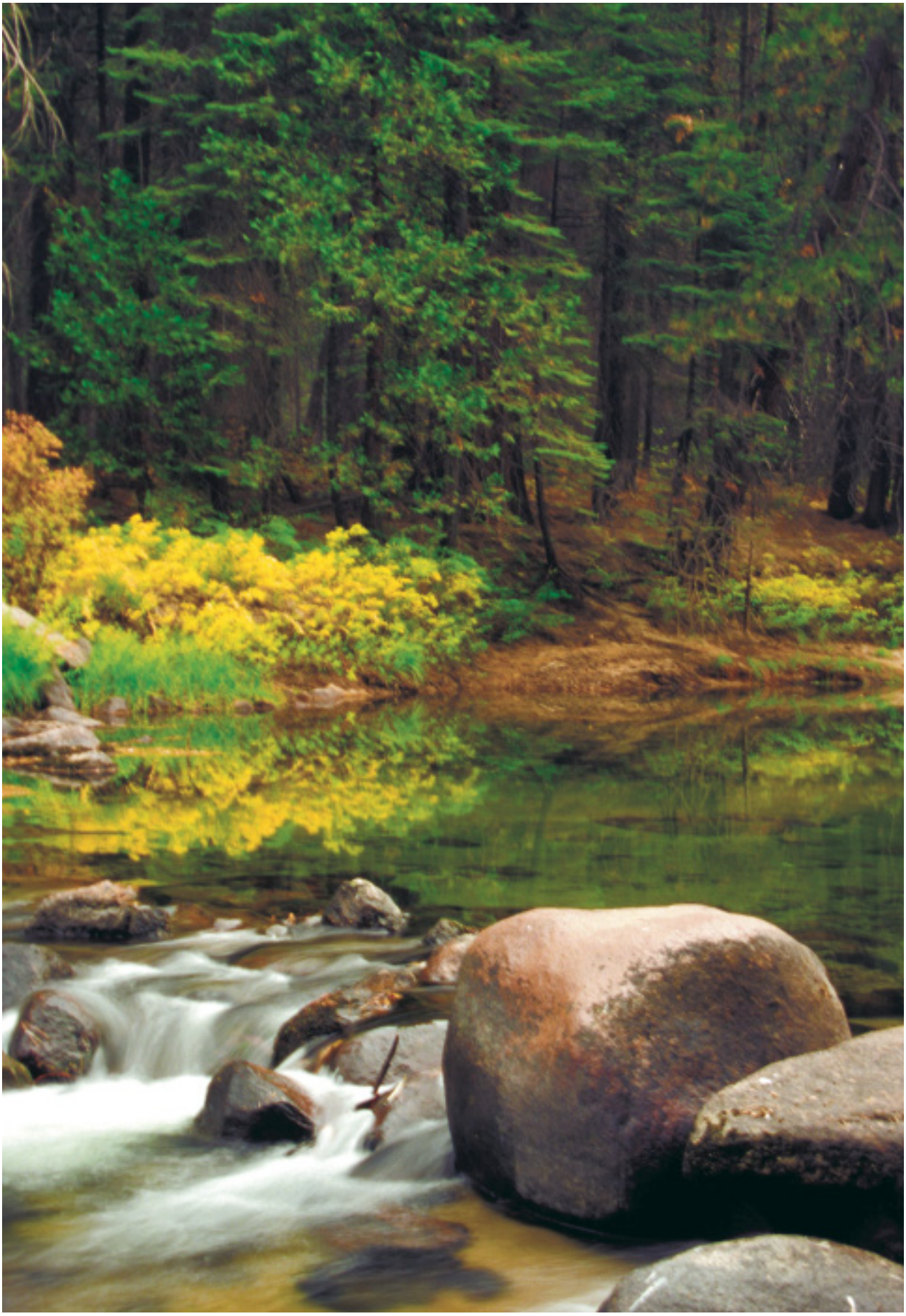
3.3 Source selection

The principal sources of private supplies are springs, wells and boreholes. Streams and rivers are also used but to a lesser extent because of the more variable quality of surface waters compared to groundwaters. Whatever the source, it must consistently yield a quantity of water sufficient to satisfy the requirements of the user.



