Closing the gap between Fork & Farm for Circular Nutrient Flows

P2GreeN

GUIDELINES FOR THE IMPLEMENTATION OF CIRCULAR SANITATION IN CITIES AND REGIONS



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ICLEI Local Governments for Sustainability EUROPE

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P2GREEN

The P2GreeN project aims to shift the paradigm towards a circular sanitation system. Guided by the 3R principles — Reduce, Reuse, Recover — P2GreeN is developing new governance and management approaches to close the loop from fork to farm. The project works with three pilot regions and four follower regions to find new ways to recover and reuse nutrients from human excreta. This guide extends beyond the scope of the project and presents a variety of case studies and best practices that contribute to the transition towards circular sanitation across all stages of the value chain, including solutions outside of the P2GreeN framework.

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ICLEI - Local Governments for Sustainability is a global network of more than 2500 local and regional governments committed to sustainable urban development and is active in 125+ countries. ICLEI Europe supports local governments across Europe, Middle East and West Asia in their transition to climate neutrality, to build more resilient and equitable communities.

EXECUTIVE SUMMARY

Section I: Introduction to circular sanitation

The current linear approach to sanitation:

- Plants require nutrients such as nitrogen (N) and phosphorus (P) to grow. Currently, Europe depends on mineral fertilisers imported from Morocco (mining of phosphorous rock), Norway and Russia (producers of nitrogen fertilisers related to natural gas supplies).
- These same nutrients are abudantly present in human excreta that ultimately enters wastewater streams. Conventional linear sanitation systems treat wastewater primarily as waste, relying on energy-intensive nutrient removal processes and costly centralised infrastructure.
- At the same time, demographic change, increasing nutrient loads, and rising operational costs are placing growing pressure on wastewater treatment systems and exposing the limits of the current model.



Figure 1: The linear sanitation approach

Definition of circular sanitation:

- Circular sanitation offers an alternative approach by treating human excreta and wastewater as valuable resources rather than waste streams. It **recovers nutrients, water, and organic matter for their reuse in agriculture** through fertiliser production and fertigation.

- Circular sanitation solutions can be grouped into two main categories:
  - **Upstream solutions**: the source separation of urine and faeces to enable recovery and treatment.
  - **Downstream solutions**: recover water, energy, and nutrients from WWTP (wastewater treatment plants).

- Existing technologies, infrastructure models, and operational innovations demonstrate that circular sanitation can be successfully integrated across different scales and settings.

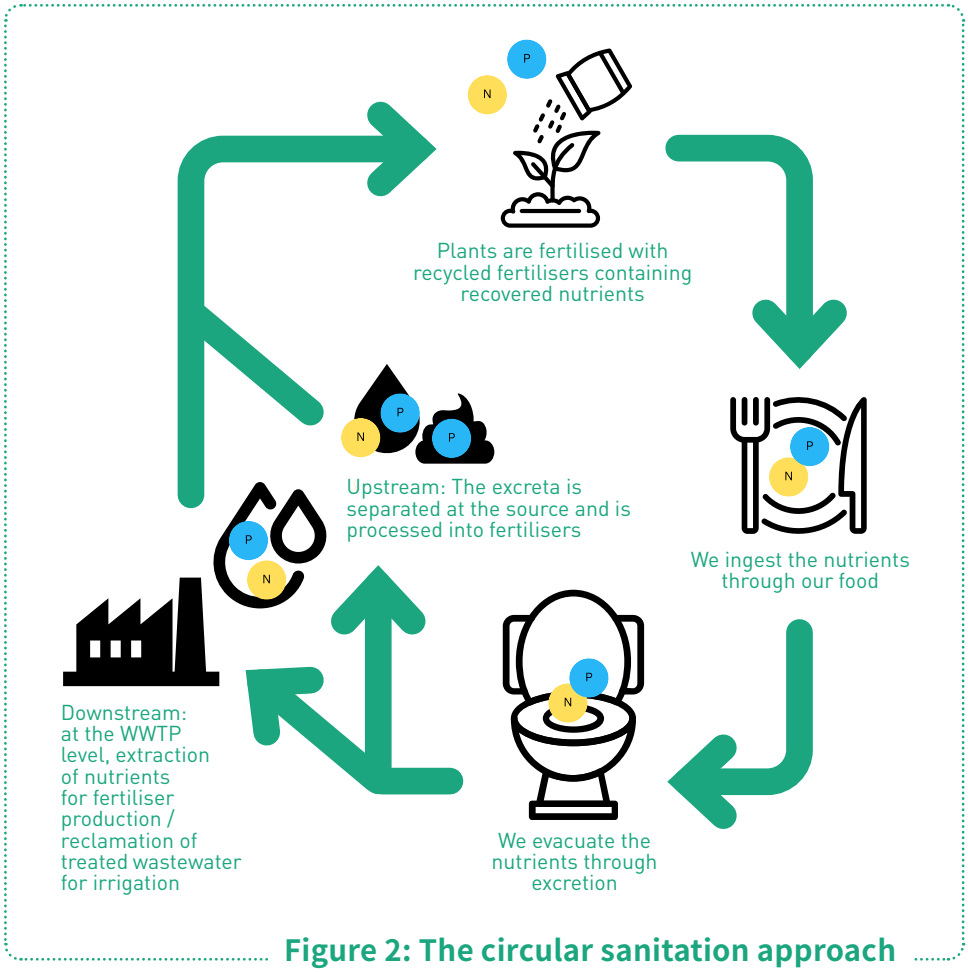


Figure 2: The circular sanitation approach

Section II: Circular sanitation for local and regional governments

The transition to circular sanitation depends on effective collaboration across sectors such as spatial planning, water management, food systems, and agriculture. As key public authorities, cities and regions are well placed to lead this process by connecting diverse stakeholders, aligning policies and priorities, and creating the enabling conditions for circular sanitation solutions to be implemented at scale.



Strategise

Integrate targets for nutrient recovery, recycled fertiliser usage or water reclamation into:	**Examples**
Sectoral strategies and action plans such as water, food, energy	Stockholm Water and Waste Targets (SE); AESN Water and Climate strategies (FR); Irish Food Vision (IE)
Cross-cutting strategies and action plans such as urban development plans, climate and resilience strategies	Ile de France Master Plan (FR)



Educate

Raise awareness among key stakeholders through:	Examples
✪ **Awareness raising** on the benefits and use of circular sanitation infrastructure	SVDP Workshops for end users (FR)
✪ **Educational programmes** in schools, science parks and universities	Sanitation360 World Toilet Day (SE)
✪ **Knowledge sharing platforms** to make existing projects and learnings publicly accessible	Toilettes Fertiles Platform (FR)
✪ **Public spaces and events** to showcase source separation and fertiliser application	Rediscovery Centre (IE); P-Bank (DE)
✪ **Community campaigns** to engage citizens and collaboratively imagine innovative sanitation systems	Toilet Time Travel (CH)



Mobilise

Engage and collaborate with public and private stakeholders such as:	Examples
✪ **Public authorities**: ensure collaboration across levels and sectors through multilevel governance, cross-department bodies and national networks	Mission Résilience (FR); ZierkulierBAR (DE); NetSan (DE); RAE (FR); VaLoo (CH)
✪ **Farmers**: involve farmers in valorisation processes to build trust and ensure that the outputs (recylced fertiliser, reclaimed water) meet their needs	KOLOS (FR); FNAB (FR); P2GreeN Pilot (ES); VivAgriLab (FR)
✪ **Start ups and businesses**: engage with innovators, property developers, construction and wastewater management companies to incentivise and guide circular sanitation approaches	P2GreeN Pilot (SE); Superlocal (NL)
✪ **Research and academia**: involve in collaborative research projects to develop innovative technologies and local value chains for the valorisation of nutrients	TeValU (FR); RecoLab (SE); Diverse water living labs (EU); Water Hub (CH)
✪ **Practitioners**: facilitate capacity building and skill training activities for architects, plumbers and planners to provide technical knowledge on circular sanitation solutions	Rés'eau 24 (FR); Eawag Toolbox (CH); Urivalyon (FR)

Implement

Adapt urban infrastructure to adopt circular sanitation in:	Examples
Temporary and off grid infrastructure: install portable toilets for urine collection from events and temporary pop ups, as well as remote areas and small settlements	Sanitation360 (SE); Darmstadt (DE); Cologne (DE); Leipzig (DE); Abereus (DE, AT, CH); mountainous areas (FR)
Public buildings: install circular sanitation infrastructure in schools, universities, administrative buildings, cultural centres, sport stadiums, transport nods or community centres.	Saint-Germé School (FR); BlueFactory (CH)
Spatial planning: promote circular and decentralised sanitation infrastructure in spatial planning documents and large-scale building projects	Block 6 (DE), Sneek (NL); Ile de France Master Plan (FR)
Wastewater management infrastructure: adapt WWTPs to enable the recovery of nutrients e.g. through struvite precipitation, ammonium stripping, membrane-based separation, bio-based or physiochemical technologies.	Braunschweig (DE); Ringsend (IE); Limassol (CY); P2GreeN Pilot (ES)
Outlet for recovered nutrients: consider outputs from circular sanitation processes as sources of income (e.g. biogas, recovered water, heat, recycled fertilisers). Recycled fertilisers can be applied to green public spaces or sold to farmers to stimulate the demand and increase social acceptance.	Nieuwe Dokken (BE); Helsingborg (SE)

Support

Provide financial and non-financial resources for circular sanitation through:	Examples
Research and innovation funds to develop alternative treatment technologies and recycled fertiliser production, and explore possibilities to address regulatory gaps	ZirkulierBAR (DE); La Fumainerie (FR); CirculaRise (DE)
Subsidies and grants for construction and agriculture, e.g. through resource efficiency, decarbonisation and drought prevention funds	Andalusia (ES); Berlin WFB 2023 (DE); FRL KrW/2024 (DE)
Taxes and tariffing schemes incentivising water reuse, decentralised wastewater treatment and pollution reduction	Murcia (ES); Geneva (CH)
Equipment, infrastructure and land to meet the logistical needs related to the production transport, storing of recycled fertilisers	KOLOS (FR)

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Glossary

CO_2	Carbon Dioxide
GHG	Greenhouse gas
N	Nitrogen
NGO	Non-Governmental Organisation
N_2O	Nitrous oxide
P	Phosphorus
SDRIF	Schéma directeur de la région Île-de-France (Master Plan for the Île de France Region)
SVDP	Saint-Vincent-de-Paul (neighborhood in Paris, FR)
WWTP	Waste Water Treatment Plant

SECTION I

An introduction to circular sanitation

This section introduces the concept of circular sanitation and presents the upstream and downstream solutions and technologies that enable circular approaches. It highlights the environmental, economic and social benefits of these solutions across diverse urban, peri-urban and rural contexts. An overview of the EU regulatory frameworks is also provided.

A. Why do we need circular sanitation?
The challenges of the conventional sanitation system.

B. What is circular sanitation?
Defining upstream and downstream solutions for circular sanitation, introducing the target audience.

C. Benefits of circular sanitation:
Reducing the costs of wastewater treatment, decreasing water pollution and greenhouse gas emissions, supporting local resilience and economy.

D. What does the regulation say?
An overview of the key EU legislations relevant to circular sanitation, opportunities for local authorities.

E. Circular sanitation for your city/region:
The relevance of circular sanitation for rapidly growing cities, declining towns and tourist areas; large transport, educational or cultural infrastructure; new housing developments; mountainous areas and natural reserves; islands; cities and regions with green areas; and peri-urban areas with agricultural land.



