

*Water Supply Administration  
For Better Management of Water Supply Services  
Course ( B )*

# **Country Reports**

Japan International Corporation of Welfare Services (JICWELS)



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# CAMBODIA



# Water Supply Administration for Better Management of Water Supply Services

## Inception Report

**Country** : Cambodia

**Organization:** Siem Reap Water Supply Authority



### Contents of Presentation

1. **Outline of Siem Reap Water Supply Authority Service (SRWSA)**
2. **Success Story of SRWSA**
3. **Recent Challenges to Improve**



# 1.Outline of Siem Reap Water Supply Authority Service

## Whole Country:

**Area** : 181, 035 km<sup>2</sup>

**Provinces:** 24 Provinces & 01 Capital City

**Cities:** 26 cities

**Population** : 15 million habitants

**Urban Population:** 3 million



## Siem Reap City



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## Siem Reap Water Supply Authority(2016)

**Service Area:** Siem Reap City 472 km<sup>2</sup>  
(12 Sangkats)

**No. of HHs** : 43,840

**Population:** 240,000

**Number of Connections:** 7,231

**Population Served:** 36,900

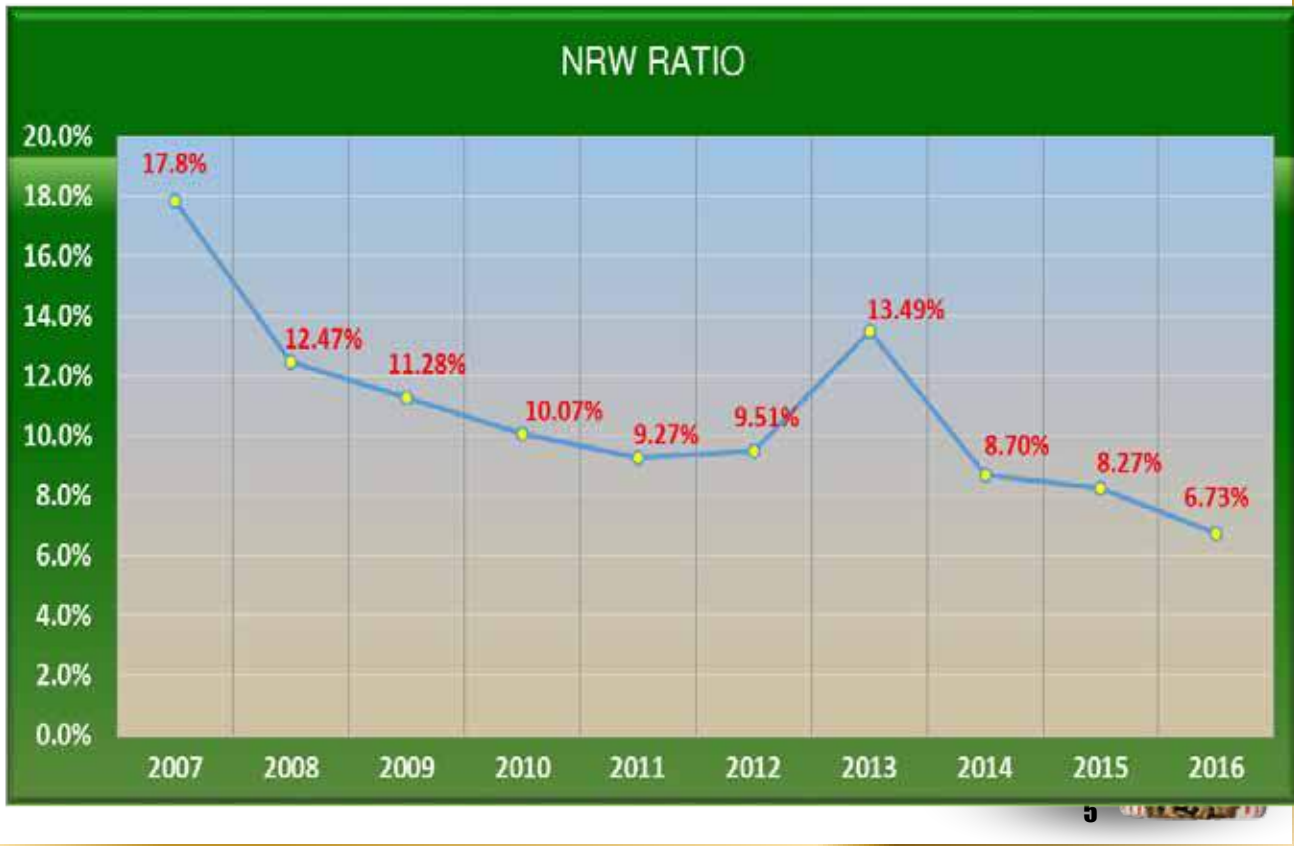
# 1.Outline of Siem Reap Water Supply Authority Service

INDICATOR	2007	2016	Goals for 2025
Production capacity m <sup>3</sup> /day	8,000	17,000	100,000
Water Quality	WHO	WHO	WHO
Coverage area	14 %	35 %	90 %
Supply duration( hr/day)	24h	24h	24h
Supply pressure	3 bar	1 bar	2 bar
Number of connections	3,578	7,231	45,000
NRW	17.84 %	6.73 %	6.5 %
Collection rate	N/A	99.90 %	99.95 %
Staff/1000 connections	8.7	11.89	5

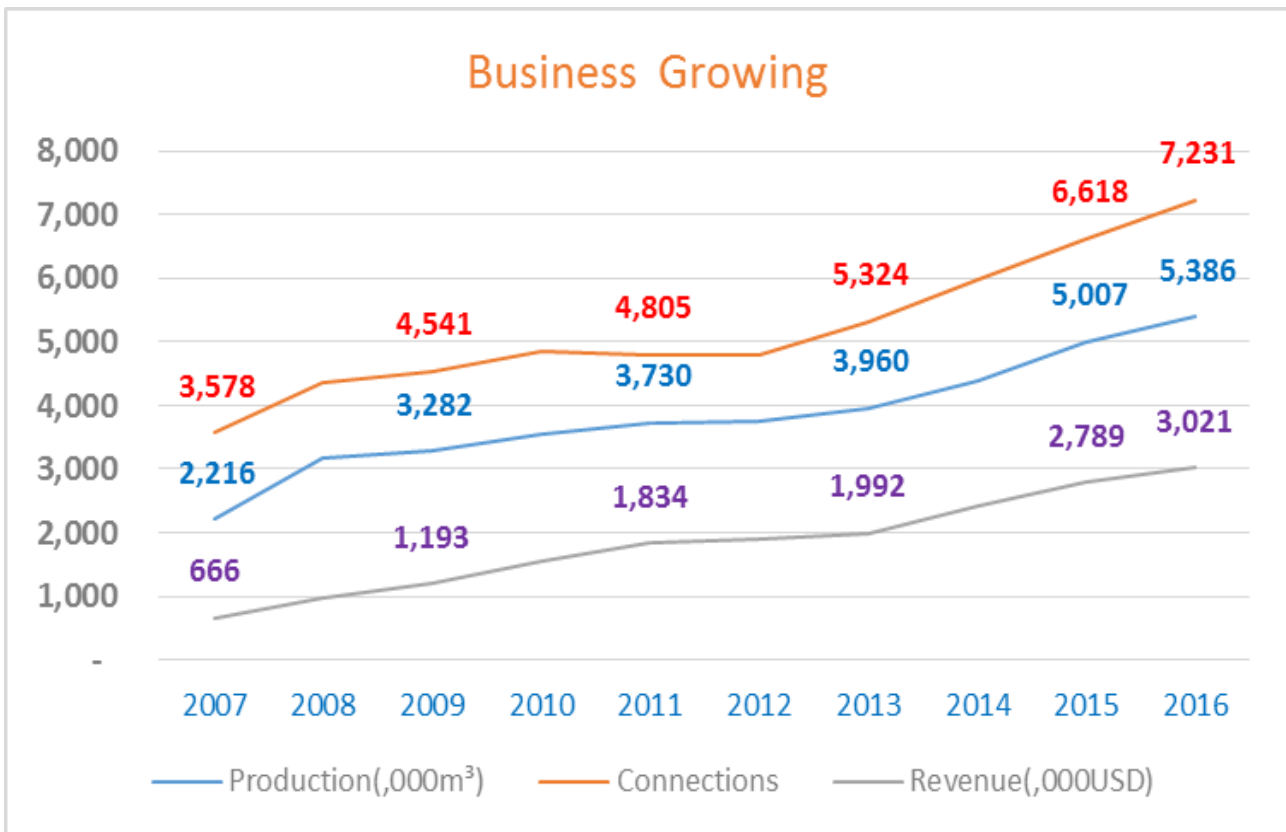


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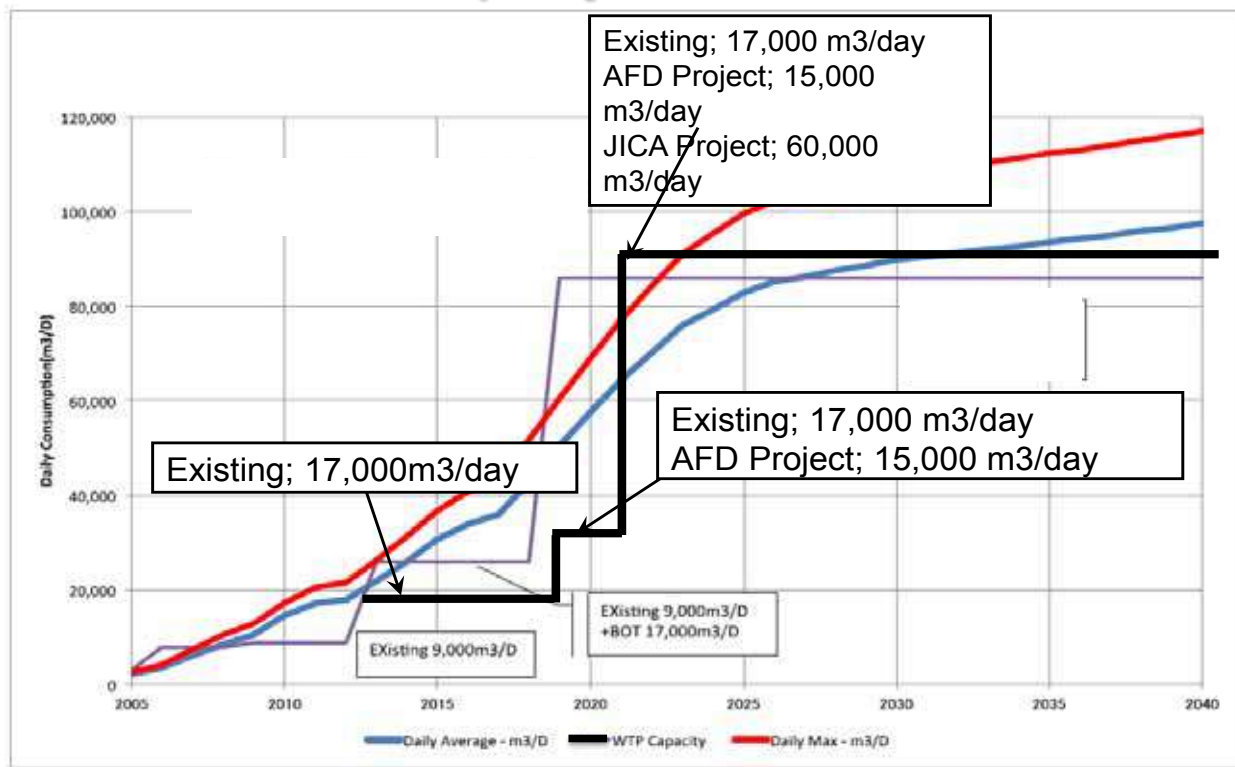
## 2.Success Story of SRWSA



## 2.Success Story of SRWSA



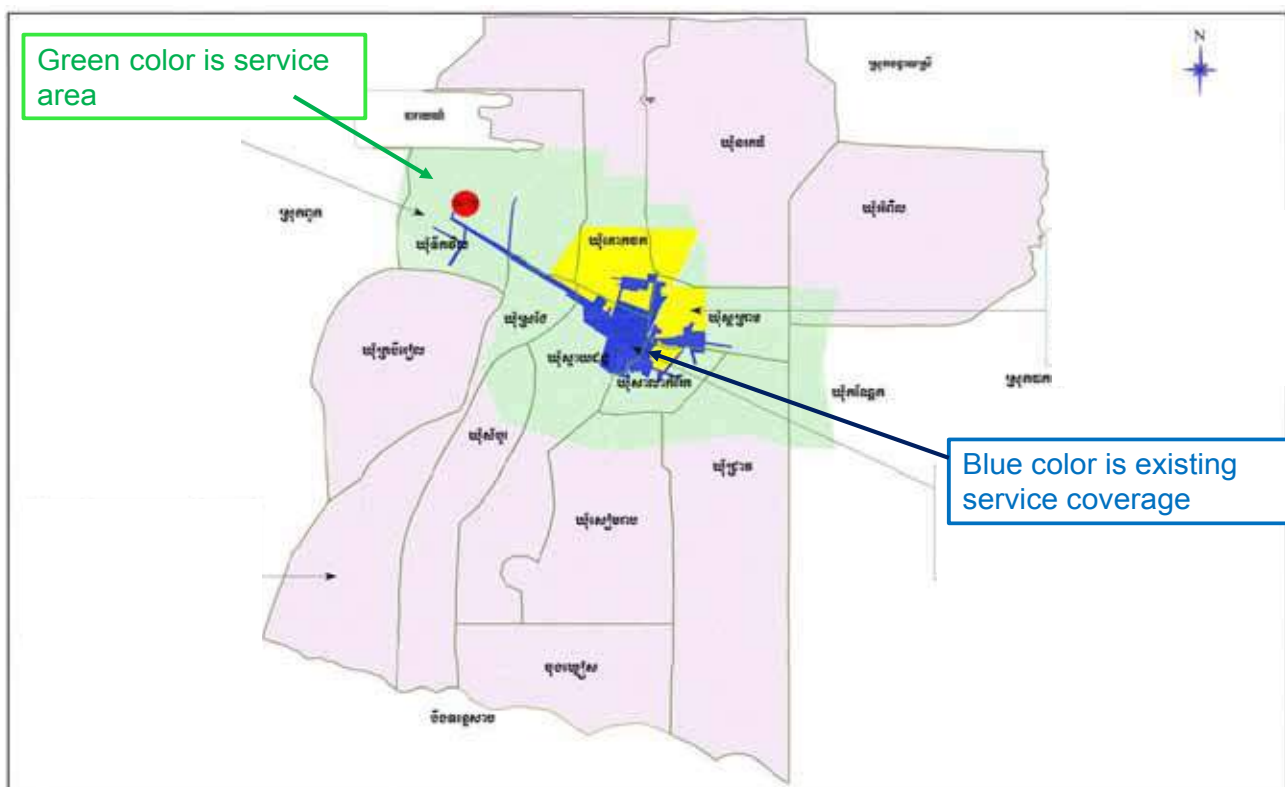
### 3.1 Production Capacity



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### 3.Recent Challenges to Improve

### 3.2 water service coverage



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# LAOS





# Country report LAO PDR

Khammouane Provincial Water Supply State Enterprise

19/9/2017

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## Content

1. Country Profile
2. Background
3. Water Supply Service
4. Performance Indicators (PI)
5. Management of Water Quality
6. Non-Revenue Water Management
7. Accounting system of Water Supply Service in FY2016
8. Khammouane Activity in Improvement of Water Supply
9. Challenges to Improvement of Water Supply Services

Khammouane Provincial Water Supply State Enterprise

19/9/2017

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# 1. Country Profile:



- Khammouane Province
- Area 16,315Km<sup>2</sup>
- 10 Districts
- Population 397,646 pp
- 579 villages, 76,599 hh
- 2 season : Dry and Rainy season.

