8	27.6	11.2	12	13.7	20.1	22.2		12.7	11.5	11.2
	Residual chlorine	mg/L	0.55	0.62	0.50	12	0.50	0.53	0.51		0.59	0.62	0.56
1	General bacteria	colony /mL	<1	<1	<1	12	<1	<1	<1		<1	<1	<1
2	*Escherichia coli*	MPN /100mL	<1.0	<1.0	<1.0	12	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0
3	Cadmium (Cd)	mg/L	<0.0003	<0.0003	<0.0003	12	<0.0003	<0.0003	<0.0003		<0.0003	<0.0003	<0.0003
4	Mercury (Hg)	mg/L	<0.05	<0.05	<0.05	12	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05
5	Selenium (Se)	mg/L	<0.001	<0.001	<0.001	12	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001
6	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	12	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001
7	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	12	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001
44	Nonionic surfactants	mg/L	<0.005	<0.005	<0.005	12	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005
45	Phenols	mg/L	<0.0005	<0.0005	<0.0005	12	<0.0005	<0.0005	<0.0005		<0.0005	<0.0005	<0.0005
46	Organic substances (Total Organic Carbon)	mg/L	0.4	0.7	0.3	12	0.7	0.4	0.5		0.3	0.3	0.3
47	pH value		7.5	7.6	7.4	12	7.5	7.5	7.5		7.4	7.5	7.5
48	Taste		Not abnormal	Not abnormal	Not abnormal	12	Not abnormal	Not abnormal	Not abnormal		Not abnormal	Not abnormal	Not abnormal
49	Odor		Not abnormal	Not abnormal	Not abnormal	12	Not abnormal	Not abnormal	Not abnormal		Not abnormal	Not abnormal	Not abnormal
50	Color	degree	<1	<1	<1	12	<1	<1	<1		<1	<1	<1
51	Turbidity	degree	<0.1	<0.1	<0.1	12	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1

360

Ⅲ-3 Evaluation & Utilization

〔Review〕

- Verification : observance of the monitoring plan
- Validation : check the monitoring plan.
- Once a year, check with the people related to the monitoring plan.
- To improve if necessary.

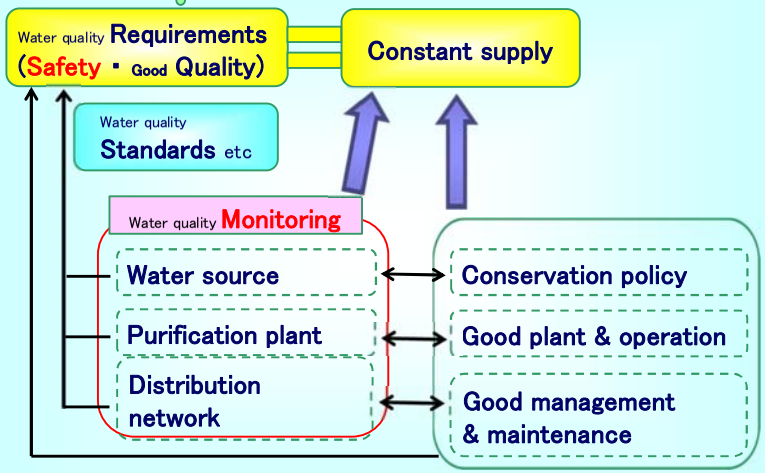


361

(Ⅳ) Summary & Advice

362

Ⅳ-1 Summary & Advice



【Concept of Water Quality Management】

363

Ⅳ-2 Summary & Advice

〔 Monitoring Plan 〕

① Basic policy
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⑩ Collaboration with relevant organizations

364

Ⅳ-3 Summary & Advice

〔Effect of Monitoring Plan〕

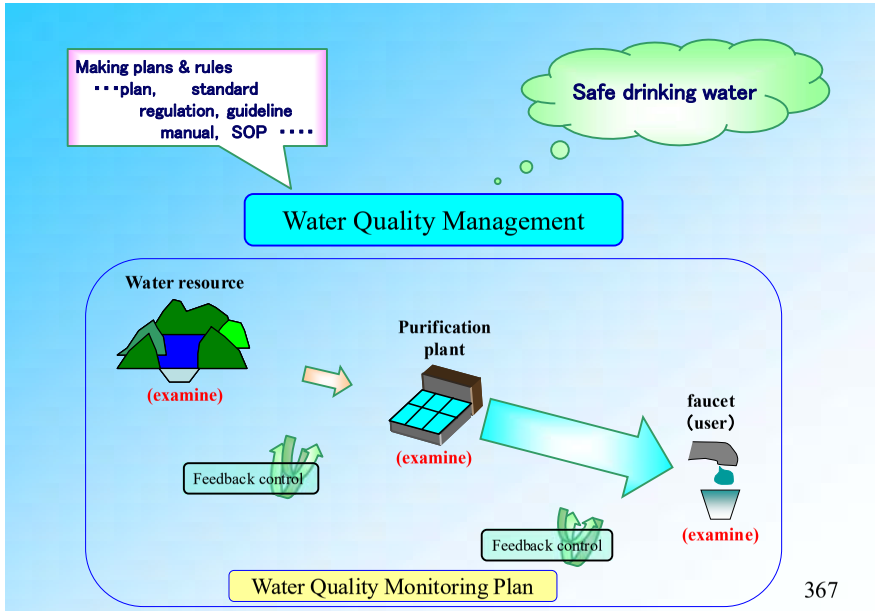
① Grasp of the whole examination works
② Information sharing about water quality examination throughout the organization
③ Inheritance of skills
④ Effective for explanation to users
⑤ Strengthen cooperation between organizations
⑥ It helps to promotion of water quality management

365

Ⅳ-4 Summary & Advice

① The basis of water quality management is monitoring plan for continuously supplying a safe tap water.
② The purpose of the monitoring plan is utilized rather then formulate.
③ You do not need to seek perfection from the start. Inevitably contents repeated operations and review will continue enhance.
④ Let's grasp the current planning content well.

366



367

PROJECT FOR IMPROVEMENT OF WATER SUPPLY MANAGEMENT OF YCDC

RECORDS OF PROJECT ACTIVITIES

Project Period: **June 2015 – June 2021**

Cooperation by: **TEC INTERNATIONAL CO., LTD. (TECI)**
TOKYO SUIDO SERVICES., LTD. (TSS)
PUBLIC UTILITY SERVICES CENTER CO., LTD. (PUC)

Under: Technical Cooperation by **JAPAN INTERNATIONAL COOPERATION AGENCY**

1

TABLE OF CONTENTS

2

1. OUTLINE OF THE PROJECT

3

OUTLINE OF THE PROJECT

Name	**The Project for Improvement of Water Supply Management of YCDC**
Overall goal	Water supply services provided by YCDC are enhanced.
Project purpose	Capacity of YCDC on the management of water supply service is improved.
Outputs	1. Capacity of YCDC on institutional management of water supply utility is improved. 2. Capacity of YCDC on NRW management is improved. 3. Capacity of YCDC on water quality management is improved.
Project target area	Greater Yangon Area
Implementing Organization	Water Resource and Water Supply Authority (WRAWSA), Yangon City Development Committee (YCDC)

4

2. OUTPUT 1

Capacity of YCDC on institutional management of water supply utility is improved

5

1-1 PREPARE OVERALL NEW ORGANIZATION STRUCTURE

6

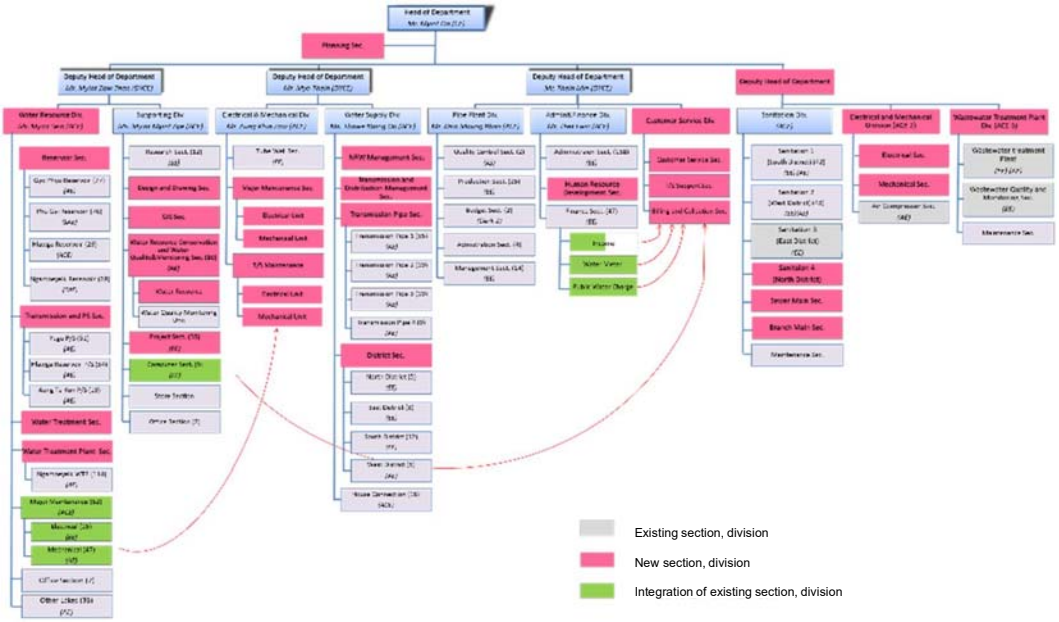
1-1-1 FUTURE IMAGE OF WRAWSA (1)

- Outcome
  - Future image of WRAWA
  - Strategic map of future image
  - Proposed institutional organization of WRAWSA
    - New establishment and integration
      - Water Treatment Section, GIS Section, Water Resource Conservation and Water Quality and Monitoring Section, Water resource section, NRW Management Section, Planning Section, Human Resource Development Section, Customer Service Division, Customer Service Management Section, public Relation Section
- Prepared Materials
  - Future Image of WRAWA
  - Strategic Map of Future Image by 4 Perspectives
  - Proposal of New Organization Structure

Future Image of WRAWA

7

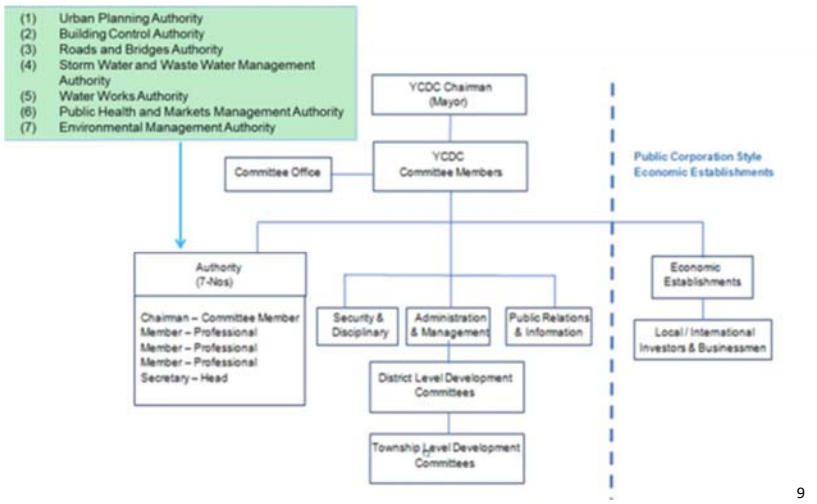
1-1-2 PROPOSED NEW ORGANIZATION STRUCTURE



8

1-1-3 PROPOSED OF ORGANIZATIONAL REFORM BY YCDC

- Proposal of organizational reform for overall YCDC
  - 7 Authorities and 3 Sections
  - WRAWSA will be divided into 2 parts: Waterworks and Wastewater Management



9

1-2 ESTABLISHING THE PLANNING SECTION

10

1-2-1 ESTABLISHING THE PLANNING SECTION IN WRAWSA

◆ Outcome

- The staff members were appointed by an official order of WRAWSA.

● Appointed members

Name	Full-time	Part-time	Remarks
U Zaw Min		✔	
U Than Han		✔	
Daw Khin San Win,		✔	
Daw Khaing Khaing Soe	✔		Study in Japan
Daw Naw Ellinar		✔	
U Tun Tun Hlaing		✔	
Daw Sandar Myint Lwin	✔		
Daw Kyawt Kay Khine	✔		
Daw Soe Yu New	✔		
Daw Aye Aye Kyu		✔	
Daw Khin Eindra Htun		✔	

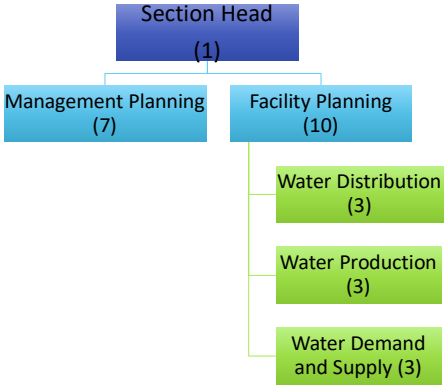
11

1-2-2 DEFINING THE DIVISION OF DUTIES OF THE PLANNING SEC. (1)

◆ Outcome

- The division of duties of the Planning Sec. were defined.

