

# (RE) CARBON CITY

*Westergouwe as example  
of living in a wetland in the  
western Netherlands*

A sustainable neighborhood that is  
based on and in the landscape ...



LUMION

introducing - framing - analyzing and designing - strategizing - transferring

|...which not only adapts to climate change...



 LUMION

introducing - framing - analyzing and designing - strategizing - transferring

| ...but also helps fight climate change...



CO<sub>2</sub>



 LUMION

introducing - framing - analyzing and designing - strategizing - transferring

...and where you live as  
part of nature.



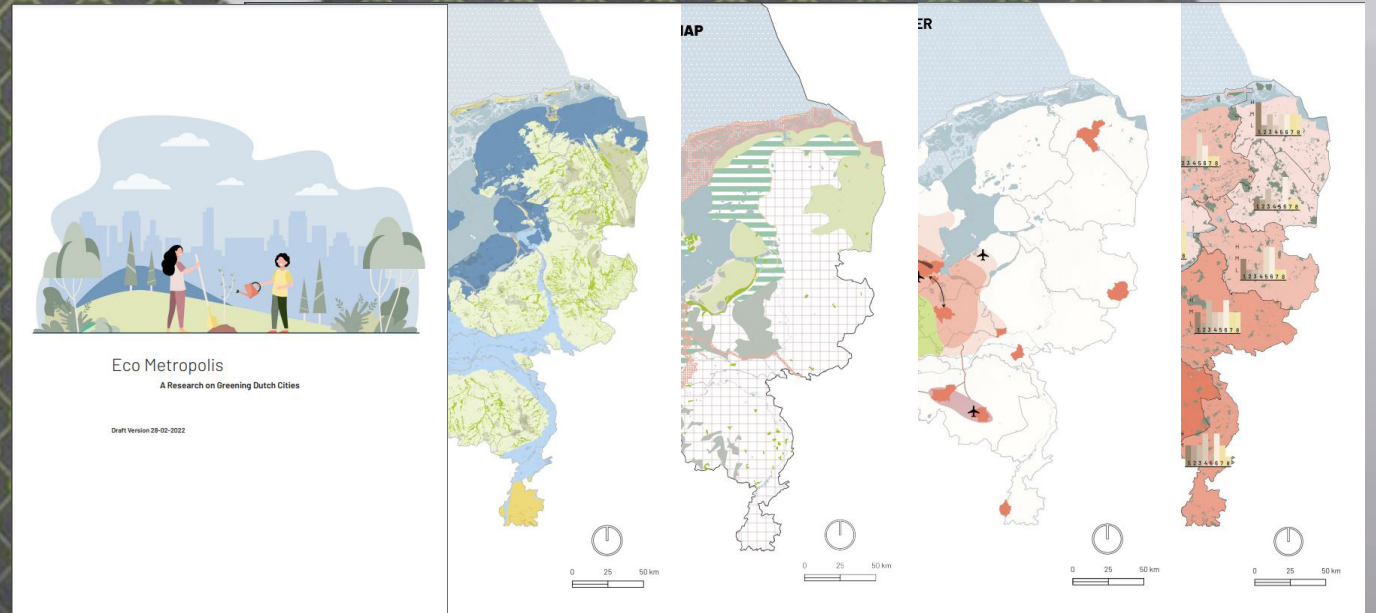
 LUMION



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## STAATSBOSBEHEER GREEN METROPOLIS VISION

Staatsbosbeheer strives for every Dutch person to be connected directly from their doorstep to a green, water-rich network that serves all households as a green utility.



## STAATSBOSBEHEER CARBON STORAGE VISION

“Over the next 10 years, we will rehydrate 5,000 hectares of peatlands, as a contribution to the Climate Agreements. We will realise half of this in the next 5 years.”



# PEATLANDS



**introducing** - framing - analyzing and designing - strategizing - transferring

# PEATLANDS



Veenweiden, by Loek Londo, Zuiderwoude, Noord-Holland in De toekomst van ons veenweidelandschap from [https://www.landschap.nl/wp-content/uploads/2019-3\\_Smolters-etal.pdf](https://www.landschap.nl/wp-content/uploads/2019-3_Smolters-etal.pdf)

**introducing** - framing - analyzing and designing - strategizing - transferring

# WHY SHOULD WE REWET PEATSOIL?

ecosystem services  
from a (re)Carbon city



# WHY SHOULD WE REWET PEATSOIL?

ecosystem services  
from a (re)Carbon city



# WHY SHOULD WE REWET PEATSOIL? ecosystem services from a (re)Carbon city



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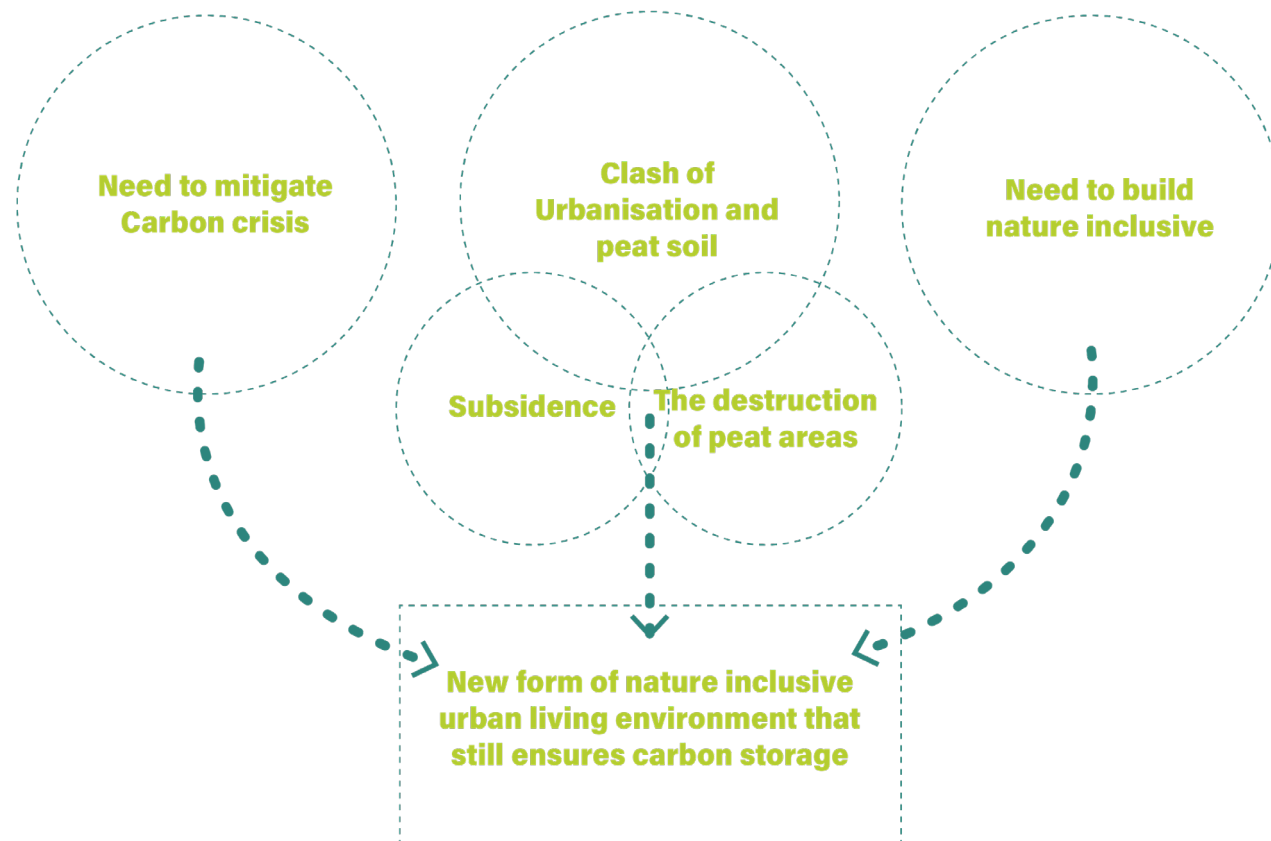
Figure 3.5 ecosystem services from a (re)Carbon city

# WHY SHOULD WE REWET PEATSOIL? ecosystem services from a (re)Carbon city

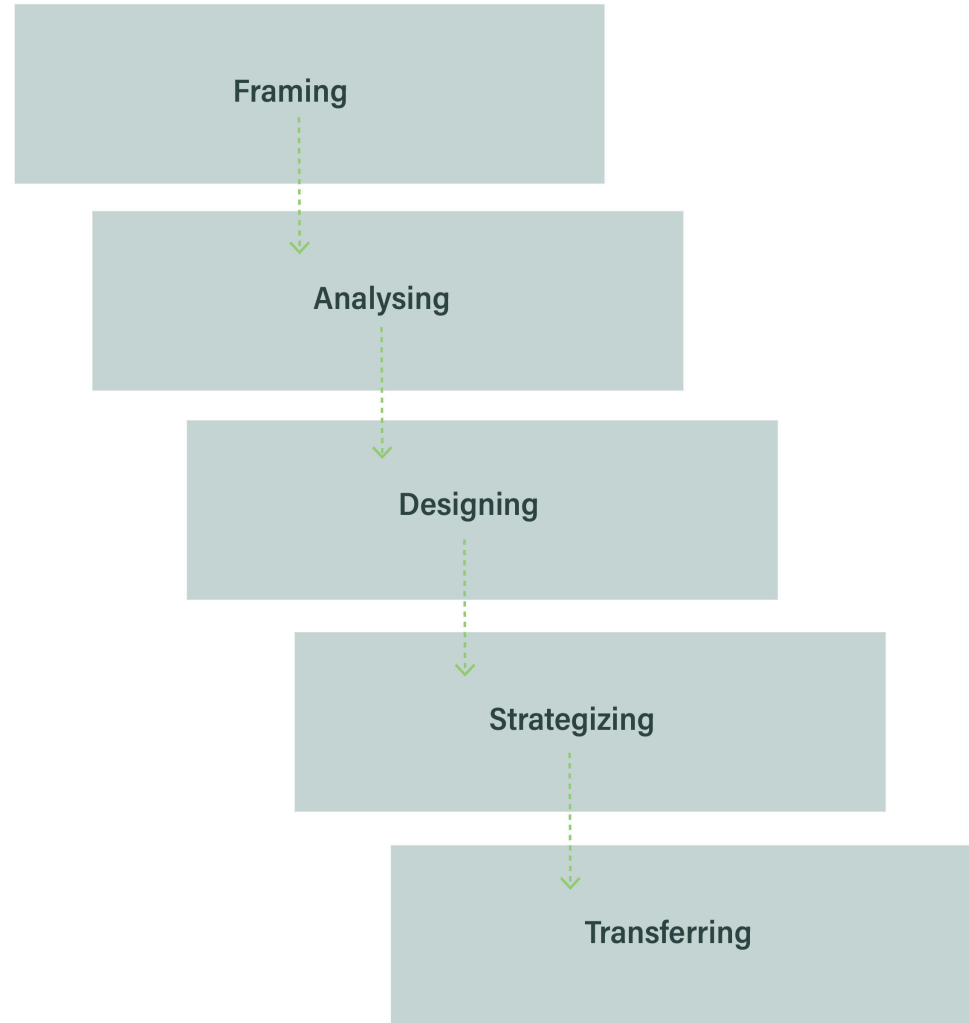


## RESEARCH AIM

This design explores a way to build a nature-inclusive living environment on top of peat soil, trying to preserve the carbon in the soil and store carbon in the built environment itself.

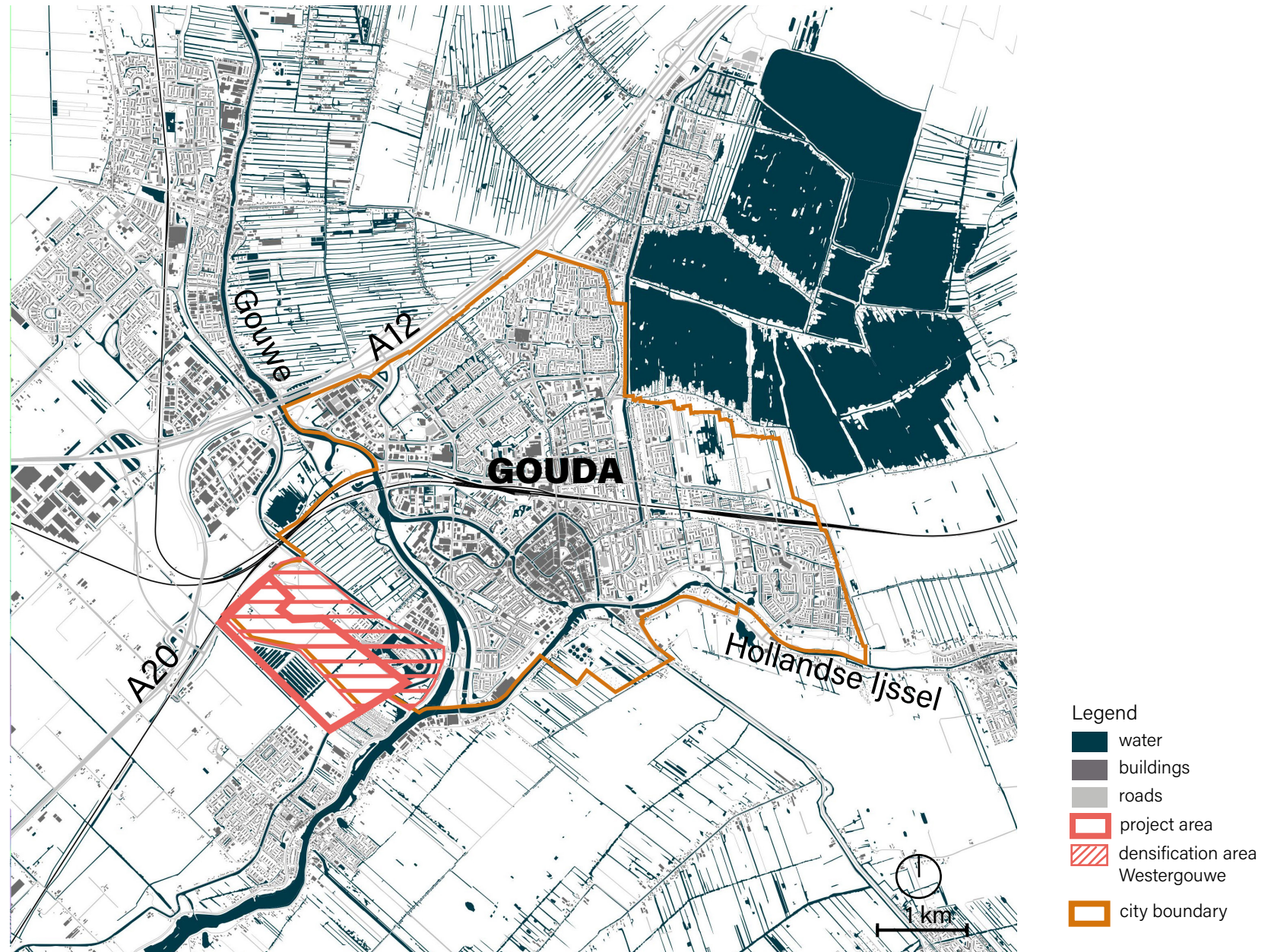


## RESEARCH APPROACH AND PRESENTATION STRUCTURE



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## THE LOCATION WESTERGOUWE



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# THE LOCATION WESTERGOUWE



figures 1.3.2 satellite image location from "google maps.nl"  
(<https://www.google.nl/maps/@52.0024003,4.6792561,2872m/data=!3m1!1e3!5m1!1e4>)

## HOW WE SHOULD NOT DO IT



**SCHIE TV: De verzakte wijk de Akkers wordt grondig aangepakt en kan er straks weer 20 jaar tegenaan**

🕒 Donderdag 2 september 2021

📍 Schiedam

Vorige week zijn de werkzaamheden in de wijk De Akkers in Schiedam-Noord van start gegaan. Het gebied is verzakt en moet worden opgehoogd.

