The Resilient Delta Initiative

Imagine living in a city.
On the shores of a river, near the sea.
Where you thrive in harmony with nature.
Fully adapted to the changing weather.
Where you live surrounded by water, safe and secure.
Where rising sea levels are no threat.
Where there is room for every citizen.
Where everybody is treated equally.
Where industry flows while the quality of life grows.
That’s a thriving place,
A great area to live in,
A resilient delta.

CONVERGENCE

The urgent and complex societal challenges of our time call for convergence; the crossing of boundaries between institutes and disciplines to create new perspectives and solutions. For this reason, TU Delft, Erasmus MC and Erasmus University Rotterdam are joining forces in the Convergence

Convergence Research

Research driven by a specific and compelling problem Convergence research is generally inspired by the need to address a specific challenge or opportunity, whether it arises from deep scientific questions or pressing societal needs.

Deep integration across disciplines

As Experts from different disciplines pursue common research challenges, their knowledge, theories, methods, data, research communities and languages become increasingly intermingled or integrated. New frameworks, paradigms or even disciplines can form sustained interactions across multiple communities.

TU Delft Erasmus MC University Medical Center Rotterdam Erasmus University Rotterdam

Convergence

The integration of our knowledge and expertise within the medical, technical, social and economic sciences, as well as the humanities will give rise to new insights, technologies, and methodologies. We believe that the unique strength of this convergence between three top institutions in the region with their complementary disciplines will lead to research and education with great societal impact.

Pandemic and Disaster Preparedness Center

Health & Technology

Healthy Start

AI, Data & Digitalisation

Resilient Delta

Ambitions

Brings together α-, β- and γ-disciplines in research and education

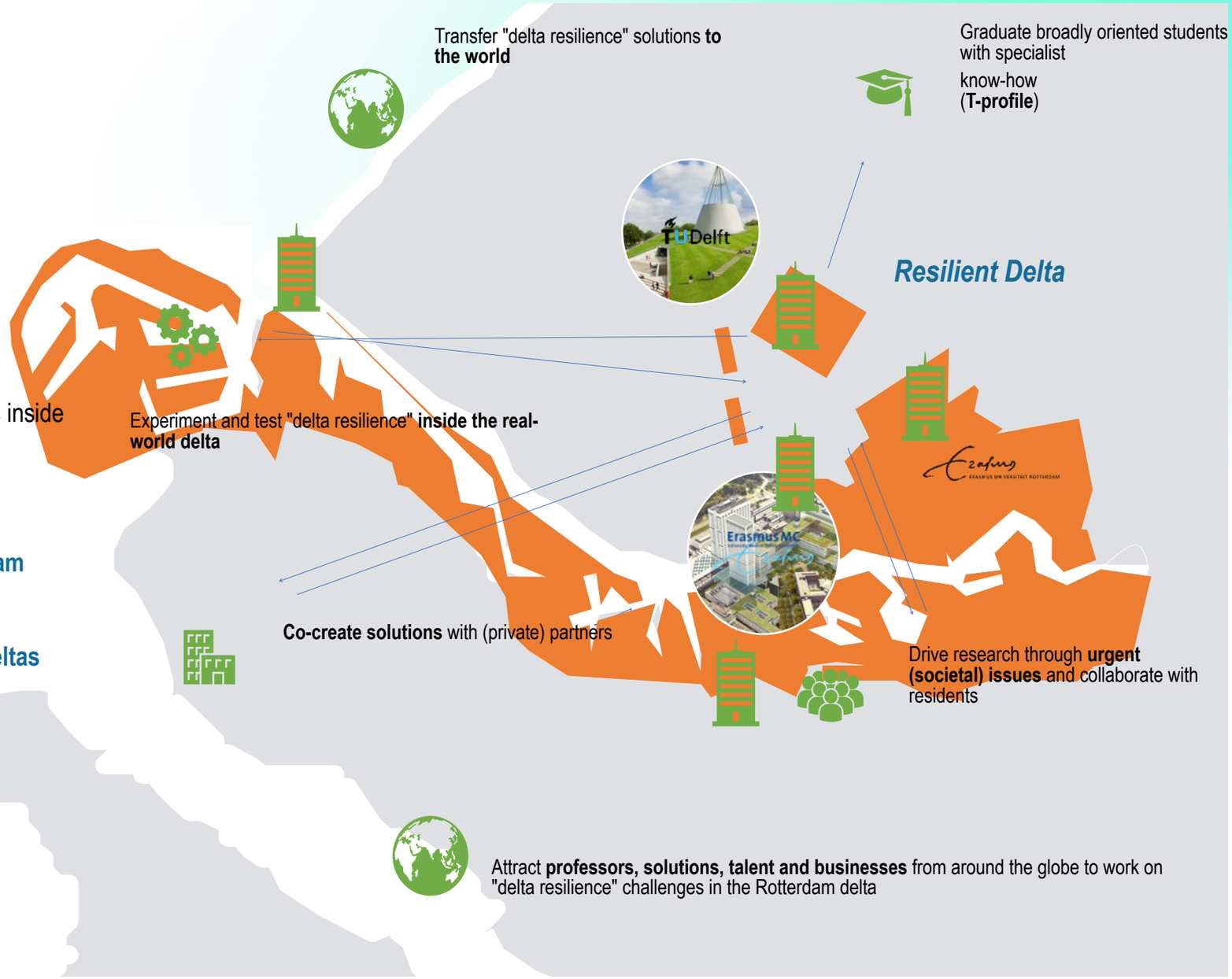
Makes the Rotterdam delta resilient by **designing solutions** inside the delta

Collaborates with residents, (private) partners and the municipality and is physically co-located **inside the Rotterdam delta**

Is the central node in a **network of international partner deltas** that research delta systems

Transfers solutions and knowledge to the world, boosting earnings capacity of the Netherlands

Educates a **global student population** and graduates




Resilient
Delta
FOR FUTURE-PROOF DELTAS
TU Delft
Erasmus MC
University Medical Center Rotterdam
Erasmus
University
Rotterdam

RESILIENT DELTA

Tackling today’s global societal challenges requires resilience, especially in the delta regions. Within Resilient Delta we work in an interdisciplinary way, collaborating with societal partners to design resilience solutions in the real-world dynamics of our living lab, the Rotterdam delta.

Structure

'our' Environment

Methodology
How to maximize the opportunities for knowledge integration? How can different fields and forms of expertise work together effective?

Delta System
What are the trends, shocks and stresses and considered interventions in particular elements of the urban delta system, and how are these interrelated?

City
How do multifaceted problems lead to increasing social inequalities within and across generations, and how can interventions contribute to an equal quality of living?

Port
How to deal with the uncertainties and changing conditions like climate change, social responsibility and the rapid emergence of new digitisation technologies, to transition the port into its future leading roles?

People

Climate

Ecology

Data Science / Sensing Technology

Action Research

Wellbeing, Health, Equity, Sustainability

Convergence Resilient Delta

TU Delft

Erasmus MC University Medical Center Rotterdam

Erasmus University Rotterdam

... From our base in the Rotterdam Metro region we strengthen the resilience of urban deltas, focusing on :

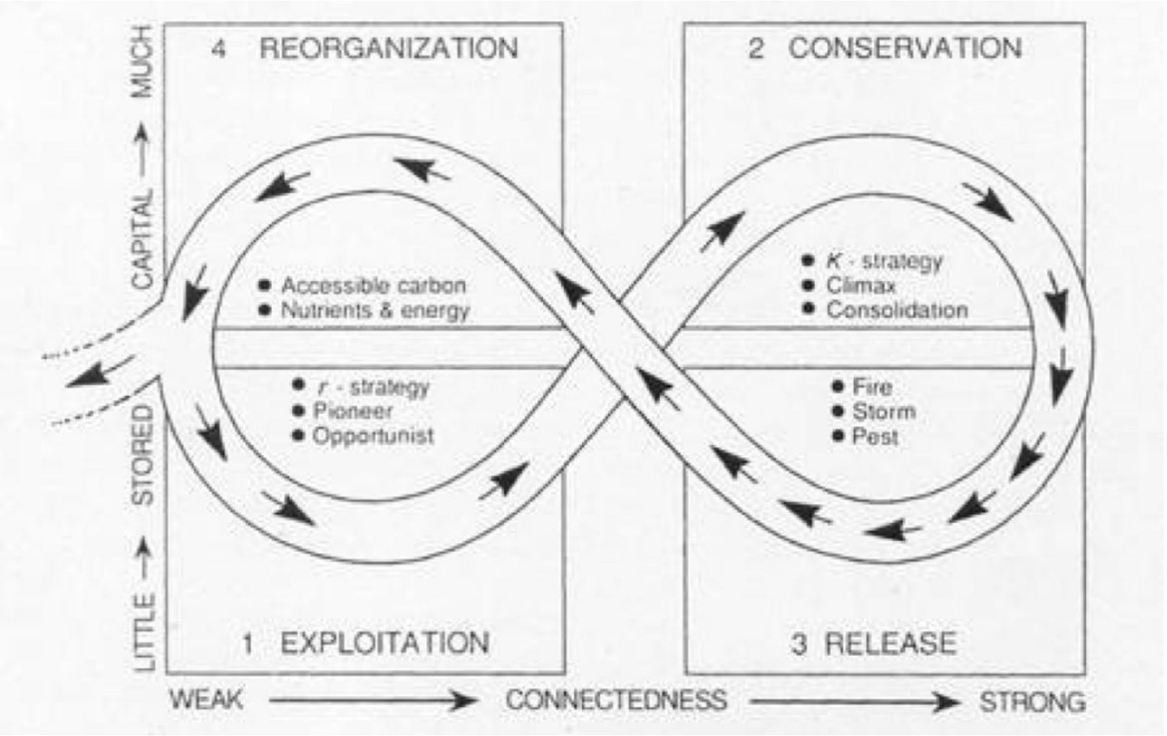
(i) ‘Broad prosperity’

(ii) ‘Zero-carbon society’

(iii) Healthy & safe living environment

(iv) Future-proof delta areas

Resilience engineering



Social resilience

prof.dr.ir. Arjan van Timmeren • TU Delft Faculty of Architecture & the Built Environment, Dept. Urbanism • Environmental Technology & Design // AMS institute Amsterdam // Resilient Delta Initiative Rotterdam

Earth rise from Lunar orbit, Apollo 8, 1968 (Space Flight Center, Flickr (CC by 2.0))

TU Delft

It is self-evident we live in the wealthiest and most scientifically advanced era of human history. Our world has become increasingly urbanized and dominated by the city, the technologically sophisticated, highly resource dependent cradles of civilization that simultaneously concentrate financial, technological, cultural and creative capital while propagating poverty, economic inequality, criminality and pollution. Yet, our demands on the biosphere are growing at such an exponential pace we have disrupted the dynamic equilibrium of the compound most integral to life: water (H_2O).

H_2O propels the climate, lubricates continental drift and shapes our geographies. Its abundance demarcates international boundaries while its scarcity sparks civil conflict. You can read this book comfortably because water vapour in the atmosphere absorbs incoming solar radiation and the oceans act as a massive heat sink that stabilizes earth's ambient temperature. This very same effect is exacerbated by the prodigious amounts of greenhouse gases we emit, resulting in a precipitous warming that threatens our long-term prospects.

Presently, cities are confronted with a number of increasingly unmanageable crises, from the triple threat of climate change, water scarcity, and environmental degradation to the deterioration of water supply and sanitation networks which will soon require radical retrofitting and/or complete replacement. This is most apparent in the countries of the Global South, where billions living in slums still lack easy access to clean water.

What can be done? Is water actually becoming scarcer? Will it be a simple matter of installing water efficient toilets and faucets? Is it something best left to the free market? Or, can our problems be disrupted by ubikquitous IT and Smart Cities?

ISBN 978-94-6186-860-2

AMS AMSTERDAM INSTITUTE FOR ADVANCED METROPOLITAN SOLUTIONS

TU Delft

UNDERPRESSURE.ONLINE

Laurence Henriquez
Arjan van Timmeren

UNDER PRESSURE:
WATER AND THE CITY

UNDER PRESSURE:
WATER AND THE CITY

Laurence Henriquez
Arjan van Timmeren

We try to map the relationship between H_2O and civilization, past, present and future. From water's fundamental importance to life and the means by which it has been metabolized by cities throughout history, to its intimate connection to the ongoing crises of our age (economic inequality, climate change, Middle East Wars, unregulated global finance) and the (sometimes ancient) solutions that are used as positive drivers of change. And, perhaps most importantly of all, they try to address the oftentimes ignored link between water and the asymmetries in social and political power that exist in the Global North and South.

IMG 3. Massive congregation of phytoplankton swirl around Gotland, Sweden

IMG 4. Mississippi River, USA

IMG 19. Alluvial fan around qanat, Iran, 2004

Capitulo. 22 de tezcatzoncatl. fo.23.

ynic amo mjc: iehoatl, ynic te piquj, ynic moxtlaca, ynic quj neltilia yn netol. Auh ynjc quych, ynjn nechichoal, ynjn tlaquen, ynjmamaneapan, ynjmoztopil, ynjntlapetla nylquauh, ynjmaiauhcocul: yoan ynjnchalchiuhxical, yoa ynjntlaquaia molcaxtotonti, quauhcaxtotonti, coquitecon totonti, muchi vmpa concaoa ia tepetzinco: atlan contepe oaia, vmpa ancpantla, ytoca tocan pantitlan.

¶ Capitulo veynte y dos, que habla del dios, llamado tezcatzo catl: que es vno de los dioses del vino.

El vino, o pulcre, desta tierra: siempre los tiempos passados, lo tuujeron por malo: por razon de los malos effectos, que del se causan. Porque los borra chos, vnos dellos, se despeñan, otros se a horcan, otros se arrojan enel agua, do de se ahogan: otros matan a otros, estando

¶ Jnic cempoalli vmume capitulo, ytechpa tlatoa in tezcatzoncatl, ynjnoan pouj centzontotochti.

Jehoatl in vctli, ieppa tlatla culli ipan machoia: catete pexiuja, tequechmecanja, teatlauja, temjctia; tetza vittonj, amo pinavilonj, a mo chicoittolonj. Auh ynjn

IMG 20. Excerpt of the *General History of Things of New Spain* by Friar Bernardino de Sahagun(1590)

IMG 29. Manhole cover from Falkirk, Scotland, 1849

IMG 44. Drinking water in Flint, Michigan, USA

IMG 30. Outside apartment building in Sacramento, California during drought conditions, 2014

IMG 73.Hamburg Hafencity, flooding protection on ground floor, Germany

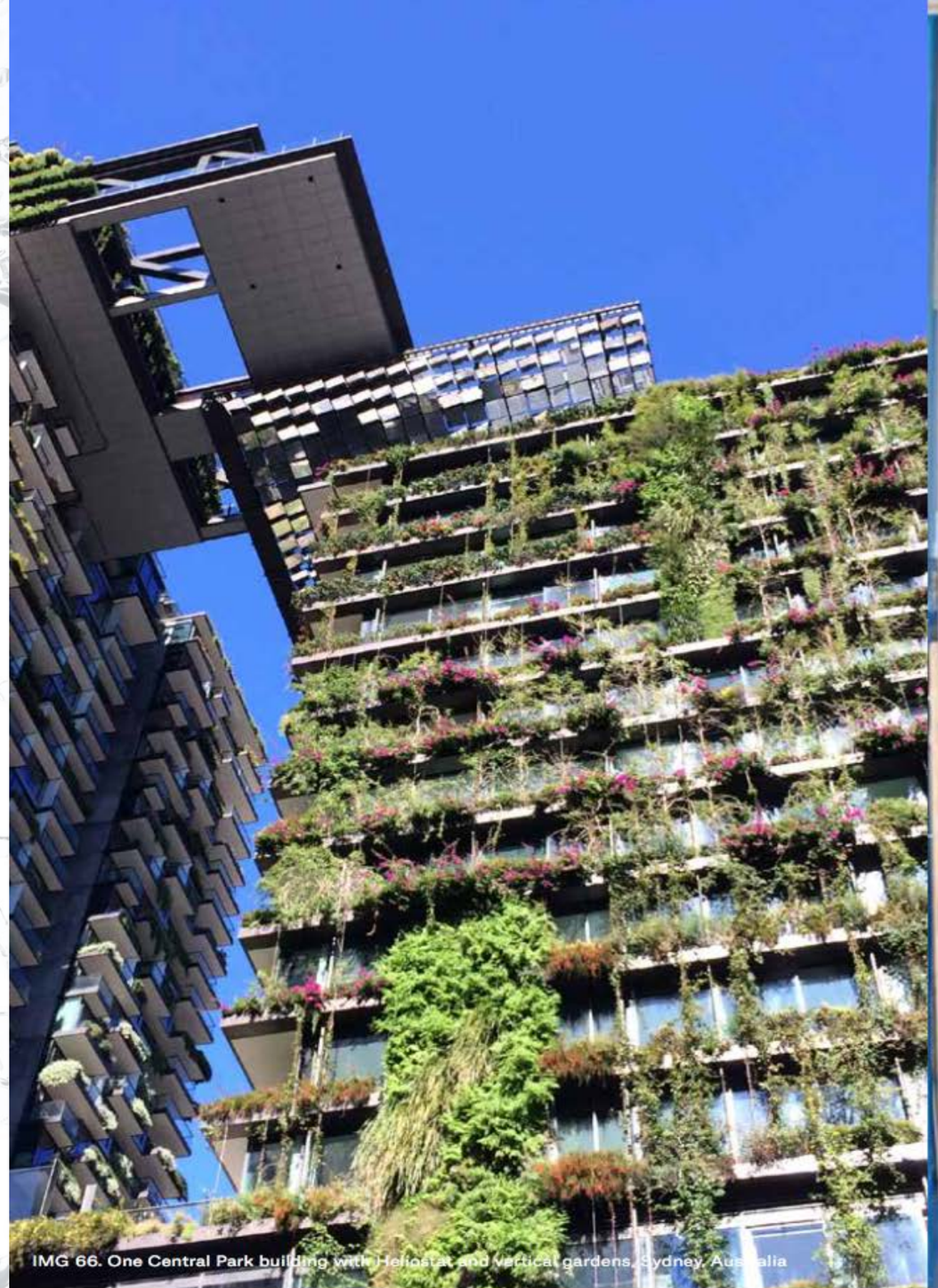
IMG 42. Water stress in El Oro, Ecuador, 2013

IMG 78. 'Riverbed' Exhibition Olafur Eliasson, Louisiana Museum of Modern Art, Humlebaek/Copenhagen

IMG 79. Construction of the new wing of La Samaritaine, Paris, France

IMG 51. Inside a reverse osmosis desalination plant in Barcelona, Spain

IMG 52. Mobile desalination unit in Tuvalu, Polynesia, 2011



IMG 66. One Central Park building with Heliostat and vertical gardens, Sydney, Australia

IMG 67. Decentralized water treatment facility in Sneek, Netherlands

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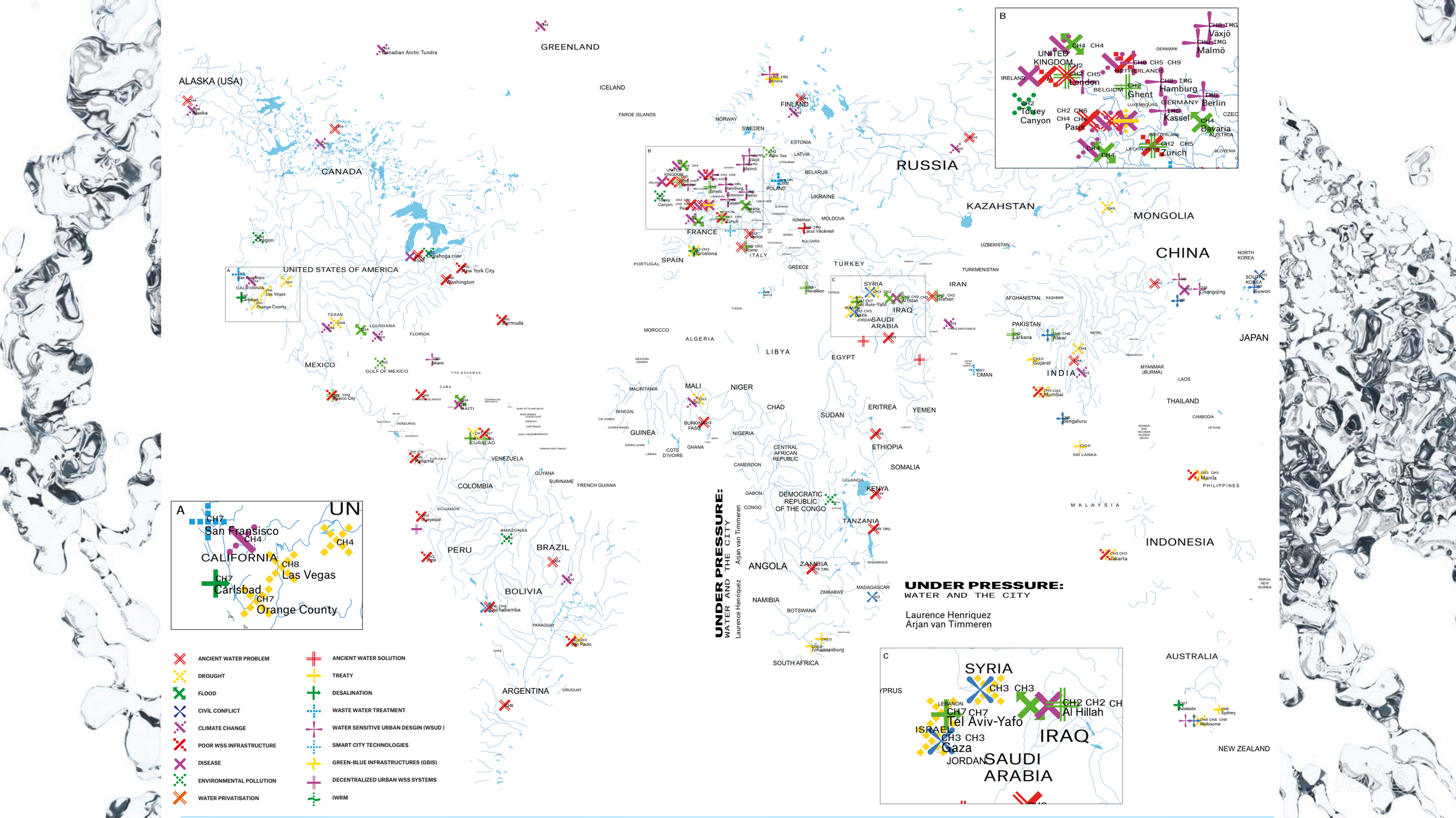
ALASKA (USA)
CANADA
GREENLAND
ICELAND
FAROE ISLANDS
NORWAY
SWEDEN
FINLAND
ESTONIA
LATVIA
LITHUANIA
BELARUS
RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
NORTH KOREA
SOUTH KOREA
JAPAN
UNITED STATES OF AMERICA
CALIFORNIA
TEXAS
LOUISIANA
FLORIDA
MEXICO
GULF OF MEXICO
THE BAHAMAS
CUBA
HAITI
JAMAICA
CURACAO
VENEZUELA
COLOMBIA
ECUADOR
PERU
BRAZIL
BOLIVIA
PARAGUAY
CHILE
ARGENTINA
URUGUAY
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AUSTRIA
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ISRAEL
CYPRUS
KUWAIT
QATAR
OMAN
YEMEN
AFGHANISTAN
KASHMIR
PAKISTAN
INDIA
NEPAL
BHUTAN
BANGLADESH
MYANMAR (BURMA)
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THAILAND
CAMBODIA
VIETNAM
SRI LANKA
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INDONESIA
PAPUA NEW GUINEA
AUSTRALIA
NEW ZEALAND
MOROCCO
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MALI
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CHAD
SUDAN
ERITREA
ETHIOPIA
SENEGAL
THE GAMBIA
GUINEA-BISSAU
GUINEA
BURKINA FASO
NIGERIA
GHANA
TOGO
BENIN
SIERRA LEONE
LIBERIA
COTE D'IVOIRE
CENTRAL AFRICAN REPUBLIC
CAMEROON
GABON
CONGO
DEMOCRATIC REPUBLIC OF THE CONGO
UGANDA
KENYA
TANZANIA
SOMALIA
DJIBOUTI
ANGOLA
ZAMBIA
ZIMBABWE
MOZAMBIQUE
MADAGASCAR
NAMIBIA
BOTSWANA
SOUTH AFRICA
SWAZILAND
LESOTHO
Canadian Arctic Tundra
Alaska
Oregon
Flint
Cuyahoga river
New York City
Washington
Bermuda
Miami
Mexico City
Panamá
Curaçao
Aruba
Barranquilla
Guayaquil
Amazonas
Cochabamba
Sao Paulo
Johannesburg
Barcelona
Rome
Heraklion
Lacul Văcăreşti
Tel Aviv-Yafo
Al Hillah
Gaza
Isfahan
Larkana
Gujarat
Mumbai
Bengaluru
Jakarta
Manila
Changqing
Suwon
Växjö
Malmö
Hamburg
Berlin
Kassel
Bavaria
Zurich
Ghent
London
Paris
Torrey Canyon
Adelaide
Sydney
Melbourne
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B
C
ANCIENT WATER PROBLEM
DROUGHT
FLOOD
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CLIMATE CHANGE
POOR WSS INFRASTRUCTURE
DISEASE
ENVIRONMENTAL POLLUTION
WATER PRIVATISATION
ANCIENT WATER SOLUTION
TREATY
DESALINATION
WASTE WATER TREATMENT
WATER SENSITIVE URBAN DESGIN (WSUD)
SMART CITY TECHNOLOGIES
GREEN-BLUE INFRASTRUCTURES (GBIS)
DECENTRALIZED URBAN WSS SYSTEMS
IWRM

Three-quarters of Dutch adults worry about impact of climate change

28/11/2023 15:00

What are the main changes?

The main changes in our climate are:

- Winters are becoming wetter, whilst the probability of severe summer downpours is growing. Furthermore, such downpours are becoming increasingly more extreme. Precipitation is increasing because warmer

Drought is the worst climate change threat for the Netherlands

May 14, 2024

Urgent action needed to prevent drinking water shortages in 2030

Publication date 03-04-2023 | 07:00

Download report

Water availability for drinking water production up to 2030 - bottlenecks and solutions

More information

Drinking water

This news in English

Quick action needed to prevent drinking water shortage in 2030

https://www.rivm.nl/nieuws/snel-actie-nodig-om-drinkwatertekort-in-2030-te-voorkomen

Rapid climate change: Netherlands needs to prepare for heat, drought & flooding

The Netherlands' climate is changing rapidly and is becoming hotter, wetter, and dryer, the Netherlands Environmental Assessment Agency (PBL) said in a report on Tuesday. The current climate risks already have "a major impact on our daily lives" and are "expected to only increase in the future," the PBL said. "It is clear that increasing climate change will lead to greater risks if the Netherlands is unable to adapt to the changing climate."

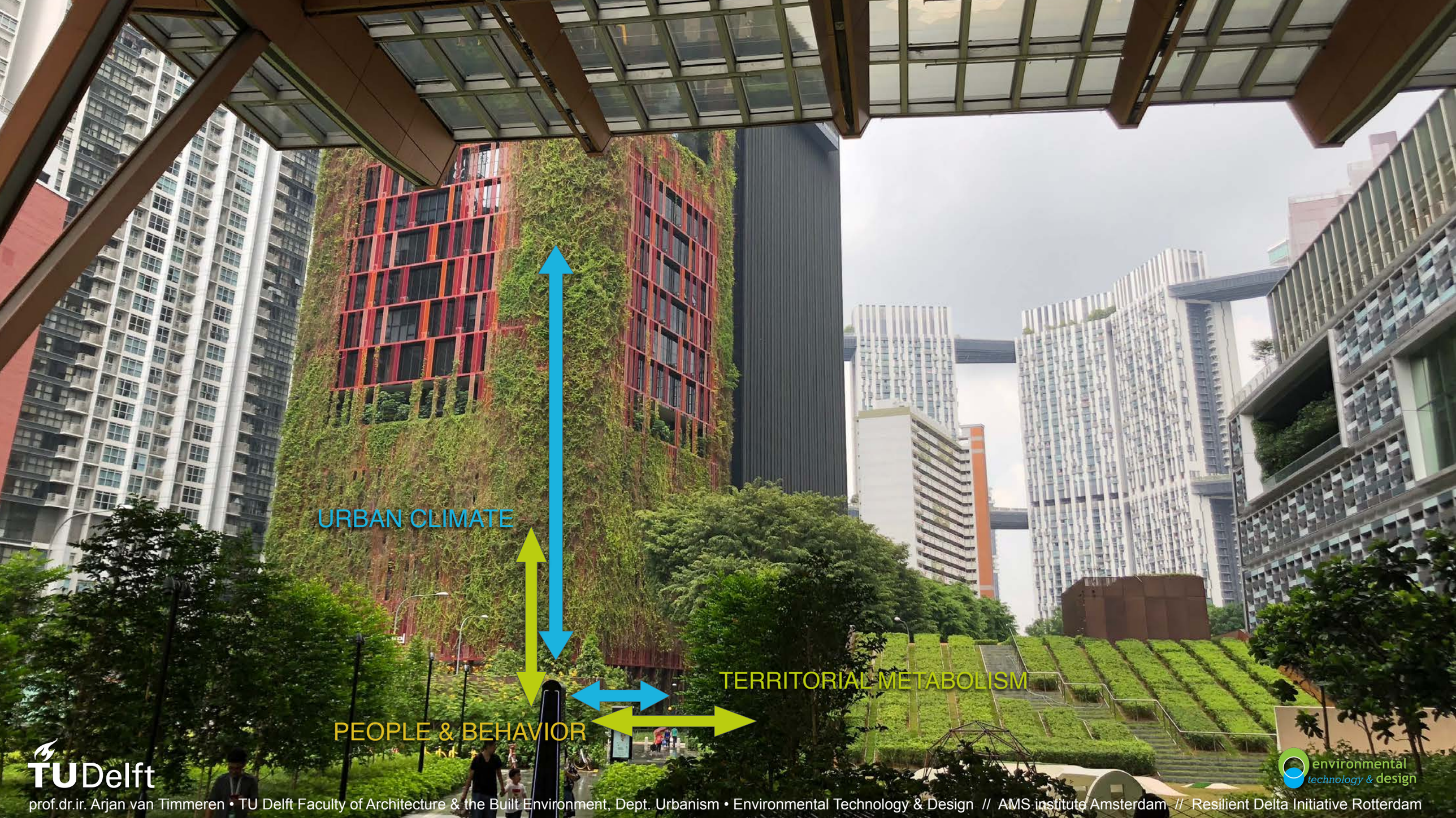
Over the past 30 years, weather record after weather record has toppled in the Netherlands and it's happening faster than expected. For example, 2019's heat record of over 40 degrees Celsius was only expected decades from now.

https://nltimes.nl/2024/05/14/rapid-climate-change-netherlands-needs-prepare-heat-drought-flooding

Water ‘Under Pressure’ | Veerkracht in de Stad | Metabolisme van de Stad

Bataafs Genootschap • 7 October 2024 • Rotterdam

prof.dr.ir. Arjan van Timmeren • TU Delft Faculty of Architecture & the Built Environment, Dept. Urbanism • Environmental Technology & Design // AMS institute Amsterdam // Resilient Delta Initiative Rotterdam



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environmental technology & design

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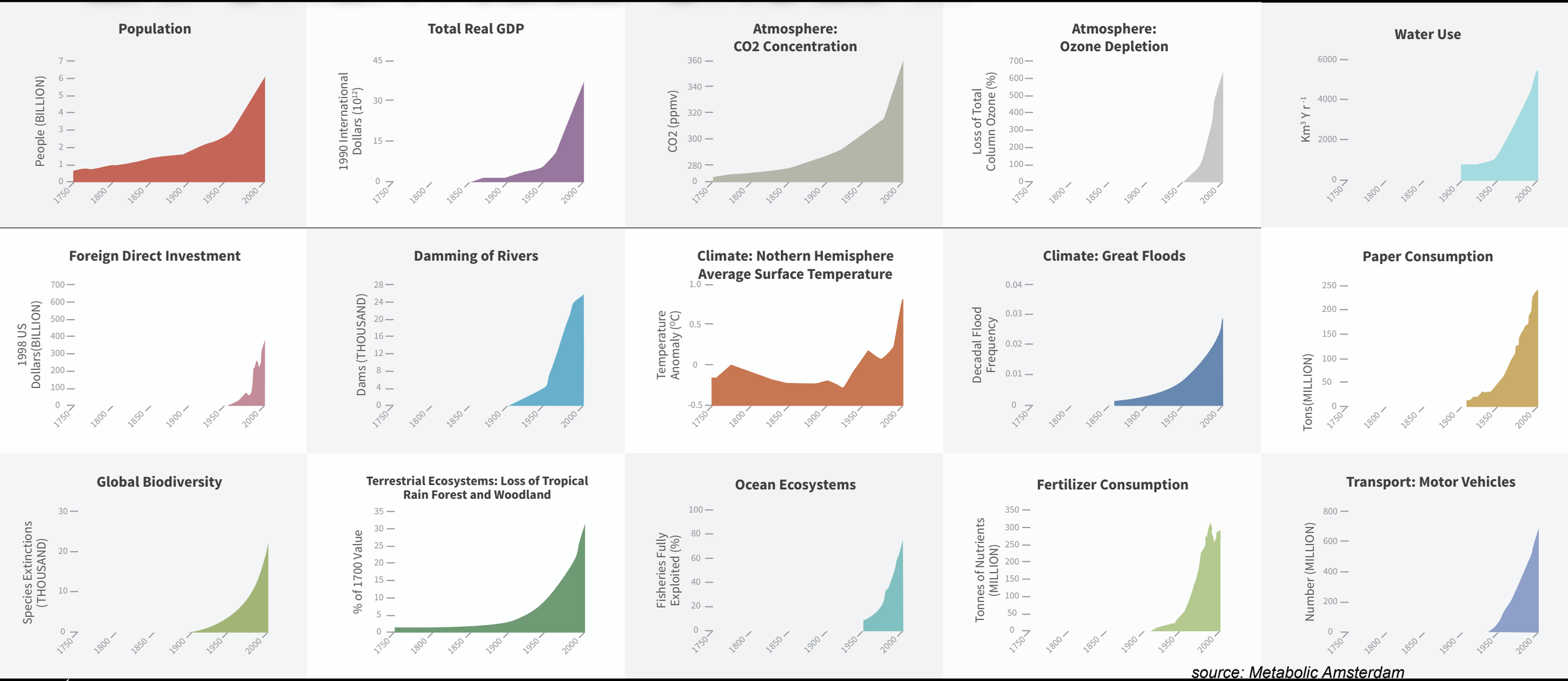
environmental technology & design

footage / courtesy: Metro Madrid

Milieuthema's		
1. Verandering klimaat 2. Verzuring 3. Verspreiding (emissies) 4. Verspilling 5. Verwijdering 6. Vermesting	Duurzaamheid toekomstige generaties	- *reducties* - *sluiten kringlopen*
7. Verstoring 8. Verspreiding 9. Vermesting	Leefbaarheid huidige generaties	- *milieuhygiëne* - *natuur en landschap* - *gezondheid*
10. Versnippering 11. Vernietiging 12. Verdroging 13. Verstoring 14. Vermesting	Oorspronkelijkheid integriteit natuur / landschap op zich	- (*niet om de mens)*

EXPONENTIËLE GROEI …



source: Metabolic Amsterdam

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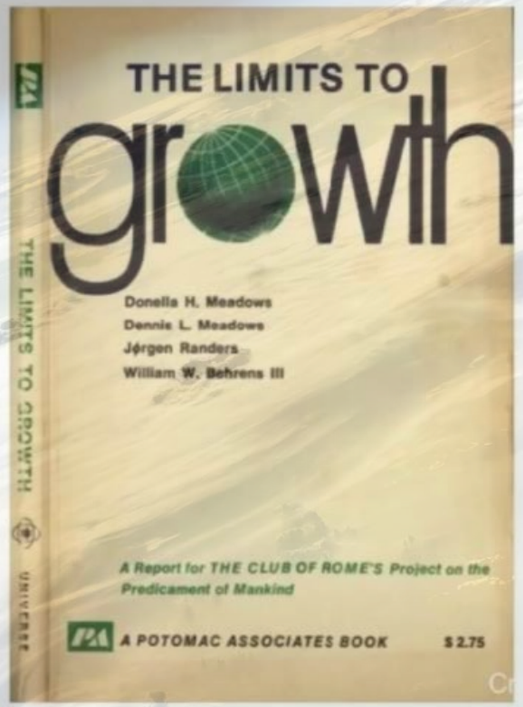
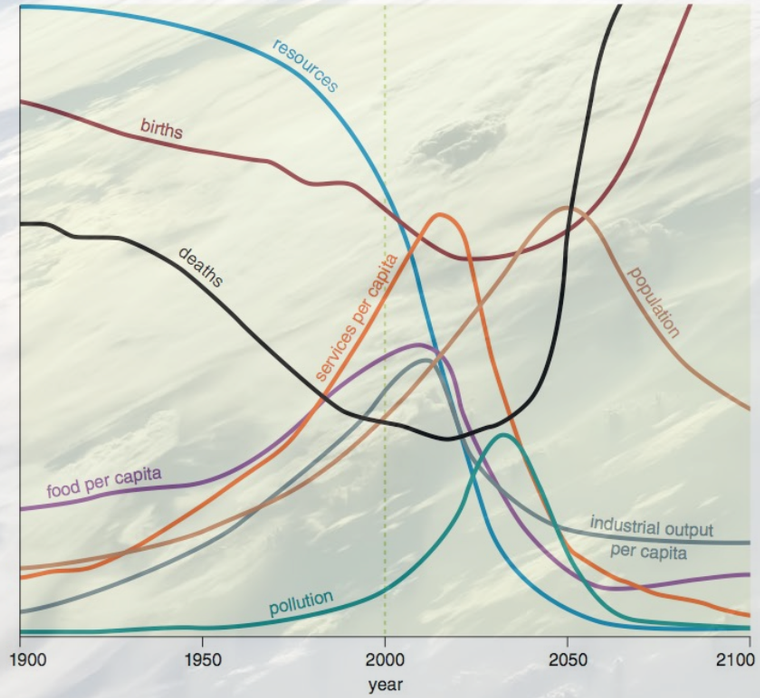
De boodschap is eenvoudig: de planeet aarde is eindig en als gevolg daarvan zal een voortdurende groei van materiële productie en consumptie binnen enkele decennia leiden tot een ineenstorting. Er zijn grenzen aan de groei die slechts tijdelijk kunnen overschreden worden.





