Current Status of Water Supply and Wastewater Management in Mandalay City

Mr. Khin Maung Thin
Head of Water Distribution Branch
(Water and Sanitation Department)
Population - 1.46 million
Area - 314.76 km²
Annual Average Rainfall - 956 mm (40in)
Annual Average Relative Humidity - 66%
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

Minister, Ministry of Development Affairs (Mayor)

Vice Mayor

Secretary

Joint Secretary

Committee Members (9 NOS)

Administration Department

Motor, Transport and Workshop Department

Market and Slaughter House Department

Finance Department

Revenue Department

Cleansing Department

Play Grounds and Garden Department

Water and Sanitation Department

City Planning and Land Administration Department

Building and Central Store Department

Roads and Bridges Department

Public Relation and Information Department

Agriculture and Livestock Department

Inspection Department
Head of Department

Deputy Head of Department

Water Distribution Branch

Tube well, Electrical and Mechanical Branch

Procurement, Maintenance and Store Branch

Sanitation Branch
Content

1. Current Water Supply Situation

2. Current Wastewater Management Situation

3. On going Water Supply & Wastewater Projects
- **Water Resource**
  - 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)
Mandalay’s Water Resources

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

Sedawgyi Dam

Yeywar Dam
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
# Surface Water Quality Monitoring Data

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

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>PARAMETER</th>
<th>DugWell (15M)</th>
<th>Shallow Well (25-40M)</th>
<th>Deep Well (100-120M AQ1)</th>
<th>(150M AQ2)</th>
<th>(300M AQ3)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>pH (Scale)</td>
<td>8</td>
<td>7.5</td>
<td>7.6</td>
<td>7.5</td>
<td>7.1</td>
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<tr>
<td>2</td>
<td>Color (Units)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Turbidity (N.T.U)</td>
<td>4.75</td>
<td>5.30</td>
<td>5.10</td>
<td>5.1</td>
<td>5.1</td>
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<tr>
<td>4</td>
<td>Conductivity (micromhos/cm)</td>
<td>720</td>
<td>519</td>
<td>703</td>
<td>390</td>
<td>336</td>
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<tr>
<td>5</td>
<td>Calcium as Ca (mg/l)</td>
<td>120</td>
<td>24</td>
<td>80</td>
<td>32</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Hardness, Total (CaCO₃) (mg/l)</td>
<td>480</td>
<td>100</td>
<td>340</td>
<td>100</td>
<td>24</td>
</tr>
<tr>
<td>7</td>
<td>Magnesium as Mg (mg/l)</td>
<td>44</td>
<td>10</td>
<td>44</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Chloride as Cl (mg/l)</td>
<td>60</td>
<td>8</td>
<td>60</td>
<td>8</td>
<td>15</td>
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<tr>
<td>9</td>
<td>Total Alkalinity (CaCO₃) (mg/l)</td>
<td>500</td>
<td>288</td>
<td>320</td>
<td>220</td>
<td>188</td>
</tr>
<tr>
<td>10</td>
<td>Iron, Total (Fe) (mg/l)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
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<tr>
<td>11</td>
<td>Manganese (Mn) (mg/l)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>12</td>
<td>Sulphate (SO₄) (mg/l)</td>
<td>&lt;300</td>
<td>&lt;200</td>
<td>&lt;200</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
</tbody>
</table>
Nos of Booster Pumping Station – (14) nos

662KW Diesel Engine – 1 unit

Control Panel Room Booster Pumping Station No.(1)

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 (Household)**: 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%
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 %)