## 2. Background



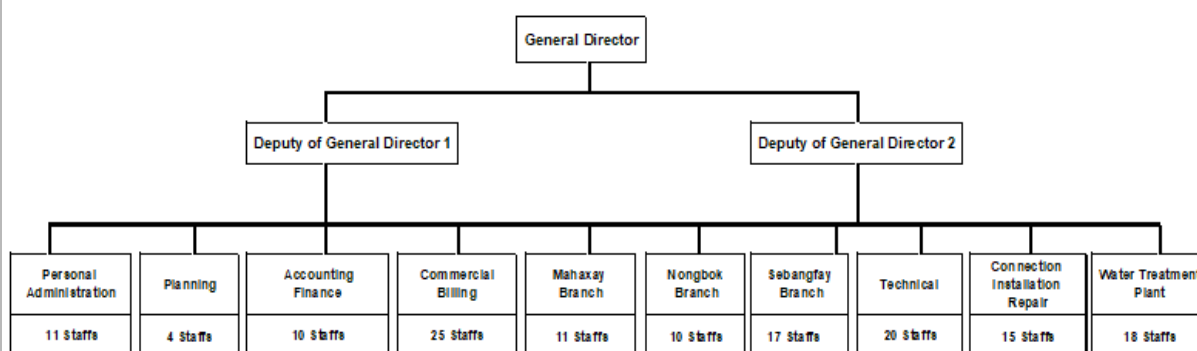
- Khammouane Water Supply State Enterprise is 100% of government investment.
- Established in 1998, supply only Thakhek district and now we have 4 service areas.
- Which implemented and operated the business under the Business Law, Water Supply Law, Labour Law, Tax Law and etc.

### Our Vision:

*"Provide Customers with Sustained, Clean and Safe Piped Water at a Fair Price"*

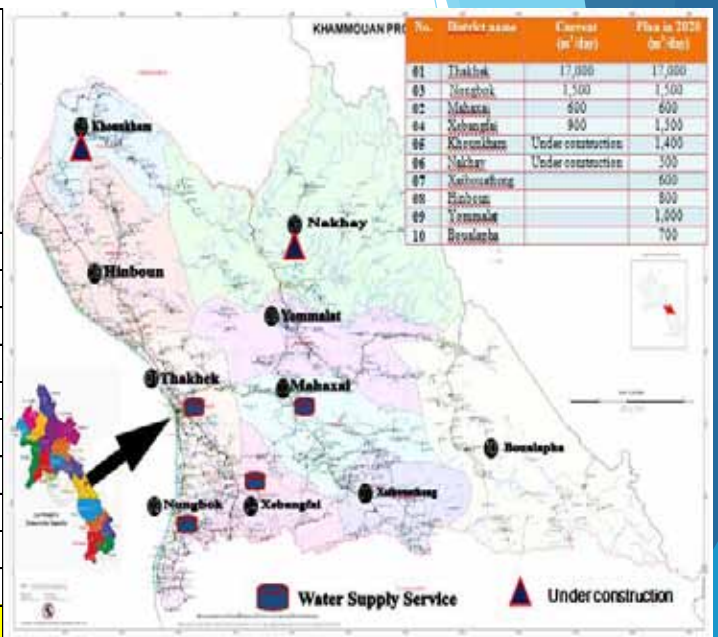
*Our Mission: KWSSE supply safe water and water supply for 24 hours with reasonable prices, a satisfactory services and develop business be stable.*

Khammouane Province Water Supply State Enterprise Organization Chart



### 3. Water Supply Service

No	District Name	Villages	Household	Population	Water meter	Water meter	Population	% Coverage of Water Service
		In Urban	In Urban	In Urban	Category Domestic	Category UnDomestic	Used Water	
		Service Area	Service Area	Service Area				
1	Thakhek	35	9,067	44,315	6,161	981	30,805	70
2	Mahasay	6	2,013	6,195	607	56	3,035	49
3	Nongbok	4	1,511	8,155	1,162	160	6,187	76
4	Hinboun	10	1,065	5,858				
5	Yommala	9	1,441	7,040				
6	Bualapha	7	1,004	5,098				
7	Nakai	2	832	3,605				
8	Sebangfay	3	878	4,758	422	59	2,168	46
9	Saybuathong	4	904	4,692				
10	Khounkham	8	1,844	10,027				
Total		88	20,559	99,743	8,352	1,256	42,195	42



Khammouane Provincial Water Supply State Enterprise

19/9/2017

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### 4. Performance Indicators (PI)

23 Performance Indicators (PI)

#### ✳ 2 PIs for Safety

- 1001. Violation ratio of water quality standard
- 1002. Direct supply from distribution main

#### ✳ 8 PIs for Stability

- 2001. Population served by water supply coverage ratio
- 2002. Restricted water supply ratio
- 2003. Supply pressure inadequacy ratio
- 2004. Hour of water interruption
- 2005. Non-Revenue Water (NRW)
- 2006. Aging of water treatment facilities
- 2007. Aging of electric and mechanical equipment
- 2008. Aging of mains

#### ✳ 13 PIs for Sustainability

- 3001. Billing issuance ratio
- 3002. Nonpayment ratio (case)
- 3003. Nonpayment ratio (money)
- 3004. Water supply service complaints
- 3005. Resolved complaints ratio
- 3006. Cost to water supply

Description of Indicator		Unit	Target	Year 2016
<b>1 Safety</b>				
1001	Violation ratio of water quality standard	%	0	0.00
1002	Direct supply from distribution main	%	80	99.52
<b>2 Stability</b>				
2001	Population served by water supply (Coverage ratio)	%	80	42.00
2002	Restricted water supply ratio	%	5	2.46
2003	Water supply pressure inadequacy ratio	%	5	5.30
2004	Hour of water interruption	hour	5	0.10
2005	NRW	%	20	21.61
2006	Aging of water treatment facilities	%	5	0.00
2007	Aging of electric and mechanical equipment	%	5	6.38
2008	Aging of main pipe	%	5	0.00
<b>3 Sustainability</b>				
3001	Billing issuance ratio	%	100	100.00
3002	No payment ratio (number)	%	0	10.95
3003	No payment ratio (amount)	%	0	23.02
3004	Water supply service complains	%	5	1.82
3005	Resolved complainintation ratio	%	100	99.19
3006	Cost to water supply	kip/m³	1,000	3,886
3007	Unit tariff of water supply	kip/m³	1,000	3,097
3008	Rate of total returns	%	110	85.45
3009	Nuber of employee' qualifications	number/person	1	0.82
3010	Training time	hour	15	13.31
3011	Years of experience for water supply service	year/person	12	7.56
3012	Revenue on water sales per personnel	Kip/person	90,000,000	77,156,860
3013	Transmission input per employee	ri/person	50,000	27,311

(Exchange rate 1u\$S/8000kp)

- 3007. Rate of total returns
- 3008. Number of employees' qualifications
- 3009. Training time
- 3011. Years of experience for water supply services
- 3012. Revenue on water sales per personnel
- 3013. Transmission water per employee

19/9/2017

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## 5. Management of Water Quality



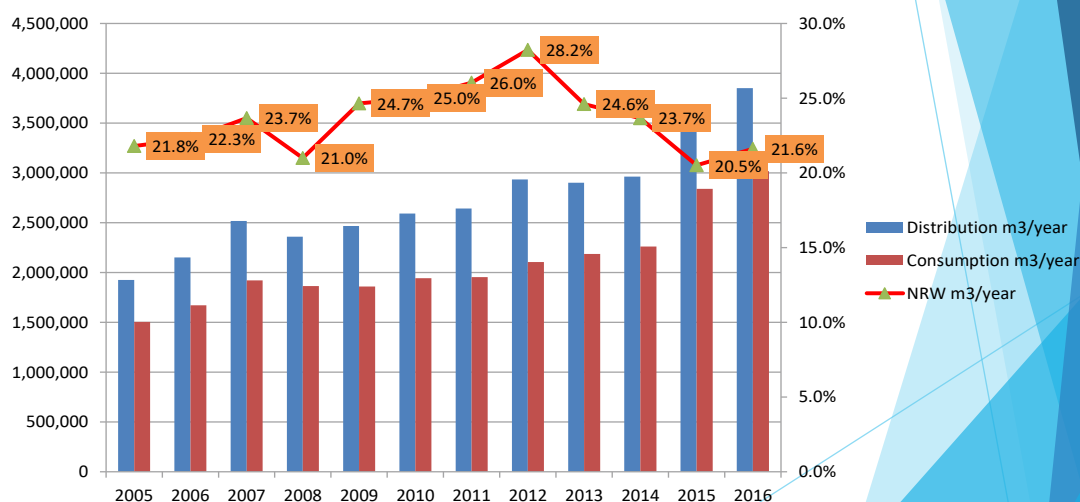
In Khammouane  
Management of water  
Quality 5 parameters :  
Arsenic, Chlorine free  
residual , Turbidity, PH  
, Color

Parameter	Unit	Permissible limit	Monitoring Frequency
Aluminum (Al)	mg/L	<0.2	Monthly
Arsenic (As)	mg/L	<0.01	Yearly
Chloride (Cl <sup>-</sup> )	mg/L	<250	Yearly
Chlorine Cl <sub>2</sub> (free residual)	mg/L	0.1-2	Weekly
Copper(Cu)	mg/L	<2	Yearly
Cyanide(CN)	mg/L	<0.5	Yearly
Fluoride (F)	mg/L	<1.5	Yearly
Iron(Fe)	mg/L	<0.3	Yearly
Lead(Pb)	mg/L	<0.01	Yearly
Manganese(Mn)	mg/L	<0.1	Yearly
Mercury(Hg)	mg/L	<0.006	Yearly
Nitrate (NO <sub>3</sub> <sup>-</sup> )	mg/L	<50	Weekly
Nitrite (NO <sub>2</sub> <sup>-</sup> )	mg/L	<3	Weekly
Sodium (Na)	mg/L	<200	Yearly
Sulfate ion(SO <sub>4</sub> <sup>2-</sup> )	mg/L	<250	Yearly
Zinc(Zn)	mg/L	<3	Yearly
Taste	-	acceptable	Weekly
E.coli	/100mL	0	Monthly
Colour	TCU	<5	Weekly
pH	-	6.5-8.5	Weekly
Conductivity	uS/cm	<1000	Yearly
Turbidity	NTU	<5	Weekly
Total hardness as CaCO <sub>3</sub>	mg/L	<300	Yearly

Khammouane Provincial Water Supply State Enterprise

## 6. Non-Revenue Water management

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Distribution	m <sup>3</sup> /year	1,926,104	2,152,049	2,517,834	2,361,321	2,468,534	2,591,919	2,642,650	2,933,995	2,901,050	2,963,778	3,573,925	3,850,958
Consumption	m <sup>3</sup> /year	1,506,055	1,672,492	1,921,782	1,865,304	1,859,952	1,943,858	1,954,435	2,105,442	2,187,057	2,262,374	2,840,795	3,018,579
NRW	m <sup>3</sup> /year	21.8%	22.3%	23.7%	21.0%	24.7%	25.0%	26.0%	28.2%	24.6%	23.7%	20.5%	21.6%



Khammouane Provincial Water Supply State Enterprise

## 7. Accounting system of Water Supply Service in 2016

Item	Category	Year					
		2008	2009	2010	2011	2012	present
1	Domestic	0.29	0.31	0.35	0.35	0.35	0.35
2	Government, Office	0.38	0.42	0.46	0.46	0.46	0.46
3	Business	0.41	0.44	0.49	0.49	0.49	0.49
4	Hotel , Gueshouse, Factory	0.47	0.52	0.57	0.57	0.57	0.57
5	Foreigner	0.47	0.52	0.57	0.57	0.57	0.57

I	Asset	Amount(Us\$)	II	Capital · Debt	Amount(Us\$)
1	Fixed asset I	7,888,202	1	Capital I	8,397,134
2	Lending etc. III	233,546	2	Debt II	398,191
3	Current assets	829,937	3	Liability III	220,275
4	Cash IV	63,915			
	<b>Total</b>	<b>9,015,600</b>		<b>Total</b>	<b>9,015,600</b>

CATEGORY		2016	
		SUM	proportion
Profit & Loss	Gross	1,367,500	100%
	Income (water supply)	1,168,250	85.4%
	Income (the others)	199,250	14.6%
	Expenditure	1,600,250	100%
	Personnel cost	736,125	46.0%
	Operation & Maintenance	652,500	40.8%
	Power	126,875	7.9%
	Chemical	74,750	4.7%
	Maintenance & Repair	106,125	6.6%
	Outsourcing	216,625	13.5%
	Others*1	128,125	8.0%
	Depreciation	203,750	12.7%
	Interest	7,875	0.5%
	Balance	(232,750)	—

Khammouane Provincial Water Supply State Enterprise



## 8. Khammouane Activity in Improvement of Water Supply

### - MaWaSu project



The Capacity Development Project for Improvement of Management Ability of Water Supply Authorities

### 1. Call center 24/7



### 2. Water leakage survey team



### 3. NRW team



### 4. Customer Interview at household



### 5. Water Class Education



### 6. Taking Over Equipment's waterworks.



### 7. Waterworks Dissemination



### 8. Long Term Plan 2012-2020

Item	Type of Plan	Plan 2012-2020
I	Waterworks supplying safe water	1,378,065,600
1	Water quality management plan (Framework & Pipeline improvement plan for reducing low residual)	1,378,065,600
2		
II	Waterworks stably supplying water	80,681,574,714
3	Facility development plan	50,993,970,000
3.1	New construction plan of WTP	33,998,400,000
3.2	New construction plan of Pipeline network	16,095,570,000
4	Expansion, renewal, improvement (large-scale repair)	3,671,898,452
4.1	Expansion plan of WTP	1,888,800,000
4.2	Expansion, renewal plan of WTP	362,166,197
4.3	Improvement (large-scale repair) plan of WTP	1,620,917,320
5	Pump Machine, large-scale repair plan	15,708,200,000
6	Pipeline expansion plan	11,917,618,257
6.1	Review current situation -> Analyze water distribution	623,827,500
6.2	Water pipe information improvement plan	8,660,000
6.3	Planned water leakage inspection plan	956,351,000
6.4	Repair framework improvement plan	2,700,995,929
6.5	Master meter improvement plan	72,910,000
6.6	Water pressure management plan	172,000,000
6.7	Pipeline improvement plan	4,314,000,000
6.7.1	Aging pipe renewal plan	3,714,000,000
6.7.2	Low-water-pressure area reducing plan	600,000,000
6.8	Water meter improvement plan (Periodical renewal)	2,269,664,838
6.9	Water meter reading improvement plan	0
III	Waterworks performing sound management	23,998,054,359
7	Human resource development plan	303,363,000
8	Staff recruitment plan	22,851,331,350
9	Call Center establishment and improvement plan	596,190,000
10	Customer questionnaire implementation plan	41,920,000
11	Waterworks education class implementation plan	106,290,000
11	Grant total	105,667,694,664

### 9. Trainings



### 10. Annual Report, Manual and Guidelines



## 9. Challenges to Improvement of Water Supply Services

- To manage Water Safety Plan .
- To supply safe water to people in service area.
- To expand of pipe network to urban service area
- To source funding to expand pipelines for increasing income.
- To develop skill of staff .
- To disseminate about waterworks to branches.

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# MONGOLIA



# WATER SUPPLY ADMINISTRATION FOR BETTER MANAGEMENT



## COUNTRY OVERVIEW



**MONGOLIA**



Capital  
Total area  
Population

Ulaanbaatar  
1,566,600 km<sup>2</sup>  
3 mil

Population just over 1 million in live in  
Ulaanbaatar city  
There are 21 aimags. Capital city  
/Ulaanbaatar city/

# COUNTRY OVERVIEW



Mongolia has 4 seasons.  
These are spring, summer, autumn and winter.

Summer time temperatures up to  $+40^{\circ}\text{C}$   
Winter is sometimes the temperature drops  
down to  $-40^{\circ}\text{C}$ ,

## ORGANIZATION INTRODUCTION



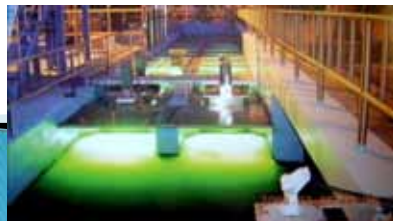
### Organization:

Water Supply and Sewerage Authority of Ulaanbaatar city

The water supply and sewerage authority (USUG) of Ulaanbaatar city was established in 1959

### Functions:

- ❖ To provide water to city residents and organizations
- ❖ To discharge and treat domestic and pre-treated industrial wastewater
- ❖ To make laboratory analyze in drinking and waste water



# Role and Responsibilities of Organization

To provide citizen of Ulaanbaatar city continuous Supply of potable water that meets standard requirement and discharge treated wastewater to nature with ecological balance.

