

# Sveriges flaggskip RecoLab – Gjenbruk av svartvann og husholdningsavfall från Oceanhamnen Helsingborg

**Interreg**  
North Sea



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Hamse Kjerstadius, Elin Ossiansson  
NSVA HELSINGBORG - SWEDEN

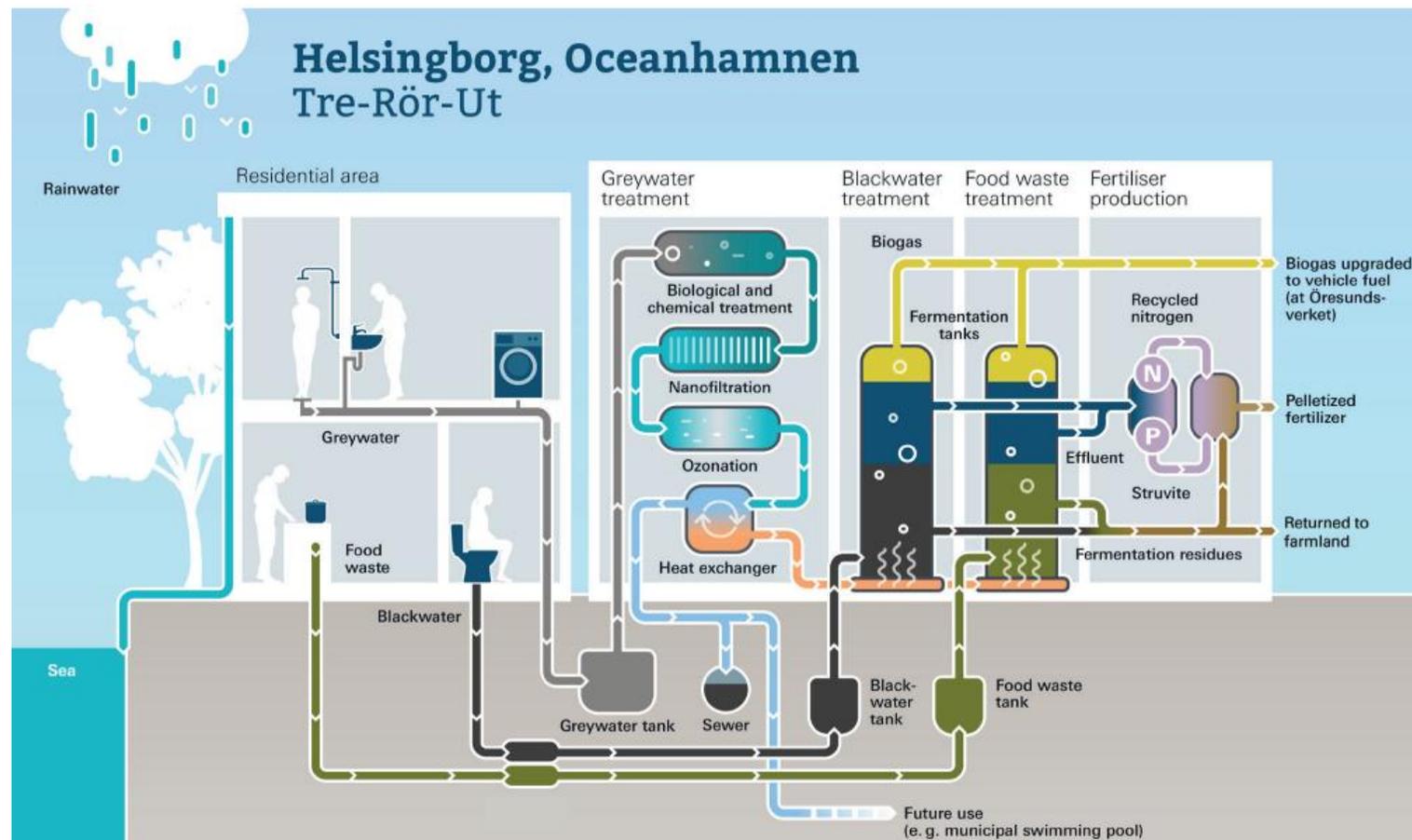


NORDVÄSTRA SKÅNES VATTEN OCH AVLOPP

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# Källsorterat avloppssystem i Oceanhamnen, Helsingborg

- Källsortering i nytt område i Helsingborg
- Ett system för att producera mer energi och öka återvinning av näringsämnen och vatten



Schelbert, V et al (2023), Tre-rör-ut synthesis report. Eawag



NORDVÄSTRA SKÅNES VATTEN OCH AVLOPP



# Blackwater Vacuum Systems

What works now and what is left to solve?

Source Separated Sanitation Summit 2025

Hamse Kjerstadius (NSVA)

Paul Telkamp (TAUW)



# Varför vakuuum?

- Svartvattnet behöver vara koncentrerat för återvinning av resurser
  - *nu ca 50 x mer koncentrerat än vanligt avlopp!*
- Så koncentrerat avlopp flyttas inte med självfall utan tryck behövs
  - *vakuuum mellan fastighet och pumpstation, därefter trycksatt avlopp.*
- Utmaning: vakuuum kräver täta rör och ny kompetens för VVS-firmor.
- Inte en utmaning: vakuuum kräver endast låg energiförbrukning (ca 10 kWh/capita/år)



# European Experiences

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5 larger demonstration areas (1000 – 2000 pe).

Oldest vacuum systems with plastic pipes are 50 years (sweden), others around 25 years (Germany and the Netherlands).

The long term maintenance is still unknown and that's why we develop maintenance plans within this project.



Old port and industrial site

**Buiksloterham**

**waternet**  
waterschap amstel gooi en vecht  
gemeente amsterdam

Treatment plants on a floating pontoon

**SUPERLOCAL**

**WATERSCHAPSBEDRIJF LIMBURG**

Rainwater, Drinking water, Grey water, Black water & Food remnants, Filtered grey water, Wash water

