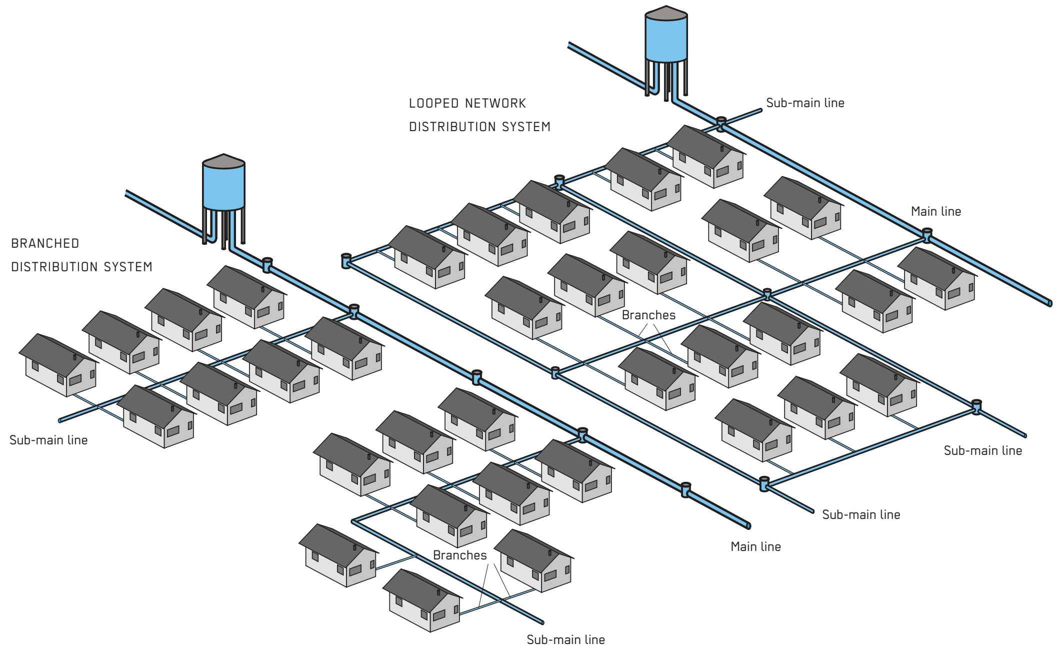
Community Distribution System

Response Phase	Application Level	Management Level	Objectives / Key Features
** Acute Response ** Stabilisation ** Recovery	Household ** Neighbourhood ** City	Household ** Shared ** Public	Water distribution at small/medium scale using gravity or pumps
Local Availability	**Technical Complexity**	**Maturity Level**	
*** High	*** High	*** High	



Community Distribution Systems transfer water from a source or treatment facility via pipes to the final distribution point (communal or household taps) using various energy sources, such as gravity or pumps. In the acute response phase, small-scale systems can be used, while medium-scale systems are more likely in the stabilisation and recovery phases.

Water demand in Community Distribution Systems varies throughout the day. Consumption is lowest at night and highest at certain peak hour periods during the day when it is needed for personal hygiene, washing and cooking. These variations need to be addressed by water storage or pump control mechanisms **(see D.6)**.

Design Considerations: There are two types of Community Distribution Systems: Branched or looped. Branched networks consist of one or more main pipes that branch out into a number of dead-end connections. Looped networks (or 'grid' configuration) consist of one or several main loops of pipe (rings) through which water is conveyed to secondary loops or branches. Branched networks are simpler to design and easier to install than looped networks, which require more interconnecting pipes, valves, and special parts, and are more complex and expensive. However, the advantage of looped networks is that they have less head loss and fewer dead legs, and have greater flexibility for repair of pipes without affecting the entire system. In both, it is important to have enough residual pressure at the furthest tap (normally taken to be at least 5 metres at the highest tap, **see S.7**).
Community Distribution Systems need to be designed considering topographical survey data, population figures and location, current and future water demand, available water sources, water quality, distance and elevation difference from the source to storage and storage to taps, number and location of taps corresponding to where people live, storage tank volume, possible pipe routes and any technical issues (e.g. road/river crossings or minimising high/low points). Any new system should be constructed to meet agreed Sphere indicators and local regulations. These include a minimum flow rate per tap of 0.125 L/s with enough taps to ensure a maximum number of 250 users per tap (to avoid excessive queues and conflict), enough water for personal and domestic hygiene (at least 15 L/person/day), and adequate drainage at community taps to reduce water

