Environmental Sanitation

CE102: Environmental Studies

Dr Subrata Hait
Department of Civil and Environmental Engineering

Sanitation

Provision for defecation with privacy, dignity and safety while preventing the environmental contamination

Toilet is a solution!

Toilet poses a big challenge!

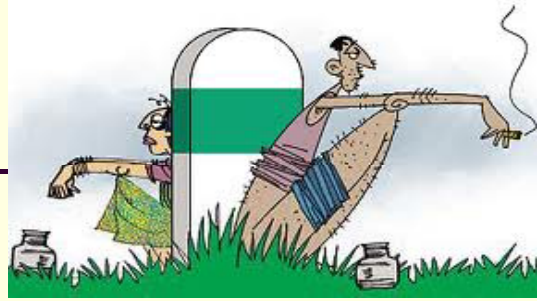
Isolation of human excreta from water bodies (surface or under-ground)/air/soil until the same is converted into safe usable product

Onsite and Offsite
Management of Human Excreta!

Characteristics of an Ideal Toilet

- ✓ Hygienic
- ✓ Easy to use
- ✓ Not many usable parts
- ✓ No odors
- ✓ Should be aesthetically pleasing
- ✓ No insect menace
- ✓ Require minimum user intervention
- ✓ Waste should be processed to a usable form

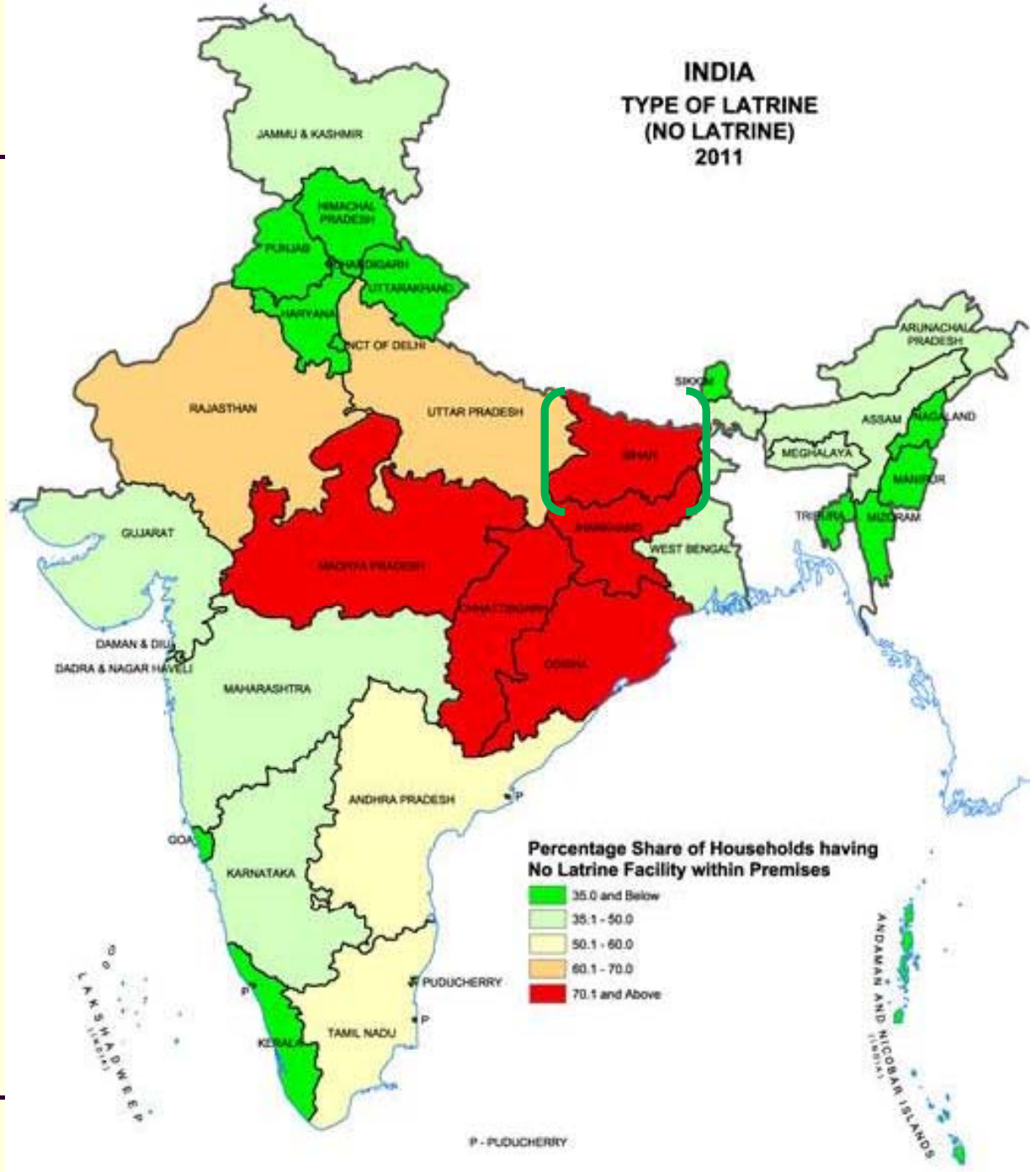
Sanitation – Hard Facts!



