Conventional Systems of Sanitation for Safeguarding Water Quality through Decentralised Phytorid System

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NEERI: Mandate

- First Institute set up in 1958 for public health Engineering
- It was renamed in 1974 by PM as NEERI and To **conduct R&D** in environmental science and engineering
- To **participate** in CSIR thrust areas and mission projects to **develop** ESTs
- To **render assistance** to industries & Government bodies to mitigate environmental pollution with sustainable technology

Why we are here???

- Waste water generation and water quality maintenance a big issue
- Rivers and lakes suffer the most
- Set an example which will mark it as a biggest difference for

SUSTAINABILITY

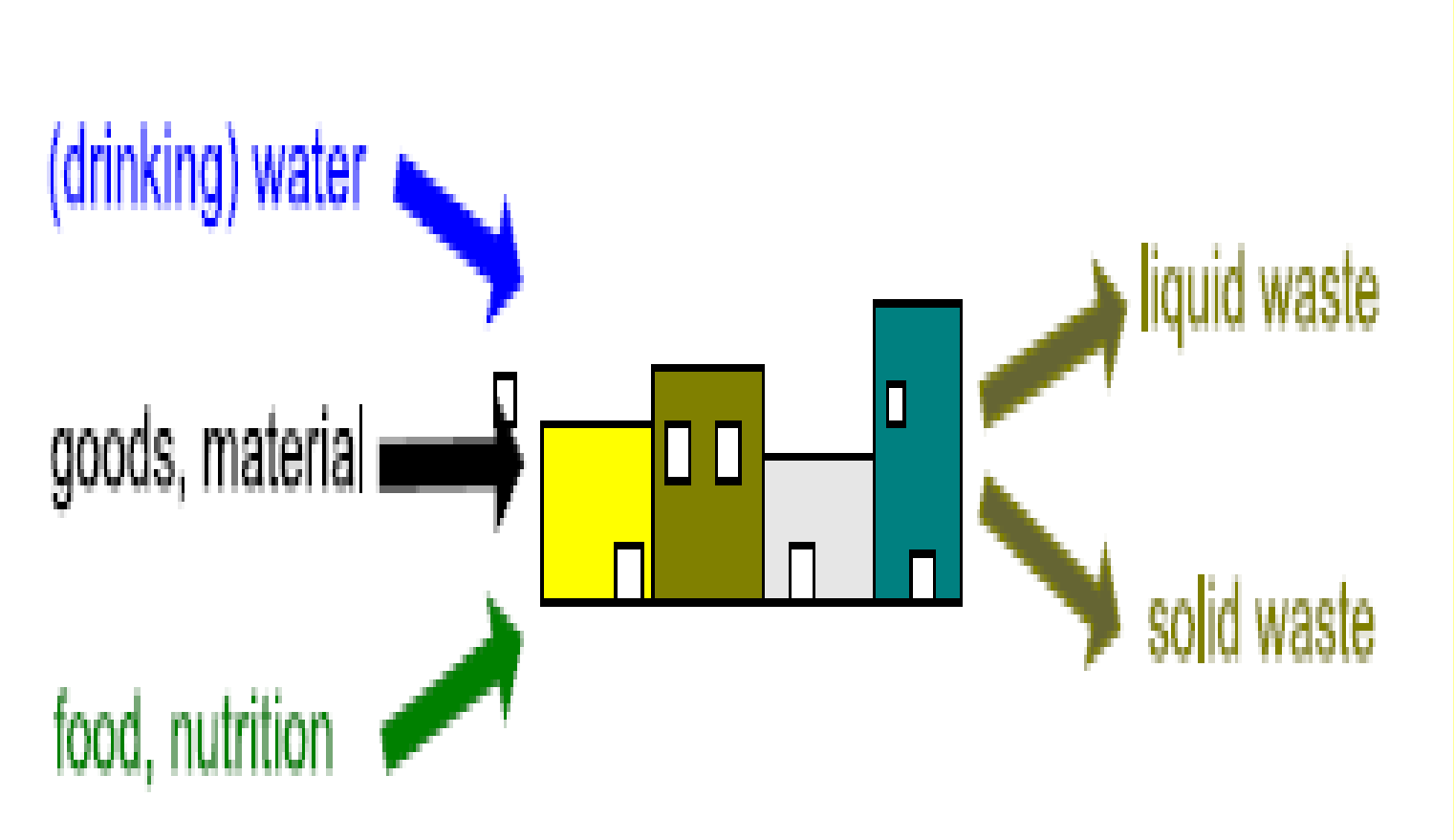
Sanitation…

- **Traditional interpretation:**
  - **Personal and household hygiene**
  - **Clean environment including water**
  - **Solid waste management**
  - **Greywater disposal and treatment**
  - **Safe excreta disposal**
  - **Stormwater handling**