<https://schie.nu/nieuws/11775/de-verzakte-wijk-de-akkers-wordt-grondig-aangepakt-en-kan-er-straks-weer-20-jaar-tegenaan>

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## THE HISTORICAL LANDSCAPE

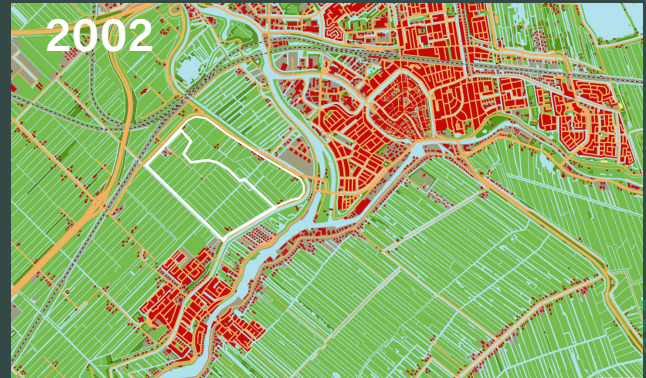
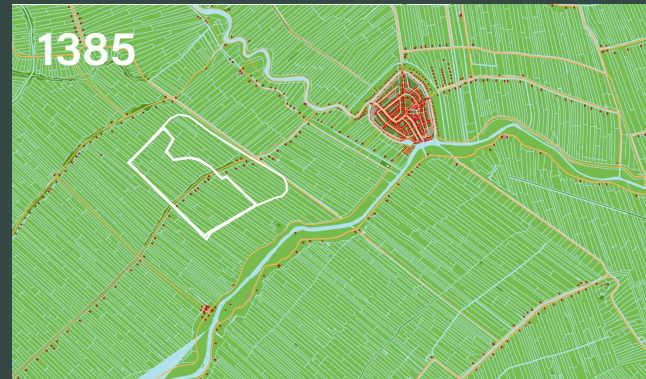
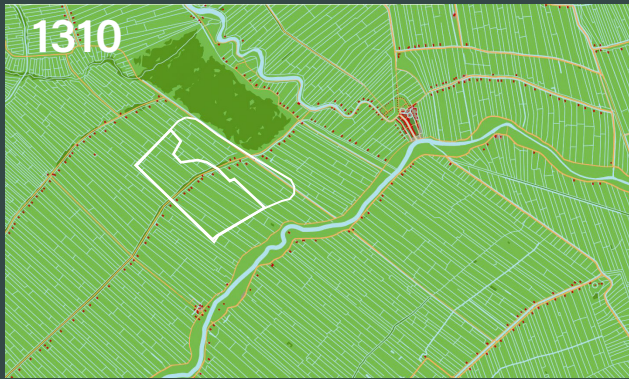
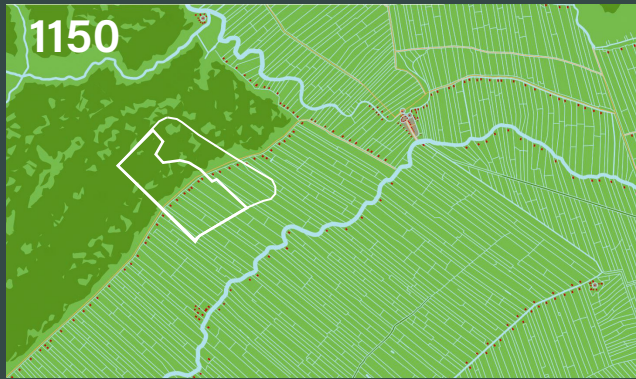


Figure 4.1 history of the landscape.  
from "mappinghistory.nl" 2021  
(<https://mappinghistory.nl/>)

# CATCHING CO<sub>2</sub> WITH REWETTED PEAT SOIL

Project Omhoog met het Veen



12 oktober 2017 Ilperveld

8 cm in 3,5 years!



Figure 3.3.3.2 Vegetation development in Omhoog met het Veen landscapeNL from *Herstel van een veenvormende veenmosvegetatie op voormalige landbouwgrond in veenweidegebieden*, Bas van der BEEK Onderzoekcentrum B-WARZ, 2018 ([https://www.landschapnoordholland.nl/files/2023-07/Van%20der%20Bee%20et%20al%202018\\_Gedragportage%20Omhoog%20het%20het%20Veen%202013-2017\\_def.pdf](https://www.landschapnoordholland.nl/files/2023-07/Van%20der%20Bee%20et%20al%202018_Gedragportage%20Omhoog%20het%20het%20Veen%202013-2017_def.pdf)) Copyright of Bas van der BEEK Onderzoekcentrum B-WARZ. All rights reserved.

Alive peatmoss layer

New peatmoss layer

Old peat layer

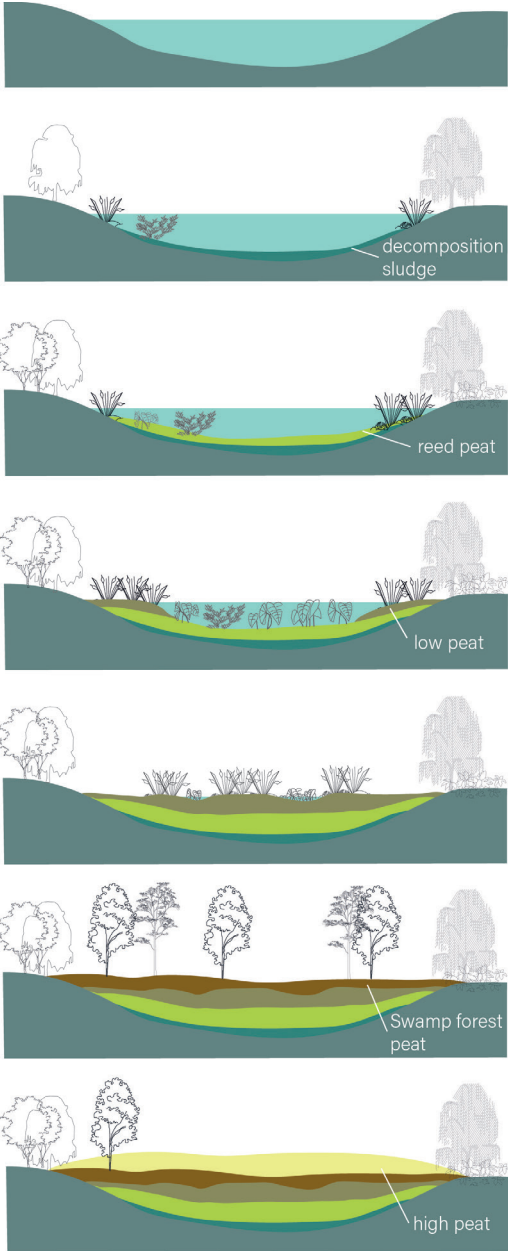


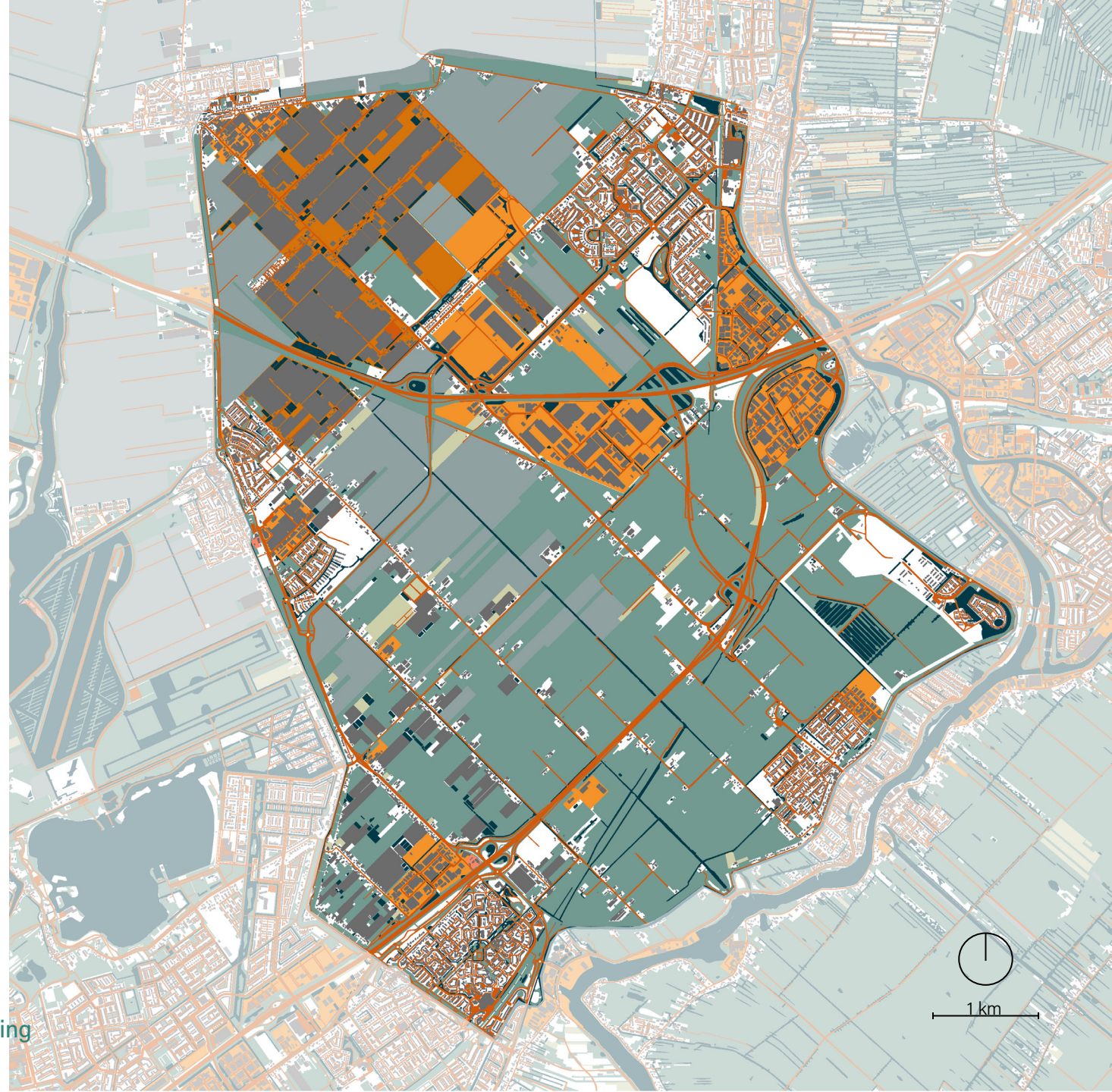
figure 3.3.3.1 the succession of peat by author, based on Afb. 7.21 Successie: het ontstaan van hoogveen by "stedentipsvoortrips.nl" (<https://www.stedentipsvoortrips.nl/flora/relaties-vier-successiebb.htm>)

# THE DANGERS OF THE ZUIDPLASPOLDER

## Polluting functions

### Legend

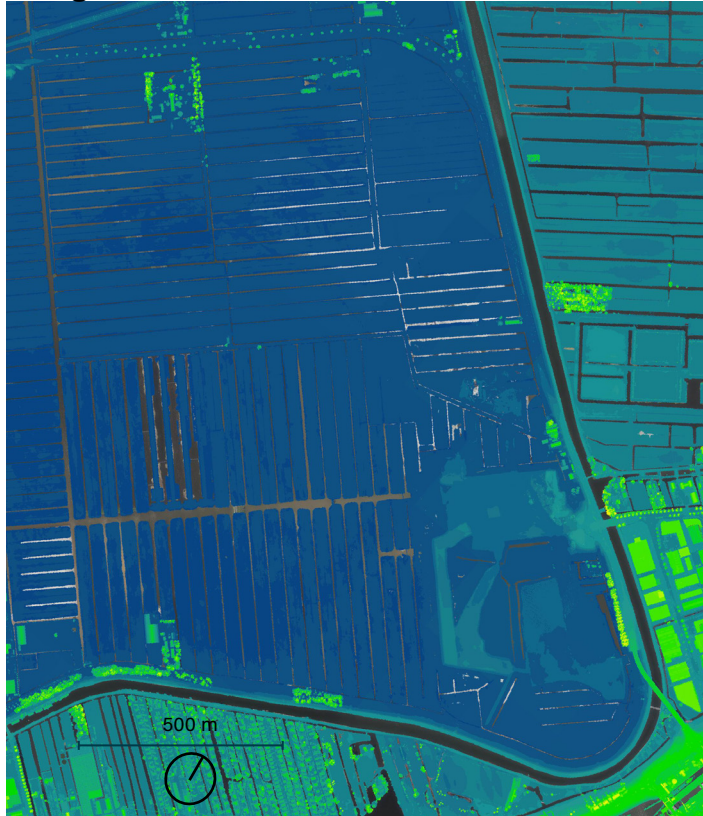
- buildings
- roads
- water
- bussinessparks
- harbour
- greenhouses
- waste management
- arable farming
- grasslands
- orchard
- tree farm



# (DE)POLDERING

## Using rainwater

### Height differences



### Water collection



### New watersystem



# (DE)POLDERING

## New watersystem

- Legend
- water deeper than 1 m
  - water 0,2 m
  - water after rainfall
  - dyke
  - existing roads
  - pumping station
  - sluis
  - waterflow