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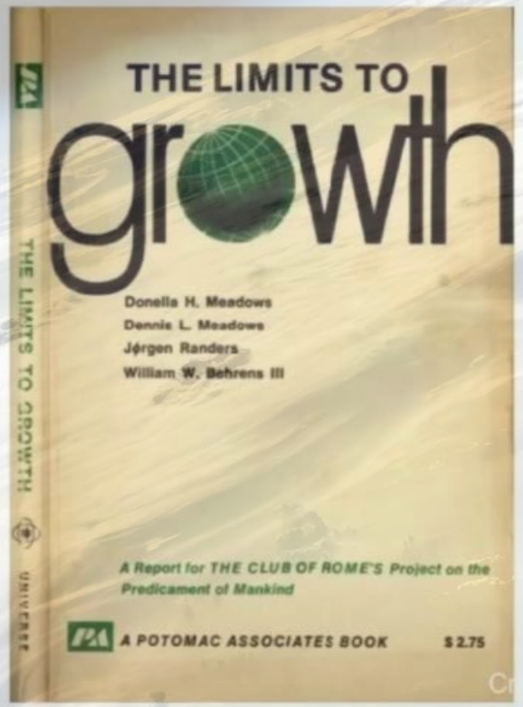

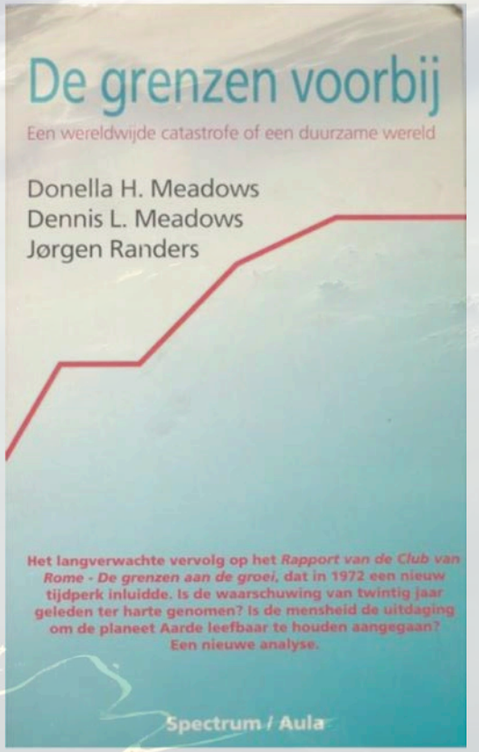

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2015

Paris Agreement / SDGs …

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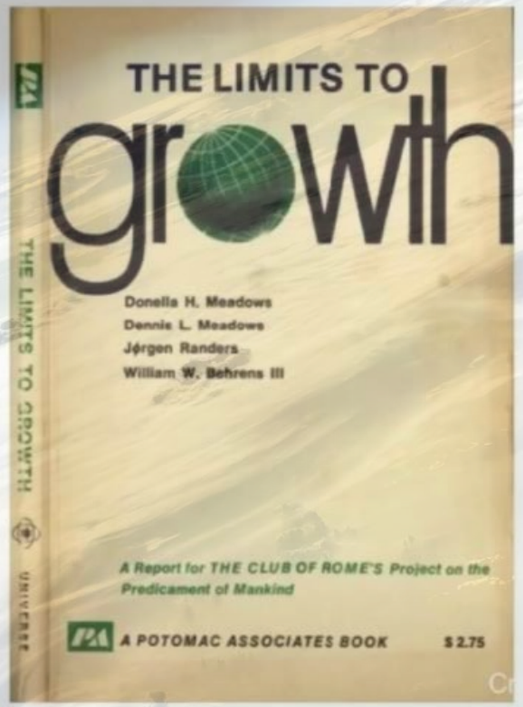

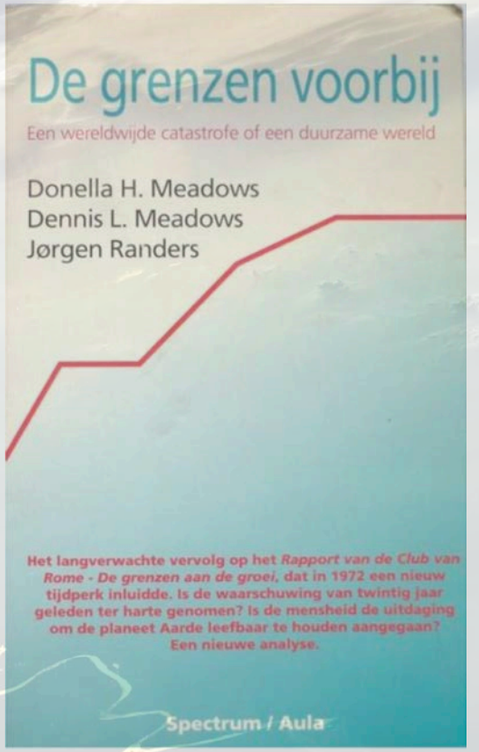

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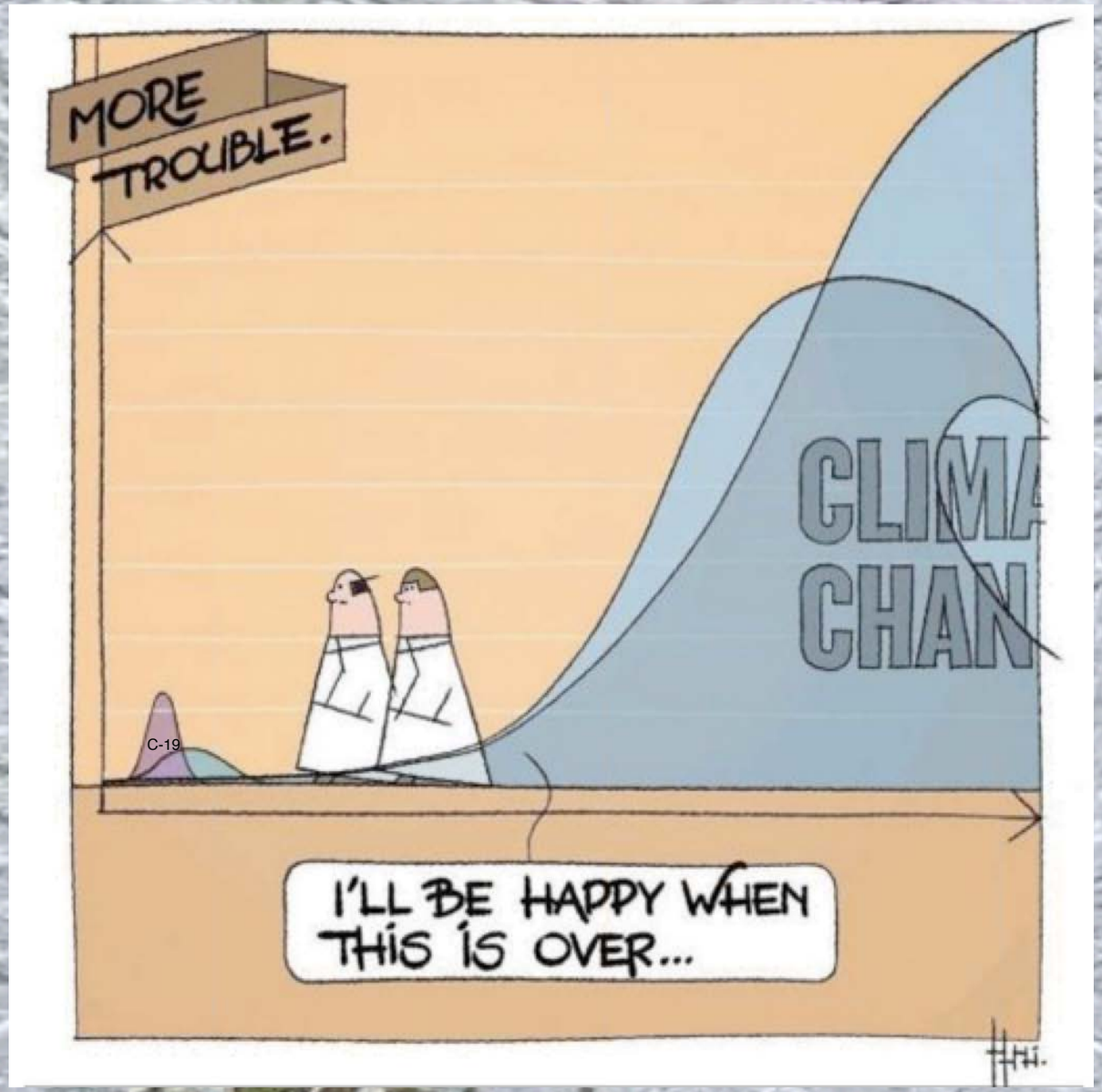
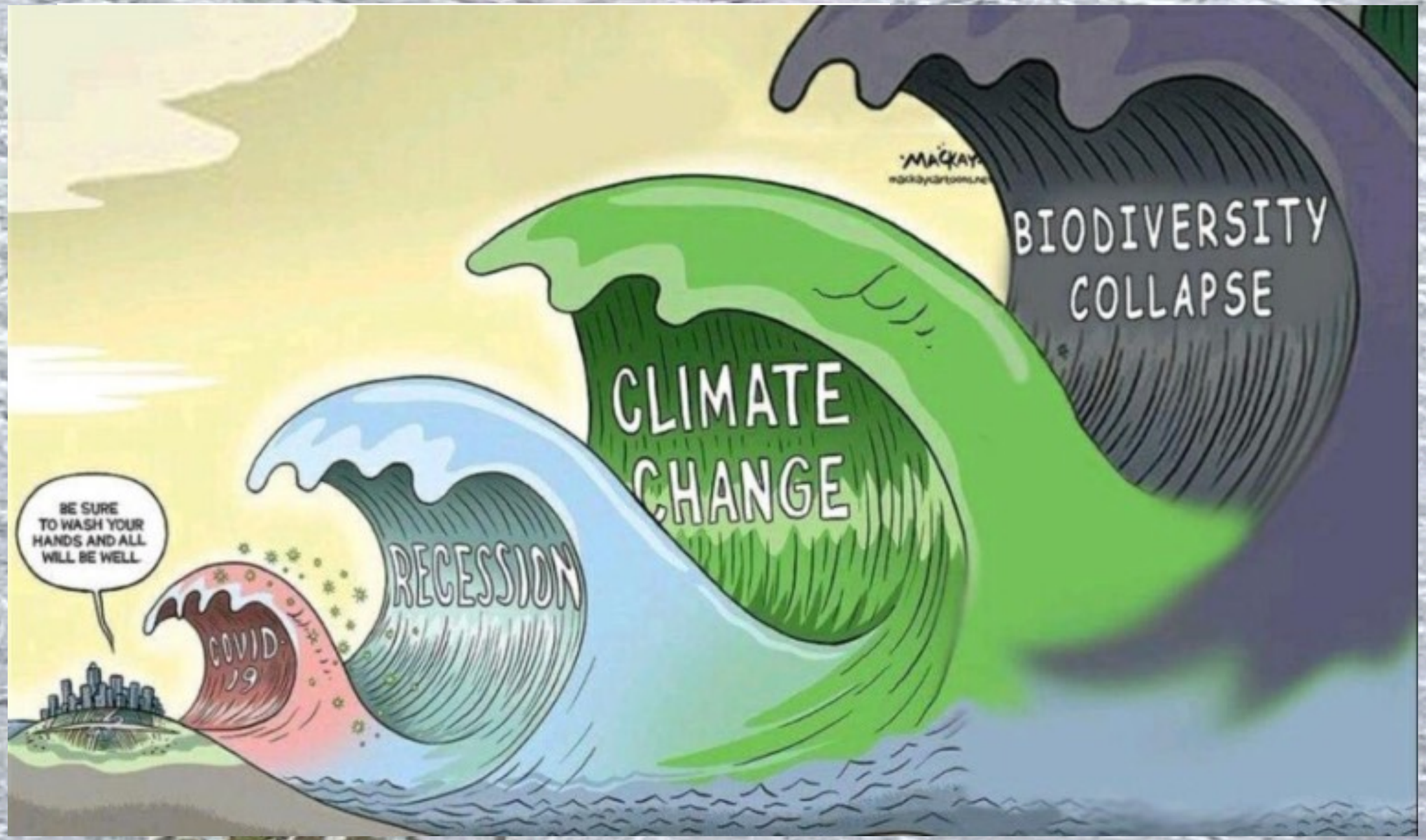
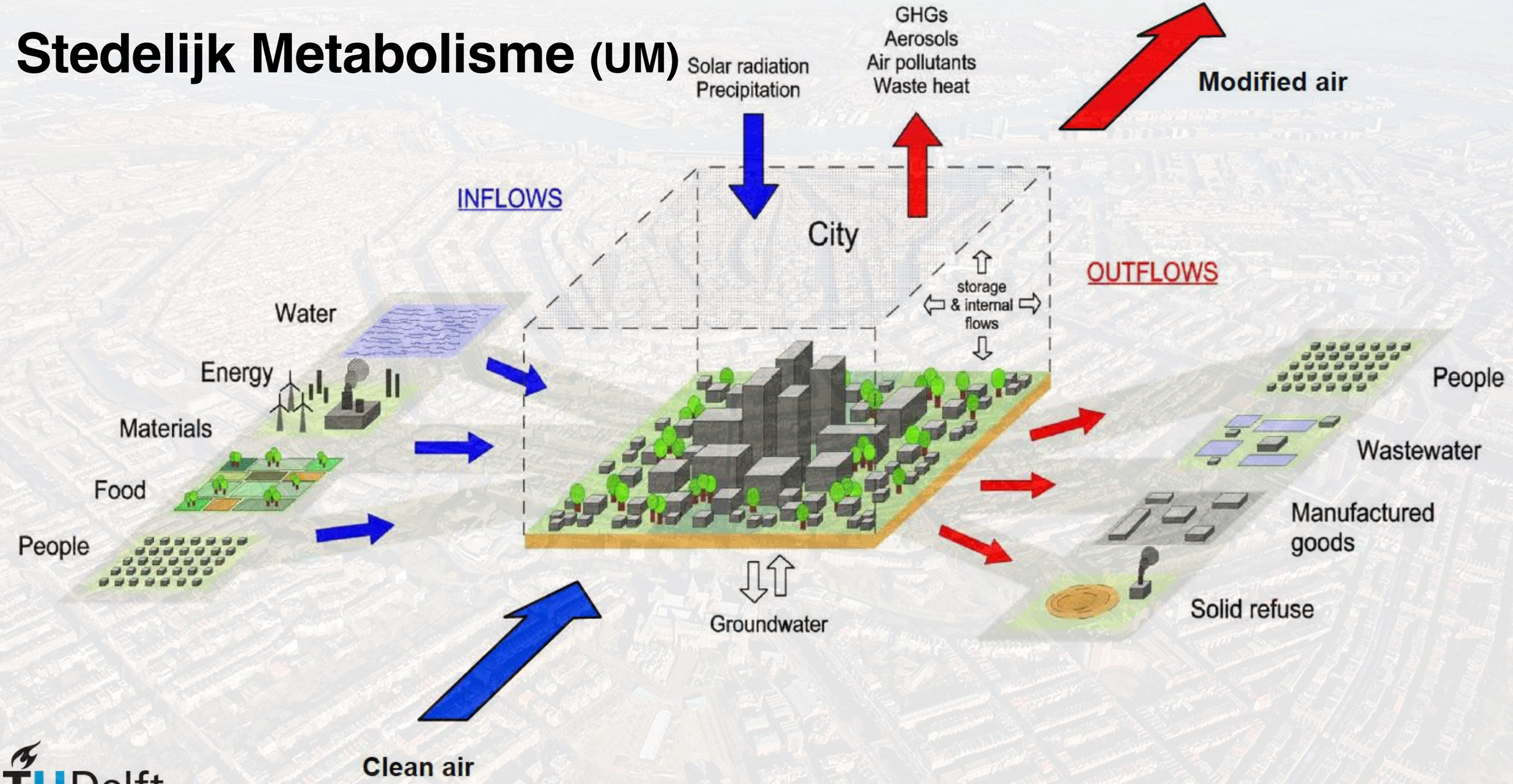


courtesy Mackay cartoons



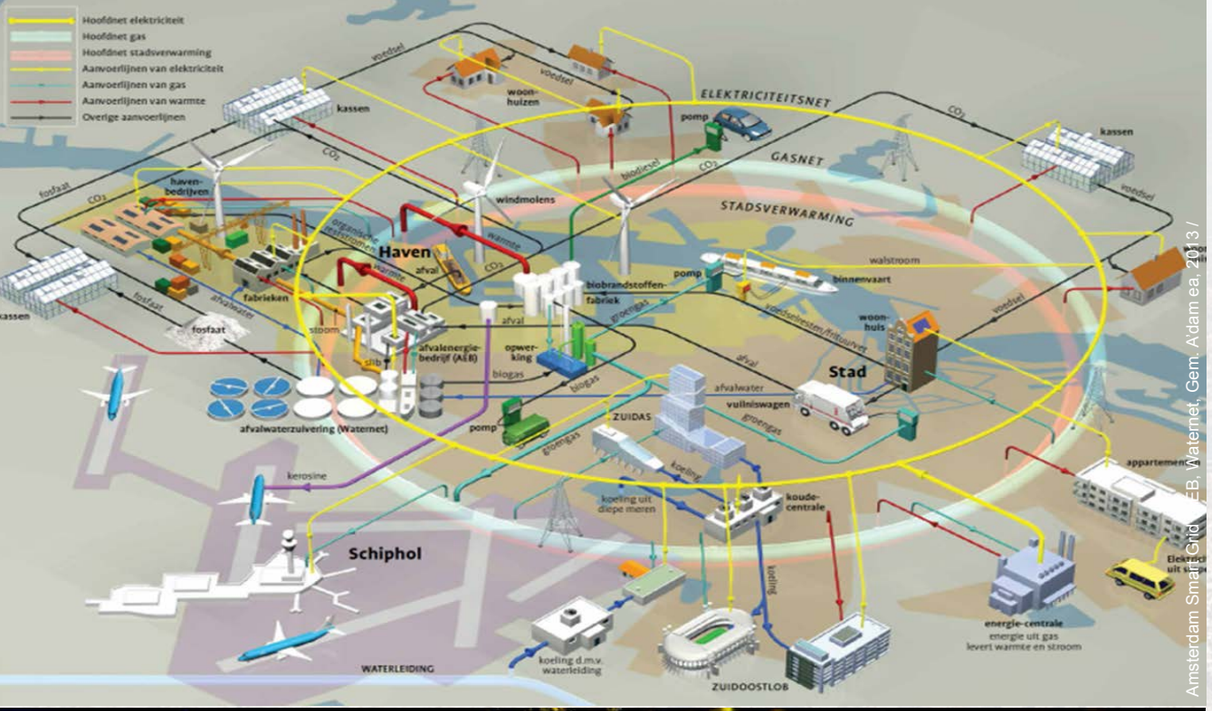
courtesy Mackay cartoons

Stedelijk Metabolisme (UM)



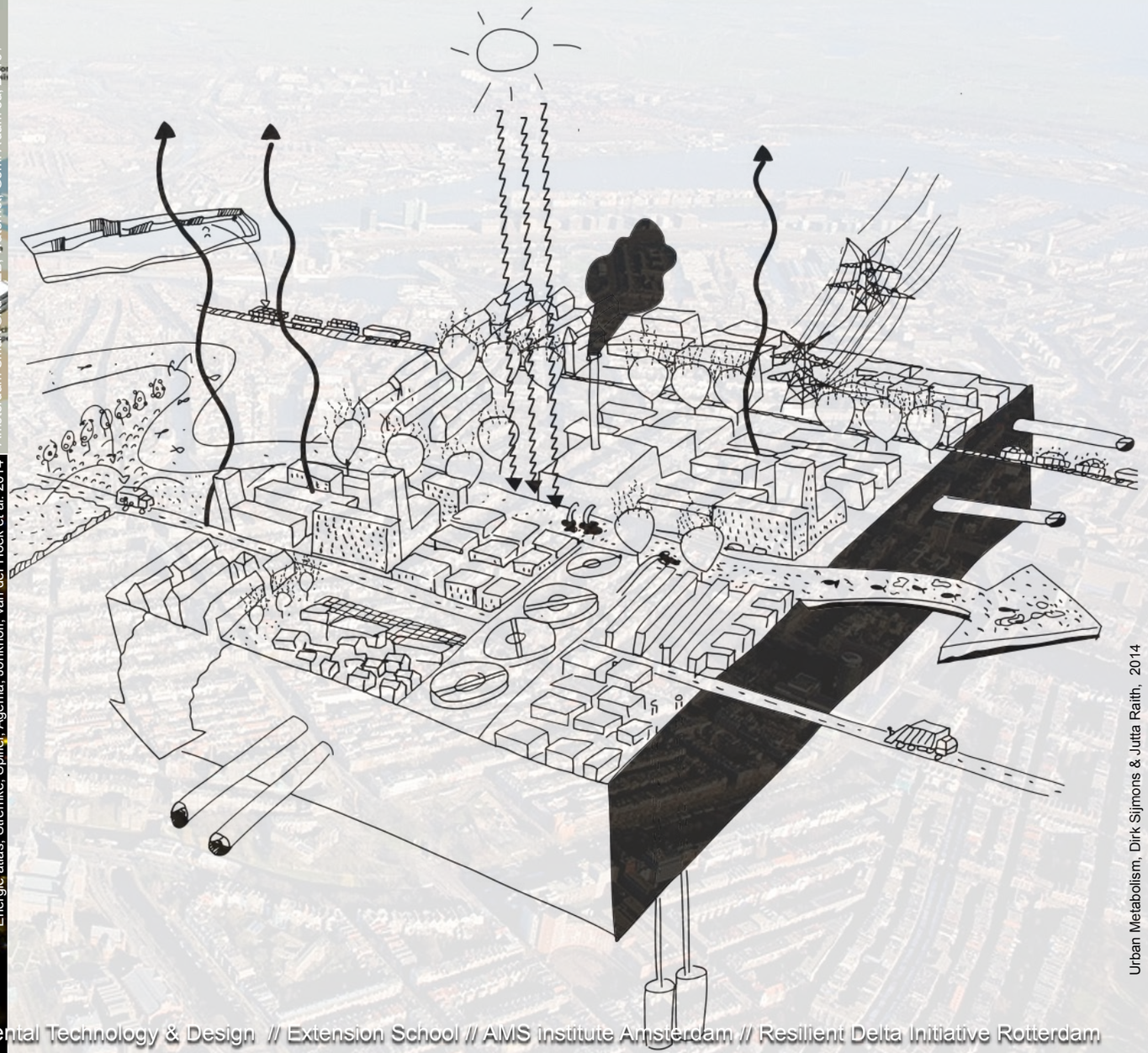
Christopher Kennedy (2015)

STEDELIJK METABOLISME (UM)

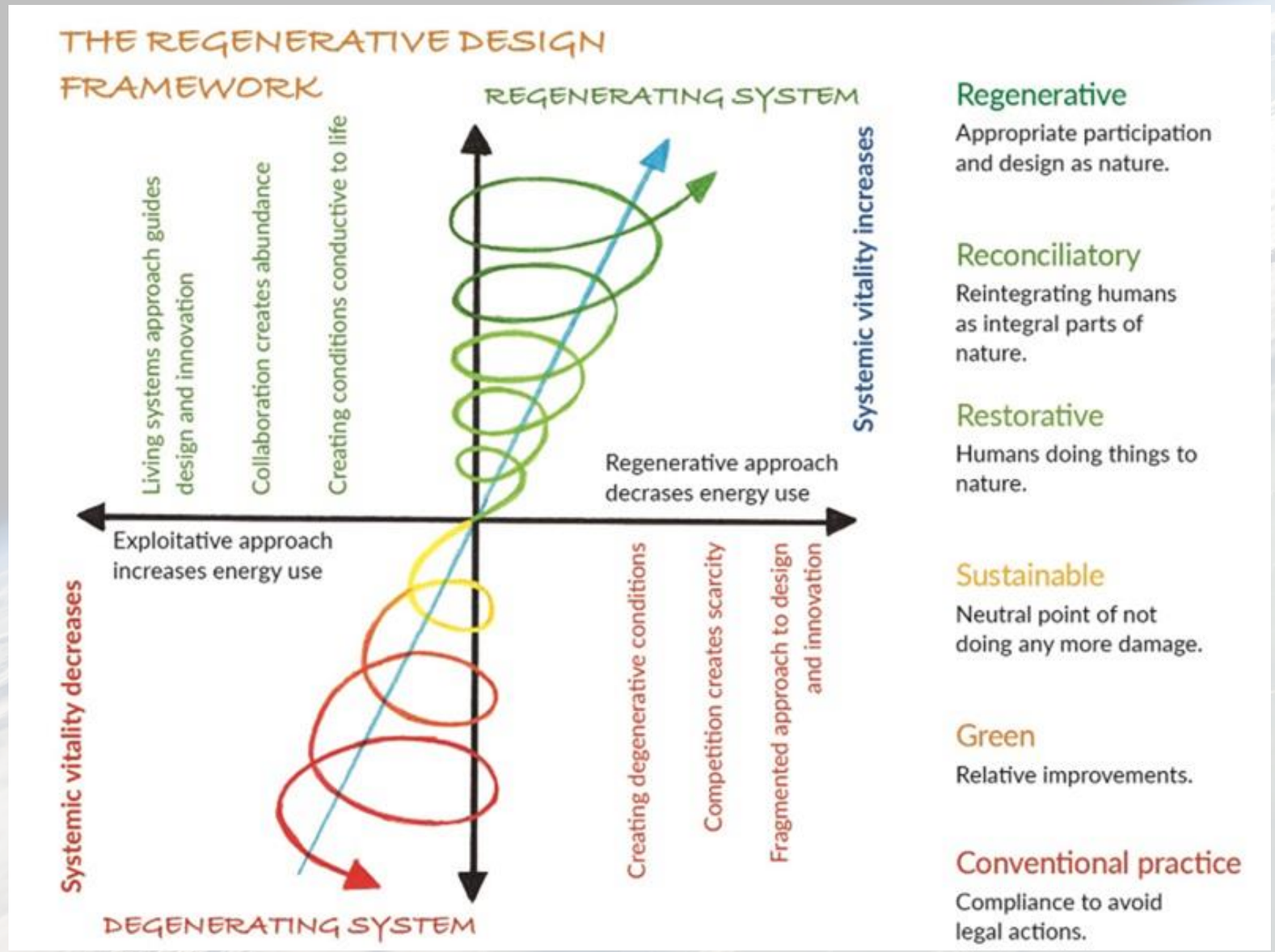


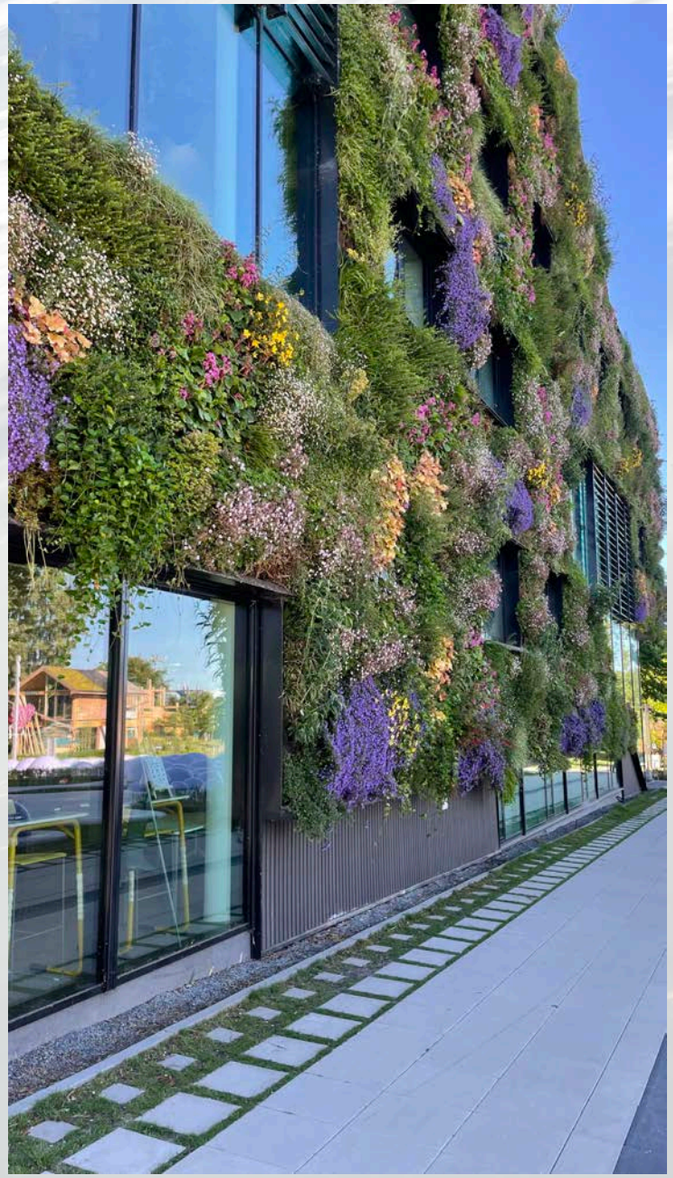
Amsterdam Smart Grid / EB, Waternet, Gem. Adam ea, 2013 /

Energie atlas, Stremke, Spiller, Agema, Jonkhoff, van der Hoek et al. 2014



Urban Metabolism, Dirk Sijmons & Jutta Raith, 2014





images : A.van Timmeren

Integreren/vertalen van andere ‘waarden’
… met name ook in de (semi) publieke ruimte

Tietgen Dormitory, Copenhagen (Lundgaar,d & Tranberg Architects 2014)

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environmental technology & design

Integreren van nieuwe eigendomsvormen …
van ‘publieke’ ruimtes…

Urban Agriculture; near the 'Dakenpark' Rotterdam, Delfshaven/Nieuw Mathenesse (the Netherlands)

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Transformeren naar & integreren van ander ruimtegebruik t.b.v. water, groen en mensen ...

Amsterdam Nieuw West / courtesy: Marco ten Brommelstroet (UvA)

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environmental technology & design

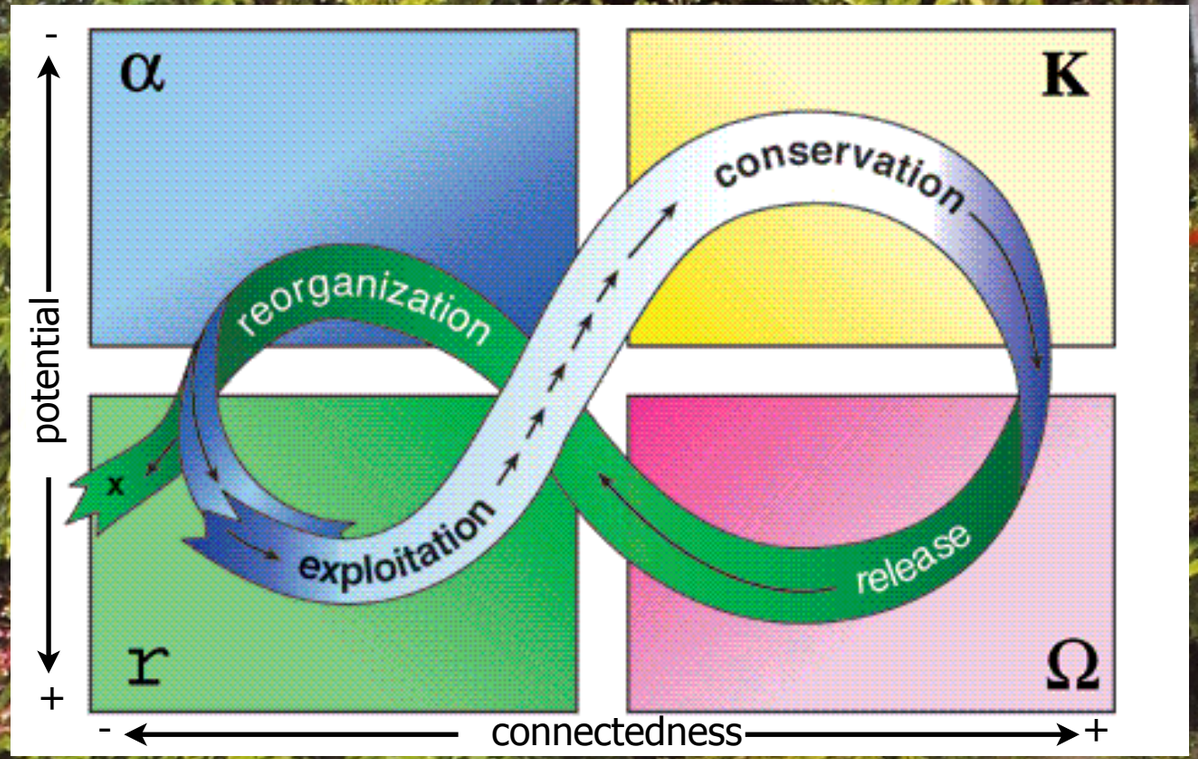
Integreren van klimaat adaptatie (& NBS) ...

courtesy: Arjan van Timmeren

"The major problems in the world are the result of the difference between how nature works and the way people think"

'An Ecology of Mind' Gregory Bateson

panarchy



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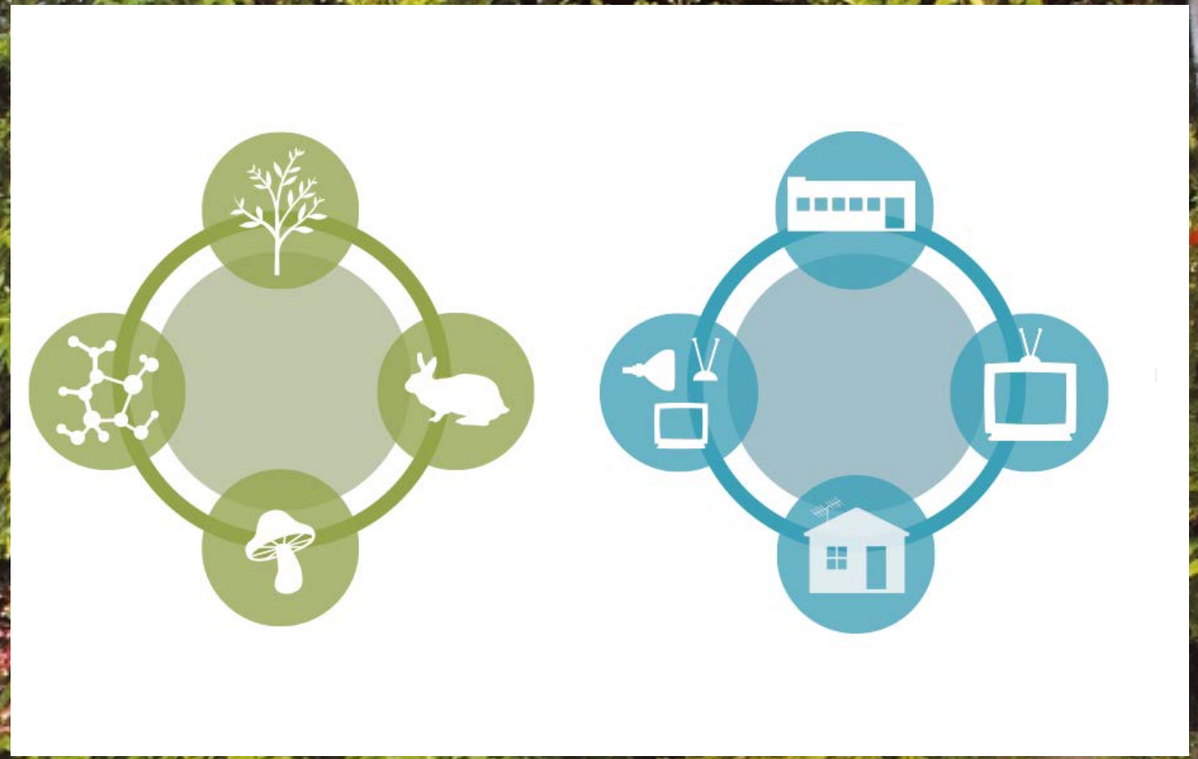

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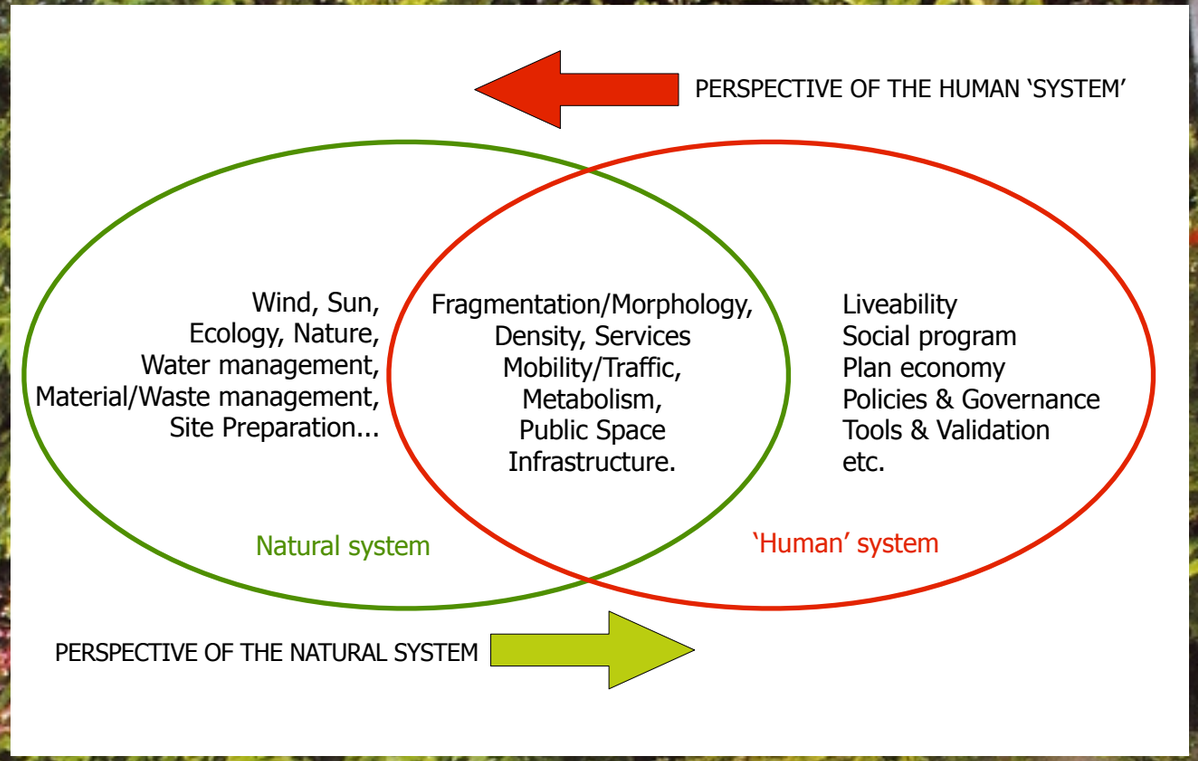

(source: Johsua Todd Ecological engineering)

'Archipuncture' & 'Regenerative Design': Bamal Canal project, China

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environmental technology & design

(source: Johsua Todd Ecological engineering)

'Archipuncture' & 'Regenerative Design': Bamai Canal project, China

Bamai Canal (China): 500 meter lang , met ca. afvalwater effluent van 12.000 pe ...

'Archipuncture' & 'Regenerative Design'; Bamai Canal project, China (source: Johsua Todd Ecological engineering)

REsource Management in Peri-urban Areas: Going Beyond Urban Metabolism

Grant Agreement No.: 688920

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688920

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Courtesy AMS Institute | 3D Printing for the Circular City | PhD candidate Fotini Setaki

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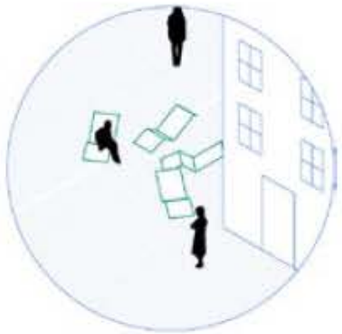
APPLICATIONS

AMS
POLES

TREE
PLANTS

BUS
STOP

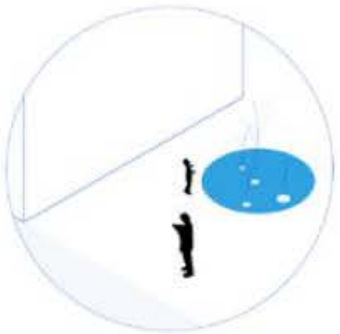


BENCH

Iam
LANDMARK

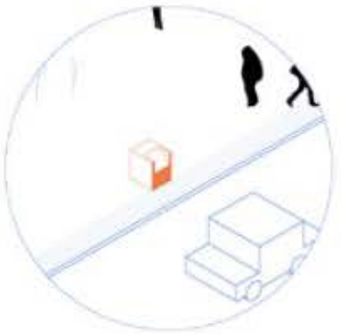
PLAYGROUND

XXX
LIGHTS



FONTAIN

BIKE
RACKS

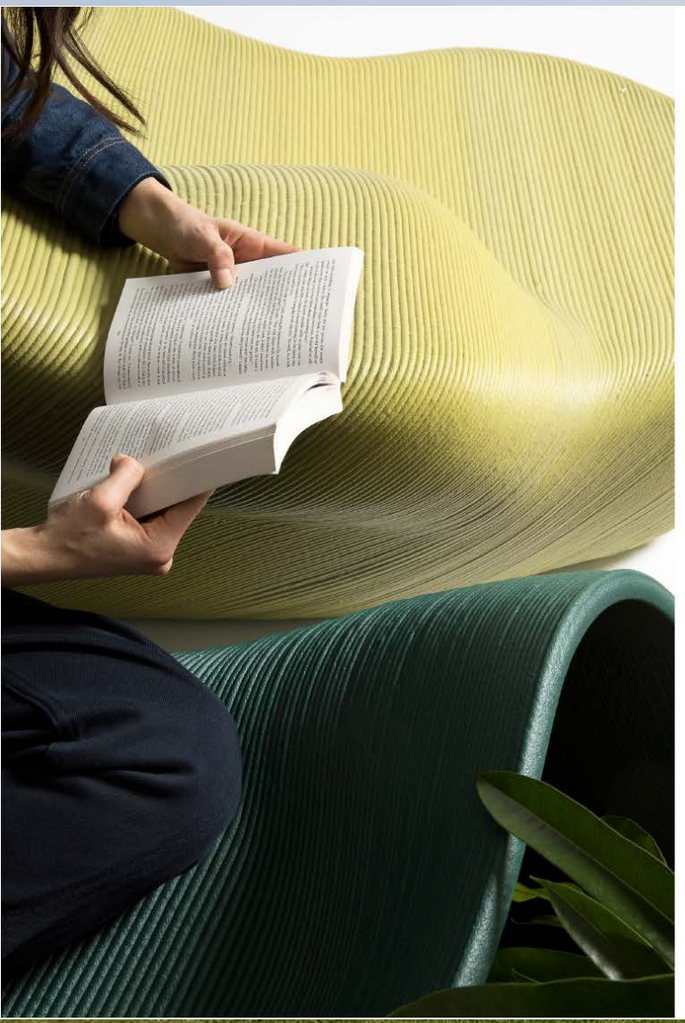


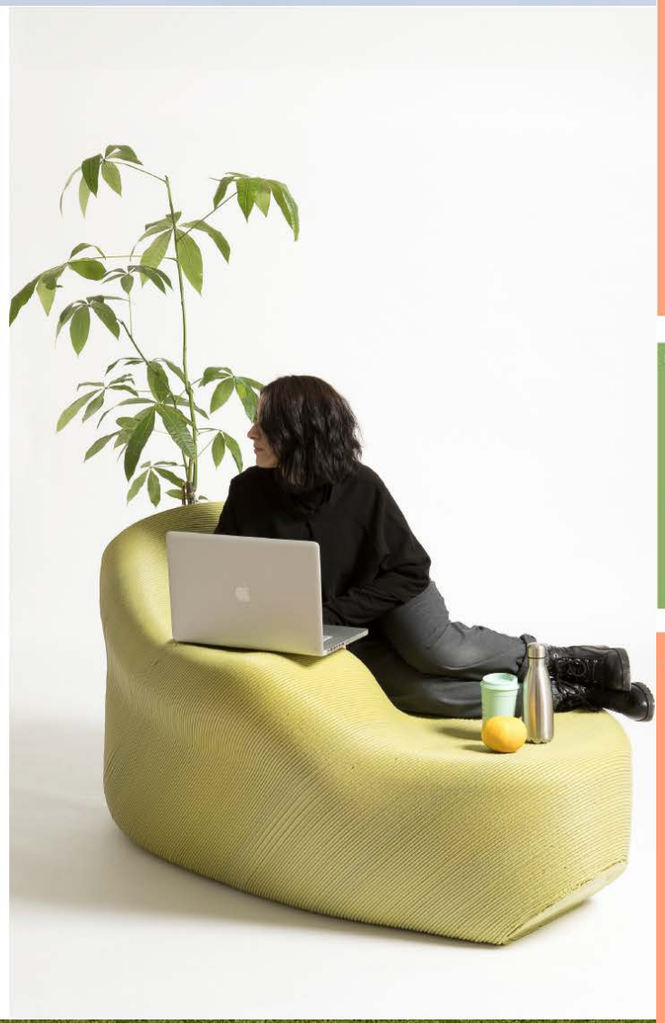
RECYCLING
BIN

DUS.

aeb

TU Delft





Print Your City

PRINT YOUR CITY

The 3 dimensions of recycling

The "Print Your City" initiative is a part of the ambitious "Zero Waste Future" program of Coca-Cola in Greece.

