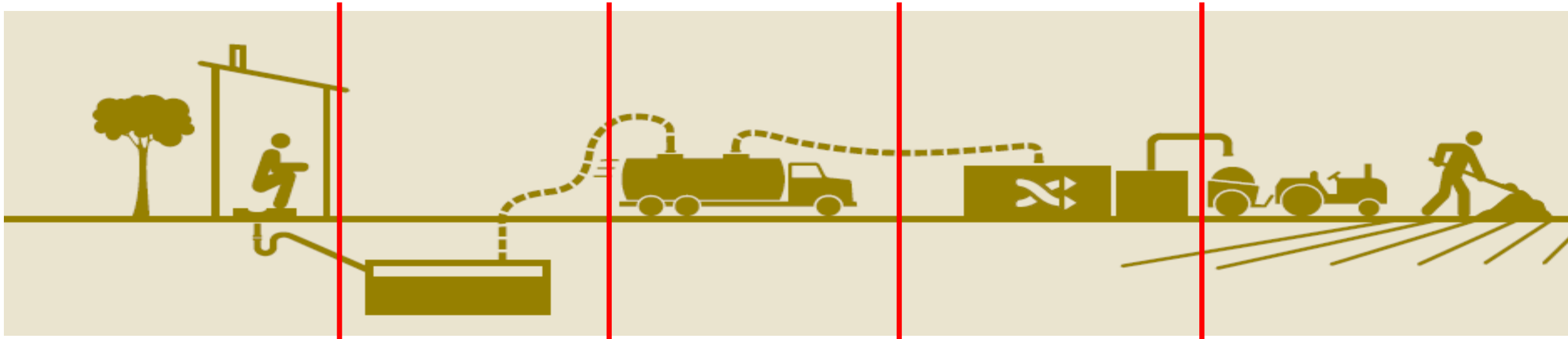
OPTIONS FOR DECENTRALIZED AND CENTRALIZEDWASTEWATER PLANTS

WATER RECLAMATION DIVISION
NATIONAL WATER SUPPLY & DRAINAGE BOARD

06TH AUGUST 2024

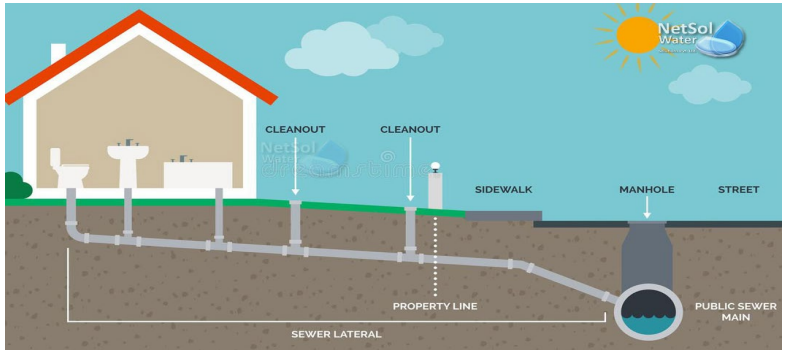
Safe Sanitation Service Chain



User Interface

Containment

Conveyance



Treatment

Reuse/Safe Disposal

Types of Sanitation Solutions

1. Onsite Sanitation Systems

- Provide of safe containment/ treatment for wastewater generated at scattered housing units, institutions, etc.
- Septic Tanks + Soakage Pits/ associated disposal systems

2. Faecal Sludge Management Systems

Facilitate safe disposal of faecal sludge from septic tanks /DEWATS to meet safe sanitation requirements

3. Decentralized Wastewater Treatment Systems (DEWATS)

- Suitable for locations where significant amount of wastewater generation
- Limited access to City Sewerage Systems due to distant location, cost implications.
- Suitable for clustered houses located away from existing city sewerage schemes. E.g. Condominium Housing, Estate Sector Housing, Schools, Hospitals, Prisons, Institutions, Public toilets in townships/pilgrim places, etc.

4. Centralized Wastewater Collection & Treatment Systems

- Economical for highly urbanized compact areas where limited space for onsite WW treatment.
- Significantly large amount of wastewater generation.

Important Facts on DEWATS

Usually function without outside energy or low energy inputs.

Tolerant towards inflow fluctuations

Usually does not require sophisticated technical equipment

If provided, it ensures more reliable operation and good stable effluent quality with energy input.

Does not require higher operation and maintenance skills.

Most operational & maintenance tasks can be carried out by the users, some maintenance services might require a local service provider.

