

Potenties voor een circulaire (huishoudelijk afval)waterketen

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State of the art

Water-based toilets and
sewers



Large dilution of feces and
urine

- * Recovery of nutrients not efficient;
- * Water cannot be used locally;
- * AD not efficient at low temperatures

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Source Separated Sanitation (New Sanitation)

Separation of toilet waste(water) from other
wastewater streams in the household

➡ Black water + Kitchen waste

➡ Grey water

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Why?

Energy efficient resource recovery and reuse,
closing resource cycles



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How to prevent dilution of blackwater?

Toilets with low water use
(≤ 1 l per flush)



Source separation of black
(feces & urine) & grey water



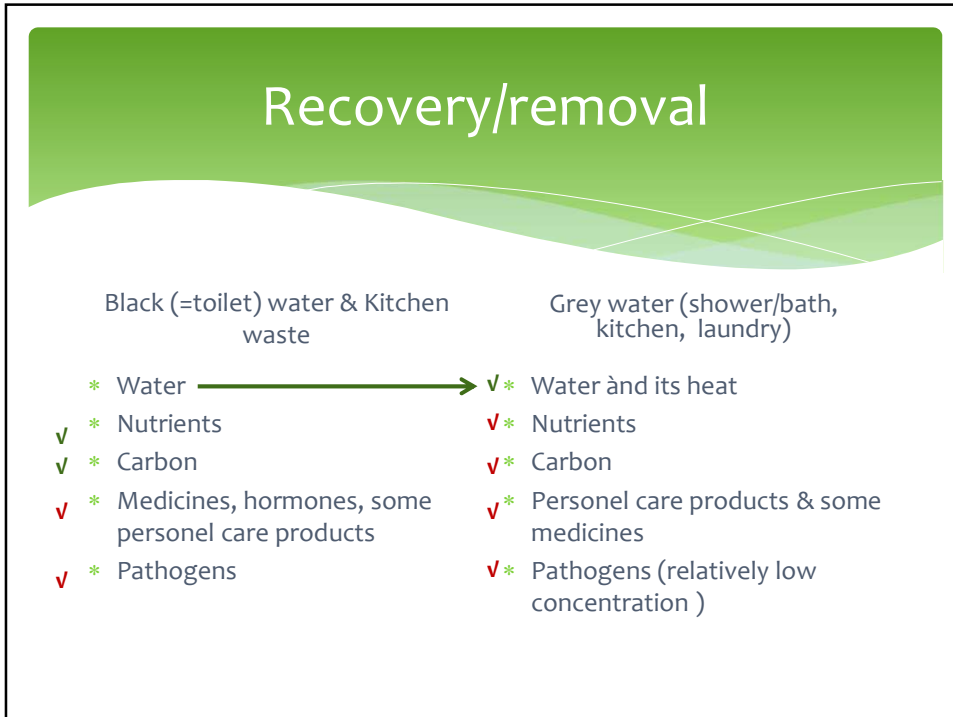
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Raw materials in Black water and Kitchen waste