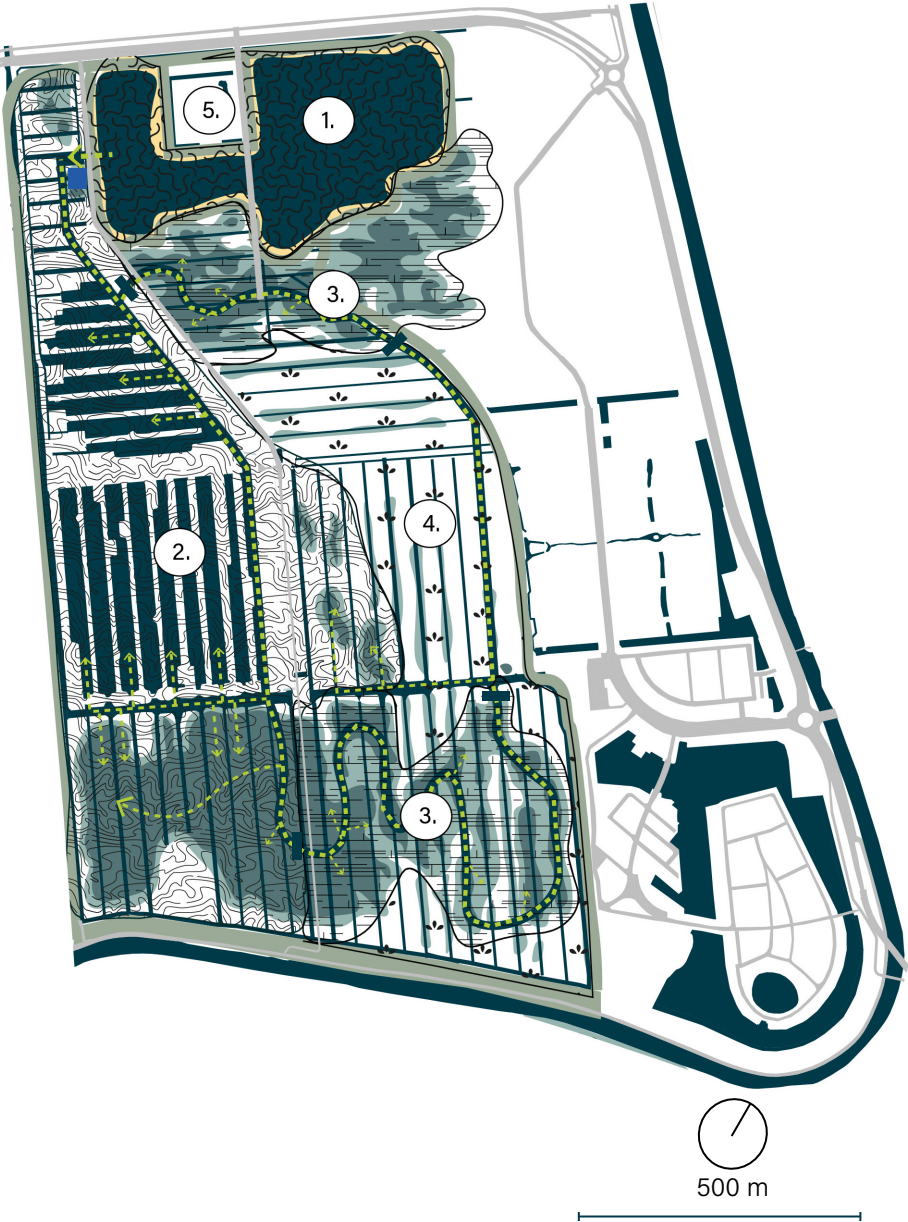
1. **WATER RESERVOIR**  
water:  
highly fluctuating  
0 to 1,6 m

2. **CONSTANTLY WET**  
water:  
constantly wet  
0 to 0,2 m

3. **PERIODICALLY WET**  
water:  
periodically wet when rain  
- 0,2 to 0,2 m

4. **HUMID**  
water:  
humid  
-0,3 to 0 m

5. **POCKET**  
water:  
dry



# A PALETTE OF BIOTOPES

New zones with their biotopes



Biotope:

"the environment associated with a particular ecological community"

- Oxford Languages

## 1. LIVING RESERVOIR

water:  
highly fluctuating (+/-1,6m)

biotopes:  
-reedland  
-willow forest

## 2. PEAT NATURE PARK

water:  
constantly wet; 0 m to +0,20 m

biotopes:  
-mesotrophic marchland  
-quacking bog

## 3. RAIN GARDEN

water:  
- 0,20 m to 0 m

biotopes:  
- humid reed peat meadow  
- alder forest

## 4. PEAT POLDER NATURE

water:  
- 0,30 m

biotopes:  
- peat meadow  
- peat roughs  
- ash alder forest

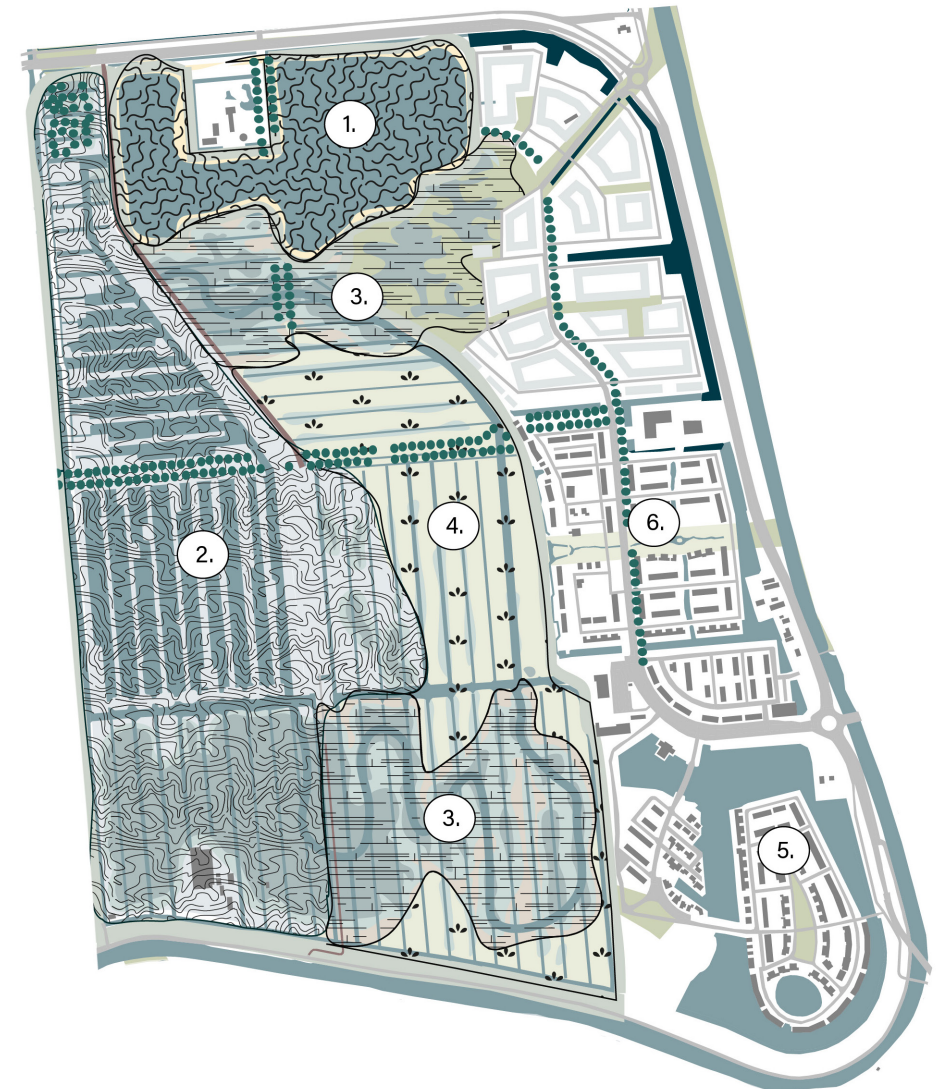
## 5. GARDENS

water:  
dry

biotopes:  
- garden biotope

## 6. WADIPARK

water:  
periodically wet when it has  
rained

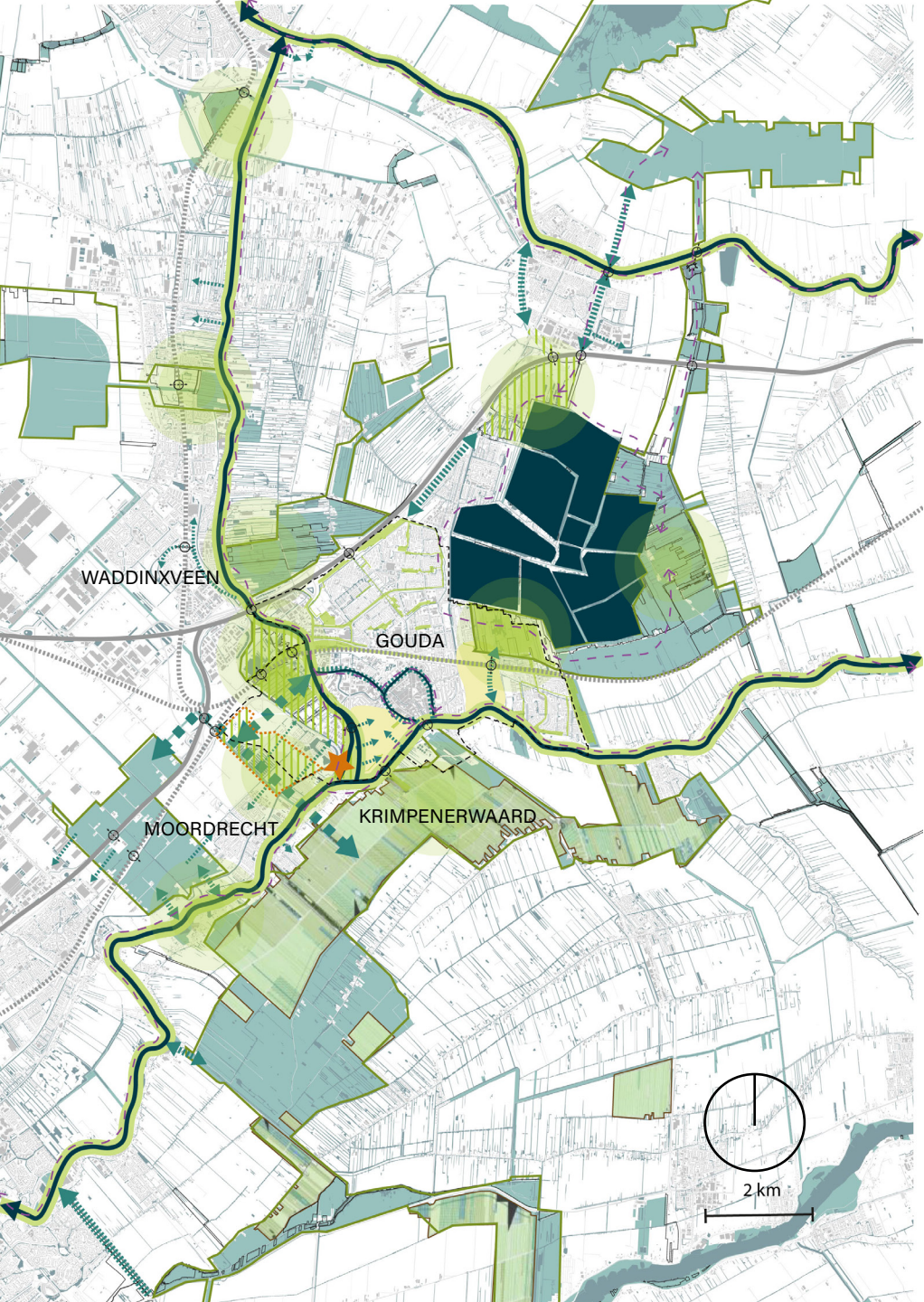


500 m

# CREATING THE GREEN METROPOLIS

## New green structure vision Gouda

- LEGEND
- Water
  - Grassland
  - Forest
  - Project location
  - Main Water Structure
  - Greenify
  - New Green Connections
  - Hotspots: places to visit
  - recreational walking/cycling route
  - Landmark
  - Bridge needed
  - Planned ecological structure Gouda
  - NNN Structure
  - Green area
  - poor livable area
  - Staatsforestry property