Grey water purification for laundries and car-wash

**HWC Jenfelder Au**

**De Nieuwe Dokken**



# Examples off ANCHOR material on vacuum



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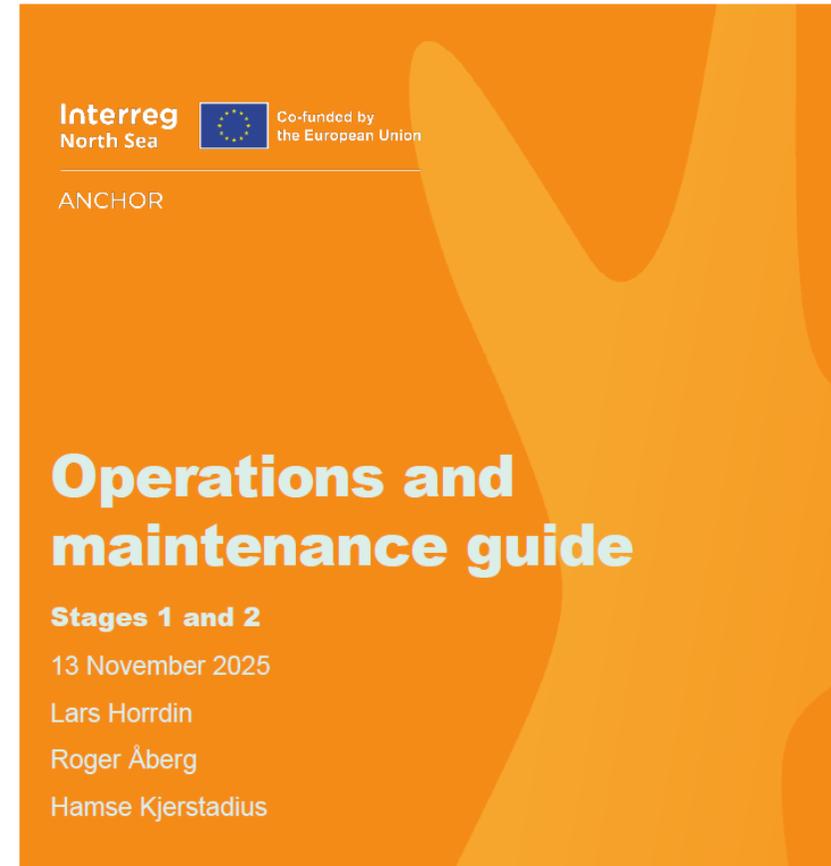
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## Lunch talk: Improving vacuum systems

Rewatch this lunch talk for water-wise cities and neighbourhoods!

**Date:** 04/12/2025 12:00pm - 1:00pm  
**Location:** Zoom meeting

[Lunch talk: Improving vacuum systems ANCHOR | Interreg North Sea](#)



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## Operations and maintenance guide

**Stages 1 and 2**

13 November 2025

Lars Horrdin  
Roger Åberg  
Hamse Kjerstadius





# What works with blackwater vacuum?

- Sewer transport & pumps
- Treatment and resource recovery
- Growing market of supplier solutions



# Blackwater sewer transportation and treatment works

- Blackwater vacuum systems are **increasing in scale** (approx. 2 000 persons) and into municipal utilities.
- In the demo sites we are developing best practice for **operation of the sewer network and pumping stations**. But it runs already today (Helsingborg 15 000 flushes a day).
- The **treatment of blackwater is confirmed** to generate more biogas and concentrations suitable for nutrient recovery. This makes resource recovery plants a real possibility.
- It is vacuum systems in the buildings we really need to solve to achieve greater spread of these systems.





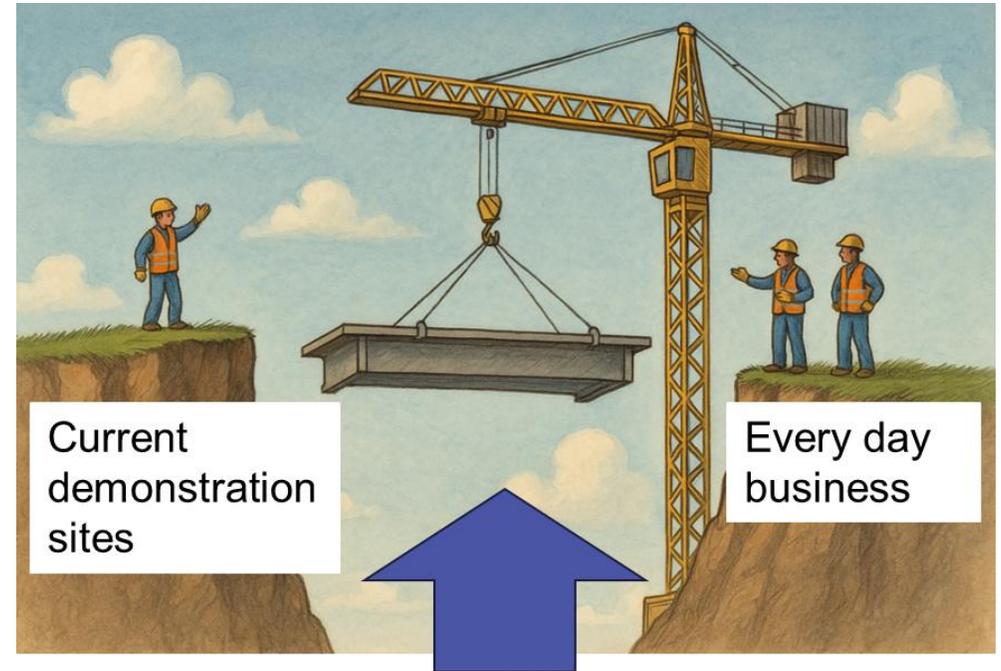
# Left to solve with blackwater vacuum

- Scaling in pipes
- Unified design & guidelines
- Lack of market available operation & maintenance for buildings



# Final thoughts on vacuum

- Vacuum systems for blackwater have been promoted by universities since the late 90's in order to enhance resource recovery. The last 10 years has seen the first municipal demonstration sites of a few thousand people.
- The vacuum technology is not yet fully matured, more work on acoustics and certifications of plumbing companies needs to be developed. As well as the interface between private properties and the municipal sewer network.
- Vacuum systems gives a very nice and smooth blackwater which is beneficial to treat at the WWTP. It is a promising technology for the future.
- Further spread of the landbased vacuum systems will develop best practice among suppliers and installation companies.
- **News 2026: Formation of a blackwater vacuum network with suppliers and municipal organisations!**

