
Wastewater Management

UNIVERSITY OF JAFFNA



Wastewater



- Water that is very harmful to the environment ,that is called wastewater
- Wastewater can be contaminated with a myriad of different components : pathogens, organic compounds, synthetic chemicals, nutrients, organic matter and heavy metals.

<https://www.flickr.com/photos/oddsock/9756106243>

Sources

Domestic Wastewater

Industrial activities

Commercial activities

agricultural activities

surface runoff or storm water

infiltration.

Wastewater, a global problem with differing regional issues

(Image of data analysis of WHO)

Domestic wastewater

Sources : Kitchen , Bath rooms and Toilet

Types : Grey wastewater

Water coming after using it from Kitchen and bathroom

Black wastewater

The waste water generating from the toilets called black water will contain urine and faecal sludge.



commons.wikimedia.org

Collection and Transport of wastewater

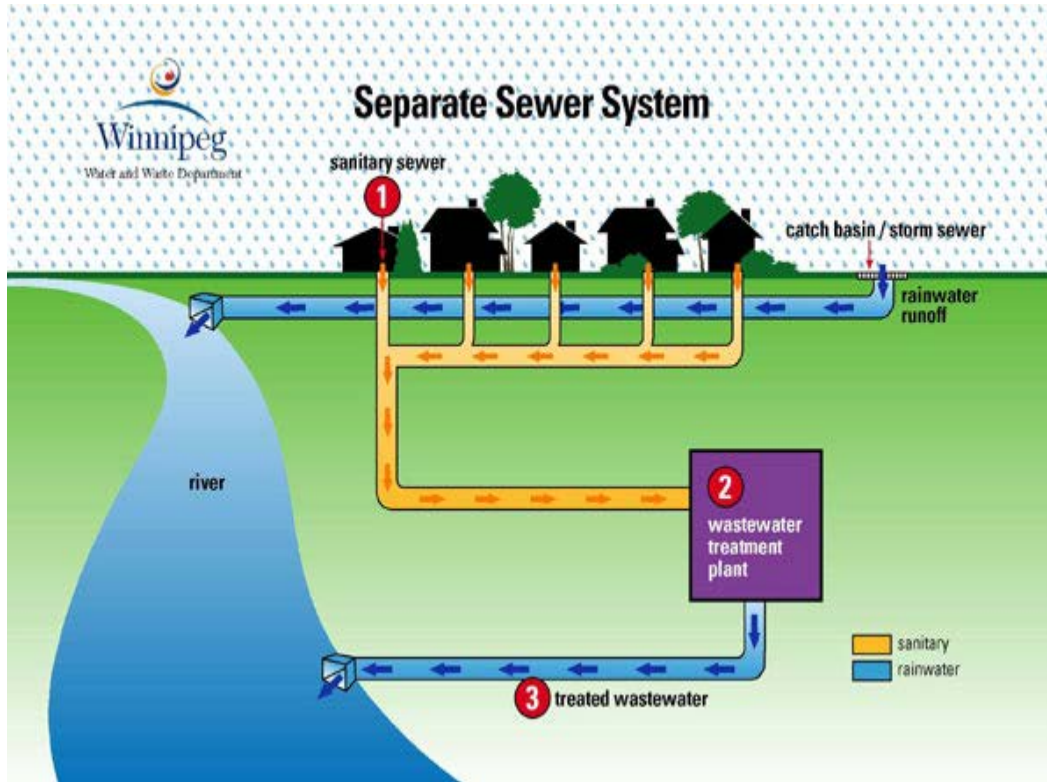
Sewerage system

The system of collecting wastewater from each waste water sources and transport to waste water treatment plant.