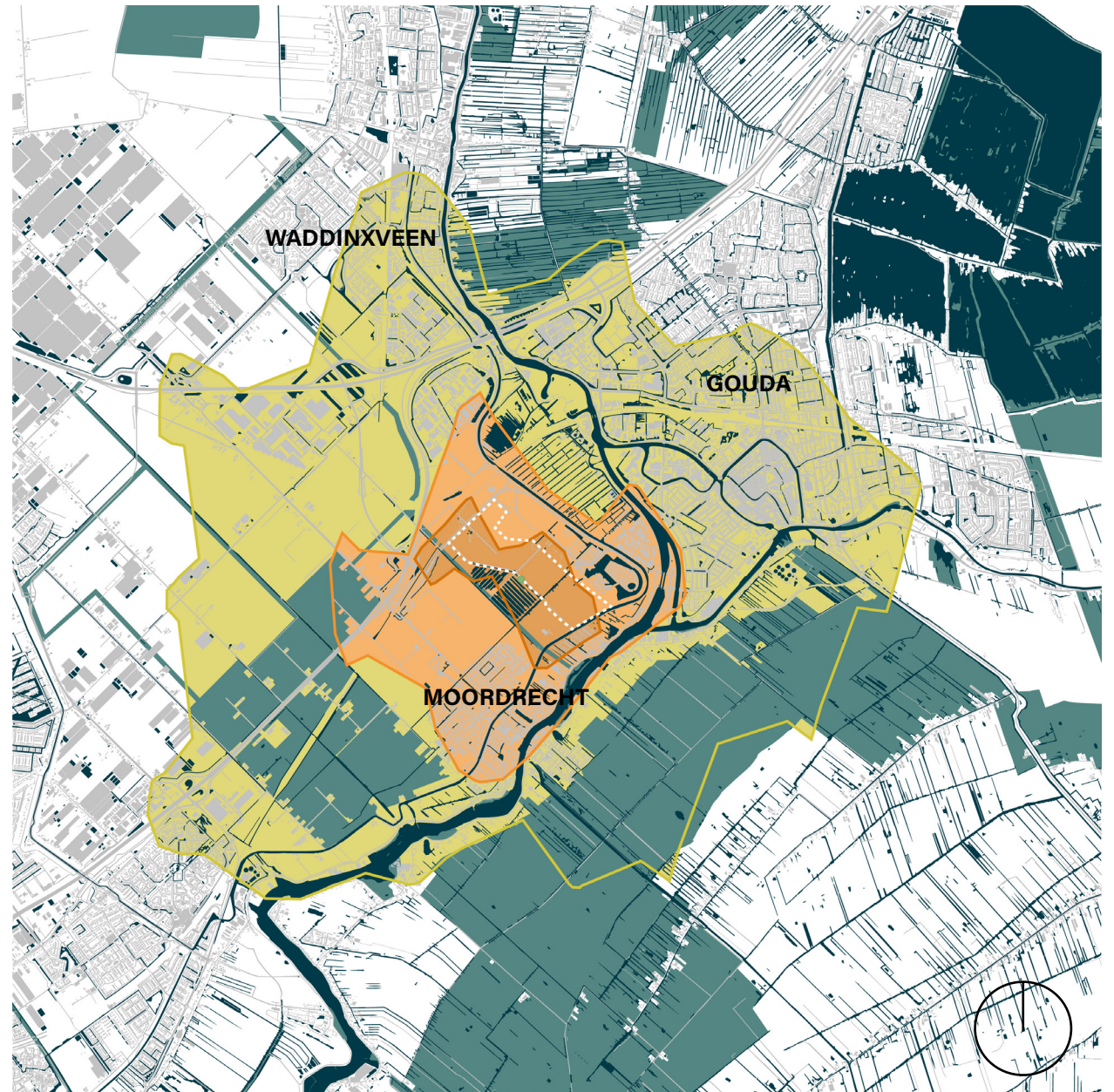


# CREATING THE GREEN METROPOLIS

Cycling time from green blue zone

## Legend

- 5 min
- 10 min
- 20 min
- NNN areas
- water
- roads



# CATCHING CO2 INTO THE BUILT ENVIRONMENT

## Peat-based carbon-storing building materials

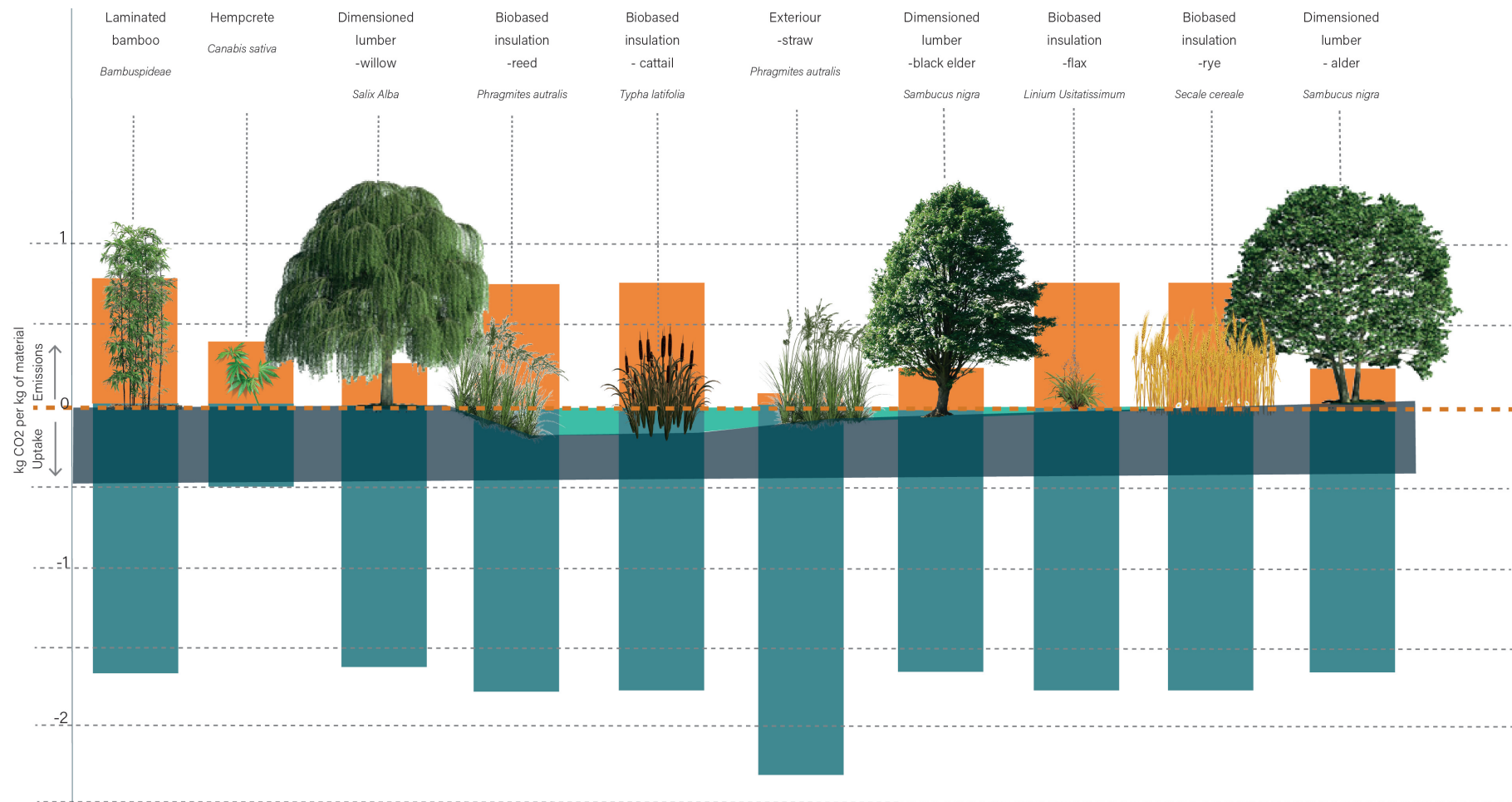


figure 3.3.2.1 Peat-based carbon-storing building materials. by author based on farm of the Future by R. Kobben, 2021, (<https://repository.tudelft.nl/islandora/object/uuid%3A20f019f6-0a50-4d44-8dc1-3c83b8743fad?collection=education>) and on Pomponi, F., Hart, J., Arehart, J. H., D'Amico, B., 2020 (<https://cdrlaw.org/wp-content/uploads/2020/09/PIIS2590332220303626.pdf>)

# WET HOUSING

## Floating homes



## Amphibious Houses



## Pole houses



# MOVING THROUGH A WETLAND

## New infrastructure

### Raised wooden pathways



Raised wooden pathways. By Pexels via Pixabay (<https://pixabay.com/nl/photos/pad-wetlands-buitenshuis-1839000/>)

### Fly ash

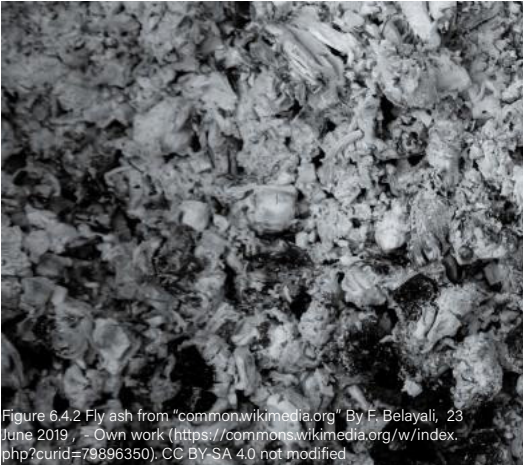


Figure 6.4.2 Fly ash from "common.wikimedia.org" By F. Belayali, 23 June 2019, - Own work (<https://commons.wikimedia.org/w/index.php?curid=79896350>); CC BY-SA 4.0 not modified

### Floating pathways

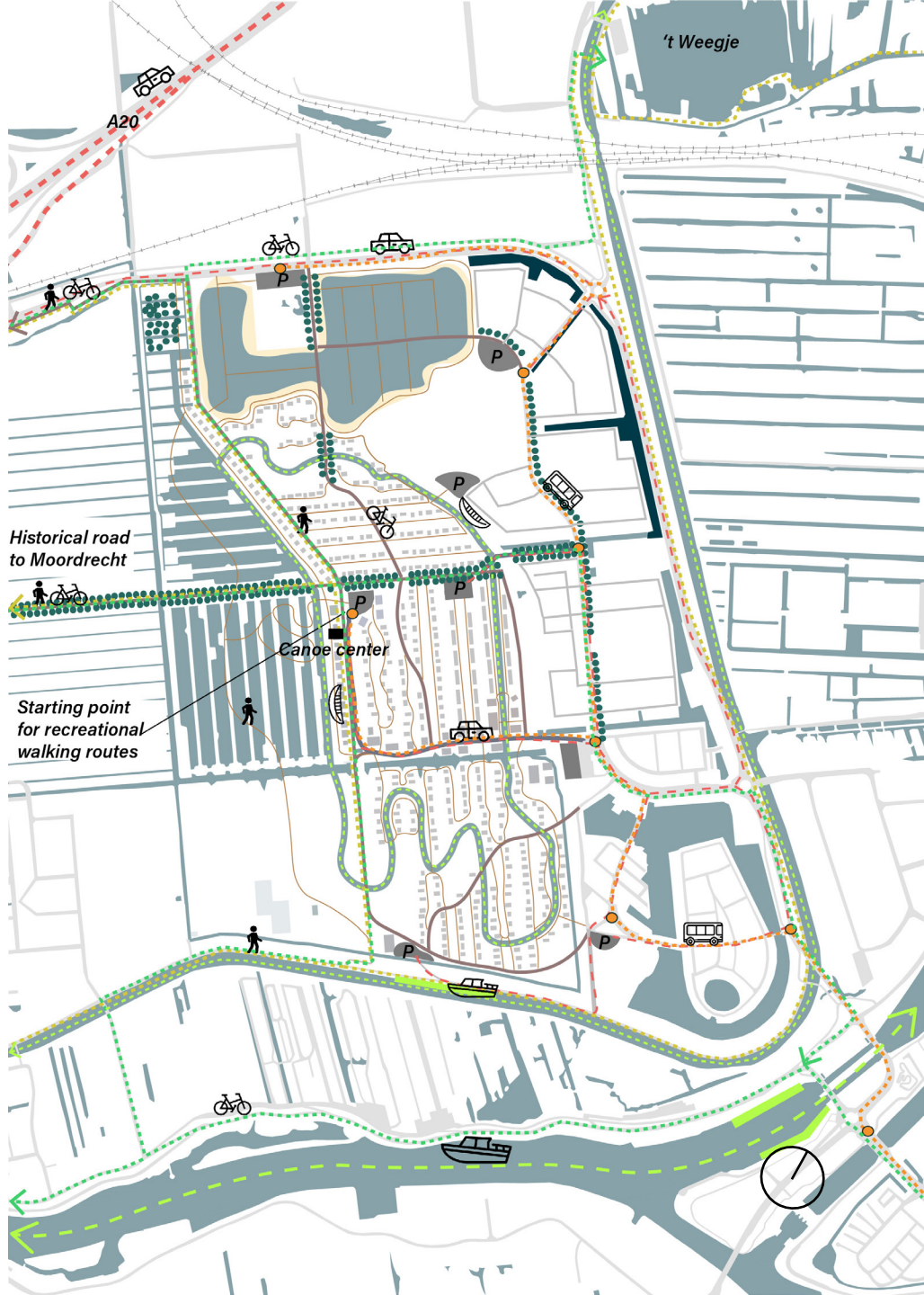


Figure 6.4.4 Floating pathways. from "flickr.com" by Province of British Columbia, 2008, (<https://www.flickr.com/photos/bcgov/photos/15358939273/>) CC BY-NC-ND 2.0

### Waterways

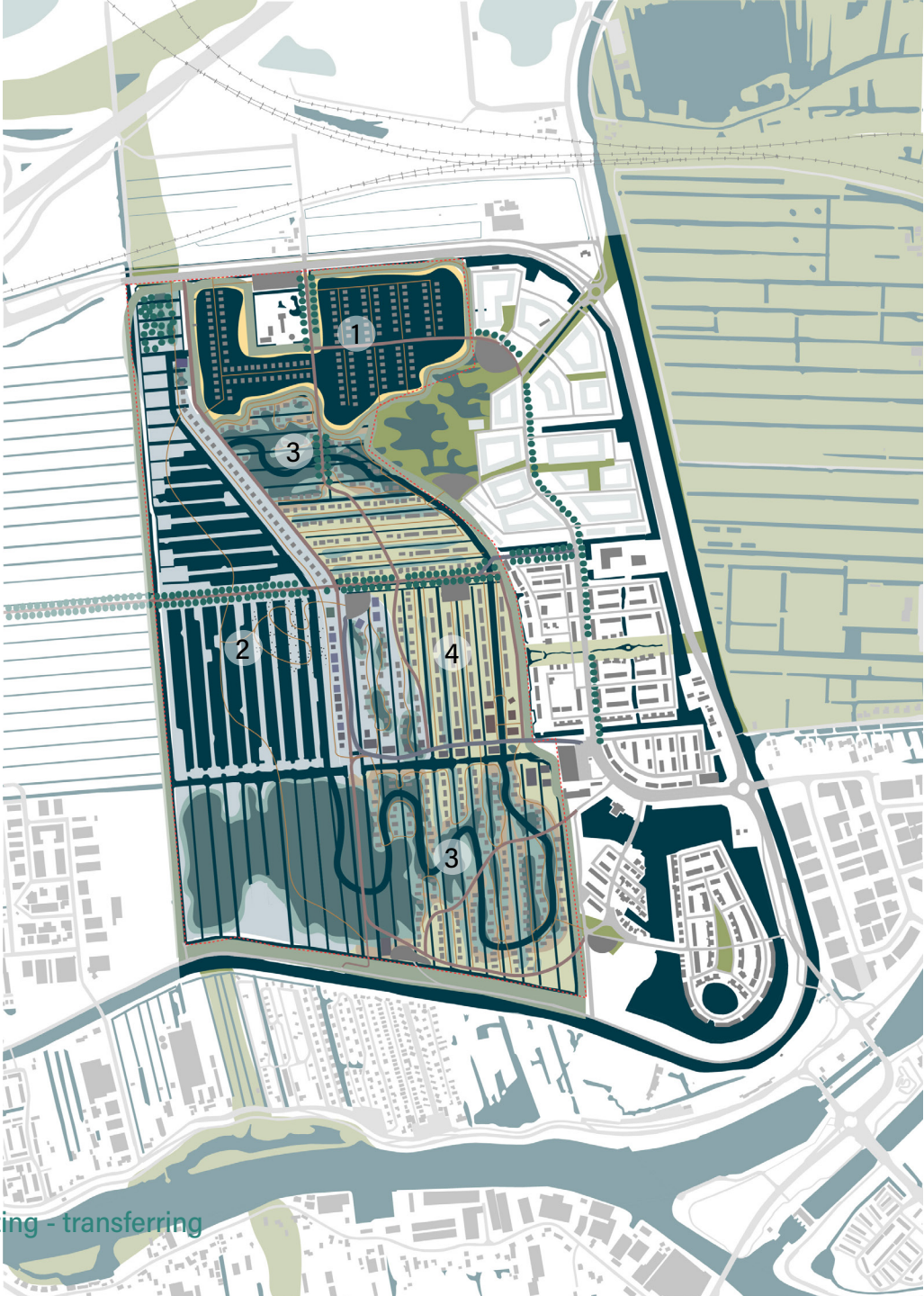


Figure 6.4.3 Waterways. By P. van der Sluijs, 6 May 2016 (<https://commons.wikimedia.org/w/index.php?curid=48601400>) CC BY-SA 3.0



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- LEGEND
- Water deeper than 1 m
  - Water 0.3m
  - Water after rain
  - Dyke
  - Car accesable roads
  - Houses
  - Buildings old design, not build yet
  - offices and shops
  - School building
  - Recreational center
  - Horeca
  - Parking
  - Main raised bicycle roads
  - Pedestrian/ bicycle paths
  - raised car accesable road
  - Playnature
  - Green outside of project area
  - Project Area



# ZONE 1 LIVING RESERVOIR

1. LIVING RESERVOIR



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# ZONE 1 : REEDLANDS AND WILLOW FORESTS



