15 June 2021

Water in balans in de Agri-Food sector

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KWR

Bridging Science to Practice

Institute for Sustainable Process Technology

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KWR

Bridging Science to Practice

Institute for Sustainable Process Technology

Institute for Sustainable Process Technology (ISPT)

Independent open innovation platform, founded by and for the process industry.

Facilitates research and development of sustainable process technologies through joint projects in which process industries, knowledge institutes and technology providers collaborate.

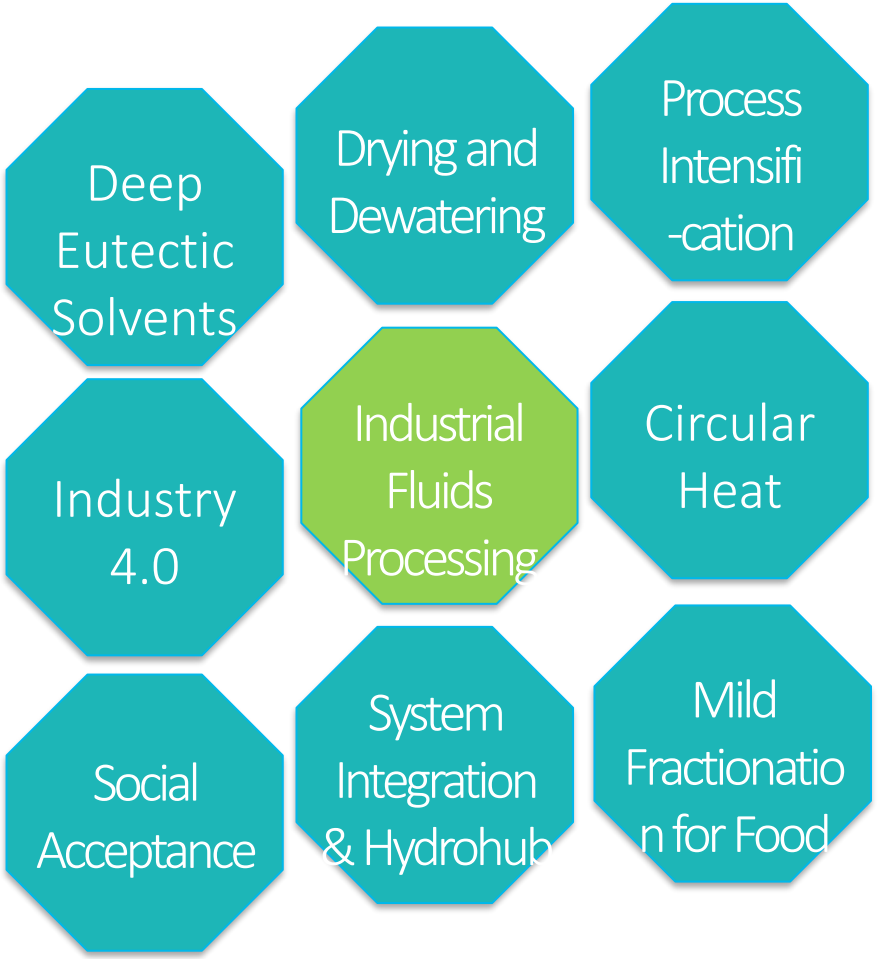
Collaboration, sharing and dissemination is crucially needed to accelerate innovation.

*"...Creating an **environment of trust** among companies, knowledge institutes and technology providers that share a common goal..."*

Institute for Sustainable Process Technology

The way ISPT works: clusters

A cluster is a set of multiple innovation activities with a common theme, all results are shared.



Institute for Sustainable Process Technology

Mission of Industrial Fluids Processing cluster

Accelerate the development of radically innovative technologies for the

separation and treatment of fluids that enable:

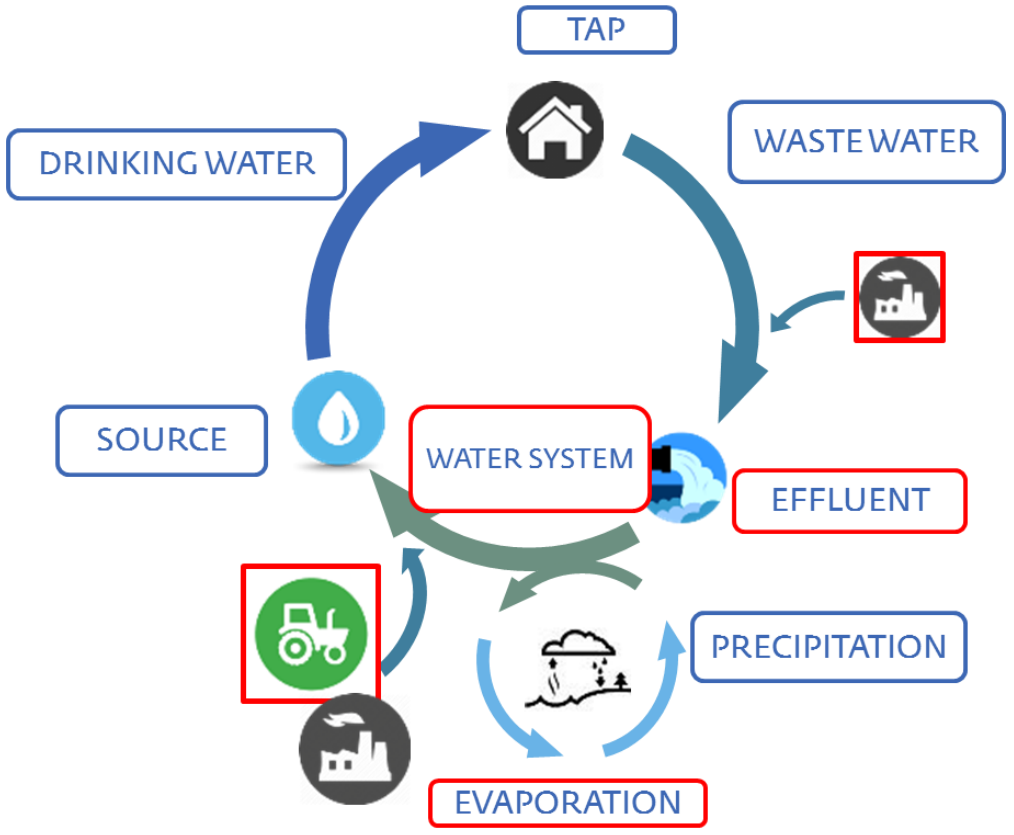
- **Intensification and electrification of the separation and treatment of liquids and gases**
- **More efficient recovery and reuse of valuable components, water and energy**
- **40-50% CO_2 reduction and/or energy savings by 2030 versus 1990**
- **Versatile platform technologies that are cost-effective, robust and future proof**
- **Accelerated application in industry by bridging science to practice**

Institute for Sustainable Process Technology

KWR Water Research Institute

Bridging Science to Practice

- Part of certification institute KIWA (1948)
- Research-based since 1973
- Independent not-for-profit entity since 2006
- ~180 scientists
- Main goal: sustainable water provision in the entire water cycle

