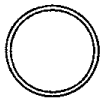
Technical Brief No. 10 dealt with WASTE STABILIZATION PONDS. Whether treatment is in ponds or in sewage plants (with percolating filters for activated sludge) sewage has to be carried in sewerage – a system of sewers.

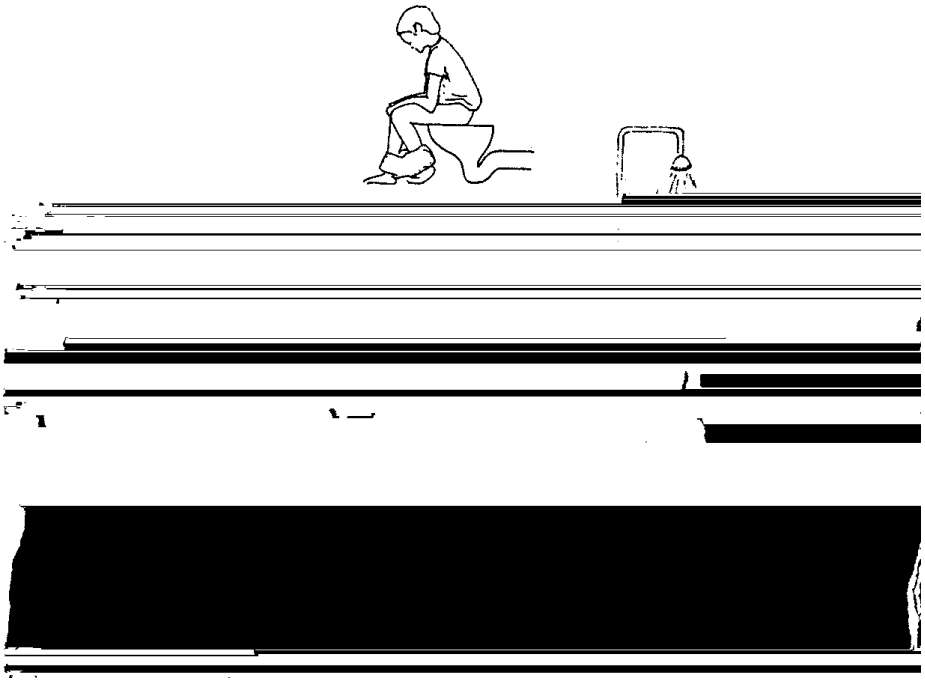
SEWERS are normally circular pipes,



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/vitri□ed
	–	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 □ow 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.

