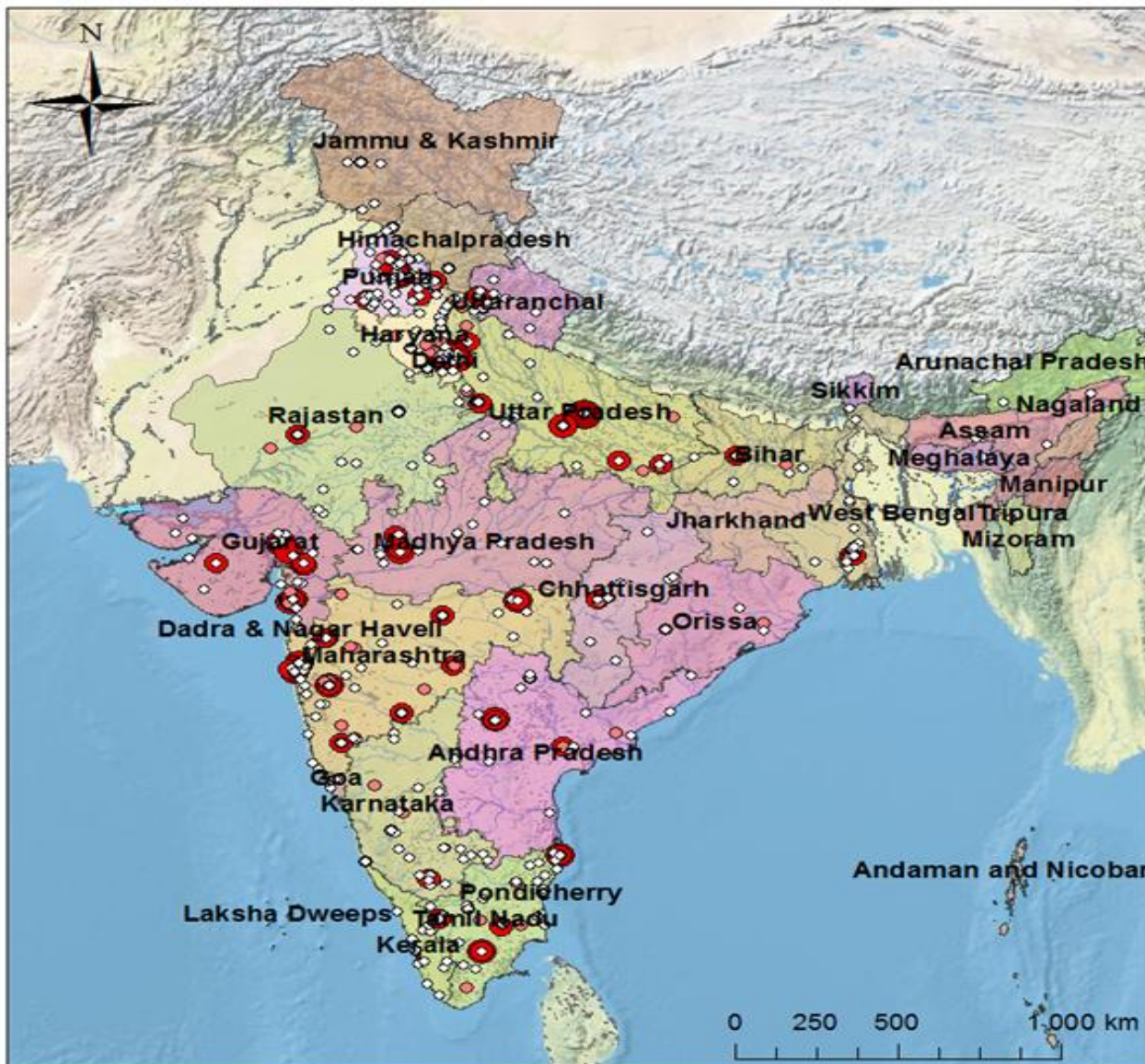


Technical-Environmental Evaluation of Existing STP,s in India

A. A. KAZMI



Dominating States in STP,s

1. Uttarakhand
2. Delhi
3. Punjab
4. Haryana
5. Uttar Pradesh
6. Gujarat
7. Maharashtra
8. Karnataka
9. Tamil Nadu

Upcoming States

1. Rajasthan
2. Madhya Pradesh
3. Andhra Pradesh

Legend
 WP1 database
 Total capacity (MLD)

- 0 - 12
- ◐ 13 - 42
- ◑ 43 - 91
- 92 - 205
- 206 - 635

Classification of Technologies

- **Based on Size**

- **> 5 MLD Plants- Large Wastewater Treatment Plants**
- **< 5 MLD Plants- Small Wastewater Treatment Plants**

Based on Location/Application

- **Category-1: Rural Areas and Peri-urban areas with Cheaper land Availability**
- **Category 2: Rural Areas and peri-urban areas with cheaper limited space**
- **Category 3: Peri-Urban areas with expensive and limited space**
- **Category 4: Peri-Urban areas with expensive and limited space and strict effluent quality**

Type of Technology		Short Name
Rural Areas with cheaper land availability and on-site package septic systems for all areas		
1	Waste stabilization ponds/Duckweed Pond/Water Hyacinth Pond	WSP
2	Onsite package (PWTS-AM series, THST series, CCST series)	On-Site- Package
Rural Areas and peri-urban areas with cheaper limited space		
3	DEWATS/BORDA	DEWATS/BORDA
4	DEWATS Others	DEWATS Others
5	VORTEX System	VORTEX
6	SoilBio Technology	SBT
7	Anaerobic Filter	AF
8	Aerated Lagoon	AL
Peri-Urban areas with expensive and limited space		
9	New GPT- ASP Type- Ion Exchange India Ltd	EA-Package
10	Extended aération	EA
11	NBF (10 KLD to 150 KLD)	Contact Aeration-Package
12	Settler + Contact aeration (STBF series)	On-site Aerobic- Package
Peri-Urban areas with expensive and limited space and strict effluent quality		
13	Moving bed biofilm reactor (including FAB)	MBBR
14	Submerged Aerobic Fixed film SAFF process/RBC	SAFF/RBC
15	Membrane Bioreactor	MBR
16	Sequencing Batch Reactor	SBR