In some cases, both operation and maintenance can be delivered by a service provider

Based on a modular, technical configuration concept.

Appropriate combinations of treatment modules can be selected, depending on the required treatment efficiency, costs, land availability, etc.

DEWATS

Can reduce pollution load to meet legal requirements.

Generated solid waste (sludge) must be handled, treated and disposed of in accordance with hygiene and environmental standards

Consider the socio-economic environment of a given location.

Neglecting these conditions will result in the failure of the technology

Can be constructed form locally available materials.

Can be implemented by the local workforce provided with high quality standards in planning.

Treatment Process for DEWATS

- Typically use of the physical and biological (anaerobic, aerobic or combination) treatment processes to reduce and remove pollutants from wastewater.

Sedimentation	• removal of easily settleable solids • anaerobic fermentation of settled solids • removal of sludge
Anaerobic Digestion	• removal of easily degradable organic solids • mineralization of suspended or dissolved organic compounds, biogas production • settling of mineralized particles, collection and ventilation of biogas • removal of sludge
Aerobic Decomposition	• removal of easily and more difficult degradable solids • mineralization of suspended or dissolved organic compounds • settling of mineralized particles • removal of sludge
Post-treatment	• removal of suspended digested solids, active bacteria mass and pathogens • settling of finest suspended solids, removal of algae • retaining of living and dead algae • removal of sludge

Treatment Options for DEWATS

Sedimentation	• Septic Tank / Holding Tank • Sedimentation Tank
Anaerobic Digestion	• Anaerobic Baffled Reactor • Anaerobic Filter (attached growth system) • Anaerobic Pond • Fully mixed digesters or Imhoff tanks • UASB (Upflow Anaerobic Sludge Blanket) Reactor/ Anaerobic Digester
Aerobic Treatment / Decomposition	• Facultative/Oxidation Ponds • Aeration Tank/Moving Bed Biofilm Reactor (MBBR) - aeration + attached growth • Trickling Filters • Down Hanging Sponge Reactors (attached growth system)
Post-treatment	• Polishing Ponds/Maturation Ponds • Gravel Filters/Constructed Wetlands • Floating Wetlands • Disinfection
Packaged Treatment Units	➢ Combination of above treatment steps Ex.:- Johkasou system, Fixed Bed Biofilm Reactor (FBBR), BioKube Treatment Systems

DEWATS Technology Selection

Appropriate technical configuration depends on the:

- volume of wastewater
- quality of wastewater
- local temperature
- underground conditions
- land availability
- costs
- legal effluent requirements (CEA Effluent Discharge Standards)
- cultural acceptance and social conditions
- final handling of the effluent (safe discharge or reuse)

Examples for De-centralized Wastewater Treatment Systems

- SLS 745 Part-I and Part-II design guidelines for designing Septic Tank, Anaerobic Filter, Soakage Pit and other associated onsite wastewater disposal systems

Septic Tank + Soakage Pit (In-situ /Precast Construction)

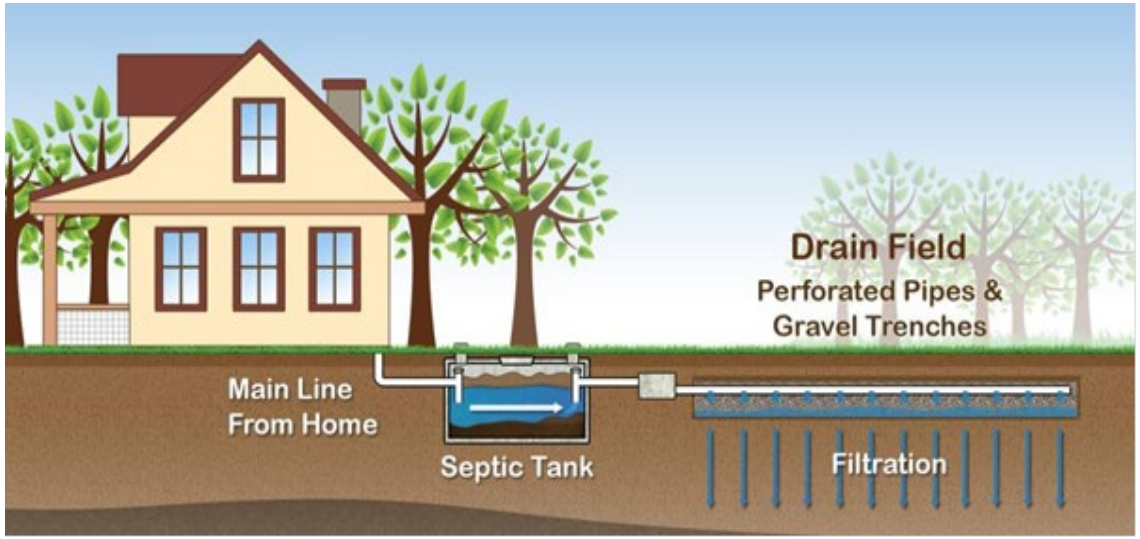
- Suitable for low seasonal ground water table (> 2.5 m) with high soil percolation capacity
- Able to remove about 50% –60% of pollutant load in the sewage
- Well designed soakage pit further removes pollutant and faecal contamination load when pass through soil
- Hardly any O&M input requirement except annual desludging of septic tank