● Composition of Planning Sec.



12

1-2-2 DEFINING THE DIVISION OF DUTIES OF THE PLANNING SEC. (2)

- Duties of Planning Sec. (1/2)

Unit	Duties
Management Planning (7)	◆ Planning and Monitoring • Formulating overall vision& mission, policy and strategy for top management • Developing overall management plan (non-technical) of waterworks in short-, mid- and long-term • Identifying problematic areas in the operations • Study, analysis and data collection on management plan • Monitoring, evaluation and improvement of plans (PDCA) ◆ Database management • Preparing non- technical database system • Developing and implementing performance bench marking systems comparable to good international standards ◆ Regulation, guidelines, standards and manuals (RGSM) • Management of existing RSGM/ SOP • Developing RSGM/ SOP and authorization • Modifying/ updating RSGM/ SOP ◆ Overall coordination with other sections and units with information collection

13

1-2-2 DEFINING THE DIVISION OF DUTIES OF THE PLANNING SEC. (3)

- Duties of Planning Sec. (2/2)

Unit	Sub-Unit	Duties
Facility Planning (9)	Water Demand and Supply (2)	◆ Planning of water supply and demand plan ◆ Planning of reservoir, intake, conveyance, production, transmission development ◆ Planning of distribution facilities development ◆ Overall coordination wit other sections and units ◆ Control of technologies to be adopted ◆ Evaluation of materials (pipe, accessories, etc) and water supply technologies ◆ Preparation of technical guidelines and standards ◆ Study and research on water supply technologies ◆ Safety measure of construction ◆ IT for technical database system
	Water Production (3)	
	Water Distribution (3)	

14

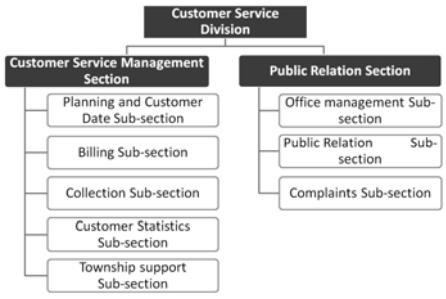
1-3 ESTABLISHING CUSTOMER SERVICE DIVISION

15

1-3-1 ESTABLISHING CUSTOMER SERVICE DIVISION

- Outcome
  - New organization structure of Customer Service Division
  - Strengthening of leadership. Currently, 10 members are working, among them 7 members are full time staff.

Photo of Kick-off meeting by Customer Service Division



Organization chart of
Customer Service Division

16

1-3-2 DEFINE THE DIVISION OF DUTIES OF THE CUSTOMER SERVICE DIVISION (1)

- Outcome
  - Duties of the Customer Service Division (Customer Service Management Section and Public Relation Section)
- Prepared Materials
  - Duties of Division

Customer Service Management Section
(1) Planning and Customer Data sub-section • to plan a new work process to improve billing and collection work • to make manual for billing and collection, and improve it • to lead introducing e-Government water tariff billing system
(2) Billing sub-section • transfer of all the computer section's work
(3) Collection sub-section • to transfer a part of the finance section's work such as confirmation of tariff revenue
(4) Customer Statistics sub-section • to make statistics of tariff such as customer number, consumption volume, tariff billing, revenue, non-payment • to make monthly report and annual report regarding water tariff
(5) Township support sub-section • to support Township when new work process is introduced • to support Township when difficult events happened • to conduct and implement training course for billing and collection work of Township
Public Relation Section
(1) Office Management Sub-Section • Overall office management of public relations • Overall management of customer service works
(2) Public Relation Sub-Section • Planning, research, coordination for improvement of customer satisfaction • Public relations and information disclosure on water supply, sewerage and sanitation
(3) Complaints Management Sub-Section • Overall management of customer complaints • Prepare the report of received complaints

Duties of the Customer Service Division

1-3-2 DEFINE THE DIVISION OF DUTIES OF THE CUSTOMER SERVICE DIVISION (2)

- Outcome
  - Survey of existing customer data system and e-Government System
  - Identification of the issues and preparation of Data System improvement Plan
  - Decide the priority of Customer Service Division
- Prepared Materials
  - Data System improvement Plan

Data System Improvement Plan

functions	2017-18 FY current , near future	2018-19 FY -1st phase	2019-20 FY -2nd phase
1 Customer database	Customer info. should be shared more timely.	Customer data migration in all T/S	SQL server
2 Meter reading management *Yapa-1 etc.*	Water consumption should be managed by excel in T/S.	Development of functions (Pilot T/S)	Spread to other T/S
3 New Billing & Collection function *New connection, Data search, Yapa-3*	The system is existed Foxpro		Re-Development of functions
4 Tariff collection management *Yapa-2, 4 - 8*	Collected and outstanding bills are managed by hand working in T/S.		Development of functions (Pilot T/S)
+ Smart functions *Complaints, Statistic*	Continuous Progress after 2nd Phase		

Customer Service Division's Priority

1-3-3 ESTABLISH OPERATION SYSTEM OF THE CUSTOMER SERVICE DIVISION

- Outcome
  - Customer management and billing/collection data system is developed
  - Billing/collection work is improved
  - Function of the Customer Service Management Section is enhanced
  - T/S Officer's Meeting is established

- Prepared Materials
  - Manuals for meter reading, tariff collection
  - SOP for tariff collection processing standard
  - SOP for customer management and tariff collection system operation procedure

Screen of Customer list

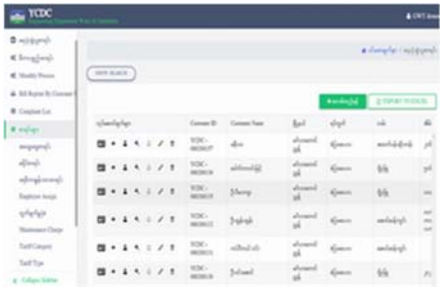


Photo of Seminar for manuals 19

1-4 DEVELOPING AND MONITORING PERFORMANCE INDICATORS (PIS)

20

1-4-1 REVIEWING THE CURRENT METHOD OF CALCULATION AND MONITORING OF PERFORMANCE DATA ON WATERWORKS

◆ Outcome

- The existing PIs and data and its reporting system are summarized and reviewed

Existing Reporting System

No	Facilities	Data	daily	weekly	monthly	Submission processess				
						ACE	DYCE	CE	C/O	R/G
1	Reservoir	water level	√		√					
		precipitation	√		√					
		storage capacity	√		√					
		electricity shortage		√	√					
		Operating Hours		√	√					
		water supplied amount		√						
2	WTP	ACH dosing rate	√		√					
		water supplied amount		√						
		electricity shortage	√							
		Operating Hours	√							
3	Pumping Station	electric consumption	√							
		Operating Hours	√							
		electricity shortage	√							
4	M & E Section	Maintenance Records			√					
		New installation			√					
		water supplied amount	√							
5	Service Reservoir	Water level			√					
6	Water supply	Maintenance Records on transmission lines		√						
		patrol records on transmission lines		√						
7	Customer service	Numbers of customers								
		water quality parameter								

Existing Indicators and Data

	Existing	
	Data	Monitoring Data
Reservoir	Storage Capacity of each reservoir	Water level and depth
	Storage curve	Precipitation
		Pump operation hour (PS)
		Electrical Breakdown records (PS)
WTP	Back washing time	ACH Dosing rate
		Electricity Power Consumption
		Water Quality
		−Turbidity (raw, treated), PH, temp., Alkalinity
Pumping		Operation Hours
		Electricity Consumption
		Flow −inflow, outflow
		Pump and Mortor
		−Ampere meter reading
		−voltage reading
		−frequency
		Transformer
		−temperature
		−voltage (inlet, outlet)
		Pressure
Service Reservoir	Storage capacity	Water level
	Age	Valve Control
Underground Water		Pumping Hours
		Electricity Consumption
		Ground Water Quality (three times per year)
		−15 parameters
Distribution	Pipe size	Pressure (some pts)
	Pipe length	Leakage repair record of main transmission pipe
	Pipe materials	

21

1-4-2 CONDUCTING TRAINING OF TRAINERS ON THE CALCULATION AND MONITORING OF PERFORMANCE INDICATORS (PIS)

◆ Outcome

- Training of trainers on monitoring PIs was comprehensively carried out after setting PIs.
- The trainers understood on the purpose of benchmarking, collection methods, meaning of PIs, composition of data sheet, data input method, and data collection system etc.
- 2 middle class staffs primarily provided trainings as trainers to T/S and District offices, and other relevant sections.
- In Term2, young staff members provided trainings also to T/S and District offices.

Training of Trainers in Planning Sec.

22

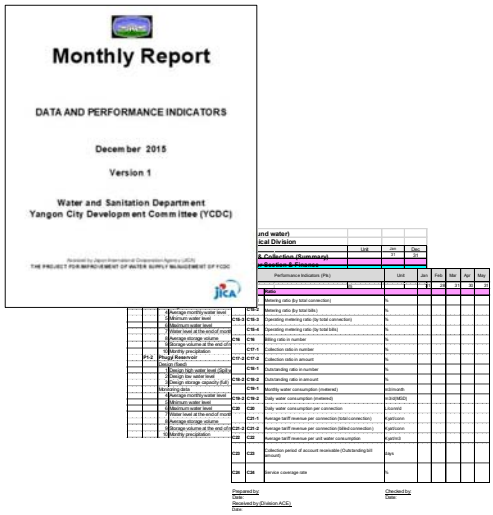
1-4-3 IDENTIFYING THE IMPORTANT AND AVAILABLE PERFORMANCE INDICATORS TO BE MONITORED

◆ Outcome

- PIs data sheets were developed by categorizing water supply services into 7 areas

Composition of PIs Datasheet

Area	Composition sheet
1. Water Supply Service	・Water Supply Service
2. Production and Transmission	・Production (Reservoir, WTP, Underground)) ・Water Flow Measurement ・Transmission System
3. Distribution	・Distribution and NRW
4. Water Quality	・Water Quality Summary ・Water Quality (Monthly) ・Water Quality (Weekly) ・Water Quality (Nyaughnapin)
5. Sales and Collection	・Sales and Collection (Summary) ・Sales and Collection (Data)
6. Finance	・Finance (Summary) ・Finance
7. Admi & HRD	・Administration and Human Resource ・Human Resource Development (Sub-sheet)

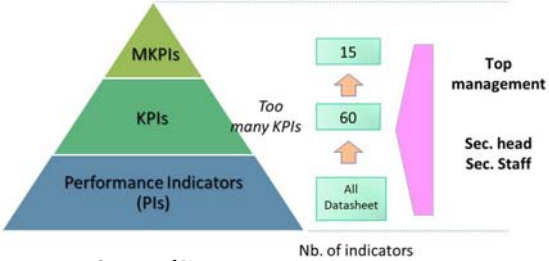


PIs Datasheet

1-4-3 IDENTIFYING THE IMPORTANT AND AVAILABLE PERFORMANCE INDICATORS TO BE MONITORED

◆ Outcome

- Sixty (60) Key Performance Indicators (KPIs) were selected from the PIs as basic PIs.
- Fifteen (15) KPIs were identified as Management KPIs (MKPIs)



Structure of PIs

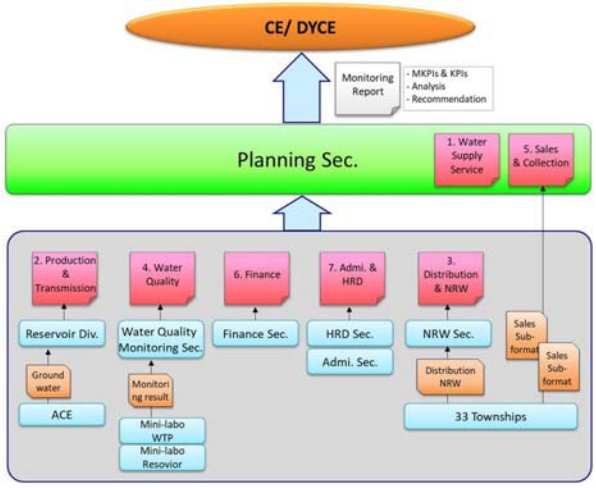
Sq/N	Symbol	Indicators	Unit	IBNET	
1. Water Supply Service					
1	S1	Service population	'000 inhabitants	IBNET	40
2	S2	Total connections	Nb.	IBNET	41
3	S28	Service coverage rate	%	IBNET	1.1
2. Production & Transmission					
4	PT4-4	Daily average total production	m3/day		
3. Distribution & NRW					
5	D9	NRW	%	IBNET	6.1
6	D14	The number of repaired pipe breaks per km	Nb./ km		
4. Water Quality					
7	Q7-2	Compliance ratio of monthly water test at tap water in TS (turbidity)	%		
8		Compliance ratio of monthly water test at tap water in TS (residual chlirine)	%	IBNET	65
5. Sales & Collection					
9	C15-3	Operating metering ratio (by total connection)	%	IBNET	7.1
10	C17-2	Collection ratio in amount	%		
6. Finance					
11	F5	Operating ratio (Operating cost coverage)	%	IBNET	24.1
12	F9	Average revenue per m3 sold	Kyat/m3 water sold	IBNET	18.1
13	F12	Unit operational cost for water sold	Kyat/m3 water sold	IBNET	11.1
7. Administration & Human Resource					
14	H8	Training period*number of trainee/Total staff	Person*day		
15	H11	Total staffs number/1000 connections	person	IBNET	12.2

