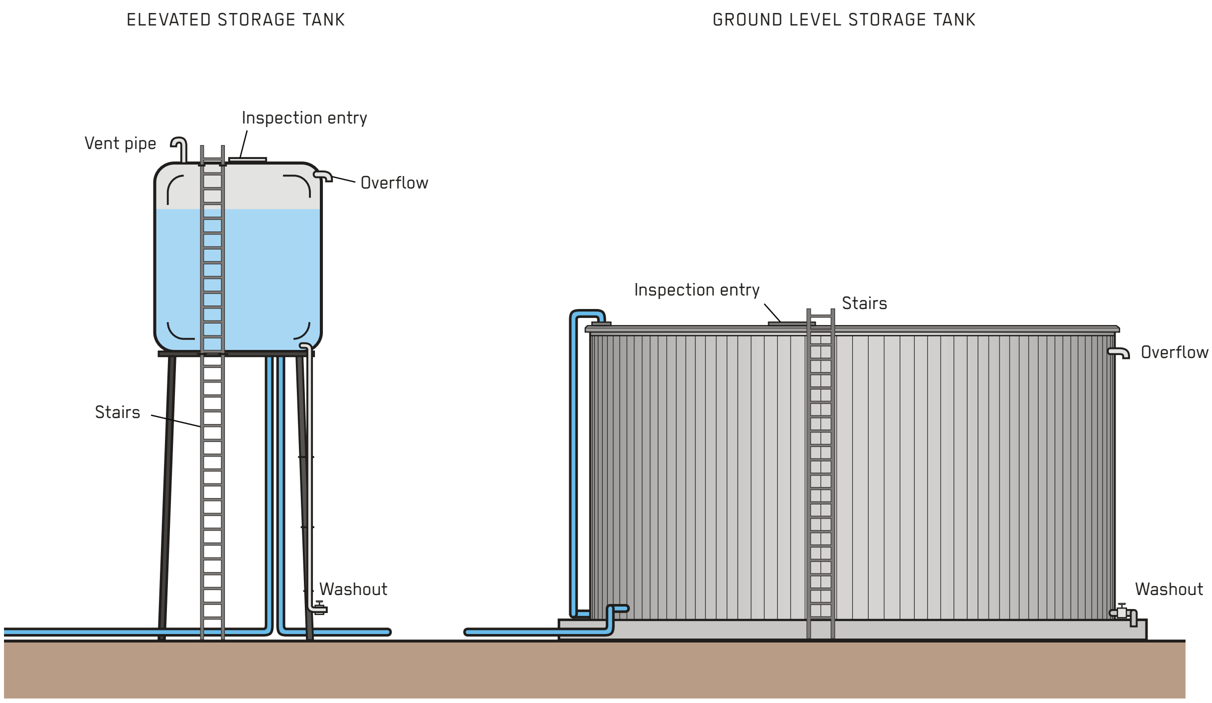
Water Storage Tank (Long-Term Locally Built)

Response Phase	Application Level	Management Level	Objectives / Key Features
* Acute Response ** Stabilisation ** Recovery	** Household ** Neighbourhood ** City	** Household ** Shared ** Public	Water storage buffer, network pressure generation
Local Availability	**Technical Complexity**	**Maturity Level**	
*** High	** Medium	*** High	



Water Storage Tanks hold large volumes of water, usually balancing supply and demand of drinking water before distribution. They are suited to all phases of an emergency.

Water Storage Tanks for drinking water are usually designed to balance water supply and demand while also ensuring sufficient pressure in a distribution system, but can also allow water to continue to flow during repairs to upstream infrastructure. Having sufficient water storage has other uses such as allowing sufficient retention time during a water treatment process or enabling pump and pipe design to be optimised.

