Design Project – SIE 2025

Sizing of the EPFL's Urine and Greywater Recovery System

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Objectives

This project develops a sustainable system to **recover resources from greywater (GW) and urine**. The main objectives are to:

- **Size** a **constructed wetland for GW treatment.**
- **Optimize collection and transport** of flows.
- **Assess GW reuse for toilet flushing.**
- **Calculate urine dilution** for Aurin* fertilizer.
- **Evaluate health risks** from coliforms in GW.

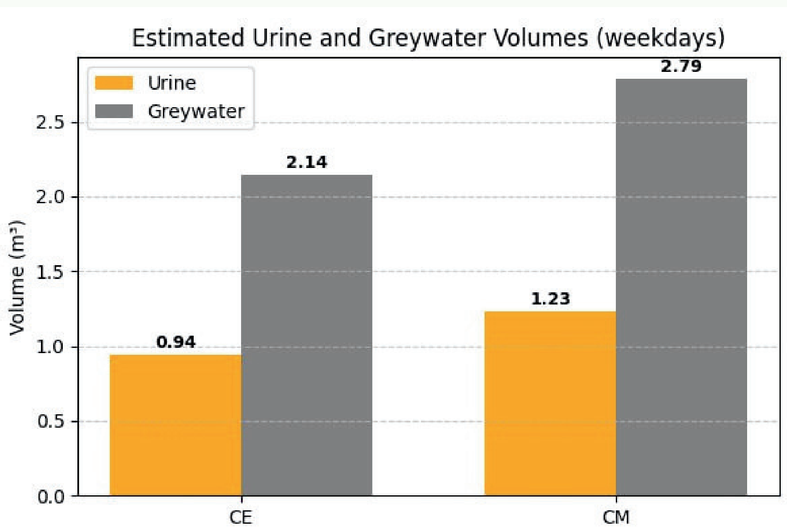
**Aurin is a Swiss-produced fertilizer made from source-separated human urine. The production process involves collecting urine from urine-diverting toilets or urinals, then treating it through a combination of biological stabilization, filtration, and distillation.*

Example of a planted terrace in CM, suitable for constructed wetland installation.

Pipelines between the CM and CE

Dicharge Production Assessment

GW and urine production were estimated and compared with data from **two storage tanks** in the CE building to extrapolate values to the entire CE and CM buildings.



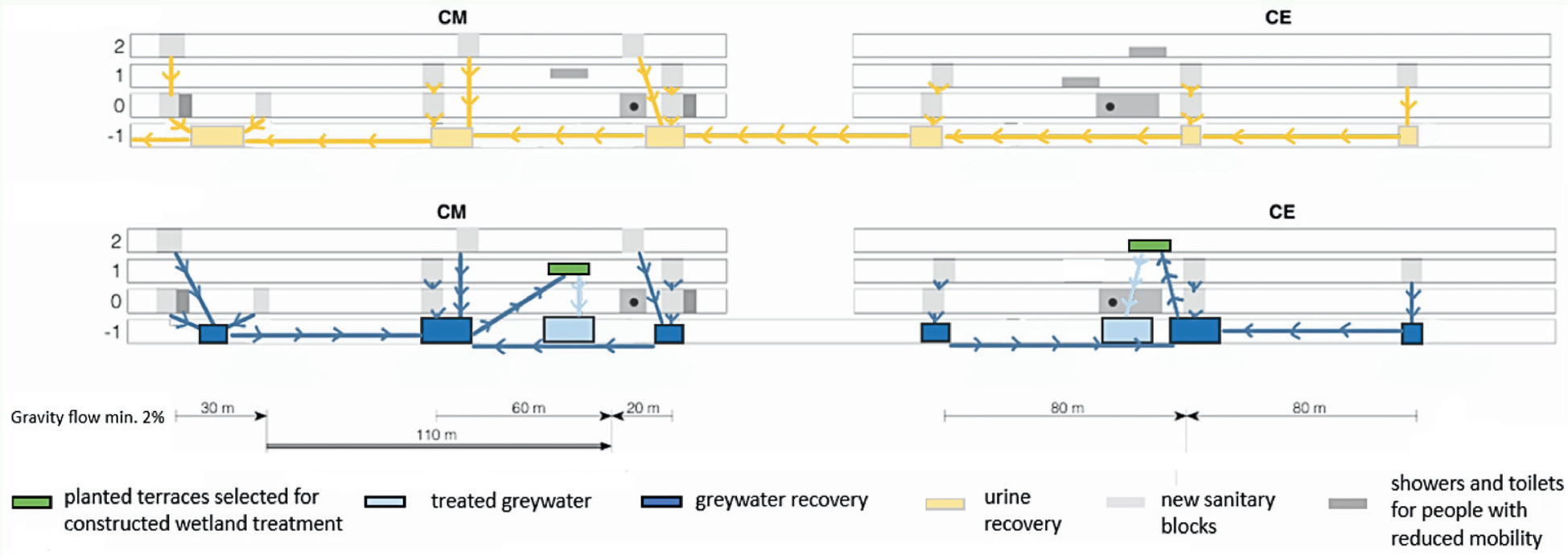
Two tanks (urine and GW) under two sanitary blocks at the CE