MKPIs

1-4-6 COLLECT DATA REQUIRED FOR SETTING PIs
1-4-7 DEVELOP CALCULATION METHOD, MANUALS AND MONITORING SYSTEM OF PIs

- Outcome
  - Calculation methods of PIs were developed and taught to C/Ps based on the manual
  - PIs data collection and monitoring system was newly established

PIs Monitoring Flow



PIs Collection and Monitoring System

25

1-4-8 PIs SETTING
1-4-9 PERIODICAL MONITORING

- Outcome
  - The necessary PIs for monitoring water services of YCDC were set up
  - Some KPIs were adopted in the Mid-term Management Plan for FY2018/19-2020/21
  - Transition of performance is under monitoring

Area	The number of KPIs
1. Water supply service	9
2. Production and transmission	12
3. Distribution	5
4. Water quality	3
5. Sales ad collection	17
6. Finance	10
7. Admin & HRD	4
Total	60

Number of KPIs by Category

Training for PIs Data Entry for T/S Staffs

26

1-5 FORMULATING REGULATIONS, STANDARDS, GUIDELINES AND MANUALS

27

1-5-1 REVIEWING THE EXISTING RSGM

- Outcome
  - Existing regulations, standards, guidelines and manuals (RSGM) are listed and reviewed.

Existing laws, regulations, guidelines and manuals

No.	Title	Issued by
1	YCDC Law (2013) (2014 updated) (2016 2nd updated)	YCDC
2	YCDC Regulations related to water and sanitation (1999, December-17)	YCDC
3	New YCDC Regulation related to water and sanitation (under drafting)	YCDC
4	Analysis of rate for Roads, bridges, buildings, electrical, airfield, research, laboratory, water supply and sanitation (2014)	Ministry of Construction
5	Guidelines for water and sanitation (1996)	Ministry of Construction
6	Reinforced concrete design by Professor U Nyi Hla Ngae	Yangon Technological University
7	Guidelines for High-rise building construction projects (Sanitary)	Committee for Quality Control of High-Rise Building
8	Guidelines for civil engineers (Including material standards) (2001)	Ministry of Construction
9	National drinking water quality standard Myanmar by Ministry of Health (2014)	Ministry of Health
10	Myanmar National Water Policy (2015)	NWRC

28

1-5-2 IDENTIFY RSGM TO BE MODIFIED AND/OR NEWLY FORMULATED

- Outcome
  - Through PCM workshop, workshop for T/S and District offices, the RSGM to be modified and/or newly formulated is identified.
  - At Myanmar-Japan Joint Seminar (MJJS), the priority and target are fixed.

List of RSGM

No.	Items	Importance (A /B/ C) *	Target within
1	Water Supply Ordinance	A	1 year
2	Manual on billing operation	A	1 year
3	Manual on collection operation	A	1 year
4	Manual for meter reading and recording	A	1 year
5	Rules for ownership of water meter and service pipe and customer's responsibility	A, B, C	1 year
6	Rule for outstanding bill	A, B	1 year
7	Rule for illegal connection	A	1 year
8	Rule for FOC	A, B	1 year
9	Rule for VIP	A	1 year
10	Rule for Fire hydrant	A, B	1-2 years
11	Enforcement of fine on NRW in customer's territory	A	1 year
12	Design standard for service pipe and water meter	A, B	1-3 years
13	General specification on water meter	B	1 year
14	General specification on service pipes	B	3 years
15	Manual for water meter installation	A	1 years
16	Manual for service pipe installation	A	1 year
17	Standard drawing on water meter installation	A, B	1 year
18	Standard drawing on service pipe installation	B	1 year
19	Maintenance and management manual on water meter	A, B	3 years
20	Design standard for transmission and distribution facilities	A, B	1-3 years
21	General specification on transmission & distribution pipes	A, B	1-3 years
22	Manual for transmission and distribution pipe installation	A, B	1-3 years
23	Standard drawing on transmission and distribution pipeline installation	A, B	1-3 years
24	Maintenance and management manual on pipeline (transmission, distribution)	A, C	1-3 years
25	Inspection of pipeline (transmission, distribution)	A, B, C	1-3 years
26	Design standard for pump and valve equipment	A, B	1-3 years
27	Manual for pump & valve installation	A, B	3 years
28	Valve maintenance/replacement manual	A	1 year
29	Pump maintenance/replacement manual	A	1 year
30	Inspection of pump & valve	A	1 year

29

1-5-3 DRAFT NECESSARY RSGM

- Outcome
  - Steering Committee No. 3 (S/C3) has launched to prepare RSGM chaired by CE.

S/C3: Regulation, Standards, Guideline, Manuals	**Chair person: CE** **Deputy chairperson: DYCE3** **Executive member: ACE, EE, Dawa Aye Aye Mar** **Leading sec: Planning sec.** **Member: Representative of the relevant sec. (Planning sec., NRW sec., House connection sec., Pipeline O&M sec., District offices, Reservoir sec.), other persons recommended by CE**

  - SOP meeting were held for 26 times
- Prepared Materials
  - Four hundred thirty-eight (438) SOPs are already prepared/drafted/under preparation

30

1-5-4 DRAFT WATER SUPPLY REGULATION (1)

◆ Outcome
- Steering committee (SC3) and working group is established.
- Sub-groups are set up.
  - A- service connection issues
  - B- Billing and collection issues
- As overseas cases, the regulations of Tokyo, Faisalabad (Pakistan) and Kenya were studied.
- Chapters of regulation is decided.
- Training in Japan was organized.
- Seminar with Advisory Committee was implemented.

Chapters of Water Supply Regulation

(1) General
(2) Water Supply
(3) Service Installation
(4) Water Tariff
(5) Prohibitions and penalties

Seminar of Advisory Committee on 21 Feb. 2028

31

1-5-4 DRAFT WATER SUPPLY REGULATION (2)

◆ Outcome
- Step by step approach to make the draft of YCDC Water Supply Regulation
  - 1st draft prepared by WG members in October 2018
  - 2nd draft prepared in March 2019
  - 3rd draft prepared in April 2019
  - Workshop with Advisory Committee in October 2019
  - Review by the Law Advisor of WRAWSA

To clearly stipulate the relation between the utility and the customer on water tariff billing/collection and house connection has been realized.

◆ Prepared Materials
- Draft YCDC Water Supply Regulation

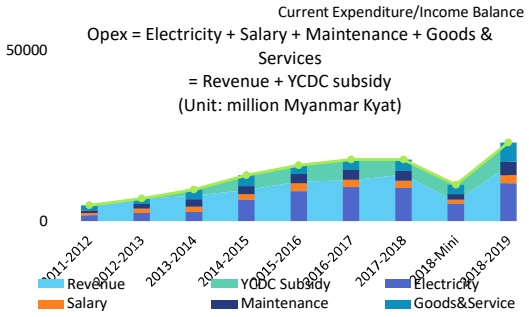
32

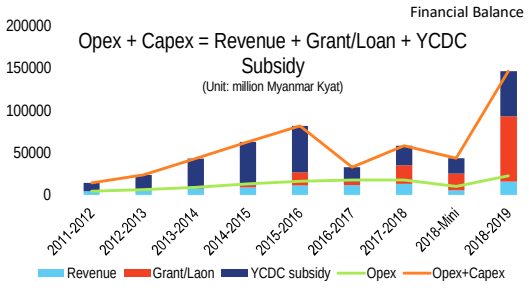
1-6 ENHANCE UNDERSTANDING ON FINANCIAL MANAGEMENT

33

1-6-1 ANALYZE THE PRESENT FINANCIAL MANAGEMENT SYSTEM

- Outcome
  - Surveyed the present financial management system
  - Surveyed the organization structure and its job description, identified the organizational issues
  - Understand the financial situation of water supply of YCDC
  - Understand the decision process of budget or water tariff rate
  - Understand the Corporate Accounting System in Myanmar
  - Understand the Water Tariff Raise in Mandalay City





34

1-6-2 IMPLEMENT TRAINING ON FINANCIAL MANAGEMENT FOR THE SUSTAINABLE OPERATION OF WATER SUPPLY SERVICE (1)

- Outcome
  - Training for sustainable financial management was done through:
    - Seminar by Expert
      - Sustainable management and organization in water supply
      - Seminar series on basics of water supply utilities
      - Tokyo's experience at the age of rapid economic growth
      - Mini-seminar on capital accounting
      - Enhancing understanding on corporate accounting
    - Training in Japan for Overall Utility Management of Waterworks in Japan"
    - Third country training (MWA, Bangkok, PPWSA, Phnom Penh)
    - Seminar with Advisory Committee members
    - Lectures by C/Ps on in-house training courses

Mini-seminars on Capital Costs and Financial management

35

1-6-2 IMPLEMENT TRAINING ON FINANCIAL MANAGEMENT FOR THE SUSTAINABLE OPERATION OF WATER SUPPLY SERVICE (2)

- Outcome
  - Understand on water tariff rate setting
    - Understand present situation about water tariff setting process in YCDC
    - Activities to enhance understanding on water tariff rate setting
      - Expert's seminar/mini-seminar series
      - Seminar with Advisory Committee member and third country training
      - Training in Japan
      - Workshop on drafting Guideline for Water Tariff Setting
      - Exercise of tariff setting

Mayor's statement "water tariff revenue has not covered costs of water supply"

C/P for Finance discussing to make manual of Water Tariff Setting

36

1-6-2 IMPLEMENT TRAINING ON FINANCIAL MANAGEMENT FOR THE SUSTAINABLE OPERATION OF WATER SUPPLY SERVICE (3)

- Outcome
  - Understanding on PPP through:
    - Seminar about PPP
    - Third country training in Bangkok
    - Training in Japan
  - New YCDC Law 2018 and PPP
    - Announcement of PPP Project
    - Presentation on PPP and reorganization to Mayor and Chief Minister in March 2019
  - Examination of Pre F/S about PPP
    - Review of financial model of PPP utilization proposed in Pre F/S
    - Collection and examination of outline, effect and challenges of similar projects in other countries
    - Proposal of two PPP options, laws and regulations of Myanmar and YCDC, and examination of feasibility of two options

The Government of the Republic of the Union of Myanmar
Yangon Region Government
Yangon City Development Committee (YCDC)

Request for Expression of Interest (EOI)

1. Applications/ Proposals for Expression of Interest (EOI) are invited from interested companies (local, international or joint venture) to carry out the works for the Project for the development of Zoning Water Distribution System (the Project) in Yangon City according to the master plan under Public-Private Partnership (PPP).
2. A complete set of the EOI documents may be purchased by the interested companies from the date of 28th August, 2019 at the address below during office hours:
   Water Resources and Water Supply Authority Office
   Yangon City Development Committee
   12-Storeyed New Office Building
   No. 390, Merchant Road, Botahtaung Township, Yangon, Myanmar.
3. Applications for EOI shall be delivered in sealed envelopes to the above address not later than 15:00 hours(local time) on 28th October, 2019 by hand. The EOI documents submitted later than the designated time and date will not be considered.
4. After the evaluation of EOIs, the Tender Committee will invite Proposal Bids from the Applicants that have been prequalified.
5. For further information, please contact Phone: +959-8627-992.

