Capacity Building on Used Water Management
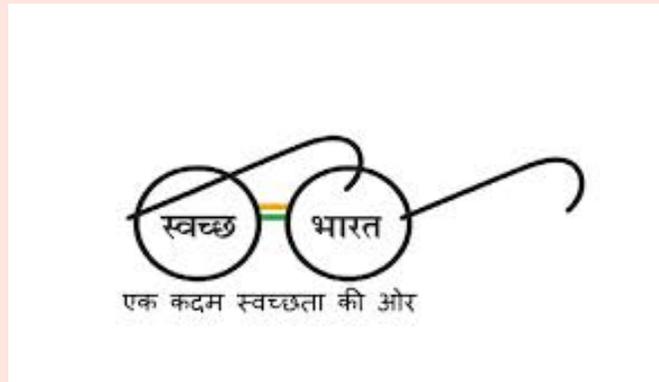
under

Swachh Bharat Mission- Urban 2.0 and Swachh Survekshan 2025-26

- Understanding of Type of Used Water
- Basic principals of treatment of used water
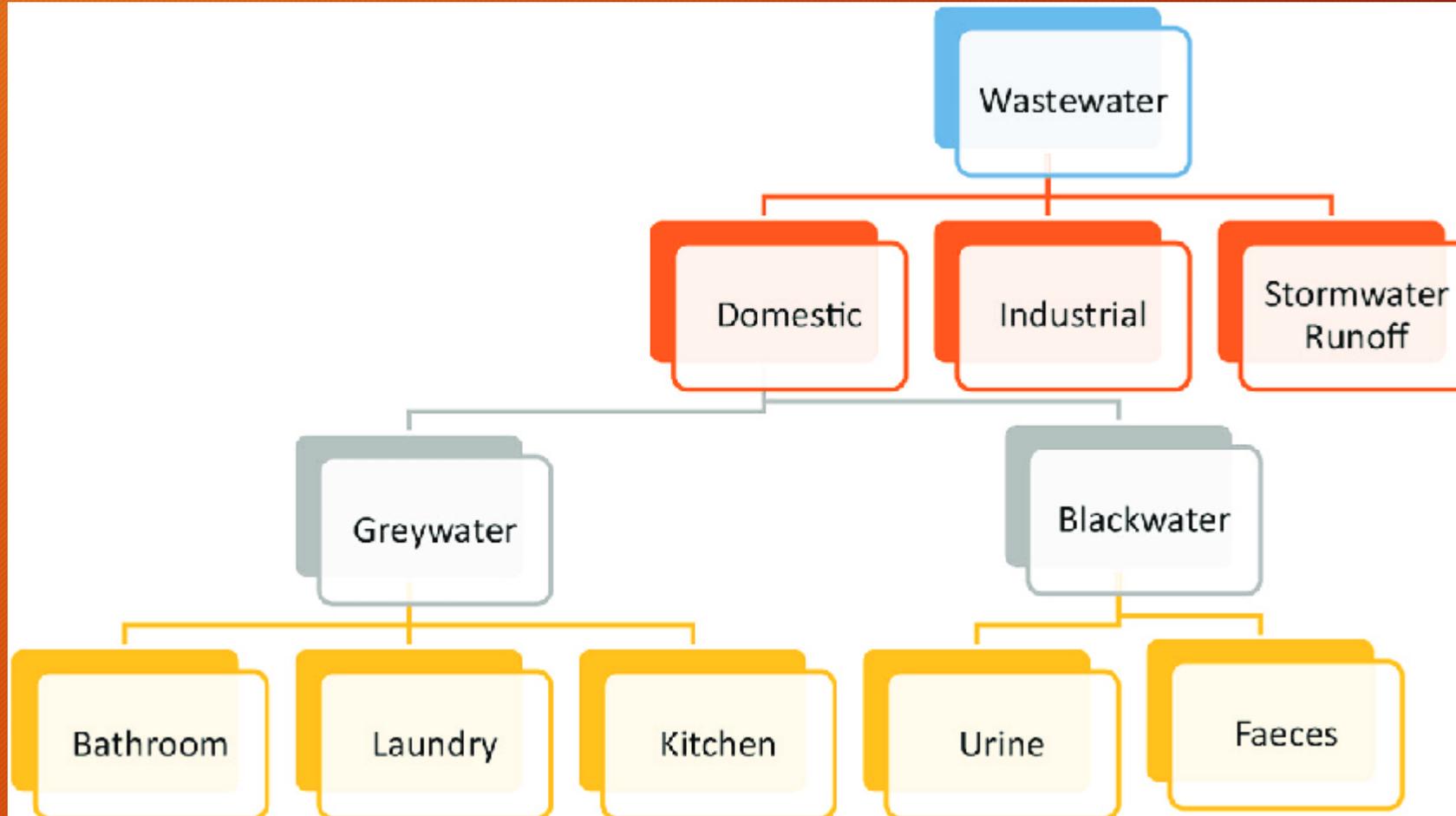- Re-use of treated used water

Promises..
- Clean and safe drinking water to all citizens.
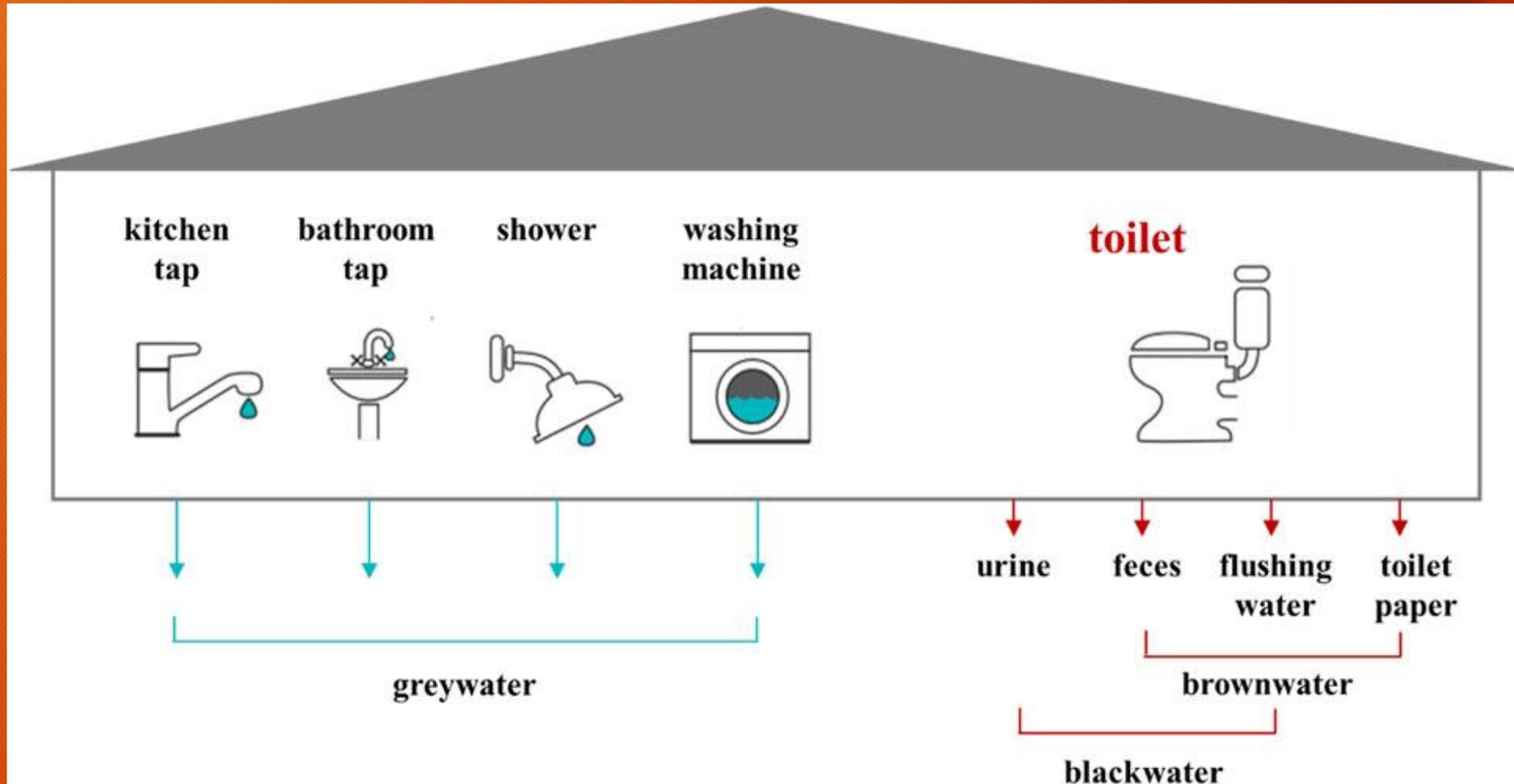- Access to toilet for each household by 2019.