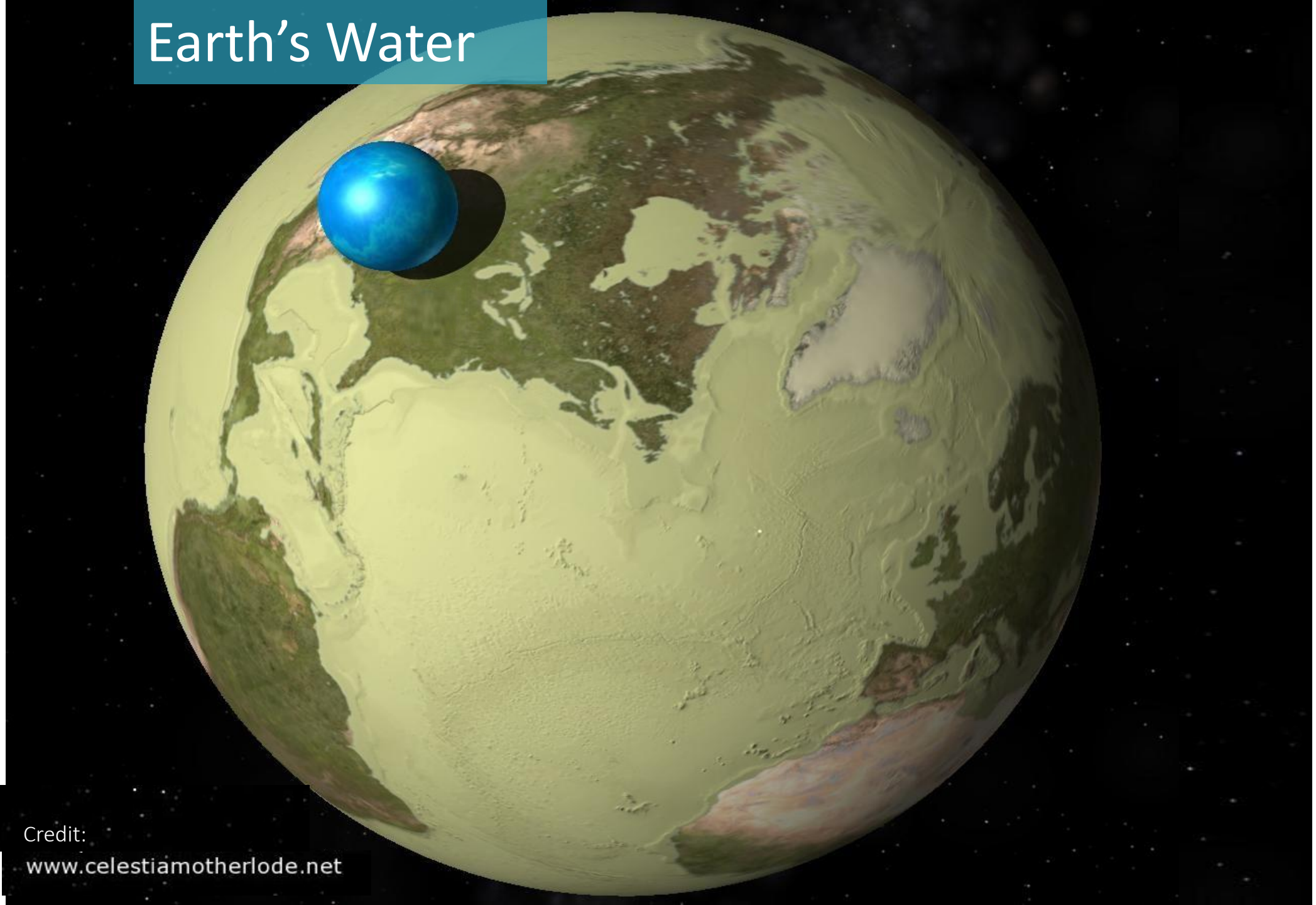


Water in the Circular Economy (WiCE)

The Blue Planet?