Tender Committee
Yangon City Development Committee

Request for Expression of Interest on PPP Project

1-6-3 CONDUCT OJT ON DEVELOPMENT OF ASSET LEDGER

- Outcome
  - Understanding on asset accounting
    - Seminars by Experts and Advisory Committee Members
    - Third country training in Bangkok and in Japan
  - Development of fixed asset ledger and management/accounting of fixed asset
    - Category of fixed asset is fixed.
    - The depreciation rate are fixed.
- Prepared Materials
  - List of fixed assets
  - SOP for fixed asset management and accounting

Discussion on fixed asset management and accounting in March 2019

Example of Depreciation Rate

Sr.no	1th Tier	2nd Tier	Year (useful life)		Depreciation Rate %		Remark
			Min	Max	Min	Max	
၁	မြေ	စာ					
		Water Conservation forest					
၂	မြေအောက်အဆို့	Steel		30		3.33	
		Brick		20		5	
		Meatal		5		20	
		wood		10		10	
		RC		50		2	
၄	မြေပြည်မီး	သစ်		10		10	
		ဝါ		3		33.33	
		အုတ်		50		2	
		သံစာတာ		10		10	
		အခြား		10		10	
		Concreate way		10		10	
၅	ဓာတ်အိမ်နှင့်ဆက်သွယ်ရေးအဆောက်အဦးများ	Low Capacity Pumping House		10		10	
		Anti Hammer		10		10	
		Indoor Sub Station	30	60	3.33	1.7	
		Electro Chlorination Building	30	60	3.33	1.7	
		Pumping Station,	30	60	3.33	1.7	
		Compressor House	30	60	3.33	1.7	
		Chamber Building	30	60	3.33	1.7	
		Indoor ဓာတ်အားခန်း	30	60	3.33	1.7	
		Outdoor ဓာတ်အားခန်း	30	60	3.33	1.7	

1-7 STRENGTHEN PUBLIC RELATIONS

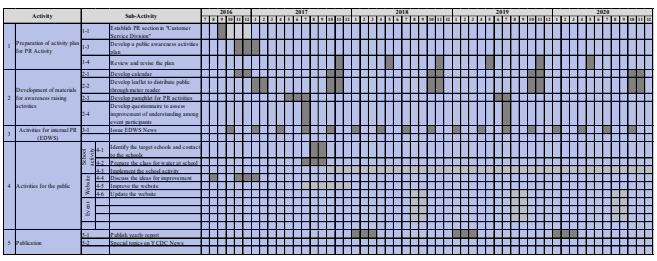
39

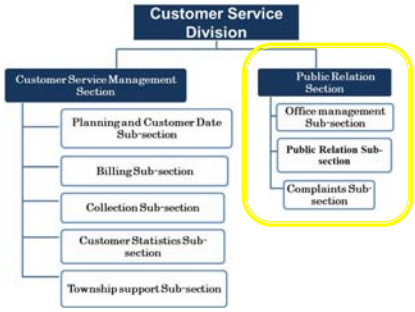
1-7-1 ANALYZE THE EFFECTIVE PUBLIC RELATIONS ON WATER SERVICE OF YCDC

◆ Outcome

- PR Section was established

- Activity plan was prepared





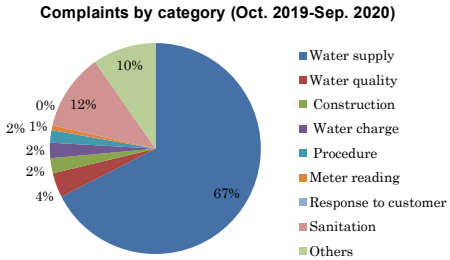
Organization chart of Customer Service Division and PR Section

40

1-7-2 CONDUCT AWARENESS RAISING OF YCDC STAFF

- Outcome
- EDWS News (6 News are published)
  - To share the information within WSD, District office and T/S office
  - To enhance the understanding of works of each department/section/office
- Complaint management (issue annual Complaint Report)
- Prepared Materials
  - Annual Complaint report

1st EDWS News



1-7-3 CONDUCT OJT ON THE PUBLIC RELATIONS ACTIVITIES

- Outcome
- Materials prepared
  - Calendar
  - School presentation
  - Awareness goods (water bottle, had, stationaries)
- School program implemented at six schools
- Awareness to public implemented
  - Myanwater, Myanmar Water, etc.
  - Poster about chlorine injection
- Prepared Materials
- School presentation

Demonstration equipment for school program

Photo of School program

Poster about chlorine injection

Calendar

1-8 STRENGTHEN HUMAN RESOURCES DEVELOPMENT

43

1-8 STRENGTHEN HUMAN RESOURCES DEVELOPMENT

44

1-8-1 REVIEW THE EXISTING HRD SYSTEM

- Outcomes
  - PCM workshop, capacity assessment
  - Interviews with key staff on existing situation and issues related to HRD
  - Survey on plumber license system
  - Survey on turnover ratio and job analysis of WA in EDWS
  - Survey on working motivation of all staff

Interview on WA Job analysis of each office

- Prepared Materials
  - Capacity Assessment Report
  - Reports of each survey results

Training course by provided by YCDC

45

1-8-2 IDENTIFY NECESSARY IMPROVEMENT IN STRUCTURE AND MATERIALS OF THE TRAININGS

- Outcome
  - Discussion of future image
  - 4 fields were identified to achieve future images;

  For HRD Section;
  1) System of training programs
  2) Training management

  For trainers;
  3) Training materials
  4) Trainers' number and their capacity

Ideal future images of HRD

- Prepared Materials
  - Ideal future images of HRD
  - Baseline Survey Report
  - Training Program Plan

Problem analysis about HRD system

46

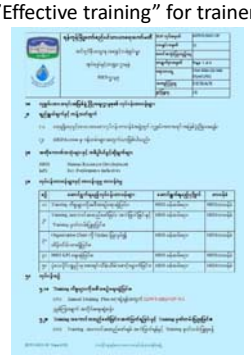
1-8-3 CONDUCT TRAININGS OF TRAINERS FOR PLANNING AND ORGANIZING THE TRAININGS

- Outcome
  - Implementation of pilot training courses

    ⇒ TOT for HRD Section; training management capacity was enhanced (through PDCA cycle of pilot courses)

    ⇒ TOT for trainers; the number of trainers increased, and Trainer's capacity was enhanced (through kick-off/wrap-up workshops).
  - Participation in Trainings abroad to learn good practices of HRD &HRM
- Prepared Materials
  - SOP & various formants for training management
  - Annual Training Plan
  - KPIs related to HRM& HRD
  - Management Improvement Plan

Mini-seminar on "Effective training" for trainers



SOP of HRD Section

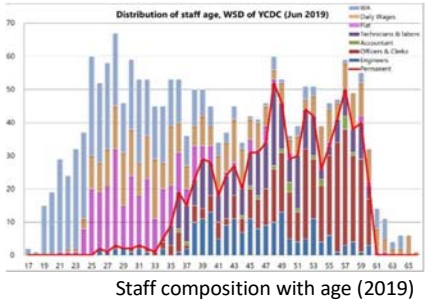
Training Course	Target	Trainees	Days	Times	2019 10	11	12	2020 1	2	3	4	5	6	7	8	9	No. of participants
New Staff	Clerk	20	5.5	2													40
	Worker	30	2.5	1													30
Pre-Officer	Pre-Officers	20	9	3													60
O & M of Pump	Operators	20	2.75	1													20
Basic PC Skills	Staff	12	8	2													24
PC Skills (Excel Adva		12	8	2													24
																	198

Annual Training Plan FY2019/2020

47

1-8-4 DEVELOP 5-YEAR AND 10-YEAR HUMAN RESOURCES DEVELOPMENT PLANS

- Outcomes
  - Training needs analysis
  - Projection of staff composition with their age
  - Survey on Training effectiveness to retain staff
- Prepared Materials
  - Human Resource Development Plan (final draft)



Staff composition with age (2019)

Preparatory meeting for training needs survey

Turnover ratio of staff

48

1-8-5 LAUNCH PRIORITY ACTIVITIES AS A PART OF IMPLEMENTING THE 5-YEAR HUMAN RESOURCES DEVELOPMENT PLAN

- Outcomes
  - Establishment of HRD sub-Section
  - Establishment of regular training implementation.
  - OJT promotion through OJT senior instructor and OJT Handbook
  - Updated organization chart
  - Clarification of duties and responsibilities of each section.
  - Establishment of library.
- Prepared Materials
  - Training materials in many fields
  - OJT Handbook
  - Organization charts
  - Description of duties & responsibilities of each section

Training course for T/S Officers

No.	Group	Training course	Target	Times/the number of participants
1	Training by level	For new staff (Engineer, clerk, worker)	New staff (less than 3 years of service)	For Engineer 7 times, 140 trainees For clerk 6 times, 119 trainees For worker 7 times, 210 trainees
2		For pre-officers	Deputy T/S engineers, SAE level	4 times, 67 trainees
3		For T/S engineers	T/S engineers	2 times, 40 trainees
4	Training by duty	O&M of tube-well pump	Pump operators of T/S	3 times, 60 trainees
		GIS and pipe mapping	Engineers in Pipe Section	1 time, 12 trainees
		NRW management	SAE	2 times, 33 trainees
5	Support for self-learning	Basic PC skill	Office staff	10 times, 118 trainees
		Water engineering	Young engineers	1 time, 40 trainees
Total				43 times, 839 trainees

* Accumulated number since the Project start.

49

3. OUTPUT 2

Capacity of YCDC on NRW management is improved

50

2-1 ESTABLISH NRW MANAGEMENT UNIT

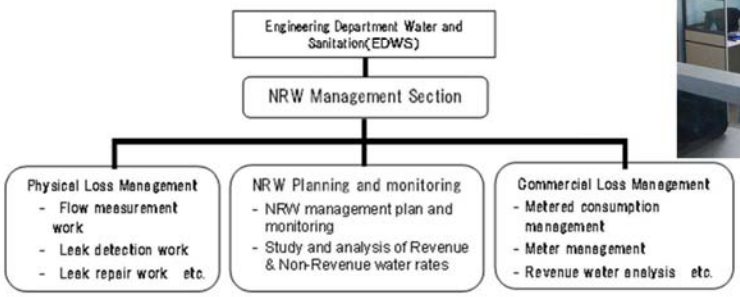
51

2-1 ESTABLISH NRW MANAGEMENT UNIT

◆ Outcome

- NRW Management Section launched on 30th January 2017
- 11 members assigned
- Duties of NRW Management section was prepared

NRW Section starting member & office



Structure of NRW Management Section

52

2-2 COLLECT AND COMPILE INFORMATION OF NRW

53

2-2 COLLECT AND COMPILE INFORMATION OF NRW

- Outcome
  - Township Surveys for all T/S were carried out two times.
  - GIS training
    - Customer Data input
    - Import paper-based map into GIS
    - SOP for data import into GIS was formulated

54

2-3&4 DEVELOP A MODEL ON THE MANAGEMENT OF PHYSICAL/COMMERCIAL LOSS AND HUMAN RESOURCE DEVELOPMENT

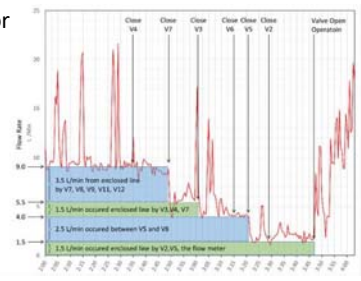
55

2-3&4 DEVELOP A MODEL ON THE MANAGEMENT OF PHYSICAL/COMMERCIAL LOSS AND HUMAN RESOURCE DEVELOPMENT (1)

- Outcome
  - Seminar
    - What is NRW?
    - Hydraulic Analysis
    - DMA Design
    - Design drawing
  - On-site training
    - Leak detection training
      - Acoustic bar, Leak detector, Leak correlator
    - Pressure measurement with logger
    - Minimum Night Flow & Step test

Leak detection training

Night Step Test in Yankin

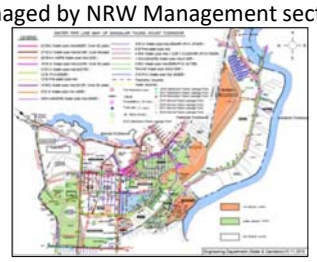


Result of Night Step Test in Yankin

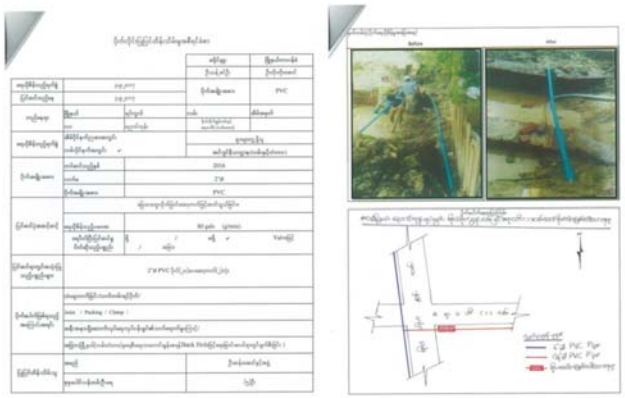
56

2-3&4 DEVELOP A MODEL ON THE MANAGEMENT OF PHYSICAL/COMMERCIAL LOSS AND HUMAN RESOURCE DEVELOPMENT (2)