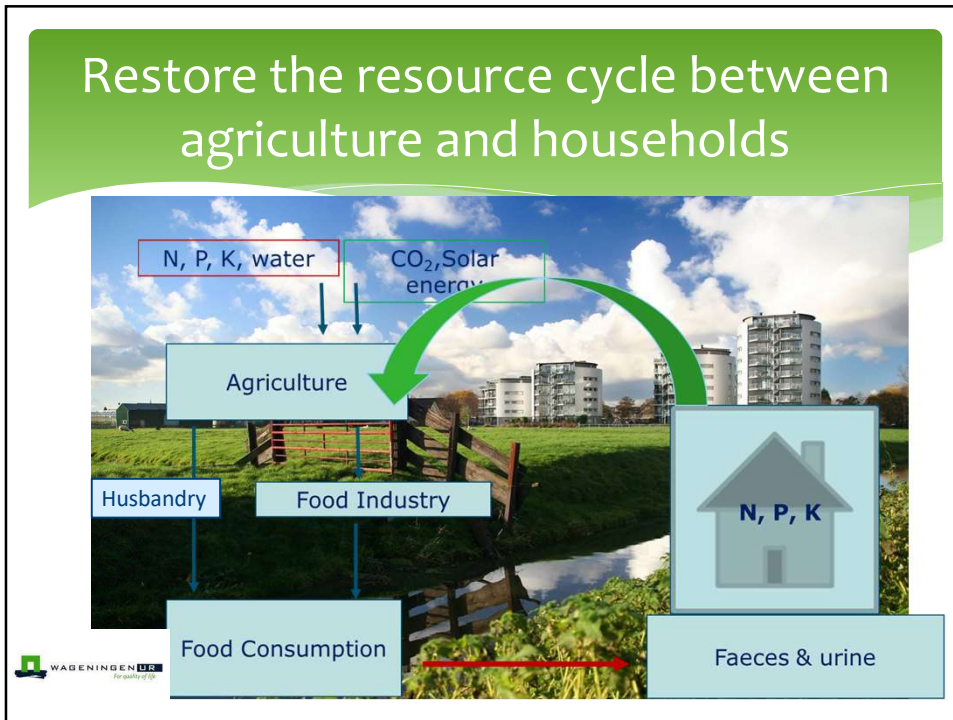
	Black water & Kitchen waste (g p ⁻¹ d ⁻¹)	% of total domestic Wastewater & Kitchen waste
N	12.3 g	92
P	1.6 g	80
K	3.9 g	84
organics	111 g COD	69

