

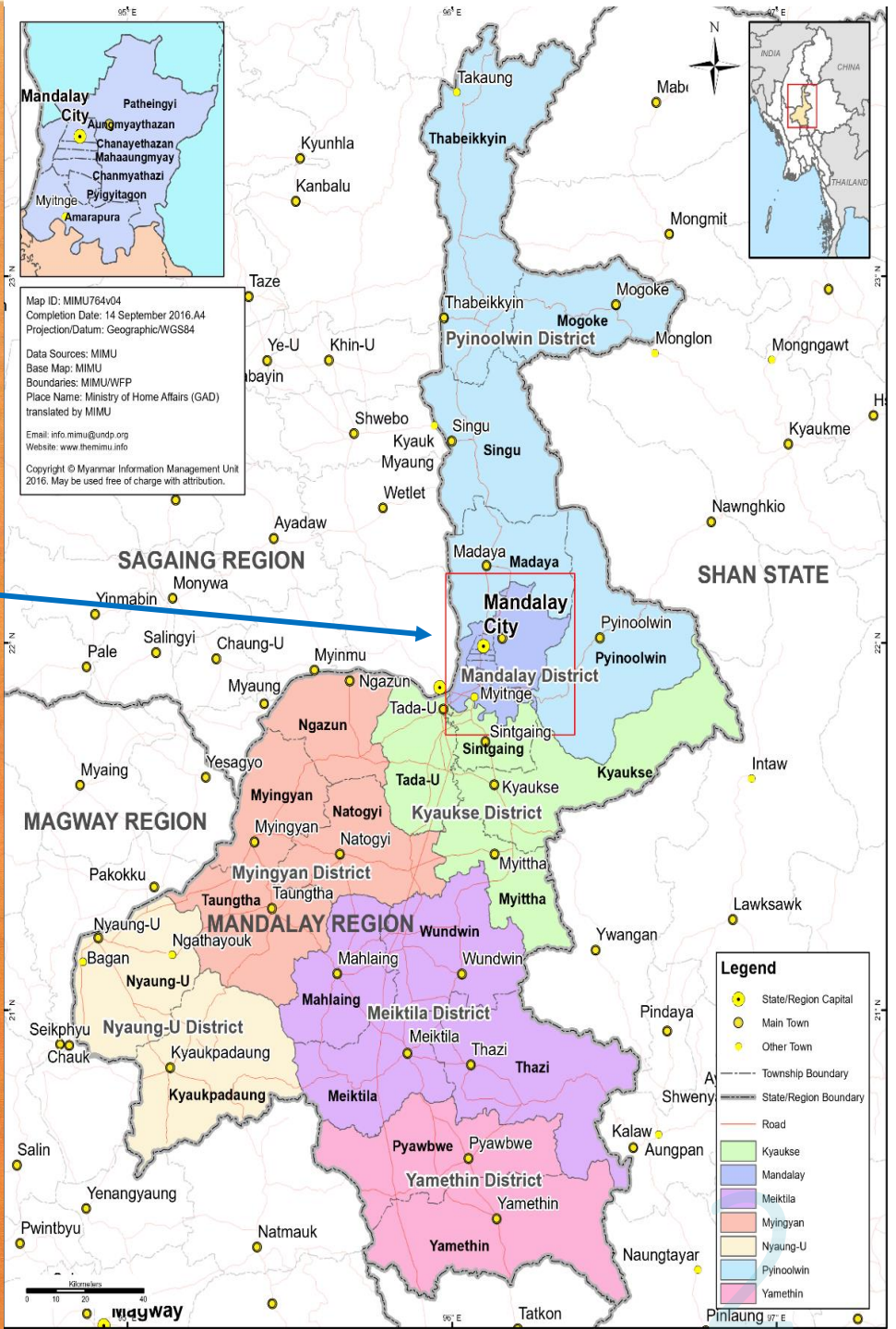
Current Status of Water Supply and Wastewater Management in Mandalay City

July, 2018

7/9/2018

Mr.Khin Maung Thin
Head of Water Distribution Branch
(Water and Sanitation Department)

UNION OF MYANMAR



Mandalay Region & Mandalay City Profile



Population - 1.46 million

Area - 314.76 km²

Annual Average Rainfall - 956 mm(40in)

Annual Average Relative Humidity- 66%



Mandalay City Development Committee



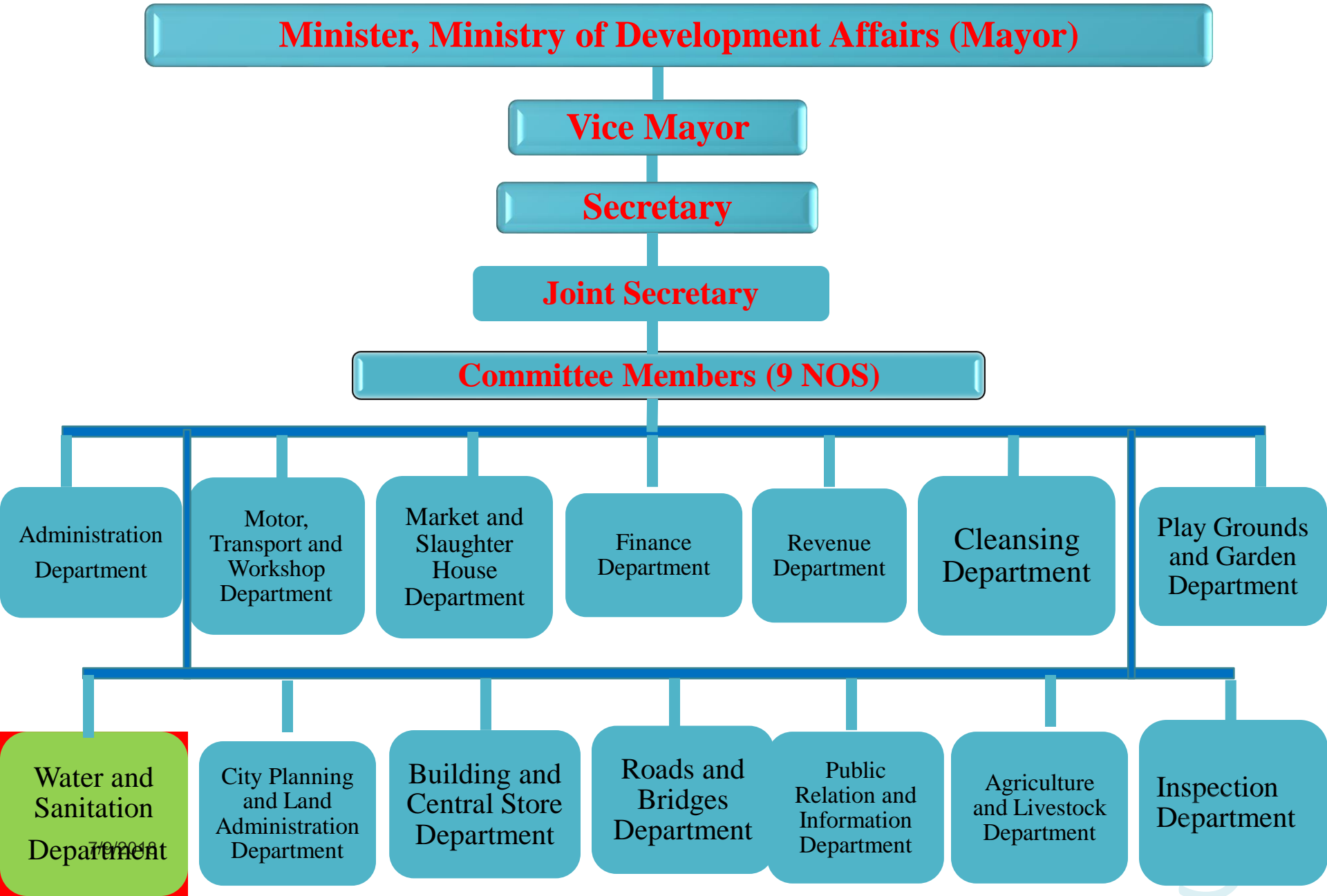
Our Missions

To keep the City clean

To make the City beautiful

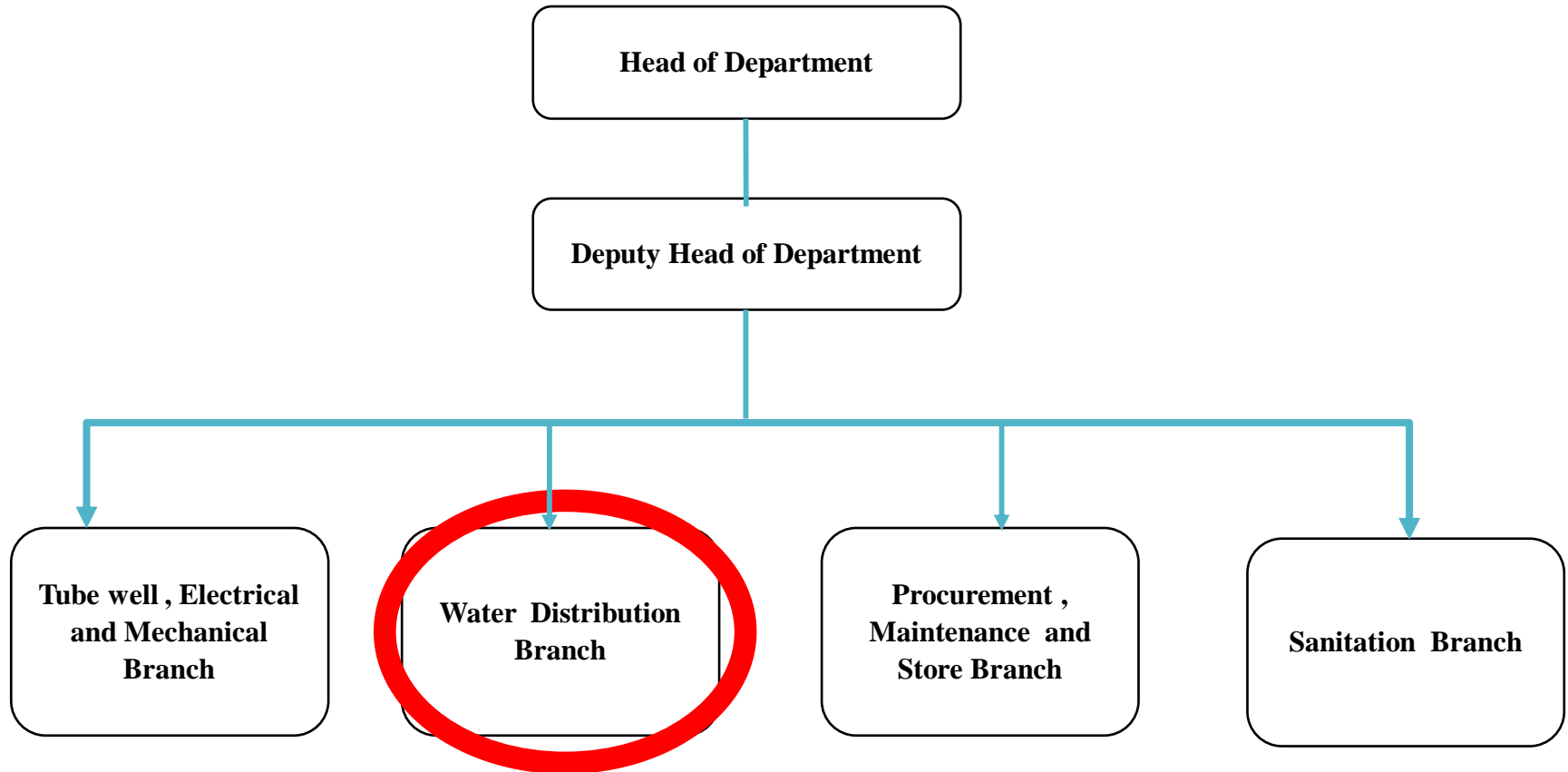
**To enable the City dwellers to enjoy
the pleasant life**

