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TAMIL NADU URBAN SANITATION SUPPORT PROGRAMME

iihs™
INDIAN INSTITUTE FOR HUMAN SETTLEMENTS

In Association With:

Keystone

Consortium for DEWATS Dissemination Society

Training programme on Fecal Sludge Management for Engineers in Trichy Corporation

Components of an FSTP

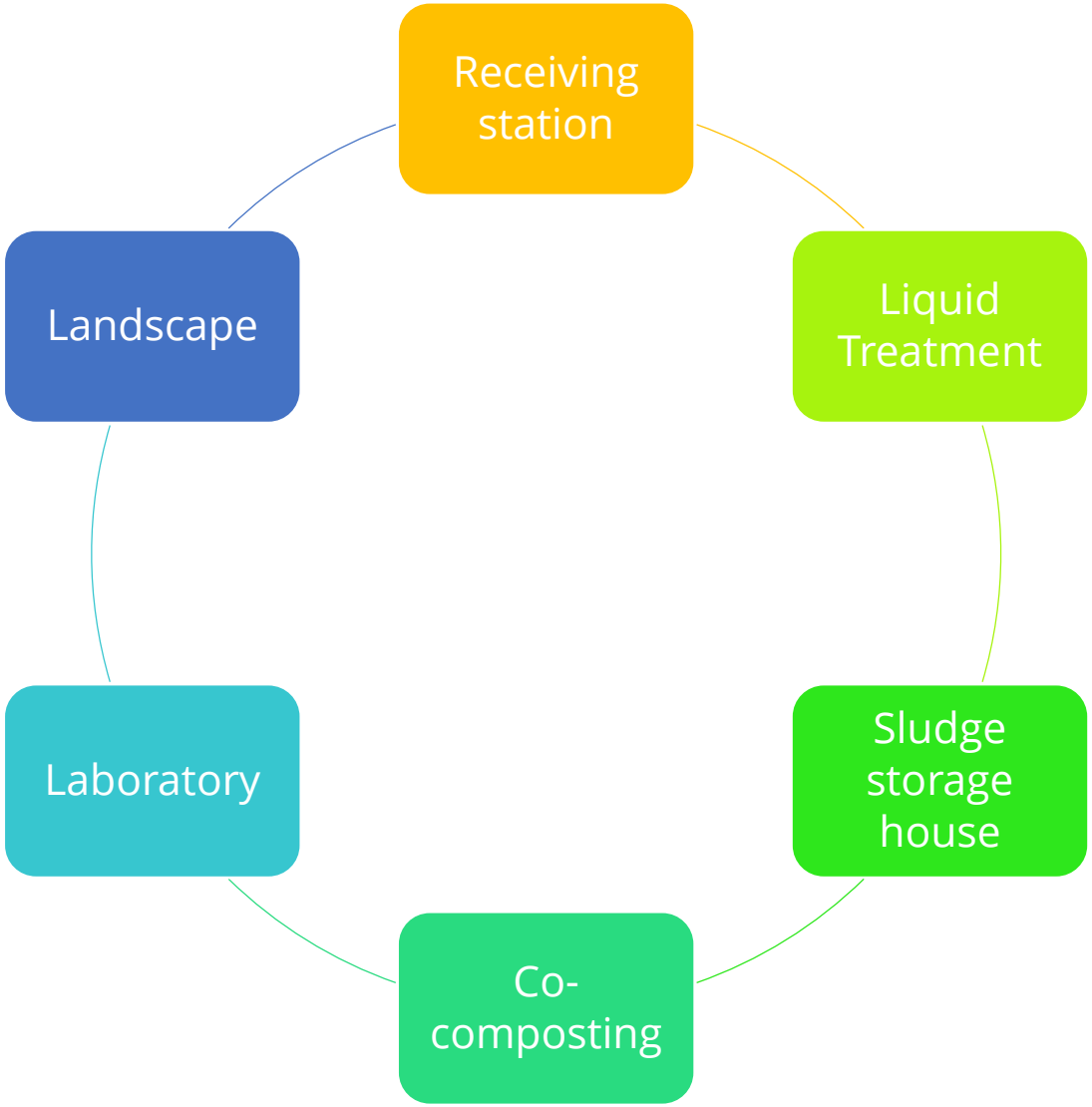
Introduction

In a Fecal Sludge Treatment Plant (FSTP), apart from the main treatment modules there are secondary components which are essential for its smooth functioning without which it is incomplete.

