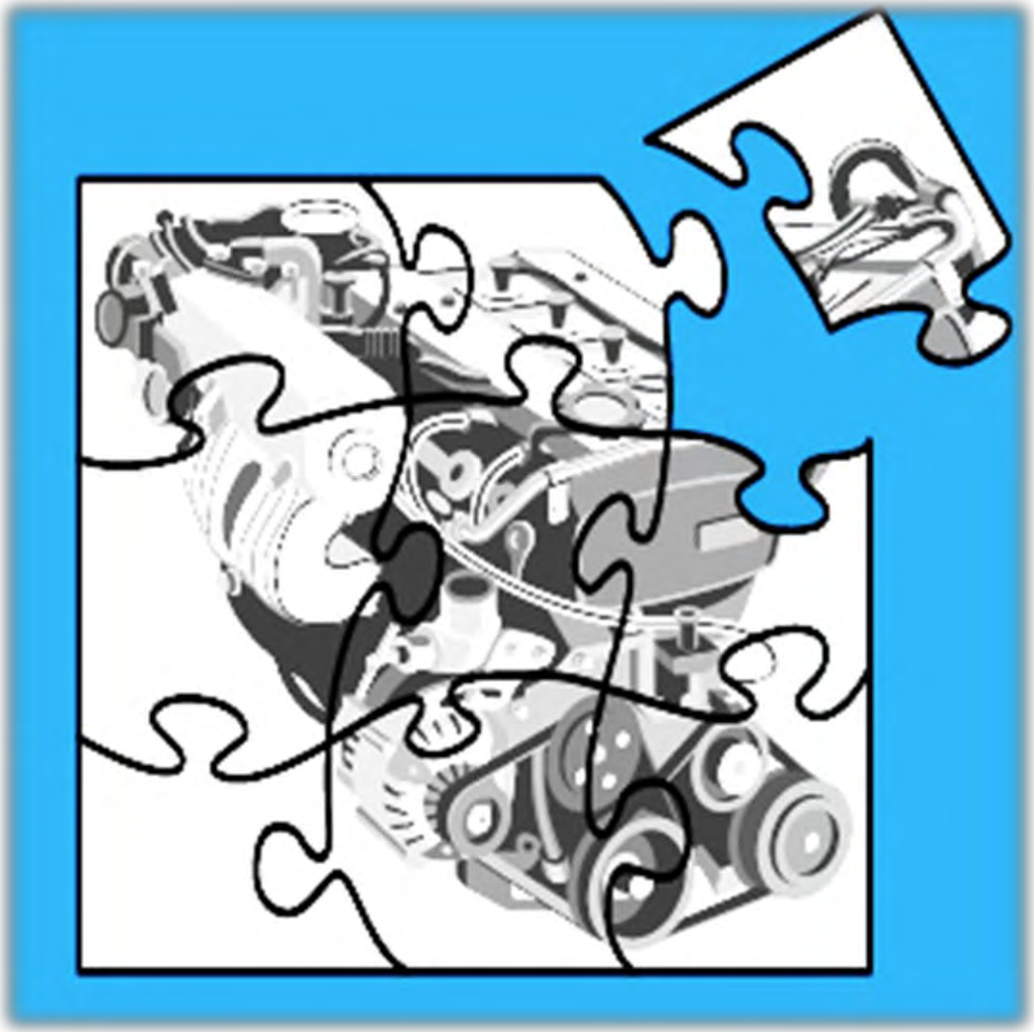
MANAGEMENT OF WATER BUSINESS

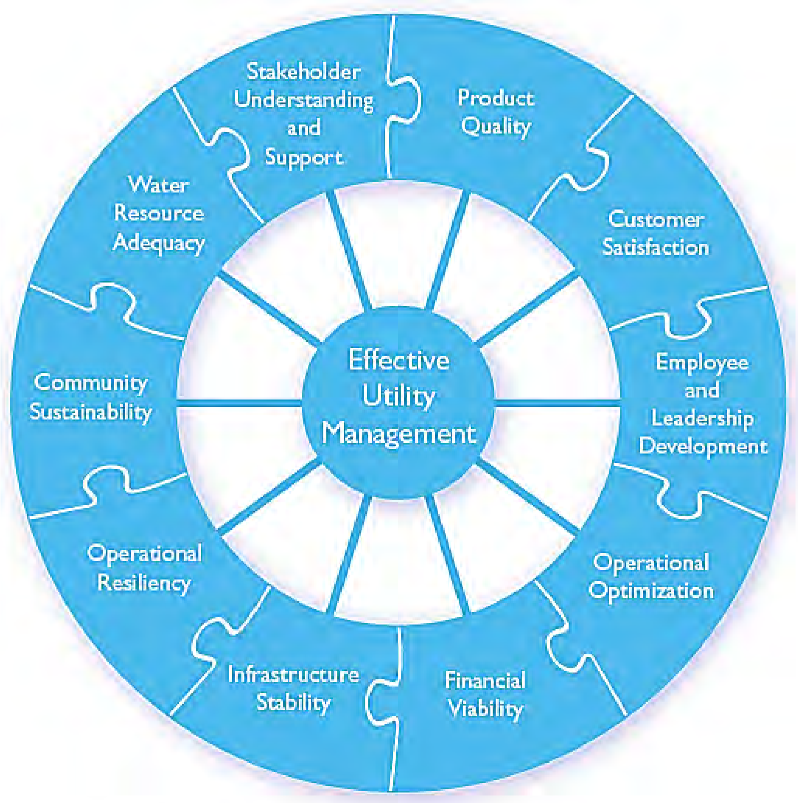


OR

BUSINESS MANAGEMENT OF WATER UTILITY

Visoth CHEA, PhD
Deputy General Director
Chea@ppwsa.com.kh
www.ppwsa.com.kh

10 ATTRIBUTES OF EFFECTIVELY MANAGED WATER UTILITIES



Ten Attributes of Effectively Managed Water Sector Utilities

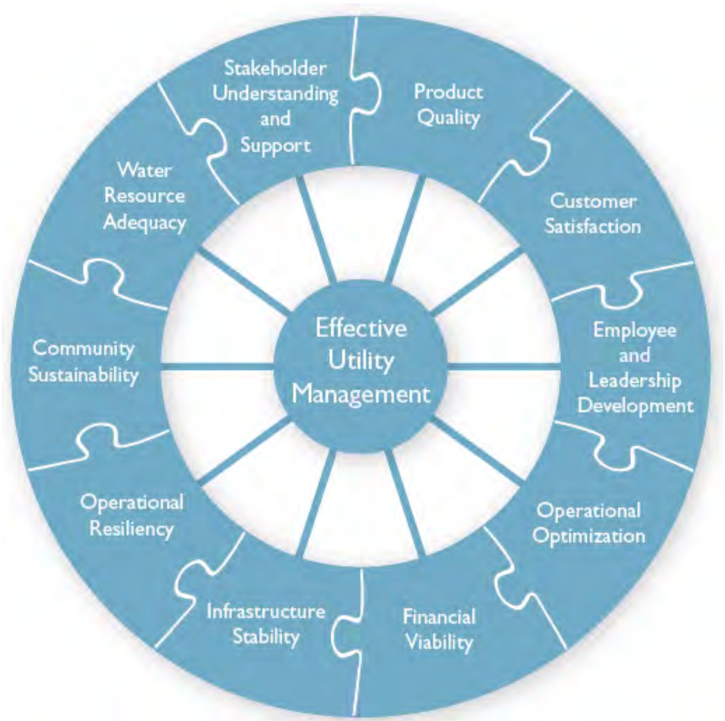
1.Product Quality

1. Product quality regulatory compliance
2. Product quality service delivery

2.Customer Satisfaction

1. Customer complaints
2. Customer service delivery
3. Customer satisfaction

10 ATTRIBUTES OF EFFECTIVELY MANAGED WATER UTILITIES



Ten Attributes of Effectively Managed Water Sector Utilities

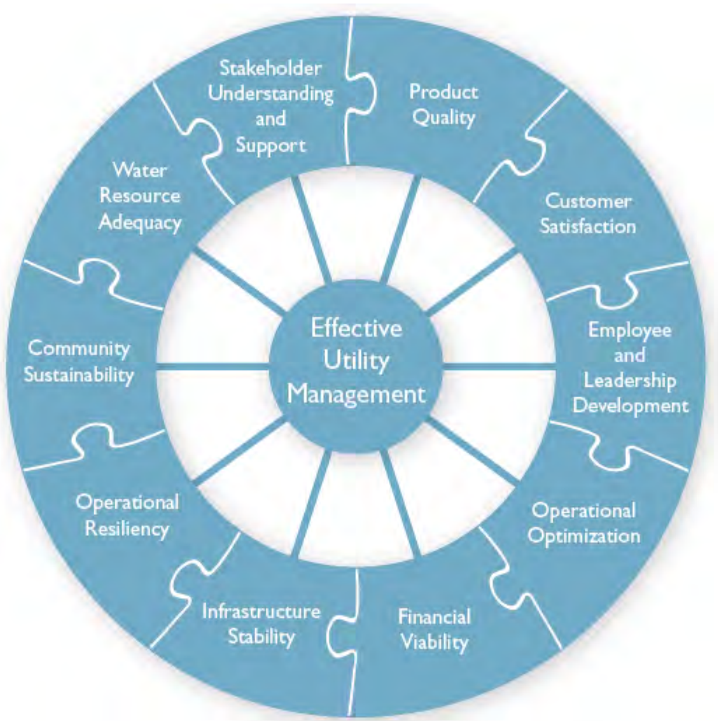
3.Employee and Leadership Development

1. Employee retention and satisfaction
2. Management of core competencies
3. Workforce succession preparedness

4.Operational Optimization

1. Resource optimization
2. Water management efficiency

10 ATTRIBUTES OF EFFECTIVELY MANAGED WATER UTILITIES



Ten Attributes of Effectively Managed Water Sector Utilities

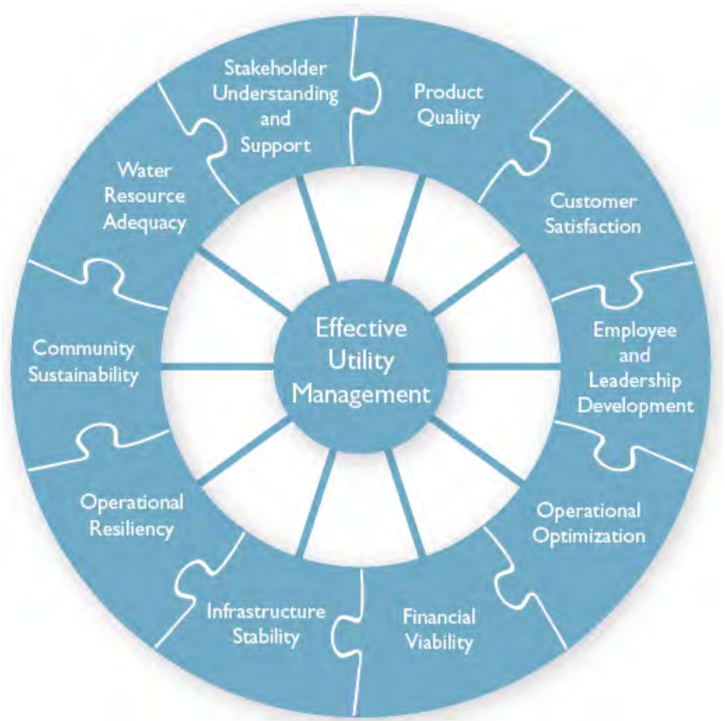
5.Financial Viability

1. Budget management effectiveness
2. Financial procedure integrity
3. Rate adequacy

6.Infrastructure Stability

1. Asset inventory
2. Asset renewal
3. Planned maintenance

10 ATTRIBUTES OF EFFECTIVELY MANAGED WATER UTILITIES



Ten Attributes of Effectively Managed Water Sector Utilities

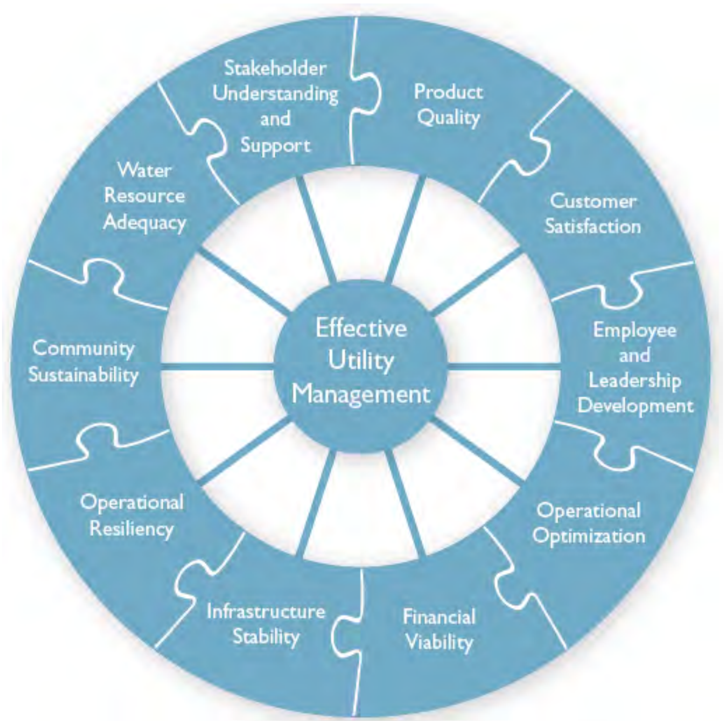
7.Operational Resiliency

1. Risk assessment and response preparedness
2. Ongoing operational resiliency
3. Operational resiliency under emergency conditions

8.Community Sustainability

1. Watershed-based infrastructure planning
2. Service affordability

10 ATTRIBUTES OF EFFECTIVELY MANAGED WATER UTILITIES



Ten Attributes of Effectively Managed Water Sector Utilities

9.Water Resource Adequacy

1. Water supply adequacy
2. Supply and demand management

10.Stakeholder Understanding and Support

1. Stakeholder consultation
2. Stakeholder satisfaction
3. Media/press coverage

PILLARS OF WATER BUSINESS

1-Planning

- Master/Strategic Plan
  - Long term plan, about 10 years
- Business Plan
  - Short term plan, 3 to 5 years
- Annual Plan
  - Operational plan, 1 years
- Monitoring
  - KIPs

PILLARS OF WATER BUSINESS

2-Production & Supply

- O&M of Treatment Plant
  - Produce water of acceptable quality & quantity
  - Effective O&M (Energy, Chemical, …)
- O&M of Distribution Network
  - Distribute water (quality & pressure)
  - Effective O&M, Low Water Loss
- O&M of Service Connections
  - Effective O&M, Accuracy of Water Meter

PILLARS OF WATER BUSINESS

3-Bill & Collection

- Customer Data Management
  - Computer Aid (application , …, up to date)
- Reading Water Meters
  - On time & Accurate reading & record
- Billing/Produce Water Bills
  - On time & Accurate billing
- Water Bill Distribution & Collection
  - On time & Accurate collection

PILLARS OF WATER BUSINESS

4-Finance & Accounting (Support)

- Financial Management
- Accounting
- Asset Management
- Stock Management

PILLARS OF WATER BUSINESS

5-Admin, HRM & D (Support)

- Organization
- Regulation, Process, Safety, SOP,…
- Administrative Works
- HR Management
- HR Development
- Public relation

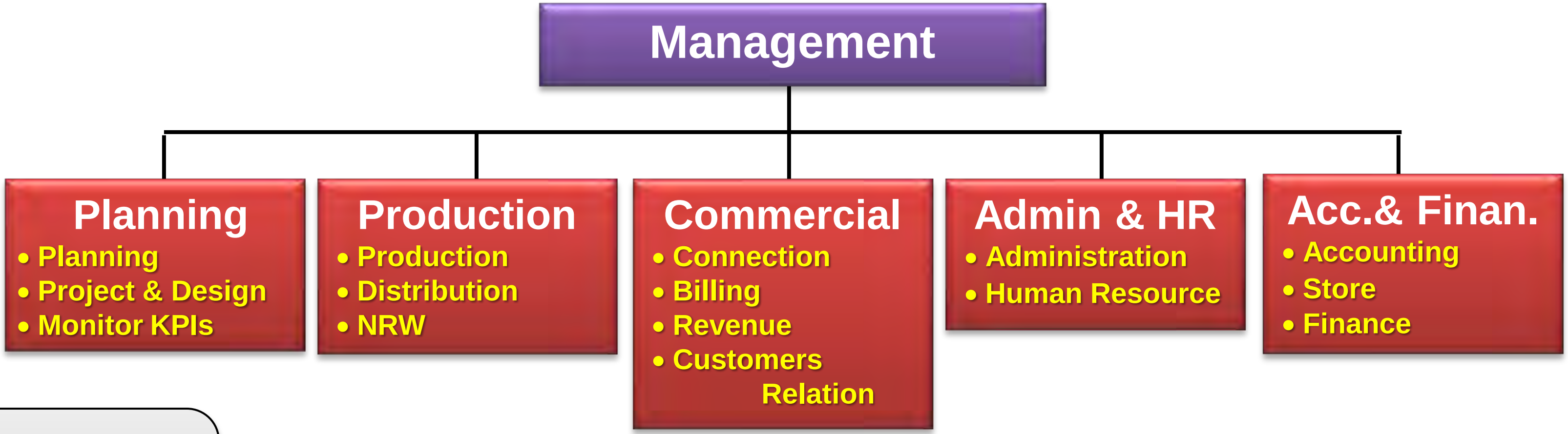
Admin & HR Department

…

…

…

REAL ORGANIZATION OF WATER BUSINESS



Management

Planning
- Planning
- Project & Design
- Monitor KPIs

Production
- Production
- Distribution
- NRW

Commercial
- Connection
- Billing
- Revenue
- Customers Relation

Admin & HR
- Administration
- Human Resource

Acc.& Finan.
- Accounting
- Store
- Finance

Organization

responses to business, jobs, tasks

Manage & Develop Resources

human, finance, asset

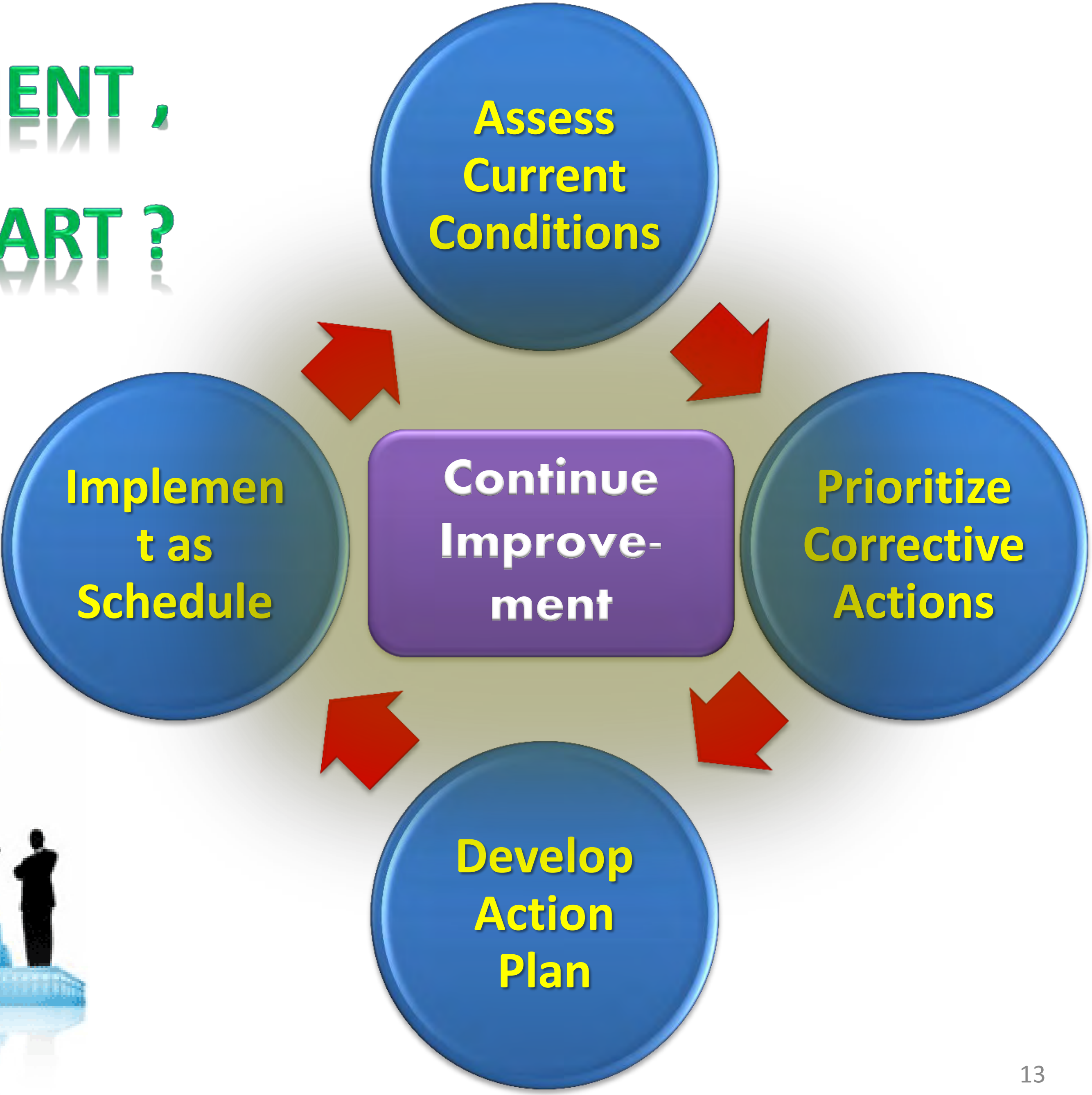
Develop & Update Roles

regulations, job-description, delegation, SOPs

Processing & Monitoring

planning, implement, KPIs

IMPROVEMENT , HOW TO START ?



Assess Current Conditions

Prioritize Corrective Actions

Develop Action Plan

Implement as Schedule

Continue Improvement

Q

A

Training Report

Course name	: Water Treatment Plant Operation for Improvement of Technical Skill and Knowledge of Local Water Supply Utilities from Nepal
Course date	: December 11-12, 2012
Number of days	**:** Two days
Place	**:** Siem Reap Water Supply Authority Office and site visit water treatment plant, Site wells and monitoring well stations
Number participants	**:** 12 (one woman) and two official coordinators from NJS Consultant Co.,Ltd.
Trainers	: two trainers at office and 7 site-field visit support officers

1. Introduction

The training course on Water Treatment Plant Operation for Improvement of Technical Skill and Knowledge of Local Water Supply Utilities from Nepal was organized by Siem Reap Water Supply Authority (SRWSA) in close cooperation with NJS Consultants Co., Ltd under JICA support on the Project for Capacity Development on Water Supply in Semi-Urban Areas in Nepal. This training course was designed to improve technical skill and knowledge for Local Water Supply Utilities in Nepal. This course was conducted for a period of two days at SRWSA by focusing on general understanding about (i) Water Supply in Siem Reap Town and Long Term Development Plan, and (ii) on how to operate water supply treatment plan by using groundwater effectiveness because groundwater around the treatment area has contaminated by Iron and Manganese.

2. Course objectives

The objectives of this course are (i) to improve technical skill and knowledge of trainees in terms of general understanding about water supply management and water treatment plant, which is using groundwater as the main source and (ii) to share knowledge, experience and to show best practice on how to remove Iron and Manganese effectively so that the participants can apply to improve the current water supply in their home country.

3. Training Process and Activities

- **Open Remarks**

Prior to start the process of the training course officially, Mr. Chan Seng La, deputy general director of SRWSA addressed warmly welcome to the participants by briefing about the background of Seam Reap Water Supply and he also would like to thanks for JICA and NJS for choosing SRWSA as a partner for cooperation between Siem Reap Water Supply Authority and Local Water Supply Utilities from Nepal regarding capacity development for Improvement of Technical Skill and Knowledge.

Siem Reap Water Supply was established in 1930 under French Colonia, at that time water supply produced only 200m³/day and it distributed to French resident area only. In 1960 this water supply system was deteriorated and repaired by USA assistance to increase the capacity of production up to 1000m³/day. During Khmer Rouge regime this water utility was closed and it was restarted its operation again in 1980 by producing two hours a day and there was no measurement to record the actual amount of treated water per day.

In 1995 water supply system was improved by French assistance by changing from surface water to use groundwater and started its operation in 1999 by producing treated water about 1400m³/day. With this amount distributed to core town area and there were only about 263 households were accessed to safe water supply networks because of old system and leakage networks so that they could not provide the service more than this.

In 1996 under JICA assistance, the Feasibility Study on Improvement of Siem Reap Water Supply System was conducted and final construction was completed in 2005. Water supply production was increased up to 8000 m³/day. This new water supply system was distributed approximately 30% of the whole population in this town. Water quality is good and met with the National Drinking Water Quality Standards.

In spite of the fact that the water production is limited, this water supply can contribute not only to provides the basic service for supporting daily living standards and welfare of the people in Seam Reap town but also to provides a major contribution for supporting tourism sector and sustainable development, which is a core strategic framework of the Royal Government for development of historical Angkor temple.

In order to address this vital issue of shortage water supply for short and long terms, SRWSA at present just have completed six wells installation and construction. With these six new wells SRWSA can produce additional up to 5000m³/day and will put it into operation by August 2013.

For long term project SRWSA has received a soft loan from JICA to construct a new water supply treatment plant that can product treated water up to 60,000m³/day. At present this project is being processed to select the consulting firm to conduct detail design. According to the long term development plant, the construction of new treatment plant will finally complete by the end of 2018. The main source for this new system will use surface water from Tonle Sap.

- **Overview of Siem Reap Water Supply System and Future Development Plan**

Mr. Cheav Channy, Deputy Director of Seam Reap Water Supply Authority presented the current overview of Siem Reap Water Supply System and Future Development Plan by concentrating on three key points (i) overview on Siem Reap provice; (ii) water supply system in Siem Reap town and (iii) Long term Development Plan.

1. **Overview on Siem Reap Province**

Siem Reap province has 11 districts with 87 communes and 178,792 families with total population of 946,656 people. The main economy is agriculture and tourism, for Siem Reap town tourism is more important than agriculture. At present Siem Reap town number of population is growing up approximately 220,000. The number of tourism has been increasing from year to year for example for this year the figure of visitors has showed about two millions.

2. **Water Supply in Siem Reap Town**

In 2006, SRWRA received a grant aid project from JICA about 15millions USD in order to construct the new water supply system with capacity 8,000 m^3/day. The main source for supply this new system is groundwater and it was required to drill 8 wells with depth of 70 meters. The distribution pipeline with a total of distances about 36 Km and it has diameters range from 75 mm to 500mm.

At present SRWSA has increased daily production up to 10,200m³/day by drilling two additional wells and expand distribution networks up to 92Km and also increase coverage service areas up to five Communes of total 13 communes. About 30% of the total population in this town has access to safe water supply network from SRWSA. So this amount of water production is still inadequate, therefore SRWSA is facing current issue that water supply cannot respond to the consumption demand of local communities and commercial residents that required to be addressed by a long term development plan.

Total numbers of household connection at present up to 4,798 and unaccounted water 9.4 % and SRWSA has 51staff and collection ratio is 97%.

Even shortage of water supply, but SRWSA has fully implemented the national water supply policy by paying attention to the poor families in giving them access to water supply network. Normal connection fee is 130$, but for the poor families the connection cost is required to monthly installation payment, which is ranging from 10 to 30% it depends on the level of the poor families.

3. **Long term Development Plan.**

Long term development has been preparing based on the current shortage of water supply and the plan has been designed is consistent with Cambodia Millenniun Developement Goal (CMDG) means that by the year of 2015 people who are living urban areas should have access to safe water supply by 80%. Based on CMDG SRWSA will still not accomplish by this goal because the new development plan will be completed by the end of 2018. The new water treatment plan will be able to produce 60,000m³/day by using surface water and it can distribute with the whole of Siem Reap town within 13 communes.

- **Iron and Manganese Removal of Siem Reap Water Treatment Plan**

Mr. Kong Sokvan, Production and Distribution Director Department presented on Iron and Management Removal of Siem Reap Water Treatment Plan by indicating three main points (i) Iron and Manganese Removal Process; (ii) Operation and maintenance of Water Treatment Plant and (iii) water quality.

1. **Iron and Manganese Removal Process**

   In order to remove iron from raw water there should use liquid chlorine gas and drop it into receiving wells. This chemical reaction will produce sedimentation and finally it drop into bottom of oxidation tanks.

   Oxidation

   - Oxidation-reduction (redox) reactions form the many water treatment processes addressing a wide range of water quality objective
   - Removal of iron, manganese, color, tastes, odor, and synthetic organics
   - Oxidizing agents, or oxidants, chlorine and chlorine dioxide.

   Adjustment of Ph

   - Control Ph and alkalinity is an essential coagulation;
   - Chlorine is more than Ph7
   - CO2 is removed, Ph is sifted back to 7.0

   Filtration:

   Sedimentation in oxidation tanks will remain some of them and filter will capture all and remove suspended solids in water.

2. **Operation and maintenance of Water Treatment Plant**

The main points of operation and maintenance are to control water quality, water demand and maintenance of treatment plant. Daily work is required to produce water and supply to the consumers and technical staff has to meet every morning to takeover or transfer information to new group in order to work on quality chemical control that have been used and check demand and supply and maintenance of facility. In the water treatment plants is required to control water quality concerning iron removal and prepare daily planning to manage pumping operation and control level of water reservoir. Check residual chlorine after filter water and clear water reservoir at tape water in resident areas. If there is water quality not meet National Water Drinking Standards, it required to adjust chlorine.

3. **Water quality**

Water quality is required to check daily, weekly and monthly. For daily check has to control 8 important parameters such as temperature, taste, odor, Ph, TDS, turbidity, color, residual chlorine. For weekly check it is required to do as the same as daily check. For monthly and trimester check are the same that required to control 20 meters namely temperature, taste, odor, Ph, TDS, turbidity, color, residual chlorine, alkalinity, iron, manganese, Aluminum, chloride, hardness, sulfate, copper, Zinc, Ammonia, nitrite and nitrate.

- **Site Visit the Existing Water Treatment Plant and Wells:**

The main purpose of this site-visiting training was to learn good management and operation of water supply facility from the real existing water supply facilities of SRWSA so that participants can get more understanding about the actual best practice on how to manage day to day basis operation and management of Iron-removal process.

- **Monitoring Well Stations**

Monitoring wells aims at helping participants to understand general about groundwater level and land subsidy that may be affected to Angkor temple area.

During the field visit wells monitoring station, staff of SRWSA showed three station of monitoring wells. One station has two monitoring wells in which one well is shallow with 40m depth and the second well has 80m depth. The purpose of installing shallow well is to monitor shallow aquifer and for the depth well is to monitor deep aquifer. Among three wells, two wells to monitor groundwater level (one well located in the east of Angkor Wat and other one located in the west of Angkor Wat) and last one well for monitoring groundwater and land subsidence located in front of Angkor Wat.

4. Methodology

For this course, SRWRA used training method and site visit at the water treatment plant, well sits, monitoring well station by giving the opportunity for all participants to raise their questions after explanation from site officers to make sure that they can capture all information that they need in order for them to apply this best practice to implement in their home country.

5. Participants' feedback of the training

At the end of the training course Mr. Satoru Oniki, coordinator of JICA/NJS expressed his appreciation about the outcome of the course because of nice presentation, well organized, good facility such as course room, good cooperation from SRWSA staff. He raised very important points by emphasis that this training course was not just to know about the water supply system in Siem Reap town, but also to take the opportunity for both side to exchange information, share experience and knowledge between the two countries.

One of the participants was expressed its satisfaction on behalf of the group by indicating that overall the course was well organized and provided a good explanation, hospitality to the participants and good management for the whole program even the site visit and he hoped that we would continue to communicate to each other to share information and experience.

6. Trainers' observation and reflection

During the training course was conducted at SRWSA office and site visit, general observation were made by trainers showed that participants were expressed their interest in asking questions because they want to know about general management of water supply system, iron and manganese removal process at water treatment plant and daily work. During the course, participants raised a lot questions concerning water consumption, unaccounted for water, water tariff and subside policy for the poor families.