The Organizational setup of Mandalay City Development Committee



Organization Chart

Water and Sanitation Department



Content

1. Current Water Supply Situation

2. Current Wastewater Management Situation

3. On going Water Supply & Wastewater Projects

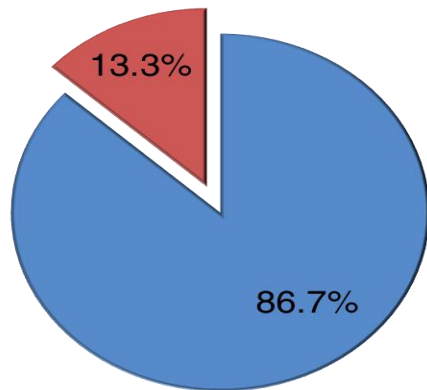
Location of Water Distribution Network

- ❖ Water Resource
 - Ground Water & Surface Water
 - Ground Water - 86.7%
 - Surface Water - 13.3%

- ❖ Transmission Pipe line - 11.2 Km
(250 mm-900mm)

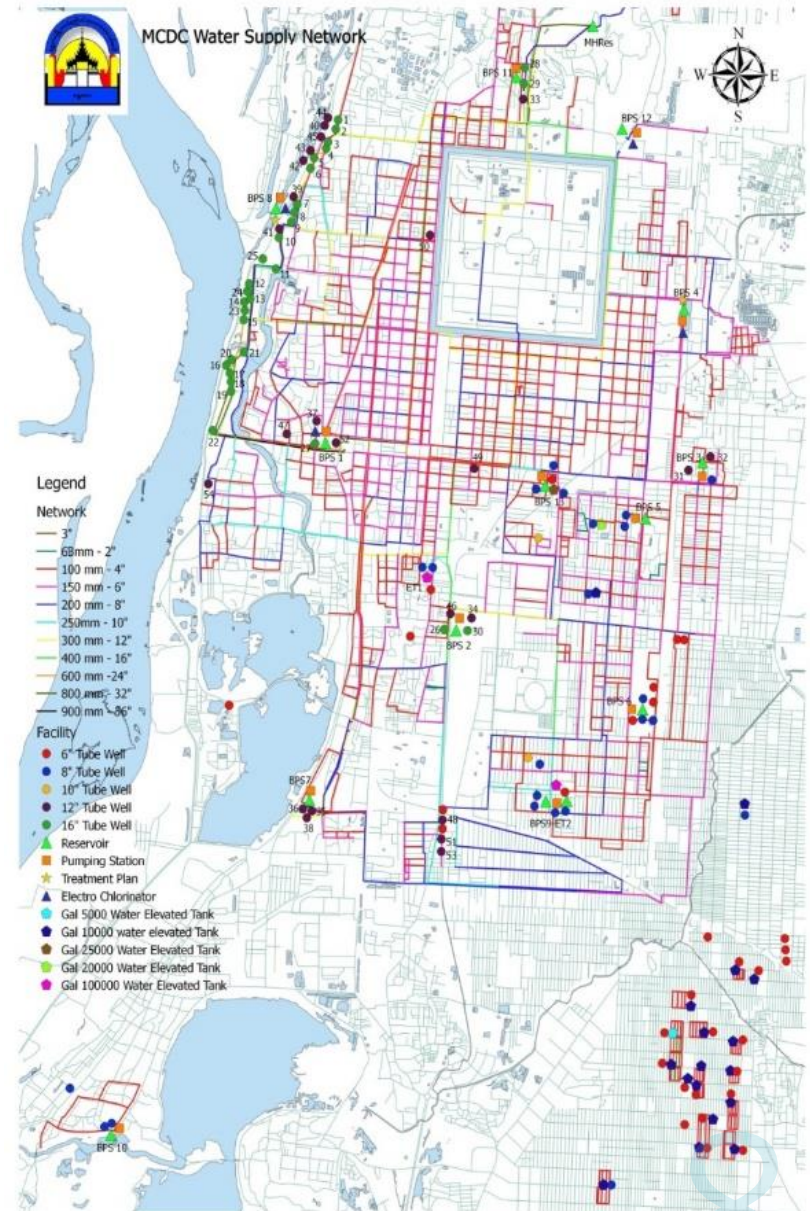
- ❖ Distribution of Pipe line - 111.67 Km
(200mm-300mm)

- ❖ Internal Network Pipe line- 252.26 Km
(100mm-150mm)



■ Ground Water
■ Surface Water

7/9/2018



Mandalay's Water Resources

```
graph TD; A[Mandalay's Water Resources] --> B[Surface Water]; A --> C[Ground Water];
```

Surface Water

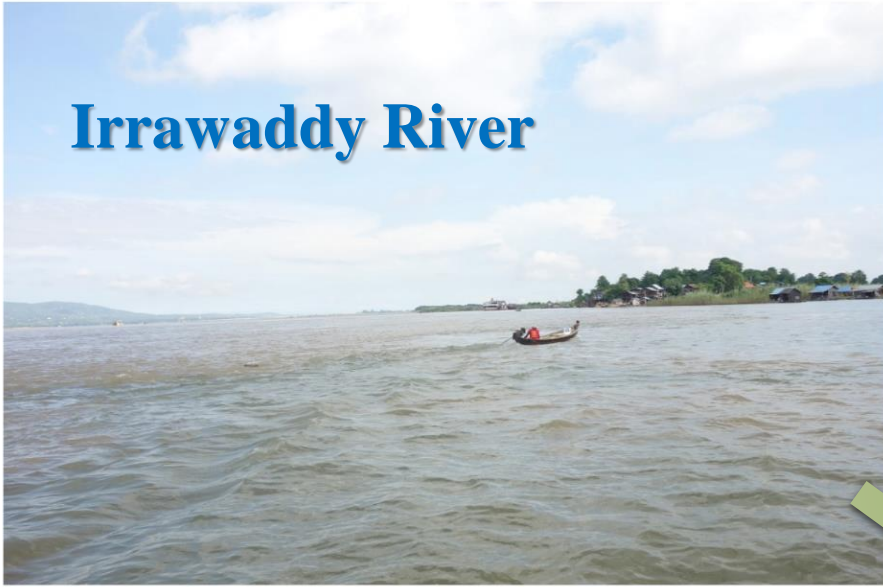
- Irrawady River
- Doke Hta Waddy River
- Sedawgyi Dam
- Taung Tha Man Lake
- Kan Taw Gyi Lake

Ground Water

- Production tube wells for city water supply system
- Private tube wells

River Bodies Near Mandalay

Irrawaddy River



**Doke Hta Waddy
(or) Myitnge River**



Prominent Lakes in Mandalay



KanDawGyi Lake



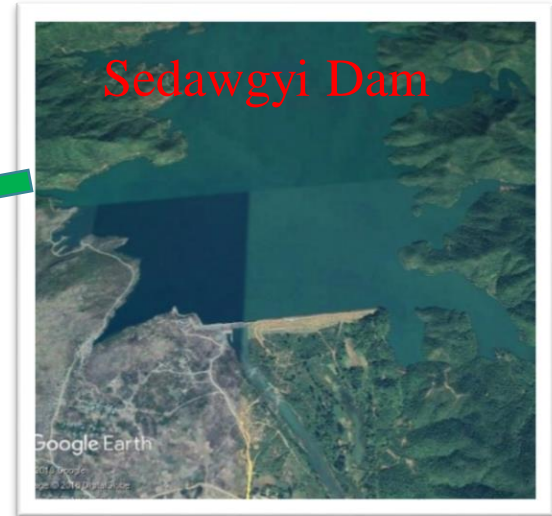
TaungTaMan Lake



Prominent Dams Near Mandalay



7/9/2018



Water Quality Monitoring



Monthly monitoring the water quality of -

1. Irrawaddy River
2. Doke Hta Waddy River
3. Moat
4. Kan Taw Kyi Lake
5. Taung Ta Man Lake



7/9/2018

Surface Water Quality Monitoring Data

Sr. No	PARAMETER	Ayeyarwaddy River	Doke Hta Waddy River	Sedaw Gyi Dam
1	PH (Scale)	6.8	7.1	6.8
2	Color (Units)	>50	30	>50
3	Turbidity (N.T.U)	90.3	3.5	27.4
4	Conductivity (micromhos/cm)	80	320	170
5	Calcium as Ca (mg/l)	8	64	16
6	Hardness, Total (CaCO₃) (mg/l)	40	200	60
7	Magnesium as Mg (mg/l)	5	10	5
8	Chloride as Cl (mg/l)	8	8	8
9	Total Alkalinity (CaCO₃) (mg/l)	56	188	80
10	Iron, Total (Fe) (mg/l)	>0.2	0.04	>0.2
11	Manganese (Mn) (mg/l)	0.03	0.03	0.03
12	Sulphate (SO₄) (mg/l)	<200	<200	<200

