

CHAPTER 5

Drainage

5.1 Problems caused by poor drainage

Removing stormwater and household wastewater (sometimes called “sullage”) is an important environmental health intervention for reducing disease. Poorly drained stormwater forms stagnant pools that provide breeding sites for disease vectors. Because of this, some diseases are more common in the wet season than the dry season. Household wastewater may also contain pathogens that can pollute groundwater sources, increasing the risk of diseases such as lymphatic filariasis. Poor drainage can lead to flooding, resulting in property loss, and people may even be forced to move to escape floodwaters. Flooding may also damage water supply infrastructure and contaminate domestic water sources.

Drainage and public health

In areas where drainage and sanitation are poor, water runs over the ground during rainstorms, picks up faeces and contaminates water sources. This contributes significantly to the spread of diseases such as typhoid and cholera, and may increase the likelihood of contracting worm infections from soil contaminated by faeces. Flooding itself may displace populations and lead to further health problems.

Source: Kolsky P. *Storm drainage: an intermediate guide to the low-cost evaluation of system performance*. London, Intermediate Technology Publications, 1998.

Drains from irrigated fields should also be properly designed and maintained, since the introduction or improvement of irrigation is often associated with an increase in the numbers of people with schistosomiasis. This is particularly true where earth drains are used and the water supply and sanitation are inadequate. Lining and properly grading the drains, removing aquatic weeds and constructing self-draining structures are all important measures for reducing health and environmental risks.

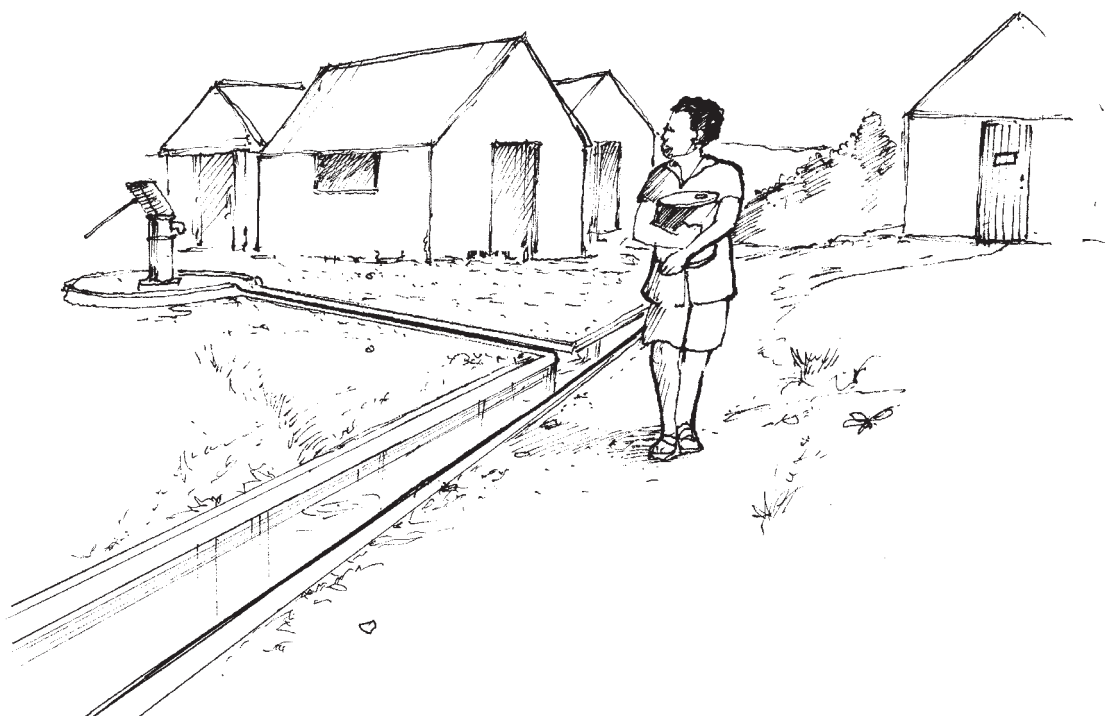
5.2 Methods for improving drainage

Designing and constructing drainage systems require expert advice from engineers to make sure that water flows away quickly and smoothly and is disposed of in a surface watercourse or soakaway. Drainage installed by one community should not create problems for other communities downstream, nor should it affect ecologically important sites. Environmental considerations should be given adequate attention: long-term changes to the environment may lead to greater health problems in the future.