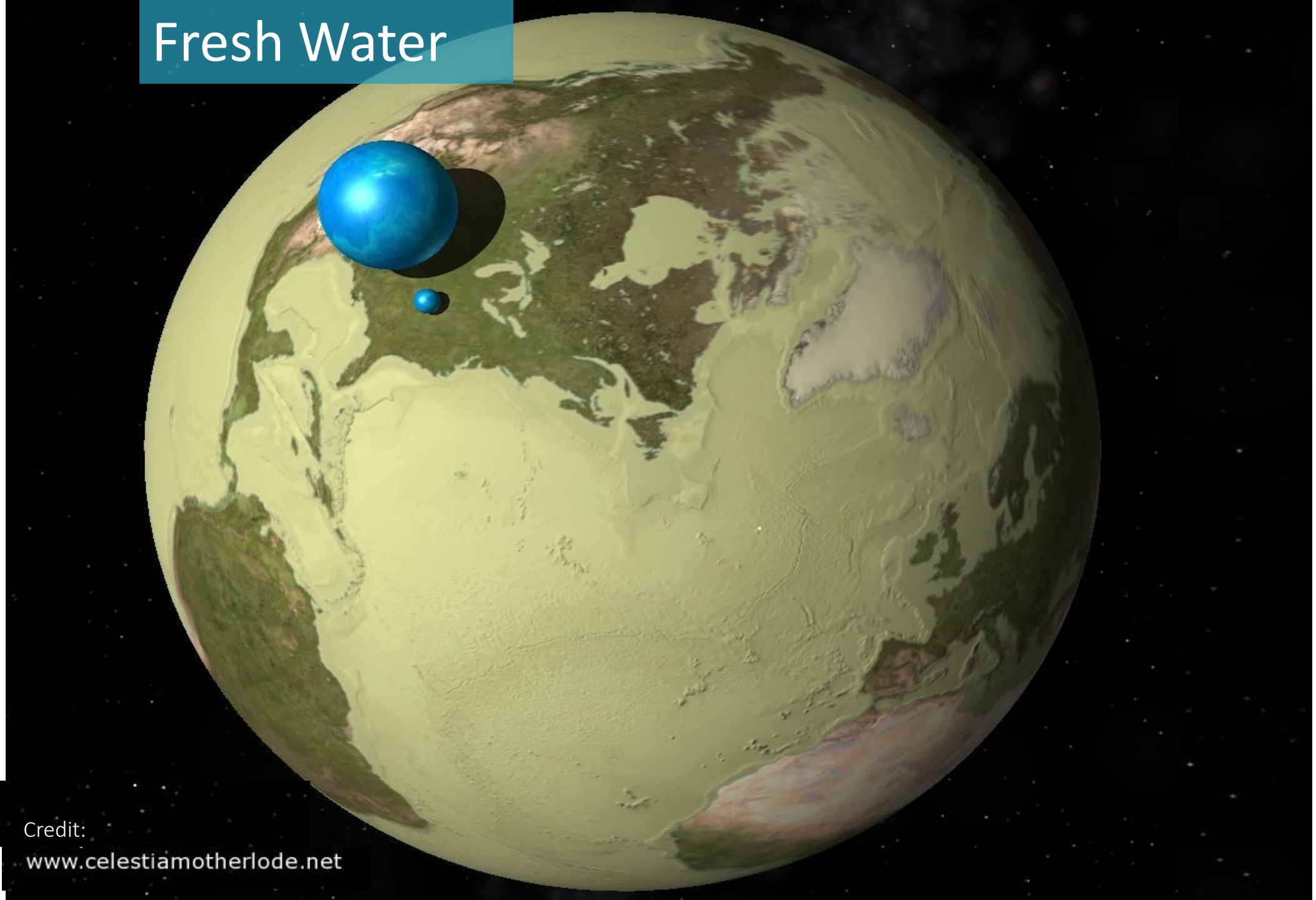
Credit:
www.celestiamotherlode.net

Earth’s Water



Credit:
www.celestiamotherlode.net

Fresh Water



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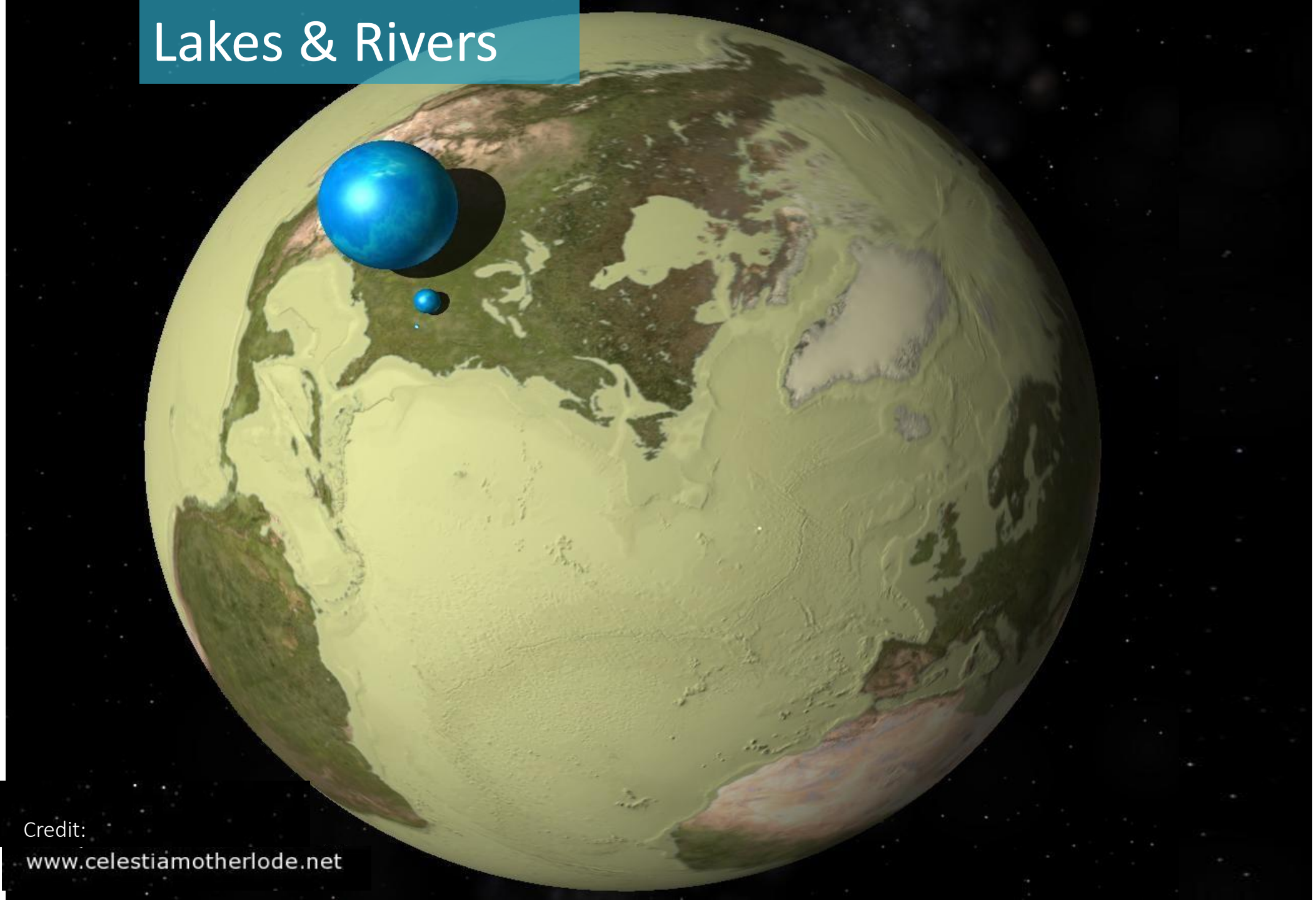
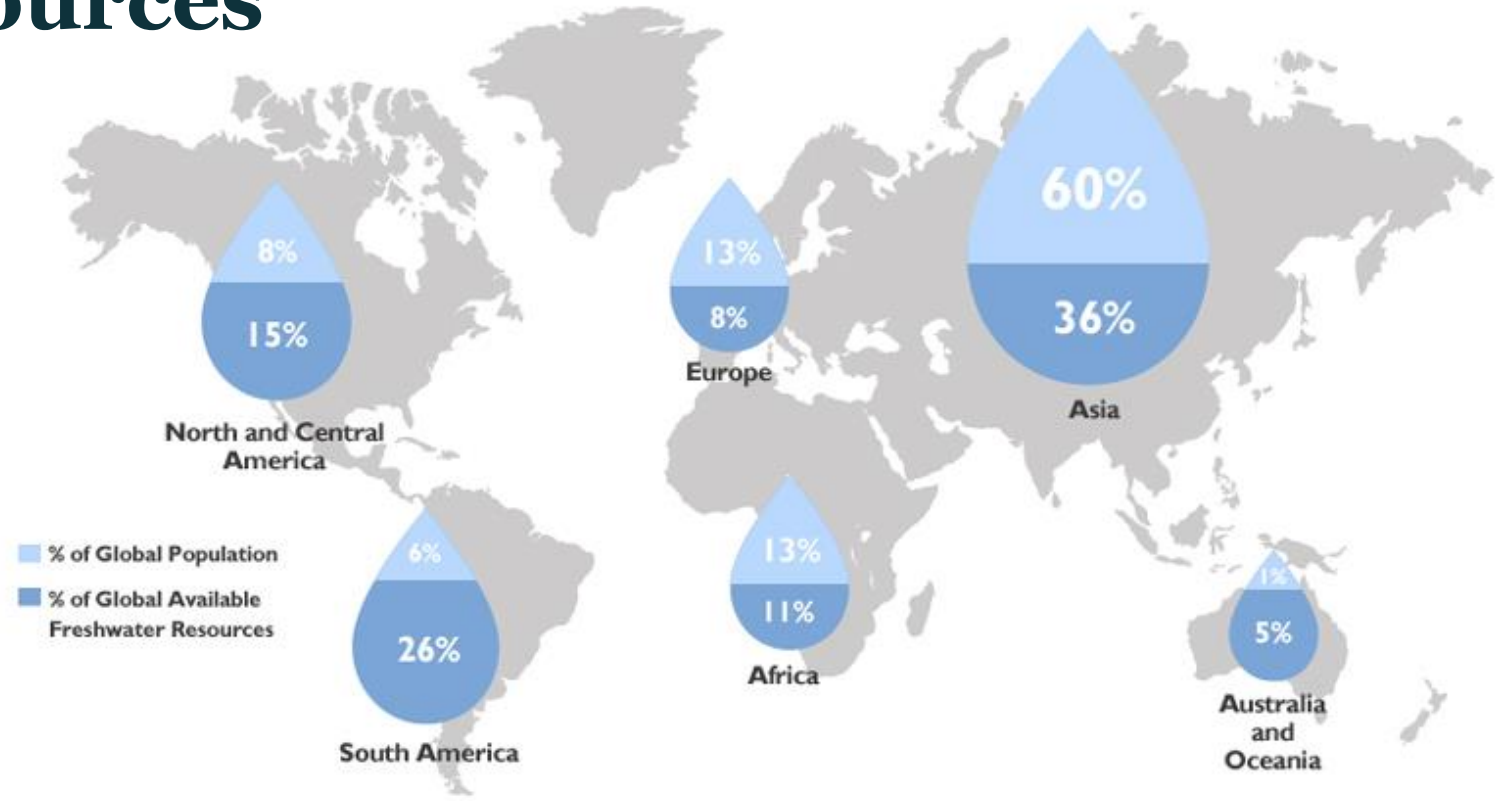
Lakes & Rivers



Credit:
www.celestiamotherlode.net

Global Population vs. Freshwater Resources



By 2025, an estimated 3 billion people will be living below the water stress threshold. Between 1995 to 2025, global population and per capita water consumption are projected to grow at a compound annual growth rate of 1.16 per cent and 0.67 per cent respectively.

Densely populated and developing regions of the world like Asia and Africa are expected to face the maximum water stress.

40% Population increase, reaching 9 billion by 2050

70% Of freshwater withdrawals made by agriculture

WHY WASTE WATER?

OVER 80% OF OUR WASTEWATER FLOWS BACK TO NATURE UNTREATED.

REDUCE: improve wastewater treatment to reduce pollutants entering the ecosystem.

REUSE: treat and use wastewater for green space irrigation and municipal cleaning.

