DOMESTIC WASTEWATER MANAGEMENT IN SRI LANKA

ENG. G.A. KUMARARATHNA

ADDL. GENERAL MANAGER (SEWERAGE)
NATIONAL WATER SUPPLY & DRAINAGE BOARD

CONTENT

❖ History
  ❖ Developments of Major Sewerage Infrastructure
  ❖ Subsequent Developments of Other Sewerage Infrastructure
  ❖ Key Legislative Instruments
  ❖ Discharge Standards
❖ Sewerage Development Goals
❖ Present Status of Sewerage in Sri Lanka
  ❖ Coverage
  ❖ Treatment Plants
  ❖ Wastewater Disposal Projects (ongoing and pipe-in-line)
❖ Future Plans & Direction
❖ Major issues
History of Sewerage Works in Sri Lanka

History:
Development of Major Sewerage Infrastructure

Introduction:
A sewer network with pump stations and two treatment plants, (located at Madampitiya and Wellawatta) were constructed during 1905-1910
Around 1956, Madampitiya TP was abandoned due to Operational problems and Wellawatta TP was abandoned due to complaints from community over nuisance and bad-odour

In 1972, a master plan was prepared by a British Consultancy Firm (Howard Humphrey) with the assistance of UNDP for the rehabilitation of Greater Colombo Sewerage System
History: Continued..

- **1983-1987:** Greater Colombo Sewerage System rehabilitated with World Bank and Saudi Assistance and two sea outfalls of 1500mm diameter were constructed at Mutwal and Wellawatta.
History: Continued...

- 1993: Updating of Wastewater Master Plan for the Greater Colombo area by an American Consultancy Firm with the assistance of World Bank
- 1998-2000: Preparation of feasibility study for the Greater Colombo area including immediate works by Atkins with the assistance of British funding
- 2000: Beira Lake Restoration Project implemented with World Bank Assistance (New PS at Slave Island and diversion of wastewater flow)
- 2006-2008: Rehabilitation of Northern Catchment (Construction of new PS at Madampitiya and 7.4 km line rehabilitation)
- 2008-2010: Colombo Sewerage Rehabilitation Project (Southern Catchment): (Construction of new PS at Wellawatta and 7.7 km line rehabilitation)
History:
Subsequent Developments of Other Sewerage Infrastructure

1980 - 2012:
Numbers of Small Scale Centralized WWTP were constructed to treat domestic waste of housing schemes and tourism associated townships

- Mattegoda Housing Scheme
- Soysapura Housing Scheme
- Raddolugama Housing Scheme
- Hantana Housing Scheme
- Digana Village Housing Scheme
- Kataragama Sewerage Scheme
- Hikkaduwa Sewerage Scheme
- Modarawile Sewerage Scheme

History:
Subsequent Developments of Other Sewerage Infrastructure Cont...

1980 - 2012:
Other WWTPs

- Jayawardenagama Housing Scheme
- Maddumagwatte Housing Scheme
- Maligawatte Housing Scheme
- Crow Island Housing Scheme
- Stace Road Housing Scheme
1980 - 2012: Several WWTPs were constructed for the treatment of WW effluents from Industries established in dedicated Export Processing Zones (EPZ) monitored by BOI.

- Biyagama EPZ: 13,000 m³/day
- Seethawaka EPZ: 9,900 m³/day
- Katunayake EPZ: 3,000 m³/day
- Mirigama EPZ: 400 m³/day
- Wathupitiwal EPZ: 900 m³/day
- Polgahawela EPZ: 450 m³/day
- Koggala EPZ: 675 m³/day
- Kandy EPZ: 1,000 m³/day
- Mawathagama EPZ: 500 m³/day
- Horana EPZ: 1,000 m³/day

Key Legislative Instruments to be considered in Sewerage Disposal (Note: not limited to sanitation only)

- Municipal Councils Ordinance No 29 of 1947
- National Water Supply & Drainage Board Act No 2 of 1974
- Urban Development Authority Law No 37 of 1978
- National Environmental Act No 47 of 1980
- Coast Conservation Act No 57 of 1981
- Water Resources Act 1994
- Fisheries and Aquatic Resource Act 1996
- Archaeological Impact Assessment Act 2000
- Marine Pollution Prevention Act No 35 of 2008
History:
With the progress in Industrial and Commercial activities, key legislative developments for issue of environmental protection license for emission or disposal of wastewater were needed in view of protecting drinking water sources.