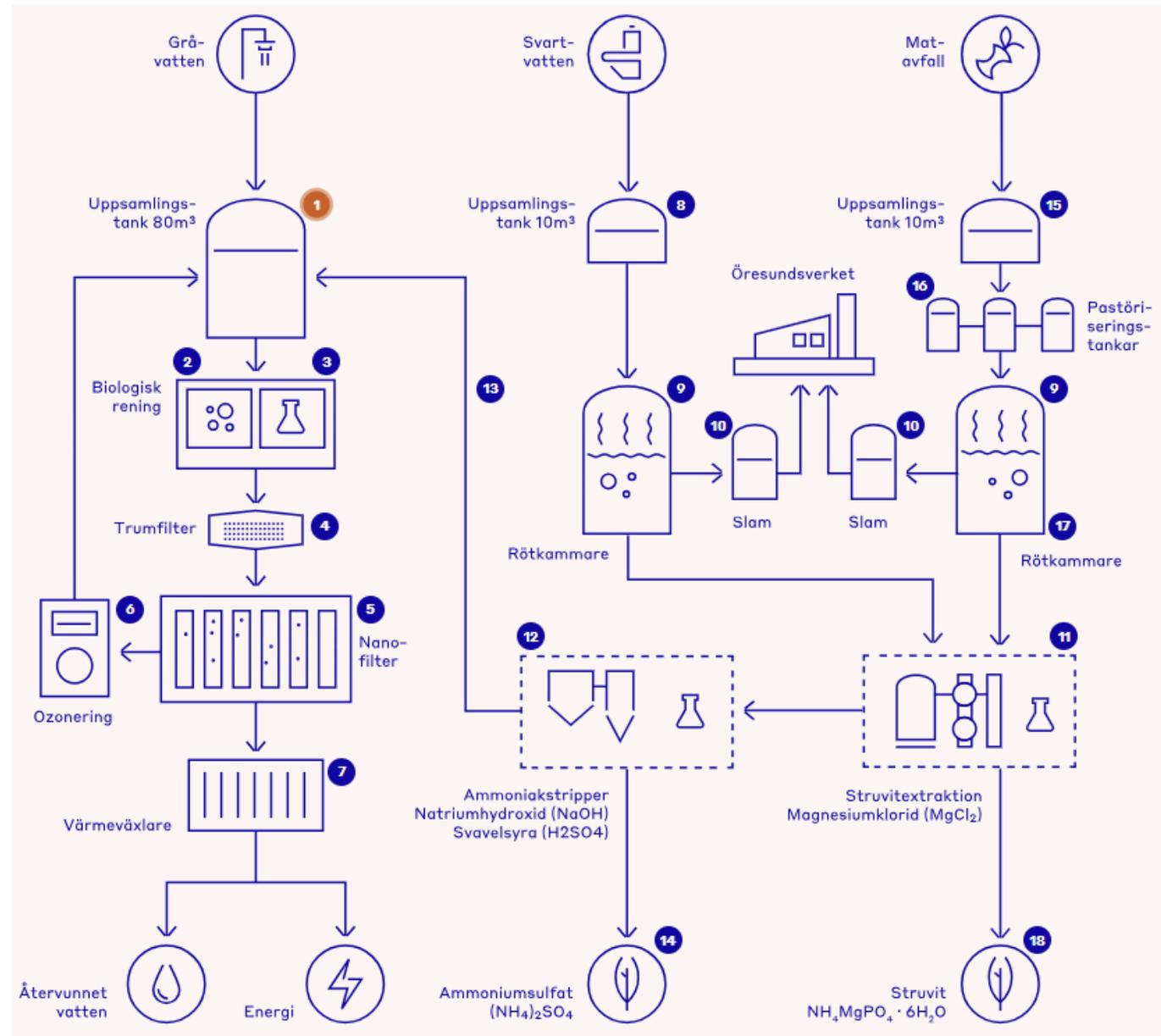


This gap has to be filled. The only way to fill it is by:

- 1) *More demonstration sites.*
- 2) *Increased knowledge spreading to developers, plumbing companies and O&M*

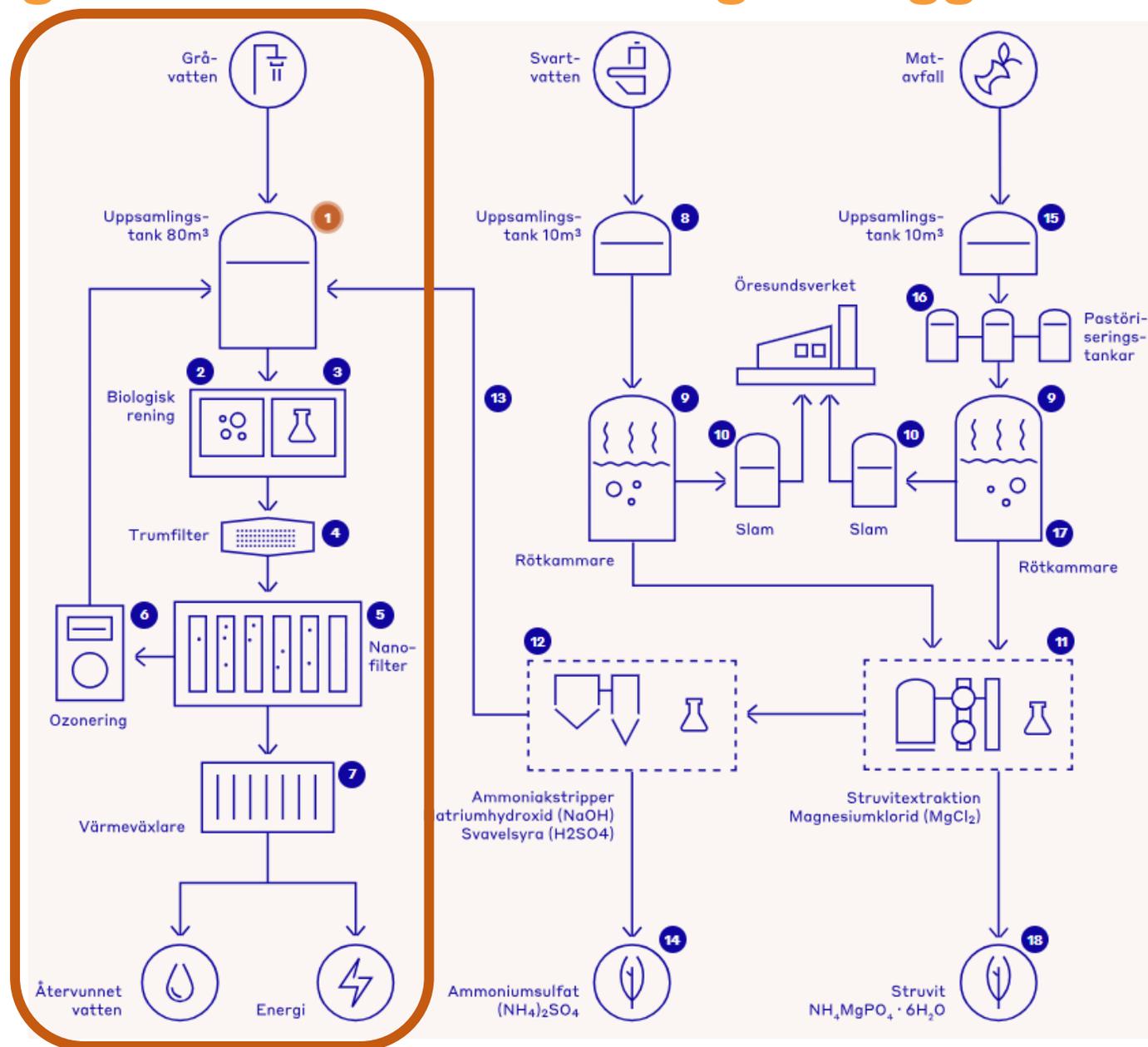
# Utvecklingsanläggningen RecoLab: behandlingsanlegg