However, SRWSA has recognized some weak points that occurred during the two days of training course such as hand out documents given a little bit late to participants, document given lack of detain explanation and English speaking of trainers are still limited.

7. Conclusion

This training course has provided good opportunity for participants who are currently working with Local Water Supply Utilities of Nepal to get general overview on Siem Reap Water Supply System and long term development. Due to SRWSA currently is using groundwater as the main sources for water supply, therefore they can learn a lot on concept of iron and manganese removal process, well pump station site and monitoring well station. This course provided all participants the opportunity to share or exchange knowledge, information and experience, not only understand about water supply system in Siem Reap but also to understand the Cambodia culture mainly historic Angkor Temples.

Participants expressed their satisfaction about the outcome of this training course, even short time but it was very useful and their expectation were met and hoped that communication should connect between SRWSA and Nepal local water supply utilities for future cooperation.

8. Recommendation

For NJS Consultant Co.,Ltd

If there is any furfure training course cooperation with SRWSA, NJS should provide briefly about the background of the Capacity Development Project, including participants that come from different government organization in order to make it easy for preparation for the course. Information about the course should provide at least one month before the course take place.

For Participants

This recommendation below has been prepared according to the site visit at water treatment plant and monitoring well stations.

1. In order to cope with nonpayment of customers should be installed lock valve located in front of water meter.
2. Wastewater backwash filter should construct dry bed sun to avoid discharge of wastewater into public land or private land because it will affect to the environment.
3. Water meter of household connection should be installed two valves of both side because it easy to maintain.
4. Pipe connection under wells should be installed with two gate valves in between Tee because it easy to make maintenance.
5. For environmental protection purpose there should be installed monitoring well stations in order to monitor changing of groundwater level and land subsidence.

Prepared by

Approved by

KHOY KHIM
Facilitator

Cheav CHANNY

Appendices

1. **List of Trainers and Support Staff**
    1. Mr. Chiev Channy, Deputy Director of SRWSA
    2. Mr. Kong Sokvan, Production and Distribution Director Department
    3. Mr. Khoy Khim, facilitator for this course
    4. Mr. Yai Moniroth, Director of Finance Department
    5. Ms. Hou Sinourn Chief of Administration
    6. Mr. Sok Hourt Chief of Account
    7. Mr. Chhut Monoroom Chief of Production
    8. Mr. Seak Chan Thorn Production officer
    9. An Vichana Production officer

2. **List of Training Materials**

    For Presentation at office
    - Laptop Computer
    - LCD Projector
    - Screen
    - CD copy file for the training course
    - Pointer
    - conference room
    - Microphone
    - Internet
    - transportation
    - Handout document
    - Refreshment

    For Site Visit
    - Production well No.1
    - Production well No. 7
    - Production well No. 8
    - Meeting room
    - Laboratory room
    - Receiving well
    - Oxidation banks
    - Pumping station
    - Chemical Building
    - Electrical Building
    - Elevated tank
    - Monitoring well station.

Siem Reap Water Supply Authority

List of Participants

Training Course on Water Treatment Plant Operation

for

Improvement of Technical Skill and Knowledge of Local Water Supply Utilities from Nepal

SRWSA: December 11 , 2012

Day one

No	Name	Institution	Position	Signature	E-mail
1	Babu kaji shrestha	WSSDO Thapa Nepal	Engineer		
2	Binod Kr. Agrawal	" "	Div. Chief		binod.dwss@hotmail.com
3	Ganesh Bahadur Thapa	WSSDO, Morang, Nepal	Div. chief		ganeshth@hotmail.com
4	Dhruva Mani Paudel	DWSS - Nepal	Senior Divisional Engineer	Paudel	dmanipaudel@yahoo.com
5	SUDARSHAN BHANDARI	DWSS. Nepal	"	Bhandari.	sudarshan_bhandari@hotmail.com.
6	TEEKA RAM PANDEY	Ministry of Urban Development (MOUD)	Under secretary		teekapa@gmail.com

DWSS - Department of Water Supply & Sewerage

7	Pramod Kumar Dubey	WSSDO Jhapa Nepal.	Engineer		
8	Anuj Upadhayay	WSSDO Morang Nepal	"		
9	Bishnu pd Gnawali	Ministry of Urban development Nepal.	Under Secretary		bpg2424@gmail.com.
10	Rajeeb Ghimire	DWSS	Senior Divisional Engineer		rajeebghimire@gmail.com
11	Binu Bajracharya	Department of water supply and Sewerage	Divisional Engineer		binu2064@gmail.com.
12	Deepak Puri	DWSS	Senior Divisional Engineer		dpuri2017@gmail.com
13	Satoru Oniki	JICA Expert			
14	Akira Hasebe	JICA Expert			
15					
16					

Siem Reap Water Supply Authority

List of Participants

Training Course on Water Treatment Plant Operation
for
Improvement of Technical Skill and Knowledge of Local Water Supply Utilities from Nepal

SRWSA: December 12, 2012

Day two

No	Name	Institution	Position	Signature	E-mail
1	Teeka Ram Pandey	Ministry of Urban Development	Under Secretary		teekapa@gmail.com
2	Pramod kumar Dutta.	WSSDO Jhapa Nepal	Engineer		
3	Sudarshan Bhandari	Department of Water Supply & Sewerage	Senior Divisional Engineer	Bhandari	sudarshan_bhandari@hotmail.com
4	Dhruva Mani Paudel	" " "	" " "	Paudel	dmanipaudel@yahoo.com
5	Binod Kumar Agrawal	WSSDO, Jhapa	Division Chief		binod.dwss@hotmail.com
6	Babu kaji Shrestha	WSSDO, Jhapa	Engineer		

7	Deepak Puri	Department of water supply and Sawerage	Senior Divisional Engineer		dpuri2017@gmail.com
8	Binu Bajracharya	,,	Divisional Engineer		binu2064@gmail.com.
9	Rajeeb Ghimire	,,	Senior Divisional Engineer		rajeebghimire@gmail.com
10	Bishnu prasad Jnawali	Ministry of urban development. Nepal.	Under Secretary		bpg2424@ gmail.com
11	Satoru Oniki	JICA Expert/NJS			njs-oniki@mbp.nifty.com
12	Anoj Upadhayay	WSSDO, Morang Nepal	Engineer		
13	Ganesh bdr Thapa	u ,,	Div chief		ganeshth@hotmail.com
14					
15					
16					

Warm Welcome to Participants from Nepal

WATER TREATMENT PLANT OPERATION FOR IMPROVEMENT OF TECHNICAL SKILL AND KNOWLEDGE OF LOCAL WATER SUPPLY UTILITIES IN NEPAL

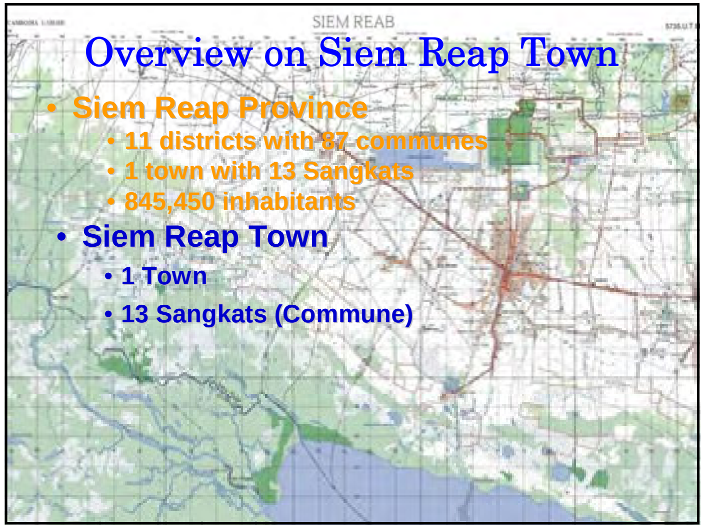
For

The Project for Capacity Development on Water Supply in Semi-Urban Areas in Nepal

On 11-12 December, 2012

Presented by: Mr. CHEAV CHANNY
Deputy General Director
Siem Reap Water Supply Authority

Contents



Overview on Siem Reap Town

- Siem Reap Province
  - 11 districts with 87 communes
  - 1 town with 13 Sangkats
  - 845,450 inhabitants
- Siem Reap Town
  - 1 Town
  - 13 Sangkats (Commune)

MAIN ECONOMIC FOR SIEM REAP TOWN

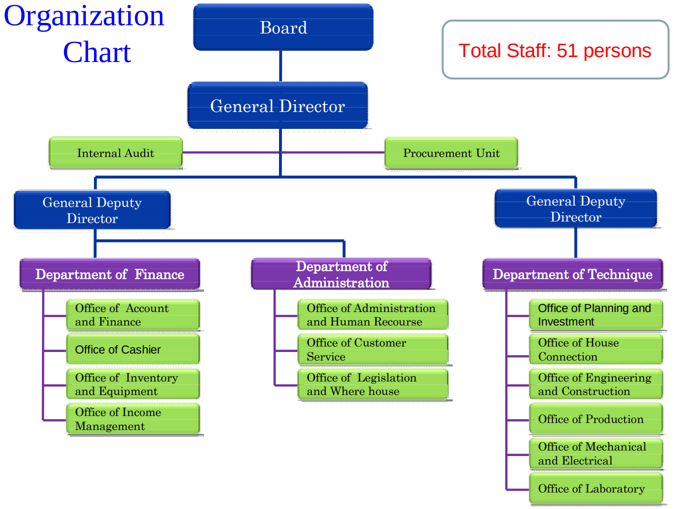
Tourist

Argriculture

2. Water Supply in Siem Reap Town

Organization Chart

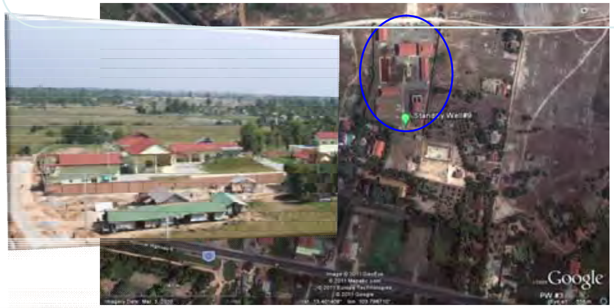
Total Staff: 51 persons



- Board
  - General Director
    - Internal Audit
    - Procurement Unit
    - General Deputy Director
      - Department of Finance
        - Office of Account and Finance
        - Office of Cashier
        - Office of Inventory and Equipment
        - Office of Income Management
      - Department of Administration
        - Office of Administration and Human Recourse
        - Office of Customer Service
        - Office of Legislation and Where house
    - General Deputy Director
      - Department of Technique
        - Office of Planning and Investment
        - Office of House Connection
        - Office of Engineering and Construction
        - Office of Production
        - Office of Mechanical and Electrical
        - Office of Laboratory

Grant Aid Project, Year 2006

- ➢Grant aid project from people of Japan through JICA for 15 millions USD; construct the new water supply system with capacity 8000 m^3/day
- ➢Production wells: 8 wells
- ➢Distribution pipelines: 36 kilometers



Coverage Service Areas

5 Sangkats of 13 Sangkats with number of 5,885 households (19,614)

Around 30% of the total population (220,000) have access to safe water supply

Distribution Pipeline:

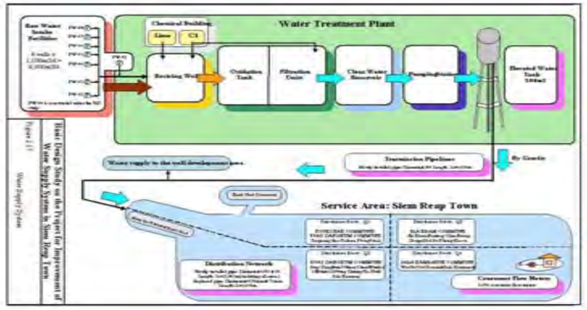
98 Kilometers

Conserve: Pricing

- Volume-based billing
- Regulated by Ministry of Industry Mine and Energy

Tariff Category	Consumption block (m³ per month)	Tariff (Riel per m³)	Tariff ($US per m³)
Domestic	1 to 7	1,100	0.275
	8 to 15	1,500	0.375
	16 to 30	1,800	0.45
	> 30	2,000	0.50
Commercial	1 to 50	1,900	0.475
	51 to 150	2,400	0.6
	151 to 350	2,900	0.725
	> 350	3,400	0.85

Layout of the Treatment Plant



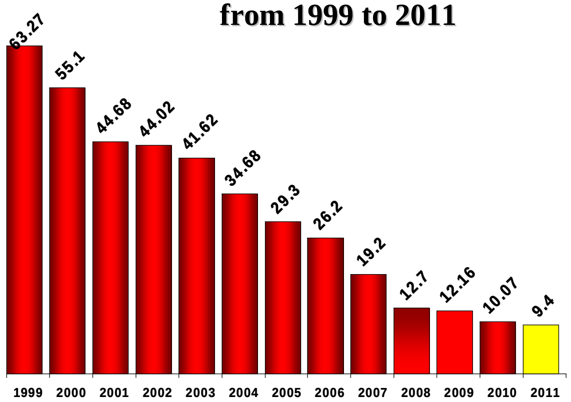
PIPE REPLACEMENT

Management of water quality

No	Description	Unit	WHO Standard	National Standard	Raw water	Clean water
1	Temperature	^{0}C	-	-	29.40	30.60
2	pH		6.5-8.5	6.5-8.5	5.36	7
3	Electrical conductivity	µs/cm	-	1600	328	70
4	Residual chlorine	mg/l	0.6-1.0	0.2-0.5	-	0.5 **at tape 0.3**
6	Iron (Fe+)	mg/l	0.3	0.3	0.83	0
7	Manganese (Mn)	mg/l	0.1	0.1	0.1	0

Reduction of non-revenue water [%]

from 1999 to 2011



Our Effort

2001	INDICATORS	2011
15	Staff /1,000 Connections	8
1,055	Production cap.: m3/d	10,200
9%	Coverage area	25%
20hr/d	Supply duration	24 hr/d
2.0 bar	Supply pressure	3.5 bars
457	Number of connections	4,798
45%	NRW	10%
73%	Collection ratio	97%
71%	Operation ratio	52.40%
Heavy Subsidy	Financial situation	Full Cost Recover

---

3. Long Term Development Plan

Cambodia Millenniun Developement Goals

Cambodia Policy for Cambodia Millennium Developement Goals (CMDG 7.11-Page 62) ,

- In Year 2010 Urban population with access to safe water source 74%
- In Year 2015 Urban population with access to safe water source 80%

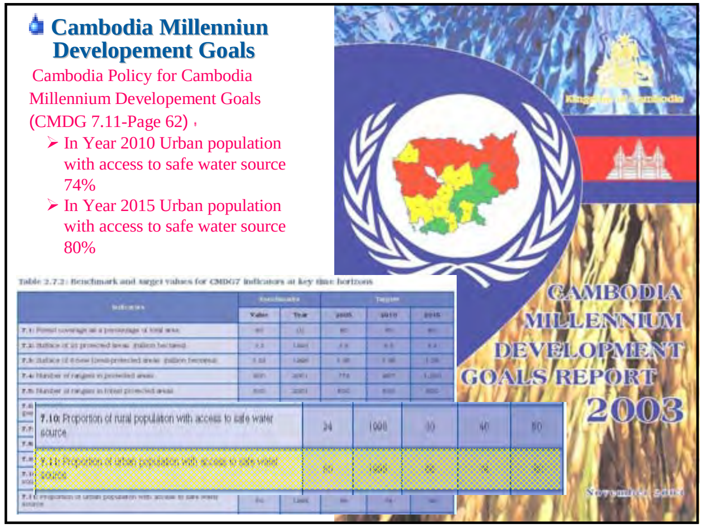
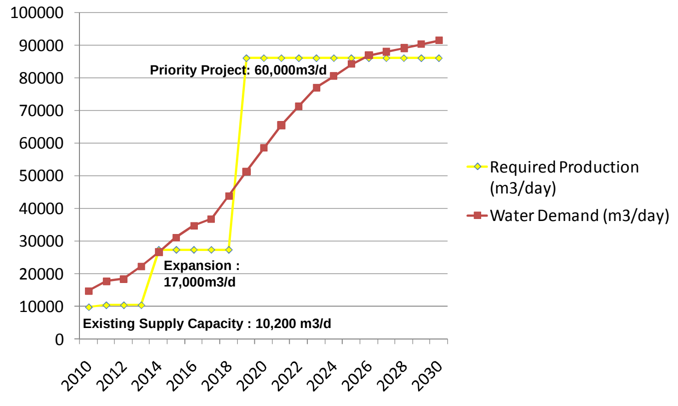
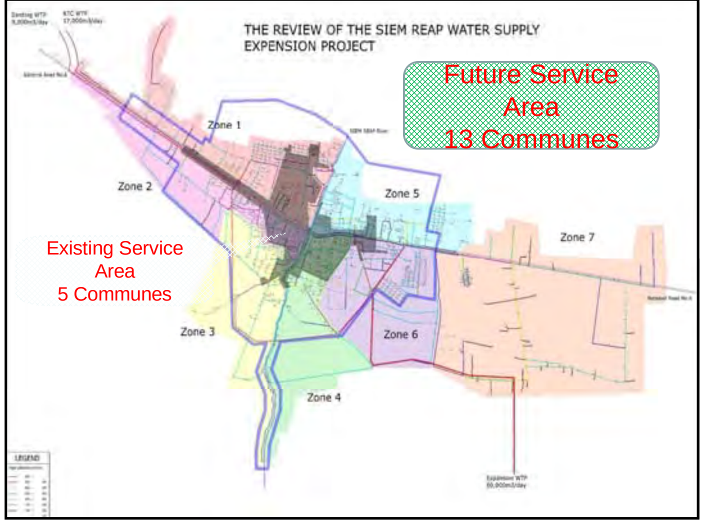


Table 2.7.2: Benchmark and target values for CMDG7 indicators at key time horizons

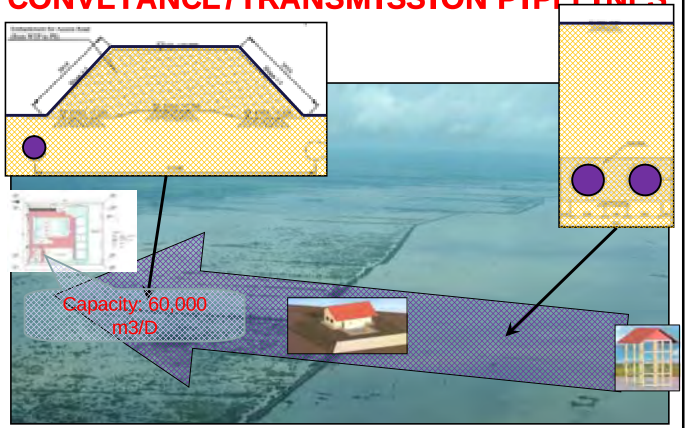
7.10: Proportion of rural population with access to safe water source 34 1998 30 40 50

Water Demand and Requirement





RAW WATER CONVEYANCE/TRANSMISSION PIPELINES



Project Cost Estimation

(X 1,000,000)

Breakdown of Cost	Total		
	Total	JICA Portion	Others
Package-1	1,855	1,855	0
Package-2	533	533	0
Package-3	627	627	0
Package-4	1,686	1,686	0
Price Escalation	1,210	1,210	0
Physical Contingency	591	591	0
Consulting Services	657	657	0
Land Acquisition	27	0	27
Administration Cost	108	0	108
VAT	397	0	397
Social Compensation	7	0	7
Interest during construction	2	2	0
Commitment Charge	0	0	0
Total	7,700	7,161	539
	Rate	76.8JPY/USD	
	Cost	USD 93,242,187.5	

Thanks

Monitoring Wells

Monitoring Wells

Location Map of Monitoring Well

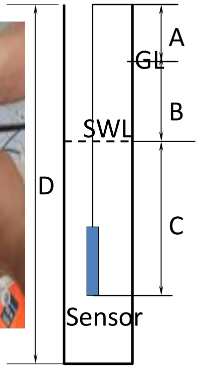
June 2005

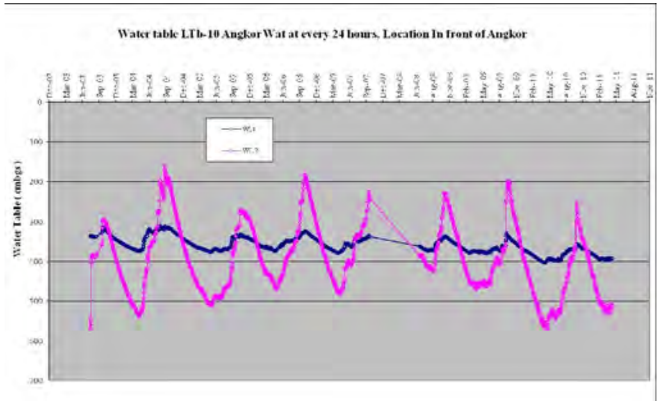
LTa-1 Depth= **72.0m**
LTa-2 Depth= 35.0m
LTb-1 Depth= **73.0m**
LTb-2 Depth= 40.0m
WT-3 Depth= 36.0m
WT-4 Depth= 29.0m
WT-5 Depth= **58.0m**
WT-6 Depth= 29.0m
WT-7 Depth= **60.0m** (well house foundation soil was subsided; necessary improvement)
WT-8 Depth= **83.0m** (stolen; no sensor)
bold: well depth over 50.0m

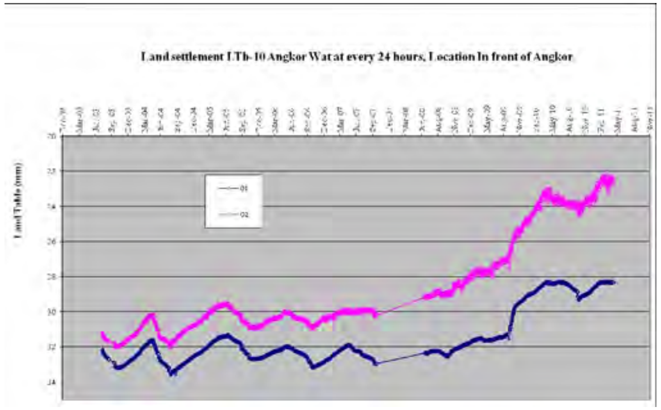
JICA : Study on Integrated Master Plan for Sustainable Development of Siem Reap/Angkor Town

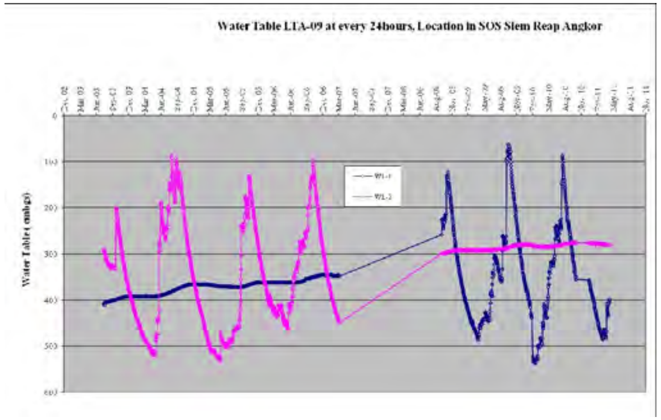
Observation Wells WT3,4,5,6,7,8,LTa and LTb installation on 1997 by JICA
Observation Wells Kravann and Khvien Installation on 2010 by JICA

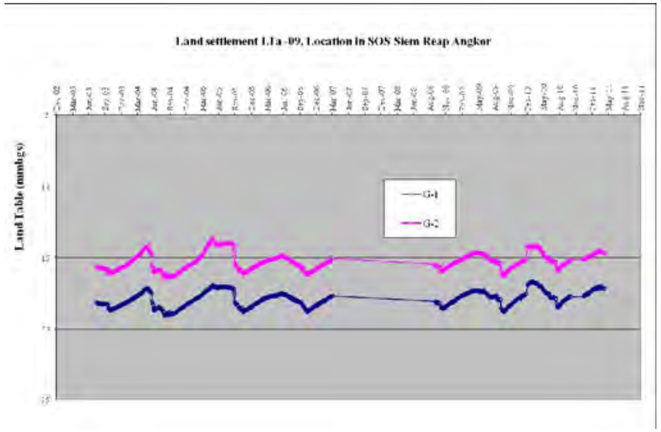
Monitoring Well Structure

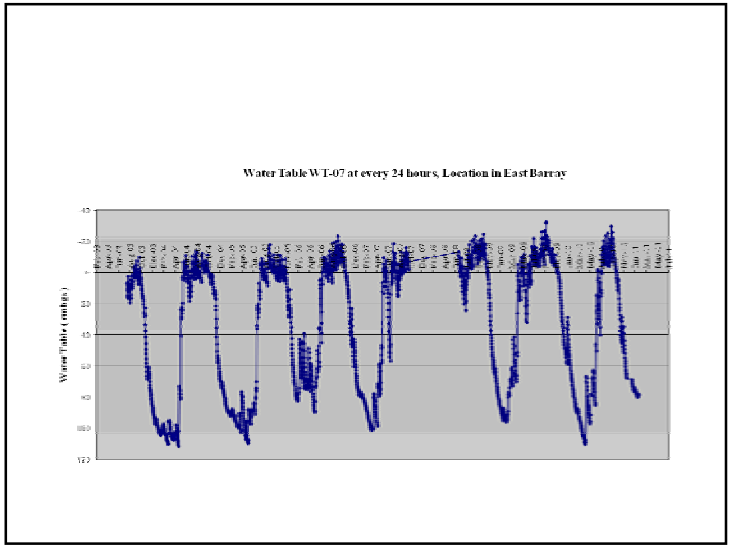


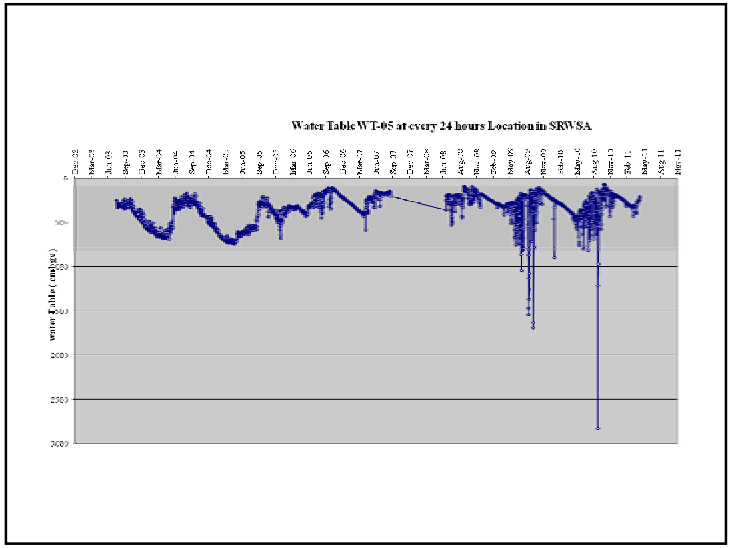

Water table LTb-10 Angkor Wat at every 24 hours, Location In front of Angkor

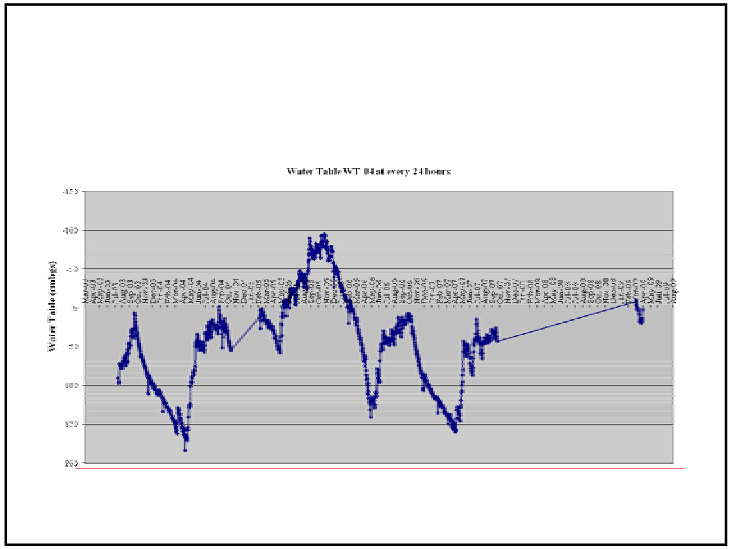

Land settlement LTb-10 Angkor Wat at every 24 hours, Location In front of Angkor

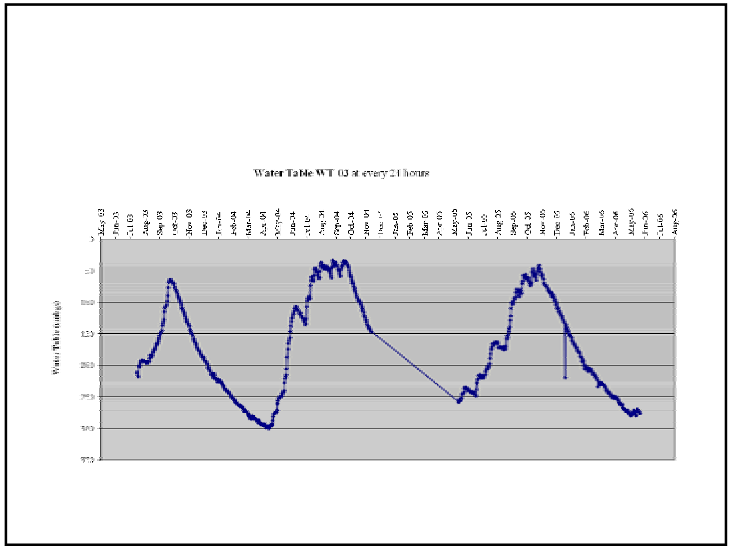

Water Table LTA-09 at every 24hours, Location in SOS Siem Reap Angkor

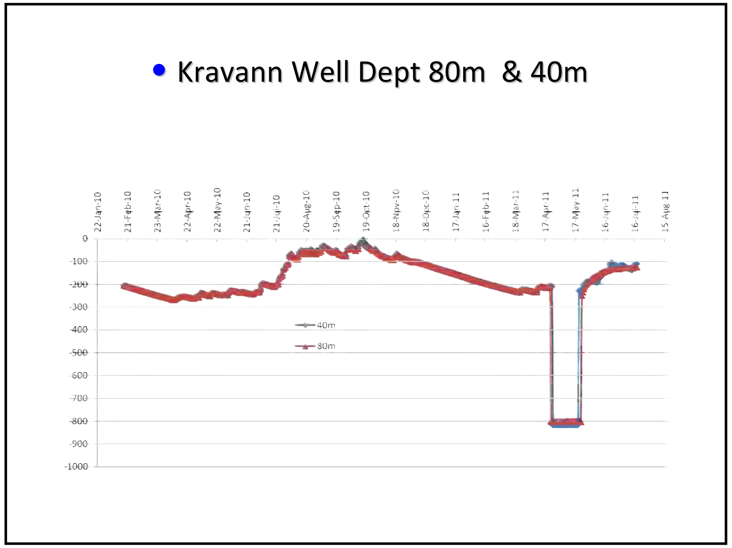

Land settlement LTa -09, Location in SOS Siem Reap Angkor


Water Table WT-07 at every 24 hours, Location in East Barray

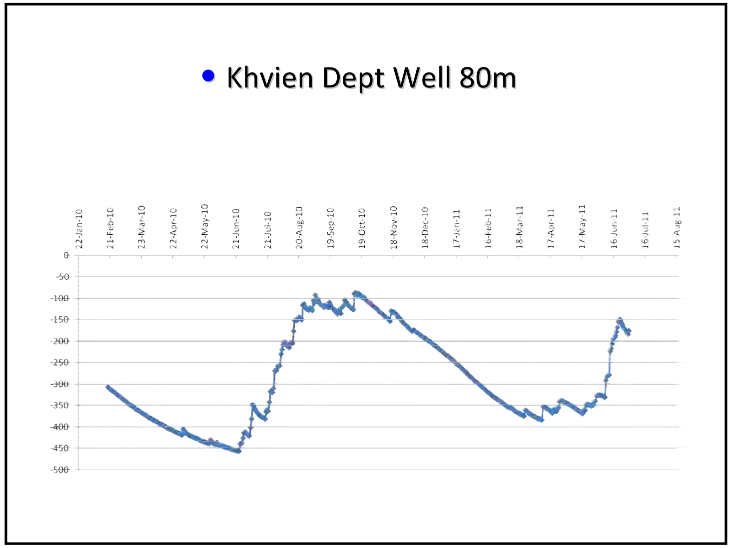

Water Table WT-05 at every 24 hours Location in SRWSA


Water Table WT 04 at every 24 hours

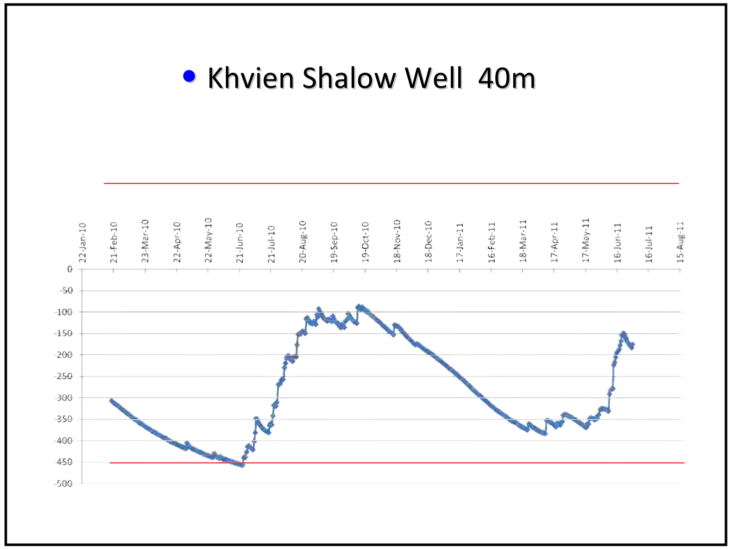

Water Table WT 03 at every 24 hours



- Kravann Well Dept 80m & 40m



- Khvien Dept Well 80m



- Khvien Shalow Well 40m

Thanks

SIEMREAP WATER SUPPLY AUTHORITY(SRWSA)

