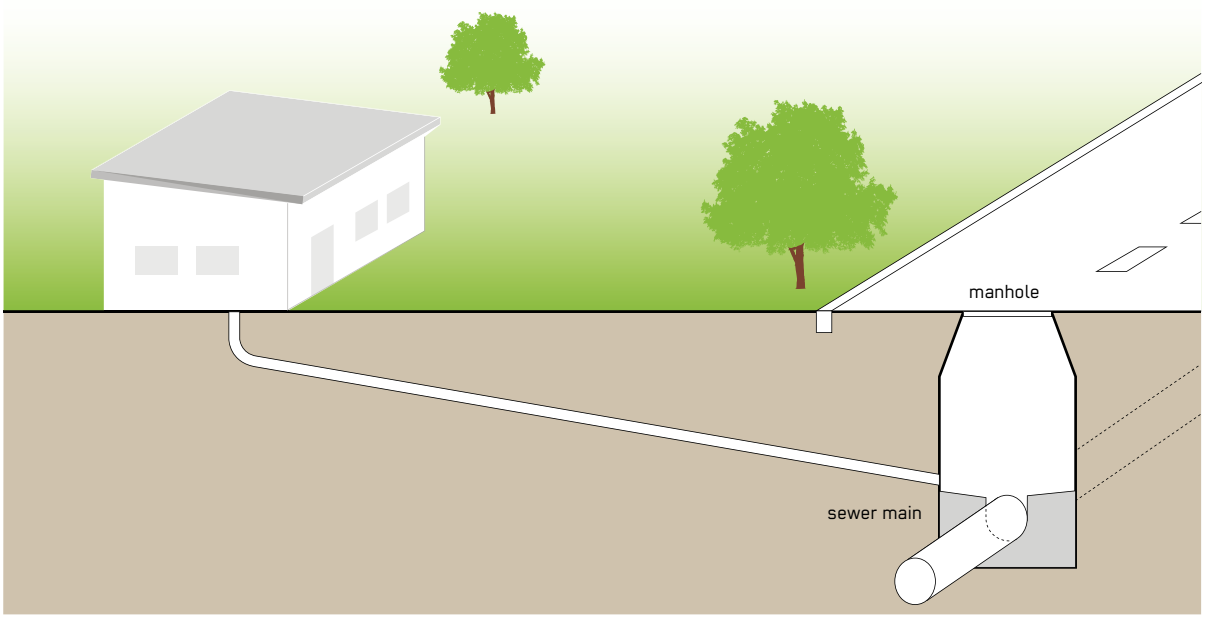
Conventional Gravity Sewer

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
Acute Response * Stabilisation ** Recovery	Household * Neighbourhood ** City	Household Shared ** Public	Conveyance of wastewater and stormwater
Space Required	**Technical Complexity**	**Inputs / Outputs**	
** Medium	*** High	● Blackwater, ● Greywater, ● Stormwater	



Conventional Gravity Sewers are networks of underground pipes that convey blackwater, greywater and, in many cases, stormwater from individual households to a (semi-) centralised treatment facility, using gravity and pumps where necessary.

The Conventional Gravity Sewer system is designed with many branches. Typically, the network is subdivided into primary (main sewer lines along main roads), secondary and tertiary networks (networks at the neighborhood and household level).

Design Considerations: Conventional Gravity Sewers normally do not require on-site pre-treatment, primary treatment or storage of household wastewater. The sewer must be designed, however, so that it maintains a self-cleansing velocity (i.e., a flow that will not allow particles to accumulate). For typical sewer diameters, a minimum velocity of between 0.6 to 0.7 m/s during peak dry weather conditions should be adopted. This requires a daily water consumption rate of more than 100 L per person per day. A constant downhill gradient must be guaranteed along the sewer length to maintain self-cleansing flows, which can require deep excavations. When a gradient cannot be maintained, a pumping station must be installed. Primary sewers are laid beneath roads, at depths between 1.5 to 3 m to avoid damages caused by traffic loads. The depth also depends on the groundwater table, the lowest point to be served (e.g. a basement) and the topography. The selection of the pipe diameter depends on projected average and peak flows. Access manholes are placed at set intervals above the sewer, at pipe intersections and at changes in pipeline direction (vertically and horizontally). Manholes should be designed to ensure that they do not become a source of stormwater inflow or groundwater infiltration. In the case that connected users discharge highly polluted wastewater (e.g. from industry or restaurants), on-site pre- and primary treatment may

be required before discharge into the sewer system to reduce the risk of clogging and the load of wastewater to the treatment plant. When the sewer carries stormwater (known then as a combined sewer), overflows are required to avoid hydraulic surcharge of treatment plants during rain events. However, combined sewers are no longer be considered state of the art. Rather, local retention and infiltration of stormwater or a separate drainage system for rainwater is recommended. The wastewater treatment system then requires smaller dimensions and is, therefore, cheaper to build, and has a higher treatment efficiency for less diluted wastewater.

Materials: Commonly used materials are concrete, PVC, vitrified clay and ductile or cast-iron pipes. Excavation requires an excavator or numerous workers with shovels, depending on soil properties.

Applicability: Sewers in the humanitarian context are usually applicable where sewers are already existing and can be rehabilitated, for example in host communities. Furthermore, the construction of a new sewer line can be part of recovery actions. As they can be designed to carry large volumes, Conventional Gravity Sewers are very appropriate to transport wastewater to a (semi-) centralised treatment facility. Planning, construction, operation and maintenance requires expert knowledge. Construction of conventional sewer systems in dense, urban areas is complicated as it disrupts urban activities and traffic. Conventional Gravity Sewers are expensive to build and, because the installation of a sewer line is disruptive and requires extensive coordination between authorities, construction companies and property owners, a professional management system must be in place. Ground shifting may cause cracks in manhole walls or pipe joints, which may become a source of groundwater infiltration or wastewater exfiltration, and compromise the performance of the sewer. Conventional Gravity Sewers can be constructed in cold climates as they are dug deep into the ground and the large and constant water flow resists freezing.

Operation and Maintenance: Manholes are used for routine inspection and sewer cleaning. Debris (e.g. grit, sticks or rags) may accumulate in manholes and block the lines. To avoid clogging caused by grease, it is important to inform users about proper oil and grease disposal. Common cleaning methods for Conventional Gravity Sewers include rodding, flushing, jetting and bailing. Sewers can be dangerous because of toxic gases and should be maintained only by professionals, although, in well-organised communities, maintenance of tertiary networks might be handed over to a well-trained group of community members. Proper personal protective equipment should always be used when entering a sewer.

Costs: Conventional Gravity Sewers have very high capital as well as operation and maintenance (O & M) costs. Conventional Gravity Sewer O & M is constant and labor intensive. The costs of household sewer connections must be included in the total cost calculations.

Social Considerations: If well-constructed and maintained, Conventional Gravity Sewers are a safe and hygienic means of transporting wastewater. This technology provides a high level of hygiene and comfort for the user. However, because the waste is conveyed to an offsite location for treatment, the ultimate health and environmental impacts are determined by the treatment provided by the downstream facility.

Strengths and Weaknesses:

⊕ Greywater and possibly stormwater can be managed concurrently
⊕ Can handle grit and other solids, as well as large volumes of flow

⊖ Very high capital costs; high O & M costs
⊖ A minimum velocity must be maintained to prevent the deposition of solids in the sewer
⊖ Difficult and costly to extend as a community changes and grows
⊖ Requires expert design, construction and maintenance

→ **References and further reading material for this technology can be found on page 193**