- Gråvatten
- Svartvatten
- Matavfall



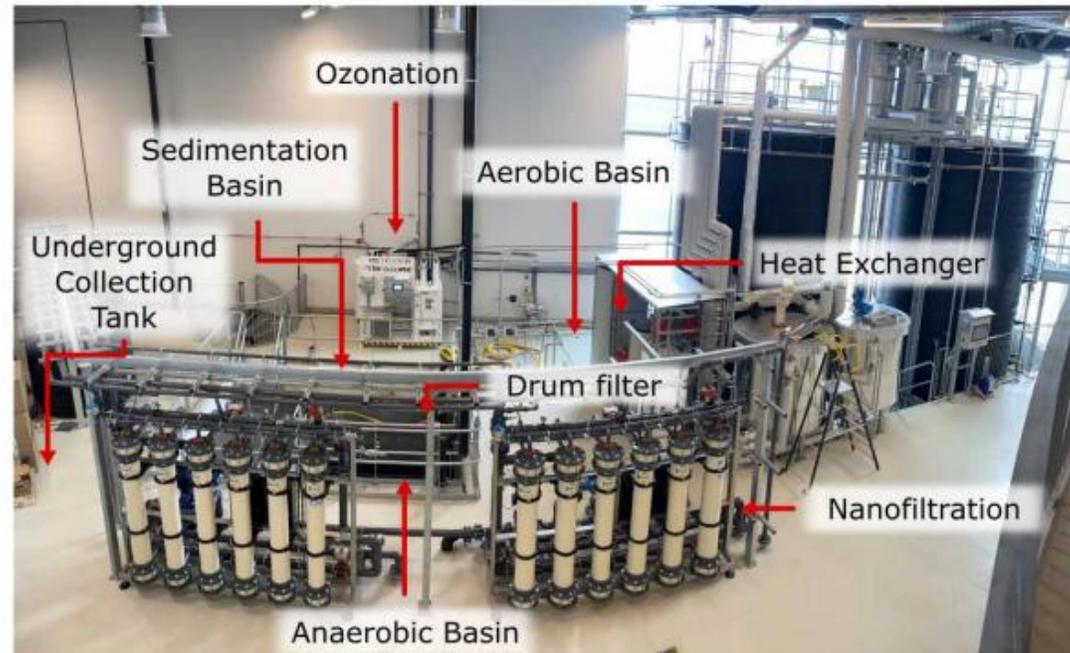
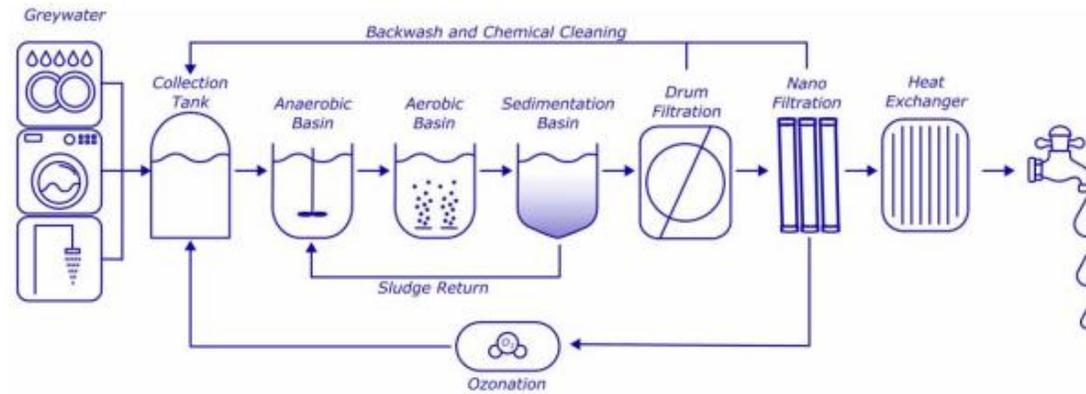
# Utvecklingsanläggningen RecoLab: behandlingsanlegg

- Gråvatten



# Gråvattenrening

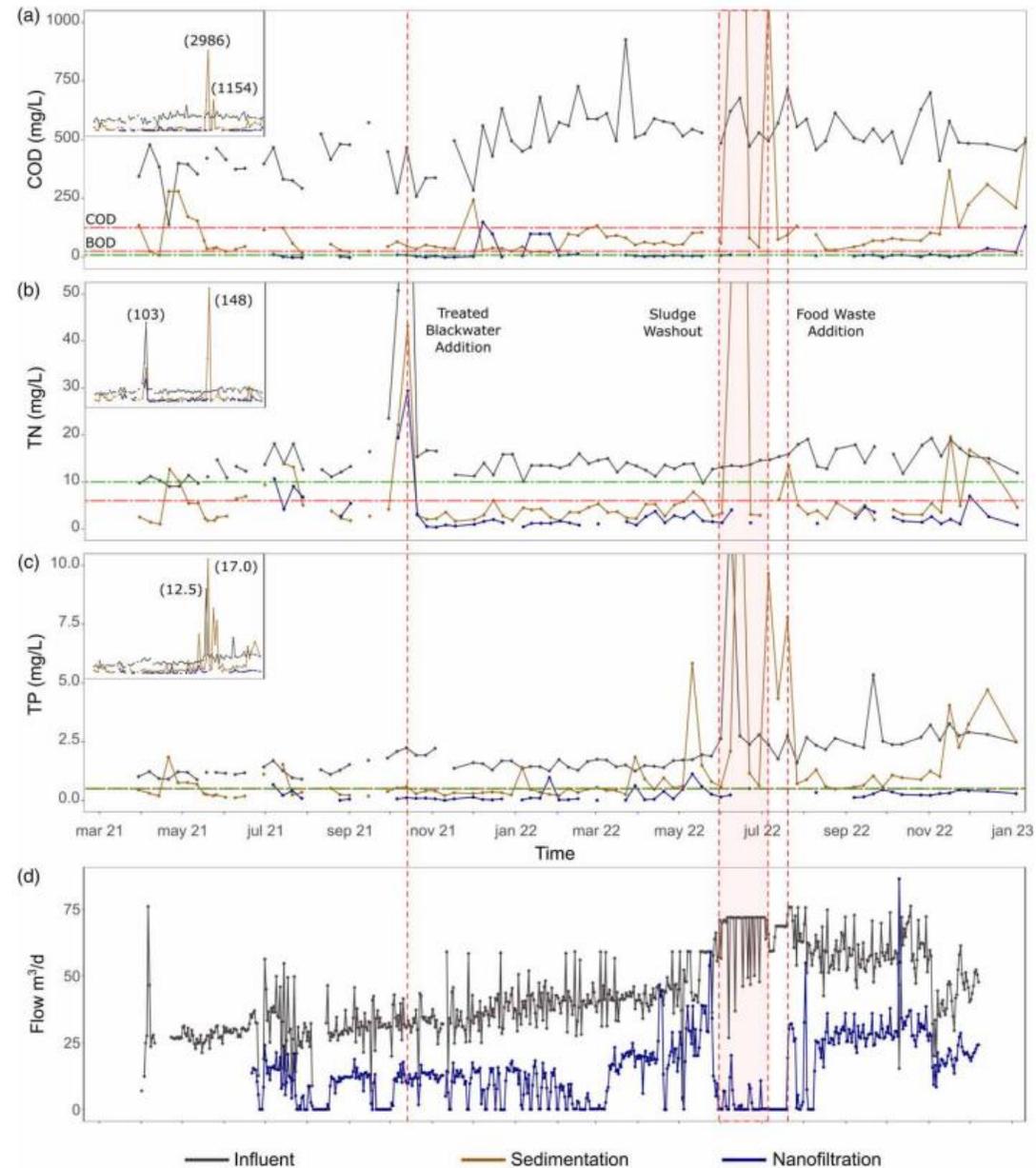
- Aktivslam, trumfilter och nanofilter
- Extra pilot med kolfilter och UV
- Gjenbruk av renat gråvatten möjligt