These components are as follows:

- Liquid Treatment
- Landscape (optional)
- Receiving Station
- Laboratory (optional)
- Sludge Storage House
- Co-composting (optional)

Components of an FSTP



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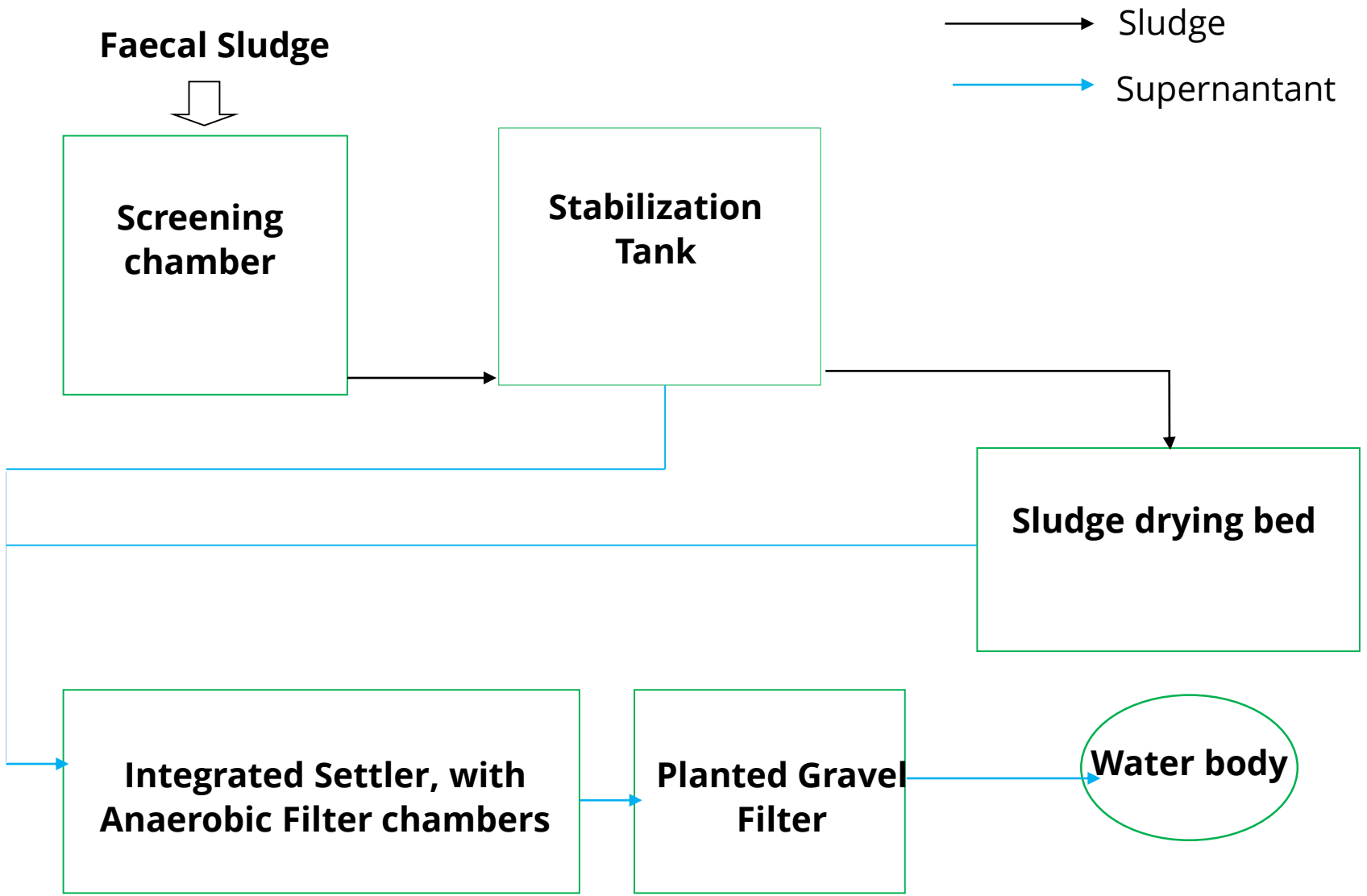
Receiving Station

- The receiving station of the FSTP must be easily accessible to the cesspool vehicle
- The path must be wide enough for the vehicle to pass
- Presence of a screening chamber at the receiving station to prohibit entry of anything other than fecal sludge

Liquid Treatment approach

- **Preliminary Treatment**
  - To prevent blockages in the following treatments processes by removing heavy solids
- **Primary Treatment**
  - To remove organic and inorganic solids by the physical process of sedimentation and floatation
- **Secondary Treatment**
  - To remove dissolved and colloidal substances from wastewater by microorganisms
- **Tertiary Treatment**
  - To remove specific substances from wastewater using biological, chemical and physical treatment methods