5.2.1 Stormwater drains

The detailed design of stormwater drains should be carried out by engineers and take into account climatic and hydrological data. These data may be scarce, or may not cover the community where work is to be carried out. In such cases, the community can help by describing where major flood problems occur in the village and providing information about previous floods. Stormwater drains should be designed to collect water from all parts of the community and lead it to a main drain, which then discharges into a local river (Figure 5.1). The size of the drains should be calculated according to the amount of water they would be expected to carry in a storm. More extreme floods occur relatively infrequently; to provide a safety margin, the maximum

Figure 5.1 *Stormwater drain through a village*



flow of water is usually calculated on the basis of floods expected to occur once every 10 or more years. If drains are designed to carry only the amount of water expected from an annual flood, they will not be able to cope with the flow of water from heavier floods, which may occur as often as every 2–3 years. This may make flooding problems worse and increase the health risks.

Stormwater drains are best constructed using a concrete lining. Earth drains are more likely to become clogged and overgrown, and cause problems with stormwater flow during minor floods. This can lead to the formation of stagnant pools and result in breeding sites for disease vectors, such as mosquitoes, increasing the risk of malaria, and snails, increasing the risk of schistosomiasis. The drains must also be properly maintained and cleaned: it is common to find that new drains become dumps for solid waste or even sewage because of inadequate maintenance. The community should therefore establish how often drains are to be cleaned and who will be responsible for the maintenance. Often, the best solution is for community members themselves to take responsibility.

Community participation in maintaining drains

It is often essential that community members participate in maintaining drains. In Indonesia, for example, residents agreed to clean the drains in front of their houses every day and this was inspected twice a week. Community members responded well to friendly inspectors who provided support for clearing the drains. Maintaining the drains soon became part of the daily routine for responsible community members.

Source: *Surface water drainage for low-income communities*. Geneva, World Health Organization, 1991

5.2.2 Sullage disposal methods

Every household generates sullage. For instance, it has been estimated that each person generates 15–20 litres per day when collecting water from a standpipe. Sullage may be disposed of either at home, using on-site methods, or through the drainage system. When sullage is disposed of at home a soakaway pit can be constructed. Alternatively, sullage can be used to irrigate small gardens, thus improving the crop yield and nutrition, and this should be promoted if possible. However, sullage can be reused this way only if it contains little or no detergent, which may damage crops.

If a soakaway is used, the pit should be located away from the house and away from water sources. Ideally, there should be a minimum of 30 metres between the soakaway pit and the nearest water source, but this distance may need to be increased if houses are uphill of water sources. It is not recommended that sullage be disposed of in pit latrines, since this may interfere

with the breakdown of excreta within the pit, and may overload latrine soak-aways where pour-flush latrines are used. When the household is connected to a form of sewerage, sullage can be disposed off in the toilet or latrine. Indeed, for some sewerage systems (such as shallow sewerage or conventional sewerage) disposal of sullage in this way ensures better functioning of the system.

5.2.3 Combined drains

Combined drains are designed to carry both stormwater and sullage. Unless a combined drain is well designed and maintained, however, sullage will pool within the drain and form insect breeding sites. These problems can be overcome by using a system with a small insert drain that carries the sullage into a larger drain for carrying stormwater. As with all drainage systems, it is essential that the drains are properly operated and maintained, and that refuse is cleared from the drains.

5.2.4 Buried drains and combined sewers

Drains may also be incorporated into sewerage systems and be buried. This is more appropriate for urban areas, but can be considered in rural areas if the village roads are paved and if flood flows are significant. Buried drains have inlet chambers at regular intervals, usually along roadsides, that allow the entry of stormwater. The drains then lead directly either to a watercourse or to a sewage-treatment works. When drains flow directly into sewage-treatment works, care must be taken not to overload the works. The stormwater should always flow either into a stabilization pond, or into a storage pool constructed to take stormwater flows above a certain volume.