Presented by: KONG SOKVAN
Department Director of Production & Distribution
SRWSA .12 . Dec .2012

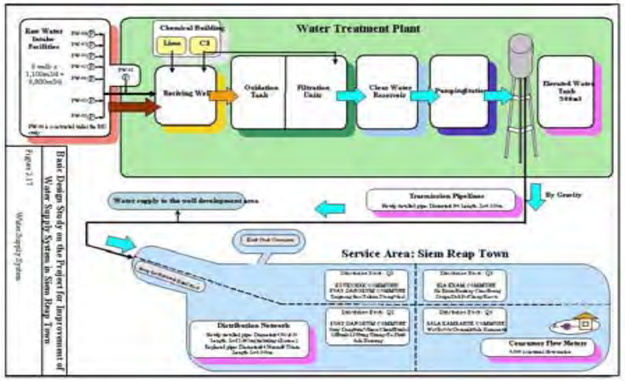
Contents

1. Iron and Manganese Removal of Siem Reap Water Treatment Process.
2. Operation.
3. Maintenance.
4. Water Quality

---

1. Water Treatment Process.

Layout of the Treatment Plant



---

1. Water Treatment Process.

Ground water

- Water temperature and quality is not so change through year
- Water turbidity is low
- few oxygen
- Erosive free carbon dioxide, iron, manganese and hydrogen sulfide
- Microorganism like Iron bacteria
- Sometimes pollution by agricultural chemicals and pesticide
- Careful monitoring of these environmental issues

1. Water Treatment Process.

Receiving Well
Iron and Manganese Removal

- Removal Process
  Oxidation (+ Sedimentation) + Filtration
  Ion Exchange
  Lime (PH adjustment)

. In case of SRWSA

2Fe + 3Cl2 → 2FeCl3 ↓
Mn + Cl2 → MnCl2 ↓

Cl2 & Lime dosing Point

---

1. Water Treatment Process.

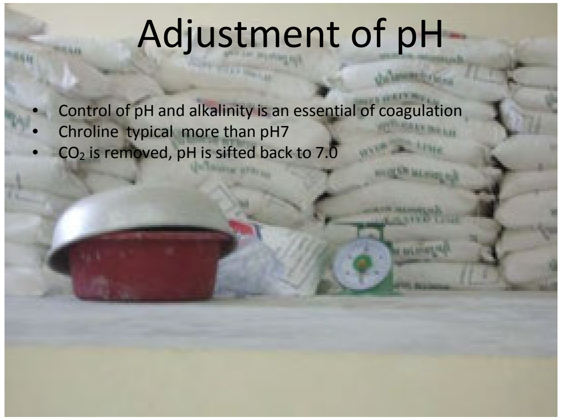
Oxidation

- Oxidation-reduction (redox) reactions form the many water treatment processes addressing a wide range of water quality objective
- Removal of iron, manganese, color, tastes, odor, and synthetic organics
- Oxidizing agents, or oxidants
  chlorine
  chlorine dioxide

FeCl3 & MnCl2 sedimentation in oxidation Tank

---

1. Water Treatment Process.



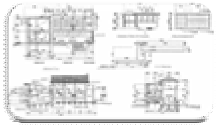
Adjustment of pH

- Control of pH and alkalinity is an essential of coagulation
- Chroline typical more than pH7
- CO_2 is removed, pH is sifted back to 7.0

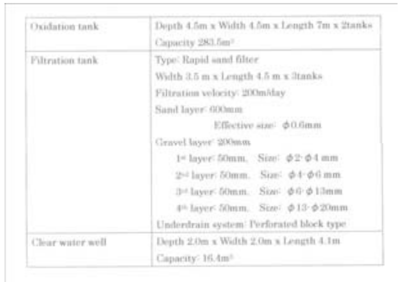
---

1. Water Treatment Process.

Filtration

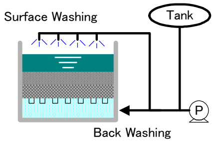


- Filtration
- The passage of water through a porous medium to remove suspended solids
- Two categories of granular filtration
  Rapid sand
  Slow sand

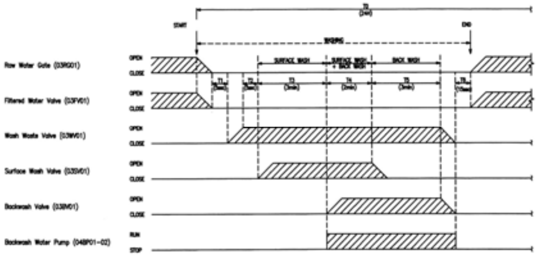


Oxidation tank	Depth 4.5m x Width 4.5m x Length 7m x 2tanks Capacity 283.5m³
Filtration tank	Type: Rapid sand filter Width 3.5 m x Length 4.5 m x 3tanks Filtration velocity: 200m/day Sand layer: 600mm Effective size: ϕ0.6mm Gravel layer: 200mm 1st layer: 50mm, Size: ϕ2-ϕ4 mm 2nd layer: 50mm, Size: ϕ4-ϕ6 mm 3rd layer: 50mm, Size: ϕ6-ϕ13mm 4th layer: 50mm, Size: ϕ13-ϕ20mm Underdrain system: Perforated block type
Clear water well	Depth 2.0m x Width 2.0m x Length 4.1m Capacity: 16.4m³

Filter Media Washing



- As the amount of solids retained increase, bed porosity decrease
- Head loss through the bed and shear on captured floc increase
- Before the head loss builds to an unacceptable level or turbidity breakthrough occurs, washing is needed
- Up flow water wash (back wash) and may be supplemented with surface wash or air scour



Disinfection

- Water could be a mode of communication for dreaded diseases such as cholera
- At first, slow sand filtration and use of uncontaminated water supplies employed to prevent the spread of waterborne diseases
- The chlorine could kill bacteria
- Most common disinfecting agents

  Chlorine
  Ozone
  Chlorine dioxide

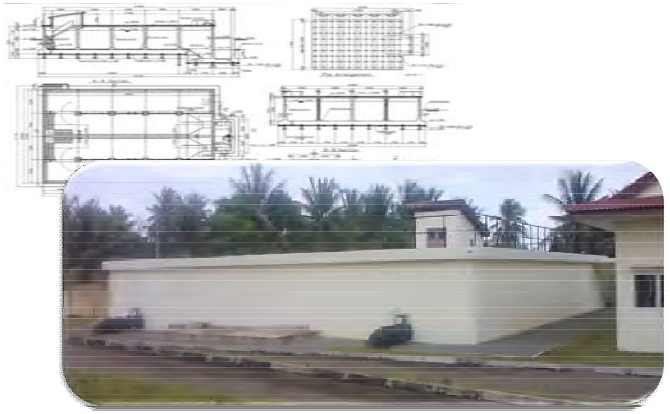
Disinfection

Chlorine Mixing Equipment

- **Oxidants are used in water treatment to accomplish a wide variety of treatment objectives**

Disinfection
Mitigation of objectionable tastes and odors
Removal of color
Removal of iron and manganese
Oxidation of organic chemicals

Clear Water Reservoir



Pumping Station

Elevated Water Tank

2. Operation

- Control of Water Quality
  - Remove Iron
  - pH control
- Control of Water Quantity
  - expect of demand and planning of pump operation
  - level control for reservoir
- Maintenance to keep good condition
  - daily
  - monthly
  - yearly

Daily Work

- Meeting -every morning-
  - Takeover or transfer Information to new group
  - Communication
- Operation
  - Quality - chemical control and check
  - Quantity - demand and supply
  - Maintenance - facility check
- Report for trouble or schedule of maintenance
  - Recording, storage and evaluation

Water Quality Control
Treatment Chemical Control

- Remove Iron

Cl_2
$2Fe(CO_3)_2+Ca(HCO_3)_2+Cl_2$
$\rightarrow 2Fe(OH)_3\downarrow +CaCl_2+6CO_2$

Oxidant mg/mgFe^{2+}
Fe 1 mg/l → Cl 0.64 mg/l

Oxidant provide a period of detention for reaction to take place

target value 0.5mg/l of residual chlorine just after filtration

target value 0.1NTU of turbidity just after filtration

The speciation of aqueous chlorine is highly pH dependent

- pH control

$Ca(OH)_2$
$CaO+H_2O \rightarrow Ca(OH)_2$
$CO_2+Ca(OH)_2 \rightarrow CaCO_3\downarrow +H_2O$

Target value pH7

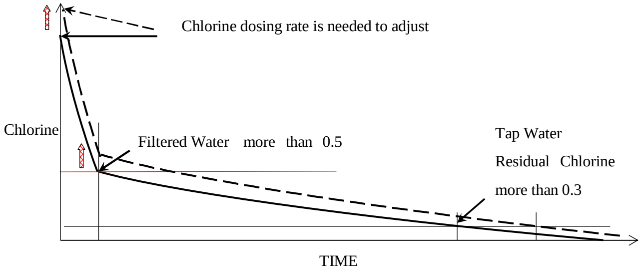
Jar test for pH control

- Jar test make better condition

-Appropriated dosing rate
-Data collecting for improvement the water quality
-Cut down the operating cost

Chlorination

- Dosing rate = Residual Chlorine at tap + consumption on pipe + demand for raw water
- Residual Chlorine at tap : more than 0.3
- Consumption on pipe : function for detention time
- Demand for raw water : Iron0.8mg/l



Water Quality Monitoring-Treatment plant

- Water Quality Analysis

-Daily(2 or 3 times per day)
-Weekly
-Monthly

Sampling points
- Intake Station
- Receiving Well
- Oxidation Tank
- Filter Unit
- Chlorine chamber
- Reservoir
- Elevated Tank

Parameter for Analyzing

Item	Parameter	Unit	Target Value	Standard
1	Temperature	℃	Acceptable	Acceptable
2	pH		7	6.5-8.5
3	Turbidity	NTU	Less than 0.1	less than 5
4	Color	Pt/Co		5
5	Iron	mg/l	0.1	0.3
6	FAC	mg/l	0.5	0.2-0.5
7	TAC	mg/l		2

Water Quantity Control

- Control of Water Quantity

Expect water demand and plan pump operation

- Water demand
  Refer to yesterday data or one week before data

- Operation condition
  Pump : 3 - 8 well pumps continuously
  (Because of pre-chlorine control keeps more than0.25kg/hr)

Target : level of reservoir
L=2.5 – 4.5 m

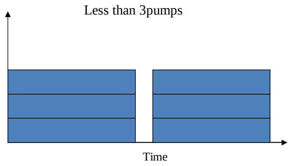
If demand is less than 3 pumps, then L=2.5m pumps start and L=4.5m pumps stop

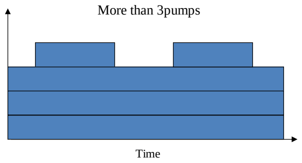
---

Water Quantity Control

- Ex.1 Water demand 2600m3/day
  2600/24/46=2.36 pumps
  Operation condition : 3 - 8 well pumps continuously
  3 well pumps run
  and
  If level of reservoir L= 4.5 m
  then
  all pump stop
  and
  If level of reservoir L= 2.5 m
  then
  3 pump run again

- Ex.2 Water demand 3600m3/day
  3600/24/46=3.26 pumps
  0.26 x 24 =6.24 6 hour
  Operation condition : 3 - pumps continuously
  6.24 hour 3 - pumps run
  then
  9:00 to 15:00 4 pump run
  and
  8:00 to 9:00 and 15:00 to 8:00 3 pumps run





---

3. Maintenance

Maintenance – Intake Facilities

Daily (Weekly) Check

- Lock check
- Measurement
  Current(A) Valve-opening(%)
  Pressure
- Pump
  Noise Vibration
- Valve
  Noise Vibration Leakage
- Instruments condition
- Pipe (Breakage or leak)
- Structure (Breakage or leak)

Yearly Check

- Insulation resistance and earth resistance Measurement
- Sludge removal and cleaning

Maintenance — Receiving Well

Size	3m x 3.2m x 3.2m
Capacity	42m_3 5 minutes detention time S=9.6m_2

Daily Check
- Water flow
- Water level
- Chemical dosing condition
- Floc condition
- Instruments condition
- Pipe (Breakage or leak)
- Structure (Breakage or leak)
- Water quality

Yearly Check
- Sludge removal and cleaning
- Structure in the water (check and repair)

Maintenance — Oxidation Tank

Size	4.5m x 7.4m x 4.5m x 2
Capacity	130m_3 x 2=260m_3 45minutes detention time S=33.3m_2

Daily Check
- Water flow
- Water level
- Floc condition
- Instruments condition
- Pipe (Breakage or leak)
- Structure (Breakage or leak)
- Water quality

Yearly Check
- Sludge removal and cleaning
- Structure in the water (check and repair)

Maintenance — Filter Unit

Size	3.5m x 4.5m x 3
Capacity	15m2 x 3 200m/day

Daily Check
- Water flow
- Water level
- Sand condition
- Filtration time check
- Instruments condition
- Pipe (Breakage or leak)
- Structure (Breakage or leak)
- Water quality
- Washing condition (water and sand)

Yearly Check
- Cleaning
- Structure in the water (check and repair)
- Waste Water quality
- Measurement of sand level
- Sand test

Maintenance — Clear water reservoir

Size	11m x 27.5m x 4.6m x 2
Capacity	2850m_3 8 hours storage capacity S= 605m_2

Daily Check
- Lock check
- Water flow
- Water level
- Instruments condition
- Pipe (Breakage or leak)
- Structure (Breakage or leak)
- Water quality

Yearly Check
- Inside condition
- Structure in the water (check and repair)

Maintenance ー Elevated tank

Size	Φ12.5m x 4.5m
Capacity	$500m_3$ 1.5hour storage capacity $S=111m_2$

Daily Check
- Lock check
- Water flow
- Water level
- Instruments condition
- Pipe (Breakage or leak)
- Structure (Breakage or leak)
- Water quality

Yearly Check
- Inside condition
- Structure in the water (check and repair)

Maintenance ー Pump station

Lift Pump	$7.0m_3$/min x 43m x 75kW x 2
Back Wash Pump	$13.5m_3$/min x 10m x 37kW x 2

Daily Check
- Lock check
- Measurement

  Current(A) Valve-opening(%) Pressure Water-Level Total-Head Flow-Rate
- Pump

  Noise Vibration Heat of gland casing Gland Water Leakage
- Motor

  Noise Vibration Smell Smoke
- Valve

  Noise Vibration Leakage
- Instruments condition
- Pipe (Breakage or leak)
- Structure (Breakage or leak)

Yearly Check
- Insulation resistance and earth resistance Measurement
- Centering Check

Maintenance ー Electric station

Daily Check
- Lock check
- Measurement

  Voltage(V) Current(A) Frequency(Hz) Power(W,Wh) Power-Factor
- Indicator condition
- Instruments condition
- Structure (Breakage or leak)

Yearly Check
- Insulation resistance and earth resistance Measurement

Maintenance ー Chemical station

Chlorinator	0.25-0.5kg-Cl2/hr x 2
Lime	0.4-1.1 l/min x 20m x2.2kW

Daily Check
- Lock check
- Chemical condition
- Measurement

  Valve-opening(%) Pressure Chemical-Level Flow-Rate
- Pump

  Noise Vibration Heat of gland casing Leakage
- Motor

  Noise Vibration Smell Smoke
- Valve

  Noise Vibration Leakage
- Instruments condition
- Pipe (Breakage or leak)
- Structure (Breakage or leak)

Yearly Check
- Gas-Detector condition

Maintenance — Laboratory

Daily Check
- Measurement
  - water temperature
  - pH
  - turbidity
  - residual chlorine
- Instruments condition
- Flow-Rate
- Table Test of water quality
- Pipe (Breakage or leak)
- Structure (Breakage or leak)

Weekly Check
- Instruments cleaning
- Instruments calibration
- Pipe cleaning

Yearly Check

4.Water Quality Analysis

Item	Parameters	Unit	DWQS	Raw Water	Clear Water
1	Temperature	Acceptable		28.8	27.6
2	Taste	Acceptable		ok	ok
3	Odor	Acceptable		ok	ok
4	p.H	Unit	6.5-8.5	5.15	7
5	TDS	mg/L	800	16.1	44.15
6	Turbidity	NTU	5	<1	<1
7	Color	TCU	5		
8	Residual Chlorine	mg/L	0.2-0.5		0.3
9	Alkalinity	mg/L		0	36
10	Iron	mg/L	0.3	0.74	0.03
11	Manganese	mg/L	0.1	0.1	0
12	Aluminum	mg/L	0.2	0.01	0
13	Chloride	mg/L	250	3.7	4.7
14	Hardness	mg/L	300	0.43	2.31
15	Sulfate	mg/L	250	1	1
16	Copper	mg/L	1	0	0
17	Zinc	mg/L	3	0.03	0.05
18	Ammonia	mg/L	1.5	0.05	0.01
19	Nitrite	mg/L	3	0.023	0.021
20	Nitrate	mg/L	50	0.1	0.1

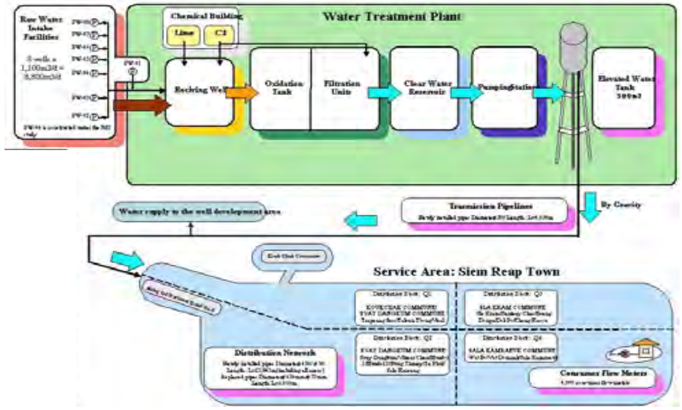
Thanks

Siem Reap Water Treatment Plant

Water Treatment Plant

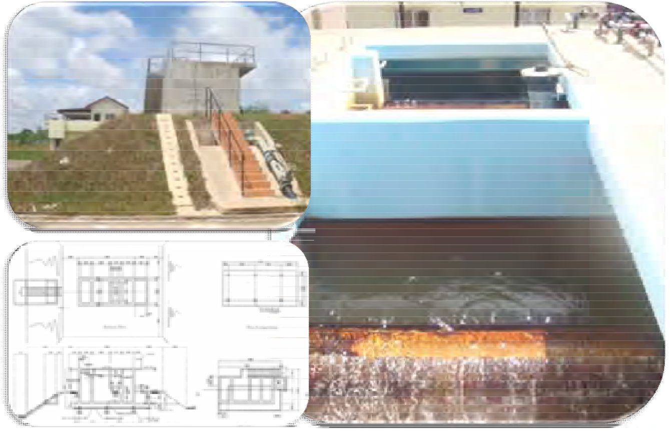
Location along national road #6

Flow Diagram



Well Productions

Receiving Well and Chemical Mixing

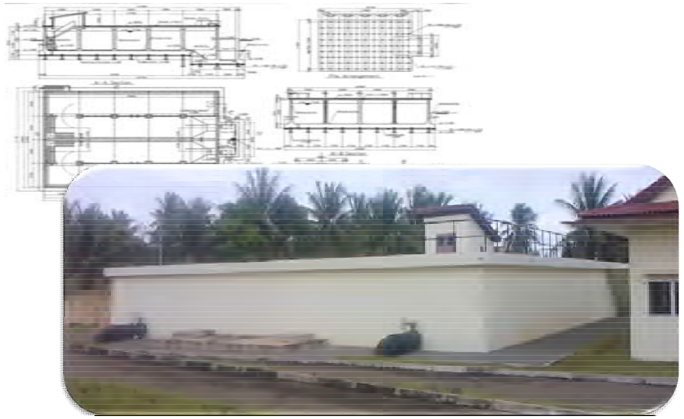


Lime Storage

Filter Tank

Disinfection

Water Reservoir



Pumping Station

Elevated Water Tank

Human Resource
and
Business Management
(Phnom Penh Water Supply Authority)

Group A

Bishnu Janawali
Rajeeb Ghimire
Binu Kunwar
Pramod Kumar Dutta

PPWSA Autonomy

Autonomy- In 1996 PPWSA was established by decree as an autonomous public utility with its own separate finances, as opposed to being a department of the municipality as it had been the case previously.

Governing board-The utility's 7-member Board comprises the General Director, representatives of the Ministry of Industry, Mines and Energy (chair), the Ministry of Economy and Finance, the Ministry of Interior, Phnom Penh's municipal government and PPWSA employees.

Financial Autonomy- Its newly gained autonomy allowed the utility to retain any revenues in excess of operating costs to improve services.

Administrative Autonomy-It also allowed it to recruit its own staff, which had not been possible previously when it had been part of the municipality.

PPWSA then (1993)

1. Financial deficit- almost bankruptcy
2. No maintenance and investment
3. Low collection efficiency
4. High NRW
5. Tariff below cost

PPWSA then- Indicator based

1993	Indicators	2010
20	Staffs/1000 Connections	2.97
65000	Production Capacity, cum/day	300000
Low	Water Quality	WHO
20%	Coverage Area	92%
10hr/d	Supply Duration	24 hr/d
0.2 bar	Supply pressure	2.5 bar
26881	Number of Connections	210000
288 km	Length of Network	1700 km
72%	NRW	5.85%
48%	Collection Ratio	99.90%
150%	Operation Ratio	37.11%
N/A	Return on Revenue	26.89%
N/A	Return on Net Asset	7.39%
N/A	Current Ratio	3.04 times
N/A	Debit Service Coverage	3.35 times
N/A	Accounts Receivable	21 days

Causes for low performance

1. Improper restructure
2. 500 staffs (22staffs/1,000con.) with less then USD 20 salary.
3. Under qualified, low discipline staffs
4. Nepotism was widely practiced. Top managers and their cycle of men were working for self interest, abuse their power for their gains.
5. The morale of other staffs was low.

PPWSA Now

1993	Indicators	2010
20	Staffs/1000 Connections	2.97
65000	Production Capacity, cum/day	300000
Low	Water Quality	WHO
20%	Coverage Area	92%
10hr/d	Supply Duration	24 hr/d
0.2 bar	Supply pressure	2.5 bar
26881	Number of Connections	210000
288 km	Length of Network	1700 km
72%	NRW	5.85%
48%	Collection Ratio	99.90%
150%	Operation Ratio	37.11%
N/A	Return on Revenue	26.89%
N/A	Return on Net Asset	7.39%
N/A	Current Ratio	3.04 times
N/A	Debit Service Coverage	3.35 times
N/A	Accounts Receivable	21 days

What has worked?

(In terms of HRM and BM)

Factors contributing success

1. Objective based HRM in PPWSA
2. Restructuring the organization
3. Setup the Roles and responsibilities
4. Management Style
5. Internal Regulation
6. Motivation- Living Support
7. Motivation- Incentive
8. Evaluation
9. Recruitment Process

Factors contributing success

HRM Objectives

Restructuring
Setup the Roles
Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. To increase staff motivation and their moral
2. To increase work efficiency
3. To keep satisfactory service to the customers
4. To keep the reasonable tariff to our people
5. To keep the sustainability of water supply.

Factors contributing success

HRM Objectives

Restructuring

Setup the Roles
Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. Simple structure with few levels and few bosses
2. Proper organization chart according to actual roles.
3. Promote young dynamic staff to the front line
4. Remove inefficient old timers to the dormant roles
5. Remove inactive manager to lower position

Factors contributing success

HRM Objectives
Restructuring

Setup the Roles

Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. Clear job description of each department and offices
2. Clear roles and responsibilities of each staff
3. Direct responsibility of managers
4. Update according to the actual condition

Factors contributing success

HRM Objectives
Restructuring
Setup the Roles
Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. Effective and timely decision
2. Delegate work with support and checking
3. Collective decision, individually responsibility

Factors contributing success

HRM Objectives
Restructuring
Setup the Roles
Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. Set up internal regulation with agreement from staff
2. Set up discipline council with members from all department
3. Provide incentive and strictly apply penalty without favour
4. Hard work and good result, better pay
5. Heavy penalty for bad intention.

Factors contributing success

HRM Objectives
Restructuring
Setup the Roles
Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. Gradually increase staff's salary based on annual financial performance
2. Create staff fund with possible contribution from all staffs
3. Support the poor staff with team spirit
4. Provide health care and taking care of them

Factors contributing success

HRM Objectives
Restructuring
Setup the Roles
Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. Provide incentive to only those who is performing well
2. Good result, better pay
3. Best staff competition with increased remuneration
4. Provide opportunity to contribute to leaderships
5. Promotion by evaluation only

Factors contributing success

HRM Objectives
Restructuring
Setup the Roles
Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. Continuous evaluation system
2. Evaluation procedure is implemented every three months
3. Transparent evaluation

Factors contributing success

HRM Objectives
Restructuring
Setup the Roles
Management Style
Internal Regulation
Motivation- Support
Motivation- Incentive
Evaluation
Recruitment Process

1. Autonomous Recruiting Committee
2. Criteria based recruitment
3. Entry process:
    - Stage 1 (Probationer/intern)
    - Stage 2 (Contractual Employee)
    - Stage 3 (Permanent Employee)

What have we learned?

(In terms of HRM and BM)

Major Learnings

1. Cultural Change
2. Motivation
3. Management Style
4. External Assistance

Major Learnings

Cultural Change
Motivation
Management Style
External Assistance

1. Educating
2. Motivating
3. **Disciplining**

4. Younger generation at front
5. Qualified staff from the source
6. Quantify the performance indicators

Major Learnings

Cultural Change
Motivation
Management Style
External Assistance

1. Performance based evaluation
2. Continuous training for skill development
3. Handsome salary
4. Incentive and punishment
5. Good performance=good earning=good incentive

Major Learnings

Cultural Change
Motivation
Management Style
External Assistance

1. Setting common goal and working together to achieve the goal
2. Longterm planning
3. Care for poor in some extent only
4. Leadership by example

Major Learnings

Cultural Change
Motivation
Management Style
External Assistance

1. Good marketing of the organization is required to invite donors
2. Start with small scale and show self motivation, efficiency, transparency and responsibility to get confidence from donor

What can be applied?

(In terms of HRM and BM)

What can be applied?

The exact replication of the learnings seems to be difficult as it demand more autonomy. Contextual and conceptual use of some of the learnings can be possible.

WUSC are more autonomous, so they can be motivated to apply some of the success measure of PPWSA.

What can be applied in organization?

1. Culture of motivating staffs
2. Culture of setting common goals and working together to achieve it
3. Recognition for extra input
4. Performance evaluation sheet is very much practical so can be used within organization as informal
5. Suggestion for policy reform to get autonomy in some extent
6. The performance indictors for utility can be replicated

How it can be applied in organization?

Some participants suggested to set aside some amount from contingency. One can evaluate the performance of the staffs internally using the performance evaluation sheet and use this amount as incentive.

THANK YOU

Water Supply Management for Improvement of Technical Skill and Knowledge of Local Water Supply Utilities in Nepal

Group B-Water Treatment Plant and Water Quality Management

Participants
Sudarshan Bhandari
Tikaram Pandey
Dhruva Mani Poudel
Babu Kaji Shrestha

Table of Content

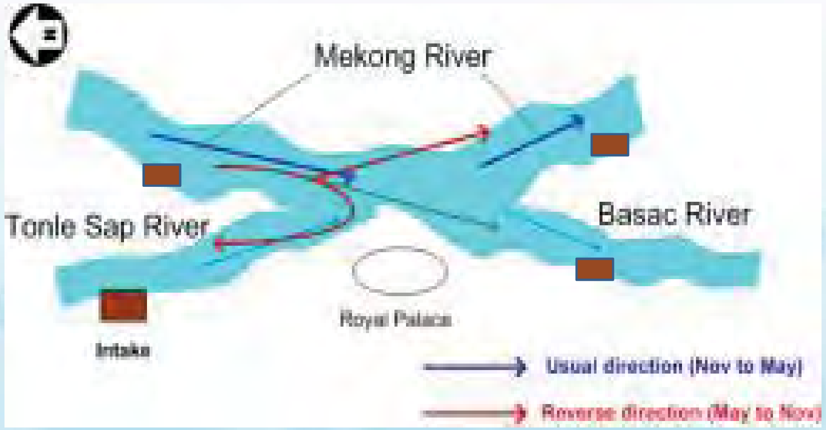
---

1. Water Quality Management of Phnom Penh Water Supply Authority.

Objective of Water Quality Management

-To provide safe drinking water to the people

- To ensure proper quality of the source water, water treatment plant , distribution system to the final destination (customer taps).



Sumpwell in Mekong River

Production Capacity

BY 2020, PPWSA WILL COVER WHOLE PHNOM PENH, TAKMAO AND SUROUNDING AREAS TO MEET INCREASING WATER DEMAND

Water Quality Standard

Cambodia established its National Drinking Water Quality Standard in 2004 with 53 parameters.