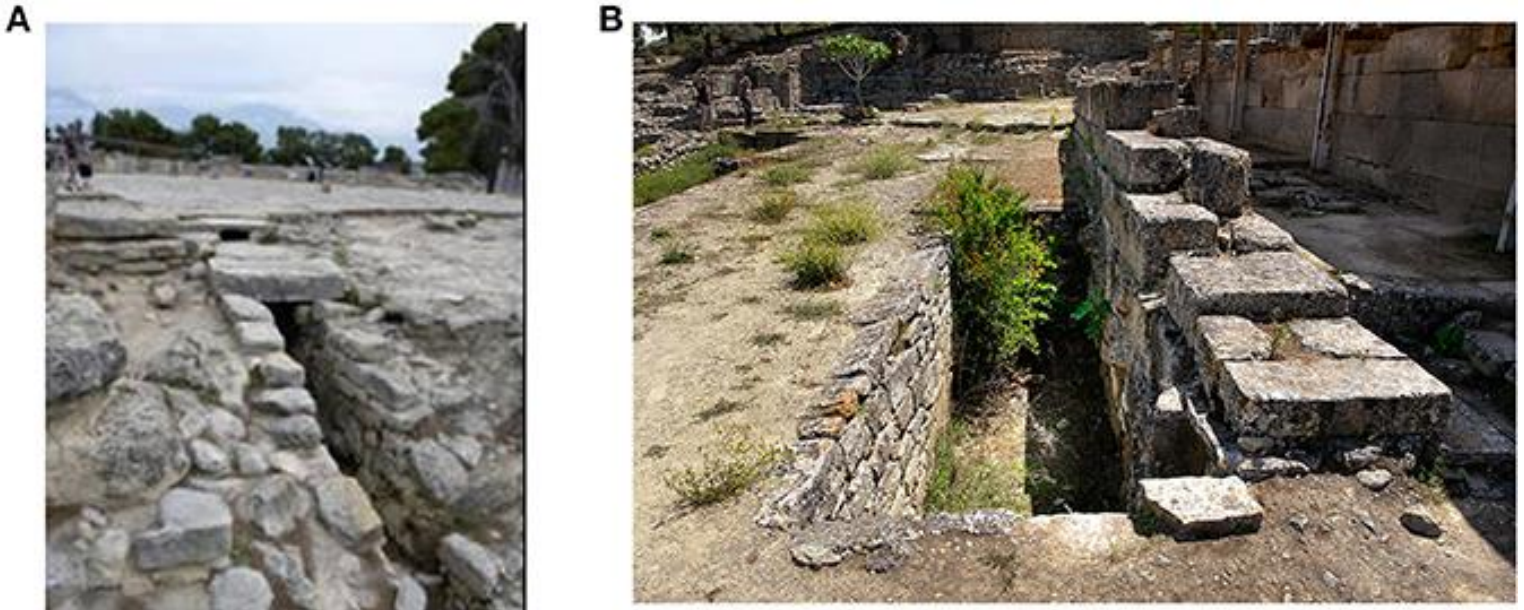
UN WATER

22 MARCH

WORLD WATER DAY

From Prehistoric Times (*ca.* 3200-1000 BC)

Wastewater has been used for irrigation and agriculture

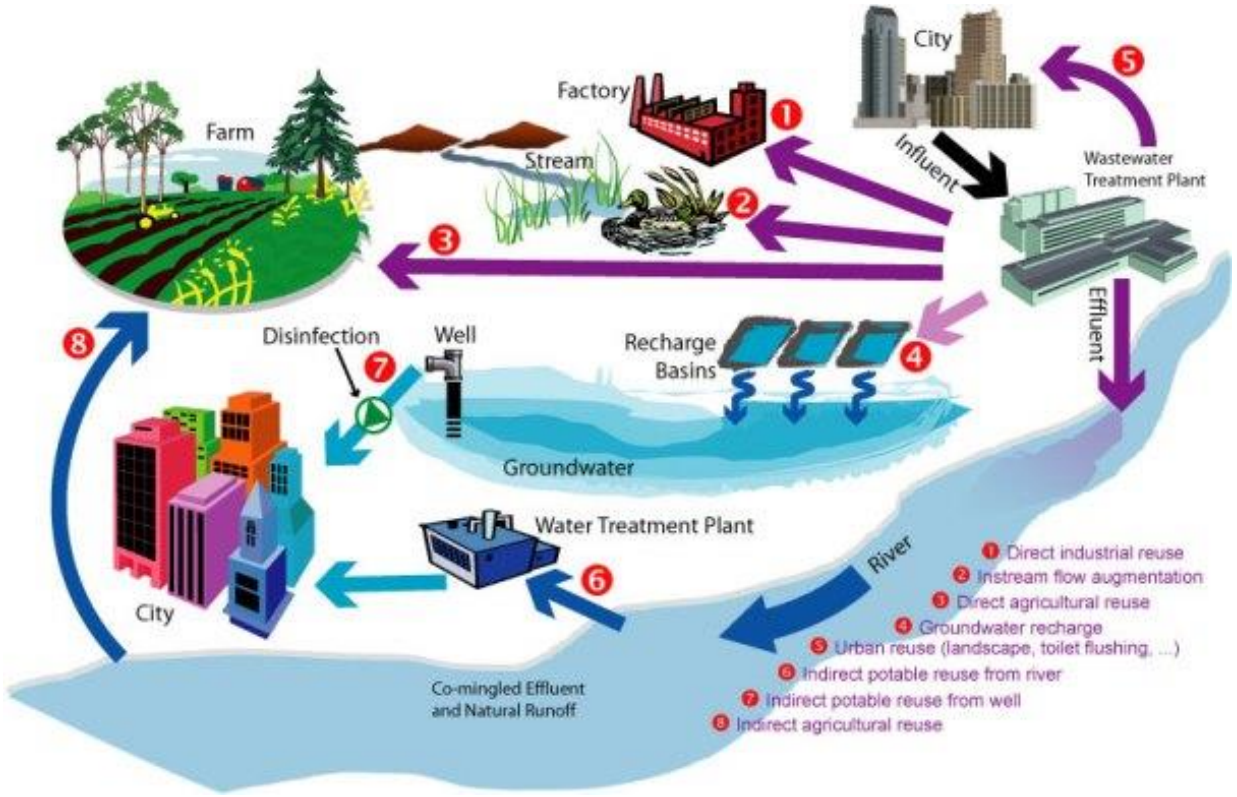


(A) water and wastewater conveyance facilities in the palace of Phaistos (Crete, Greece) used to transport water to farmland

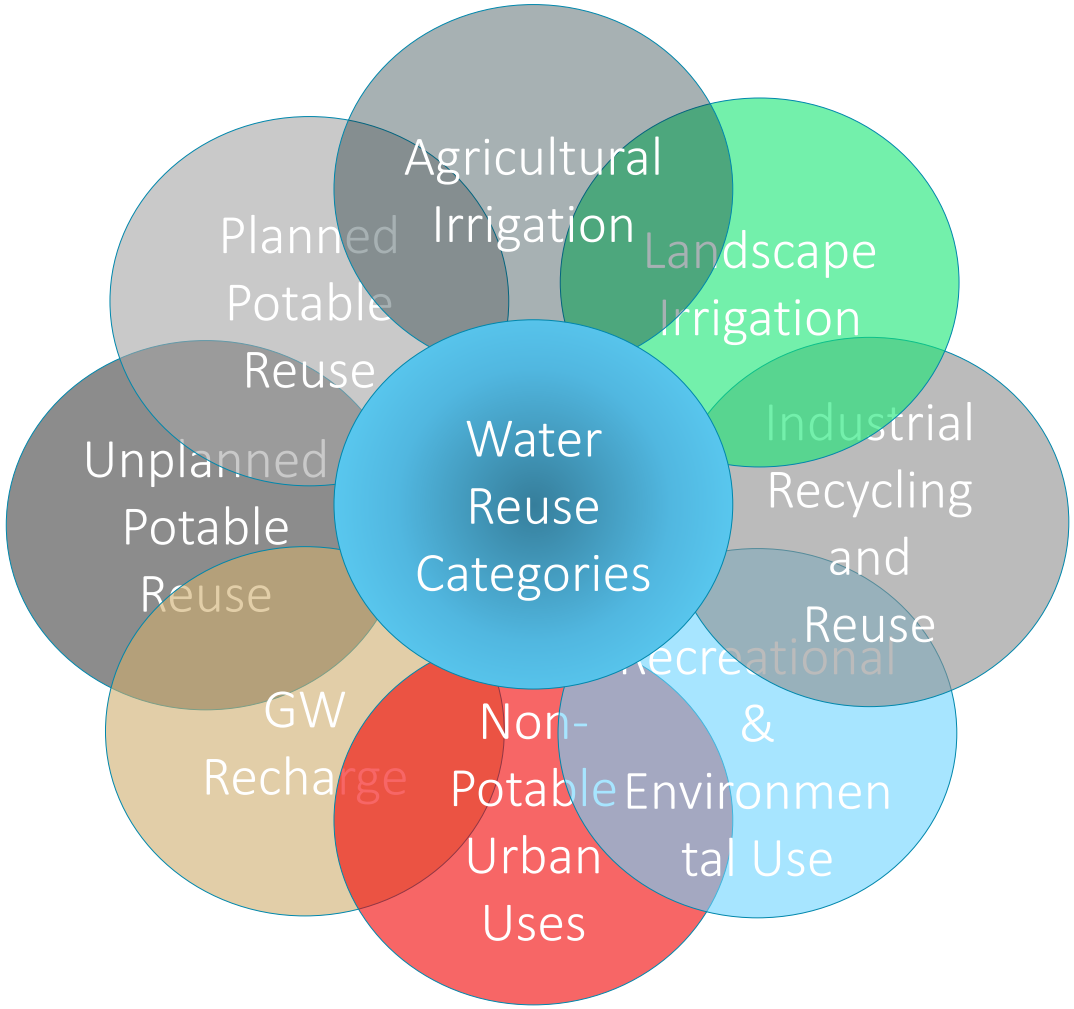
(B) cistern in the villa of Hagia Triada (Crete, Greece) used for water storage for subsequent land application purposes.