- **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

Greywater
Toilet effluent
(partially)
Strom water

Fecal sludge
MCDC
Oxidation pond

Drainage
## Domestic wastewater flow

### Drainage coverage

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Drain</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ShweTaChaung</td>
<td>7.14 miles</td>
</tr>
<tr>
<td>2.</td>
<td>NgweTaChaung</td>
<td>4.7 miles</td>
</tr>
<tr>
<td>3.</td>
<td>Mingalar</td>
<td>0.96 miles</td>
</tr>
<tr>
<td>4.</td>
<td>Columbo</td>
<td>3.57 miles</td>
</tr>
<tr>
<td>5.</td>
<td>Nadi</td>
<td>5.78 miles</td>
</tr>
<tr>
<td>6.</td>
<td>Payandaw</td>
<td>7.01 miles</td>
</tr>
<tr>
<td>7.</td>
<td>Thingazar</td>
<td>2.95 miles</td>
</tr>
<tr>
<td>8.</td>
<td>MyaungGyi</td>
<td>1.76 miles</td>
</tr>
<tr>
<td>9.</td>
<td>TatMyaw</td>
<td>2.79 miles</td>
</tr>
</tbody>
</table>

<p>| Length of Drains | 36.64 miles |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Pumping station Name</th>
<th>Discharge rate (m³/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Kat Kyaw</td>
<td>4090</td>
</tr>
<tr>
<td>2.</td>
<td>Shwe Gae</td>
<td>11818</td>
</tr>
<tr>
<td>3.</td>
<td>Sangha Hospital (Kandawgyi)</td>
<td>4540</td>
</tr>
<tr>
<td>4.</td>
<td>Zaungkalaw</td>
<td>4540</td>
</tr>
<tr>
<td>5.</td>
<td>Thingazar</td>
<td>4545</td>
</tr>
<tr>
<td>6.</td>
<td>Nagarni Pagoda (Kandawgyi)</td>
<td>2045</td>
</tr>
</tbody>
</table>

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
Domestic wastewater Management

Fecal sludge Collection & Disposal

Greywater
Toilet effluent (partly)
Strom water
Drainage

CITY WATER

Fecal sludge
MCDC
Oxidation pond
Septic Sludge Collection Disposing and Treatment

- No mandatory desludging

~ 12 miles

Oxidation pond
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

- The trucks cannot enter some places because of narrow road

1 Trip - 29100 ks
1000 gal (4.545 m³)

10-15 feet wide road
Rental Housing Complex for slum and squatter

- Number of Buildings: 14 nos
- Room per Buildings: 72 nos
- Total Rooms: 1008 nos
- Total Population: above 5000
- Building Area: 76x48 sq-ft
- Room Area: 10x20 sq-ft

Hnin Si Rental Housing
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

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7/9/2018
### 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 NIPPON KOEI / Myanmar KOEI International
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
<table>
<thead>
<tr>
<th><strong>AFD Loan Project for Improvement of Water Supply System and NRW Reduction</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Loan Amount</strong></td>
</tr>
<tr>
<td><strong>Funded Source</strong></td>
</tr>
<tr>
<td><strong>Project name</strong></td>
</tr>
<tr>
<td><strong>Implementation Period</strong></td>
</tr>
<tr>
<td><strong>Signing Loan Agreement</strong></td>
</tr>
<tr>
<td><strong>Estimated Completion Date</strong></td>
</tr>
<tr>
<td><strong>Interest Rate</strong></td>
</tr>
<tr>
<td><strong>Grant Amount (European United)</strong></td>
</tr>
<tr>
<td><strong>Signing Grant Agreement</strong></td>
</tr>
<tr>
<td><strong>Total Amount (Loan + Grant)</strong></td>
</tr>
<tr>
<td><strong>Consultant Organization</strong></td>
</tr>
</tbody>
</table>
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

NRW management:
- Renewing 20% of existing watermeters
- Renewing 20% of existing connections
- Renewing 5% of existing pipelines
- Installation of 50 flowmeters and 100 valves to create DMAs
- Purchase leakage detection equipment (6)
- Regulation systems at the inlet of reservoirs

SAFEGE Consulting Engineers

Water supply PROJECT - AFD Project

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### 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 x 40000 gal/hr capacity tubewells)

2. Transmission from intake wells to No.7 booster pump station (2.28 km 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 (14.741 km 200mm to 450mm dia DI, 38.579 km of 75mm to 150mm dia PVC, 43.74 km 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
- 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

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

7/9/2018
Centralized Wastewater Treatment Plant Construction Project

Diagram for Wastewater Treatment Plant
THANK YOU FOR YOUR ATTENTION