Hall, A. et al. (2024) Treatment of greywater with nanofiltration for nutrient removal – 2-year experience from Helsingborg  
doi: 10.2166/wpt.2024.050

# Gråvattenrening

- Ut från nanofilter:
- COD 9 + 14 mg/l
- TN 2,6+ 2,4 mg/l
- TP 0,21 + 0,21 mg/l

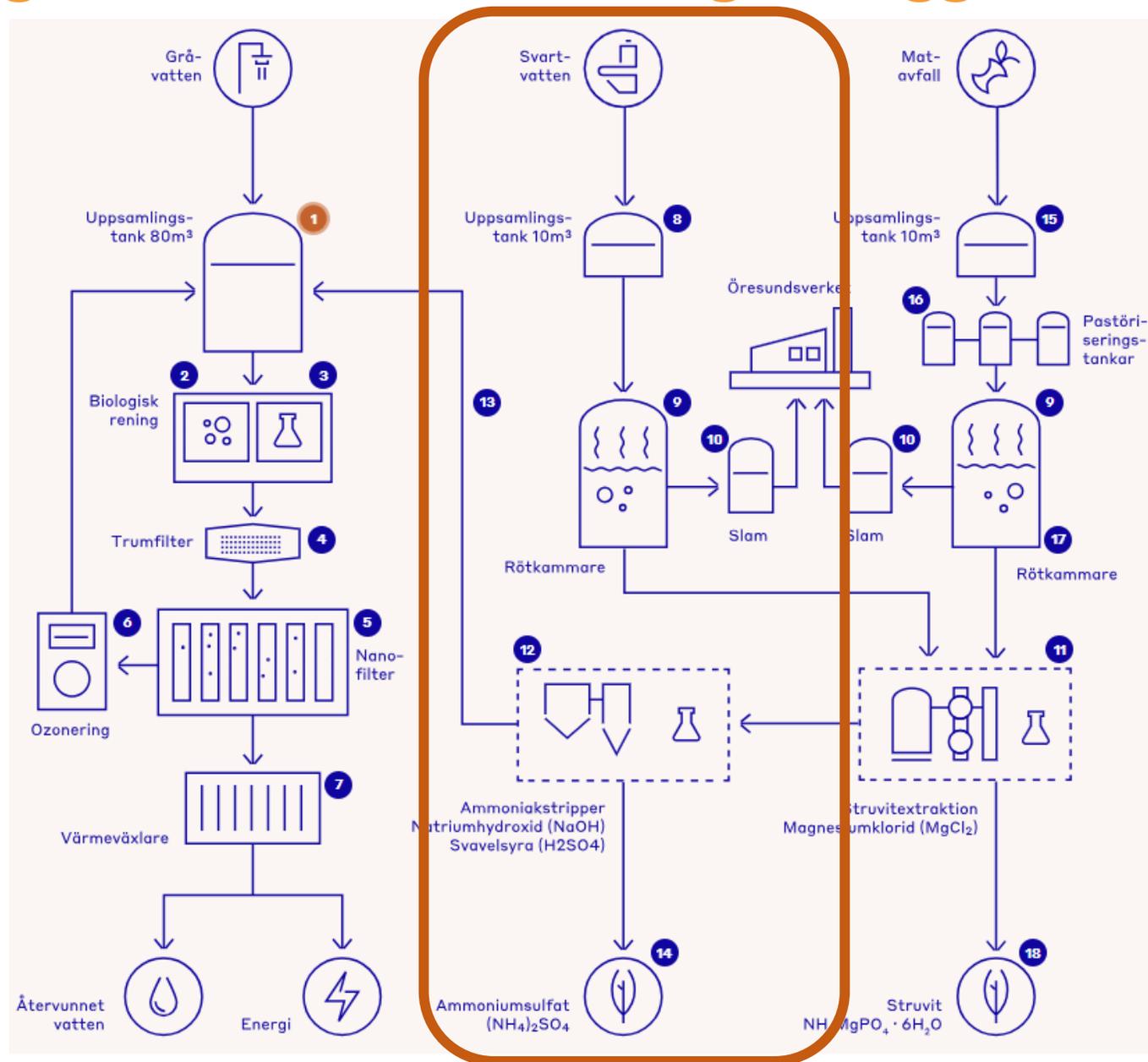


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# Utvecklingsanläggningen RecoLab: behandlingsanlegg

- Svartvatten



# Svartvatten passar för biogasproduktion

## Mera biogas med källsorterat system!

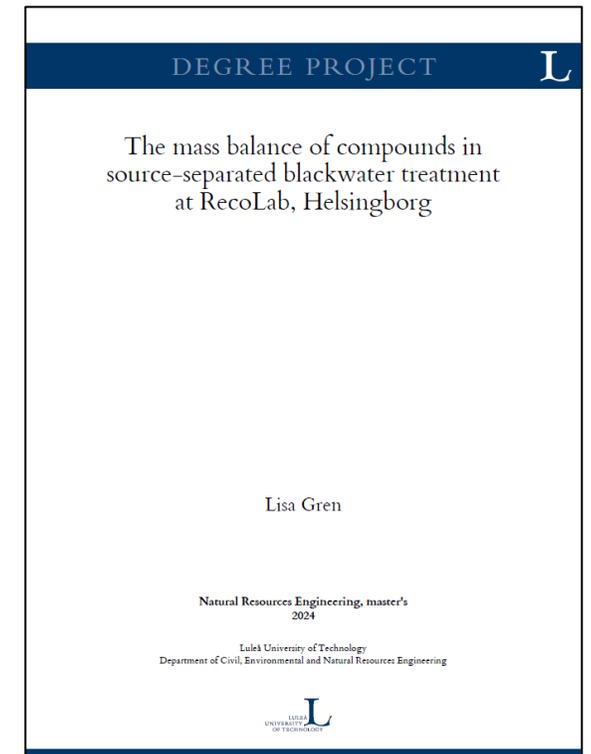
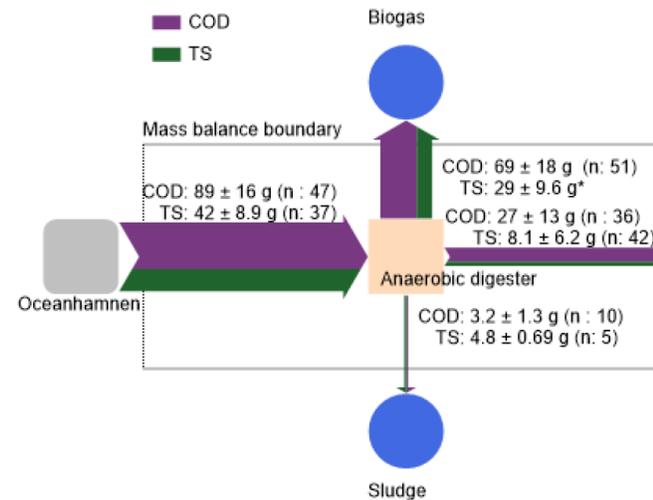
- COD i svartvatten tillräckligt hög för rötning
- Approx. 3m<sup>3</sup> biogas per m<sup>3</sup> svartvatten
- 22 NL CH<sub>4</sub>/pe/d → 65% mer biogas per person\*