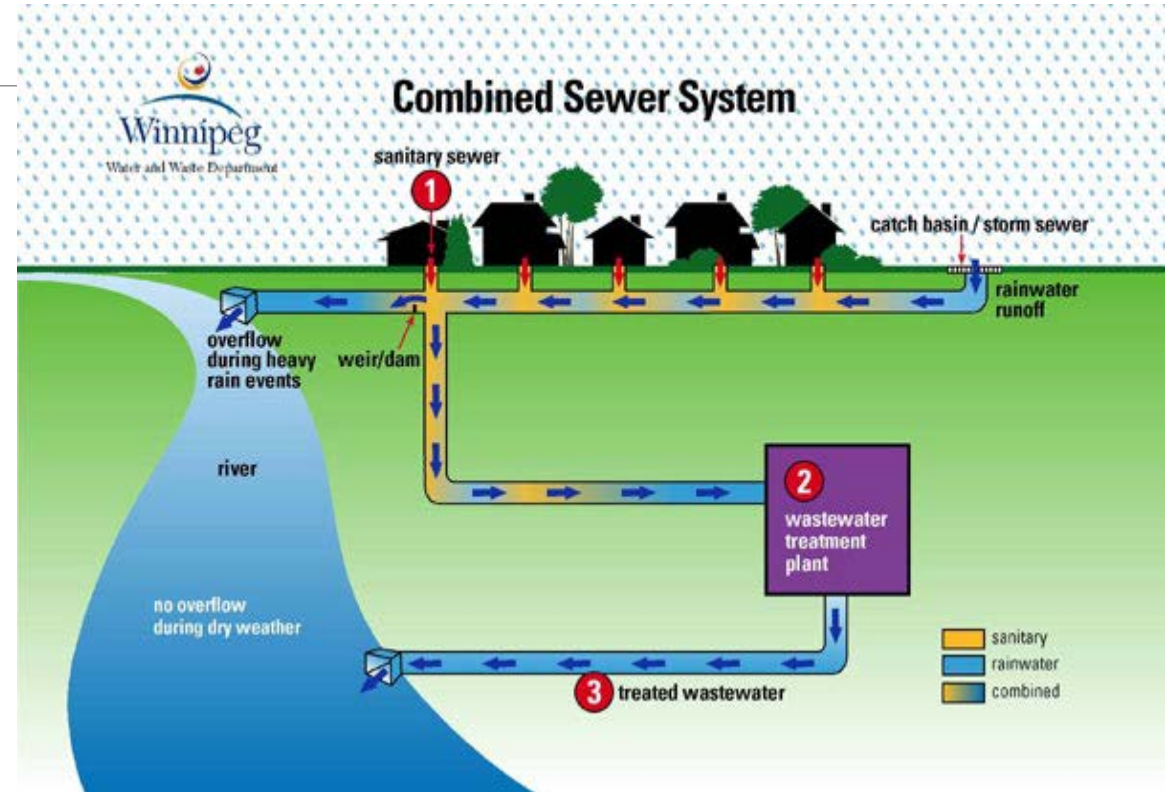
Two methods of conveyance:

- The separate sewerage system
Collecting and convey wastewater and storm water separate pipe lines.
- The combined sewerage system
wastewater and storm water both are conveying in same pipe lines.

Collection and Transport of wastewater



Separate Sewer system



Combined sewer system

Collection and Transport of wastewater

Combined sewerage system

- pipes that convey domestic sewage, industrial wastewater and storm water runoff.
- Environmentally friendly and comfortable for user

Separate sewerage system

- Separate sewer systems are designed to convey wastewater and storm water in separate pipes
- Sanitary sewer systems collect and transport wastewater
- Storm sewer systems collect and transport storm water runoff

Combined sewerage system

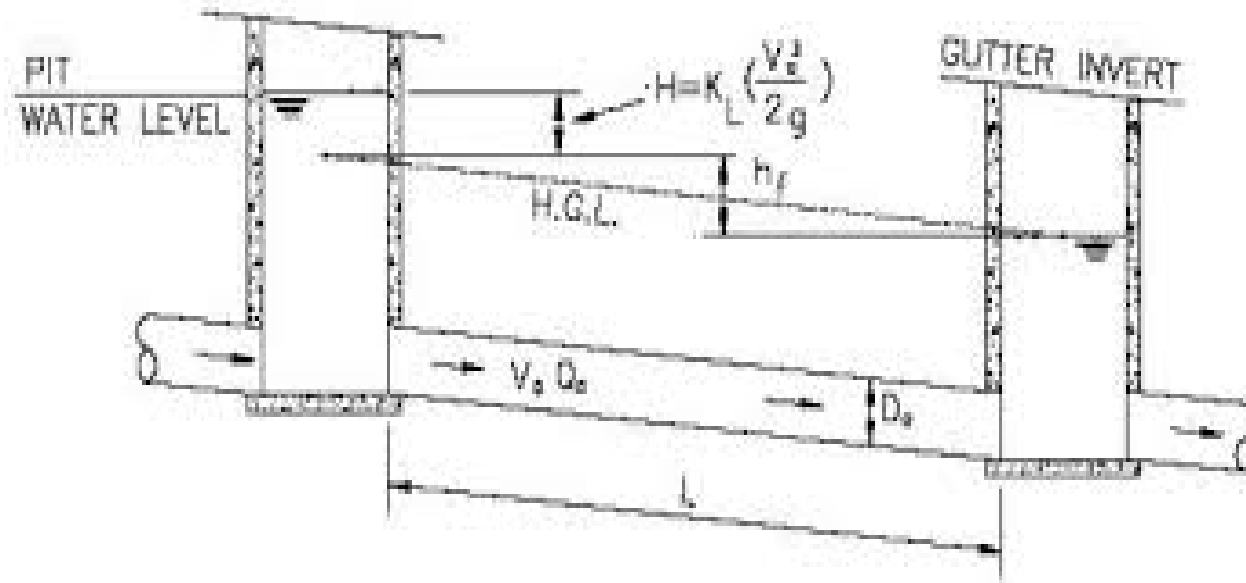
Advantages	Disadvantages
Do not require on-site pre-treatment or storage of the wastewater	The initial cost is high
Suitable for urban areas	Maintenance costs are high consists mainly inspection, unblocking and repair
Storm water and wastewater can be managed at the same time	Extension of the system can be difficult and costly
Convenience method	Recycling of nutrients and energy becomes difficult
	Need skill personals