Image: jobescompany.com

A. Why do we need circular sanitation?

Introduction

To feed our population, agriculture depends heavily on mineral fertilisers rich in key nutrients such as nitrogen (N), phosphorus (P) and potassium (K), which are essential for plant growth. These nutrients later cycle through our bodies via the food we eat, ending up in wastewater through excretion.

A few centuries ago, the nutrient-rich excreta was used for fertigation in agriculture (Esculier 2018). Nowadays, the sanitation system is linear: nutrients are removed from collected wastewater and discharged as waste sludge in landfills or as pollutants in rivers and oceans. Meanwhile, the production and import of synthetic fertilisers comes with significant financial and environmental costs (OCAPI 2023). A circular sanitation approach aims to recover and reuse the valuable resources present in wastewater instead of disposing them as waste.

Challenges of the linear sanitation system

The linear sanitation system faces multiple challenges related to wastewater treatment capacity, pollution of water bodies, high financial and energy costs, and dependency on imported fertilisers. The shift to a circular sanitation system could contribute to addressing these challenges (Krause et al. 2021), providing many benefits which are outlined in Section I.C.



Dependency on imported fertilisers:

Phosphorus used in agriculture comes mainly from phosphate rock, a non-renewable mineral resource mined in non European countries, primarily Morocco. For mineral N fertilisers, the production process is mostly located in countries with high supplies of natural gas, such as Norway or Russia. Thus, there is a growing concern about Europe's dependency on imports for future supply of fertilisers needed for farming (Statista Research Department 2025; EC 2025).



Energy and financial costs:

To address increasing volumes of wastewater and higher nutrient pollution, the linear sanitation system requires energy-intensive technologies and costly infrastructure upgrades. The increased operational costs result in higher water bills for households.



Wastewater treatment plant (WWTP) capacity and nutrient pollution:

Many WWTPs operate beyond their limits, especially in cities with population growth, seasonal tourism and changing environmental conditions, such as increased rainfall and storms (Aziz et al. 2024; Rodríguez-Alcántara et al. 2024). This leads to combined sewer overflows that release untreated wastewater into rivers, lakes, and other water bodies. The excess of nutrients contained in wastewater, like N and P, disrupts aquatic fauna and flora and can lead to eutrophication (Carstensen et al. 2014).

B. What is circular sanitation?

Definition

Circular sanitation - often referred to as sustainable or resource-oriented sanitation - can be defined as a system of managing human excreta (urine and faeces) and wastewater that focuses on recovering nutrients and organic matter back into the environment, typically for agricultural use (fertiliser production and fertigation), thus limiting the consumption of potable water and reducing environmental impact (SuSanA 2008).



Figure 1: The linear sanitation approach

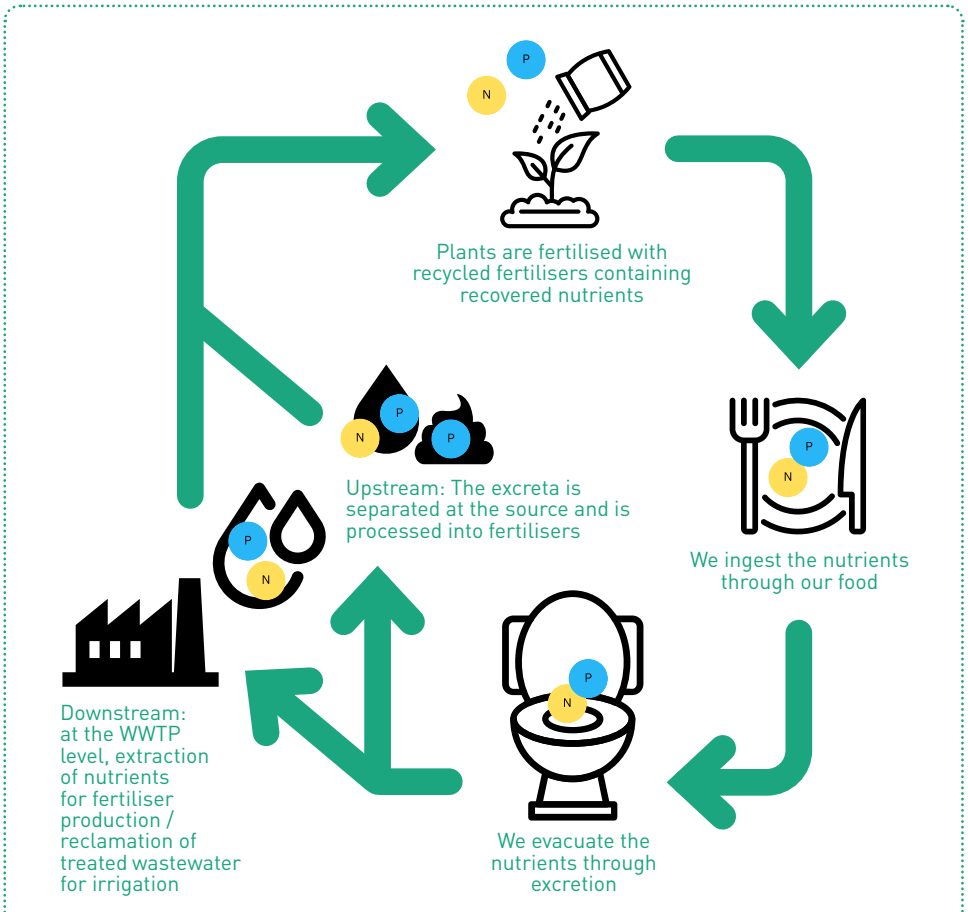


Figure 2: The circular sanitation approach

Solutions for circular sanitation

Circular sanitation involves various types of infrastructure and technologies at different stages of the sanitation value chain. These can be classified into two main categories which will be developed in this section: upstream solutions, i.e. the source separation of urine and faeces, and downstream solutions, i.e. wastewater recovery and reuse. Other resources can be recovered and reused including grey water, biogas, energy and heat.

Table 1 provides a non-exhaustive overview of the technologies for source separation and water reclamation, together with examples from the P2GreeN project.[1]

Collection method	Type	Recovered resource	Treatment method(s)	Reuse
Urine-diverting flush toilets	Upstream	Yellow water / Urine	Storage, drying Complementary: concentration, nitrification, stabilisation	Fertilisation of crops & green spaces
Urine-diverting dry toilets	Upstream	Urine and faeces	Urine: storage, drying, complementary: concentration, nitrification, stabilisation Faeces: Sanitisation, composting, screening	Urine: Fertilisation of crops and green spaces Faeces: Production of compost, fertiliser, biochar, or biogas
Water reclamation	Down-stream	WWTP effluent (nutrient-rich wastewater)	Primary, secondary and tertiary wastewater treatment, disinfection	Irrigation of crops and green spaces

Table 1: Technologies for circular sanitation

1 All presented examples are referenced by unique numbers throughout the report. A complete list of all case studies is provided in Table 3 in the Annex.

Upstream or downstream solutions?

The choice of approach mainly depends on the context in which it is being implemented. Upstream solutions are often more efficient for recovering nutrients and reducing the burden on treatment plants. They work especially well in individual buildings, in new developments, or in areas which are disconnected from existing sewer networks. Downstream solutions are more suitable for dense settlements and areas where wastewater treatment infrastructure is present at scale. In many cases, a combination of both approaches offers the most effective path toward circular sanitation.

Upstream solutions: urine and faeces source separation and reuse

Upstream solutions, also called source-separation, refer to the separation of human excreta as it enters the toilet. Through infrastructure such as redesigned toilets or toilet attachments, urine and/or faeces can be collected and treated separately for further fertiliser use.

Urine contains the largest proportion of valuable nutrients in human excreta, such as nitrogen and phosphorus. Urine can be used as a fertiliser through treatment processes such as storage, nitrification or concentration (OCAPI 2023). **Faeces** also contain valuable nutrients, such as organic carbon and phosphorus. Faeces (e.g. in the form of dry toilet contents) can be treated through composting systems, pyrolysis units and anaerobic digesters, which convert organic mass into reusable resources such as compost, biochar, sludge fertiliser and biogas (Beneker et al. 2024).

Resources:

- Overview of source-separation technologies: Arceau Guide (FR); DWA Guide (ENG).
- OCAPI Practical Information Sheet on urine use in agriculture.
- DIN SPEC 91421 for the quality assurance of recycling products from dry toilets for use in horticulture

Example (16): German P2GreeN pilot

Goldeimer developed a sanitisation, composting and screening process for faces collected from dry toilets at festivals. The compost is used for fertilisation since 2025.



Operation of faecal matter composting in Ollsen (DE).
Source: Goldeimer

Example (51): Swedish P2reeN Pilot

With Sanitation360's technology, urine is collected at the source, then stabilized and dried to produce nutrient-rich fertilizer pellets compatible with standard farming equipment. The fertilizer is currently being used to grow barley for a local brewery's beer production.



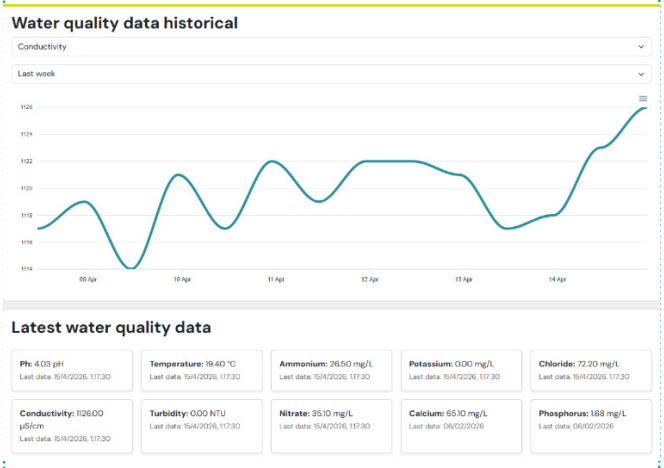
Urine fertiliser as solid pellets.
Source: Sanitation360

Downstream solutions: wastewater recovery and reuse

Downstream solutions focus on recovering resources (water, energy or nutrients) from wastewater once it reaches the treatment facilities. Today's wastewater treatment technologies - such as membrane and disc filtration, electrolysis, treatment wetlands, and anaerobic ponds - can meet the quality, health, and safety standards required to make reclaimed water suitable for agricultural irrigation, one of the most water-intensive sectors (Casielles et al. 2022). Smart fertigation solutions[2] contribute to reducing nutrient release in the groundwater and decreasing fertilizer demand.

Example (25): Spanish P2GreeN pilot

In collaboration with the municipal wastewater treatment plant of Algarrobo, Bioazul set up a further treatment for the reclaimed water to be used to irrigate mangos and avocados cultivated by TROPS. A smart fertigation tool is used to adjust the amount of nutrients added to the crops, reducing the risk of pollution of surface and groundwater.



Algorithm and web-based interface for nutrient management and monitoring. Source: Agualytics

Resource:

- The FIT4REUSE project provides an overview of water reclamation technologies for each water quality classes according to EU regulations[3] (Casielles et al. 2022).

Figures and facts

- Of the 40 billion m^3 of treated urban wastewater generated annually, only 1 billion m^3 is being reused which constitutes a mere 2,5% (EC 2025).
- Human urine and faeces contribute significantly to the nutrient load to a central sewage system, i.e. up to 80% of N and 60% of P in wastewater (Häfner et al. 2023).
- Toilet waste is about three times less contaminated by heavy metals than manure from cattle and pigs (Larsen et al. 2013).
- Composting human excreta destroys pathogens, bacteria, viruses and parasites. This process can take between 2 and 14 months (WHO 2018).
- Pharmaceutical residues degrade faster in the soil than in water (FNAB 2024).
- In the Île-de-France region, 6.3 million m^3 of urine are produced annually, which corresponds to 45,000 tonnes of nitrogen (N) and 3,000 tonnes of phosphorus (P). This can be compared to the annual consumption of mineral nitrogen and phosphorus in agriculture, estimated at 65,000 tonnes and 7,600 tonnes respectively (AESN 2025).