Can we, as citizens, take advantage of plastic waste and use it to build our cities?
Of course we can! With the power of recycling and 3D Printing!

Join us and turn waste, into an opportunity. Through this website and with the help of the principles of cyclical economy, you can design new furniture for your neighborhood.

Voting for the first square has finished. The results will be presented on January 10! Until then, you can visit us at the Zero Waste Lab where together we can

START NOW!

Print Your City

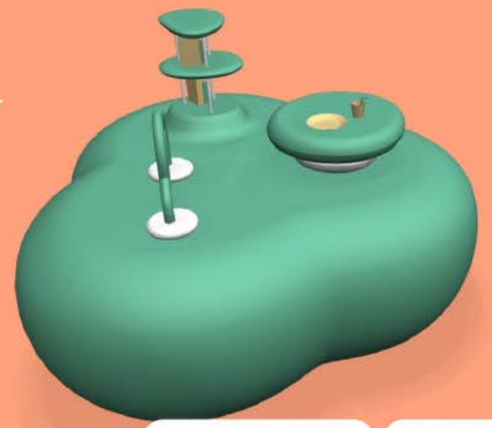
This is your design!

We will need to recycle **95kg** of plastic in order to print this bench.

SHARE NOW

Share your design with your friends now and let's decorate our city!

Currently we are working through your designs. The first results will be presented



MAKE A NEW DESIGN

MOST POPULAR DESIGNS

Courtesy AMS Institute | 3D Printing for the Circular City | PhD candidate Fotemi Setaki

thenewraw.org | printyour.city


Courtesy AMS Institute | 3D Printing for the Circular City | PhD candidate Foteini Setaki

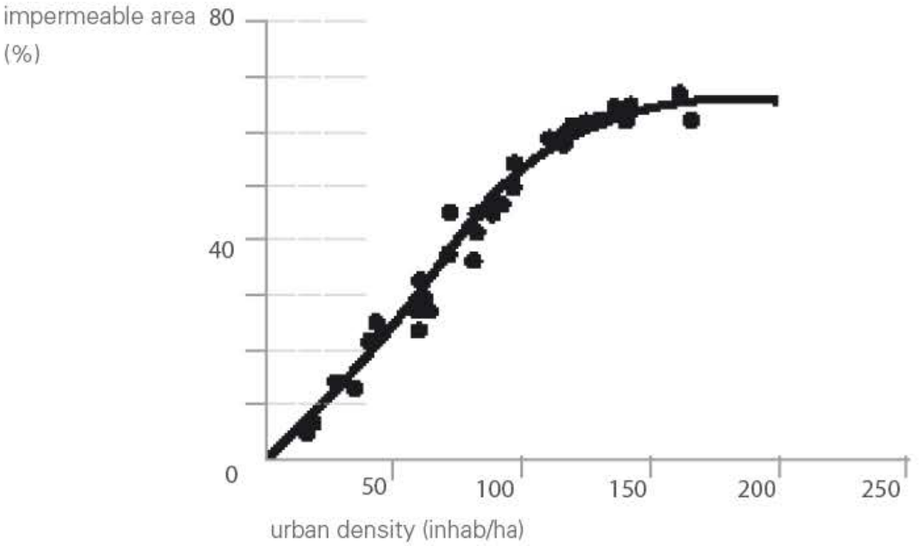
Inform about Circularity

Courtesy AMS Institute | 3D Printing for the Circular City | PhD candidate Foteini Setaki, Island of Thessaloniki


infiltration planters

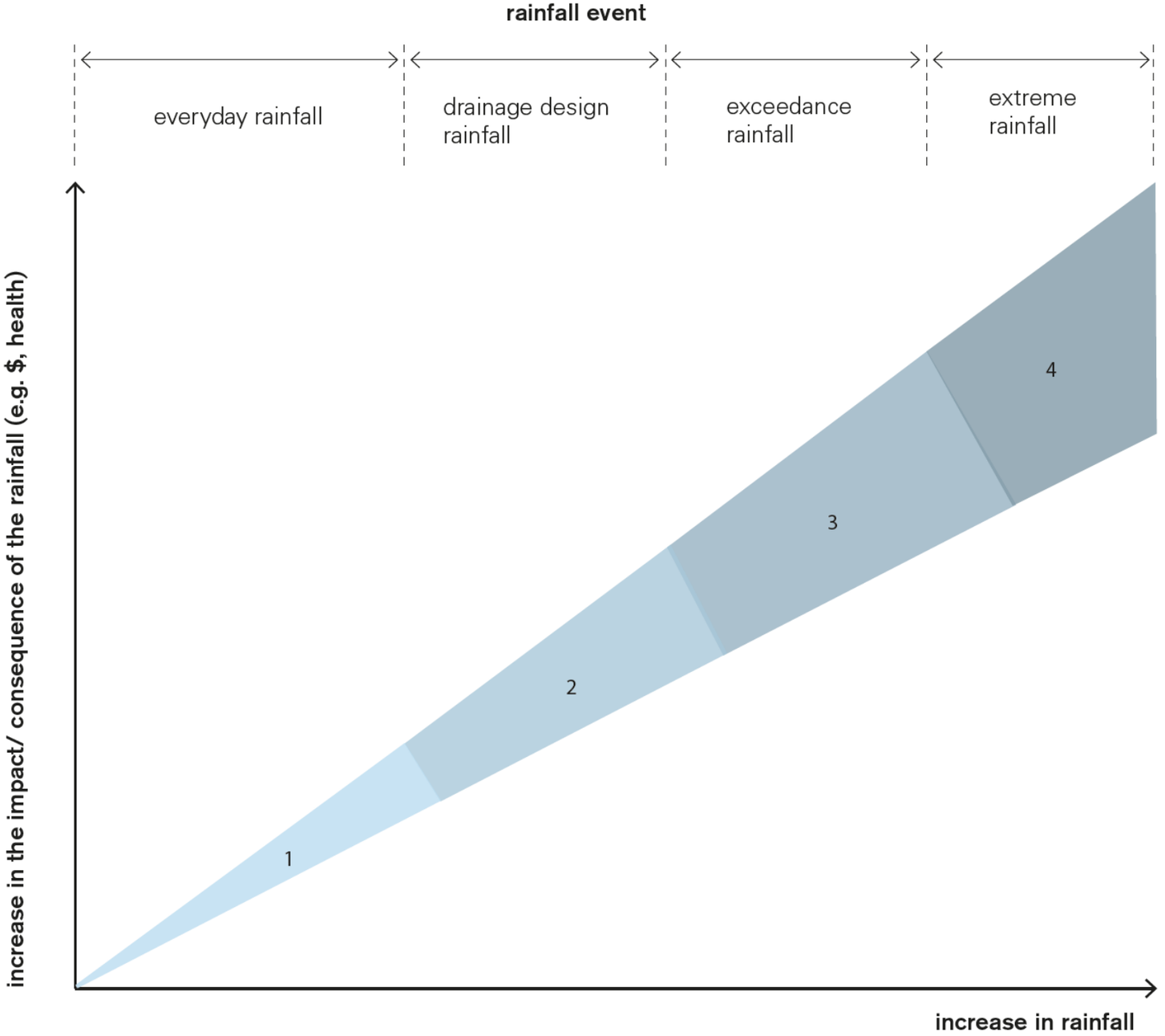
Hybrid GreenlBlue

Urban gradient expressed by different urban density values and related surface impermeability



Tucci & Campana (2001)

Street in Sydney (Australia); photo: A.van Timmeren



design approach and reason to manage rainfall

4th domain
emergency response and spatial planning to minimise and manage impacts

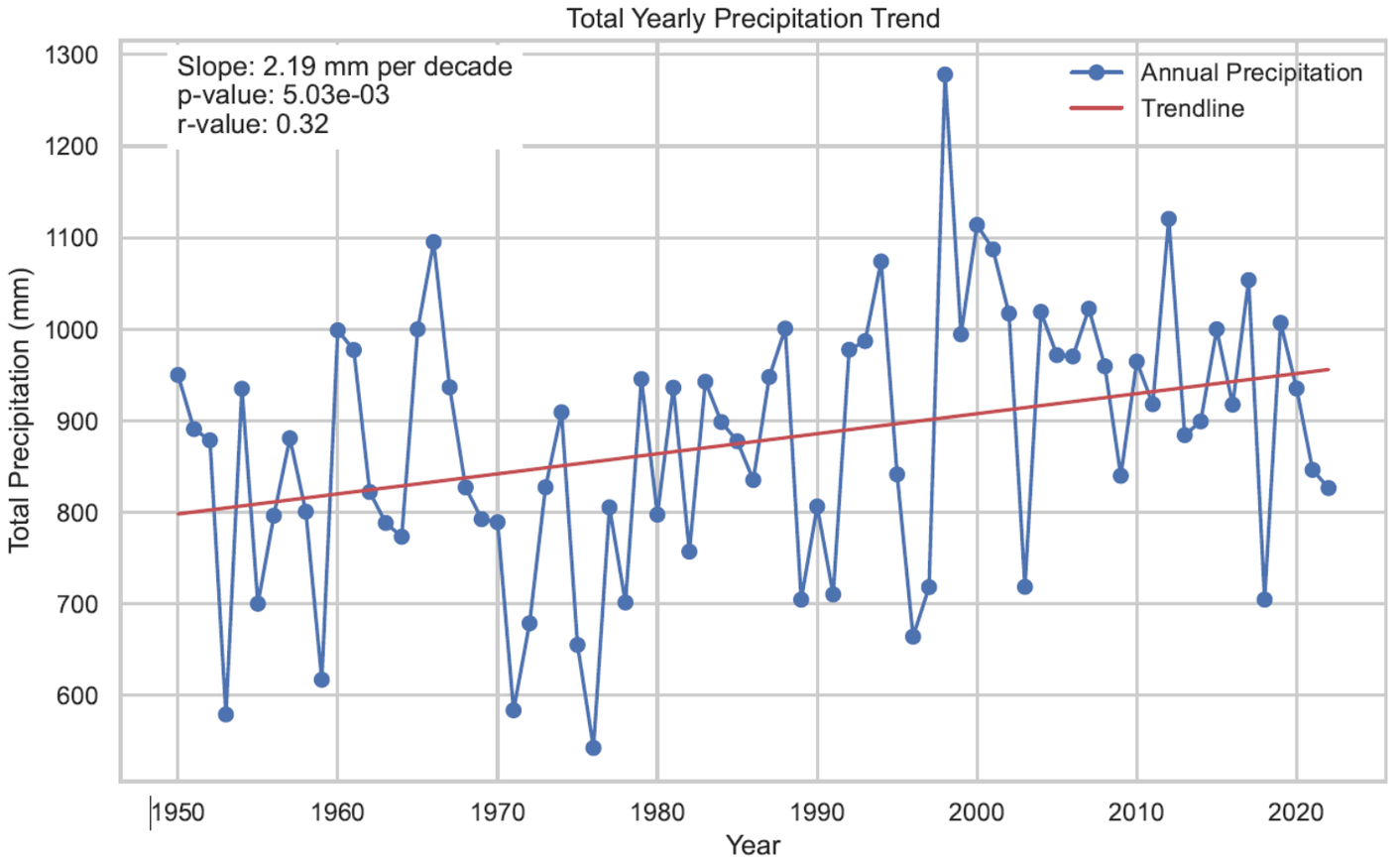
3th domain
design for exceedance emergency and spatial planning. manage water in preferred locations

2nd domain
conventional drainage (e.g. sewers) and SuDS to limit flooding

1st domain
drainage/ maintenance to limit pollution and blockages causing flooding

source:
Ashley et. al (2015): Managing urban flooding from heavy rainfall (encouraging the uptake of designing for exceedance).

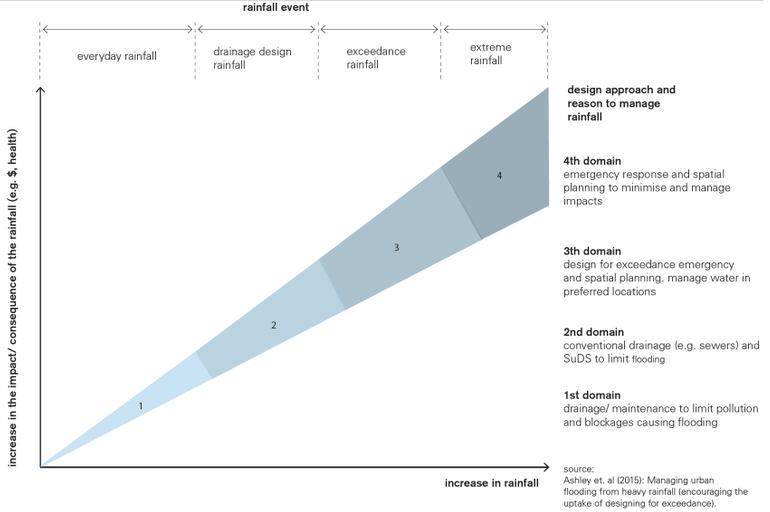
There is an increasing trend in annual precipitation

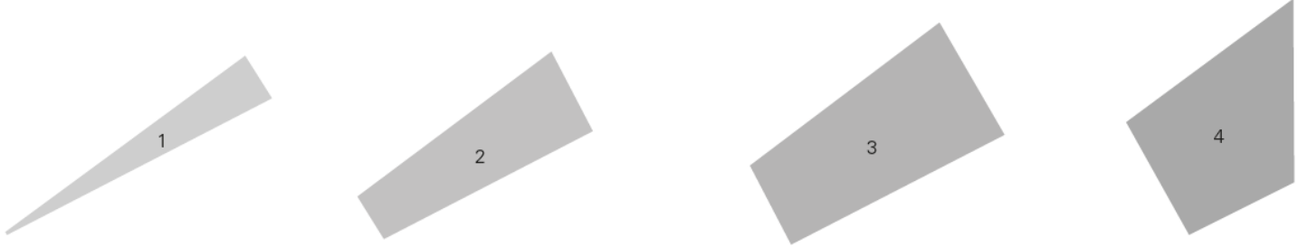


on average, the total yearly precipitation has increased by **2.19 millimeters** every **10 years**

A **p-value less** than **0.05** generally suggests that the trend observed is statistically significant, meaning that it's unlikely to have occurred by random chance.

r-value of **0.32** suggests a moderate positive trend over time.





design approach and reason to manage rainfall

1. drainage/ maintenance to limit pollution and blockages causing flooding

- separated stormwater drainage system
- regulation of water flow of rivers
- reduce obstacles in the floodplain conveyance

2. conventional drainage (e.g. sewers) and SuDS to limit flooding

-delay drainage - infiltration
- raingarden
- infiltration planters
- curbside raingarden
- green roofs
- swales
- infiltration trench
- pervious pavement
- infiltration basin

-delay drainage - buffer/ storage
- detention basin
- retention pond
- wetland

-water quality
- water factory
- sand trap filter

3. design for exceedance emergency and spatial planning. manage water in preferred locations

conveyance and storage of exceedance flows

-diversion structures
- river bypass
- berms

-conveyance structures:
- swales
- ditches
- street gutters
- urban creek

-multipurpose spaces
- green areas
- flodable public spaces
- sport courts
- playgrounds
- parking spots
- traffic islands
- small streets

-green reservoirs
- reedbeds
- forebay

-underground structures
- underground tanks, cisterns and pools

-attenuing flow peaks
- land form depressions in the canal forming public spaces

4. emergency response and spatial planning to minimise and manage impacts

-diversion structures
- paths for flood return to river
- cloudburst boulevards
- underground diversion tunnel

-emengency measures
- connection with multiple bridges
- amphibious houses
- houses starting one storey upper the street level
- concrete frame buildings for structure resistance against water
- scape routes

improve awareness- all domains

- combine green with blue infrastructures
- implement public meeting spaces close to green blue infrastructures
- implement perenial open water structures
- change water into a playful structure
- transform water facilities into parks
- propose seasonal design
- change public spaces into floodable spaces
- implement open gutters, canals, creeks
- introduce green blue elements into the landscape
- introduce variety of landscapes in different districts
- transform urban spaces into a more natural habitat
- generate system of green blue spaces in urban areas
- bring people closer to water bodies
- bring water bodies closer to people
- implement more water lowers the ambient temperature in summer
- implement more water binds dust particles
- implement more water humidifies the air
- implement riverfront parks revive the presence of the rivers
- transform green roofs into rooftop gardens

‘Bos op Poten’…


vanaf
24 mei
BOS OP POTEN
walking forest
yürüyen orman
Binnenkort! Een tijdelijk bos van minimaal
20 verplaatsbare bomen op het Handelsplein
Coming soon! A temporary forest of at least 20
movable trees on the Handelsplein from 24 May

‘Bos op Poten’...

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BOS OP POTEN TIMELINE

april - may 2023

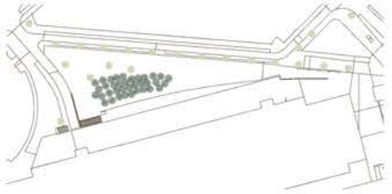
search for a place

verschoorstraat

visserijplein

handelsplein

observation
conversation
email
configuration



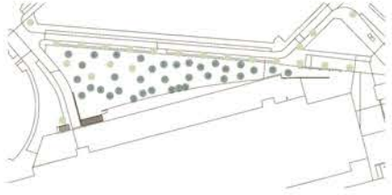
21 june 2023

welcoming event

configuration
interaction
drawing/map
written idea
number

#1 boomworkshop | wat weet je over ons?
#2 bosopstelling | waar zet je ons neer?
#3 ideeënboom | wat wil je doen in het bos?
#4 namenwedstrijd | hoe wil je ons noemen?
#5 oplaadstation | even bijtanken in de schaduw

+/- 60-80 people attended
11 people signed up for co-caring
58 ideas for activities in the forest
10 configuration maps created



2 august 2023

interview round neighbors

conversation

what influence has bos op poten on the square?
what value does it have for you?
what do you think of the current configuration?
would you like to take care of the trees?

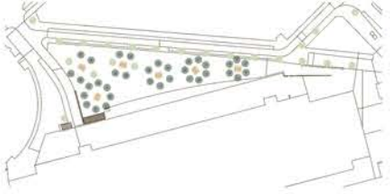
10 short interviews

29 august 2023

moving day #1

conversation
configuration
number
initiative

€2.500 raised via citizen initiative
5 picnic benches were bought and placed
30 people attended



30 september 2023

storm op komst

observation
conversation

data types

observation
conversation
email
configuration
interaction
drawing/map
written idea
number
article/promotion
initiative

article/promotion
conversation
interaction

general

3 articles published

article/promotion
email

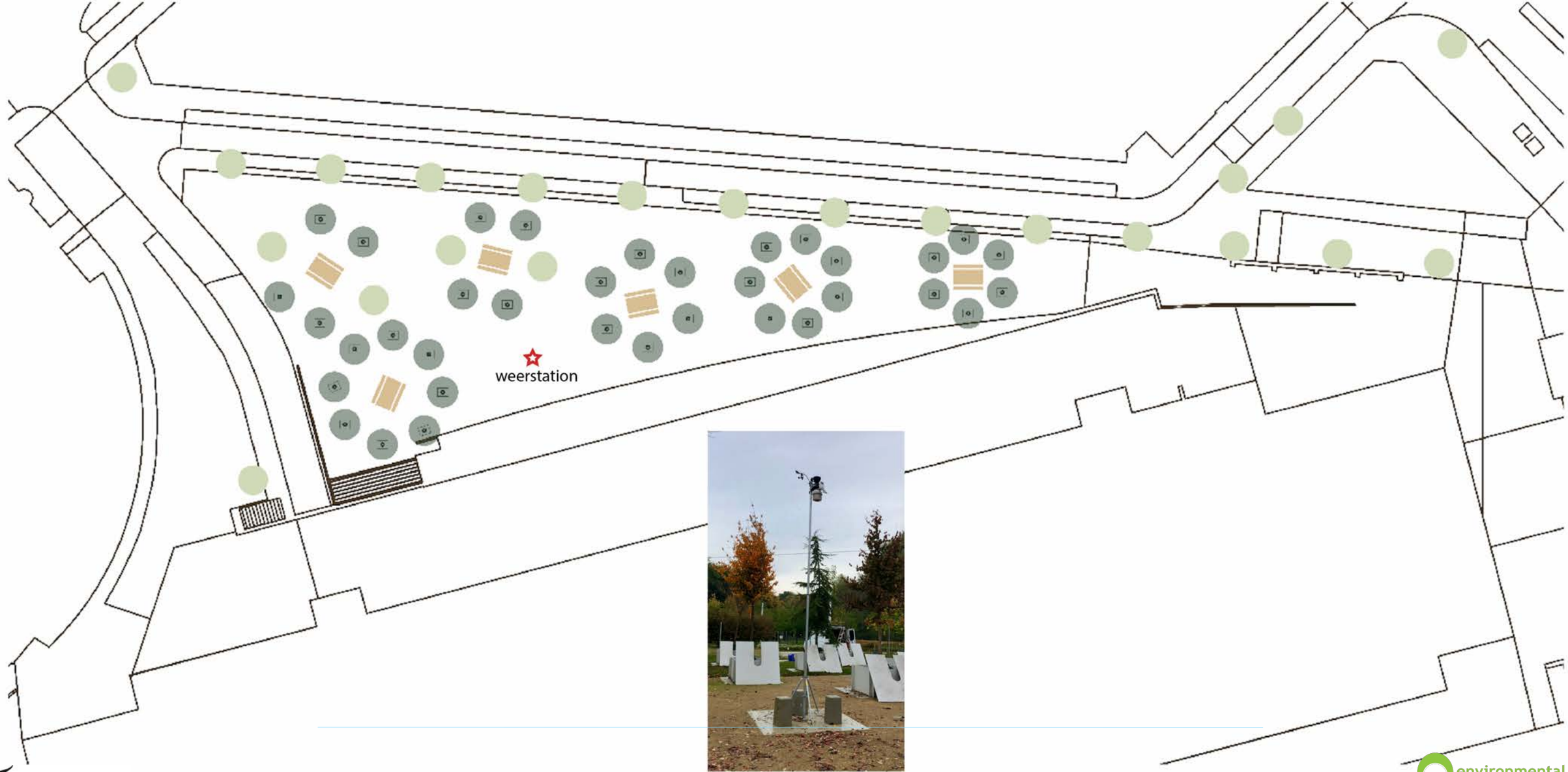
bos op poten website

30+ emails via website
3 people reached out for pictures or an article
3 people reached out for a similar project in their area

email

watering

Convergence TUD-EUR-EMC Resilient Delta initiative • TUDelft 'Bos op Poten' project











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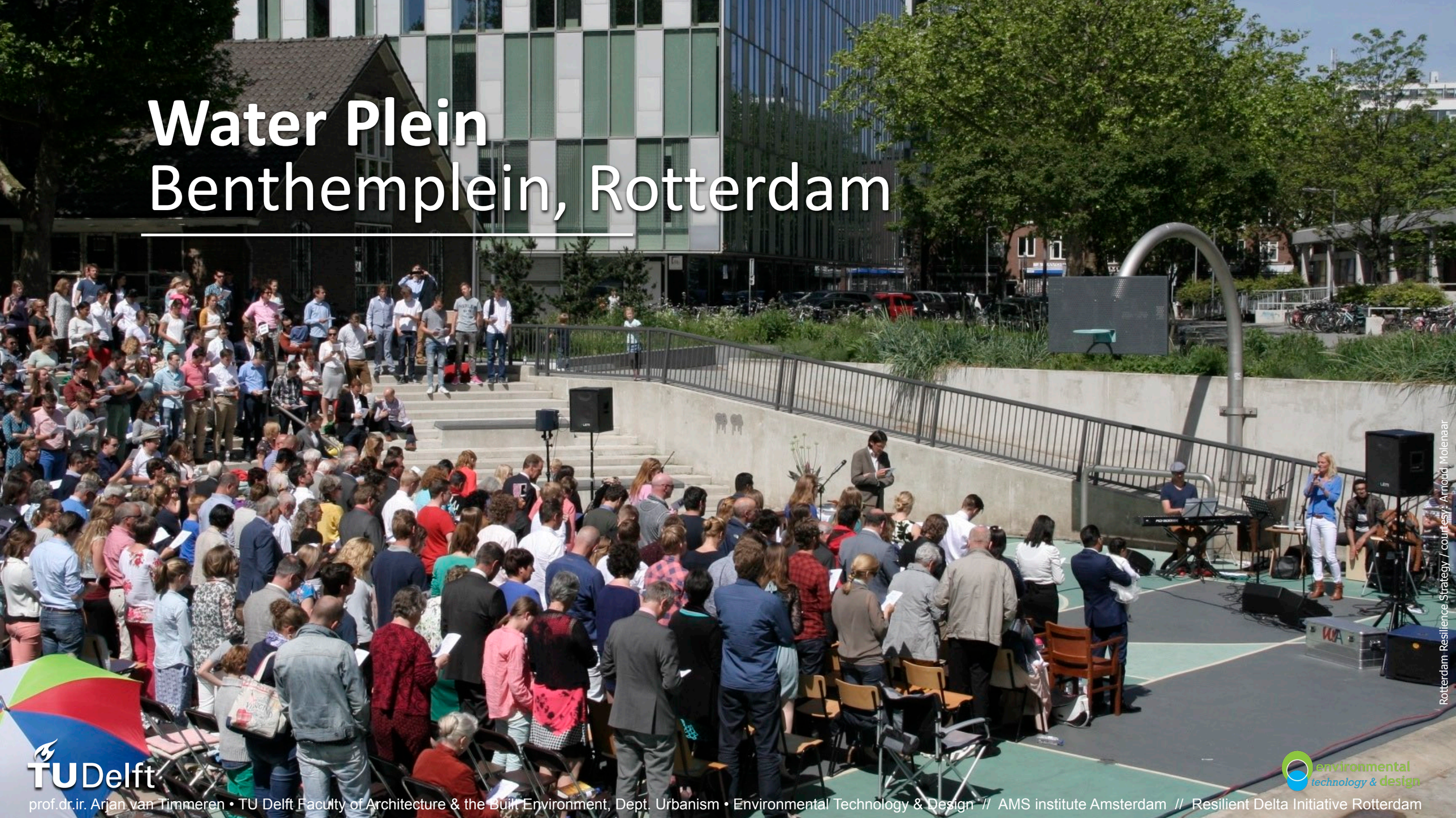
Rotterdam Resilience Strategy / courtesy: Arnoud Molenaar / except top right (A.van Timmeren) and top left (MVRDV)

Water Plein
Benthemplein, Rotterdam



Rotterdam Resilience Strategy / courtesy: Arnoud Molenaar

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‘Resilience by Design’

Rotterdam Resilience Strategy / courtesy: Arnoud Molenaar

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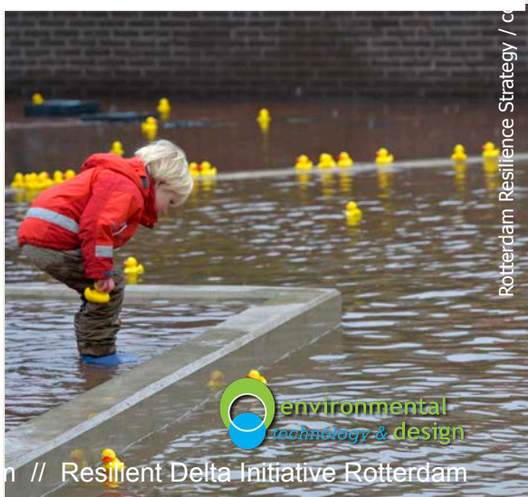
environmental technology & design



Rotterdam Resilience Strategy / courtesy: Arnoud Molenaar

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Groene Daken Programma R'dam (460.000 m2)

Rotterdam Resilience Strategy / courtesy: Arnoud Molenaar

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‘MULTI-FUNCTIONAL ROOFTOP LANDSCAPE’

Rotterdam Resilience Strategy / courtesy: Arnould Molenaar

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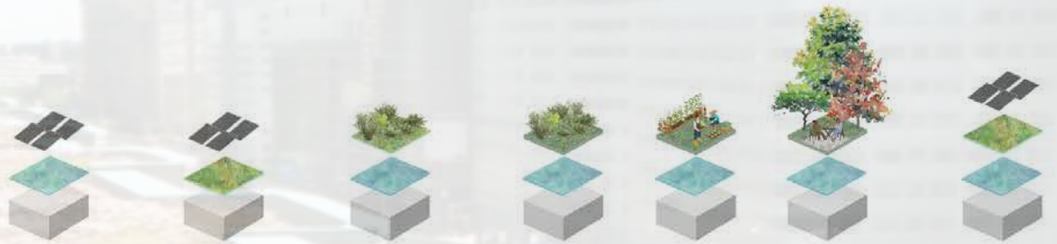
Rooftop Strategy

Elements of the base layer

PROPERTIES	ENERGY TRANSITION	FLOODING	UHI-EFFECT (medium)			UHI-EFFECT (high)	LACK OF BIODIVERSITY		
water storage	0mm	70-300mm	18mm	25mm	19mm	30-80mm	30-80mm	150-370mm	110-160mm
substrate layer	0mm	0mm	30mm	60mm	60mm	60-150mm	150-210mm	230-400mm	230-400mm
weight	>6kg/m2	70-300kg/m2	55kg/m2	90kg/m2	90kg/m2	<95kg/m2	95kg/m2	310kg/m2	320kg/m2
vegetation	no	no	sedum	sedum (herbs, grasses)	sedum, herbs grasses	herbs, bushes	herbs, bushes	perennials, trees, grass, pavement	perennials, trees, grass, pavement
reference	Solarge DUO	Waterdak (Amsterdam Rainproof)	Dakbegroeiing lichtgewicht (Optigrün)	Dakbegroeiing economisch dak (Optigrün)	Meander FKM 30 (Optigrün)	Natuurdak (Optigrün)	Natuurdak (Optigrün)	Drossel Intensief (Optigrün)	Daktuin (Optigrün)
cost	€257/m2 (Vattenfall)	€100-150/m2 (Duurzaam 010)	€45-100/m2 (Sedumdak-bedekking)	€45-100/m2 (Sedumdak-bedekking)	€45-100/m2 (Sedumdak-bedekking)	€100-120/m2 (Sedumdak-bedekking)	€120-150/m2 (Interpolis)	€120-150/m2 (Interpolis)	€120-150/m2 (Interpolis)



PROPERTIES	FLOODING X ENERGY TRANSITION	UHI-EFFECT (medium) x ENERGY TRANSITION	UHI-EFFECT (medium) X FLOODING	UHI-EFFECT (high) X FLOODING			UHI-EFFECT (medium) X FLOODING X ENERGY TRANSITION
water storage	95-150mm	95-150mm	70-80mm	70-80mm	70-126mm	180-230mm	95-150mm
substrate layer	0mm	80mm	60-80mm	80-210mm	80-400mm	250-400mm	80mm
weight	<120kg/m2	120kg/m2	<95kg/m2	95kg/m2	150kg/m2	600kg/m2	120kg/m2
vegetation	no	sedum	herbs, bushes	herbs, bushes	vegetables, fruits	perennials, trees, grass, pavement	sedum
reference	Solargroendak WRB (Optigrün)	Solargroendak WRB (Optigrün)	Natuurdak (Optigrün)	Natuurdak (Optigrün)	Dakbegroeiing (dakmoestuin) (Optigrün)	Dakpark (verblijfsdak) (Optigrün)	Solargroendak WRB (Optigrün)

Graduation Project Joëlle Hermans (2022) / courtesy: Joëlle Hermans

Rooftop Strategy

Elements of the social layer

GROWING POPULATION

PROPERTIES	public park, event area	green community centre, cafe, yoga school	green, outdoor workspace	vegetable garden	shared rooftop garden, playground	rooftop garden, terrace
function						
accessibility	public	public	communal	communal	private	private
maintenance	municipality	municipality	municipality, private ownership	housing corporation	housing corporation, private ownership	private ownership
building height	<15m	<15m	0-40m	0-40m	0-40m	0-40m
reinforce supporting structure	yes	yes	yes	yes	yes	no
ownership	housing corporation, municipality	municipality	property manager	community (residents)	community (residents)	owner

CONNECTION

PROPERTIES	green facade	elevated walkway	green bridge	green pergolas: enrich, strenghten connetions for flora and fauna
function				
accessibility	public, community, private	public, community	nobody	nobody
maintenance	municipality, community, house owner	municipality	municipality	municipality, community, house owner
reinforce supporting structure	no	yes	yes	no
ownership	housing corporation, municipality,private ownership	housing corporation, municipality	housing corporation, municipality	housing corporation, municipality,private ownership

Graduation Project Joëlle Hermans (2022) / courtesy: Joëlle Hermans

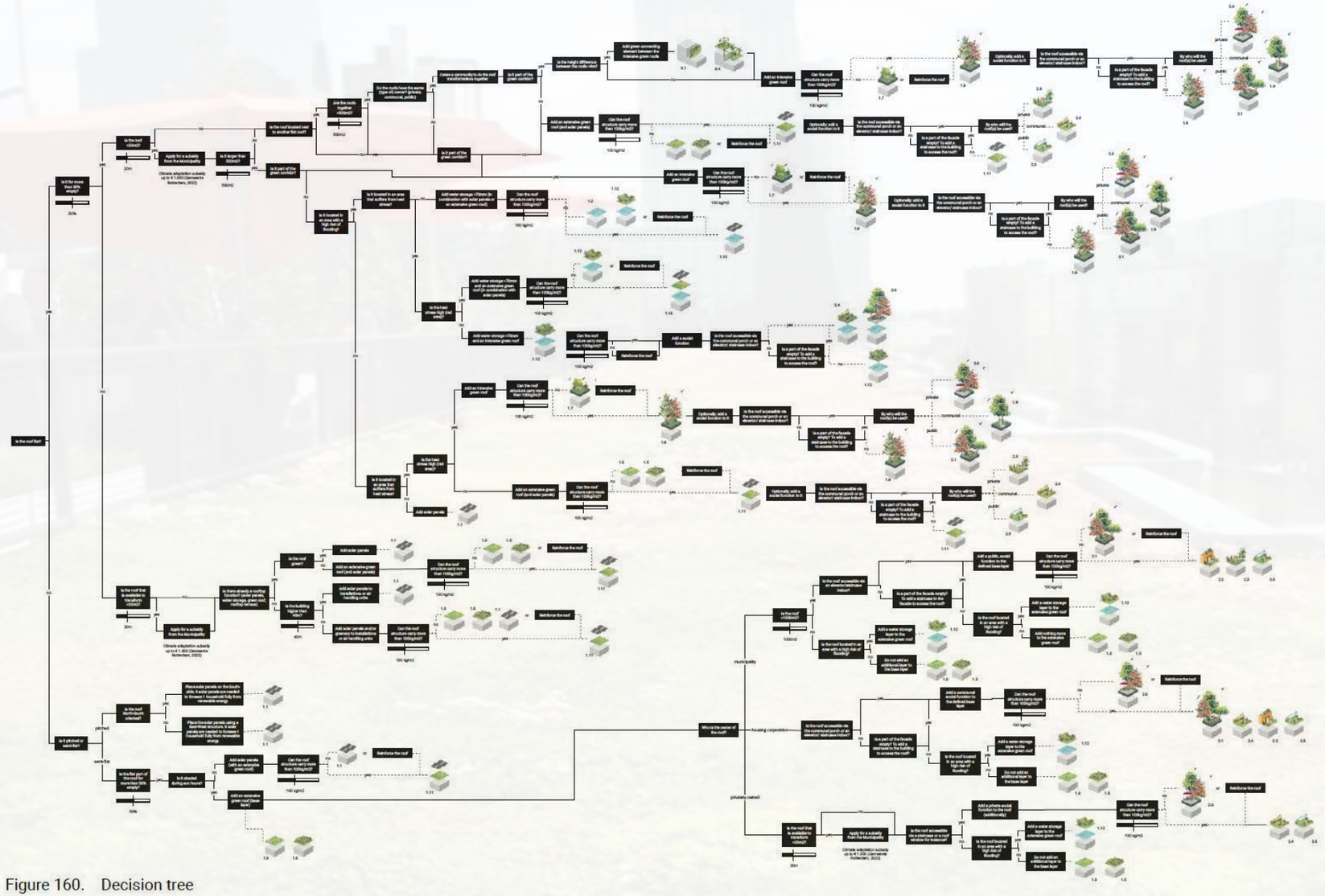
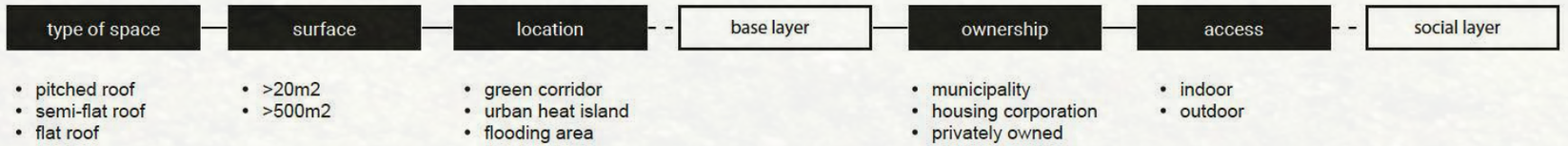


Figure 160. Decision tree



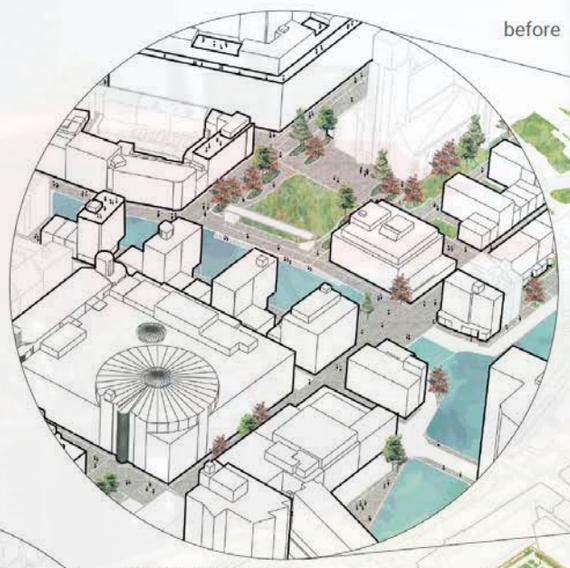
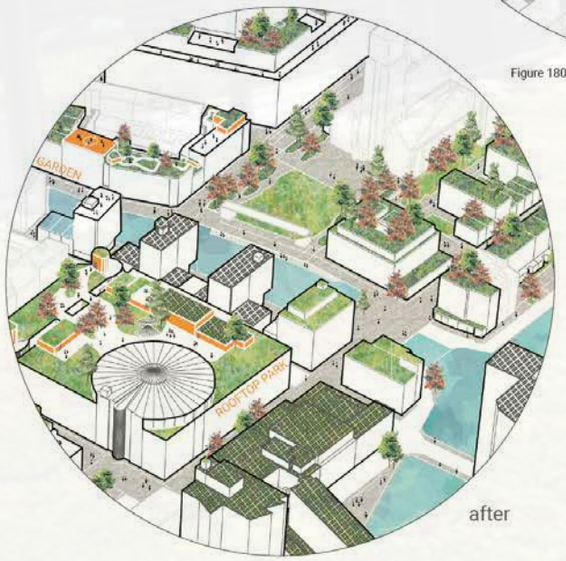