Process Flow of FSTP



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Liquid Treatment Options

- Sequential Batch Reactor
- Activated Sludge Process
- Membrane Bioreactor
- Soil Biotechnology
- Rotating Biological Contactor
- Aerators
- Moving Bed Bio Reactor/ Fluidized Aerobic Bioreactor
- Trickling Filter
- Aerated Lagoons
- Upflow Anaerobic Sludge Blanket (USAB)

Settler (ST)

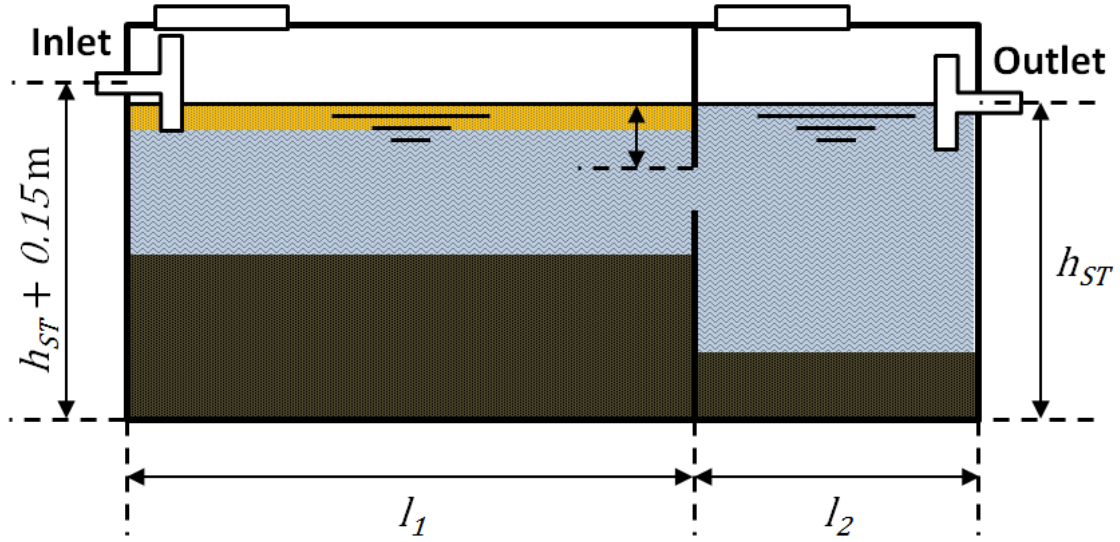
Settler | ABR | AF | PGF | SCF | UV and Chlorination

Settler (ST)

Primary Treatment Unit

- Consists of 2 compartments
  - Second chamber approx. 0.5 x length of first chamber
- Retaining of settling particles through sedimentation
- Retaining of scum/floating particles on top
  - Effluent is free of settleable solids
- Dissolved and suspended matter passes untreated t

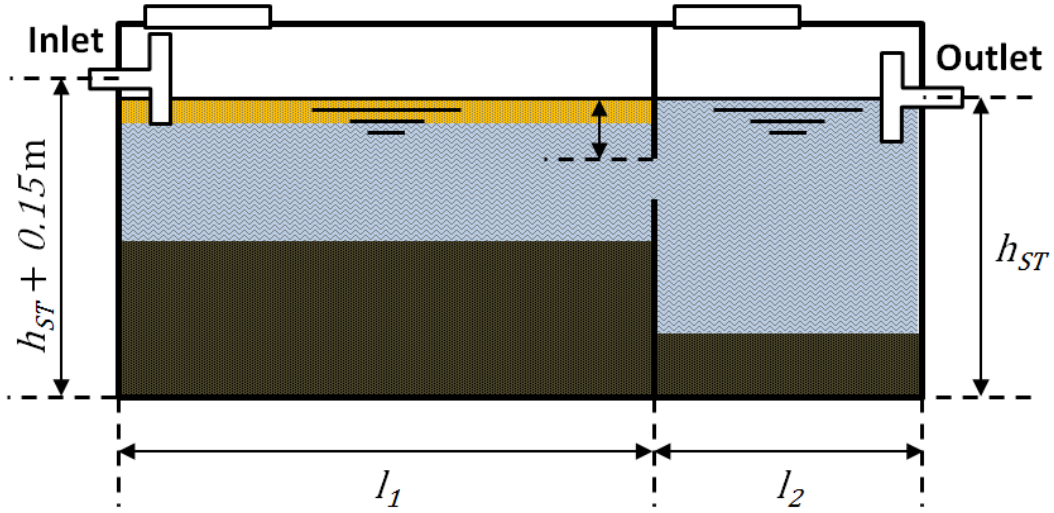
  next stage



Settler (ST)