STPs Selected for Northern India

3.2 MLD, MBBR, Habak, Srinagar
4.5 MLD, MBBR, Lam Nishat, Srinagar

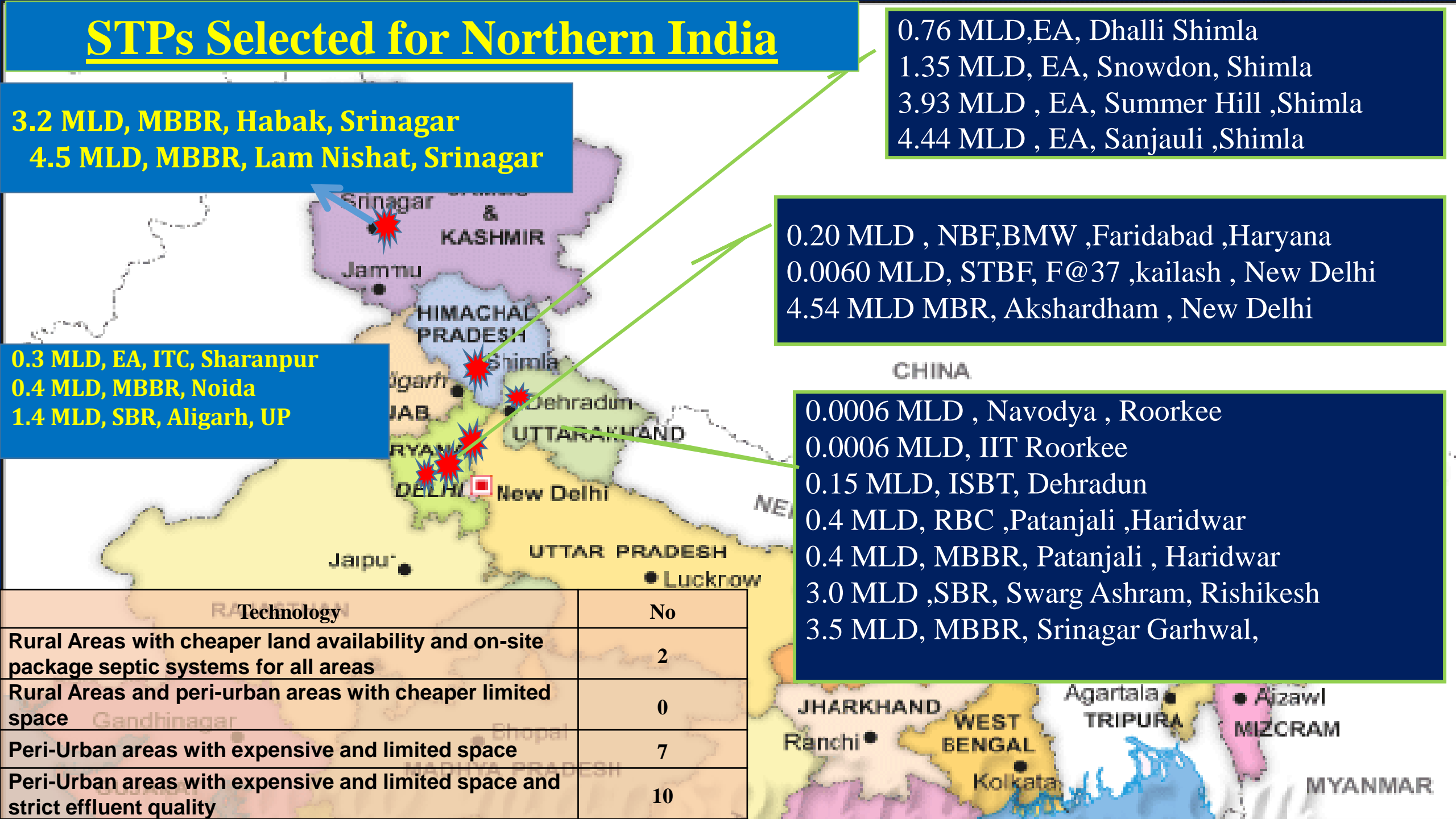
0.3 MLD, EA, ITC, Sharanpur
0.4 MLD, MBBR, Noida
1.4 MLD, SBR, Aligarh, UP

0.76 MLD, EA, Dhalli Shimla
 1.35 MLD, EA, Snowdon, Shimla
 3.93 MLD, EA, Summer Hill, Shimla
 4.44 MLD, EA, Sanjauli, Shimla

0.20 MLD, NBF, BMW, Faridabad, Haryana
 0.0060 MLD, STBF, F@37, Kailash, New Delhi
 4.54 MLD MBR, Akshardham, New Delhi

0.0006 MLD, Navodya, Roorkee
 0.0006 MLD, IIT Roorkee
 0.15 MLD, ISBT, Dehradun
 0.4 MLD, RBC, Patanjali, Haridwar
 0.4 MLD, MBBR, Patanjali, Haridwar
 3.0 MLD, SBR, Swarg Ashram, Rishikesh
 3.5 MLD, MBBR, Srinagar Garhwal,

Technology	No
Rural Areas with cheaper land availability and on-site package septic systems for all areas	2
Rural Areas and peri-urban areas with cheaper limited space	0
Peri-Urban areas with expensive and limited space	7
Peri-Urban areas with expensive and limited space and strict effluent quality	10