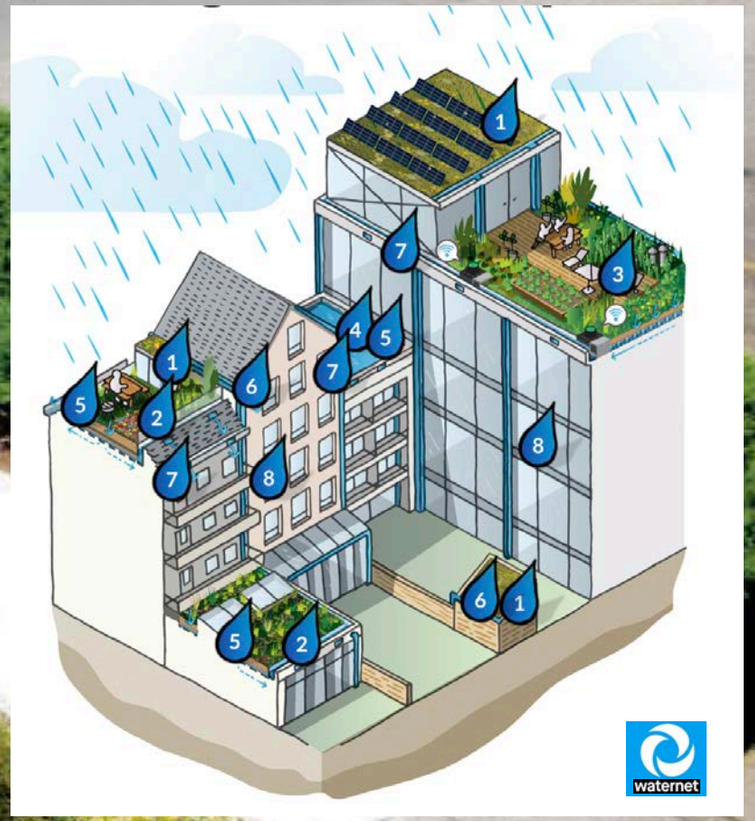
Figure 180. Old situation area 2



Graduation Project Joëlle Hermans (2022) / courtesy: Joëlle Hermans


waternet


waternet


waternet

GREEN WATER
-WATER HUBS-

• RAINWATER HARVESTIGES •
FOR GREENHOUSES


H2Ortus
Hortus café (de Oranjerie)

Drinking water usage in the De Hortus botanical garden

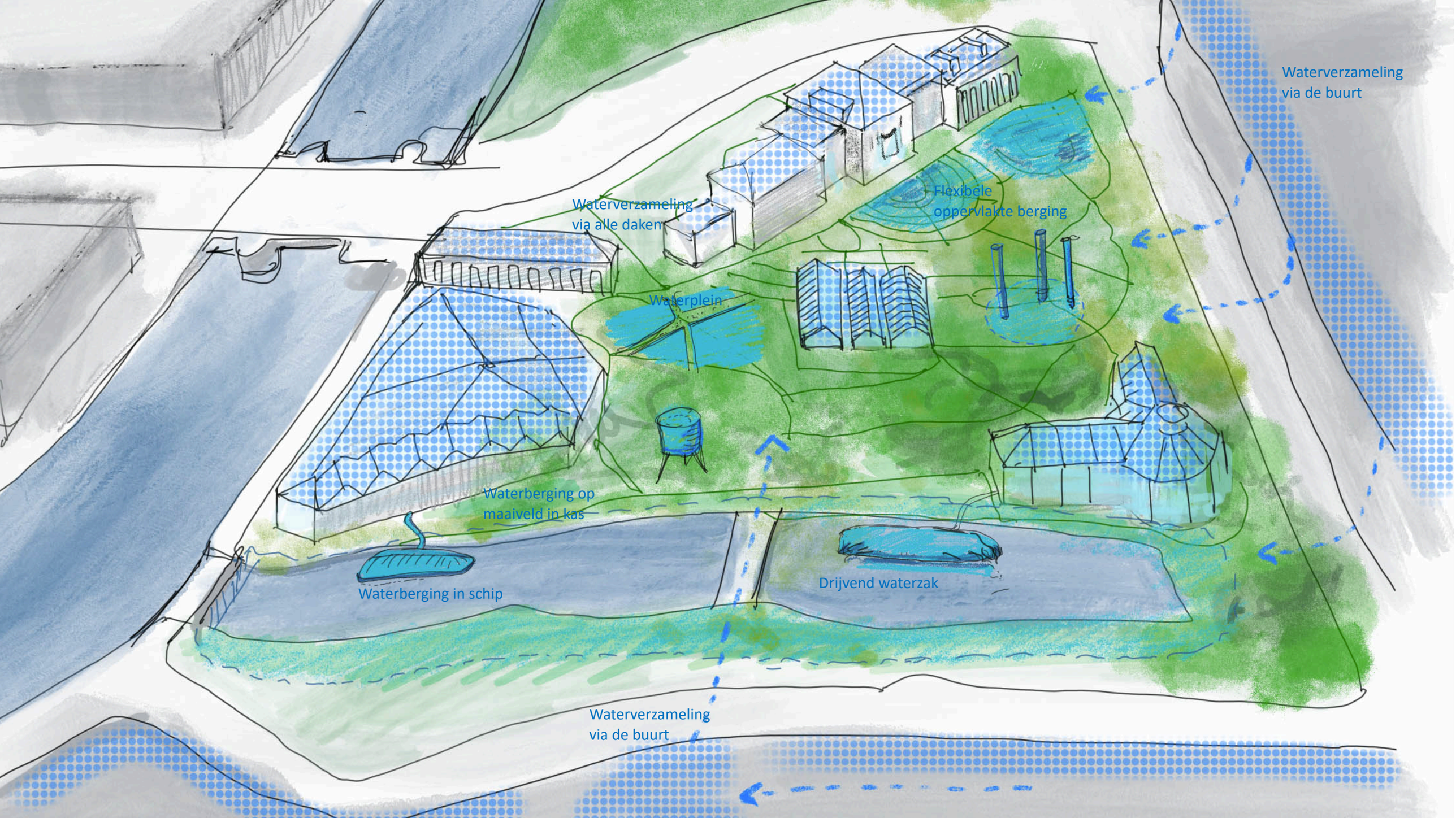
Carliene Blok

"We've been **seeing longer**, dryer periods, and we believe **tap water** will be **scarce in the future**. **Rainwater** is **the best source** of water for plants. So, for sustainability and water security reasons, we wanted to look into how we could **collect, store, and use rainwater** in our **greenhouses** and **gardens**."

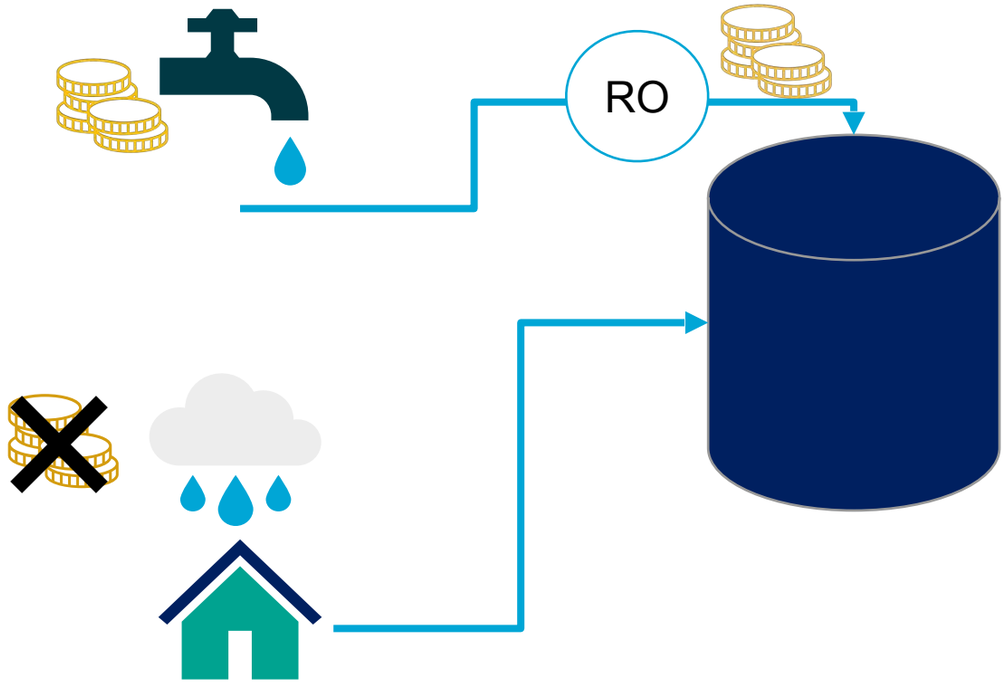
Reinout Havinga

The prediction of reduced **availability of clean water** due to climate change (and increased water use) is supported by two references from government organizations is the main motivation."

2 swimming pools = 5000 cubic meters = drinking water for 2,500 people


Waterverzameling
via de buurt
Waterverzameling
via alle daken
Flexibele
oppervlakte berging
Waterplein
Waterberging op
maaiveld in kas
Waterberging in schip
Drijvend waterzak
Waterverzameling
via de buurt

De Hortus pays both drinking water bills and reverse osmosis application



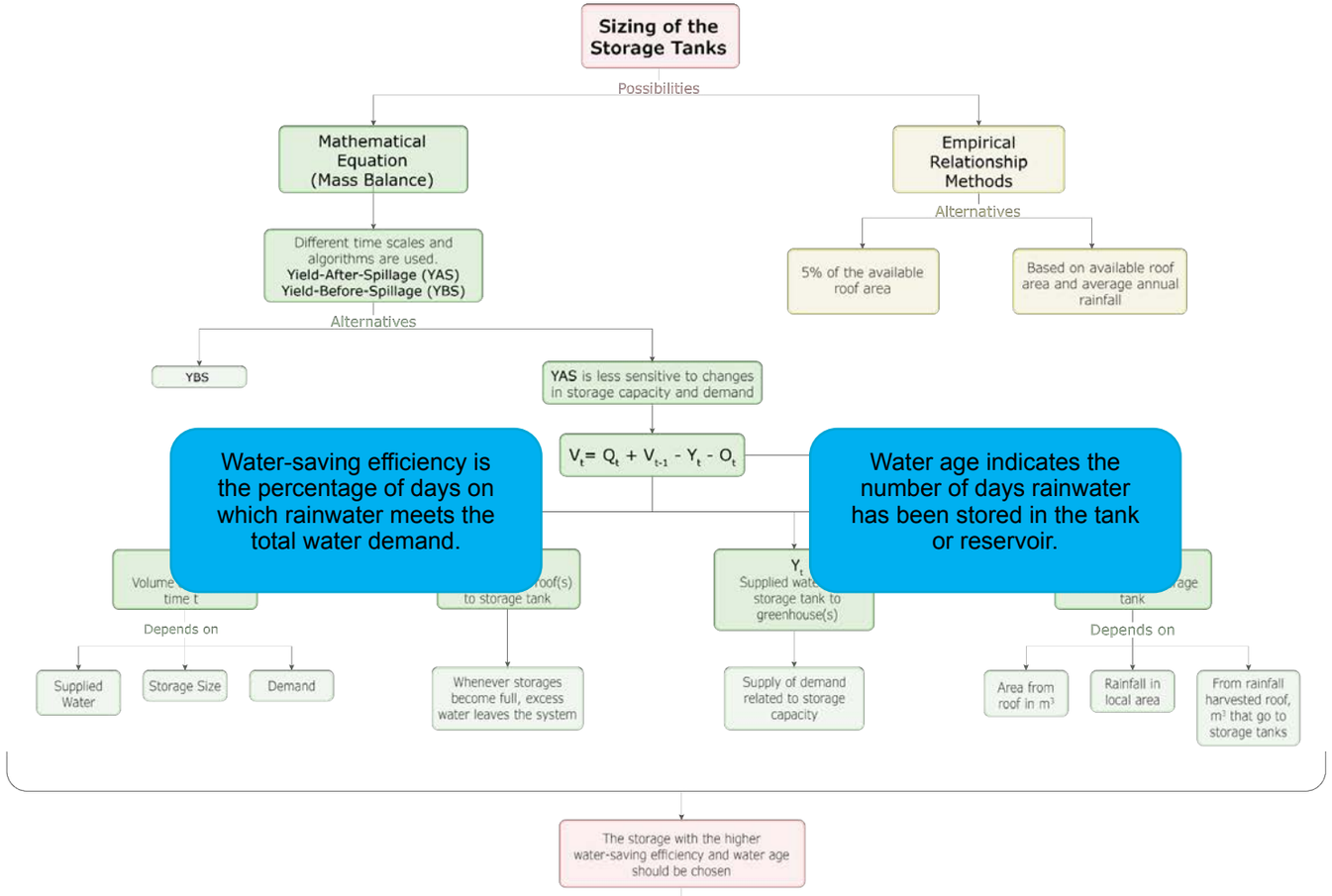
The parameters (chemical, physical, microbial) of the interest were determined

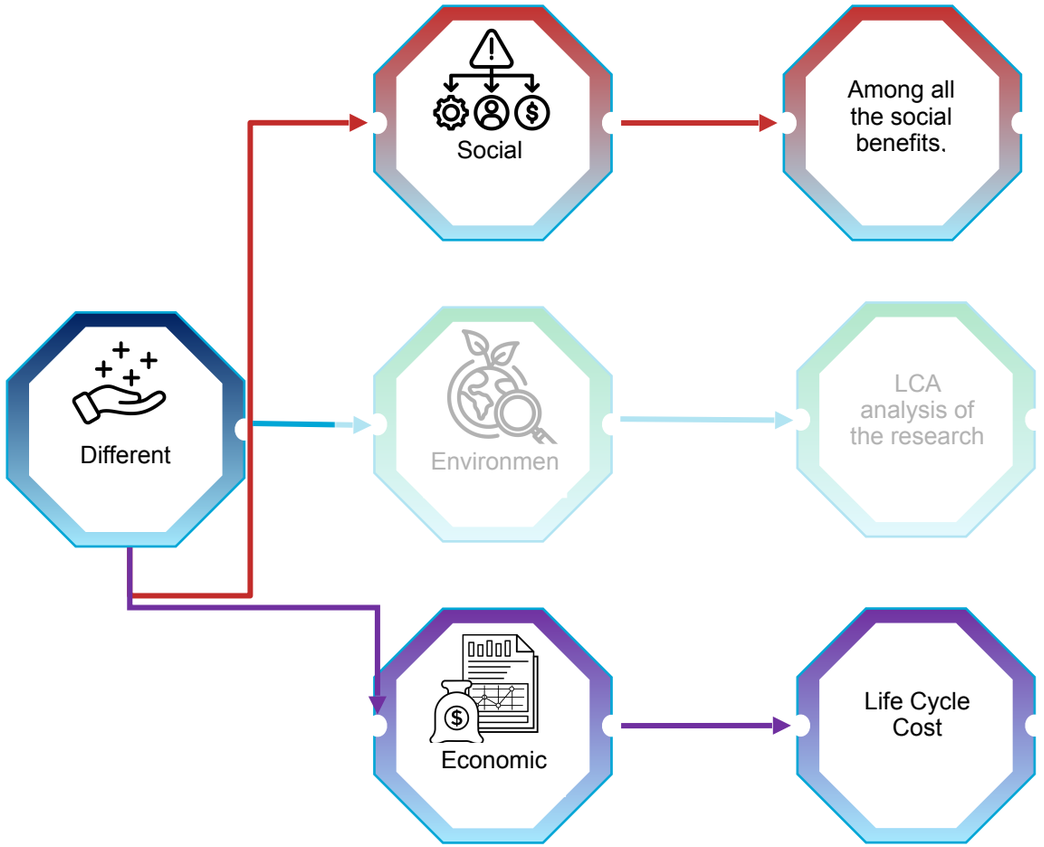
Based on the selected parameters, the potential concentration was determined, followed by an assessment of the risk of infection.

Based on the established limit, the decision was made whether to implement treatment or not.

The Life Cycle Cost Analysis (LCCA) of the treatment is performed, including the LCCA of the storage size.

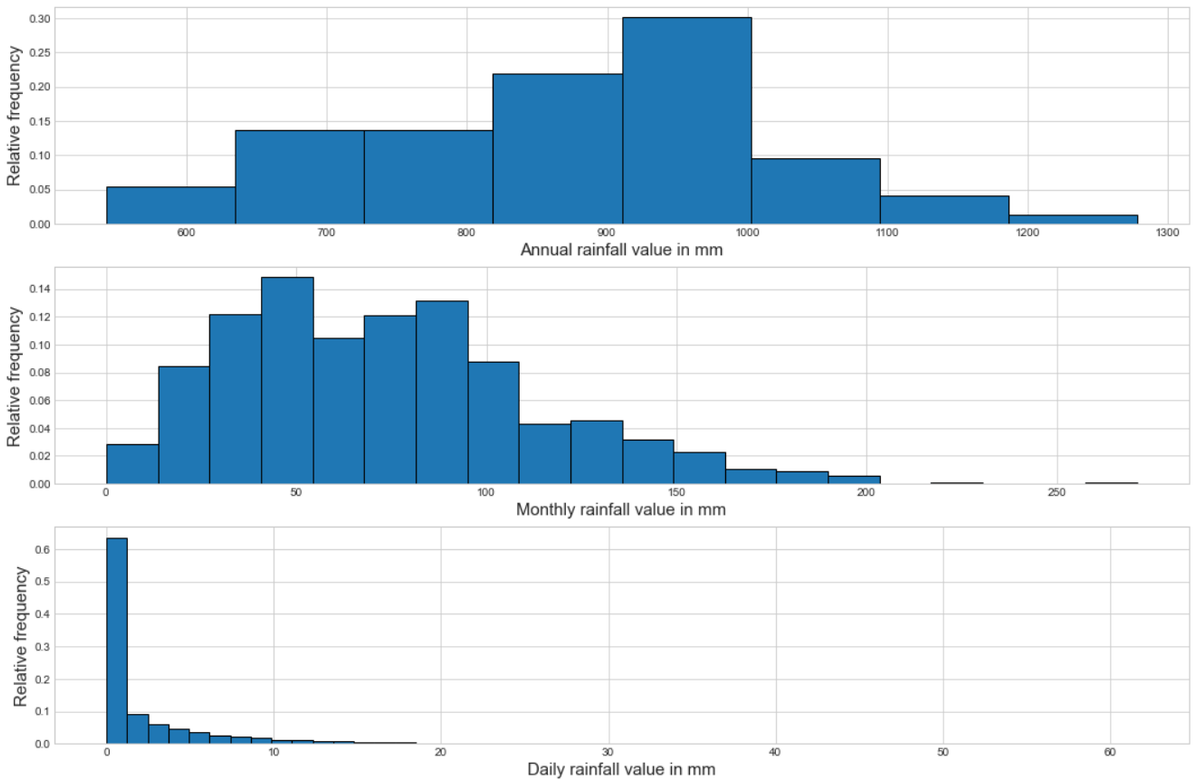
Methodology for designing the tank of the RWH

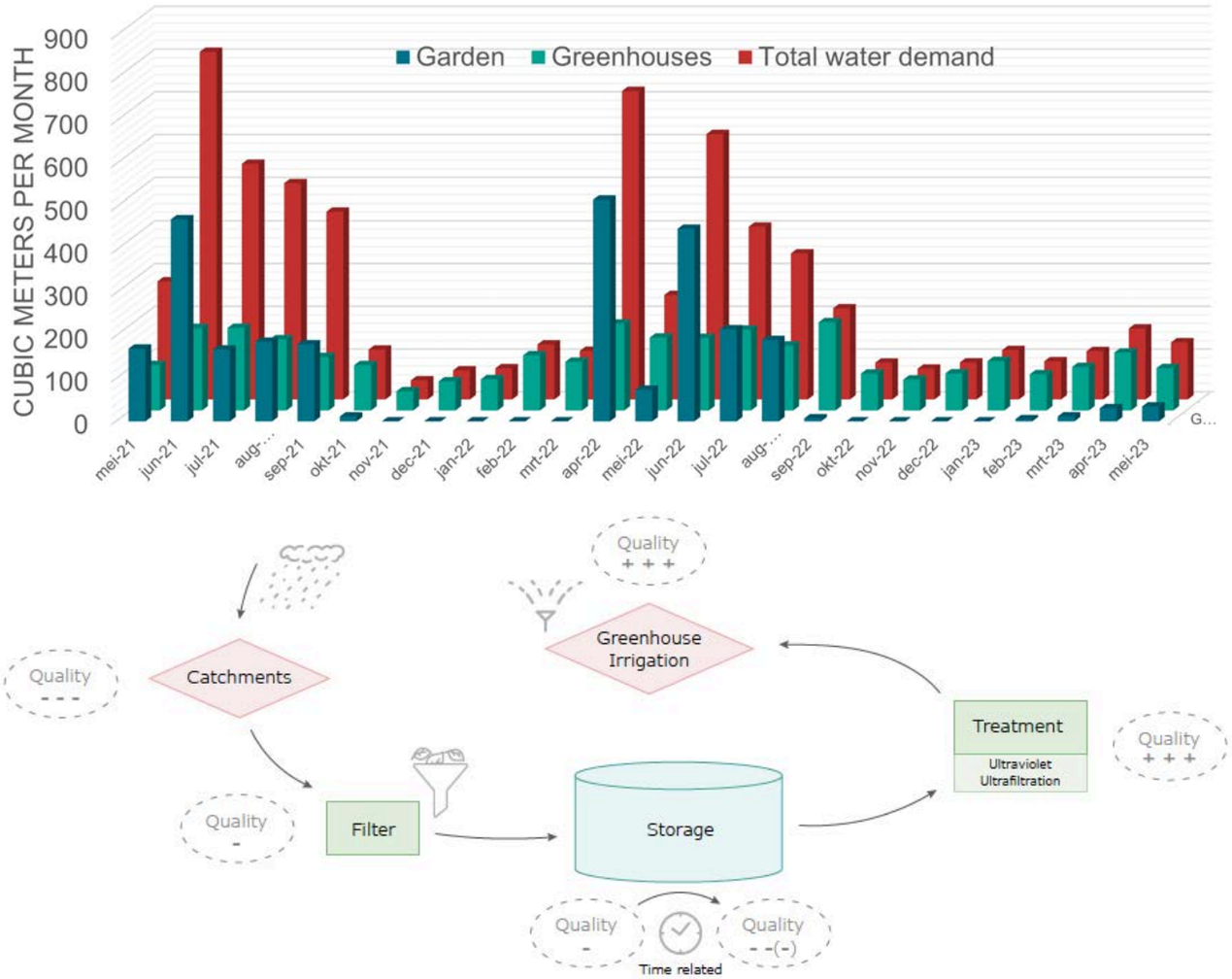




Different benefits can be derived from the RWH system

The rain gauges data showed on average 880 mm annually, 70 mm monthly, and 2.5 mm daily





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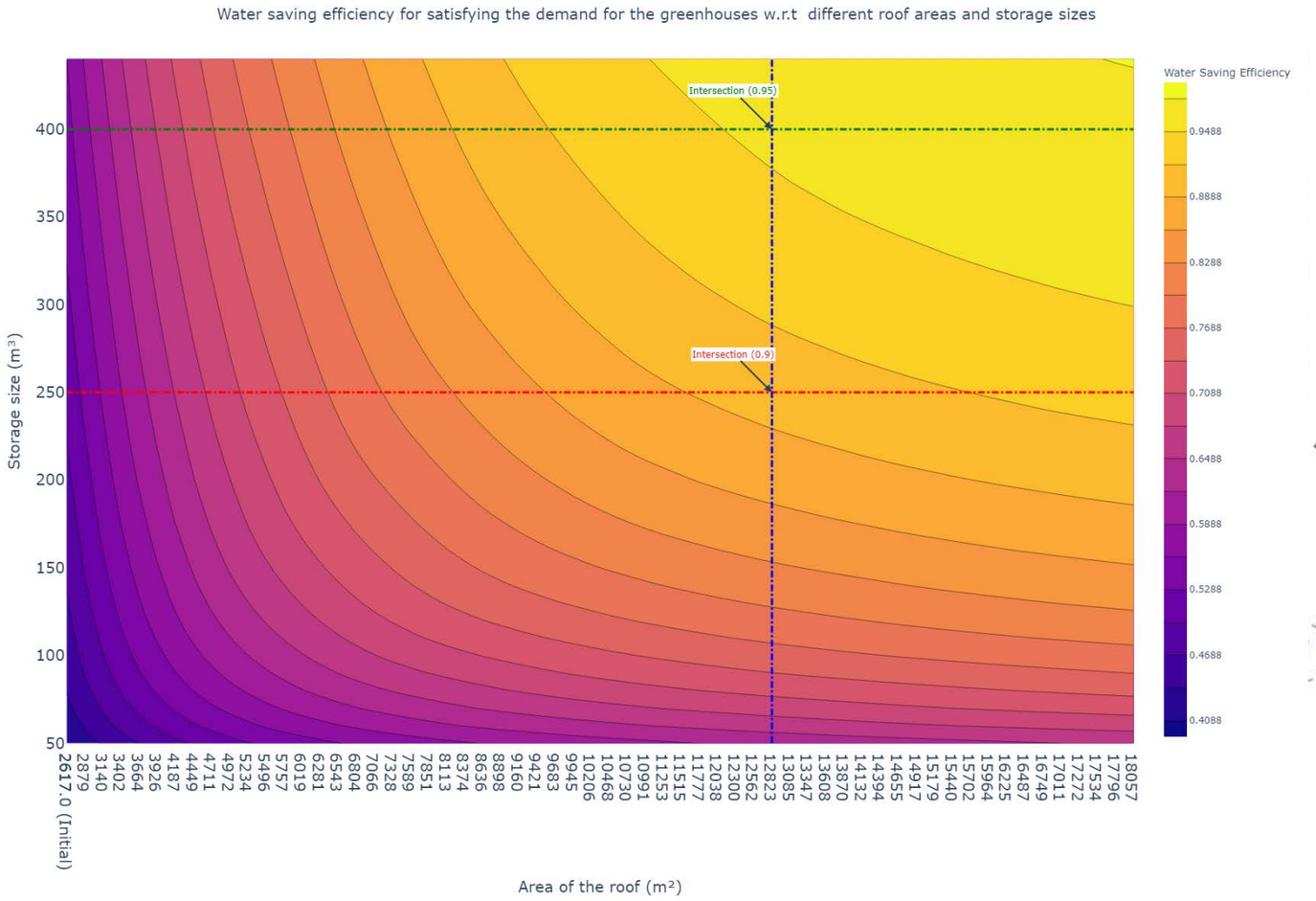

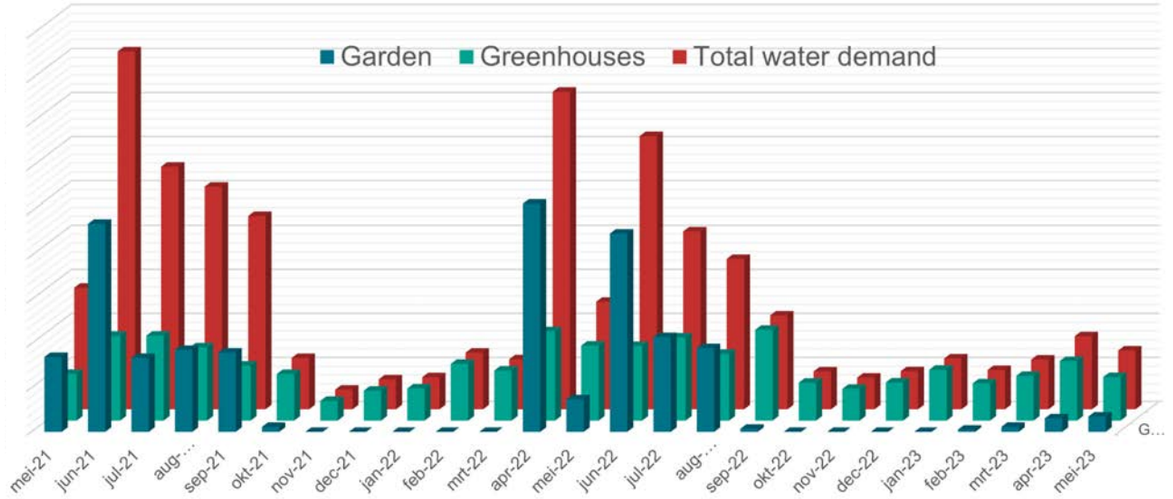

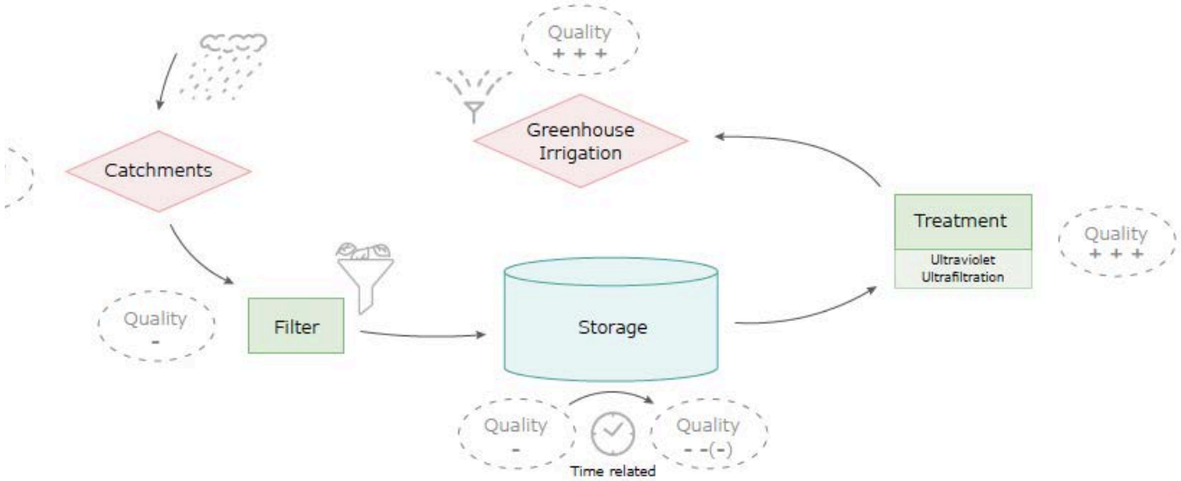

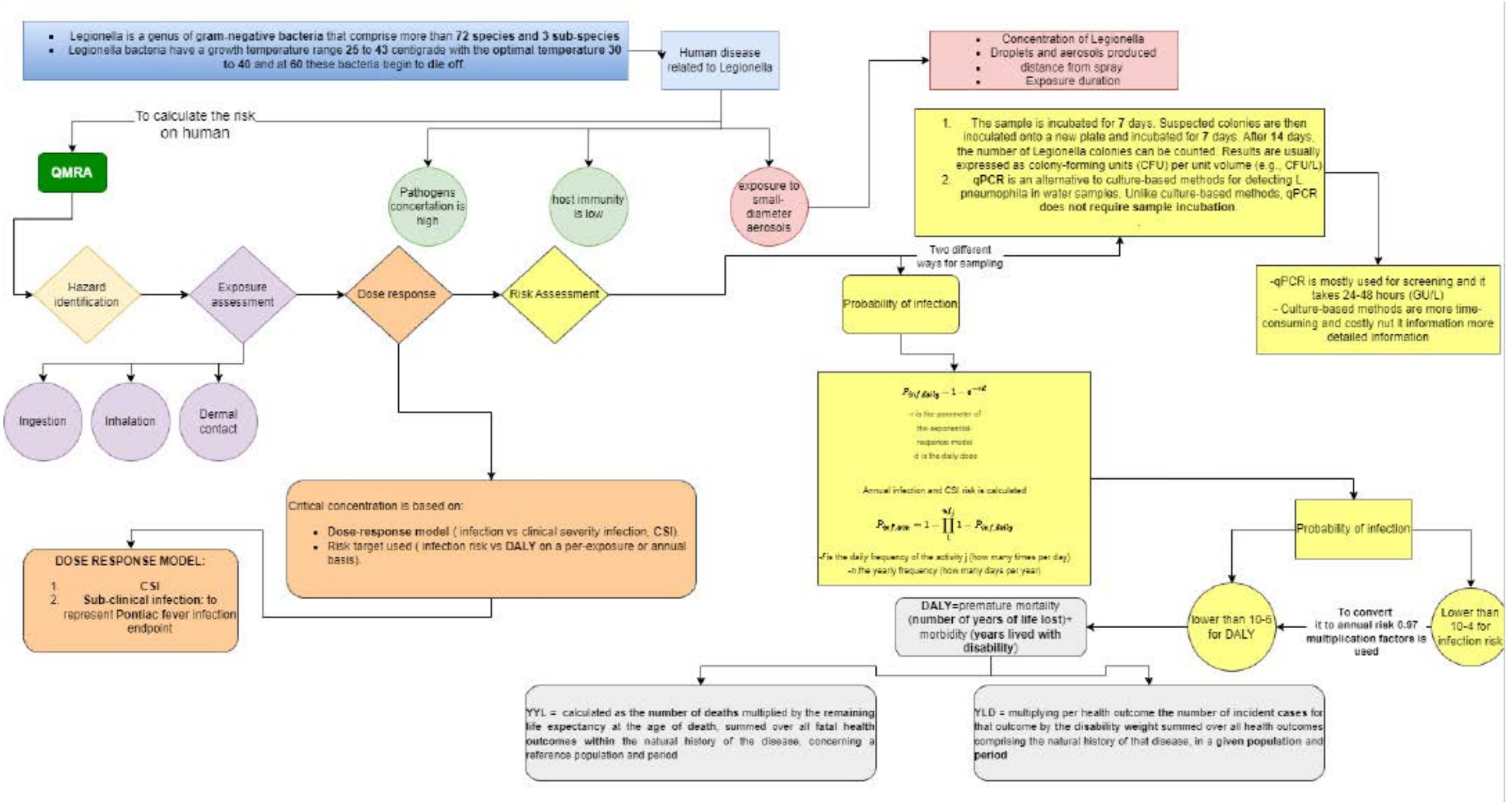
Legionella is a genus of gram-negative bacteria that comprise more than 72 species and 3 sub-species
Legionella bacteria have a growth temperature range 25 to 43 centigrade with the optimal temperature 30 to 40 and at 60 these bacteria begin to die off
Human disease related to Legionella
To calculate the risk on human
QMRA
Pathogens concertation is high
host immunity is low
exposure to small-diameter aerosols
Concentration of Legionella
Droplets and aerosols produced
distance from spray
Exposure duration
1. The sample is incubated for 7 days. Suspected colonies are then inoculated onto a new plate and incubated for 7 days. After 14 days, the number of Legionella colonies can be counted. Results are usually expressed as colony-forming units (CFU) per unit volume (e.g., CFU/L)
2. qPCR is an alternative to culture-based methods for detecting L. pneumophila in water samples. Unlike culture-based methods, qPCR does not require sample incubation
Hazard identification
Exposure assessment
Dose response
Risk Assessment
Two different ways for sampling
-qPCR is mostly used for screening and it takes 24-48 hours (GU/L)
- Culture-based methods are more time-consuming and costly nut it information more detailed information
Probability of infection
Ingestion
Inhalation
Dermal contact
$P_{inf,daily} = 1 - e^{-rd}$
r is the parameter of the exponential-response model
d is the daily dose
Annual infection and CSI risk is calculated
$P_{inf,year} = 1 - \prod_{i}^{n_j} 1 - P_{inf,daily}$
-fix the daily frequency of the activity j (how many times per day)
-n the yearly frequency (how many days per year)
Probability of infection
Critical concentration is based on:
Dose-response model (infection vs clinical severity infection, CSI).
Risk target used (infection risk vs DALY on a per-exposure or annual basis).
DOSE RESPONSE MODEL:
1. CSI
2. Sub-clinical infection: to represent Pontiac fever infection endpoint
DALY=premature mortality (number of years of life lost)+ morbidity (years lived with disability)
lower than 10-6 for DALY
To convert it to annual risk 0.97 multiplication factors is used
Lower than 10-4 for infection risk
YYL = calculated as the number of deaths multiplied by the remaining life expectancy at the age of death, summed over all fatal health outcomes within the natural history of the disease, concerning a reference population and period
YLD = multiplying per health outcome the number of incident cases for that outcome by the disability weight summed over all health outcomes comprising the natural history of that disease, in a given population and period

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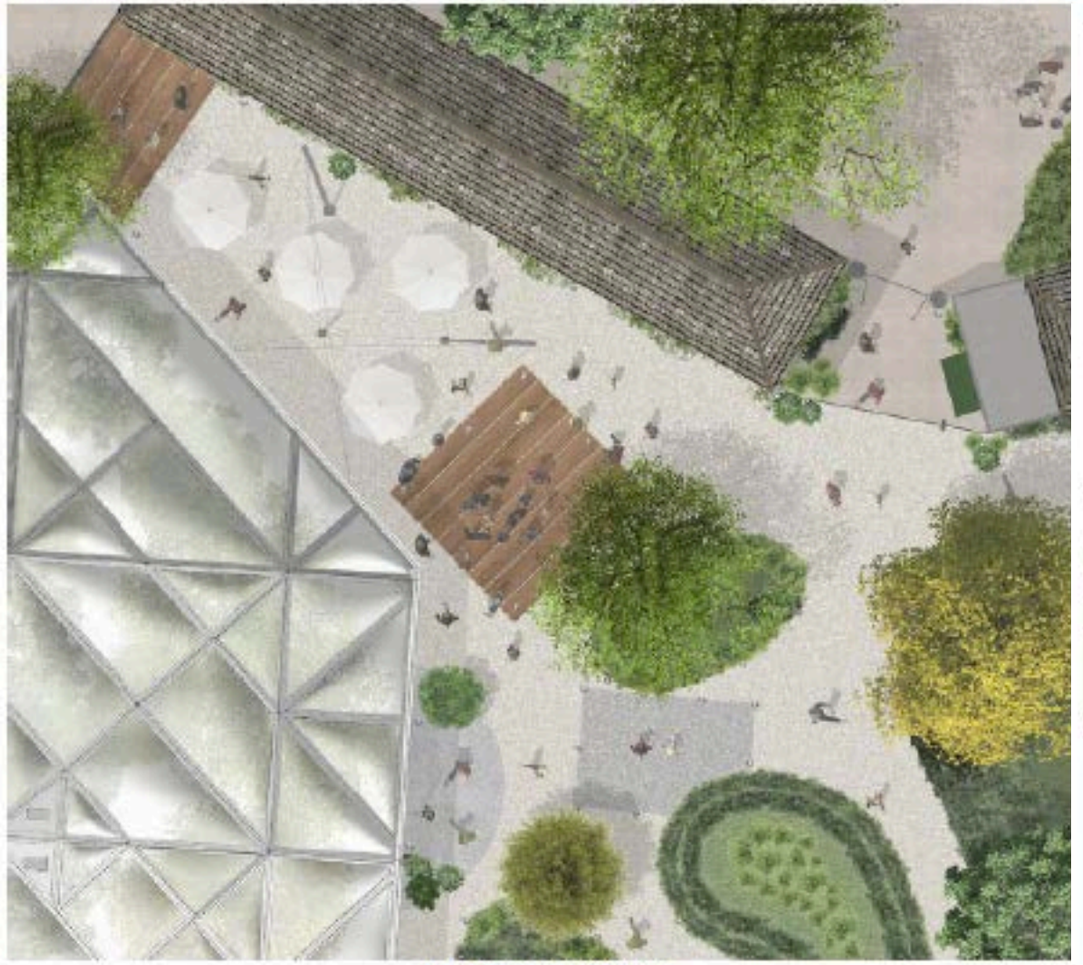
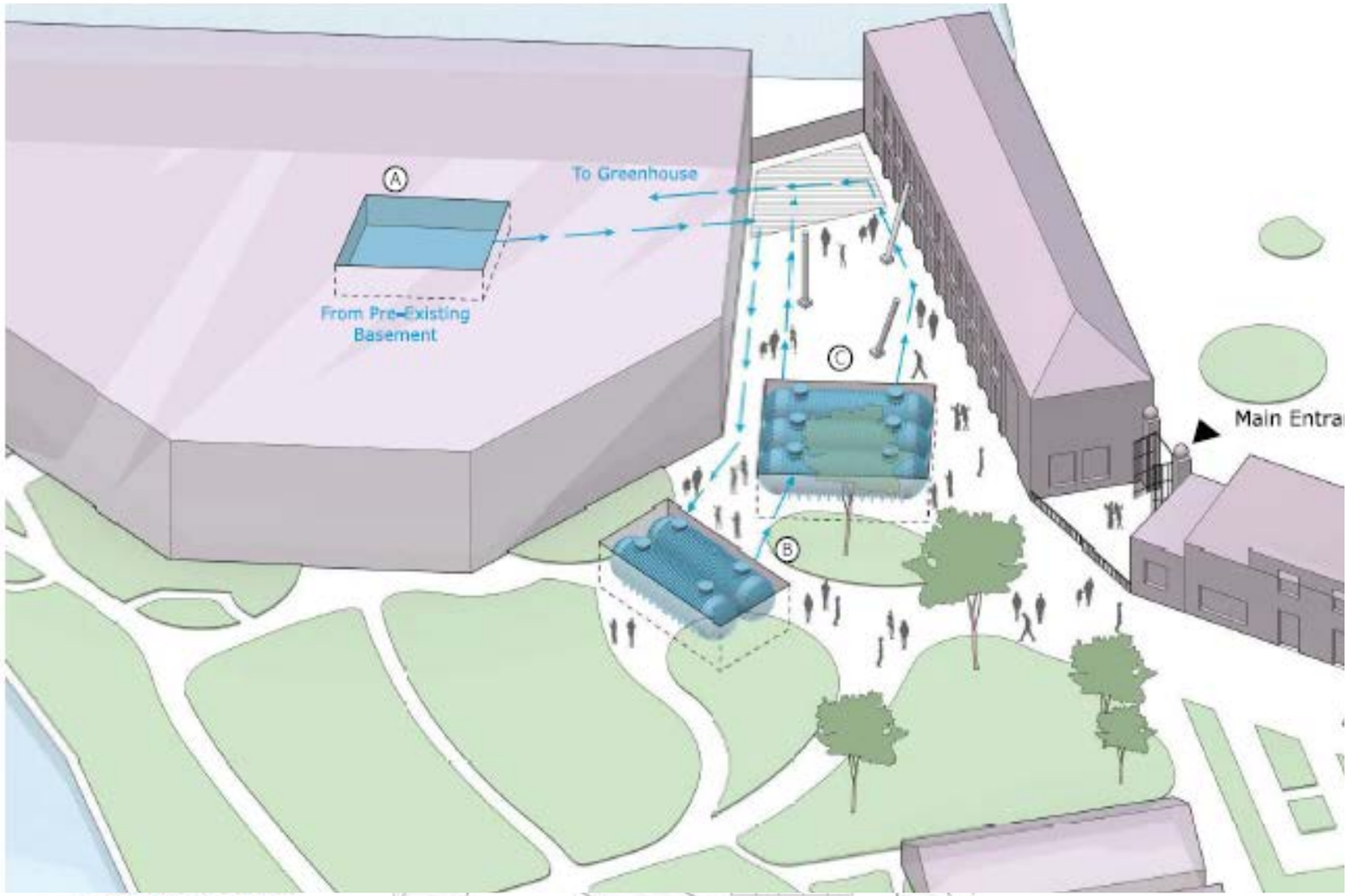


Top Illustrated View

As the large rainwater tanks will be buried underground, they are not visible to visitors of the Hortus. But there, aside educational signs, some subtle hints in the floor are included that are useful and at the same time make the required size of a rainwater harvesting system visible. For now, we propose a wooden deck as part of the terrace of the Hortus' Oranjerie over three of the tanks. Above the other two tanks, a change of paving material or colour may be enough. This can be combined with some lights and information panels that explain the system and indicate, how full or empty the water storage is at the moment.