National Environmental Policy:
- 1982: Created Central Environmental Authority (CEA) as the national regulatory and enforcement agency
- 2001: Set up Ministry of Environment and Natural Resources (MENR)
- 2003: Formulated National Environment Policy (NEP)

Discharge Standards:
As per the Sec (1) of the Gazette Extraordinary 9No.1534/18) of the Democratic Socialist Republic of Sri Lanka (01.02.2008), the following discharge standards exist.

Tolerance limits for;
- The discharge of industrial waste into inland surface water bodies,
- Industrial waste discharged on land for irrigation purpose,
- Industrial and domestic waste discharged into marine coastal areas,
- Waste from rubber factories being discharged into inland surface waters,
Discharge Standards (Cont..)

As per the Sec (1) of the Gazette Extraordinary (No.1534/18) of the Democratic Socialist Republic of Sri Lanka (01.02.2008), the Following Discharge Standards Exist.

Tolerance Limits for;

- Waste from textile industry being discharged into inland surface waters,
- Waste being discharged from tanning industries,
- Discharge of wastewater effluents into public sewers with central WW treatment plants,

---

Development Goals of Sewerage In Sri Lanka
Development Goals of Sewerage

Millennium Development Goals (MDG)
- Access to adequate sanitation for 90% of population of Sri Lanka by 2015 and 100% by 2025,
- Piped Sewerage systems to major urban areas and selected growth centers,
- Availability of Standard On-site sanitation to all those not connected to a sewer system,

GOSL Goals (Mahinda Chinthanaya)
- Provision of Piped Sewerage systems to major urban areas and selected growth centers,
- Facilitate for Standard On-site sanitation to all those not connected to a sewer system,
- Sri Lanka Government Targets for Pipe Borne Sewerage
  (Mahinda Chinthanaya 2010, P61-62)

<table>
<thead>
<tr>
<th>Year</th>
<th>2005</th>
<th>2009</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe borne sewerage coverage (%)</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>7.0</td>
</tr>
</tbody>
</table>
Present Status of Sewerage In Sri Lanka

<table>
<thead>
<tr>
<th>Sanitation Type</th>
<th>Estimated Population Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piped Sewerage (Offsite)</td>
<td>507,435 (02.5%)</td>
</tr>
<tr>
<td>Onsite Sanitation</td>
<td>16,887,200 (83.2%)</td>
</tr>
<tr>
<td>Without Proper Sanitation (Includes Type Unknown/Other, Pit Latrines)</td>
<td>2,902,500 (14.3%)</td>
</tr>
</tbody>
</table>

(Present Scenario of Sanitation Coverage)

(Projection as at end of 2010 based on sources from NWS&DB, Census and Statistical Data Publication 2001 & Annual Health Bulletin 2006-2007)
### Population coverage by Piped Sewerage

<table>
<thead>
<tr>
<th>City</th>
<th>Total Population</th>
<th>Estimated Population coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombo city</td>
<td>715,000</td>
<td>435,615</td>
</tr>
<tr>
<td>Dehiwala / Mt. Lavinia</td>
<td>112,000</td>
<td>10,790</td>
</tr>
<tr>
<td>Kolonnawa</td>
<td>60,000</td>
<td>6,380</td>
</tr>
<tr>
<td>Kataragama</td>
<td>20,000</td>
<td>4,500</td>
</tr>
<tr>
<td>Hikkaduwa</td>
<td>30,000</td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>937,000</strong></td>
<td><strong>460,285</strong></td>
</tr>
</tbody>
</table>