- Providing basic sanitation facility has become an issue of prime importance as per the UN Millennium Development Goal (MDG) target to 'halve by 2015 the proportion of people without access to basic sanitation'
- According to the WHO-UNICEF Joint Monitoring Report (2012), India accounts for 626 million (59%) of the 1.1 billion people in the world who practice open defecation
- India still tops in open defecation! According to the WHO-UNICEF latest update (2014): "Globally, India continues to be the country with the highest number of people (597 million people) practising open defecation"
- The incidence of open defecation in the Indian State of Bihar is on the higher side with more than 70% households are without toilet facility as per the latest Census of India (2011)
- Lack of public toilet facility in major cities/towns of Bihar including State Capital Patna

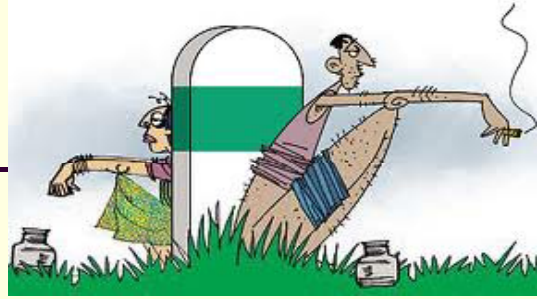
Sanitation

Toilet Map of India



Courtesy: Census of India 2011

Sanitation – Hard Facts!