Technical System Layout Plan

The underground tanks are positioned to not interfere with existing foundations, pipes and cables. There is a height difference between the tanks. In case of heavy rainfalls, the tanks fill up naturally. Only once the water is used, it requires pumping. Clustering several tanks makes it possible to move the water from one tank to the other, and clean or maintain the tanks separately.

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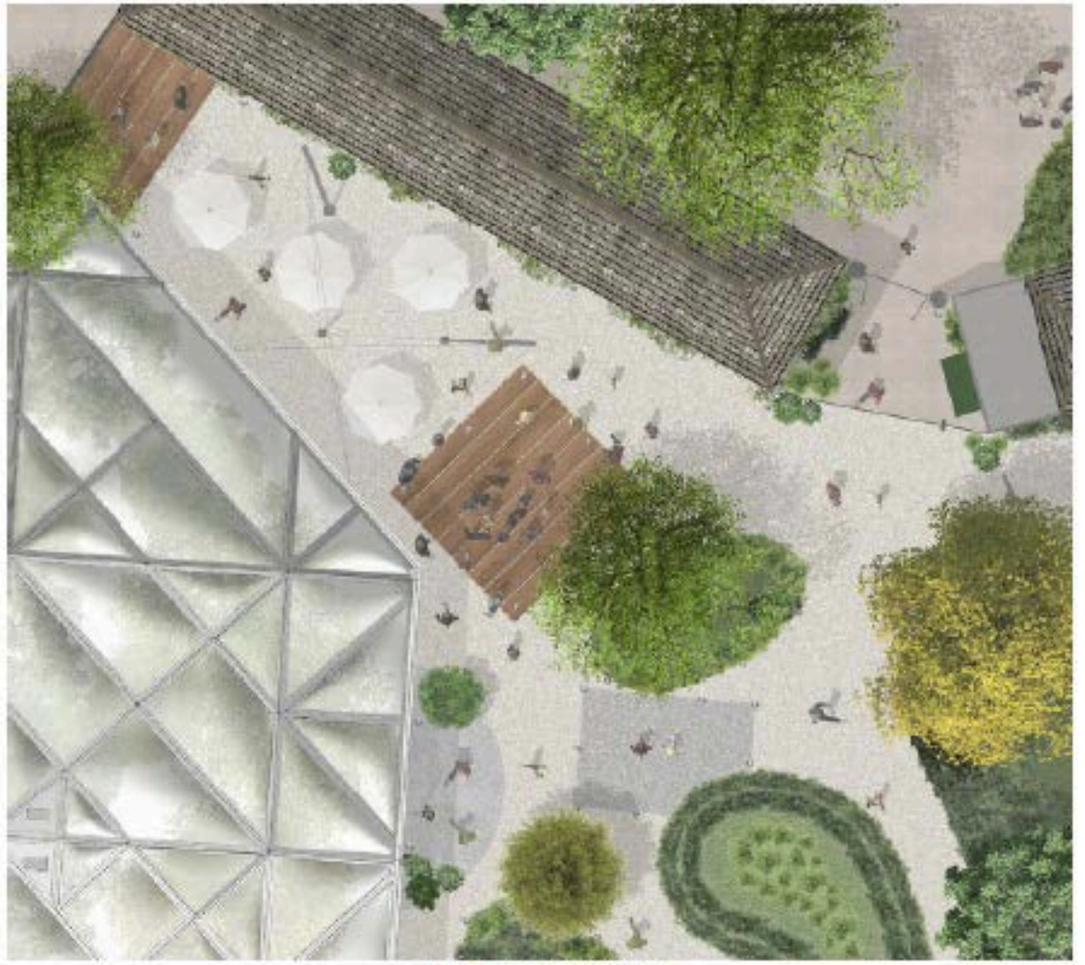

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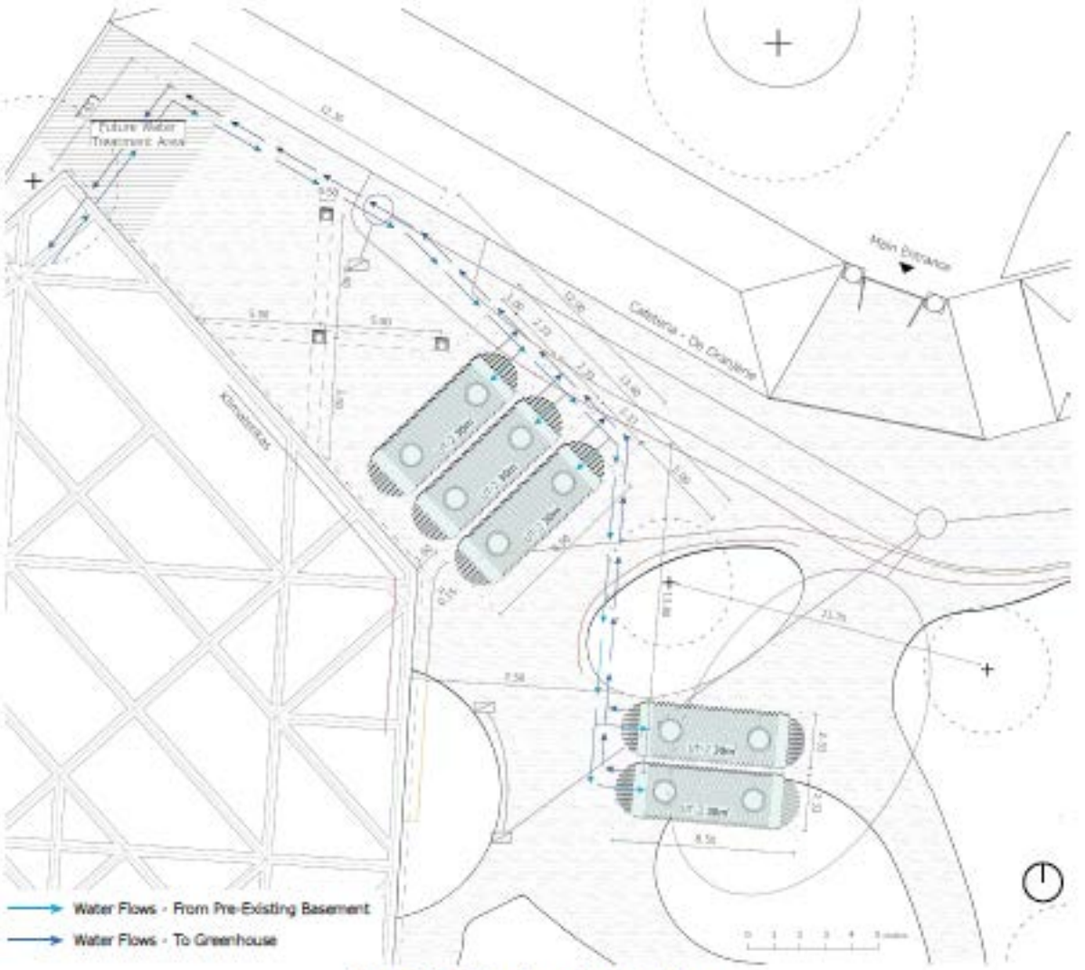

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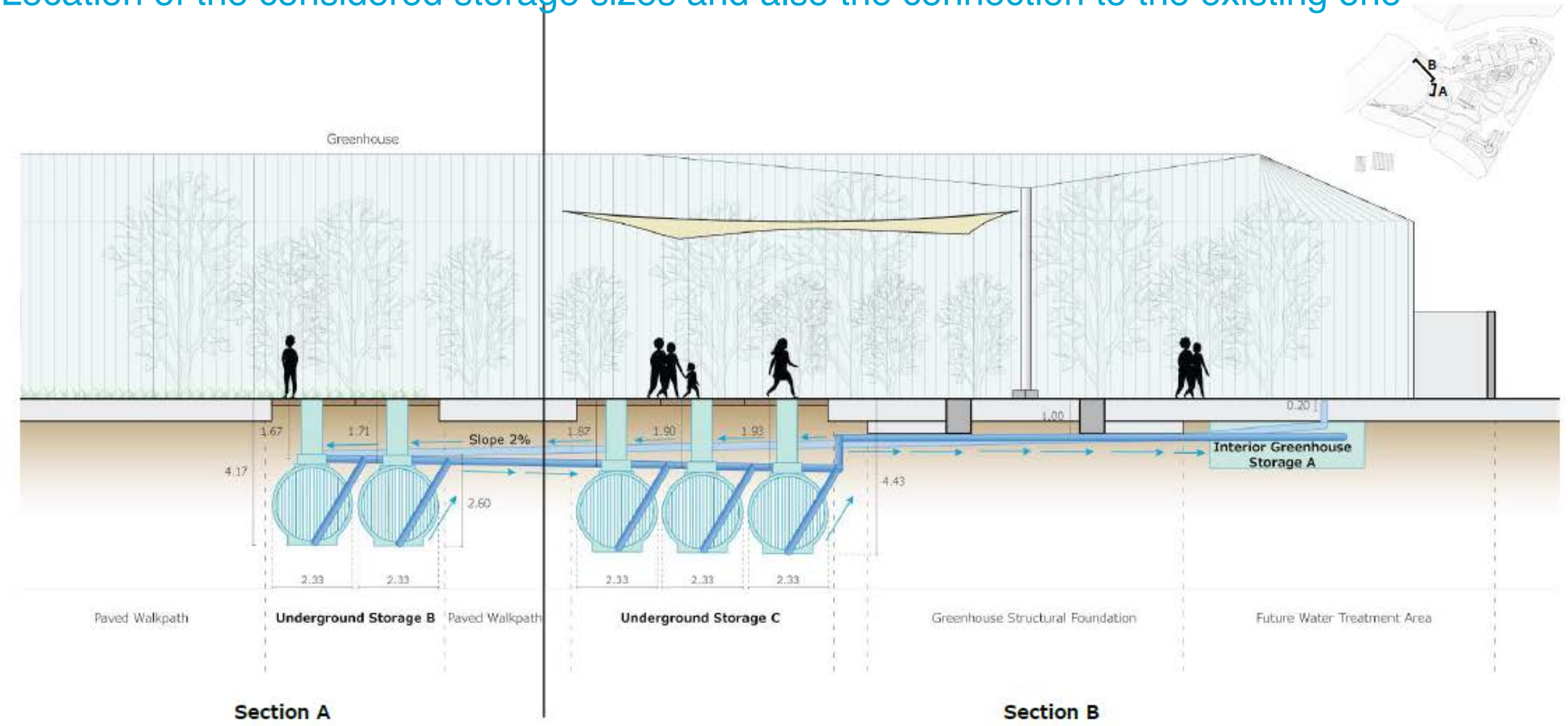
Location of the considered storage sizes and also the connection to the existing one



A possible solution for meeting the outside gardening …

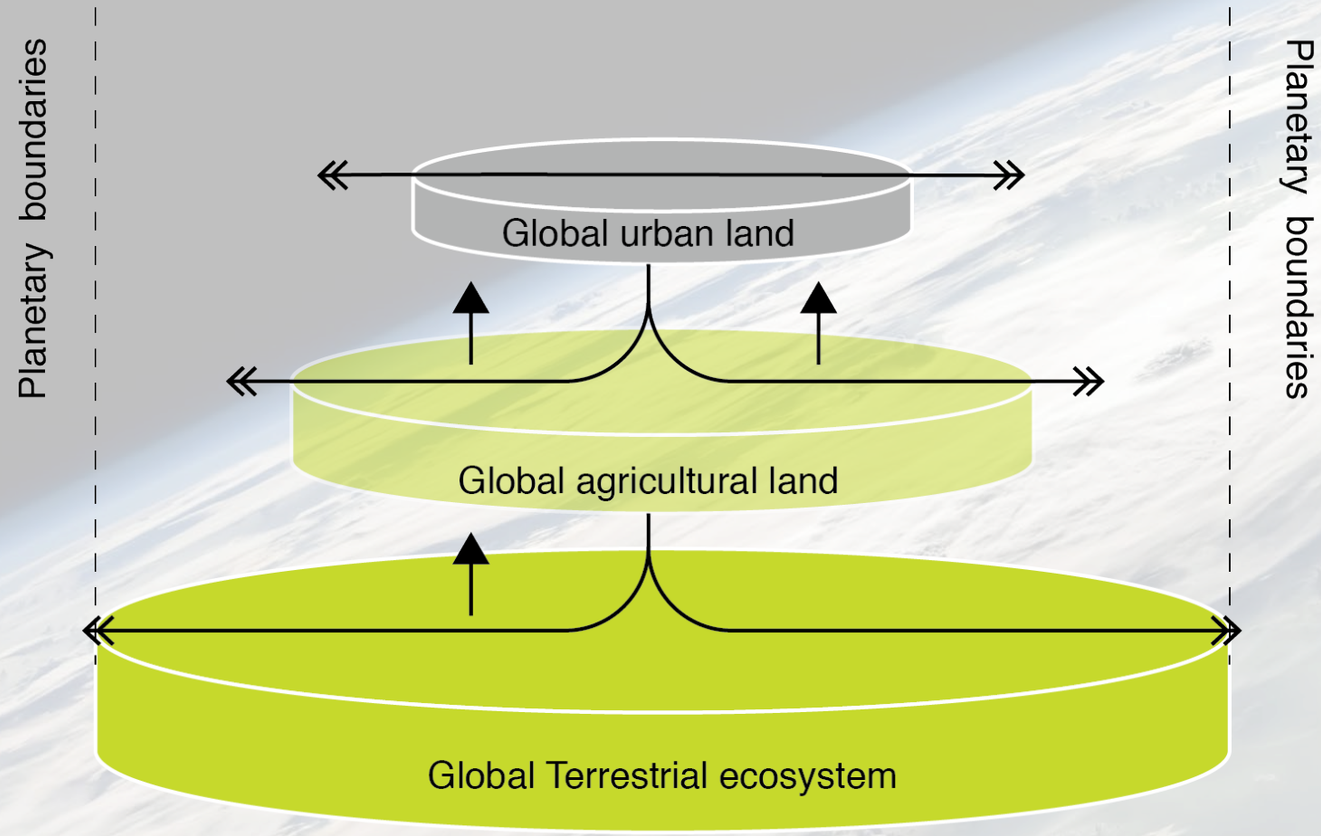
next …

Using ancient storage for meeting the outside gardening demand

ARTIS Zoo

> more different qualities
> 150,000m³ in stead of 5000 m³ !)

Cascading Resources / Land Encroachment



← Land-use expansion pressures, amplifying impacts on the earth systems

↑ Ecosystem services, providing food security

THE ANTHROPOCENE REVIEW

Review

The Anthropocene Review
1–27

DOI: 10.1177/2053019619856672
journals.sagepub.com/home/anr
SAGE

Global urbanization and food production in direct competition for land: Leverage places to mitigate impacts on SDG2 and on the Earth System

Stephan Barthel,[1,2] Christian Isendahl,[3] Benjamin N Vis,[4] Axel Drescher,[5] Daniel L Evans[6] and Arjan van Timmeren[7]

Abstract

Global urbanization and food production are in direct competition for land. This paper carries out a critical review of how displacing crop production from urban and peri-urban land to other areas – because of issues related to soil quality – will demand a substantially larger proportion of the Earth's terrestrial land surface than the surface area lost to urban encroachment. Such relationships may trigger further distancing effects and unfair social-ecological teleconnections. It risks also setting in motion amplifying effects within the Earth System. In combination, such multiple stressors set the scene for food riots in cities of the Global South. Our review identifies viable leverage points on which to act in order to navigate urban expansion away from fertile croplands. We first elaborate on the political complexities in declaring urban and peri-urban lands with fertile soils as one global commons. We find that the combination of an advisory global policy aligned with regional policies enabling robust common properties rights for bottom-up actors and movements in urban and peri-urban agriculture (UPA) as multi-level leverage places to intervene. To substantiate the ability of aligning global advisory policy with regional planning, we review both past and contemporary examples where empowering local social-ecological UPA practices and circular economies have had a stimulating effect on urban resilience and helped preserve, restore, and maintain urban lands with healthy soils.

Keywords

cropland, economic globalization, food security, Global South, global sustainability, human resilience, social-ecological teleconnection, soil health, urban and peri-urban agriculture, urbanization

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Email: stephan.barthel@hig.se

S.Barthel, C.Isendahl, B.N.Vis, A.Drescher, D.L.Evans, A.van Timmeren (2019)

Cascading Resources / Land Encroachment

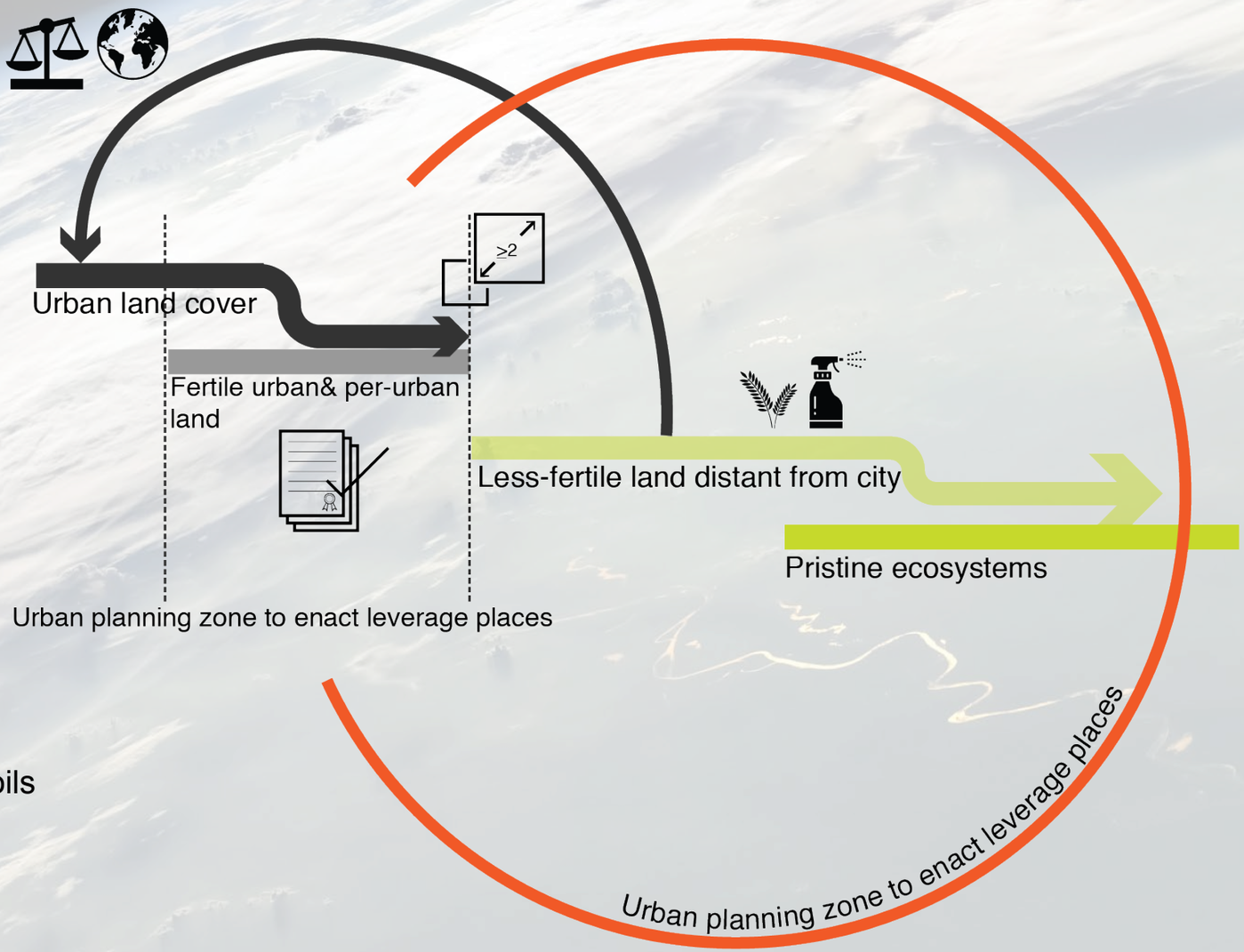
Financialization and distantiation characterize the global resource market

Unequal power relations dominate trade conditions

Weak planning regulations govern urban expansion

Agricultural intensification strategies and monoculture attempt to compensate loss of proximate fertile soils

Compensating the loss of fertile urban and per-urban soils requires twice the land elsewhere



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Cascading Resources / Land Encroachment

Financialization and distantiation characterize the global food market

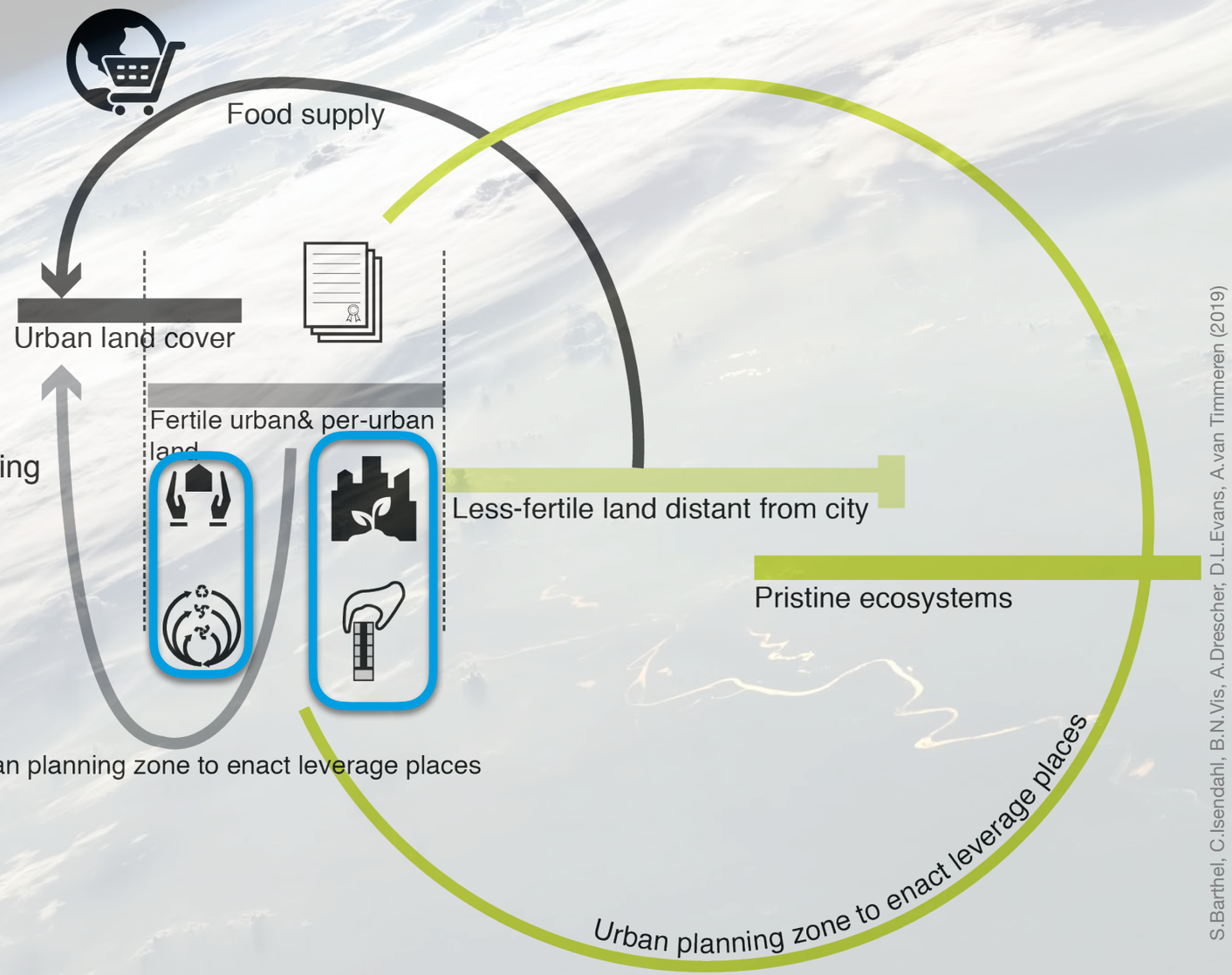
Global advisory policy becomes aligned with regional planning

Land suitable for farming is protected and preserved

Food produced in urban and peri-urban zones.

Robust common property rights to movements in UPA

Circular economy principle operate locally



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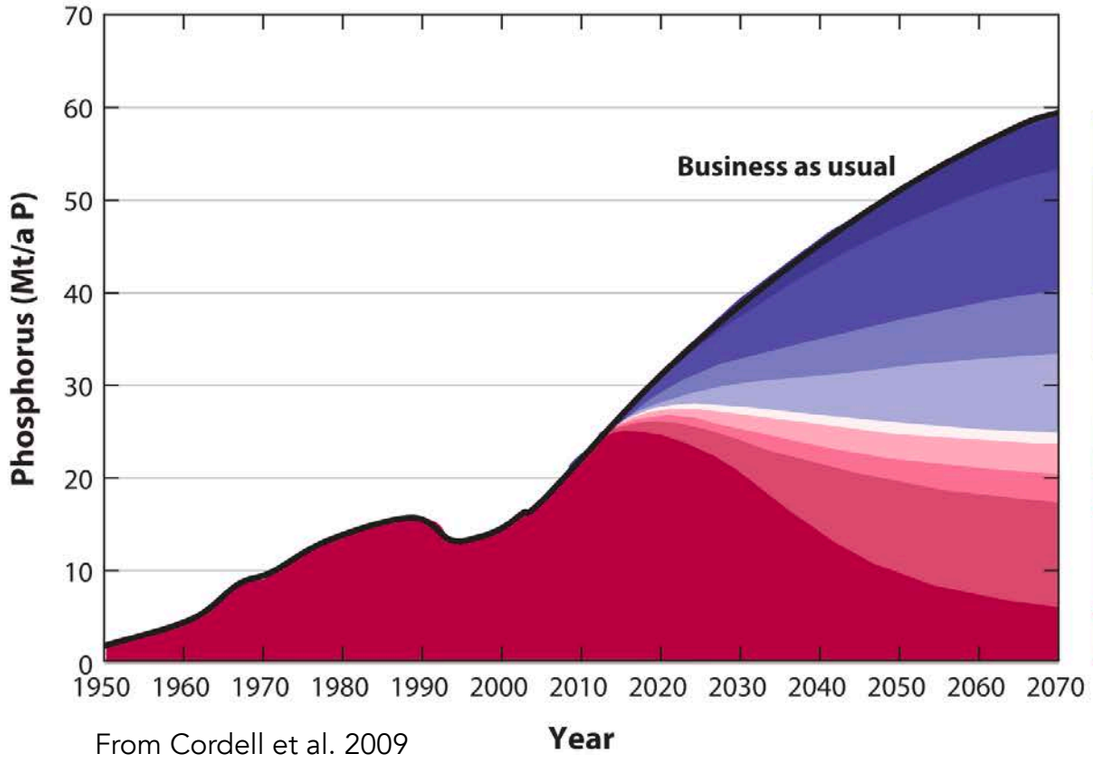
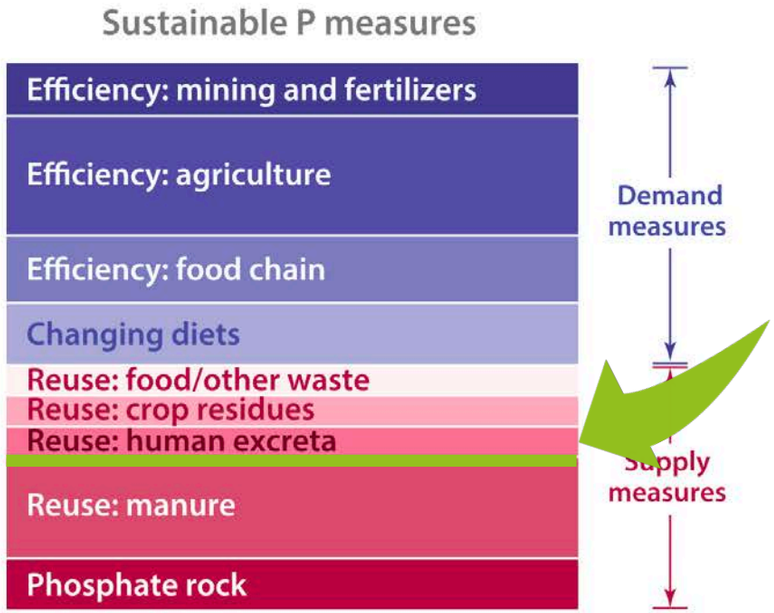
TUDelft prof.dr.ir. Arjan van Timmeren • TUDelft• Faculty of Architecture • Environmental Technology & Design // Extension School // AMS institute Amsterdam // Resilient Delta Initiative Rotterdam

- The need for **Phosphorus recovery** – switching to a **CIRCULAR** nutrient economy:



From Cordell et al. 2009

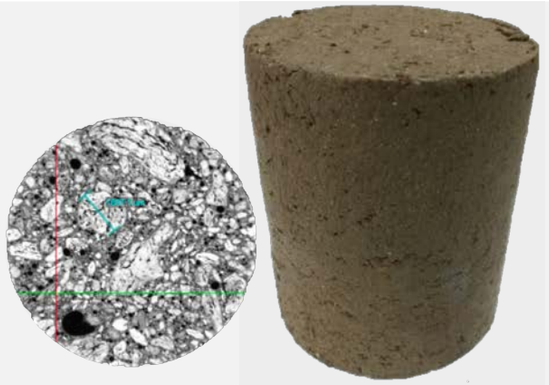


This project has received funding from the European Union's Horizon 2020 research and innovation Programme under grant agreement N° 776751

Pilot demonstration of extraction of phosphorus from municipal waste

- The **Phosphorus recovery demo** in the context of **CINDERELA** :

Sewage sludge from municipal wastewater treatment is one of the most voluminous and costly waste streams in urban areas



Sewage sludge-based composites are promising Secondary Raw Materials

But we want to **recover v**aluable phosphorus before it ends up "wasted" in the sludge

15 P Phosphorus 30.974

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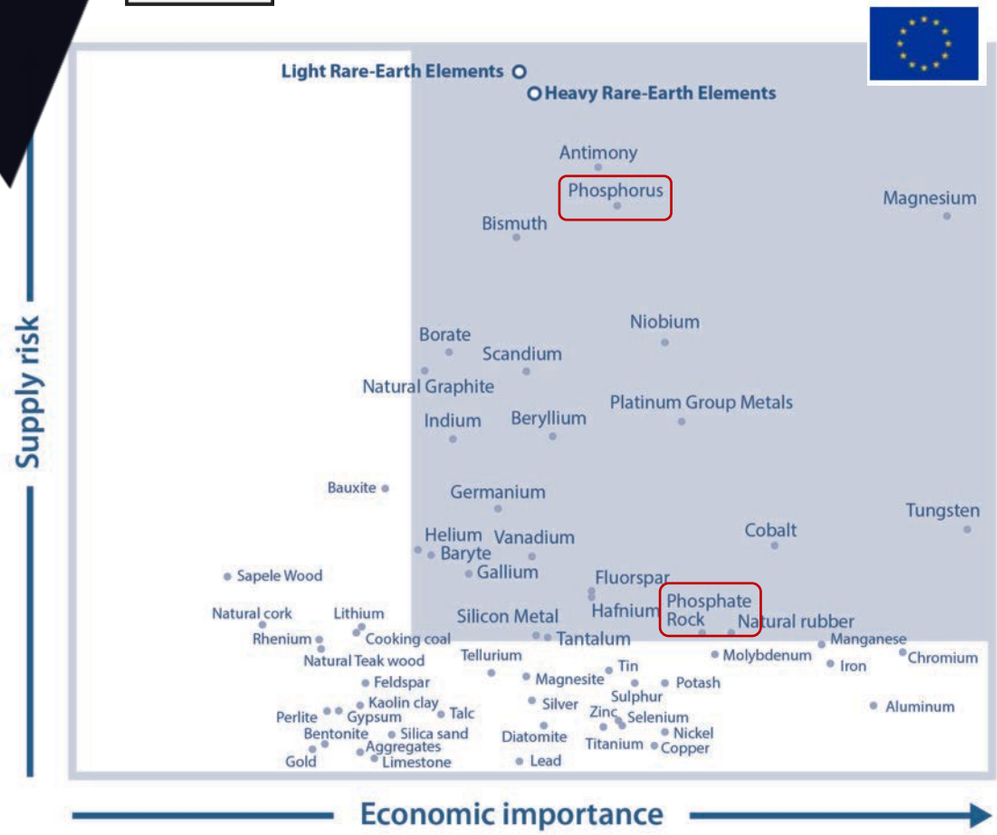
What does the construction sector and multiscalarity have to do with P?