adapted from Zeeman & Kujawa-Roeleveld, 2011

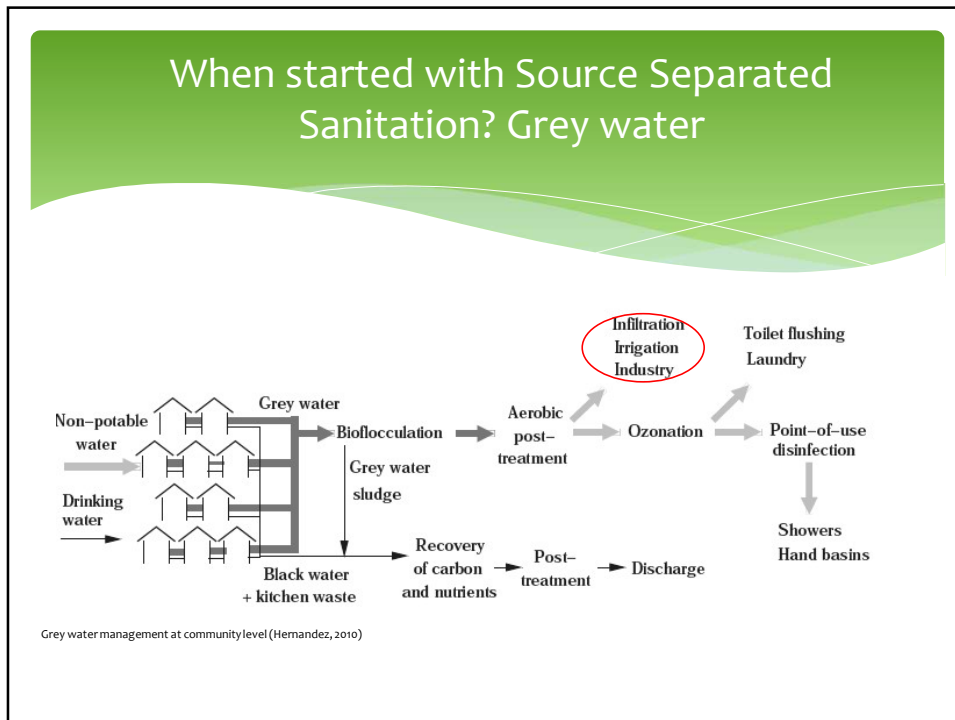
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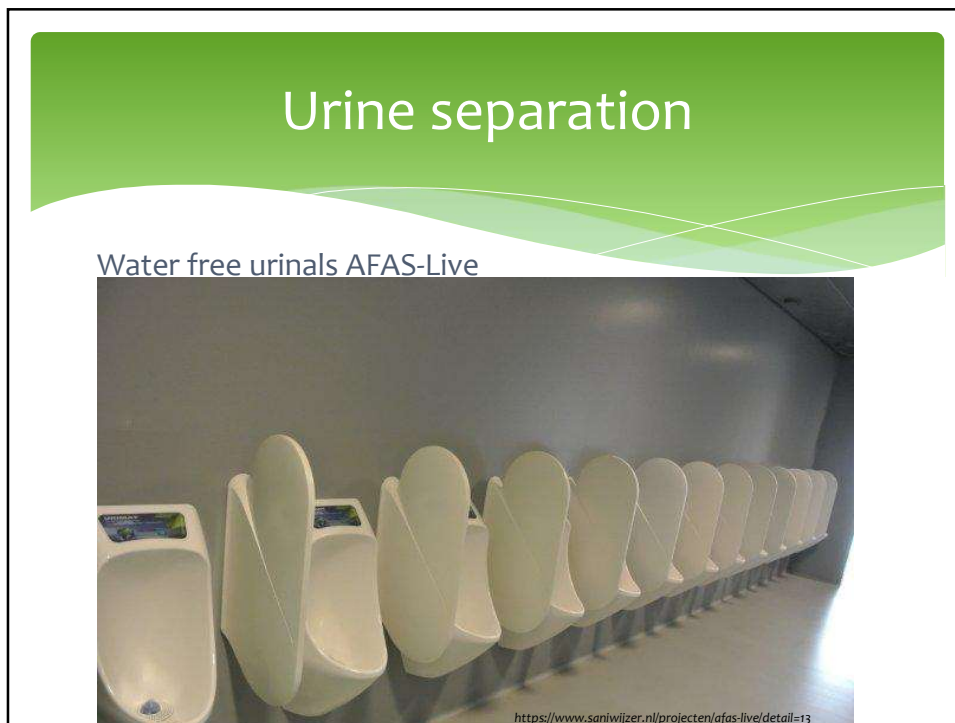
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Urine separation

Separation toilet and fertiliser recovery; EAWAG Switzerland



<https://www.laufen.com/news-stories/save-smart-sanitation-2>

Separation & Drying toilet SLU, Sweden



Credit: EOOS NEXT & Sanitation360
<https://www.thesourcemagazine.org/the-disruptive-opportunity-for-mainstreaming-urine-recycling/>



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Vuna technology

The Vuna Process for a safe and efficient nutrient recycling.

Collect

Waterless urinals or urine diverting toilets collect urine: z.B. Laufen saveit oder Ecodomeo resp. Sanisphere.

Stabilise

The Vuna Process biologically transforms nitrogen (nitrification).

Purify

The activated carbon eliminates all pharmaceuticals and hormones.

Concentrate

The distiller eliminates all pathogens and reduces the liquid volume.

Fertilise

The process produces water and Aurin – Vuna's liquid fertiliser for all plants.

Fresh urine

What happens with all substances contained in urine?

- ✗ Heavy metals – not present in urine.
- ✗ Bad smell & volatile ammonia
- ✗ Pharmaceuticals & hormones
- ✗ Pathogens
- ✓ **Primary nutrients** (nitrogen, phosphorus, potassium etc.)
- ✓ **Secondary nutrients** (e.g. boron, iron, zinc)

Aurin fertiliser

Distilled water

✓ treated, concentrated, and preserved; the essence, which boosts your plants.