2 Smart fertigation is the controlled delivery of water and fertilisers through irrigation systems using sensors or automation to optimize fertiliser and water use efficiency while minimizing nutrient losses and environmental impacts.

3 Treatment of urban wastewater is regulated by requirements set out in Directive 91/271/EEC.

Introducing the target audience

To implement circular sanitation at local and regional levels, collaboration is required across different sectors, such as spatial planning, water, food and agriculture. Through their competences, cities and regions are the best placed to bring together and have influence over stakeholders coming from these different sectors (CCRE CEMR 2021). This document often refers to cities and regions, or to local and regional governments. In fact, this includes all subnational governments and public administrations, each of them having distinct roles and responsibilities, such as:

Regions oversee regional development, including spatial and urban planning, housing, agriculture, tourism, wastewater treatment, and environmental protection. Their powers differ widely: for example, Spain's decentralised system grants broad regional authority, while the Netherlands' centralised model limits regional autonomy (CCRE CEMR 2021).

Cities and municipalities manage spatial and urban planning, agriculture, and rural development. They are often responsible for schools, tourism, and recreational areas (CCRE CEMR 2021), which often require tailored sanitation systems.

River basin authorities manage water within defined basins, operating at regional (DE, NL) or national (UK, ES) levels. Their tasks include strategic planning, policy development (e.g. nutrient load targets), monitoring, regulatory oversight (e.g. discharge limits), and incentives such as pollution charges. In France, some basin authorities have developed strategic documents which address nutrient overloads (see Section II.A. STRATEGISE).

Public water utilities manage drinking water supply and wastewater collection and treatment. Their role is primarily operational, implementing higher-level strategies. Guided by regulations or sustainability goals, they can advance circular sanitation through water reuse, nutrient recovery, and energy efficiency initiatives.

Wastewater management companies can be public (e.g. Germany, the Netherlands, Austria) or partly privatized (e.g. France, Spain). They operate and maintain WWTPs, manage sludge, and ensure compliance with EU standards. Though mainly operational, they can set proactive targets for nutrient recovery and circular practices (see Section II.A. STRATEGISE).

Irrigation consortia are cooperatives of farmers managing collective irrigation systems. They distribute water for agriculture under regional water policies and maintain infrastructure. Their authority lies in local water management, while regional or basin authorities set broader strategic goals.

C. Benefits of circular sanitation

This section offers an overview of the multiple benefits offered by the circular sanitation approach.



Brings the costs of sanitation down:

Wastewater treatment plants remove nitrogen and phosphorus from wastewater to prevent water pollution and meet environmental discharge standards. The process of nitrogen removal within WWTPs is highly energy- and space-intensive (Häfner et al. 2023), with high operational costs. Source-separation reduces the amount of N and P that need to be removed from wastewater and can help to offload existing WWTPs, which increasingly face capacity issues in growing cities or areas with seasonal tourism (L'Institut Paris Région et al. 2024; Aziz et al. 2024; Rodríguez-Alcántara et al. 2024).



Reduces pressures on water bodies:

Circular sanitation contributes to improving local water quality by reducing nutrient pollution. This is a crucial aspect as over 60% of the EU water surfaces (rivers, lakes, transitional and coastal waters) do not reach a good ecological status (EEA 2024). Nutrient recovery reduces the amount of P and N entering water bodies, which are the main cause for eutrophication4. It has been shown that urine source separation to produce urine-based fertilisers has the potential to reduce eutrophication by 40% to 60% by virtue of diverting nutrients away from wastewater treatment and aquatic discharge and by enabling direct agricultural reuse of nutrients (Martin et al. 2023). When combined with smart fertigation5, the use of recycled fertilisers also reduces groundwater contamination (P2GreeN 2023 - Axarquia Region).



Promotes decentralised and flexible sanitation infrastructure:

Centralised sanitation systems i.e. large scale sewer networks carrying wastewater to central WWTPs, are often expensive to build and maintain. Upstream solutions for circular sanitation largely rely on decentralised infrastructure which treat waste close to where it is produced, such as composting toilets, septic tanks, and small-scale treatment units. These decentralised sanitation systems are smaller, more flexible, cost-effective, and easier to implement in remote or rural areas (L'Institut Paris Région et al. 2024). Another key aspect is the reversibility of upstream solutions. This flexibility encourages a more experimental approach and allows technologies to be tested even before all issues are fully resolved, which increases user acceptance (Joveniaux et de Gouvello 2021).

4 Eutrophication is a phenomenon where excess nutrients (especially N and P) accumulate in a water body, causing rapid growth of aquatic plants and algae, ultimately leading to the suffocation and death of other aquatic organisms.

5 Smart fertigation is the controlled delivery of water and fertilisers through irrigation systems using sensors or automation to optimize fertiliser and water use efficiency while minimizing nutrient losses and environmental impacts.

Reduces greenhouse gas (GHG) emissions:

Several sources of greenhouse gas emissions can be reduced through the transition towards circular sanitation systems. The production of mineral fertilisers, mostly based on fossil energy, currently represents 1.3% of global CO_2 emissions (IFA 2024). At the WWTP level, nitrogen removal is the most energy-intensive part of the treatment process (Häfner et al. 2023) and can release significant amounts of nitrous oxide (N_2O), a gas with a global warming potential 273 times higher than CO_2 (Song et al. 2024). Local fertiliser production also reduces the transport emissions linked to imported fertilisers.

Improves local resilience:

Diversifying sanitation infrastructure strengthens resilience of communities and natural ecosystems. In drought-prone regions, wastewater reclamation can significantly reduce freshwater demand. Simultaneously, the production of recycled fertilisers lowers dependency on imports, which is particularly relevant in the face of geopolitical uncertainty and a volatile global fertiliser market (DWA 2010; EC 2019). During crises, circular sanitation solutions, such as urine dehydration systems, can provide hygienic, space-efficient alternatives, reducing urine storage volume by over 90% (Senecal et Vinnerås 2017). Moreover, source separation not only protects local water bodies from nutrient pollution but also helps mitigate public health risks, including the spread of antimicrobial resistance (Londong et al. 2023).

Supports local economy:

The production of domestic fertilisers offers a promising local and profitable source of essential nutrients. In 2017, the EU fertiliser market was valued at €17 billion (EC 2019), yet it still relies on imports for 30% of its N and 68% of its phosphate consumption (EC 2022). The price of locally produced recycled fertilizers is more stable than that of synthetic fertilizers, whose cost strongly depends on volatile natural gas prices.

At the same time, reducing freshwater demand can lead to significant cost and energy savings (Anand et Apul 2011). Expanding the European water industry by 1%, for example through measures such as water reuse, could generate up to 20,000 new jobs (EIB 2022). Additionally, improving the quality of local lakes and rivers not only supports environmental goals but can also enhance tourism opportunities, particularly in eco-tourism and water sports.

D. What do the regulations say?

Circular sanitation is an emerging concept. Rather than being governed by a single law, it is addressed through different parts of several EU Regulations and Directives. The most relevant rules fall into five connected policy areas: waste, wastewater, water reuse, fertilisers, and organic farming.

Waste Framework Directive (Directive 2008/98/EC). This directive sets the overall rules for waste management in the EU.

- Faecal matter may fall outside the scope of the directive in certain cases.
- Wastewater is excluded where it is already covered by other EU legislation, such as the Urban Wastewater Treatment Directive. Because "wastewater" is not precisely defined, Member States and local authorities have some flexibility in how they interpret and regulate it.
- Materials can be declared "no longer waste" (end-of-waste status) if they have a clear use, meet quality standards, and pose no risk to health or the environment. This can be decided through EU or national criteria or on a case-by-case basis.

Urban Wastewater Treatment Directive (UWWTD – Directive 2024/3019, revised). The directive focuses on protecting human health and the environment from wastewater discharges. Key elements include:

- Ensuring safe treatment and discharge of urban wastewater.
- Introducing extended producer responsibility (EPR) for pharmaceutical and cosmetic producers to reduce harmful substances entering wastewater.
- Requiring nutrient removal through advanced treatment where necessary.
- Encouraging nutrient recovery from wastewater and sludge.
- Promoting reuse of treated urban wastewater, provided environmental objectives and ecological flows are protected and rules under the Water Reuse Regulation are followed.

Some aspects remain under discussion at EU level, including how source-separated urine should be defined and regulated. In cases where wastewater is not discharged, other legislation such as the Waste Framework Directive may apply instead.

Water Reuse Regulation (Regulation 2020/741). This regulation establishes minimum safety standards for reusing treated wastewater in agricultural irrigation. It requires:

- Risk management plans,
- Monitoring of water quality,
- Transparency and public information.

Member States may adopt stricter standards, decide not to use reclaimed water, or extend its use to other applications (such as industrial uses) under national rules.

Fertiliser Products Regulation (Regulation 2019/1009). This regulation governs fertilising products that can be marketed across the EU.

- Some recycled materials are already included, such as compost, CMC (Component Material Category) 3 and precipitated phosphate salts, CMC 12.

- Fertilisers derived directly from human urine or faeces are not yet specifically regulated under this framework.
- The regulation focuses on placing fertilisers on the market, while rules for their use on land remain mostly national, subject to other EU legislation such as the Nitrates Directive.
- The European Commission is currently studying whether human-derived nutrients could be included in the future.

Organic Farming Regulation (Regulation 2021/1165). In organic farming, composted or liquid animal excrements may be used as fertilisers, subject to certain restrictions.

EU legislation takes two main forms:

- Regulations apply directly in all EU Member States and set uniform rules.
- Directives define a common objective but allow countries to decide how to implement it in national law.

Because directives must be transposed into national legislation, rules can vary between countries. This is why the regulatory framework for circular sanitation may appear fragmented across Member States.

Furthermore, as part of the European Green Deal, the EU has set the goal of cutting nutrient losses to freshwater by 50% by 2030 through the Farm to Fork Strategy (2020), the Zero Pollution Action Plan (2021), and the Integrated Nutrient Management Plan (INMAP, 2023). Achieving this target requires strategies such as reducing excess use of mineral fertilisers. This creates both regulatory opportunities and market demand for scaling up secondary nutrient sources, which can substitute synthetic inputs while lowering nutrient losses.

National level

At the country level, rules can be fragmented. In the EU system, a regulation is a binding rule with fixed methods that applies directly across all Member States, while a directive sets a binding goal but leaves flexibility to Member States on how to achieve it. Directives require transposition into national law, which explains differences in national approaches.

Resource:

- More details about Circular Sanitation legislation in the P2GreeN "Scoping review" describing the status of the legislative framework and the upcoming P2GreeN Final Report describing the status of the legislative framework, future perspectives and recommendations both in pilot and follower regions.

What can local and regional auhtorities do?

- Use their control over waste and wastewater management to identify and make use of the flexibility within EU legislation to adopt rules that allow flexible approaches to the collection, treatment, and reuse of faeces and urine by organisations with suitable innovative processes and products.
- Authorise and monitor water reuse projects, for example by reviewing, approving, and overseeing the risk management plans for agricultural water reuse developed by water reuse operators, in line with the JRC technical guidance.
- Facilitate the use of fertilising products covered by EU or national regulations, including through the principle of mutual recognition: if a product is already authorised in one EU country, authorisation may be sought in another Member State on the basis of that approval.
- Explore solutions and influence upcoming regulations by participating in public consultations (e.g., the Circular Economy Act and the Fertilising Products Regulation consultations, which recently concluded), engaging in regulatory sandbox networks, and contributing to specialised platforms such as the European Sustainable Phosphorus Platform (ESPP).