Central Wastewater Treatment Plant is responsible to treat wastewater for effluent standard condition and to keep clean environment of the downstream of Tuul river. Current wastewater treatment efficiency is not high and industrial pollution become more problematic and sludge treatment also difficult, the fore Central Government spending money for modernization and reconstruction, also most important operation and maintenance of CWWTP for our division.

## Issues and problems today

- Regarding water supply
- Monitoring water distribution network and improve economic and ecological efficiency water infrastructure
- Lining of water distribution lines and find good technology keeping natural water quality
- Water and energy nexus

## Wastewater problems today

- Higher pollution in raw wastewater
- Lower treatment rate, not meet effluent standard of Mongolia
- Over flow and over load
- Need to be modernized CWWTP
- High energy use, from the aeration so on
- Old technics and not good condition technics
- Bad smell and need to be full treat sludge

## Brief description of my assignments

- Modernization and rehabilitation of existing WWTP and ways of improvement
- Lining and protection water networks
- Learn technics and technologies to monitor and control of pipes and distribution lines.
- I will make my contribution to solve the problems related to the Waste water treatment plant and sewerage system in Mongolia Ulaanbaatar city after coming back training.

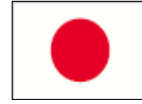


**THANK YOU FOR ATTENTION**

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# MYANMAR





**The Republic of The Union of Myanmar**  
**Yangon City Development Committee**

**Water Supply Administration for Better Management of Water Supply  
Services (B)**



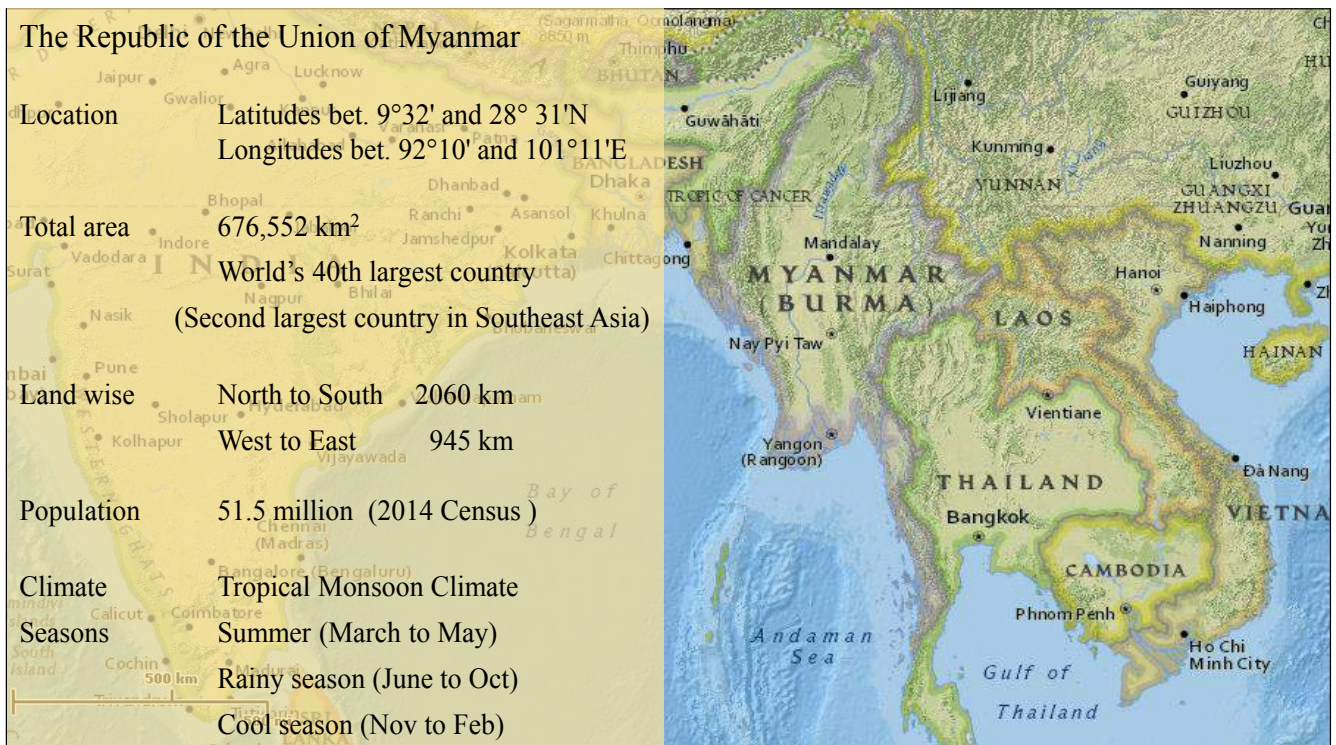
20.9.2017

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- **About Myanmar and Yangon City**
- **Organization Chart of YCDC and Engineering Department (Water and Sanitation), EDWS**
- **Existing Water Supply System**
- **Planned Water Supply System for Future**
- **Challenges and Issues of Existing Water Supply System**
- **Current Activities for Existing Water Supply System**

## About Myanmar and Yangon City

### Myanmar



## About Myanmar and Yangon City

### Yangon

#### Yangon City

Largest City of Myanmar (Former Capital City)

**Location** Latitudes bet. 16°45' and 17°N  
Longitudes bet. 96° and 96°15' E

**Area** 794.4 km<sup>2</sup>

**Population** 5.21 million (2014 Census)

**Pop. Growth Rate** ~ 2.5 %

**Max. Temperature** 37.5°C in April

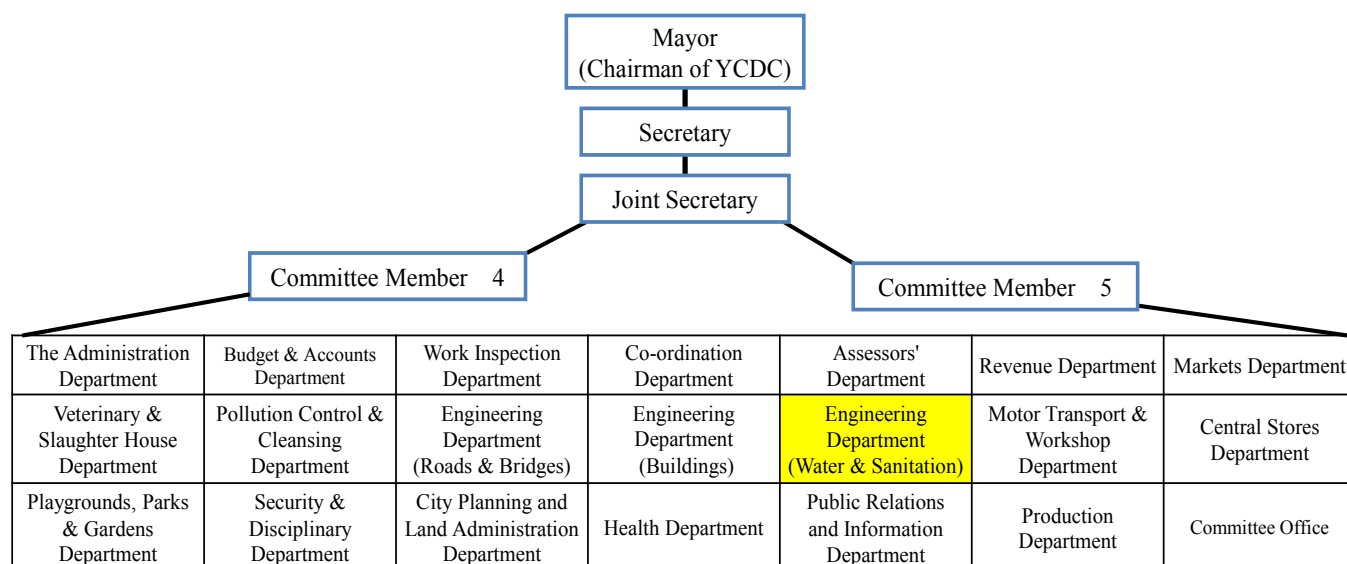
**Min Temperature** 17.8°C in January

**Annual Rainfall** 2700 mm

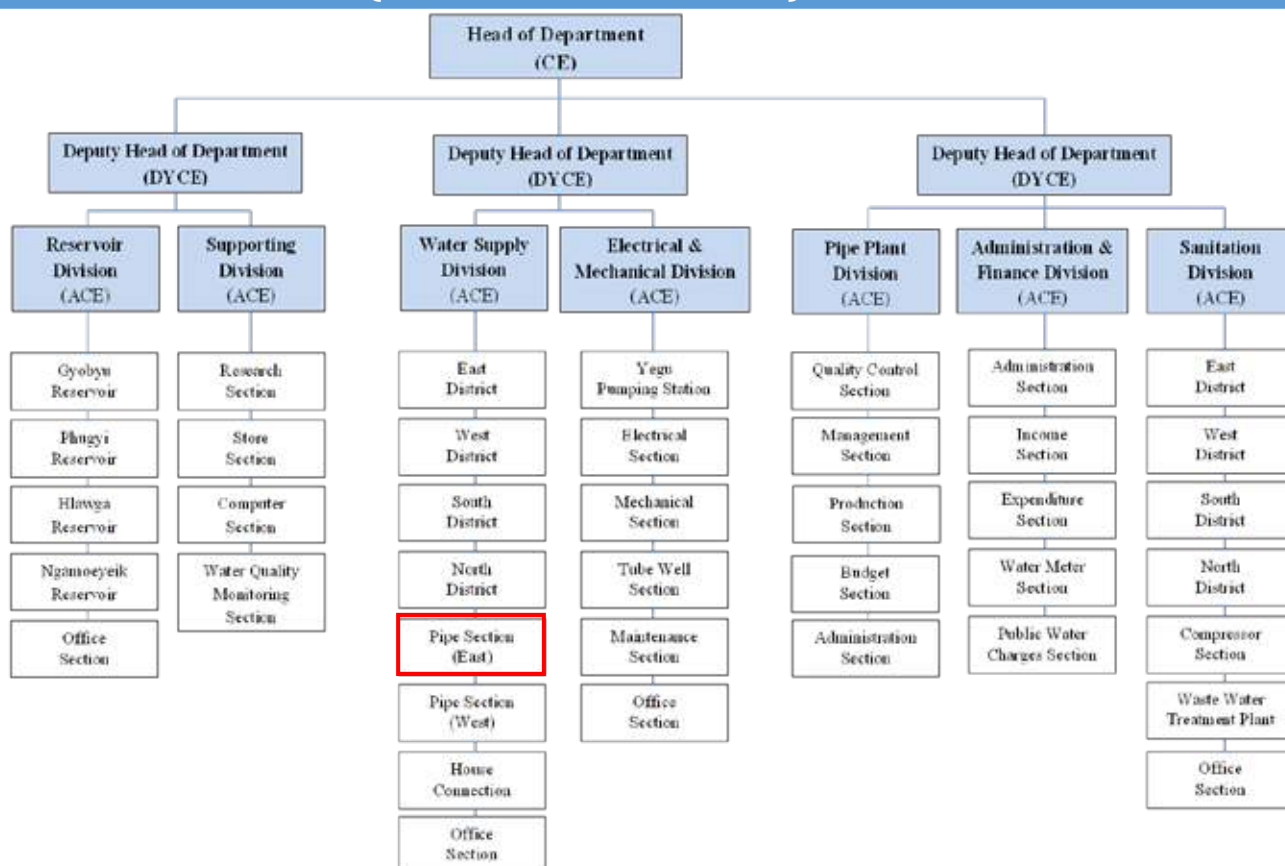


# Organization Chart of YCDC and Engineering Department (Water and Sanitation),EDWS

## Organization Chart of Yangon City Development Committee



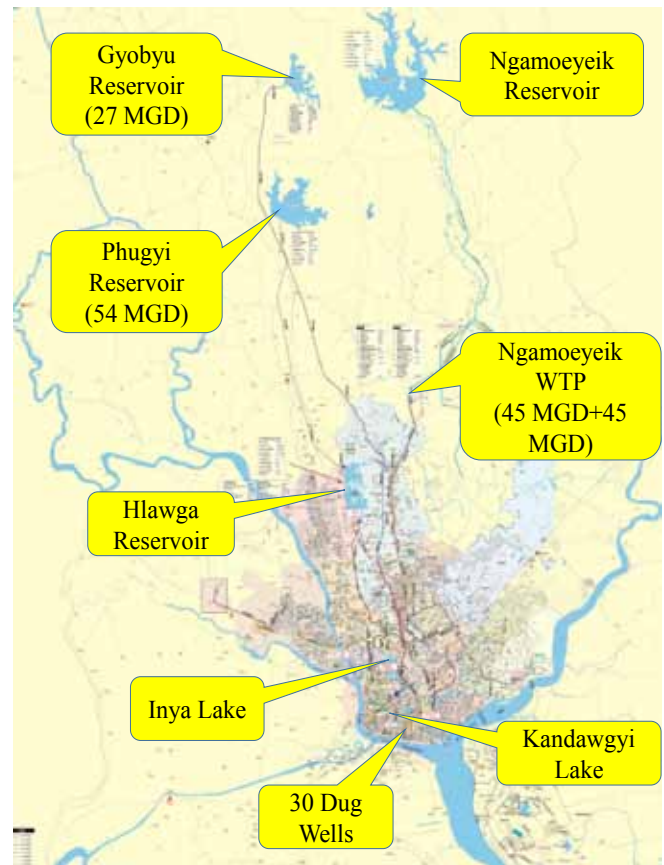
# Organization Chart of YCDC and Engineering Department (Water and Sanitation),EDWS



# Existing Water Supply System

## History of Yangon City Water Supply System

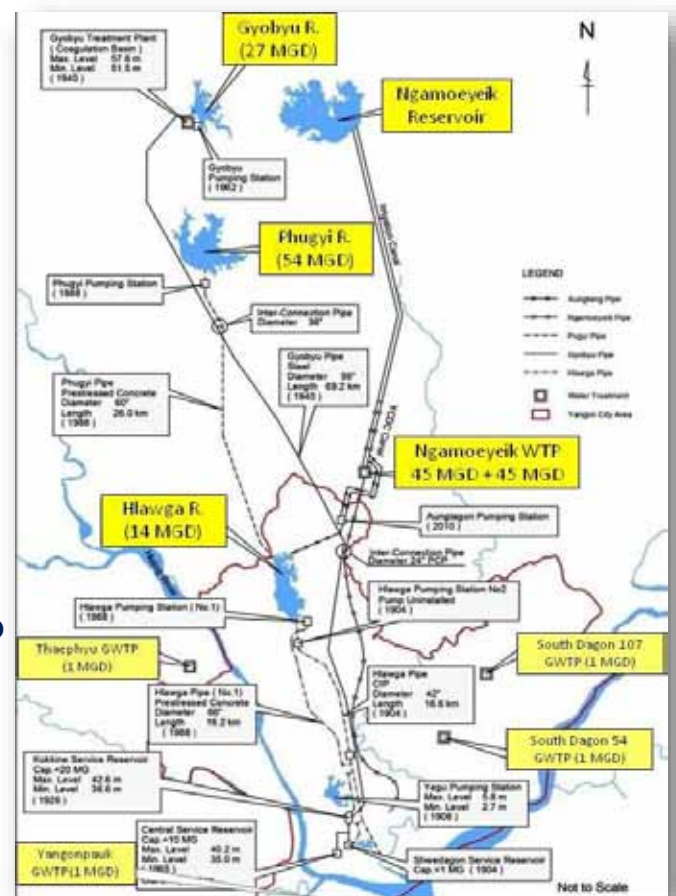
- 1842 Dug Wells (30)
- 1879 Kandawgyi lake
- 1884 Innya lake
- 1904 Hlawga Reservoir
- 1940 Gyobyu Reservoir
- 1992 Phugyi Reservoir
- 2005 Nyaunghnapin Water treatment Plant(1<sup>st</sup> Phase)
- 2013 Nyaunghnapin Water treatment Plant(2<sup>nd</sup> Phase)  
has been operating since April, 2013 .
- 2014 Lagunbyin water treatment plant has been implementing



