Grey-water Treatment and Technologies

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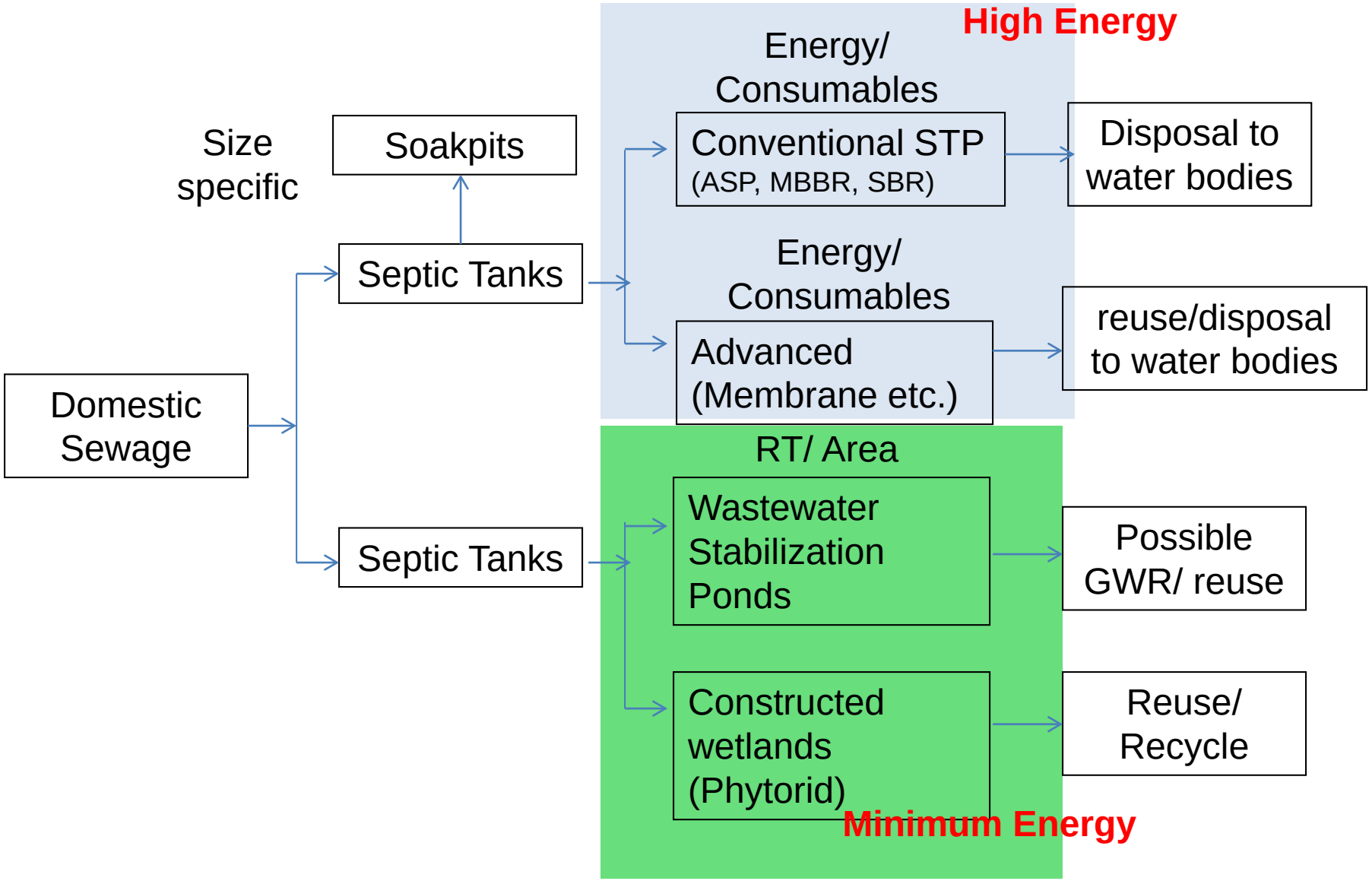
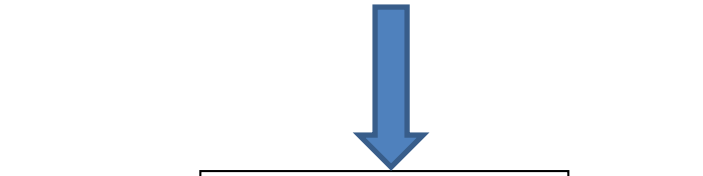
Sewage Treatment: Methods, Issues, solutions