Example (1): VunaNexus (CH)

Aurin is a urine-based fertiliser that can be produced locally using Vuna Nexus technology. It has received national authorisation within the EU first in Austria, and subsequently in France through mutual recognition (Vunanexus 2025; E-Phy 2025).



Aurin fertiliser.
Source: Vuna.ch

Example:
Expert consultation (DE)

Goldeimer GmbH, AGRA; VunaNexus and IGZ joined a German Regulatory Sandboxes Network for the development of legislation aiming to facilitate novel governance frameworks and market entry of innovations with the Regulatory Sandboxes Innovation Portal as contact point (BMWE 2025).

E. Circular sanitation for your city / region

Circular sanitation can address a variety of challenges related to local socio-economic or geographical factors. It is particularly relevant to certain geographical contexts and offers substantial benefits as compared to conventional sanitation. At the same time, these different contexts can help determine which type of solution should be chosen: upstream, downstream or a mix of upstream and downstream solutions. More details on the implementation of circular sanitation solutions in cities and regions can be found in Section II.D. IMPLEMENT.

Rapidly growing cities, declining towns, tourist areas



Upstream solutions - benefits and opportunities:

- Adaptable to varying influx of visitors
- Offloads local WWTPs through reduction of nutrient load
- Energy and water savings

Example (44): AFAS Live (NL)

The AFAS Live event complex in Amsterdam uses water-free and separative urinals for phosphate recovery (Saniwijzeer 2025).



Water-free urinals AFAS Live.
Source: Saniwijzer.nl | HMH

New housing developments

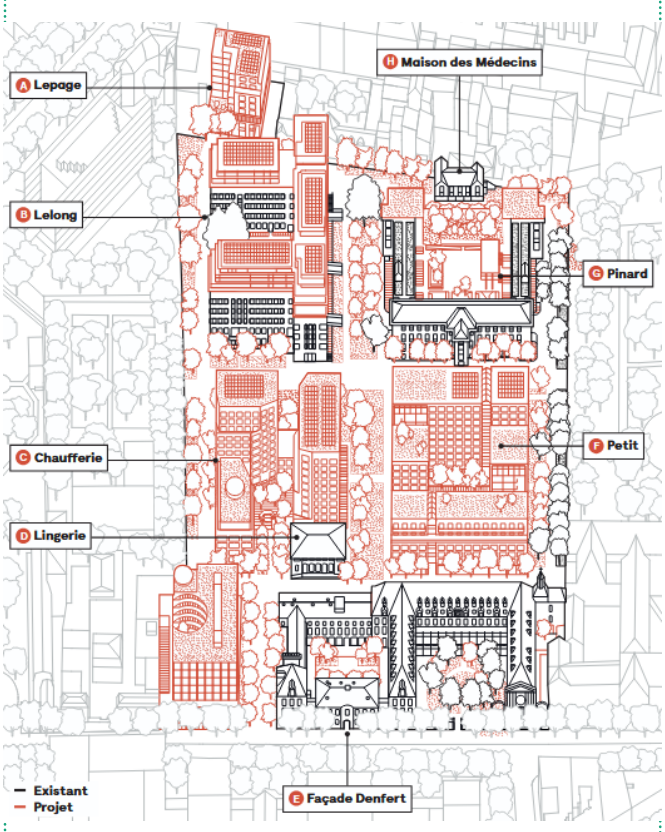


Upstream solutions - benefits and opportunities:

- On-site collection, separation and treatment infrastructure from the start
- Energy and water savings

Example (31): Paris SVDP (FR)

The Saint-Vincent-de-Paul (SVDP) neighbourhood is being constructed with urine diversion flush toilets in the buildings, a separate urine collection network and a local treatment plant (Joveniaux et al. 2022).



Plan of Saint-Vincent-de-Paul.
Source: Paris Métropole Aménagement | anyojibeltrando

Mountainous areas & natural reserves



Upstream solutions - benefits and opportunities:

- Decentralised system for remote areas with limited accessibility
- Lightweight or temporary infrastructure
- Local use of produced fertiliser and reclaimed water
- Water saving in areas with limited freshwater supply Preserves local biodiversity by limiting nutrient discharge in local water bodies
- Low maintenance necessary

Example (40): Alps and Pyrénées (FR; CH)

Several examples of dry toilets and composting systems exist in the Pyrénées and in the Alps. In some cases, the compost is valorized locally, while in others it is transported to neighbouring municipalities (Moretto et Anais 2018).



Refuge de l'Aigle, Mont Blanc.
Source: Pierre Et Terre 2018 | Loïc Perrin

Islands



Mix of upstream and downstream solutions - benefits and opportunities:

- Decentralised system for remote areas with limited accessibility
- Local use of produced fertilisers and reclaimed water
- Preserves local biodiversity by limiting nutrient discharge in water bodies

Example (8): Limassol (CY)

In Cyprus, the local WWTP includes N and P tertiary treatment and reuse for local irrigation purposes (Maffetone et Gawlik 2022).



View of the Limassol – Amathus water reuse system (Cyprus).
Source: Maffetone et Gawlik 2022

Cities & regions with green areas

Mix of upstream and downstream solutions - benefits and opportunities:

- Local use of produced fertilisers
- Creation of a public market to incentivise circular sanitation
- Reduces dependency on imported fertilisers, strengthens local resilience
- Offloads local WWTPs through reduction of nutrient load

Example (31): Paris SVDP (FR)

Paris is planning to use the urine-based fertiliser produced in SVDP internally on the city's green spaces. This local application has facilitated the assessment of agronomic quality, addressed health and safety concerns, and supported the licensing process. The purchase of the urine-based fertiliser at the same price as liquid fertilisers enables the operation costs to break even (Joveniaux et al. 2022).

Peri-urban areas surrounded by agricultural land

Mix of upstream and downstream solutions - benefits and opportunities:

- Local use of produced fertilisers and reclaimed water
- Addresses farmer's needs

Example (3): The Vergers (CH)

The Vergers agricultural cooperative uses the fertilizer produced in the housing project Équilibre, which includes buildings in peri-urban Geneva (CH) close to agricultural land (Joveniaux et al. 2023).



Farm Les Planchers, Les Vergers (Meyrin).
Source: Coopérative Equilibre

SECTION II

How local & regional governments can implement circular sanitation

This section aims to present local and regional governments which levers they can use to accelerate the transition towards a circular sanitation system within their territory. The section is divided in five subsections.

All examples presented in this section are referenced by unique numbers. A complete list of all case studies is provided in Table 3 in the Annex.

A. Strategise:
how can local and regional authorities embed circular sanitation in their strategies and action plans?

B. Educate:
how can local and regional authorities raise awareness among citizens, farmers and key stakeholders to facilitate the adoption of circular sanitation?

C. Mobilise:
how can local and regional authorities engage and collaborate with public and private stakeholders, ensuring cross-sectoral and multilateral cooperation?

D. Implement:
how can local and regional authorities adapt their infrastructure to implement circular sanitation solutions?

E. Support:
how can local and regional authorities provide financial and non-financial support to research, initiatives and actors focusing on circular sanitation approaches?



Image: ecomaxglobal.com

A. STRATEGISE
Embed circular sanitation in strategies and action plans

As elected bodies, local and regional governments are responsible for developing long-term visions and strategies for their territories. This section addresses how cities and regions can embed circular sanitation into sectoral strategies and action plans (water, agri-food, climate or resilience) as well as in overarching and cross-cutting roadmaps.

Strategies set a long-term vision, define targets and align the priorities of stakeholders from different sectors (Ellen MacArthur Foundation 2019; Lander Svendsen et al 2020). They are translated into action plans, defining a set of actions to be implemented for different sectors, policy areas or organisations. Whether it is in sectoral action plans or in general strategies, embedding circular sanitation nto these documents can greatly support its development.

Here, political buy-in - or the active support and commitment of political stakeholders for a project or policy - is key. Public institutions can contribute to bringing circular sanitation in the political agenda by raising awareness among elected officials and decision makers across public departments (Joveniaux et de Gouvello 2021).

Embedding circular sanitation into water strategies and action plans

Cities and regions can integrate circular sanitation into existing strategies and action plans to set a long-term vision for this approach. Currently, circular sanitation targets are often specific to the water sector, and are set by water companies or water agencies themselves.

Example (50): Stockholm's Water and Waste Utility targets (SE)

Stockholm's Water and Waste Utility sets targets of circular resource use at neighbourhood scale, including the reduction of chemical fertiliser dependency through reused sludge nutrients. It provides guidelines and recommendations for actors at each stage of the value chain, housing, transportation, storage, and crop growing (Johansson 2000; Skambraks et al. 2017).

Example (39): water management strategy and plan of the AESN (FR)

The climate adaptation and the water management plans of the Water Agency of Seine Normandy (AESN) both include actions to reduce nutrient overload, including to improve sanitation and reuse of waste water, valorise sewage sludge, or restore cycles or subproducts through source separation or dry toilets (AESN 2022; AESN 2023).

Embedding circular sanitation into other sectoral strategies and action plans

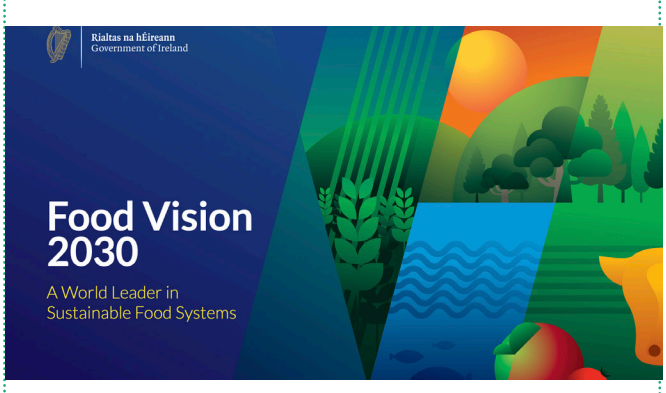
Beyond the water sector, cities and regions can integrate circular sanitation into food, energy, resilience or climate strategies and roadmaps. Objectives can be related to funding, infrastructure, or concrete action plans. For example, setting goals for recycled fertiliser usage in food strategies represents a strong lever to achieve a circular and local food chain, while creating policy-driven demand for fertilisers.

Embedding circular sanitation into overarching strategies

The integration of circular sanitation in **overarching strategies and roadmaps** demonstrates political buy-in from municipal or regional councils, since it shows an interest in the topic of circular sanitation and a willingness to explore related solutions. This creates a favourable environment for the emergence of niche projects and the development of experimental and innovative solutions (Joveniaux et al. 2023).

Example (42): Irish Food Vision

The Irish Food Vision 2030 Strategy includes the objective of reducing the nitrous oxide emissions associated with chemical fertiliser use by 50% by 2030 (Irish Department of Agriculture, Food and the Marine 2022).



Irish Food Vision.
Source: Department of Agriculture, Food and the Marine

Example (26): The Île-de-France Region Master Plan (FR)

The Schéma directeur de la région Île-de-France (SDRIF-E) is a strategic document which frames the planning and support of urban growth. It covers 1,276 municipalities, addressing topics such as green spaces or regional transport. It promotes circular sanitation through the Regulatory Orientation OR 37, which mandates new developments to reduce the discharge of N & P in the sanitation network. The SDRIF will be translated into local urban planning documents by 2029 (Région Île-de-France n.d.).