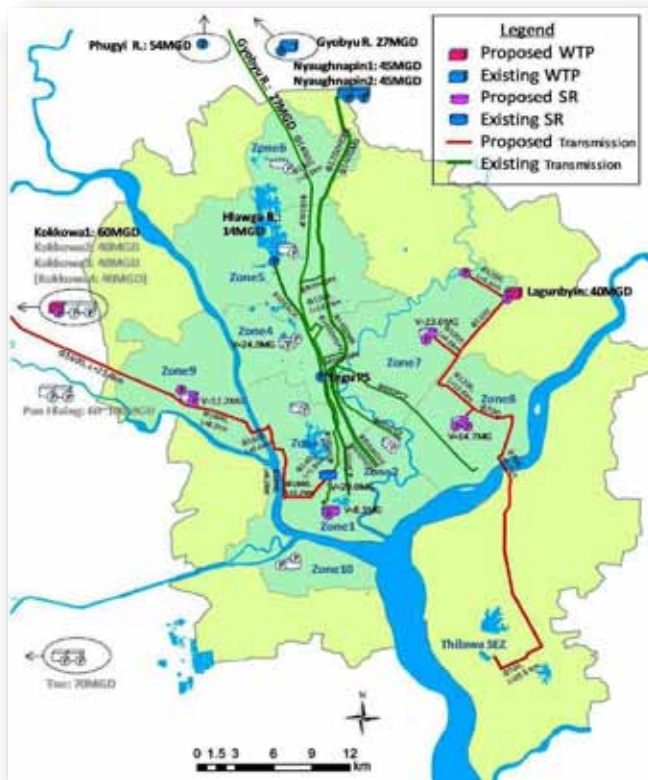
# Existing Water Supply System

Gyobyu Reservoir	27 MGD
Phugyi Reservoir	54 MGD
Hlawga Reservoir	14 MGD
Ngamoeyeik WTP (1 <sup>st</sup> phase)	45 MGD
Ngamoeyeik WTP (2 <sup>nd</sup> phase)	45 MGD
YCDC Tube Wells (425 nos.)	16 MGD
<b>Total Water Supply Capacity</b>	<b>201 MGD</b>

<b>Main Water Sources</b>	<b>Surface water (92%)</b>
	<b>Groundwater ( 8%)</b>
<b>Total Population</b>	5,209,541 → 156 MGD (2014 Census data)
<b>Served Population</b>	~ 2,050,000 (2015/16 field survey data)
<b>Demand coverage</b>	<b>approx. 40 %</b>
<b>Non-revenue water</b>	<b>approx. 50 %</b>



## Planned Water Supply System for Future



Water Supply System for 2025

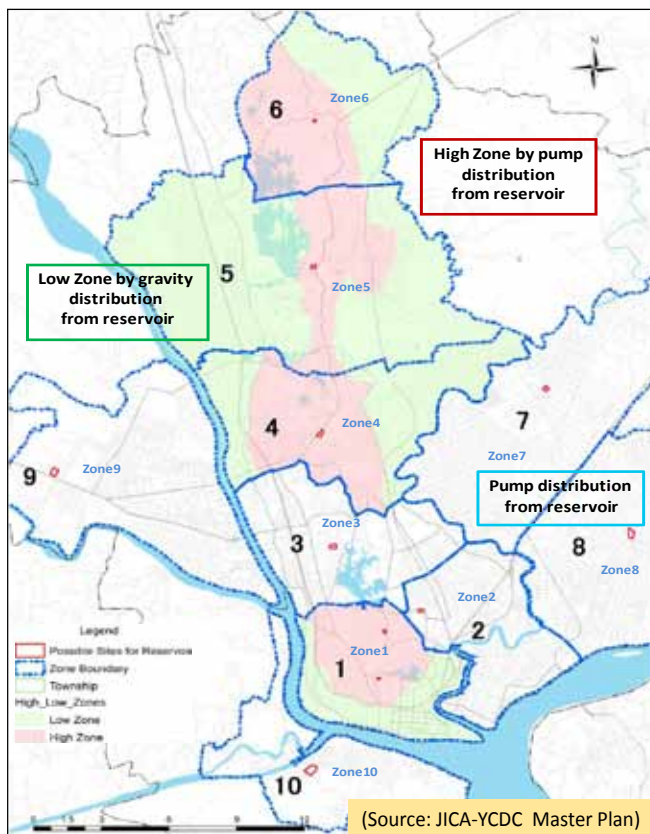


Water Supply System for 2040

(Source: JICA-YCDC Master Plan)

## Planned Water Supply System for Future

### Zoning System Plan for Yangon City



(Source: JICA-YCDC Master Plan)

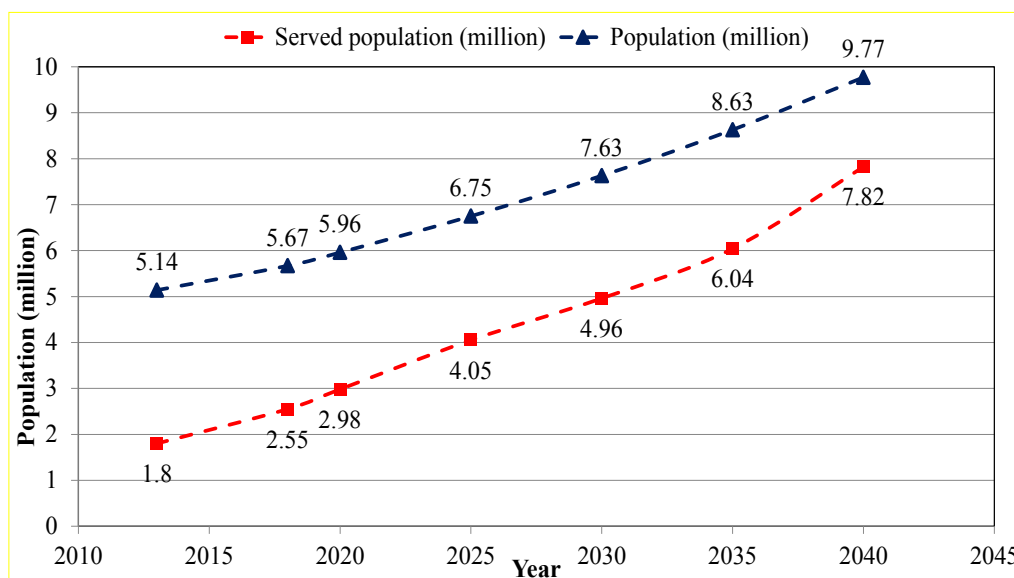
Zone	Name of Zone	Township & Township Group's
1	Central area	Central Business District (CBD) Inner Urban Ring (IUR)
2	Tarmwe, Thaketa	Tarmwe, Thingangyun, Thaketa
3	Hlaing	Mayangone, Yankin, Hlaing
4	Mayangone	(South) Mingalardon, North Okkalapa, (South) Insein
5	Mingalardon, Shwepyithar	(Center) Mingalardon, (North) Insein, Shwepyithar
6	North side	(North) Mingalardon
7	East side 1	East Dagon, North Dagon
8	East side 2	South Dagon, Dagon Seikkan
9	West side	Hlaingtharyar
10	South side	Dala, Seikkyi-Khanaungto, (West) Kyeemyindaing

## Planned Water Supply System for Future

### Future Service Level Targets in Yangon City

Performance Indicators (PIs)	Target Year						
	2013	2018	2020	2025	2030	2035	2040
Demand coverage (%)	35	45	50	60	65	70	80
Served population (million)	1.8	2.55	2.98	4.05	4.96	6.04	7.82
Non-revenue water (%)	66	51	46	35	26	20	15
Leakage rate (%)	50	37	33	25	18	13	10
Water consumption (gpcd)	30	30	30	35	35	35	40
Avg. Supply Pressure (bar)	0.75	-	-	> 1.5			
Avg. Supply duration (hour)	8hrs.	-	-	24hrs.			
Water quality	Potable	Drinkable					

## Planned Water Supply System for Future



Performance Indicators (PIs)	Target Year						
	2013	2018	2020	2025	2030	2035	2040
Demand coverage (%)	35	45	50	60	65	70	80
Served population (million)	1.8	2.55	2.98	4.05	4.96	6.04	7.82

## Challenges and Issues of Existing Water Supply System

### Current Issues

- Aged Transmission Pipe line  
Frequent Pipe Break, Higher Leakage,
- Complex Distribution Without Zoning System  
Unstable Water Pressure, Intermittence water Supply,
- Higher NRW Rate  
FOC connection , Damaged Meter, Spaghetti Service Pipe, Theft,
- Water Shortage at outskirt areas of Yangon



Frequent Pipe Break in Transmission line



Aged Transmission and Distribution Pipe



Damaged Water Meter



Spaghetti Pipe



13 Water Supply By Water Boxer

## Challenges and Issues of Existing Water Supply System

Water Shortage occur at outskirt area of Yangon especially on the other bank of Yangon river and Hlaing river in Summer

Water Boxer Truck , Boat and Navy ship are used for drinking water supply



Water Supply By Water Boxer



Water Supply By Boat



Water Supply By Motor Boat

14

## Challenges and Issues of Existing Water Supply System



By using water carrying boats by Navy



Waiting for drinking water sharing from boats



By using water tanker



Managing to share water from tankers

## Current Activities for Existing Water Supply System

- Management on spaghetti
- Pipe Line cleansing and reinstallation
- Damaged meter Replacement and New meter installation
- Transmission Pipe Line Repair
- Initiation of Laboratory for Drinking Water quality testing
- Initiation of Laboratory for Waste Water quality testing
- New pipe line network installation
- Technical Assistant for International Cooperation

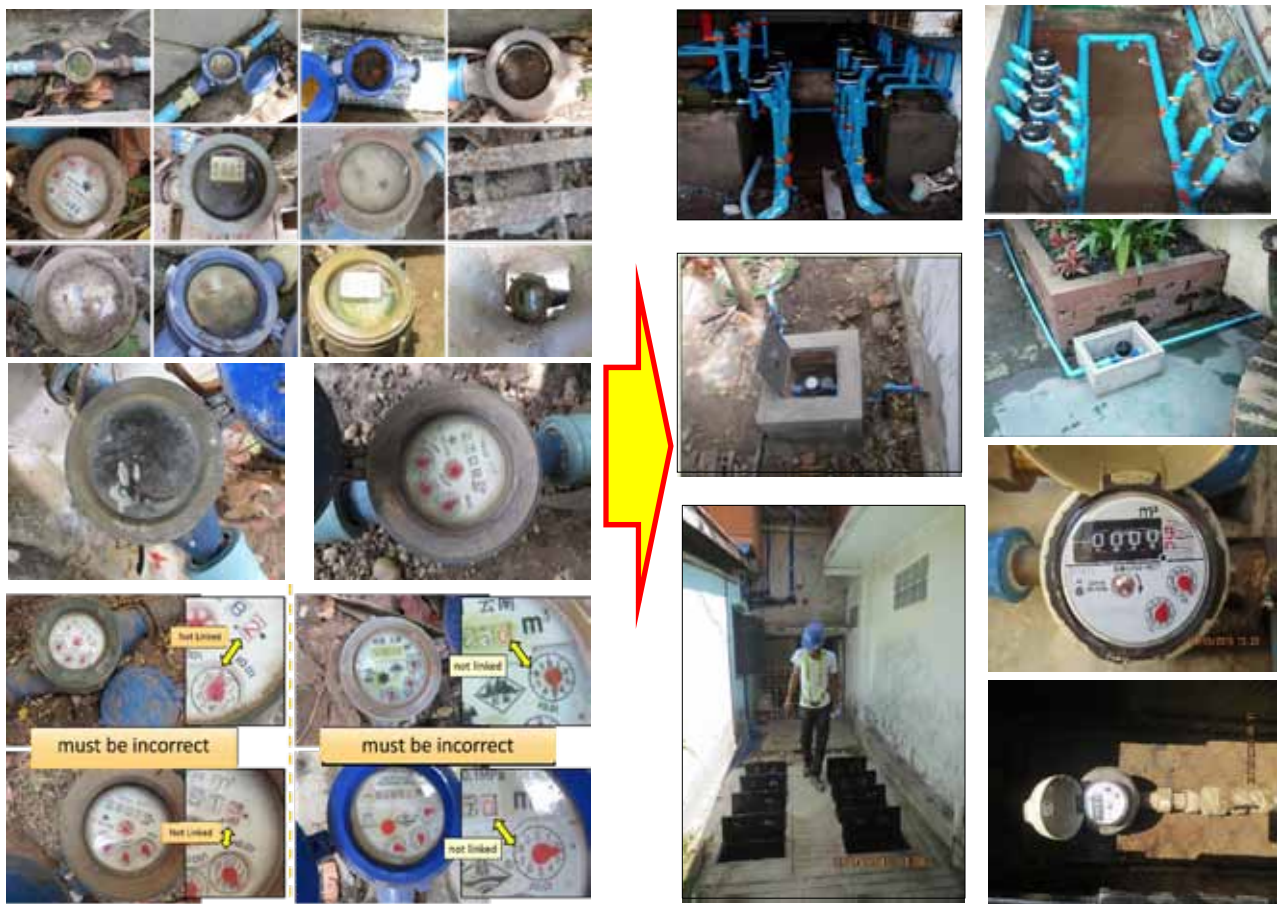
## MANAGEMENT ON SPAGHETTI



## PIPE LINE CLEANING AND REINSTALLATION



## DAMAGED METER REPLACEMENT AND NEW METER NSTALLATION



## TRANSMISSION PIPE BURST REPAIEMENT



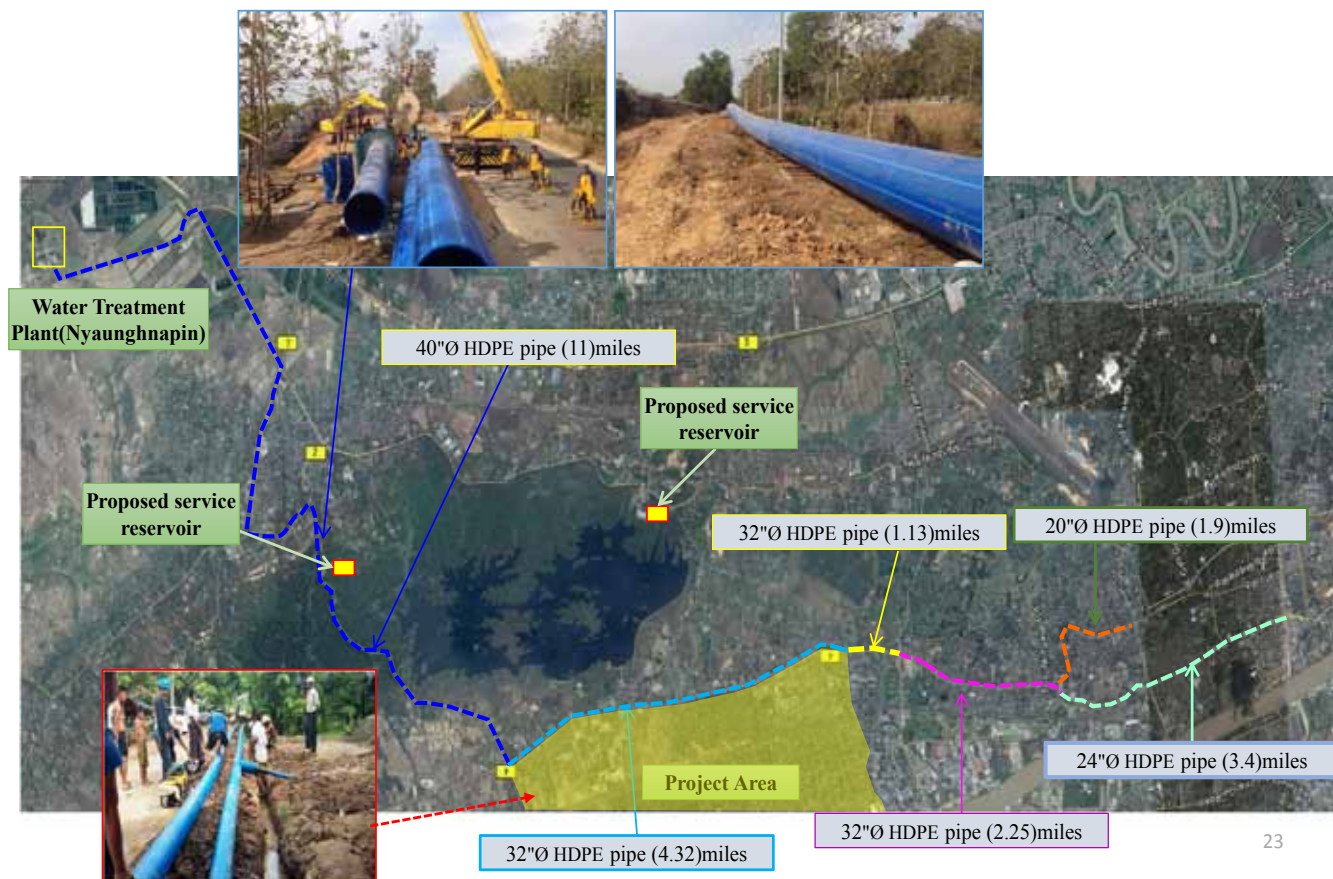
## INITIATION OF LABORATORY FOR DRINKING WATER QUALITY TESTING



## INTIATION OF LABORATORY FOR WASTE WATER QUALITY TESTING



## NEW WATER SUPPLY INSTALLATION PROJECT (Shwepyithar Township)



## Technical Assistant for International Cooperation

Activities for Institutional Management



Activities for Non-Revenue Water Management



Activities for Water Quality Management



*Water Supply Administration*  
*For Better Management of Water Supply Services*  
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NEPAL





# Water Supply Administration for Better Management of Water Supply Services

## Inception Report Presentation

1. Country: Nepal
2. Position : Under Secretary
3. Organization: Ministry of Water Supply and Sanitation

## outline of Water Supply Services

- land area of 147,181 sq.
- 75 districts, 753 local bodies and 7 provinces
- Department of Water Supply and Sewerage (DWSS) was formally established in 1972. It is the formal step towards organized institutional effort to achieve higher level of water and sanitation access.
- DWSS is carrying on its responsibility of planning, implementation, operation, repair and maintenance of water supply and sanitation systems throughout the country.
- Besides DWSS, various other agencies like Melamchi Water supply Project, Rural Water Supply and Sanitation Fund Development Board, Kathmandu Valley Water Supply Management Board, Project Implementation Directorate, Kathmandu Uppatyaka Khanepani Limited, Nepal Water Supply Corporation also came into existence on the due course of time.

