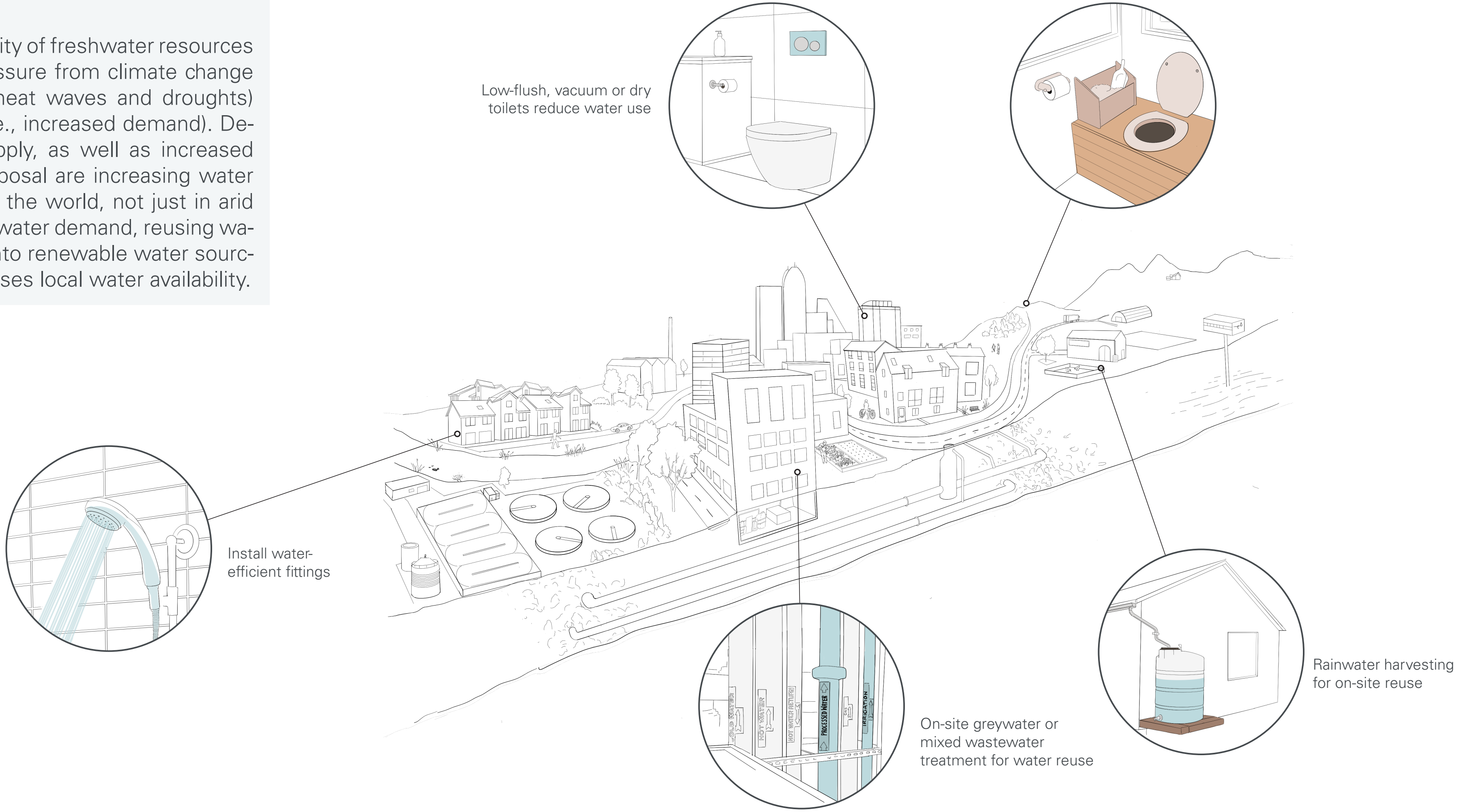
SAVE WATER

eawag aquatic research

GOAL

The availability and reliability of freshwater resources are under increasing pressure from climate change (e.g., warmer weather, heat waves and droughts) and rapid urbanization (i.e., increased demand). Decreased and variable supply, as well as increased abstraction, use, and disposal are increasing water scarcity in many parts of the world, not just in arid environments. Reducing water demand, reusing water on site, and tapping into renewable water sources (e.g., rainwater) increases local water availability.