Schéma directeur de la région Île-de-France (SDRIF).
Source: Région Ile de France

B. EDUCATE
Raise awareness amongst key stakeholders

Human excreta is a taboo in European society. Transitioning to circular sanitation requires challenging this taboo by raising awareness and promoting social acceptance. This section addresses how local and regional governments can do so through awareness-raising campaigns, educational programmes, experience sharing platforms, community events, merchandising or public installations.

Introduction

One of the most important obstacles to the implementation of circular sanitation is the lack of awareness or knowledge among key stakeholders of the sanitation value chain, but also among citizens and end-users of the sanitation infrastructure (McConville et al 2017; Joveniaux et al. 2023). Cities and regions can play a key role in raising awareness among farmers, citizens, water utilities and relevant municipal departments about the benefits and opportunities offered by circular sanitation approaches. Sharing clear and accessible information is a powerful way to promote their adoption. For example, Giberti et Dereli (2022) show that the percentage of individuals in favour of urine-based fertilisers increased by 15% after reading information material.

Education campaigns

Cities and regions can **develop awareness-raising programs** about source separation and the use and benefits of recycled fertilisers, in order to address misconceptions and provide accurate information about the safety and the benefits of these approaches. This increases the likelihood that the infrastructure is accepted and properly used by end users, while a lack of awareness and engagement tend to create resistance amongst them (Smart City Sweden, n.d.).

Example (31): workshops for future SVDP inhabitants (Paris, FR)

The City of Paris trained future SVDP inhabitants on the use of the sanitation system. They were shown an explanatory video, participated in workshops, and were allowed to test a demonstration installation before moving in the neighborhood. After the workshop, over 80% of surveyed future residents (n=46) were in favour of the solution, and only 11% expressed discontentment regarding the usage restrictions (Joveniaux 2024).

Cities and regions can support **educational programmes for children and young citizens in schools, science parks or universities**, through workshops on the benefits and possibilities for wastewater reuse, or through the integration of circular sanitation and nutrient recovery in the curricula of higher educational programmes.

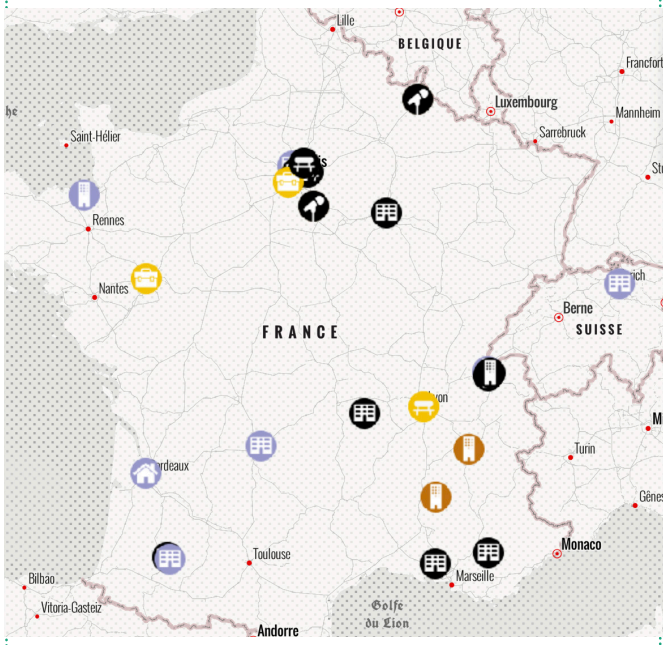
Example (51): educational event by Sanitation360 (SE)

Sanitation360 organised a week-long event for the World Toilet Day, using playful methods to familiarize children with the topic of nutrient recovery in urine and faeces (Sanitation360 2024).

Cities and regions can **share best practices for circular sanitation** and make practical knowledge publicly accessible, e.g. through online sharing platforms. For more tailored communication, local governments can directly address the concerns of specific stakeholder groups e.g. publication in popular agricultural journals to address the applications of recycled fertilisers for farmers.

Example (36): Toilettes Fertiles (FR)

The experience sharing platform Toilettes Fertiles provides an overview of source separation initiatives in France, with a description of the technology, governance model, challenges and learnings for each case study (L'Institut Paris Région et al. 2024).



Map of sites with source seperation solutions [screenshot].
Source: Toilettes Fertiles Platform

Cities and regions can use several methods and products to make circular sanitation more entertaining and playful to ensure acceptance across generations and social groups.

Example (5): Toilet Time Travel (CH)

This public event, organised by VaLoo, invites citizens to learn about the evolution of the sanitation system over time and to participate in collaborative sessions in order to discuss and imagine the innovations of tomorrow (VaLoo 2024).



Toilet Time Travel – General Meeting (Bern).
Source: VaLoo

Cities can also raise awareness and increase engagement among citizens through **community campaigns and events.**

Example: Video game

The P2GreeN project is currently developing a video game to educate on circular sanitation and simulate its different impacts in rural and urban contexts. The game will be available in 2026.

Example (14; 30): Merchandising

Both Goldeimer and OCAPI advertise merchandise to promote circular sanitation in a playful manner, including games, books, and other gift ideas.



A urine reservoir with a sprinkler system.
Source: OCAPI Gift Ideas

Example (20): P-Bank (DE)

At the Bauhaus Institute for Infrastructure Solutions in Weimar, a separative toilet for phosphorous recovery is used to showcase information on P resources and their use in fertilisers (P-Bank 2025).



Picture of the P-Bank.
Source: P-Bank

Public installations

Regions and cities can showcase source separation and fertiliser application in public spaces to inform how and why excreta are being collected and used.

Example (41): Rediscovery Centre (IE)

The Rediscovery Centre in Dublin (IE) is a demonstration centre of the circular economy. The toilets of the center have a collection and treatment system onsite. Excreta are turned into compost which is used on the garden beds for landscaping and plants. A large infographic along the wall informs visitors of their green contribution (The Rediscovery Centre 2025).



Rediscovery centre (Dublin).
Source: Rediscovery Centre

C. MOBILISE
Engage and collaborate with public and private stakeholders for multi-level and cross-sectoral governance

Circular sanitation spans across three sectoral value chains, namely water management, agriculture and the built environment, each of which involves a diverse landscape of stakeholders on a given territory, such as public institutions, farmers, businesses, NGOs and academia. This is where local and regional governments can come into play: as publicly legitimized and territorially grounded actors, they are in a unique position to coordinate, mediate and align actors across governance levels and sectors (Joveniaux et de Gouvello 2021).

By involving the private sector, academia, or civil society early on in the decision making processes, cities and regions can raise awareness, uncover unexpected opportunities, and create a sense of commitment amongst key stakeholders (Ellen MacArthur Foundation 2019; ERRIN 2025).

In addition, the involvement of end users reinforces the social acceptance of circular sanitation solutions, as the systems are adapted to the needs and preferences of inhabitants rather than being imposed on them (Joveniaux et al. 2023).

Resource:

- the P2GreeN D4.3 report provides a summary of stakeholder engagement strategies for different target groups (Schmid et al. 2024).

Multi-level governance

Circular sanitation involves a wide range of responsibilities and competences that are distributed across different levels of government, municipalities, regions, national agencies, and specialized bodies such as wastewater management companies and river basin authorities. This can lead to siloed work, and conflicts between regulations and competences. This is why cities and regions have to ensure collaboration and coordination across all governance levels: internally (between the city departments), locally, regionally, and nationally.

Collaboration within local and regional administrations

Circular sanitation cuts across departments boundaries, making it necessary to establish **a cross-collaborative body, responsible for the coordination between different departments and agencies**.

Example (31): Mission Résilience (FR)

The Paris City's General Secretariat opened a special department - Mission Résilience - to overcome the division between the City of Paris, the Paris Métropole Aménagement, and between the different city departments. This structure successfully oversaw a collective discussion and decision-making process around the SVDP municipal scale project (Joveniaux et al. 2022).

Collaboration at regional level

Cities and regions can collaborate with regional authorities involved in the water and agri-food sectors, such as river basin authorities in order to address gaps in knowledge and skills, funding and infrastructure related to circular sanitation.

Example (39): AESN (FR)

The Agence de l'Eau Seine Normandie (a French Regional River Basin Authority) is subsidising collective source separation projects on its territory, covering up to 80% of the costs for public facilities and 40% for private facilities (Joveniaux et de Gouvello 2021).

Example (27): KOLOS project (FR)

For the project KOLOS, the Lyon Metropole collaborates with two local municipalities (Quincieux and Lissieu) to assess the impact of source-separation on the nutrient load in wastewater streams. The involvement of the Metropole offered legitimacy to the research project and increased the trust of the two municipalities in its relevance (Valdelfener et Brun 2025).



Demonstration plot of Kolos: maize fertilised with Lisain.
Source: LEESU | Florent Brun

To engage and convince diverse regional actors to invest in circular sanitation, local and regional governments can **leverage context-specific common interests and address key territorial issues** e.g. pollution in a local river, drought exposure, soil degradation, saturation of wastewater treatment infrastructure (Valdelfener et Brun 2025).

Collaboration at national and international level

Cities and regions can create or join networks and alliances for circular sanitation in order to access knowledge and best practices for the implementation of circular sanitation systems.

Example (5; 19; 32): National networks (DE, FR, CH)

Several networks for circular sanitation have been established to bring together stakeholders from research, innovation, and practice, to foster collaboration, exchange knowledge, and promote best practices. Examples include NetSan (DE), RAE (FR) and VaLoo (CH).

Example (21): ZirkulierBAR Network (DE)

The ZierkulierBAR Transfer Network is a self-organised network of municipalities established to share good practices and successful examples for circular sanitation (ZirkulierBAR 2025).

Cities and regions can engage with national or European authorities and policy makers to advocate for clear and supportive regulations regarding the use of human excreta in agriculture, for example the development of safety standards that would reinforce trust among farmers and other key actors. Another possibility is to leverage regional monitoring data on nutrient pollution and WWTP performance to demonstrate the issues in the conventional sanitation and agricultural systems.

Example (9): Prague (CZ)

Prague was involved in lobbying lawmakers to amend existing laws and regulations on the use of human excreta-based fertilisers. Experts and researchers from the Czech Technical University and the University of Chemistry and Technology have studied the effects of using recycled water on plants to inform further wastewater reuse practices (Wider Uptake 2025; Joveniaux et al., forthcoming).

Engage with farmers

Beyond the collection and treatment of wastewater, circular sanitation also implies revalorising the recovered nutrients within the agri-food system. Thus, as end users of the excreta-based fertilisers and other outputs (e.g. reclaimed water), farmers play an integral part in the value chain of circular sanitation. Farmer engagement is essential to overcoming scepticism around the use of excreta-based fertilisers (**Schmid et al. 2024**). A study by OCAPI found that 80% of surveyed farmers are open to using such fertilisers if key safety and regulatory concerns are addressed (FNAB 2024). Involving farmers also ensures that valorisation methods and outputs are tailored to local needs. For example, the needs in terms of fertilisers or compost are not the same for cereal production or viticulture (**MAMMO 2024**).

Cities and regions can organise workshops and seminars for farmers, which highlight successful case studies and address main concerns such as nutrient content, release rates and safety measures.

Example (29): FNAB WEbinar (FR)

The French National Federation for Organic Agriculture (FNAB) has organised a webinar on the use of human excreta for organic farming. Several experts were invited to present the types of sanitation-based fertilisers and their application, to present successful cases, and address health and safety risks (**FNAB 2024**).

Cities and regions can select demonstration farms to showcase the use and benefits of sanitation-based fertilisers, allowing farmers to learn from real-world applications, and to see how recycled fertilisers can be used similarly to mineral or manure fertilisers.