- Outcome
  - Leakage management by NRW section
    - Formulate new Leakage record format
      - ✓ T/S office started to use new format
      - ✓ Establish new leakage record management system
      - ✓ T/S launched to record leak repair work
      - ✓ All reported leak point is marked into pipeline map
    - All submitted leakage records are collected and managed by NRW Management section



Leakage point map



T/S office started to record leakage repair work

57

2-3&4 DEVELOP A MODEL ON THE MANAGEMENT OF PHYSICAL/COMMERCIAL LOSS AND HUMAN RESOURCE DEVELOPMENT (3)

- Outcome
  - Leakage factor survey of transmission pipe
  - Service connection for directly branched from Gyobyu transmission line was surveyed

Transmission pipe survey

Direct branch situation from Gyobyu line

Service connections to Bago T/S

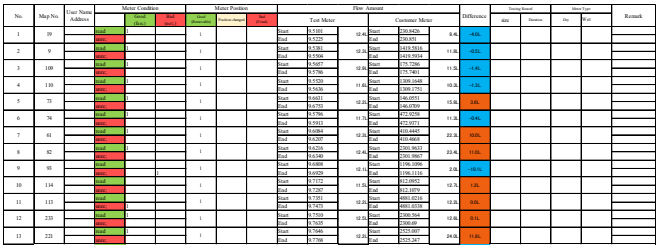
58

2-3&4 DEVELOP A MODEL ON THE MANAGEMENT OF PHYSICAL/COMMERCIAL LOSS AND HUMAN RESOURCE DEVELOPMENT (4)

- Outcome
  - Seminars
    - Damaged meter & meter function
    - Water supply type
    - Guideline for water supply equipment
  - On-site training
    - Meter function test
    - Meter condition survey for all T/S

Meter function test by test meter

Broken meters

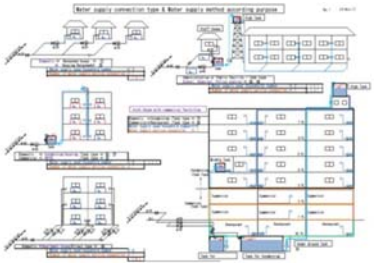


Function test results

2-3&4 DEVELOP A MODEL ON THE MANAGEMENT OF PHYSICAL/COMMERCIAL LOSS AND HUMAN RESOURCE DEVELOPMENT (5)

- Outcome
  - Seminars
    - Commercial loss seminar for T/S officers
    - Customer survey by business categories
    - Survey meters for commercial (size, condition)
    - Bulk meter survey
    - Water supply connection type

Bulk meter survey



Seminar document (supply type)

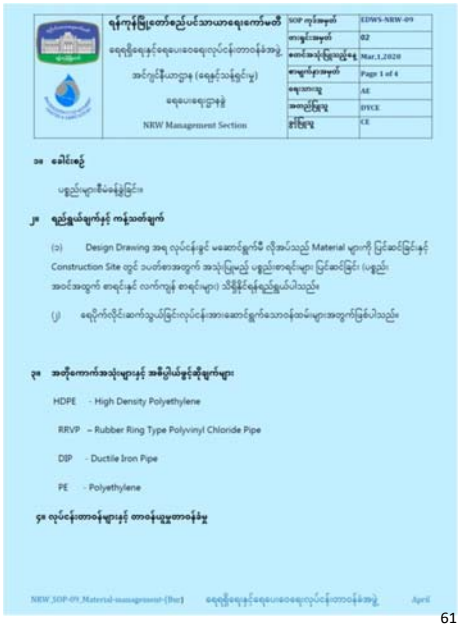
Interview to T/S officer

Seminar for T/S officers

2-3&4 FORMULATE MANUALS ON PHYSICAL/COMMERCIAL LOSS

- Outcome
  - SOPs for NRW management were formulated through pilot project
    - SOPs will be applied to not only NRW section but also to all related sections.
    - Totally 26 SOPs were formulated by NRW section through NRW Pilot Project (Yankin Phase1)

Name of Standard Operating Procedures			
SOP－01	Plane Table Survey	SOP－14	Leakage Volume Measurement
SOP－02	Pavement Cutting Line Marking	SOP－15	Leak Detection
SOP－03	How to check digging depth and so on	SOP－16	Leak Correlator
SOP－04	Construction Signboard	SOP－17	Minimum Night Flow Measurement
SOP－05	Pipe laying	SOP－18	Night Step Test
SOP－06	Pressure Test	SOP－19	Customer Survey
SOP－07	Drilling for service connection	SOP－20	DMA Monitoring
SOP－08	Back Fill	SOP－21	Meter Function Check
SOP－09	Material management	SOP－22	Survey of Damage Meters
SOP－10	Equipment management	SOP－23	Leakage Record
SOP－11	Pipe Line Drawing	SOP－24	Daily Report
SOP－12	Pressure Measurement	SOP－25	Tasks of NRW Section
SOP－13	Flow Measurement	SOP－26	Valve Box installation


NRW Management Section

HDPE - High Density Polyethylene

RRVP – Rubber Ring Type Polyvinyl Chloride Pipe

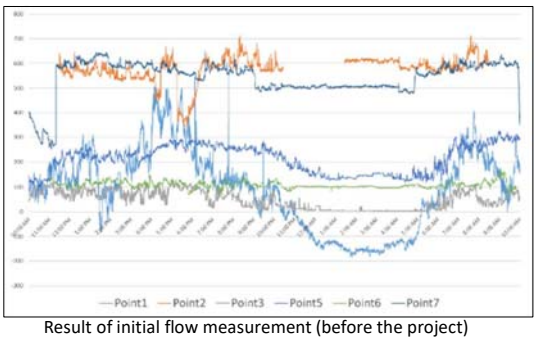
DIP - Ductile Iron Pipe

PE - Polyethylene

61

NRW REDUCTION PROJECT BY NRW SECTION (NORTH OKKALAPA TOWNSHIP)

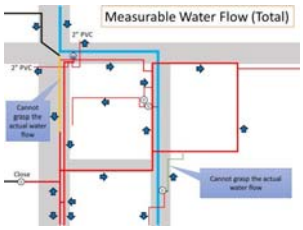
- Outcome
  - Survey of current pipelines and calculate initial NRW rate
  - Planning for flow measurement
  - Design and hydraulic analysis was carried out by NRW C/Ps



Result of initial flow measurement (before the project)


Survey for planning DMAs


Confirm inlet point for target area



Flow measurement planning by C/P

Record of existing pipeline survey

62

NRW REDUCTION PROJECT BY NRW SECTION (NORTH OKKALAPA TOWNSHIP)

- Construction was carried out
  - Set up DMA
    - Separating into 3 DMAs
    - Supervised by NRW section with utilizing what they learned so far
  - Trial for using original items
    - Meter Box
    - Valve box and valve key
    - Flow meter chamber

Project location & plan of DMAs


Connecting to existing distribution line

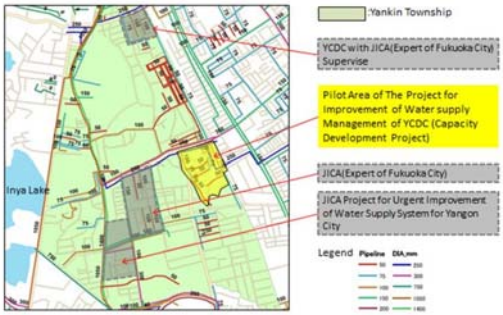

Flow meter Chamber


New meter with Meter Box

63

PILOT PROJECT (13WARD, YANKIN)

- Outcome
  - Preparation and pre-training for pilot project
    - Yankin T/S 13ward was selected as a pilot area according to criteria for NRW pilot project
    - Customer survey in pilot area was conducted in 2015
    - Basic information of pilot area was collected



Location of pilot area (Yankin T/S)


Customer survey (Interview by C/P)


Road length survey for planning

64

PILOT PROJECT (13WARD, YANKIN)

- Outcome
  - Preparation and pre-training for pilot project
    - Plane table survey and map creation
    - Water pressure measurement
    - Training plan was prepared

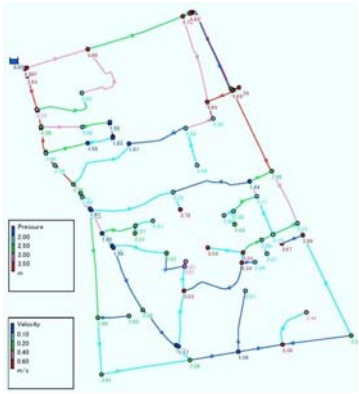
Training of plane table survey

Scaled map created by C/Ps

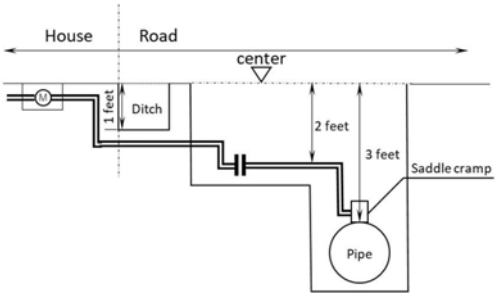
65

PILOT PROJECT (13WARD, YANKIN)

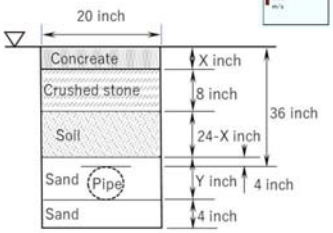
- Outcome
  - Preparation and pre-training for pilot project
    - Test digging was carried out to confirm actual existing pipeline
    - Hydraulic analysis
    - Design drawing
    - Formulate a standard design of trench and service lines



Hydraulic analysis result



Design of House connection



Digging and backfill design for pilot project

66

PILOT PROJECT (13WARD, YANKIN)

- Outcome (Before construction of pilot project started)
  - Dec. 2018 - NRW section & 8 members from T/S were assigned for NRW pilot project
  - Pre-training was executed for new C/Ps from T/S
    - Pipeline Drawing, Detail diagram drawing
    - Record of work
    - Basic knowledge of piping work
    - Site visit (Lagunpyin project)

Meeting with pilot project C/Ps

Yankin pilot area - Field survey

Site survey – Lagunpyin project

67

PILOT PROJECT (13WARD, YANKIN)

- Outcome
  - Pilot project was implemented between Jan and Nov 2019
  - Import piping material and tools from Japan was arrived in Jan 2019
  - Public announcement for customers in 13 ward of Yankin was held on 17th Jan 2019
  - Flow measurement to calculate initial NRW rate

Dec. 2018 | 2019 | Rainy Season | Nov.

Procured material for pilot project

Public announcement of pilot project

Site OJT was launched in Jan 2019

68

PILOT PROJECT (13WARD, YANKIN)

- Outcome
  - Recording of construction
    - Daily report with drawing and consumed material list
    - Pressure test
    - Material management
    - Completion drawing

Morning meeting

Daily report written by C/P

Pressure test

69

PILOT PROJECT (13WARD, YANKIN)

- Outcome
  - Proper Piping work
    - Training of pipe cutting
    - Proper pipe jointing for RRVP, DIP, HDPE(butt-fusion)
    - Pipe repair work
  - Training of safety measures (Helmet, Safety Shoes, etc.)
  - Learned how to use construction machines and tools
  - Proper digging and backfill according to the design

Sometimes heavy rain suspended the project

Pipe cutting training

C/P trained piping work in trench (RRVP)

C/P learned backfill and construction photo

70

PILOT PROJECT (13WARD, YANKIN)

- Outcome
  - Flowmeter and logger was installed with flowmeter chamber
  - Understand necessity of valve and install into proper location
  - Installation of underground type fire hydrant and training for wash-out
  - Proper meter location & meter box installation
  - Proper tapping work under pressure with drilling machine

NRW was improved !	
Before the project	After the project
96.9%	**5.5%**

*NRW rate will be monitored continuously by NRW section

Meter reading with new meter by C/P

Setting a logger

Install meter at proper location with meter box

71

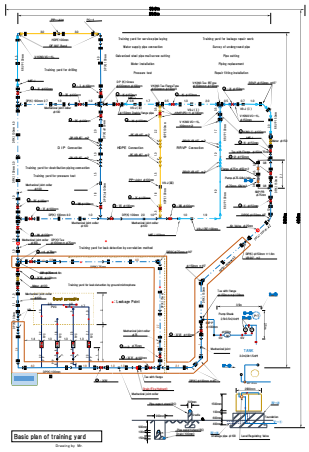
2-5 DEVELOP TRAINING YARD FOR NRW MANAGEMENT

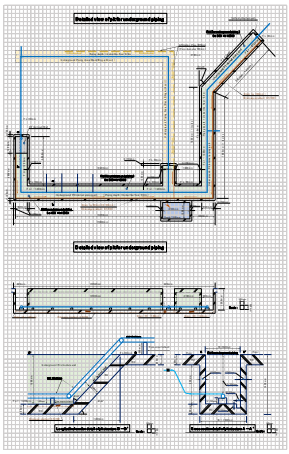
72

2-5 DEVELOP TRAINING YARD FOR NRW MANAGEMENT

- Outcome
  - Yegu pumping station was selected for the place of NRW training yard
  - Facilities of training yard was designed