\* As compared to the biogas production from municipal wastewater: <https://doi.org/10.1016/j.jenvman.2017.03.094>

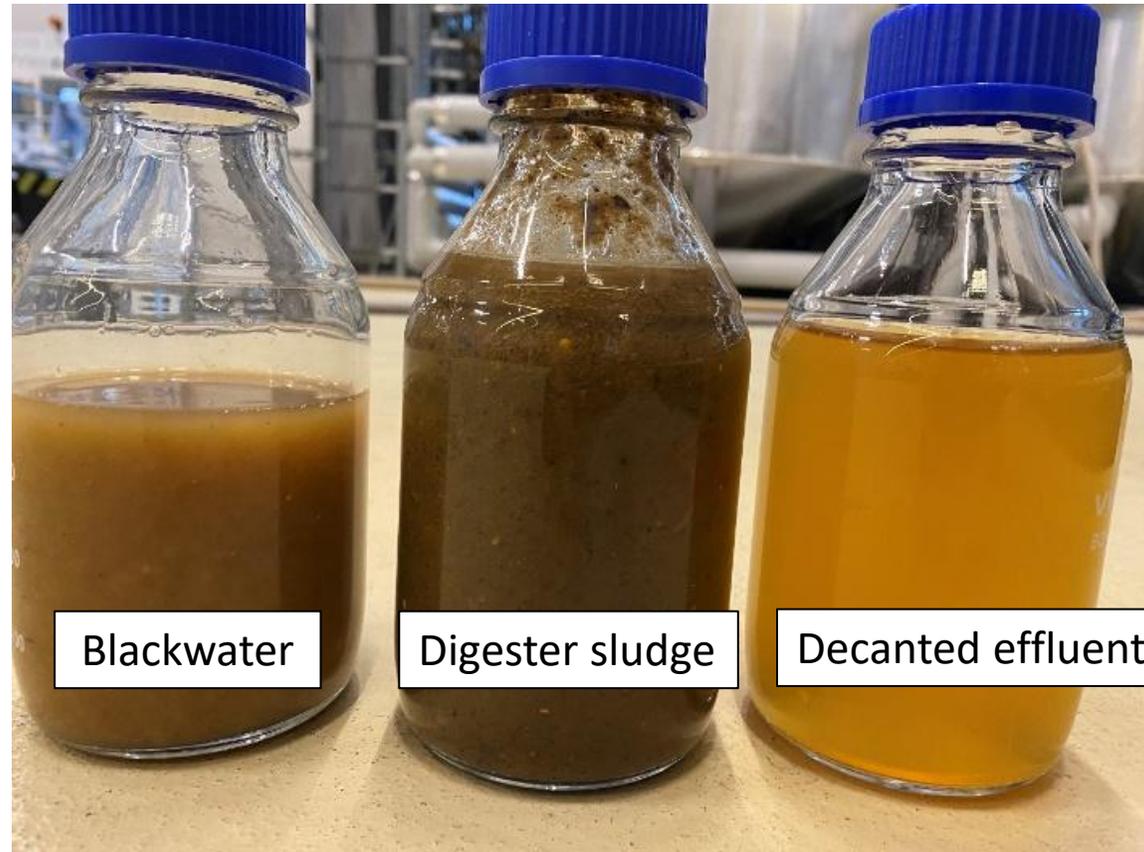
# Svartvatten passar för biogasproduktion

- 80% TS och 70% COD reduktion
- Låg slamproduktion
- Optimering av driften och slamtäcket i UASB I ANCHOR



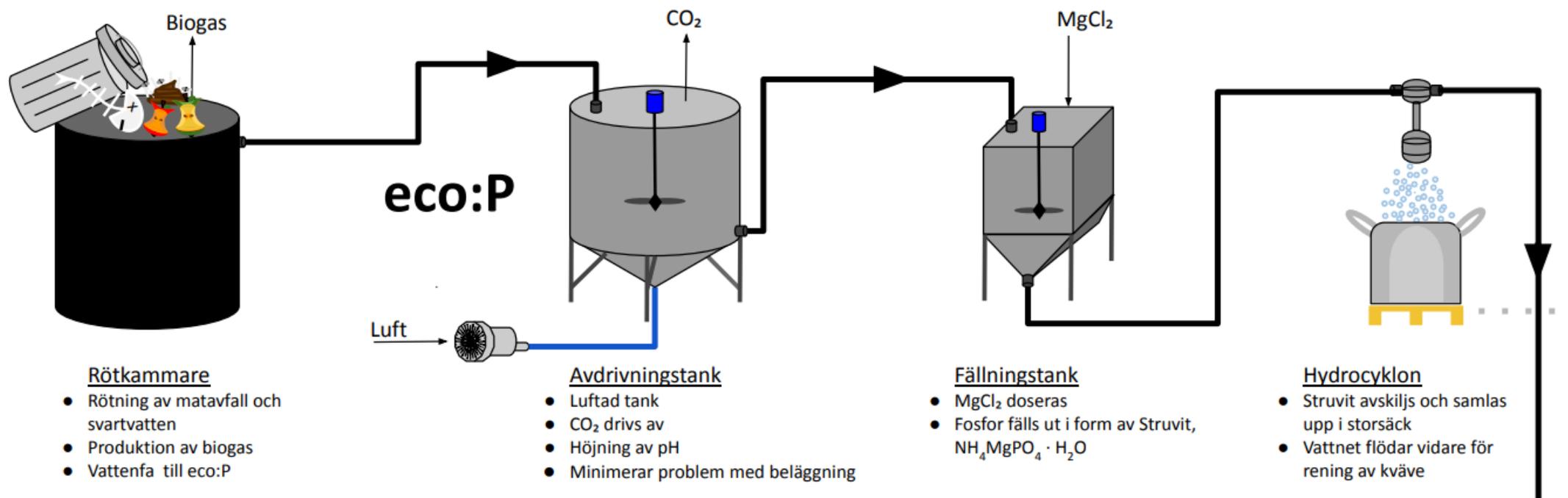
## Svartvatten efter rötning

- 98% av kväve (1 200 mg NH<sub>4</sub>-N/L)
- 85% av fosfor (90 mg PO<sub>4</sub>-P/L)
- Goda förutsättningar för återvinning (gjenbruk) av N och P