Science Behind Sewage Treatment

Sewage Components
- Particulates, Suspended
- Particulates dissolved (mostly salts)
- Organic matter (dissolved)
- Nutrients (N, P)
- Fecal Coliform

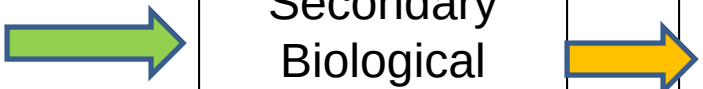


Coagulants
- Conventionally alum
- Surfactants

Physical Separation

Solid Separations (terminal settling velocity)

Oxygen Supply
- Conventionally aerators
- Diffusers

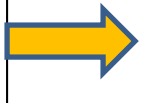


Secondary Biological Treatment

- Biochemical Oxidation of Organics to H_2O and CO_2
- Nitrification-denitrification
- Bio-availability of nutrients
- Biomass growth/recycle

Disinfecting agent (strong oxidants)
- Conventionally Chlorine
- Hypo-chlorides
- Ozone

Tertiary Disinfection Treatment



Pathogen removal

Approach for Rural Setup

Sewage Components
- Particulates, Suspended
- Particulates dissolved (mostly salts)
- Organic matter (dissolved)
- Nutrients (N, P)
- Fecal Coliform

No Chemicals, Let it be Physical

Physical Separation

Solid Separations (Impact separation, Against gravity force)

Oxygen Supply
- **Nature employed, let plants take care**
- **NO electrical/mechanical**

Secondary Biological Treatment

- Biochemical Oxidation of Organics to H_2O and CO_2
- Nitrification-denitrification
- Bio-availability of nutrients, **and uptake**
- **NO Excess** Biomass growth

irrigation reuse

Disinfecting
- **solar disinfwction**

Tertiary Disinfection Treatment

- Pathogen removal
- **No carcinogenic chlorinated compounds**

Technology Selection Approach

Sr. No.	Technology	Application	Advantages	Challenges
1	Soak-pit	House-hold	Low cost Can treat wastewater	High water table area Potential to contaminate GW Water can not be recycled directly Solid particles in Grey water
2	Decentralised CWs	Community levels	Moderate Costs and operation is easier Water available for reuse	Topography should support for gravity flow Will need to consider avoiding solid waste
3	End-of the village CWs	Village Level	Already some places ww ponds are created, applicable very well. Can convert WWSPs to handle more wastewater	Receives entire wastewater which could have faecal matter (at least animal waste) Technology becomes slightly capex extenssive

Design Approach

- Operating windows for wastewater, parameters
- Source based selection of unit operations
- Space availability and levels
- Proximity of end use of treated water
- Quality of water required
- Soil strata
- Design of plant, conceptual, structural and asthetics

Extent of Treatment

- In case of Grey-water, pollutant loads are low
- If the reuse is for irrigation purpose then treatment upto BOD <30 mg/L should be fine
- Grey water treatment should be considered as different than STP

Decentralized treatment: + points

- Improve reachability, reduce the need for sewage transportation system
- Allowing use of the treated water in-situ
- Minimizing pumping, transportation, thus energy efficient
- Smaller systems technically empowering the smaller LUBs
- Treatment where it is needed

Phytorid: Paradigm Shift in STP Technology

- Technology is based on ecological wastewater treatment designed to mimic the cleansing functions of wetlands with a smaller footprint .
- Combination of Physical separation and nature available biological components to treat sewage.
- Designed to effectively work in tropical conditions and properly camouflage in the aesthetics of landscape.