Primary Treatment Unit

- To prevent blocking: inlet and outlet as T-pipe
- Outlet should be approx. 20 cm lower than inlet
- Settled particles accumulate as sludge at the bottom
  - Desludging necessary every 1 to 3 years
  - No manual emptying, use vacuum truck or similar
  - Settlers need a vent pipe to release gas
- Suitable for all climates
- Retention time: approx. 2 hours
- BOD removal efficiency:
  - 20 – 30 %



Settler (ST)

Primary Treatment Unit

Settler (ST)

Primary Treatment Unit

Settler (ST)

Primary Treatment Unit

Anaerobic Baffled Reactor (ABR)

Settler | **ABR** | AF | PGF | SCF | UV and Chlorination

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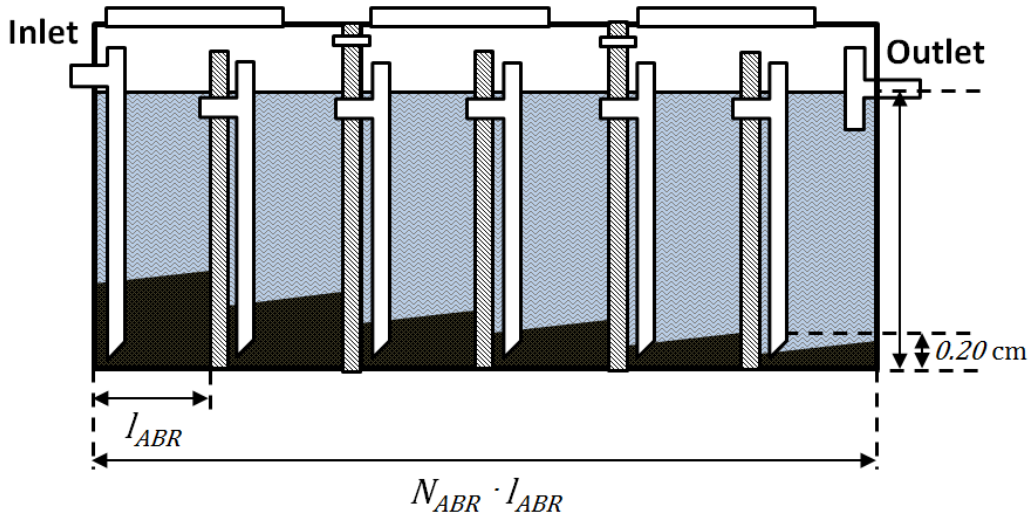
Anaerobic Baffled Reactor (ABR)

Secondary Treatment Unit

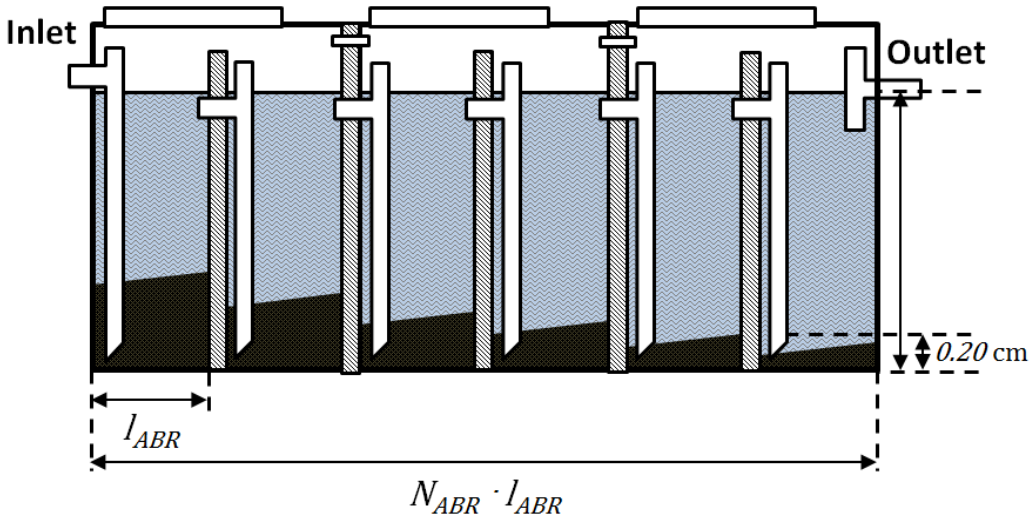
- Anaerobic treatment
  - Absence of free oxygen
- Wastewater passes series of up-flow chambers
  - Built-up of active microbial sludge blanket
  - Biological treatment
- Treatment (degradation) of suspended and dissolved solids by increased contact time with anaerobic bacteria
- Design parameter:
  - Retention time
  - Temperature
  - Number of chamber
  - Up-flow velocity