Selected place for training yard in Yegu pumping station





Design of pipe facilities, accessories, and pit

73

CONSTRUCT NRW TRAINING YARD

- Outcome
  - Construction started in 2019
  - Import pipe material and tools from Japan were arrived in Sep 2019
  - Piping work in the yard was carried out by Yankin pilot project counterparts between Sep 2019 and Jan 2020

Foundation and flamework construction

Piping work training field

All pipes were installed by C/P

74

OPENING CEREMONY

- Outcome
  - Jan.2020 - Opening Ceremony
  - Training demonstration was carried out by C/Ps
    - Pipe jointing
    - Leak detection (leak detector, leak correlator)
    - Pressure test
    - Drilling work for branching service line

Explain leak detection training to Mayor

NRW Training Center

Tape cutting ceremony

Banquet

75

FIRST TRAINING IN TRAINING CENTER

- Outcome
  - First Training was carried out in Jan, 2020
    - C/Ps of Yankin pilot project were selected as trainers for field training
    - 4 courses of NRW training were conducted for 20 trainees by trainers who joined pilot project

Trainers (Yankin Pilot Project C/Ps)

21/Jan	Tue	AM:Seminar（What's waterworks） PM:Seminar（What's waterworks）,Instruction for C/Ps in Training yard
22/Jan	Wed	AM:Seminar（Planning waterworks） PM:Seminar（Hydraulic analysis）
23/Jan	Thu	Instruction for C/Ps in Training yard Pipe Jointing, Leak Detection, Drilling, Pressure Test
24/Jan	Fri	Instruction for C/Ps in Training yard Pipe Jointing, Leak Detection, Drilling, Pressure Test
25/Jan	Sat	—
26/Jan	Sun	—
27/Jan	Mon	AM7:00～ Opening ceremony PM13:00～ Seminar（Hydraulic analysis）
28/Jan	Tue	AM:Seminar（Outline of NRW、Hydraulic analysis） PM: Final Examination
29/Jan	Wed	AM: Lecture (Lecturer: U Zaw Win Aung, Daw Yu Yu Hla Baw)
30/Jan	Thu	Closing

Schedule of first training of training center

Practical training (Drilling)

Seminar in lecture room

76

2-6 DEVELOP AND SUPPORT IMPLEMENTATION OF THE NRW MANAGEMENT PLANS

77

2-6 DEVELOP AND SUPPORT IMPLEMENTATION OF THE NRW MANAGEMENT PLANS

◆ Outcome

- ☐ Established and launched NRW action plan till 2020(mid term)
- ☐ Established NRW management plan

(Table of contents of the plan)

1. Existing Situation of NRW
2. Countermeasures
3. Cost benefit analysis of NRW activities
4. Other related activities
5. NRW Management Plan

NRW action plan (Authorized in 2018)

Category	Policy	No	Objective
NRW Management	Improve information accuracy	1	Create and update pipeline map
		2	Collect basic data regarding NRW management
	Grasp actual NRW situation	3	Grasp NRW rate periodically by data collecting on distribution and effective water (revenue, non-revenue)
		4	NRW management in existing DMA
Physical Loss	Proactive leak prevention	5	Design/construct DMA system in pipe network
		6	Pipe laying at proper location to prevent leakage
		7	Prevent leakage at branch point
		8	Implement water pressure test to prevent leakage
	Reactive leak prevention	9	Efficient leak detection/repair on existing transmission/distribution pipe
		10	Repair leakage in proper repair method
		11	Record every leakage repair work
Commercial Loss	Measure exact water consumption	12	Grasp situation of existing meter function
		13	Install meter at proper location
		14	Water meter maintenance by EDWS
		15	Maintain measurement accuracy of water meter
		16	Solve non-metered customer
		17	Secure function of large size meter
		18	Proper meter-reading to get exact consumption
		19	Fairness in collecting water charge
		20	Eliminate illegal connections
		21	Decrease broken rate of new meter

78

4. OUTPUT 3

Capacity of YCDC on water quality management is improved

79

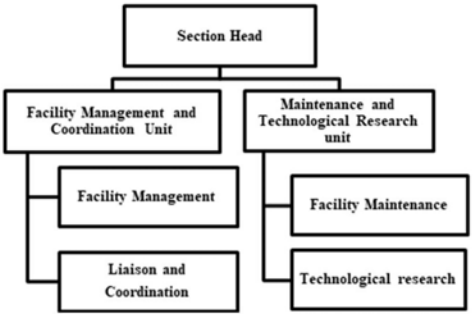
3-1 ESTABLISH WATER TREATMENT SECTION

80

3-1 ESTABLISH WATER TREATMENT SECTION

◆ Outcome

Organization of water treatment section



Duties of water treatment section

- Things reservoirs, intakes, raw water transmissions, water treatment and clear water transmissions
  - ✓ Management of facilities and equipment of reservoirs, intakes, raw water transmissions, water treatment plants and clear water transmissions.
  - ✓ Liaison and coordination with relevant ministries, agencies and organizations about water use of reservoir and river water.
  - ✓ Liaison and coordination with relevant ministries, agencies and organizations about prevention of water quality pollution of reservoir, river and open channel water.
  - ✓ Liaison and coordination with water treatment plants and reservoirs about information of operation, maintenance and water treatment technology.
  - ✓ Management, control and collection of water treatment technology and information.
  - ✓ Planning and research of the maintenance of the facilities and equipment.
  - ✓ Making comprehensive improvement, renewal and maintenance program of the facilities and equipment.

81

3-2 ESTABLISH TASK FORCE TEAM (TFT) FOR WATER TREATMENT IMPROVEMENT

82

3-2-1 ESTABLISH TFT AND TFT SEMINARS FOR WATER TREATMENT IMPROVEMENT

◆ Outcome

- Contents of TFT seminar on sand filter improvement

Date	Contents of seminar
27th, Aug. 2016	● Basic Design Parameters on Design Standard ● Rapid Sand Filtration ● Filter media sieve analysis ● Filter improvement plan
6th, Sep. 2016	
26th, Oct. 2016	

- Contents of Joint seminar & meeting on sand filter improvement

Date	Contents of seminar & meeting
28th, June 2017	● Duties and their schedule of Water Treatment Section ● Documents need to be store or made related to the Filter Improvement Activity ● Progress of the filter improvement TFT ● Rapid Filter Improvement TFT; Pilot basin of Phase 2 ● Rapid Filter Improvement TFT; Pilot basin of Phase 1
23rd, Aug. 2017	
3rd, Oct. 2017	
28th, Nov. 2017	
23rd, Jan. 2018	
16th, March 2018	

- Photo of seminar

- Filter media sieving

83

3-2-2 ESTABLISH TFT AND TFT SEMINARS FOR WATER CHLORINATION BASIC PLAN

◆ Outcome

- Date and contents of seminar and discussion on disinfection

Date	Contents of seminar
16th, May 2016	Water Treatment and Disinfection Dosing of Chlorine and Residual chlorine Requirement of Disinfection and Water Quality Test Advantage and Disadvantage of Chlorination New Chlorine Generator in Yegu Pumping Station Advantage and Disadvantage of Chlorination Chemistry of Chlorine Consumption of Chlorine in Various Water Residual chlorine New Chlorine Generator in Yegu Pumping Station Reaction of Chlorine and Ammonia Old Chlorine Generator in Yegu Pumping Station Ultraviolet Treatment Meeting about chlorination & disinfection Things necessary for the Chlorination WG Chlorine dosing house Basic Policy of chlorination in Japan
17th, May 2016	
1st, Nov. 2016	
22nd, May 2018	
27th, Aug. 2018	
17th, Oct. 2018	

- Study tour of chlorination facility

84

3-3 DEVELOP SOPS FOR WATER QUALITY MANAGEMENT

85

3-3-1 ESTABLISH CENTRAL LABORATORY

◆ Outcome

- 19 SOPs for Nyaunghnapin WTP
- 70 SOPs for Yegu PS
- 45 SOPs for central laboratory
- 12 SOPs for mini laboratory

SOP system

SOP trial verification (review) at Yegu pumping station

Instruction in the SOP training

Trainings using SOPs in Nyaunghnapin WTP

86

3-4 CAPACITY ENHANCEMENT OF LABORATORIES AND WATER QUALITY MONITORING SYSTEM

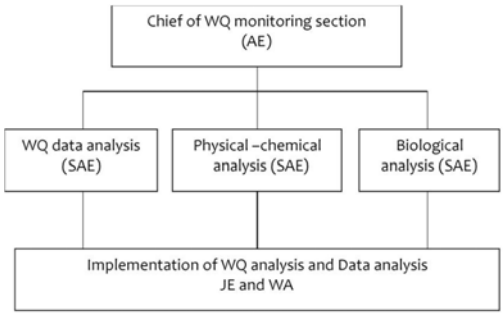
87

3-4-1 ESTABLISH CENTRAL LABORATORY

◆ Outcome

- Central laboratory was established in EDWS HQ building
- 11 staffs were assigned.

Organization of central laboratory



- History of Central laboratory


Pre-training in old YCDC HQ building (2014)


1st central laboratory in old YCDC HQ building (2015)


New central laboratory in new YCDC HQ building (2016-)
Modern analysis equipment is installed

88

3-4-2 INSTALLATION OF MINI LABORATORY

◆ Outcome

● 5 mini laboratories were established

Laboratory	Function of laboratory
Nyaunghnapin WTP mini laboratory	• Process monitoring of water treatment • Water quality monitoring of treated water
Yegu pumping station mini laboratory	• Water quality monitoring of service reservoir in Yegu PS
Hlawga reservoir mini laboratory	• Water quality monitoring of Hlawga reservoir
Phyugyi reservoir mini laboratory	• Water quality monitoring of Phyugyi reservoir
Gyobyu reservoir mini laboratory	• Water quality monitoring of Gyobyu reservoir

Nyaunghnapin WTP

Yegu PS

Hlawga reservoir

Phyugyi reservoir

Gyobyu reservoir

3-4-3 CAPACITY ENHANCEMENT OF CENTRAL LABORATORY

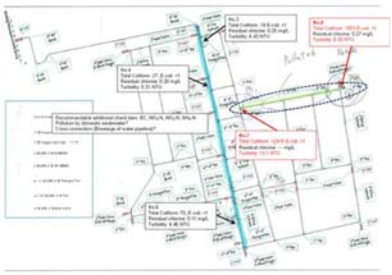
◆ Outcome

● Knowledge was cultivated by seminar

Date	Main contents of seminar
Feb 1.2016	• Monitoring plan development • Case Example of Monitoring Plan in Japan • Review of existing monitoring plan of YCDC
Feb 10.2016	• Water Quality Monitoring Plan • Water quality monitoring item
May 5.2016	• Safety Handling of Sodium Hypochlorite
Jun.9.2016	• Validation of Analysis Method • Example of DPD Residual Chlorine Analysis Method • Quality control of YCDC laboratory
Jun.10. 2016	• Statistic calculation of water quality monitoring data
Oct.25.2016	• Preparation of Small laboratory
Dec.27.2016	• Operation training of small laboratory equipment
Dec.28.2016	• Operation training of SS measurement
Feb.15.2017	• Water quality monitoring item
Jul.20.2018	• Introduction QA / QC system • Test method of internal quality control • Accuracy control chart and Precision control chart
Jul.24.2018	• Accuracy control chart and precision control chart
Jul.26.2018	• Accuracy control chart and precision control chart (Part2) • Chart drawing and assessment of data quality
Jan.19.2019	• Simple mathematical tool for data quality management • Data quality management structure for EDWS central laboratory • Introduction Quality control manual for EDWS central laboratory

• OJT in water quality monitoring work

Residual chlorine survey

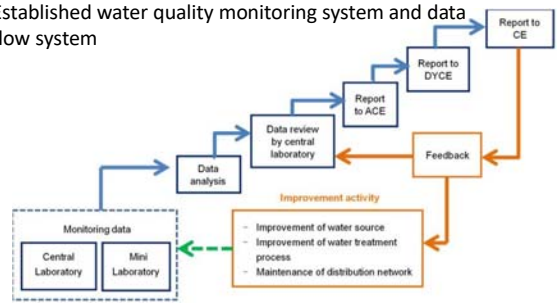


Data analysis of residual chlorine and biological survey

3-4-4 CAPACITY ENHANCEMENT OF MINI LABORATORY AND ESTABLISH WATER QUALITY MONITORING SYSTEM

- Outcome
  - Technical seminar by central laboratory staff
  - Traveling technical guidance by central laboratory staff
  - EDWS water quality monitoring system including central laboratory and mini laboratory was established