REDUCE WATER USE

Swap out water-intensive appliances and toilets, with waterless and water-efficient alternatives. Appliances can be anything from faucet fittings to water recirculating showers to dry or vacuum toilets. Such fixtures minimize water demand, and some also reduce the energy demand needed to heat the water.

REUSE WATER

Treat used water (e.g. greywater, blackwater, mixed water) streams to provide an alternative water supply for non-potable and potable reuse. Depending on the desired end use, water is treated to match end use demand for quality and quantity, to provide reliable and safe water supply. Reusing water minimizes demand for drinking water supply and diverts hydraulic flow to existing sewer infrastructure.

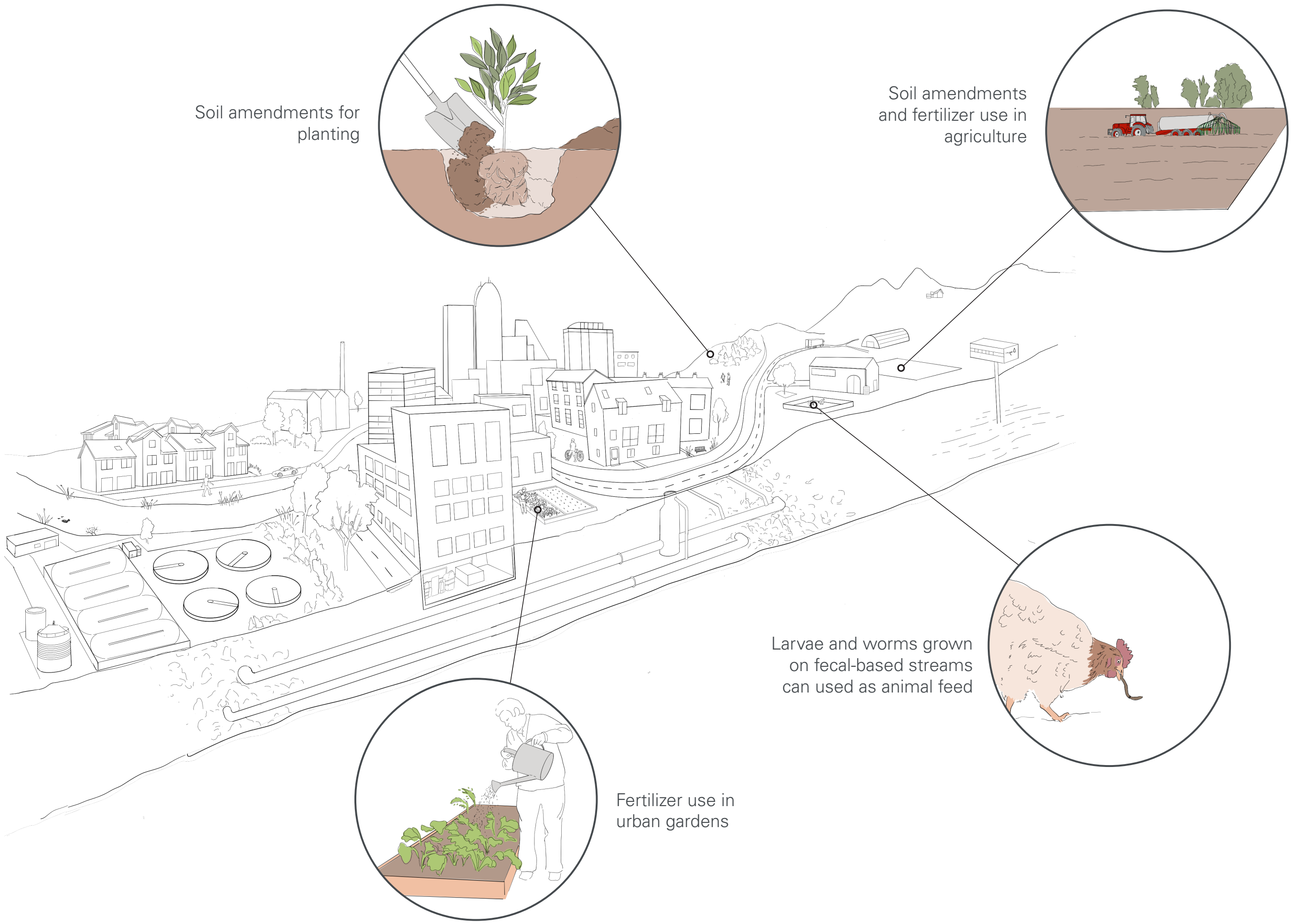
CAPTURE RAINWATER

Harvest rainwater for fit-for-purpose reuse. Depending on the desired end-use, these water sources can be treated to match end-use demand for quality and quantity, including irrigation, non-potable reuse and potable reuse. Using captured water minimizes demand for drinking water supply and diverts hydraulic flow to existing sewer infrastructure.