Ground Water Resources and Modelling in Mandalay City

Zone - 1

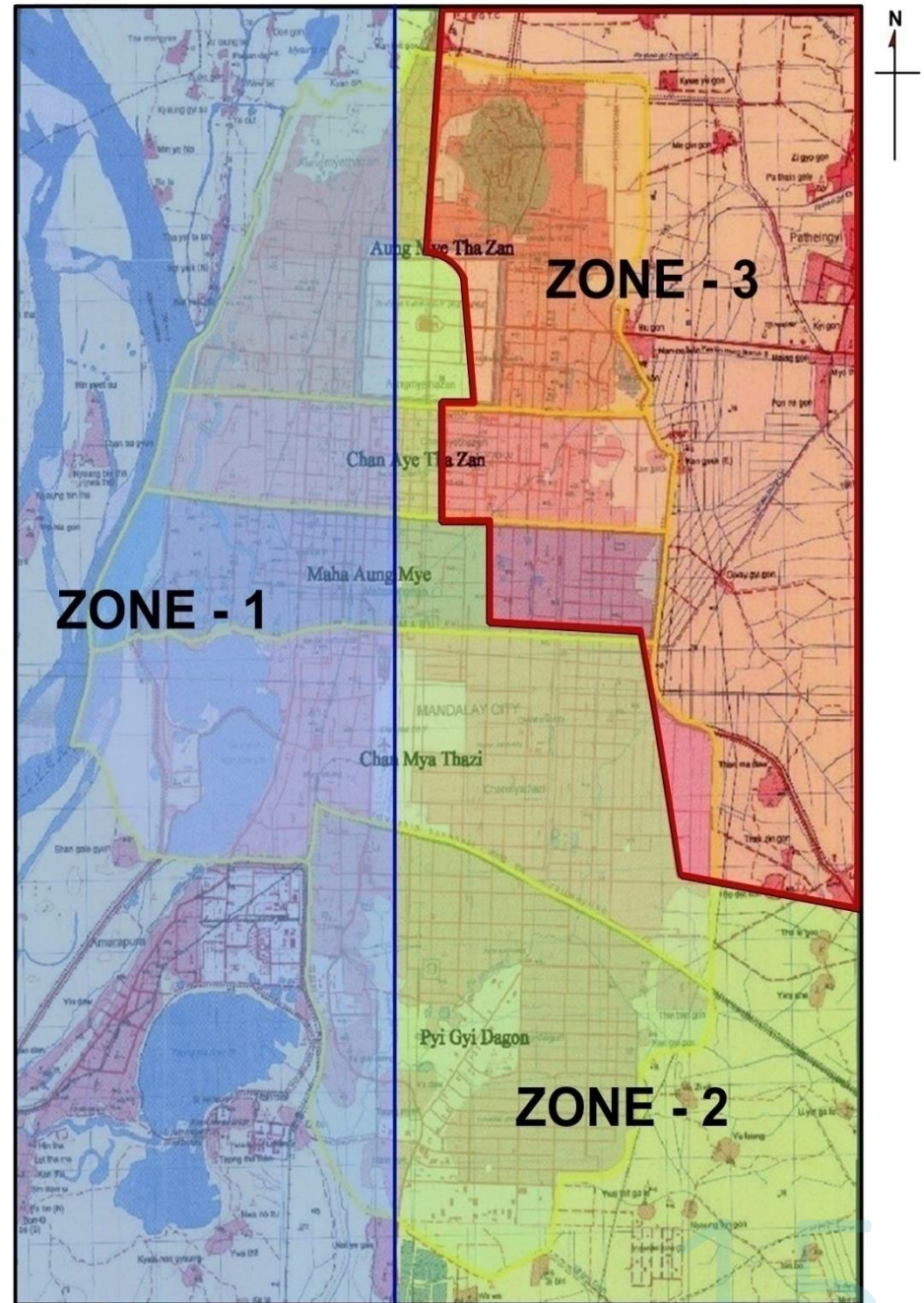
- Best Well Field Area

Zone - 2

- Moderate Well Field Area

Zone - 3

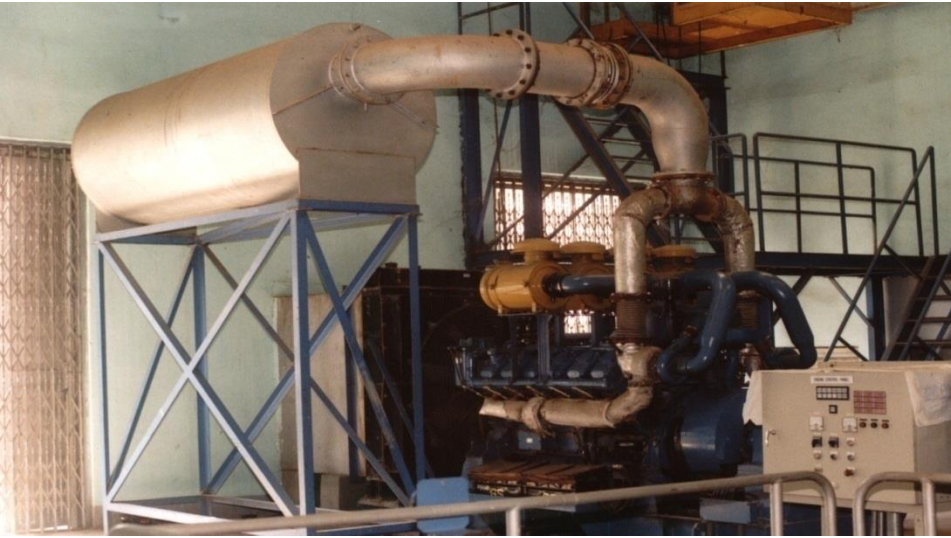
- Poor Well Field Area



Water Quality Monitoring Data For Ground Water Resources

Sr. No	PARAMETER	DugWell (15M)	Shallow Well (25-40M)	Deep Well		
				(100-120M) AQ1	(150M) AQ2	(300M) AQ3
1	pH (Scale)	8	7.5	7.6	7.5	7.1
2	Color (Units)	5	5	5	5	5
3	Turbidity (N.T.U)	4.75	5.30	5.10	5.1	5.1
4	Conductivity (micromhos/cm)	720	519	703	390	336
5	Calcium as Ca (mg/l)	120	24	80	32	8
6	Hardness, Total (CaCO₃) (mg/l)	480	100	340	100	24
7	Magnesium as Mg (mg/l)	44	10	44	5	1
8	Chloride as Cl (mg/l)	60	8	60	8	15
9	Total Alkalinity (CaCO₃) (mg/l)	500	288	320	220	188
10	Iron, Total (Fe) (mg/l)	0.01	0.01	0.01	0.01	0.01
11	Manganese (Mn) (mg/l)	0.01	0.01	0.01	0.01	0.01
12	Sulphate (SO₄) (mg/l)	<300	<200	<200	<200	<200

Nos of Booster Pumping Station – (14)nos



662KW Diesel Engine – 1 unit



Control Panel Room Booster Pumping
Station No.(1)
7/9/2018



410KW Booster Pump – 4 units

Average Water Distribution from BPSs



- (07:00) AM – (11:00) AM
(Northern Part of 35 Street)
- (14:30) PM – (17:30) PM
(Aungzan, Chanzan, Mahar, Chansi)
- (22:00) PM – (01:00) AM
(Southern Part of 35 Street)

Current NRW Situation

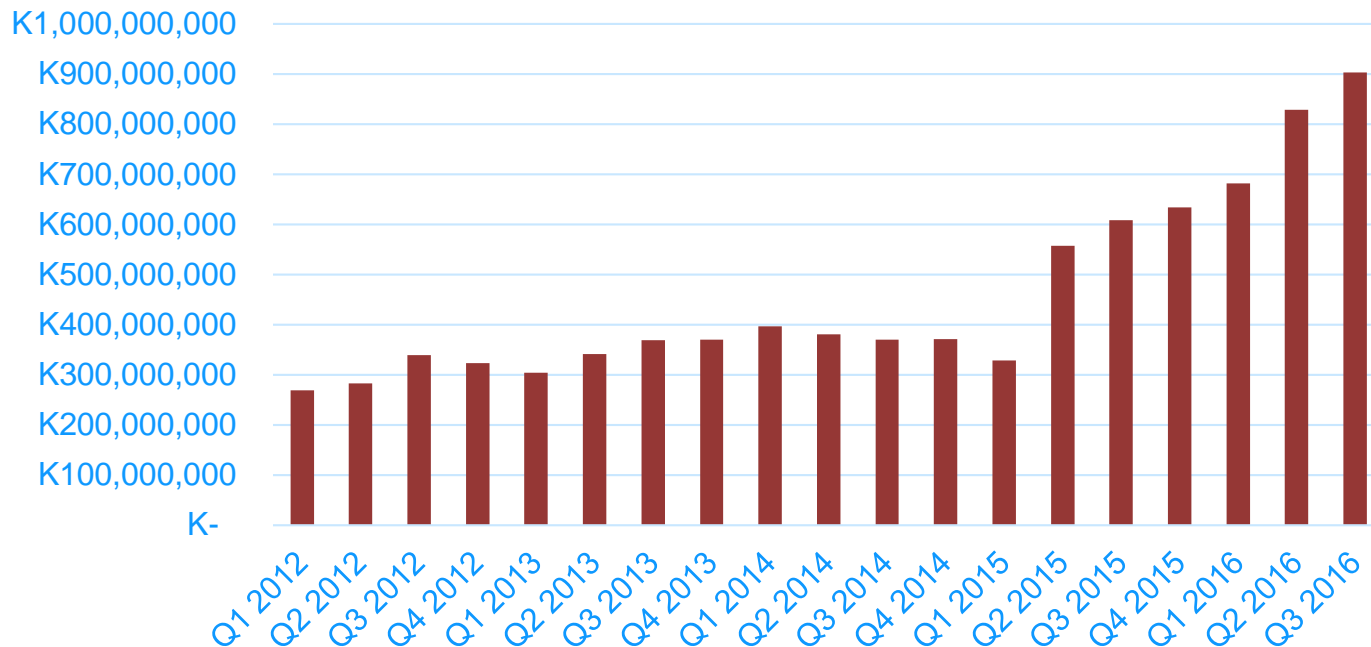
- Total Water Meter - 99677 Nos
- Per Capita Consumption - 135 lpcd
- Water Tariff (Hosuehold) - 200 mmKyats per m³
- Water Tariff (Commercial) - 260 mmKyats per m³
- Electricity Bill (1-100)Units - 35 mmKyat per KWH
- Electricity Bill (101-200)Units - 40 mmKyat per KWH
- Electricity Bill (above 200)Units - 50 mmKyat per KWH
- **Present NRW Rate** -52%

7/9/2018

Problem of water service in Mandalay

- Water quality (sediments, not drinkable)
- Interruptions of service (**only Intermittent supply, not 24/7**)
- Low pressure
- Free of Charge Water consumer
- Pipe Leakages

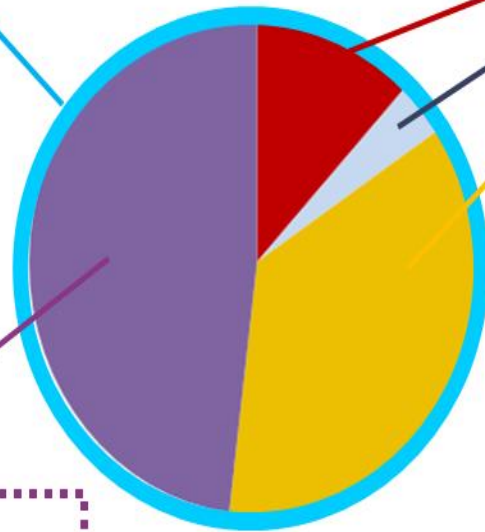
Money lost by MCDC due to NRW



Water Balance

Produced water
100 000 m³/d

Non Revenue Water
52 000 m³/d (52 %)