- Awareness programmes to change the behaviour.
- No new schools, colleges, bus stands and dispensaries to be built without treatment plant.

What is Wastewater or Used Water?

What is Black & Grey Water?

Snapshot of Used Water Management

PARAMETER	GREY WATER	BLACK WATER
Type	Contaminated or Used Water have chemicals and no sewage	Used water with sewage content.
Composition	Chemicals – [No fecal contamination]	Sewage rich in organic materials, micro-nutrients, and nitrogen
Source	Bath, shower, sinks or washing machines	Urinals & toilets
Treatment	Sand filtration, lava filter systems, controlled wetlands and living walls.	**Biogas Settler, Imhoff Tank, Anaerobic Baffled Reactor (ABR), Anaerobic Filter, Waste Stabilisation Ponds, Aerated Pond, Free-Water Surface CW, Horizontal Subsurface Flow CW, Vertical Flow CW, Trickling Filter, UASB Reactor, Activated Sludge.**

Composition of Used Water
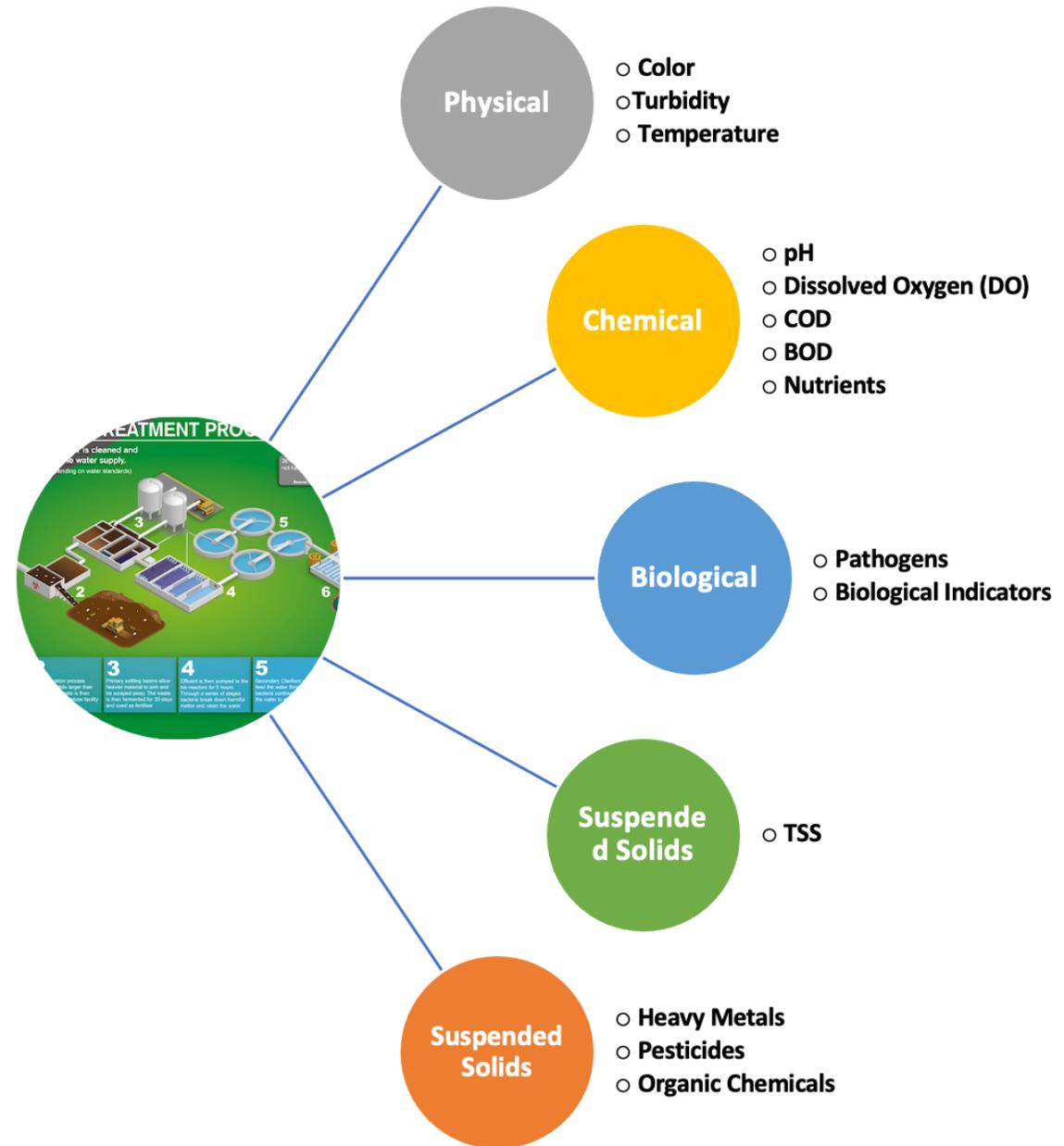
Used Water Treatment
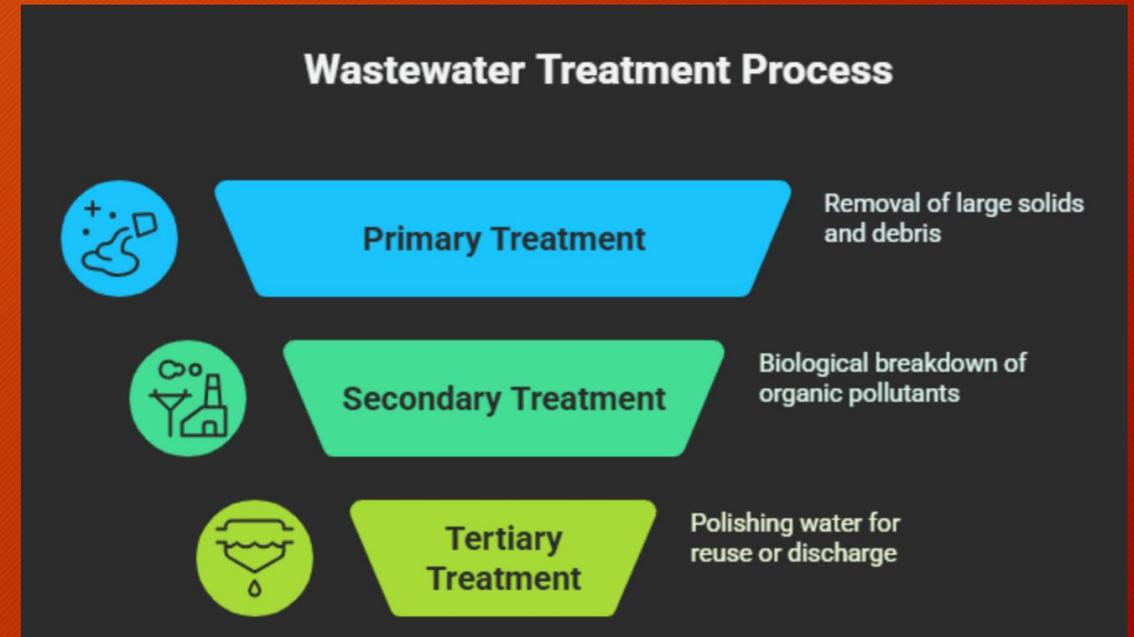
Need for Wastewater Treatment

- Municipal sewage has many types of impurities such as floating objects, suspended solids, dissolved solids, dissolved gases and microorganisms. Along with human organic waste, detergents, pesticides and pharmaceuticals also get added to it. Wastewater, therefore, can also be called water of different form where, if the concentration of impurities is reduced, can have applications similar to that of freshwater. Municipal wastewater treatment is the process of ejecting the harmful pollutants from wastewater

Objectives of Wastewater Treatment

The ultimate aim of wastewater treatment is to reduce the quantity of pollutants entering the natural environment, in some cases the specific goals can change from case to case. Specific goals of wastewater treatment can be as follows:

- To supply water to industries such as cement, pipe manufacturing, stone cutting or thermal power plant as process water,

- To reduce the eutrophication of the surface water bodies such as lakes,

- To reduce the dependency on the rain and irrigation canal water by reuse in agriculture in drought prone areas,

- To improve the ground water table through indirect aquifer recharge techniques.