Source: Angelakis, et al., 2018. Water reuse: from ancient to modern times and the future. *Frontiers in Environmental Science*, 6, p.26.

Water Reuse Applications



Source: https://equilibriuminsustainability.wordpress.com/2011/09/22/saving-water/



Source: Tchobanoglous et al. (2003)

ASR for agriculture & horticulture

Aquifer Storage and Recovery (ASR)

ASR-Coastal® for agriculture & horticulture

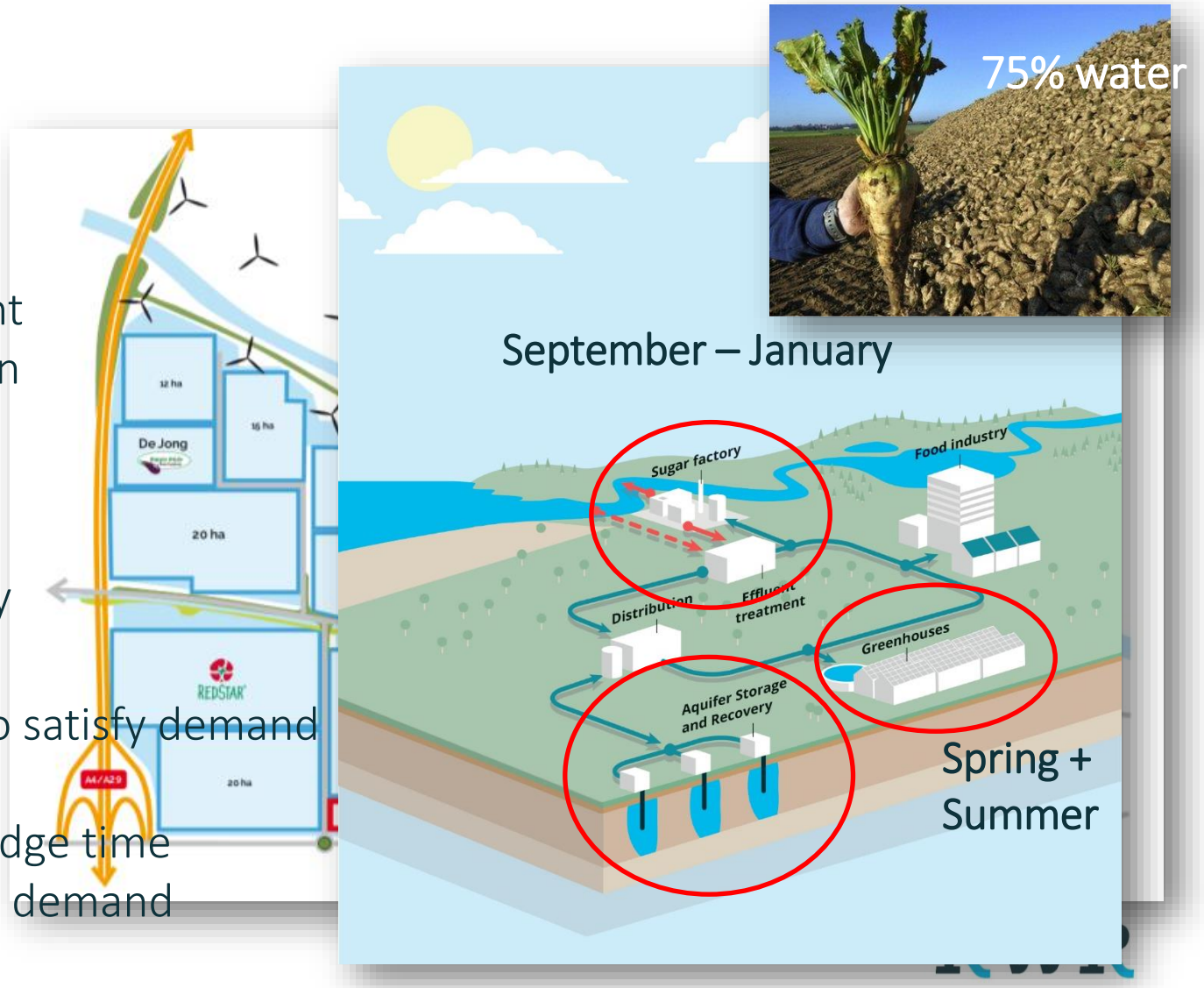
Nieuw Prinsenland:
260 ha of modern greenhouse area

Brackish environment
Demand for irrigation water >
Supply of rainwater

Nearby sugar factory

Wastewater reuse to satisfy demand

& ASR-Coastal to bridge time between supply and demand



Adaptive drainage and cross-sectoral water reuse

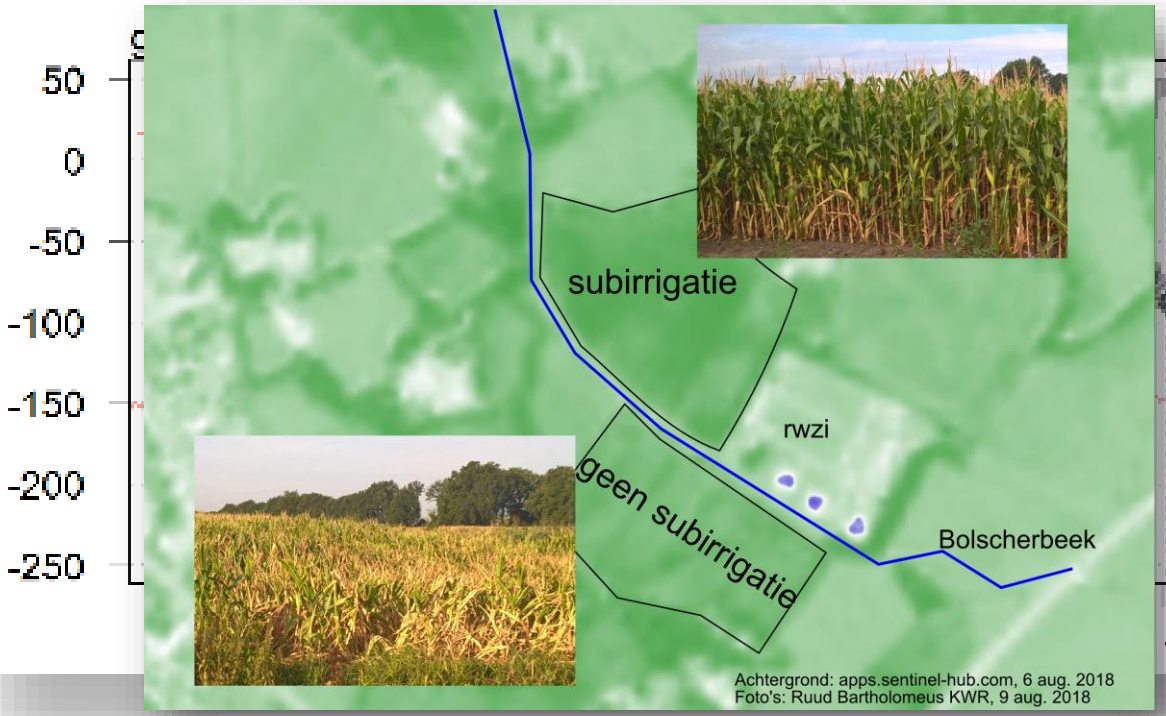
Sub-irrigation with industrial and treated domestic wastewater

Bavaria brewery – food industry to agriculture

Haaksbergen – domestic wastewater to agriculture

Adaptive drainage and cross-sectoral water reuse

Sub-irrigation with industrial and treated domestic wastewater



Groundwater level with (measured; circles) and without (modelled; red line) sub-irrigation