### HOUSING SCHEMES

<table>
<thead>
<tr>
<th>Housing Scheme</th>
<th>No. of Connections</th>
<th>Population Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soysapura Housing Scheme</td>
<td>2,368</td>
<td>11,840</td>
</tr>
<tr>
<td>Matthegoda Housing Scheme</td>
<td>1,240</td>
<td>6,200</td>
</tr>
<tr>
<td>Jayawadanagama Housing Scheme</td>
<td>850</td>
<td>4,250</td>
</tr>
<tr>
<td>Maddumagewatta Housing Scheme</td>
<td>192</td>
<td>960</td>
</tr>
<tr>
<td>Raddolugama Housing Scheme</td>
<td>2,100</td>
<td>10,500</td>
</tr>
<tr>
<td>Maligawatta Housing Scheme</td>
<td>1,510</td>
<td>7,550</td>
</tr>
<tr>
<td>Crow Island Housing Scheme</td>
<td>294</td>
<td>1,470</td>
</tr>
<tr>
<td>Stace Road Housing Scheme</td>
<td>240</td>
<td>1,200</td>
</tr>
<tr>
<td>Hantana Housing Scheme</td>
<td>385</td>
<td>1,925</td>
</tr>
<tr>
<td>Digana Village Housing Scheme</td>
<td>250</td>
<td>1,250</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9,429</strong></td>
<td><strong>47,150</strong></td>
</tr>
</tbody>
</table>

### Wastewater Treatment Systems at BOI assisted Export Processing Zones

<table>
<thead>
<tr>
<th>No.</th>
<th>Export Processing Zone</th>
<th>Capacity m$^3$/day</th>
<th>Wastewater Treatment System</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biyagama</td>
<td>13,000</td>
<td>Extended Aeration system with Mechanical Aerated Lagoon system (Flow through type)</td>
<td>Proposed to augment up to 20,000 $m^3$/day</td>
</tr>
<tr>
<td>2</td>
<td>Seethawaka</td>
<td>9,900</td>
<td>Extended Aeration System</td>
<td>Proposed to augment up to 12,900 $m^3$/day</td>
</tr>
<tr>
<td>3</td>
<td>Katunayake</td>
<td>3,000</td>
<td>Mechanical Aerated Lagoon (Flow through type)</td>
<td>Completed</td>
</tr>
<tr>
<td>4</td>
<td>Mirigama</td>
<td>400</td>
<td>Package Plant</td>
<td>Completed</td>
</tr>
<tr>
<td>5</td>
<td>Wathupitiwala</td>
<td>900</td>
<td>Package Plant</td>
<td>Complete</td>
</tr>
<tr>
<td>6</td>
<td>Polgahawela</td>
<td>450</td>
<td>Extended Aeration System</td>
<td>Completed</td>
</tr>
<tr>
<td>7</td>
<td>Koggala</td>
<td>675</td>
<td>Extended Aeration System</td>
<td>Proposed to augment up to 2,000 $m^3$/day</td>
</tr>
<tr>
<td>8</td>
<td>Kandy</td>
<td>1,000</td>
<td>Extended Aeration System</td>
<td>Under construction</td>
</tr>
<tr>
<td>9</td>
<td>Mawathagama</td>
<td>500</td>
<td>Extended Aeration System</td>
<td>Completed</td>
</tr>
<tr>
<td>10</td>
<td>Horana</td>
<td>1,000</td>
<td>Package Plant (Rotating Biological Contactors)</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td><strong>Total of Capacities</strong></td>
<td><strong>30,825</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Natural Wastewater Treatment System at Hikkaduwa (Waste Stabilization Ponds)

Locations of Sewerage Schemes in Colombo City and Suburbs
Locations of Major Wastewater Treatment Plants in Operation

Wastewater Disposal Projects in Sri Lanka
Major Projects

- Ongoing Major Projects (Mobilized)
  - Ja Ela/Ekala – Ratmalan/Moratuwa Wastewater Disposal Project
  - Kandy City Wastewater Management Project
  - GPOBA
  - Greater Colombo Wastewater Management Project
  - Jaffna Municipality Sewerage Project
  - Colombo Sewerage Rehabilitation Project - Southern Catchment: (Completed)

- Projects in Bidding Stage
  - Jayawardana Pura/ Kotte Wastewater Disposal Project
  - Hambantota Wastewater Disposal Project
  - Kataragama Wastewater Disposal Project
  - Kurunegala Water & Wastewater Project

Major Projects .... Contd.