## REEDLAND



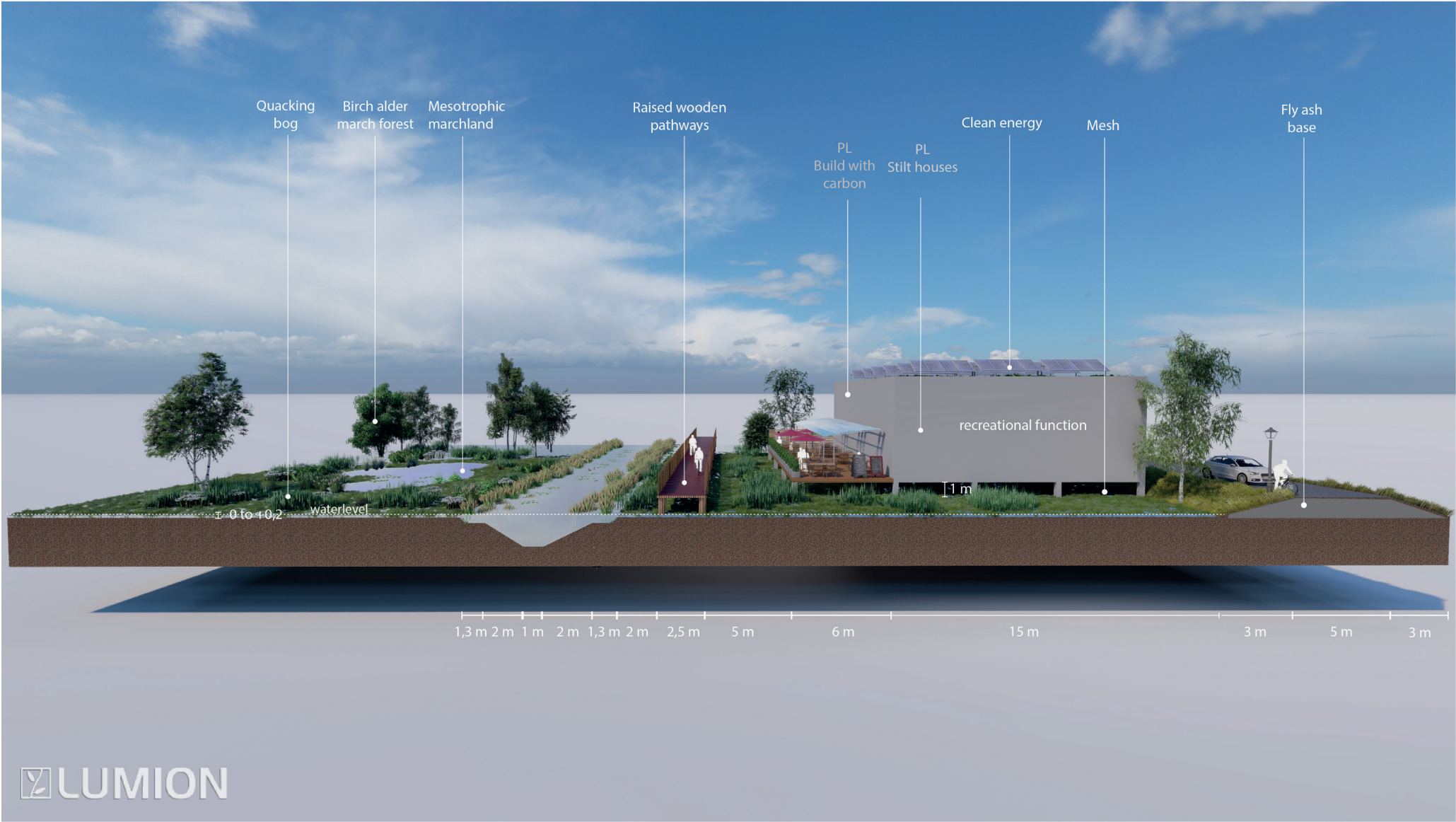
## WILLOW FOREST



introducing - framing - **analyzing and designing** - strategizing - transferring

# ZONE 2 PEAT NATURE

2. PEAT NATURE PARK



## ZONE 2: MARCHLANDS, QUACKING BOGS AND MARCHFORESTS



MESOTROPHIC  
MARCHLAND



QUACKING BOG



BIRCH ALDER MARCH  
FOREST



# ZONE 3 RAINGARDEN

3. RAIN GARDEN



## ZONE 3: REED MEADOWS, HUMID PEAT MEADOWS AND ALDER FORESTS



### HUMID PEAT REED MEADOW



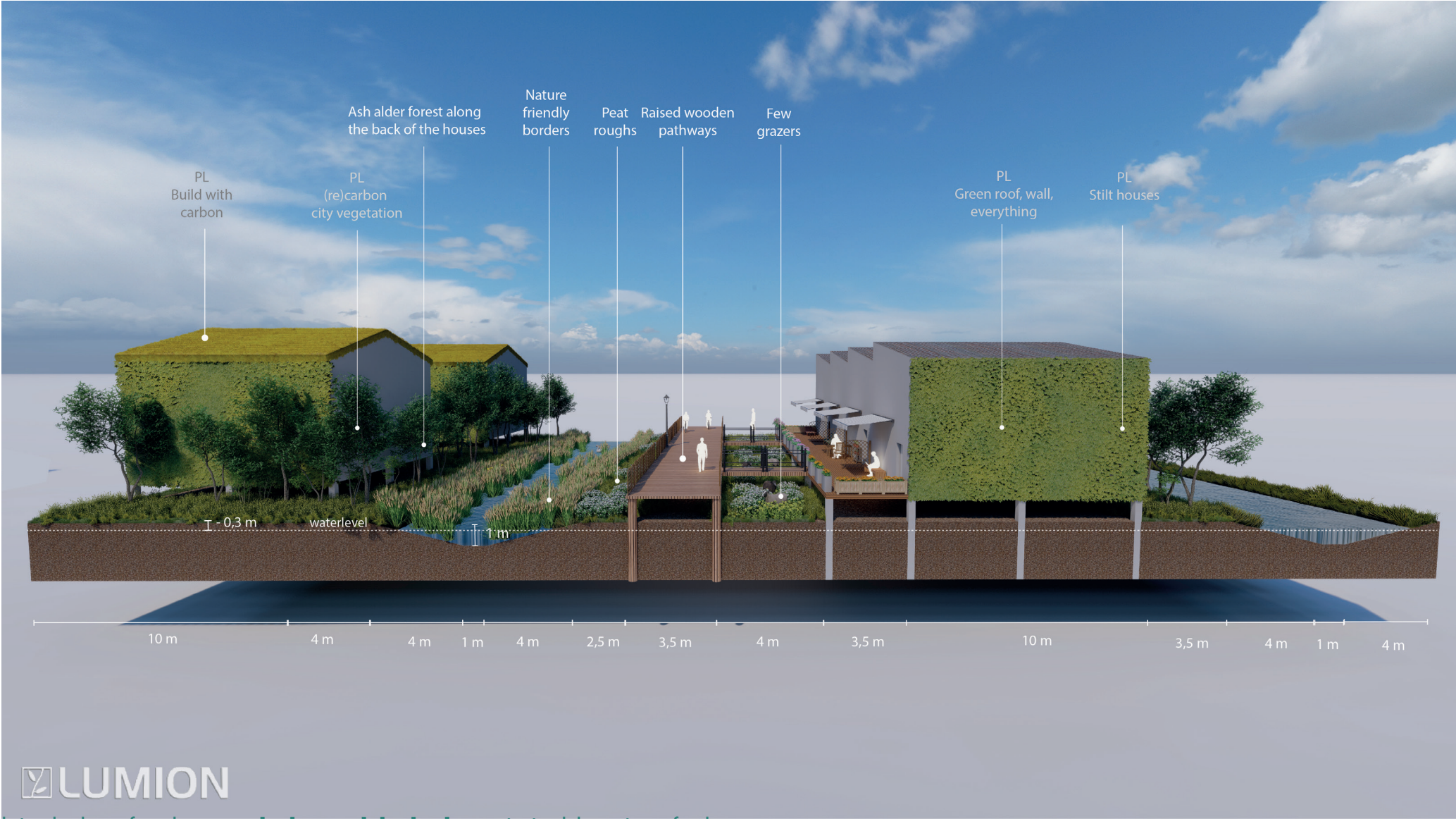
### ALDER FOREST



introducing - framing - **analyzing and designing** - strategizing - transferring

# ZONE 4 PEAT POLDER NATURE

4. PEAT POLDER NATURE



introducing - framing - **analyzing and designing** - strategizing - transferring