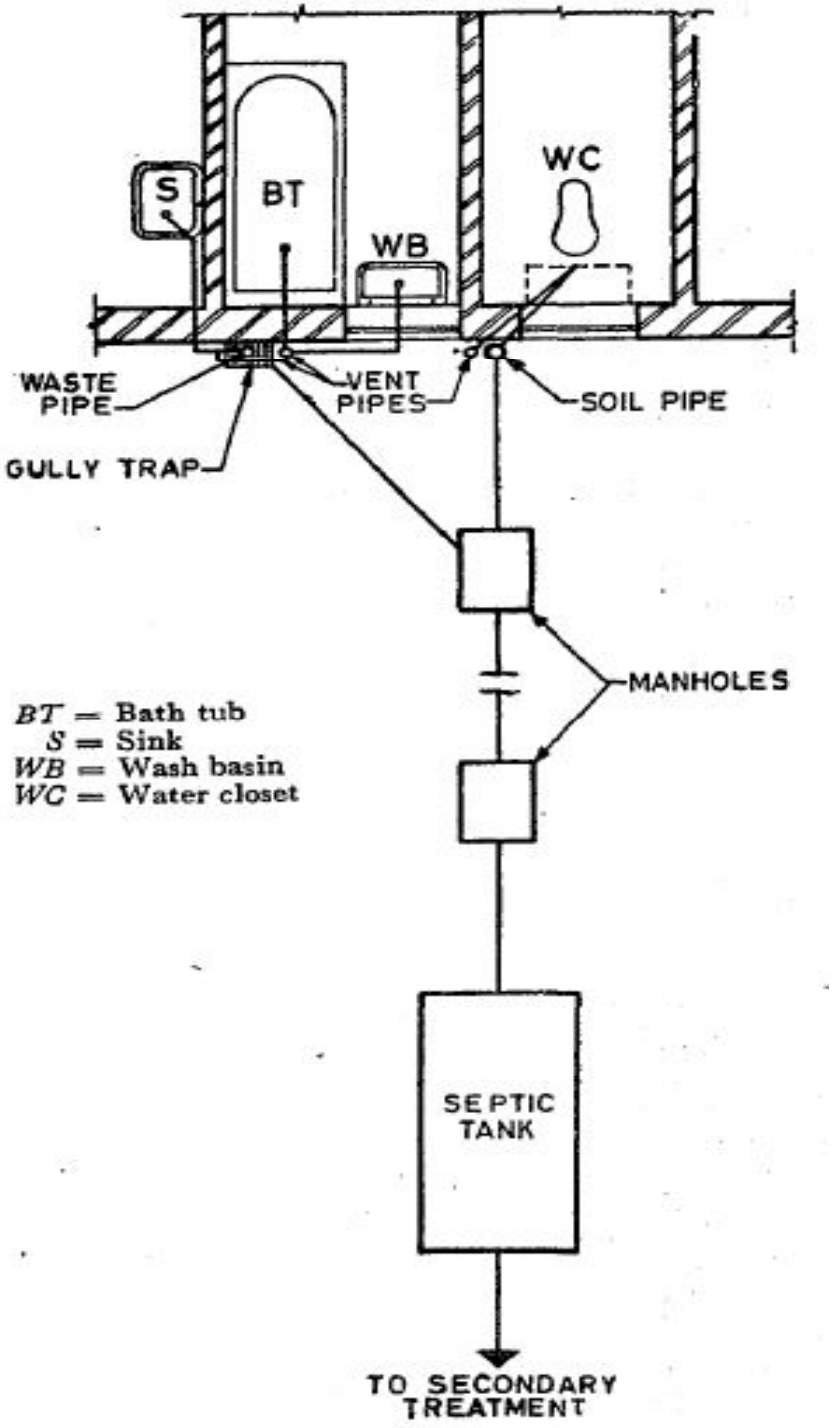


- The present estimated sewage (domestic wastewater) generation in Patna is 225 MLD and this is expected to increase to 551 MLD by 2030
- The total sewage treatment capacity created in the city is of the order of 110 MLD although only 49 MLD capacity is presently utilized due to various reasons
- About 176 MLD sewage is directly discharged into the Ganga River and Punpun River (which ultimately joins the Ganga River) without any treatment

- Patna city currently generates approximately 680 metric tonnes per day of solid waste and it is estimated that 1500 metric tonne of solid waste will be generated every day in Patna by year 2038
- Presently most of the city solid wastes are dumped without any treatment in depressions, ditches or by the sides of the road (Present Dumping Site: Low-lying lands/areas beside the Bypass Road) in an unscientific manner
- The proposed sanitary landfill site (approximate 80 acre) would come up at Ramchak Bairiya village on Patna-Gaya Road with capacity of treating 600 to 1,000 tonnes of solid waste every day

Building Sanitation

Toilet Pan (i) Indian Type (left) and (ii) Western Type (right)