IMPORTANCE OF SEWAGE WATER TREATMENT PLANT

➢ It is very important **to provide some degree of treatment to wastewater before it can be used** for agricultural or landscape irrigation or for aquaculture.

➢ The principal objective of sewage treatment is generally to **allow human effluents to be disposed of without danger to human health** or unacceptable damage to the natural environment.

➢ According to a research, a **large number of people die** from water born diseases in most of the developing countries. Therefore, it is very important to get the proper treatment of the water for a healthy living.

WASTE WATER TREATMENT PROCEDURE

Sewage treatment generally involves three stages, called
- PRIMARY TREATMENT
- SECONDARY TREATMENT
- TERTIARY TREATMENT

- **TYPES OF THE TREATMENT PROCESS**

| Sr. No.	Type of treatment	Type of treatment unit	Name of the unit	Type of impurities removed
1.	Physical treatment	Physical	Screen	Large suspended and floating matter
		Physical	Grit chamber	Grit
		Physical	Clarifiers	Silt, sand and other heavier matter
2.	Chemical treatment	Chemical	Chemical reactors	Dissolved chemicals
3.	Biological treatment	Biological	-Trickling filters -Activated sludge Plant -Rotating biological contactors - Digesters	Dissolved organic chemicals

1. Primary Wastewater Treatment – Removing the Obvious

- At this stage, wastewater flows through bar screens and grit chambers to trap debris such as plastics, sand, and silt. It then moves into a primary sedimentation tank where heavier particles settle at the bottom, forming sludge, while grease and oils float to the top and are skimmed off.

- This phase is purely physical and doesn't eliminate dissolved organic matter, but it's essential for preventing blockages and preparing the sewage for further treatment.
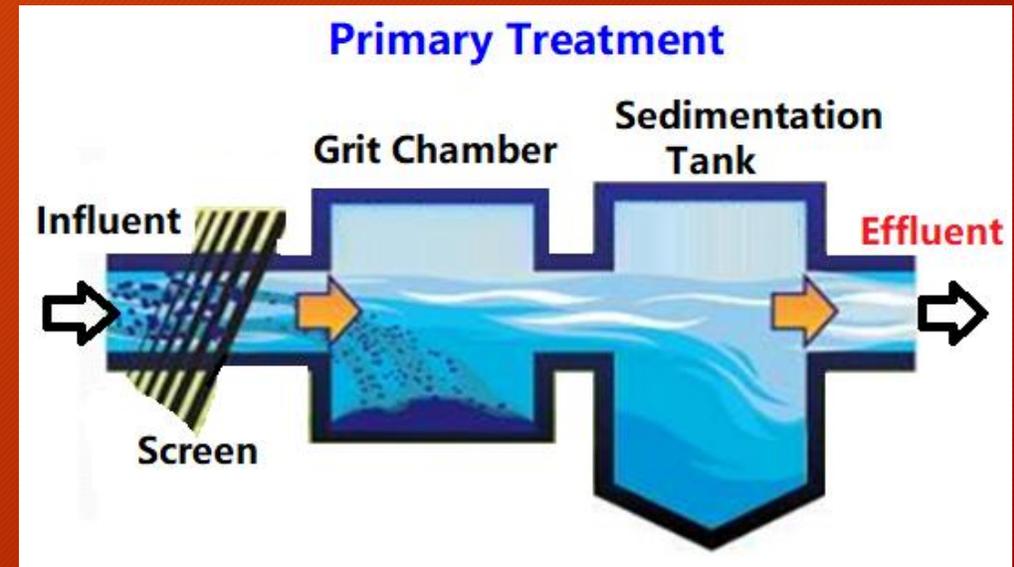
2. Secondary Wastewater Treatment – The Biological Clean-up

- Wastewater from the primary stage enters aeration tanks, where oxygen is added to promote the growth of aerobic bacteria. These microbes feed on the organic waste, converting it into less harmful substances. The resulting mixture then flows into a secondary clarifier where the biological sludge settles and is separated.

- This method is commonly known as the **activated sludge process** and is a standard in any modern **sewage treatment plant** design, especially for housing societies and commercial projects.

- Secondary treatment drastically reduces **biological oxygen demand (BOD)** and removes pathogens—ensuring that the **STP plant** meets national discharge norms.
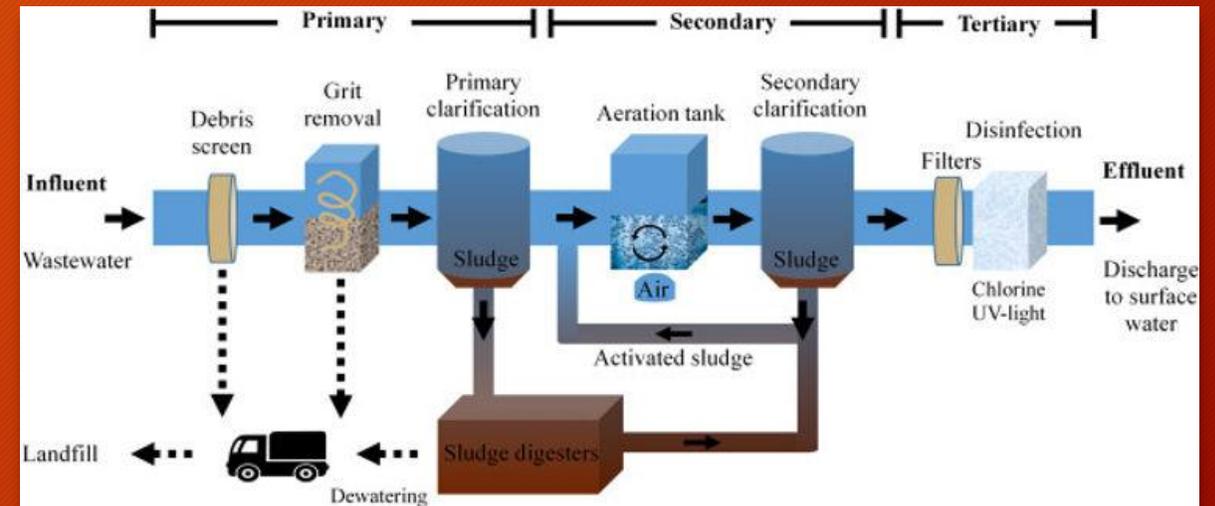
3. Tertiary Wastewater Treatment – Making Water Reusable

- This advanced treatment involves several processes such as sand filtration, membrane filtration (like RO or UF), disinfection using chlorine or UV light, and sometimes chemical dosing to remove nutrients like nitrogen and phosphorus.

- Many waste water treatment plants in India now include tertiary treatment, especially in regions facing water shortages. The reclaimed water is reused for flushing, gardening, and even cooling towers in industries.

Secondary treatment

- The main purpose of secondary treatment is to provide BOD removal beyond what is achievable by primary treatment.

- There are three commonly used approaches, two of these approaches, **the trickling filter (Fixed biomass)** and the **activated sludge process (floating biomass)**, sequentially follow normal primary treatment.