Anaerobic Baffled Reactor (ABR)

Secondary Treatment Unit

- **Resistant to flow fluctuations**
- **Start-up time**
  - Full efficiency after approx. 6 months (built-up of active sludge blanket)
  - "Seeding" with sludge from other ABR can shorten start-up time
- **Suitable for all climates**
  - Lower efficiency in colder regions
- **Effluent requires further treatment or appropriate discharge**
- **BOD removal efficiency up to 95%**
- **Desludging only necessary when excess sludge is observed**



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Anaerobic Baffled Reactor (ABR)

Secondary Treatment Unit

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Anaerobic Baffled Reactor (ABR)

Secondary Treatment Unit

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Anaerobic Baffled Reactor (ABR)

Secondary Treatment Unit



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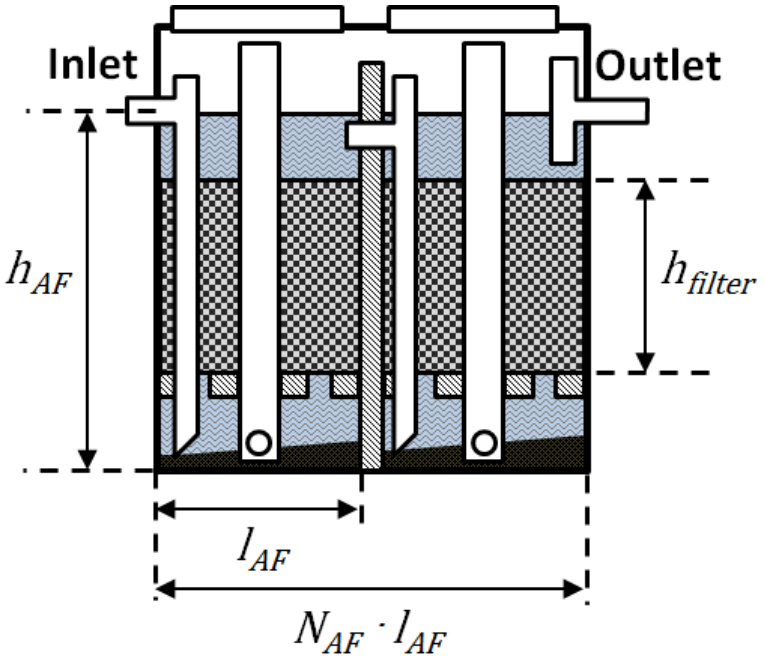
Anaerobic filter (AF)

Settler | ABR | **AF** | PGF | SCF | UV and Chlorination

Anaerobic Filter (AF)

Secondary Treatment Unit

- Anaerobic treatment (absence of oxygen)
- Wastewater passes series of up-flow chambers containing filter material
  - Built-up of activated microbial sludge on filter material surface
  - Biological treatment
- Treatment (degradation) of suspended and dissolved solids by extended contact time with anaerobic bacteria
- BOD removal efficiency up to 95 %
- De-sludging only necessary when excess sludge is observed



Anaerobic Filter (AF)

Secondary Treatment Unit

- Filter material used:
  - Gravel
  - Crushed rocks
  - Cinder
  - specially formed plastic pieces (corrugated pipes, bottle necks, etc.)

Anaerobic Filter (AF)