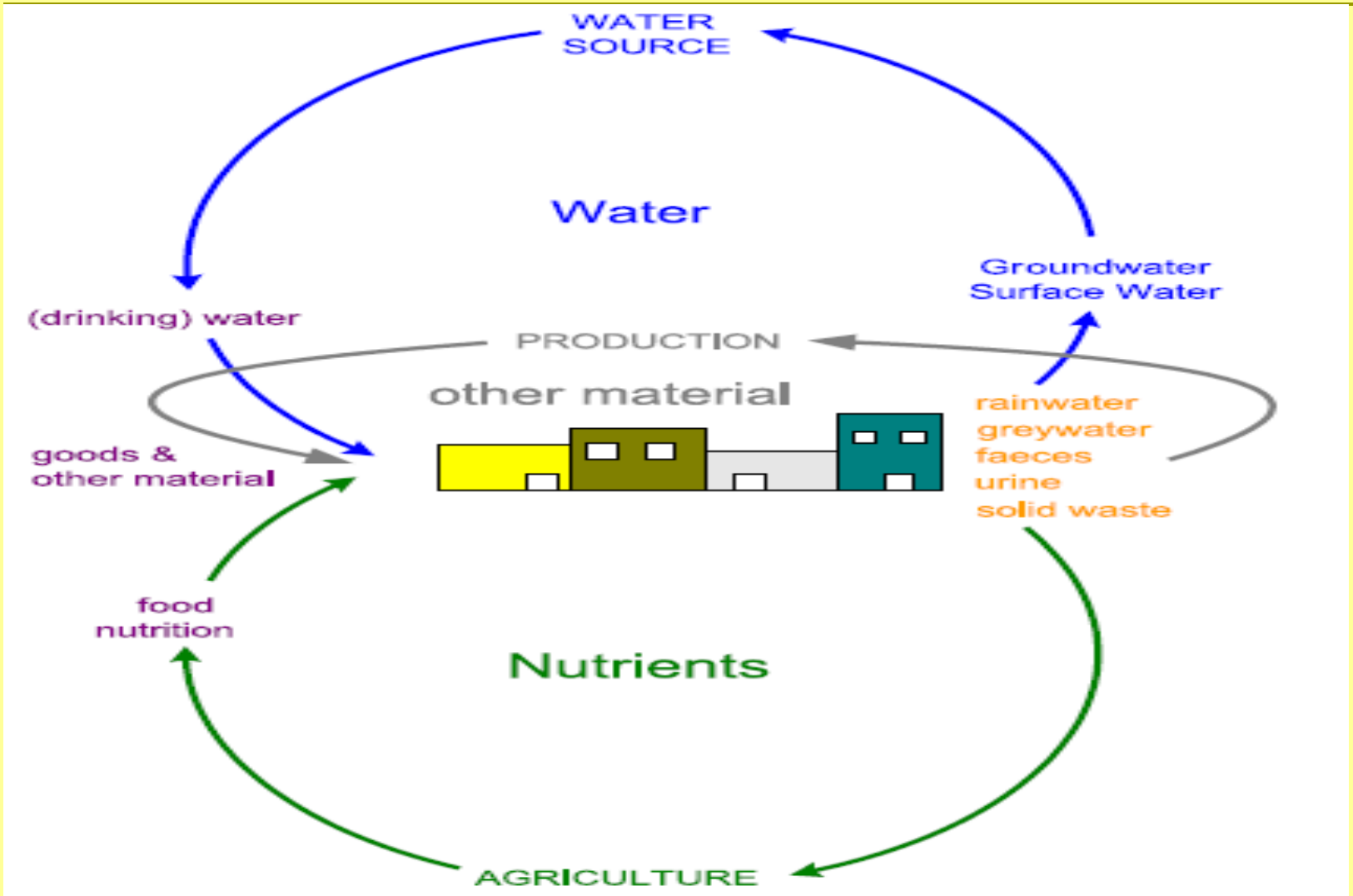
Sanitation …

- **Modern interpretation**
  - **Acceptance,**
  - **affordable,**
  - **convenience and pride**
  - **Environmentally sustainable (comprises variety of prospective)**
    - **Ecology**
    - **Economy**
    - **Resource**
    - **Social**
    - **reuse**

Linear flow in conventional sanitation system



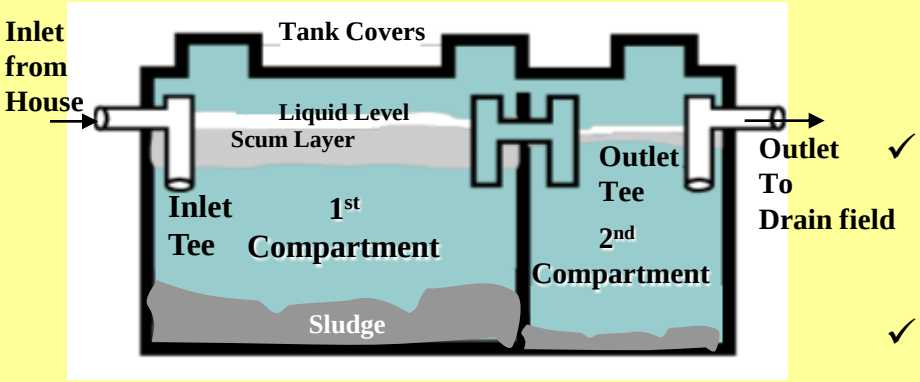
Approach of treatment should be like circular flow



Conventional Systems and Why We lost track ???

Septic Tank

- ✓ Used for the treatment of wastewater from individual households
- ✓ Employs anaerobic digestion to reduce the volume of solids settled out of the wastewater



- ✓ Usually removes about 40% of the incoming BOD and about 80% of the incoming SS
- ✓ Anaerobic process results in a relatively infrequent need for desludging
- ✓ Design should consider a sludge allowance of 0.05 m^3/ person year for sizing of the units

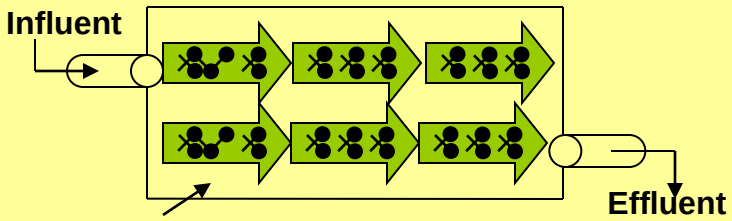
What has been changed by NEERI

- A septic tank with addition of high digestion
- Longer Cleaning Frequency
- High Efficiency for Solids Removal (up to 70%)
- Much Higher BOD Removal (up to 60%)
- Low Footprint (less space)