## ZONE 4: PEAT MEADOWS, PEAT ROUGHS AND ASH ALDER FORESTS



PEAT MEADOW



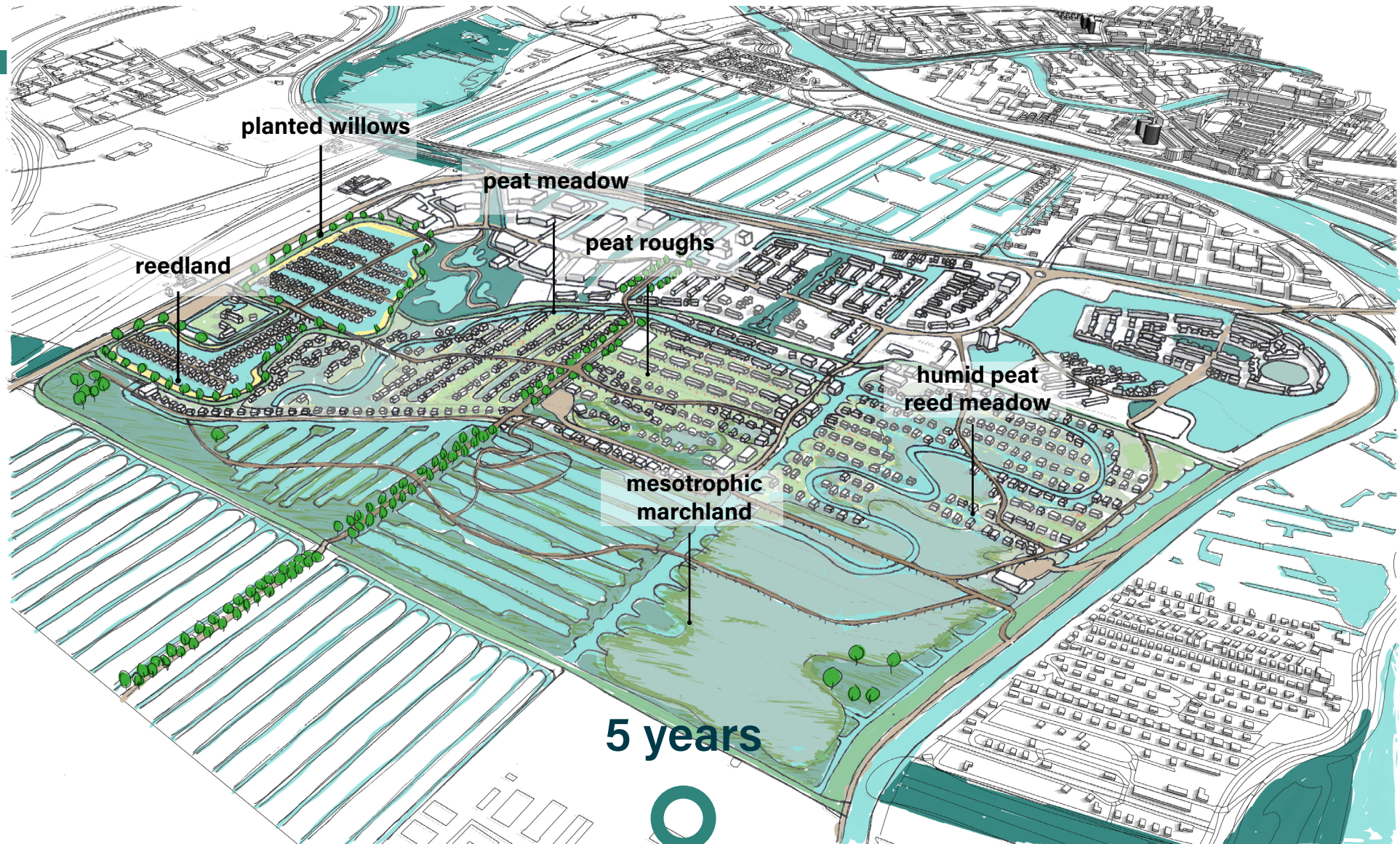
PEAT ROUGHS



ASH ALDER FOREST



# DESIGN THROUGH TIME



realization

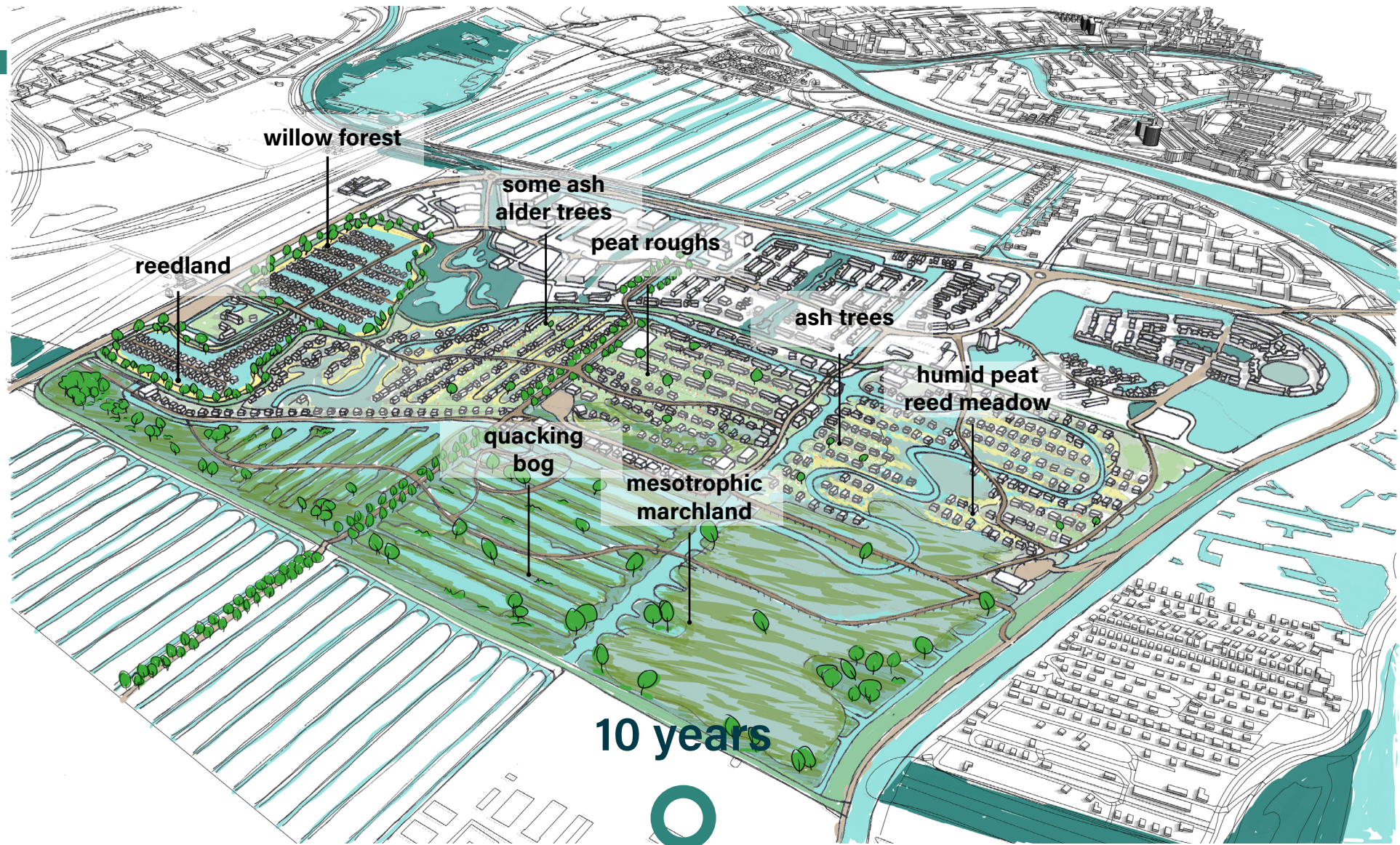
5 years

10 years



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# DESIGN THROUGH TIME



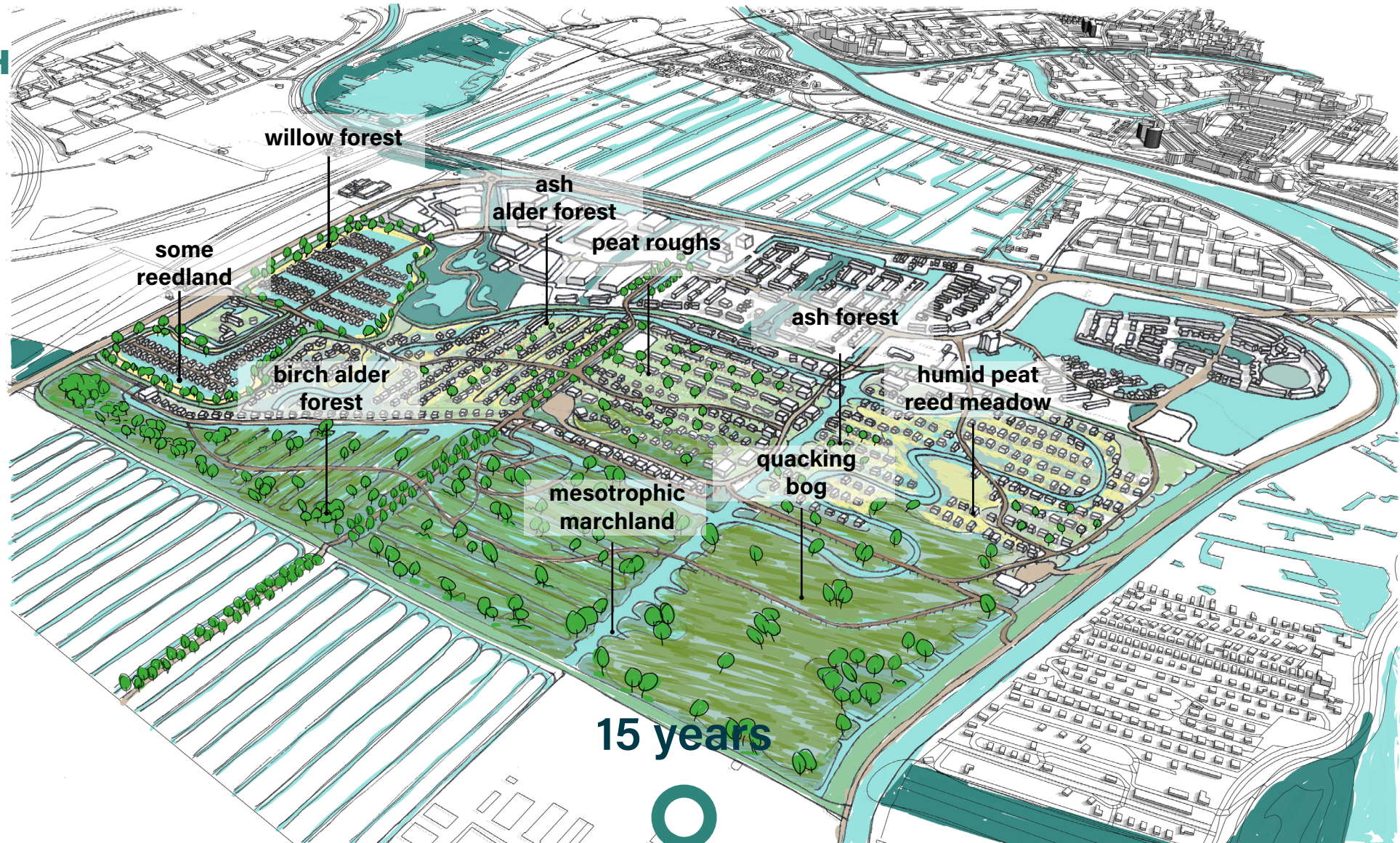
5 years

10 years

15 years

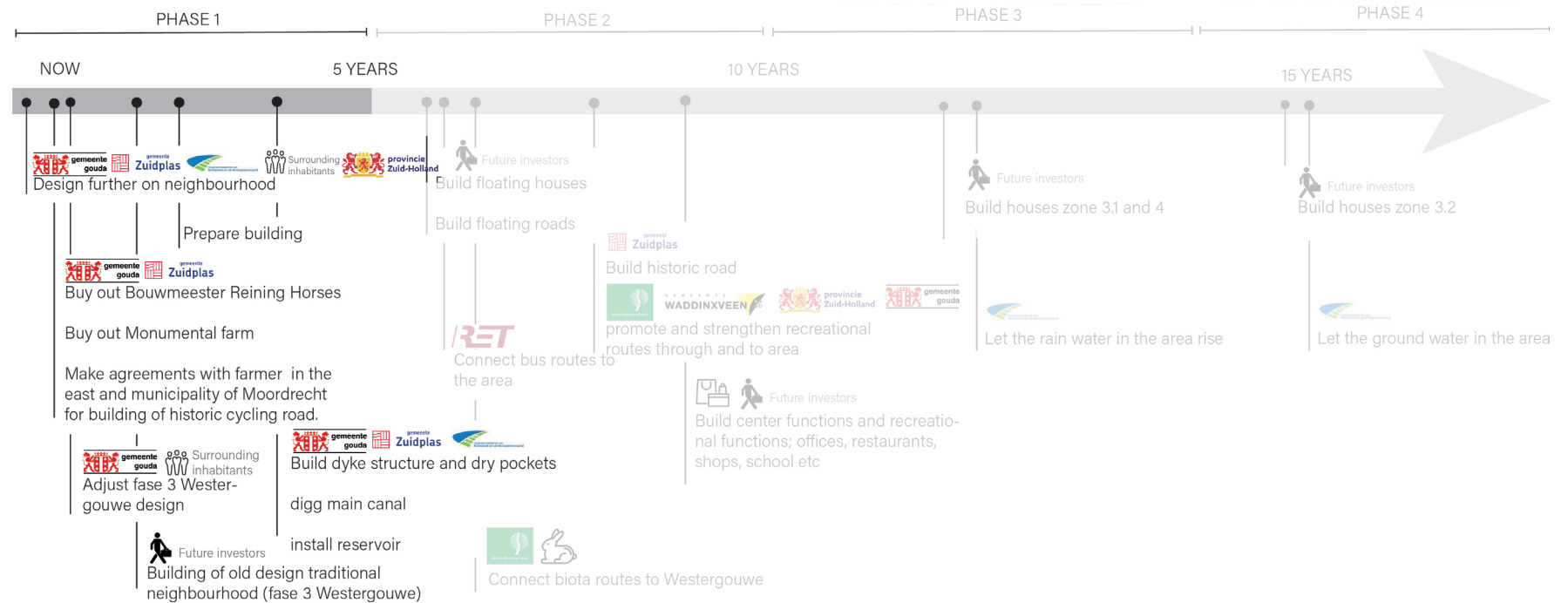
introducing - framing - **analyzing and designing** - strategizing - transferring

## DESIGN THROUGH TIME



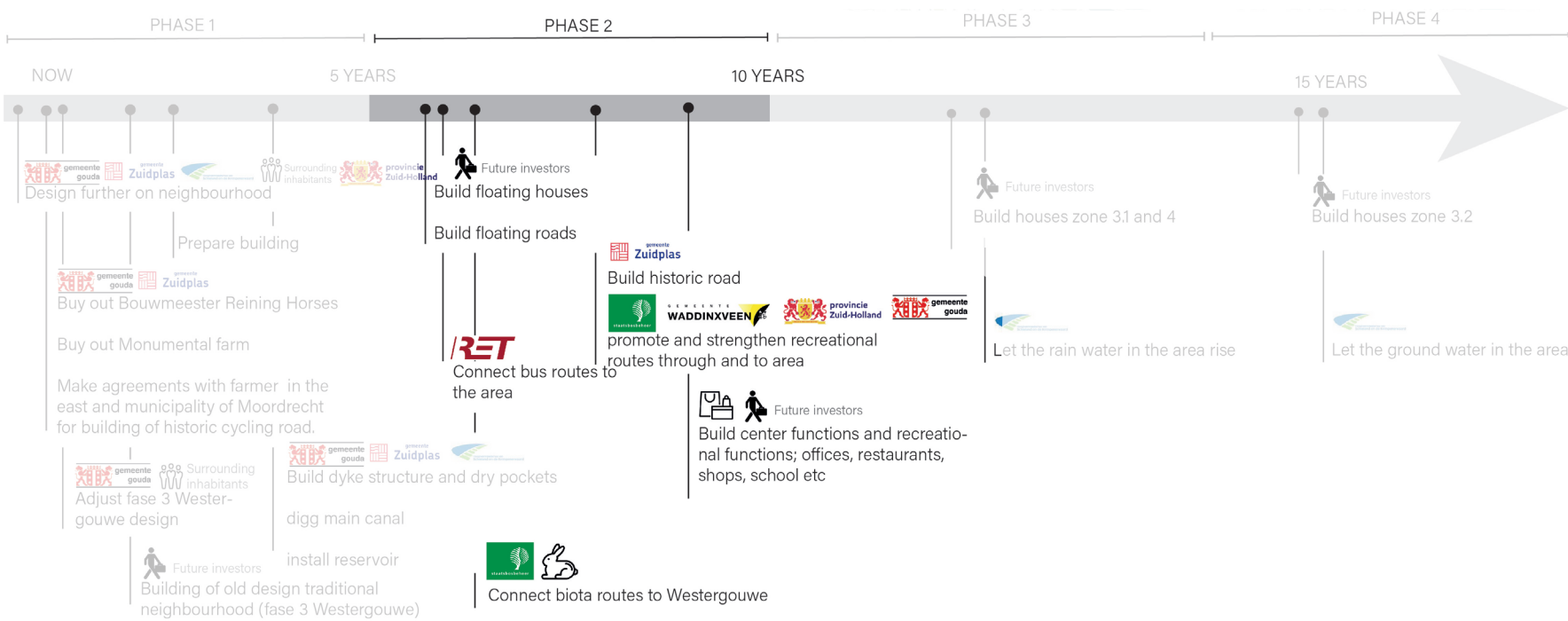
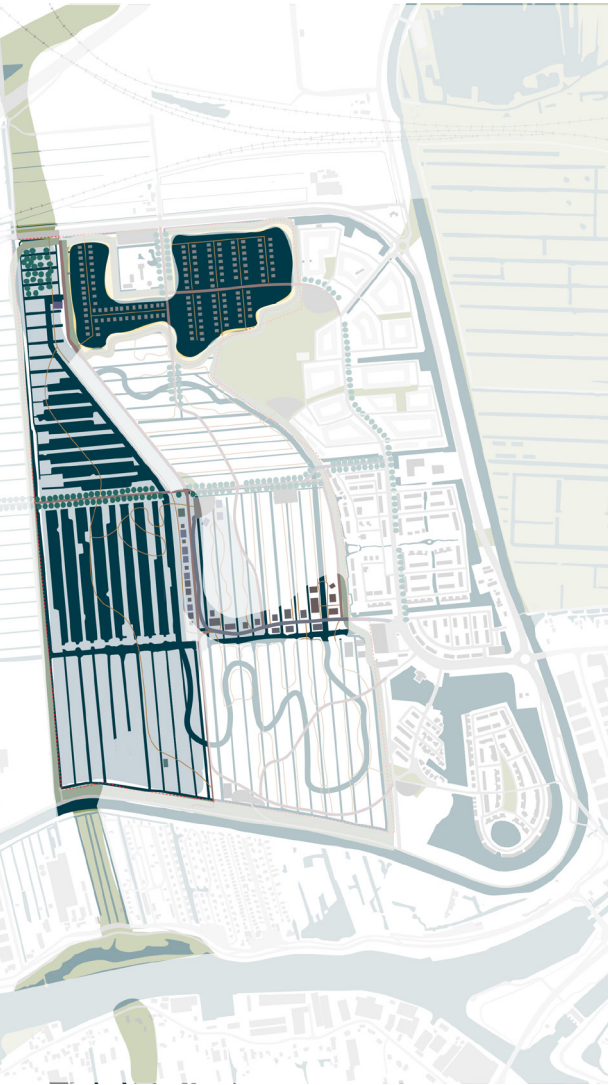
10 years

15 years

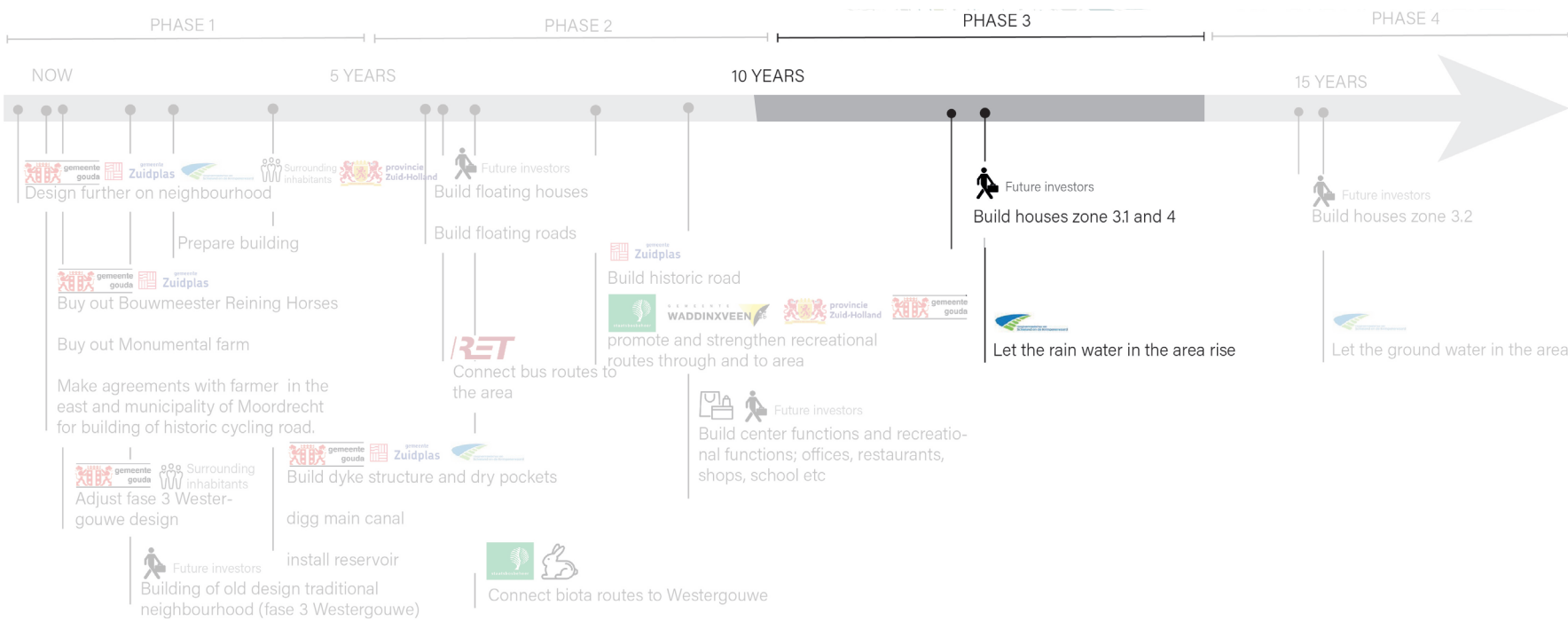
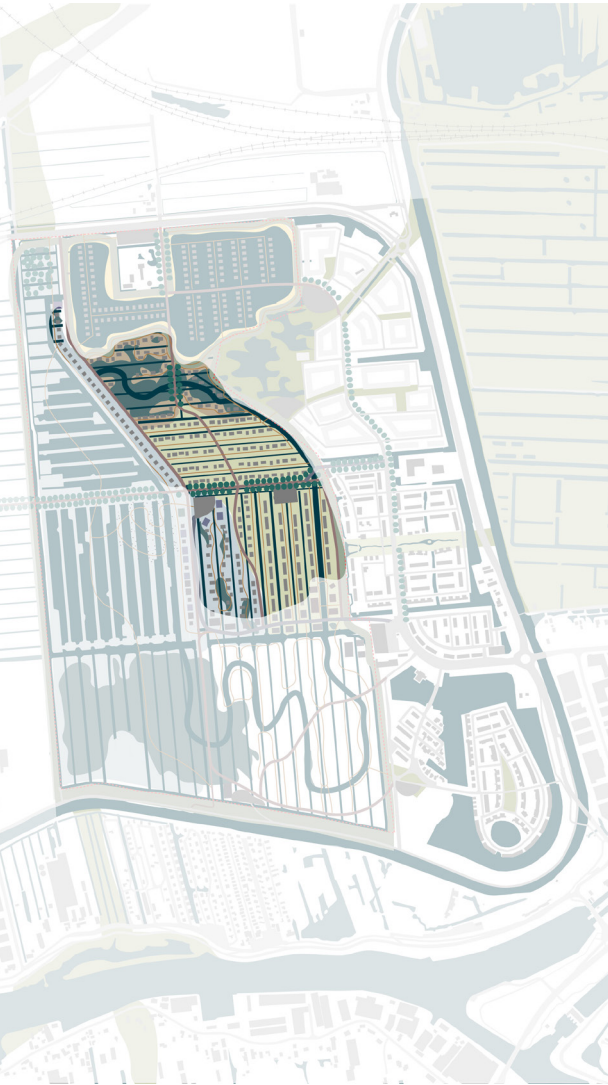