Limitations;

- Soil/site limitations (soil percolation capacity and high ground water table)
- Availability of space
- At least 50 feet away from dug wells and surface water sources
- Not suitable for reuse

Septic Tank + Seepage Trenches/Beds

- Suitable for high seasonal ground water table (>1.0 m) with moderate/high soil percolation capacity
- Hardly any O&M input requirement except annual desludging of septic tank



Limitations;

- Soil/site limitations (soil percolation capacity and high ground water table)
- More land required compared to septic tank + soakage pit system
- Landscape disturbance

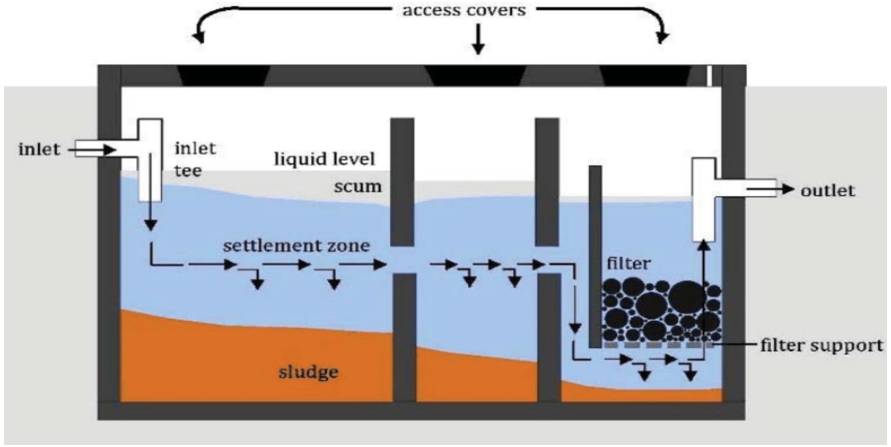
Septic Tank + Anaerobic Filter + Soakage Pits

- Suitable for individual dwelling or small commercial/institutional establishments
- Able to remove some pollutant loads below CEA discharge standards
- Hardly any O&M input requirement except annual desludging of septic tank

Successful implemented 3554 of similar systems under GPOBA project

Capacity – 1 m3/day

Treatment efficiency >90%, Effluent BOD_5 < 30 mg/l



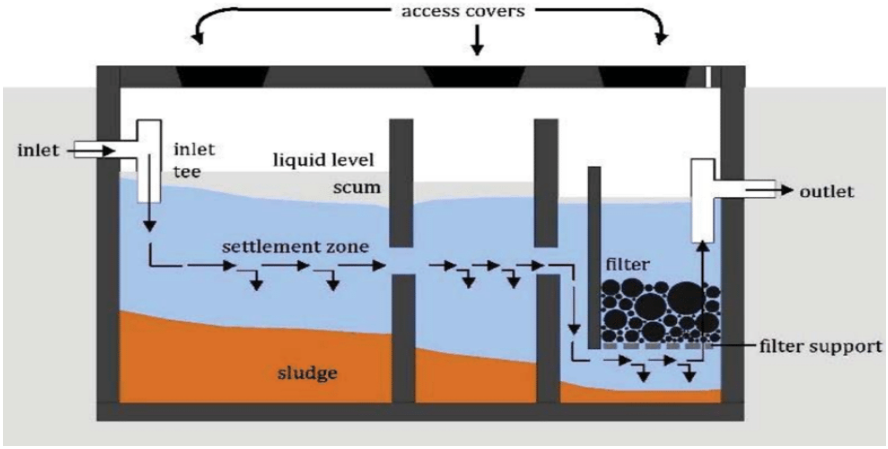
Septic Tank + Anaerobic Filter + Wetlands

- Suitable for individual dwelling or small commercial/institutional establishments where more/sufficient land is available
- Able to remove pollutant loads below CEA discharge standards
- Possibility for effluent reuse preferably after disinfection
- Hardly any O&M input requirement except annual desludging of septic tank and trimming and removal of excess wetland plants and dried leaves.