- Projects in Pipeline
  - Ratmalana-Moratuwa & Jaela/Ekala - Phase II Wastewater Disposal Project
  - Dehiwala/ Mt. Lavinia Piped Sewerage Coverage Expansion
  - Maharagama and Boralisgamuwa Wastewater Disposal System
  - Negombo WW Disposal System
  - Chilaw Piped Sewerage System
  - Puttalam Piped Sewerage System
  - Galle WW Disposal System
  - Kattankudy WW Disposal System
  - Gampaha Sewerage Project
  - Batticaloa WW Disposal System
  - Improvement to WW Disposal System of Cancer Hospital (Design Stage)
  - Improvement to WW Disposal Systems of Government Hospitals
  - Data Collection Survey for 13 Towns by JICA
Details of On Going Piped Sewerage Projects

<table>
<thead>
<tr>
<th>SCHEME</th>
<th>POPULATION COVERAGE</th>
<th>TOTAL ESTIMATED COST (Rs. Mn.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Colombo Sewerage Rehabilitation Project – Southern Catchment</td>
<td>180,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Wastewater Disposal Project for Ratmalana/ Moratuwa and Jaela / Ekala Areas - Phase I</td>
<td>80,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Kandy City Wastewater Disposal Project</td>
<td>55,000 + 150,000 Floating population</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>GPOBA (The Global Partnership on Output Based Aid)</td>
<td>76,400</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Jaffna Municipality Sewerage Project</td>
<td>100,000</td>
</tr>
<tr>
<td>6</td>
<td>Greater Colombo Waste Management Project - NWSDB</td>
<td>150,000</td>
</tr>
<tr>
<td>7</td>
<td>Greater Colombo Waste Management Project – CMC</td>
<td>600,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>1,391,400</strong></td>
</tr>
</tbody>
</table>
### Details of Projects In Pipe Line ... Contd.

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>POPULATION</th>
<th>TEC / RS. M</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 Negombo WW Disposal System</td>
<td>86,700</td>
<td>6,700</td>
</tr>
<tr>
<td>08 Chilaw Piped Sewerage System</td>
<td>4,700</td>
<td>2,445</td>
</tr>
<tr>
<td>09 Puttalam Piped Sewerage System</td>
<td>7,200</td>
<td>2,605</td>
</tr>
<tr>
<td>10 Kattankudy WW Disposal System</td>
<td>79,000</td>
<td>3,194</td>
</tr>
<tr>
<td>11 Galle WW Treatment System</td>
<td>34,600</td>
<td>2,248</td>
</tr>
<tr>
<td>12 Expansion of Piped Sewerage Coverage to Dehiwala/ Mt. Lavinia</td>
<td>138,000</td>
<td>7,446</td>
</tr>
<tr>
<td>13 Batticaloa WW Disposal System</td>
<td>64,200</td>
<td>1,960</td>
</tr>
<tr>
<td>14 Gampaha Sewerage Project</td>
<td>25,000</td>
<td>803</td>
</tr>
<tr>
<td>15 Cancer Hospital •Connects to Ratmalana /Moratuwa wastewater treatment plant</td>
<td>2,000</td>
<td>238</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>742,000</strong></td>
<td><strong>76,786</strong></td>
</tr>
</tbody>
</table>

### Details of Projects In Pipe Line

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>POPULATION</th>
<th>TEC / RS. M</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Kurunegala Water &amp; Wastewater Project</td>
<td>32,000</td>
<td>8,283</td>
</tr>
<tr>
<td>02 Hambantota WW Treatment System</td>
<td>30,400</td>
<td>6,782</td>
</tr>
<tr>
<td>03 Sri Jayawardenepura Kotte Sewerage Project</td>
<td>138,300</td>
<td>22,060</td>
</tr>
<tr>
<td>04 Wastewater Disposal Project for Ratmalana-Moratuwa &amp; Jaela/Ekala - Phase II</td>
<td>49,600</td>
<td>8,462</td>
</tr>
<tr>
<td>05 Augmentation of Kataragama Sacred City Sewerage Project</td>
<td>23,000</td>
<td>1,324</td>
</tr>
<tr>
<td>06 Waste Water Disposal System for Maharagama and Boralesgamuwa UC Area</td>
<td>27,300</td>
<td>2,281</td>
</tr>
</tbody>
</table>
Future Plans and Direction

Technical Approach, Design Principles, Disposal Methods

Technical Approach (cont..)