RECOVER NUTRIENTS & ORGANIC MATTER

GOAL

Current linear nutrient flows are characterized by: 1) cheap and resource-intensive fertilizer production that relies on fossil fuels, and finite, spatially-concentrated ore reserves, 2) food and farming systems that contribute to soil nutrient imbalances and soil organic matter depletion, and 3) and human excreta management practices that result in irretrievable losses of nutrients and organic matter to air, water, and landfills. Nutrients discharged to surface waters can cause eutrophication (algal blooms, dead zones, and fish kills). Recovering nutrients and organic matter from streams containing human excreta diverts nutrients from existing infrastructure, reduces losses, and allows for the production of renewable fertilizers and soil amendments.



PRODUCE FERTILIZER

Separate wastewater streams containing urine and/or feces at the source to facilitate the treatment and targeted extraction of nutrients as fertilizers, minimizing pollution and losses. Recovery can target specific nutrients (often one macronutrient) or several nutrients (macro- and micronutrients). The recovered products can be reused as fertilizer in agriculture, horticulture, plant nurseries, and on sport fields.

PRODUCE SOIL AMENDMENT

Separate fecal streams at the source, or after solid-liquid separation of mixed wastewater, to aid nutrient and organic matter recovery. Treatment and recovery processes of the fecal streams, potentially combined with kitchen and/or garden waste, produce soil amendments that increase soil health and supply nutrients. Source separation also lowers pollutants, like heavy metals, compared to sludge from centralized treatment plants.

PRODUCE BIOMASS

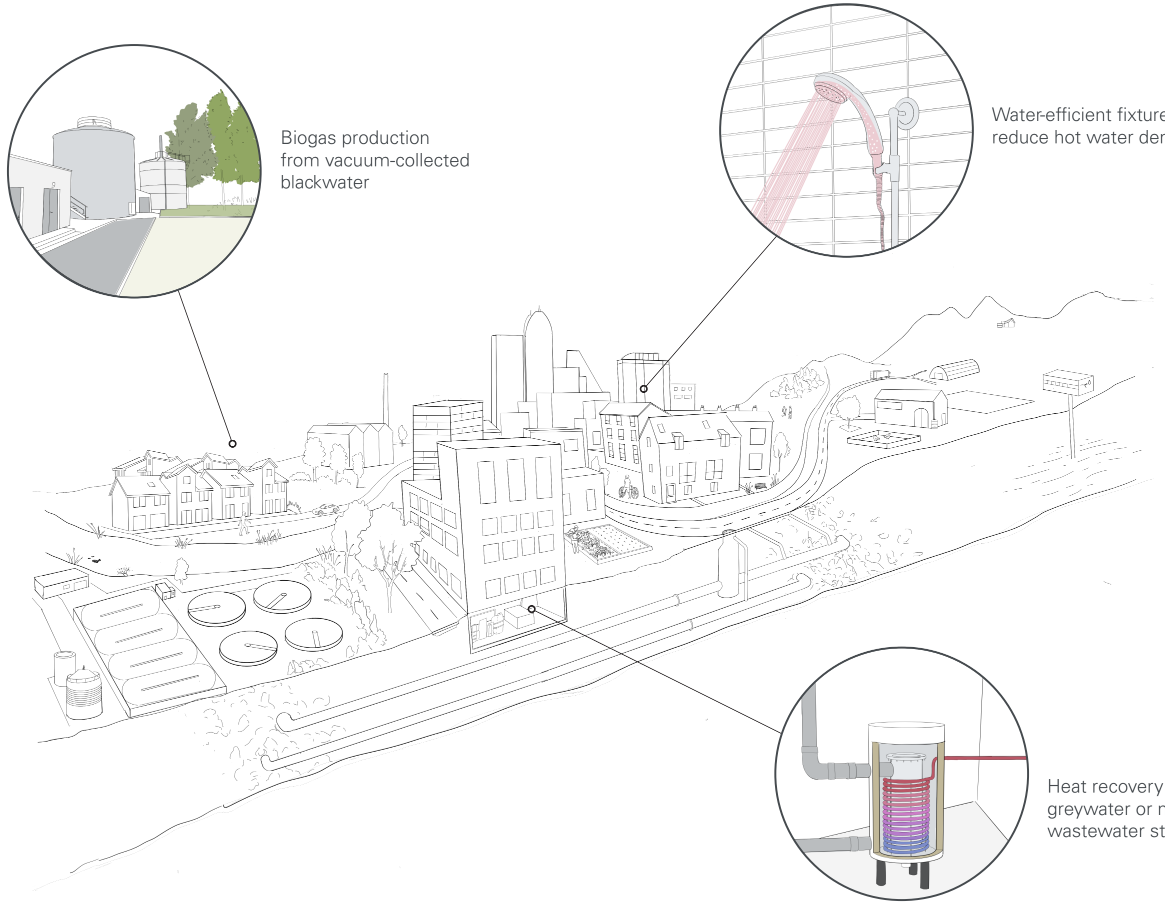
Use streams containing urine and/or feces to grow or produce algal biomass, worms or insects (e.g., black soldier fly larvae). While algae is often grown on nutrient-rich liquids, such as urine, larvae and worms can be grown on fecal biomass and/or kitchen waste. The products can be used as, or in, animal feed, or used as soil amendments/fertilizer (e.g., algae)