- Customers losses
- Metering losses
- Real losses
- Billed Water

Billed water

Billed : 40 000 m³/d

Fix billed : 8 000 m³/d

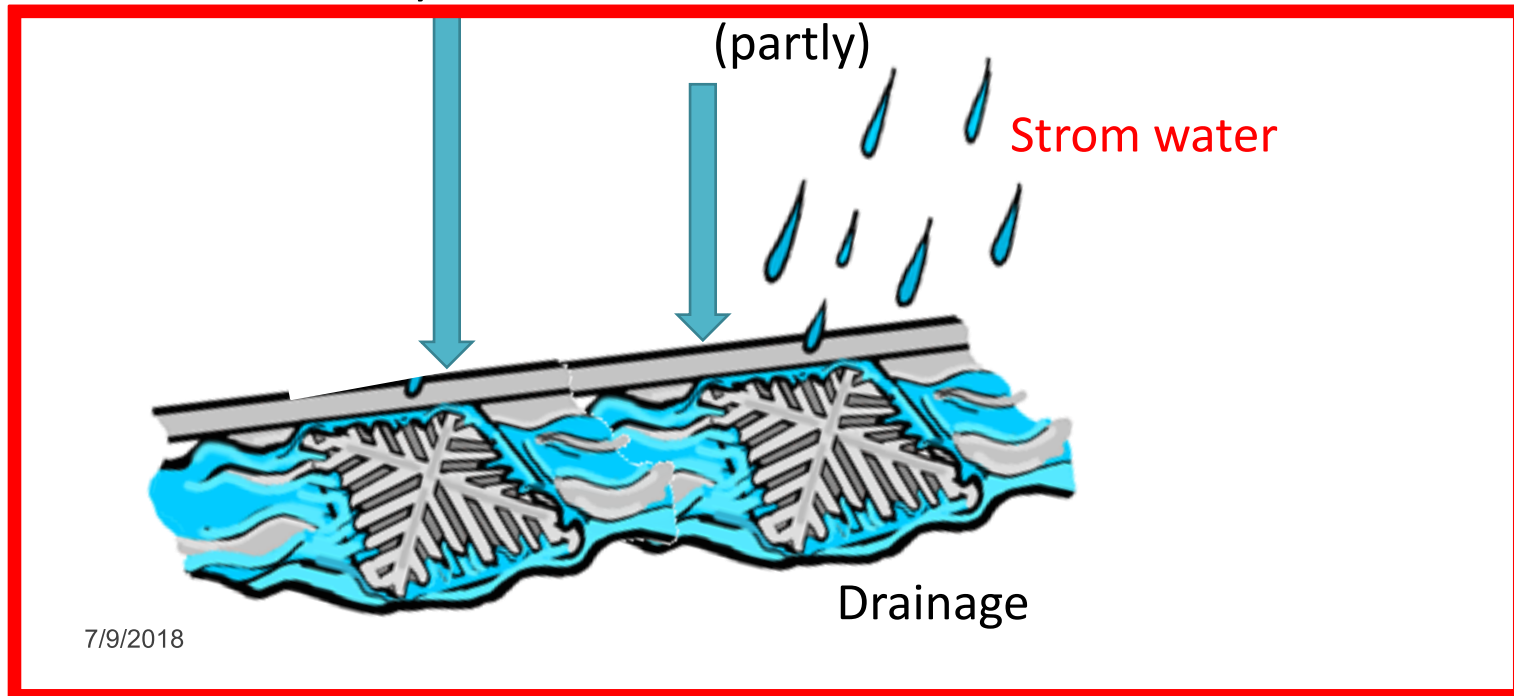
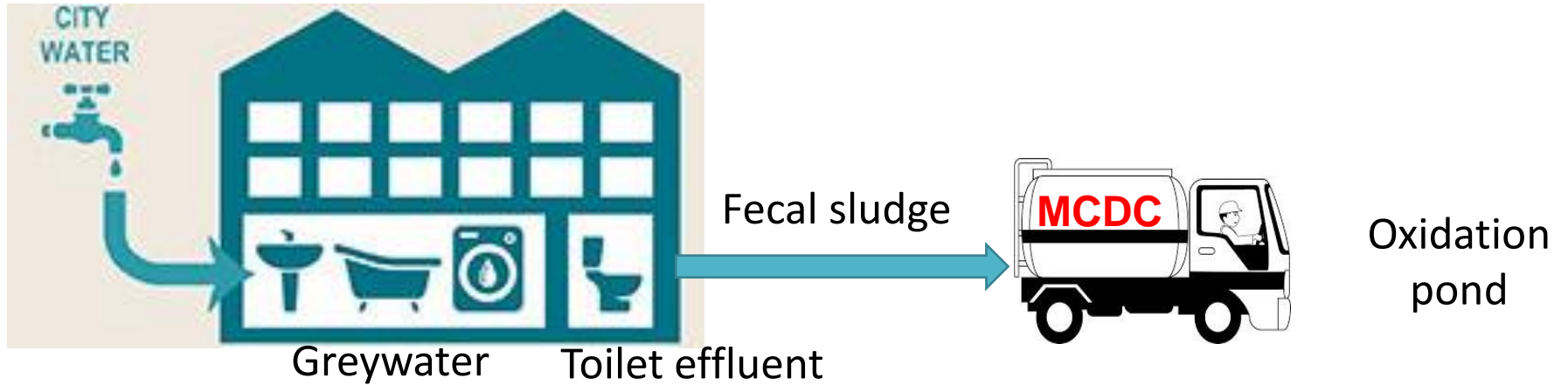
Total : 48 000 m³/d



Wastewater Management in Mandalay City

Domestic wastewater Management

Storm water Management



Domestic wastewater flow

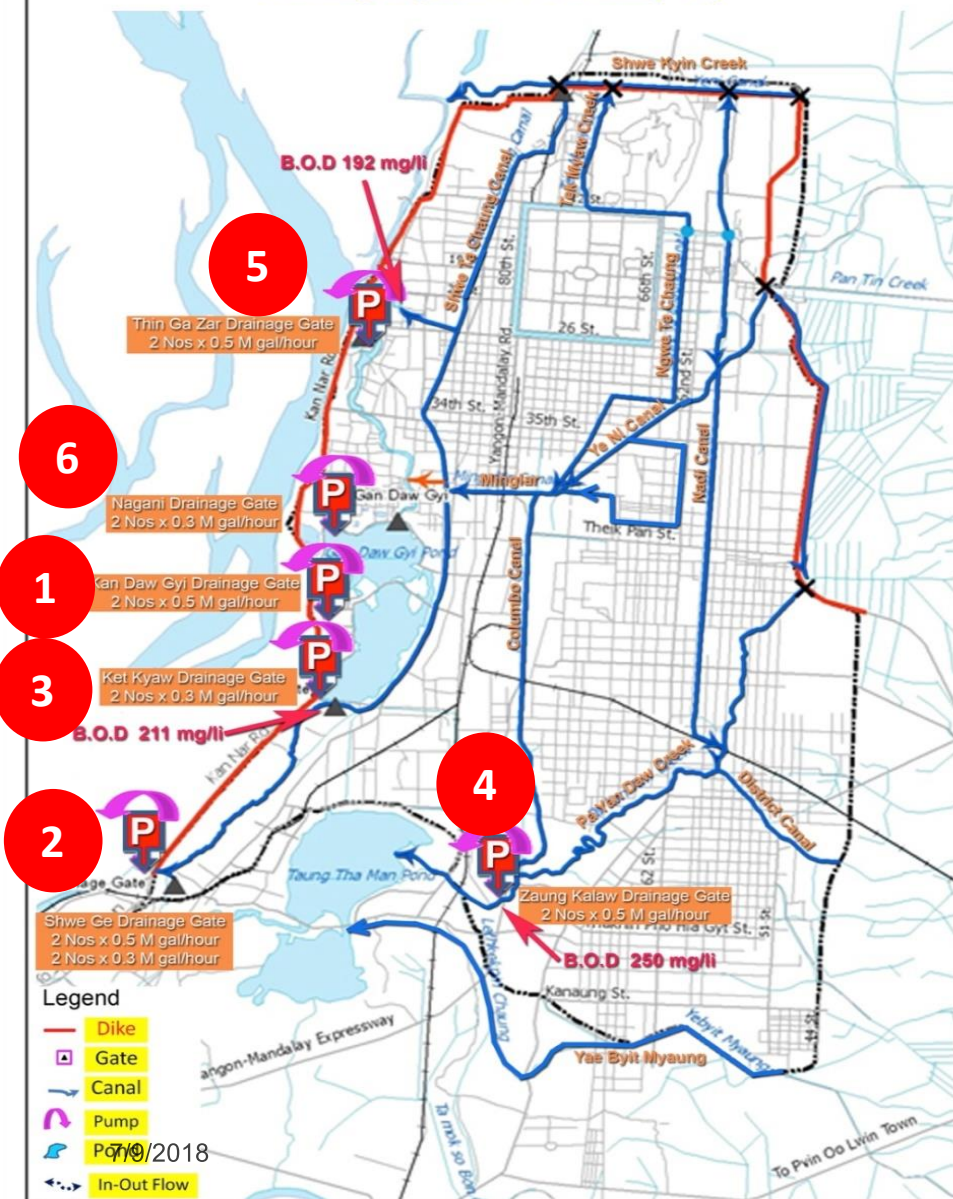
Drainage coverage

No.	Name of Drain	Length
1.	ShweTaChaung	7.14 miles
2.	NgweTaChaung	4.7 miles
3.	Mingalar	0.96 miles
4.	Columbo	3.57 miles
5.	Nadi	5.78 miles
6.	Payandaw	7.01 miles
7.	Thingazar	2.95 miles
8.	MyaungGyi	1.76 miles
9.	TatMyaw	2.79 miles
7/9/2018	Length of Drains	36.64 miles



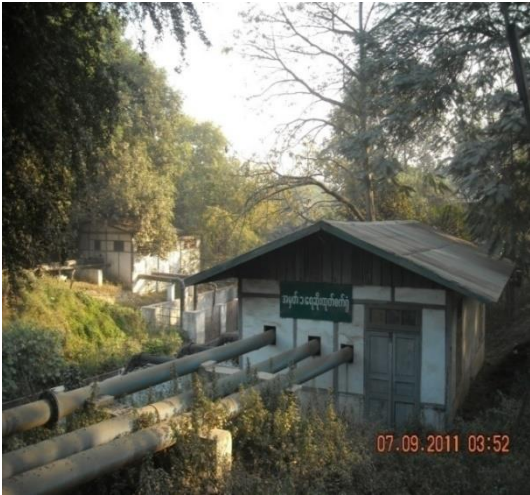
Wastewater Pumping Station

Drainage System in Mandalay City



No.	Pumping station Name	Discharge rate (m ³ /hr)
1.	Kat Kyaw	4090
2.	Shwe Gae	11818
3.	Sangha Hopital (Kandawgyi)	4540
4.	Zaungkalaw	4540
5.	Thingazar	4545
6.	Nagarni Pagoda (Kandawgyi)	2045
Total		31578