Established water quality monitoring system and data flow system



Technical seminar in central laboratory

Traveling technical guidance in mini laboratory

91

3-5 OJT ON WATER QUALITY MANAGEMENT AT THE PILOT TREATMENT PLANT

92

3-5-1 DIAGNOSE FUNCTION OF TREATMENT PROCESSES OF NYAUNGHNAPIN WTP

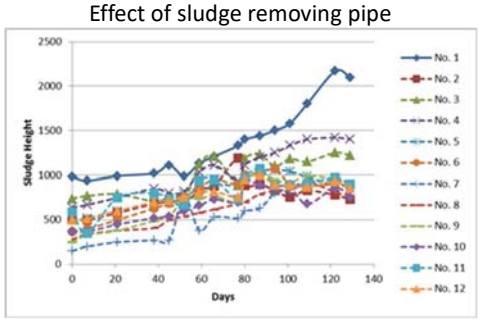
◆ Outcome

- Sludge removing pipe

- Effect of sludge removing

- Adjacent sedimentation basins of which colors are different in Phase 2
- Right: after sludge removing

Effect of sludge removing pipe



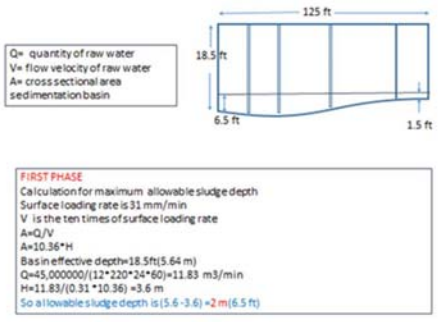
- No. 1 (solid line): sludge removing pipe installed basin
- No.2-12(dotted line): sludge removing pipe is not installed
- C/Ps evaluate that the installed pipes have only limited effect of promoting sludge discharge.
- By installing new sludge removing, cleaning of the settling basin can be done in a shorter time.

93

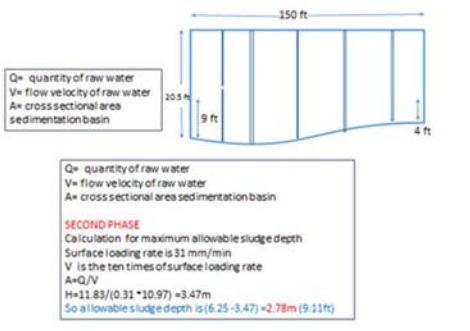
3-5-2 ACCEPTABLE SLUDGE DEPTH IN A SEDIMENTATION BASIN AND MAKING ANNUAL SLUDGE REMOVAL PLAN

◆ Outcome

- To keep a critical flow rate to ensure sludge settling, allowable sludge depth was calculated.
- Sludge removal plan was established: partial sludge removing using the drainage pipes twice a year, and a complete sludge removal once a year
- Create and store sludge removal records



Calculation result of critical flow rate at which the sedimented sludge is rolled up at Phase 1



Calculation result of critical flow rate at which the sedimented sludge is rolled up at Phase 2

94

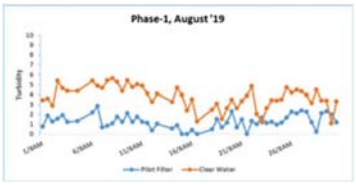
3-5-3 IMPROVEMENT SAND FILTRATION TANK

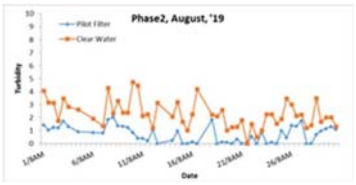
◆ Outcome

- Improvement Nyaunghnapin WTP Sand filtration tank
- Designate one pilot filter for each of Phase 1 and Phase 2
- Improvement function of pilot filter

 Replaced wash water drainage valve	 Raised outflow weir	 Replaced gravel	 Replaced filter sand
 Replaced effluent valve	 Replacement work of filter sand	 Replaced anthracite	 Newly set surface wash nozzle

- Improved filtrated water turbidity





Latest data (Aug. 2019)
Turbidity of filtered water was around 2 NTU.

95

3-6 OJT ON IMPROVEMENT OF WATER QUALITY SUPPLIED FROM RESERVOIRS

96

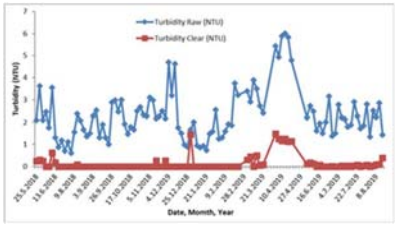
3-6-1 WATER TREATMENT EXPERIMENT IN RESERVOIR

◆ Outcome

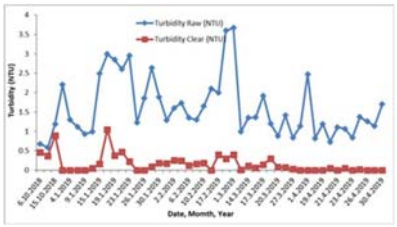
- Water treatment experiment was launched
- Direct filtration method was selected
- Experimental apparatus was installed in Gyobyu and Hlawga reservoir

Gyobyu reservoir
experimental apparatus

Hlawga reservoir
experimental apparatus



Experimental result at Gyobyu reservoir



Experimental result at Hlawga reservoir

97

3-7 INSTALLATION AND OPERATION OF NEW CHLORINATION FACILITY

98

3-7-1 NEW CHLORINATION FACILITY

◆ Outcome

- New chlorination facilities (4locations: Hlawga PS, Yegu PS, Nyaunghnapin WTP and Lagunpyin WTP) were constructed.
- Operation of new chlorination facility was commenced in Jan. 2019.



Storage tank　　Injection pump　　Injection point

Component of chlorine injection facility



Delivery of sodium hypochlorite

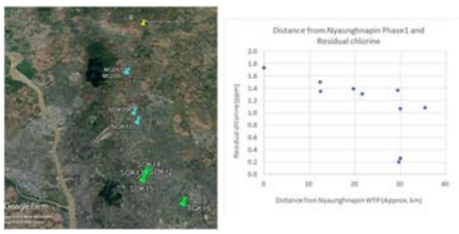

Instruction by contractor

99

3-7-2 CONSIDERATION OF RESIDUAL CHLORINE MANAGEMENT

◆ Outcome

- Working Group for disinfection management was established.
- Collecting water quality data for consideration of disinfection management



Sampling location of residual chlorine survey and survey data

Subject

Reporting on the results of working group meeting for drafting Chlorination Basic Plan.

1. Concerning with the matter mentioned above, Engineering Department (water & Sanitation) has been trying to supply clean & drinkable water to the city dwellers. To be able to improve/achieve supply works, it's planned to dose the chlorine and to implement it, we setup Working Group to be able to draft Chlorination Basic Plan on 8 July 2018.
2. The working group meeting to draft Basic Plan was held on 9 July 2018 and again on 14 August 2018, the meeting led by DYCE 1 was held and there were 10 participants including JICA TA Expert and discussed on the needs and things to be prepared to draft Chlorination Basic Plan.
   - A) When in purchasing Sodium Hypochlorite Solutions which will be used for Chlorination, the specification of it should be the same as the one designed by Lagunpyin Water Supply Project Team & Consultant Team.
   - B) When setting the control parameter for chlorine dosing, it's to set Fecal coliform value.
   - C) The Operational Parameter of Chlorination Dosing Work, it's to set Residual Chlorine Amount as (0.2-1) ppm according to WHO Standard.
   - D) The Initial Chlorine dosing amount should be set according to the proposed section (dosing amount for Lagunpyin WTP will be set by Lagunpyin WTP Project Consultant Team, Ngamoeyeik WTP, Hlawga Reservoir, Yegu Pumping Station will be used/dosed according to proposed amount) and after that the dosing amount will be adjusted based on Residual Chlorine Amount on ground.
   - E) Setting the points along respective Transmission pipelines & Distribution lines to check/measure Residual Chlorine.
   - F) Discuss with GIS Section & pipe sections to make/get a specific pipeline map.
3. Besides, JICA Expert also suggested that before starting chlorine dosing system, it's to clean Service reservoirs & pipelines. It's also to consider the water detention time in the pipeline when the power failure and it's needed to know the exact starting time of chlorination dosing works and more workshops will be held to be able to draft Chlorination Basic Plan.
4. Therefore, I would like to submit the discussed things by Working Group & JICA Expert for Chlorination Basic Plan and would like to receive further instructions.

Ei Khaing Mon, Section Head (Assistant Engineer)

100

3-8 INSTALLATION AND OPERATION OF ULTRASONIC FLOWMETER SYSTEM

101

3-8-1 INSTALLATION ULTRASONIC FLOWMETER SYSTEM

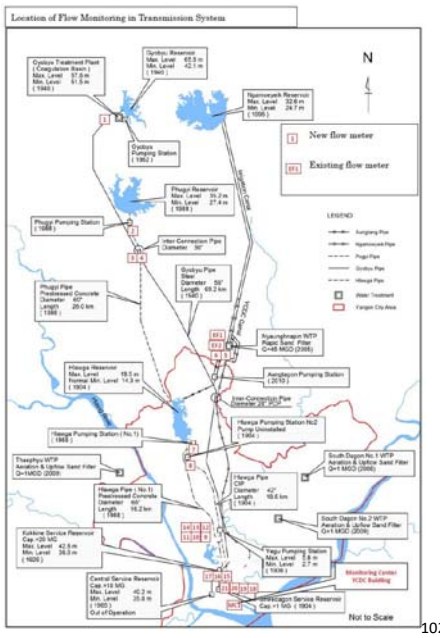
◆ Outcome

- 21 ultrasonic flowmeters and data collection system were installed.

No.	Location
1	After Gyobyu Reservoir
2	After Phugyi Reservoir at Aqueduct
3, 4	Phugyi and Gyobyu pipe connection at Pyawbwesu Pump Station
5, 6	Nyaughnapin Phase 1&2 WTP
-	Nyaughnapin Existing No.1 (PS)
-	Nyaughnapin Existing No.2 (PS)
7	Hlawga PS No.1
8	Hlawga PS No.2
9,10,11,12,13,14	Yegu PS
15,16,17	Kokkine Service Reservoir
18,19,20,21	Shwedagon Service Reservoir
Data collection system: EDWS HQ	



Installation work



102

3-8-2 OJT AND OPERATION OF ULTRASONIC FLOWMETER SYSTEM

◆ Outcome

- OJT for flowmeter operation and data collection system were conducted.
- Collection of flow data was started Oct. 2019.

List of OJT

Date	Venue	Contents
2019/6/28	Yegu PS	Operation of flow meter and field training
2019/10/30	Yegu PS	Operation of flow meter kiosk
2019/11/1	EDWS HQ	Operation of data collection system

Displayed data on data collection system

OJT at Yegu PS

OJT at EDWS HQ

103

5. OVERSEA TRAINING (JAPAN, THIRD COUNTRIES)

104

5-1 OVERSEA TRAINING (JAPAN)

105

5-1 OVERSEA TRAINING (JAPAN)

- Period: 24 Jan. – 31 Jan. 2018
- Course: Overall Utility Management of Waterworks in Japan
- Number of Trainees: 9 members
- Venue: Tokyo Waterworks Bureau, Tokyo Metropolitan Government
- Outcome

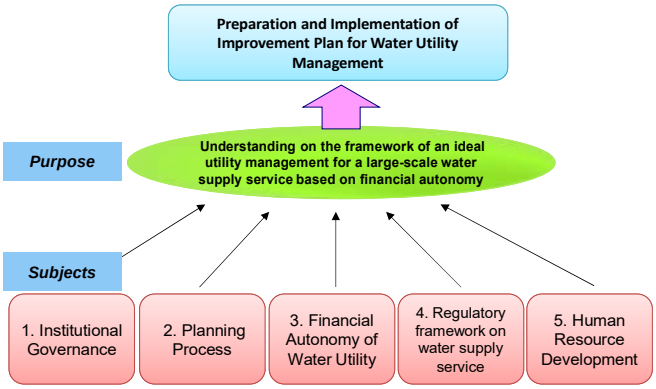
• Trainees deepened their understanding on the subjects *(see Table on the right)*