<https://vuna.ch/en/urin-recycling-technologie/>

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First vacuum system Flintenbreite Lübeck, Germany

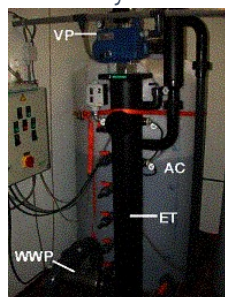


<https://enviropaul.wordpress.com/2019/07/21/flintenbreite-the-original-vacuum-toilets/>

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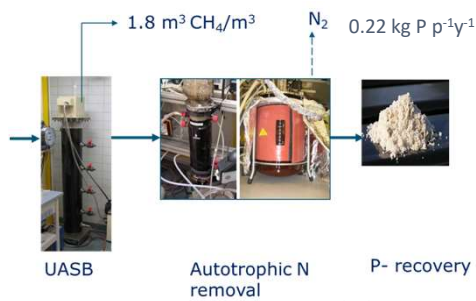
Research

Wageningen University-EETE, early 2000's



K. Kujawa-Roeleveld, T. Elmitwalli, A. Gaillard, M. van Leeuwen and G. Zeeman (2003). Water Science and Technology 48-4;121-128

WETSUS & Wageningen University-EETE



De Graaff et al. (2010), Water; De Graaff et al., (2010), Water Research; De Graaff et al., (2011), Water Research 2*; De Graaff et al., (2011), WS&T



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First demonstration for 32 houses in 2006



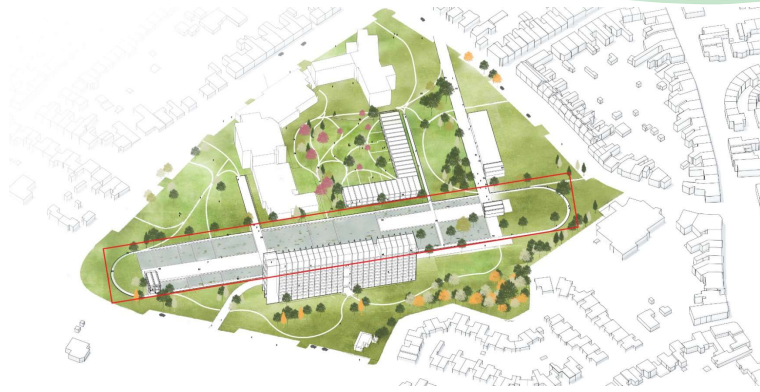
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First full scale application 200 houses in Sneek (NL), 2011



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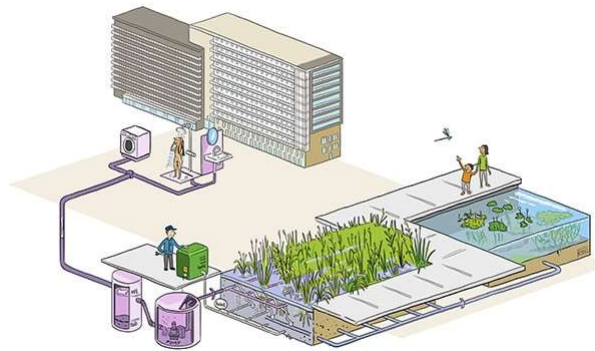
SUPERLOCAL in Kerkrade; 100 houses



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SUPERLOCAL in Kerkrade; GW aerated constructed wetland

*



<https://www.ew-instalatietechniek.nl/artikelen/kerkrade-sluit-kringloop-van-water>

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The Hague, Ministry of Infrastructure & Environment

Office building
Opening in 2016

Vacuum toilets & water free
urinals



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Venlo, Villa Flora

Office building
Opening in 2012



Venlo, Vila Flora;



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Wageningen, NIOO

Office building
Opening in 2012



NEDERLANDS INSTITUUT VOOR ECOLOGIE
NETHERLANDS INSTITUTE OF ECOLOGY


WAGENINGEN UR
For quality of life

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Run4Life - General overview


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Run4Life large scale demonstration...