- The third, **ponds (oxidation ponds or lagoons)**, can provide equivalent results without preliminary treatment

Secondary treatment: trickling filters

- Trickling Filters are tanks filled with solid media (plastic, stones) over which the WW is trickled
- a bio-film grows on the media and metabolizes the organics in the WW, using natural or forced air draught
- The film sloughs off, requiring a secondary clarifier to separate the sludge from the 'secondary effluent'

Trickling filter

sprinkler

filter

feed pipe

filter support

collection

air

outlet
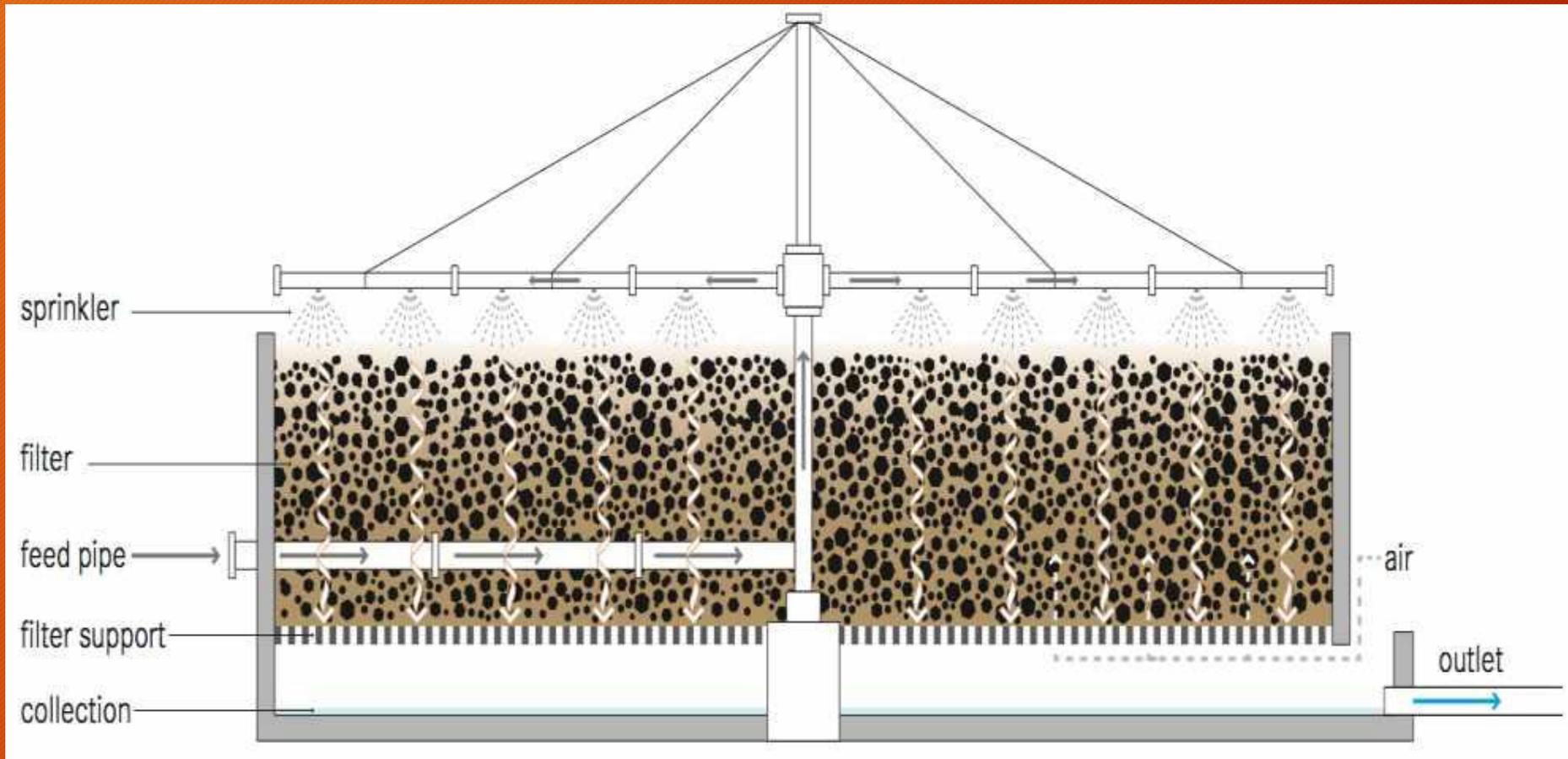
# Secondary treatment: trickling filters

Secondary treatment: activated sludge

- The basic components of an activated sludge sewage treatment system include an aeration tank and a secondary clarifier.
- Primary effluent is mixed with settled solids (biomass) recycled from the secondary clarifier and is then introduced into the aeration tank.
- Air is supplied continuously into the mixture.
- Wastewater is fed continuously into an aerated tank, where the microorganisms metabolize and biologically flocculate the organics.
- Microorganisms (activated sludge) are settled from the aerated mixed liquor in the final clarifier and are returned to the aeration tank. A portion of the concentrated solids from the bottom of the settling tank must be removed from the process (waste activated sludge).
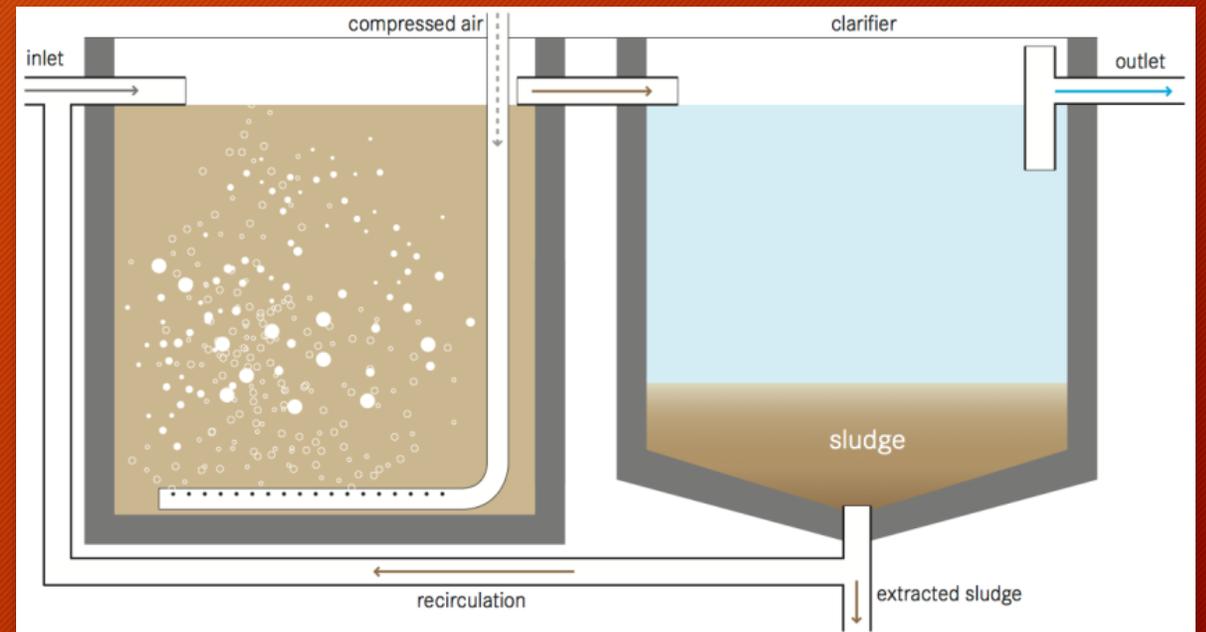
Secondary treatment: Waste Stabilization Pond

- Waste Stabilization Ponds (WSPs) are large, man- made water bodies. The ponds can be used individually, or linked in a series for improved treatment. There are three types of ponds,
  (1) anaerobic,
  (2) facultative and
  (3) aerobic (maturation),
  each with different treatment and design characteristics.

- Ponds are relatively easy to build and manage, can accommodate large fluctuations in flow. The actual degree of treatment provided depends on the type and number of ponds used.