SAVE ENERGY

eawag
aquatic research

GOAL

Heating water, for showers, sinks, and appliances, requires energy. Once used, residual heat quickly dissipates into the receiving sewer system and wastewater treatment plant. Energy savings can be achieved by reducing the consumption of hot water or by recovering residual heat from wastewater streams (e.g., greywater) on site. Valorization of organic matter to produce biogas, or heat, helps diversify energy supply and reduce dependence on external power sources.



REDUCE HEAT DEMAND

Install fixtures that reduce hot water demand, such as shower head fittings and water efficient washing machines, and thus also reduce the energy needed for heating. Showers that recirculate hot water also reduce energy demand.

RECOVER HEAT

Use passive systems to heat up water, or actively recover heat from grey- or mixed wastewater through heat exchangers at different scales. To reduce heat dissipation, recovery should take place close to the source.

PRODUCE ENERGY

Produce gas, pellets, or heat from streams containing feces (and toilet paper). Digesting feces or vacuum-collected blackwater, with or without organic food waste, produces biogas. Combustion or pyrolysis oxidizes dried fecal matter.

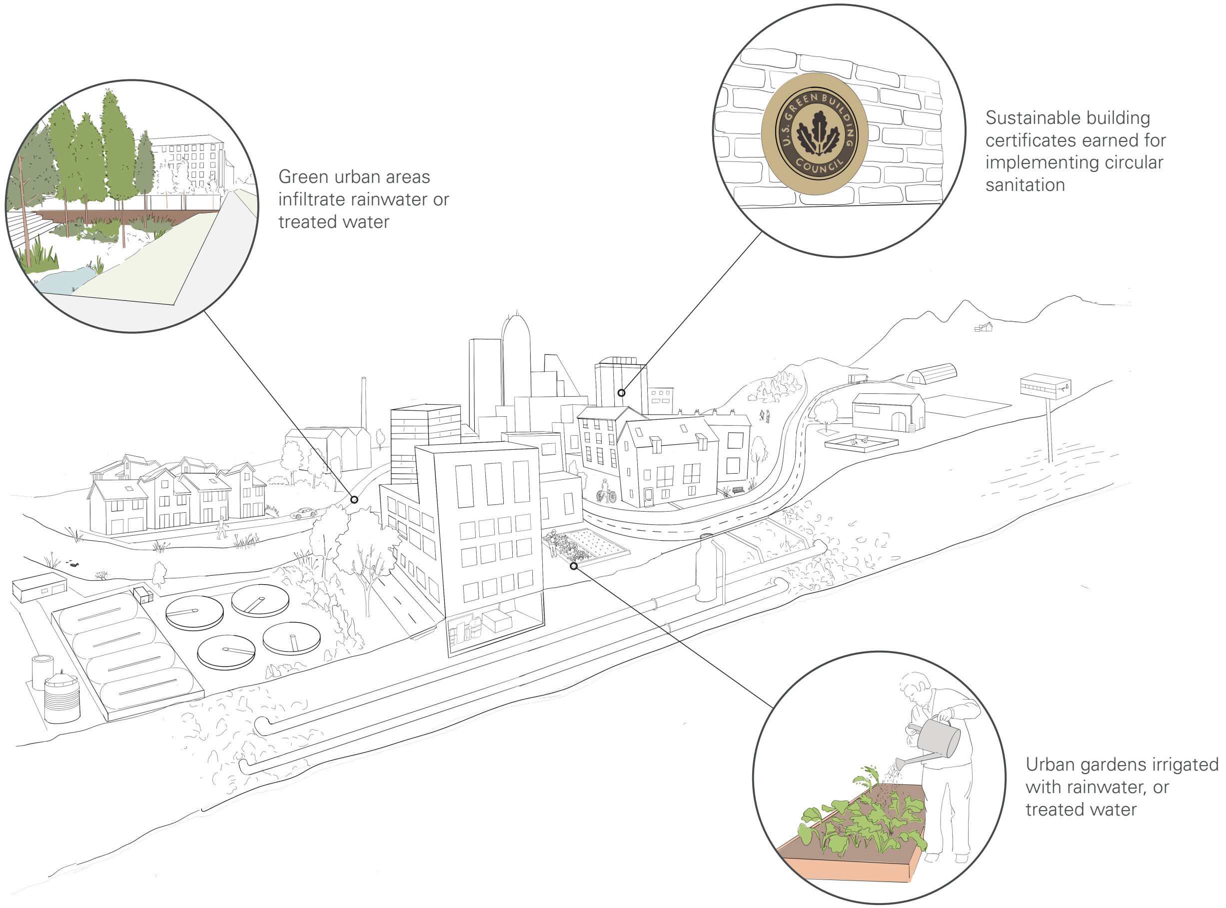
BUILD RESILIENT CITIES

eawag aquatic research

GOAL