National Drinking Water Quality Standard of Cambodia

	Bacteriological			
1	Thermotolerant coliforms or *E.coli*	less than	0	/100mL
2	Total coliforms	less than	0	/100mL
	Inorganic			
3	Arsenic	less than	0.05	mg/L
4	Barium	less than	0.7	mg/L
5	Cadmium	less than	0.003	mg/L
6	Chromium	less than	0.05	mg/L
7	Cyanide	less than	0.07	mg/L
8	Fluoride	less than	1.5	mg/L
9	Lead	less than	0.01	mg/L
10	Mercury	less than	0.001	mg/L
11	Nickel	less than	0.02	mg/L
12	Nitrate	less than	50	mg/L
13	Nitrite	less than	3	mg/L
14	Selenium	less than	0.01	mg/L

	Organic			
15	Polychlorinated biphenyls	less than	0.5	mg/L
16	Benzene	less than	10	mg/L
17	Trihalomethanes	less than	250	mg/L
18	2,4-D	less than	30	mg/L
19	Aldrin and Dieldrin	less than	0.3	mg/L
20	Carbofuran	less than	10	mg/L
21	Chlordane	less than	0.2	mg/L
22	DDT	less than	20	mg/L
23	Dichlorvos	less than	1	mg/L
24	Dimethoate	less than	6	mg/L
25	Endosulfan	less than	30	mg/L
26	Endrin	less than	0.6	mg/L
27	Glyphosate	less than	10	mg/L
28	Heptachlor	less than	0.3	mg/L
29	Hexachlorobenzene	less than	1	mg/L
30	Methyl parathion	less than	0.3	mg/L
31	Mevinphos	less than	5	mg/L
32	Monocrotophos	less than	1	mg/L
33	Paraquat	less than	30	mg/L
34	Parathion	less than	10	mg/L
35	Permethrin	less than	20	mg/L

	Physical and chemical: aesthetic			
36	Taste	Acceptable		
37	Odor	Acceptable		
38	Color	less than	5	TCU
39	Turbidity	less than	5	NTU
40	Residual chlorine	0.2 - 0.5		mg/L
41	pH	6.5 - 8.5		
42	Aluminium	less than	0.2	mg/L
43	Ammonia	less than	1.5	mg/L
44	Chloride	less than	250	mg/L
45	Copper	less than	1	mg/L
46	Hardness	less than	300	mg/L
47	Hydrogen sulfide	less than	0.05	mg/L
48	Iron	less than	0.3	mg/L
49	Manganese	less than	0.1	mg/L
50	Sodium	less than	200	mg/L
51	Sulfate	less than	250	mg/L
52	Total dissolved solids	less than	800	mg/L
53	Zinc	less than	3	mg/L

Water Treatment Plant Process

Water Treatment Plant

Rapid Sand Filter during backwashing

Frequency and Sampling Point

Daily: **3 times** (8:30, 11:00, 14:30)
- Raw water
- Settled water
- Filtered water
- Treated water

Weekly: **1 time**
- Raw water
- Treated water

Monthly, Yearly : **1 time**
- Raw water
- Treated water

Sampling frequency

Daily	Weekly	Monthly	Yearly
Temperature, pH, Turbidity, Conductivity, Suspended Solid, Total Dissolve Solid, Color, Free Available Chlorine, Total Available Chlorine, Alkalinity ,	Total coliforms, E. coli, Ca hardness, Total hardness, Magnesium hardness, Organic substance, Dissolved oxygen, Algae.	Aluminum, Ammonia, Ammonia Nitrogen, Carbon Dioxide, Copper, Chloride, Cyanide, Chromium Total, Chromium Hexavalent, Fluoride, Iron, Manganese, Nitrate Nitrogen, Nitrate, Nitrite Nitrogen, Nitrite, Zinc, Phosphate, Sulfide, Sulfate.	Barium (Ba) Cadmium (Cd) Lead (Pb) Mercury (Hg) Nickel (Ni) Selenium (Se) Sodium (Na)
NEPAL Turbidity, pH, color,Taste,odour, Residual chlorine	TDS (Quaterly)	EC, E Coli, Total Coliform, Ammonia, Chloride, Nitrate, Total Hardness, Calcium	Iron,Manganese, Sulphate, Arsenic, Cadmium, copper, flouride, cyanide, lead, chromium, zinc, mercury, aluminium

Network (Customer tap) Water Quality

Weekly:

80 sampling points taken by PPWSA staffs from their house for testing by Water Testing Laboratory.

Parameter:

Temperature, pH, Turbidity, Color, Conductivity, Free Available Chlorine, Total Available Chlorine, Total coliforms, E. coli.

Water Quality Analysis Methods

. Parameters	Method Analysis
pH	pH Meter, HACH
Turbidity	Turbidimeter, HACH
Conductivity	Conductivity Meter, HACH
Suspended Solid	Spectrophotometer, HACH
Total Dissolve Solid	Conductivity Meter, HACH
Free Available Chlorine	Pocket Colorimeter, HACH
Total Available Chlorine	Pocket Colorimeter, HACH
Alkalinity	Titration with H_2SO_4
Total Hardness	Titration with EDTA
Ca Hardness	Titration with EDTA
Organic Substance	Titration
Dissolved Oxygen	D.O meter, HACH
E-coli, Total Coliform	Membrane Filtration

Water Quality Analysis Methods (cont.1)

. Parameter	Method
Color	UV-Visible Spectrophotometer
UV, Absorption	UV-Visible Spectrophotometer
Aluminum,Ammonia,Ammonia Nitrogen,CO2, Copper,Chloride, Cyanide,chromium total, chromium hexavalent, flouride, Iron, Manganese,Nitrate, Nitrate Nitrogen,Nitrite, Nitrite Nitrogen,Zinc ,Phosphate, Sulfide, Sulfate	Spectrophotometer, HACH

Data Management

- Daily Report
- Weekly Report
- Month Report
- Yearly Report

Disclosure of Information

Public Relation

Customer complaints it means to determine the exact water quality

24 hr service communication with the customers.

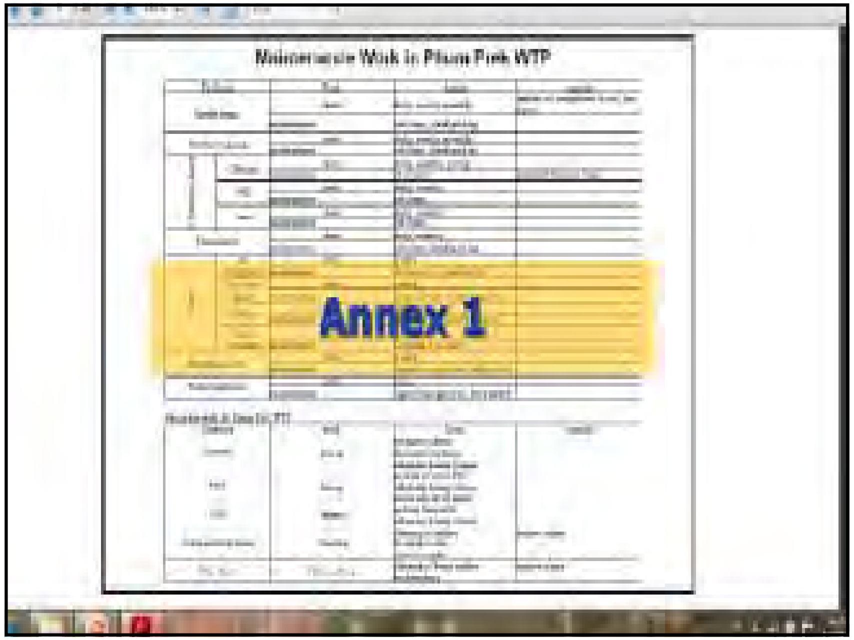
Establishment of warning programs.
24 hr permanent team.

Public Education

- To educate the customers to understand the need of residual chlorine in the water.
(Killing bacteria, Better life, No need to boil)

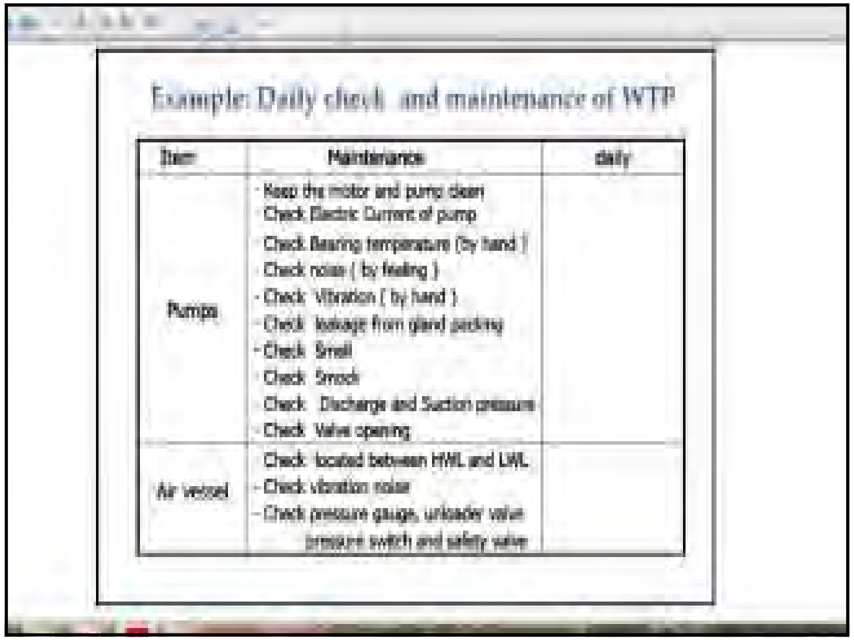
- Smell of res chlorine in the water is not effect to the life (WHO standard is 0.10 mg/l - 1.0 mg/l).

-Effective and regular communication with the customers and public awareness.



Maintenance Work in Phnom Penh WTP

Annex 1

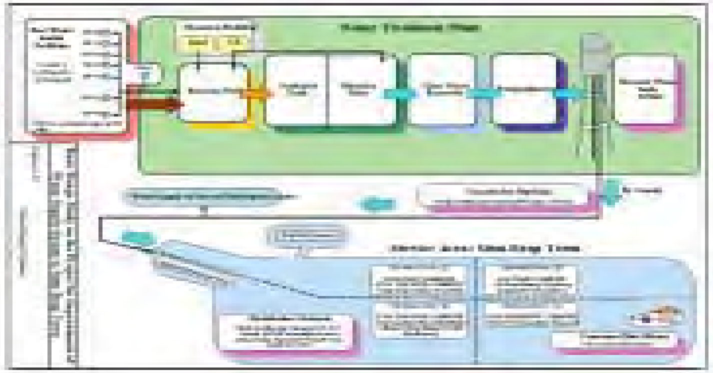


Example: Daily check and maintenance of WTP

Item	Maintenance	daily
Pumps	- Keep the motor and pump clean - Check Electric Current of pump - Check Bearing temperature (by hand) - Check noise (by feeling) - Check Vibration (by hand) - Check leakage from gland packing - Check Smell - Check Smock - Check Discharge and Suction pressure - Check Valve opening	
Air vessel	- Check located between HWL and LWL - Check vibration noise - Check pressure gauge, unloader valve pressure switch and safety valve	

2. Water Quality Management of Siem Ream Water Supply Authority

Layout of the Treatment Plant



Treatment Units

Management of water quality

No	Description	Unit	WHO Standard	National Standard	Raw water	Clean water
1	Temperature	^{0}C	-	-	29.40	30.60
2	pH		6.5-8.5	6.5-8.5	5.36	7
3	Electrical conductivity	µs/cm	-	1600	328	70
4	Residual chlorine	mg/l	0.6-1.0	0.2-0.5	-	0.5 **at tap 0.3**
6	Iron (Fe+)	mg/l	0.3	0.3	0.83	0
7	Manganese (Mn)	mg/l	0.1	0.1	0.1	0

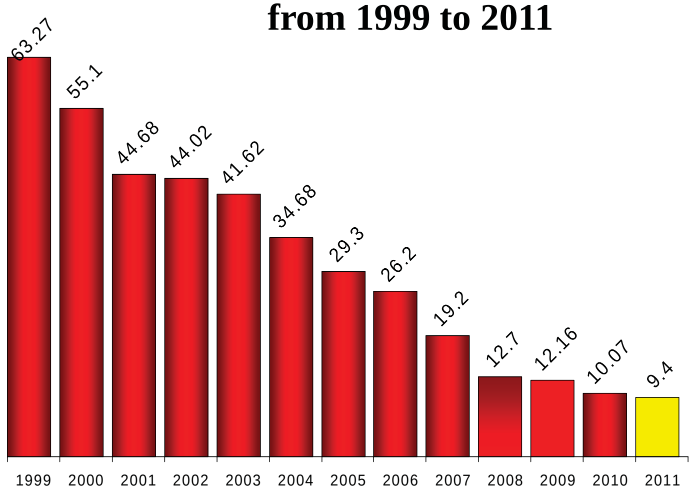
Tariff: Pricing

- Volume-based billing
- Regulated by Ministry of Industry Mine and Energy

Tariff Category	Consumption block (m^3 per month)	Tariff (Riel per m^3)	Tariff ($US per m^3)
Domestic	1 to 7	1,100	0.275
	8 to 15	1,500	0.375
	16 to 30	1,800	0.45
	> 30	2,000	0.50
Commercial	1 to 50	1,900	0.475
	51 to 150	2,400	0.6
	151 to 350	2,900	0.725
	> 350	3,400	0.85

Reduction of non-revenue water [%]

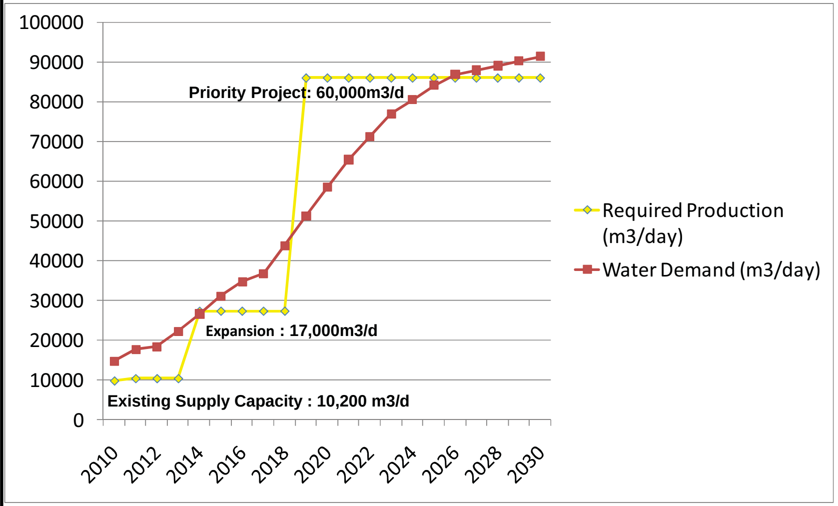
from 1999 to 2011



Comparision

2001	INDICATORS	2011
15	Staff /1,000 Connections	8
1,055	Production cap.: m3/d	10,200
9%	Coverage area	25%
20hr/d	Supply duration	24 hr/d
2.0 bar	Supply pressure	3.5 bars
457	Number of connections	4,798
45%	NRW	10%
73%	Collection ratio	97%
Heavy Subsidy	Financial situation	Full Cost Recovery

Water Demand and Production



Siem Reap Water Supply System-Control Room

3. Lesson Learning

- Dedication of the staff
- Motivation (handsome salary, intensive)
- Importance of Standard operating procedure (SOP)
- Importance of Checklist
- Reward and Punishment system
- Regular maintenance
- Communication between lab and operator

Lesson Learning…..contd

- Promotion on performance based
- Tariff should be fixed based on cost recovery principle
- Water is not a public goods it is an economic goods
- Maintaining Good construction Quality
- Maintaining of Quality of all fixtures

4. Applicability in our context

- Be a role model
- Central water laboratory can be run with minimum equipments
- Preparation of SOP and checklist for different treatment units
- These all materials are very important to shear among us to strengthen the knowledge on Water quality
- Chlorination is also an alternative option for iron removal which can use in our context.

Recommendation

DWSS should built one model water supply project having computerized system to control, operate the whole process . This project will be the example for all other water supply projects.

Thanks

Welcome

Group C

Group members

1. Deepak Puri
2. Binod Kumar Agrawal
3. Ganesh Bahadur Thapa
4. Anoj Upadhaya y

Covered topics

1. Distribution facilities and maintenance
2. Water Meter
3. Electromechanical appliances and their maintenance

Contents

Objectives set out

- Sustainable supply of safe water
- Cut down the high expenditure for repairing
- Regular maintenance
- Construction securing satisfactory function
- Improvement of components as per SOP

Facilities

Water pipe section

DI Pipe used

250 mm dia & more: length 6 m

Push, mechanical, self anchored, flanged joint

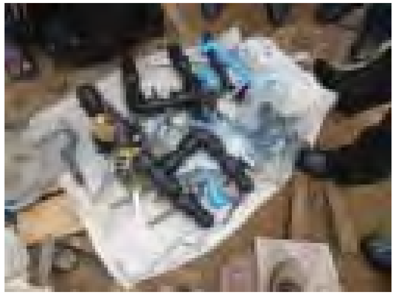

HDPE Pipe used

< 250 mm dia : length 11.7m

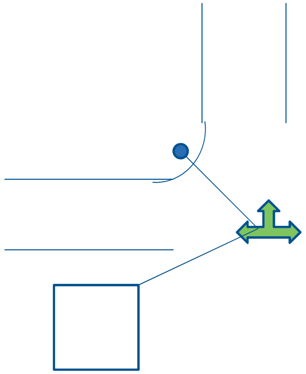
Electric fusion or Electrical heating plate


Material for hhs connections

- Material supplied by company up to meter ensure the quality in cheap




Facilities Records: Coordinates, Reference point etc

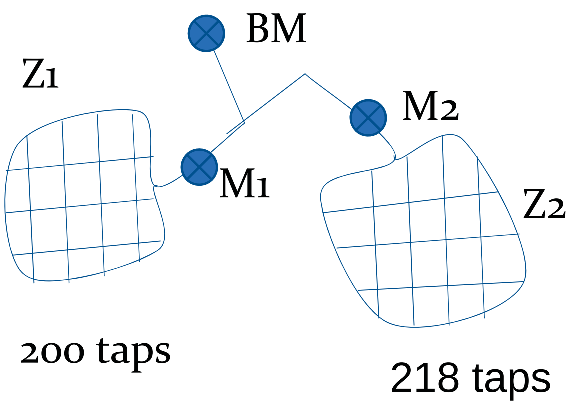


Detail information	
Component	Equal Tee
Diameter	250 mm
Material	DI
Tee number	21
Location	7 January Chowk
R1- Electric pole	11.0 m
R2-Corner of Bld	15.5 m

Fittings and fixture

- Regular checking-Air valve 1 yrs, W/O valve 6 month, cleaning pipe every 2 years
- Use butterfly valve if size higher
- Time to time tightening of nut and bolt
- Change of washer
- Greasing and painting if necessary
- Appropriate location of facilities -considering future plan

Zone Meter



Major learnings

- External assistance is necessary only for investment. For O/M does not need subsidy
- Tariff must cover cost. Without financially viable, the services could not be sustainable and expanded.
- The water utility need to operate independently rather than being Government organizations. Autonomous give the flexibility on management, responsibility, efficiency and motivation of staffs.

Major learnings contd….

- Hundred percent household connection with class C water meters reduce burden of O/M
- Replace less accurate class B water meters.
- Set up inspection team to control illegal connections.
- Incentives for informant of illegal connections.

Applicability in our context

Distribution facilities maintenance

- Preparation of the as built drawing indicating the coordinate, reference point etc.
- Jointing of HDPE pipe by electric fusion or electrical heating plate wherever possible
- Application of SOP(Standard Operation Procedure) in completed as well as ongoing project
- Facilitate to install zone water flow meter for counting
- Reduction of the dead end system gradually and increment of the dead end to looping of existing pipe network

---

Applicability cont..

Water meter

- Adopt better quality(Class-C) and more accurate water meter
- Supply and installed all fitting and fixture required from the maim line to the meter of the consumer taking the charge from user so that the quality can be maintain
- Practice on meter calibration to manage the grievances of the user
  - Actual meter reading
  - Production and loss count
  - Recording on check list

Applicability cont..

Water meter cont..

- Recording and monitoring formats can be use
- Facilitate to follow the SO

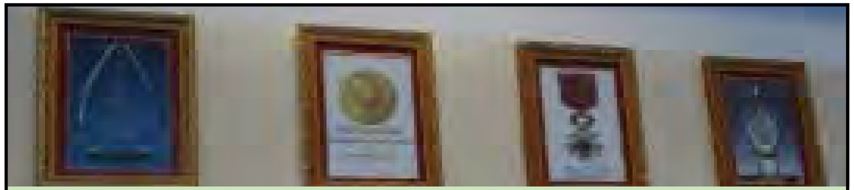
Electrical appliance

- Regular maintenance inspection
- Brain storming workshop of Pump Operator
- Facilitate WUSCs to hire the electrical sub-engineer in case of larger size project

---

Action Plan

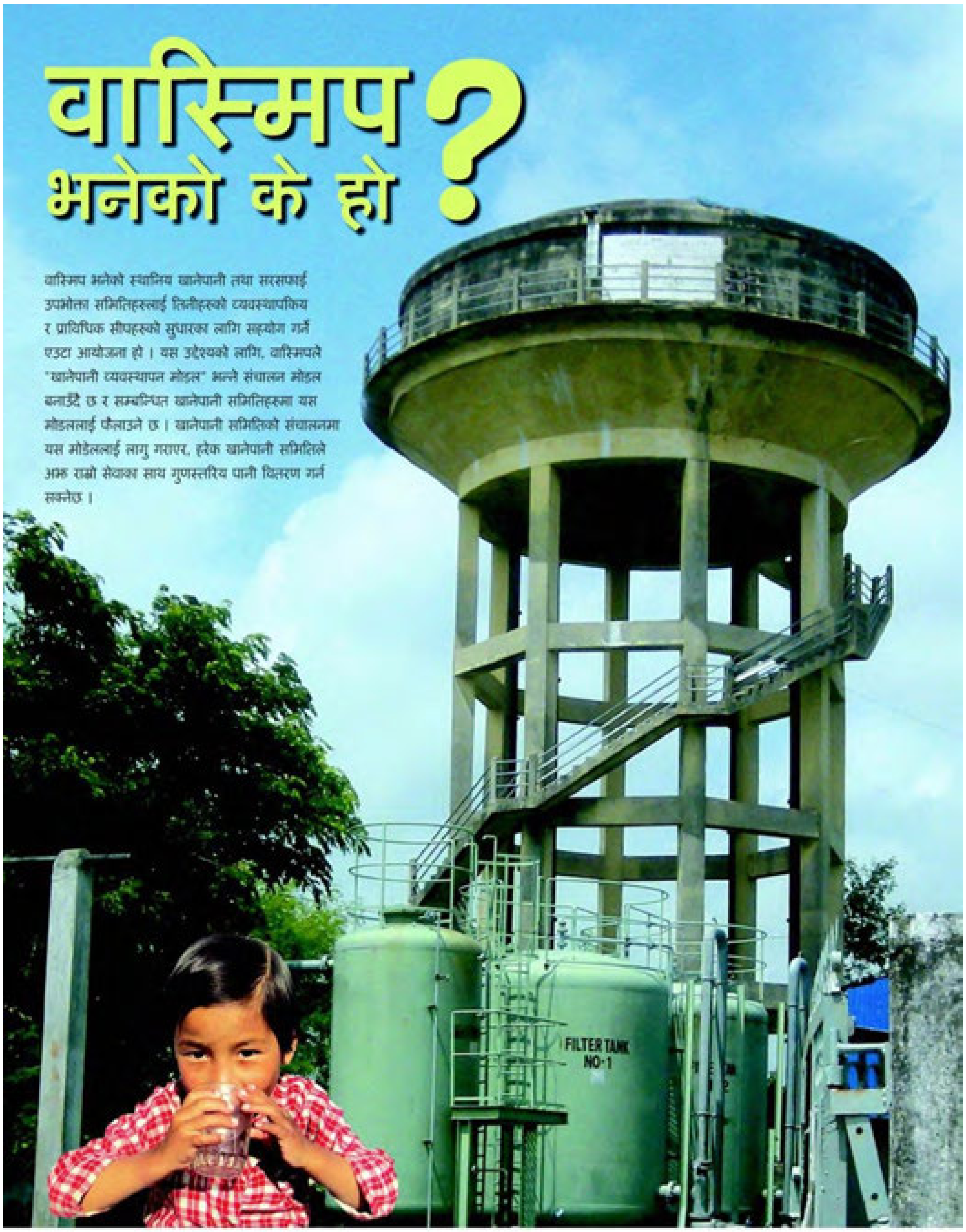
SN	What	When	Who	How
1	As built drawing	End of Mar	WSSDO	Coordinating the user
2	Pipe jointing using Electric heating plate	1st Jan 013	WSSDO	Making mandatory for more than 90 mm dia
3	Prepare & apply SOP	End of FY	DWSS	Expert group with in org
4	Facilitate to installed ZM	End of FY	WSSDO	Coordinating WUSCs
5	Loop design training	Next FY	CHRDU	Organizing in Region
6	Meter calibration	End of Mar	WSSDO	Coordinating WUSCs
7	Practice of Zone meter	End of FY	WSSDO	Coordinating WUSCs
8	Link reward to performance	End of FY	WUSCs	Coordinating WSSDO
9	Use of formats	End of FY	WSSDO	Coordinating WUSCs



Core reasons of the change of PPWSA from bankruptcy to sustainability are:

1. Collective decide, individually responsible
2. Manager must be the model for their subordinates
3. Determination, Dedication & Discipline

Thank you

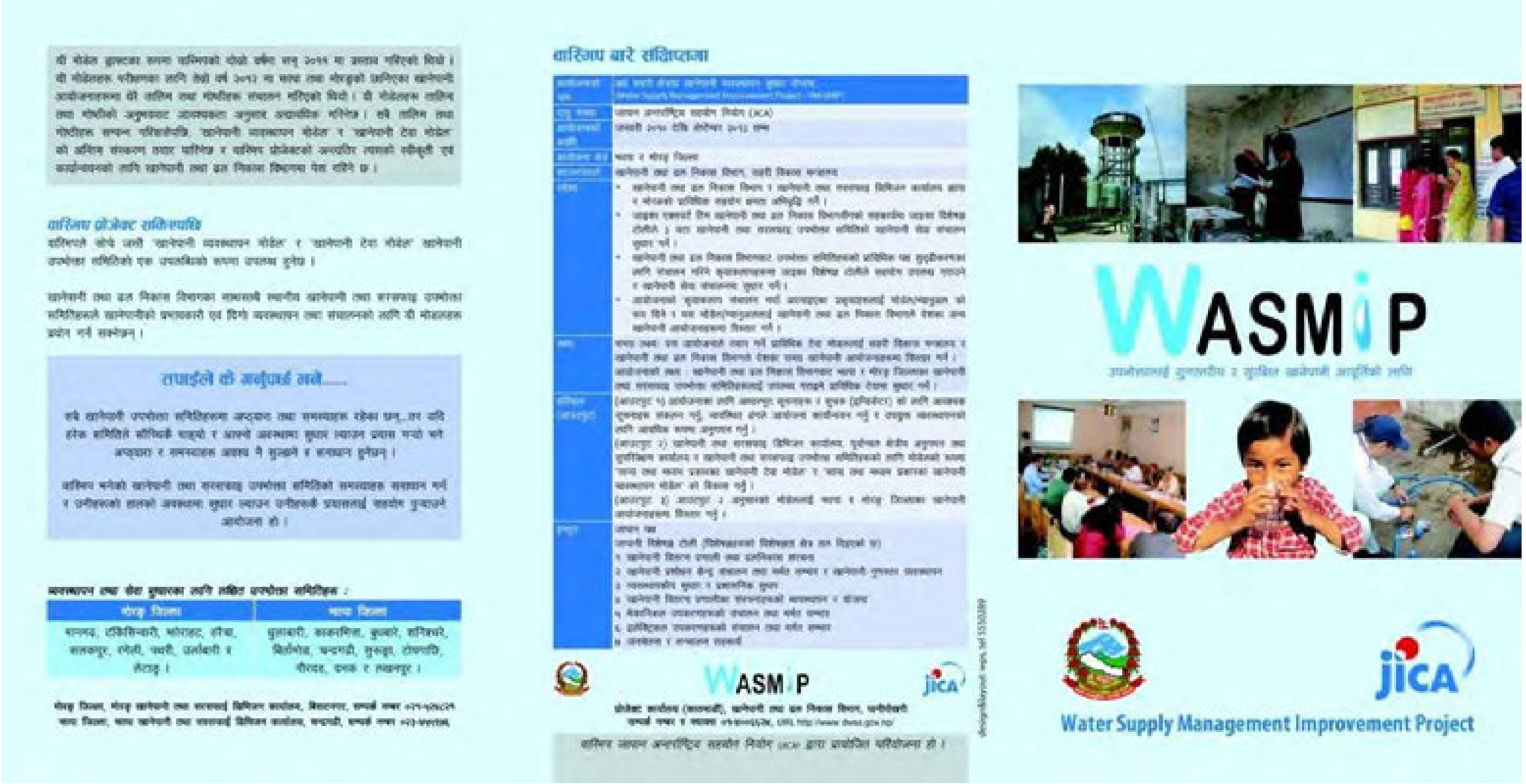


वास्मिप भनेको के हो ?

वास्मिप भनेको स्थानिय खानेपानी तथा सरसफाई उपभोक्ता समितिहरूलाई तिनीहरूको व्यवस्थापकिय र प्राविधिक सीपहरूको सुधारका लागि सहयोग गर्ने एउटा आयोजना हो । यस उद्देश्यको लागि, वास्मिपले "खानेपानी व्यवस्थापन मोडल" भन्ने संचालन मोडल बनाउँदै छ र सम्बन्धित खानेपानी समितिहरूमा यस मोडललाई फैलाउने छ । खानेपानी समितिको संचालनमा यस मोडेललाई लागु गराएर, हरेक खानेपानी समितिले अझ राम्रो सेवाका साथ गुणस्तरिय पानी वितरण गर्न सक्नेछ ।

WASMIP

मोरङ्ग जिल्ला, मोरङ्ग खानेपानी तथा सरसफाई डिभिजन कार्यालय, बिराटनगर, सम्पर्क नम्बर ०२१-५२४८२१
झापा जिल्ला, झापा खानेपानी तथा सरसफाई डिभिजन कार्यालय, चन्द्रगढी, सम्पर्क नम्बर ०२३-४५५१७६
प्रोजेक्ट कार्यालय (काठमाडौं), खानेपानी तथा ढल निकास विभाग, पानीपोखरी, सम्पर्क नम्बर र फ्याक्स ०१-४००६६२४, URL http://www.dwss.gov.np/



वासिम्प प्रोजेक्ट सकिएपछि

तपाईंले के गर्नुपर्छ भने......