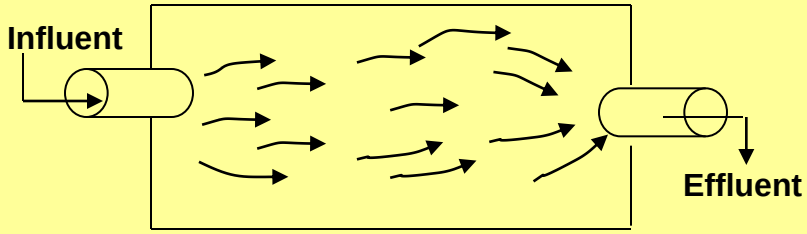
- **Amenable to further treatment and reuse**

Biological Treatment..

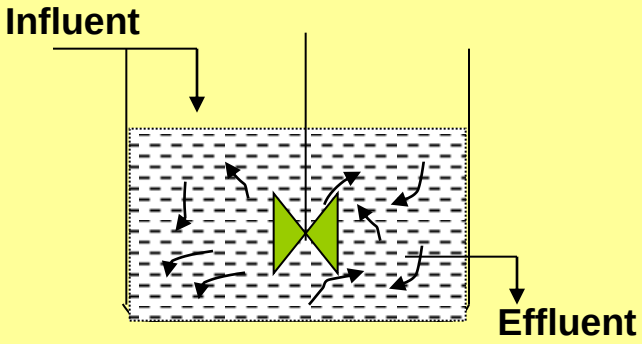
- Aerobic biological oxidation systems can be classified into different types: **all need continuous energy input**



a) Plug Flow



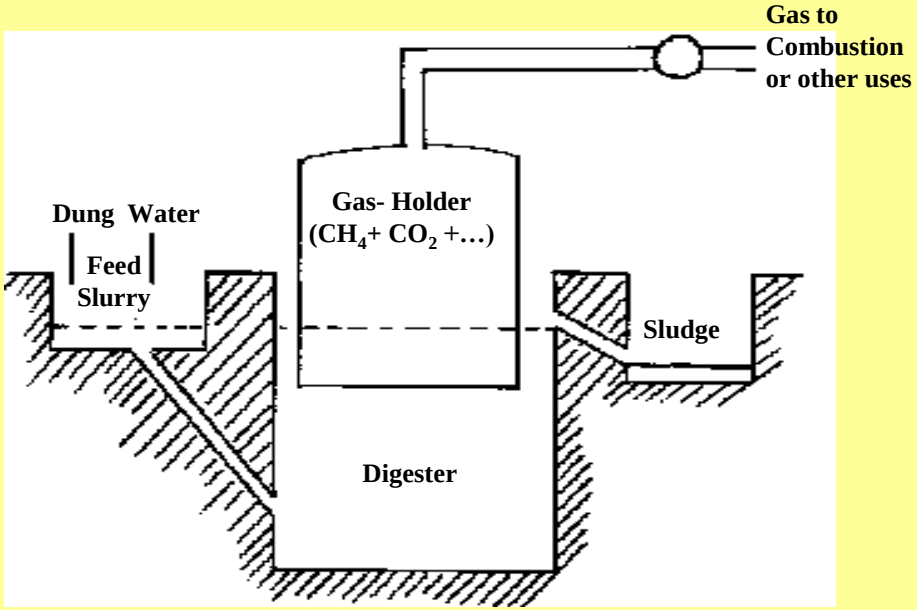
b) Mixed Flow



c) Completely Mixed Flow

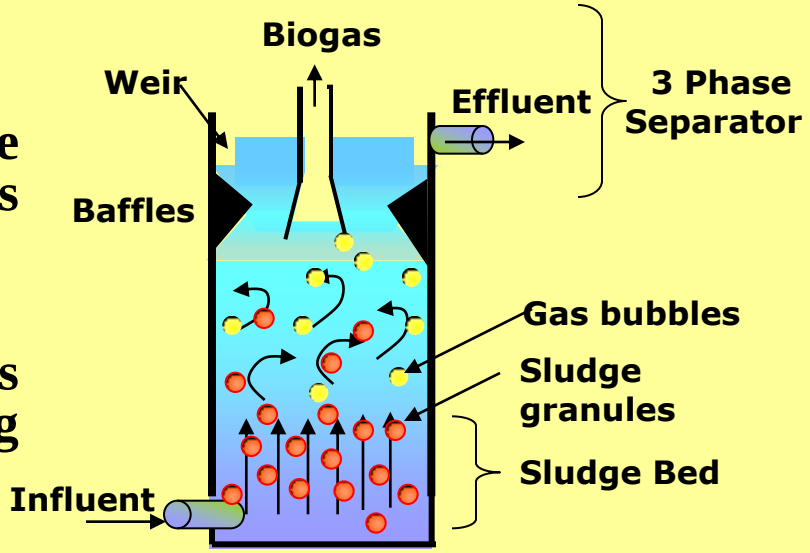
Biogas Units

- ✓ **Rural biogas units receive both domestic and animal wastes from a household**
- ✓ **Provide a valuable source of cooking gas as well as a fertilizer -rich residue**
- ✓ **Usually designed on the basis of about 2.5 kg VS/m^3 and a retention time of about 20 days**
- ✓ **Typical units are 1-5 m^3 in capacity**



Upflow Anaerobic Sludge Blanket: Many units installed under YAP

- Maintains high concentration of biomass through formation of highly settleable microbial aggregates
- Wastewater flows upwards through a layer of sludge
- At the top of the reactor, phase separation between gas-solid-liquid takes place
- Any biomass leaving the reaction zone is directly recirculated from the settling zone
- Suitable for both soluble waste and those containing particulate matter



Direction of Waste Treatment …..