Design Considerations: A Water Storage Tank can be situated either at ground level, elevated (can ease distribution through gravity) or subsurface. This placement depends on both the water source (e.g. at ground level if collecting rainwater from a roof, or subsurface when rainwater is harvested from ground collection surfaces) as well as where water will be sent to in relation to the topography (e.g. an elevated tank is needed in flat terrain for sufficient pressure, but a ground tank might suffice in a hilly area). Below-ground tanks generally require pumps to distribute the water to the target population, and leaks in these tanks are harder to detect.
The size of water tank depends on the quantity of water entering and leaving the tank over the course of a day. This should, at a minimum, meet the daily water demand, flow rates and number of water points based on agreed Sphere indicators, in order to avoid excessive queues and conflict. The tank design must account for the specific points of peak demand during the day (typically two peaks), compared to the slower inflow into the tank that occurs over

more hours (24 hours in the case of a spring or fewer hours when using pumps). When shown graphically, the storage requirement can be calculated as the difference between the lowest and highest peaks in water level over the course of a day, and for smaller systems is done usually assuming all taps will be open during peak hours. It is good practice to have enough storage for at least one day to allow for contingencies (e.g. problems or repair work in other parts of the system).
The type of pumping system can influence tank sizing. For example, a storage capacity to cover up to three days is recommended with solar- or wind-powered pumping **(see S.9, S.10)**. Where the tank volume required is too large for easy construction, more than one tank can be built and connected in parallel. The benefits of additional storage capacity need to be weighed against the costs.
Water Storage Tanks need to withstand local climatic and geological conditions and be designed and placed according to the local situation. Tanks for treated water are typically located nearer the population than the source to reduce the cost of pipework (since larger diameter pipes are needed to deliver peak demand from the tank than are needed to steadily supply the tank over a longer time period). Collapsing risks should be minimised, especially close to houses. In colder climates, tanks may have to be insulated to prevent water from freezing. For solid-walled tanks, this can either be done from the outside or by burying the tanks. Where snow is likely, the tank roof should also be able to withstand snow load. Where tanks are constructed in areas with expansive clays, care must be taken to have a strong enough foundation and connections from tank base to walls in order to avoid structural failure.
Tank accessories must also be carefully considered. A screened ventilation pipe is required to prevent pressure or vacuum to build up when the tank is being filled or emptied. A drain and valve are needed for cleaning, where it can also be useful to have a bypass line directly connecting the tank inlet and outlet (the total static pressure from source to taps should be checked first). For rainwater tanks, a first-flush mechanism can reduce the amount of silting. Inlet, outlet and overflow pipes need screens to prevent insect breeding. An access cover and external/internal access ladder will be needed for maintenance. Unsafe surroundings need to be prevented, which can be done using fences to prevent people from falling or drowning, which could occur if someone is able to climb up an elevated tank or access a lower situated tank. Lightning protection should also be added.

Materials: Materials required for locally built Water Storage Tanks mainly include the storage tank, where options include plastic prefabricated tanks, and those made from a variety of other materials including bricks/cement, reinforced concrete, ferrocement, stone masonry, metal, plastic and rubber lining. Elevated tanks also require a stand or tower structure and pipes with valve controls, and subsurface tanks require pumps to abstract and distribute the water.

Applicability: Long-term locally built Water Storage Tanks are mainly used in the stabilisation and recovery phases, since these tanks have a more complex structure compared to transportable Water Storage Tanks **(see D.5)**.

Operation and Maintenance: O&M tasks include tank cleaning and opening/closing valves to prevent sticking. The amount of sediment to clean depends on the source (e.g. water from a spring is more likely to arrive with silt), and involves draining the tank using drain pipe/valve, washing out the inside, and carrying out any repairs necessary to the structure. Shock chlorination (at a rate of 50 mg/L) can also be used for disinfection.

Health and Safety: Good structural design is required to prevent tank collapse. Tanks should also be fenced off to avoid people accessing them and injuring themselves. The design should minimise insect breeding. It is also recommended that control valves of overhead tanks be installed at ground level where possible to make it safer for the operator (to avoiding climbing) as well as to make operation easier. Elevated or ground-level tanks should be sited away from houses.

Costs: Capital costs for storage tanks vary a lot depending on the type of tank and related structures. Costs for elevated concrete tanks are at the highest end, at about 700 USD per m^3 storage. Ongoing running costs are low though, especially where gravity is used to distribute water.

Social and Environmental Considerations: There are not many social concerns since storage tanks do not affect users directly. Long-lasting materials should be used for storage tank construction to limit waste generation over time.

Strengths and Weaknesses:

(+) Balances inflow with peak demand
(+) Has low ongoing costs
(+) Available in different designs for the whole range of needs

(−) Risk of failure if badly constructed or designed
(−) Requires significant capital cost

→ **References and further reading material for this technology can be found on page 220**