Secondary Treatment Unit

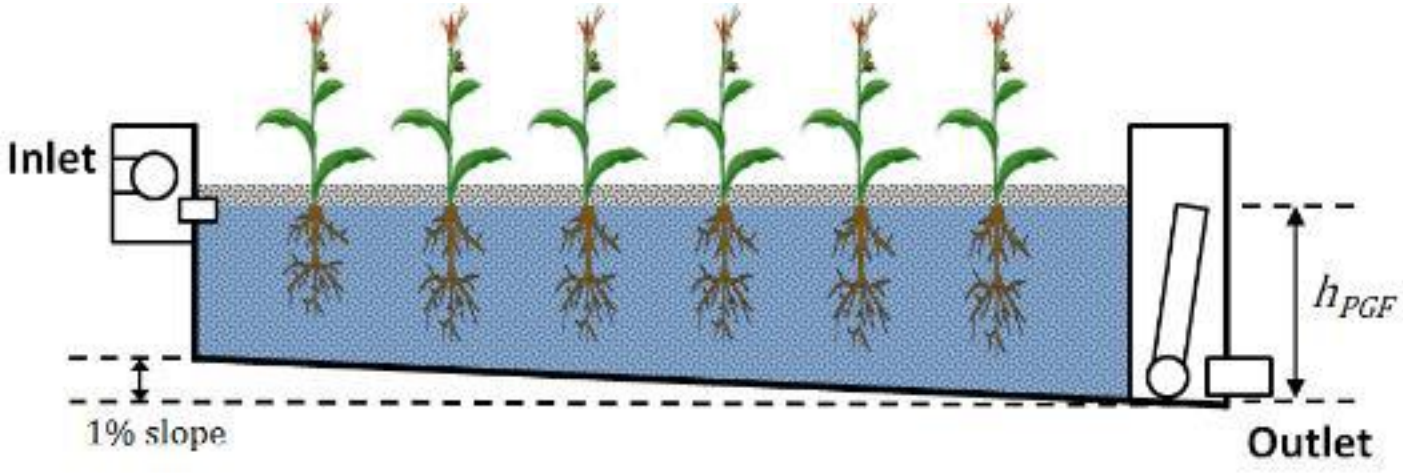
Planted gravel filter (PGF)

Settler | ABR | AF | **PGF** | SCF | UV and Chlorination

Planted Gravel Filter (PGF)

Tertiary Treatment Unit

- Aerobic treatment (presence of oxygen)
- Root of plants and void in filter material provide oxygen
- Water height in filter controlled by swivel pipe
  - Usually 0.60 m
  - Sub-surface flow flow (prevent mosquito breeding)
- Horizontal, sub-surface flow
- Wastewater needs pre-treatment before entering PGF



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Planted Gravel Filter (PGF)

Tertiary Treatment Unit

Planted Gravel Filter (PGF)

Tertiary Treatment Unit

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Planted Gravel Filter (PGF)

Tertiary Treatment Unit


Papyrus cluster


Canas Indica


Reed Juncas


Colacasia

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Planted Gravel Filter (PGF)

Tertiary Treatment Unit

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Sand and Carbon Filter (SCF)

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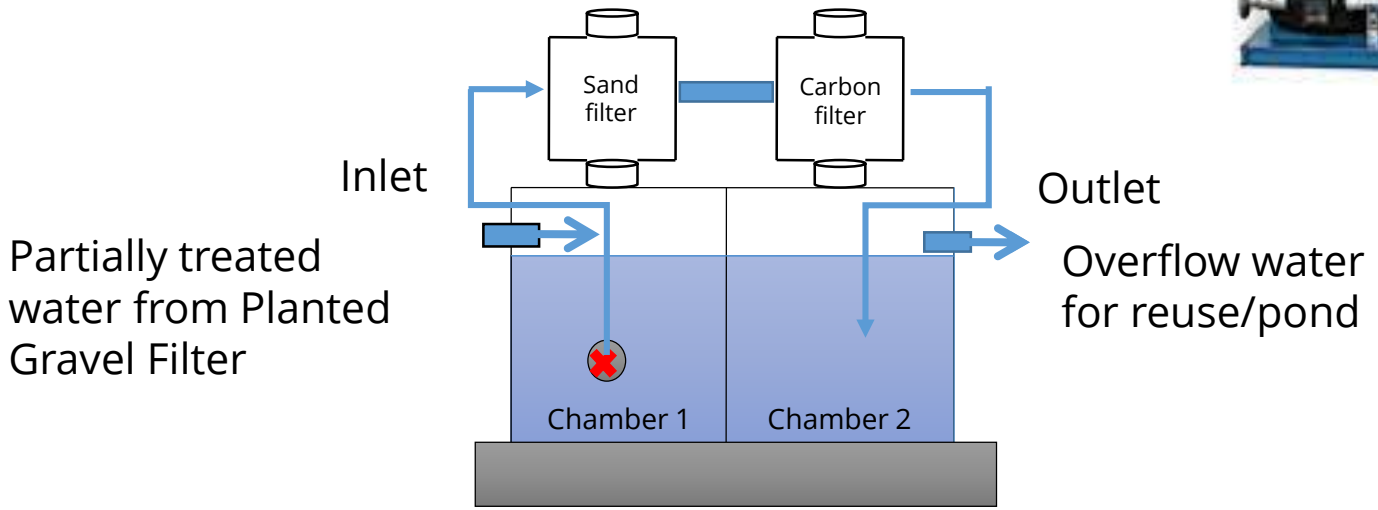
Sand and Carbon Filter (SCF)

- Performance : Removes Turbidity, TSS, colour, odour and heavy metals
- Consists of: Graded sand media, Activated carbon media