- Its no more a situation of treating to meet certain standard and discharge in nearby water bodies
- Pressure from public and authorities to show more commitment
- Water cost rising
- Disposal not easy
- Long term liability
- Waste water disposal making water non-potable

Water availability is the Key Issue

What is more attractive!!

- Energy free or low cost treatment: Sustainability : not best technology
- Methods which can make things easier
  - WETLAND PLANTS BASED TREATMENT
  - COMBINATION OF CONVENTIONAL TREATMENT WITH NEW ONES

A study conducted by NEERI, 2001 showed that almost 85 percent of the activated sludge treatment plants were non-functional

USE OF WETLAND TECHNOLOGY: PHYTORID

Wetland system can be used to improve the quality of wastewater originating from

- **Domestic wastewater**
- **Agricultural wastewater**
- **Slaughter House Waste**
- **Fish pond discharges**
- **Pre treated industrial wastewater**
- **Municipal Landfill leachates**

NEERI developed a Sub-surface wetland technology: PhytoRid

- It needs less space : Equivalent to ASP
- Does not cause odour
- **Does not provide surface for mosquitoes breeding**
- **No power/electricity: Gravity flow**
- 1/5th of O&M cost compared to other technology
- National (2007) and International Patents (Australian and European Patent), 2005

Inaugurated by
Shri Suresh Shetty

(Honbl'e State Minister)
Medical Education Higher & Technical Education

On

World Environment Day
5th June, 2006

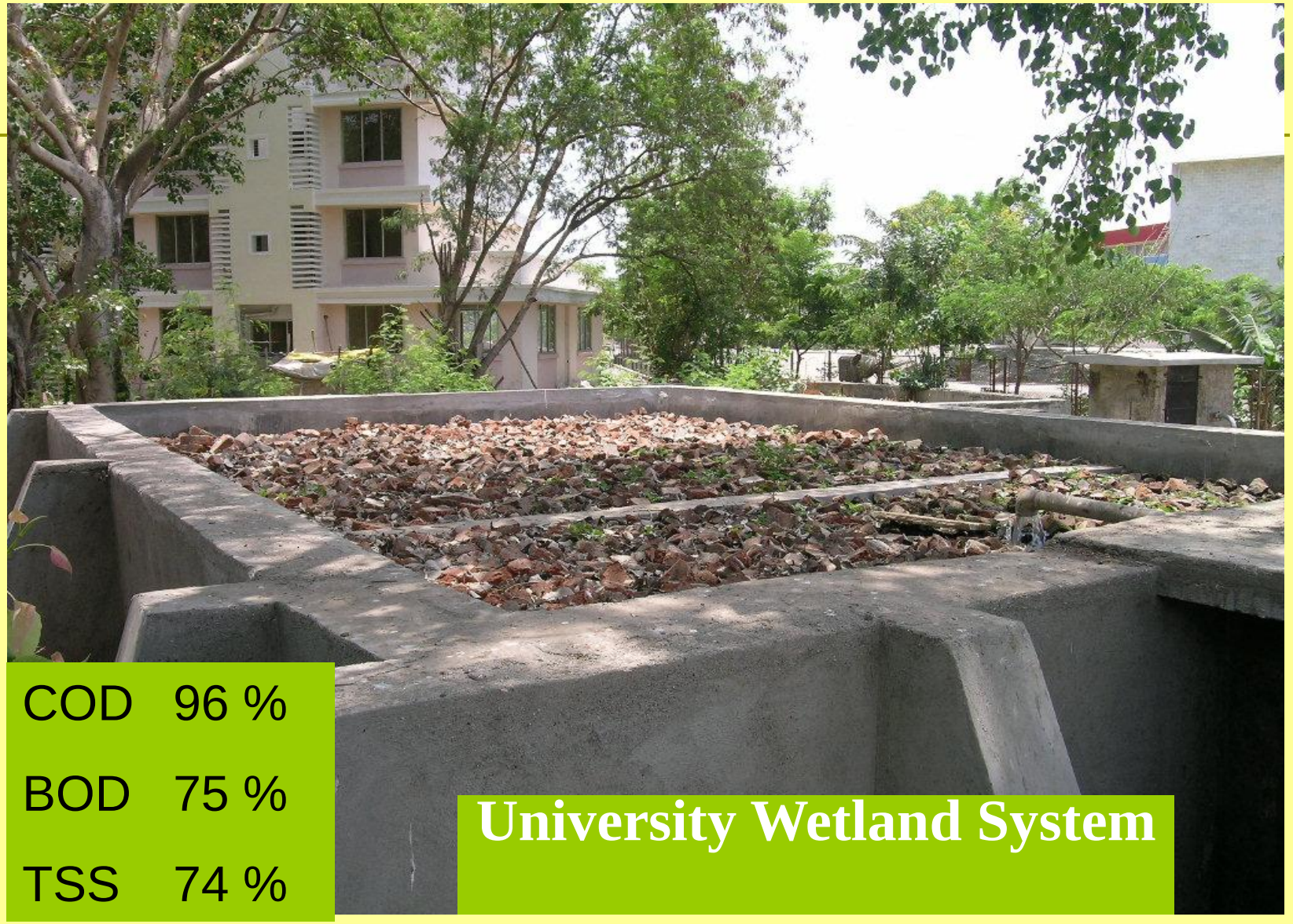
at

Kalina Campus
Mumbai University

FEATURES OF THE SYSTEM

Secondary Advanced Cell with Filter Media in 3 Layers

Tertiary Biological Cell with Filter Media & Wetland Plants



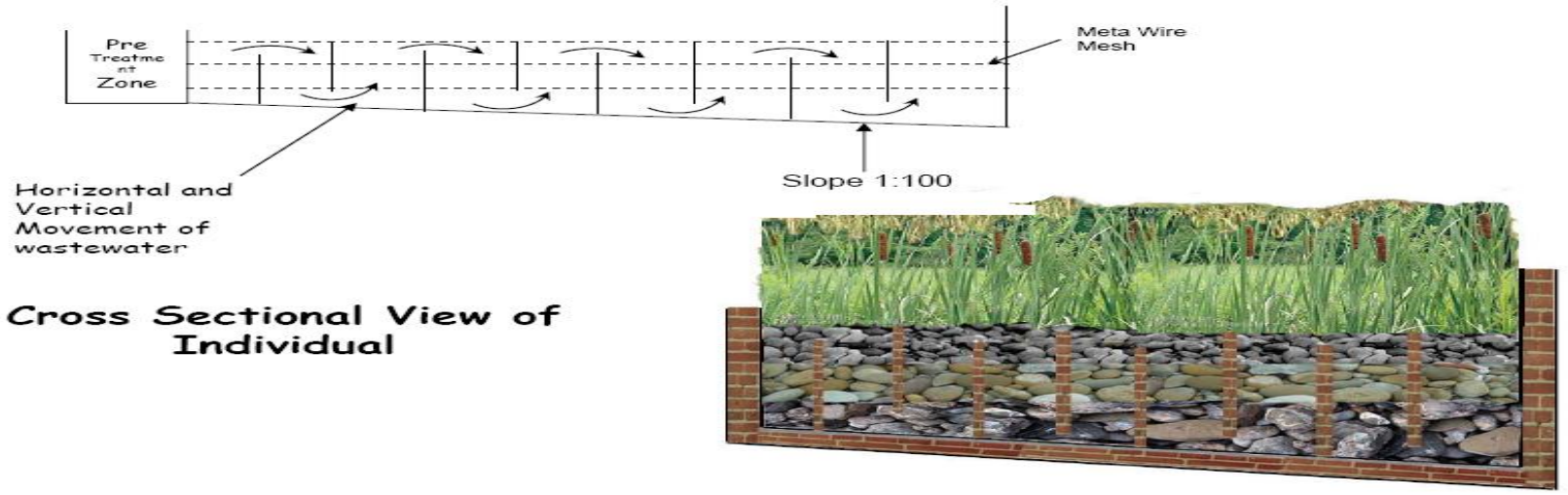
COD	96 %
BOD	75 %
TSS	74 %

University Wetland System

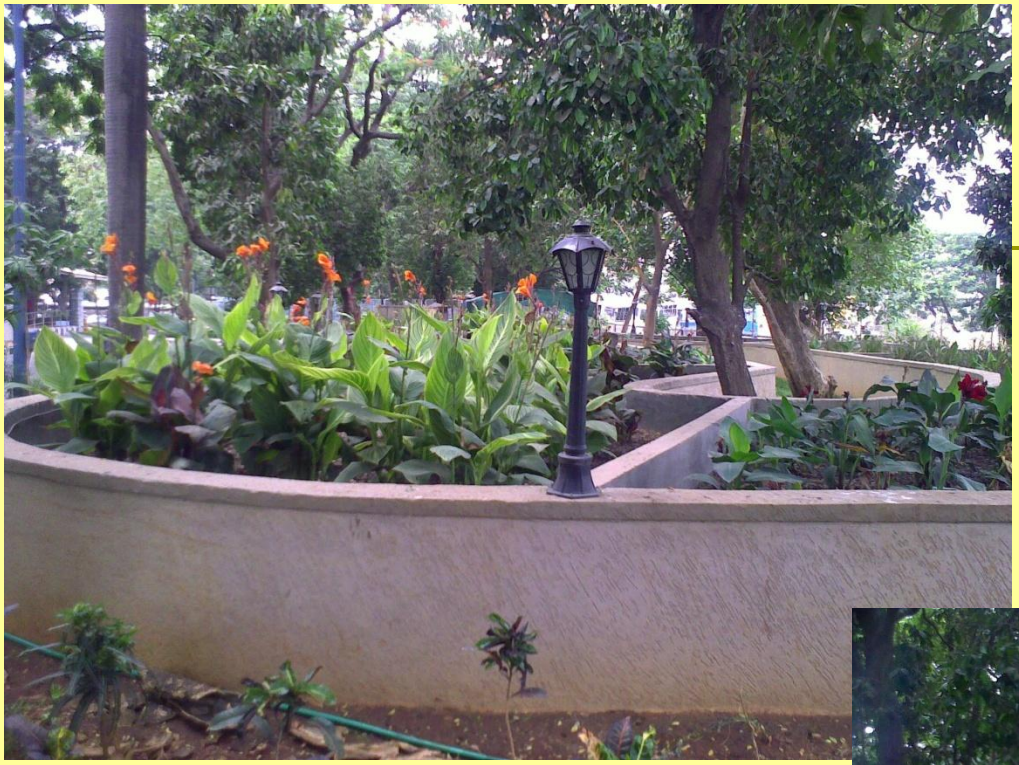
University Wetland System

Panvel Wetland System

LAYOUT DESIGNS



SIEMENS



It forms part of their garden area

MAHINDRA & MAHINDRA, iGATPURI

In Office and Residential Complex: Grey Water

KOLIMB AGRICULTURAL COLLEGE (TITWALA-THANE DIST.)