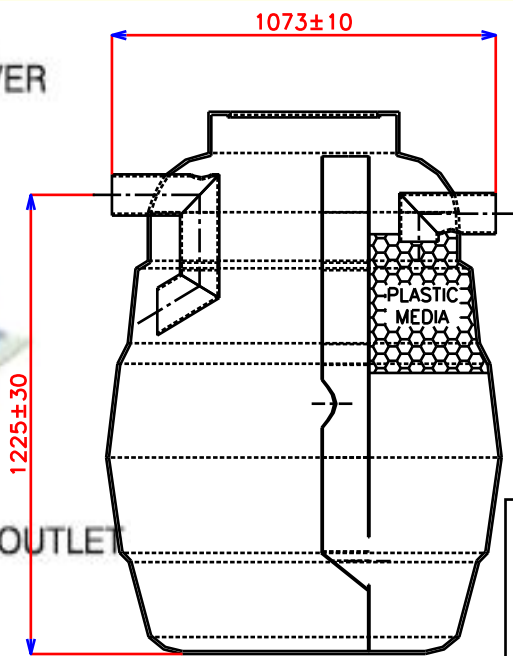
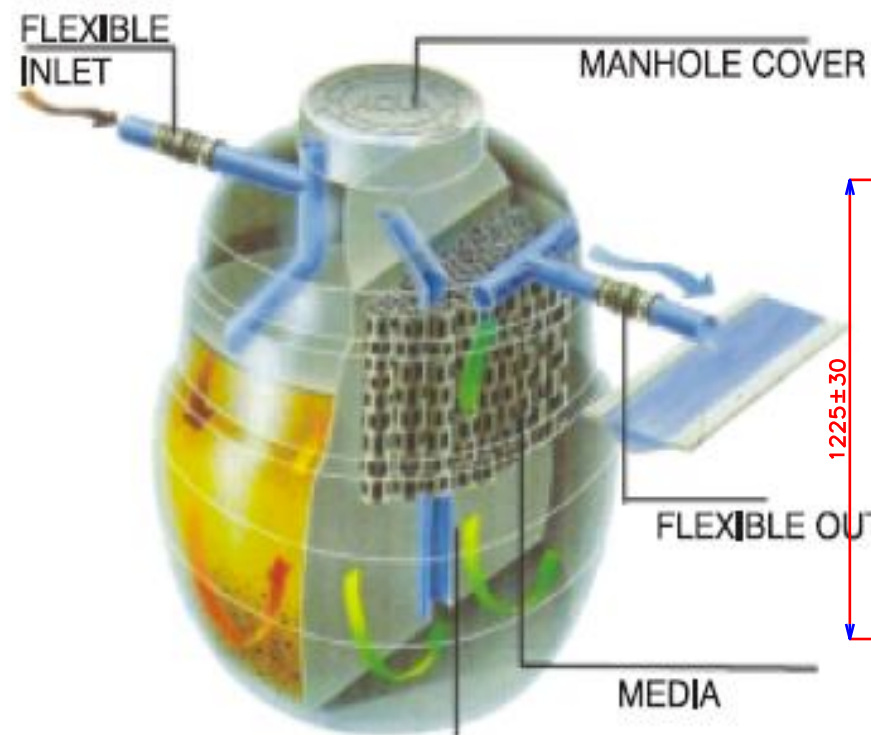


1.0 Rural Areas with cheaper land availability and on-site package septic systems for all areas

✓ People Served - 30 (Approx)

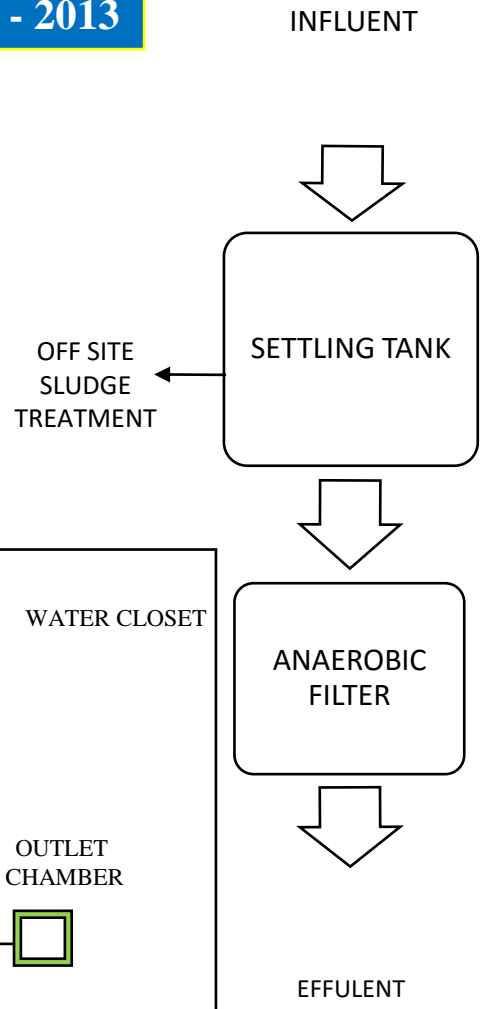
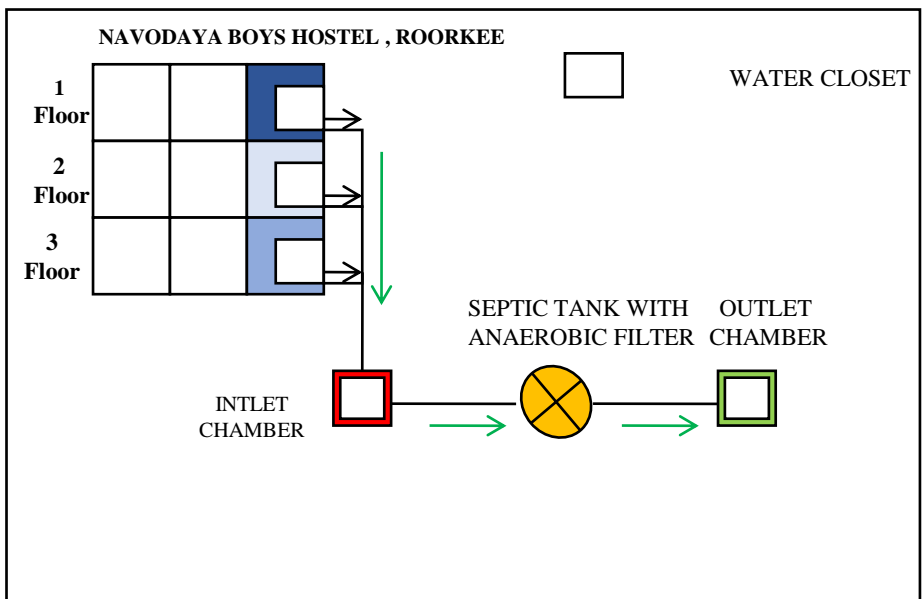
✓ Capital Cost - 50,000/- (Approx)