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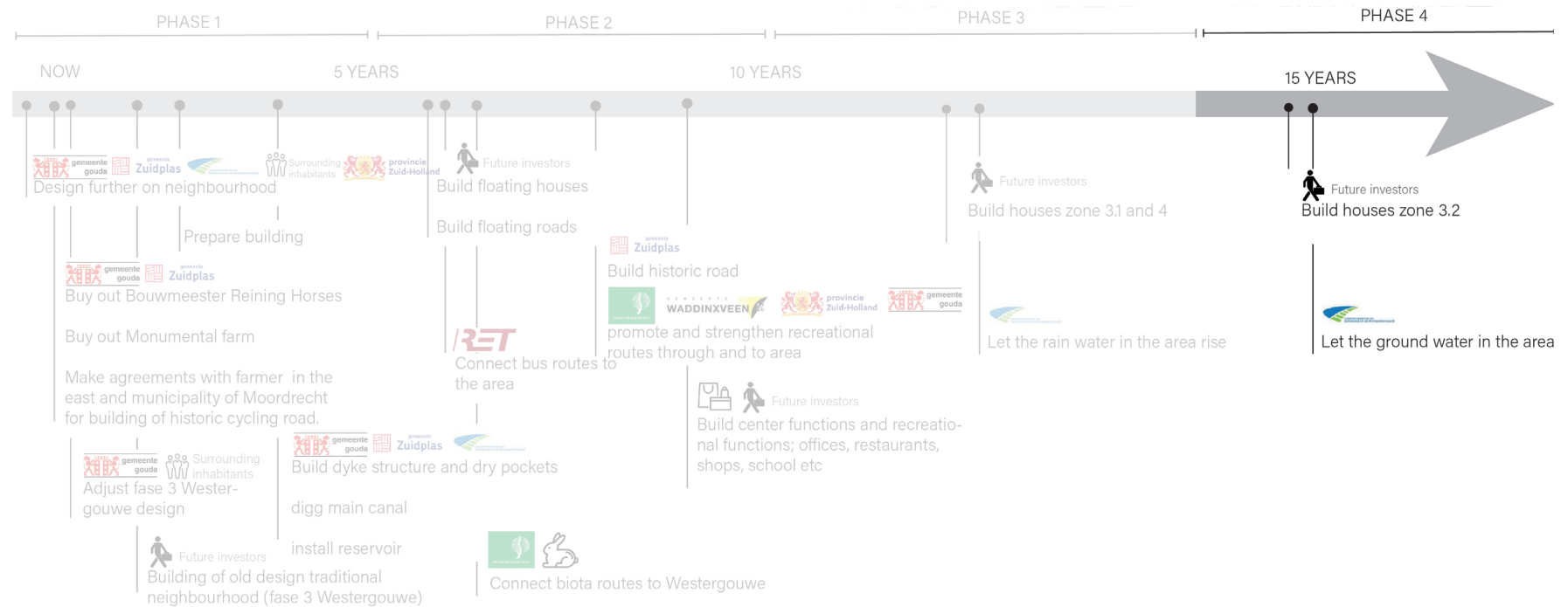
# PHASING AND STAKEHOLDERS



# PHASING AND STAKEHOLDERS



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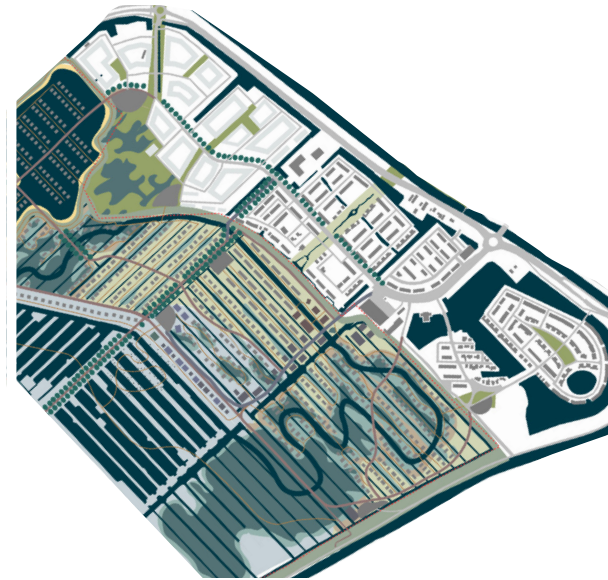
## POSITIONING



Old and new masterplan



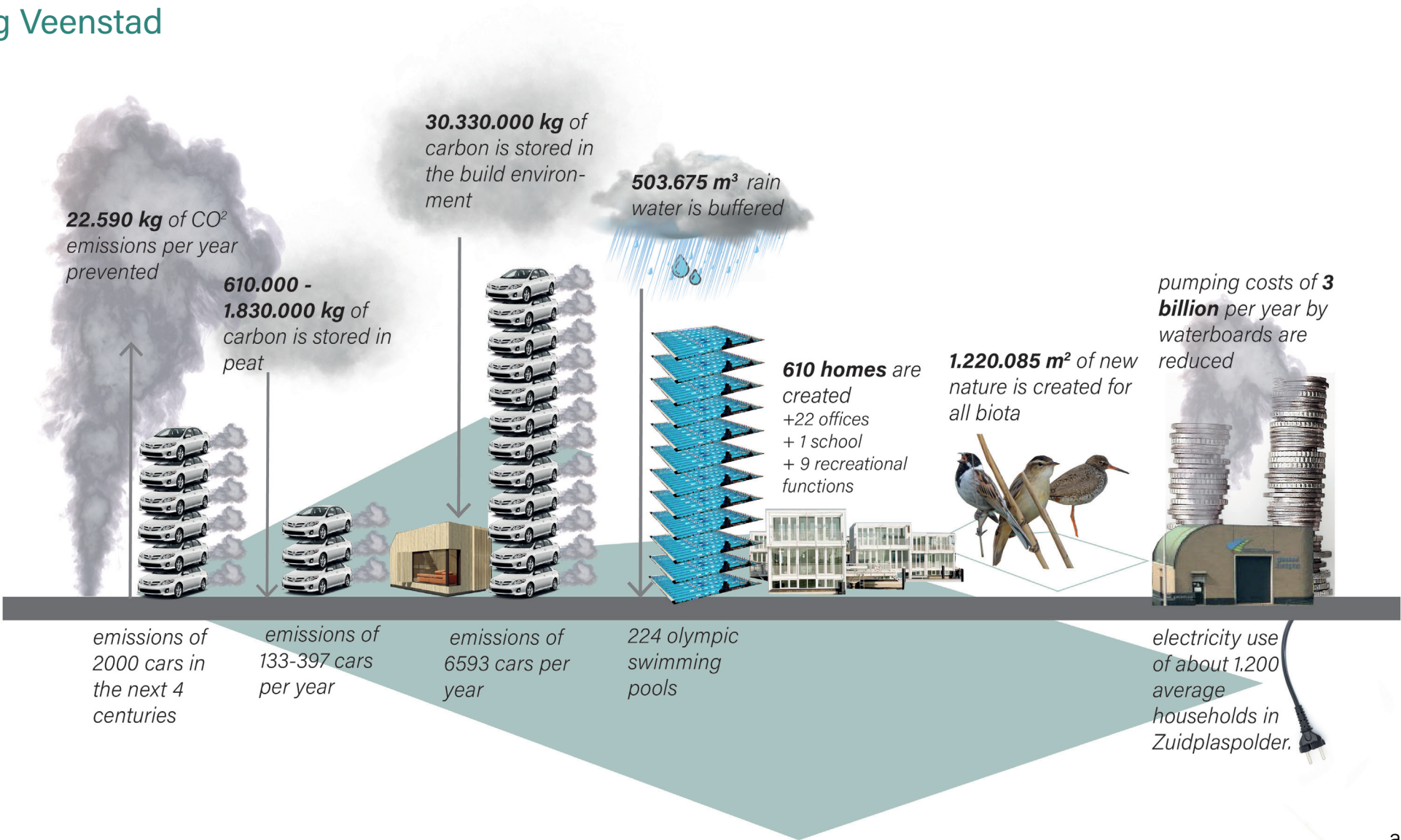
 3,462 to 4,000  
 45 ha

## VEENSTAD



  2,250 to 3,000  
  122 ha

POSITIONING  
quantifying Veenstad



about 7000 per year

# FOR URBAN DESIGNERS, PLANNERS AND LANDSCAPE ARCHITECTS

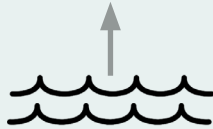
## process

### STEP 1 LANDSCAPE FIRST

**ELEMENT 1:**  
Understanding of the un-  
derlying landscape



**ELEMENT 2**  
Raise groundwater levels



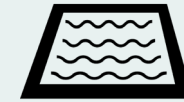
**ELEMENT 3**  
take rainwater into account



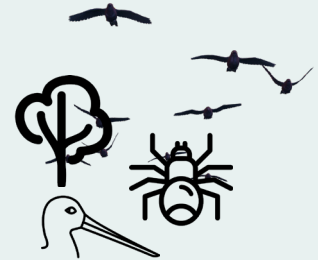
**ELEMENT 4**  
Create closed watersystem  
to ensure water quality



**ELEMENT 5**  
Create waterbuffer, pockets,  
and helofytenfilter



**ELEMENT 6**  
Think of desired biotopes  
& maintainance



### STEP 2 SYNERGETIC DEVELOPMENT OF SITE SPECIFIC AMBITIONS

**ELEMENT 7**  
Look at stakeholders



**ELEMENT 8**  
Combine carbon objective  
with site specific goals



### STEP 3 WET HOUSING

**ELEMENT 9**  
Look at negative space  
for new wet housing



**ELEMENT 10**  
place housing types +  
functions



### STEP 4 INFRASTRUCTURE AND NEW PUBLIC LIFE

**ELEMENT 11**  
Create desired  
infrastructure



**ELEMENT 12**  
New wet publics space

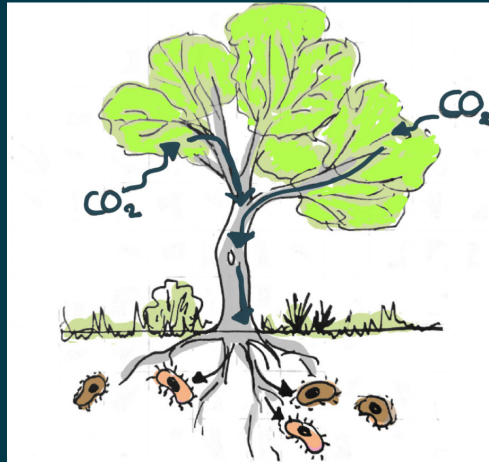


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# FOR URBAN DESIGNERS, PLANNERS AND LANDSCAPE ARCHITECTS

## Pattern language

### HEALTHY SOIL , HEALTHY ECOSYSTEM



*General, zone 4*

#### Hypothesis

**A healthy soil means less carbon dioxide in the air.**

#### Theoretical Back-up

Carbon dioxide is used by plants that filter CO<sub>2</sub> out of the air, which transfer this to the roots. These roots contain bacteria that use/store the carbon. In this way, soil has a unique ability to store carbon dioxide in the ground. Storing carbon dioxide in the soil means less global warming.

#### Practical implication

To create healthy soil, we should take care of the microbes in the soil. For example, farmers should avoid tillage/plowing, avoid the use of toxic chemicals, and the use of artificial fertilizer. Also, open bare land should be changed into overgrown land to keep/store CO<sub>2</sub>.