## outline of Water Supply Sevices contd....

### Major Water Utility Operators In Nepal

- Users Communities mostly in Rural Areas and some of the emerging small towns as well
- Kathmandu Uppatyaka Khanepani Limited for Kathmandu valley
- Nepal Water Supply Corporation in 23 cities throughout the country except Kathmandu valley

## outline of Water Supply Sevices contd....

### Main Utility Regulators

- Ministry of Water Supply and Sanitation
- Department of Water Supply and Sewerage
- Rural Water Supply and Sanitation Fund Development Board

# Outline of Water Supply Services contd....

## Legal Basis of Water Supply Services

WASH Sector is governed by some guiding policies, rules and regulations. The major governing policies are:

- National Water Plan, 2005
- National Drinking Water Quality Standards, 2063
- Rural Water Supply Policy, 2004
- Water Resource Act, 1992
- Water Tax Act, 2023

# Outline of Water Supply Services contd....

## Recent Policy Intervention

- Reaching the unreached First
- One House One Tap & One toilet
- Total Sanitation in ODF Declared Areas
- Water Safety Plan in each local level is in progress
- Preparation of Umbrella Act is in progress
- Sector Development Plan for fifteen years (2016-2030) is in final stage

# Outline of Water Supply Services contd....

## Program Wise Intervention

- WASH programs and activities to be carried out by all three tiers of governments
- Emphasis on co-investment Projects, Small emerging town projects
- Sustainability and functionality of existing projects
- Climate change and disaster resilient WASH Structures Development
- Water quality improvement and arsenic contamination free water supply in the Terai region
- Emphasis given on water sources conservation and River Health
- East West Trunk line development and development of impounding projects
- Phase I of National Pride Melamchi water supply project which aims at supplying (27.5 KM Tunnel- one of the rarest projects in Asia Continent) is in final stage of completion and Phase II is in progress

## Achievement Made so far

### Current Status of Water Supply and sanitation in Nepal

S.N.	Main Performance Indicator	Achievement By 2017	Broad Sectoral Objective by 2017	Gap
1.	Access to Basic Water Supply Services	87 %	100 %	13 %
2.	Access to Basic Sanitation Facilities	92 %	100 %	8 %
3.	Access to Medium/ High level Water services	18%	27 %	9 %

## Achievement Made so far contd....

- More than 40,000 water supply projects are providing water supply services throughout the country
- More than 5500 projects throughout the country are in progress
- About 70 co – investment projects, 47 ADB Funded emerging small town projects are under construction phase

## Achievement Made so far contd....

- National Pride Melamchi Water Supply Project- Phase I is expected to be completed by December this year. ( Initially JICA provided Rs 5 billion grant for the project )
- Integrated water Supply and sewerage projects are in implementation phase through out the country
- Water Safety Plan for all local bodies are under preparation phase in the technical assistance of JICA

## Achievement Made so far contd....

- Rs. 5 billion worth JICA technical assistance ship project to improve water supply situation in Most Beautiful City of Nepal- Pokhara is in progress.
- It is expected that water supply situation of Pokhara city will improve remarkably after the completion of this project.

## Achievement Made so far contd....

- Beside this, Bhairahawa Water Supply Project and Nepalgunj Water supply project are in hand under Nepal Water supply Corporation.
- Integrated Dharan Water Supply Project, Biratnagar Water Supply Project, Bhairahawa Water Supply Project and Dhangadi water supply project under the ministry of Urban Development ( mother organization of MoWSS) are major urban projects among others.
- These are some of the key urban water supply projects which will improve the urban area water supply situation remarkably in the next five years.

## Achievement Made so far contd....

- Till the date 2552 village development committees, 137 municipalities, 41 districts and 2 zones in Nepal have been declared ODF areas.
- Many other similar units are waiting to be declared ODF areas. (Now the declaration ceremony has been postponed due to multiple layer election in the country)
- Nepal is in the preparation of declaring ODF Free country by the December this year.
- Feeling pride to share Sanitation Movement in Nepal is remarkable achievement in south Asian comparison.

## Achievement Made so far contd....

- Total Sanitation Program have been launched simultaneously in ODF Declared areas.
- And, water sources protection and river health programs are in state priorities.
- Rain water harvesting, water recharge, refill and reuse projects( though small in number), multiple stage water pumping/lifting projects are the some of the exemplary projects in the country.

## Recent challenges to improve the service level

- only fifteen percent of total population has access to Medium/High quality drinking water facilities. Maintaining & fostering drinking water quality is the central issue these days. WASH sector is facing mounting challenges regarding quality issue. Some of them are-
- The WASH sector in Nepal has confronted challenges at conceptual, methodological and operational levels regarding quality.

## Recent challenges to improve the service level

- At Conceptual level segregation of quality assurance level from basic, medium and High level is not been done yet. Quality Assurance in blanket approach is not effective anywhere. It crops up a genuine question on quality assurance.
- Project Bank of potential projects based on national priorities and other relevant indicators is a must. Formulation of action plan and coining the action points supported by other prerequisites is necessary for achieving national goal.

## Recent challenges to improve the service level

- Availability and easy access to quality assurance tools , water quality labs at local level, adequate and dedicated water quality staffs, water quality section in field level as well are necessary to carry on quality assurance activities effectively which are ambiguous at present.
- The engagement of private sector agencies, research institutions and universities is inadequate in the WASH sector's Quality assurance.

## Recent challenges to improve the service level

- Engagement of intra-sectoral experts and resource persons is lacking in the WASH sector.
- The sub-national level WASH coordination committees and local bodies are largely engaged in ODF and total sanitation initiatives but they lack motivation and capacity to address Quality water supply, FSM, climate change and disaster related aspects.
- The WASH sector visibly lacks efforts towards research and development on Quality assurance aspects.

## Recent challenges to improve the service level

- The WASH sector lacks the Quality management information system at sectoral level.
- Dual water supply modalities; one for free and another for water bill payable are creating sense of discrimination among the people and some of them are subject to involved in the water bill lessening and sometimes hiding activities.
- Old and defunct Water Supply System (about twenty percent of past constructed projects)
- Poor Institutional capacity and state commitment in controlling NRW.

## Recent challenges to improve the service level

- Meeting the national targets of ensuring basic sanitation facilities for all by 2017 and basic water supply facilities by 2019.
- Meeting the Sustainable Development Goal no 6 in Nepalese Context.
- Establishment of strategic units (research and development, training, quality control and networking) for the specialization and diversification of its services.

*Water Supply Administration*  
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# PAKISTAN



# WATER SUPPLY ADMINISTRATION FOR BETTER MANAGEMENT OF WATER SUPPLY SERVICES

**Country** : **Pakistan**  
**Position** : **Chief of Section**  
**Organization** : **Planning & Development  
Department, Government  
of Balochistan, Pakistan**

## BASIC FACTS ABOUT PAKISTAN

- **Area:** **33rd-largest country spanning  
881,913 square kilometers  
(340,509 square miles)**
- **Population:** **207.77 million (2017)**
- **Population using safe water:**  
**Out of total population 91% has  
access to an **Improved Water  
Source**, although this does not  
necessarily mean that the  
water from these sources is  
safe to drink.**

## BASIC FACTS ABOUT PAKISTAN

► **Climate** : There are four distinct seasons: a cool, dry winter from December through February; a hot, dry spring from March through May; the summer rainy season, or southwest monsoon period, from June through September; and the retreating monsoon period of October and November. Rainfall varies greatly from year to year, and patterns of alternate flooding and drought are common



# MAIN SOURCES OF WATER IN BALOCHISTAN

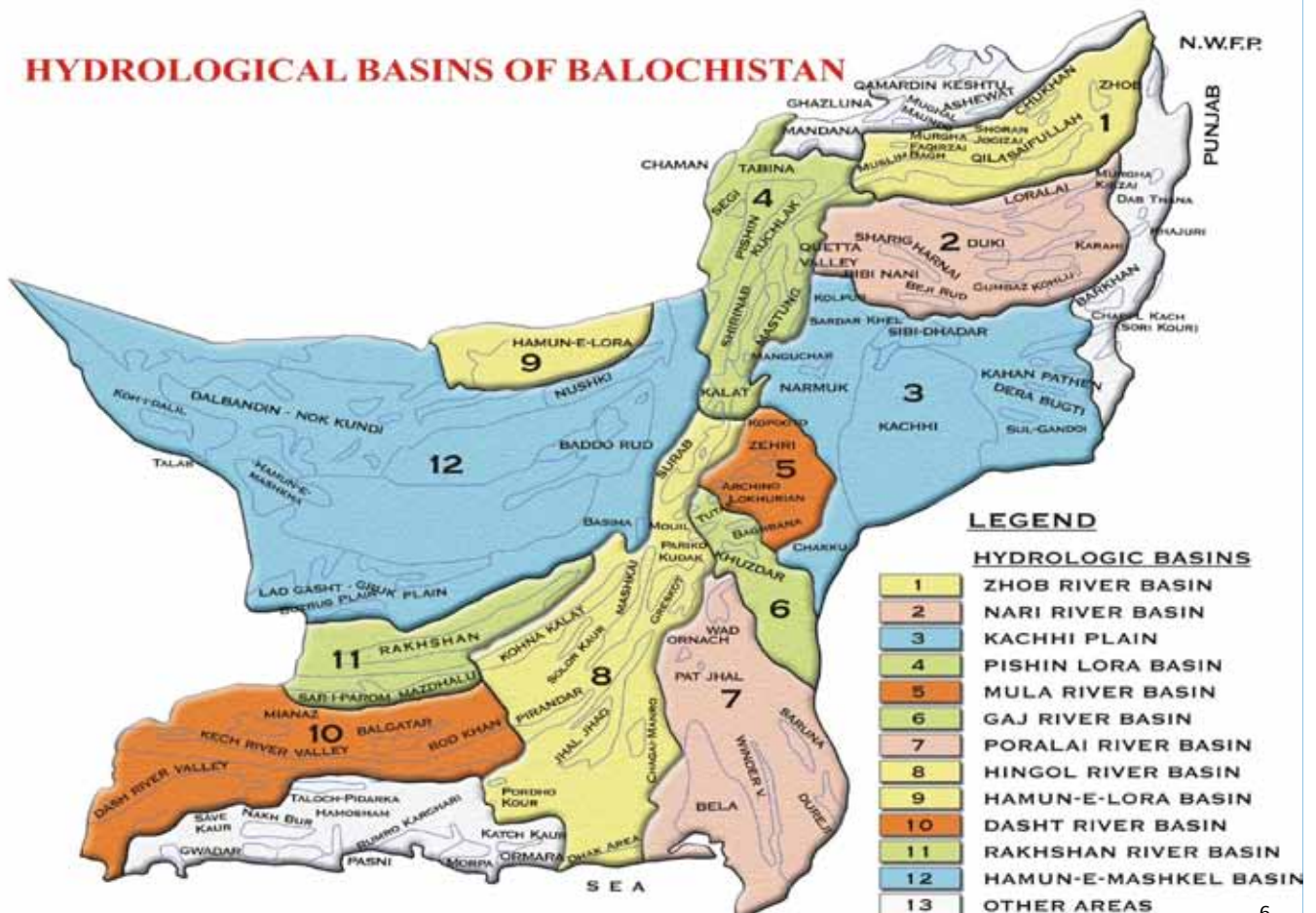
- ▶ In Balochistan, the main source of water for agriculture, Livestock and domestic use is rainfall and ground water. The rainfall is unevenly distributed with high degree of variation and the choice mostly left is to use ground-water resources. *Tube well*



Same source of water for humans and animals.



## HYDROLOGICAL BASINS OF BALOCHISTAN



## BASIC FACTS ABOUT BALOCHISTAN

- ▶ **Area:** **347,190 (sq. km)**  
(about 44% of Pakistan)
- ▶ **Population:** **12.34 million (2017)**
- ▶ **Population using safe water:**  
**Out of total population**  
**72% has access to an**  
**Improved Water Source.**

## BASIC FACTS ABOUT BALOCHISTAN

- ▶ **Climate** : The climate of the upper highlands is characterized by very cold winters and warm summers. Average annual precipitation in Balochistan varies from 2 to 20 inches (50 to 500 mm). Maximum precipitation falls in the northeastern areas with annual average rain fall ranging from 8 to 20 inches (200 to 500 mm).