Wastewater pumping station



No-(1) Kat Kyaw



No-(2) Shwe Gae



No-(3) Sangha Hospital



No-(4) Zaungkalaw



No-(5) Thingazar

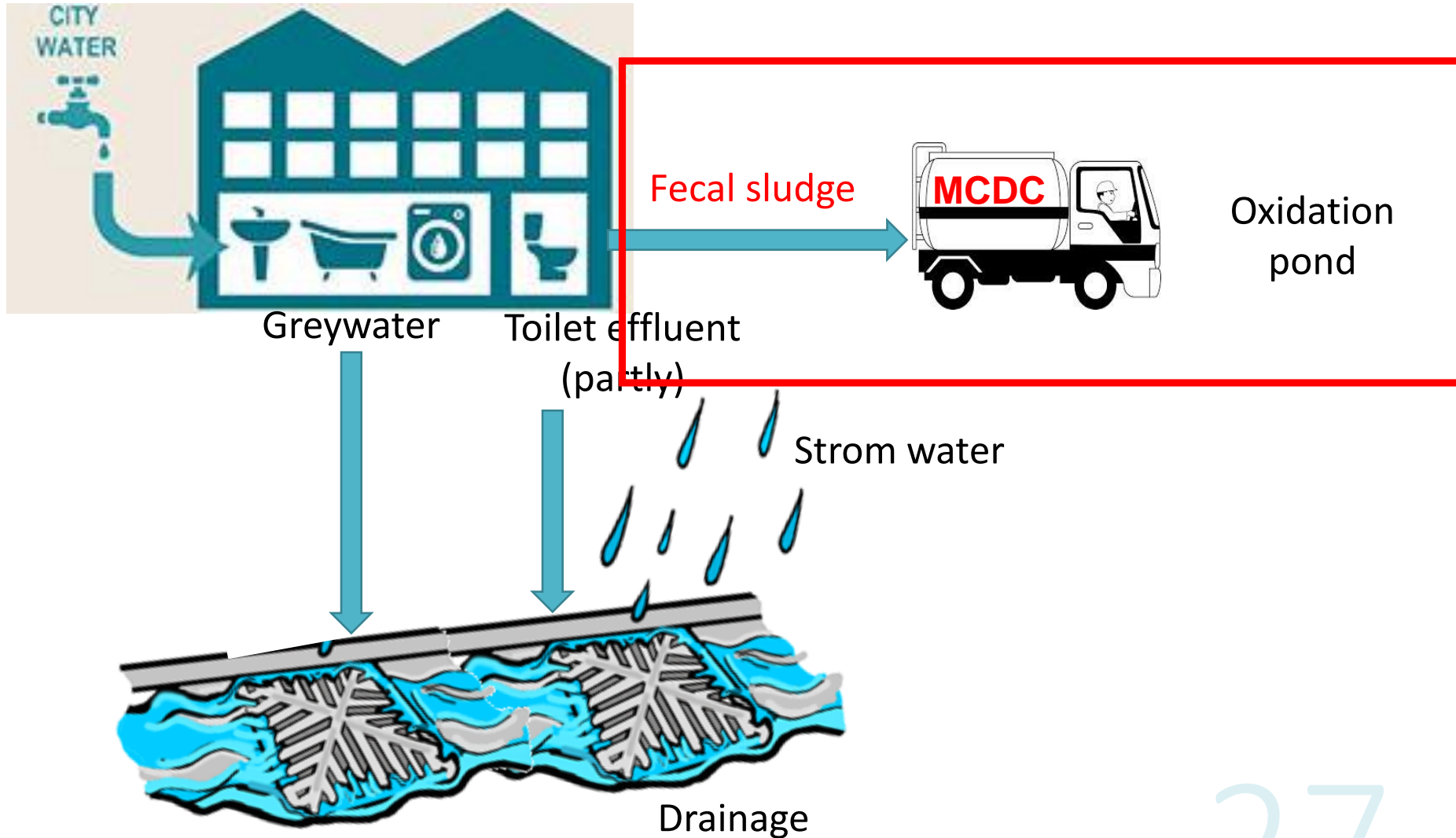


No-(6) Nagani Pagoda

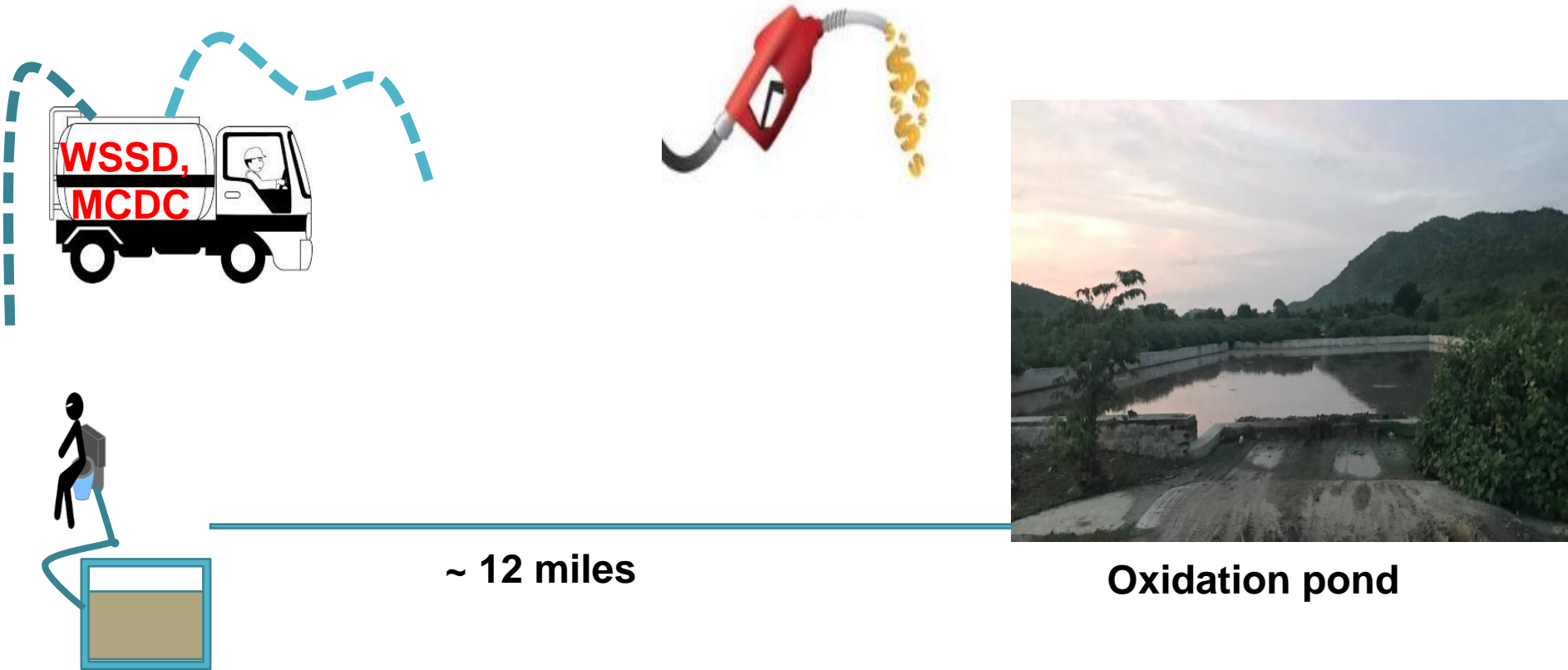
7/9/2018

Domestic wastewater Management

Fecal sludge Collection & Disposal



Septic Sludge Collection Disposing and Treatment



- No mandatory desludging

Collection/Transportation and Treatment



- Transportation route are managed by Wastewater Management Supervisor
- Service time is from 8:30-15:30 for 7 days/week
- 3 workers (one driver + two cleaning workers)
- 20-30 trips/day
- 10 trucks

**1000 gal
(4.545 m³)**

**1 Trip-
29100 ks**

- The trucks cannot enter some places
because of narrow road

**10-15 feet
wide road**



Rental Housing Complex for slum and squatter

Hnin Si Rental Housing



Number of Buildings - 14 nos

Room per Buildings - 72 nos

Total Rooms - 1008 nos

Total Population - above 5000

Bxuilding Area - 76x48 sq-ft

Room Area - 10x20 sq-ft

Rental Housing Wastewater Treatment System By Johkasou



Nos of Johkasou - 6 nos

Capacity - 150m³

Total Volume - 900m³

Effluent BOD- <50 mg/l

Manufacture - Daiki Axis

Company (Japan)

On Going Water Supply & Wastewater Project

Project Related Information

• Loan + Grant Project - Two Units (ADB & AFD)

1. Title of ADB Loan Project - Wastewater Treatment Plant and Collection System
Grant aid Organization - Urban Climate Change Resilience Trust Fund(UCCRTF)
2. Title of AFD Loan Project - Improvement of Water Supply System and NRW Reduction
Grant aid Organization - European Union(EU)

• Grant Project - Two Units (JICA & AFD)

1. JICA Grant Project - water supply system for 30 % Population of Pyigyitagon Township
2. AFD Grant Project - Amarapura Water supply and sanitation System

ADB Loan project for Wastewater Treatment Plant and Collection System

- Loan Amount (From ADB) - **60 millions(USD)**
- Funded Source - Asian Development Bank
- Project name - Wastewater Treatment Plant and Collection System
- Implementing Period - 7 years (from 2016 to 2023)
- Signing Loan Agreement - 9.9.2016
- Estimated Completion Date - 30.1.2023
- Interest Rate - 1% in grace period (7 Years)
- 1.5% in repayment period (23 years)
- Grant Amount (From UCCRTF) - **4 millions(USD)**
- Signing Grant Agreement - 9.9.2016
- Total Amount(Loan+Grant) - **64 millions(USD)**
- Consultant Organization - SUEZ in association with