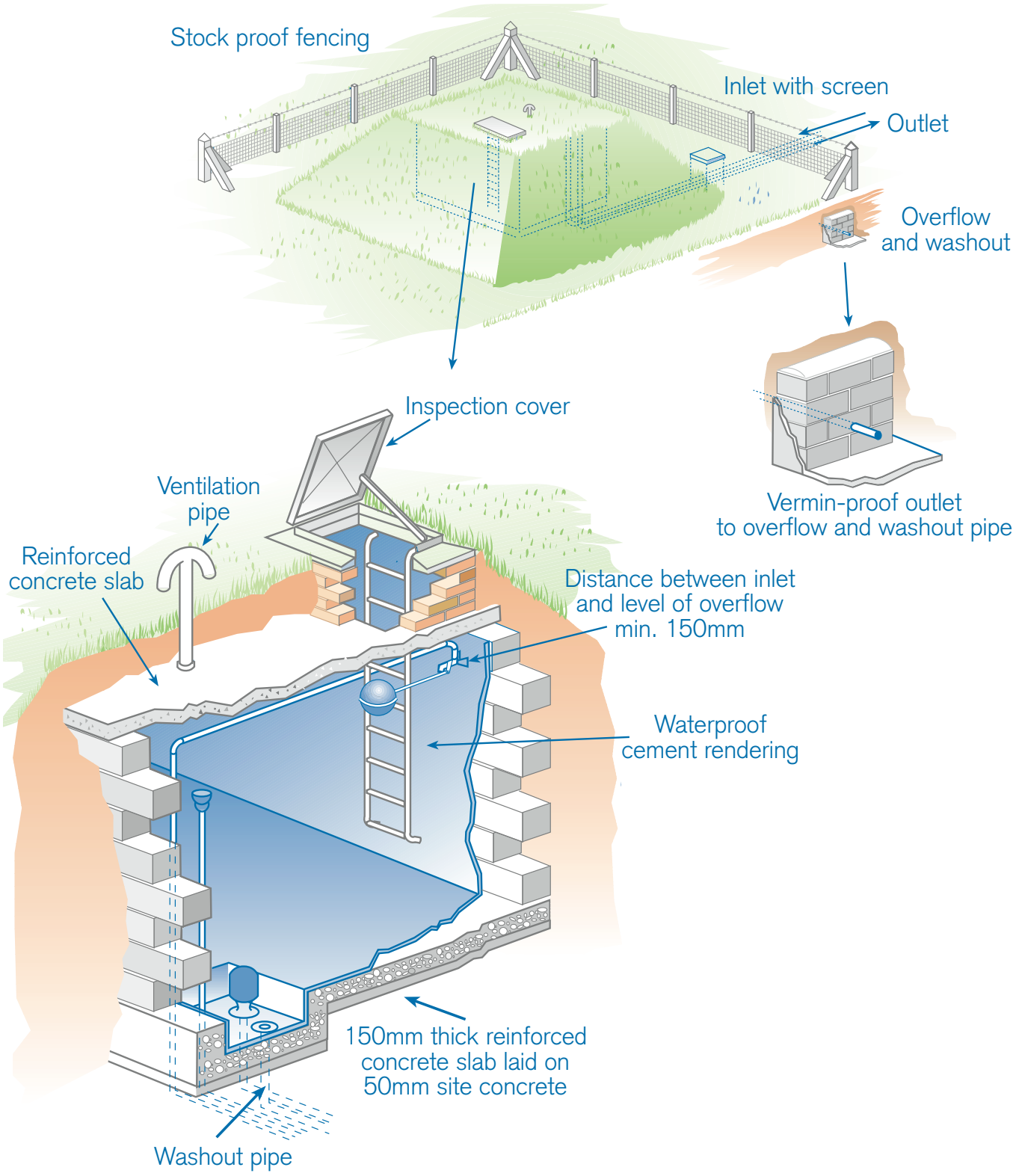
3.3.1 Streams and rivers

Streams and rivers offer more reliable yields but may be susceptible to pollution and may exhibit variable quality. The risk and extent of pollution depends on the catchment and the activities being undertaken on it. Waters derived from upland catchments that are not unduly peaty and not used for agricultural purposes are usually of good chemical quality. However, soft acidic upland waters derived from peaty moorland catchments may be corrosive and contain relatively high concentrations of dissolved metals. Small streams often exhibit variable quality because of the activities of man and animals within the catchment and will have high levels of colour from humic and fulvic acids.

Lowland surface waters are likely to be of poorer quality. The quality of surface waters may show a strong seasonal variability. Colour may be highest in late autumn and winter. Turbidity and microbiological contamination may be highest following periods of heavy rainfall.

Because of these potential problems, a surface water source is normally only considered for use as a drinking water supply where a groundwater source is unavailable. Water treatment will require a minimum of filtration and disinfection and should be designed for the worst expected raw water quality which is likely to be experienced for short periods during and after rainfall (and snow melt) events. A small reservoir or tank installed at the source can provide a period of settlement and reduce the variability in water quality. This tank will require regular inspection and cleaning. Figure 3.4 shows the construction of brick or concrete reservoirs; pre-cast concrete reservoirs can also be used.