# **WATER SUPPLY SERVICES IN BALOCHISTAN**

## **► Responsibility:**

**the planning & Development Department aims for better Planning and Monitoring of feasible and sustainable projects including to expand water supply resources in reach of every individual of Balochistan through the Public Health Engineering Department and Water & Sanitation Authority**



## **A VIEW OF COMPLETE WATER SUPPLY PROJECT**




# AGRICULTURE WITH GROUNDWATER




## SUCCESS STORIES OF WATER SUPPLY SERVICES

- ▶ **the government is installing water filtration / reverse osmoses plants for safe and hygienic water throughout the province and more than 500 filtration plants have been installed throughout the province to ensure supply of safe drinking water to the population of Balochistan.**
- ▶ **for the same purpose Water quality labs are also established in most of the areas.**
- ▶ **More than 1200 water supply schemes are functional throughout the province.**

## **SUCCESS STORIES OF WATER SUPPLY SERVICES**

- ▶ **450 small dams have been constructed in Balochistan while about 200 small and medium dams are under construction to increase the water table of Balochistan.**
  - ▶ **“Mangi Dam Project” is under construction while feasibility study will be soon completed for “Babar Kach Dam” from where water will be supplied to Quetta, the capital city Balochistan. Hopefully after completion of these two dams the water problem of Quetta city will be solved.**
- 

## **RECENT CALLENGES TO IMPROVE THE WATER SUPPLY SERVICES**

- ▶ **Due to increasing population, low rainfall and the prevailing drought has affected the groundwater reservoirs drastically causing a situation of groundwater mining and disturbing the equilibrium between the recharge and discharge. The over exploitation of this vital source has become a threat to the province. The groundwater is depleting every year, in some places even with one meter per year.**
- 

# WATER TABLE ON DECLINE



## RECENT CHALLENGES TO IMPROVE THE WATER SUPPLY SERVICES

- ▶ **The influx of Afghan Refugees has also increased the water demand.**



## **RECENT CALLENGES TO IMPROVE THE WATER SUPPLY SERVICES**

- ▶ **Water is being distributed in the localities without any scientific technique, the non replacement of corroded pipes has caused further shortage and rust pipes have caused health problem for vast majority of the inhabitants as receiving contaminated water for drinking because of the failure in the system.**



## **RECENT CALLENGES TO IMPROVE THE WATER SUPPLY SERVICES**




## RECENT CALLENGES TO IMPROVE THE WATER SUPPLY SERVICES

- ▶ **Balochistan has about 771 kms long coastline and Gwadar, the port city's Considered to be the backbone of the China-Pakistan Economic Corridor (CPEC), has been in the grip of a water crisis over the last several years. The major source of water in Gwadar is rainwater, collected and stored in the Akra Kaur dam which is not enough to serve the needs of the current population of the district. Sometimes, due to long drought spells, the reservoir dries up. There is no other source of drinking water for the general people than the Akra Kaur dam. Therefore in port city huge investment is required for more dams to harvest rain water and installation of desalination plants.**

### GWADAR CITY, PORT & AKRA KAUR DAM



# **SOLUTION**

- ▶ **For availability of water Balochistan requires construction of more dams and reservoirs along with desalination plants in coastal areas.**
  - ▶ **Rusted and corrode pipelines need to be replaced to minimize waste of water.**
  - ▶ **There should be a proper and permanent Directorate within the Irrigation Department to monitor the underground water level and quality.**
  - ▶ **Mass awareness campaign should be made through electronic and print media for controlling waste of water in households.**
- 



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PERU



# Water Supply Administration for Better Management of Water Supply Services

## Inception Report Presentation

- 
- 1. Country: Perú
  - 2. Position: Water Supply and Sanitation Specialist
  - 3. Company: SEDAPAL

### 1. Outline of Water Supply Services of your Organization

- ✿ SEDAPAL S.A. (Servicio de Agua Potable y Alcantarillado de Lima) is a Peruvian state-owned water utility providing water and sewerage services to Lima and Callao. The company's water network system comprises 19 regulated lake schemes, 03 dams, 03 potable water treatment plants (La Atarjea, Chillón and Huachipa), in addition to 367 underground wells. Its water distribution network spans 14,115 km and supplies drinking water for 1.5 million water connections. WTP La Atarjea (main) was built in 1956.

#### Whole Country:

Area : 1 285 216 km<sup>2</sup>

Population : 31 488 625 inhabitants

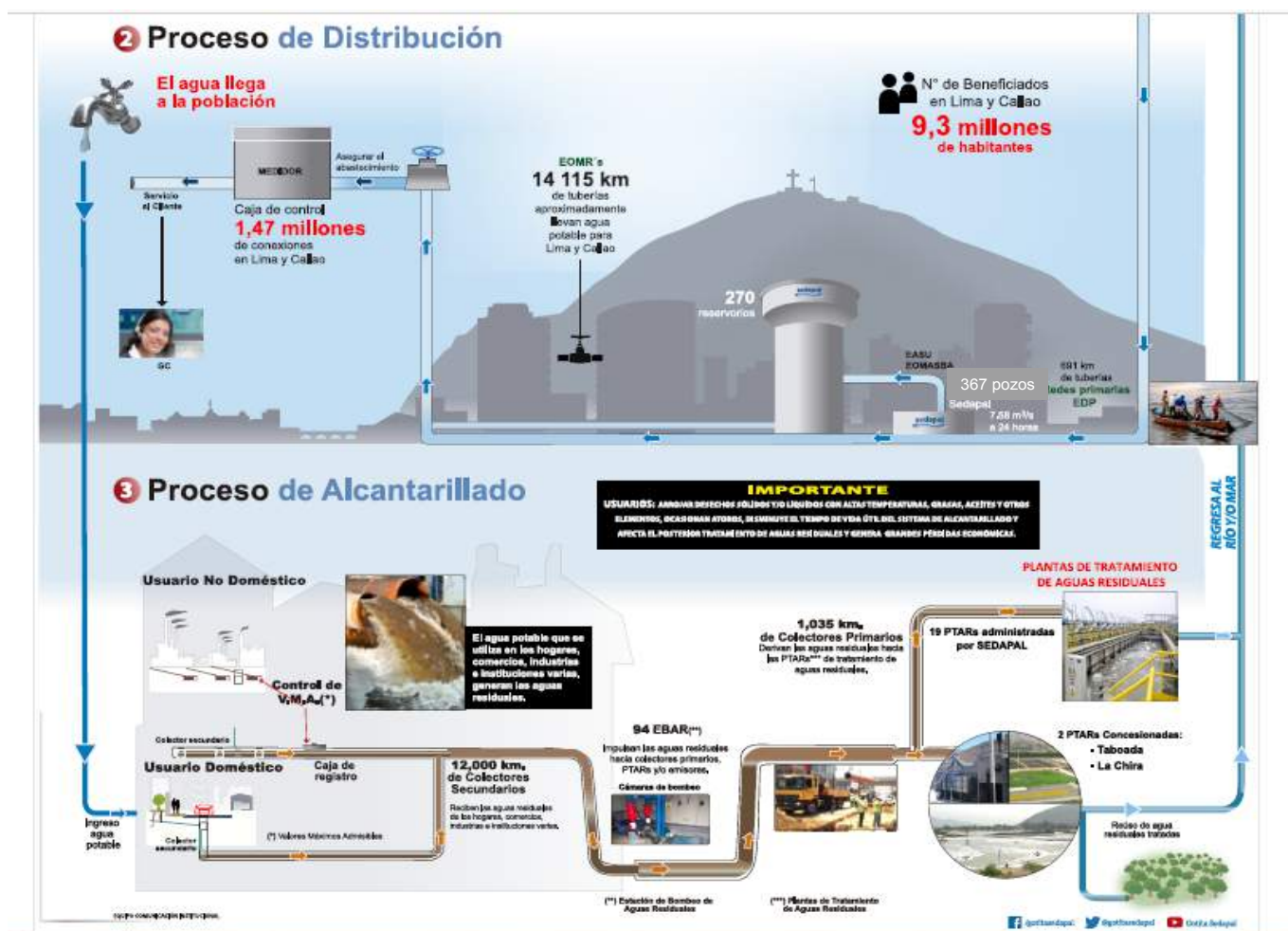
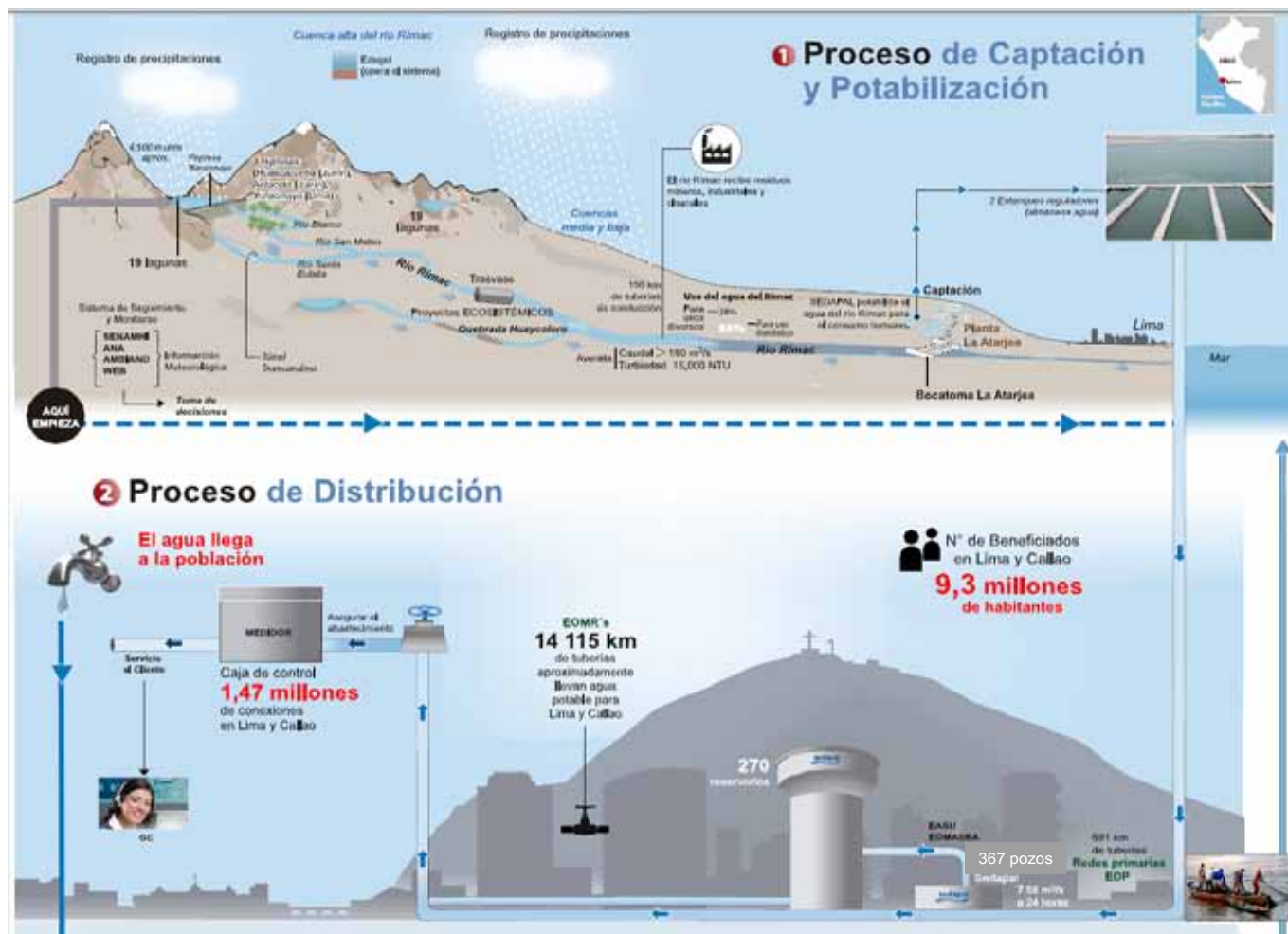
Proportion of population using safely managed drinking water services : 85.7 %

#### Your Water Supply System/City:

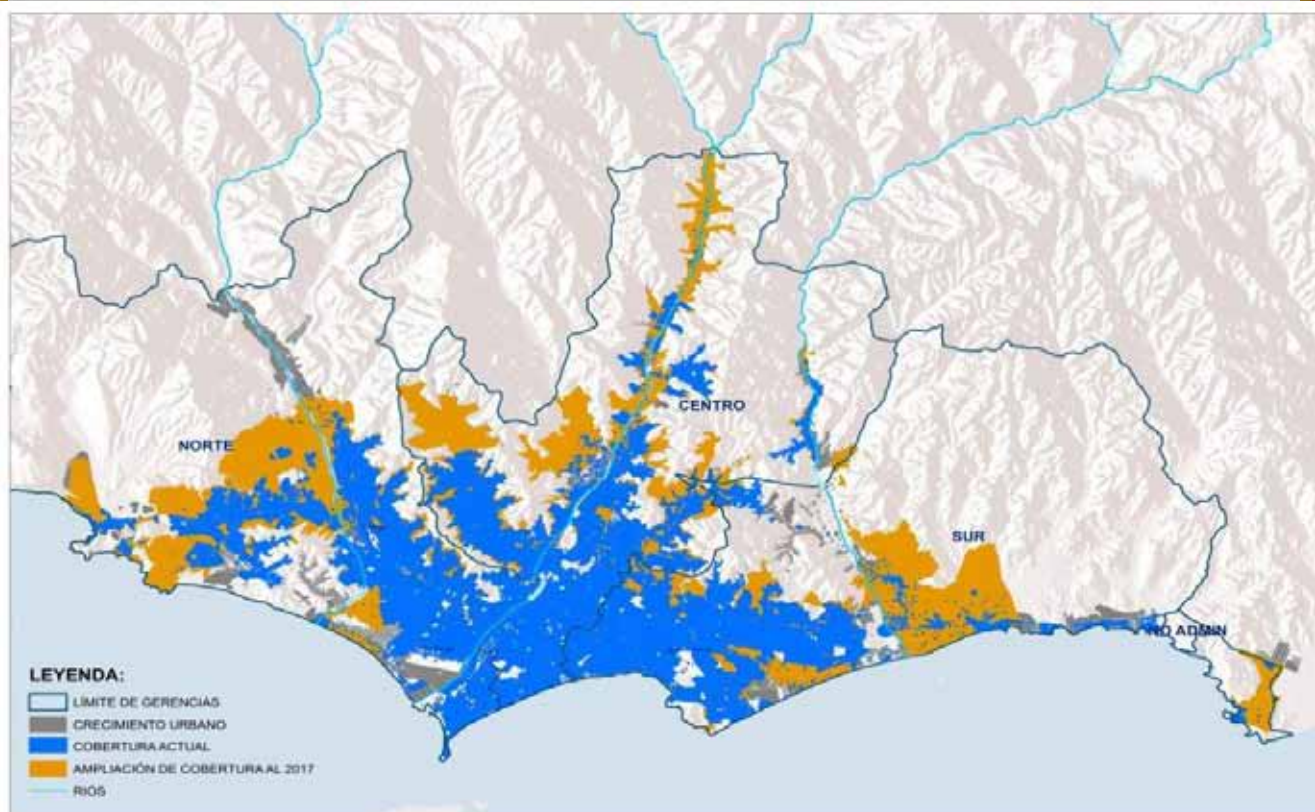
Service Area : 2 672 km<sup>2</sup>

Population Served: 9.3 million inhabitants





# Urban and service area development



## 1. Outline of Water Supply Services of your Organization

INDICATORS	2007	2017	Goals for 2025
<b>Staff/1,000 connections</b>	1.86	1.68	1.79
<b>Production capacity (m3/day)</b>	1,783,014	1,958,082	2,094,205
<b>Water quality</b>	WHO Guidelines	WHO Guidelines	WHO Guidelines
<b>Coverage area</b>	90.7%	93.5%	100%
<b>Supply duration (hr/day)</b>	21.23	21.7	24
<b>Supply pressure</b>	0.96 bar	2.3 bar	2.5 bars
<b>Number of connections</b>	1,194,879	1,473,743	1,685,880
<b>NRW</b>	36.99%	27.5%	25% (2020) 20% (2025)
<b>Staff number</b>	2,217	2,464	2,635



## 2. Success Story of your Water Supply Services

- SEDAPAL - The Drinking Water and Sewerage Service for Lima, is a regulated natural monopoly that provides a service of first necessity to the population of Lima and Callao.
- SEDAPAL is the single water utility authorized to operate in the territory of Lima and Callao, which holds 30% of the national population.
- SEDAPAL is supported by the Peruvian Government (its sole and main shareholder) given the strategic importance of the water sector and specific national policies.
- SEDAPAL has good operational performance, improvement in indicators, adequate access to internal and external funding sources under flexible and competitive conditions.
- PPP is always welcome in SEDAPAL. Already four (04) private companies operating infrastructure for SEDAPAL



## 3. Recent Challenges to Improvement of Water Supply Services

- Need for investments in storage, treatment of surface and residual water, to meet the demand of the growing population of Lima and Callao.
- The explicit aim of the Government to achieve 100% water coverage for Lima and Callao.
- Growing interest of the Private Sector in investing in sanitation works.
- Extension of the scope of operation of SEDAPAL (under geographical connectivity), by request and terms of the MVCS.
- Gain more support of the MVCS in financing projects aiming coverage expansion for the water service and sewerage services.



# Water Supply Administration for Better Management of Water Supply Services

1. Country: Perú
2. Position: Special Projects Engineer
3. Company: SEDAPAL



## 1. Outline of Water Supply Services of your Organization

- SEDAPAL S.A. (Servicio de Agua Potable y Alcantarillado de Lima) is a enterprise which provides water supply and sewerage to Lima and Callao. The system of water is supplied for 03 water treatment plants. It has 367 underground wells.