Example (38): VivAgriLab (FR)

VivAgriLab in the southwest Paris region, is an applied research project which includes the valorisation of urine as an agricultural fertiliser: “Trials are being conducted on experimental plots of wheat and corn on two farms, resulting in yields equivalent to those obtained with synthetic fertilisers” (**Université Paris-Saclay 2025**).

Cities and regions can also **collaborate with farmers to test and implement solutions for water reuse in agriculture**.

Example (25): Spanish P2GreeN Pilot

La Axarquía region is piloting mango and avocado plantations with use of reclaimed water, in collaboration with the farmers association TROPS (Bioazul 2023).



Project Axarquia Sostenible for irrigation with reclaimed water.
Source: Bioazul

Farmers also strongly trust their advisors, like Chambers of agriculture. Cities and regions can make sure that they are informed about the latest research and developments on recycled fertilisers so they can pass on their knowledge.

Engage with businesses

To develop and to scale up circular sanitation solutions, local and regional governments should actively engage with the private sector. Innovative SMEs and start-ups can offer and test new technologies, while more established players, such as property developers, construction or wastewater management companies, require incentives and guidance to implement new sanitation models.

Several challenges can be faced when trying to engage the private sector, such as mistrust and reluctance due to the lack of profitable business cases and the experimental nature of circular sanitation projects. As mentioned earlier, cross-collaborative bodies within the public administration can help address these challenges, as they enable to align the stakeholders around common objectives, increase access to funding, and prioritise the experimental nature of the project over its profitability (Joveniaux et de Gouvello 2021).

Innovative SMEs and start-ups

Cities and regions can support technology development and entrepreneurial activities in order to accelerate technological developments of immature technologies.

Example: Sweden

The support of technology development and entrepreneurial activities in Sweden led to the development of technical norms and standards which facilitate the market expansion of circular sanitation solutions (McConville et al. 2017).

Cities and regions can **work with entrepreneurs** to co-collect human excreta and produce recycled fertilisers using their technologies. They can also mandate existing companies to collect urine from public events and festivals.

Example (4): Winterthur (CH)

Kompotoi (a company that sells and rents composting toilets) collects large quantities of human excreta, but struggles to valorise it in a profitable manner. The city of Winterthur is currently planning to install a public system for Kompotoi to address this issue (Vuna Nexus 2025).

Example (51): Swedish P2 GreeN Pilot

The Gotland Bryggeri is applying urine-based fertiliser from Sanitation360 to harvest barley fields for beer production. The beer production, currently at an experimental stage, eventually aims to enter the market.

Cities and regions can **facilitate capacity building and skill training activities** for stakeholders from the construction sector such as architects, plumbers and planners, to provide technical knowledge on circular sanitation infrastructure.

Example (33): Rés'eau24 (FR)

The Dordogne Departmental Council and the Technical Agency created Rés'eau24, which gathers elected officials and technicians in the field of water and sanitation in Dordogne in order to discuss issues related to water and wastewater management, share experience and know-how, and ensure technical and regulatory alignment. A similar model exists within the French Public Service for Non-Collective Sanitation (SPANC) (Dordogne 2023; Aquagir 2025).



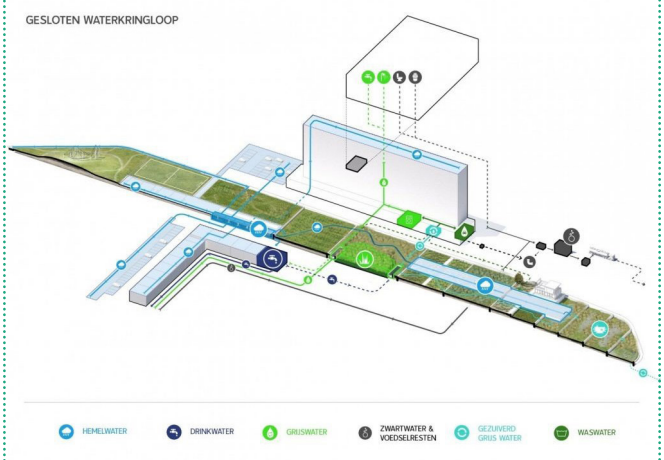
Rés'Eau 24 visit of Baulzac WWTP with Organica process, France.
Source: Aquagir | ATD 24

Established businesses

Cities and regions can collaborate with established businesses for the implementation of circular sanitation projects and developments, be they developers, utility companies or office managers.

Example (47): Superlocal (NL)

For the Superlocal Project in Kerkade NL, a district of 130 households was disconnected from the sewer system, and a system of rainwater collection and reuse was implemented. Greywater is reused as washing water, while black water is processed into biogas, convertible into electricity, heat and fertilisers. The project was led by the municipality and the regional water authority, in cooperation with private institutions, including real estate development companies and the trade association for demolition contractors VERAS (Joveniaux et al., forthcoming).



Superlocal closed water system.
Source: Superlocal

Resources:

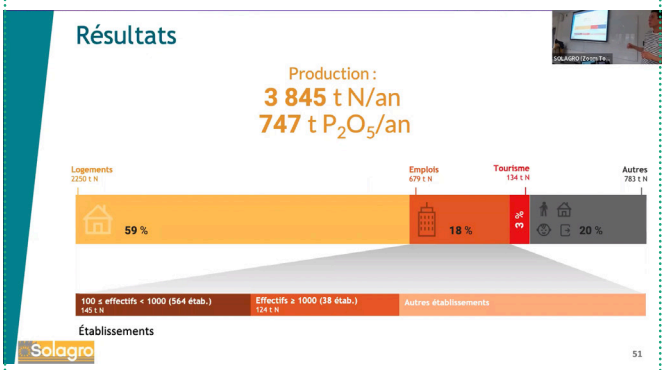
- Eawag Circular Sanitation Toolbox for the planning, construction, and management of sanitation systems.
- P2Green Blueprint - How to Initiate, Manage and Scale Circular Sanitation Solutions.

Engage with research, NGOs and living labs

Local and regional governments can **support or participate in non-governmental working groups** invested in circular sanitation. Cities and regions can collaborate with universities and research institutes to develop innovative technologies and approaches necessary to implement circular sanitation projects, or to engage diverse stakeholders from the value chain.

Example (35): TeValU (FR)

The TeValU project, led by Solagro, INSA and TBI, estimated the potential production and usage of N and P in the area of Toulouse (FR). The results of the study and the benefits of urine valorisation were presented during a seminar in 2022, which brought together researchers and practitioners, including public institutions, actors from the water management and sanitation sector, real estate companies, and farmers (Solagro 2022).



Presentation of results of the TeValu Project [screenshot]. Source: Solagro

Example (37): Urivalyon (FR)

Urivalyon is a collective under the 107 Social Innovation Hub, which brings together actors from the building and agricultural sector as well as intermediaries in order to facilitate the implementation of circular sanitation in Lyon. Each group of stakeholders has different missions, from awareness raising to supporting the implementation of pilot projects. The Lyon Métropole plays an active role in this network and supports the collective in accessing funding and regulatory advice (Coulaud 2025).

Example (27): KOLOS (FR)

For the KOLOS project in collaboration with Lyon Métropole, researchers from OCAPI led a series of workshops gathering citizens, representatives of local authorities and farmers to address the concerns of all stakeholders before the implementation of a research project on urine-based fertilisers (Valdelfener et Brun 2025).

Cities and regions can **support innovation hubs or living labs** for circular sanitation. These structures offer an environment for diverse stakeholders to collaborate and increase their skills and technical knowledge on the topic.

Example (6): Water Hub (CH)

The Water Hub in Dübendorf (CH) is a living lab led by researchers from Eawag. It fosters collaboration with industry and academia, and facilitates the installment and testing of technologies for circular sanitation. It collaborates with industry, researchers and partners. One of the projects developed within the Water Hub is the urine-based fertiliser Aurin, which is already approved in Switzerland, Austria, Liechtenstein, and France (Eawag 2025; Vuna 2025).



Eawag Water Hub, Dübendorf.
Source: Eawag Virtual Waterhub tour

Example (49): RecoLab (SE)

The RecoLab in Sweden offers visits to municipalities, academia or companies, and the possibility to rent test beds to process black water, grey water and food waste from the sewage streams from Oceanhamnen (RecoLab 2025).



Recolab, Sweden.
Source: RecoLab

Resource:

- List of existing water-oriented living labs all over Europe (Water Europe 2024).

D. IMPLEMENT
Adapt urban infrastructure & create an outlet for circular sanitation

Cities and regions are not merely facilitators or promoters; they are also doers, actively investing in and implementing the circular economy through their core competences in waste and water management, public works, and spatial planning. This section highlights concrete options to implement circular sanitation on the ground, exploring upstream and downstream solutions available to cities and regions, as well as the possibilities to create a market for recovered nutrients.

Introduction

The multiple competences of local and regional governments open many opportunities for the implementation of source separation and nutrient recovery infrastructure through urban and regional planning, waste water management, agriculture, public buildings and events (McConville et al. 2017). Water being a public utility, city-led projects can contribute to a shift towards a decentralized sanitation system, while demonstrating economic feasibility and inspiring actors from the private sector (Joveniaux et de Gouvello 2021).

Resources:

- Eawag Circular Sanitation Toolbox for the planning, construction, and management of sanitation systems.
- ZierkulierbAR Handbook for the sanitary and nutrient transition for municipalities and practitioners (in German).
- Toilettes fertiles experience sharing platform for source separation in France.

Implementing upstream solutions

This chapter illustrates how cities and regions can implement upstream solutions in temporary or off-grid infrastructure, public buildings, or more broadly in spatial planning.

Temporary and off-grid infrastructure

Circular sanitation infrastructure is particularly relevant for temporary or off-grid settings, as well as for small settlements and remote areas that are difficult to connect to centralized sewage networks, or where existing systems are undersized and face sudden population influxes (L'Institut Paris Region et al. 2024).

Small settlements, as one of the major untreated sources of pollution in Europe (Water News Europe 2022), represent an opportunity to use circular sanitation systems as a cost-effective and low-energy solution for new or upgraded sanitation infrastructure (Pistocchi et al. 2019).

For **events and temporary pop ups**, cities and regions can rent portable toilets from local toilet rental companies to collect urine from public events, festivals or during the tourist season (Goldeimer 2025; L'Institut Paris Region et al. 2024).

Example (51): Uppsala (SE)

Public toilets from Sanitation360 in festivals and public events, such as the Walpurgis Festival in Sweden, where 12,000 L of urine were collected and transformed into fertilisers for farmers in 2024 (SVT Nyheter 2024).

Example (4; 14): Darmstadt (DE)

The city of Darmstadt is providing composting toilets that can be rented for public and private events, which are produced by Kompotoi. The service includes delivery and collection of the toilet as well as the valorisation of the resources (EAD 2025).



Kompotoi toilets.
Source: EAD Darmstadt

Infrastructure for source separation can also be installed in outdoor spaces such as public squares and parks.

Example (17): Cologne (DE)

Cologne installed a public dry toilet from which the excreta are collected and valorised as compost. The project is a collaboration between the pilot project Holy Shit, the city of Cologne and the local waste and wastewater management companies. The compost can however not yet be used in agriculture because of legal restrictions (StEB Köln 2024).

Example (18): Leipzig (DE)

The Leipzig City Council invested in semi-stationary dry toilets for public sanitation services, in cooperation with 20 external suppliers. A new responsible operator was opened to manage the public sanitary infrastructure (Stadt Leipzig 2024; Stadt Leipzig Ratsinformation 2025).