Sewage sludge = **SRM** Secondary Raw Material

15 **P** Phosphorus 30.974 = **CRM** Critical Raw Material



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Pilot demonstration of extraction of phosphorus from municipal waste

- The need for **Phosphorus recovery** – switching to a **CIRCULAR** nutrient economy:

Phosphate rock is a **finite resource** and its mining and transport is energy intensive

Phosphorus ending up "wasted" in ecosystems has **severe ecological consequences**

Scarcity → Linear economy → Pollution

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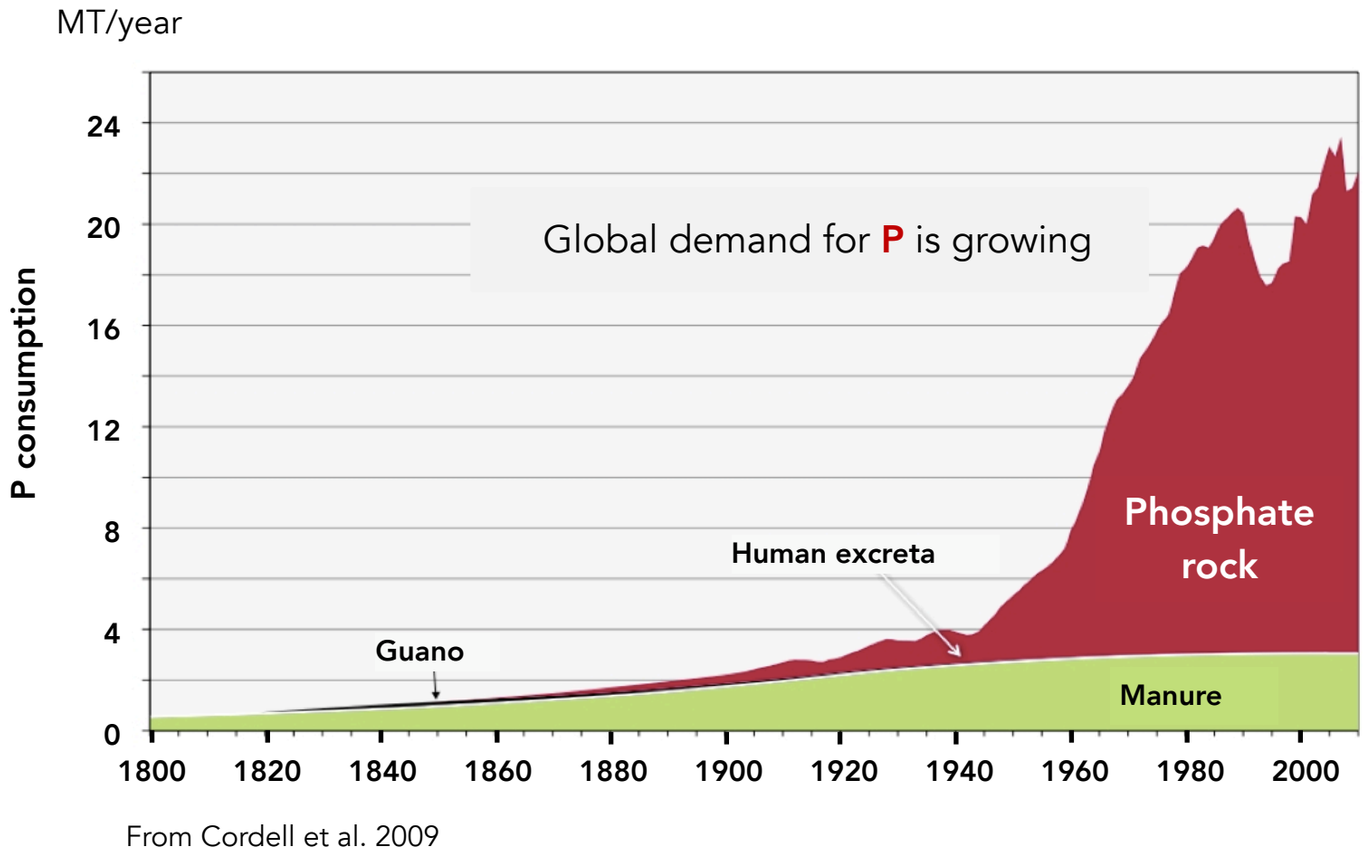
- The need for **Phosphorus recovery** – switching to a **CIRCULAR** nutrient economy:



From Cordell et al. 2009

primarily (ca. 90%) for fertilizer

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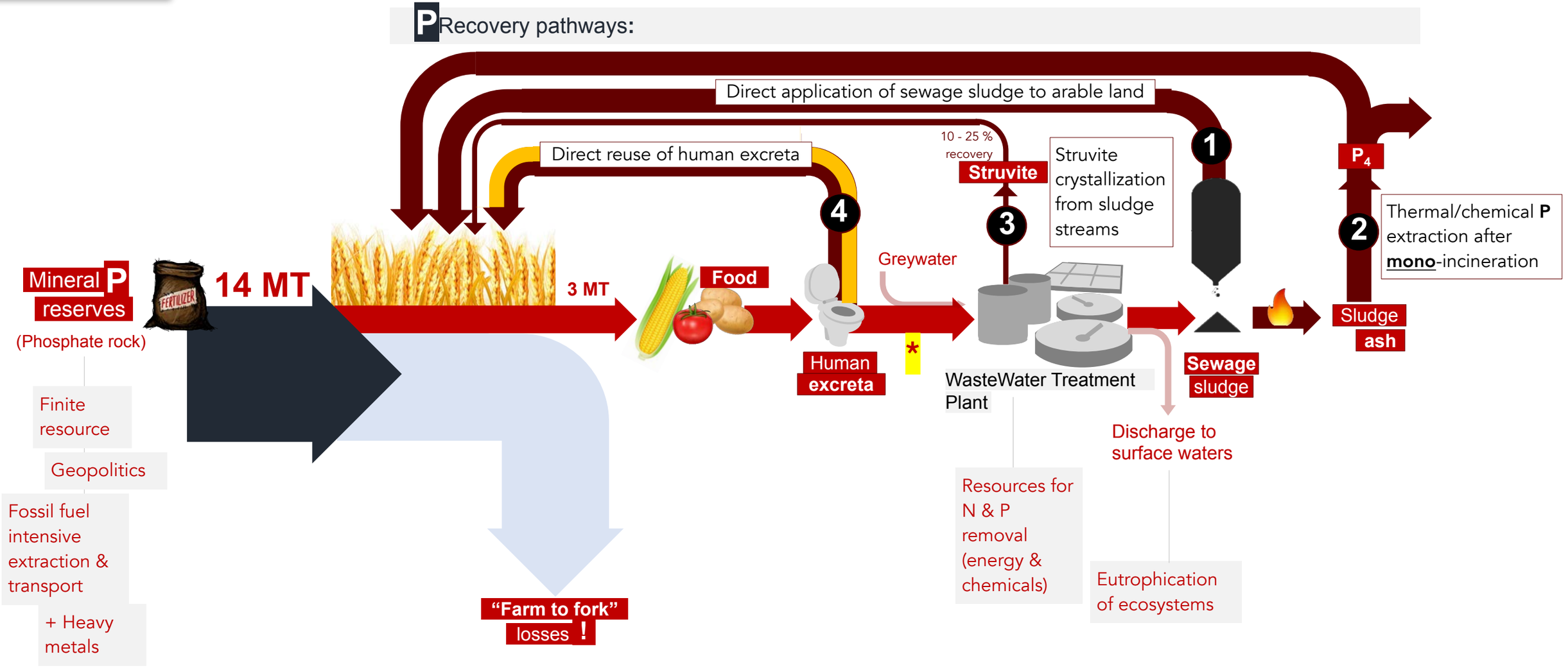
Pilot demonstration of extraction of phosphorus from municipal waste ; P -Recovery Pathways :



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Pilot demonstration of extraction of phosphorus from municipal waste ; existing projects (A'dam)

- Hotspots for **Phosphorus recovery** in the wastewater treatment chain: **case studies** in Amsterdam

	1 Household/Neighborhood	2 Municipal Wastewater Treatment Plant	3 Sludge incineration facilities
Waste stream	Urine * * Blackwater *	Sludge digestate Sludge liquor * WAS thickening liquor	Sewage sludge ash
Recovery Process	Fluidized bed, or continuously stirred reactor w/ addition of Mg * *	Aerated reactors w/ addition of Mg * Other	Diverse thermal and chemical processes
Product	Struvite * *	Most common: Struvite * Also: Calcium Phosphates	H_3PO_4 Calcium phosphates MAP

* DE CEUVEL
* BUIKSLOTERHAM
* FOSVAATJE

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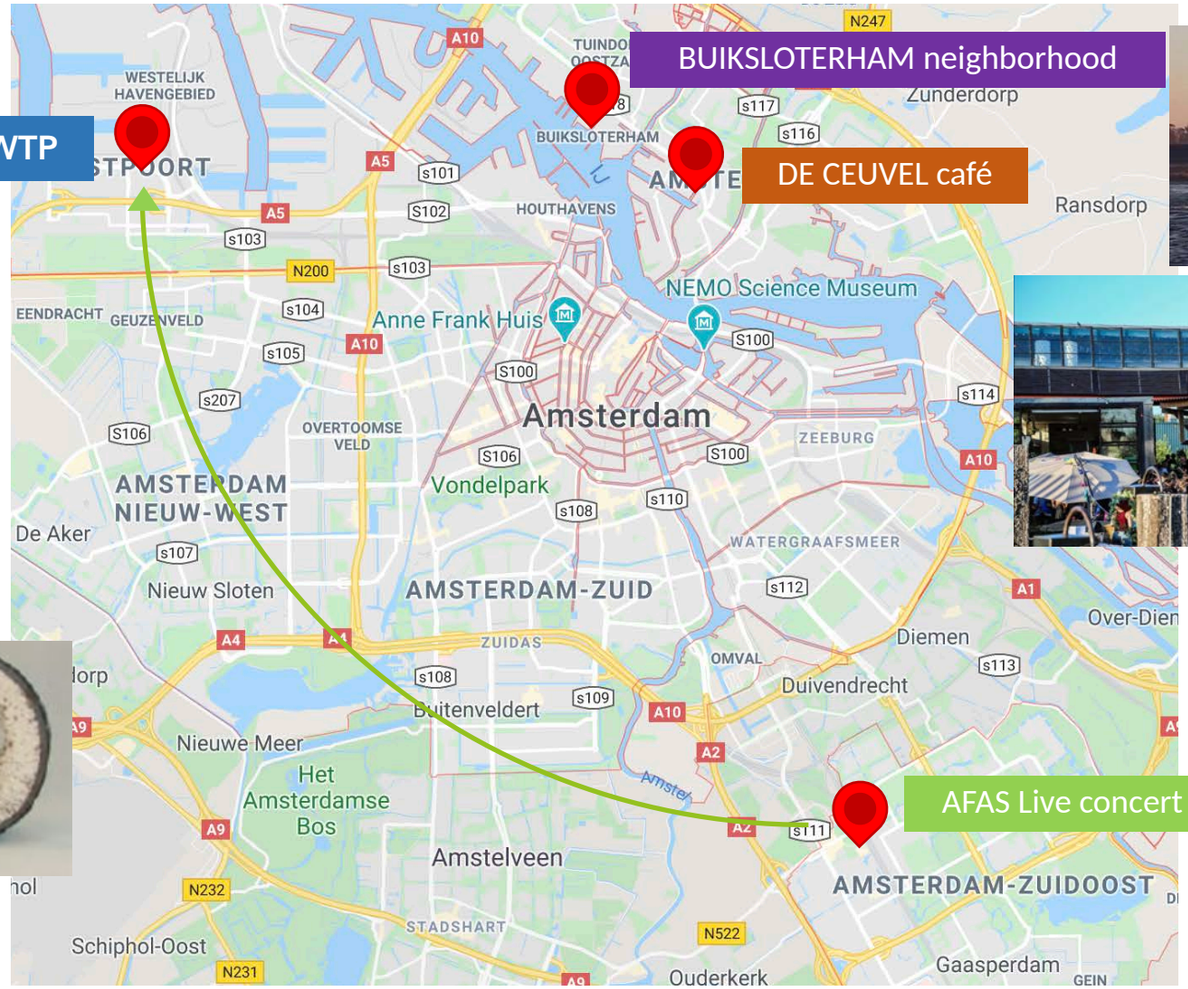
Pilot demonstration of extraction of phosphorus from municipal waste ; existing projects (A'dam)

- Hotspots for **Phosphorus recovery** in the wastewater treatment chain: **case studies** in Amsterdam

Amsterdam – West WWTP



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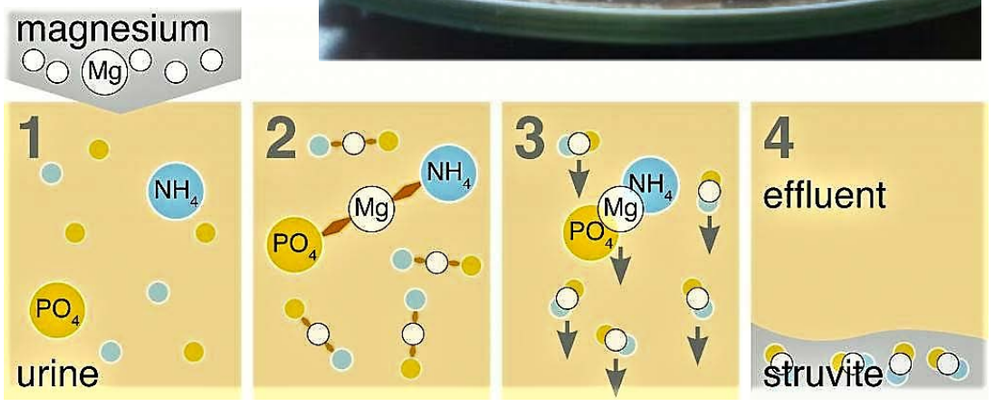
Pilot demonstration of extraction of phosphorus from municipal waste ; conventional ways…?

Struvite precipitation

vs.

Complete nutrient recovery



- **Nitrogen** & **micronutrients** are recovered along with P
- Full waste stream is treated
- **Distilled water** as a byproduct
- Product is **free of pathogens & pharmaceuticals**
- Liquid fertilizer can be used for **hydroponics** in urban environment

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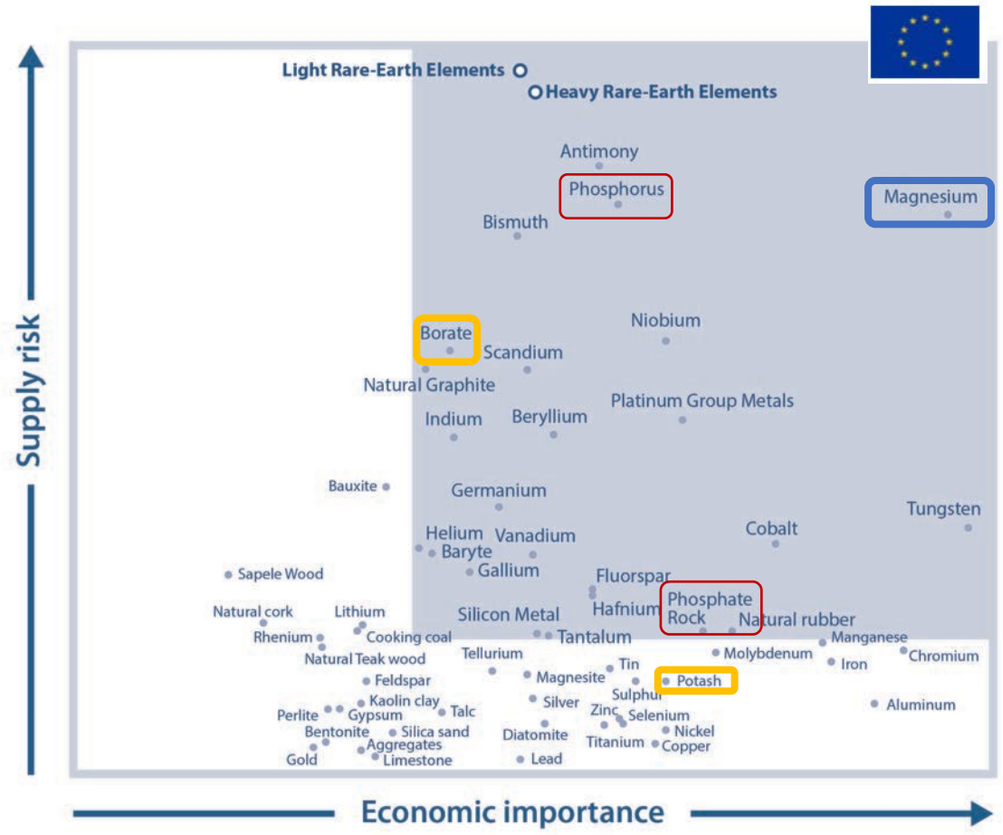
Pilot demonstration of extraction of phosphorus from municipal waste ; Complete Nutr. recovery

CRM
Critical Raw Materials



Complete nutrient recovery

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prof.dr.ir. Arjan van Timmeren • TUDelft• Faculty of Architecture • Environmental Technology & Design // Extension School // AMS institute Amsterdam // Resilient Delta Initiative Rotterdam

Pilot demonstration of extraction of phosphorus from municipal waste … gender bias ?

1. Location
2. Urine collection

Previous initiatives:

Alternatives considered:

"No mix" toilets

Vacuum toilets

Approach chosen:

New prototype

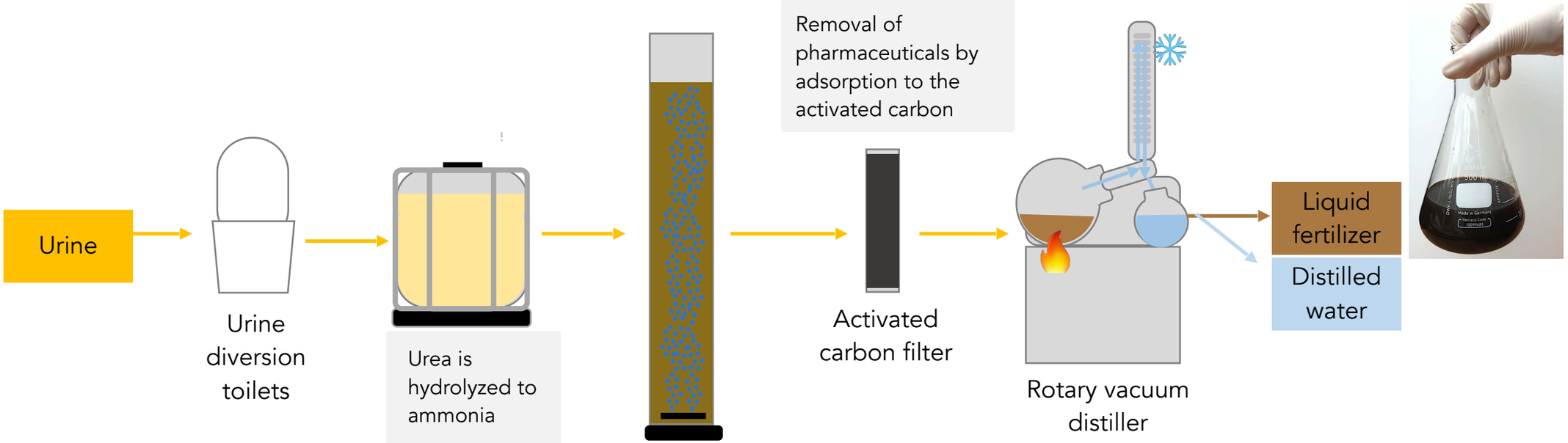
LAUFEN

This project has received funding from the European Union's Horizon 2020 research and innovation Programme under grant agreement N° 776751

The Phosphorus (& other nutrients) recovery demo

Complete nutrient recovery

COLLECTION | STORAGE | STABILIZATION | PURIFICATION | CONCENTRATION



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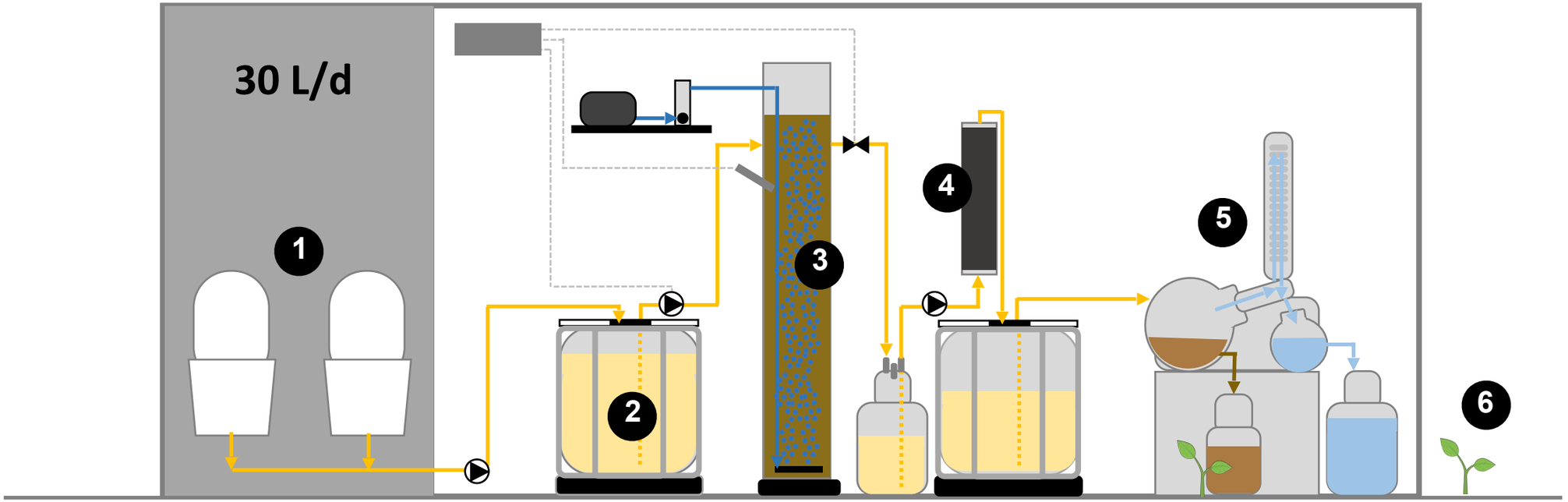
The Phosphorus (& other nutrients) recovery demo



1 Urine separation toilets
2 Urine storage
3 Nitrification Bioreactor
4 Activated Carbon Filter
5 Distillation
6 Fertilizer use

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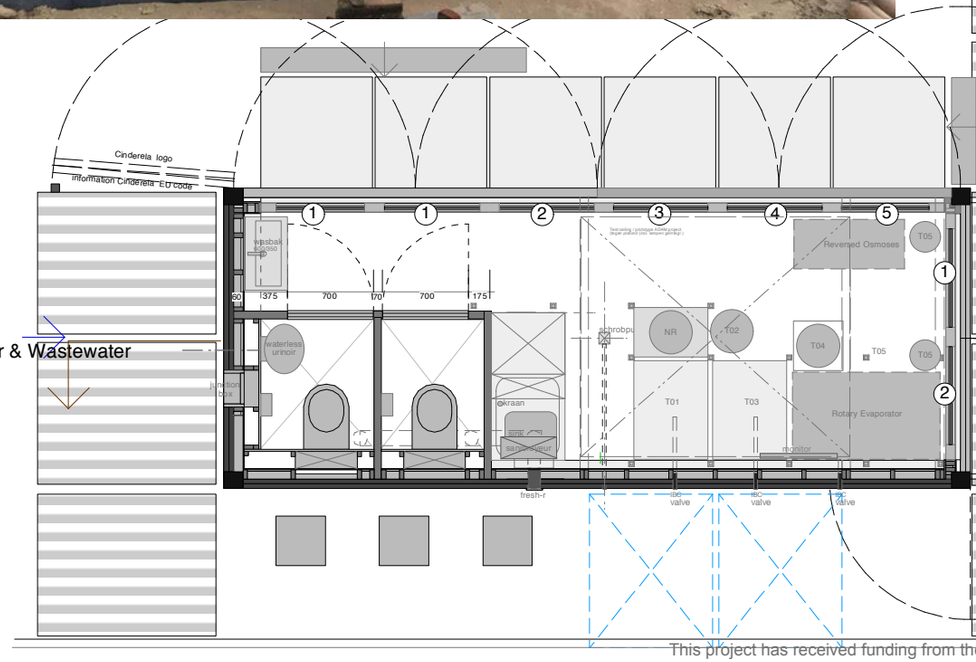

er & Wastewater

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Pilot demonstration of extraction of phosphorus from municipal waste ; on location Amsterdam

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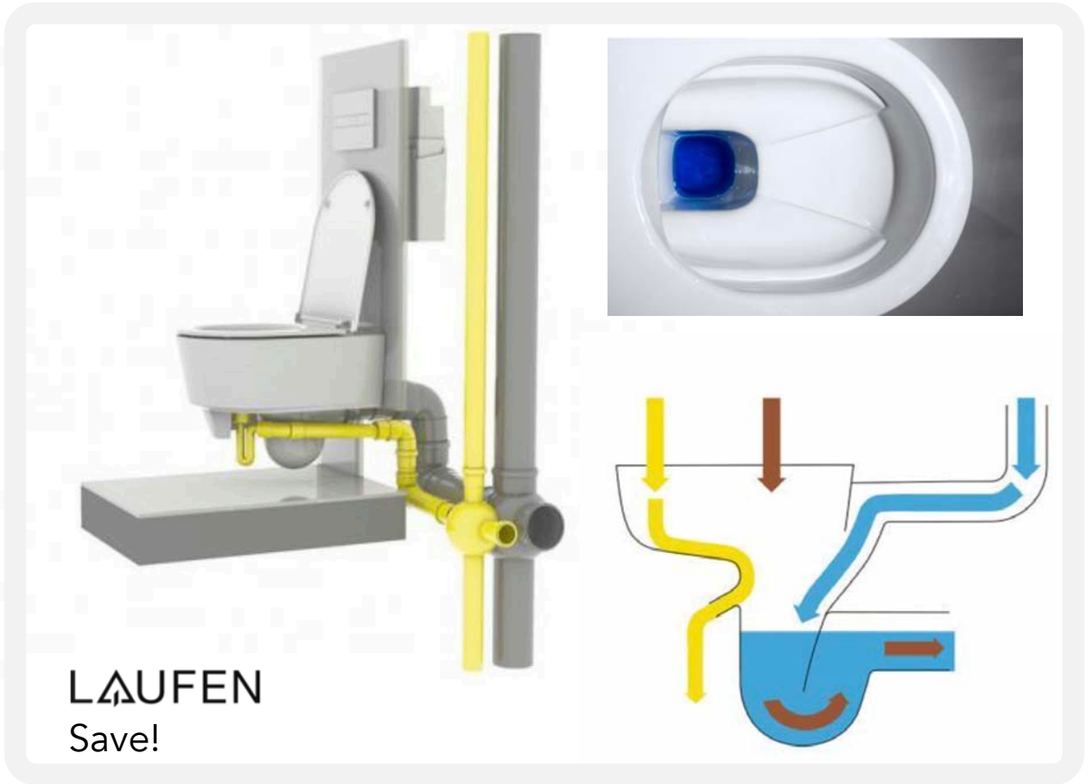
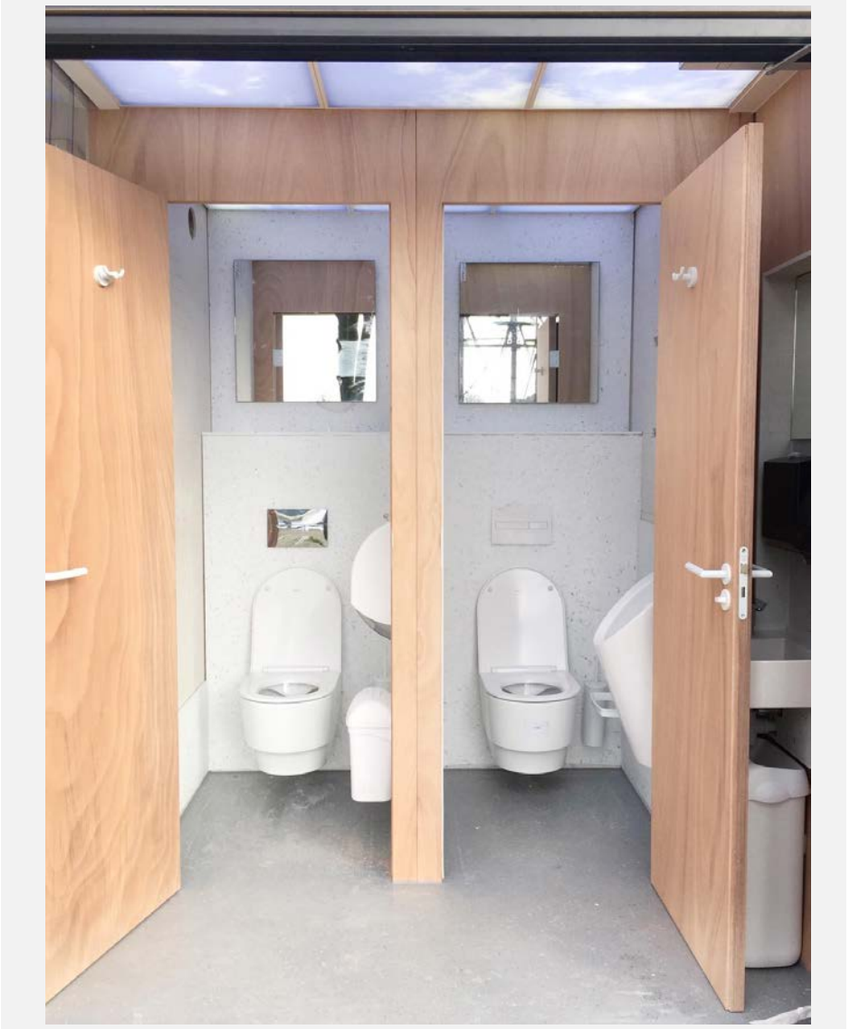
Source separation of urine (toilet innovation, by Laufen)

1 Toilets:





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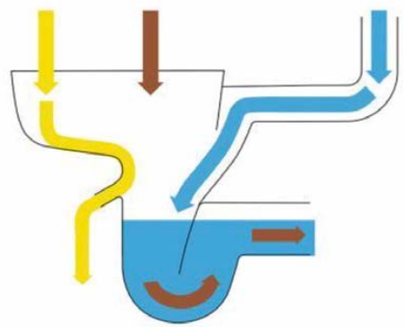
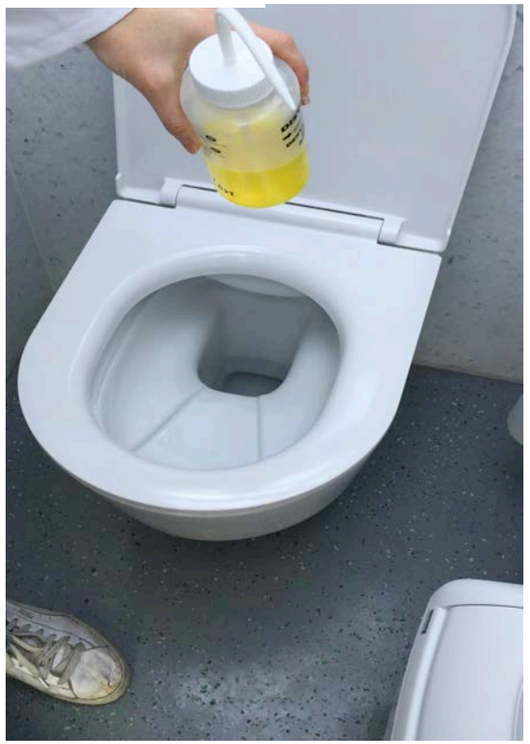
Source separation of urine (toilet innovation, by Laufen)





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The Phosphorus (& other nutrients) recovery demo (source separation / urine storage)

1. Urine separation toilets
2. Urine storage
3. Nitrification Bioreactor
4. Activated Carbon Filter
5. Distillation/RO
6. Fertilizer use

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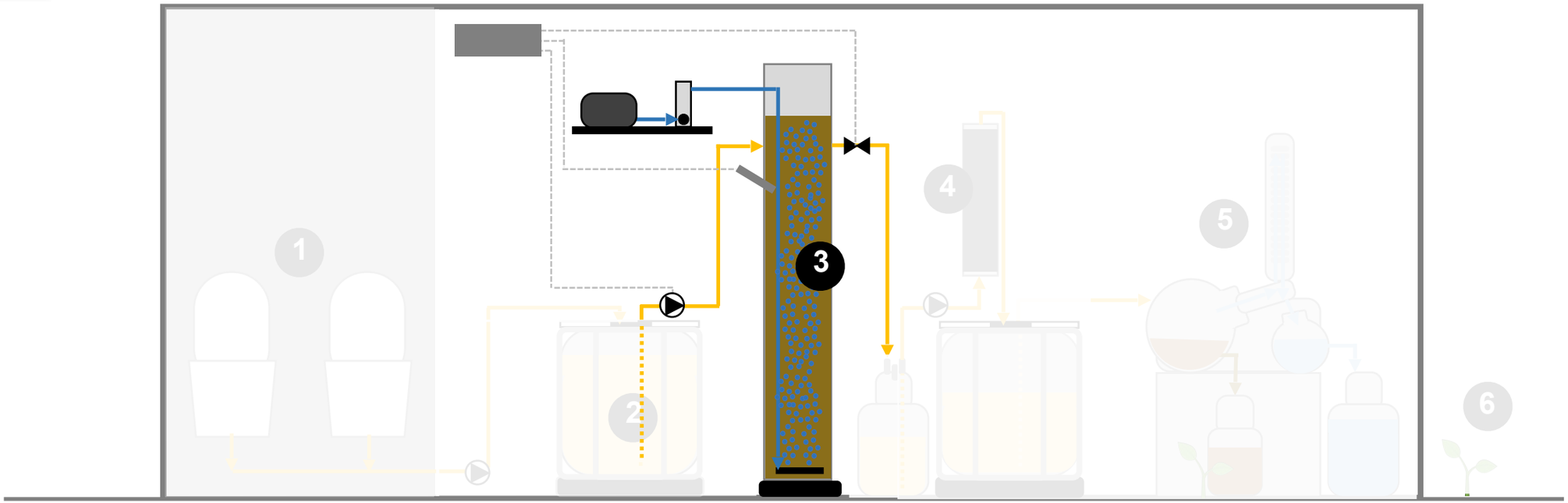
The Phosphorus (& other nutrients) recovery demo ; aeration & nitrification



1 Urine separation toilets

2 Urine storage

3 Nitrification Bioreactor

4 Activated Carbon Filter

5 Distillation/RO

6 Fertilizer use

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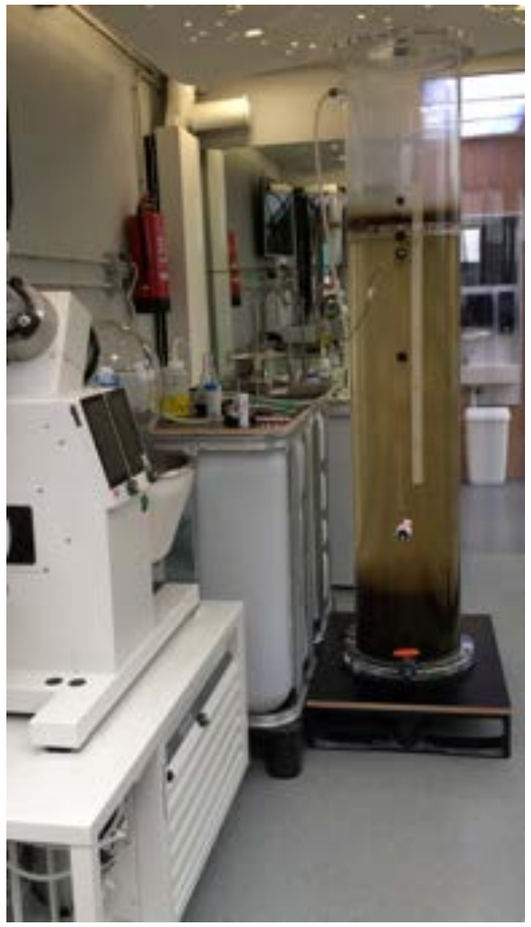
The Phosphorus (& other nutrients) recovery demo ; aeration & nitrification



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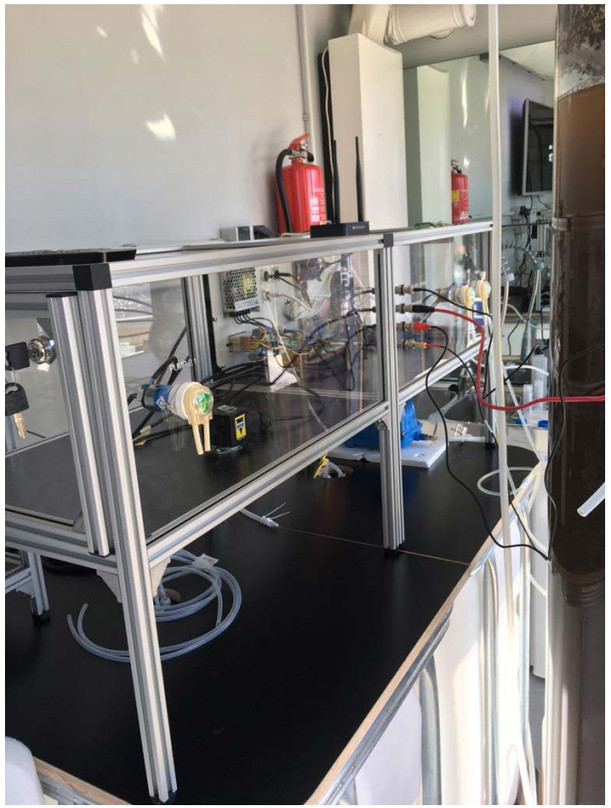
The Phosphorus (& other nutrients) recovery demo ; data logging



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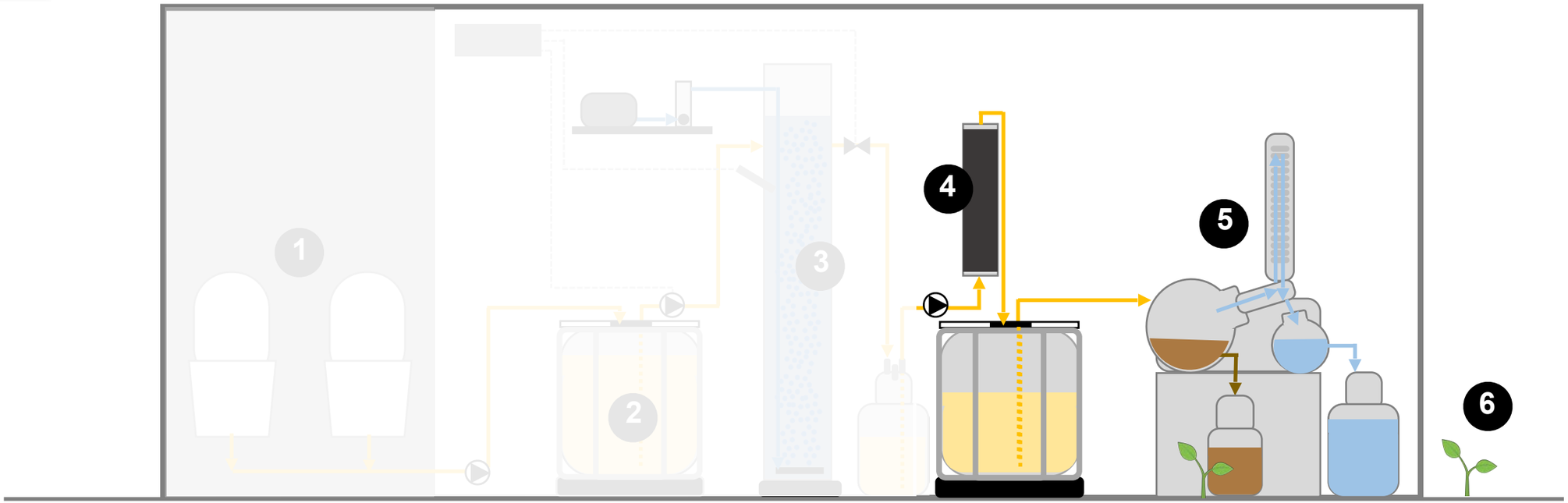
The Phosphorus (& other nutrients) recovery demo ; activated carbon filtration, distillation



1 Urine separation toilets
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6 Fertilizer use

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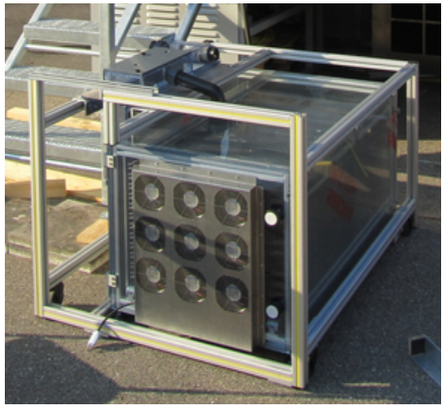
The Phosphorus (& other nutrients) recovery demo ; alternative configurations

Industrial evaporator

Drying beds



Reverse Osmosis

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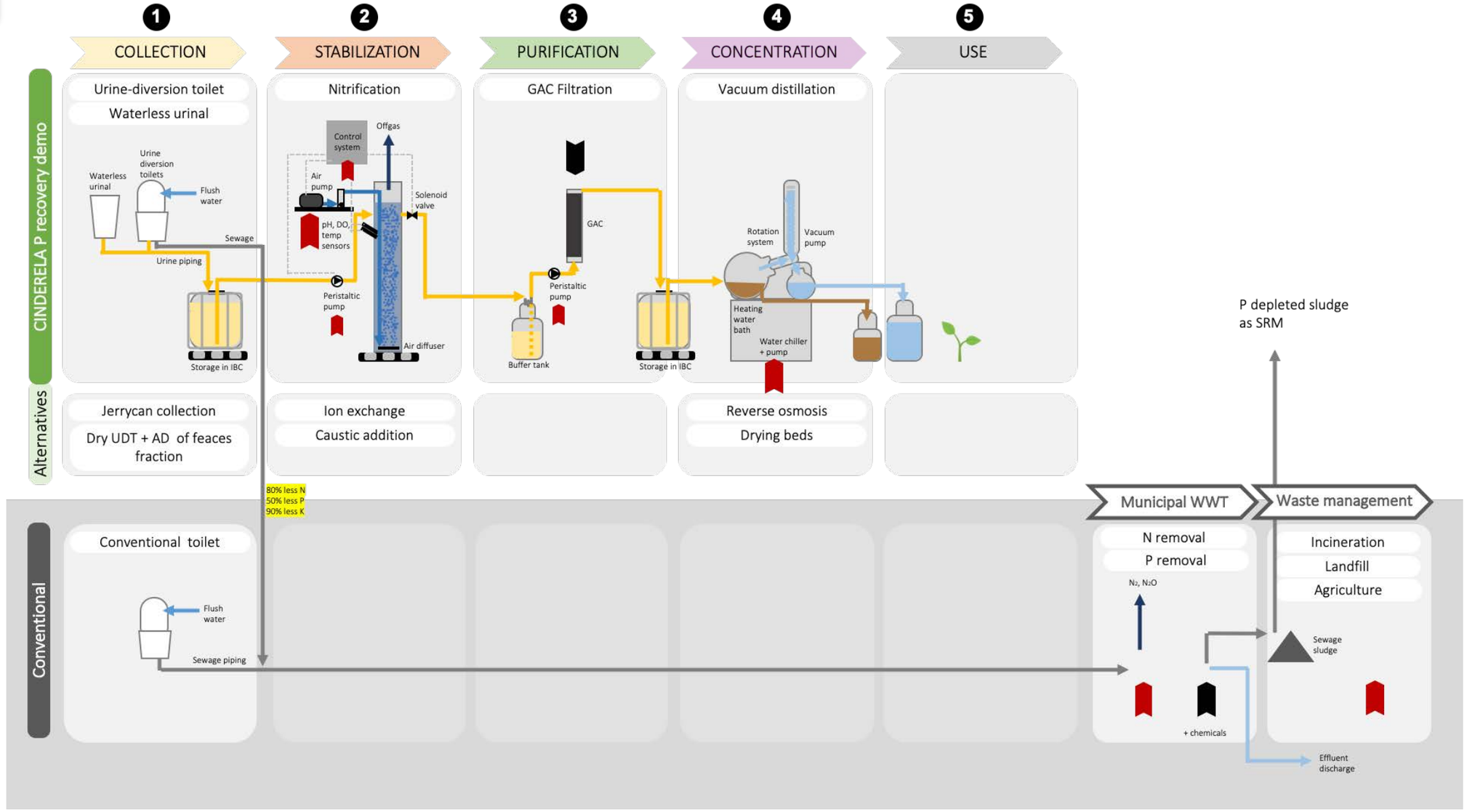
LCA, LCC, S-LCA

SYSTEMS THINKING



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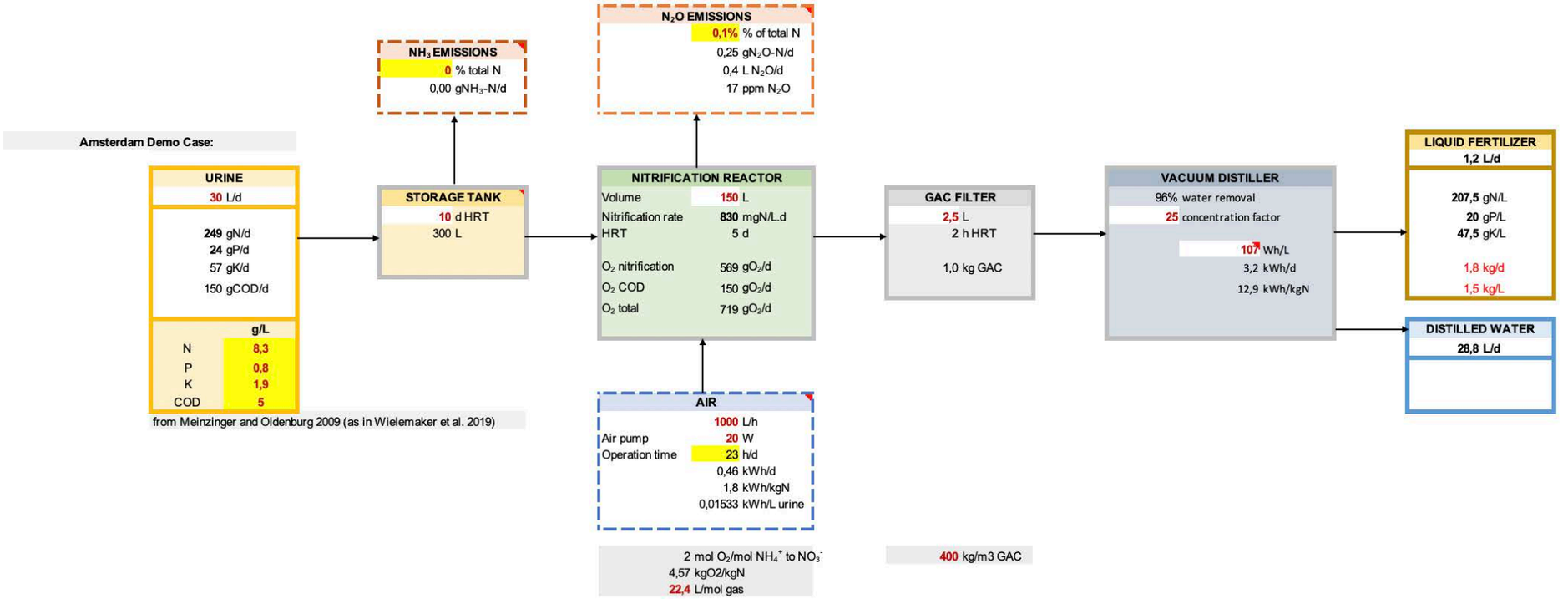
Input in red

Fuctional unit:	1 m^3 WW
Equivalent to:	
	1% Vol urine in WW
	10 L urine
	83 g N
	8 g P
	10,2 kg urine

1 ton of urine	1 ton of fertilizer
Equivalent to:	Equivalent to:
1,02 kg/L - density	1,5 kg/L - density
980 L urine	667 L fertilizer
8,1 kg N	138,3 kg N
0,8 kg P	13,3 kg P



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ALL READY…. ?