Separate sewerage system

Advantages	Disadvantages
Grey and black water can manage separately from Surface run off	High capital costs, more expensive than combined sewer system
Limited risk of sewage flow	Requires skilled engineers and operators
Can consider use of storm water	Problems associated with blockages and breakdown of pumping equipment
Moderate operation costs	Adequate treatment and/or disposal required for a large point source discharge

Sewerage system – Design Aspects

Gravity sewerage conveyance system



<http://www.sewerhistory.org/>

Sewerage system – Design Aspects

Design capacity and design flow

Sewer capacities shall be designed for the estimated ultimate tributary population

The capability of downstream sewers to accept future flow made tributary to the collection system shall be evaluated by the engineer.

Design parameters

1. Size of the pipe
2. Depth of the pipe line
3. Slope for gravity lines

Sewerage system – Design Aspects

Velocity calculation for gravity sewers

$$V = \frac{1}{n} R h^{\frac{2}{3}} S^{\frac{1}{2}}$$

V = velocity

n = coefficient of roughness (Manning), n = 0.013

S = slope of energy grade line

R_H = hydraulic radius

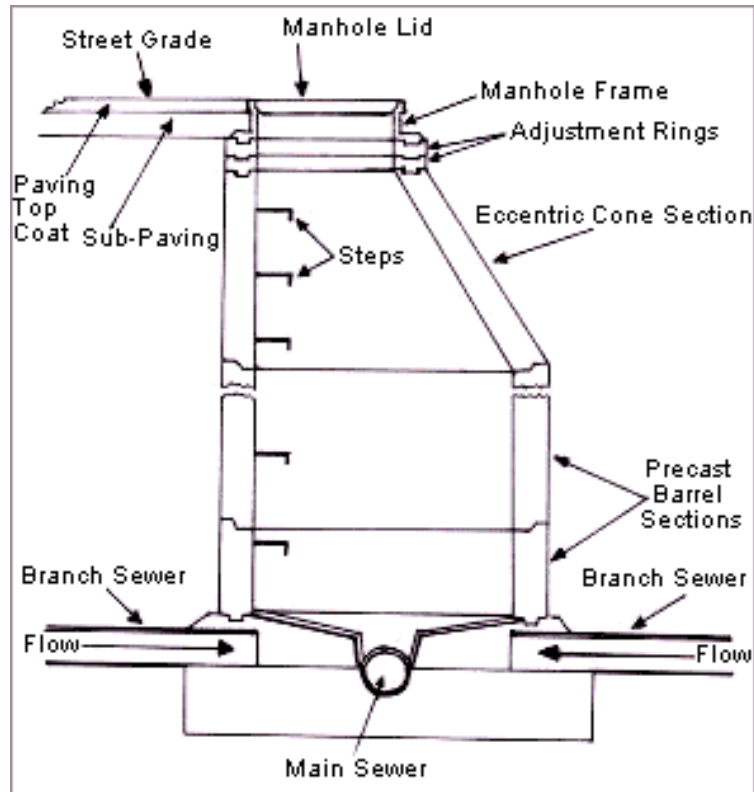
Minimize Solids Deposition

High Velocity Protection

Steep Slope Protection

Sewerage system – Design Aspects

Manholes



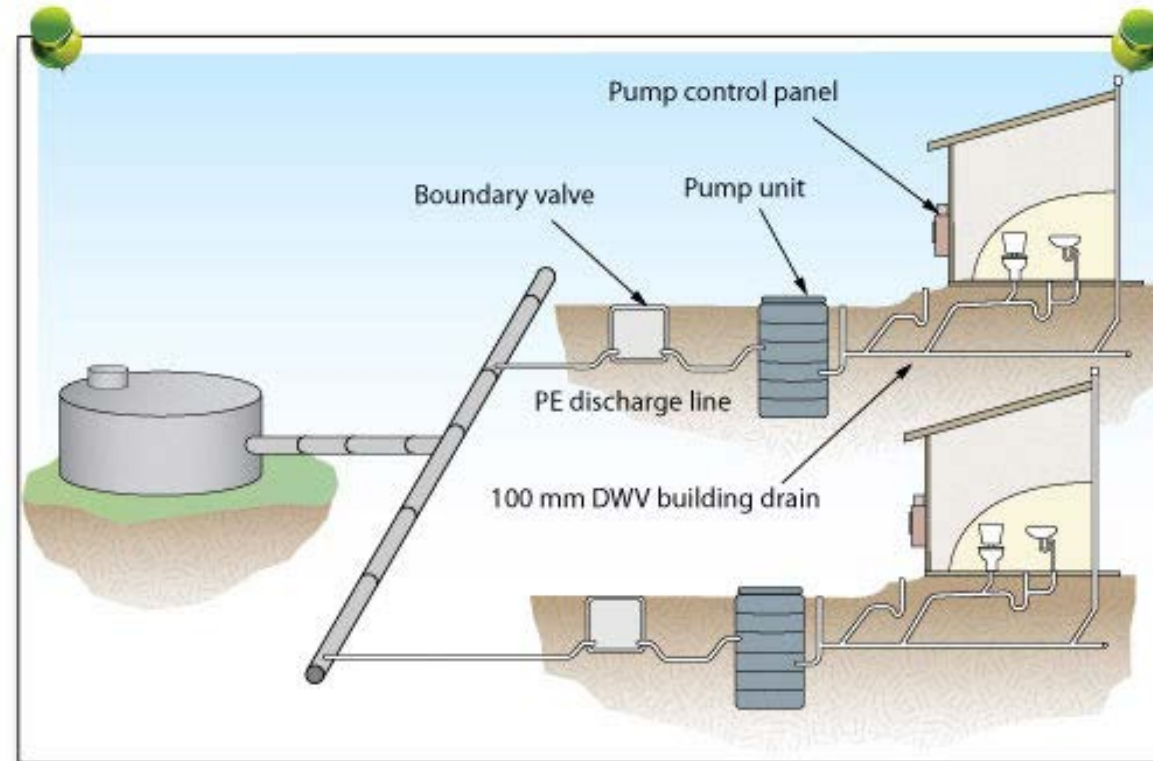
- ✓ Manholes shall be installed: at the end of each line, at all changes in grade, size, or alignment, at all intersections, and at distances required in the specifications.
- ✓ Drop manholes should be constructed with an outside drop connection. Inside drop connections (when necessary) shall be secured to the interior wall of the manhole and access shall be provided for cleaning.

Sewerage system – Design Aspects

Pressure sewerage conveyance system

This system should have pump in every houses

Expensive



Sewerage system – Design Aspects

Design of Pump Station

Sewerage system – Design Aspects

Introduction to EPA-NET software

Wastewater Management

Wastewater management should consider the sustainable management of wastewater from source to re-entry into the environment.

Waste water management approaches can be decided by considering on, whether the area is urban or rural,

- the size and density of the population,

- level of economic development,

- technical capacity and system of governance in place

Waste water Management

- Reuse

Relatively clean water such as Bathing and Kitchen waste water can reuse without treatment for Irrigation and Flushing toilets.

- Recycle

Wastewater can be reuse for non-drinking purposes after treatment (onsite or off site)

Closed loop treatment system – Wastewater should collect, treat and reuse on-site

Wastewater reclamation – Treated wastewater use for different purposes

Waste water Management

- Treat and Discharge

Wastewater can be collect ,treat and discharge into the any natural water body without harmful to the environment.