For **national parks or mountainous areas**, public authorities can procure lightweight infrastructure for circular sanitation, such as dry toilets connected to composters (L'Institut Paris Région et al. 2024).

Resource:

- Guide to ecological sanitation in mountain areas (Moretto et Chesneau 2018).

Example (22): Abereus (DE, AT, CH)

Abereus is providing dry toilets in a large number of national parks in Germany, Austria and Switzerland. These also serve Abereus to showcase their innovative toilets to municipalities, associations, companies and citizens (ABEREUS 2024).



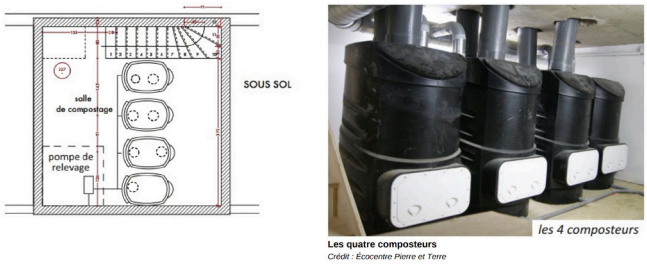
Self-sufficient toilet from Abereus in natural park Fränkische Schweiz.
Source: Abereus

Publicly owned buildings

Cities and regions can **install circular sanitation infrastructure in public buildings**, such as schools and universities, administrative buildings and offices, cultural centers (e.g. religious buildings, museums, libraries), sport stadiums, transport nodes (e.g. train stations, ports, airports) or community centers. Public buildings have the potential to collect an important amount of excreta, and can familiarize citizens with the use of circular sanitation infrastructure (L'Institut Paris Région et al. 2024).

Example (34): Saint-Germé School (FR)

The primary school Saint-Germé installed dry toilets with an in-house composting system. The produced compost is reused occasionally by the school (OCAPI n.d.).



Four composters at the basement of the St Germé school, France.
Source: OCAPI | Pierre et Terre

Spatial planning

When planning new housing developments, Cities have the opportunity to implement large-scale semi-decentralised circular sanitation infrastructure, and to support citizens in the use of this infrastructure (L'Institut Paris Région et al. 2024).

Example (2): BlueFactory (CH)

The BlueFactory in Fribourg (CH) is an innovation district where 52 sustainability-oriented companies rent low carbon spaces for their offices. Urine is recycled into fertiliser using the VUNA technology and greywater is collected and reused entirely onsite. BFF SA is the sole owner of the blue factory site, with the Canton and the City of Fribourg being equal shareholders (BFF SA 2025; Vuna Nexus 2025).



Aerial vue of the Blue Factory.
Source: BFF SA | Stéphane Schmutz

Example (46): Sneek (NL)

The municipality supported the decentralisation of 250 households for the developments of Noorderhoek and Lemmerweg in Sneek. The local treatment plant processes source-separated black and grey water and includes solids and nutrient removal and the possibility of phosphorus recovery as struvite[6] (Skambraks et al. 2017).



Sneek water utility, Netherlands.
Source: Groen Blauwe Netwerken | Waterschoon

6 Struvite is a crystalline mineral composed of magnesium ammonium phosphate (Zamparas 2021)

Example (11): Block 6 Berlin (DE)

In the housing development Block 6 Berlin, grey water is recycled in a local treatment plant of the company Pontos. It enables the saving of 3 million litres of fresh water per year and "shows that decentralized drainage concepts with greywater recycling are possible in developments with high urban density" (Sdg 21 2016).



Block 6 (Berlin).
Source: Sdg21

Local and regional governments can promote circular sanitation in spatial planning documents in order to encourage or mandate the development of circular sanitation in public and private developments. For this, they should consider the space and infrastructure required for separate faeces and urine management or composting (e.g. piping, buildings, monitoring equipment).

Example (26): SDRIF Master Plan (FR)

The Master Plan of the Île-de-France Region (SDRIF-E) promotes urine source separation and valorisation of human excreta in Orientation no. 37 (Région Île-de-France n.d.). The Institut Paris Region offers tailored support to municipalities to implement the Orientation in their local urban plans, including technical documents with relevant information and resources for localities.

Local and regional governments can set **planning requirements to support circular sanitation in new developments**, for example by integrating existing certification into their planning documentation.

Resources:

Certification schemes for circular sanitation in urban planning:

- BREEAM sustainability assessment method for buildings and infrastructure. Encourages water reuse and can be used for new developments.
- ISO 30500 Standard for non-sewered sanitation systems. Can be used for building permitting.
- C2C Certification to assess circularity and sustainability performance. Includes standards encouraging responsible and circular use of water. Can be used for new developments.
- Quantitative water consumption indicator by the German Sustainable Building Council (DGNB) to assess water consumption and recycling of wastewater and rainwater. Can be used for public procurement.
- DWA-A 272E Principles for the Planning and Implementation of New Alternative Sanitation Systems (NASS). Can be used for building permitting.
- DWA-A 262 for biological treatment of municipal wastewater.
- DWA Topics Non-Potable Water Reuse, Development, Technologies and International Framework for Agricultural, Urban and Industrial Uses.
- DWA-M 277 Guidelines for the Dimensioning of Treatment and Use of Greywater.

Implementing downstream solutions

This chapter provides an overview of solutions to adapt conventional wastewater infrastructure and management in order to transition towards circular sanitation systems. This should be considered as a complementary solution to upstream solutions, which are the best strategy for nutrient valorisation in terms of cost and environmental impact (Rey-Martínez et al 2024).

However, source separation cannot always be implemented in existing settlements due to the path dependencies and infrastructure lock-ins of current wastewater management systems. Thus, it will also be necessary to partially adapt the existing infrastructure in order to recover nutrients and to return clean water to the ecosystems.

Adapting WWTPs

Nutrient removal processes in conventional WWTPs involve nitrification, denitrification and biological phosphorus elimination, which are both highly energy intensive and costly (Fraunhofer IGB 2025; Häfner et al. 2023). Certain technologies are emerging to adapt centralized systems for nutrient recovery, with ongoing progress in this area. Solutions at the treatment level include struvite precipitation, ammonium stripping, membrane-based separation, bio-based or physiochemical technologies for nutrient recovery (Farghali et al 2024).

Example (12): Braunschweig WWTP (DE)

The Braunschweig WWTP has been adapted to optimize the recovery of struvite from precipitation and crystallisation processes. According to the P-Net project, with this new technology, "up to 70 percent of the phosphate can be removed from the sewage sludge. Unlike other processes that recover phosphate from sewage sludge or sludge ash, this process is purely biological and requires no additional operating resources." The conversion will enable the Braunschweig WWTP to comply with the requirements of the new German Sewage Sludge Ordinance[7] (TU Braunschweig 2024).

Resources for WWTP adaptation:

- Phos4You technical report for phosphorus recovery from wastewater.
- Life Enrich project for the replicability of nutrient recovery technologies in WWTPs.

Example (43): Ringsend WWTP (IE)

In Ringsend, the largest WWTP in Ireland is implementing the Ostara technology for phosphorus and nitrogen recovery. These nutrients are transformed into market-ready fertilisers through struvite crystallisation using the WASSTRIP technology (Murphy Ireland 2023). In accordance with EU 2023/12, the resulting struvite can be applied in ecological farming (Joveniaux et al., forthcoming).



Ringsend WWTP Phosphorous reactor (left) and magnesium oxide storage silo (right).
Source: Water Projects | Murphy Ireland

7 With the amendment of the Sewage Sludge Ordinance in 2017, German operators of sewage plants will have to recover and recycle phosphorus from sewage sludge or sludge incineration ash by 2029.

Water reclamation

Additional treatment stages in WWTPs can also enable the reclaiming of treated wastewater for local use, e.g. irrigation of agricultural fields and green spaces or cooling of industrial facilities.

Example (8): Limassol (CY)

In Limassol, wastewater is treated for N and P removal, and the tertiary effluent is reused to irrigate green areas, olive trees, citrus trees and crops for animal feeds (Maffettone et Gawlik 2022).



View of the Limassol – Amathus water reuse system (Cyprus).
Source: Maffetone et Gawlik 2022

Example (25): Spanish P2GreeN Pilot

Bioazul developed a water reclamation plant to treat municipal waste water. Reclaimed water is used to irrigate mangos and avocados cultivated by TROPS. A smart fertigation tool is used to adjust the amount of nutrients added to the crops, reducing the risk of pollution of surface and groundwater.

Create an outlet for recovered nutrients

The implementation of circular sanitation infrastructure is only relevant and beneficial if the recovered nutrients and other outputs are actually used in agriculture or for green spaces. The reuse and application of these materials enables to close the nutrient loop and achieve a truly circular sanitation system. It is also important to note that the transition towards more sustainable food systems implies reducing fertiliser use, in order to avoid nutrient leakage into natural ecosystems.

Cities and regions can contribute to stimulate demand by procuring circular sanitation infrastructure and outputs, such as recycled fertilisers for public land and green spaces.

Example (31): Paris SVDP (FR)

The urine-based fertilisers produced in Saint-Vincent de Paul will be used to fertilise public lawns and plantations in horticulture centres of the City of Paris (Joveniaux et al., forthcoming).

They can also **work with technology providers and innovators to finance the production of fertiliser** which can be applied to green public spaces or sold to farmers. Other sources of income can be biogas, recovered water and heat.

When planning circular sanitation infrastructure, public authorities **should work in collaboration with farmers** to ensure that valorisation methods and outputs are tailored to local needs. For example, the needs in terms of fertilisers or compost are not the same for cereal production or viticulture (MAMMO 2024).

Example (45): Nieuwe Dokken (BE)

The city of Ghent (BE) collaborates with the housing project Nieuwe Dokken (400 households), where source-separated and purified wastewater is sold as process water to a local industry. Recovered heat, biogas and fertilisers are also sold on the local market (Skambraks et al. 2017; De Nieuwe Dokken 2025).



Aerial vue of Nieuwe Dokken, Ghent.
Source: Nieuwe Dokken

Example (48): Helsingborg H+ (SE)

The urban renewal project H+ transforms an old port and industrial area into a new city district. The infrastructure separates blackwater, greywater and foodwaste at the source. The project strengthened the connection between the city and farmland, which influenced the later choice to implement source separation systems (Skambraks et al. 2017).



H + Cityscape Visualisation.
Source: Area21 | ADEPT, Schønherr

E. SUPPORT
Financial and non-financial resources for circular sanitation

Across Europe, cities and regions play an essential role in supporting their businesses and developing new value chains. This section highlights how they can offer support to circular sanitation projects and initiatives by financing research and development, providing grants and subsidies to projects, implementing favourable taxes and water tariffing mechanisms or providing non-financial resources such as land, equipment or infrastructure (Ellen MacArthur Foundation 2019).

Funding research & innovation

Cities and regions can **finance research projects** for treatment technologies and alternative fertilisers. They can also support research cooperatives to explore technological and organisational possibilities and to address the current limitations in regulations and standards (McConville et al 2017).

Example (21): ZirkulierBAR (DE)

Within the ZirkulierBAR project, Kreiswerke Barnim GmbH was hosting the first pilot plant in Germany for the production of quality-assured recycled fertilisers from contents of dry toilets in Eberswalde, with faecal composting by Finizio GmbH and urine treatment by VunaNexus. The project developed a comprehensive database on the quality and pollutant levels of recycled fertilisers. It was funded by REGION.innovativ, a funding scheme for innovative circular economy projects in structurally weak regions in Germany (Kreiswerke Barnim 2023; Krause et al. 2024; Kommunen Innovativ n.d.).