Responsible Water Reuse

SAFE WATER REUSE
REQUIRES AN INTERDISCIPLINARY APPROACH

Sustainability

Legislation and regulations

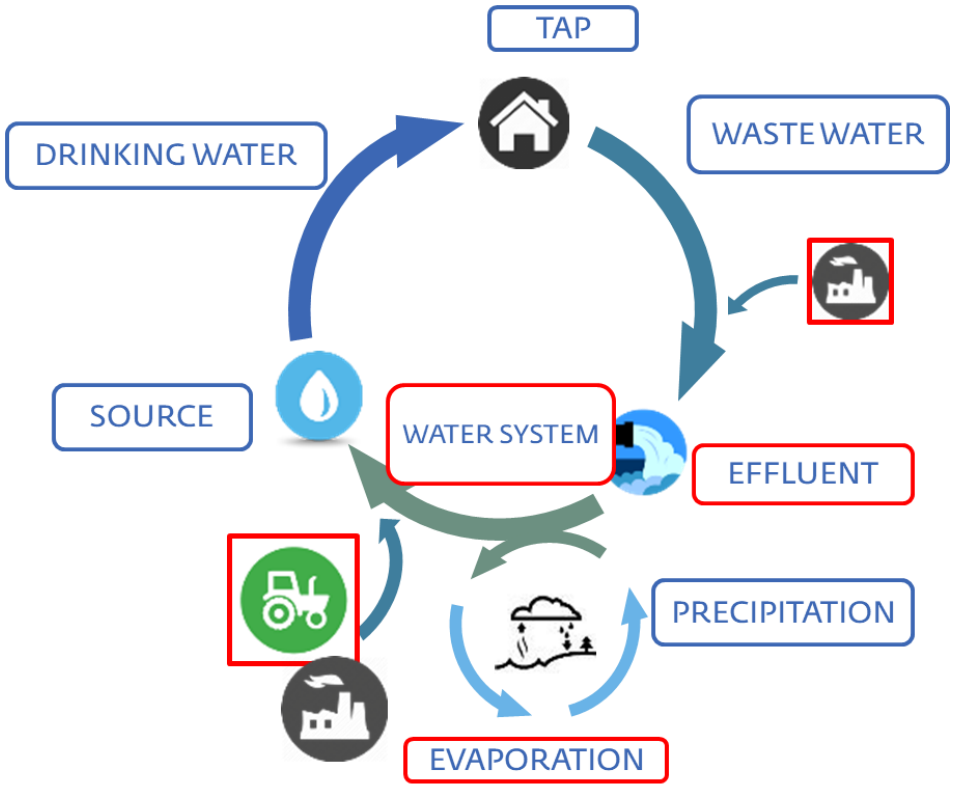
Water treatment technologies

Health and safety (QMRA)

Reuse in agriculture or industry

Subsurface water storage

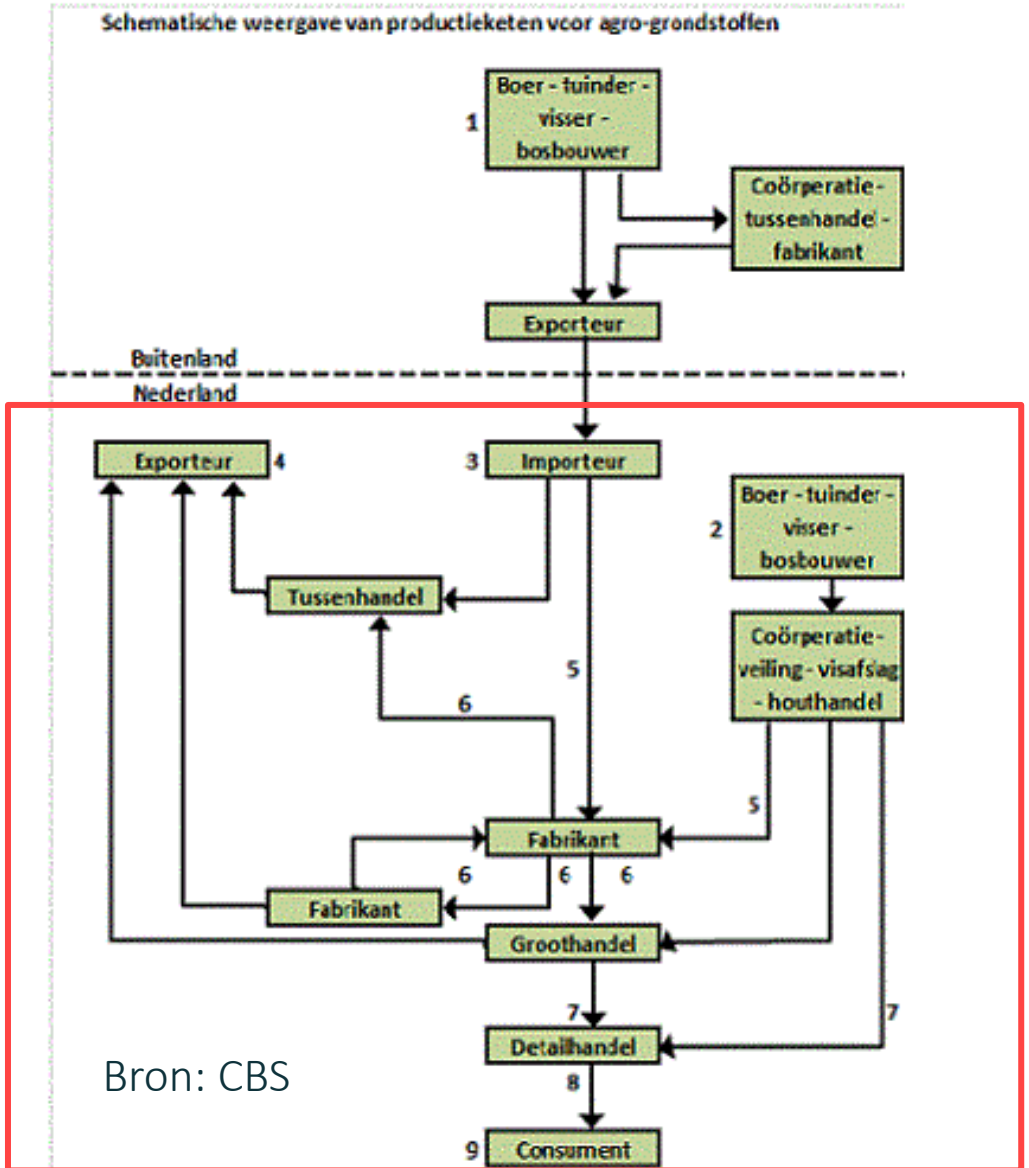
INTEGRATING URBAN AND NATURAL WATER SYSTEMS



Borging van effluent rwzi voor glastuinbouwsector

Doel:

Effluent op een veilige manier inzetten in de glastuinbouw, die gedragen wordt door partners in de hele keten van teelt tot consument.



Bron: CBS

Water reuse regulation 2020/741
Effective: 06-23-2023
Just guidelines

From ‘safe discharge of wastewater’ to the ‘responsible reuse of wastewater and its purification for the targeted use’

(Milou Dingemans, KWR).

REGULATION (EU) 2020/741 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 25 May 2020

on minimum requirements for water reuse

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 192(1) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee ([1]),

Having regard to the opinion of the Committee of the Regions ([2]),

Acting in accordance with the ordinary legislative procedure ([3]),

Whereas:

(1) The water resources of the Union are increasingly coming under pressure, leading to water scarcity and a deterioration in water quality. In particular, climate change, unpredictable weather patterns and drought are contributing significantly to the strain on the availability of freshwater, arising from urban development and agriculture.

(2) The Union's ability to respond to the increasing pressures on water resources could be improved by wider reuse of treated waste water, limiting extraction from surface water bodies and groundwater bodies, reducing the impact of discharge of treated waste water into water bodies, and promoting water savings through multiple uses for urban waste water, while ensuring a high level of environmental protection. Directive 2000/60/EC of the European Parliament and of the Council ([4]) mentions water reuse, in combination with the promotion of the use of water-efficient technologies in industry and water-saving irrigation techniques, as one of the supplementary measures Member States may choose to apply to achieve that Directive's objectives of good qualitative and quantitative water status for surface water bodies and groundwater bodies. Council Directive 91/271/EEC ([5]) requires that treated waste water be reused whenever appropriate.

LNV, Vision 07 2019

Realisatieplan **Visie LNV**
Op weg met nieuw perspectief

Omschakeling naar kringlooplandbouw in 2030 is nodig om de landbouw, tuinbouw en visserij nieuwe perspectieven te geven. Het is een omschakeling van voortdurende verlaging van de kostprijs van producten naar voortdurende verlaging van het verbruik van grondstoffen en een zorgvuldig beheer van bodem, water en natuur.
Het Realisatieplan bevat de beleidsinzet die deze omschakeling stimuleert.