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ALL READY…. DEMONSTRATOR ‘ON TOUR’ …

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DEMONSTRATOR ‘ON TOUR’ … first stop at TU Delft Science Center / Botanical Garden

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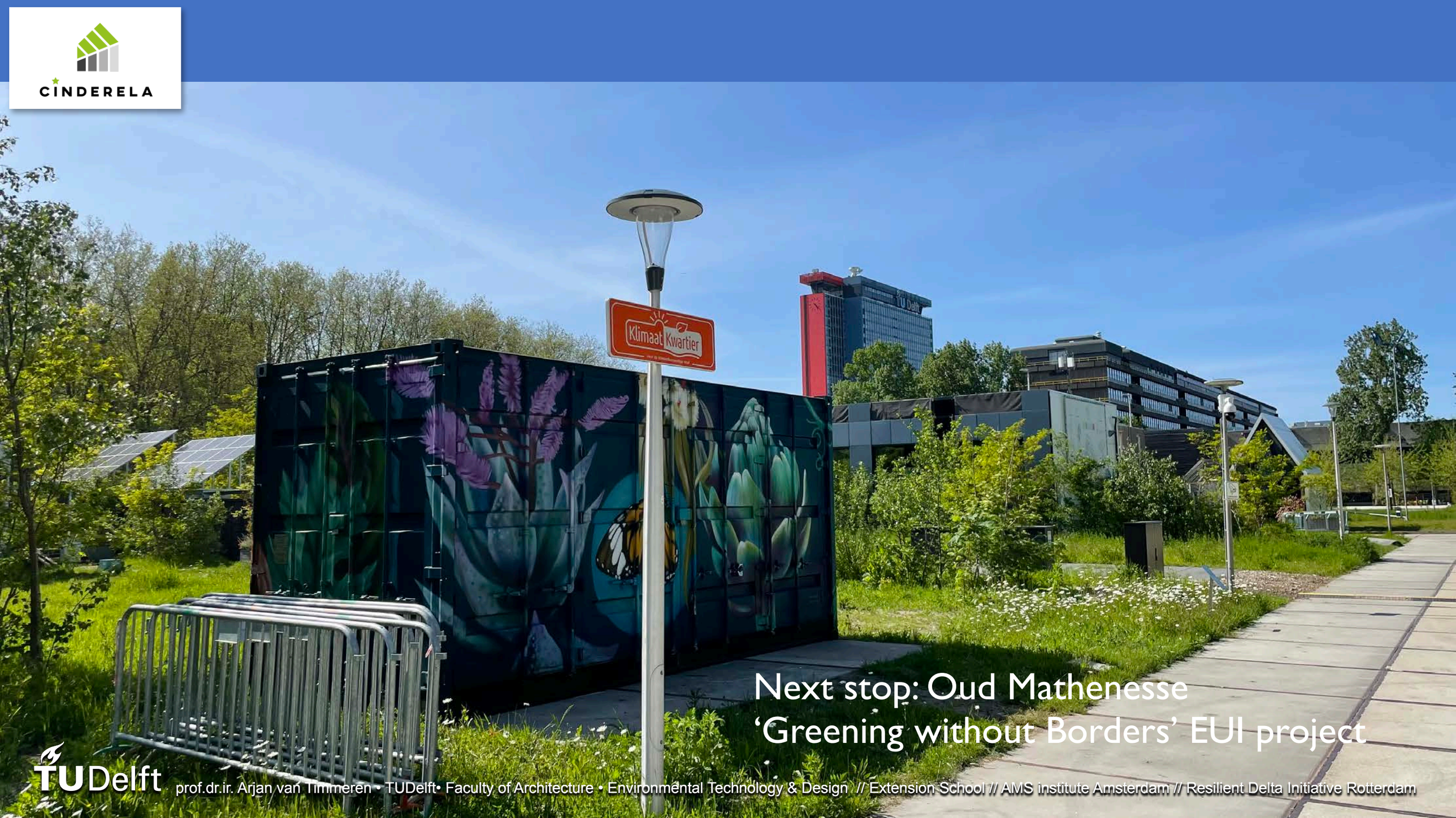
Aula Congrescentrum


Lorentzweg
STAPPEN/STEPS


Building
25
The Green Village
Leveranciersingang
Van den Broekweg 3-31
TUDelft



CINDERELA

Next stop: Oud Mathenesse
‘Greening without Borders’ EUI project

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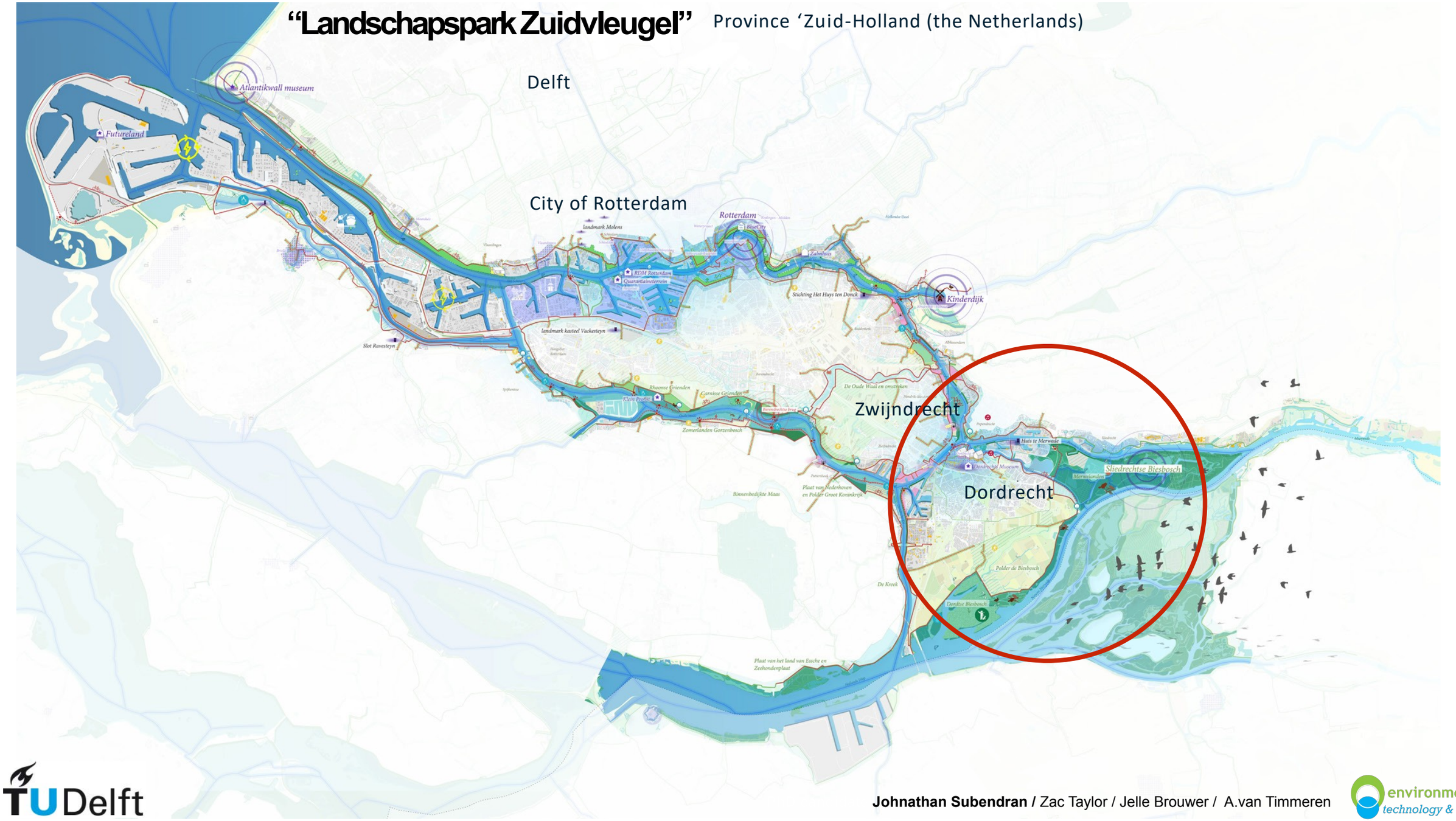
“Landschapspark Zuidvleugel”

Province ‘Zuid-Holland (the Netherlands)



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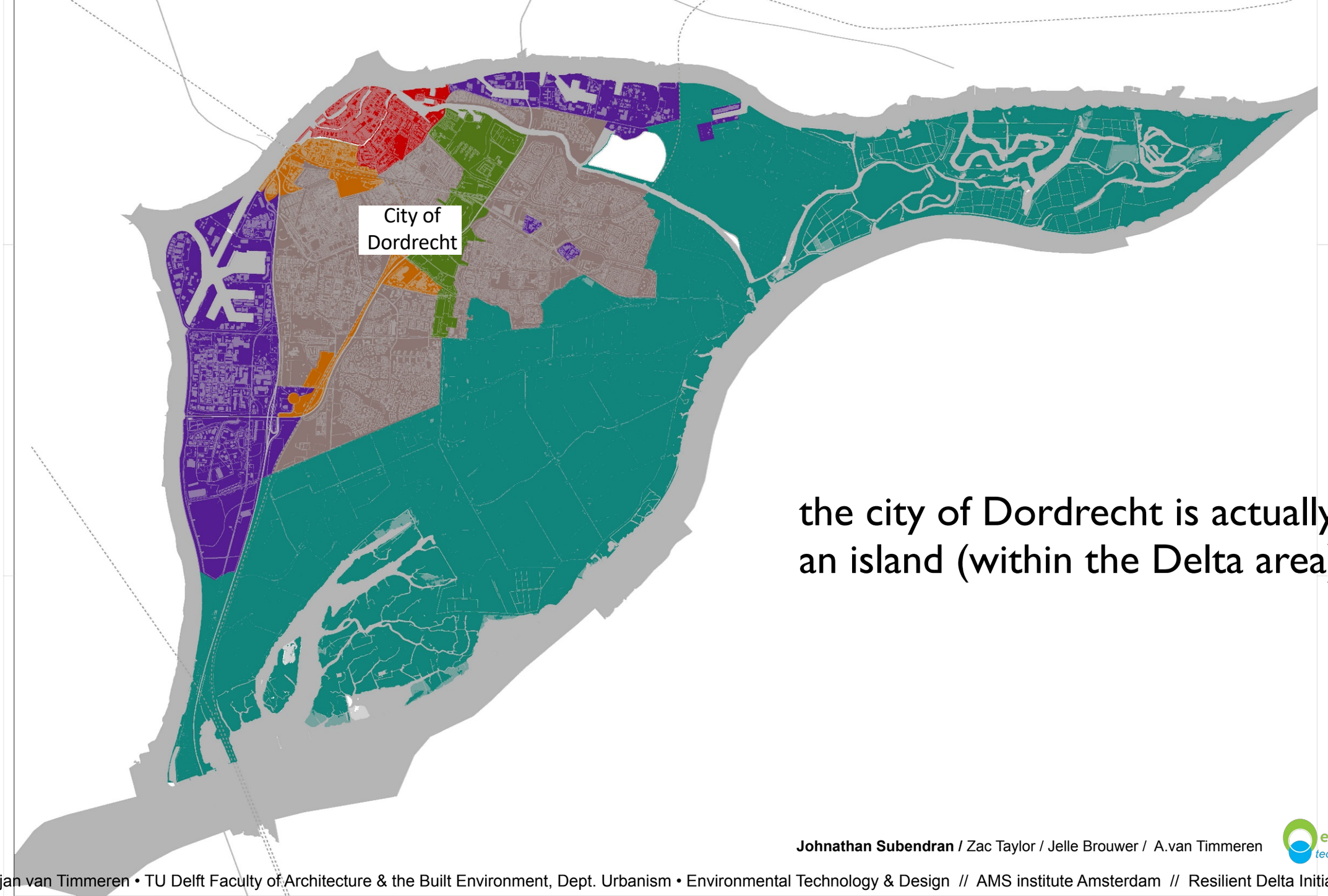

the city of Dordrecht is actually an island (within the Delta area)

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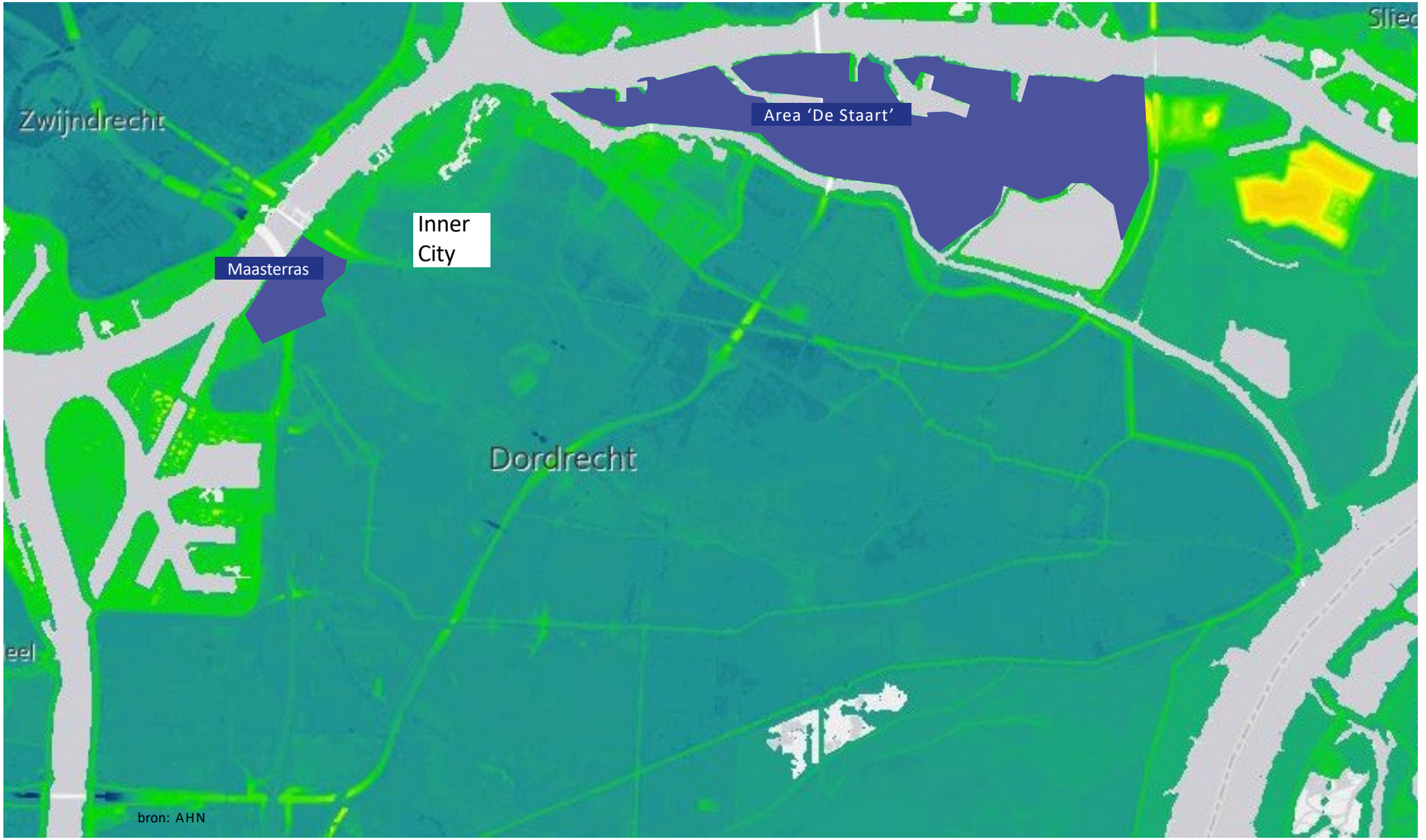
Elevations Public Space in relation to rivers / waterways (& dykes)



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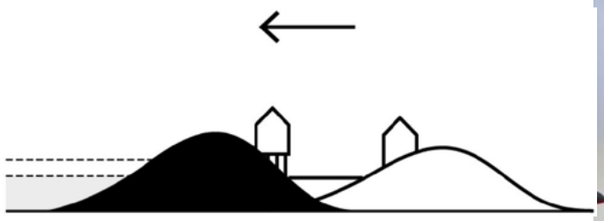
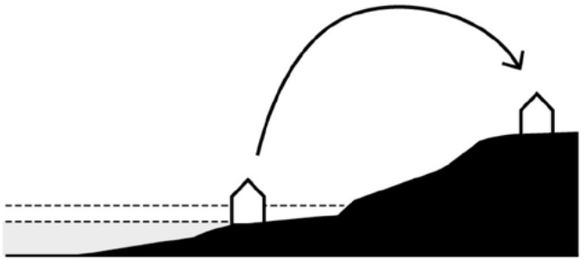
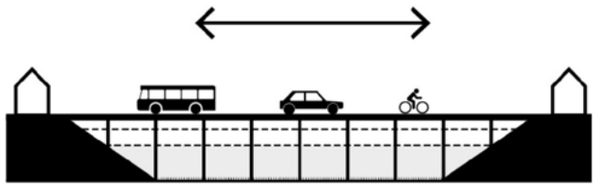
Seaward
‘Attack’



Adapt
‘Withdraw’



Protect/semi-open
‘Connect’



Protect/semi-closed
‘Defend’

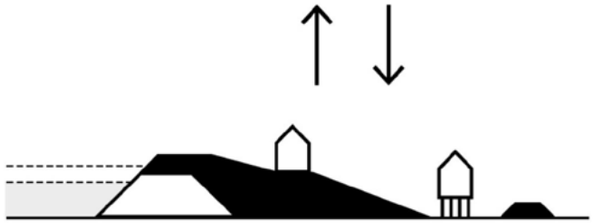
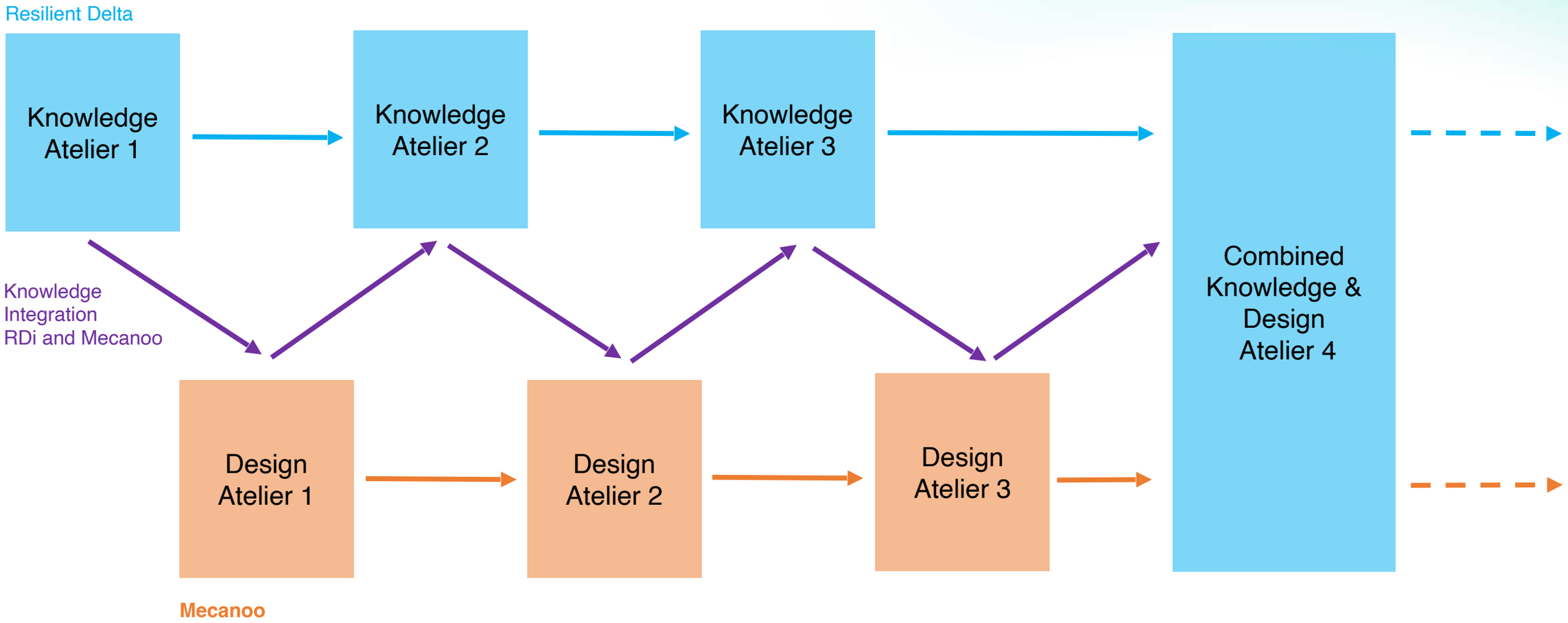


image: A.van Timmeren

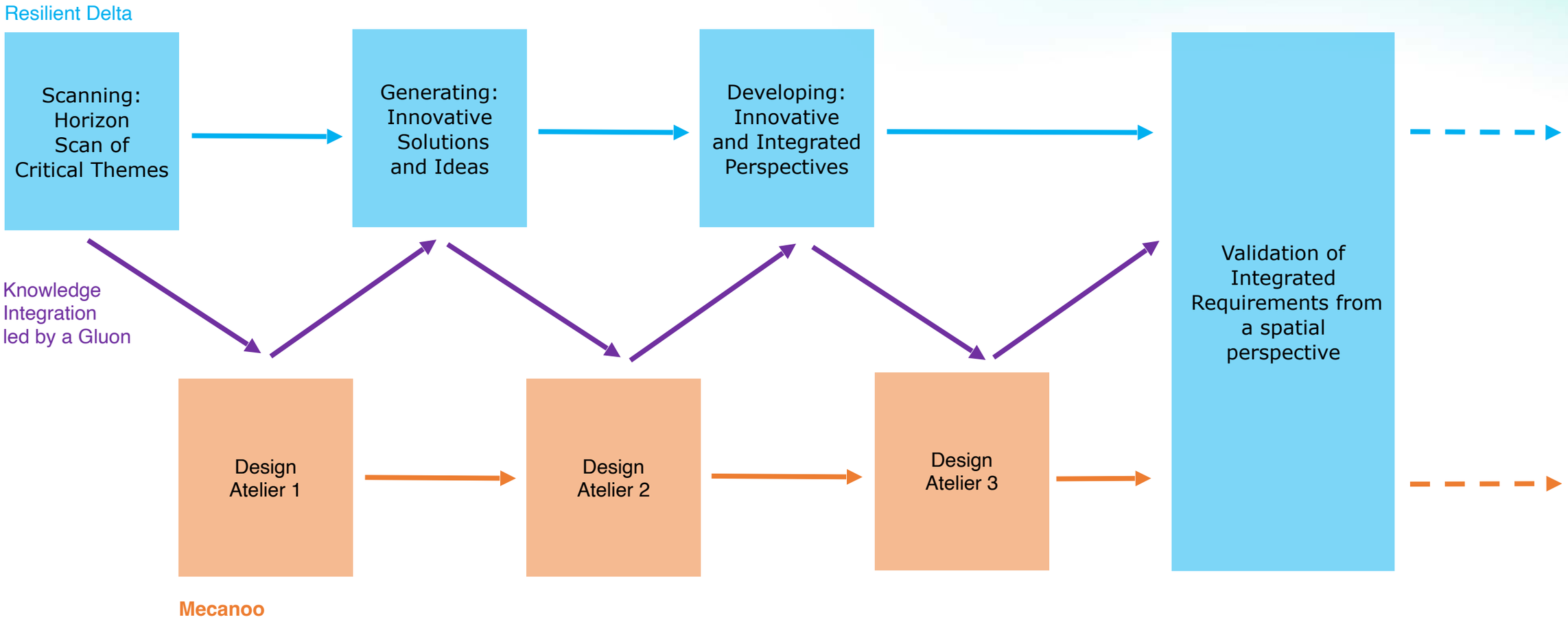
Resilient Delta Initiative

i.s.m. Mecanoo architecten / Delft



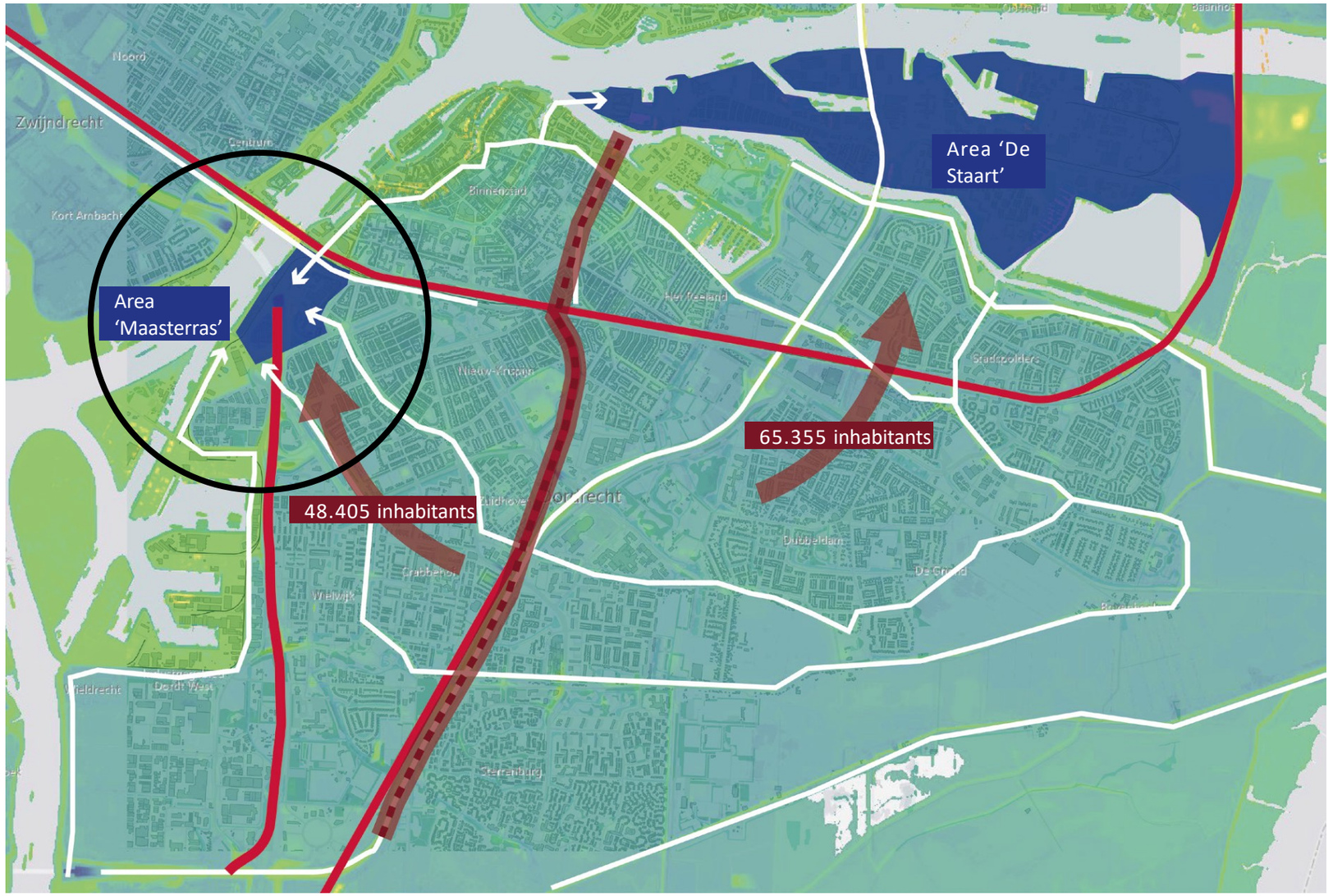
Resilient Delta Initiative

i.s.m. Mecanoo architecten / Delft



Elevated areas 'liminal space' as 'Public Shelters' during extreme flooding events in Dordrecht (NL)

who will go where ?



TU Delft

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environmental technology & design

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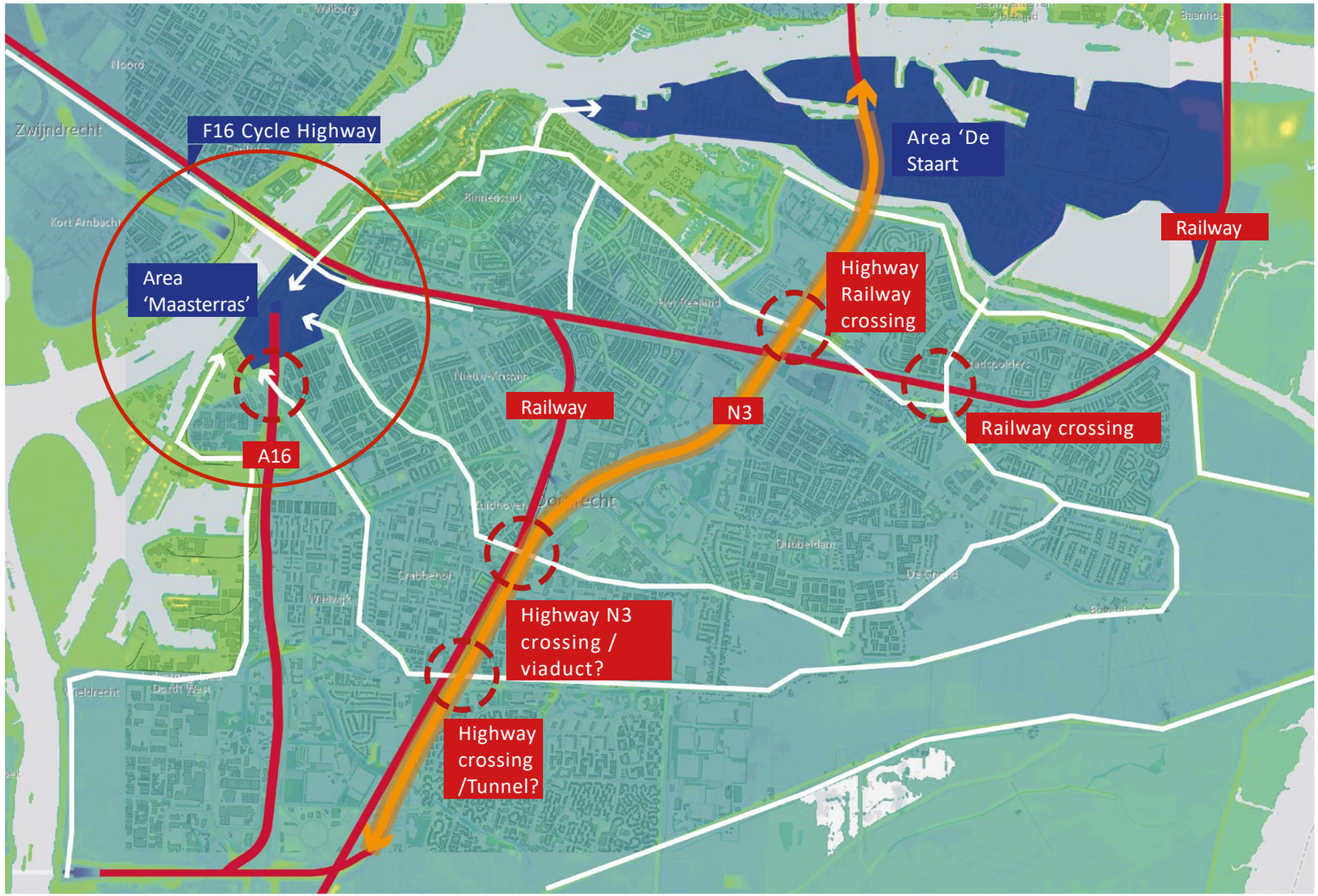
Elevated areas 'liminal space' as 'Public Shelters' during extreme flooding events in Dordrecht (NL)

barries along escape routes …



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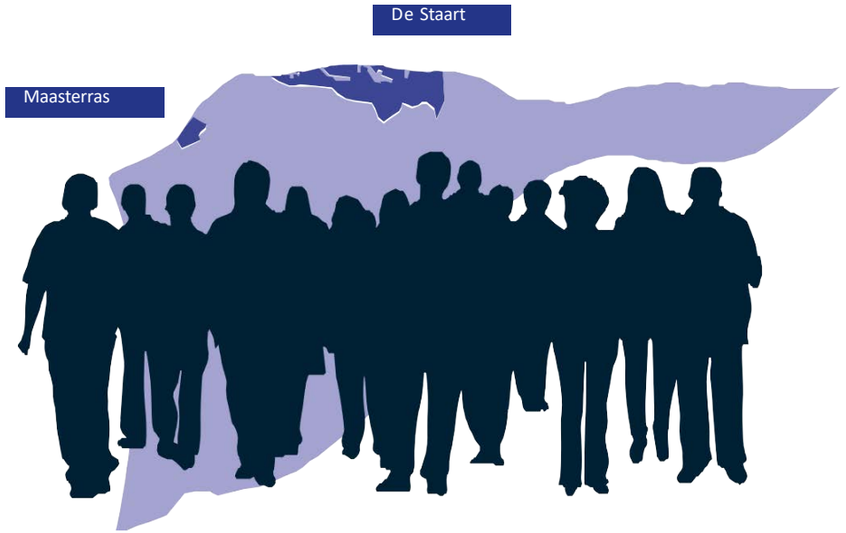
Shelter locations in Dordrecht

who goes where ?

20%
escapes / is able to escape from ‘the island’ (Dordrecht)

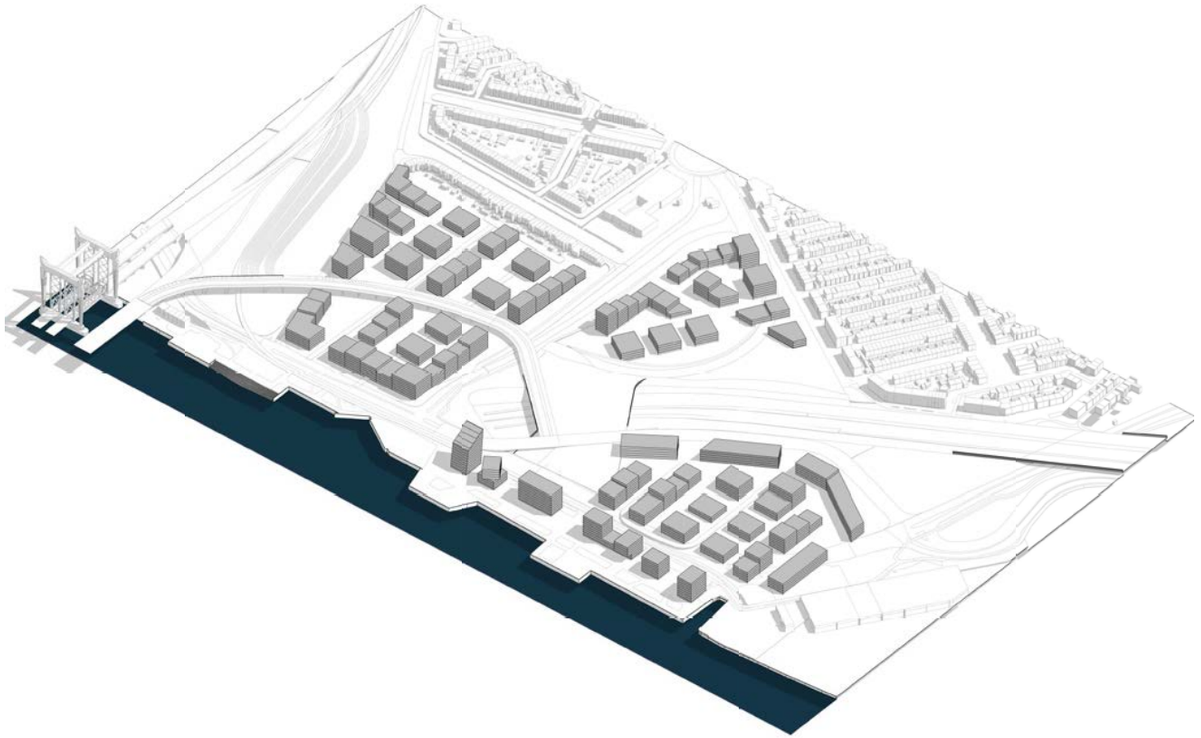
10%
take shelter in their own houses (vertical evacuation)



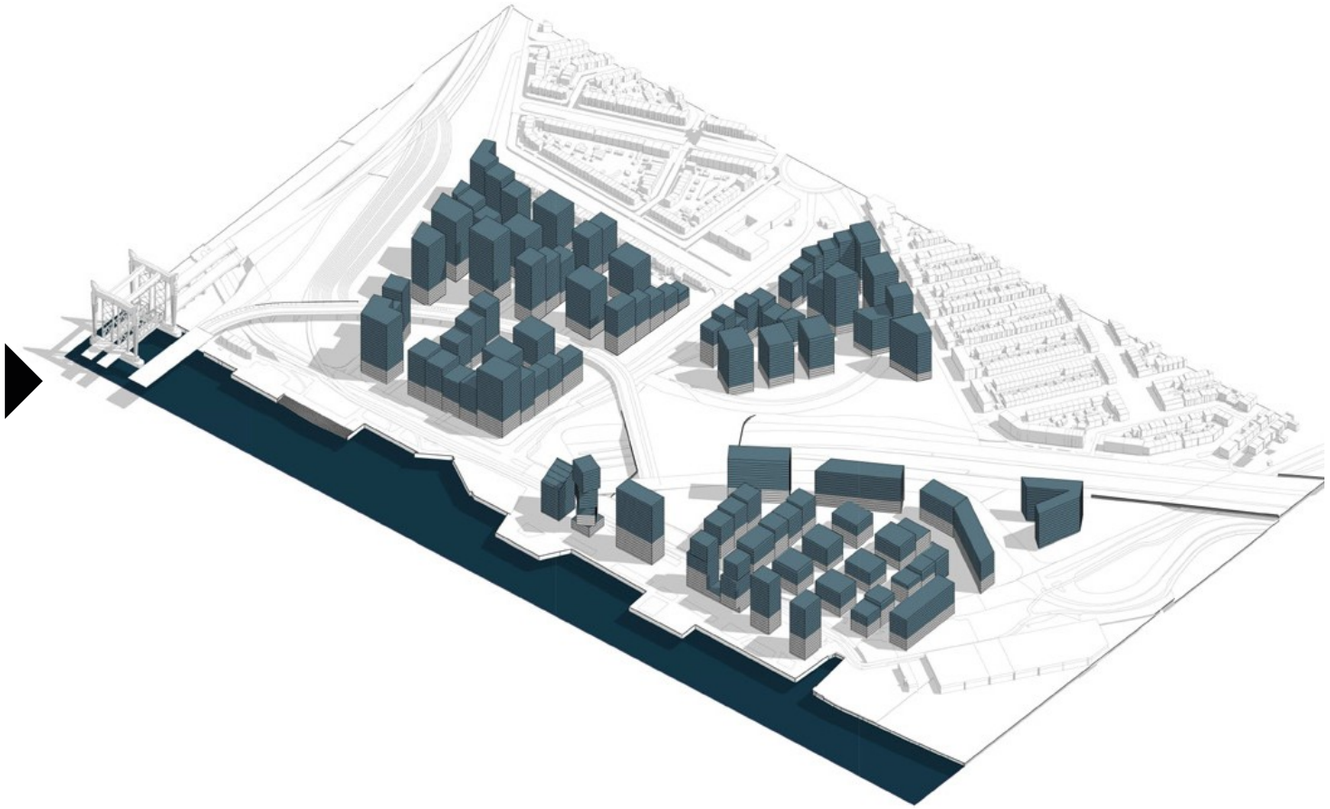
70%
take shelter on one of the main City Shelter-Locations