- Design for treat the grey wastewater generated
- Design to treat the flow of 5 CMD
- Operation starts from June 2009
- Treatment system has septic chamber and Phytorid system
- Treated water is reuse for gardens, vermin-compost plant

TREATED WATER QUALITY

Typical Performance Characteristics for Various Treatment Methods

Sr.	Items	Conventional activated sludge	UASB	Extended Aeration	Facultative Aerated Lagoons	PhytoRid Technology
1	Performance BOD Removal %	85-92	75-78	95-98	75-85	80-95
2.	Sludge	First digest then dry on beds or use mech devices	Directly dry on beds or use mech devices	No digestion dry on sand beds or use mech devices	Mech. Desludging once in 5-10 years	Negligible
3.	Equipment Requirement (excluding screening and grit removal common to all processes)	Aerators, recycle pumps, scrappers, thickeners, digesters, dryers gas equipment	Nil except gas collection and flaring gas conversion to elect is optional	Aerations, recycle pumps sludge, scrappers for large settlers	Aerators only	None, all flows by gravity
4.	Operational Characteristics	Skilled operation reqd.	Simpler than ASP	Simpler than ASP	Simple	Unskilled operator
5.	Special features	Considerable equipment and skilled operation reqd specially when gas collection and usage considered	Minimal to negligible power reqd. makes it economical at even if gas revenue is neglected	BOD removal highest effluent nitrified high power reqd. Favoured for small and medium plants	Power reqd. similar to ASP operation simpler	Plant species and odour less operations

Operational and being implemented PhytoRid System

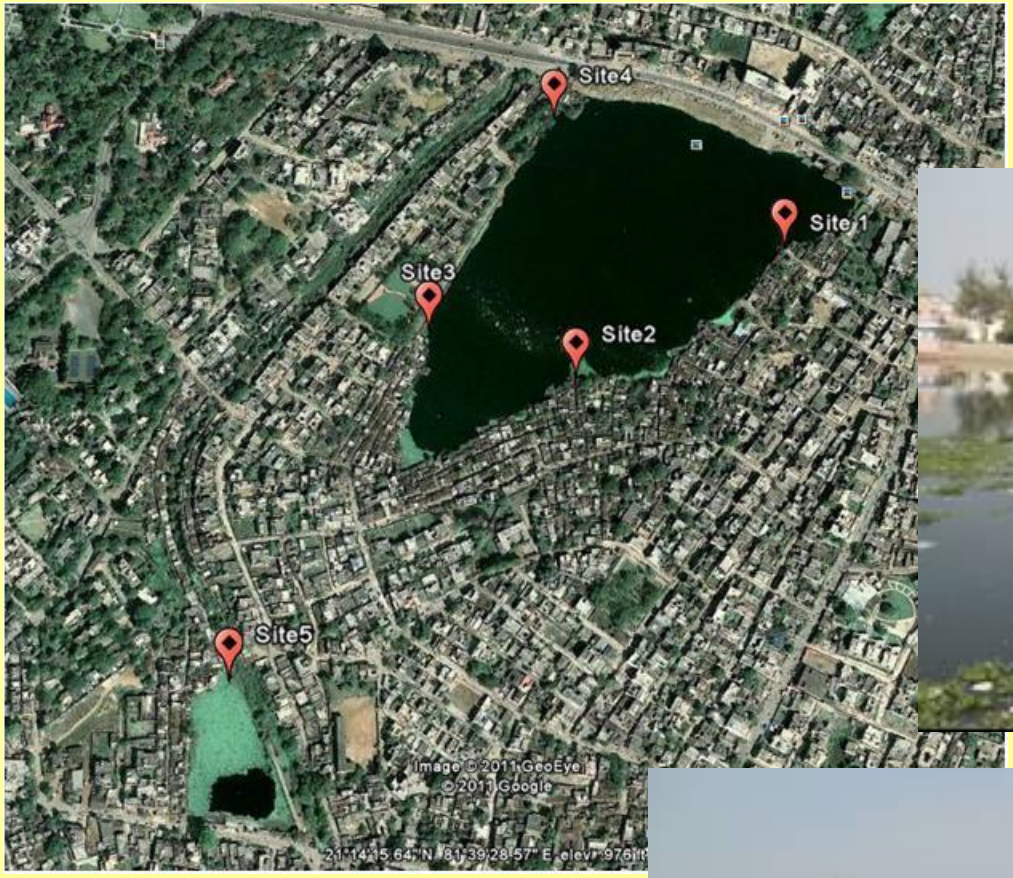
- **Raj Bhawan, Mumbai**
- **CIDCO at Panvel**
- **Kalina, Mumbai**
- **Premier Industry Campus**
- **Murbad School**
- **Chakan Industry**
- **Kalyan, Household**
- **NEERI, Mumbai**

- **Slaughter House, Aurangabad, Nashik, Nagpur, Chandrapur**
- **Matheran Town Feasibility**
- **Ammunition Factory, Khadki**
- **Dairy Industry**
- **64 villages in CIDCO area: as Corporate Social Responsibility Project**
- **Housing complexes in Thane, Pune, Bangalore**