GEZAMENLIJK KRINGLOOPLANDBOUW CONCREET MAKEN

- Gezonde bodem is de basis
- Dierlijke mest voorop
- Voedselresten als veevoer
- Voedselproductie verbetert natuur, milieu en klimaat
- Samenwerking in de regio en agroketens

WAT DOET HET BELEID

- Bevorderen precisielandbouw en innovatie op boerenerf
- Meer experimenteerruimte bieden
- EU-beleid (waaronder GLB) richten op kringlooplandbouw
- Overheidsgrond benutten voor omschakeling
- Via samenwerking reststromen benutten
- Boer belonen voor duurzaam produceren
- Belemmerende regels rond mest en afval wegnemen
- Korte ketens ondersteunen

Nederland koploper kringlooplandbouw in 2030

WAT IS ER NODIG?

- Goed verdienvermogen ondernemers
- Kennis en innovatie van hoog niveau
- Voortbouwen op internationale voorsprong
- Landbouw en natuur verbonden
- Waardering voor voedsel en agrarisch ondernemers
- Stimulerende wet- en regelgeving

Why circular food and water systems?

Side effects of extensive Dutch agrifood production (AP)

Nutrient emission to (natural) environment

> Decrease in ecosystems biodiversity

>> *Reuse of (nutrient rich) rest streams in circular AP*

Challenges in water supply management

Climate change > Heavy rainfall & extended drought periods

> Diminishing water sources for irrigation

>> *Increased use of industrial process water in AP*

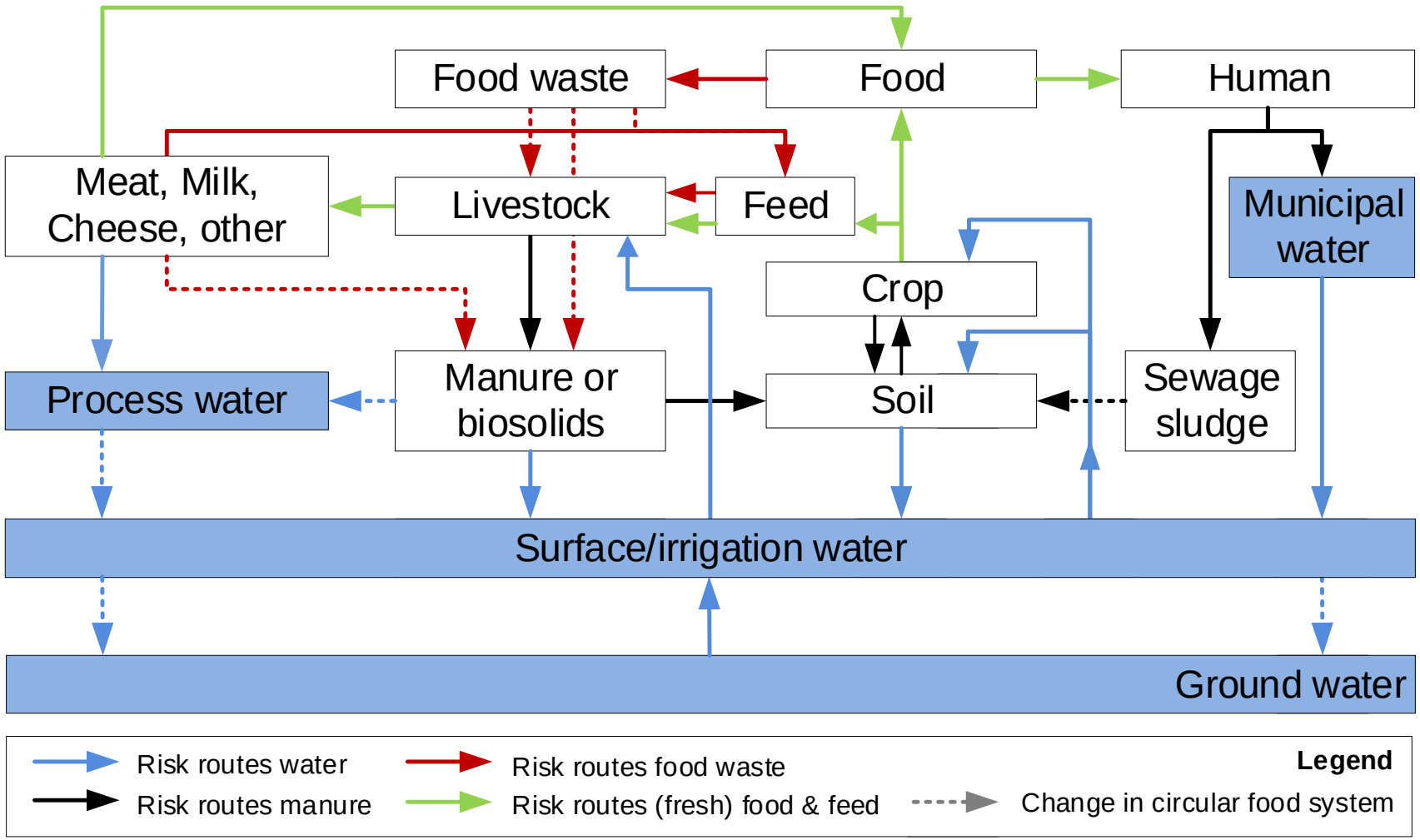
Food safety in circular food & water systems

What is circular agrifood production (AP)?

- Protect the natural environment
- No nutrient losses from the AP system
  - Less nutrient imports (soy, fertilizers)
  - Full use of animal manure
  - Reuse of rest streams from food production/consumption
  - Use of human sludge and waste water (full closure of nutrient cycle)
  - Use of industrial process water

Food safety in circular food & water systems

But still, guarantee safe foods



Possible sources and transmission routes for food pathogens in a circular food and water system.

Microbial risks requiring monitoring in circular AP

Animal diseases via surface water to animals
Pathogens via food rests streams (swill) to animals
Humans pathogens via irrigation water to fruit and vegetable crops
Humans pathogens via fresh manure (and rain water) to crops
Plant and animal viruses via groundwater to crops and livestock

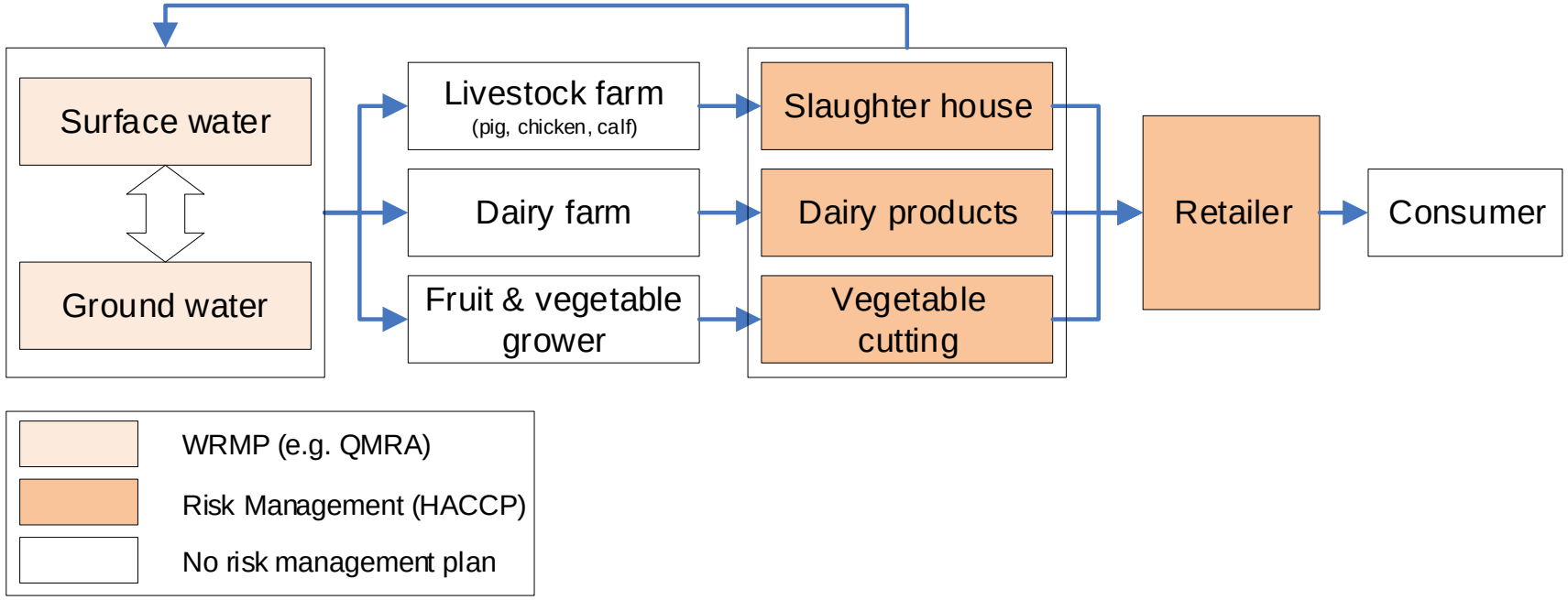
Food safety in circular food & water systems