# Utvecklingsanläggningen RecoLab: P- gjenbruk

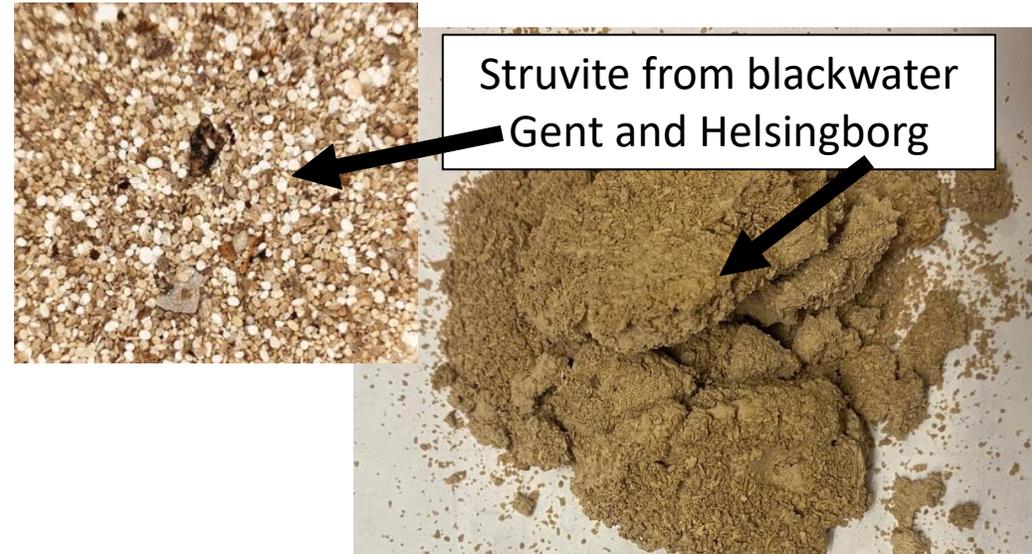
- Struvitfällning genom tillsats av  $MgCl_2$
- Satsvis process som bildar mindre kristaller



# Struvit: gjenbruk av P

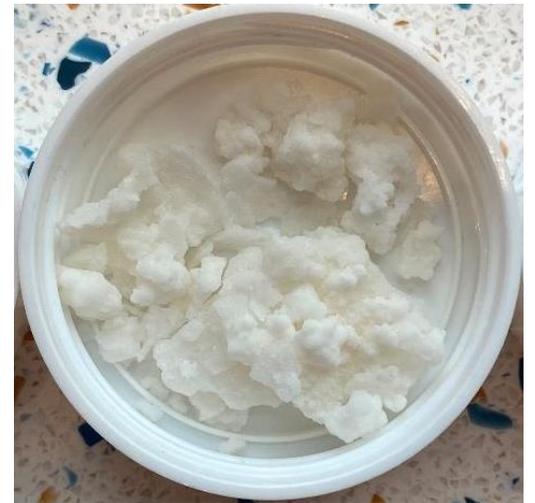
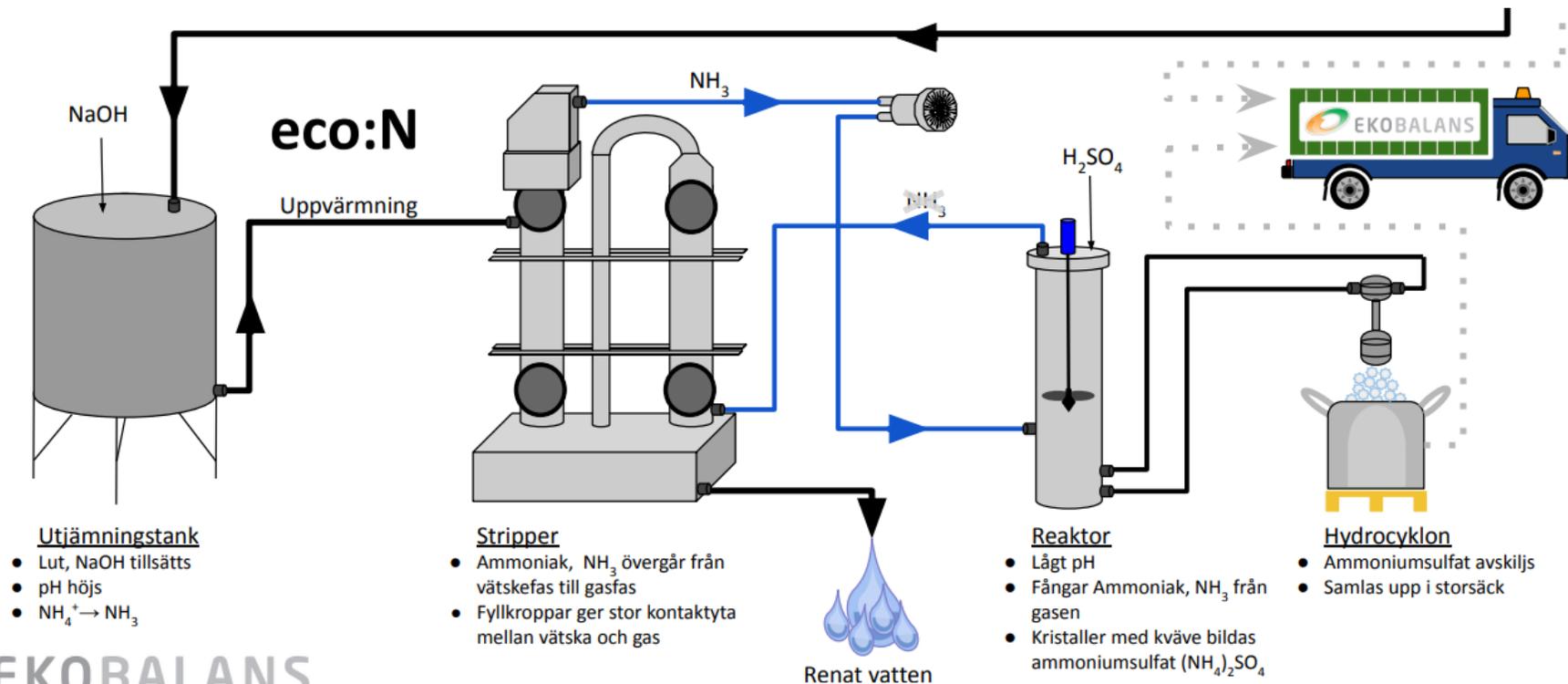
- Finns i Helsingborg, Ghent, och Nederländerna
- EU fertilizer (2019/1009). End of waste & ekologisk odling
- Ren produkt (Cd/P <1)!