Proposed Wastewater Project Mapping Area

Works Packages

4 large Works Packages

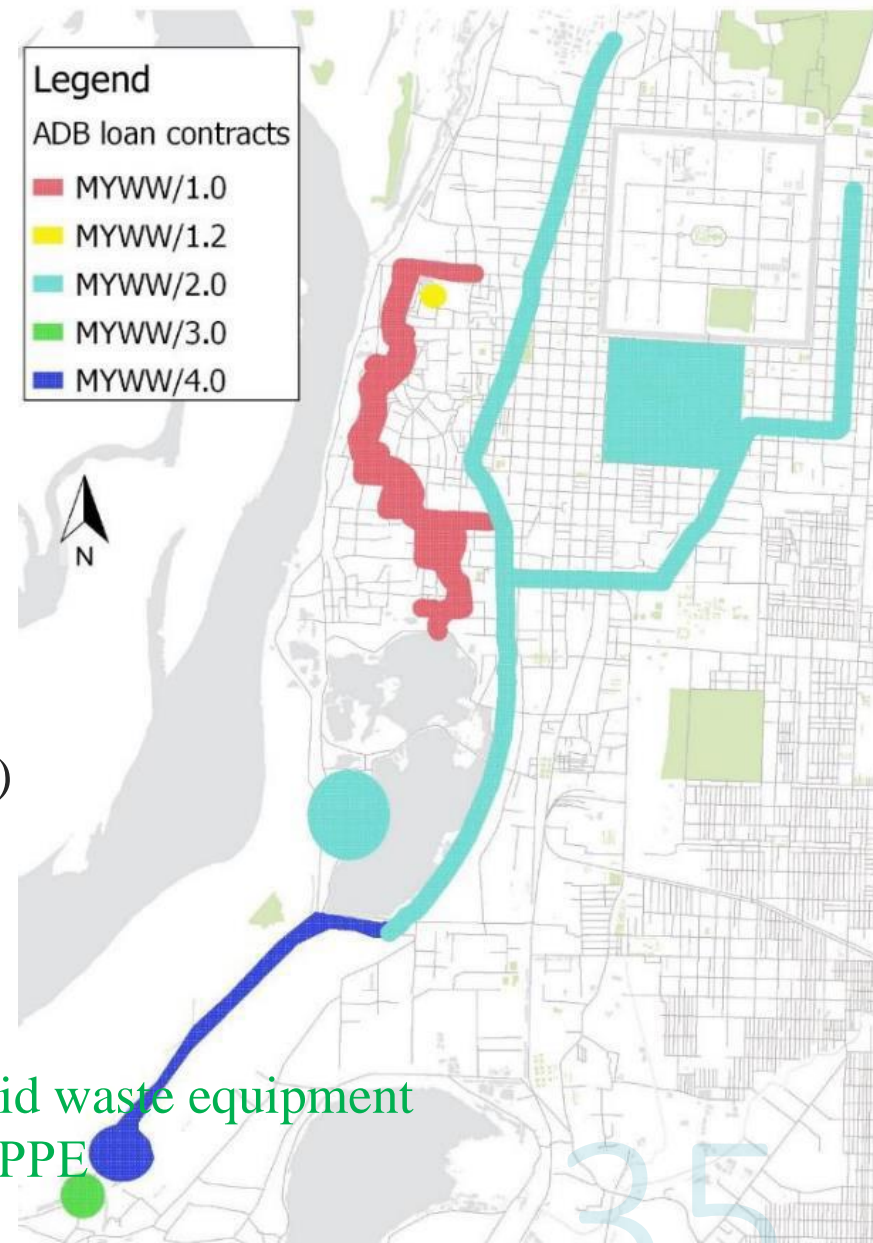
- MYWW/1.0
 - Thingazar interceptor
 - TGZ WW Pumping Station
- MYWW/2.0
 - STC interceptor
 - NTC / Mingalar interceptor
 - Kandawgyi Pumping Station
- MYWW/3.0:
 - ShweGe Pumping Station.

MYWW/4.0: (DBO)

- Nankad Lake WWTP (75000m³/day)
- Pipeline & KetKyaw PS.

3 small works and goods packages

- MYWW/20.0: Septage vehicles (10nos)
- MYWW/1.1: Thingazar community based solid waste equipment
- MYWW/1.3: Street cleansing equipment and PPE



AFD Loan Project for Improvement of Water Supply System and NRW Reduction

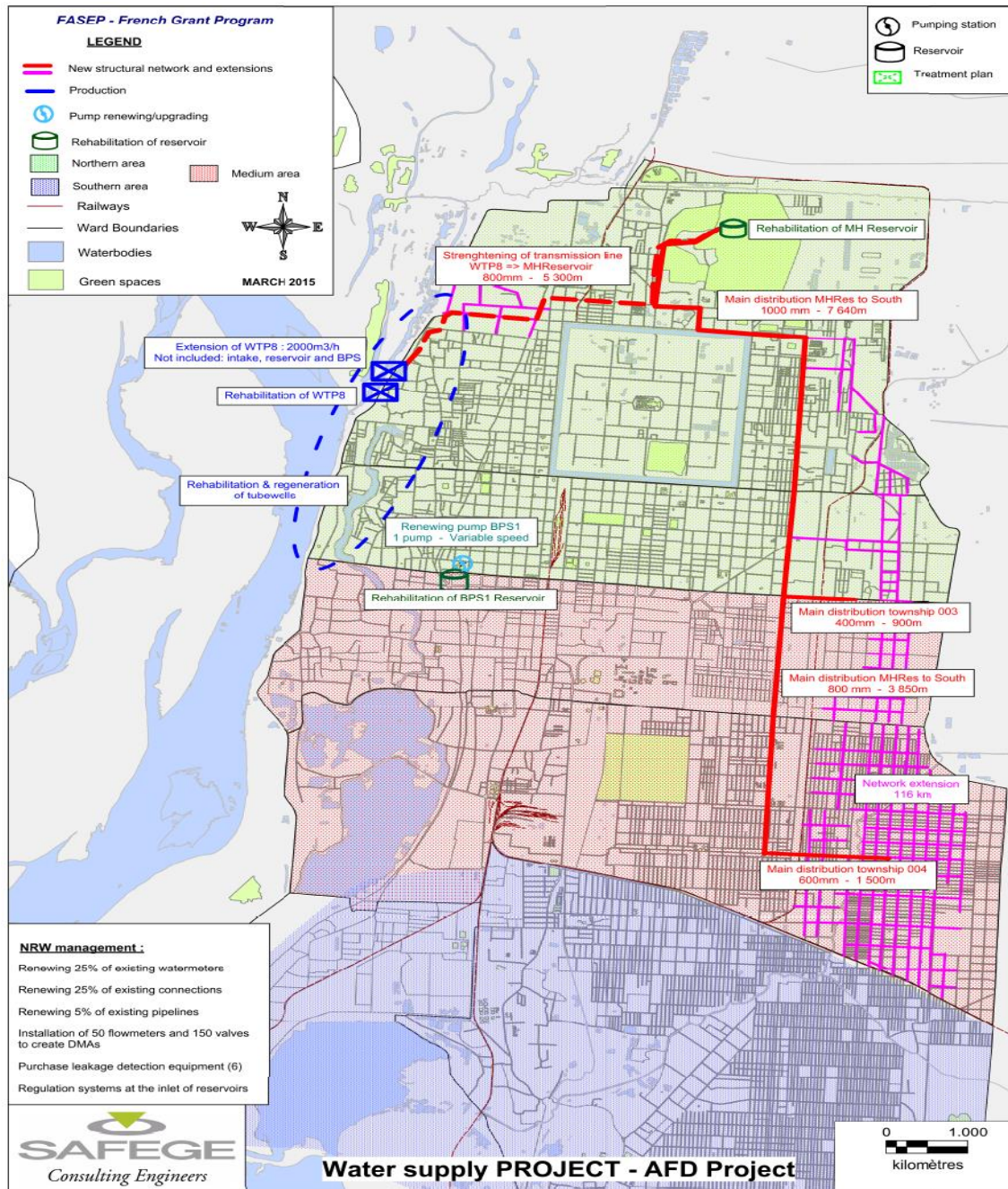
- Loan Amount - 40 millions(Euro)
- Funded Source - French Development Agency
- Project name - Improvement of Water Supply System and NRW Reduction
- Implementation Period - 7 years (from 2016 to 2023)
- Signing Loan Agreement - 21.10.2016
- Estimated Completion Date - 30.1.2023
- Interest Rate - 1% yearly
- Grant Amount (European United) - 8 millions (Euro)
- Signing Grant Agreement - 12.1.2017
- Total Amount(Loan + Grant) - 48 millions (Euro)
- Consultant Organization - SUEZ/ Eguard/ Egis

Improvement Water Supply Project

Works Packages

- MYWS/10.0: WTP 9 New Treatment Plant
- MYWS/11.0: Regeneration Tubewells
- MYWS/12.0: WTP 8 Rehabilitation
- MYWS/13.0: Transmission Main Pipelines(Two Pipelines from WTP 8 & 9)
- MYWS/20.0: NRW + Network Reinforcing
- MYWS/31.0: Network Extensions
- MYWS/31.0N: Network Extensions North (Township 1,2,3 & Part of 4)
- MYWS/31.0S: Network Extensions South (Township Part of 4)
- MYWS/31.0C: Network Extensions- Connections (All Townships 1,2,3, 4)
- MYWS/40.0: Tertiary Network may be Sein Pan DMA
- MYWS/50.0:Project Implementation Consultant and Tariff Reform consultant
- MYWS/51.0: Awareness Raising