Elevated areas ‘liminal space’ as ‘Public Shelters’ during extreme flooding events in Dordrecht (NL)

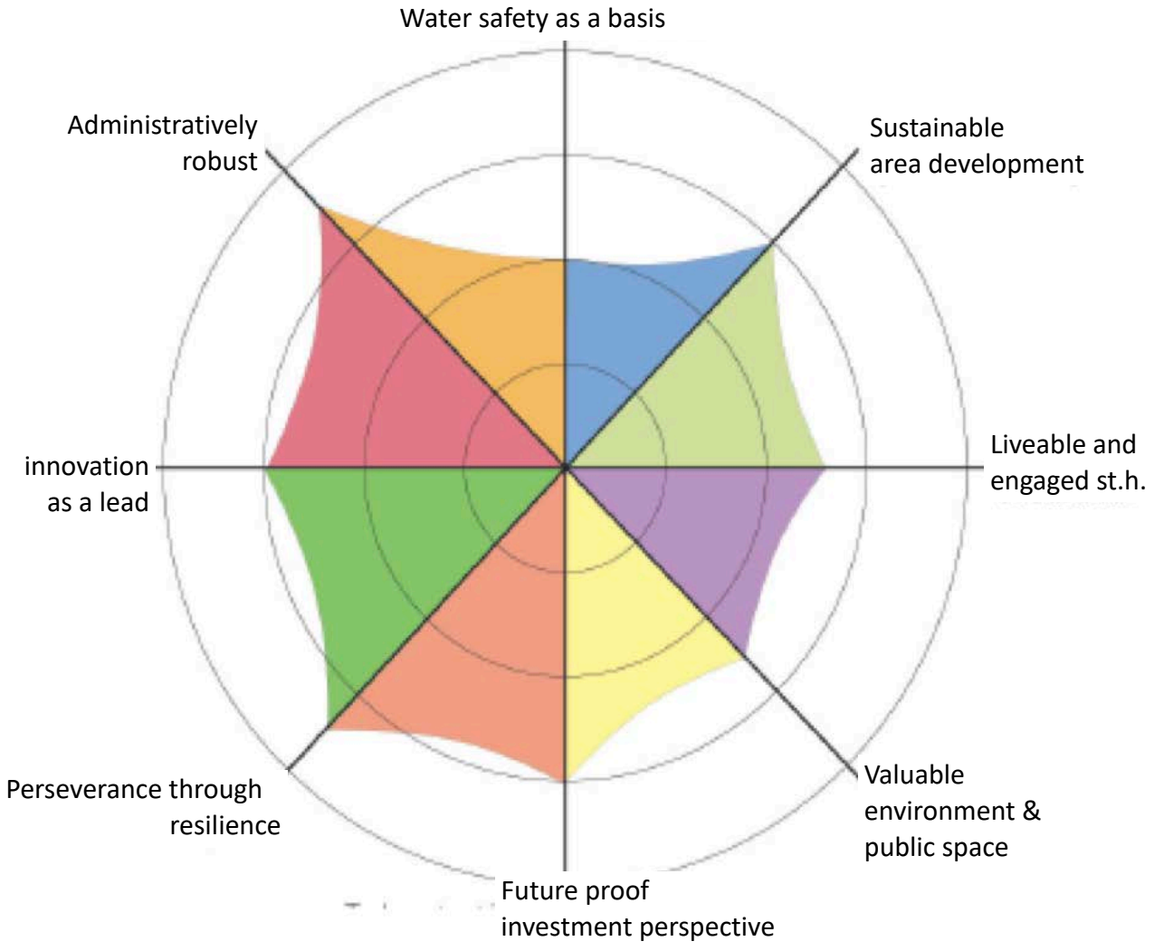
impact of the use of this resilience strategy on the development of the ‘Maasterras’ area …



Original plan
approx. 2.000 houses



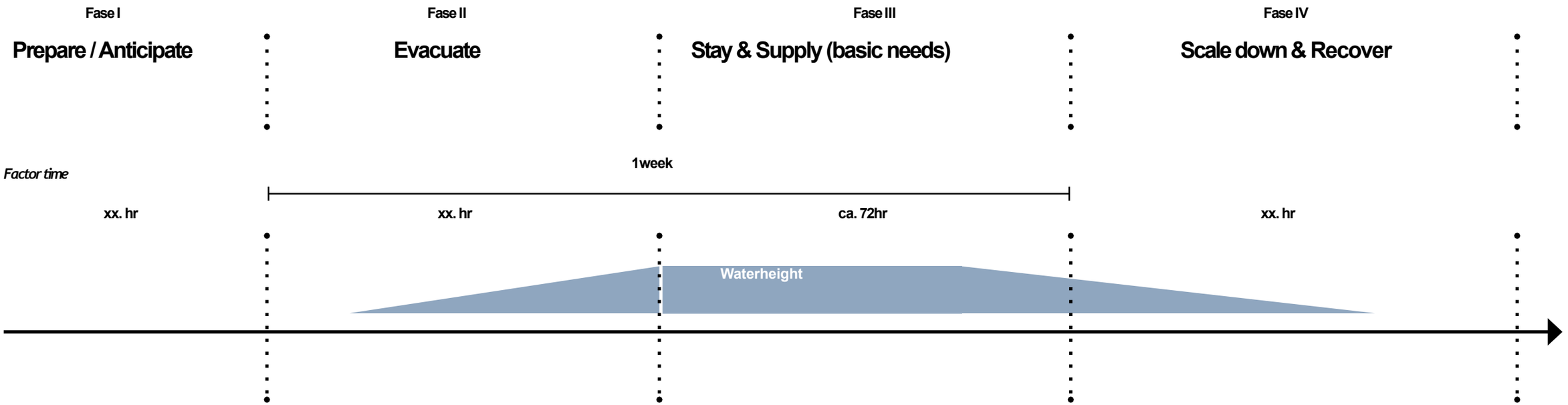
Safehaven as part of the
development approx. 7.879 houses



Area development Principes :

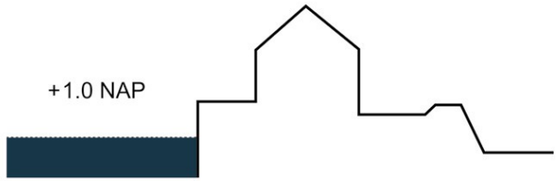
1. **Water safety as a basis**
2. **Sustainable Area Development**
3. **Liveable and engaged stakeholders**
4. **Valuable environment (ecology/soil)**
5. **Future-proof investment perspective**
6. **Perseverance through resilience**
7. **Innovation as a lead / brand**
8. **Administratively robust**

Timeline in case of a flooding / disaster



Fase 1; Prepare / Anticipate

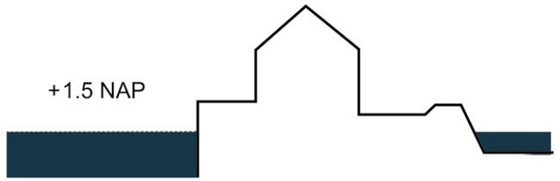
Threat & warning communication

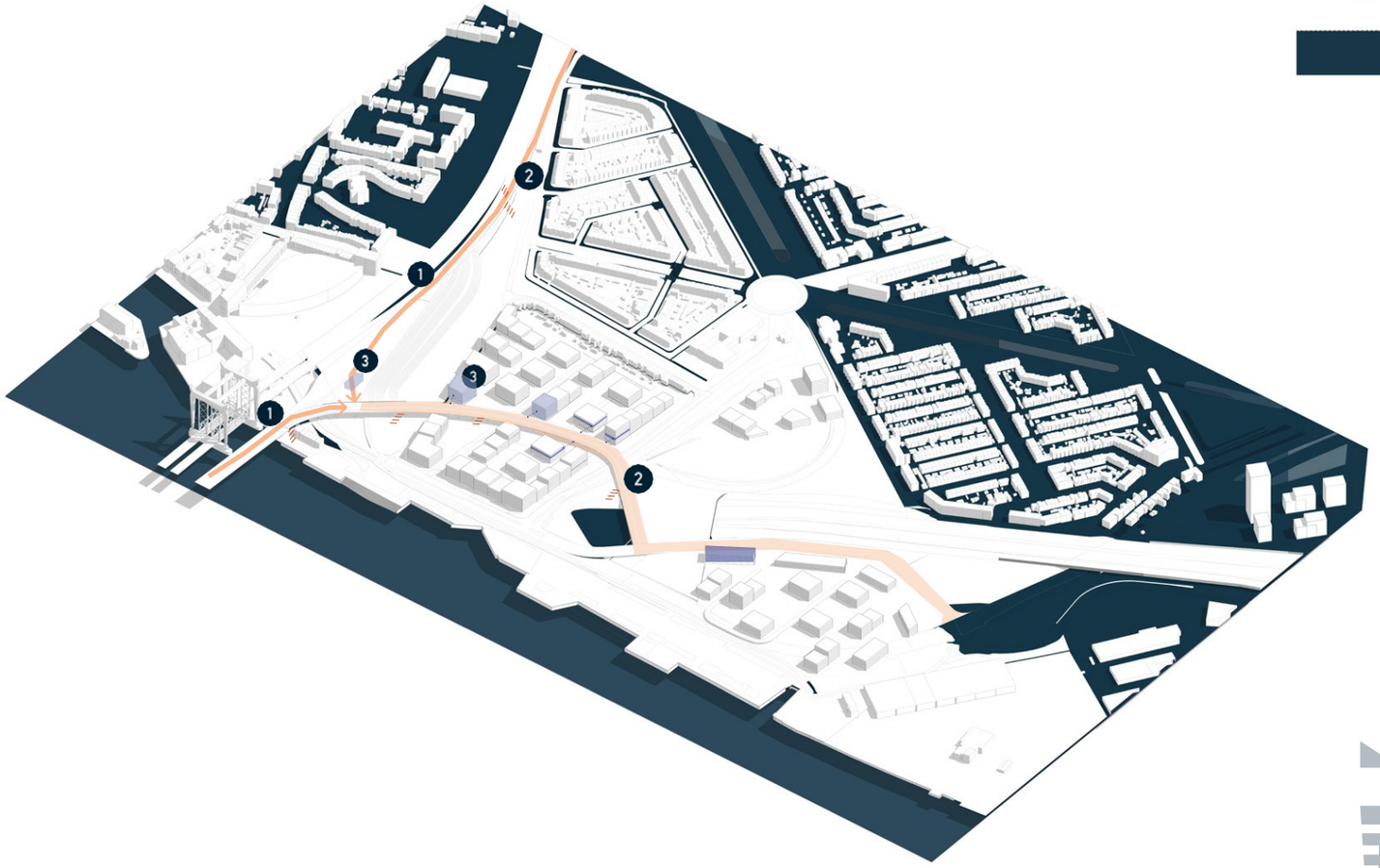


1. Duidelijkheid wie waarheen gaat
   Ouders -> scholen van kinderen, Bewoners op werk -> blijven daar, Mensen in omliggend gebied thuis of onderweg -> naar M3 en M4
2. Bewoners en eigenaren woningen en publieke gebouwen vluchtlocatie zijn op de hoogte van functie
3. Bewoners M3 en M4 bereiden eigen woning voor

Fase 2; Evacuation

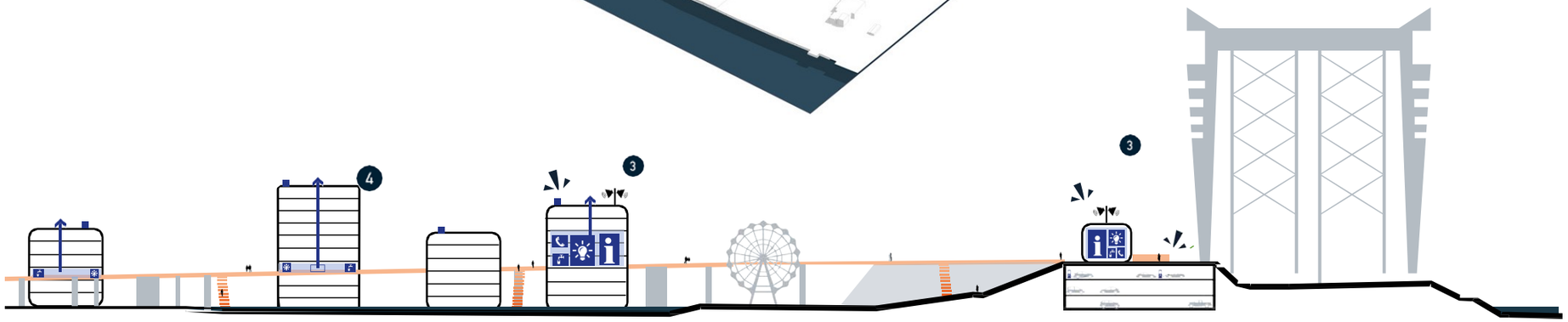
Escape routes and collection points





1. Fietspaden herkenbare vluchtroutes richting M3 en M4
2. Meerdere opgangen naar vluchtroute
3. Voorzieningen langs vluchtroute functioneren als eerste opvangplek voor evacuees. Deze worden herkenbare informatie en coordinatie punten.
4. Publieke / gemeenschappelijke ruimte (Cafe / restaurant / lobby) op droge hoogte met toegang tot brugweg per gebouw als gemeenschappelijk en coordinatiepunt per gebouwcluster.

   Noodvoorziening voor elektriciteit in gebouwen op hoogte. Informatie, communicatie en verlichting gemobiliseerd naar sub-coordinatie punt.



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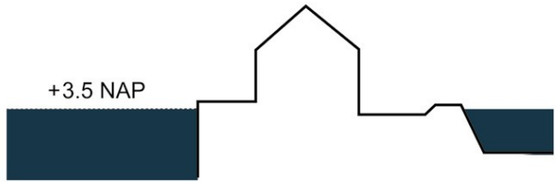
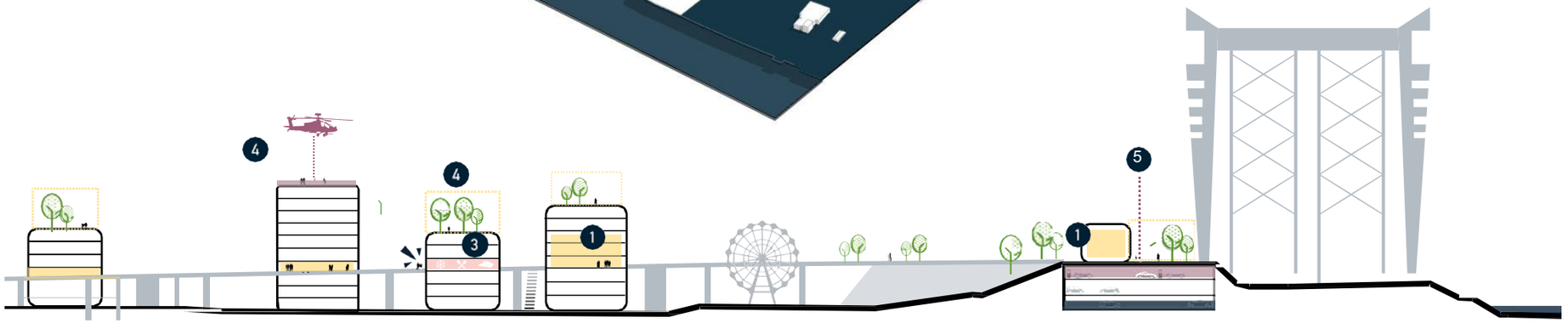
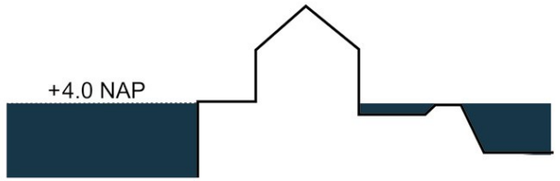
Fase 3; Stay (Shelter) and supply of basic needs



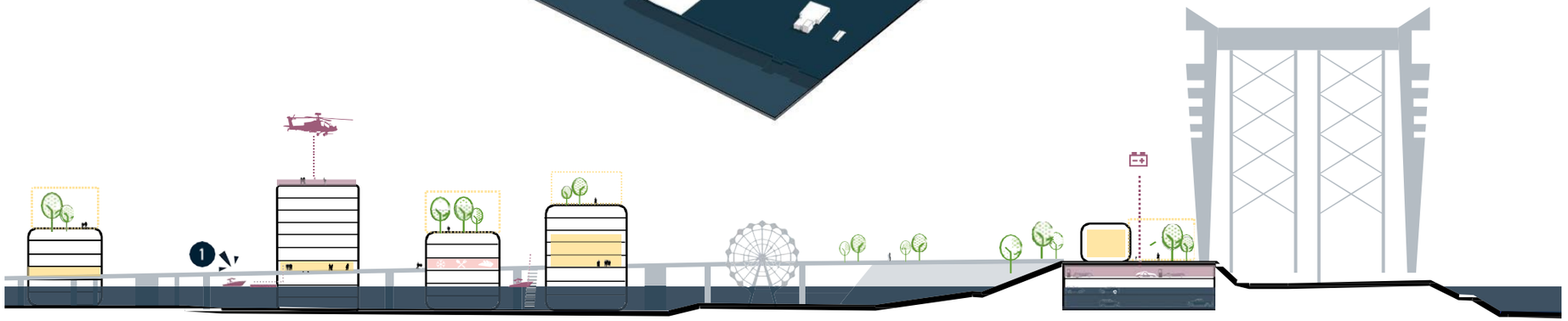
1. Publieke / gemeenschappelijke ruimtes met toegang tot brugweg funcioneren als gemeenschappelijke plek per gebouw waar noodvoorzieningen zijn: Elektriciteit / Wifi / Sanitair / dekens.
2. Drinkwaterpunten op veilige hoogte
3. Supermarkt op veilighe hoogte en toegang tot elektriciteit zorgt voor een grote voedselevooraad.
4. Daktuinen met beschutting toegankelijk voor gehele gebouw, mogelijkheid tot landen helikopter.
5. Elektrische auto's op bovenste etage parkeergarage: accu's (en laadpalen?) kunnen gebruikt worden. Toegang tot bovenste etage parkeergarage vanaf brugweg is noodzakelijk.
6. Hulpgoederen per boot: goede connectie tot aanlegplaats boten.



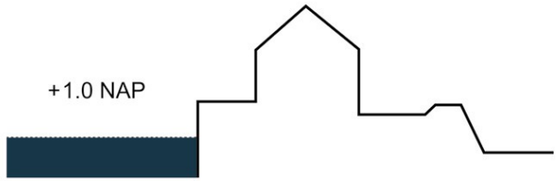
Fase 3; Stay (Shelter) and supply of basic needs (what if?)

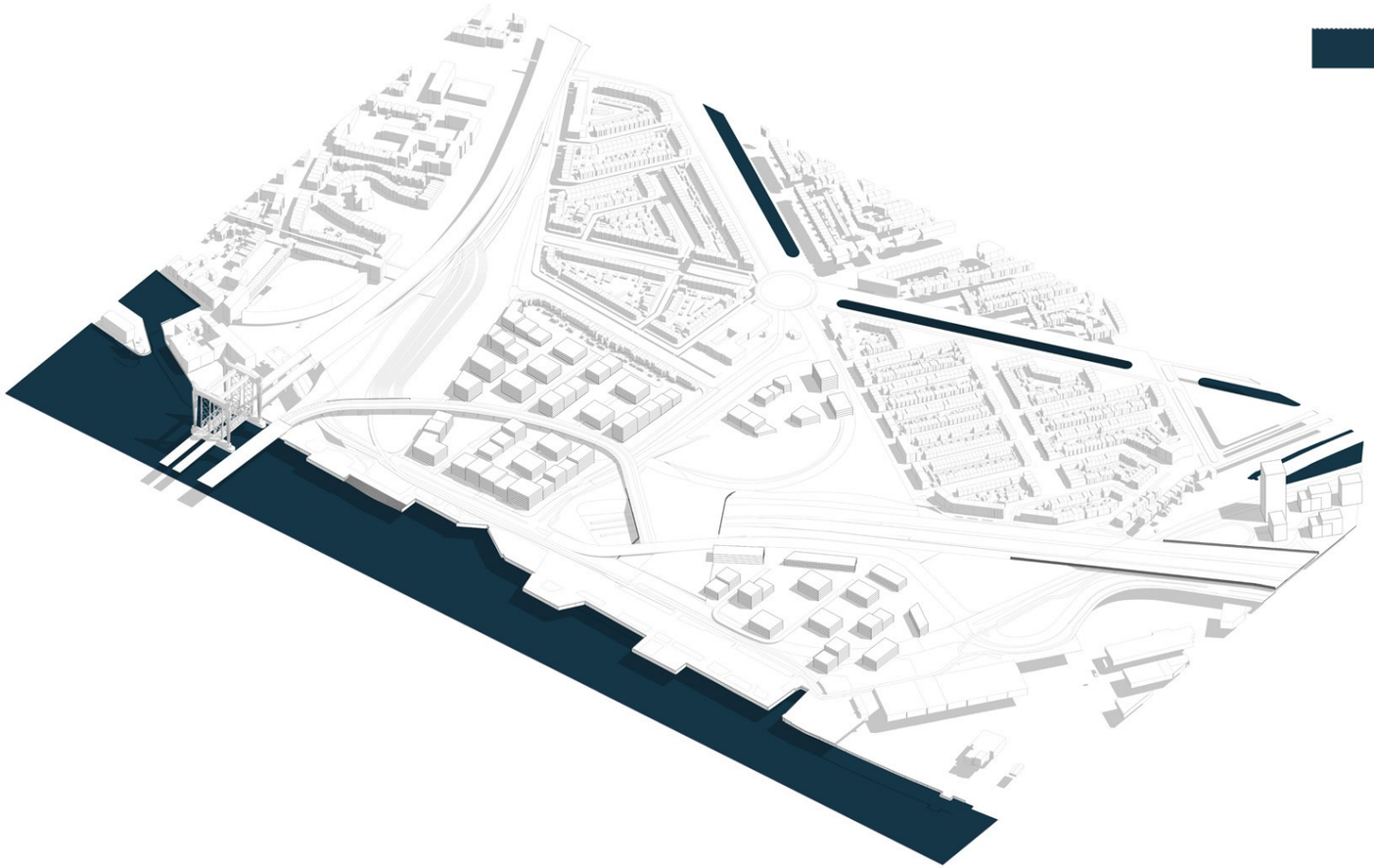


1 Aanlegplaatsen per boot op onderste verdiepingen

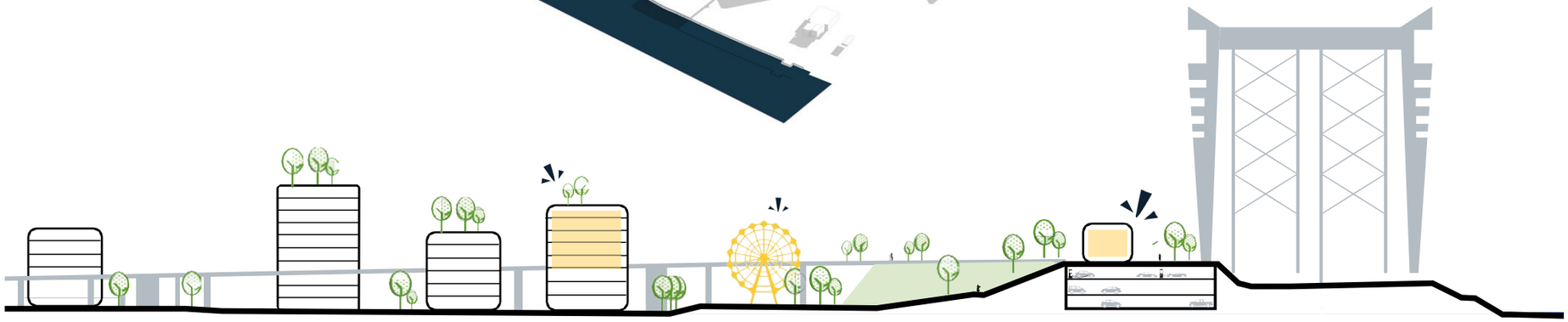


Fase 4; Scale down and Recover





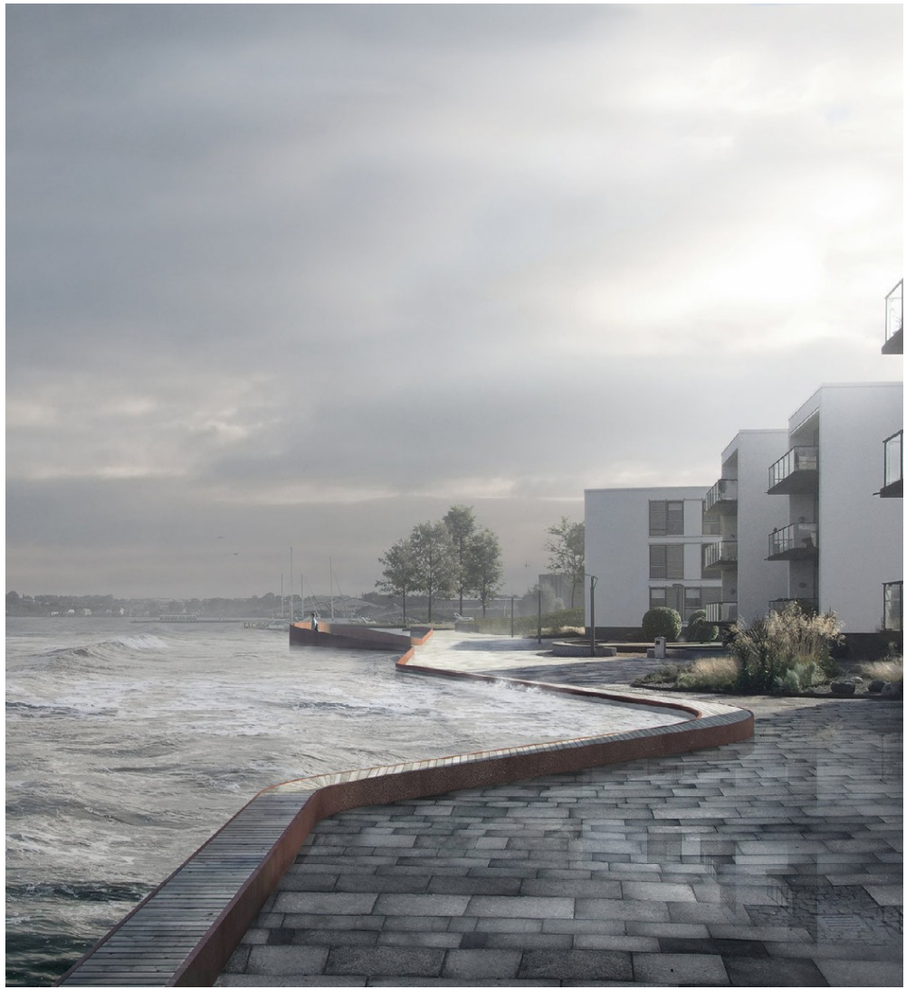
- Fast way out watergangen (wadi's / verlaagde voetpaden)
- Adaptieve beplanting - link naar Biesbosch?
- Gebied M3 en M4 nog in tact
- Kosten heropbouw lager



Adaptive waterfront

Climate harbour - design

normal tide condition



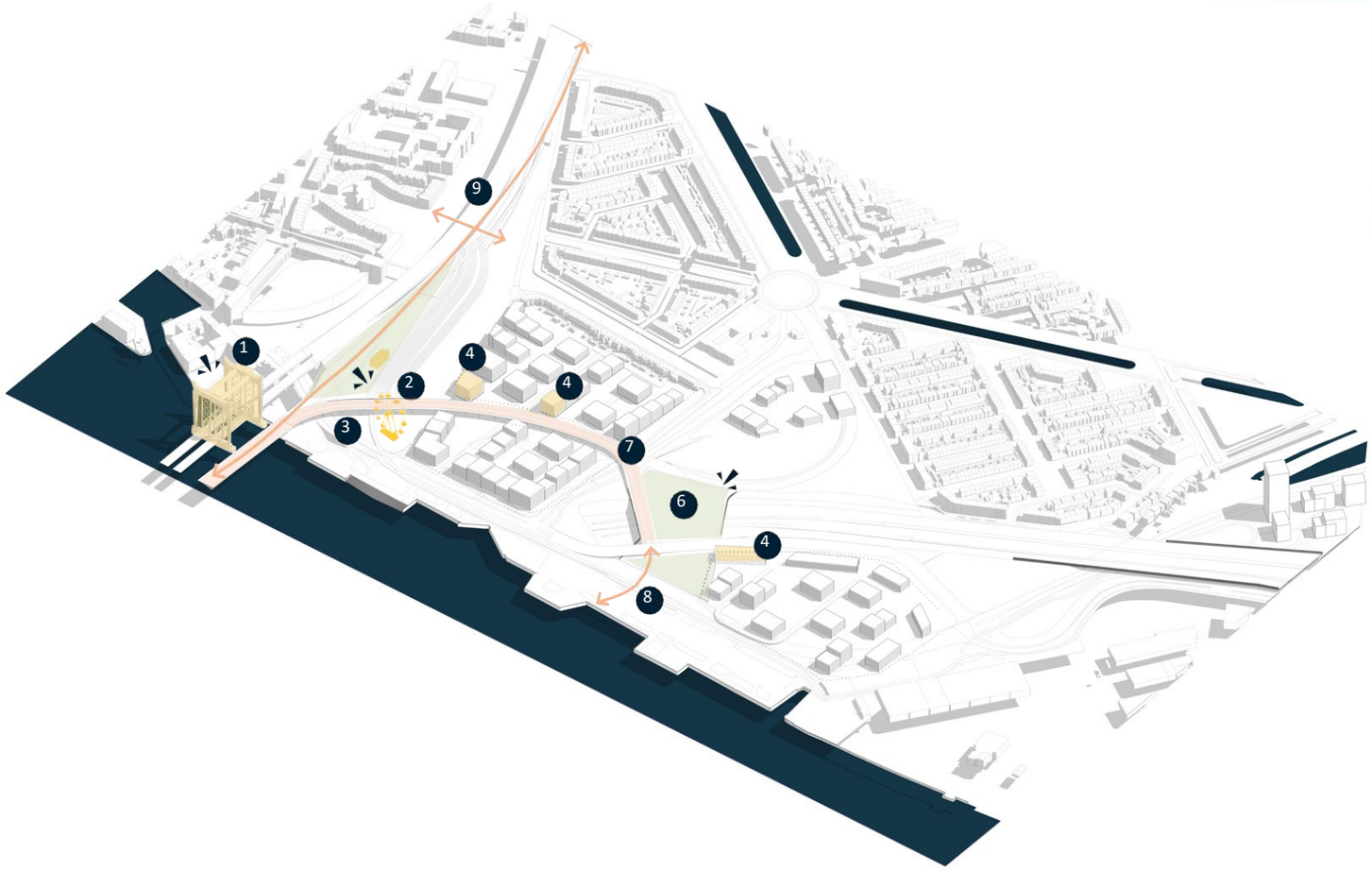
high-tide condition

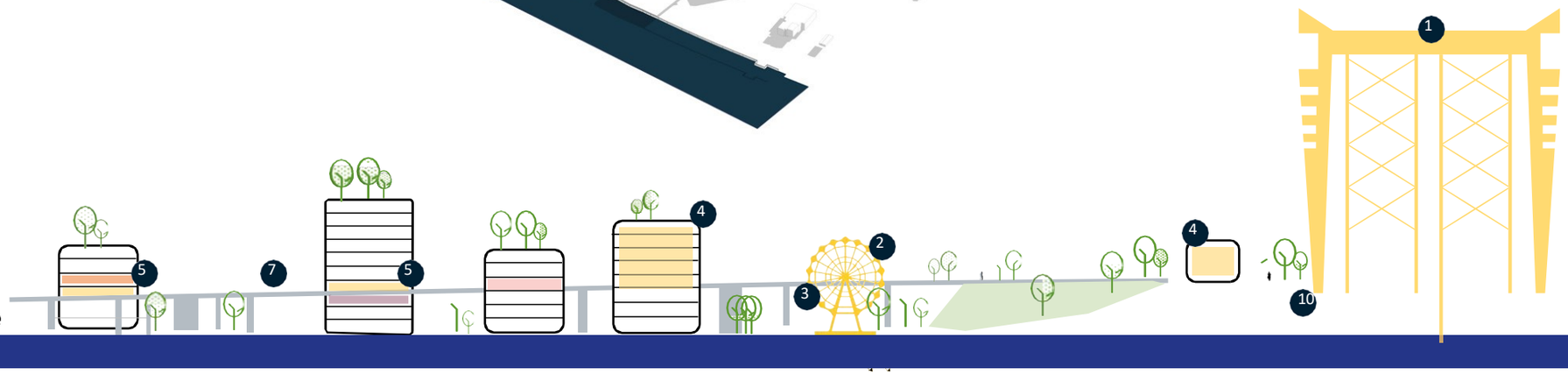
Adaptive waterfront

Climate harbour - design

Resilient Delta Initiative

i.s.m. Mecanoo architects / Delft





1. Maasterras kent enkele markante herkenningspunten zoals Spoorbrug en autovrije Zwijndrechtsebrug.
2. Maasterras beschikt over 8.000m² evenemententerrein en heeft daarmee aantrekkingskracht op de hele stad.
3. Stroomvoorziening evenemententerrein kan op veilige hoogte als noodvoorziening fungeren
4. Locatie programma staat nog niet vast; Belangrijke voorzieningen kunnen een belangrijke plek langs de vluchtroutes krijgen.
5. Voorzieningen en publieke functies kunnen op verdiepingen geplaatst worden.
6. Gedeeltelijke overkapping snelweg als extra veilige openbare ruimte.
7. Autovrije Brugweg als 2e maaiveld
8. Directe toegang tot Kade
9. F16 en fietstunnel verbinden Maasterras met het omliggende gebied en zorgen voor een goede toegankelijkheid.
10. Parkeergarage kan noodstroomvoorzieningen bergen door middel van elektrische auto's.

convergence

TU Delft · Erasmus MC · Erasmus University Rotterdam

Resilient Delta Initiative

i.s.m. Mecanoo architects / Delft

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convergence

TU Delft

Erasmus MC

Erasmus University Rotterdam

Render of Area Development plan
Maasterras area Mecanoo Architects

WOHA Rethinking cities for the age of global warming…

Verdergaand integreren kavel, gebouw en publieke ruimte/groen & tegen gaan van ‘verdozing’

houten lamellen random geplaatst in gevelbeeld

groen gevel als opgaande continuering van Waterpark

entree onder uitstekende gevelband/luifel

parkeren deels uit zicht dmv. halfhoge heg

stalen erfafscheiding (stripstaal)

houten structuur / continuering lamellen

Amsterdam Osdorp BPA02 ; Interstellar / Heembouw SADC Project VEGA Amsterdam

TU Delft

prof.dr.ir. Arjan van Timmeren • TU Delft Faculty of Architecture & the Built Environment, Dept. Urbanism • Environmental Technology & Design // AMS institute Amsterdam // Resilient Delta Initiative Rotterdam

Verder introduceren van ‘natuur inclusiviteit’ , CE & Biobased bouwen (bouwmaterialen) …

Locatie: Volop in de zon, gelegen tussen parkeerplaatsen en groene zone.
Type: Tussen de spanten, rasternet waar klimplanten in kunnen groeien en aangebonden worden, open structuur zonder achterwand
Hoogte: Maximaal 7 meter.
Extra: Spanten mogen niet begroeid worden, moeten vrij blijven van takken, kleine insectenhotels worden toegevoegd

Amsterdam Osdorp BPAO2 ; Interstellar / Heembouw SADC Project VEGA Amsterdam

Verdergaand activeren van Duurzame Mobiliteit (LV, EV, deelmobiliteit, etc.) in groene milieus

Locatie: Vlakvulling tussen lamellen met een vertanding.
Type: Tussen de lamellen, rasternet waar klimplanten in kunnen groeien en aangebonden worden,
Hoogte: 10 meter.
Extra: 1 of 2 soorten per verticaal vlak, om streepjespatroon te verduidelijken zetwerk rondom de panelen voorkomt ingroeien van klimplanten

Amsterdam Osdorp BP AO2 ; Interstel | Heembouw | OD Project VEGA Amsterdam

Verdergaand activeren van WELL perspectief (certificering) / biophilic architecture …

Locatie: Vlakvulling tussen lamellen met een vertanding.
Type: Tussen de lamellen, rasternet waar klimplanten in kunnen groeien en aangebonden worden,
Hoogte: 10 meter.
Extra: 1 of 2 soorten per verticaal vlak, om streepjespatroon te verduidelijken zetwerk rondom de panelen voorkomt ingroeien van klimplanten

Amsterdam Osdorp BPKO2 ; Interstelar / Heembouw SADC Project VEGA Amsterdam

Environmental Design / Key components

Biophilic design is a concept used within the building industry to increase occupant connectivity to the natural environment through the use of direct nature, indirect nature, and space and place conditions.

Used at both the building and city-scale, it aims for health, environmental, and economic benefits for building occupants and urban environments.

We amplify this concept of direct and indirect nature to that of **urban design and spatial integration of environmental solutions for the sake of sustainability (Urban Metabolism ao) and liveability (Urban Climate ao).**

URBAN CLIMATE

Liminal space : ”liminal" comes from the Latin word “limen,” which means threshold. To be in a liminal space means to be on the precipice of something new but not quite there yet. You can be in a liminal space physically, emotionally, or metaphorically. Being in a liminal space can be incredibly uncomfortable for most people, but can also be used as a design strategy for change…

TERRITORIAL METABOLISM

ENVIRONMENTAL DESIGN

image: A.van Timmeren

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environmental technology & design

environmental technology & design

Met dank.

TUDelft

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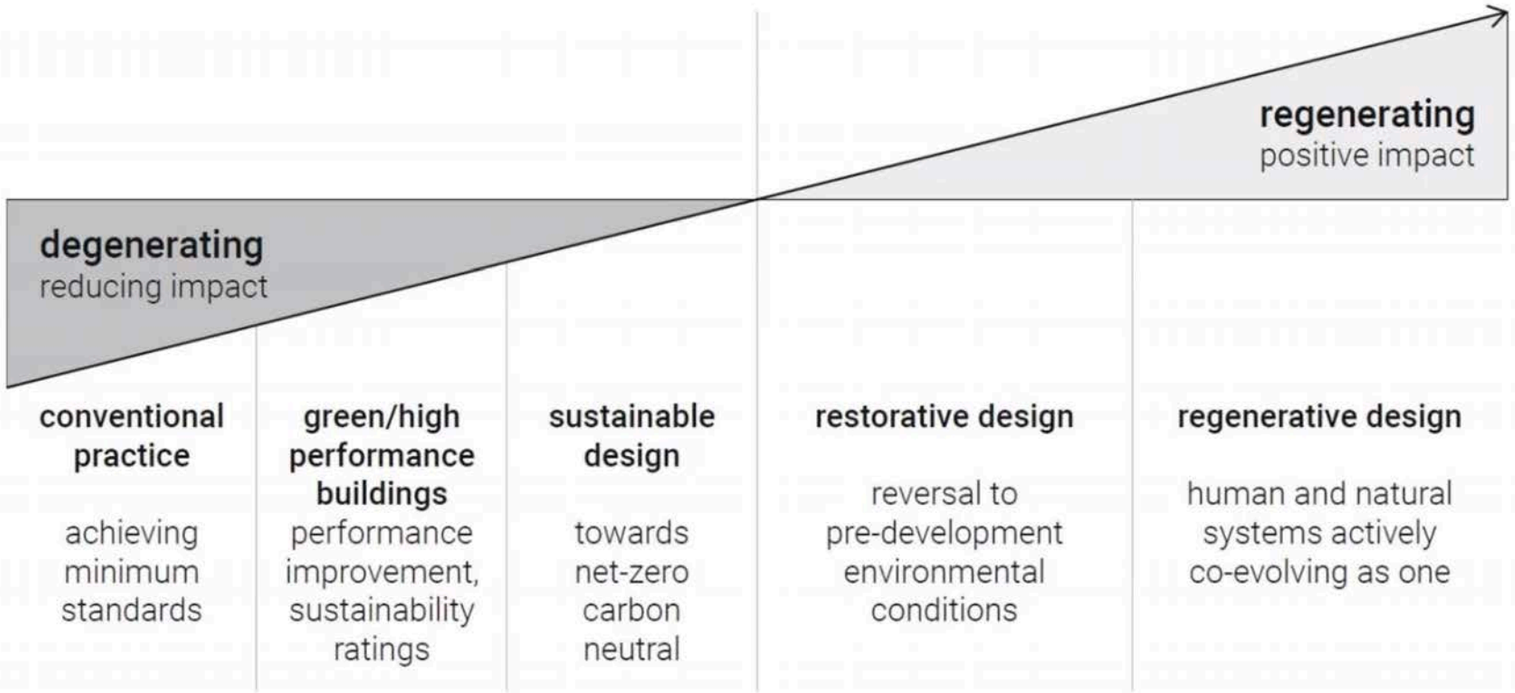
From Sustainable to Regenerative

Inventing a more prosperous society :
liveable, sustainable, resilient and just…

environmental technology & design



Thank you.