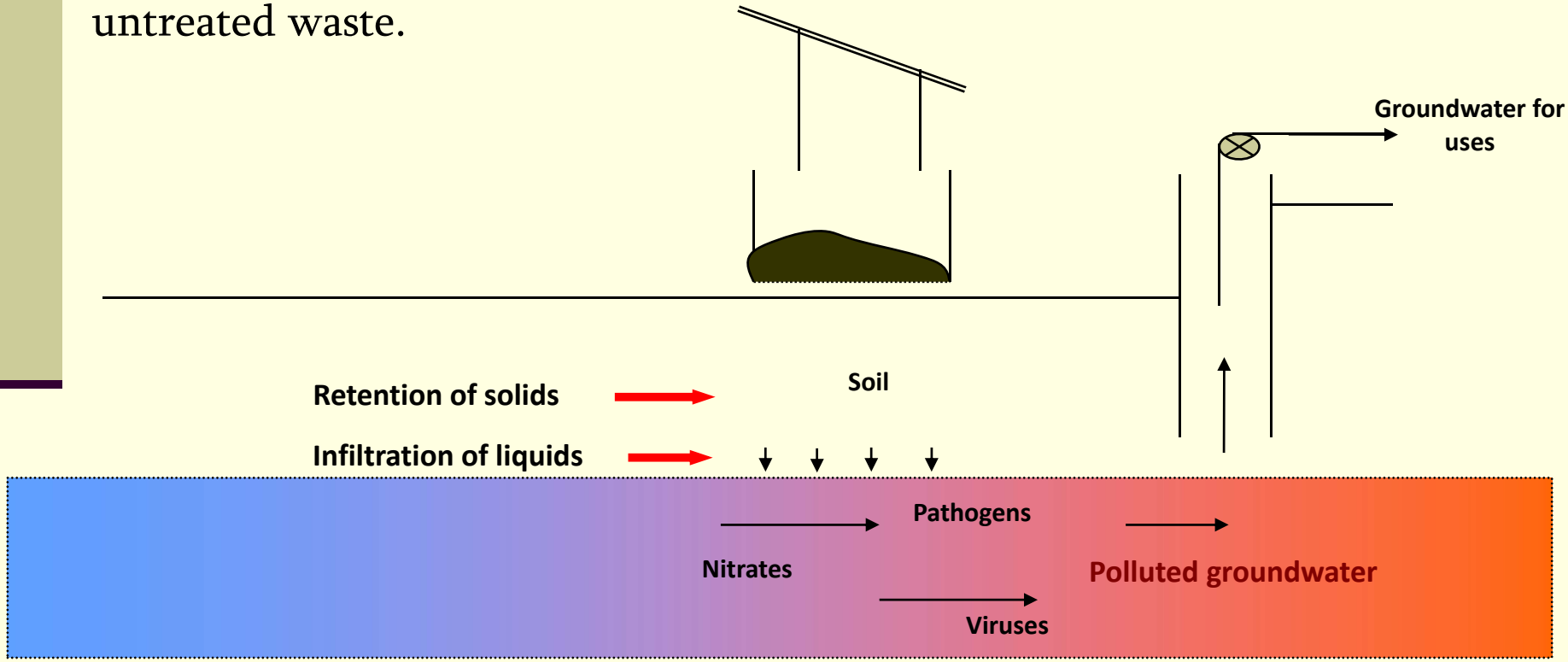


Conventional Way of Sanitation - Septic Tank

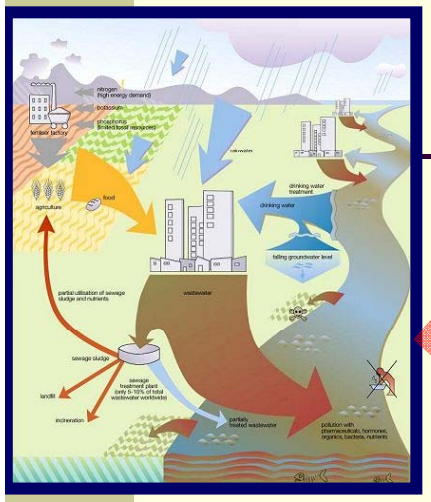
- A septic tank is being extensively used over the years for storing and digesting the settled fecal solids/sludge
- Septic tank is categorized under anaerobic decomposition as the digestion of settled sludge occurs under anaerobic condition
- Since foul gases will be evolved under anaerobic decomposition, the septic tank is generally covered with a high vent shaft for escape of gases
- The effluent from the septic tank is sufficiently foul in nature and generally disposed of either in soil absorption system, say soak pit/cess-pool or to be treated in sewage treatment plant (STP) before discharge
- The sludge settled at the bottom of the tank is allowed to remain in the tank for a period of several months during which they are decomposed/digested using anaerobic bacteria and must be further stabilized before disposal
- Digested sludge from tank is periodically removed at the intervals of 6-12 months, but not exceeding 3 years

Conventional Way of Sanitation & Waste Management

- The idea that human excreta are wastes with no useful purpose is a modern misconception!
- This has led to the development of so-called “drop and store” or “flush and forget” sanitation solutions!
- In this paradigm, precious drinking water is used to transport excreta into the water cycle misusing our rivers, oceans and aquifers as a sink for untreated waste.



Dependency on Pollution Infrastructure and Concept "Solution to Pollution is Dilution"



Present Sanitation Model: Conventional Water-borne Sanitation

Chemical Fertilizer

Food

Water Supply

Agriculture

As organic fertilizer

Wastewater (Blackwater + Graywater)

Ground Water

Surface Water

Directly used as soil-conditioner (3%)

Wastewater Treatment Plant

Untreated Wastewater

Composting (2%)

Land-Filling (95%)

POLLUTION

Sludge

Partially Treated Effluent

POLLUTION

Political Economy of Defecation!

- Topic nobody talks about
- Sewage systems constitute an ecologically mindless technology
- Consider first the large amount of water that is used just to carry away a small quantity of human excreta
- Big dams and tube-wells are needed to bring this water home leading to enormous environmental problems
- Then large quantities of water that get flushed down the toilet pollute rivers and large water bodies

This…. Nobody talks about. It is neither rational, just or sustainable

A Paradigm Shift is needed!

O' my dear tree!
How can I be like you
so that you can use
my droppings?