Example (28): La Fumainerie (FR)

La Fumainerie was set up by local authorities to experiment source separation with interested households. 90% of the project costs were covered by public authorities, including Région Nouvelle Aquitaine, Bordeaux Métropole, and the Mérignac Municipality (Joveniaux et al. 2022).



A bucket of Bokashi is poured into the electromechanical composter, la Fumainerie, Bordeaux.
Source: MAMMO

Cities and regions can **support accelerators and incubators** for start ups and small businesses developing circular sanitation technologies.

Example (13): CirculaRise Accelerator (DE)

The Yunus Environmental Hub supports businesses dedicated to circular solutions through the CirculaRise Accelerator.

Direct support of projects

Local governments can use regional funds such as climate compensation, drought funds and decarbonisation funds to invest in circular sanitation (CCRE CEMR 2021).

Example (23): Andalusia (ES)

The Andalusia region uses regional funds related to drought legislation to invest in improved water treatment infrastructure and wastewater reuse (Zarza 2024).



Taberna Desert, Almería, Spain.
Source: Smart Water Magazine | Pablo González-Cebrián

Grants and subsidies for construction

Cities and regions can offer grants or subsidies for the construction of buildings that integrate circular sanitation solutions.

Example (10): Berlin WFB 2023 (DE)

The Berlin Housing Construction Subsidy WFB 2023 supports sustainable and resource-conserving construction methods, including subsidies for housing units with circular sanitation solutions.

Regions can support municipalities, companies, public waste authorities and NGOs to **finance circular sanitation infrastructure**.

Example (15): FRL KrW/2024 (DE)

The Förderrichtlinie Kreislaufwirtschaft (FRL KrW/2024) in Saxony provides grants of up to 60% of project costs for circular economy related projects, including phosphorus recovery from sewage sludge.

Grants and subsidies for agriculture

Once farmers overcome the reluctance to use excreta-based fertilisers, the second barrier that they face is cost. Cities and regions can provide subsidies for recycled fertilisers to make them cost-competitive with synthetic fertilisers (Parfitt 2023).

In order to address the distrust of farmers, they can also subsidise frequent soil testing and monitoring, which is often too expensive for farmers (Parfitt 2023).

Taxes and water tariffs

The treatment of wastewater at the source could be considered as a service to be paid by the municipality, as it relieves centralised WWTP. Yet, there is still a lack of financial mechanisms to incentivize source separation at the local level. **Water reuse tariffs** can be implemented to incentivise farmers to reuse water resources.

Example (24): Murcia (ES)

Murcia is providing 121m³ regenerated water free of charge to farmers, resulting in 98% of wastewater reused for the irrigation of agricultural surface (Esamur 2023).



Cieza sewage treatment plant in Murcia, where water is reclaimed for irrigation.
Source: Gomez Espin et al. (2025)

Resources:

- P2GreeN Approach to Water Tariffing for public authorities (Connolly et al. 2025).
- Report on Pricing Water Resources and Water and Sanitation Services (OECD 2010).
- Guidelines for setting Water Tariffs (Water Research Commission 2000).

Local governments can support the adoption of circular sanitation technologies in local water treatment infrastructure, for example by **granting derogations on sewer connections or reducing taxes and fees on wastewater**.

Example (3; 5): Geneva (CH)

The Water Services in Geneva offered institutional and political support to the Equilibre Cooperative, by giving them necessary authorizations for the implementation of experimental composting toilets, and by reducing the water connection and treatment fees (Joveniaux et al. 2023). Geneva is also planning to exempt the sewage tax on the Bistoquette, a participative housing complex where wastewater is treated and reused locally (La Bistoquette 2024; Vuna Nexus 2025).



Composting system situated under a terrace. Equilibre housing complex Soubeyran, Geneva.
Source: Cooperative Equilibre

Cities and regions can **use taxes on water pollution to finance circular sanitation solutions**. French local governments are discussing the potential introduction of a Wastewater Pollution Tax to finance source separation infrastructures in the long term (Joveniaux et de Gouvello 2021).

Conclusion

This guide offered an entry point into the ways cities and regions can support, foster, and accelerate the transition toward circular sanitation systems. By outlining key levers and practical examples, it aims to equip local and regional authorities with a starting point for action. Circular sanitation is not only a matter of wastewater management; it is an opportunity to reduce water and soil pollution, decrease emissions, improve local resilience and support the local economy. As demonstrated throughout this document, public authorities have a unique capacity to educate, mobilise and support key stakeholders and to integrate circular principles into strategies, planning documents and urban infrastructure.

Limitations

This guide was not designed as a technical, in-depth report. Rather, it offers an entry point to the various levers available to public authorities, which can be explored further. The included examples illustrate the diversity of solutions existing in Europe, but they do not provide an exhaustive overview of case studies for circular sanitation. Local factors (including regulatory frameworks, resource availability, infrastructure, and cultural factors) vary widely, and adaptations will be necessary to determine which approaches are most suitable for each territory.

Future outlook

Numerous pilot projects have emerged across Europe, developing a portfolio of readily deployable solutions adapted to multiple contexts. The priority for the coming years should be the upscaling and mainstreaming of circular sanitation approaches within targeted territories.

Advances in technology, shifts in regulation, and growing awareness are likely to expand the opportunities available to local and regional governments. More detailed guidance will be needed on topics such as financing models, regulatory and legal aspects, impact assessment, health and safety standards, and cross-sectoral governance approaches.

ANNEX
Case study table

	Case Study	Country	Description	Strategise	Educate	Mobilise	Implement	Support
1	Aurin (Vuna Nexus technology)	CH	Urine-based fertiliser authorized in Switzerland, Austria and France.				X	
2	Blue Factory	CH	Innovation district with urine recovery and reuse, applying the Vuna Nexus technology. Water reclamation.				X	X
3	Équilibre	CH	Development project of 3 existing and 7 upcoming housing complexes with separate collection and composting facilities developed by aneco.				X	X
4	Kompotoi	CH	Company renting and selling composting toilets, works closely with public authorities.				X	
5	La Bistoquette	CH	Housing cooperative with separate collection of excreta which are valorised into fertilisers. Greywater is reclaimed for irrigation and flushing.					X
6	VaLoo	CH	Association of practitioners, scientists, researchers and other stakeholders for the promotion resource-oriented sanitation systems. Regularly organises public events on circular sanitation.		X	X		
7	Water Hub	CH	Living lab led by researchers for the development and testing of technologies for circular sanitation.		X	X		X
8	Limassol	CY	WWTP with N and P treatment, water reuse for irrigation.				X	

Table 2: Case sudy table

	Case Study	Country	Description	Strategise	Educate	Mobilise	Implement	Support
9	New Water Line	CZ	The Prague WWTP installed treatment technologies aiming to demonstrate the use of treated effluent for irrigation purposes.	X			X	
10	Berlin WFB Subsidy	DE	Financial support of resource-conserving construction methods.					X
11	Block 6 Berlin	DE	Housing development with decentralized drainage and greywater recycling systems.				X	
12	Braunschweig WWTP	DE	Recovery of phosphorous.				X	
13	CirculaRise Accelerator	DE	Support of circular businesses.					X
14	Darmstadt	DE	City provides composting toilets to be rented for public and private events. In partnership with Kompotoi.				X	
15	FRL KrW/2024	DE	Grants for circular economy related projects.					X
16	German P2GreeN Pilot	DE	Recovery of urine (VunaNexus technology) and faeces (Goldeimer) for the production of fertiliser.		X		X	
17	Holy Shit	DE	Installed a public dry toilet in Cologne. Excreta valorised as compost.				X	
18	Leipzig	DE	City Council invested in dry toilets for public spaces.				X	
19	NetSan	DE	Network for sustainable sanitary systems. Gathers actors from science and research as well as startups and SMEs.			X		
20	P-Bank	DE	Separative toilet installed in Weimar, educating the public on phosphorous resources and fertilisers.		X			

	Case Study	Country	Description	Strategise	Educate	Mobilise	Implement	Support
21	ZirkulierBAR	DE	Production of recycled fertiliser. Creation of a database on fertiliser quality. Establishment of a network of municipalities for circular sanitation.			X	X	X
22	Abereus	DE AT CH	Provides dry toilets in national parks.				X	
23	Andalusia	ES	Regional funds for wastewater treatment and reuse.					X
24	Murcia	ES	Reclaimed water is provided free of charge to farmers for irrigation purposes.					X
25	Spanish P2GreeN Pilot	DE	Wastewater reclamation for irrigation, combined with smart fertigation tool (Bioazul, Trops).				X	
26	Ile-de-France Regional Master Plan (SDRIF-E)	FR	Strategic (urban) planning document which includes circular sanitation objectives.	X			X	X
27	KOLOS	FR	Research project in collaboration with municipalities and farmers to test recycled fertilisers in the Lyon Metropolitan area. Collaboration with OCAPI (see below).			X	X	X
28	La Fumainerie	FR	Experimentation of source-separation in households.				X	X
29	National Federation for Organic Agriculture (FNAB)	FR	Informs and supports farmers for the adoption of recycled fertilisers.		X	X		X
30	OCAPI	FR	Action-oriented research programme the valorisation of human excreta. Works closely with public authorities and other stakeholders.		X	X		X
31	Paris Saint-Vincent-de-Paul	FR	Housing complex with separate collection and treatment infrastructure. Recovered nutrients used for city's green spaces.	X		X	X	

	Case Study	Country	Description	Strategise	Educate	Mobilise	Implement	Support
32	RAE	FR	French network for ecological sanitation. Gathers actors from research, design offices, construction and distribution, as well as promoters and end users.			X		
33	Rés'eau24	FR	Gathers elected officials and technicians to discuss wastewater management.		X	X		
34	Saint-Germé School	FR	In-house separation and treatment system for wastewater and urine.				X	
35	TeValU	FR	Research project on the production and use of N and P in the territory of Toulouse. Results presented to key stakeholders.		X	X		
36	Toilettes Fertiles	FR	Online knowledge-sharing platform showcasing case studies of source-separation initiatives in France.		X			X
37	Urivalyon	FR	Collective of actors across the value chain for the implementation of circular sanitation in Lyon.		X	X		
38	VivAgriLab	FR	Applied research project for the application of recycled fertilisers.				X	X
39	Water Agency Seine Normandy (AESN)	FR	Regional water agency. Developed plans and subsidies to support source separation projects.	X				
40	Mountain shelters (multiple)	FR CH	Mountain shelters with source separation and composting facilities.				X	
41	Rediscovery Centre	IE	Demonstration centre for circular economy, with separate collection and treatment infrastructure.		X			

	Case Study	Country	Description	Strategise	Educate	Mobilise	Implement	Support
42	Irish Food Vision	IE	Food strategy including objectives on reduction of chemical fertiliser use.	X				
44	AFAS Live	NL	French network for ecological sanitation. Gathers actors from research, design offices, construction and distribution, as well as promoters and end users.				X	
45	Nieuwe Dokken	NL	Housing development with wastewater treatment and reuse. Recovery of heat, biogas and fertilisers.				X	
46	Sneek	NL	Housing development with source-separation of black and grey water, including nutrient recovery.				X	
47	Superlocal	NL	Housing complex with separate collection and treatment infrastructure.			X	X	
48	Helsingborg H+	SE	Housing development with source-separation for blackwater and greywater.				X	
49	RecoLab	SE	Living lab with test beds for wastewater processing.		X	X		
50	Stockholm Water and Waste Utility	SE	Targets for circular nutrient use from wastewater.	X				
51	Swedish P2GreeN Pilot	SE	Collection of urine from public toilets and festivals to produce recycled fertiliser, tested for barley production in local brewery.		X		X	

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