व्यवस्थापन तथा सेवा सुधारका लागि लक्षित उपभोक्ता समितिहरू :

मोरङ जिल्ला	झापा जिल्ला
मानपद, टंकीसिनुवारी, भोराहट, रौंचा, सालकपुर, रंगेली, पथरी, उर्लाबारी र लेटाङ ।	बुधबारी, काकरभिट्टा, कुमारे, शनिश्चरे, बिर्तामोड, चन्द्रगढी, सुरुङ्गा, टोपगाछी, गौरादह, दमक र लखनपुर ।

वासिम्प बारे संक्षिप्तता

आयोजनाको नाम	Water Supply Management Improvement Project – WASMIP
	जापान अन्तर्राष्ट्रिय सहयोग नियोग (JICA)
आयोजनाको अवधि	जनवरी २०१० देखि सेप्टेम्बर २०१३ सम्म
आयोजना क्षेत्र	झापा र मोरङ जिल्ला
	खानेपानी तथा ढल निकास विभाग, सहरी विकास मन्त्रालय

WASMiP

वासिम्प जापान अन्तर्राष्ट्रिय सहयोग नियोग (JICA) द्वारा प्रायोजित परियोजना हो ।

WASMiP

उपभोक्तालाई गुणस्तरीय र सुरक्षित खानेपानी आपूर्तिको लागि

Water Supply Management Improvement Project

JICA

WASMIP
प्रस्तुत गर्दछ

असल/खराब बानी

खानेपानी प्रयोग गर्दा

खानेपानी उपभोक्ता तथा सरसफाइ समितिलाई समुदायमा सुरक्षित खानेपानी उपलब्ध गराउन उपभोक्ताहरूको सहयोग अत्यावश्यक हुन्छ। यो पर्चामा खानेपानी प्रयोग गर्दाको असल र खराब बानी बारे उल्लेख गरिएको छ।

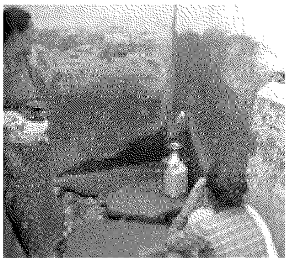
असल बानी

१. **पानीको बचावट गर्ने :** नचाहिने बेलामा धारा खुल्लै छोडेर पानी खेर जान नदिने। धारा बन्द राख्ने र पानी खेर जानबाट बचाउने।

२. **पानीमा क्लोरिन भएमा सुरक्षित महशुस गर्ने :** क्लोरिनमा ब्याक्टेरिया मार्न सक्ने क्षमता हुन्छ। खानेपानीमा क्लोरिनको गन्ध आयो भने चिन्ता नलिने। आफ्नो धारामा आउने पानीमा क्लोरिन अवशेषको मात्रा ०.२ मिलिग्राम प्रतिलिटर भन्दा बढि हुनुपर्दछ। पानीमा क्लोरिन अवशेषको मात्रा कम भएको खण्डमा आउँ, टाइफाइड, हैजा जस्ता पानीजन्य रोग लाग्न सक्छ।

३. **पानी चुहावट भएको खबर गर्ने :** आफ्नो घर कम्पाउण्ड बाहिर पानी चुहावट भइरहेको देख्नु भएमा यथाशक्य छिटो खानेपानी उपभोक्ता तथा सरसफाइ समितिलाई खबर गर्ने। लामो समयसम्म पानी चुहीएर खेर गइरह्यो भने समितिले वितरण गर्ने पानीको परिमाण घट्छ।

४. **पानी धमिलो आएमा खबर गर्ने :** खानेपानी धमिलो अथवा खिया लागेको रङ्गको देखिएमा खानेपानी उपभोक्ता तथा सरसफाइ समितिलाई खबर गर्ने। खानेपानी वितरण पाइपलाइनहरूको अन्तिम भागमा पानी नबगेर जम्मा भइराख्दा पानीको गुणस्तरमा ह्रास आएर यस्तो रङ्ग देखिएको हुन सक्छ।



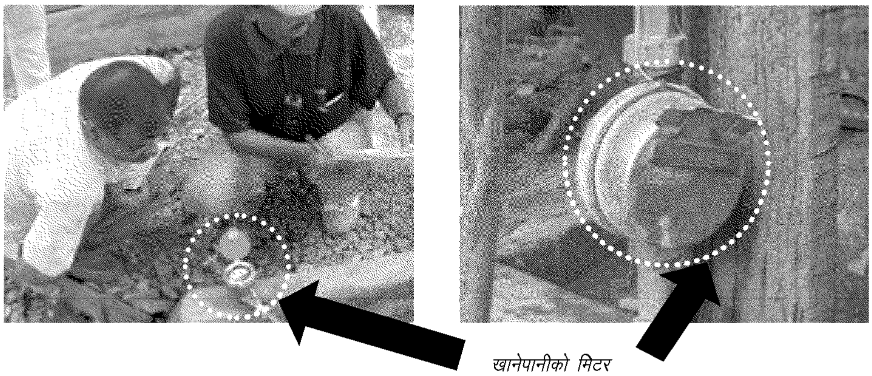
खानेपानीको प्रयोग गर्नुहुँदा पानी खेर नजाओस् भनि ध्यान पुर्‍याउनुहोस्।

खानेपानी सम्बन्धि केहि समस्या भएमा उपभोक्ता समितिमा गएर भन्नुहोस्।

प्राविधिक आएर तपाईको समस्या जाँच गरी समाधान गरिदिनेछ।

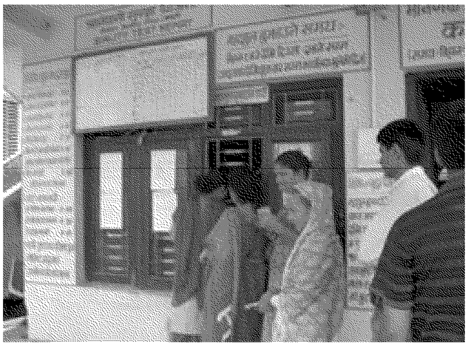
खराब बानी

१. **खानेपानीको मिटर बिगार्ने :** मिटरले तँपाईले उपभोग गर्नुभएको पानीको परिमाण देखाउँछ । आवश्यक नपर्दा पनि खानेपानीको मिटर चलाउनु राम्रो बानी होइन । त्यसैले, अनावश्यक रूपमा खानेपानीको मिटर नचलाउने र कुनै पनि कुरा मिटरमा नठोक्ने ।



खानेपानीको मिटर

२. **खानेपानीको महशुल नतिर्ने :** खानेपानी चोर्ने बानी राम्रो होइन । तँपाईले तिरेको खानेपानीको महशुलबाट खानेपानी उपभोक्ता तथा सरसफाइ समितिलाई शुद्ध र सुरक्षित खानेपानी वितरणको लागि चाहिने कोष जुटाउन र धेरै जनतालाई सेवा प्रदान गर्न मद्दत पुग्दछ । त्यसैले खानेपानी उचित तरिकाले र जिम्मेवार भै प्रयोग गर्ने ।



खानेपानी उपभोक्ता समितिमा जाऔं र पानीको महशुल तिरौं ।

थप जानकारीका लागि

मोरङ्ग जिल्ला, मोरङ्ग खानेपानी तथा सरसफाई डिभिजन कार्यालय, बिराटनगर, सम्पर्क नम्बर ०२१-५२४८२१

झापा जिल्ला, झापा खानेपानी तथा सरसफाई डिभिजन कार्यालय, चन्द्रगढी, सम्पर्क नम्बर ०२३-४५५९७६

प्रोजेक्ट कार्यालय (काठमाडौं), खानेपानी तथा ढल निकास विभाग, पानीपोखरी

सम्पर्क नम्बर र फ्याक्स ०१-४००६६२४, URL http://www.dwss.gov.np/

4th Monitoring and evaluation of WASMIP Project

Date: 18th July, 2013 to 22nd July, 2013

4th Monitoring and evaluation team of WASMIP Project

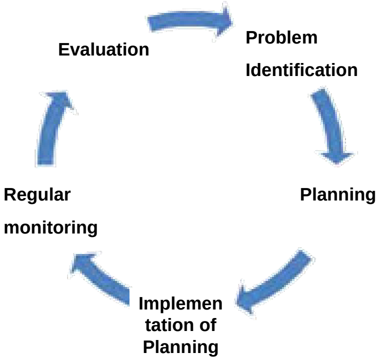
❑ Regional monitoring and supervision office
- Divisonal engineer- Chok Prasad Dhital

❑ Water Supply and Sanitation Division Office
- Division chief- Binod Agrawal
- Division chief- Ganesh Thapa

❑ Department of Water Supply and Sewerage
- SDE- Shrawan Kumar Upadhyay
- SDE- Lakshmi Nath Nepal
- Engineer- Rinku Shrestha

❑ JICA
- Engineer- Roshan Suwal

Monitoring and Evaluation cycle



Problem Identification

Planning

Implementation of Planning

Regular monitoring

Evaluation

4th Monitoring and evaluation of WASMIP Project

❑ Following 8 projects in Jhapa district in 18th-19th July, 2013
- Dhulabari Water Supply Project
- Birtamode Water Supply Project
- Budhabare Water Supply Project
- Chandragadhi Water Supply Project
- Surunga Water Supply Project
- Gauradaha Water Supply Project
- Topgachhi Water Supply Project
- Lakhanpur Water Supply Project

4th Monitoring and evaluation of WASMIP Project

❑ Following 6 projects in Morang district in 2013, 21th-22th July

- Urlabari Water Supply Project
- Pathari Water Supply Project
- Salakpur Water Supply Project
- Jhorahat Water Supply Project
- Mangadh Water Supply Project
- Tankisinuwari Water Supply Project

4th Monitoring and evaluation of WASMIP Project

Monitoring and evaluation indicators

❑ Organizational management- regular meeting, general meeting, work division, office management

❑ Financial management- water tariff rate, status of arrears, status of fixed deposit in bank/ loan clearance, status of billing record

❑ Complaint management- status of complaint record, method of solving complaint

❑ Business plan- made or not, implementing aspect

❑ Water quality- daily/monthly/semi-yearly/yearly, water quality record, importance of quality

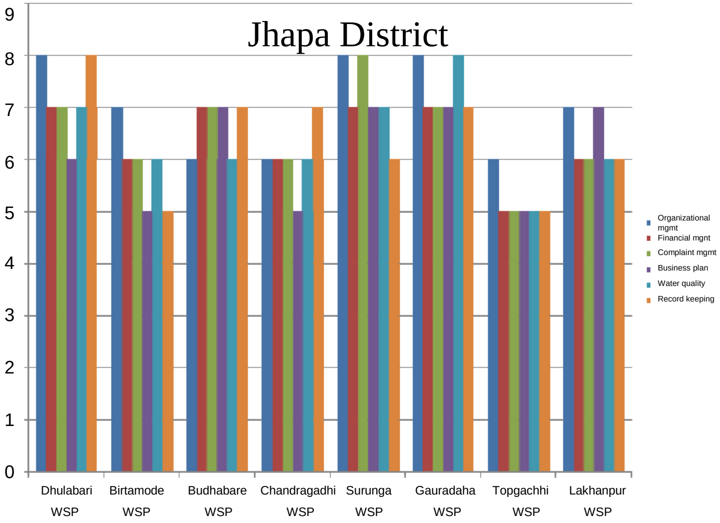
❑ Record keeping

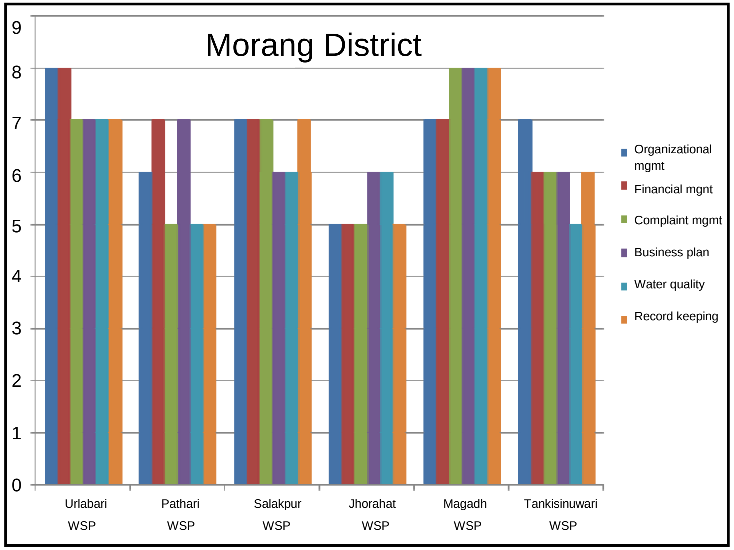
Procedures of Monitoring and evaluation

❑ Questionnaires

❑ Group discussion

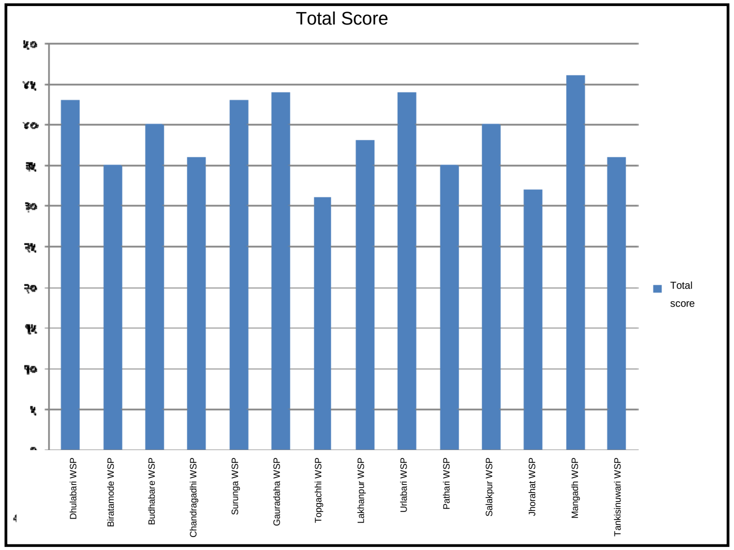
❑ On-site inspection and monitoring





Positive aspects

- Understanding the importance of pure drinking water
- Starting the installation work of flow meter
- Business plan is almost made
- Status of arrears is minimum
- Plan of expanding water supply in all organization



Aspects for improvement

- Seen of additional deep tube well required in some project
- Must give priority in water quality
- Record keeping of production and distribution and control in leakage
- Water tariff should be increased progressively
- Business plan should be implemented
- Record should be managed (account and goods)
- Should conduct public awareness program

Suggestion

- Provide training regarding accounting and computerized billing system
- Provide technical training as per necessity
- Provide training regarding water quality/water quality test kit should be managed
- Itahari lab must be improved
- Public awareness program is necessary
- Manage regular monitoring of different projects forming joint monitoring team with DWSS, RMSO and WSSDO

Thank You!

Water Supply Service Operation Regulation – 2012

Department of Water Supply and Sewerage

Contents of Presentation

- **Water Supply Service Operation Regulation 2012**
- **Sample forms of Reporting and Monitoring**
- **Discussions**

Efforts done for Water Supply service operation

- In past DWSS itself operated Water Supply service
- After Government's latest rule, water supply service operated through WUSC
- Increasing community ownership lead to water supply service extension
- Consumers capacity has been developed respectively
- Due to the effective operation by community, increased in private investment
- Decrease in daily work pressure regarding operation and management of water supply facility
- Due to commercial operation of the public service government, consumers and service provider, all are benefitted.

Challenges

- Availability of sufficient water in tap or increase in access of water.
- Providing water with Government water quality standard
- Extension and sustainable operation of water supply facilities
- Increasing technical capacity of WUSC and service provider
- Regular repair and maintenance of water supply facilities
- Preparing business plan have to operate effectively
- Waste water treatment and using it as source like for bio gas, compost etc
- Institutionalizing communication and cooperation between DWSS and WUSC.

Water Supply Service Operation Regulation 2012

Objective:

To make water supply service qualitative, reliable and affordable by maintaining quality, regularity, transparency and accountability in service operation with monitoring, evaluating, supervising and regulating it.

Roles of Service provider

- Providing reliable and affordable drinking water
- Checking the certain parameter likes (turbidity, P.H and Residual chlorine) to confirm the quality of drinking water
- Auditing
- Protecting and managing the property
- Make changes by taking advice for Water Supply facilities
- Appropriate management of tariff and connection fee
- Registering as service provider institution and conduct regular periodic election
- Treat equally in Water supply service operation.
- Facilitate poor and disadvantage groups in access to water supply service.
- Preparing report and description related to water supply and making it public

Responsibilities of DWSS

Monitoring, Supervising and Regulating

- Quality and regularity of water
- Tariff collection and use
- Audit report of WUSC and Election
- Regular repair and maintenance of Water Supply Facilities
- Extension and replacement of Facilities
- Facilatate in water supply for poor groups

Facilitation and coordination

- Capacity development programs for service provider
- Technical suggestion and guidance for making water supply service qualitative, fast, reliable and effective
- Regular interaction and contact with service provider.
- Coordination and facilitation to make water supply service effective

Reporting and Monitoring sample forms

Reporting and Monitoring Forms

- Water production record form
- Water consumption record form
- Drinking water quality check form
- Consumer’s complain record form
- Regular repair maintenance check form of different components related with water supply
- Tariff collection record form
- Water supply related machines and equipment’s description form.
- Used and spare goods record form
- Sample of annual report that should be provided by Service provider
- Sample of annual report that should be prepared by Division or Sub-Division Office
- Necessary trainings for Service provider

Thank You!

Expected achievements achieved by the Department from the implementation of the Regulation

- Repair and maintenance of Structure and entire physical associated with water supply system.
- Regular supply of qualitative facilities water
- Capacity development of the consumers
- Regular coordination, contact and communication between department and Users committees.
- Periodic data related with Water supply
- Increasing the accessibility and disadvantage of the poor group in water supply
- Uniformity in water supply service operation working procedure

Project for Capacity Development on Water Supply in Semi-Urban Areas

in brief

Presented By

Binu Bajracharya Kunwar

February 10, 2013

Background

Improvement of Water Supply Facilities in Urban and Semi-Urban Centres (2006-2007)

Dhulabari Water Supply Project

Gauradaha Water Supply Project

Mangadh Water Supply Project

Background

Capacity Development on Water Supply in Semi-Urban Areas

- MM between Preparatory Study Team and GON on 15 August 2008
- RD between JICA and MPPW on 27 February 2009 in accordance with the Agreement on Technical Cooperation between GOJ & GON signed in September 2003

Outline of the Project

Objectives

- To improve DWSS/WSSDO's technical assistance capacity to conduct improvement programs in Morang and Jhapa
- To improve water services in 3 WUSCs through JICA Expert Team
- To provide and facilitate DWSS activities on strengthening technical assistance to WUSCs
- To summarize enforcement process as a model/manual to replicate in other WS utilities

Outline of the Project

Project Duration

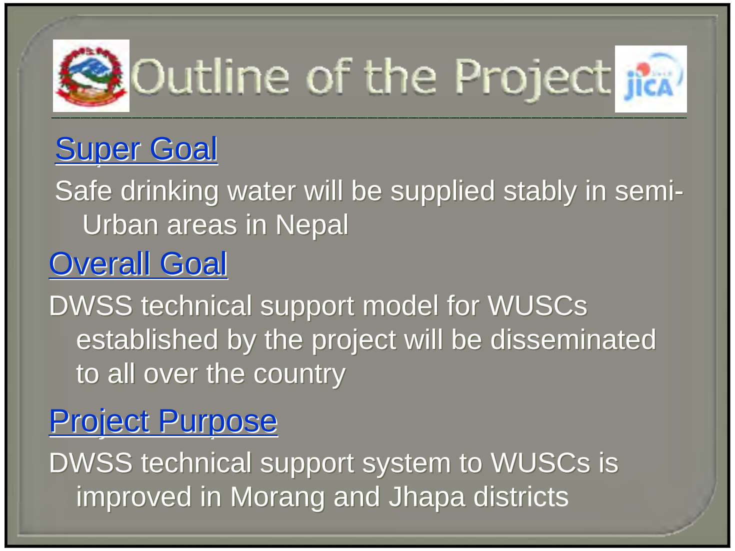
January 2010 ~ September 2013

Target Area

Jhapa and Morang districts

Target Groups

DWSS, WUSCs and Water Users



Outline of the Project

Super Goal

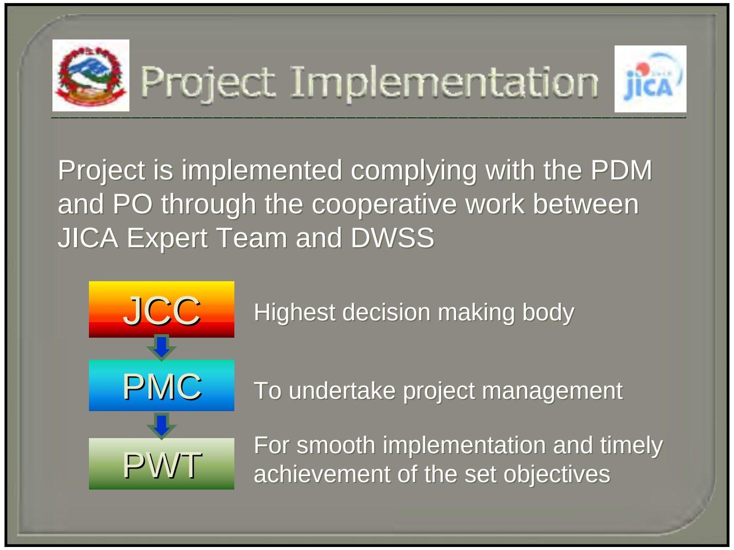
Safe drinking water will be supplied stably in semi-Urban areas in Nepal

Overall Goal

DWSS technical support model for WUSCs established by the project will be disseminated to all over the country

Project Purpose

DWSS technical support system to WUSCs is improved in Morang and Jhapa districts



Project Implementation

Project is implemented complying with the PDM and PO through the cooperative work between JICA Expert Team and DWSS

JCC — Highest decision making body

PMC — To undertake project management

PWT — For smooth implementation and timely achievement of the set objectives

Input

Japanese Side

1. Experts
   - Chief/Water Supply
   - WTP O&M/Water Quality Management
   - Management Improvement/Administrative Buildup
   - Water Distribution Facilities Management and Planning
   - Public Awareness/ Coordination
   - Mechanical Equipment O&M
   - Electrical Equipment O&M

Input

2. Provision Equipment
   - o Vehicles, Motorbikes
   - o Water quality test equipments
   - o Computers and test equipments
   - o Spare parts and tools for maintenance of distribution system
   - o Spare parts and tools for WTP maintenance
   - o Office generators
3. Training in-country and third-countries, in Japan

Input

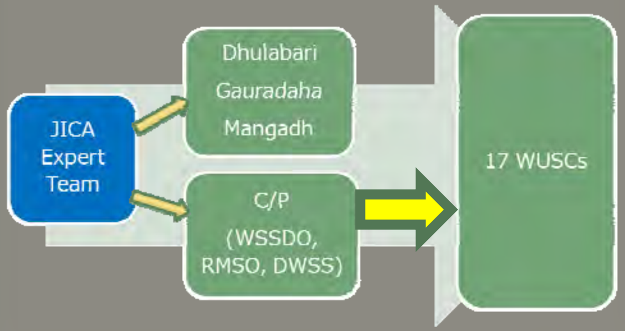
Nepalese Side

1. Counterpart personnel
2. Office Facilities in DWSS Building and in Jhapa and Morang WSSDOs
3. Necessary Budget (the Project related budget, domestic transportation/ accommodation allowance for training/ workshops, telephone and electricity charges)

Activities

- Conduct baseline survey in target area
- Conduct technical, managerial, organizational and financial capacity assessment of C/Ps
- Conduct training/OJT and workshops for targeted WUSCs, prepare SOPs and provide technical support for service improvement
- Prepare WUSC Management Model and WUSC Support Model for small and medium-sized water supply utilities
- Implement WUSC Management & Support Models

Activities



JICA Expert Team

Dhulabari

Gauradaha

Mangadh

C/P

(WSSDO, RMSO, DWSS)

17 WUSCs

Outcome

- Based on the technical support model/manual established, the support system to 17 WUSCs in Jhapa and Morang is improved
- The safe drinking water services by 3 WUSCs is improved in comparison to the beginning of the Project

Thank You

O&M Monitoring Workshop:
Its Background and Policy

Binu Bajracharya Kunwar
Senior Divisional Engineer
Department of Water Supply and Sewerage

February 10, 2013
Biratnagar

Sector Policy and Approach

- To provide and ensure **safe, convenient and adequate water supply to all** Nepalese people, with **sanitation as an integral component**, and with **specific focus on disadvantaged group**
- To ensure **involvement and participation of the users**' groups **in the construction, operation and maintenance** of water systems
- **WUSCs**, as elected representatives of the water users association (WUA) members, **work as investors of infrastructure as well as operators of the completed infrastructure**. **WSSDO provides technical support to WUSCs** in the development and operation of the facilities

---

Cost Sharing in Project Implementation, Operation and Maintenance (O&M)

Before 2047 BS	Government	Users
Implementation	100	0
Operation & Maintenance	100	0

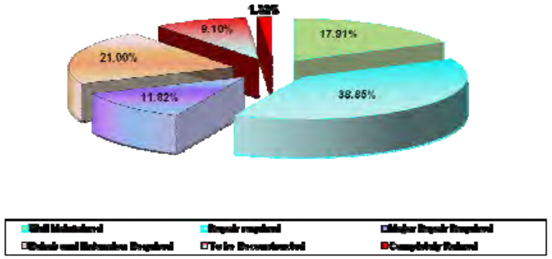
2047 – 2060 BS	Government	Users
Implementation	90	10
Operation & Maintenance	0	100

After 2060 BS

Project Modality	Implementation		Operation & Maintenance	
	Government	Users	Government	Users
Rural WSS Project	80	20	0	100
Urban WSS Project	70	30	0	100
Small Town WSS Project	50	50	0	100
Cost Sharing Program	60	40	0	100

Current Scenario of Completed Water Supply Schemes

Total No. of Completed Schemes: ~ 38,307



Source: NMIP, DWSS, 2010

What are the reasons behind the deterioration of most of the water supply systems?

Even after creating such assets by investing millions of rupees,

they are unable to provide the services effectively to the community for which they have been constructed

---

Objectives of Operation and Maintenance (O&M)

To provide safe and clean drinking water in adequate quantity and desired quality, at adequate pressure at convenient location and time and as economically as possible on a sustainable basis

---

Causes Behind Deterioration of the Water Supply Systems

The responsibility of operation, maintenance and revenue collection is vested with the WUSC

But,

the absence of proper O&M has been observed in most of the systems

Why So?

- Do WUSC feel that government has pulled out its hand from the system loading them with financial, operational, technical, and managerial burden
- Do WUSC feel that O&M does not concern them—believing that when the system is out of order someone will come and put it right!

If not,

lack of attention to the important aspect of O&M of water supply schemes

---

Definition of Operation and Maintenance (O&M)

Operation

In an engineering sense, **operation refers to timely and daily operation of the components of a Water Supply system** such as intakes, treatment plant, machinery and equipment, conveying mains, service reservoirs and distribution system etc. **effectively by various technical personnel**, which is a routine function

Maintenance

Is an **art of keeping the structures, plants, machinery and equipment and other facilities in an optimum working order**. Maintenance includes preventive maintenance or corrective maintenance, mechanical adjustments, repairs, corrective action and planned maintenance.

Key Issues Contributing to Poor Operation and Maintenance (O&M)

a) Lack of finance, inadequate data on Operation & Maintenance
b) Inappropriate system design; and inadequate workmanship
c) Multiplicity of agencies, overlapping responsibilities
d) Inadequate training of personnel
e) Lesser attraction of maintenance jobs in career planning
f) Lack of performance evaluation and regular monitoring
g) Inadequate emphasis on preventive maintenance
h) Lack of operation manuals
i) Lack of appreciation of the importance of facilities by the community
j) Lack of real time field information etc.

Preventive Maintenance

Primary Goal of Preventive Maintenance is:

- to prevent the failure before it actually occurs
- to preserve and restore equipment reliability by replacing worn components before they actually fail evaluate

The ideal preventive maintenance program would prevent all equipment failure before it occurs

---

Preventive Maintenance

1. **The care and servicing** by personnel **for maintaining equipment and facilities in satisfactory operating condition** by providing for systematic inspection, detection, and correction of incipient (just beginning) failures either before they occur or before they develop into major defects.
2. **Maintenance**, including tests, measurements, adjustments, and parts replacement, **performed specifically to prevent faults from occurring**

Project Initiation on Preventive Maintenance

Maintenance Inspection Team (MIT)

Assess WUSC's condition

Aware WUSCs to maintain records

Aware WUSCs on Preventive Maintenance

Objectives of MIT Workshop

MIT Workshop

Enhance efficiency of O&M

Establish link between WUSCs & WSSDO

Assess existing status of O&M

Share Knowledge and Experiences

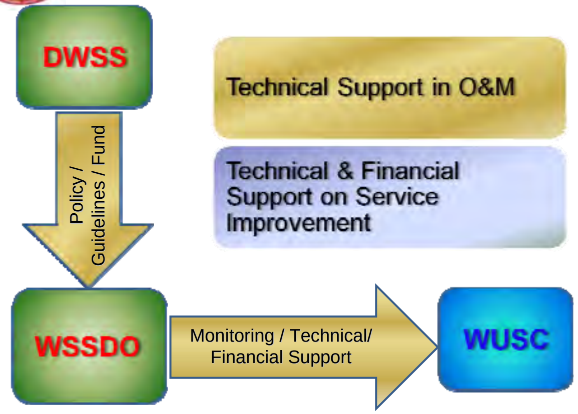
Initiate mutual learning process

Develop relationship with co-organizations

Create common understandings of problems and solutions

Identify existing and new strategies for sustainability

Way Forward



Technical Support in O&M

Technical & Financial Support on Service Improvement

Thank You

for Your Attention

Concept of
Maintenance Inspection Team
to be set up,
Roles to play of each section
(DWSS, WSSDO, MIT, WUSC)

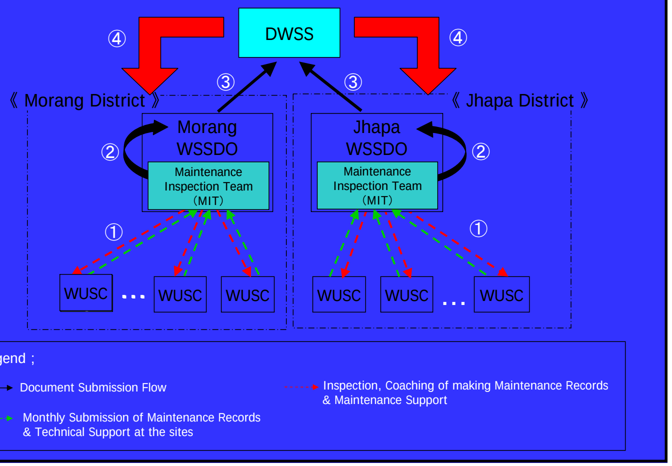
Presented by:

Binod Kumar Agrawal

Division Chief, WSSDO, Jhapa

Date: 10th Feb 2013 at Biratnagar

Functions of the Team (Flow Chart)



Legend ;

→ Document Submission Flow

⇢ Monthly Submission of Maintenance Records & Technical Support at the sites

⇢ Inspection, Coaching of making Maintenance Records & Maintenance Support

---

gd:t]

&

WARM WELCOME TO ALL

Who will make and be responsible for the document?

Writer	Report	Responsibility
DO Chief	On-site Reports	DWSS
	⬆	
MIT	Evaluation Sheet	DO Chief
	⬆	
MIT	Inspection Sheet	DO Chief
	⬆	
WUSC	*Maintenance Record*	*MIT*

Most Important!!!

Roles to play

- Actions to be taken by each section -

A. DWSS

- Plan to secure the budget for O&M monitoring activity such as regular inspections conducted by MIT (Maintenance Inspection Team) and “O&M Monitoring Annual Workshop”.

- Promote WSSDO to submit “On-Site Report”, which shall show overall situation of the WUSCs and common issues at the site in the district. Then, approve the report with some advisory comment to it.

- Promote WSSDO to hold “O&M Monitoring Annual Workshop” and join this as a presenter to inform the O&M policy of the year and next year.

- Conduct an annual site survey for cross checking whether the report submitted by WSSDO properly show the actual condition of the site. As a proposal, it could be effective to conduct this survey without notice.

B. WSSDO (Division Chief)

- Make “On-Site Report”, which shall include the action plan to be implemented for solving the issues at the site as well as explanation for overall situation of the WUSCs. The contents of this report shall be based on “Inspection Report” submitted by MIT.

- Promote and manage the schedule of MIT Team Leaders and Sub Leaders to conduct an inspection every 3rd month and to submit the “Inspection Report” with each cycle.

- Host “O&M Monitoring Annual Workshop”. Make a workshop program, then share it with and invite DWSS and WUSCs to join it.

- Make a budget plan for O&M activity in order of priority based on “Inspection Report”. It would be effective and efficient if it reflect the actual situations at the site from the serious and preventive point of views.

C. MIT

(Maintenance Inspection Team,
especially for Team Leaders and Sub Leaders)

- Implement the regular inspection to each WUSC every 3rd month to check the actual situation and improvement of O&M at the sites.

- Provide guidance to WUSCs to keep O&M record properly and to do preventive maintenance constantly by themselves through their inspections.

- Make and submit “Inspection Report” to the division chief with each cycle. The report needs to be approved by the division chief.

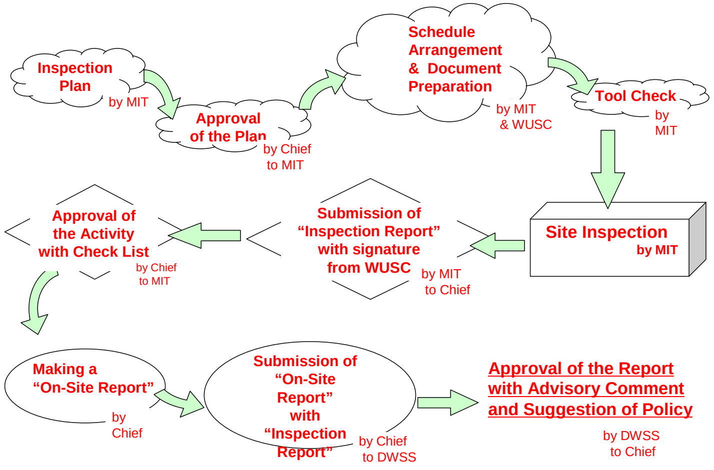
- Promote WUSCs to make and submit an expense record for O&M every time MIT visit them for the inspection.

- Help the division chief to make an arrangement of “O&M Monitoring Annual Workshop” and join it as a presenter.

D. WUSC

- Make an Equipment List of current equipment and the ones to be newly installed from now on.
- Make and keep a Daily Operational Record based on the guidance given by MIT.
- Make and keep a Preventive Maintenance Record based on the guidance given by MIT.
- Make an expense record for O&M and submit it to MIT.
- Provide the Preventive Maintenance on their own facility and equipment continuously based on the guidance given by MIT.
- Participate actively in “O&M Monitoring Annual Workshop” and share knowledge and experiences with the participants of workshop.

