17. Intermediate and communal models for drinking-water supply and sanitation

Plumbing codes usually require that every occupied building should have a supply of drinking-water. A piped drinking-water system will require a sewerage system to dispose of the increased volume of wastewater that is generated. Until these are achieved, "plumbing", in the sense used in these guidelines, is impossible. There are various intermediate stages between the use of an unprotected natural source and the attainment of this goal. This includes situations where public drinking-water supply and waste disposal are only partly available, and where cost or other constraints require the establishment of basic communal sanitation facilities as an interim measure.

17.1 Intermediate types of drinking-water supply and sanitation

In a community with no public drinking-water supply service, the first improvement that may be made is the provision of a safe water source such as a protected well or protected spring. The second may be the provision of a handpump or other device through which water can be delivered directly into a carrying container. The next stage may be the establishment of a central point to which water is pumped, and where it is stored and possibly chlorinated before being collected. A further improvement comes when treated water is piped to public standpipes close to the homes of those who will draw their water from them, or the piping of water to a private standpipe within each property or compound. The final stage before the installation of plumbing and plumbing fixtures is the installation of a single faucet within the house, usually serving a kitchen sink.

The foregoing service level is linked to likely quantities of water used and the hygiene consequences of such use. Table 17.1 illustrates a ladder of services under the perspective of distance and time to source.

From a public health point of view, the crucial aspects to take into account include the protection of the water source to prevent contamination, and provision of access to water on individual properties, thus eliminating the need for carrying household supplies and storing them within the home. In many cases the earlier stages may be bypassed, such as when a complete new public drinking-water supply is installed in a community that previously had no protected water source. More commonly, economic constraints make it necessary to provide a somewhat more restricted service initially so that the drinking-water supply is improved incrementally in parallel with the community's improving social conditions.

TABLE 17.1 SERVICE LEVEL DESCRIPTORS OF WATER IN RELATION TO HYGIENE

Service level description	Distance/time measure	Likely quantities collected	Level of health concern
No access	More than 1000 metres, or 30 minutes total collection time	Very low: often less than 5 litres per capita per day	Very high as hygiene not assured and consumption needs may be at risk. Quality difficult to assure; emphasis on effective use and water handling hygiene
Basic access	Between 100 and 1000 metres, or 5 to 30 minutes total collection time	Low: average is unlikely to exceed 20 litres per capita per day; laundry and/or bathing may occur at water source with additional volumes of water	Medium: not all requirements may be met. Quality difficult to assure
Intermediate access	On plot, e.g. single tap in house or yard	Medium: likely to be around 50 litres per capita per day, higher volumes unlikely as energy/time requirements still significant	Low: most basic hygiene and consumption needs met. Bathing and laundry possible on site, which may increase frequency of laundering. Issues of effective use still important. Quality more readily assured
Optimal access	Water is piped into the home through multiple taps	Varies significantly but probably above 100 litres per capita per day and may be up to 300 litres per capita per day	Very low: all uses can be met, quality readily assured

Source: Howard and Bartram 2003.

It is important to emphasize the ultimate goal of providing on-plot water supplies to every household, and to ensure that providing any intermediate level of service is carried out with this ultimate goal in mind. For instance, mains laid to public standpipes should not be of a size merely adequate to serve those standpipes, but of sufficient carrying capacity to permit house connections to be made later. Otherwise, the expense of replacement by larger diameter pipes in the future will be an obstacle to the implementation of the next stage of improvement.

Where mains and sewers are planned to be installed in the near future, or where water supplies but no sewers have been constructed, any private intermediate arrangements should be so designed and installed as to be readily adapted to comply with local codes of practice. This will ultimately be advantageous to both the individual householder and to the authority having jurisdiction. Connection to a future public supply is made easier and cheaper if the internal piping and fixtures already comply with the relevant provisions of the plumbing code. Similarly, drainage to a septic tank or cesspool should be so

designed and installed that it can be diverted to a future sewer from a convenient access chamber with no alteration necessary other than the disconnection and filling in of the disposal tank or cesspool.