European Union flag

Horizon 2020, GA 730285.



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Nieuwe Dokken
Ghent (BE); 1200 p.e.







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Nieuwe Dokken
Ghent (BE); 1200 p.e.







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Nieuwe Dokken recovery/treatment system

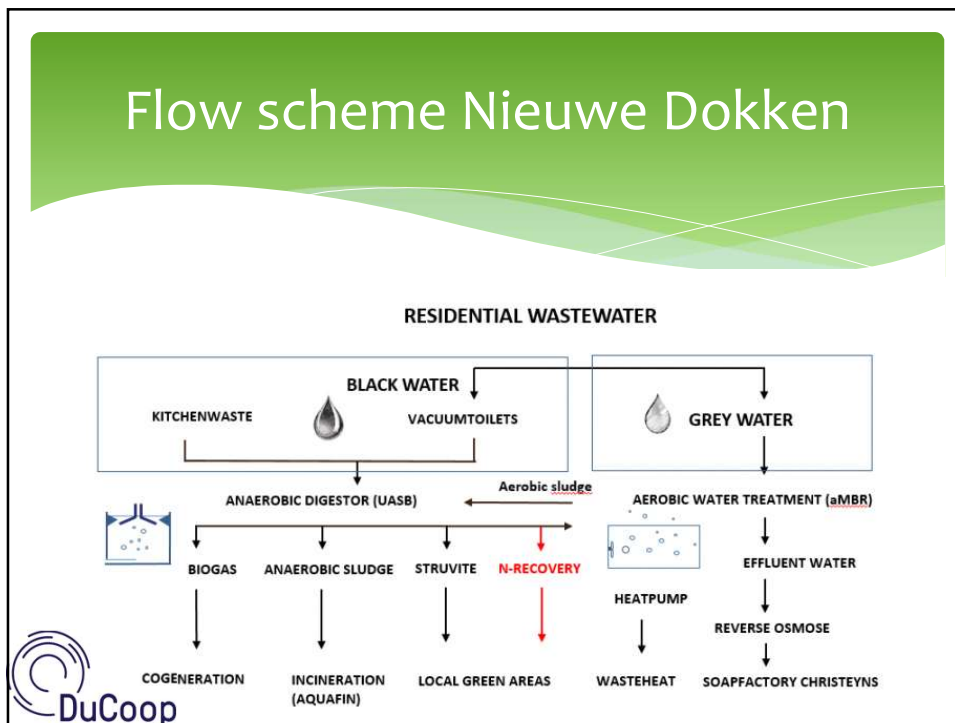






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Nieuwe Dokken, Ghent

UASB for BW+KW
Struvite precipitation
GW treatment, recycling to industry;

Ducoop provides sustainability services to residents of the Nieuwe Dokken.



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H+, Helsingborg (SE); Oceanhamnen district 2300 p.e.



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H+, Helsingborg (SE) 

Oceanhamnen district 2300 p.e.



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H+, Helsingborg

UASB for BW
UASB for KW

struvite precipitation and ammonia stripping

Water (treated GW+BW) recovery for swimming pool

GLOBAL WATER AWARD 2022!



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New Sanitation, Jenfelder Au, Hamburg, Germany



Opening:
18-06-2019

<https://www.iba-hamburg.de/en/projects/quarter-jenfelder-au/projekt/jenfelder-au.html>

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New Sanitation, future

More experience with the use of products in practice;

Exchange of knowledge and experiences;

Several new projects in preparation;

It is important to know why projects sometimes do not lead to application.

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Conclusions

- * Concentrating (**do not dilute**) feces and urine is the key to efficient resource recovery;
- * Recovery products of New Sanitation are Biogas, heat, BW sludge, Water, Nitrogen and Phosphorus;
- * New Sanitation is a proven, but still developing/improving concept;
- * Climate change mitigation and energy shortage can stimulate New Sanitation application.