O & M Monitoring Flow Chart



Inspection Plan by MIT

Approval of the Plan by Chief to MIT

Schedule Arrangement & Document Preparation by MIT & WUSC

Tool Check by MIT

Site Inspection by MIT

Submission of “Inspection Report” with signature from WUSC by MIT to Chief

Approval of the Activity with Check List by Chief to MIT

Making a “On-Site Report” by Chief

Submission of “On-Site Report” with “Inspection Report” by Chief to DWSS

Approval of the Report with Advisory Comment and Suggestion of Policy by DWSS to Chief

Welcome

Operation, Maintenance and Monitoring
Kick Off Workshop

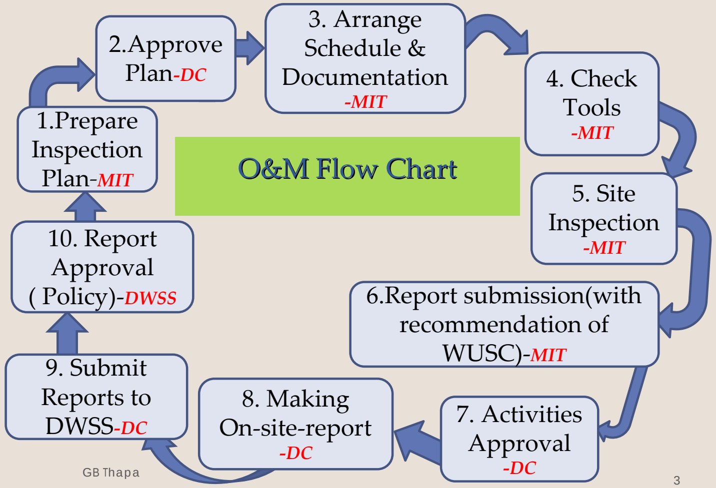
Annual plan

-aflif{s of]hgf_

10 Feb 2013

Presentation

- Concept of annual plan
- Major activities of the Maintenance inspection Team (MIT)
- General annual plan
- Annual plan of the 2013



O&M Flow Chart

1.Prepare Inspection Plan-*MIT*

2.Approve Plan-*DC*

3. Arrange Schedule & Documentation -*MIT*

4. Check Tools -*MIT*

5. Site Inspection -*MIT*

6.Report submission(with recommendation of WUSC)-*MIT*

7. Activities Approval -*DC*

8. Making On-site-report -*DC*

9. Submit Reports to DWSS-*DC*

10. Report Approval (Policy)-*DWSS*

---

1. Inspection Plan & Record

Plan Date:

Inspection Schedule	
Members :	
No. of license plate :	
Vehicle Type : 4WD	2. Chief Signature for Plan

3. Arrange Schedule & Documentation

Record(/ page)

Date	Start (Time & Place)	End (Time & Place)	Mileage	Members	Sig
			Initial mileage		

Chief Signature for Activity

Summary of O/M activities

MIT	WUSC			Insp Plan	Tool Check List	Evaluation Sheet	Required Goods List	Inspection Sheet			Preventive Maintenance Record			Inspection Record	Activity Expence Record
	No.	Name	Operators					Water Quality	Water Distribution & Water Meter	Mechanical & Electrical	Mechanical	Electrical−1	Electrical−2		
TL: AU	1.	Urlabari	Om Pokhrel Krishna Saru Magar					—	—						

Annual Plan for MIT Activities Coming year

Jhapa

MIT	WUSC			Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	No.	Name	Operators	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score
TL: Pramod Kumar Dutta SL: Rudra Bdr. Neupane	1.	Karkarvitta	Yam Pd. Pokhrel Laxmi Narayan Majhi			●		O&M Monitoring annual workshop				●						●						●			
	2.	Buddhabare	Purna Kumar Subedi Devi Pd. Nepal			●						●						●						●			
	3.	Sanischhare	Arjun Karki Ranga Lal Karki			●						●						●						●			
	4.	Birtamod	Durga Pd. Bhattarai Krishna Bhakta Katel			●						●						●						●			
	5.	Dhulabari	Nar Bdr. Dahal Kul Bdr. Sarki			●						●						●						●			
	6.	Chandragadhi	Prahlad Rajbanshi Mohan Basnet			●						●						●						●			
TL: Babu Kaji Shrestha SL: Rajeev Sharma	7.	Lakhanpur	Min Bdr. Basnet Dev Kumar Rai			●						●						●						●			
	8.	Gauradaha	Prem Shivakoti Chitra Bdr. Magar			●						●						●						●			
	9.	Topgacchi −1	Dhurva Bhujel Amrit Rai			●						●						●						●			
	10.	Topgacchi −3	Tulsi Nepal Purna Shrestha			●						●						●						●			
	11.	Damak	Manoj Pokhrel Gopal Shivakoti			●						●						●						●			
	12.	Surunga	Manorath Bhattarai Kajiman Sauden			●						●						●						●			

Annual Plan for MIT Activity

2013

MIT	WUSC			Jan		Feb		Mar		Apr		May		Jun		Jul		Aug	
	No.	Name	Oper	Plan	Score	Plan	Scor	Plan	Scor	Plan	Scor	Plan	Scor	Plan	Scor	Plan	Score	Plan	Scor
TL/S TL	1.	P1	O1 O2	●		O/M monitoring kick off workshop				●						●		Annual Workshop	
	2.	P2	O1 O2	●						●						●			
	3.	P3	O1 O2	●						●						●			
	4.	P4	O1 O2	●						●						●			

1. Mechanical and Electromechanical
2. Water Distribution and Water meter
3. Water Quality

Following is the summary of annual records of MIT activities

Major repair/maintenance

- Procurement of maintenance tools such as Insulation test kit, electric heating plate etc
- Water measuring flow meter- 2 set per project
- If new boring or major repair is be done in deep tube well
- If new submersible pump is to be installed
- If new costlier structures , large size pipe is to be extended

---

Minor repair/maintenance cont..

- Regular maintenance (removal of bloc, leakage control, cleaning tank, back washing, regular supply)
- Repair of water facilities (Intake, pipe line, Valve chambers etc)
- Keeping daily or periodical operational record of pump/panel bard/treatment plant/distribution facilities/meters etc.

Minor repair/maintenance cont..

- Electro-mechanical (Pump, Panel board, Electric cables, poor insulation in wiring)
- Preventive maintenance of Electro mechanical equipment(Flow cell, filter of compressor, belt of compressor, pressure gauge etc)
- Extension of small length pipe line if necessary
- Replacement of minor fittings, meter and other required equipment etc.

THANK YOU

Introduction of actual activities of Maintenance Inspection Team

Presenter
Er. Anoj Upadhayay
WSSDO, Morang

SHEDULE OF VISITED PROJECT

- On jan-27, Haraicha (Participated Haraicha& salakpur WUSC)
- On jan-27 , Jhorahat (Participated jhorahat & Mangadh WUSC)
- On jan-28, Pathari(Participated Pathari Urlabari Letang & Rangeli)
- On jan-28, Rangeli (Participated Rangeli)
- On jan-29, Tankisinwari (Participated Tankisinwari)

Activities

➡ Evaluation Form (Scoring of WUSC)

➡ Required goods list

➡ Inspection of mechanical and electrical part

Maintenance Record
(Check,Situation,Cause & Countermeasure)

- Equipment List
- Daily regular maintenance record
- Operational Record
- Guide lines (O & M manual, specifications,Drawing etc)
- Repair work

Quality of the record

- Equipment List
- Maintenance Record
- Operational Record
- Repair work Record
- Accident Record

Preventive Maintenance
(Check,Situation,Cause,Countermeasures)

Maintenance tools & Spare parts

- Maintenance Tools (Adjustable Wrench, Allen wrench, Driver , pliers, Ratchet Wrench etc)
- Electrical Tools (Voltage Detector, Multi meter, Clamp Meter, Insulation Resistance Tester)
- Safety Tools(Eye glass, Gloves, Shoes)
- Spare Parts List
- Consumable Records

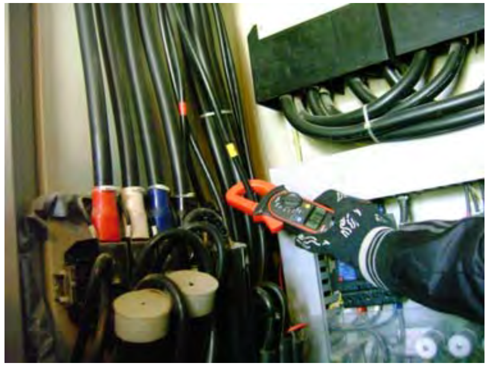
Improvement attitude to on-site issues

- Improvement of maintenance record
- Improvement of preventing maintenance activity
- Improvement of tools Preparation
- Improvement of spare parts stock
- Improvement of the issues pointed out previously

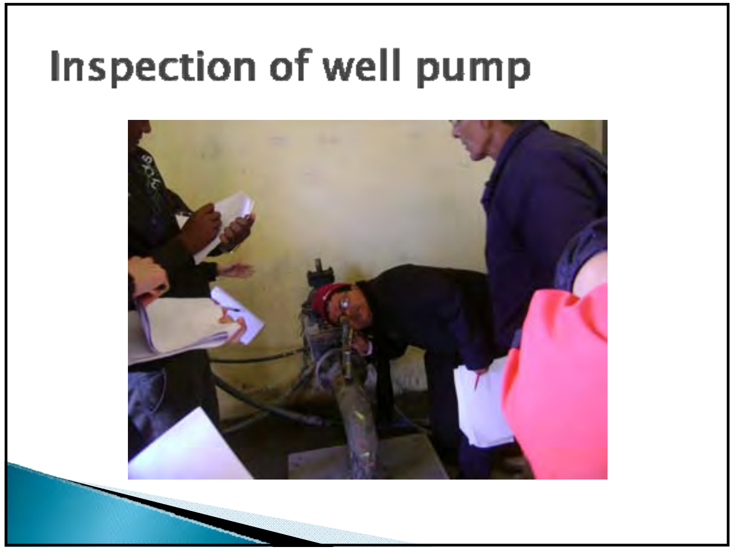
Inspection of operation

Insulation Test Meter

Test with clamp meter



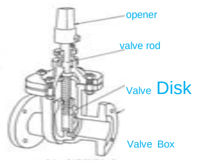
Inspection of Record



Inspection of well pump

Inspection of Panel Board

SOP on Water Distribution Facilities and Water Meter Reading & Meter Calibration



Presented by
Er. Anoj Upadhayay
WSSDO, Morang

---

1. What Is SOP ?

SOP: Standard Operation Procedure

1) SOP gives the information about the function, appropriate location, installation, operation, procedure and record keeping etc. which are standard .

2) SOP can avoid the future problems on operation and maintenance

3) SOP plays a vital role to make a sustainable projects

---

2. What are in SOP?

2.1 Water Distribution Facility

- Information of Water Distribution Facilities
- Distribution Pipeline and Other Structure's Relation
- Pipeline System - Dead End and Grit network
- Necessity of Looping and Methods
- Use of Check Sheet on Preventive Maintenance
- Sluice Valve, Gate Valve, Butterfly Valve
  - Cause, Instance, Measure

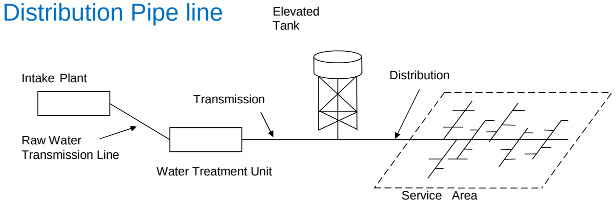
2.2 Water Meter

- Meter Types, Meters Function, appropriate location, precautions on Installation Installation Methods etc.
- Meter Reading, Meter calibration in the project site.
- Meter Maintenance and Recording of Meter etc.

3. System of Water Supply

Regular Check of Distribution

- Intake structure
- Raw water Transmission Line
- Water Treatment Pant
- Transmission pipe line
- Elevated Tank
- Distribution Pipe line



Elevated Tank

Intake Plant

Transmission

Distribution

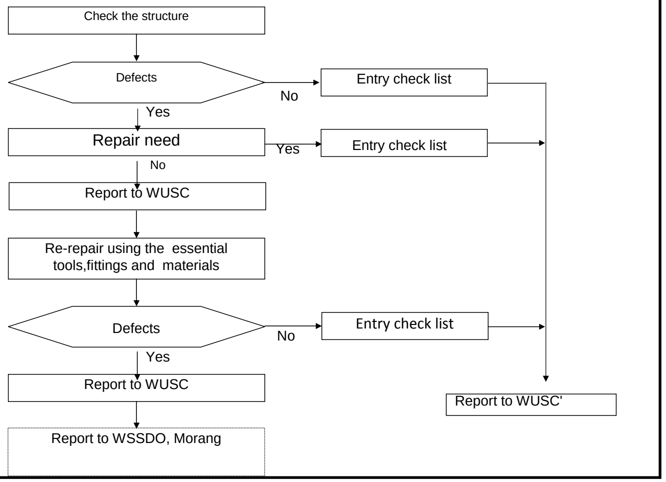
Raw Water Transmission Line

Water Treatment Unit

Service Area

---

4. Inspection and Reporting Process



Check the structure

Defects

No

Entry check list

Yes

Repair need

Yes

Entry check list

No

Report to WUSC

Re-repair using the essential tools,fittings and materials

Defects

No

Entry check list

Yes

Report to WUSC

Report to WUSC'

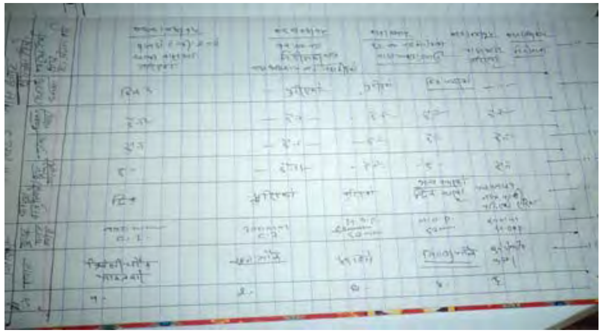
Report to WSSDO, Morang

---

5. Check List Entry

---

6. Check list prepared from WUSC



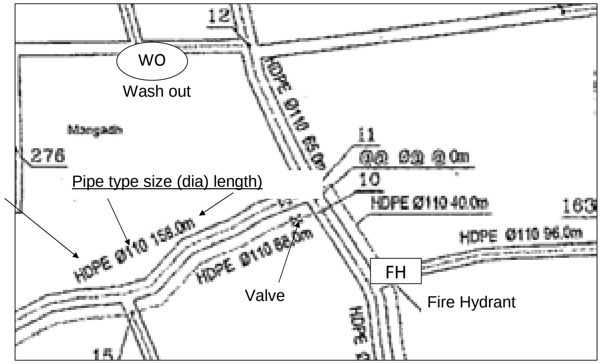
7. Check Sheet – Intake (surface water)

SN	(Inspected Date)	Fencing	(Crack, Leakage)	(Status)	Water Quality(Turbidity,odour, Color etc)	Strainer)	(Block, Deposits)	Maintenance (Day,Month. Year)
	Example							
	12/10/2011	5 m	Canal surface cracked	Dirt collected in inlet of Intake	Turbid	Holes Blocked, needs cleaning	4 cm deposited	Strainer 12/10/2011 concrete 12/10/2011 Screen /and Pit Clearance 12/10/2011 Removing sand from Canal 12/10/2011

Photo

8. Deep Well Inspection

9. Water Distribution Network



10. Present situation of SOP in Morang

- Developing and Improving on keeping old Drawing of Pipeline network
- Low improvement on updating of Drawing, existing and extension of new pipeline etc.
- WUSC has developed keeping Repair & Maintenance recorded gradually in Register (Date, Location, Reasons of Repair/ Maintenance Material used, etc.).
- Except Mangadh Project, The tendency of recording preventive maintenance on check sheets is insufficient but it has been improving.
- WUSC repairs the leakage though Sluice valve by Packing GARAMSUTA

11. SOP on Water Meter

- WUSC repairs the complain meter taking minimum charge. (Removing sand, grits, alga etc. from Valve).
- WUSC calibrates tentatively with a master meter method that the Meter shows actual or not. Mangadh WUSC has set up calibration.
- WUSC treats customer complains on water meter problems.

12. Content of SOP on Water Meter

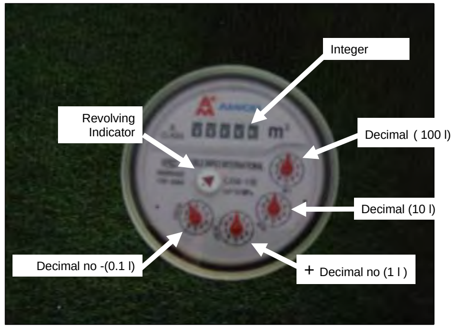
1. Installation of Water Meter, Service Pipe and Meter Reading
2. Responsibility of Meter Installation and Meter Maintenance
3. Meter calibration (Necessity, Methods)
4. Malfunction of Meter and repair technique
5. Management of Meter(Store, record, Specifications
6. Record of distribution to consumer)

13. Water Meter

Installed Meter

Water
Meter

14. Meter Reading
(Water Flow Measure)



15. Water Meter and Calibration

Water Meter Accuracy Management
(ERMSO Laboratory, Itahari, Sunsari district)

Objective of Establishment

- To check performance of Water Meter (Based on Charge)
- To make a master (standard) meter for calibration

Process of Calibration

- Difference between water flow and Meters reading
- Calculation of Water Flow Through Water Gauge
- Accuracy check (Itahari Laboratory) ±**2 - 5 %**

---

16. Examination of Instrumental error with reference (Standard) water Meter

- **Error %= (Indiscrete Value of TM- Indiscrete Value of MM) / Indiscrete Value of MM *100%**

➢Allowable Error : Max = ±10% in the project site (Consumers Meter)

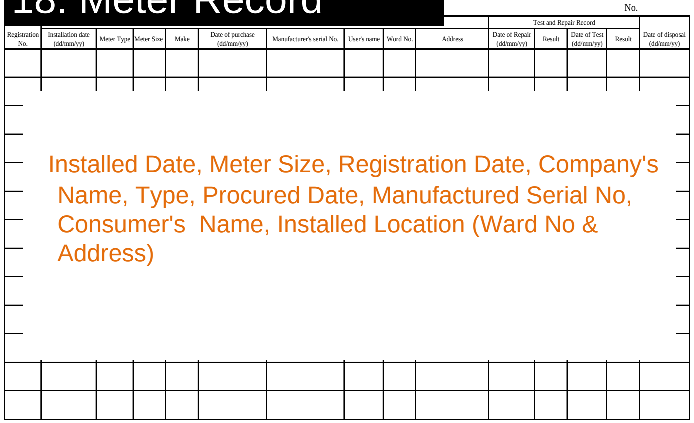
---

17. Concept of Flow Meter calibration introduced

Complain handling especially assuring the accuracy of flow meter

---

18. Meter Record

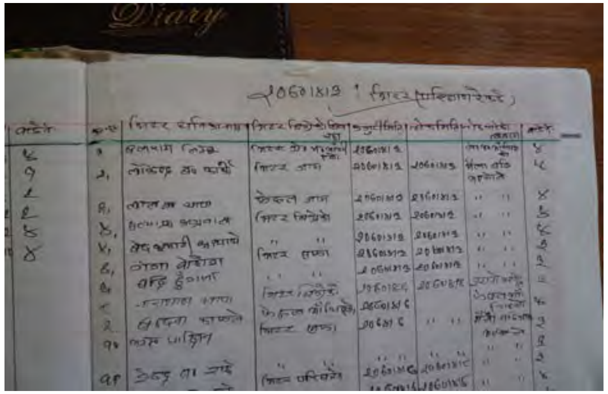


No.

										Test and Repair Record				
Registration No.	Installation date (dd/mm/yy)	Meter Type	Meter Size	Make	Date of purchase (dd/mm/yy)	Manufacturer's serial No.	User's name	Word No.	Address	Date of Repair (dd/mm/yy)	Result	Date of Test (dd/mm/yy)	Result	Date of disposal (dd/mm/yy)

Installed Date, Meter Size, Registration Date, Company's Name, Type, Procured Date, Manufactured Serial No, Consumer's Name, Installed Location (Ward No & Address)

19. Record of Meter repair and calibration from WUSC



---

20. Recommendation

- WUSC should record facility condition periodically with Check-Sheets and maintain facilities interval of 1-2 month, and when customer complaints or problems raised.
- Project's pipeline drawing (Distribution Network Map) should be updated regularly. All the key structures (Valve chambers-No., location, Valve type, pipe size and material) should be shown on the Map and be coincided with the distribution facility ledger.
- WUSCs should manage water meters properly with the SOP
- Malfunctioning water meter should be calibrated with a Master Meter (Standard Meter), and it can treat customer complaints.

Thank you very much for your attention.

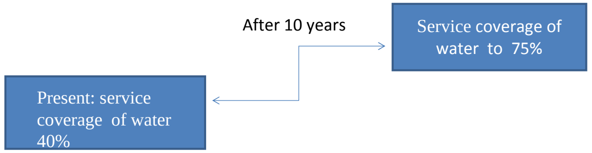
BUSINESS PLAN

September 13, 2013

How to reach ideal status???

- Set target step by step
- means for achieving this ideal status :

BUSINESS PLAN



After 10 years

Service coverage of water to 75%

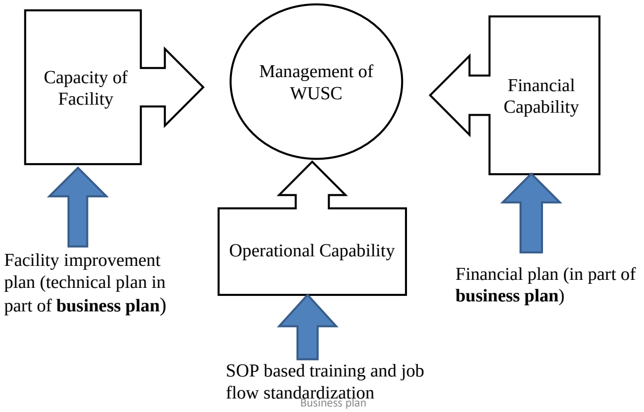
Present: service coverage of water 40%

Management model of WUSC

Ideal state of WUSC(water users and sanitation committee)

- provide safe water affordably in stable manner to maximum people in their jurisdiction with reasonable cost
- Ideal state: explained with mission and vision
- Mission :what WUSC must do
- Vision: what WUSC want to be

WUSC management model



Capacity of Facility

Management of WUSC

Financial Capability

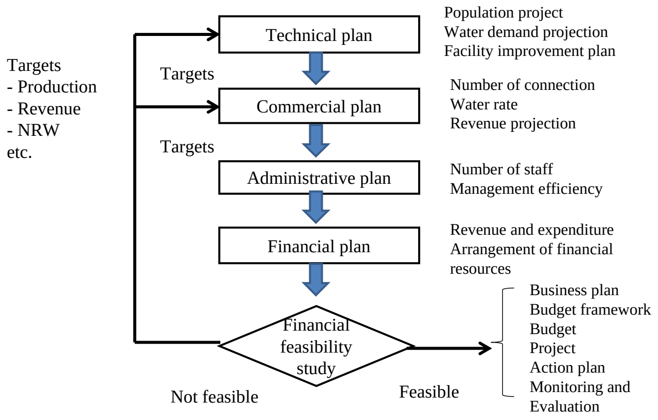
Operational Capability

Facility improvement plan (technical plan in part of **business plan**)

Financial plan (in part of **business plan**)

SOP based training and job flow standardization

BUISNESS PLAN CONCEPT



Targets
- Production
- Revenue
- NRW
etc.

Targets

Targets

Technical plan

Population project
Water demand projection
Facility improvement plan

Commercial plan

Number of connection
Water rate
Revenue projection

Administrative plan

Number of staff
Management efficiency

Financial plan

Revenue and expenditure
Arrangement of financial resources

Financial feasibility study

Not feasible

Feasible

Business plan
Budget framework
Budget
Project
Action plan
Monitoring and Evaluation

Technical plan

- Plan includes preventive maintenance cost, based on the life of the facility (ex.

  Large Rehabilitation of elevated tank after 10 years)
- facility improvement plan might increase the cost for fuel, power.
- NRW/UFW is also considered (plan to decrease)

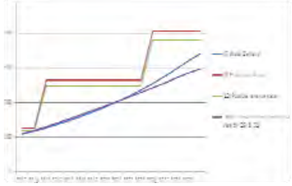
Technical plan

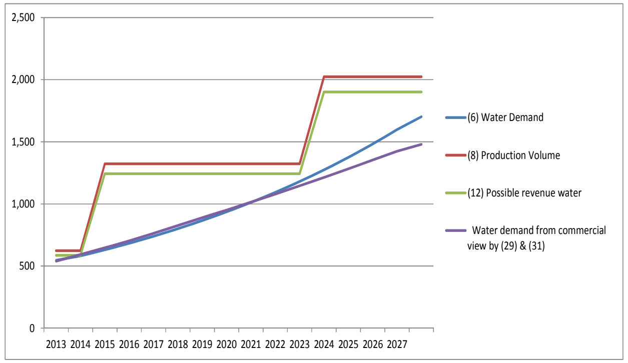
- Population projection
- Water demand projection
- *Check whether existing facility meet the water demand in the future plan or not*
- If Water demand exceeds the capacity of facility , plan for facility improvement

---

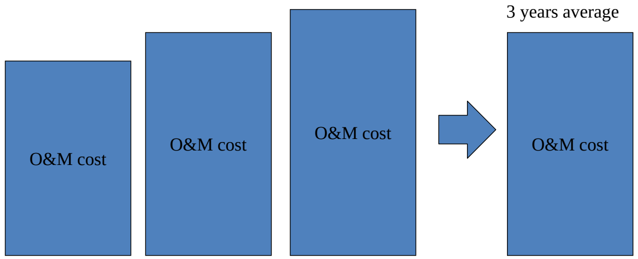
Technical plan

- Facility improvement plan gives idea about capital expenditure
- gives the direction for arranging the financial resources (ex. loan, grant)
- The information of capital expenditure is directly linked with financial plan.
- The expenditure increase in that year due to facility improvement.





-Example: Set the water rate average of 3 years such that it covers O and M cost


3 years average

O&M cost

O&M cost

O&M cost

O&M cost

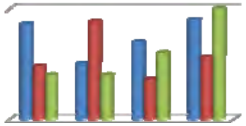
Commercial plan

- Number of connection
- Planning is done for water rate
- Water rate determines revenue from sales of water
- *Setting the right water rate is very important , it covers the administrative and O and M cost*
- This information is linked with financial plan

Administrative plan

- Number of staff
- Salaries and wages
- Over and under staffing effect management efficiency
- Number of connection determines the staff, ex: ***per staff connection should be between 120 and 200,***

Financial plan



- Revenue and expenditure
- Revenue from sales of water
- Revenue from others (ex: meter sales, penalty)
- Expenditure(ex: power, fuel, chemicals)
- Revenue for capital expenditure: loan, grant
- Capital expenditure: facility improvement and large scale rehabilitation

---

- When financial plan is feasible, business plan is prepared
- Business plan is implemented in terms of project
- Provide framework for budget allocation
- *Monitoring and evaluation is must, the information needs to be updated every year in plan*

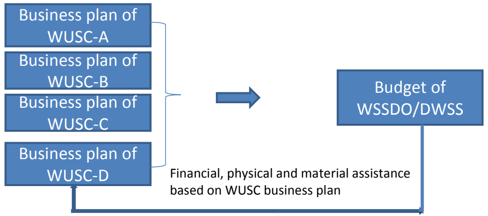
Financial plan

- Guides WUSC for financial resources arrangement
- Basis for providing the loan, grant to WUSC (Ex: government can allocate the budget required in that year)
- End balance should be positive to be financially feasible
- If end balance is negative review other plans such as change the scope of facility improvement / increase the water rate

---

Support model: Support strategy

- ➢ Document suggest DWSS for assisting WUSC based on their business plan
- ➢ DWSS should ask WUSC to submit their business plan and confirm what assistance is required
- ➢ Aligning all business plans of WUSC in the jurisdiction, WSSDO can easily understand the total picture of their assistance requirement



Business plan of WUSC-A

Business plan of WUSC-B

Business plan of WUSC-C

Business plan of WUSC-D

Budget of WSSDO/DWSS

Financial, physical and material assistance based on WUSC business plan

WUSC with their business plan

- In Morang: Pathari, Tankisinuwari, Salakhpur, Mangadh,,Urlabari
- Only orientation about business plan :Haraicha, Jhorahat, Rangeli
- In Jhapa: Chandragadhi, Dhulabari, Lakhanpur, Gauradaha

THANK YOU

Business plan sample

The Project for Capacity Development on Water Supply in Semi-urban Areas

Water Quality Management

SOP on water quality management

Sudarshan Bhandari,
Section Chief
Water Quality Improvement and Monitoring Section
DWSS
13 September 2013

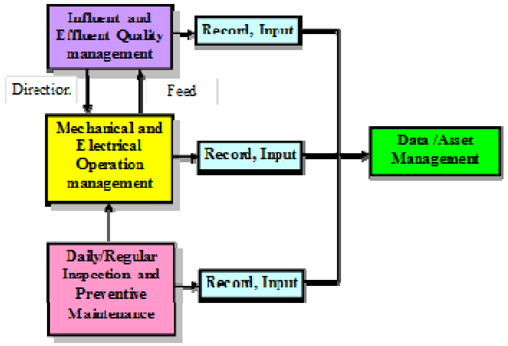
The Project for Capacity Development on Water Supply in Semi-urban Areas

- **Project Period**:

  February 2010-September 2013
- **Actual On-the-Job Training period of Water Quality Management**:

  August 2010-Feburay 2013

What is Water Quality Management



What is Water Quality Management

◆Water Quality Management consists of;

✓ Water Quality Analysis and quantitative purification process control and,

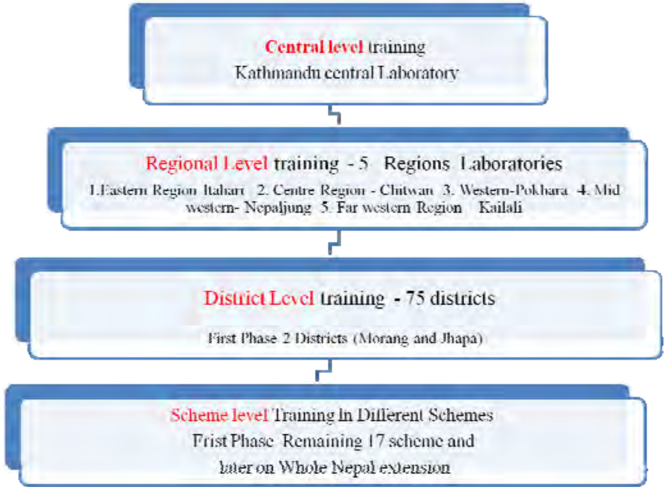
✓ Evaluation of the plant by comparison of the original design

➢ Quantitative purification process control means

- To operate the water treatment plant properly based on accurate water quality results

Objectives of the Capacity Strengthening in Water Quality Management

- to assist DWSS staff by JICA Expert to train as a trainer on Water Quality Management in **central level** and expand to **scheme level for Project Sustainability**



Central level training
Kathmandu central Laboratory

Regional Level training - 5 Regions Laboratories
1.Eastern Region Itahari 2. Centre Region - Chitwan 3. Western-Pokhara 4. Mid western- Nepaljung 5. Far western Region Kailali

District Level training - 75 districts
First Phase 2 Districts (Morang and Jhapa)

Scheme level Training In Different Schemes
Frist Phase Remaining 17 scheme and
later on Whole Nepal extension

Key Point of the Trainings:

On the job Training for Project Sustainability:

- JICA Expert and DWSS staff who are certified as the trainer by JICA Expert conducted on the job training at Morag and Jhapa WSSDO and Mangadh, Gouradaha and Dhulabari WUSC.
- Extent this skill to remaining 17 WUSCs of Morang and Jhapa Districts

---

Key Points of a series of Training

1. How to secure analysis accuracy in water quality analysis at DWSS Central Laboratory in order to **establish Traceability from Central Laboratory** where official analysis methods are to be used **to regional laboratories and WUSCs where simple analysis methods or kits are to be used**
2. To understand water purification process through simple experiments such as jar test and iron removal test and theoretical exercises for coagulation, sedimentation, filtration and chrorine disinfection
3. How to use the analysis results in daily operation and evaluation of the purification plant

Some Key Points to Secure Analysis Accuracy-1

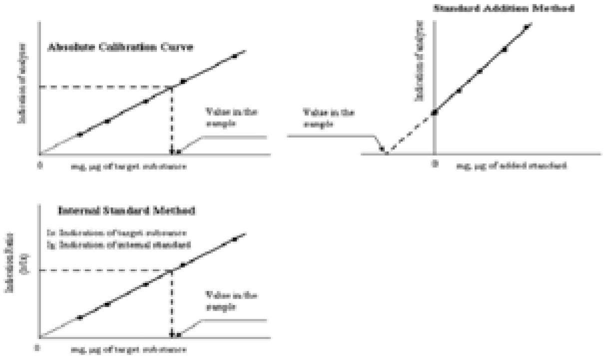
1. To calibrate analytical instruments by standard (reference) solutions and to know determination range
2. To confirm the reliability of analysis methods to be used at regional laboratories and simple analysis kits to be used at site by using standard (reference) solutions and with comparison of official method.