Figure 3.4 Brick or concrete reservoirs



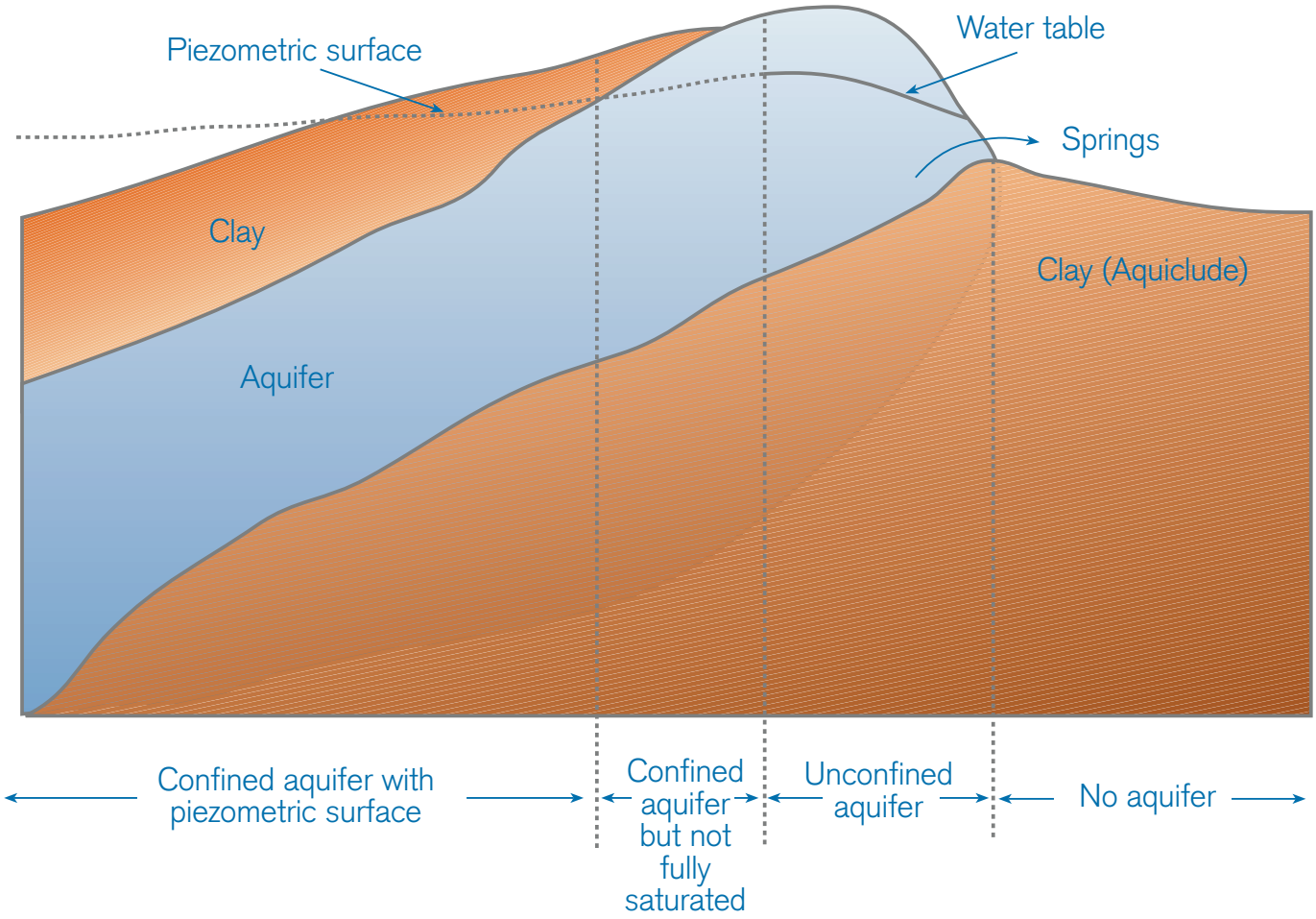
3.3.2 Springs

Where the water table intersects the surface, a springline is formed. The presence of fissuring can determine where the principal springs occur. The quantity of water available from a spring depends on its source. Most reliable are springs issuing from deep-seated aquifers whereas those from perched water tables or supported by flow from fissured limestone or granite aquifers may dry up after a short period without rain. Spring sources can be of good chemical and microbiological quality although springs from shallow strata (where there is a relatively high water table) or fractured strata may be of variable quality because of surface contamination. The treatment of spring waters is usually simpler than for surface waters because spring water is likely to contain less suspended matter.

Some ‘spring’ sources used for small water supplies are in fact artificial land drains. If the whole drainage system is properly maintained, the quantity and quality of water may be acceptable for a drinking water supply but for assessing treatment needs, a land drain should be regarded as effectively a surface water. If maintenance is poor, the water quality and flow may decrease. The probability of agricultural pollution must be considered carefully.

Much shallow throughflow is soil water which can be mistaken for a spring source. The quality of soil throughflow is likly to be unacceptable.

Figure 3.5 A Spring



3.3.3 Wells and boreholes