- **Delhi Nallas, Kushak and Chirag**
- **NOIDA Industrial Area Nalla Rejuvenation**
- **Municipal Corporation of Delhi (Chirag Nalla water)**
- **New Raipur Development**
- **Jabalpur, Durg and Bhilai Waste water source cleaning**
- **Lonar, Goa, Yawatmal and others**

Some Work of NEERI's Technology for Lakes and Nalla Waste Water Treatment

Telibandha Lake, Raipur



Lake Area: 11 Ha
Phytorid Capacity 2 MLD
Proposed to develop 3 plant at periphery

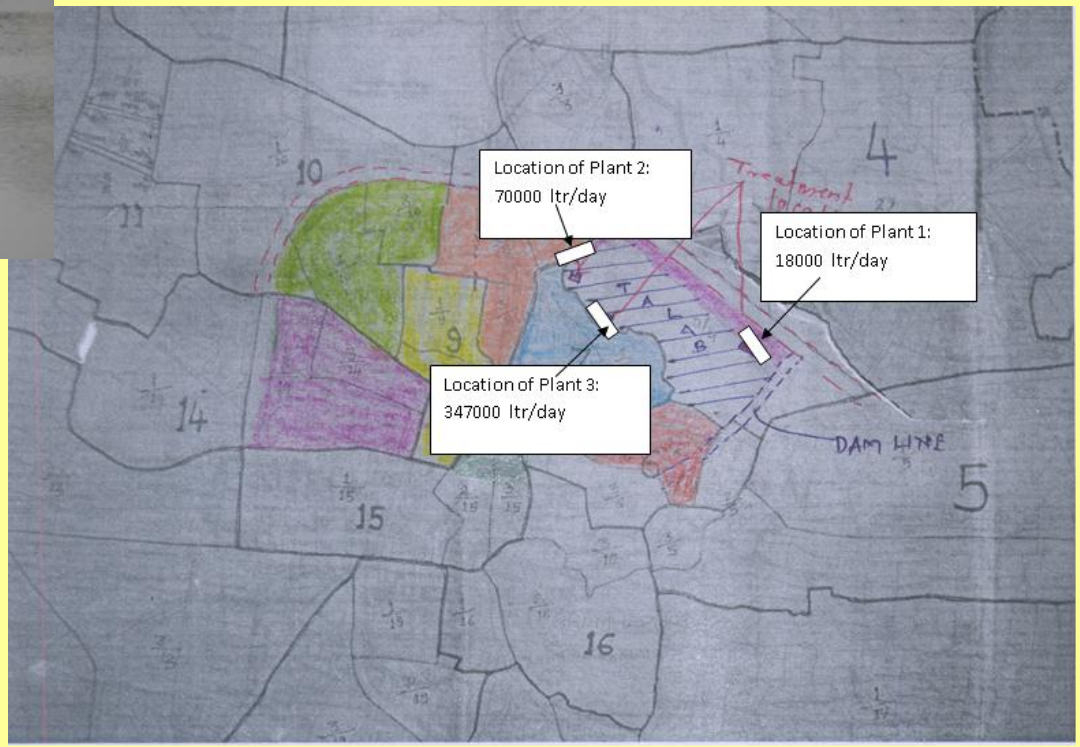
Second Phase started

Under Consideration

Lonar Lake (under threat), Maharashtra

Lake Area: 3 Ha
Phytorid Capacity 500 KLD
Plant Construction completed under commissioning
Will Treat entire Sewage from Lonar City

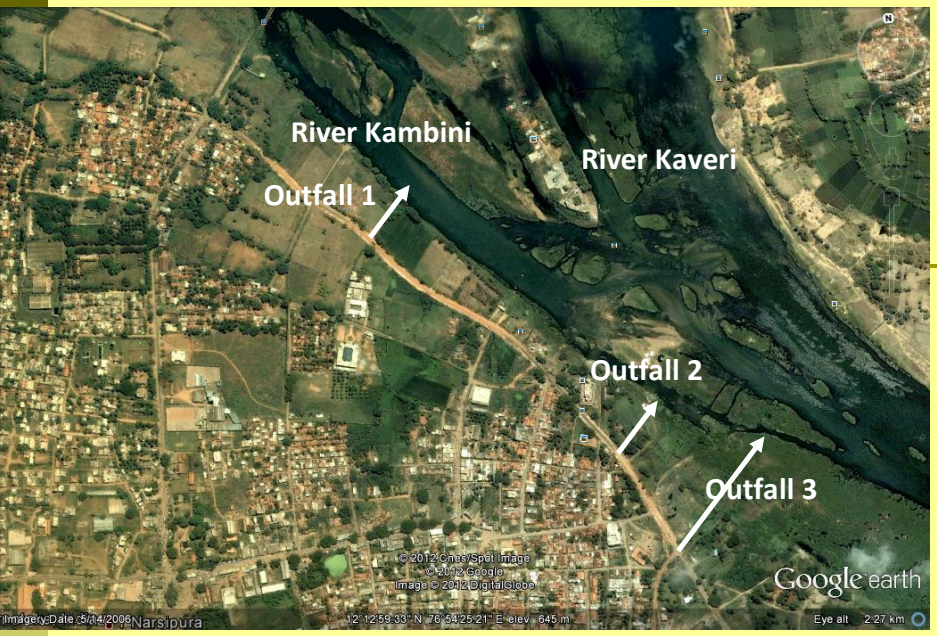
Kot Lake Brahmapuri, Maharashtra



Phytorid Capacity 450KLD
Project Approved

Under design

T. Nasripura, Mysure



Proposed Site for Phytorid for River Pollution Reduction

View of Nag Nadi-Naala from University library road

View of Nag Nadi-Naala towards Panchsheel

Nag Nadi- Naala
Width: 6.4 meters
Depth: 11 inches (0.2794 meters)
Length: 500 meters**(between university road and panchsheel)**
Estimate flow : 4 MLD