✓ Year of Installation - 2013



Flexible - In & Outlet

Pall Ring Media



2.0 Rural Areas and peri-urban areas with cheaper limited space: Technologies



AERATED LAGOON



SOIL BIOTECHNOLOGY



DEWATS OTHERS



VORTEX SYSTEM



CONSTRUCTED WETLANDS



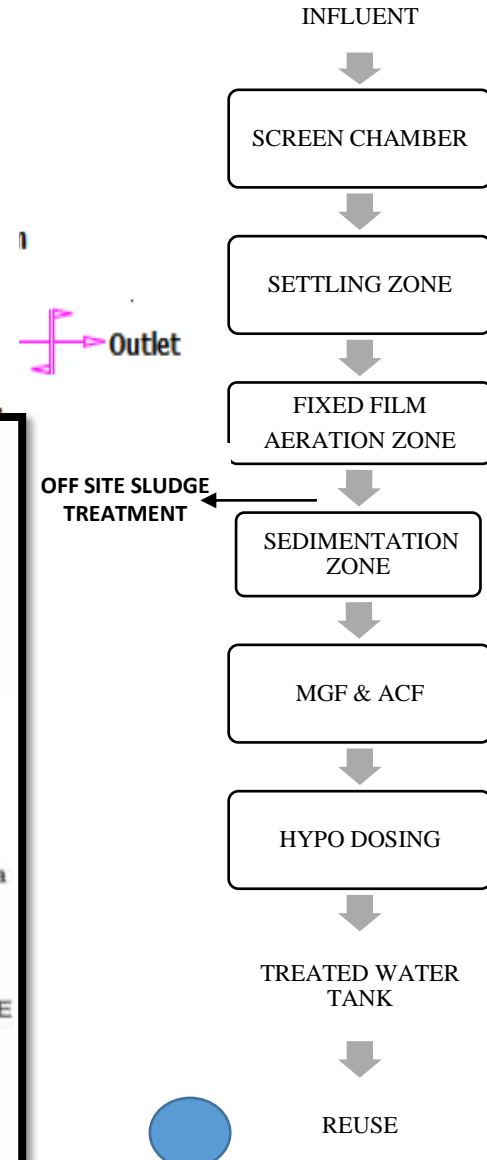
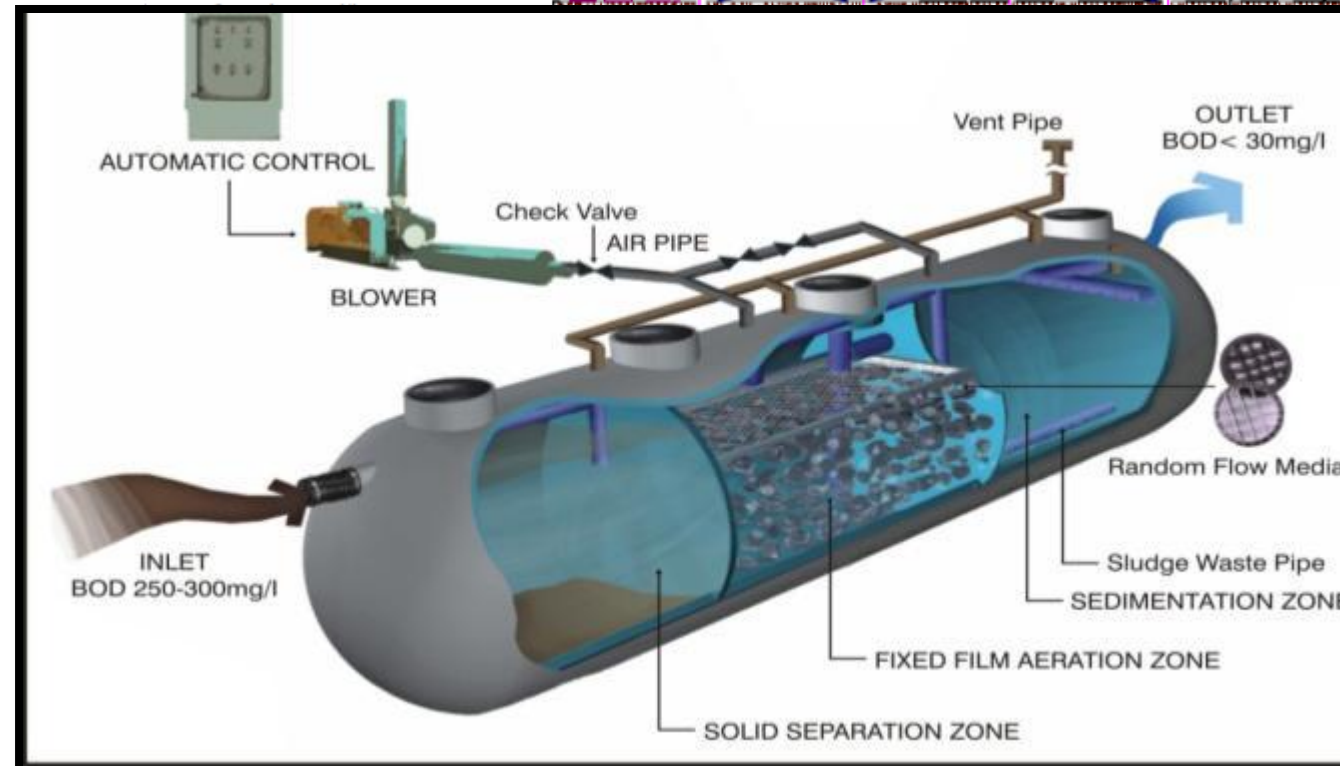
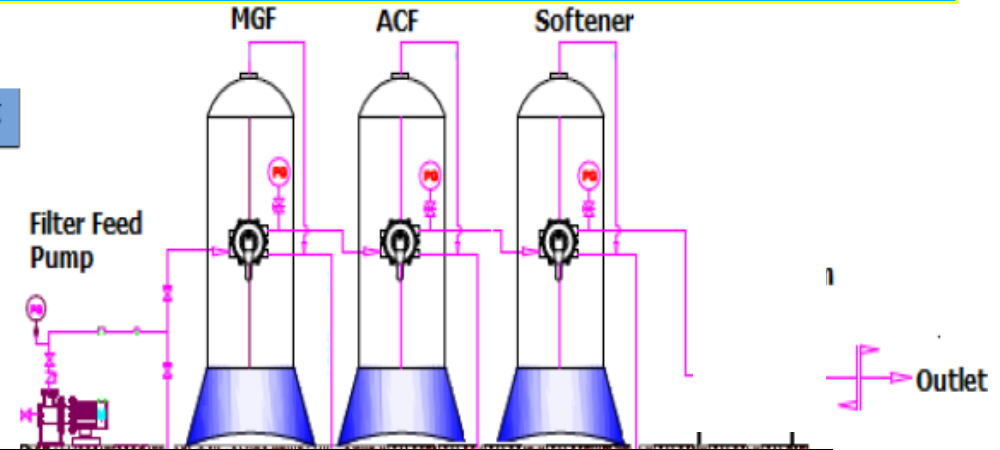
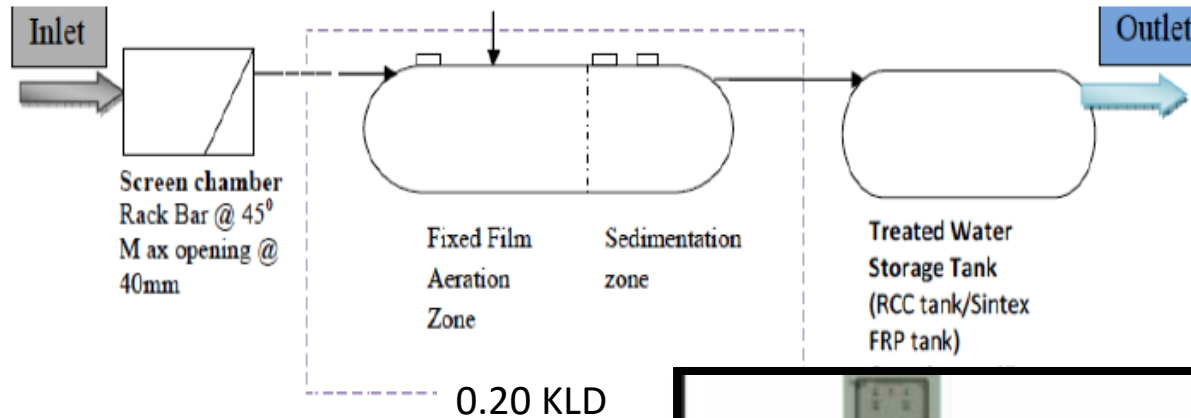
BORDA DEWATS