   Do not use simple analysis kit or simple analysis methods blindly

Some Key Points to Secure Analysis Accuracy-2

1. To use standard addition method to avoid hindering substances (Refer to Slide 11and Slide 12)
2. To conduct blank test without fail
3. To clarify significant figures (Refer to Slide 14)
4. To understand advantages and disadvantages of the analysis method in question with the understanding analysis principal
5. To prepare analysis flow chart (Refer to Slide 13)
6. Water grade
7. To pay attention of reagent's effectiveness

Calibration Curve



Training at DWSS Central Laboratory

1. **Contents of Training**

① **Water Quality Analysis**

② **Simple experiment to understand purification Process:** Jar Test and Iron removal test

2. **Methodologies -** THEORITICAL AS WELL AS PRACTICAL

2. .

Training at DWSS Central Laboratory (Water Quality Analysis)-1

1. Main objectives of the training on water quality analysis

- ➢ To improve the ability and awareness to seek for analysis accuracy by using official methods to establish the base of traceability
- ➢ To confirm the reliability of simple analysis kit and simple analysis methods

---

Training at DWSS Central Laboratory (Water Quality Analysis-2)

2. The parameters of the training

① pH: Calibration by pH standard solutions

② Turbidity: Digital turbidity meter, spectrophotometer and eye-comparison method

③ Color: Spectrophotometer and Eye-comparison method

④ Free Residual Chlorine: Eye-comparison method (Simple analysis kit)

Confirmation of reliability by using chlorine standard solution

⑤ M-Alkalinity: Titration method

Confirmation of reliability of simple analysis kit by comparison with official analysis method

---

Training at DWSS Central Laboratory (Water Quality Analysis)-2

⑥ Iron: Spectrophotometer, AAS method

i. Confirmation of reliability of simple analysis kit

ii. The differences of the results with and without acid digestion and absolute calibration and standard addition method

⑥ Arsenic: Confirmation of reliability of arsenic digital meter by comparison of official method

⑦ Anmomium ion: Internationally used official method,

The differences of the results by absolute calibration and standard addition method

---

Jar Test

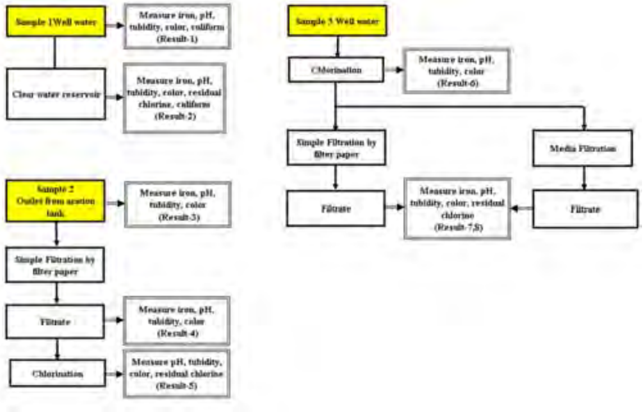
- Jar test is used to deicide optimum chemical feeding rate like alum for coagulant and design specification of sedimentation tank
- Main factors of optimum chemical feeding rate
- Particle sinking velocity
- Sludge volume
- Nature of filtration velocity of supernatant
- Estimation of optimum feeding rate of alum P (mg/L)

$P = 2\ \mathrm{x}\ \{6+2\ \mathrm{x}\ (T)^{1/2}$, T: Turbidity

in case of $Al_2(SO_4)_3 \cdot 18H_2O$

A Picture of Jar Test

Simple Experiment (Iron Removal)



Sample 1Well water → Measure iron, pH, tubidity, color, coliform (Result-1)

Clear water reservoir → Measure iron, pH, tubidity, color, residual chlorine, coliform (Result-2)

Sample 2 Outlet from aration tank → Measure iron, pH, tubidity, color (Result-3)

Simple Filtration by filter paper

Filtrate → Measure iron, pH, tubidity, color (Result-4)

Chlorination → Measure pH, tubidity, color, residual chlorine (Result-5)

Sample 3 Well water

Chlorination → Measure iron, pH, tubidity, color (Result-6)

Simple Filtration by filter paper

Media Filtration

Filtrate

Filtrate

Measure iron, pH, tubidity, color, residual chlorine (Result-7,8)

SOP on Water Quality Management

1. Contents of SOP

- **Nepali versions of O/M manuals** for Mangadah, Gauradaha and Dhulabari WUSC were distributed at each 3 WUSC in 2010, basically O/M shall be conducted by the manuals for the 3 WUSCs.
- **SOP on Water Quality Management:**

✓ Summarizing the materials used for the set of trainings for 3 years at DWSS Central Laboratory, 2 WSSDO (Morang and Jhapa) and 3USCs (Mangadh, Gauradaha and Dhulabari)

✓ Adding of supplementary as the key points of water quality management including design and evaluation of the Water Purification Plant

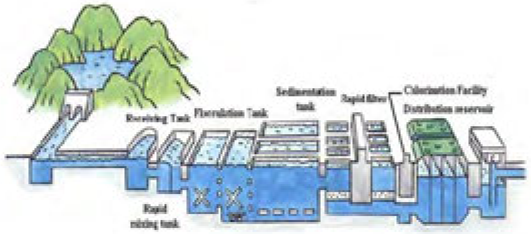
✓ A. Consists of water purification process management and

✓ B. Water quality analysis

A. SOP for Water Purification Process Management

A-1 Water treatment process and equipment/facilities which consist of process

1.Coagulation-sedimentation-rapid filtration.



The key points of this process

(1) Alum dosing rate (An example of how to calculate in SOP)

(2) Rapid mixing basin and flocculation basin with slow mixing:

- ➢ Mixing intensity and retention time (G and Gt value) (Examples of how to calculate in SOP)

(3) Sedimentation basin

- ➢ Average velocity and surface area load: (Examples of how to calculate in SOP)

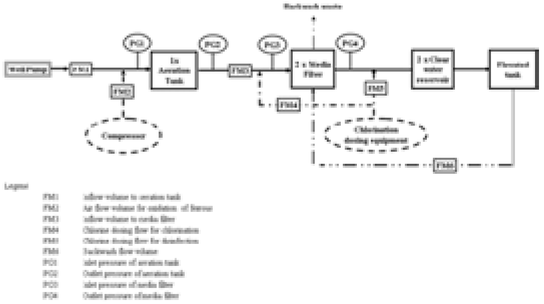
(4) Rapid Filter

- ➢ Effective size, Uniformity coefficient, Harmonic mean size of media, Filtration velocity and optimum backwash velocity and timing of backwash

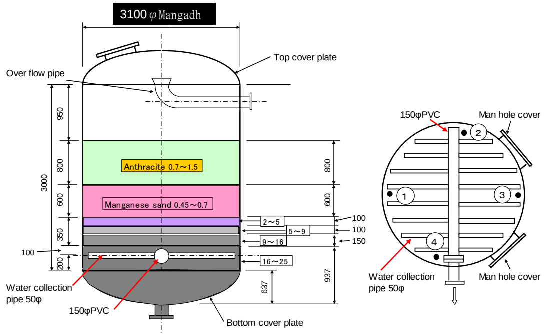
(Examples of how to calculate in SOP)

---

2. Iron Removal Plant with Manganese Sand



Conceptual Flow Sheet of Iron Removal Process (Mangadh and Gauradaha)



Filter media laying

S.No.	Name of Filter media & Size	Filling Height (mm)	Top level from bottom of top cover	Total Volume (m³)
1	Gravel 16～25	*1 937	2700	5.30
2	Gravel 9～16	150	2550	1.14
3	Gravel 5～9	100	2450	0.76
4	Gravel 2～5	100	2350	0.76
5	Manganese sand	600	1750	4.53
6	Anthracite	800	950	6.04

*1 Filling level is 300mm from top of bottom cover

Structure of Iron Removal Filter

The key points of this process

(1) Air supply (Examples of how to calculate in SOP)

(2) Filtration velocity and optimum backwash velocity and timing of backwash (Examples of how to calculate in SOP)

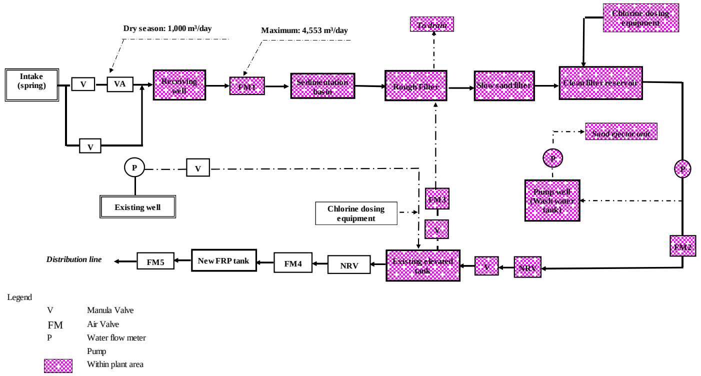
Chlorine Dosing rate

- FRC concentration is recommended 0.2- 0.4 mg/L at tap.
- It is said and confirmed in many countries that fecal coliform is not detected under the condition of more than 0.2 mg/L of FRC.
- Chlorine dosing rate (mg/L) = 0.56 x [Fe^{2+}] (Ferrous iron) + 1.3 x [Mn] (Manganese)+ 7. 7 x [NH_3] (Ammonia) + 0. 5

(An example of how to calculate in SOP)

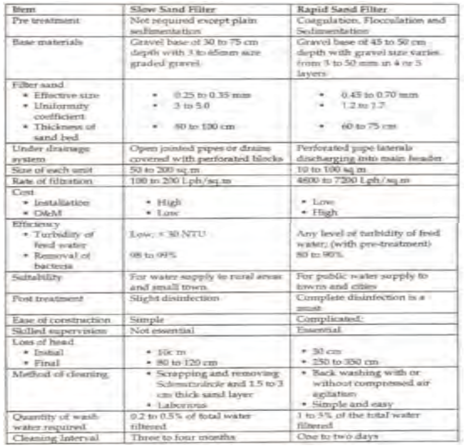
---

3. Slow Sand Filtration Process



Conceptual Flow Sheet of Slow Sand Filter Process (Dhulabari)

Features of Rapid and Slow Sand Filter



Item	Slow Sand Filter	Rapid Sand Filter
Pre treatment	Not required except plain sedimentation	Coagulation, Flocculation and Sedimentation
Base materials	Gravel base of 30 to 75 cm depth with 3 to 65mm size graded gravel	Gravel base of 45 to 50 cm depth with gravel size varies from 3 to 50 mm in 4 or 5 layers
Filter sand • Effective size • Uniformity coefficient • Thickness of sand bed	• 0.25 to 0.35 mm • 3 to 5.0 • 80 to 100 cm	• 0.45 to 0.70 mm • 1.2 to 1.7 • 60 to 75 cm
Under drainage system	Open jointed pipes or drains covered with perforated blocks	Perforated pipe laterals discharging into main header
Size of each unit	50 to 200 sq.m	10 to 100 sq m
Rate of filtration	100 to 200 Lph/sq.m	4800 to 7200 Lph/sq.m
Cost • Installation • O&M	• High • Low	• Low • High
Efficiency • Turbidity of feed water • Removal of bacteria	Low; < 30 NTU 98 to 99%	Any level of turbidity of feed water; (with pre-treatment) 80 to 90%
Suitability	For water supply to rural areas and small town	For public water supply to towns and cities
Post treatment	Slight disinfection	Complete disinfection is a must
Ease of construction	Simple	Complicated:
Skilled supervision	Not essential	Essential
Loss of head • Initial • Final	• 10c m • 80 to 120 cm	• 30 cm • 250 to 350 cm
Method of cleaning	• Scrapping and removing Schmutzdecke and 1.5 to 3 cm thick sand layer • Laborious	• Back washing with or without compressed air agitation • Simple and easy
Quantity of wash water required	0.2 to 0.5% of total water filtered	1 to 5% of the total water filtered
Cleaning Interval	Three to four months	One to two days

A-2 Maintenance of the equipment/facilities

A-3 Flow management

A-4 Record Formats for Water Quality Management (Refer to Appendix-1)

A-5 Trouble shooting: Refer to manual of each equipment

B. SOP for Water Quality Analysis

B-1 **Purpose of water quality analysis**

B-2 **Water quality criteria** (Refer to Appendix-3)

B-3 **Sampling**

B-4 **Frequency of water quality analysis: Daily or defined in SOP at each WUSC**

B-5 **Water quality analysis methods: Simple analysis kits**

B-6 **Data management** (Refer to Appendix-1)

B-7 **Disclosure of information**

B-8 **Closing**

References, etc. in SOP

- ✓ Reference-1: How to check residual ferrous iron
- ✓ Reference-2: How to make dilute color standard solution
- ✓ Key points of operation
- ✓ Pay attention to chlorine solution handling
- ✓ Key points of daily operation of Plain Sedimentation Basin of Slow Sand Filter Process
- ✓ Remarks: Backwash of Rough filter
- ✓ Remarks: How to take sample
- ✓ Reference-3 : How to estimate FRC without chlorine test kit.

Appendixes

- **Appendix-1: Record format**
- **Appendix-2: O/M manuals for 3 WUSCs**
- **Appendix-3: Meanings of Drinking Water Quality Standard**
- **Appendix-4: Simple Water Quality Analysis Kits for Site Analysis**
- **Appendix-5: Purchase Price of Simple Analysis Kits, etc. (Reference)**

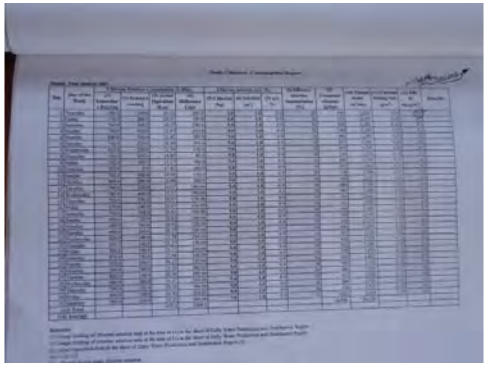
Apendix-1: Record Formats-1

- Daily Water Production and Distribution Report
- Daily Chlorine Consumption Report
- Compressor Operation
- Filtration rate of Iron Removal Filter (Mangadh WUSC)
- Backwash velocity (Mangadh)
- Daily Electricity Consumption Report
- Backwash velocity (Gauradaha)
- Filtration rate of Slow Sand Filter (Dhulabari WUSC)
- Filtration rate of Iron Removal Filter (Gauradaha WUSC)
- Filtration rate of Rough Filter (Dhulabari WUSC)

Apendix-1: Record Formats-2

- Backwash velocity of Rough Filter (Dhulabri WUSC)
- Water Quality Analysis Record
- Daily Alum Consumption Report

A picture of Record Format



Water quality National and International issues

Sampling Frequency

Daily	Weekly	Monthly	Yearly
International Issues : (CAMBODIA) Temperature, pH, Turbidity, Conductivity, Suspended Solid, Total Dissolve Solid, Color, Free Available Chlorine, Total Available Chlorine, Alkalinity ,	Total coliforms, E. coli, Ca hardness, Total hardness, Magnesium hardness, Organic substance, Dissolved oxygen, Algae.	Aluminum, Ammonia, Ammonia Nitrogen, Carbon Dioxide, Copper, Chloride, Cyanide, Chromium Total, Chromium Hexavalent, Fluoride, Iron, Manganese, Nitrate Nitrogen, Nitrate, Nitrite Nitrogen, Nitrite, Zinc, Phosphate, Sulfide, Sulfate.	Barium (Ba) Cadmium (Cd) Lead (Pb) Mercury (Hg) Nickel (Ni) Selenium (Se) Sodium (Na)
NEPAL Turbidity, pH, color,Taste,odour, Residual chlorine	TDS (Quaterly)	EC, E Coli, Total Coliform, Ammonia, Chloride, Nitrate, Total Hardness, Calcium	Iron,Manganese, Sulphate, Arsenic, Cadmium, copper, flouride, cyanide, lead, chromium, zinc, mercury, aluminium

Recommendations from JICA Expert

- Don’t use simple analysis kits and simple analysis methods without confirmation of reliability with comparison of official methods
- Increase the parameters DWSS can measure by official methods.
- strengthen the Central Laboratory first, then strengthen regional laboratories
- Study more on water purification process design and evaluation

Remind that for even Nepali parameters DWSS can measure at present are limited due to lack of analytical instruments, pre-treatment equipment and regents, etc.

Pictures of a series of the Training-1

1. From JICA Expert to Trainees

Pictures of a series of the Training-2

2. From DWSS (WSSDO) trainers to WUSC

3. At WUSCs

Pictures of a series of the Training-3

4. Demonstration of training by the trainers certified by JICA Expert

5. Simple experiment

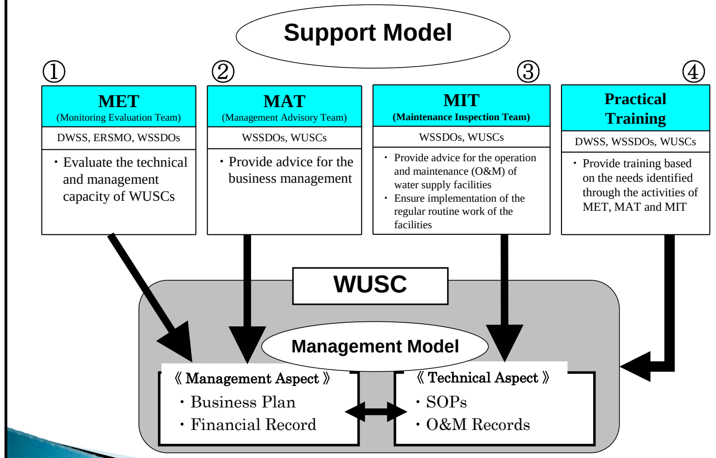
Iron removal test
Left: Manganese sand
Right: Sand

Jar test
Measurement of particle sinking velocity

Thank you all and specially for JICA , Mr. IZAWA-san for conducting valuable training

WASMiP
MIT, MAT & MET
&
Major outcomes

Division chief Ganesh Bdr. Thapa
WSSDO, Morang



Support Model

① **MET** (Monitoring Evaluation Team)
DWSS, ERSMO, WSSDOs
- Evaluate the technical and management capacity of WUSCs

② **MAT** (Management Advisory Team)
WSSDOs, WUSCs
- Provide advice for the business management

③ **MIT** (Maintenance Inspection Team)
WSSDOs, WUSCs
- Provide advice for the operation and maintenance (O&M) of water supply facilities
- Ensure implementation of the regular routine work of the facilities

④ **Practical Training**
DWSS, WSSDOs, WUSCs
- Provide training based on the needs identified through the activities of MET, MAT and MIT

WUSC

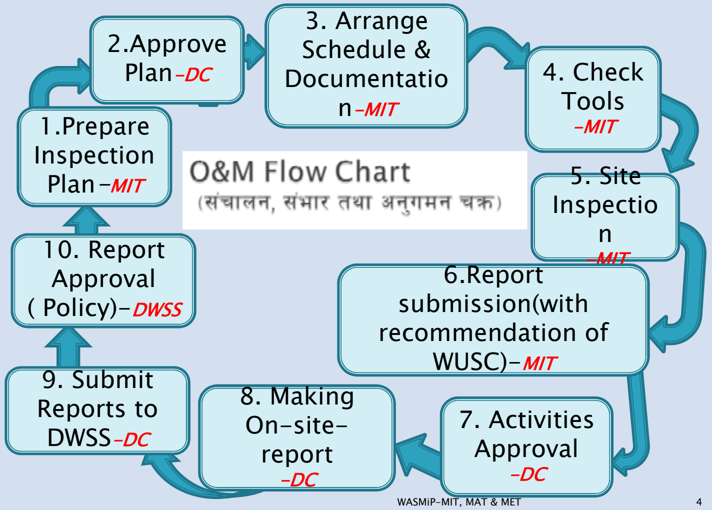
Management Model

《Management Aspect》
- Business Plan
- Financial Record

《Technical Aspect》
- SOPs
- O&M Records

MIT (Maintenance Inspection Team)

- Formation
  - 2 Team Leader +2 Sub-leader from WSSDO
  - 2 technical staff from each project
- Action- 3 times Field inspection per year
  - Technical knowledge transfer
  - checking of operation data
  - preventive maintenance etc
  - submission of evaluation
  - Comparison of Evaluation
- Current status of projects- 16 to 80%
- Target of MIT-100%



O&M Flow Chart
(संचालन, संभार तथा अनुगमन चक्र)

1.Prepare Inspection Plan -*MIT*
2.Approve Plan-*DC*
3. Arrange Schedule & Documentation-*MIT*
4. Check Tools -*MIT*
5. Site Inspection -*MIT*
6.Report submission(with recommendation of WUSC)-*MIT*
7. Activities Approval -*DC*
8. Making On-site-report -*DC*
9. Submit Reports to DWSS-*DC*
10. Report Approval (Policy)-*DWSS*

Annual Plan for MIT Activity 2013

MIT	WUSC			Jan		Feb		Mar		Apr		May		Jun		Jul		Aug	
	No.	Name	Oper	Plan	Score	Plan	Scor	Plan	Scor	Plan	Scor	Plan	Scor	Plan	Scor	Plan	Score	Plan	Scor
TL/STL	1.	P1	O1	●		**O/M monitoring kick off workshop**				●						●		**Annual Workshop**	
			O2																
	2.	P2	O1	●						●						●			
			O2																
	3.	P3	O1	●						●						●			
			O2																
	4.	P4	O1	●						●						●			
			O2																

On the job training in Haraicha

Inspection

well pump

Operation

MIT Project Evaluation Form

SN	Evaluation criteria	Check list Sub-criteria	Check	Status	Cause	Solution
1	SOP					
2	O & M Record					
3	Analysis and tools management	a. b. c.				
4	WQ analysis & Use					
5	Improvement and behavioral change					

MIT activities help to improve indicators without investment

SN	WUSC	Ist inspection (score)	2nd Inspection (Score)	3rd Inspection (Score)
1	Haraicha	41 %	47 %	47 %
2	Jhorahat	35 %	41 %	46 %
3	Letang	35 %	36 %	42 %
4	Mangirdh	75 %	86 %	90 %
5	Pathari	43 %	48 %	60 %
6	Rangeli	14 %	18 %	19 %
7	Salakpur	35 %	43 %	56 %
8	Tankisinwari	34 %	39 %	45 %
9	Urlabari	45 %	49 %	65 %

MAT- Management Advisory Team

- Formation
  - Division Chief+ Financial advisor (now-DO Engineer)
  - Technical Advisor (DO Engineer)
  - WUSC (Chair person Manager)

Activities of MAT(Management Advisory Team)

- Site Visit for Business Planning (April-may)
- Review monthly report(Every month)
- Planning of Practical training(Time to time)

Annual Plan for MAT Activity, Morang

MAT Member						Mnothly Report Submission					Site Visit for Business Planning
WSSDO			WUSC								
Management	Financila Advisor	Technical Advisor	No.	Name	Person in charge (CP: Chair Person) (MG: Manager)	Jul	Aug	Sep	Oct	Nov	※Apr – May
Team Leader ; G B Thapa	G B Thapa (For the time being)	Main: Anoj Upadhyay Sub: Govinda Koirala	1.	Urlabari	CP: Mr. Bhupal Singh Jimi (MG: Mr. Raju Budhathoki)						
			2.	Letang	CP: Mr. Shanker Rai (MG: Mr. Ramesh Shrestha)						
			3.	Pathari	CP: Mr. Bir Bahadur Basnet (MG: Mr. Seban Singh Karki)						
			4.	Haraicha	CP: Mr. Bir Bahadur Khulal (MG: Mr. Dil Bahadr Dahal)						
			5.	Mangadh	CP: Ram Bahadur Ghimire (MG: Mr. Ganga Prasad Acharya)						
		Main: Rabindra Nath Dev Sub: Jaya Deep Rajbanshi	6.	Salakpur	CP: Mr. Govinda Bahadur Basnet (MG: Mr. Rajan Regmi)						
			7.	Tankisinuwari	CP: Mr. Shiv Narayan Mandal (MG: Ms. Amana Rajbanshi)						
			8.	Jhorahat	CP: Mr. Kumar Wagle (MG: Mr. Bhola Neupane)						
			9.	Rangeli	CP: Mr. Pradeep Sha (MG: Mr. Shiv Raj Dahal)						

-

-MAT Site Visit Plan & Record -

Plan Date:

Inspection Schedule	
Members :	
No. of license plate :	
Vehicle Type : 4WD	

MAT Activity Expences Record (page /)

MAT Team Leader: ________

________ *Inspection 2013*

No.	Day	Contents (Purchase of Tools or Consumable, Daily Allowance etc)	Qty	Cost	Purpose	Payment Recipient	Remarks
1.							
2.							
3.							
15.							

Total Cost : ________

- MET– Monitoring & Evaluation Team
  - Main purpose– Checking of WUSC ’s condition is improving or not?
  - Formation–DWSS+ ERMSO+DO Chief
  - Action– Evaluation, Suggestion

This year’s MET activities

M&E methodology

- ❑ Questionnaire
- ❑ Discussion
- ❑ Observation

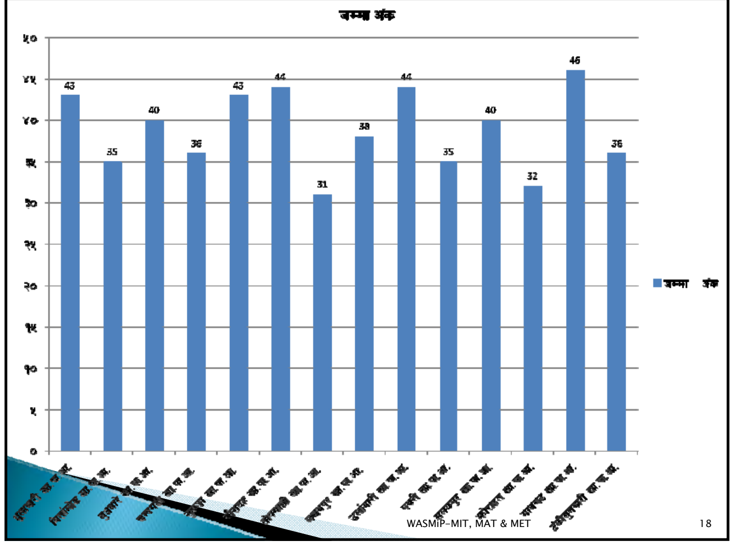
22/07/2013

21/07/2013

WASMiP 4th M & E

M & E Indicators

1. **Institutional Mgt.**—regular meeting, AGM, Job description, office management
2. **Financial Mgt**— Tariff rate/ dept//Balance/loan/billing record
3. **Complain Mgt**— Record and network for handling
4. **Business plan**— Yes/No, implementation
5. **Water Quality**— Daily/Monthly/half yearly/yearly/recording & use
6. **Record Keeping**



Good points

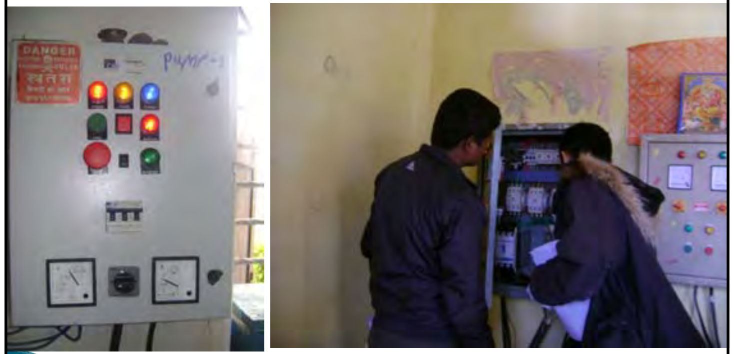
- Understanding of Importance of **quality drinking water**
- Installed **Water Flow Meter** to count loss of water
- Almost all WUSCs has prepared **Business plan**
- Very **minimum bad dept** amount reminded
- All WUSC willing to **extend the service area**

MET,s Recommendation

- Extension of physical facilities: eg. Deep Well]
- Recording of production and billing
- Water tariff as per expenditure
- Execution of Business Plan
- Both financial and Store record keeping
- Technical trainings & Awareness creation program
- Strengthening of Itahari Lab
- Regular M&E by joint team of DWSS, RMSO, WSSDO

Major Outcomes

Inspection of Panel Board



Defect faults in electricity panel board has improved by WUSC (I,e Pathari,s panel board,Tankisinwari's panel board, etc)

Display of Water Test Report
Mangirdh & Urlabari WUSC

Urlabari

Record Keeping system established

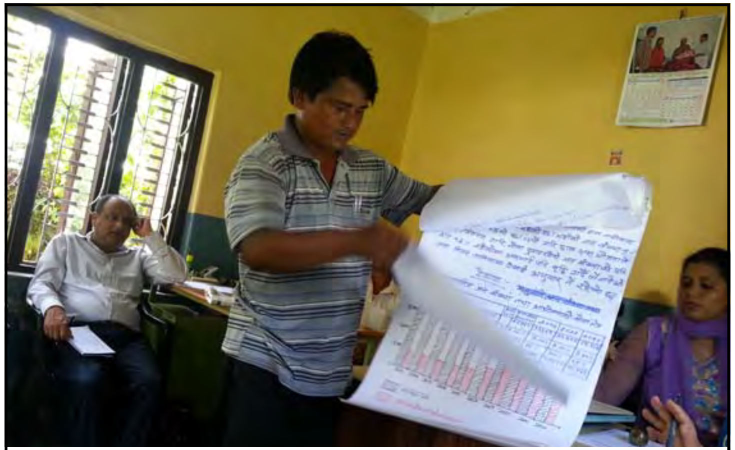
1. Mechanical and Electromechanical
2. Water Distribution and Water meter
3. Water Quality

WSSDO/WUSCs felt responsibility to improve Water Quality (workshop of 22 WUSCs)

Operational guideline implementation/ Planning for Water Quality Improvement

Outcome of Workshop

SN	What ?	When ?	Who?	How?	Indicator
1	Business plan Preparation	April 014			
2	Complain Handling and record keeping	Continue			
3	Access to ultra poor started	January 014			
4	Review of water tarriff	Within this FY			
5	General Assembly	January each year			
6	Technical Training	Sep in each year			
7	District WASH Connference	October Each year			
8	Joint Monitoring and Evaluation	July each year			
9	Water quality analysis 27 parameter	at least 1 time/year			
10	Special parameter test and display	2 times/year			
11	Water Safety Plan implementation	Continue			
12	Project area ODF declaration	Continue			



Business plan prepared (Mangardh, Pathari, Salakpur, Urlabari and plan rest WUSC are preparing Business)

WSSDO' personnel & WUSCs sensitized-Improved to some extent-Rangeli and Pathari and Tanki in line.