Proposed Extension Water Treatment Plant & Network



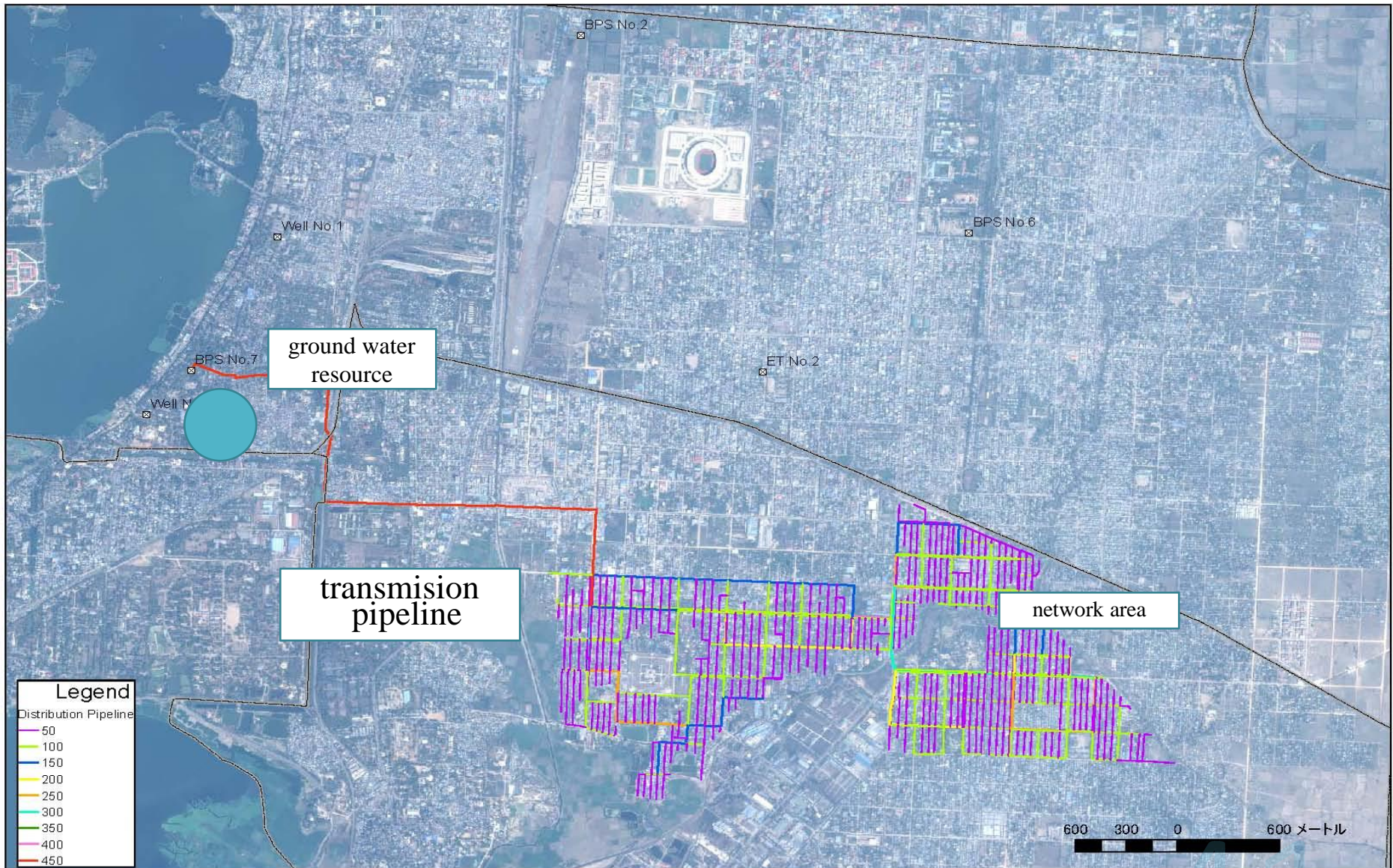
Pyi Gyi Tagon Water Supply System Granted by JICA

- Funded source - **Japan International Cooperation Agency (JICA)**
- Project name - Improvement of Water Supply System in Mandalay City
- Grant Amount - **2.555 Billions Yen**
- Implementing Sector - water supply system for 30 % Population of Pyigyitagon Township
- Water Supply Amount - **9386 m3/day**
- Population served - **59077 Persons**
- Coverage Area (Ward) - **Ga Nge, Ga Gyi, Nga, Thin Pan Kone & Nge Taw Kyi Kone**
- Implementing Period - 3 years (from 2016 to 2018)
- Consultant Organization - TEC international Co., Ltd.
- Contractor - **Tobishima Corporation**
- Signing Grant Agreement - 3.6.2015
- Commencement Date -16.9.2016
- Estimated Completion Date -30.9.2018

Scope of Work

1. Construction of intake well facilities (3 nos 12”dia x40000gal/hr capacity tubewells)
2. Transmission from intake wells to No.7 booster pump station (2.28km of 250mm & 350mm dia DI pipe laying work)
3. Distribution reservoir (650000 gal) and distribution pump station in No.7 booster pump station
4. Distribution main from No.7 booster pump station (14.741km 200mm to 450mm dia DI, 38.579km of 75mm to150mm dia PVC, 43.74km of 50mm dia PE)
5. Targeted house connection (8232 nos)
6. Disinfection facilities (chlorination system for 9 main distribution reservoirs)

Distribution Network Area Supplied by JICA Grant Project





Concrete Casting for Wall of Pump Pit



Lean Concrete for Chlorination Room



**Reinforcing Bar & Form Installation
at Distribution Pump Station**



**Concrete Casting at Distribution
Pump Station**

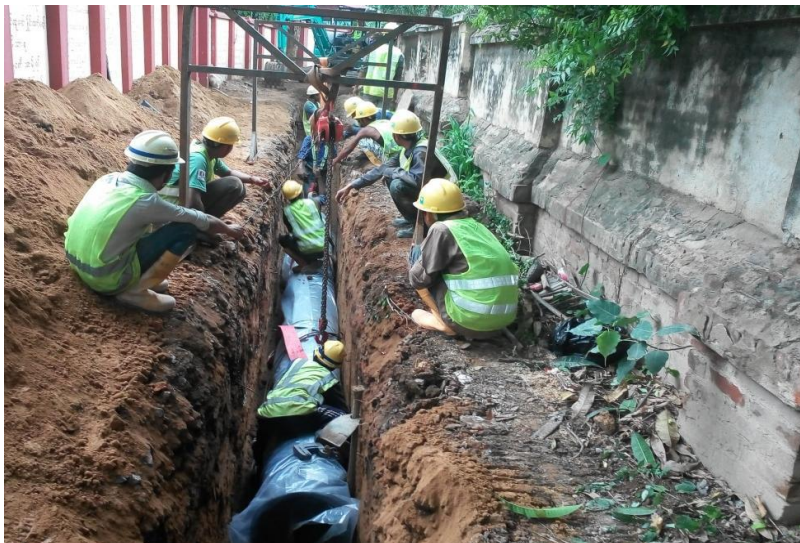
Pipe Laying and Jointing Works by JICA Grant Project



Inspection for Depth of Pipe Bed



Water Meter Installation



7/9/2018
PE Pipe Laying Work at D2 Area



Back Filling & Road Restoration

House Connection and Water Meter Installation Works by JICA Grant Project



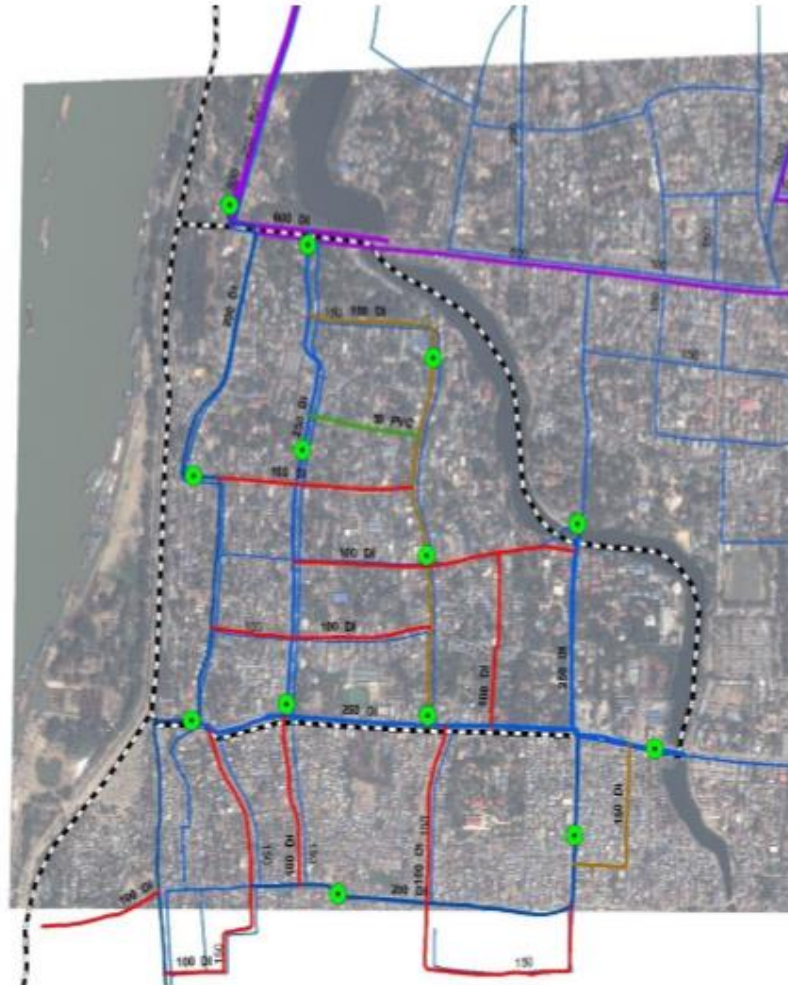
Project for Amarapura Water Supply System (Granted By French Development Agency; AFD)

- Grant Amount - 2.5 millions Euro
- Funded source -French Development Agency
- Project name - Amarapura Water supply and sanitation Project
- Water Supply Amount - 3200m³/day
- Population served - 15000 nos (2000 household)
- Coverage Area (Ward) - Kantan , Taunggyi, Sin Swe Put, Odaw, Lay Su
- Implementing Period - 4 years (from 2016 to 2019)
- Consultant Organization - Gret in association with SUEZ SAS
- Signing Grant Agreement - 24.2.2015
- Commencement Date -23.11.2016
- Estimated Completion Date - 30.1.2019

Scope of Work

1. Construction of intake well facilities (Existing 3 nos 200mm tubewells)
2. Distribution reservoir (150,000 gal) and distribution pump station in Kyantan
3. Distribution main (2.15km of 63mm, 110mm,160mm dia HDPE)
4. Targeted house connection (2000 nos)
5. Disinfection facilities (chlorine dosing)

NRW Reduction Pilot Project by AFD Grant at Sein Pan Ward, Maha Aung Myae Township