3.0 Peri-Urban areas with expensive and limited space

P3 : 0.20 MLD
, BMW, Faridabad, Haryana

- ✓ People Served - 185 -250 (Approx) ;Capital Cost - 16.5 Lacs (Approx)
- ✓ Year of Installation - 2012

Process Flow



Snowdon



Sanjauli



Extended Aeration – Shimla (H.P)

Dhali



Summer Hill



4.0 Peri-Urban areas with expensive and limited space and strict effluent quality

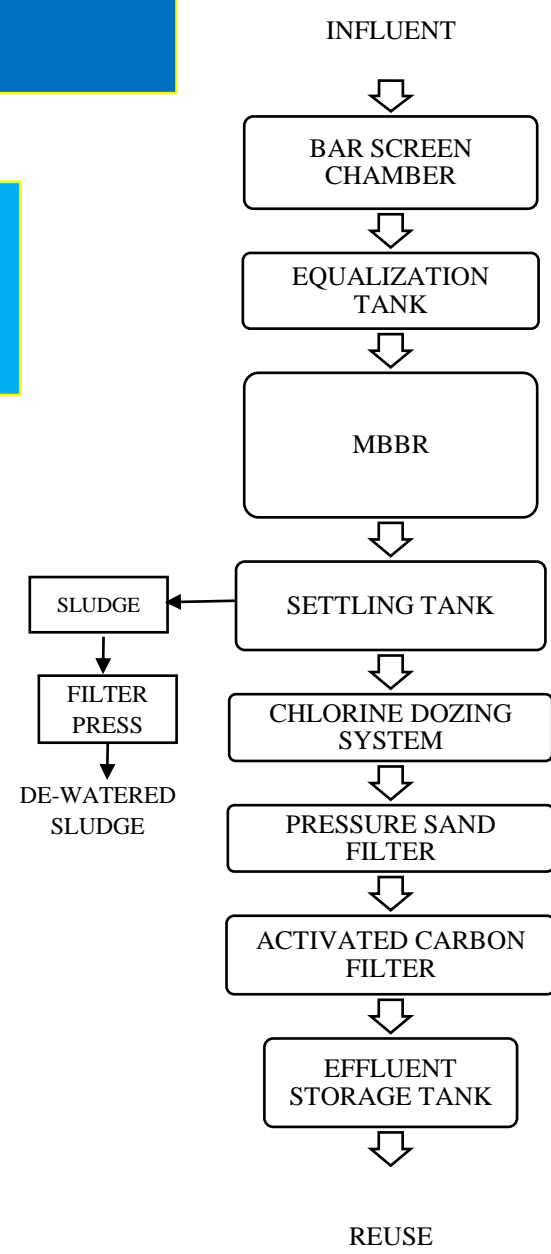
0.40 MLD , MBBR ,Patanjali, Haridwar

Moving Bed = Mobile surface
Bio Reactor = Bio reactor for biological treatment

- ✓ People Served – 2000 (Approx)
- ✓ Capital Cost - 98 Lacs (Approx)
- ✓ Year of Constr - 2014

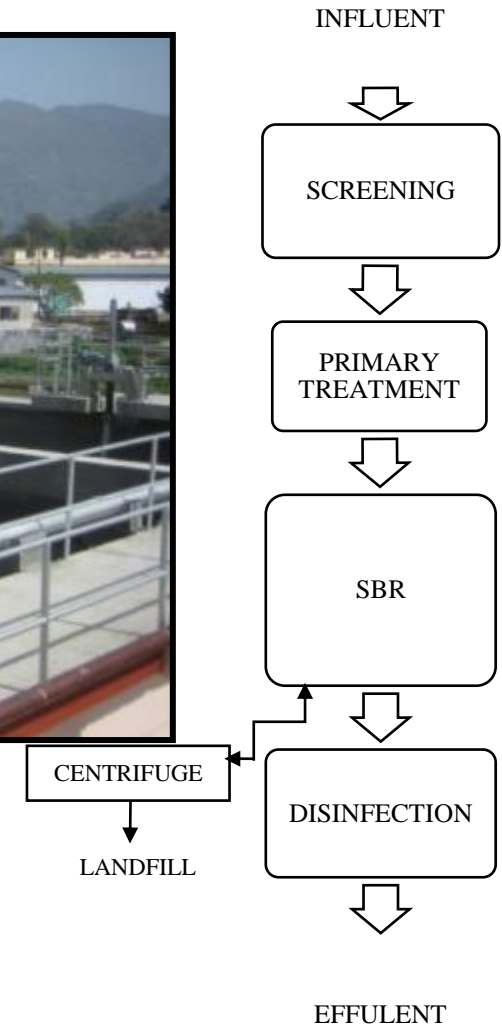


Process Flow



SEQUENTIAL BATCH REACTOR (SBR)