### My Country Peru

Area : 1 285 216 km<sup>2</sup>  
Population : 31 488 625 of people  
85.7 % of population have drinking water services

### Water Supply System of Lima:

Service Area : 2 672 km<sup>2</sup>  
Population Served: 9.3 million of people



## 1. Outline of Water Supply Services of your Organization

INDICATORS	2007	2017	Goals for 2025
Staff/1,000 connections	1.86	1.68	N.A.
Production capacity (m3/day)	1,783,014	1,958,082	N.A.
Water quality	WHO Guidelines	WHO Guidelines	WHO Guidelines
Coverage area	90.7%	93.5%	100%
Supply duration (hr/day)	21.23	21.7	24
Supply pressure	0.96 bar	2.3 bar	2.5 bar
Number of connections	1,194,879	1,473,743	1,685,880
NRW	36.99%	27.5%	25% (2020) 20% ? (2025)
Collection ratio	N.A.	N.A.	N.A.
Staff number	2,217	2,464	N.A.



## 2. Success Story of Water Supply Services

- SEDAPAL is supported by the Peruvian Government (its sole and main shareholder) which is given the strategic importance of the water sector and specific national policies.
- During the last 10 years, SEDAPAL has gotten decreased values of NRW from 37 to 27,5%.
- SEDAPAL is using method of desalinization of sea water as a treatment of drinking water for south part of Lima, for water supply to districts located near to the sea.



## 2. Success Story of Water Supply Services

We have two control centers:

- The SCADA for primary system automation (diameter >14").
- The SCADA for plant automation.
- It permits a supervision and remote operation through a radio or optical fiber



## 2. Success Story of Water Supply Services

- For rehabilitation SEDAPAL is using pipe bursting method (without trench) for installing pipe in north part of Lima. 40 Years of age of pipelines
- SEDAPAL is installing polyethylene material pipes to reduce the risk of displacement and collapse due to earthquake events



## 2. Success Story of Water Supply Services

### Movil Laboratories for Leakage Detection

Within its Control and Loss Reduction Program, together with the installation of home meters, SEDAPAL performs tasks to detect leaks in the distribution networks.

Each mobile laboratory is equipped with a high-sensitivity correlator. They also have implements such as point leak detectors, geophones, piping detectors, metal detectors.



## 2. Success Story of Water Supply Services

### Inspection of wells by CCTV (Video)

Since 1995, SEDAPAL is using a modern system of inspection of wells (CCTV), which consists that allows visual inspections of water wells, drill holes and monitoring wells up to 300 m deep, with diameters of 4 to 18 inches.



### 3. Recent Challenges to Improvement of Water Supply Services

- The explicit aim of the Government to achieve 100% water coverage for Lima and Callao.
- Having 100% of installation of home meters .
- Gain more support of the MVCS in financing projects aiming coverage expansion and rehabilitation of the water supply. Reduction of Non-Revenue Water in 2,5 percentage points from 2017 to 2020.



### 3. Recent Challenges to Improvement of Water Supply Services

- Having a adequate planification for building houses in lands approved by City Hall.





*Water Supply Administration*  
*For Better Management of Water Supply Services*  
*Course ( B )*

# TIMOR-LESTE





COUNTRY : REPUBLIC DEMOCRATIC OF TIMOR LESTE

POSITION : Chief of Water Production

ORGANIZATION : National Directorate of Water Supply Timor Leste



## **Ministry of Public Works, Transportation and Telecommunication Timor Leste 2017**



# Timor Leste Country Reports



The country total area of 14,874 km<sup>2</sup>

The total of population of 1.2 million people (in 2015)

Republica Democratica de Timor-Leste ( RDTL )

**Nationality:** Timorese.

**Religion:** Catholic 96 %.

**Languages:** Portuguese, Tetum (official); English, Bahasa Indonesia (working languages).

**Capital City:** Dili Country , Calling Code: **+670**

**Government:** Type: Parliamentary democracy.

**Independence:** 28 November 1975 (from Portugal).

**Restoration of independence:** 20 May 2002. (from Indonesia)

**Constitution:** March 2002.

**Natural resources:** Gold, petroleum, natural gas, manganese, marble.

**Agriculture products:** Coffee, rice, corn, cassava, sweet potatoes, soybeans, cabbage, mangoes, bananas, vanilla.

Timor-Leste/Population 1.241 million (2015)

## Outline of Presentation

### I. Outline of Water Supply Services of your Organization

- Government and Subsector governance Role
- Structure of Organisations DNSA
- Donor Environment
- Overview Water Supply Service (DNSA) Timor Leste

### II. Success Story of Water Supply Services Timor Leste

- Water Supply Service Delivery
- 4 Water treatment Plant Capacity to be treated
- CYCLES OF MANAGEMENT AND MAINTENANCE
- Monthly Total capacity
- Global Versus National Priority

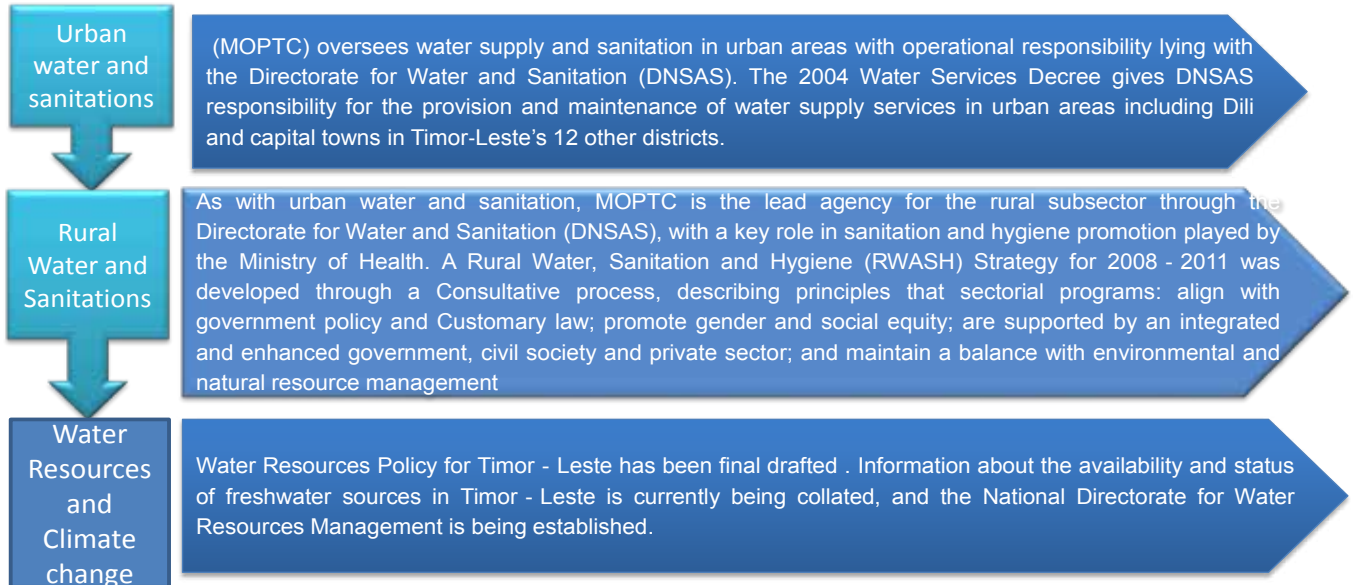
### III. Recent Challenges to Improvement of Water supply Services

- Future Challenge

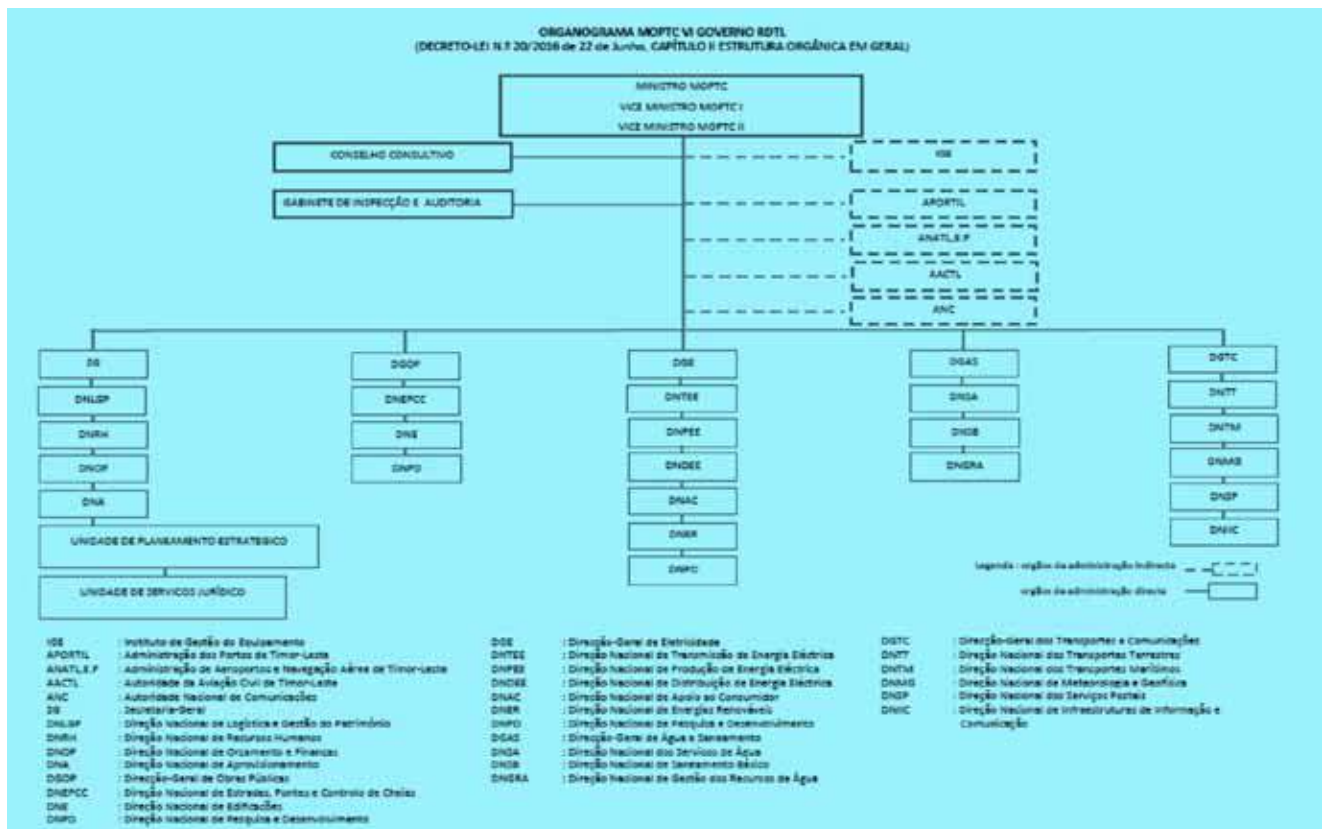
## I. Outline of Water Supply Services of your Organization

### Government and Subsector governance Role

The DNSA was established in 2002 by the government after East Timor received a full administrative system by the UN transition, at which time water supply was a very vital issue throughout Timor-Leste because the shortage of clean water was felt everywhere. The National Directorate for Water and Sanitation (DNSAS) and the National Directorate for Water Resource Management (DNGRA) and Directorate National Basic of Sanitations (DNSB) are the key technical agencies responsible for water supply and sanitation



## Structure of Organisations DNSA



# Overview Water Supply Service (DNSA) Timor Leste

Timor-Leste is on track in achieving the Millennium Development Goal (MDG-SDG 6 ) target for safe drinking water by 2015 with total increase in access to safe drinking water from 62 per cent of the total population to 69 per cent from 2005 to 2010 (55%-60% for rural water; 80%-91% for urban water). Timor-Leste Strategic Development Plan 2011 – 2020

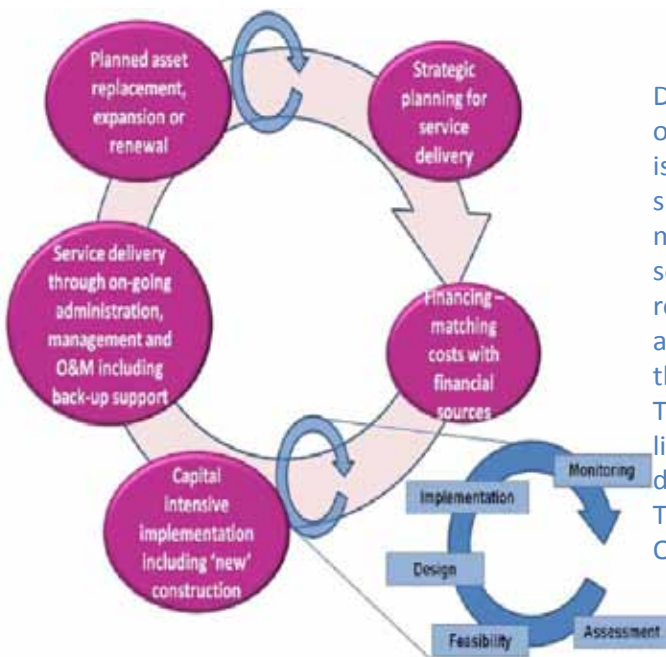
The Government Priorities for Water Supply and Sanitations that already done:

- Upgrade Water Supply in Dili, Because of increase Populations in need of clean water.
- Establish of Rural Water supply in 12 District of Timor Leste
- Maintenance of uneducated of system in 12 District because the system that we have's Indonesia time.
- Improve Water Resources sector items of Quality and Quantity
- Works closely and Train the local people to manage their own water and their facilities GMF
- Establish Water data Base; SIBS by DNSA, SIJDRI by DNGRA

The water supply sources of surface water intakes for Dili are at Bemós, Bemori, Maloa, Nahaek, Lakolo, Mutudare and Benamauk in the Guguleu-Milimanu mountain range on the south of Dili. The surface water sources are run-of-river and supply water under gravity to the four treatment plants, except the Maloa source. There are 25 groundwater supply bores within the Dili Aquifer making up about half of the Dili water supply

## II. Success Story of Water Supply Services Timor Leste

### OPERATION AND MAINTENANCE WITHIN A 'SERVICE DELIVERY APPROACH'



DNSA considers O&M within the broader concept of a service delivery approach. The reason for this is that O&M is interconnected with other areas, such as the existing institutional framework, management, accountability, technical quality, social dynamics, financial management, human resources and skills in the sector. To consider O&M as a solely technical function and in isolation of these would risk proposing unrealistic solutions. This is in line with international thinking and recent literature that advocates a focus on a 'service delivery approach' (Lockwood and Smits, 2011). This approach considers the system as a whole, and O&M as one function in this whole (see Figure 1)

# Water Supply Service Delivery

A service delivery approach recognises three discrete levels: (i) the national or state level enabling environment (ii) service authority functions, often carried out by local government or devolved levels of national agencies; (iii) service provider, who performs the day-to-day management of a water system (see Figure 2).



## CYCLES OF MANAGEMENT AND MAINTENANCE

The operation and maintenance is part of a wider system of management and service provision to an expected service level. In many cases in Timor-Leste, systems are caught in a vicious cycle, and the challenge is to shift this dynamic to a virtuous cycle of sustainable service provision.