Proposed design of Phytorid

Estimated land area required: 2563 m^2

For a plant capacity of 1000 m^3/day

Entire length of the plant: 267m

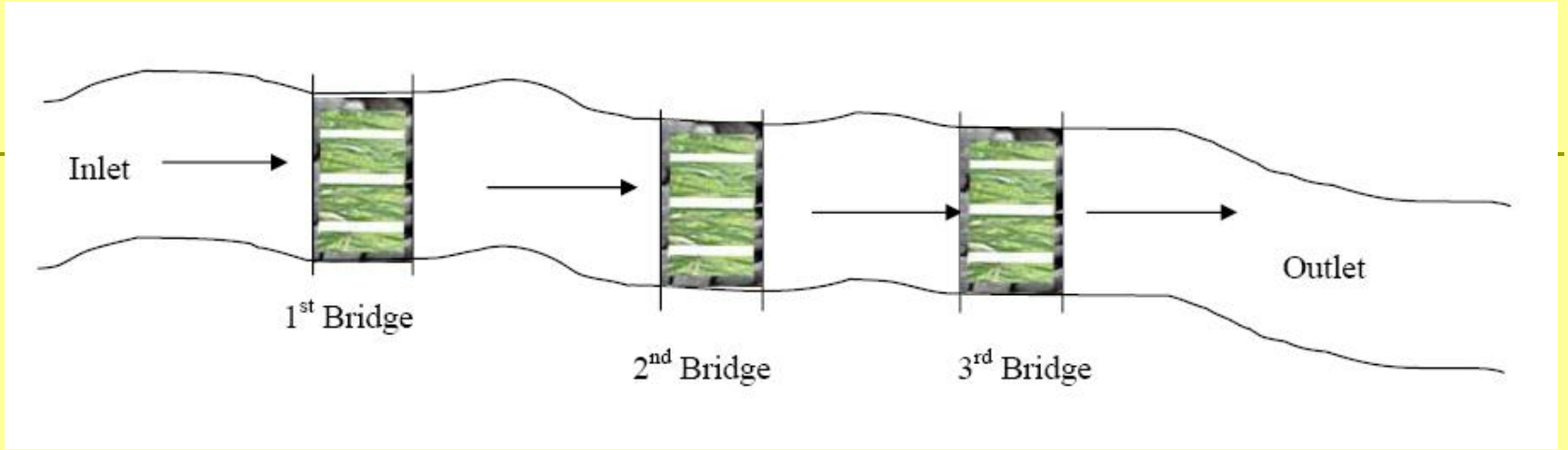
For a plant capacity of 1000 m^3/day

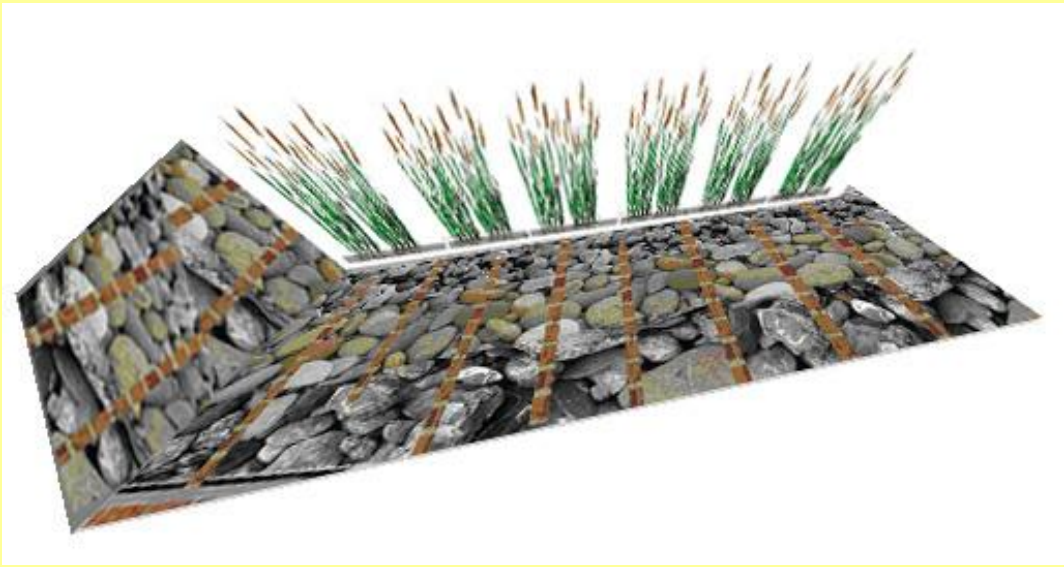
Length of the Phytorid bed: 184 m

Dimension: 1.5m depth X 184m length X 8m width

Project completion period: 12 months

Design Feature for PRAJ Project





3-D View of Individual Wetland Bridge

Design for a typical lake

Proposed Design for the Nallah

Conclusions

- **Wastewater management issues are integral to the water supply, sanitation and health of the population.**
- **WW Management is no more a concept which needs to work with only Governmental Grants**
- **It must have payback possibility to the society**
- **Urban poor sanitation is a separate issue, however, it is linked with the overall sanitation plan of the city.**

It leads to overall improvement in the City Sanitation leading to better HEALTH AND ENVIRONMENT