3.0 MLD , SWARG ASHRAM , RISHIKESH

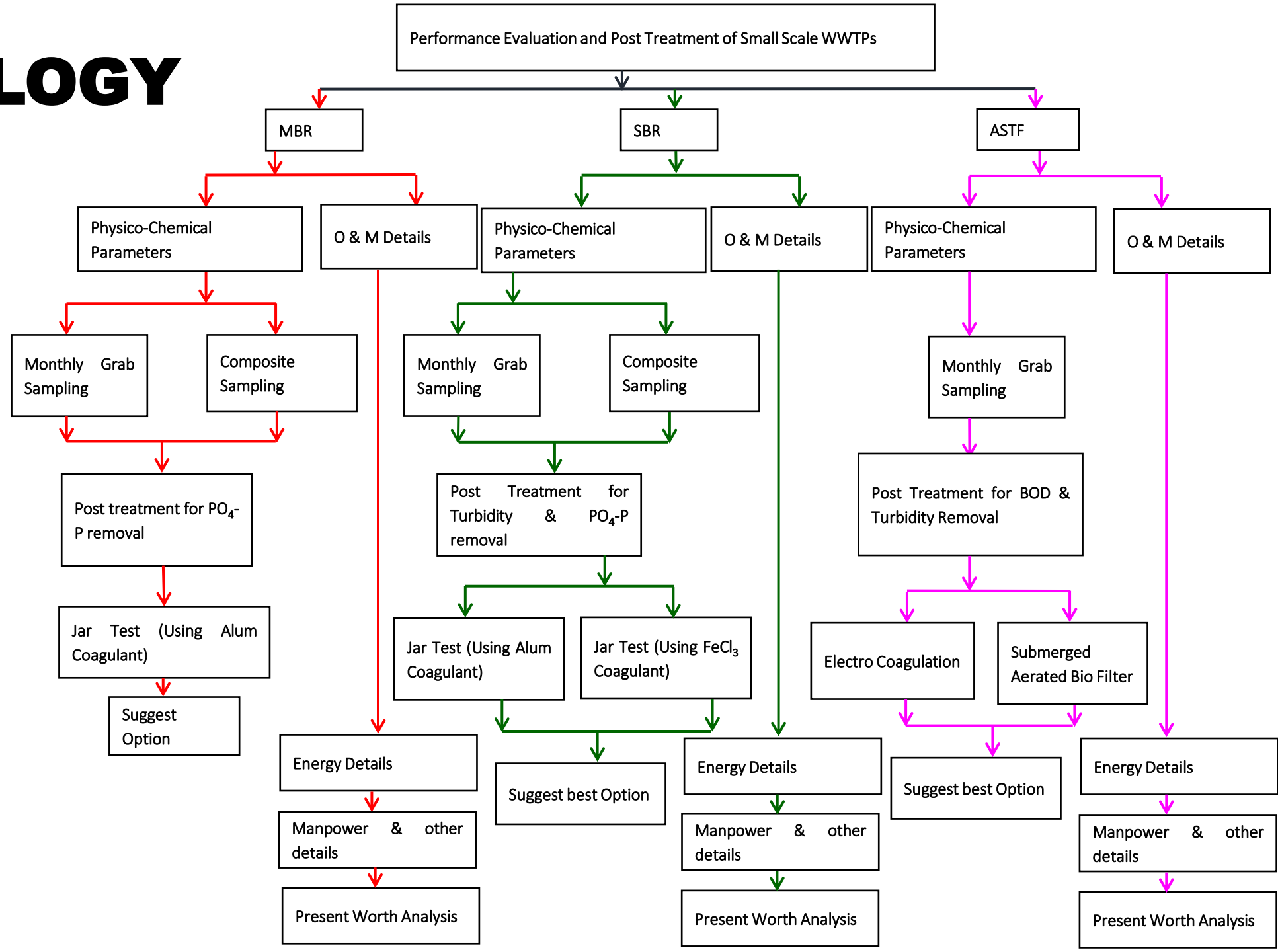


S.No.	Technology	Capacity (Designed) MLD	Actual Flow (MLD)	Land Area (m2)	Land Usage (m2/MLD) Estimated	Capital (Rs. Lacs)	Capital cost (Lacs/MLD) Estimated	KW-h/m ³ of wastewater treated	KW-h/kg of BOD removed	Rs/m ³ of wastewater treated	Rs/Kg BOD removed	BOD removal %	COD removal %	TSS removal %
								Designed flow based	Designed flow based	Designed flow based	Designed flow based			
1	PACKAGE AF	0.0006	0.0006	4	6666.7	0.5 (2012)	833.3	0.00	0.0	6.8	18.2	65	66	65
2	PACKAGE AF	0.0006	0.0006	4	6666.7	0.5 (2012)	833.3	0.00	0.0	4.6	19.5	66	64	62
3	STBF	0.0060	0.0060	10	1666.7	4.6 (2011)	766.7	0.15	0.5	5.1	16.2	81	81	80
4	NBF	0.2	0.20	40	200.0	25 (2012)	82.5	0.22	1.1	4.4	22.1	90	91	88
5	EA, ITC	0.3	0.3	110	366.0	-	-	-	-	-	-	84	79	87
6	SAFF, ISBT	0.15	0.15	80	533.3	-	-	-	-	-	-	83	82	84
7	MBBR, Samsung	0.35	0.35	180	514.3	70	200.0	0.79	2.84	12.8	45.8	96	95	95
8	MBBR, DLF	0.4	0.4	230	573.8	78	195.0	0.79	2.32	14.3	42.0	96	94	94
9	PATANJALI , MBBR	0.4	0.38	270	675.0	98 (2014)	245.0	0.57	1.9	10.1	33.7	96	95	96
10	RBC, Patanjali	0.45	0.45	220	488.9	95.6 (2013)	212.4	0.51	1.7	9.9	33.9	96	96	95
11	EA DHALLI	0.76	0.60	1350	1776.3	178.7 (2005)-Hills	235.1	0.53	1.8	7.8	26.2	91	92	90
12	EA SNOWDON	1.35	0.90	2140.4	1585.5	232.5 (2005)-Hills	172.2	0.46	1.3	6.0	17.1	93	93	91
13	SBR, HARDUAGANJ	1.4	1.4	550	392	230 (2011)	164.2	0.28	-	-	-	95	97	91
14	SBR RISHIKESH	3.0	1.50	1413.6	471.2	600 (2010)	200.0	0.26	1.4	3.3	17.4	96	94	94
15	MBBR, Habak, Srinagar	3.2	3.2	570	178	312 (2005)	97.5	-	-	-	-	83	78	80
16	MBBR, Srinagar	3.5	1.5	1700	485	-	-	0.153	0.3	-	-	95	96	91
17	EA SUMMER	3.93	2.60	6894.8	1754.4	316 (2005)- Hills	80.4	0.42	1.6	3.4	12.5	91	92	90
18	EA SANJAULI	4.44	3.00	7630.3	1718.5	358 (2005)-Hills	80.6	0.47	1.8	3.0	11.1	90	92	90
19	MBBR, LAM NISHAT	4.5	4.5	520	115	355 (2005)	78.8	-	-	-	-	94	91	96
20	MBR	4.54	1.00	3200	704.8	2400 (2010)	528.6	0.39	1.3	6.4	21.1	98	98	97