Constructed Wetland Sizing

GW production estimates guided wetland sizing. Due to low organic pollution, **hydraulic load became the limiting factor**, ensuring sufficient surface area for flow retention and treatment efficiency.

Constructed wetland sizing method [m²]	CM	CE
VUNA - Hydraulic load	18.58	14.29
Kadlec & Knight (1996) - Hydraulic load	31.17	35.73
Nivala J. and al. - Hydraulic load	18.58	14.29
VUNA - Organic load	2.11	1.68
Jardin d'Assainissement (Aquatiris) - Organic load	5.00	5.00
Final sizing	**18.58**	**14.29**

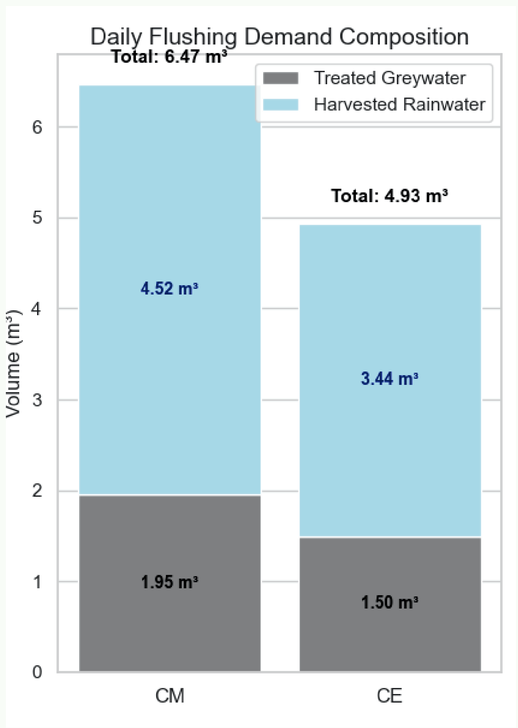
Urine and Greywater Collection and Transport



Storage tanks were **optimized for compactness and capacity**. Urine goes to La Coupole for Aurin production; greywater is treated on-site by the constructed wetlands and reused for flushing.

Schematic section of the GW and urine recovery systems for the CM and CE buildings

Treated Greywater Recovery

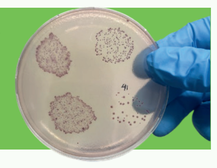


Flushing water needs for buildings CM and CE were estimated. **Treated GW from the constructed wetland could meet approximately 30%** of this demand for both buildings. The remaining **70%** would need to be covered by **additionnal harvested rainwater.**

Urine Dilution Factor

Urinal flush volume was halved during the study, reducing the dilution factor from **1.59 to 1.25**. This led to less urine volume produced but **higher NH_4^+-N concentration, improving Aurin fertilizer quality.**

Microbiological Safety in Greywater Reuse



GW samples showed **very high total coliform levels** (up to 3.5×10^7 CFU/mL). Although **E.coli was not detected**, such contamination poses a microbiological risk, especially through **aerosol exposure during toilet flushing**. Constructed wetlands alone may not sufficiently reduce pathogens. **Additional disinfection,** such as **UV treatment or fine filtration**, is recommended.

Conclusion

- Recovery systems in CM and CE are feasible and fit current infrastructure.
- Using GW and rainwater for toilet flushing can reduce potable water use.
- Lower urinal flush volume improves Aurin production efficiency.
- This project supports EPFL's sustainability goals.