Example of successful implementation of Septic tank + Anaerobic biofilter + Wetland and Chlorination system for a house in Panadura.

Capacity – 1 m3/day

Treatment efficiency >90%, Effluent BOD5 < 20 mg/l



Septic tank + Up flow Anaerobic Filter + Wetlands + Reuse system

Jaffna University Female Hostel in operation since 2014

Capacity – 45 m3/day

Treatment efficiency >90%, Effluent BOD5 < 30 mg/l

Septic tank + Up flow Anaerobic Filter + Sub-surface Wetland and Chlorination system

Ratmalana Tsunami Resettlement Housing Scheme (324 Housing Units – 4 Storied buildings in 2011)

Capacity – 200 m3/day

Treatment efficiency > 90%, Effluent BOD5 < 30 mg/l

Septic tank + Up flow Anaerobic Filter + Constructed Wetlands

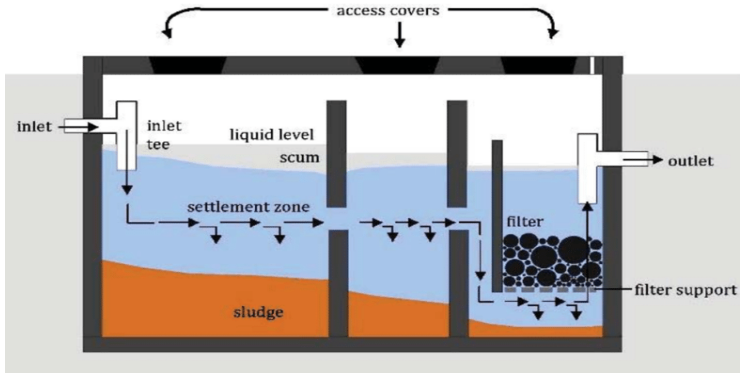
DEWATS at Adams Peak in operation since year 2014

Capacity – 65 m3/day

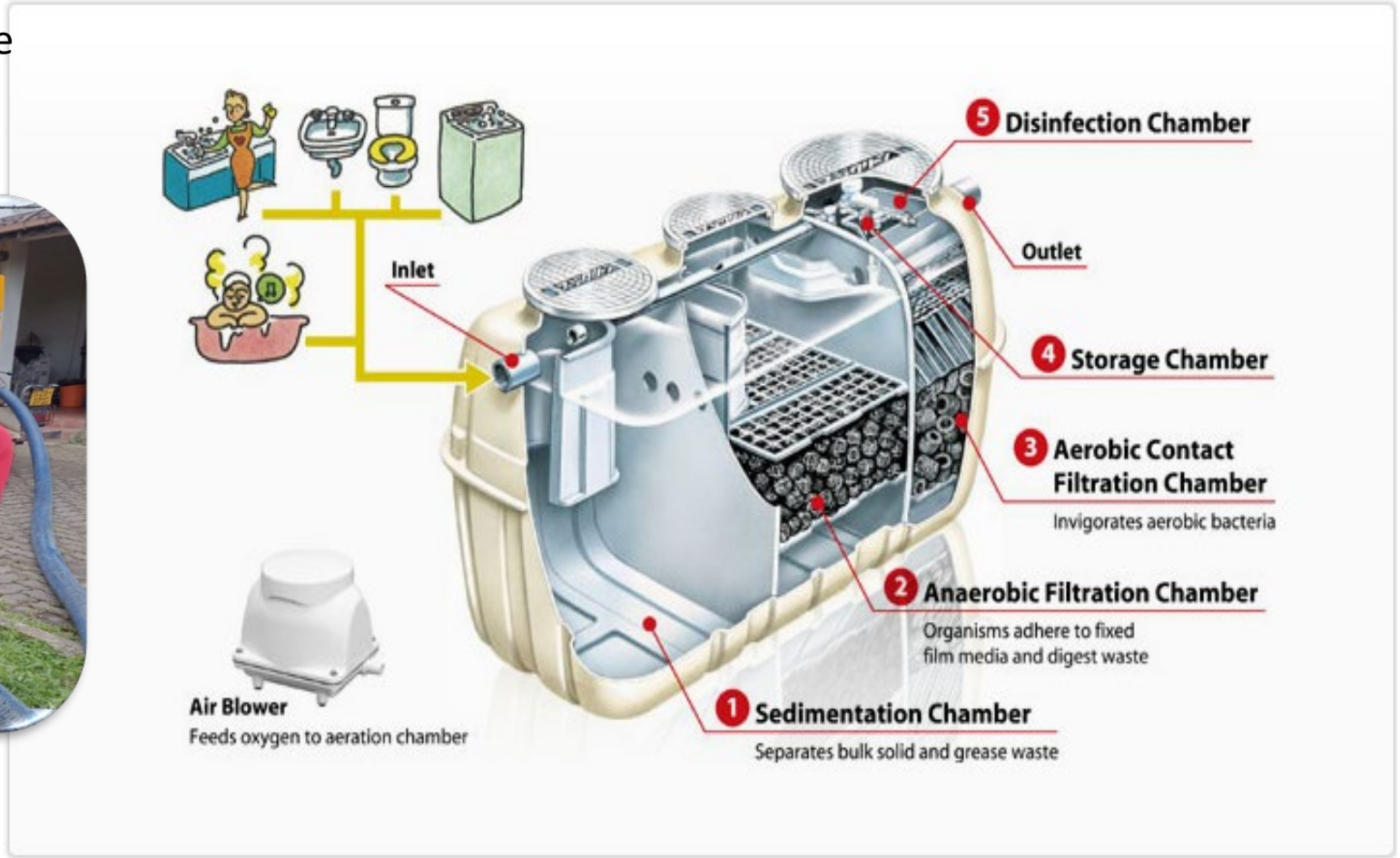
Treatment efficiency >90%, Effluent BOD_5 < 30 mg/l