Parameter	Inlet sewage quality	Treated water quality	Standards for inland surface water	Standards Land Irrigation
pH	7.1 to 7.5	7.2	5.5-9.0	5.5-9.0
BoD (mg/L)	80 to 300	<10 to 20	30	100
CoD (mg/L)	130 to 350	< 50 to 100	250	Not Specified
TSS (mg/L)	80 to 90	< 15	100	200
Fecal Coli Farm (MNP/100ml)	10^6 to 10^7	<500	---	---
Nitrogen (mg/L)	10 to 50	4-5	5	Not Specified
Phosphate (mg/L)	10 to 50	1-4	5	Not Specified

Phytorid Technology:

Case studies

Area
Required is
0.2-0.3 Sqm
per capita

Phytorid Treating Nag River Water: Pilot Project

Raw sewage in nallah

Plant at Agricultural college, PKV Nagpur
Plant Capacity 100 m^3/day

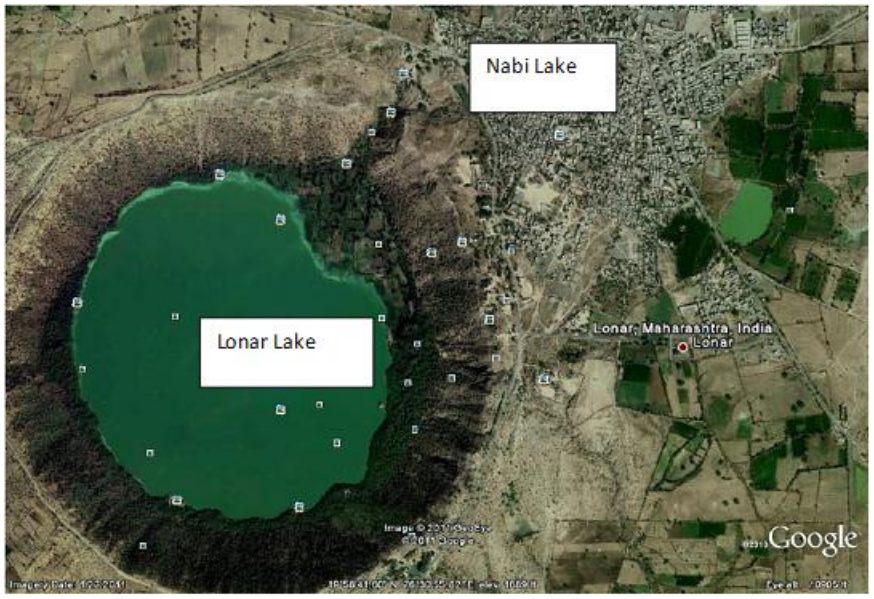
Phytorid System

Treated water

Performance of PHYTORID for Sewage typical results

Parameter	Inlet sewage quality	Treated water quality	Standards for inland surface water	Standards Land Irrigation
pH	7.1 to 7.5	7.2	5.5-9.0	5.5-9.0
Biochemical Oxygen Demand (mg/L)	40 to 130	<10	30	100
Chemical Oxygen Demand (mg/L)	130 to 350	< 20-35	250	Not Specified
Total Suspended solids (mg/L)	80 to 90	< 10	100	200
Fecal Coli Farm (MNP/100ml)	10^6 to 10^7	<20	---	---
Nitrogen (mg/L)	10 to 50	4-5	5	Not Specified
Phosphate (mg/L)	10 to 50	1-4	5	Not Specified