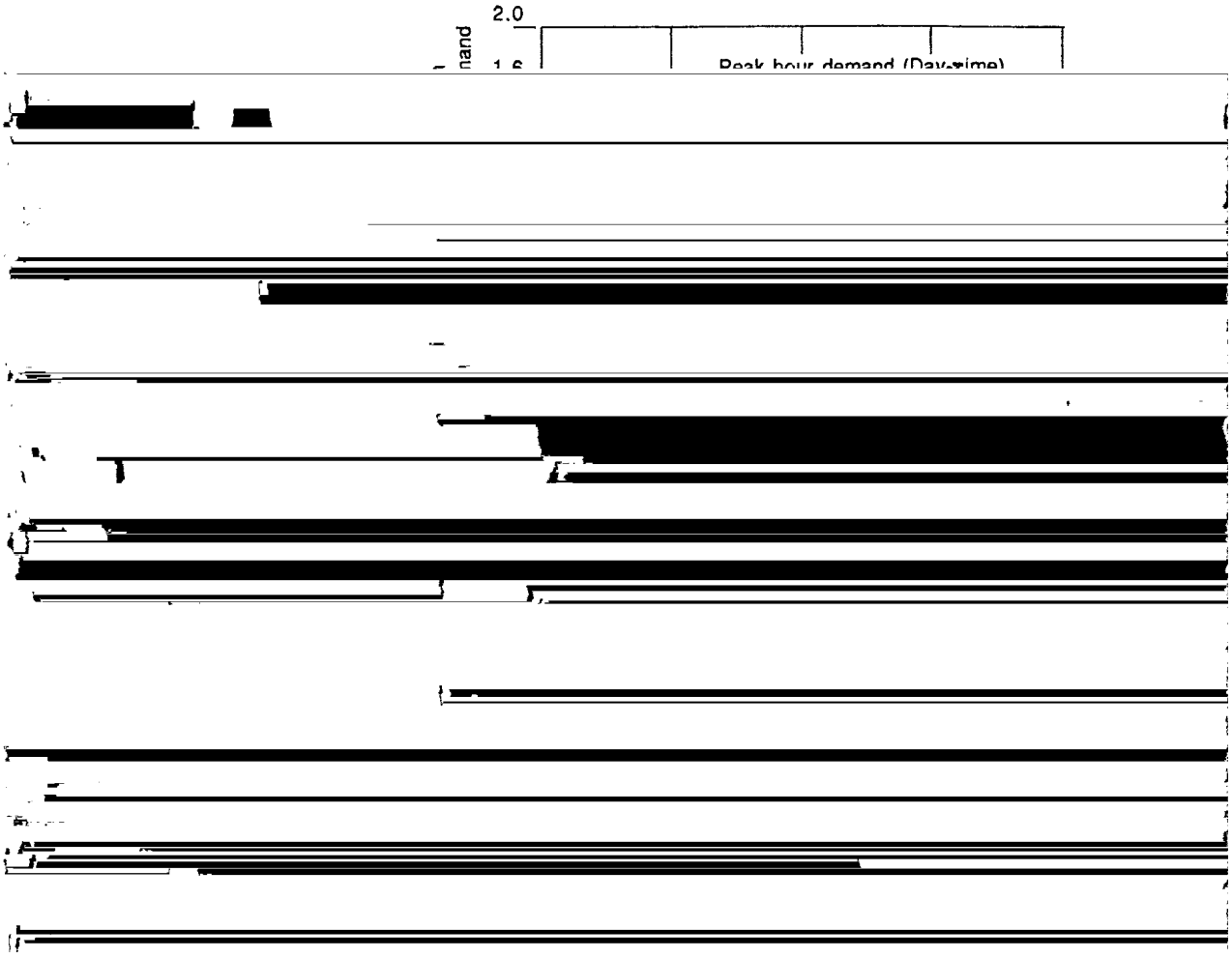
Most sewers are designed to carry foul sewage only.

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

Nevertheless, some raIn always gets into foul sewers.

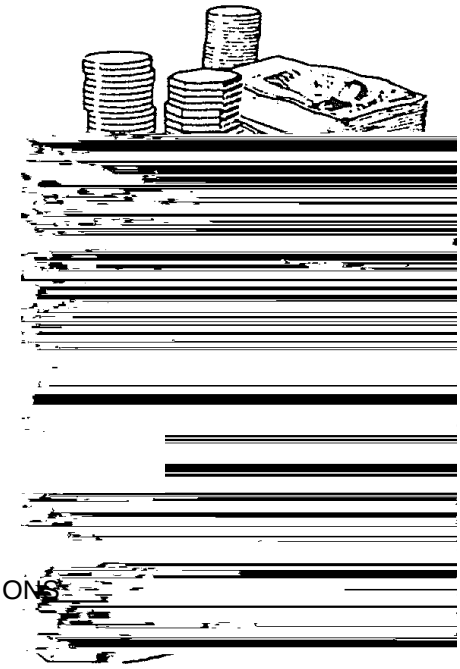
Design

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:



Sewerage

Disadvantages and limitations of Sewerage



HIGH COST

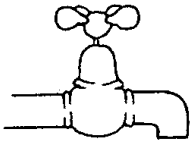
Sewerage is the most expensive of all sanitation systems. Sewers alone may cost up to $1300 per person.

WATER USE

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.

HOUSE CONNECTIONS

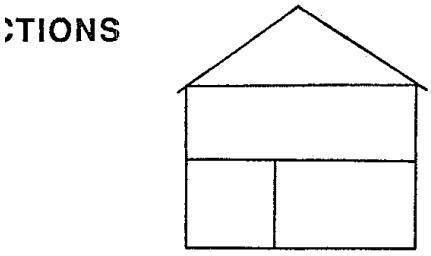
Every house must have piped water with multiple outlets to w.c., bathroom and kitchen. Internal plumbing is expensive.



GOOD DESIGN

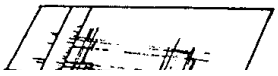
Sewerage systems must be designed by quali□ed technologists.

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



CONSTRUCTION

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



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.

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