Packaged Type Treatment Units

- Sedimentation, Anaerobic Filter, **Aeration Tank / MBBR**, Storage and Disinfection
- Capacity usually 1-50 m3/day
- Needs energy input for aeration
- Good effluent quality & possible for reuse
- Requires periodic operation and maintenance
- Requires sludge disposal in every 6 months



Desludging of the Johkasou system at the Ministry of Water Supply



Other Types of DEWATS

Defense Headquarters - Akuregoda
Activated Sludge Extended Aeration Treatment System + Maturation Ponds
1200 m3/day

- High energy intensive treatment process

Kegalle Hospital
Imhoff tank + Trickling Filter System

Peliyagoda Fish Market
UASB+ MBR System

- High energy intensive treatment process
- Very good effluent quality
- Reuse for floor washing

Centralized Wastewater Treatment Systems/Urban Sewerage Systems

- Centralized large-scale plants that serve expansive municipal or regional service areas
- Used high-tech equipment and high energy intensive process
- Coupled with large sewer reticulation system
- Need skilled work force for O & M

Kandy City WWMP- (Oxidation Ditch)

Capacity – 14,000 m^3/day

Population Coverage– 55,000 (Domestic)

Ja Ela Ekala WWMP - (A_2O)

Capacity – 7,500 m^3/day

Population Coverage– 8,000(Domestic) + Industrial/ 73,500 PE

Greater Kurunagala WMMP- (AO)

Capacity – 4,500 m^3/day

Population Coverage– 25,000(Domestic)

Kataragama WMMP- (Aerated Lagoons)

Capacity -3,000 m^3/day

Population Coverage– 12,000 (Domestic)

Thank You

What is a Faecal Sludge Treatment Plant (FSTP)?

- After Faecal Sludge/Septage is de-sludged/removed from Septic Tanks/Pit Latrines, it has to be transported by means of Gulley Bowsers to Faecal Sludge Treatment Plants(FSTPs) for treatment.

- The treated wastewater has to be complied with CEA discharge standards.

Existing Faecal Sludge Treatment Plants in Sri Lanka

Mechanized Faecal Sludge Treatment Plants(FSTPs)- Activated Sludge

Weligepola Faecal Sludge Treatment Plant (25m^3/Day)

Thalawakele Faecal Sludge Treatment Plant (25m^3/Day)

Ruwanwella Faecal Sludge Treatment Plant (25m^3/Day)

Existing Faecal Sludge Treatment Plants

Waste Stabilization Pond Systems

Mulathivu Faecal Sludge Treatment Plant (25m3/day)

Kilinochchi Faecal Sludge Treatment Plant (25m3/day)

Chilaw Faecal Sludge Treatment Plant (25m3/day)