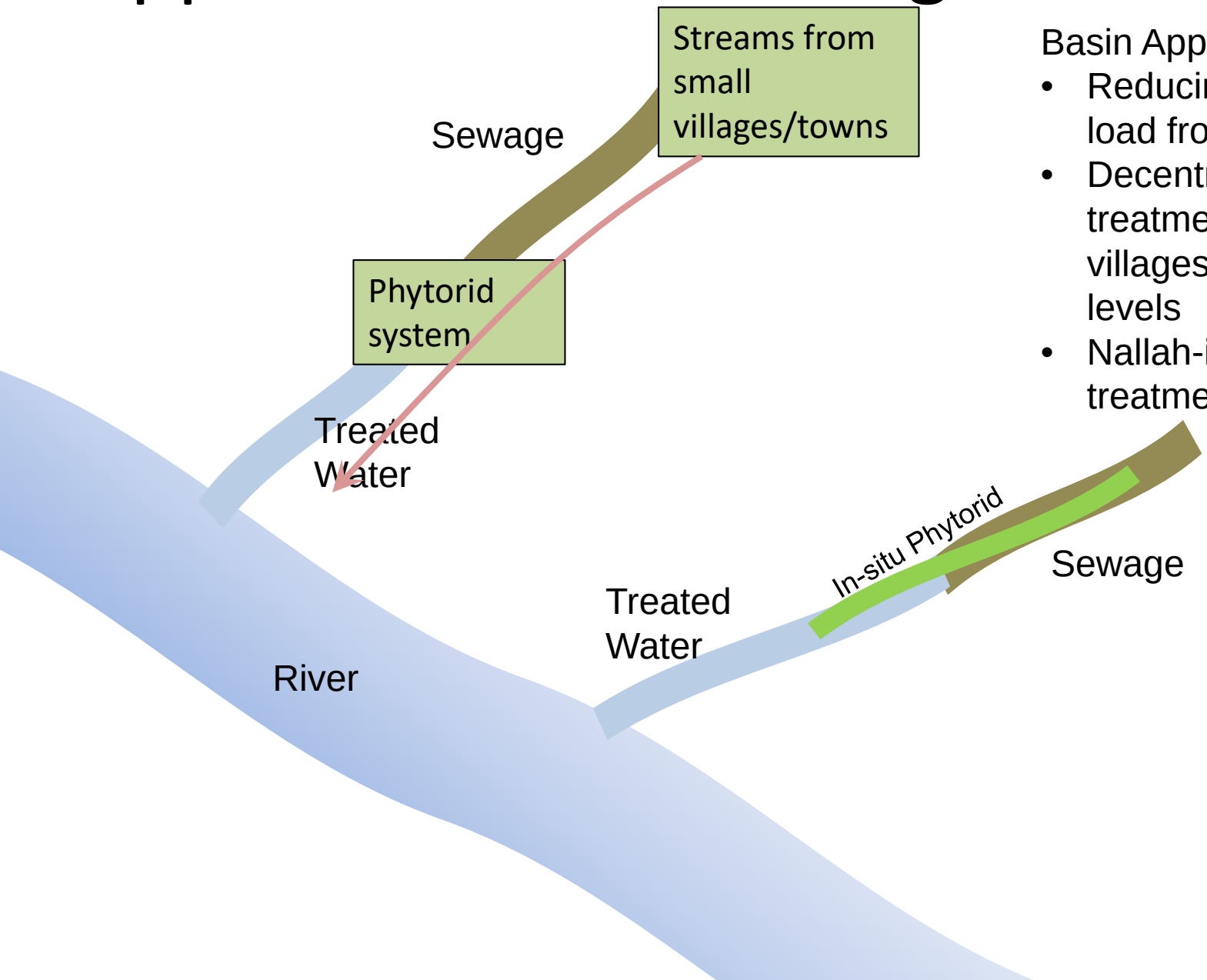
Case Study: Semi-Urban



Lonar Lake, Maharashtra

Capacity:500 kld
Area: 600 m^2
Reuse of Treated Water: Irrigation

Approach for the sewage treatment



Basin Approach

- Reducing pollution load from sewage
- Decentralised treatment system at villages and town levels
- Nallah-in-situ treatment

NEERI

Maharashtra Project: NABARD-MJP

Sr No	Village	Capacity of WWTP (In MLD)
1	Shiroli	0.85& 0.25
2	Kodoli	1.0&0.15
3	Lonand	0.7
4	Ozar	1.0 & 0.6
5	Kalwan	0.6
6	Chandwad	1
7	Pimpalgaon	1
8	Jamkhed	0.6&0.50
9	Shevgaon	1
10	Murbad	0.55 &0.45
11	Pasthal	0.6
12	Varangaon	0.6
13	Loni Kalbhor	1
14	Hiwarkhed	0.55

Operation and Maintenance

Periods in Months	1	2	3	4	5	6	7	8	9	10	11	12
Maintenance Item												
Replantation (partial if needed)			O									O
Water Quality analysis	O	O	O		O		O		O			O
Cleaning of Screening Chamber [this could be every week, in case load of floating matter is high]	O	O	O	O	O	O	O	O	O	O	O	O
Harvesting of overgrown plants and roots			O			O			O			O
Hydraulics/ water level Checks						O						O
Solids Cleaning in Phytorid Chambers				O				O				O
Cleaning of Settling chamber												O
Gravel checks and reshuffle			O			O			O			O
Pump maintenance (if pump is installed)			O			O			O			O
Biomedia augmentation (10% of the first time addition)			O			O						O

Conclusions

- Constructed wetland is the needed innovative technology: Ecologically benign
- Nearly free of fossil based energy therefore sustainable and doable
- Cost effective in terms of O&M is most important factor

Thank You

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