Object	mg Cd/kg P
RecoLab influent	8.1
RecoLab sludge	13
RecoLab struvite	0.68
SPCR178 certification	17
Revaq certification	22



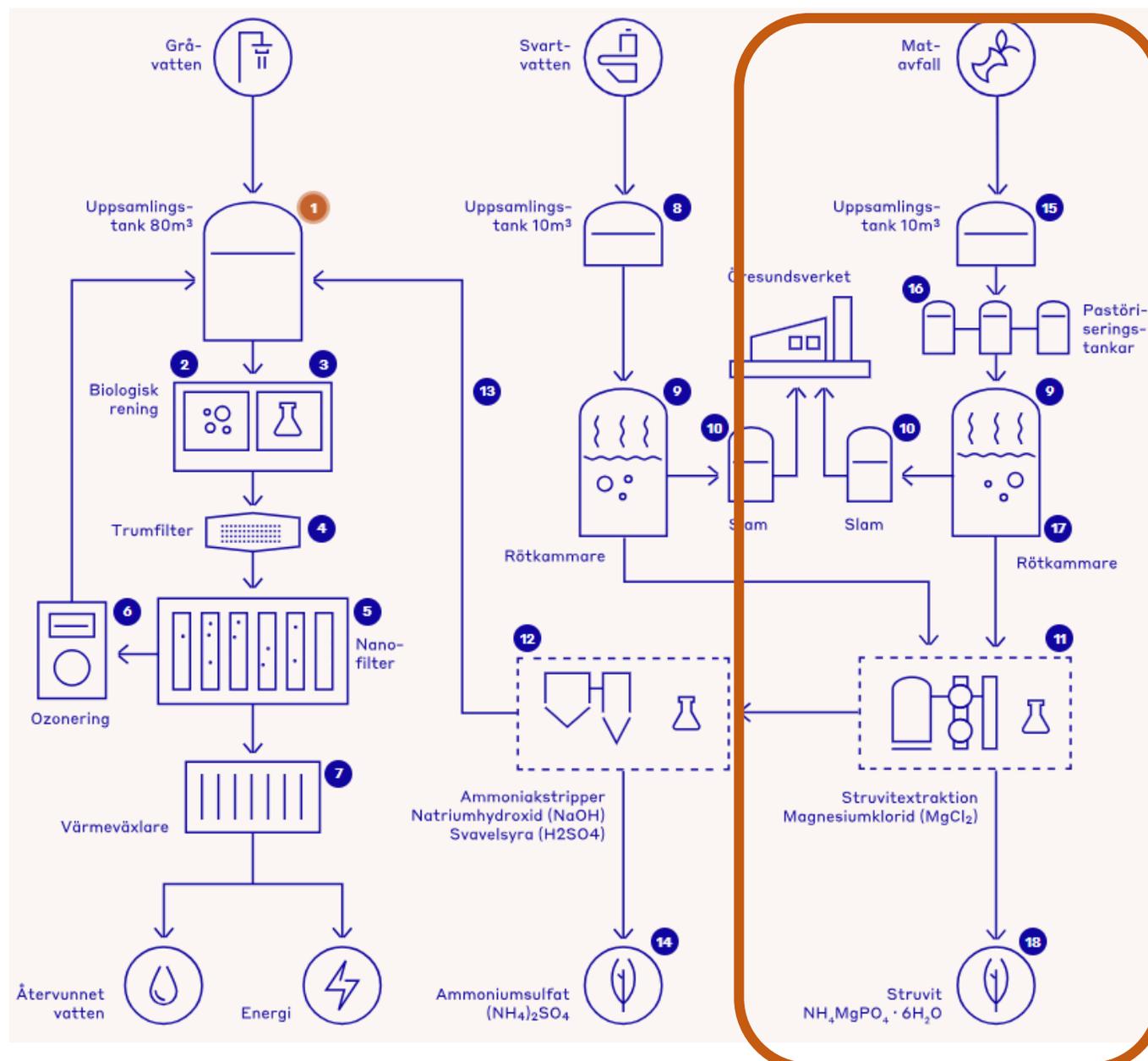
# Utvecklingsanläggningen RecoLab: N- återvinning

- Stripper och reaktor med tillsats av svavelsyra
- Ammoniumsulfat i fast form



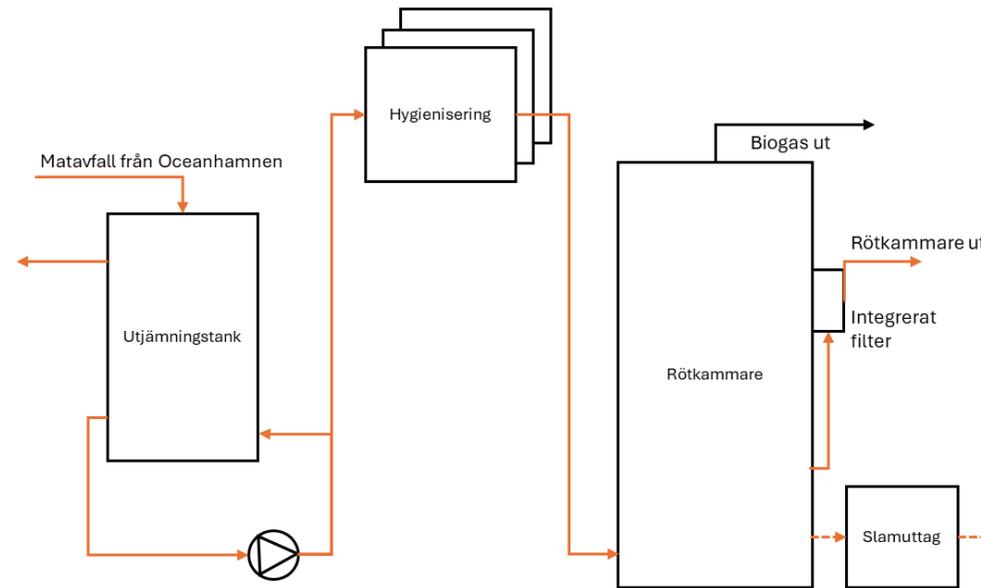
# Utvecklingsanläggningen RecoLab: behandlingsanlegg

- Matavfall



# Utvecklingsanläggningen RecoLab: matavfall

- Utspätt matavfall
- Ska byggas om för att få ett tjockare matavfall till rötning



Nuvarande utformning



# Tack för oss!



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