- Ponds can be used as the sole type of treatment or they can be used in conjunction with other forms of wastewater treatment (i.e., other treatment processes followed by a pond or a pond followed by other treatment processes).
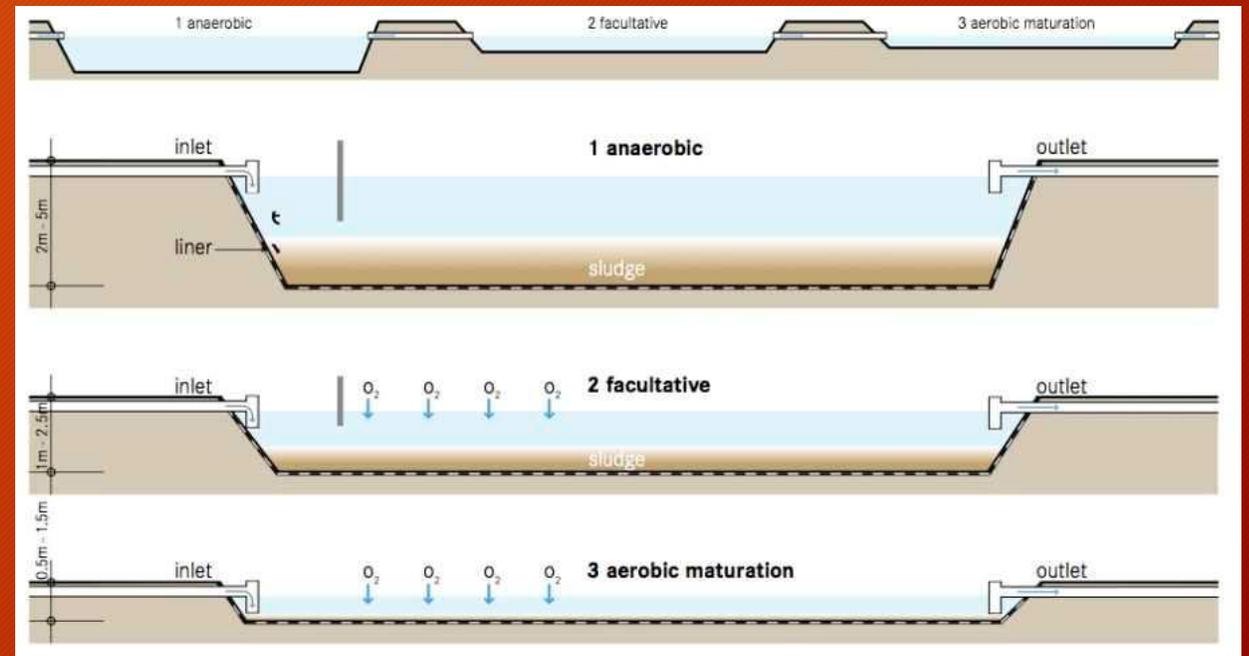
Waste stabilization ponds

A **pond-system** comprises:
- **anaerobic** sedimentation ponds,
- alternating **facultative** (aerobic) ponds and
- several **maturation** ponds (post-treatment ponds)
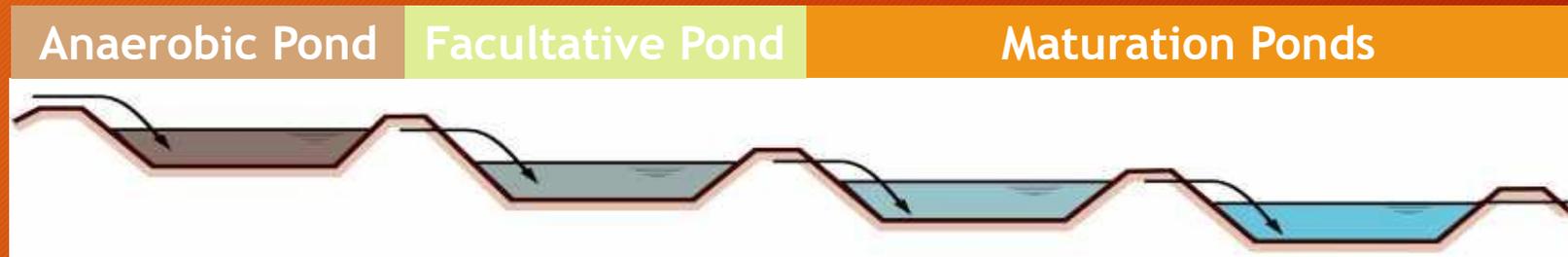
	Anaerobic Pond	Facultative Pond	Maturation Ponds
Design	Deep (2-5m) and highly loaded but rather small area	Shallow (<1.5m) but large → Oxygen supply (algae, wind, artificial aeration)	Shallow (<1m) but large area
Flow	Hydraulic retention time: 1 to 3 days	Hydraulic retention time: 10 to 20 days	Hydraulic retention time: 10 days
Function	Sedimentation and anaerobic stabilisation of sludge (BOD reduction 40-50%) → **settling**	Aerobic degradation of suspended and dissolved matter (BOD reduction 50-70%) → **degradation**	Final sedimentation of suspended solids, bacteria mass and pathogens → **hygienization**

Sandec Training Tool

Stabilization Pond (natural)

Secondary treatment: Biogas reactor

- A biogas reactor or anaerobic digester is an anaerobic treatment technology that produces
(a) a digested slurry (digestate) that can be used as a fertilizer and
(b) biogas that can be used for energy.
- A biogas reactor is an airtight chamber that facilitates the anaerobic degradation of blackwater, sludge, and/ or biodegradable waste.
- This technology can be applied at the household level, in small neighbourhoods or for the stabilization of sludge at large wastewater treatment plants. It is best used where regular feeding is possible.
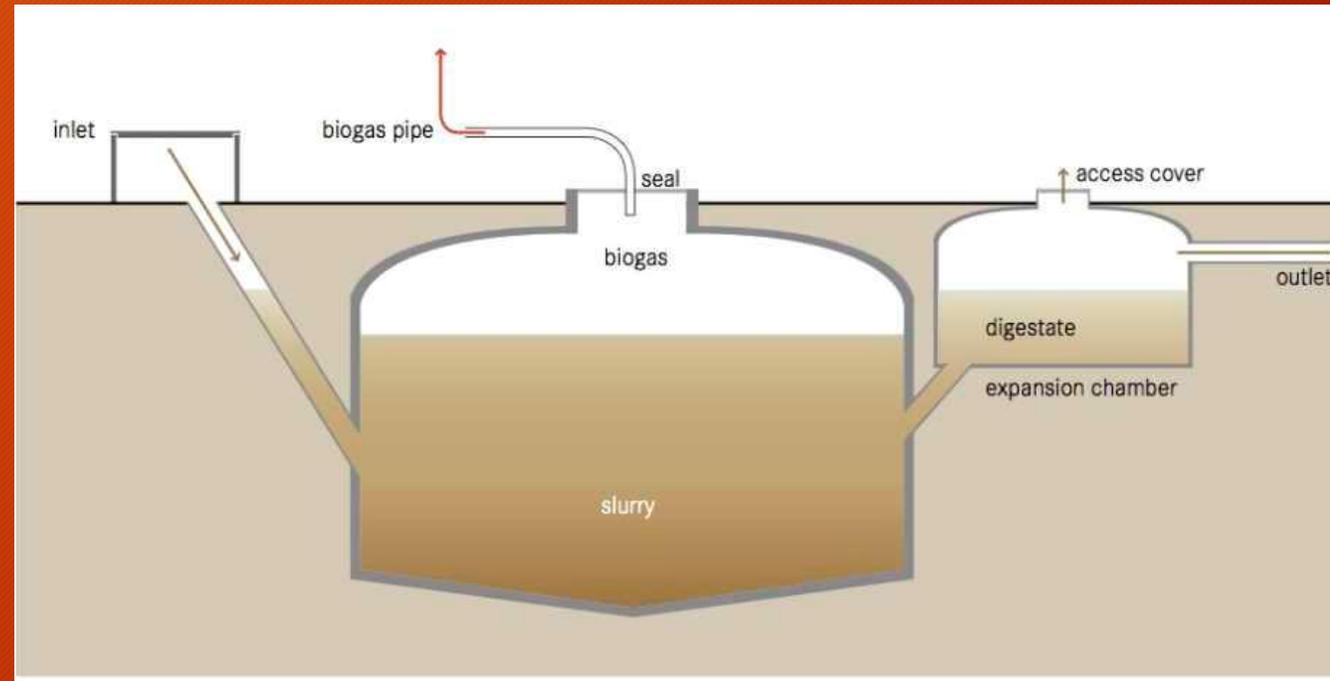
Sludge handling