Topics	Topics also includes;
1) Overview of EDWS, 2) Institutional Governance, and Financial Autonomy of Water Utility	+ Vision of water utility + Organization chart + Reorganization + Authority to approve budget, project etc.
3) Planning System	+ Planning system + Functions of planning section + Procedures to formulate plans + Execution and monitoring of plans
4) Fixed Asset Management and Corporate Accounting	+ Fixed Asset management + Financial accounting system + Formulation of financial plan
5) Laws and Regulations	+ Existing Laws and regulations related to water supply service, and utilities, tariff setting + Relationship with other authorities
6) Rules (Duties and Rights) on Water Supply	+ Water supply regulation + RGSMs within water utility
7) Human Resource Development	+ HRD Policy, plan, HRM + Training management
8) Actions to Materialize the Missions/Master Plan	+ Problem solving to implement visions and M/P

Training Subjects

106

5-1 OVERSEA TRAINING (JAPAN)



- Training Concept and Subjects

Trainee's Name	C/P Team			
	Planning	RSGM	Finance	HRD
1. D. Aye Pa Pa Nyo (ACE) E&M	v			
2. D. May Oo Lwin (EE) Finance			v	
3. U Pyi Soe (EE) Reservoir		v		
4. D. Khin Khin Htwe (AE) Finance			v	
5. D. Khin Than Oo (SAE) House Conn.		v		
6. D. Yamin (SAE) Research		v		
7. D. Khin Zin Mar Myint (Program.) HRD				v
8. D. May Thet Kyaw (Acc 3) Finance			v	
9. D. Nyo Nyo Htun Kyaw (Ass. Supervisor) HRD				v

- List of Trainees

107

5-1 OVERSEA TRAINING (JAPAN)

- Lecture scene by Tokyo Waterworks Bureau

- Practical Training for Pipe Connection and Leakage Detection

- Review of Training with Experts

108

5-1 OVERSEA TRAINING (JAPAN)

- Review Presentation by Trainees

- Study Tour for Tokyo Waterworks Historical Museum

- Closing Ceremony

109

5-2 OVERSEA TRAINING (THIRD COUNTRIES)

110

5-2 OVERSEA TRAINING (THAILAND)

- Period: 20 Nov. – 30 Nov. 2016
- Course: Overall Water Supply Management
- Number of Trainees: 10 members
- Venue: Metropolitan Waterworks Authority (MWA)
- Outcome

• Trainees deepened their understanding on the subjects *(see Table on the right)*

Common Topics	Specialized Topics
1) Institutional Governance and Organization of water utility 2) Role and function of planning section	1) Financial Management + P/L and B/S + Asset accounting + Water tariff + Financial plan
3) Learn practices of waterworks management/ planning by using PIs and PDCA cycle	2) Business plan of water supply utility +Planning functions + Monitoring PIs + Strategic planning + Business plan
4) Utilization of PPP (private sector involvement in water supply management)	3) Standards, guidelines, manuals + Importance + Development process + Construction and inspection
5) HRD activities	4) Human resource development + Organization and responsibility + HRD plan + training management
6) Corporate accounting system and Fixed asset management	+ Personnel evaluation + OJT
7) Whole structure of standards, guidelines, and manual, SOPs.	
8) Actions for problem solving （such as leadership）	

● Training Subjects

5-2 OVERSEA TRAINING (CAMBODIA)

- Period: 16 Jan. – 24 Jan. 2017
- Course: Overall Water Supply Management
- Number of Trainees: 10 members
- Venue: Phnom Penh Water Supply Authority (PPWSA)
- Outcome

• Trainees deepened their understanding on the subjects *(see Table on the right)*

Common Topics	Specialized Topics
1) Institutional Governance and Organization of water utility + Autonomous utility management + Works/ functions + Revenue increase and cost reduction	1) Financial Management + P/L and B/S + Asset accounting + Water tariff + Financial plan
2) Overall activities as water supply utility + Mission and vision + Effective organization structure + Function of department/ section	2) Business plan of water supply utility +Planning functions + Monitoring PIs + Strategic planning + Business plan
3) Whole structure of standards, guidelines, and manual, SOPs. + Legislation system + Guideline, manual, SOP + Inspection	3) Standards, guidelines, manuals + Importance + Development process + Construction and inspection
4) Actions for problem solving + Good practice + Development of leadership + Problem solving	4) Human resource development + Organization and responsibility + HRD plan + training management
5) Wrap-up Discussion	+ Personnel evaluation + OJT

● Training Subjects

5-2 OVERSEA TRAINING (CAMBODIA)

- Period: 16 Jan. – 24 Jan. 2017
- Course: Non-Revenue Water Management
- Number of Trainees: 12 members
- Venue: Phnom Penh Water Supply Authority (PPWSA)
- Outcome

• Trainees deepened their understanding on the subjects *(see Table on the right)*

Common Topics
1) NRW countermeasures as management strategy
2) NRW countermeasures as business strategy.
3) Meter reading, Billing, Tariff collection, Non-payment management, customer data management
Distribution and NRW Management
+ Overall NRW Management Measures + Countermeasures against Physical Loss + Countermeasures against Commercial Loss
Billing and Collecting Management
+ Meter reading + Billing + Tariff collection + Customer data management + Role of Head Office and Branch + PR activities and complaint management

● Training Subjects

113

5-2 OVERSEA TRAINING (CAMBODIA)

● Training Scenes

114

5-2 OVERSEA TRAINING (CAMBODIA)

- Period: 13 Feb. – 22 Feb. 2018
- Course: O&M of WTP and water quality management
- Number of Trainees: 9 members
- Venue: Phnom Penh Water Supply Authority (PPWSA)
- Outcome
- Trainees deepened their understanding on the subjects *(see Table on the right)*

Common Topics
1) Introduction of PPWSA
2) Site visit of PPWSA water works facility
3) Water treatment and water quality management
4) SOP management system
5) Summary of chlorination in PPWSA
6) Water quality monitoring system in WTP
O&M of WTP
+ Management of WTP and O&M with SOP + Importance of preventive maintenance
Water quality management
+ Planning of water quality monitoring. + Quality control of water quality monitoring data + Quality control of water quality monitoring data (practical training) + Utilization of WQ monitoring data

● Training Subjects

115

5-2 OVERSEA TRAINING (CAMBODIA)

● Training Scenes

116

6. CONFERENCE PRESENTATION

117

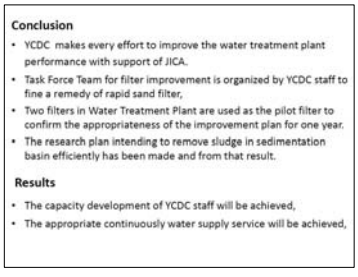
6-1 2018 JWWA Annual Conference

◆ Outcome

- Date and venue: 26 Oct. 2018, Fukuoka
- Presentation: Mr. Zaw Oo
- Title: Cooperative improvement of water treatment plant function in Yangon city, Myanmar with Japan


Cooperative improvement of Water Treatment Plant function in Yangon City, Myanmar with Japan;

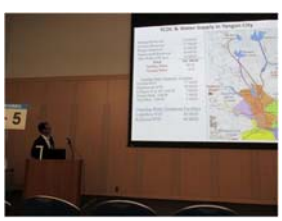
Zaw Oo (Yangon City Development Committee)
Thit Lwin (Yangon City Development Committee)
Katsuhiko Terashima (Tokyo Engineering Consultant Co., JICA Expert)


Conclusion

- YCDC makes every effort to improve the water treatment plant performance with support of JICA.
- Task Force Team for filter improvement is organized by YCDC staff to fine a remedy of rapid sand filter,
- Two filters in Water Treatment Plant are used as the pilot filter to confirm the appropriateness of the improvement plan for one year.
- The research plan intending to remove sludge in sedimentation basin efficiently has been made and from that result.

Results

- The capacity development of YCDC staff will be achieved,
- The appropriate continuously water supply service will be achieved,



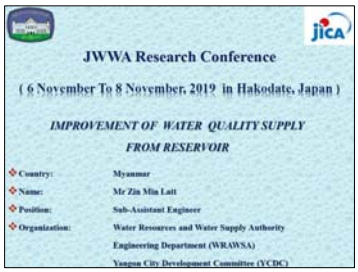
Presentation by Mr. Zaw Oo

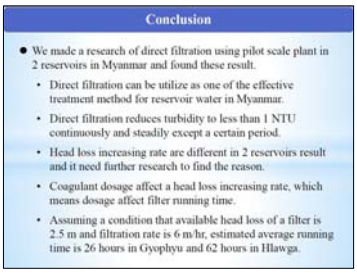
118

6-2 2019 JWWA Annual Conference (Part1)

◆ Outcome

- Date and venue: 7 Nov. 2019, Hakodate
- Presentation: Mr. Zin Min Latt
- Title: Improvement of Water Quality supply from Reservoir





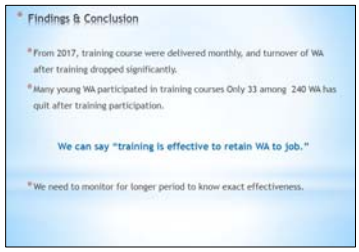
Presentation by Mr. Zin Min Latt

119

6-3 2019 JWWA Annual Conference (Part2)

◆ Outcome

- ◆Date and venue: 7 Nov. 2019, Hakodate
- ◆Presentation: Ms. Khin Zin Mar Myint
- ◆Title: Training effectiveness to retain staff members



Presentation by Ms. Khin Zin Mar Myint

120

7. 5S & KAIZEN

Aiming at improving office works by changing mind-set as well as staff's behavior.

121

7. 5S & KAIZEN

◆ Outcomes

- Most offices practiced 5S&Kaizen activities.
- Bottom-up activities stimulated offices to initiate improvement at site.

Topics	Outcomes of activities
Session 1: 5S and 7 wastes	Seminar ⇒ 63 offices applied at site.
Session 2: Continuous Improvement (Kaizen)	Seminar ⇒ 62 offices applied at site.
Session 3: How to find points to be improved?	Seminar ⇒ Each office made fish-bone analysis.
Session 4: How to implement Kaizen?	Seminar ⇒ Each office analyzed and sorted priorities of issues.

◆Prepared Materials

- 5S Checklist
- Training materials on 5S & Kaizen for regular training course.

5S; Before & After in T/S office

Workshop for problem solving

Fish-bone analysis of each office

122

8. SPECIAL TRAINING BY YANGON TECH UNIVERSITY

Aiming to refresh basic theory on water supply engineering and understand how to apply them in work.

123

8. SPECIAL TRAINING UNDER COOPERATION WITH YANGON TECHNOLOGICAL UNIVERSITY

- Outcomes
  - 47 engineers learnt theory and application of water engineering.
  - Subjects; Fluid mechanics, open canal, pipe network, water supply (demand projection), water treatment (treatment process, water quality analysis and monitoring)

Lectures by YTU lecturers

Practical exercises by officer

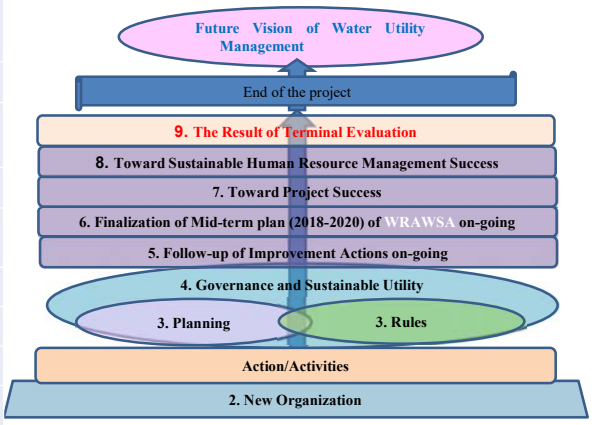
124

9. JCC

125

9. SCHEDULE AND MAIN THEME OF JCC

S.N	Date	AC participation	Main theme	Participants
1st JCC	27~29, Jan. 2016	1st ACS	Establish Future Vision of Water Utility Management of YCDC (Utility Financial Management, NRW and Water Quality Management)	Day1=67 Day2=78 Day3=70
2nd JCC	25, Aug. 2016	No	Establish New Organization	108
3rd JCC	30 Jan~ 1 Feb. 2017	2nd ACS	Overview of Planning and Rules to guide actions of new organization for achievement of future vision	Day1=95 Day2=88 Day3=75
4th JCC	7 Sept, 2017	No	Good Governance/ Sustainable Utility and Management Improvement Plan	93
5th JCC	26 Feb 2018	3rd (separate)	Follow-up of Improvement Actions on-going	105
6th JCC	10 Oct 2018	No	Finalization of Mid-term plan (2018-2020) of WRAWSA	116
7th JCC	1 Mar 2019	No	Toward the Project Success and further growth to achieve WRAWSA Vision	137
8th JCC	24 Oct 2019	No	Toward Sustainable Human Resource Management	103
9th JCC	30 Jan 2020	4th (separate)	The Result of Terminal Evaluation (Achievements, Evaluation, Recommendations and Lessons Learned of the Project)	91



126