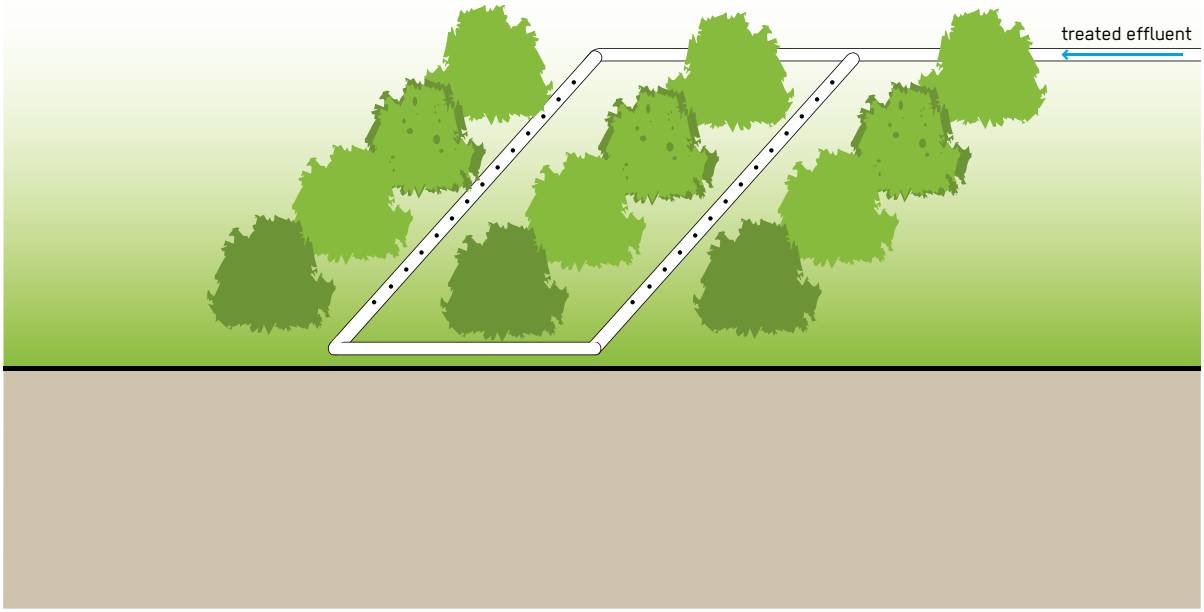
Irrigation

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
Acute Response ** Stabilisation ** Recovery	** Household ** Neighbourhood ** City	** Household ** Shared ** Public	Productive use of water and nutrients
Space Required	**Technical Complexity**	**Inputs**	**Outputs**
*** High	** Medium	● Effluent, ● Stormwater, ● Stored Urine	● Biomass



To reduce the dependence on freshwater and maintain a constant source of water for irrigation throughout the year, wastewater of varying quality can be used in agriculture and horticulture. However, only water that has had secondary treatment (i.e. physical and biological treatment) should be used to limit the risk of crop contamination and the health risks to workers.

There are two kinds of Irrigation technologies appropriate for treated wastewater: (1) drip irrigation above or below ground, where the water is slowly dripped on or near the root area; and (2) surface water irrigation where water is routed over-land in a series of dug channels or furrows. To minimise evaporation and contact with pathogens, spray or sprinkler irrigation should be avoided. Adequately treated wastewater can significantly reduce dependence on fresh water, and/or improve crop yields by supplying water and nutrients to plants. Raw sewage or untreated blackwater should not be used, and even well treated water should be used with caution. Long-term use of poorly or improperly treated water may cause long-term damage to the soil structure and its ability to hold water.

Design Considerations: The application rate must be appropriate for soil, crop and climate, or it could hinder growth. To increase the nutrient value, urine can be dosed into irrigation water; this is called "fertigation" (fertilisation plus irrigation). The dilution ratio has to be adapted to the specific needs and resistance of the crop. In drip irrigation systems care should be taken to ensure that there is sufficient head (i.e. pressure) and maintenance to reduce the potential for clogging (especially, with urine from which struvite will spontaneously precipitate).

Materials: A filtration unit to reduce the risk of clogging is highly recommended before the irrigation water is used in a drip irrigation system. A drip irrigation system can be constructed using locally available materials such as a storage tank, and a hose or drip tape. Ready-made kits are also widely available.

Applicability: Irrigation with treated wastewater can be considered an option in the stabilisation and recovery phases of emergencies. Increasingly, food production and 'camp greening' programmes are being implemented. Reusing treated greywater for irrigation can reduce dependency on other freshwater supplies.

Operation and Maintenance: Drip irrigation systems must be periodically flushed to avoid biofilm growth and clogging from all types of solids. Pipes should be checked for leaks, as they are prone to damage from rodents and humans. Large-scale operations will require a trained operator. Workers should wear appropriate personal protective equipment.

Health and Safety: Adequate treatment (i.e. adequate pathogen reduction) should precede any irrigation scheme to limit health risks to those who come into contact with the water. Even treated effluent can still be contaminated depending on the degree of treatment the effluent has undergone. When effluent is used for irrigation, households and industries connected to the system should be made aware of the products that are and are not appropriate to discharge into the system. Drip irrigation is the only type of irrigation that should be used with edible crops, and even then, care should be taken to prevent workers and harvested crops from coming into contact with the treated effluent. The World Health Organization Guidelines for the Safe Use of Wastewater, Excreta and Greywater should be consulted for detailed information and specific guidance.

Costs: Transport costs of the treated water to the fields must be considered. Overall costs are highly dependent on the system applied. Irrigation with treated wastewater can generate revenue by increasing agricultural yields and save money if it replaces the need for other fertilisers and water. Commercial scale irrigation systems for industrial production are expensive, requiring pumps and an operator. Small-scale drip irrigation systems can be constructed out of locally available low-tech materials, and are inexpensive.

Social Considerations: The greatest barrier to the use of treated wastewater for Irrigation is social acceptance. It may not be acceptable to use irrigation water coming from a water-based sanitation system for edible crops. However, it may still be an option for biomass production, fodder crops and municipal projects such as irrigation of parks, street trees, etc. Depending on the source of the wastewater and on the treatment method, it can be treated to a level where it no longer generates significant odour or vector problems. Following appropriate safety and application regulations is important.

Strengths and Weaknesses:

⊕ Reduces depletion of groundwater and improves the availability of drinking water
⊕ Reduces the need for fertiliser
⊕ Potential for local job creation and income generation
⊕ Low risk of pathogen transmission if water is properly treated

⊖ May require expert design and installation
⊖ Drip irrigation sensitive to clogging
⊖ Risk of soil salinisation if the soil is prone to the accumulation of salts
⊖ Social acceptance may be low in some areas

→ **References and further reading material for this technology can be found on page 196**