- The ultimate purpose is the conversion of wastewater sludge into a form that can be handled economically and disposed off without damaging the environment or creating nuisance conditions
- Sludge treatment accounts for more than half of the total costs in a typical secondary treatment plant
- Sludge treatment methods are generally divided into three major categories:
  - thickening,
  - stabilization including inactivation of pathogenic organisms, and
  - dewatering

sludge   organics   sludge + organics
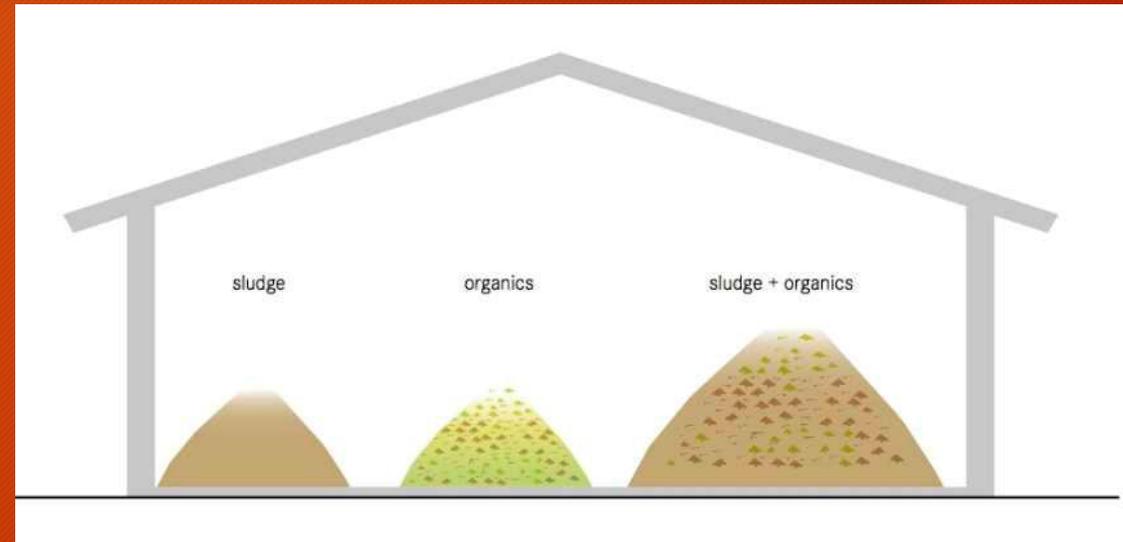
GREY WATER DISPOSAL

What is Grey water?

Grey water is all wastewater that is discharged from a house, excluding black water (toilet water). This includes water from showers, bathtubs, sinks, kitchen, dishwashers, laundry tubs, and washing machines .It commonly contains soap, shampoo, toothpaste, food scraps, cooking oils, detergents and hair. Grey water makes up the largest proportion of the total wastewater flow from households in terms of volume. Typically, 50-80% of the household wastewater is grey water.

Advanced greywater treatment
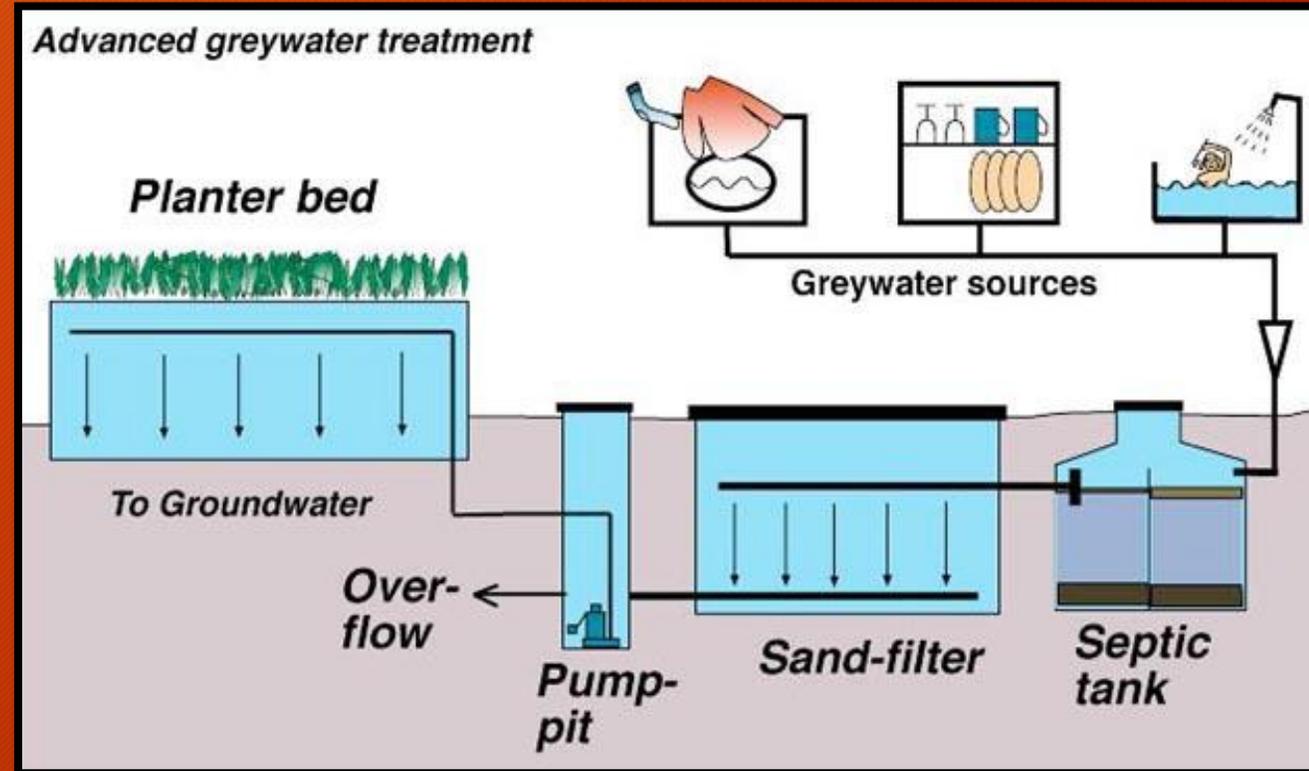
Use of Treated Grey Water

- Most grey water ends up as effluent in rivers and oceans. There are other alternatives to eliminating greywater that allow for efficient use; using it to irrigate plants is a common practice. The plants use contaminants of greywater, such as food particles, as nutrients in their growth. However, salt and soap residues can be toxic to microbial and plant life alike, but can be absorbed and degraded through constructed wetlands and aquatic plants such as sedges, rushes, and grasses.