O' my dear friend!
You need my
droppings so do I
need yours

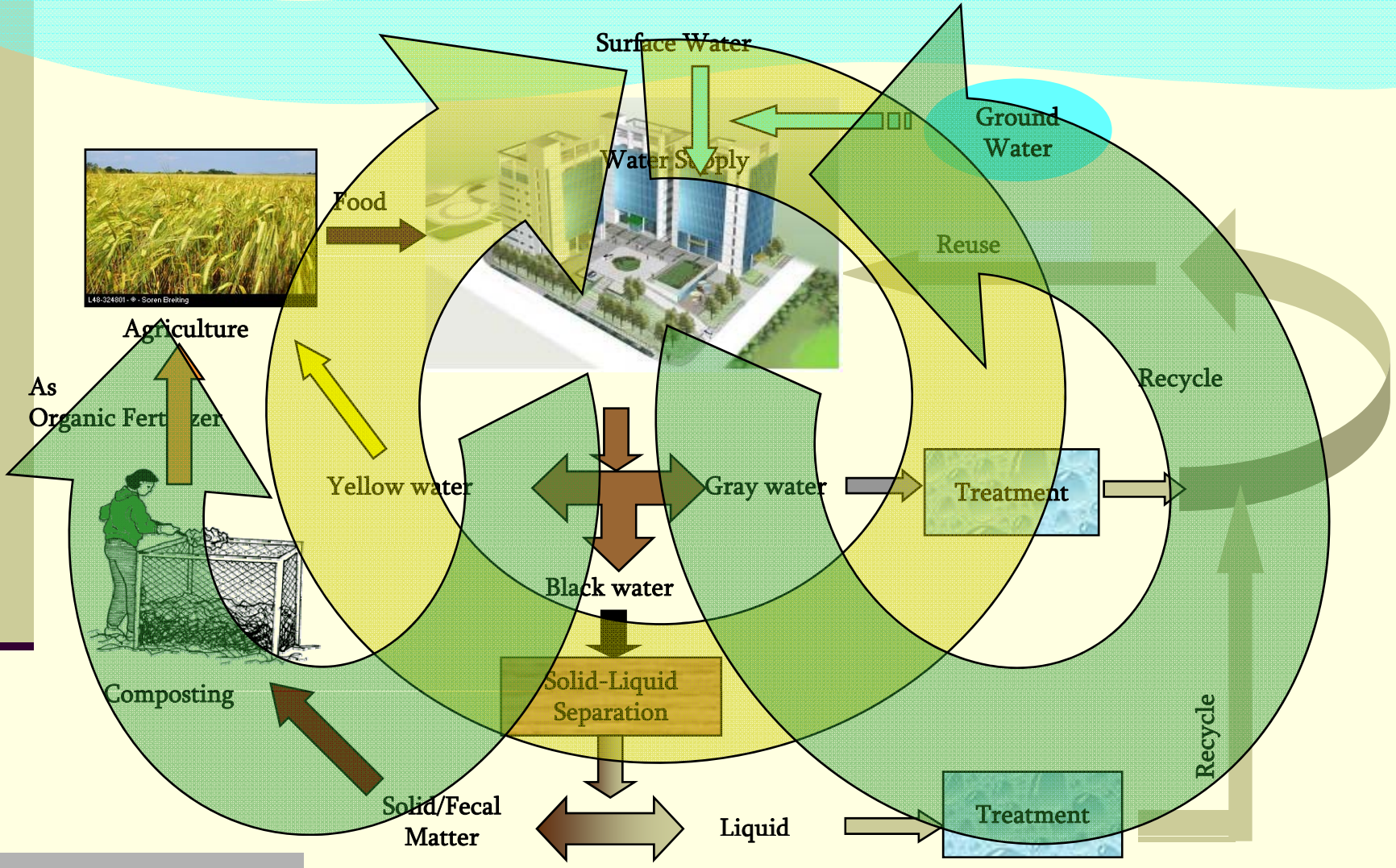
"A Message"

Human Excreta !

Let us not dispose on River Bed, rather convert into manure and use for agriculture

A humble way to give back to the Mother Earth than polluting water bodies!

Alternative Mode - Ecological Sanitation (EcoSan)