Detailed Evaluation of Small STP,s

Location [1]	Settlement [2]	WW [3]	Size [4]	Type of STP	Technology / Unit Processes	Reuse
Bankura, West Bengal	Residential	Combined	5	WSP	Duckweed +Fish Pond, Water Hyacinth Pond	Fishing. Part of the water: gardening, cultivation of veg.
Roorkee	Institutional-Residential School	Blackwater	1	On-Site-Package	On site Settler + Aanaerobic filter, Settling Tank	No reuse (ground infiltration)
Padduchery	Institutional-Residential School	Combined	35	VORTEX/CSR	Settler + ABR + Vortex	Gardening
Worli Mumbai	Municipal	Combined	3000	SBT	Chemically Enhanced Coagulation+ Soil Filter, Soli immobilized biofilter	Gardening
Chennai	Institutional - IIT Chennai	Combined	1400	AL	Aerated Lagoon	Landscaping and toilet flushing
Tumkur, Karnataka	Institutional - Religious School	Combined	1000	EA/OD	Aeration tank + settler (EA/OD)	Gardening
Greenfield City	Residential	Combined	1600	MBBR	Aeration Tank (Moving Media) + Tube settler	Gardening (landscaping)
Chennai	(L&T)	Combined	400	MBBR	Aeration Tank (Moving Media) + Settling Tank	Landscaping on L&T premises
Nirvana Mumbai	Residential	Combined	2000	MBBR	Aeration Tank (Moving Media) + Settling Tank	Gardening Flushing Construction
Kolkata- West Bengal	Residential	Combined	550	SAFF	Aeration Tank (Fixed Media) + Settling Tank	Cooling water and landscaping
Delhi	Municipal	Combined	1000	MBR	MBR	Landscaping, toilet flushing
Rishikesh	Municipal	Combined	2000	SBR	SBR	No reuse (discharge on the river)
Kolkata	Residential	Combined	650	AF	Anaerobic Filter + Multimedia Filter + Activated carbon Filter	Coling water, landscaping
NITIE,	Institutional	Combined	300	EA /ASB	Extended Aeration	Gardening

METHODOLOGY



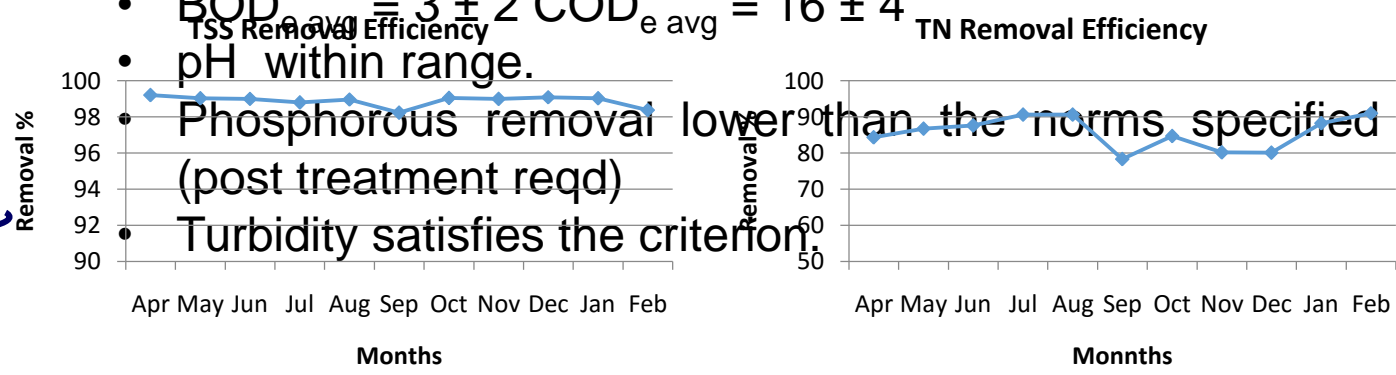
RESULTS MBR

	AVERAGE ± SD	
	INFL	EFFL
pH	7.4±0.4	7.9±0.3
TSS (mg/L)	303±72	3±0.5
VSS (mg/L)	160±39	2±0.4
BOD (mg/L)	214±39	2±2
BODf (mg/L)	132±98	1.3±0.8
COD (mg O ₂ /L)	488±85	15±3
CODf (mg O ₂ /L)	257±49	8±3
TKN (mgN/L)	47.7±11.7	2.91±1.4
N-NH ₄ ⁺ (mgN/L)	35±7.1	1.9±1.1
N-NO ₃ (mgN/L)	3.9±1.6	4.4±1.7
PO ₄ ⁻³ (mgP/L)	7.2±2.1	1.4±0.4
PO ₄ ⁻³ Total (mgP/L)	11.1±2.9	2.5±0.8
Total Alkalinity (mgCaCO ₃ /L)	385.8±31.9	172.1±58.6
Turbidity(NTU)	137.35±9.7	1.80±0.3