pooling. The walking distance to the standpipe should not exceed 500 metres, and a round trip including collection should not take more than 30 minutes.
The pipe diameter should be chosen according to the required velocity (0.7–3 m/s to limit silting and scour), potential future expansion (e.g. potentially choosing a larger pipe) and economics (lowest total capital, maintenance and fuel costs are achieved with a velocity of around 0.75 m/s). Pipes and taps should withstand the pressure when all taps are shut. The choice of pipe material may be influenced by pipe jointing and repair considerations. While PVC pipes are cheaper and easier to maintain, they require more joints, which increases the risk for error and pipe leakage, and they are more brittle and susceptible to sun damage. PE pipes are more expensive, though come in long rolls requiring fewer joints. However, these joints need either expensive compression fittings or a butt-welding machine that uses a generator. When laying pipes, it is important to ensure correct trenching, bedding and backfilling to prevent damage and leaks (changes in pipe type, for example to galvanised pipe, are an option for road or stream crossings). In general, water pipes should be laid above wastewater pipes to reduce risk of cross-contamination. The geolocation and the depth of pipes and valves should be made before backfilling. In cold climates where the ground freezes yearly, pipes should be below the frost line.

Materials: Distribution Systems require a lot of different materials, including for the source intake, pumping system, storage tank, pipes/valves/fittings, tapstands and spare parts. Local availability depends on design and particular context.

Applicability: Community Water Distribution Networks are common in urban and peri-urban areas. In rural areas, simpler networks with household or yard connections or public standpipes may be more appropriate. While in the acute response phase, small-scale distribution systems can be set up quickly with minimal design (e.g. bladder tanks and tapstands), in the stabilisation and recovery phases, these get replaced with larger Distribution Systems where construction starts becoming more complex and substantial investment is needed. Therefore, proper design and planning are essential in these cases.

Operation and Maintenance: With gravity flow, O&M is moderate. Since O&M increases as soon as pumps are introduced, it is better to design for fewer pumps or for solar pumping. Leakage usually causes the biggest O&M challenge, and can occur for various reasons such as illegal connections, soil movement and structure, traffic loading, poor quality of pipe jointing, damage due to excavation for other reasons, ageing, corrosion, and high pressure or temperature changes. Siltation can be another challenge due to poor design of intakes and pipes, improper treatment or recontamination from leaking joints. This may require flushing, swabbing or air scouring and pipe disinfection. Other O&M tasks include replacing taps, valves, emptying washout valves (at low points in a piped system), carrying out tank repairs and water quality monitoring for residual chlorine levels **(see T.6)**. An air block can clog the pipes at high points, so air release valves can be installed.

Health and Safety: People can be injured falling into the trench during pipe laying, especially at night. There is also a big concern around elevated water tanks, where appropriate structural design is needed to prevent collapse **(see D.6)**. Health risks can arise from the more intermittent operation of smaller systems, which can cause negative pressure and subsequent contamination at leaking joints. This can reduce residual chlorine levels in the system and pose a microbiological health risk at the point of use.

Costs: Capital costs tend to be high, mostly because of the distribution network. Ongoing running costs can vary. Where only gravity is used, ongoing costs are low, but where water is pumped at any point in the system, ongoing costs will increase. Therefore, it is better to design out or reduce the need for pumps where possible and/or to opt for solar pumping. Solar pumps have much lower ongoing costs, with payback within a few years, as well as few carbon emissions **(see S.10)**.

Social and Environmental Considerations: It is important to involve users in certain aspects of the planning process (e.g. tapstand location and design). Land ownership should be clarified, and agreements should be made for all land where pipes, tanks and tapstands will be located to avoid future claims or conflict. Household connections may considerably increase water consumption (and wastage) and require proper subsequent disposal systems for grey or black water. Illegal pipe tapping can also be an issue. For larger numbers of consumers, the installation of meters is recommended.

Strengths and Weaknesses:

- (+) A more convenient and desirable way of distributing water to users
- (+) Has lower levels of contamination compared to water carried in jerrycans and trucks
- (+) During continuous supply, no need for safe water storage or household water treatment
- (+) Has low ongoing costs where gravity or solar pumping is used

- (−) Needs significant topographical survey and design work and difficult terrain can restrict pipe laying
- (−) Requires significant capital cost and often limited in availability of pipe material, valves/fittings and tapstands

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