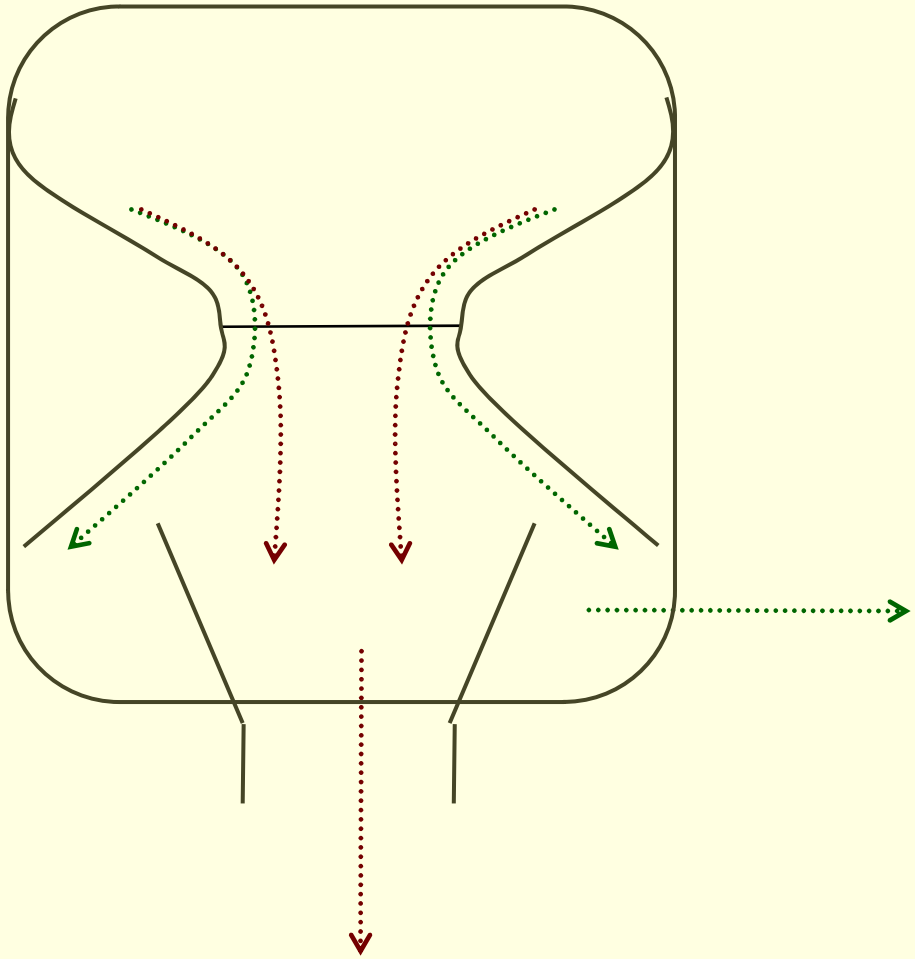


Sustainable Sanitation: Challenges

- **Development of novel low-cost sanitation model** with goals of water recycling, minimum use of fresh water and conversion of human excreta to organic manure to support agricultural needs
- **Toilet design** to suit children, differently-abled persons, emergency situations, etc.
- **Treatment and management of toilet liquid and solid wastes** for reuse and recycling as organic manure in agriculture
- **Situational Sanitation Analysis** of target areas/localities for the present status of sanitation and waste management
- **Setting-up of public toilet facilities** in urban and rural areas
- **Public awareness campaign** in form of seminar/workshop among masses to inculcate benefits of proper sanitation practices

Eco-friendly Zero Discharge Toilet (ZDT)

Solid-Liquid Separator - A Simple Device



Solid-Liquid Separator - A Simple Device

Solid-Liquid Separator - A Simple Device

Post-processing of Human Excreta - Paradigm Shift!

- Use human feces for producing quality organic manure than Biogas
- Get Urea, Ammonia, Potash and Phosphate from Urine than Chemical Fertilizer Industries

Post-processing of Human Excreta - Paradigm Shift!

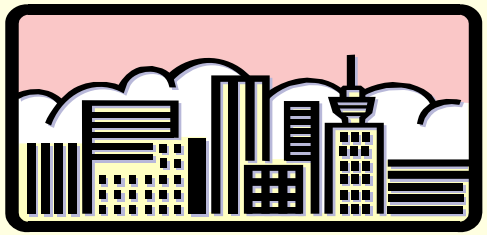
Mixing and Pre-composting

Vermicomposting (Vermibins)

Vermicompost (Organic Manure)

Sustainable Sanitation: Opportunities

Waste → Wealth



Organic Manure

Modern Night Soil Industry

Employment

Agriculture boost

Environmental protection

Concluding

- We need inexpensive solutions but should not compromise on quality and long term objectives
- There are no easy options, we have to be disciplined and be ready to use expensive solutions for modern life style
- Excreta matters can not be just left like that, we have to engage with it
- Sanitation and agriculture has to be linked
- Large scale use of excreta in agriculture and not disposing somehow

Concluding

A Paradigm Shift in Human Excreta Management Practices: Blend of Advanced Technologies with Traditional Wisdom

"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn."

-*Alvin Toffler*

"Rethinking the Future"