Many small drinking water supplies are derived from wells and boreholes. Wells are usually of large diameter, not less than about one metre, and dug by hand or, more rarely, by a mechanical excavator. Boreholes are of smaller diameter, variable depth and are drilled by a specialist contractor using percussion or rotary drilling.

The quantity of water available will depend on the characteristics of the aquifer and can be determined by test pumping after construction. A well or borehole that penetrates an extensive aquifer will be the most reliable. A well or borehole sunk into a perched aquifer may dry up after a short period without rain. Normally, a properly designed and constructed borehole will be able to supply water sufficient for at least a single household. Water is usually pumped from a well or borehole by a surface mounted or submersible pump.

Water abstracted from deep wells and boreholes may have originated from catchments several miles away. If the aquifer is a porous stratum, such as sand or gravel, the water will have undergone thorough filtration. Such water will usually be of very good quality. Some aquifers, such as limestone or granite strata, may be fissured and the filtration of the water will not have been so thorough. Groundwaters abstracted from shallow wells and boreholes may be prone to local pollution unless adequate precautions are taken. Groundwaters are usually of good quality and treatment may consist of disinfection only. However, some groundwaters contain high concentrations of iron and manganese, which are usually removed by oxidation and filtration. Others may be polluted by nitrate or pesticides derived from agricultural or other activities or by chlorinated solvents from industrial sites.

Figure 3.6 Typical Borehole Construction