Water Supply and Sanitation Project in Amarapura Township



Geotechnical Survey



Group Discussion on the procedure for new connections



Interview in the service area of BPS 10

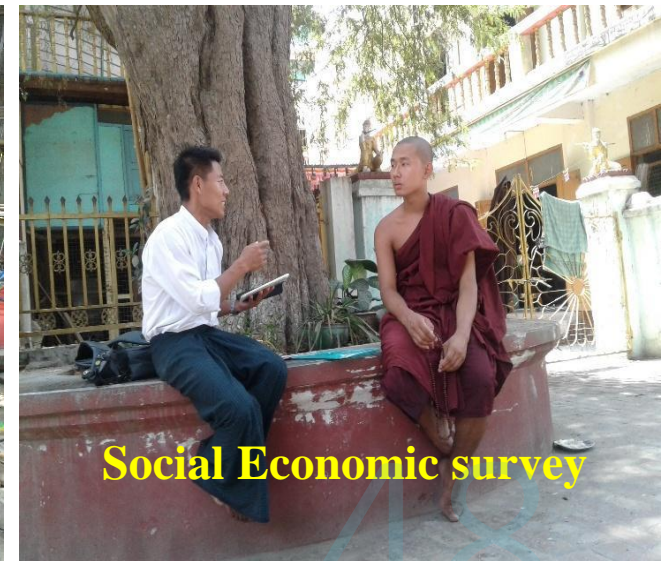


Water Quality Analysis

7/19/2018



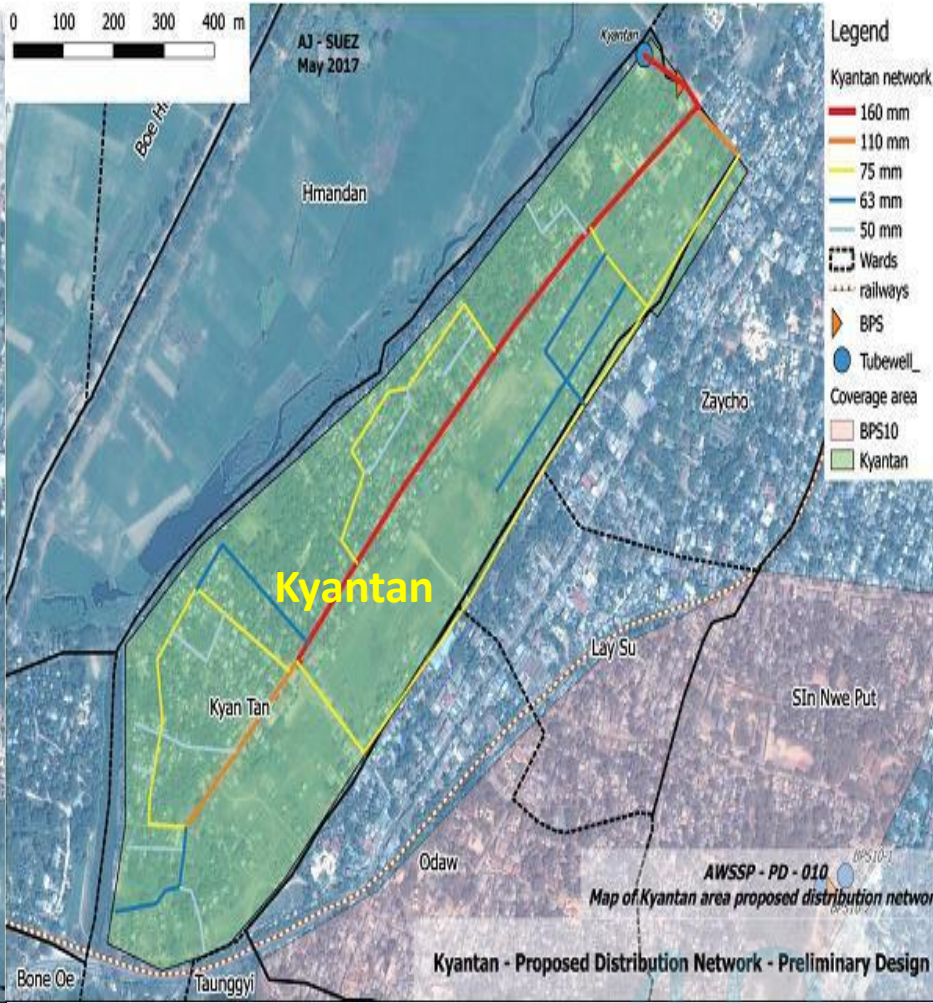
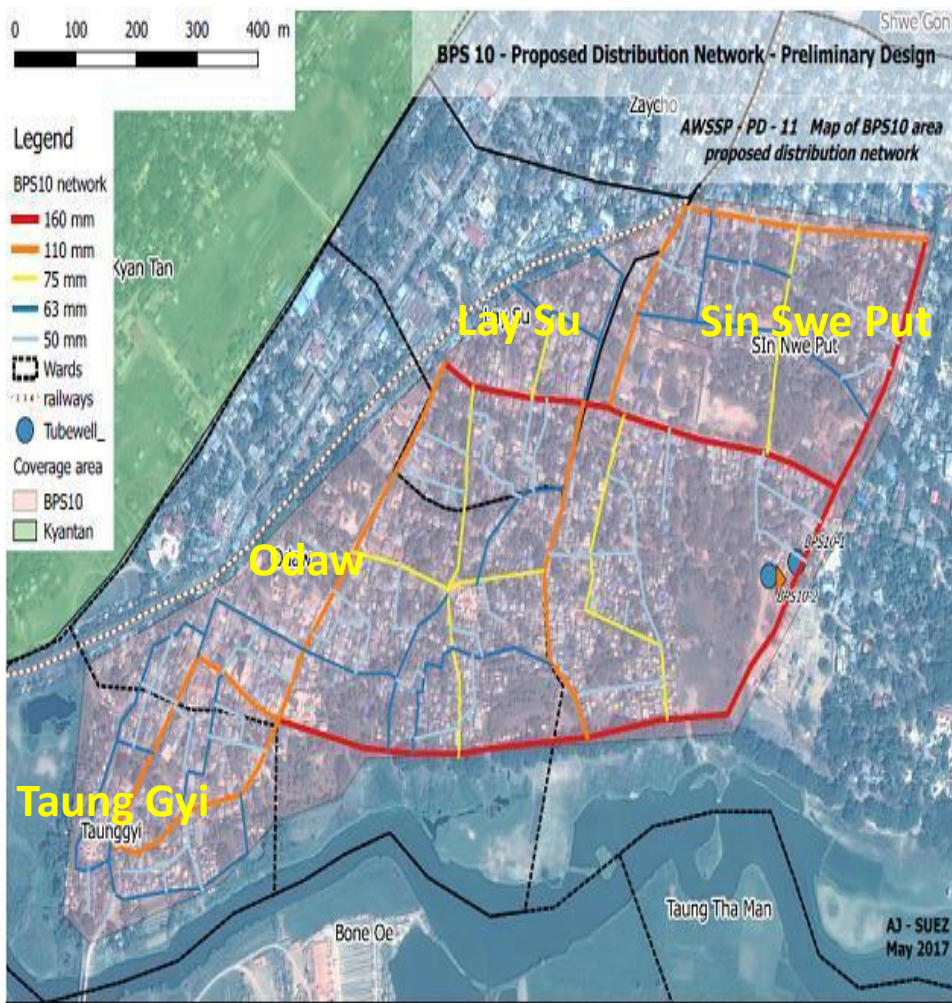
Water Quality Analysis



Social Economic survey

Works

- Data collection, hydraulic modelling, pumping tests, topographical surveys and geotechnical investigations completed

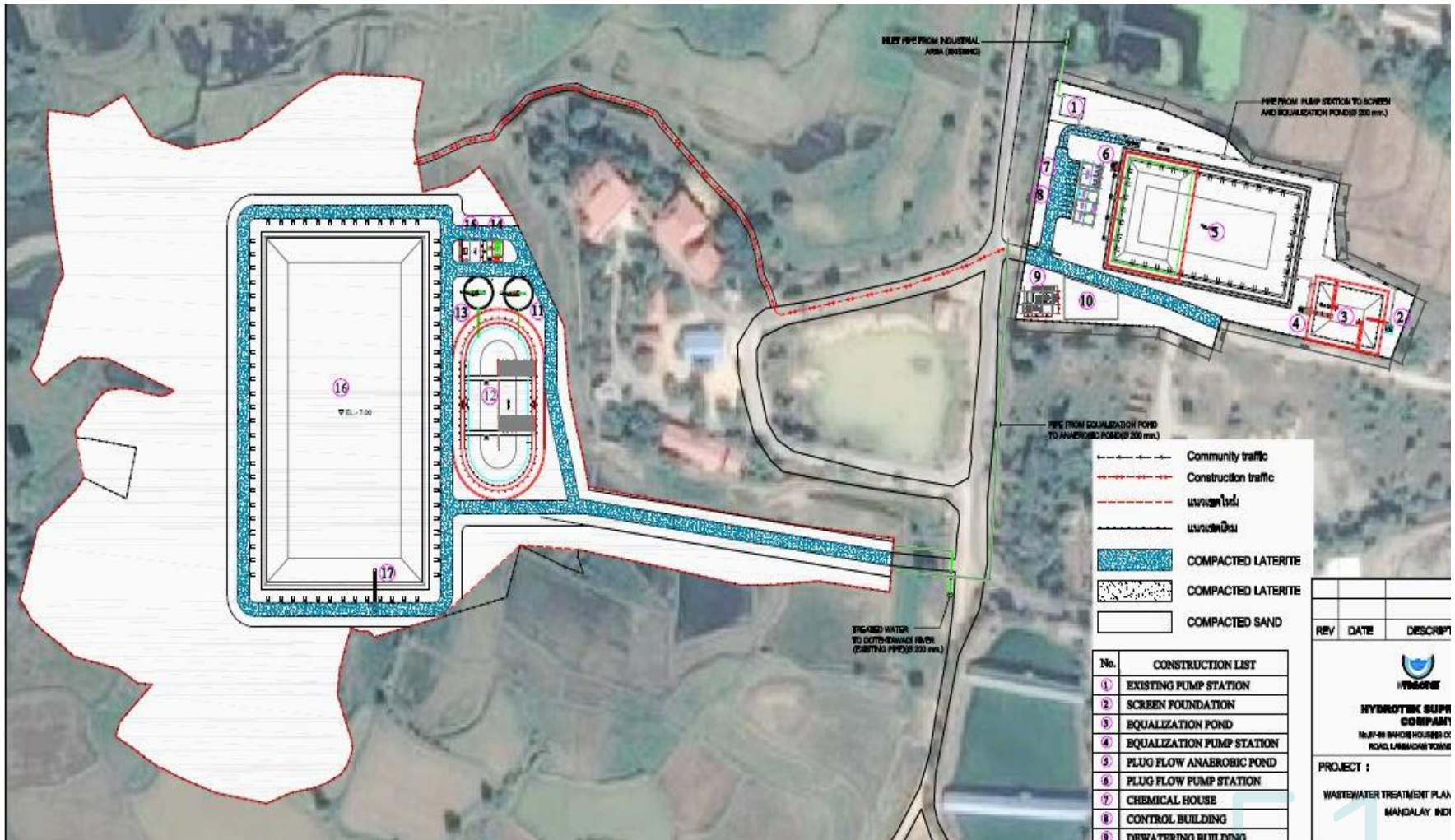


Centralized Wastewater Treatment Plant Construction Project

- ✓ Company Name -Hydrotek Supreme Mandalay Co.,Ltd (Thailand)
- ✓ Method of Project Implementation - BOT (Built, Operate, Transfer)
- ✓ Contract Period of BOT -50 Years
- ✓ Type of Process - Up flow Anaerobic sludge Blanket and activated sludge system (UASB)
- ✓ Area of Service - Mandalay Industrial Zone
- ✓ Effluent BOD5 after treatment - ≤ 50 mg/l
- ✓ Main Power Supply to Central Waste Water - By MCDC
- ✓ Land Required for Construction of Central Wastewater Treatment Plant - Approx. (20 Acres),
- ✓ Investment Cost - USD\$ (10.37) million

Centralized Wastewater Treatment Plant Construction Project

Diagram for Wastewater Treatment Plant



7/9/2018

51

A night scene of a lake with Christmas lights reflecting in the water. The sky is dark blue with some clouds. In the background, there are trees and buildings, some of which are lit up with warm lights. The water in the foreground is calm, reflecting the lights from the trees and buildings. The overall atmosphere is peaceful and festive.

THANK YOU FOR YOUR
ATTENTION