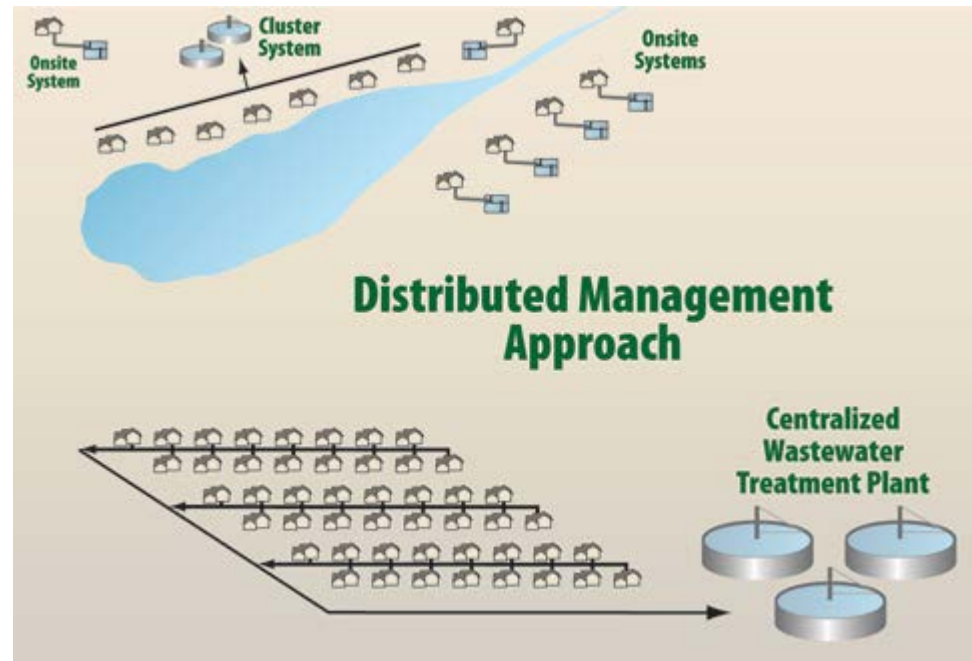
- ✓ Centralized wastewater treatment facility

collect wastewater from many users for treatment at one or few sites

- ✓ Decentralized wastewater treatment facility

Generally this is on-site systems, collecting and treating wastewater from individual users or small clusters of users at the neighborhood or small community level.

Centralized and Decentralized system



<http://webapps.icma.org/>

Centralized treatment system

Conventional gravity sewers

One centralized wastewater treatment facility for certain area

Effluent discharge directly to surface water

High capital cost for construction

Transfers water away from source basin, so leakage problems etc.

Long, disruptive construction

Skilled persons need to design and maintenance

Potential for catastrophic failure

Decentralized treatment system

Onsite or cluster systems

Multiple treatment and soil dispersal or reuse facilities

Low-cost, shallow sewer systems for clusters

Lower capital costs

Keeps water close

Short, less-disruptive construction

Basic operation skills required

Failure consequences felt in smaller area

Waste water as a Resource

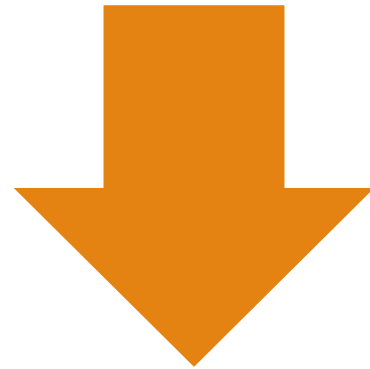
Reuse of wastewater depends on the individual household waste management practices such as separation of urine and faecal matters.

Application of wastewater as a resource,

drought-resistant source of water (especially for agriculture or industry)

- source of nutrients for agriculture
- soil conditioner
- source of energy/heat.

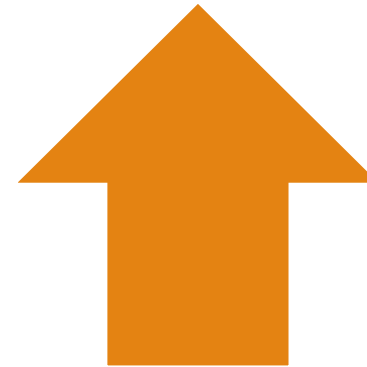
Challenges



Problems
related to
wastewater



Wastewater
as a
Resource



Acknowledgement

“Minimum Design Criteria for the permitting of Gravity Sewers “ Adopted by the Division of Water Quality on February 12, 1996, Updated to 15A NCAC 2T Regulations on March 2008 .

“Type of Sewer Systems “, Solomon Seyoum

“ Waste water Management” , PLTW

“Wastewater Management A UN-Water Analytical Brief”