EU 2020/741: Water Reuse Management Plan (WRMP) by supplier

- Describe the water reuse system
- Identify potential hazards
- Identify recipients at risk
- Conduct a risk assessment human, animal and environmental health
- Specify additional water quality requirement on top of minimum requirements
- Identify preventive measure
- Have a quality control system operable
- Ensure environmental monitoring
- Have procedures to manage incidents and calamities

Food safety regulations

- Every producer responsible for food safety
- Risk assessment system in place (Hazard Analysis and Critical Control Points - HACCP)
  - Farmers and growers exempt from HACCP



Limitations & Challenges

- Water suppliers have no control over entire chain: from supply to irrigation
- No harmonized risk assessment system across the entire production chain
- Farmers not in control over quality of water, fertilizers and rest streams for feed, but still liable & vulnerable to litigation (pathogen tracing by DNA seq.)
- EU 2020/741 needs further detailing:
  - E. coli not a proper indicator for other pathogens:
    - (Campylobacter, Salmonella, Listeria, Norovirus, Adenovirus, Eggs of parasitic worms)
  - Lacking associated minimum requirements for pathogens
- No regulation for groundwater recharge
- ..

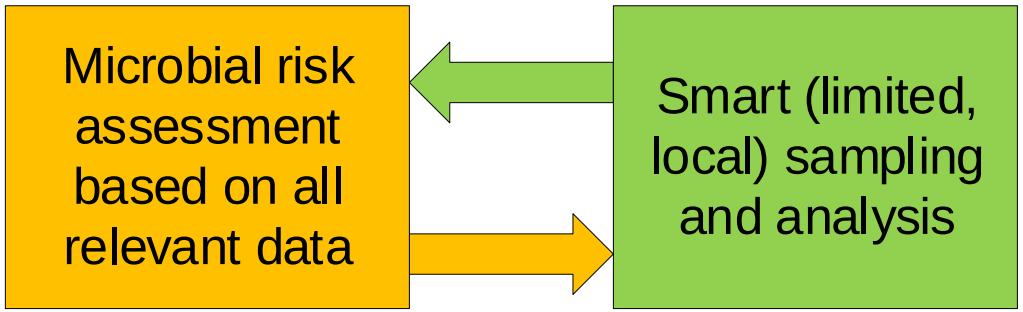
Challenges & needs

A clear regulatory and legal framework for all stakeholders
Who is responsible for what quality and how?
Interdisciplinary risk assessment system for a range of pathogens
Where and when do we foresee pathogens emerging?
Risk monitoring system (e.g. water suppliers, users and authorities)
What is the actual microbial quality (water, rest products food, crops)?

Food safety in circular food & water systems

What is the plan?

- A Risk Assessment Platform for microbial risks in food production
- Based on commonly used assessment tools (QMRA and HACCP)
- Based on all relevant data
  - (Manure application, crop type, farm type, geographic, water infra, pathogens, weather)
- High resolution (500m, manure related risks) & real time (weather related risks)
- Dashboard for sharing microbial risk indicators
- Where and when field sampling and pathogen ID needed



Advantages for stakeholders

- Understand risks > predict risks > assess effect of interventions
- One risk-assessment approach for multiple sectors/stakeholders
- Optimal (smart) sampling and pathogen analyses (cost reduction)
- All parties same data
- Decision making based on real time data (e.g. irrigation or harvest)
- Allow benefits and risk weighing of water and rest stream re-use
- Repository for historic, expert and aggregated data

Food safety in circular food & water systems

Agriculture-Water-Food PPS project proposal by Andries Koops, Adriaan Antonis, Gertjan Geerling, Nynke Hofstra, Anniek de Jong, Imke Leenen, Hans Marvin, Gertjan Medema, Patrick Smeets

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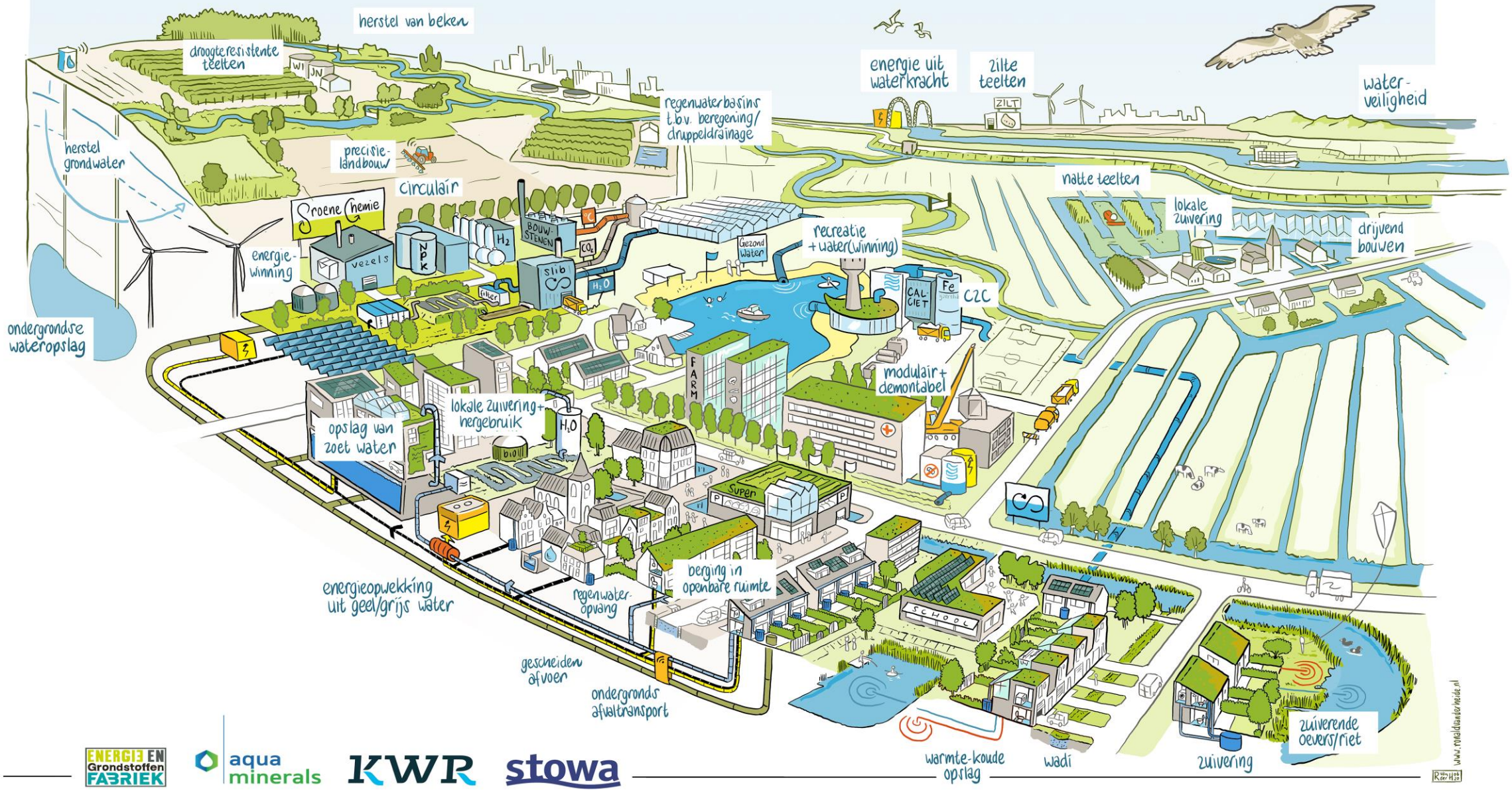

ENERGIE EN Grondstoffen FABRIEK aqua minerals KWR stowa

www.kwrwater.nl/actueel/watersector-zet-koers-uit-naar-de-circulaire-economie/

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