- GREY WATER RECYCLING - Most greywater should be recycled and collected using a separate plumbing system from black water. Domestic greywater can be recycled directly within the home, garden or company and used either immediately or processed and stored.
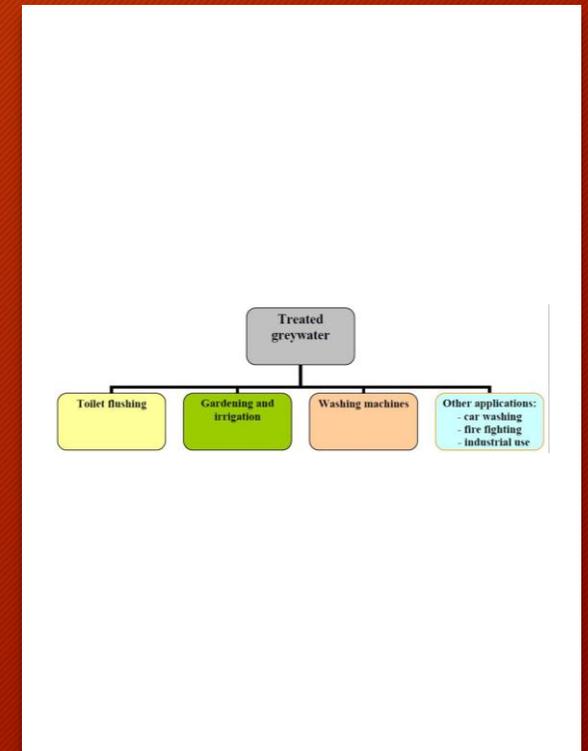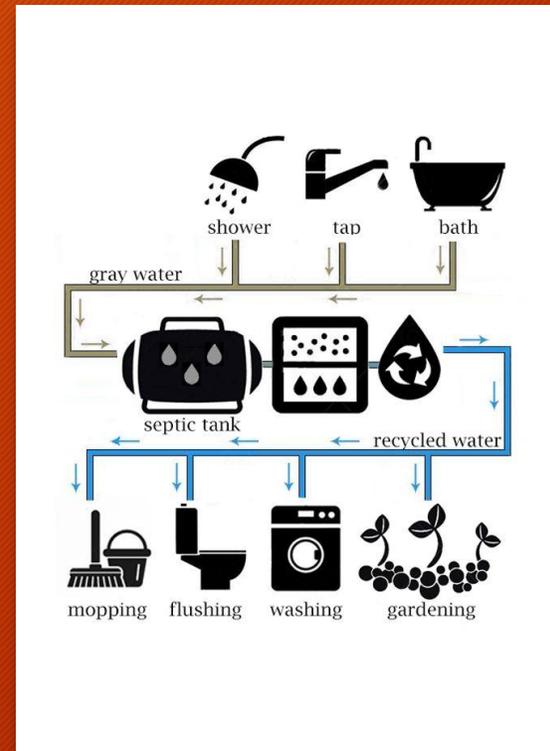
ECOLOGICAL BENEFITS OF GREYWATER RECYCLING

Because greywater use, especially domestically, reduces demand on conventional water supplies and pressure on sewage treatment systems, its use is very beneficial to local waterways. In times of drought, especially in urban areas, greywater use in gardens or toilet systems helps to achieve some of the goals of ecologically sustainable development.

The potential ecological benefits of greywater recycling include :

➢Lower freshwater extraction from rivers and aquifers.

➢Less impact from septic tank and treatment plant infrastructure.

➢Topsoil nitrification.

➢Reduced energy use and chemical pollution from treatment.

➢Groundwater recharge.

➢Increased plant growth.

➢Reclamation of nutrients.

➢Greater quality of surface and ground water when preserved by the natural purification in the top layers of soil than generated water treatment processes.
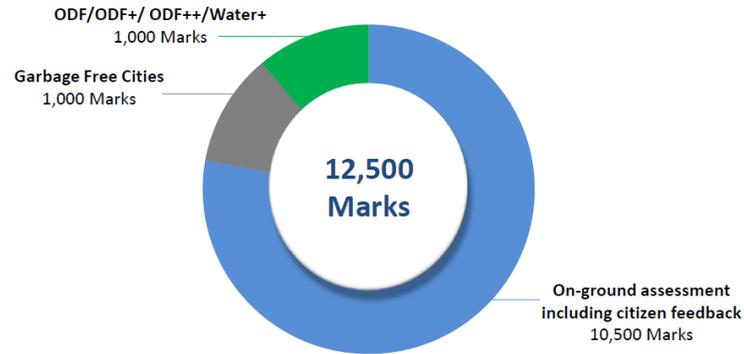
Used Water Management and Swachh Survekshan 2025-26

Marks- 1000

SWACHH SURVEKSHAN 2025-26 OVERVIEW

DISTRIBUTION OF MARKS (12,500 MARKS)

ODF/ODF+/ ODF++/Water+
1,000 Marks

Garbage Free Cities
1,000 Marks

12,500 Marks

On-ground assessment including citizen feedback
10,500 Marks

DETAILED BIFURCATION OF 10,500 MARKS

Sections	% Marks	Marks	Indicators	Sub- Indicators
1. Visible Cleanliness	15%	1,500	12	33
2. Segregation, Collection & Transportation of waste	10%	1,000	3	12
3. Solid Waste Management	15%	1,500	11	25
4. Access to Sanitation	10%	1,000	4	36
5. Used Water Management	10%	1,000	5	8
6. Mechanization of desludging services	5%	500	3	19
7. Advocacy for Swachhta	15%	1,500	6	24
8. Ecosystem Strengthening & Institutional Parameters	8%	1,000	2	5
9. Overall Welfare of Sanitation Workers	5%	500	2	9
10. Citizen Feedback & Grievance Redressal	10%	1,000	2	2
Total		**10,500**	**50**	**173**

* Indicators which are not applicable for particular category of ULBs, the marks will be redistributed proportionally to other relevant indicators.

8

SECTION 5: USED WATER MANAGEMENT

1,000 MARKS, 10%

No.	Indicator	Marks
5.1	Connectivity to a closed system	150
5.2	Sewage/Faecal Sludge Transportation	`300
5.3	Scientific processing of faecal sludge and sewage (Capacity)	200
5.4	Scientific processing of faecal sludge and sewage (Treatment)	250
5.5	Scientific processing of faecal sludge and sewage (Reuse/Recycle)	100
	TOTAL	**1,000**

47

INDICATOR 5.1 - Connectivity to a closed system

Is the usedwater generated within the ULB's jurisdiction connected to a closed system for proper collection, transportation, and treatment?

OBJECTIVE

The objective of the indicator is to assess whether the ULB ensures that waste generated within its jurisdiction is effectively connected to a closed system for collection, transportation, and treatment, thereby preventing open dumping and maintaining hygiene standards.

VALIDATION METHODOLOGY

The validation for this indicator will be carried out by visiting the residential areas, commercial areas, public areas, toilets, urinals within the ULB's jurisdiction. Photographs and videos will be captured at the sampled locations. Additionally, citizen validation Interviews will also be conducted.

Citizen Validation | Direct Observation | Desktop Assessment

APPLICABILITY

Very Small (< 20k Population)	Small (20k - 50k Population)	Medium (50k - 3 Lakh Population)	Big (3 Lakh - 10 Lakh population)	Million Plus (> 10 Lakh population)
✔	✔	✔	✔	✔

SCHEME OF MARKING   MAX MARKS: 150

What percentage of Households, Commercial Institutions, Establishments and Public area CTs/PTs are connected to a closed system such as sewerage, septic tank + soak pit, twin-pit system etc. (no open system/connection/flow/discharge) (graded approach)

$$\text{Marks Scored} = \left[\frac{\text{Total Citizen Validaition samples Passed} + \text{Total Direct Observation Samples Passed}}{\text{Total Samples Assessed}}\right] \times \text{Maximum Marks for the indicator}$$

INDICATOR 5.2 - Sewage/Fecal Sludge Transportation

Is the sewer system coverage adequate to ensure all areas within the ULB's jurisdiction are connected to the system for proper wastewater management?

OBJECTIVE

The objective of the indicator is to assess whether the ULB is efficiently and regularly transporting sewage and fecal sludge from collection points to designated treatment plants, ensuring proper sanitation and preventing contamination within its jurisdiction.

VALIDATION METHODOLOGY

The validation for this indicator will be carried out through desktop assessment by assessing the documents along with photographic evidences provided against this indicator by the ULB with sign and stamp of the Nodal Officer.

Direct Observation | Desktop Assessment

APPLICABILITY

Very Small (< 20k Population)	Small (20k - 50k Population)	Medium (50k - 3 Lakh Population)	Big (3 Lakh - 10 Lakh population)	Million Plus (> 10 Lakh population)
✔	✔	✔	✔	✔

SCHEME OF MARKING	MAX MARKS: 300
Is the sewer system coverage adequate to ensure all areas within the ULB's jurisdiction are connected to the system for proper wastewater management?	75
Is routine maintenance and repair of the sewer system being conducted regularly to ensure its proper functioning and prevent blockages or failures within the ULB's jurisdiction?	75
Is the transport for scheduled desludging being provided regularly and adequately to ensure timely and efficient waste removal within the ULB's jurisdiction?	75
Is the interception and diversion (I&D) system adequately covering all areas within the ULB's jurisdiction to prevent untreated wastewater from entering water bodies?	75

INDICATOR 5.3 - Scientific processing capacity of fecal sludge and sewage of the ULB

Whether capacity of FSTP and STP in the city is matching with the total fecal sludge and sewage which is collected/generated in the city?