Flow meter are installed to count water and importance of water counting, NRW, RW

Jhodahat

Salakpur

Concept of Flow Meter calibiration introduced

Complain handling especially assuring the accuracy of flow meter

Good learning transferred to ongoing & other completed projects organizing 2 Workshop

Biratnagar

Urlabari

Conduction of workshop of WUSCs

7 Member Eastern WASHMiP conference team formed in 2070/4/8
(Chair by Urlabari)

Physical facilities

Annual Conference

Consumer Satisfaction

Rehave

Sustainability

Record keeping

WQ Analysis & implementation

Maintenance

Continue monitoring

Way to forward

- Continuity & replication of the program
- Improvement of the physical facilities
- Regular joint monitoring as of this year
- Establish the reward and recognition system
- Effective linkage among: DWSS, WSSDO & WUSCs
- Implementation of business plan
- Ensure the access to ultra poor

Thank you

Activities performed under *WASMIP*

Presented by:
Binod Kr. Agrawal
Division Chief
Water Supply and Sanitation Division Office
Jhapa

Projects run by WASMIP in Jhapa

1.Kakadvitta 2. Dhulabari
3. Budhabare 4. Shanishchare
5. Birtamode 6. Chandragadhi
7. Surunga 8. Topgachhi Sch.1
9. Topgachhi Sch.2
10. Topgachhi Sch.3
11. Lakhanpur 12. Damak
13. Gauradah 14. Juropani

Background

- WASMIP program started in Morang and Jhapa district since 2010
- Involvement of both Gravity and Pumping System
- Programme in Morang-9 projects and Jhapa-14 projects
- Covered Support model and management model

Support from JICA

1. Training on Management & Technical
   - Management - Staff Sizing, Mobilization of Staff, Job description, Monitoring Evaluation, penalty and rewards system, Business plan preparation
   - Technical - Electromechanical, Distribution facilities, Water Quality, Water meter

Activities

Result sheet 2013

MIT (Maintenance Inspection Team)

- Main Purpose - Supervision of Operation and Maintenance
- Formation - 2 team leader + 2 sub-leader + 2 technical staff from each project.
- Action - Field inspection at each 3 month interval, technical knowledge transfer, preventive maintenance etc., submission of evaluation, comparison of evaluation, recent status of projects (22-90%), vision (100%)

WUSC			Jan		Feb		Apr		Jul		Aug	
No.	Name	Operators	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score
1.	Karkarvitta	Yam Pd. Pokhrel Laxmi Narayan Majhi	●	45	O&M Monitoring Kick-Off Workshop		●	50	●	54	O&M Monitoring Annual Workshop	
2.	Buddhabare	Purna Kumar Subedi Devi Pd. Nepal	●	33			●	30	●	33		
3.	Sanischhare	Arjun Karki Ranga Lal Karki	●	22			●	21	●	26		
4.	Birtamod	Durga Pd. Bhattarai Krishna Bhakta Katel	●	39			●	38	●	47		
5.	Dhulabari	Nar Bdr. Dahal Kul Bdr. Sarki	●	82			●	76	●	84		
6.	Chandragadhi	Prahlad Rajbanshi Mohan Basnet	●	28			●	40	●	43		
7.	Lakhanpur	Min Bdr. Basnet Dev Kumar Rai	●	41			●	46	●	50		
8.	Gauradaha	Prem Shivakoti Chitra Bdr. Magar	●	91			●	86	●	90		
9.	Topgacchi-1	Dhurva Bhujel Amrit Rai	●	44			●	43	●	48		
10.	Topgacchi-2	Tulsi Nepal Purna Shrestha	●	16			●	18	●	22		
11	Topgachhi-3	Tulsi Nepal/Purna shrestha		0				0		0		
12	Damak	Manorath Pokhrel Gopal Shivakoti	●	69			●	63	●	78		
13	Surunga	Manorath Bhattarai Kajiman Sauden	●	52			●	77	●	79		

Comparison of Projects 2013

SN	Project Name	First Evaluation	First Evaluation	First Evaluation
1	Topgachhi 3	0	0	0
2	Gauradah	91	86	90
3	Topgachhi 2	16	18	22
4	Surunga	52	77	79

Annual Work Plan (2013-2014)

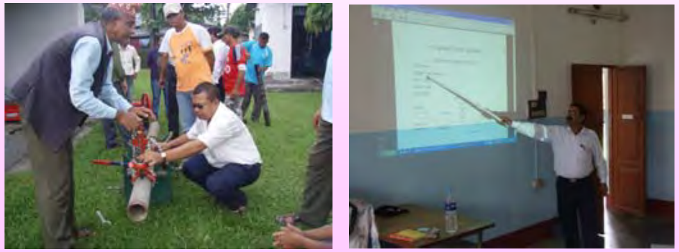
Comparison of Projects 2013

- Topgachhi 3 - Not in operation/run
- Gauradah - Electromechanical, water quality & distribution system are very good according to evaluation form
- Topgachhi 2 - Gradual progress according to evaluation form
- Surunga - Depth feel from the learning of first evaluation

WUSC			Oct		Nov		Jan		Apr		May		July	
No.	Name	Operators	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score	Plan	Score
1.	Karkarvitta	Yam Pd. Pokhrel Laxmi Narayan Majhi	*		O&M Monitoring Kick-Off Workshop		*		*		O&M Monitoring Kick-Off Workshop		*	
2.	Buddhabare	Purna Kumar Subedi Devi Pd. Nepal	*				*		*				*	
3.	Sanischhare	Arjun Karki Ranga Lal Karki	*				*		*				*	
4.	Birtamod	Durga Pd. Bhattarai Krishna Bhakta Katel	*				*		*				*	
5.	Dhulabari	Nar Bdr. Dahal Kul Bdr. Sarki	*				*		*				*	
6.	Chandragadhi	Prahlad Rajbanshi Mohan Basnet	*				*		*				*	
7.	Lakhanpur	Min Bdr. Basnet Dev Kumar Rai	*				*		*				*	
8.	Gauradaha	Prem Shivakoti Chitra Bdr. Magar	*				*		*				*	
9.	Topgacchi-1	Dhurva Bhujel Amrit Rai	*				*		*				*	
10.	Topgacchi-2	Tulsi Nepal Purna Shrestha	*				*		*				*	
12	Topgacchi-3	Tulsi Nepal Purna Shrestha	*				*		*				*	
12	Damak	Manoj Pokhrel Gopal Shivakoti	*						*				*	
13	Surunga	Manorath Bhattarai Kajiman Sauden	*				*		*				*	

Tasks

- Evaluation Form (by the results of projects)
- List of important goods
- Verification of mechanical and electrical



MET (Monitoring & Evaluation Team)

- Main Purpose - Check of WUSC's condition is improving or not?
- Formation - DWSS + ERMSO + DO Chief

According to the result of monitoring and evaluation on July, 2013

WUSU's Name	Scored	Rank
Mangadh	46	First
Urlabari	44	Second
Gauradah	44	Second
Dhulabari	43	Third
Surugna	43	Third

Tasks of MET

- Main Purpose - Check of WUSC's condition
- Indicators to check the condition -

1. Improvement of professional efficiency
2. Improvement of technical knowledge
3. Improvement of water quality
4. Regular maintenance
5. Protection from leakage
6. Improvement of recording
7. Regular Monitoring
   a. Electromechanical   b. Water Quality
   c. Distribution System

MAT (Management Advisory Team)

- Main Purpose - Creating commercial project
- Formation - Division Chief + Financial Advisor (DO Accountant) + Technical Advisor (DO Engineer) + WUSC (Chair Person + Manager)

Activities of MAT

- Site visit for Business Planning (April-May)
- Review monthly report (Every month)
- Practical training (Time to time)

Learning from WASMIP

- Getting information about projects' condition according to evaluation form
- Getting information about construction list
- Regular Check (quality of electrical and mechanical, water distribution system, accidental cases, insulation check)

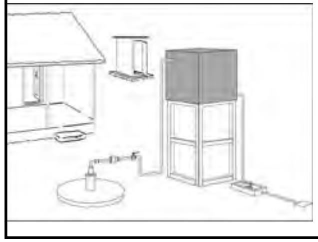
Annual Plan of MIT

SN	Month	Details
1	October	Monitoring and evaluation
2	November	Meeting
3	January	Monitoring and evaluation
4	April	Monitoring and evaluation
5	May	Meeting
6	July	Monitoring and evaluation

Thank you all.

Management and Support Model for Water Supply System in Semi Urban Area

(Dedicated to Taoka Model)



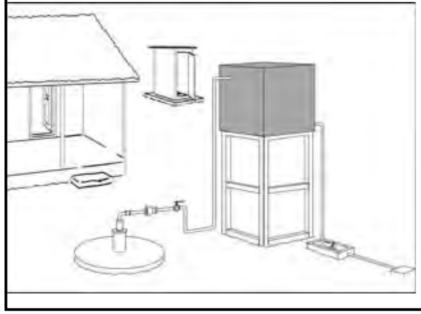
Presented by: Nam Raj Khatri
2013

Background

- ❖ JICA supported for Capacity Development on Water Supply in Semi-urban Areas (WASMIP)
- ❖ "Small and medium sized water supply management model", under which WUSCs provide water supply services to citizens
- ❖ Small and medium sized water supply support model", under which DWSS conducts technical support for WUSCs

---

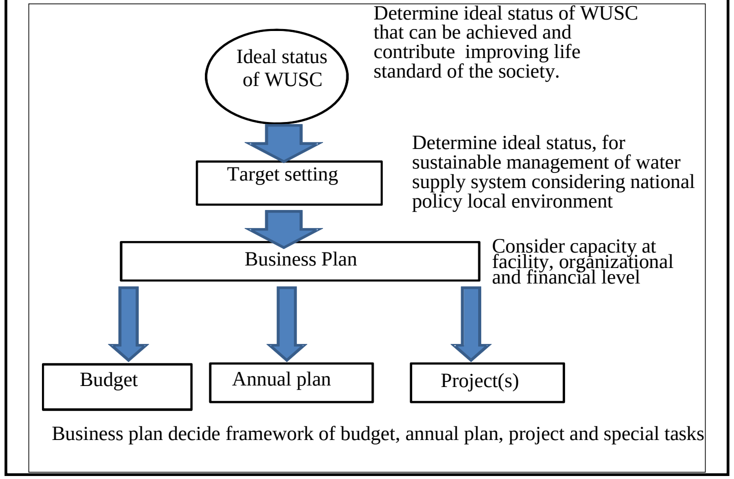
Management Model for Water Supply System in Semi Urban Area



Management Model: Introduction

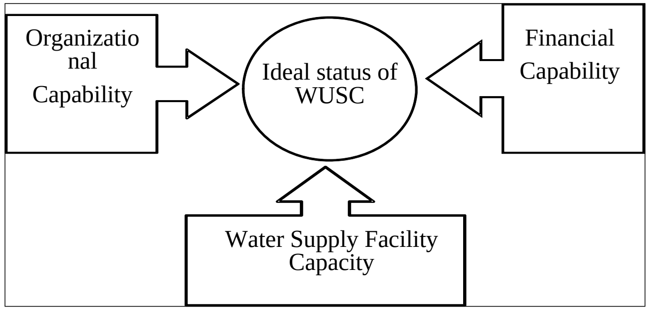
- ❖ Management model simply sets ideal status of water supply services in the future by WUSC called target setting
- ❖ Designs the way to achieve such status called business plan.
- ❖ WUSC can achieve target with strengthening sufficient institutional and functional, and financial capability
- ❖ DWSS need to provide technical and financial support
- ❖ WUSC can implement the business plan and achieve that ideal status.

Management Model: Structure



Business plan decide framework of budget, annual plan, project and special tasks

Management Model: Required capacity



Management Model: Target Example

Area	Targets
Safe water:	• Quality of water meets Nepal standard. • WUSC has facility and capability for monitoring water quality • WUSC applies Water Safety Plan for continuous safety of water
Affordability:	• Consumption per capita per day of user meets national standard. • 85 litter per day per capita or 100 liter per day per capita or more • WUSC follows water tariff guideline set by Water tariff Fixation Committee • Water rate is fair enough for achieving cost recovery as well as affordable to poor people
Stability:	• WUSC provides water for 24 hours a day and 12 months a year • WUSC provides water with sufficient pressure in pipelines? (Range from 5 to 20 meter) • Water facility has sufficient capability for providing water in a sustainable way
Service coverage	• Service coverage ratio meets with national standard • Up to 90% of the service area by 2020

Management Model: Organization Capacity

Demand of organizational capability	≦	Organizational capability
-Institutional demand -Functional demand -Demand on leadership, negotiation and problem solving skill -Demand on business transaction management regarding speed timeliness, accuracy and handling large volume transaction		-Fine institutional set up -Strengthening functional capability, business process standardization, training for skill enhancement -Strengthening leadership skill -Computerization for improving accuracy, speed and capability for handling large, volume business transaction as well as business process standardization

Management Model: Facility capacity

Water Demand ≦ **Capacity of facility**

Service coverage

Population service

Consumption per capita per day

Water resources

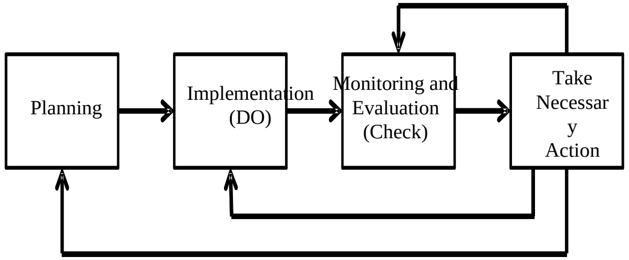
Capacity of intake facility

Capacity of purification facility

Capacity of pipe networks Leakage and loss

NRW/UFW

Management Model: PCDA



Management Model: Financial facility

Financial Demand ≦ **Financial capability**

(Capital cost)

-Cost for fixed asset

-Cost of construction project

-Cost of vehicles

(Operational cost)

-Salaries and wages

-Power

-Chemical

-Repair and maintenance

-Office management

-Financial cost, if any

-Revenue from sales of water and service

Water rate

Collection efficiency

-Revenue from annual membership due

-Grant and subsidiary

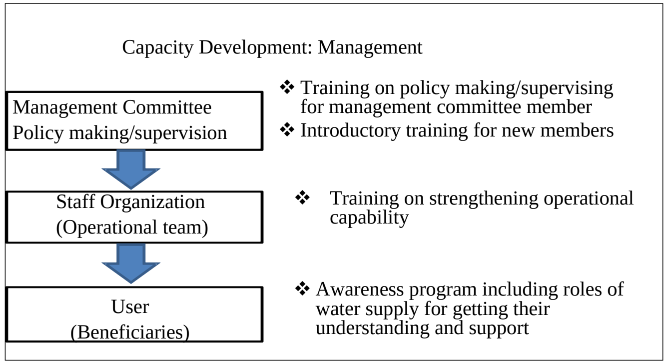
-Deposit

-Accounting accuracy

-Loan if any

Organization management: Structurure

Management structures of WUSC consist of three layers:



Capacity Development: Management

Management Committee Policy making/supervision

- ❖ Training on policy making/supervising for management committee member
- ❖ Introductory training for new members

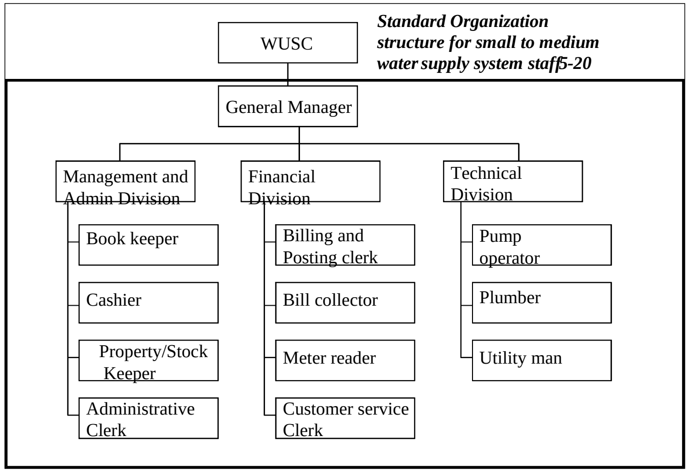
Staff Organization (Operational team)

- ❖ Training on strengthening operational capability

User (Beneficiaries)

- ❖ Awareness program including roles of water supply for getting their understanding and support

Organization management: function/Staff



Standard Organization structure for small to medium water supply system staff5-20

WUSC

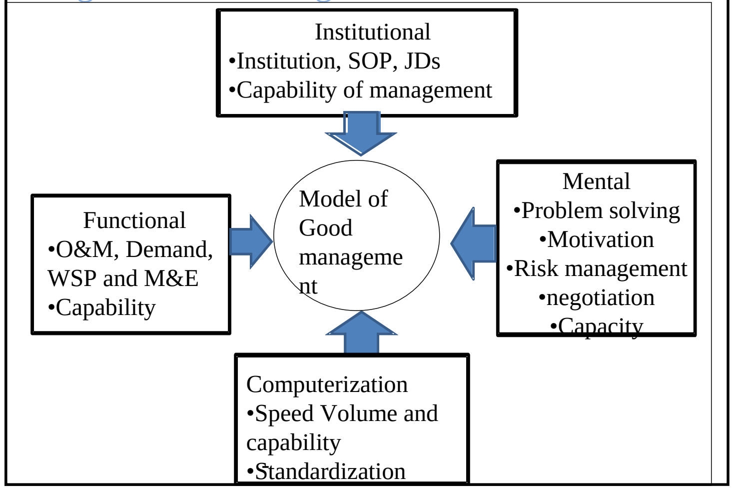
General Manager

Management and Admin Division
- Book keeper
- Cashier
- Property/Stock Keeper
- Administrative Clerk

Financial Division
- Billing and Posting clerk
- Bill collector
- Meter reader
- Customer service Clerk

Technical Division
- Pump operator
- Plumber
- Utility man

Organization management: function/Staff



Institutional
- Institution, SOP, JDs
- Capability of management

Functional
- O&M, Demand, WSP and M&E
- Capability

Model of Good management

Mental
- Problem solving
- Motivation
- Risk management
- negotiation
- Capacity

Computerization
- Speed Volume and capability
- Standardization

Physical Facilities Management:

Management Areas Detail Points to be Checked	**Baseline (Status at the beginning of the Project)**	**Goals of the target WUSCs (Status what the Management Model should be)**	**Means of Verification**
1.1 O&M of Water Treatment Plant			
-Documentation management		-To keep all necessary documentations including manual and SOP for O&M. -To revise the documents when necessary.	-Keeping status of manual and SOPs
-Formats		-To prepare formats with the consideration of what to be analyzed and to be evaluated. -To prepare equipment inspection format.	-Equipment inspection format prepared. -Contents of record filled in the operation format
-Treatment process Understanding		-To execute operation in accordance with the water quality and quantity and process evaluation.	-Check of understanding of treatment process --Contents of record filled in the operation format

---

Physical Facilities Management:

3.1 O&M of Water Treatment Plant
3.2 O&M of Water Distribution Facilities
3.3 Water Meter Calibration/Management
3.4 Emergency Countermeasures
3.5 Water Quality Management
3.6Billing and Collection
3.7 Customer Ledger Management
3.8 Claim Handling
3.9 Preparation of Annual Report
3.10 Preparation of Business Plan
3.11 Educational Campaign to Public
3.12 Monitoring & Evaluation
3.13 Accounting system
3.14 Monthly report

Monitoring and Evaluation: Concept

- ❖keep watching achievement by monthly report and annual report.
- ❖Joint monitoring and evaluation to WUSC regarding M&E performance indicators, target and achievement is recommendable
- ❖Use Indicators for monitoring
- ❖Set target for evaluations
- ❖Make monitoring schedules

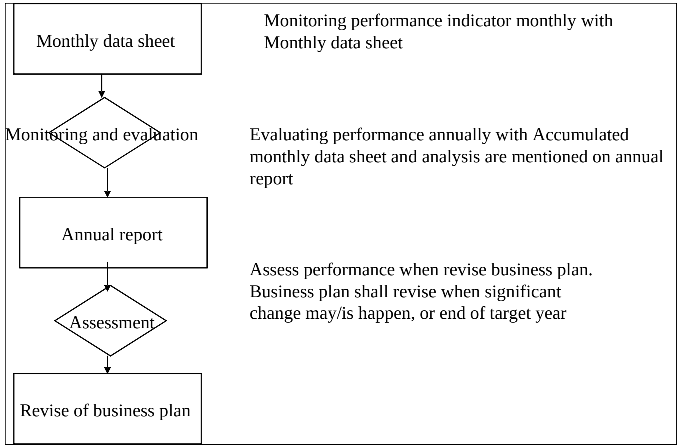
Monitoring and Evaluation: Indicators

SN	Performance Indicators	Unit	Base line 2013	2016	2019	2022	2025
A	Technical						
1	Coverage	%					
2	Population served	No					
3	Production	m^3 /d					
4	Av consumption per connection	m^3 /m					
5	Active connections	No					
6	Unaccounted for Water(UFW)	%					
7	Non Revenue Water(NRW)	%					
8	No of pipe breaks	No/Yr /km					
9	Sample meting WQ standard	%					

Monitoring and Evaluation: Indicators

SN	Performance Indicators	Unit	Base line 2013	2016	2019	2022	2025
10	Service hours	hr/day					
B	Management						
11	Number of Staff	No					
12	Number of connection per staff	No					
10	Collection efficiency	%					
	Consumer complains	No/m					
	Financial						
11	Revenue collection from operations	Rs/Yr					
12	Expenditure for operation	Rs('000/Yr					
13	Cash balance	Rs/Yr					
14	Operational cost	Rs/ m^3					

Monitoring and Evaluation: M&E Flow



Monthly data sheet

Monitoring performance indicator monthly with Monthly data sheet

Monitoring and evaluation

Evaluating performance annually with Accumulated monthly data sheet and analysis are mentioned on annual report

Annual report

Assess performance when revise business plan. Business plan shall revise when significant change may/is happen, or end of target year

Assessment

Revise of business plan

Coordination and conference:

Purpose of such conference are:

❖To share project operation and management experiences among WUSCs

❖To build the system of mutual support and cooperation among WUSCs

❖To learn from experiences and best practices of others

Coordination and conference:

Organization of Conference: Conference committee will be established within a region. The Chairperson, vice chairperson and secretary will be selected by participating WUSCs.

Members of the conference committee will comprise of:

-Chairperson and Secretary from WUSCs ,

- Regional Chief of RMSO

-Division Chiefs of WSSDOs ,

- Representative from DWSS

Documentation:

❖ The Water Supply Management Model requires various documents for systematic operations of the water supply system.

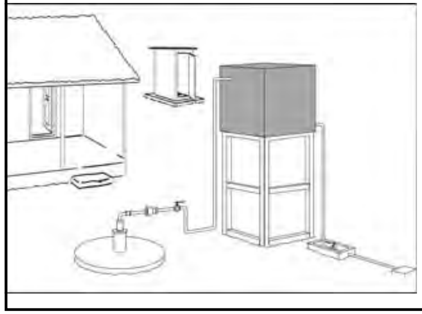
❖ Some documents will be provided by DWSS as model and some need to be developed by WUSC for their specific process.

❖ Guideline, Business plan, Operational manual and SOPs are the key documents.

❖ The WUSCs should utilize these documents in their operation to ensure proper water supply management.

❖ Useful when DWSS plans to strengthen the organizational capability of WUSC, especially to strengthen the function of WUSC with training.

Support Model for Water Supply System in Semi Urban Area



Background

- JICA supported for Capacity Development on Water Supply in Semi-urban Areas (WASMIP)
- "Small and medium sized water supply management model", under which WUSCs provide water supply services to citizens
- Small and medium sized water supply support model", under which DWSS conducts technical support for WUSCs

Support model: Structure

- **"WUSC support model"** explains what DWSS can do on the realization of WUSC's dream through their business plans.
- **"Maintenance Inspection Team (MIT)"**explains about support system to be arranged in WSSDOs for assisting WUSCs on O&M of water supply systems.
- **"Management Advisory Team"** highlights the aspects of assistance to administrative management of WUSCs through support system established in WSSDOs.
- "**Monitoring and Evaluation**" introduces ways for monitoring and communication between WUSCs and DWSS.

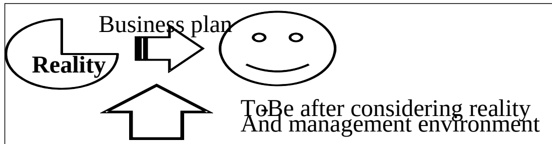
Management Model: Introduction

- Management model simply sets ideal status of water supply services in the future by WUSC called target setting
- Designs the way to achieve such status called business plan.
- WUSC can achieve target with strengthening sufficient institutional and functional, and financial capability
- DWSS need to provide technical and financial support
- WUSC can implement the business plan and achieve that ideal status.

Support model: WUSC capacity

- WUSC has sufficient functionality of policy making, decision making and governance for its operation
- WUSC has sufficient capacity for carrying out sustained operational works for producing adequate and safe water which is affordable to maxim number of people in the service area.
- WUSC has sufficient financial capacity to operate, maintain and sustain water supply services for longer period
- Users understand importance of good hygiene practice and roles of water supply, and support activity of WUSC.

Support model: Support Areas



Support to WUSC:

1.Guide to optimize institutional system

2.Provide training to enhance knowledge of staff

3.Provide OJT to strengthen skills and knowledge of staff

4.Provide opportunity for sharing and exchange information between water supply service providers

5.Provide financial assistance

6.Provide material support

Support model: Support strategy

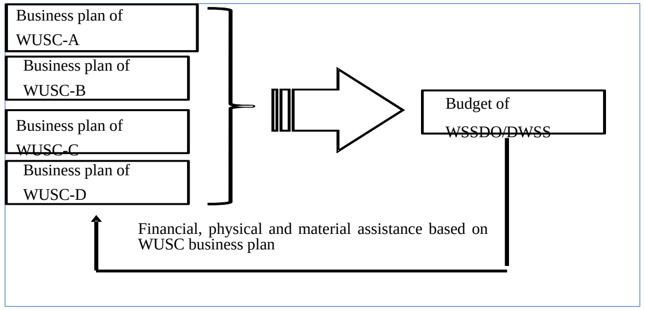
Support Area	Operational strategy	Responsibilities/Frequency
1. Provide an opportunity for information exchange between WUSC	# Exchange visit for management committee & staffs # publication and distribution of booklets, brochure and news letters # liaison conference #Establishment of websites	- Based on annual plan of DWSS and
1. Provide financial resources	# Provide financial support and loan arrangement for new project and rehabilitation project # provide resources for maintenance and capacity development based on need performance	- Based on Business plan
1. Provide physical facilities and materials resources	# Provision of pipes, fittings, tools to WUSC # Computer, equipments # Lab equipments # Guidelines and manuals	- Based on business plan and joint monitoring and commitment on conference

Support model: Support strategy

Support Area	Operational strategy	Responsibilities/Frequency
1. Guide to set-up institutional system	# Provide guidance to develop statute and registration of WUSC # Incentives for best performance of WUSC # Tie-up with VDC/DDC # Encourage to place right man at right place # # provide operational and maintenance manual/guidelines	-In the beginning of project set up and then refreshment periodically
1. Provide training for capacity of staff	# Organize technical training for maintenance workers, pump operators, meter readers, plumber Organize training on Water Safety Plan # Organize training on Sanitation # Organize training on Computer, Electro-mechanical and Plumbing # Organize management training for WUSC and managers	-Based on capacity development plan of WUSC
1. Provide OJT to ensure skills of staffs	# Preconstruction training # Maintenance Workers training #Plumbing training #Pump operator, meter reading, leak detection training # water quality testing and water safety plan # Treatment plant operator, disinfection training # Management training	- Based on annual plan of DWSS

Support model: Support strategy

- ❖ Document suggests DWSS for assisting WUSC based on their business plan
- ❖ Confirm the need and eligibility of assistance.
- ❖ Align the need of assistance in their annual budget accordingly.



Business plan of WUSC-A

Business plan of WUSC-B

Business plan of WUSC-C

Business plan of WUSC-D

Budget of WSSDO/DWSS

Financial, physical and material assistance based on WUSC business plan

Maintenance Inspection Team(MIT): Purpose

- Purpose of Maintenance Inspection Team(MIT) is to enhance WUSC's capacity on solving problems themselves on-site.
- MIT facilitates to have access to the experts on the repair and maintenance of the equipment and on the operation of water supply and water treatment process.
- MIT also helps solve the problem unsolved due to lack of knowledge or awareness and enhance preventive maintenance process.
- Effectiveness of MIT depends on o evaluation indicators, ease on maintenance support and sharing information.

Maintenance Inspection Team: Team

Team composition

MIT is joint team of WSSDO staff and WUSC's operators. Sometime DWSS staff and external resource persons as expert can be also included for special purpose.

1. Team Leader – Engineer from WSSDO
2. Assistant team Leader – Sub-Engineer from WSSDO
3. Member – On-site operator in charge of corresponding WUSC

Maintenance Inspection Team: Function

- Evaluating performance in terms of operation of system, equipment and quality of water.
- Provide environment to WUSCs to solve problems on site.
- Encourage preventive maintenance
- Observe maintenance records
- Provide easy maintenance support

Management Advisory Team: Purpose

- Purpose of Management Advisory Team(MAT) is to assist WUSCs on the management of water supply system to ensure sustainable and safe water at affordable cost to the maximum people within their jurisdictions.

Management Advisory Team: Team

Composition of Management Advisory Team

- The Team shall be composed of three experts :-
    - management,
    - technical and
    - financial areas.

- The Team can be staff from DWSS and WSSDO or outsourced under special provision.

Management Advisory Team: Technical Advisor

- An Engineers of WSSDO or external can play roles of technical advisor.
- Providing technical advices (regarding, water demand projection by WUSC, facility improvement planning by WUSC,
- Advise on basic design of facilities, advise on cost estimation of facility improvement planning,
- Advise/training of WUSC staff for facility operation and maintenance, and WSP
- Review implementation of business plan

Management Advisory Team: Management Advisor

- The Chief of WSSDO or external can play roles of management advisor.
- Providing management advice (regarding number of connection, water rate improvement, recruitment of staff, management efficiency, training of staff, etc.),
- Monitoring management performance of WUSCs monthly
- Evaluating management performance annually with other team members and WUSC
- Doing necessary arrangement on technical and financial support to WUSC

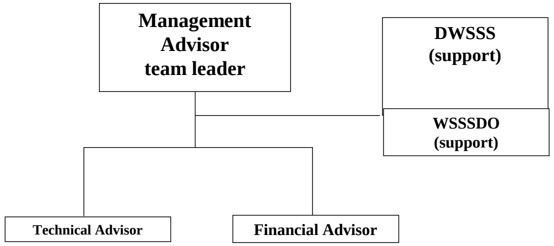
Management Advisory Team: Financial Advisor

❖ An Engineers or chief of WSSDO or external can play role of financial advisor. Roles of Financial advisor are:

❖Providing financial advices to WUSCs regarding water tariff setting, financial planning and financial resources arrangement.

❖Reviewing implementation of the business plan with WUSC annually and providing advises on update, if necessary

Management Advisory Team: Chart



Management Advisor team leader

DWSSS (support)

WSSSDO (support)

Technical Advisor

Financial Advisor

- ❖ Providing advises on management of WUSC upon their request
- ❖ Monitoring management performance of WUSC based on trimester report submitted by WUSC
- ❖ Conducting annual joint evaluation on implementation of business plan.

Monitoring and Evaluation

- ❖ Joint monitoring and evaluation to WUSC regarding M&E performance indicators, target and achievement is recommendable.
- ❖ Suggested performance indicator would be mentioned on section of M&E.
- ❖ Based on the M&E, DWSS may recommends enforcement of management capability or efficiency.

Monitoring and Evaluation: Indicators

A	Technical	Unit	Baseline	Target	Achievement
1	Coverage	%			
2	Population served	No			
3	Production	m^3/d			
4	Av consumption per connection	m^3/m			
5	Active connections	No			
6	Unaccounted for Water(UFW)	%			
7	Non Revenue Water(NRW)	%			
8	No of pipe breaks	No/Yr/ km			
9	Sample meting WQ standard	%			

Monitoring and Evaluation: Indicators

SN	Performance Indicators	Unit	Base line 2013	Target	Achievement
10	Service hours	hr/day			
B	Management				
11	Number of Staff	No			
12	Number of connection per staff	No			
10	Collection efficiency	%			
	Consumer complains	No/m			
	Financial				
11	Revenue collection from operations	Rs/Yr			
12	Expenditure for operation	Rs('000 /Yr)			
13	Cash balance	Rs/Yr			
14	Operational cost	Rs/m^3			