Urbanization has significant impact on resource flows, concentrating the use and loss of water, nutrients, and energy. Warmer weather increases demand for cooling and irrigation, while heavy rainfall leads to more frequent stormwater overflows into sewers. Recovering and reusing resources from wastewater, and closing resource cycles between urban activities, can improve local self-sufficiency and climate resilience. Many sustainable building certifications, such as BREEAM and LEED*, recognize the contribution of circular sanitation to meeting their sustainability criteria. Certified projects often enhance public image and property values.

*BREEAM: Building Research Establishment Environmental Assessment Method; LEED: Leadership in Energy and Environmental Design



SUPPORT BLUE-GREEN INFRASTRUCTURE

Use rainwater and/or reuse treated water to support 'blue' urban hydrological functions and provide a water source for the irrigation of 'green' vegetation. Blue-green infrastructure positively impacts the urban environment: increasing biodiversity, mitigating climate change (e.g., urban cooling), and promoting of human health and well-being.

COMPLY WITH CERTIFICATIONS

Water, nutrient and energy management practices are prerequisites to obtain sustainable building certifications (e.g., BREEAM, LEED, Living Building, Minergie). The impact that circular sanitation implementations have on the final score can vary depending on the type of certification, project, context, etc. Often the labels only indicate targets and principles and leave ample margin for the selection of specific solutions.

