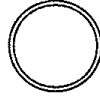
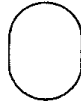


Technical Brief No. 10 dealt with WASTE STABILIZATION PONDS. Whether treatment is in ponds or in sewage plants (with percolating filters for activated sludge) sewage has to be carried in sewerage – a system of sewers.

SEWERS are normally circular pipes,



although some sewers have other shapes.



SEWERS are made from the following materials:

- | | | |
|---------------------|---|-------------------------------------|
| plastics | – | usually small diameters (62-300mm) |
| | – | care needed with storage |
| asbestos cement | – | liable to damage during transport |
| clayware | – | should be glazed/vitrified |
| | – | can be made locally |
| bricks | – | local kiln-dried bricks can be used |
| plain concrete | – | requires smooth inside surface |
| reinforced concrete | – | |



The quantity of foul sewage depends on the amount of water supplied. If 75 – 200 litres per person per day is provided, the sewage flow may be taken as 80% of the water supply.

Greater water use is often due to garden watering, and the water used for this does not go into the sewers.

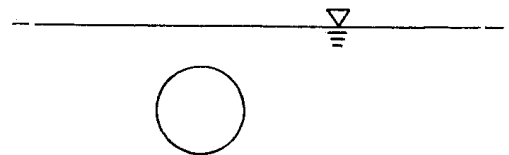


Most sewers are designed to carry foul sewage only.

Rainfall is removed in a separate system of storm drains or monsoon drains.



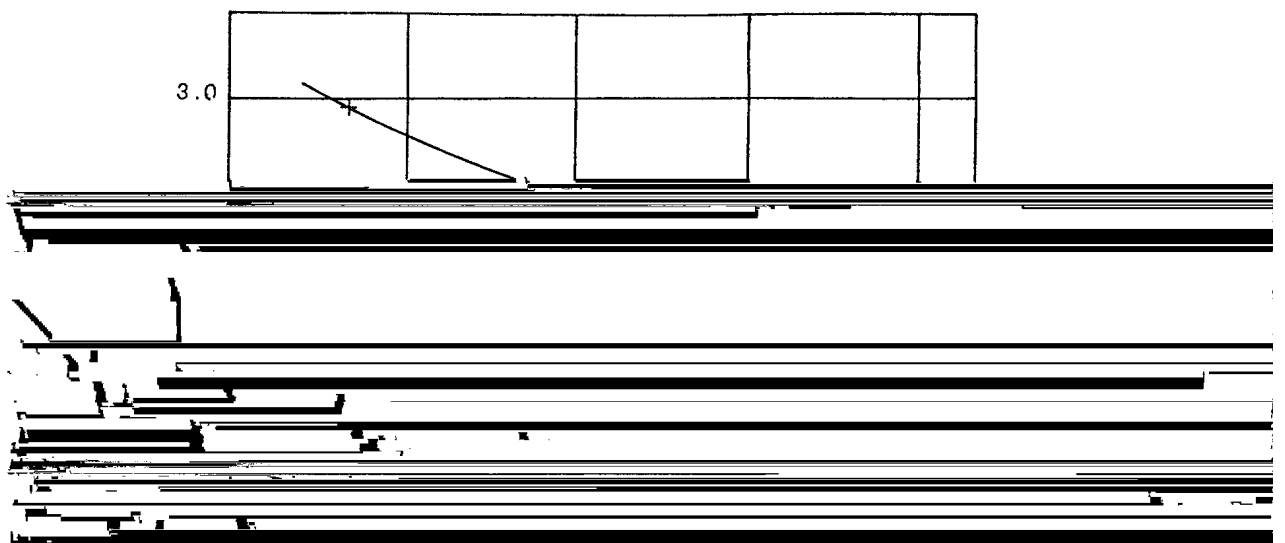
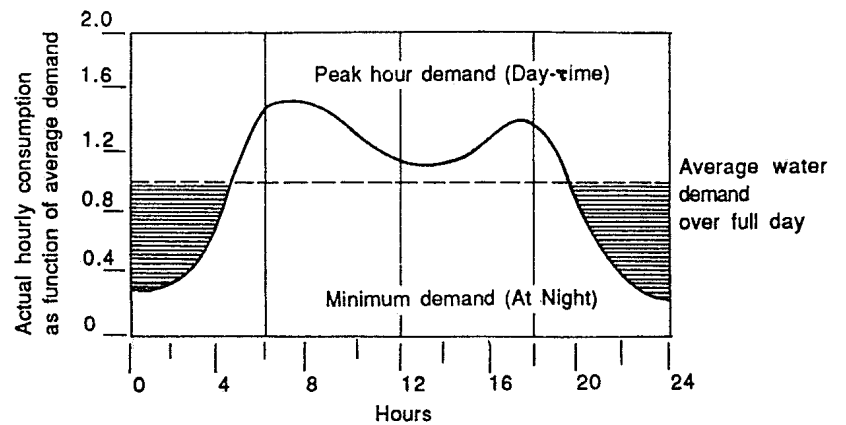
Water flows down the drain to the sewer.



Design

1. The gradient should be sufficient to ensure that the velocity is at least 0.6 metres per second when carrying the maximum daily flow. Solids are then carried along the sewer. Minimum gradients to give this velocity are:

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Sewerage

Disadvantages and limitations of Sewerage

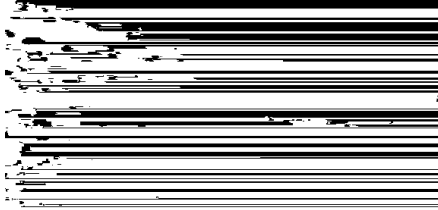
Sewerage is the most expensive of all sanitation systems. Sewers alone may cost up to \$1300 per person.

HIGH COST



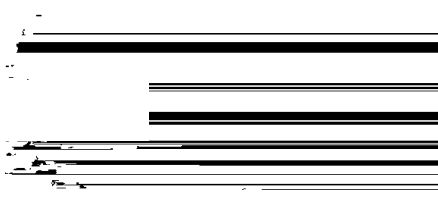
Good piped water distribution is essential. Sewers block if supply is intermittent or if the water supply falls during dry weather. Normally there must be a supply sufficient for 75 litres per person per day.

WATER USE



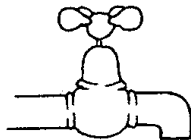
Every house must have piped water with multiple outlets to w.c., bathroom and kitchen. Internal plumbing is expensive.

HOUSE CONNECTIONS



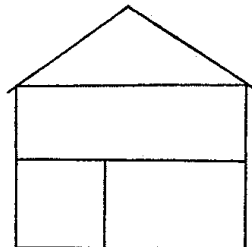
Sewerage systems must be designed by qualified technologists.

GOOD DESIGN



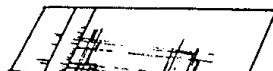
N.B. Engineers with conventional training based on industrialized country technology are often more capable of designing sewerage systems than low-cost sanitation options.

CONNECTIONS



To ensure good operation and long life, sewer laying should be supervised by professional engineers or surveyors.

CONSTRUCTION



Unconventional Sewerage

Two systems with reduced diameter and reduced gradient have been installed in a few places.

1. SMALL BORE SEWERS carry effluent from tanks (septic tanks, aqua-privies or interceptor chambers). Solids are retained in the tanks, so there is less risk of sewer blockage, providing solids are regularly removed from the tanks.
2. In high-density housing areas, CONDOMINIAL SEWERAGE uses conventional sewer pipes laid at a shallow depth within plots, normally behind the houses. Householders are responsible for clearing any blockage within their plots.