OBJECTIVE

The objective of the indicator is to assess whether the ULB is ensuring the adequate capacity of FSTP and STP for scientific processing of fecal sludge and sewage, following appropriate treatment protocols to protect public health and the environment

VALIDATION METHODOLOGY

The validation for this indicator will be carried out by visiting the FSTP and STP facilities where city waste is being treated. Photographs and videos will be captured at the sampled locations.

Direct Observation   Desktop Assessment

APPLICABILITY

Very Small (< 20k Population)	Small (20k - 50k Population)	Medium (50k - 3 Lakh Population)	Big (3 Lakh - 10 Lakh population)	Million Plus (> 10 Lakh population)
✓	✓	✓	✓	✓

SCHEME OF MARKING   MAX MARKS: 200

Percentage of capacity of FSTP and STP in the city is matching with the total fecal sludge and sewage generation

$$Marks\ Scored = \left[\frac{Sum\ of\ Capacity\ of\ all\ functional\ FSTP/STPs\ assessed\ during\ field\ visit}{Total\ faecal\ sludge/sewage\ generation\ in\ the\ city}\right] \times Maximum\ Marks\ for\ the\ indicator$$

INDICATOR 5.4 - Scientific processing of fecal sludge and sewage

What percentage of fecal sludge and sewage generated from households, commercial establishments, and public or community toilets is being scientifically processed at fecal Sludge Treatment Plants (FSTPs) or Sewage Treatment Plants (STPs)?

OBJECTIVE

The objective of the indicator is to assess whether the ULB is ensuring the scientific processing of fecal sludge and sewage, following appropriate treatment protocols to protect public health and the environment

VALIDATION METHODOLOGY

The validation for this indicator will be carried out by visiting the FSTP and STP facilities where city waste is being treated. Photographs and videos will be captured at the sampled locations.

Direct Observation   Desktop Assessment

APPLICABILITY

Very Small (< 20k Population)	Small (20k - 50k Population)	Medium (50k - 3 Lakh Population)	Big (3 Lakh - 10 Lakh population)	Million Plus (> 10 Lakh population)
✓	✓	✓	✓	✓

SCHEME OF MARKING   MAX MARKS: 250

Percentage of total fecal sludge and sewage treated out of total fecal sludge and sewage generated in the city

At least 70% of total faecal sludge and sewage generated is being treated	250
At least 50% of total faecal sludge and sewage generated is being treated	200
At least 25% of total faecal sludge and sewage generated is being treated	150
<25% of total faecal sludge and sewage generated is being treated	0

$$Marks\ Scored = \left[\frac{Faecal\ sludge/sewage\ treated\ by\ all\ functional\ FSTP/STPs\ assessed\ during\ field\ visit}{Total\ faecal\ sludge/sewage\ generation\ in\ the\ city}\right] \times Maximum\ Marks\ for\ the\ indicator$$

INDICATOR 5.5 - Scientific processing and recycle/reuse of treated used water

What percentage treated used-water is reused, recycled by the ULB?

OBJECTIVE

The objective of the indicator is to assess whether the ULB is utilizing the treated used-water by recycling or reusing.

VALIDATION METHODOLOGY

The validation for this indicator will be carried out by visiting the FSTP and STP facilities where city waste is being treated. Photographs and videos will be captured at the sampled locations.

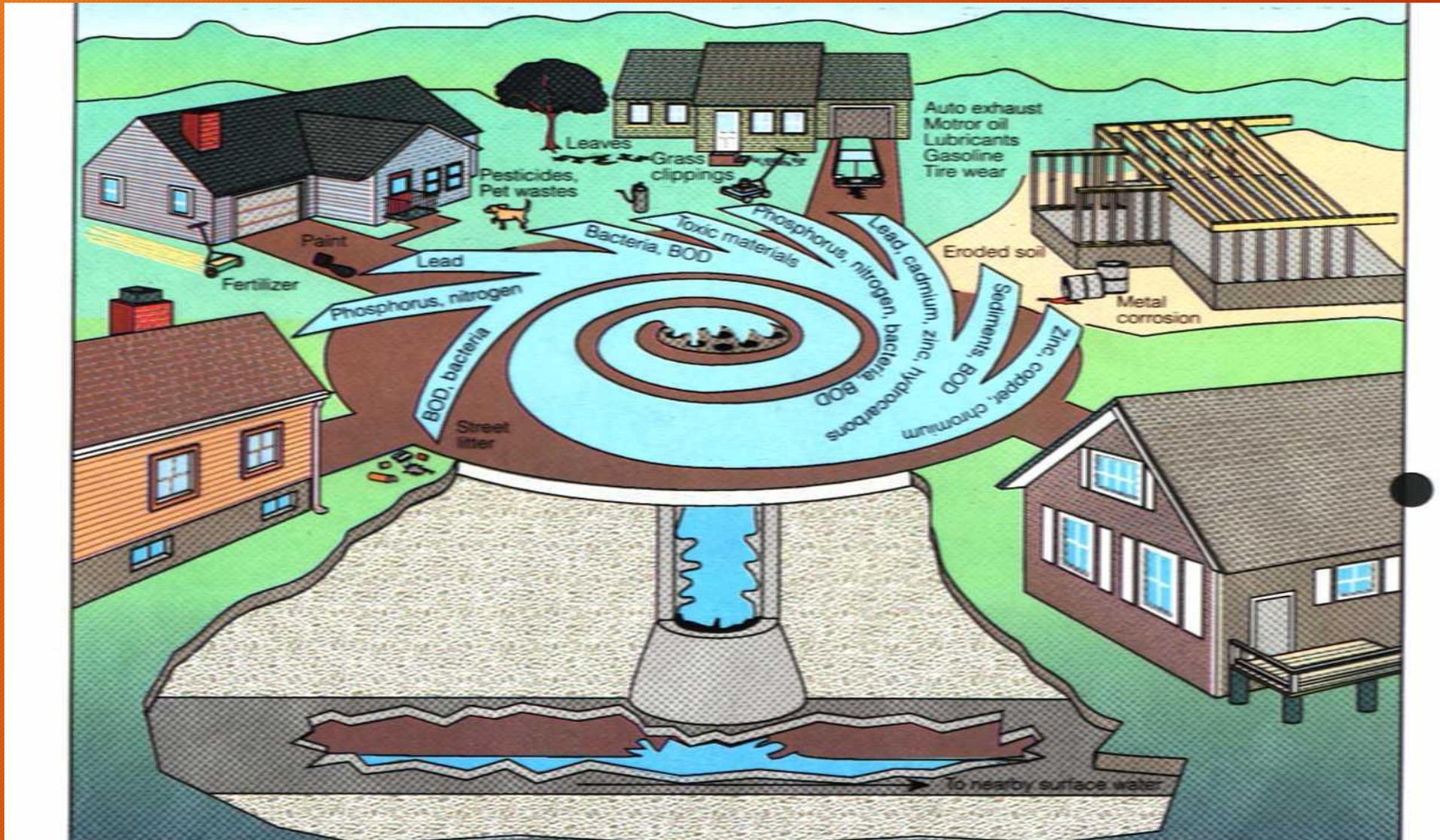Direct Observation   Desktop Assessment

APPLICABILITY

Very Small (< 20k Population)	Small (20k - 50k Population)	Medium (50k - 3 Lakh Population)	Big (3 Lakh - 10 Lakh population)	Million Plus (> 10 Lakh population)
✓	✓	✓	✓	✓ Revenue Generation from sale of treated water is mandatory

SCHEME OF MARKING   MAX MARKS: 100

Whether treated wastewater is reused/recycled?	
>20% treated used-water is reused/recycled	100
10% - <20% treated used-water is reused/recycled	70
<10% treated used-water is reused/recycled	40
No treated used-water is reused/recycled	0

$$Marks\ Scored = \left[\frac{Total\ treated\ used\ water\ reused/recycled\ by\ all\ functional\ FSTP/STPs\ assessed\ during\ field\ visit}{Total\ treated\ used\ water\ generated\ by\ all\ functional\ FSTP/STPs}\right] \times Maximum\ Marks\ for\ the\ indicator$$

THANK YOU