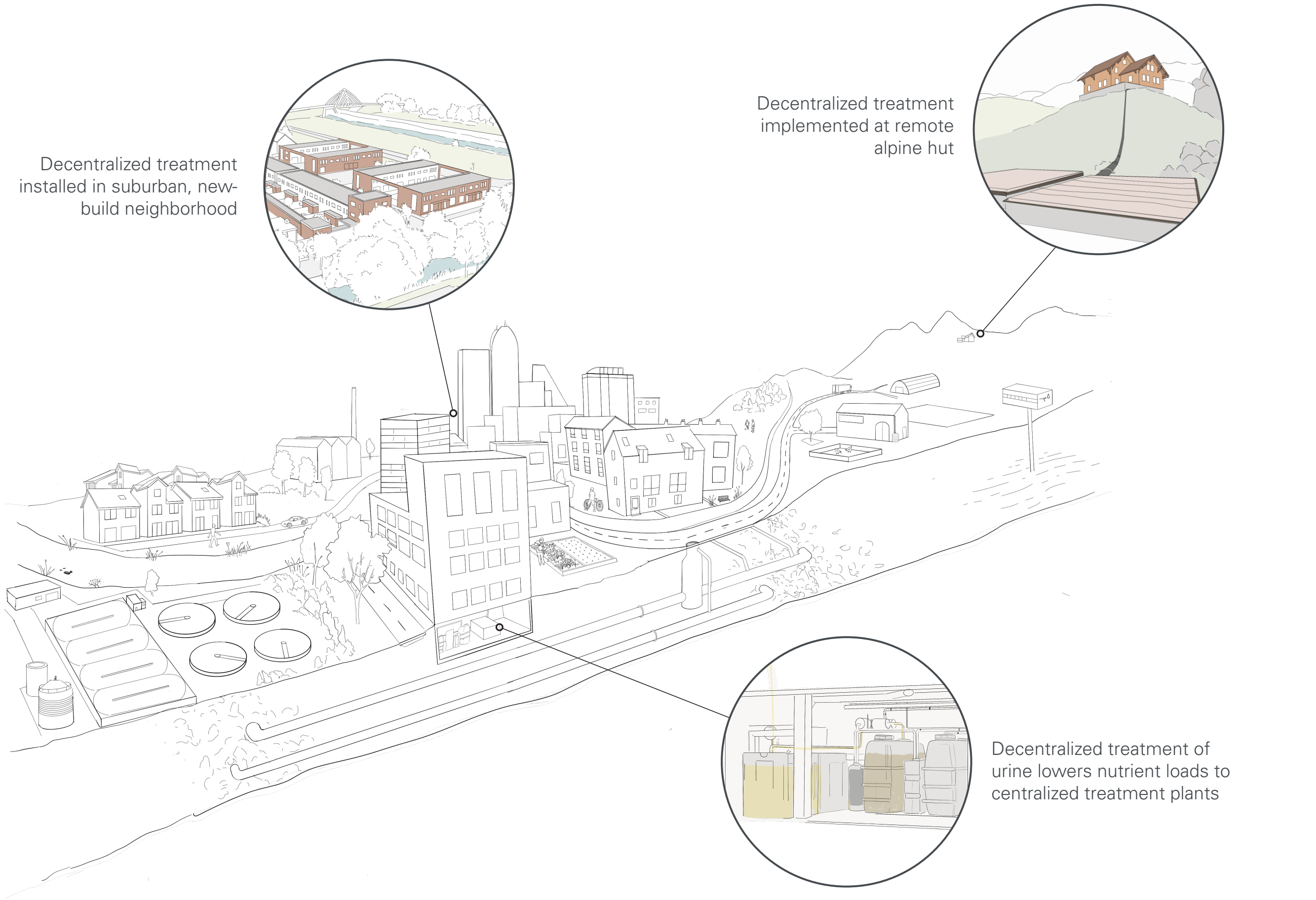
PROMOTE A CIRCULAR ECONOMY

A circular economy aims to decouple economic activity from the consumption of finite resources; it promotes an economy where resources are circulated. The recovery of nutrients, water, and energy from source-separated streams reduces dependencies on external inputs, minimizes waste production, reduces pollution, and enhances local resource availability.

TREAT DECENTRALLY

GOAL

In many contexts, centralized infrastructure is absent, such as in sparsely-populated and remote areas, or in areas where financial burden of centralized systems is too high. Infrastructure may also be absent where urbanization outpaces the implementation of centralized infrastructure. In other cases, existing sewer and/or treatment infrastructure is ageing or is at capacity. Decentralized treatment, of some or all streams can replace or extend the operating capacity of existing infrastructure, deferring expensive investments. Decentralized treatment also allows for autarkic solutions and allows for experimentation and flexibility in design and operation.



DEVELOP INDEPENDENT OF THE GRID

In areas where centralized drinking and/or wastewater infrastructure is absent (e.g., remote hut, village or settlement), or when it is desired to exercise grid autonomy, on-site or decentralised sanitation provides water supply and wastewater treatment.

RELIEVE THE GRID

Diverting the total volume (e.g. greywater, flush water, rainwater) and nutrient load (e.g. urine and feces) from existing sewers and treatment plants extends their operating capacity and increases their treatment performance. Such solutions help avoid or postpone costly expansions. Diverted streams need to be treated, reused or discharged (semi-)decentrally.

TAILOR SOLUTIONS PER CONTEXT

Buildings, neighborhoods or cities may face different challenges. Decentralization allows for the implementation of tailored solutions that are flexible and adaptable. These solutions not only address local challenges but also reduce vulnerability during disasters.