17.2 Household water treatment

In the absence of access to a safe and reliable central water system, consumers must make their own provisions to be assured of the safety of the water that they use for drinking and food preparation. Several methods are available and more are in development. They range from low-tech approaches like boiling to chemical disinfection using chlorine or iodine, various forms of sand or ceramic filters and disinfection using sunlight. More sophisticated techniques include combined coagulation and disinfection products, ultraviolet lamps and devices that can disinfect, filter and remove chemicals and improve the aesthetic quality of the water, and more expensive solutions like safe bottled water. Disinfection is almost always essential. Water authorities should initiate these programmes and work to ensure that a range of these technologies or systems are available, such that consumers can choose what is acceptable, affordable and appropriate for their household. As a minimum they should work to ensure that the training and information that consumers need to make good decisions is available. Authorities should also monitor these situations to be sure that the household treatment is functioning successfully. It is always important that the water quality problem is understood so that appropriate treatment methods can be selected if something beyond microbial control is a concern. It is also important that, where appropriate, water treatment devices have been tested and certified to specific claims and performance (Cotruvo 2005; WHO 2005). With recent research indicating that household-based approaches to managing water are cost effective, lead to significant diarrhoeal disease reductions and are rapidly deployable, WHO has taken the lead in coordinating the International Network to Promote Household Water Treatment and Safe Storage (WHO 2006b).

17.3 Communal systems for drinking-water supply and sanitation

Factors other than installation costs may delay improvements at an intermediate stage. In densely populated or periurban slum areas, the cost of internal plumbing might be greater than the value of the properties to be served. It might seem logical in this case to halt drinking-water supply improvements at the public standpipe stage pending the renovation and rebuilding of unsanitary housing. However, waterborne infectious disease will not wait and it is those in vulnerable circumstances that are most in need of facilities for safe drinking-water, personal hygiene and clothes washing. In the interim, provision of communal latrines, bathhouses and laundries may therefore be a reasonable strategy, their expense being justified by the improvement in the health of the public as a whole, as well as in the quality of life of the individuals who will use them.

A form of sanitation particularly suitable to crowded cities is the aqua privy, consisting of a single underground septic tank upon which are built a number of individual latrines. Outlets from the latrines drop vertically through the tank roof and discharge under the surface of the septic liquid below. If properly designed, constructed and maintained, an aqua privy can serve the needs of four or more households, each having its own private cubicle containing a latrine. Sewage is broken down and liquefied and the effluent liquid is comparatively innocuous. However, under dense population conditions the removal of this liquid may present a problem if the subsoil is impervious. A drainage system to collect the effluent from a number of aqua privies may be constructed at a fraction of the cost of sewers. Because only liquid is discharged and there is consequently no danger of blockage, smaller pipe sizes may be used for the drains. Accumulated solids either must be removed when the system is filled to capacity or another site found, and the excavation suitably covered and backfilled.

Plumbing in and for communal facilities needs to be more robust than that installed on private premises. Precautions need to be taken in the design against vandalism, theft and misuse. Brass faucets are particularly subject to vandalism if they can be easily unscrewed: drilling a hole in the threaded union and fastening with a set screw or rivet is one security method. Standpipes and exposed piping may be embedded in concrete, though this makes maintenance more difficult. High-level flushing cisterns and shower control valves may be mounted above the ceiling with only the chain and handle visible in the cubicle. The seats of pedestal water closet bowls can be made of sturdy wood, preferably open at the front and fixed, rather than of hinged plastic. Control valves, whether below ground or mounted in the building, are better enclosed in lockable boxes. Similar considerations may govern the design of truly public facilities, like those erected in markets or other public places.

The plumbing of multiple latrines, bathhouses and laundries should comply with the general principles of the plumbing code with regard to cross-connection, backsiphonage and backflow. By providing each with its own storage tank, peak use flows are evened out and economies may be possible in the delivery mains and connections. In many arid areas, it is customary to provide storage at groups of standpipes for the same reason.

Above all, the maintenance of the installations will depend upon the cooperation of those using them. Efforts to build a sense of communal ownership and pride of possession are important so that cooperation is voluntarily given or assured by peer pressure, and enforcement is therefore unnecessary. In this way, communal sanitary facilities can be kept clean and working with the minimum need for supervision and inspection.