Historical approach:
- Domestic Wastewater (Urban, Sub-urban, Rural areas)
  - Prior to 1960’s, only pit latrines,
  - 1960-1970’s, Cess-pits, septic tanks + soakage pits, in UC, MC areas,
- Individual WW Treatment systems in Hospitals, Hotels, Major Gov. Institutions, Housing Schemes
  - 1970-1980’s, Tricking filters, waste stabilization ponds,
  - 1980 – 1985’s, Activated sludge process with extended aeration by mechanical aeration,
  - 1985 onwards, deep Sea-outfall, activated sludge process, RBC, mechanically aerated waste stabilization ponds
Technical Approach (cont..)

- **Present and Future: On-Site Systems**
  - In MC areas Mostly preferred Option: Septic Tanks + Soakage pits after building approval by MC + UDA, if pipe sewerage is not available,
  - Rural areas Preferred Options: Septic Tanks + Soakage pits, Cess Pools (if GW table permits) after building approval by UC or Pradeshiya Sabha,
  - Additional Treatment for Effluents from septic tanks followed by anaerobic filters for needy “Clustered Housing”,
  - Dry Compost Toilets in Dry, well drained soil conditions,

Technical Approach, Design Principles (cont..)

- **At Present and Future in Off-Site Systems:**
  - **Design principles**
    - All flows by gravity and capacity of pumping stations will be phased out,
    - Extremely deep sewers (> 4.5 m) will be avoided,
    - Full treatment of WW with natural systems is adopted wherever lands are available,
    - Compact facilities for systems with limited land availability and for small systems,
    - Discharge of fully treated effluent to inland water bodies or by short sea outfall,
    - Discharge of the un-treated WW by deep sea outfall,
    - Effluent quality requirement is achieved,
Future Plans and Direction in WW Management (cont..)

- Wastewater in Townships with Institutional and Commercial areas will be disposed either by
  - Individual sewer Systems comprising full treatment, the effluent discharged to Inland water body /or short sea out fall,
  - Individual system comprising partial treatment, the effluent discharged to wetlands /or short sea out fall,
  - Individual system with no treatment, the effluent discharge to long sea out fall,

- Wastewater in housing schemes in sub-urban settings will be disposed
  - with appropriate low cost WW treatment methods (waste stabilization ponds, combination of septic tanks / anaerobic filters, simplified small bore sewer system)

Future Plans and Direction in WW Management (cont..)

- Industrial Wastewater
  - Dedicated Centralized sewer Systems comprising full treatment located within the industrial zones, the effluent discharged to Inland water body or Central public WW collection system,
Major Issues

Technical, Social, Environmental, Economical

Urban Sewerage Infrastructure

Specific Planning Issues

- **Land Constraints**
  - Rapid urban developments plans without due consideration to WW disposal infrastructure and nuisance buffer zones take up much land,

- **Higher Environmental Standards which are not practicable in certain circumstances,**

- **Risks of Water Resource Contamination**
  - Possibilities of sewage overflows within water catchments

- **Visual Impacts and public objection due to odor**

- **Costly alternatives subsequent to town/ housing/ road development projects**

- **Laying of sewer reticulation through highly congested areas.**
Planning for Long Term Needs of Wastewater Management

Need to address major issues:

- Adequate and timely provision of sewerage facilities to meet future needs,
- Enhance and prolong the life of existing sewer reticulation system,
- Provide adequate safeguard to the environment by installing sewerage infrastructure in par with the other developments,
- Establishing and maintain Monitoring and surveillance systems for industrial WW effluents,
- Recognizing the priority of the development needs in the sewerage infrastructures,

Environmental and Economical Issues

- Public objection to sewerage infrastructure due to odor and devaluation of adjacent real state economic values,
- High maintenance cost of infrastructure and inability to recover at least the O & M cost,
- Sustainability of systems due to low affordability of the consumers,
- Restrictions on sludge disposal sites by regulators,
- Practical limitations in implementing effluent discharge regulations,
- Practical limitations in maintaining large numbers of scattered individual WW systems in Hospitals, Housing schemes etc
Social and Institutional Issues

- Limitations of skill work force to maintain the systems,
- Low Social recognition for sanitation workers,
- Difficult work environment and lack of incentives for workers,
- Consistent maintenance of workers safety standards,
- High investment needs for the plant and equipments to sustain the sewerage infrastructure,
- Lack of awareness of the public about sanitations and health risks.

Thank You