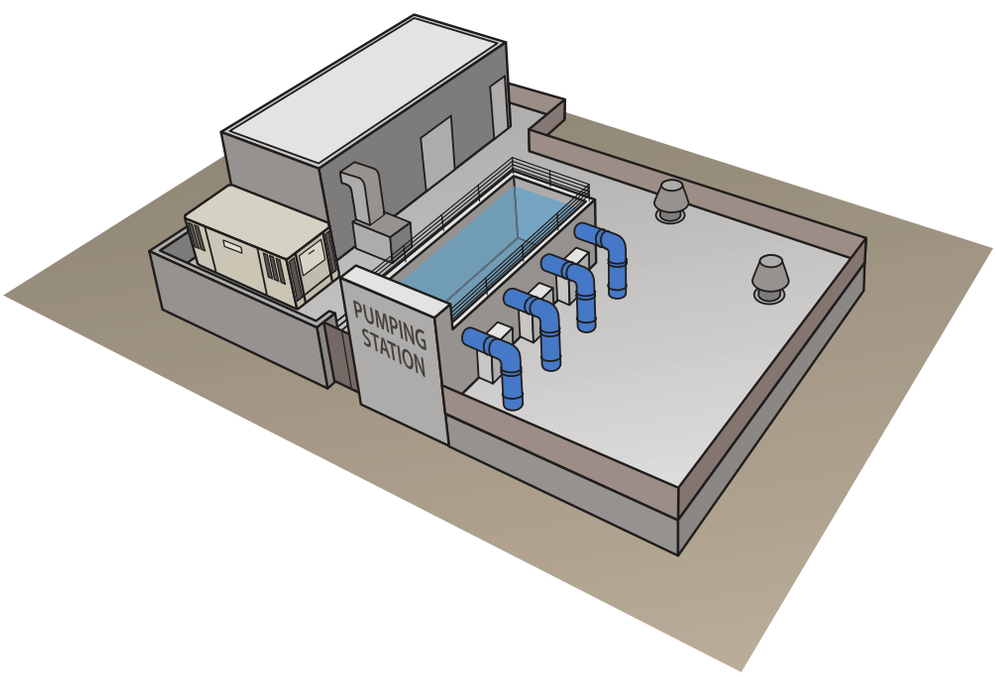
Pumping Station

Response Phase	Application Level	Management Level	Objectives / Key Features
** Acute Response ** Stabilisation ** Recovery	Household ** Neighbourhood ** City	Household * Shared ** Public	Complete pumping systems to provide pressurised water
Local Availability	**Technical Complexity**	**Maturity Level**	
** Medium	** Medium	*** High	



A Pumping Station is an entire system dedicated to pumping water and a wide range of other liquids. Clean water Pumping Stations range in size from small, prefabricated or skid-mounted systems capable of providing water to a few households to large, municipal- or industrial-scale permanent installations that are up to several hundred kilowatt in size and that require detailed design by engineers followed by complex construction. Smaller systems exist that can be quickly deployed in all phases of an emergency, whereas large Pumping Stations tend to be part of a well-functioning municipal water supply system, and as such, will not be used in an emergency unless in the case of the rehabilitation of an existing plant.

A Pumping Station includes all components and subsystems necessary to provide pressurised flow, including pumps, valves, in-station piping, controls, standby/backup power (if desired) and instrumentation. Pumping Stations do not necessarily include the power-generating source for pumping. Clean water Pumping Stations are available in several different scales and levels of complexity, and may form part of a water treatment element, such as disinfection and intermediate storage.

Design Considerations: The most important design considerations for Pumping Stations are the required flow rate and the required discharge pressure. These are determined by a detailed analysis of the population and geography being served, treatment plant capacity, storage capacity, pumping times, and systems hydraulics. For small Pumping Stations, flow rates may be quickly estimated using Sphere guidelines and discharge pressures which are dictated by water elevation in a storage tank along with energy losses in the discharge piping **(see A.8)**. For larger, more complicated systems, a detailed engineering analysis is required. Other design considerations include characteristics of the pumped liquid, pressure, conditions upstream of the Pumping Station, environmental exposure, inter-operability of components and maintenance capabilities. With the exception of small,

temporary systems, detailed engineering design is essential, particularly for permanent and semi-permanent systems that must be designed in conjunction with the rest of the system network.

Materials: Small Pumping Stations (skid-mounted systems) can be prefabricated and shipped to a site ready for pumping. In acute emergency settings, simple systems are either made up of readily locally available elements or standard pre-packaged elements held in store by major emergency WASH providers. Larger systems must be analysed on a per-component basis to determine appropriate materials and component types. As capacities and pressures increase, different pump types should be considered, as the effects of scaling are more prominent on component design. For example, forces and reactions on pump bearings become more critical as the pump scales to larger flows and pressures.

Applicability: Pumping Stations are part of many well-managed water systems for neighbourhoods or municipalities. Large Pumping Stations take considerable time to design and construct and are therefore most applicable in recovery or post-disaster contexts. Small skid-mounted pumping systems can help to provide clean water in acute responses to disasters and all subsequent stages of the response. Where access to electrical power is limited, Pumping Stations can be configured with supplemental power, such as from small engine generators. Some Pumping Stations can also be packaged to be driven by engines, directly enabling quick system deployment in a natural disaster where restoration of electricity may take several weeks to months. Depending on the water source characteristics (the location above or below the elevation of the Pumping Station, the turbidity or chemical make-up) the type of pumps used may vary. For example, if the available water source is an aquifer, then a submersible pump may be required to bring the water to ground level. Here, factors such as the depth of water, amount of flow and size of the well will require a customised pump design, which will be a limiting factor for being able to use standard, skid-mounted designs. Each Pumping Station should therefore be designed for its individual needs. For clean water systems, the type of pump and installation can be scaled to a specific level. Depending on capacity and pressure requirements, entire Pumping Stations can be rented based on local availability. Custom designs typically need 20–24 weeks for equipment procurement and assembly.

Operation and Maintenance: Large Pumping Stations require more intensive and skilled O&M. Regular maintenance is required for all mechanical and wearing components. Operations of large Pumping Stations may be complex and require dedicated control systems. Sufficient time for installation and O&M should be allowed for, based on the complexity of the system installed. If the installed pumps are not designed to be used with fluids other than clean water, Pumping Stations may experience excessive wear and tear of components, electrical overload and clogging.

Health and Safety: Safety precautions should be exercised around any electro-mechanical equipment. Hazards associated with Pumping Stations may include the risk of electric shock, rotating equipment, open water, and pressurised flow.

Costs: Costs for complete Pumping Stations are high and are closely tied to capacity and construction materials.

Social and Environmental Considerations: The end users of a water supply system typically do not interact with a Pumping Station. The complexity of O&M of the system should be considered, though trained and capable staff are always required. Electric, gasoline or diesel engines are commonly used as power sources in Pumping Stations. From an environmental point of view, the electric motor is the most favoured power source because of its cleanliness, relatively low noise, and lower pollutant emissions. An electrical pump may also be driven with solar power.

Strengths and Weaknesses:

⊕ Mature and scalable technology
⊕ Many technical options to fit a given situation

⊖ Can be very expensive
⊖ Requires highly trained staff

→ **References and further reading material for this technology can be found on page 217**