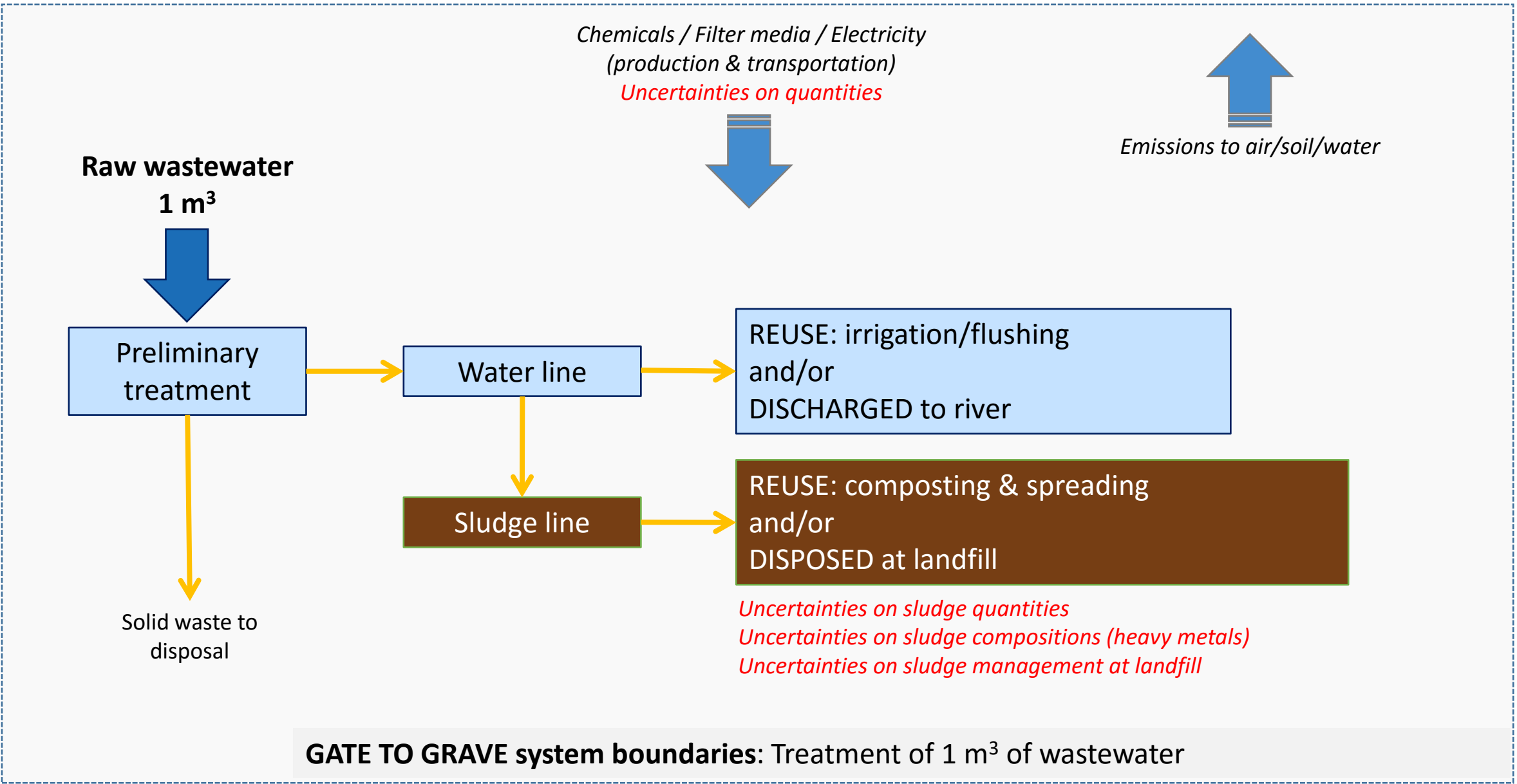
BOD	COD	TSS	TN
98.59%	96.44%	98.94%	84.85%



- **Analysis**
 - $BOD_{i\ avg} = 214 \pm 40$ & $COD_{i\ avg} = 489 \pm 85$ i.e. within range.
 - $BOD_{e\ avg} = 3 \pm 2$ & $COD_{e\ avg} = 16 \pm 4$
 - pH within range.
 - Phosphorous removal lower than the norms specified (post treatment reqd)
 - Turbidity satisfies the criterion.



Life Cycle Assessment



Hygiene Assessment

Date	Pathogen removal (%)					Pathogen removal (LOG reduction)				
	TC	FC	Salmonella	Ascaris eggs	Shigella	TC	FC	Salmonella	Ascaris eggs	Shigella
Apr-14	99.95	99.93	90.91	93.33	94.74	3.308	3.156	1.04	1.18	1.28
May-14	99.93	99.91	91.67	93.33	90.00	3.156	3.061	1.08	1.18	1.00
Jun-14	99.93	99.87	92.31	93.33	90.00	3.156	2.885	1.11	1.18	1.00
Jul-14	99.80	99.60	87.50	90.00	93.33	2.699	2.398	0.90	1.00	1.18
Aug-14	99.67	99.73	91.67	90.00	94.44	2.477	2.574	1.08	1.00	1.26
Sep-14	99.87	99.80	90.00	94.44	95.00	2.885	2.690	1.00	1.26	1.30
Oct-14	99.83	99.80	95.45	95.00	96.15	2.760	2.690	1.34	1.30	1.41
Nov-14	99.93	99.88	95.00	93.75	94.74	3.156	2.903	1.30	1.20	1.28
Dec-14	99.80	99.73	94.44	95.00	93.33	2.699	2.574	1.26	1.30	1.18
Jan-15	99.88	99.82	90.00	93.33	95.00	2.903	2.740	1.00	1.18	1.30
Feb-15	99.93	99.86	90.91	93.33	95.00	3.146	2.845	1.04	1.18	1.30
Mar-15	99.90	99.91	92.86	93.33	94.44	3.021	3.061	1.15	1.18	1.26
Average	99.87	99.82	91.89	93.18	93.85	2.947	2.798	1.109	1.177	1.228
SD	0.08	0.10	2.31	1.62	1.95	0.25	0.23	0.13	0.10	0.12
SD (%)	0.08	0.10	2.51	1.74	2.08	8.51	8.16	11.89	8.12	10.03

Challenge

Sl. No.	Industry	Parameters	Standards for New STPs (Design after notification date)*
1.	Sewage Treatment Plant	pH	6.5-9.0
2.		BOD, mg/l	10
3.		COD, mg/l	50
4.		TSS, mg/l	10
5.		NH ₄ -N, mg/l	5
6.		N-total, mg/l	10
7.		Fecal Coliform, MPN/100ml	<230
8.		PO ₄ -P, mg/l	2

Note: i) These standards will be applicable for discharge in water resources as well as for land disposal. The standards for Fecal Coliform may not be applied for use of treated sewage in industrial purposes.
ii) Achievements of Standards for existing STPs within 02 years from date of notification.