UV Filtration and Chlorination

Settler | ABR | AF | PGF | SCF | **UV and Chlorination**

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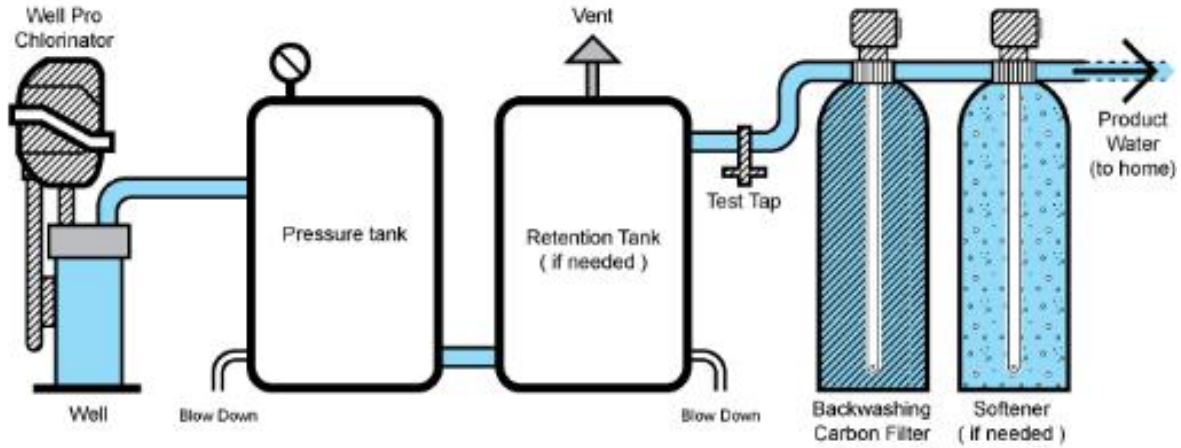
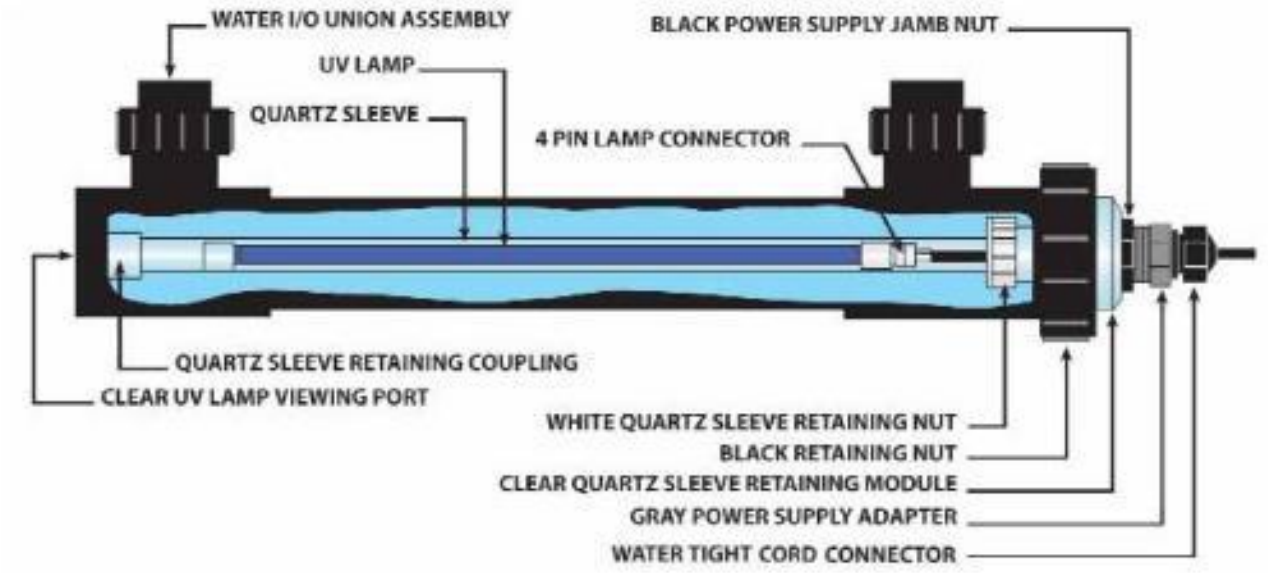
Laboratory

- A laboratory is vital for the functioning of an FSTP, mainly for monitoring the quality of treatment and R&D purposes
- Wastewater and faecal sludge is analyzed for physical, chemical and biological characteristics
- Parameters that are measured in a laboratory are COD, BOD, TSS, total N, Total coliform, etc.
- Planned sampling at the inlet/outlet of the modules are carried out at least quarterly