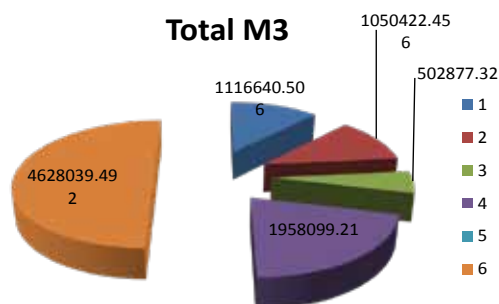
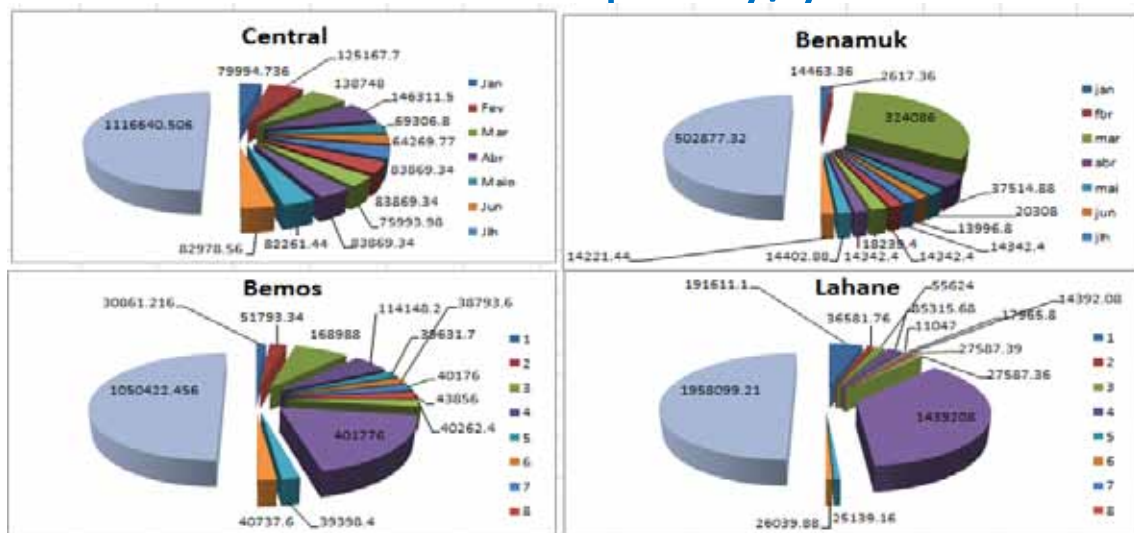
## 4 Water treatment Plant Capacity in Dili

No	Water treatment Plant	Capacitas Rezervoer. m3	Capacity treatment m3/ day	Capacity treatment m3/Hour	Capacity treatment m3/ menit	Capacity treatment m3/Sec	Capacity treatment l/s	Head
1	WTP. Central	3000	Q= 6.600 m3/day	System 275.00	System 4.584	System 0.0764	system 76 l/s	H = 239 mm
2	WTP. Bemos	1500	Q= 2.000 m3/day	System 83.34	System 1.389	System 0.0232	Capacity 23 l/s	H= 148 mm
3	WTP. Lahane	800	Q= 2.600 m3/day	System 108.34	System 1.806	System 0.0301	Capacity 30 l/s	H= 217 mm
4	WTP. Benamuk	400	Q= 600 m3/day	System 25.00	System 0.417	System 0.0070	Capacity 10 l/s	H= 91 mm

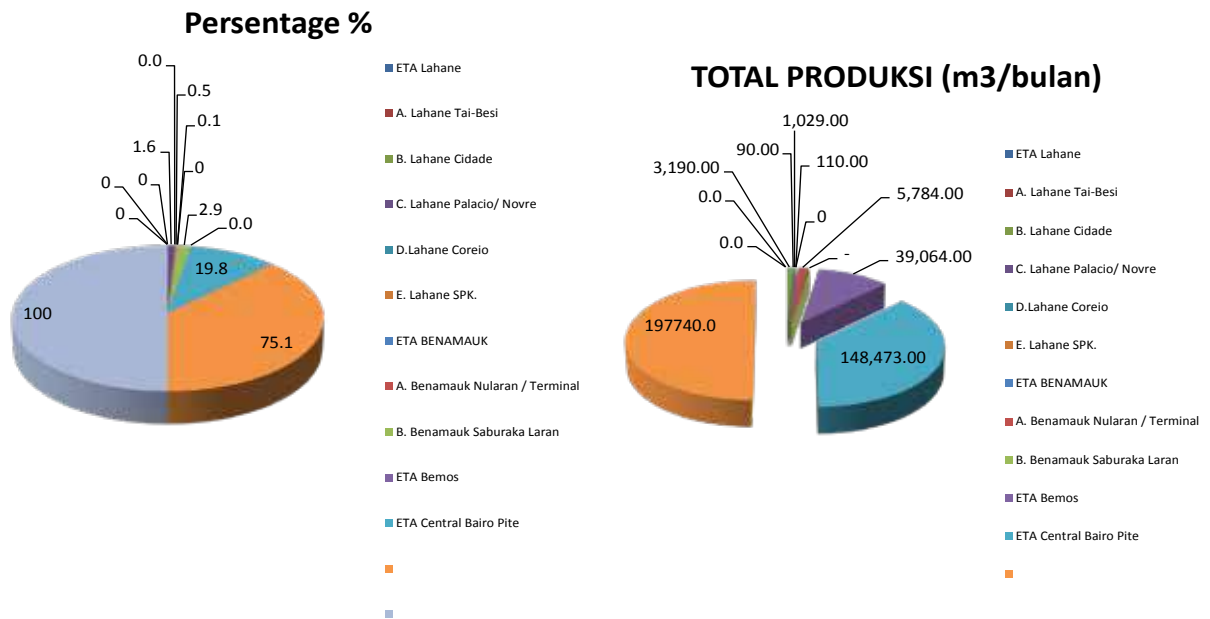
Dili,13-10-2016

Source section of Production

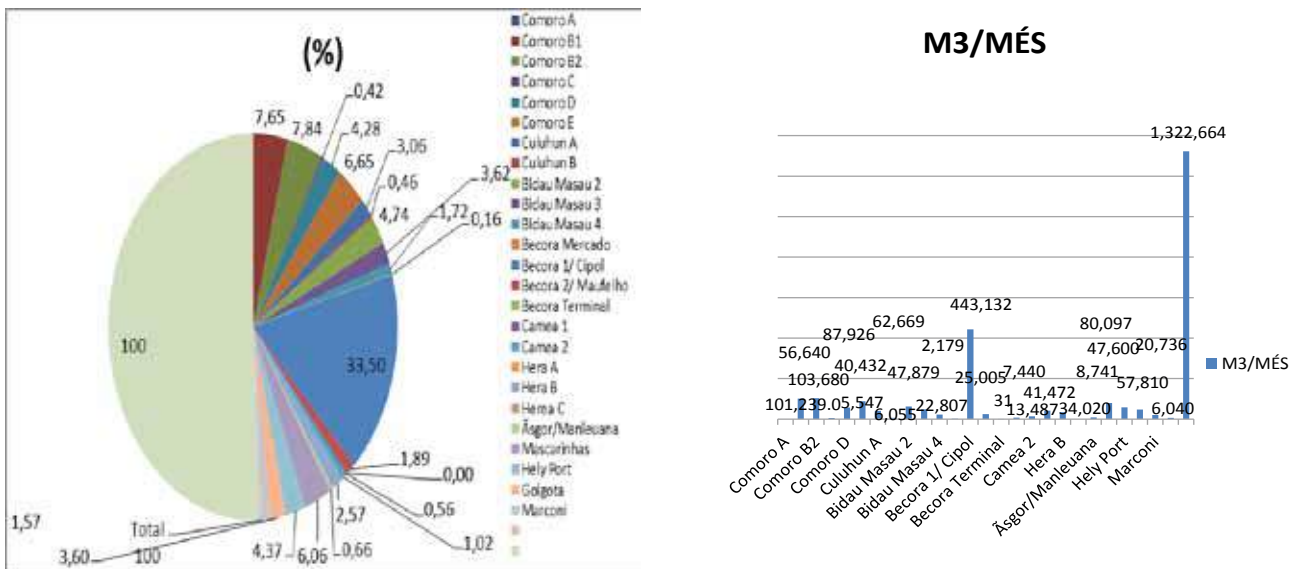
## 4 WTP Total capacity/years



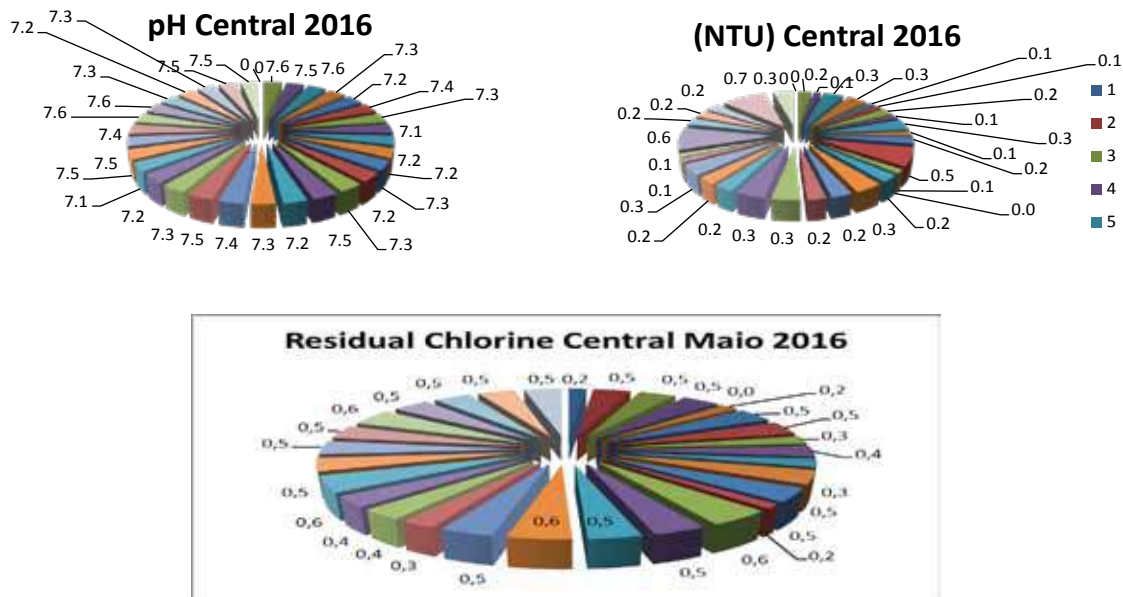
## 4 WTP total Production/Month



## Total Production of Borhole/Month



# Water Quality



## III. Recent Challenges to Improvement of Water supply Services

The situated of water supply in Dili, currently 25 water supply bores located in the Dili aquifer around the Comoro River and Becora River. These currently supply about half of the daily water and could be significantly upgraded without impacting on the freshwater/saltwater interface at the sea. It is suggested that an additional nine bores could be constructed around the Comoro River to act as standby sources of water during drought conditions. The locations will be dictated by the availability of government land, a minimum separation distance of 400 metres from other bores and from the sea and pipeline and power line considerations. Preliminary drilling sites are shown in Figure 7. WATER SUPPLY OPTIONS

Method	Potential Supply	Cost (\$1,000)	Advantages	Disadvantages	Technical Feasibility	Timing	Cultural Acceptance	Ecosystem Impact
Leak Detection and Repair	200 l/s	\$200	Recover lost water	Ongoing	Very Difficult	1-2 years	Conflict Illegal connections	Minor
Comoro River Dam	500+ l/s	\$20,000	Storage	Technical Problems	Very Difficult	6-10 years	Relocation, failure risk	Major
Waterfall Capture	50 - 100 l/s	\$20,000	Simple intake	Pipeline Risks	Difficult Pipeline	2 years	Traditional ownership	Reduction in baseflow
Comoro River Infiltration Gallery*	200 l/s	\$4,000	Only Chlorination	Flood damage	Simple	2 years	Acceptable	Reduction in baseflow
Groundwater Bores*	200 l/s	\$3,000	Direct Injection	High OPEX	Simple	2 years	Land ownership issues	None

Note: \* only chlorination required

The leak detection and repair in itself is a well documented process but it must be carried out in conjunction with all the other “technical” aspects (management systems, O&M systems, billing systems etc) that need to be in place before a leak detection programme can yield the potential supply improvement

The Common functionality problems viewed in Maliana and Atabae (Top left: unused water point due to solar pump failure, Top right: rusting pipe joint, Bottom left: mainline pipe leakage, Bottom right: leakage at intake)



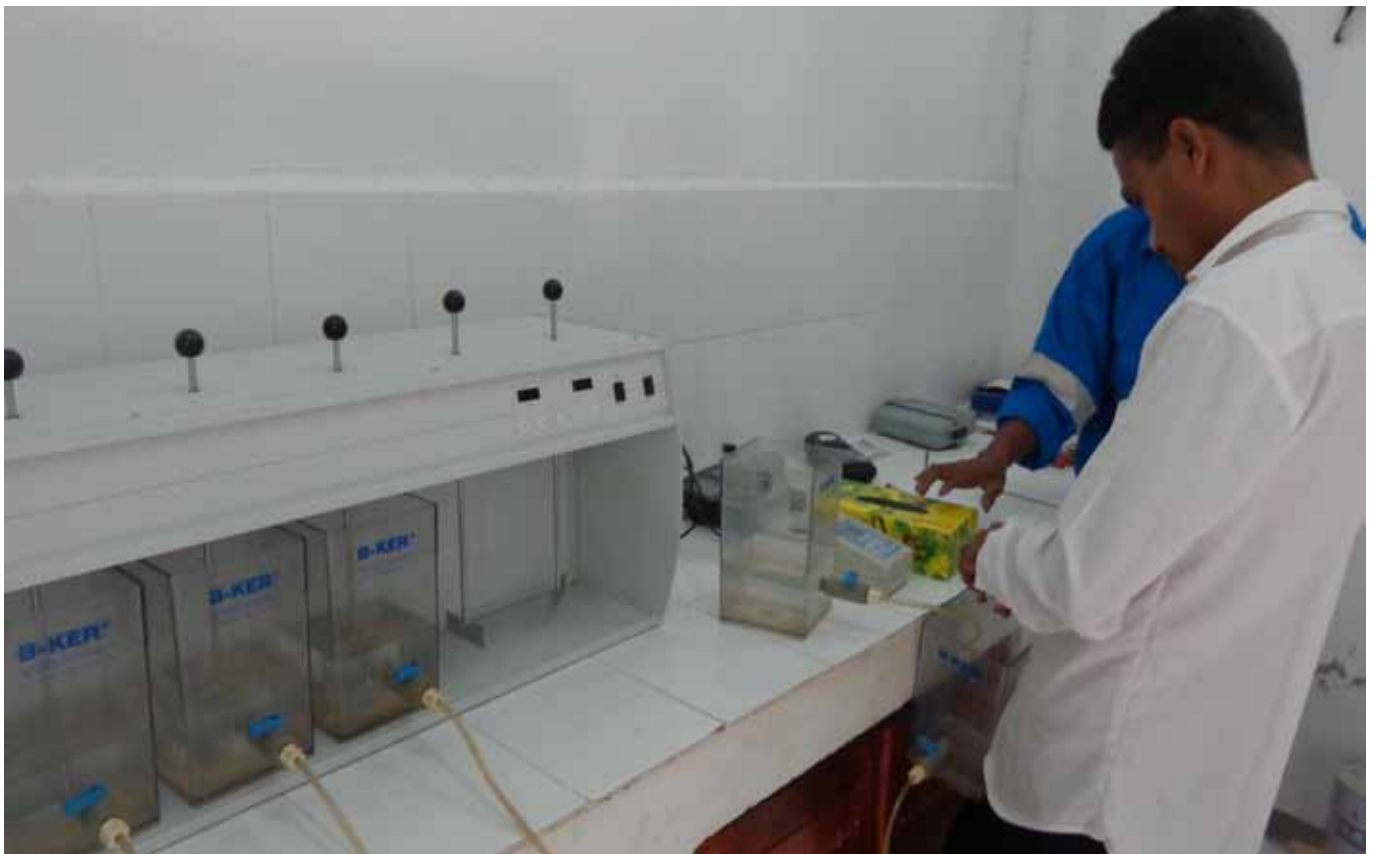
# Future Challenge

1. Upgrade water quality
2. Maintenance of Water supply system
3. Costumer services for better services
4. Improve Water treatment system
5. Capacity building

## Documentation

- Installation procedure
- Assembly and disassembly method
- Start up procedure
- Operation instruction
- Detailed design, Calculation sheet
- Drawings
- Components, parts, materials, quantities
- Maintenance instruction
- Lubricant list, Spare part list
- Recommendation / Pros and Cons
- Troubleshooting
- Etc.

THANK YOU  
OBRIGADO



# WTP Central







# WTP Benamuk













Japan International Corporation of Welfare Services (JICWELS) was established with the sanction of the Minister for Health, Labour and Welfare in July 1983 and implements international technical cooperation programmes with purpose of contributing to the promotion of health and social welfare activities in the friendly nations.

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公益社団法人国際厚生事業団（JICWELS）は、国際的な保健・福祉分野の国際協力に貢献することを目的として、1983 年（昭和 58 年）7 月 7 日に厚生省（現厚生労働省）から社団法人の認可を受け設立されました。開発途上国の行政官研修や WHO フェローの受入れ、調査企画や研究開発並びに情報の交換及び広報活動など、海外諸国との国際交流活動を推進しています。



〒105-0001

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