UV Filtration and Chlorination

- The final stage of treatment is disinfection
- Can be achieved by
  - UV filtration
  - Chlorination





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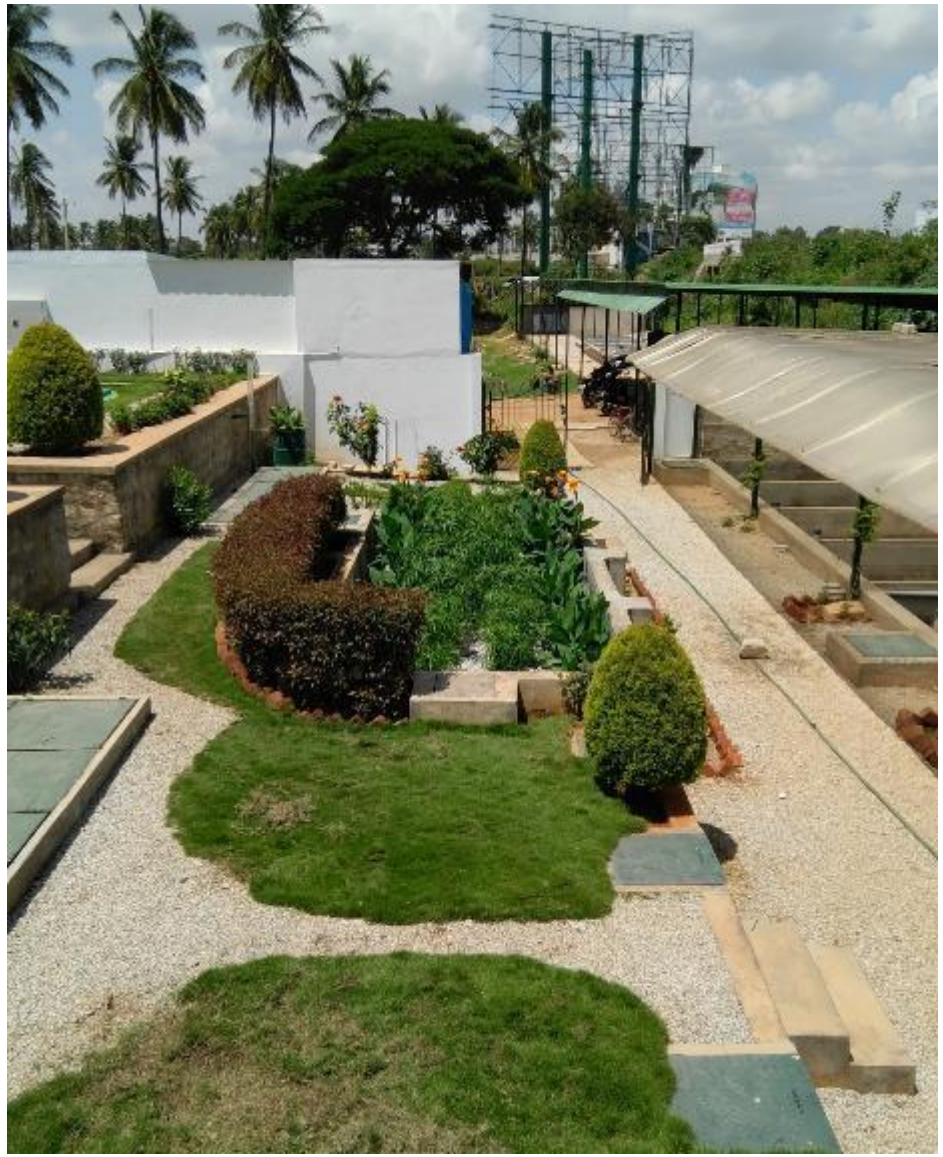
Sludge storage & co-composting

- Treated sludge is stored in sheds after drying in drying beds
- Presence of a storage house post treatment to prevent its contamination by moisture.
- Co-composted sludge is stored in bags for ease in transportation.
- Co-composting process is carried out in response to the significant presence of pathogens after the sludge treatment.
- Shredded organic MSW is placed, alternating with dried fecal sludge in 2:1 ratio by weight, called windrows.
- Sufficient moisture is added periodically to the windrows.
- At the end of 60 days, healthy co-compost is formed, devoid of pathogens.

Landscape

- Since most of the modules are underground, the above portion of the plant can be used for aesthetic appeal
- Common uses are gardening, car parking, etc.
- Possibility of smell from the modules can be arrested with planting trees around the boundary, which in turn attract flora and fauna



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Thank You