# FOR OTHER SITES; LETS GO NATIONAL!

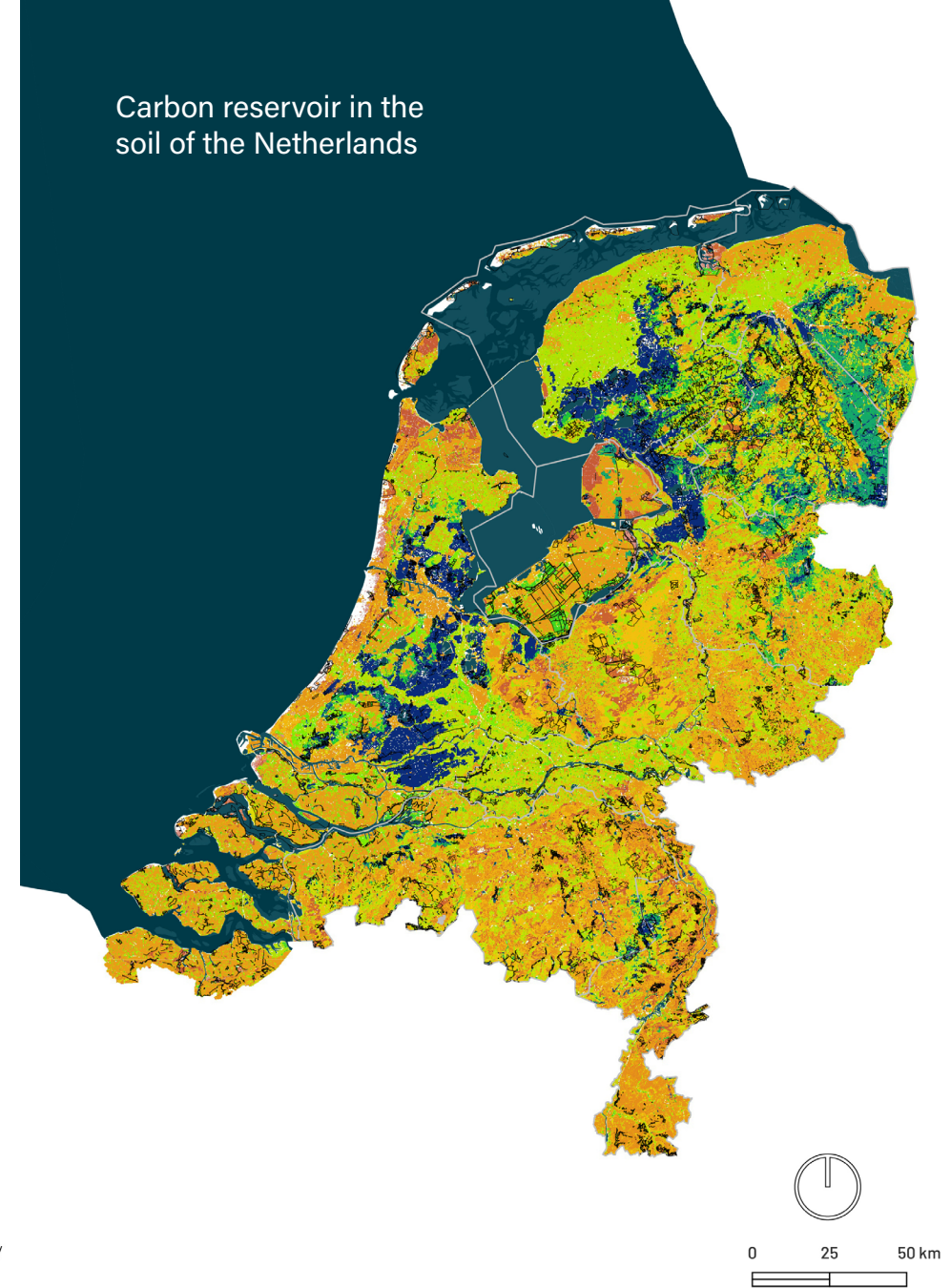
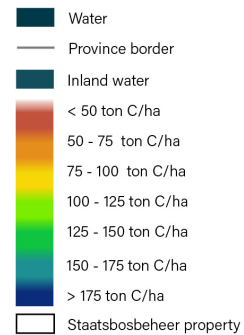
urgency 1: carbon reservoir

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Carbon reservoir in the  
soil of the Netherlands

## LEGEND

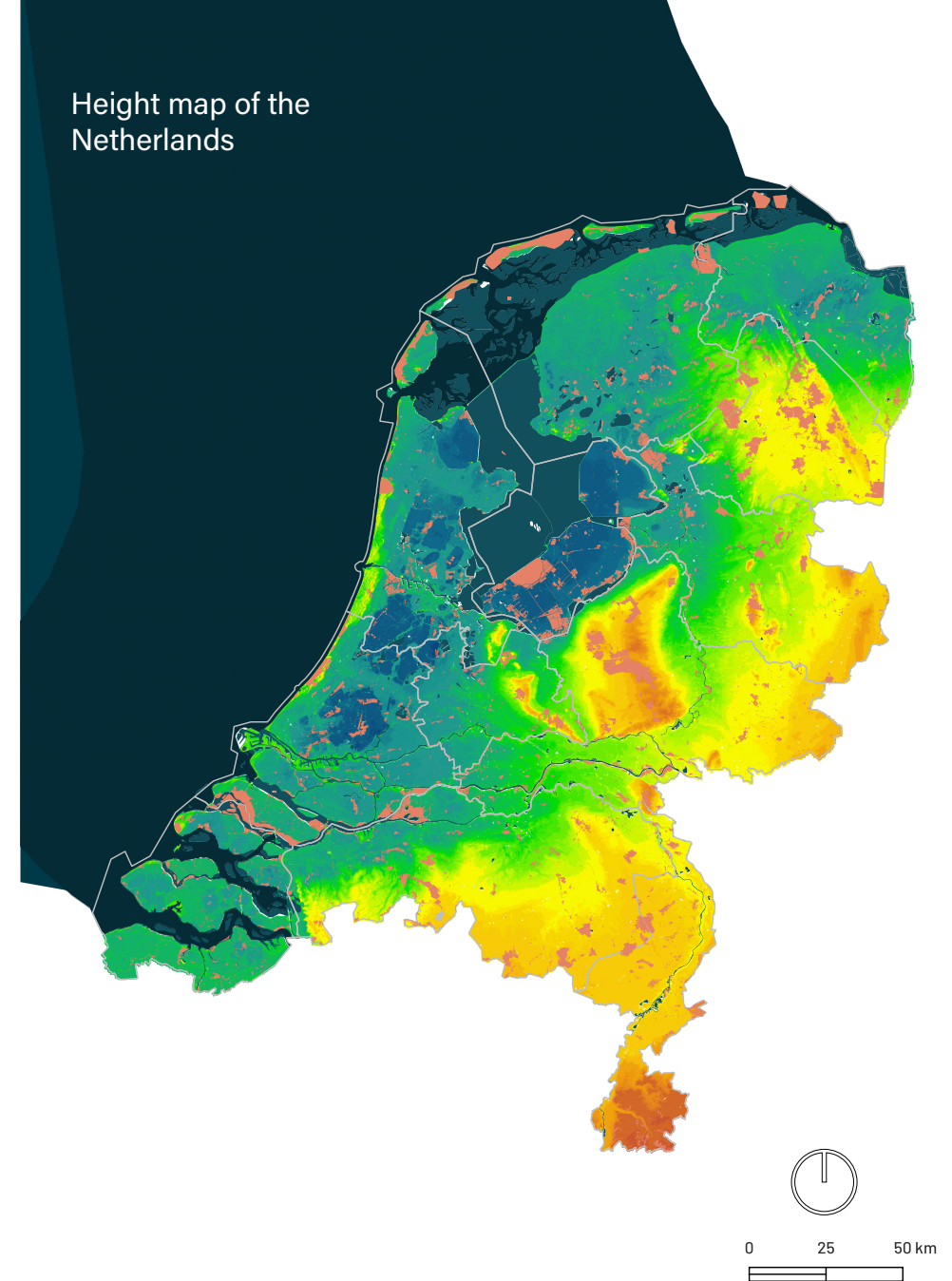
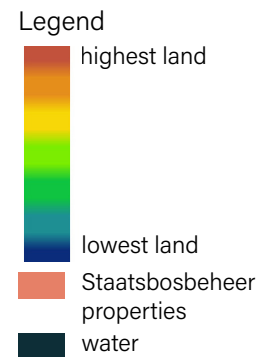


# FOR OTHER SITES; LETS GO NATIONAL!

urgency 2: the ending polder system

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## FOR OTHER SITES; LETS GO NATIONAL!

### urgency 3: the housing need

**Examples of municipalities that meet all three urgencies:**

*De ronde Venen*

*Nieuwkoop*

*Woerden*

*Ouder Amstel*

*Amsterdam*

*Wijdemereren*

*Eemnes*

*Bunschoten*

*Bodegraven Reeuwijk*

*Alphen aan den Rijn*

*Oudewater*

*Krimpenerwaard*

*Rotterdam*

*Zoeterwoude*

*Capelle aan den IJssel*

*Kaag en Braasem*

*Voorschoten*

*Gooise meren*

*Landsmeer*

*Watermeer*

*Oostzaan*

*Zaanstad*

*Wassenaar*

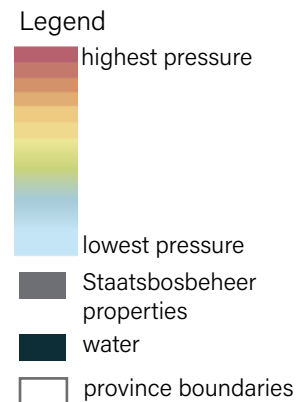
*Uitgeest*

*Alkmaar*

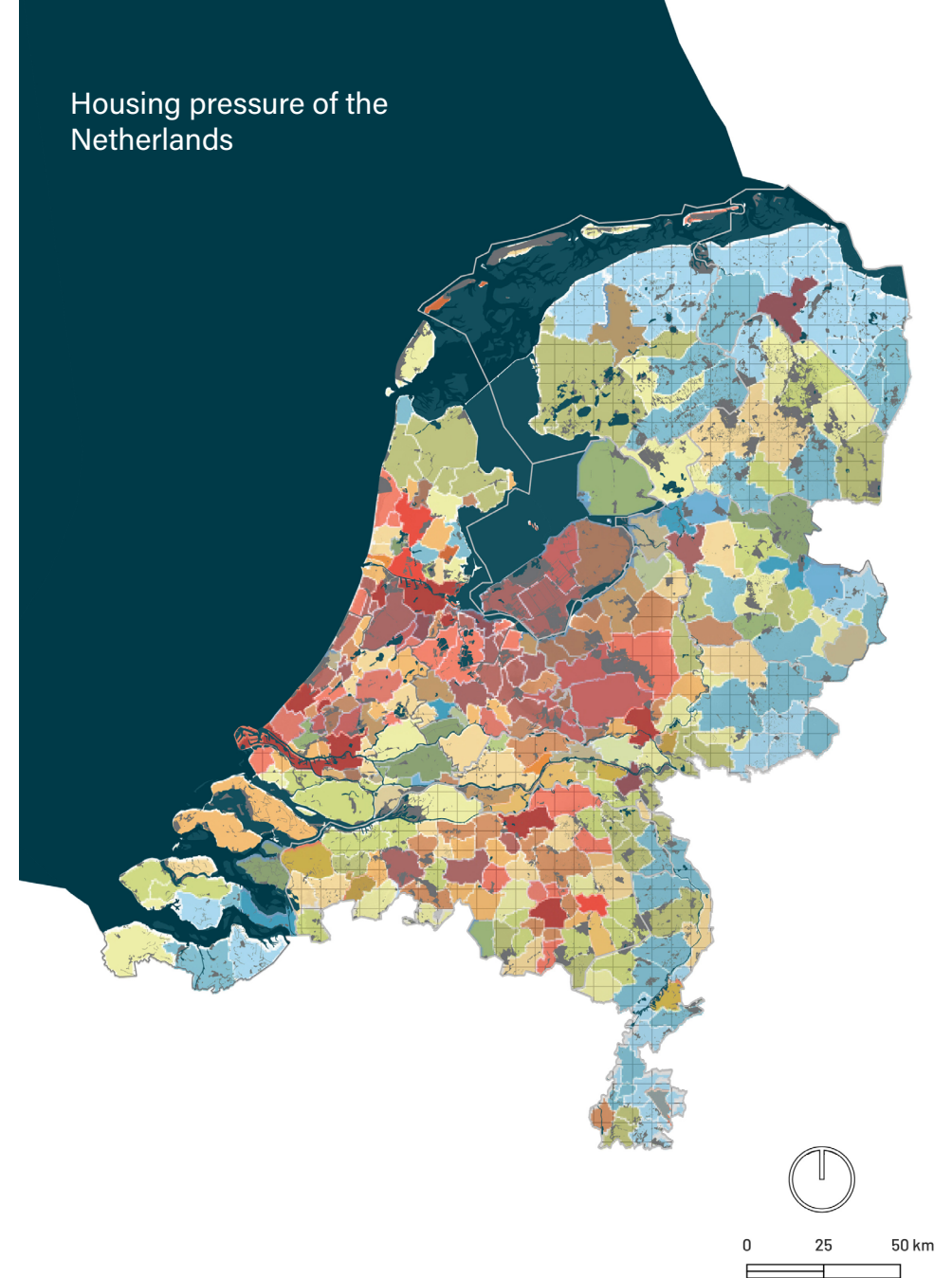
*Midden Delfland*

*Pijnacker*

*Nootdorp*



Housing pressure of the Netherlands

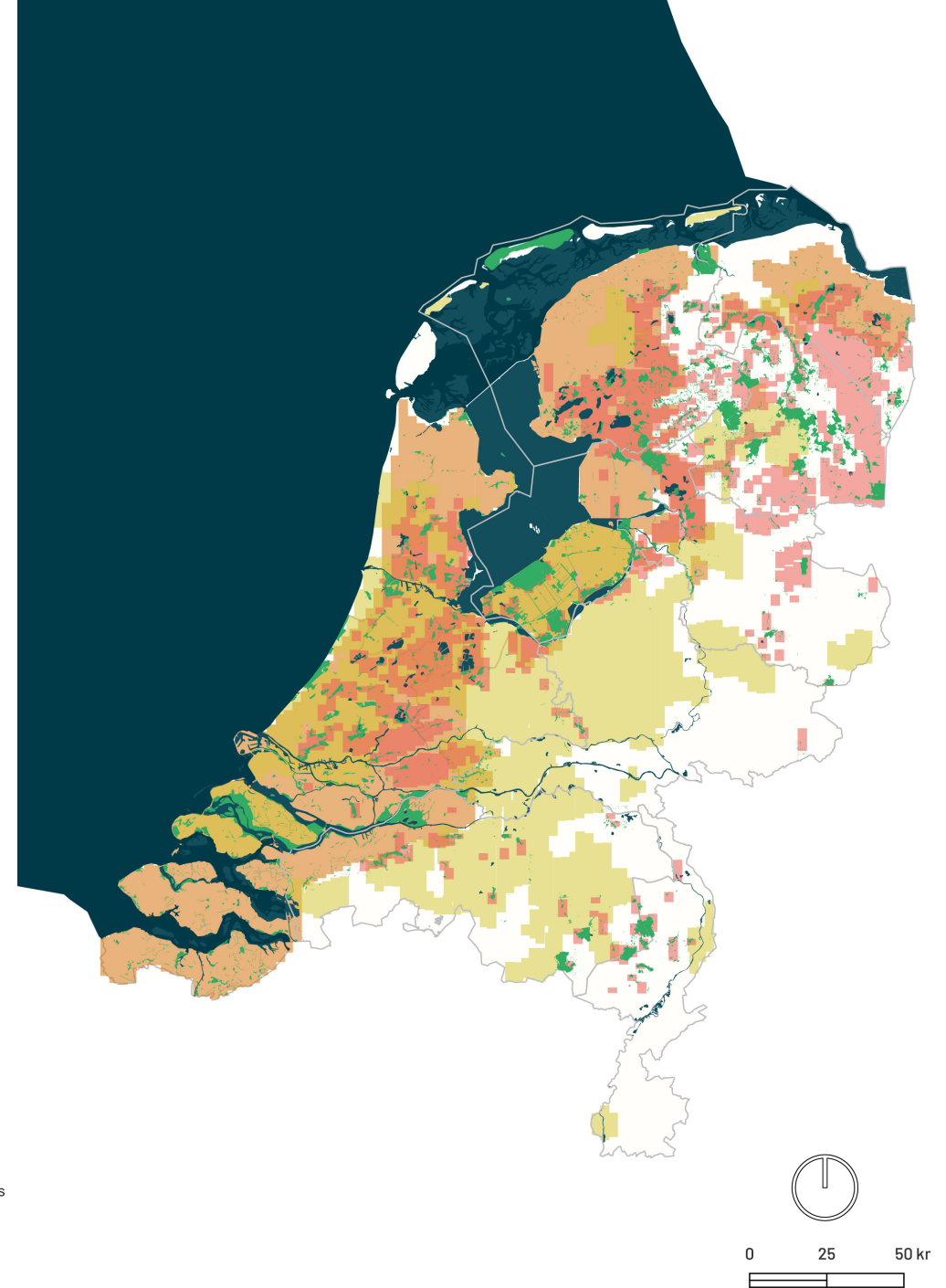


# FOR OTHER SITES; LETS GO NATIONAL!

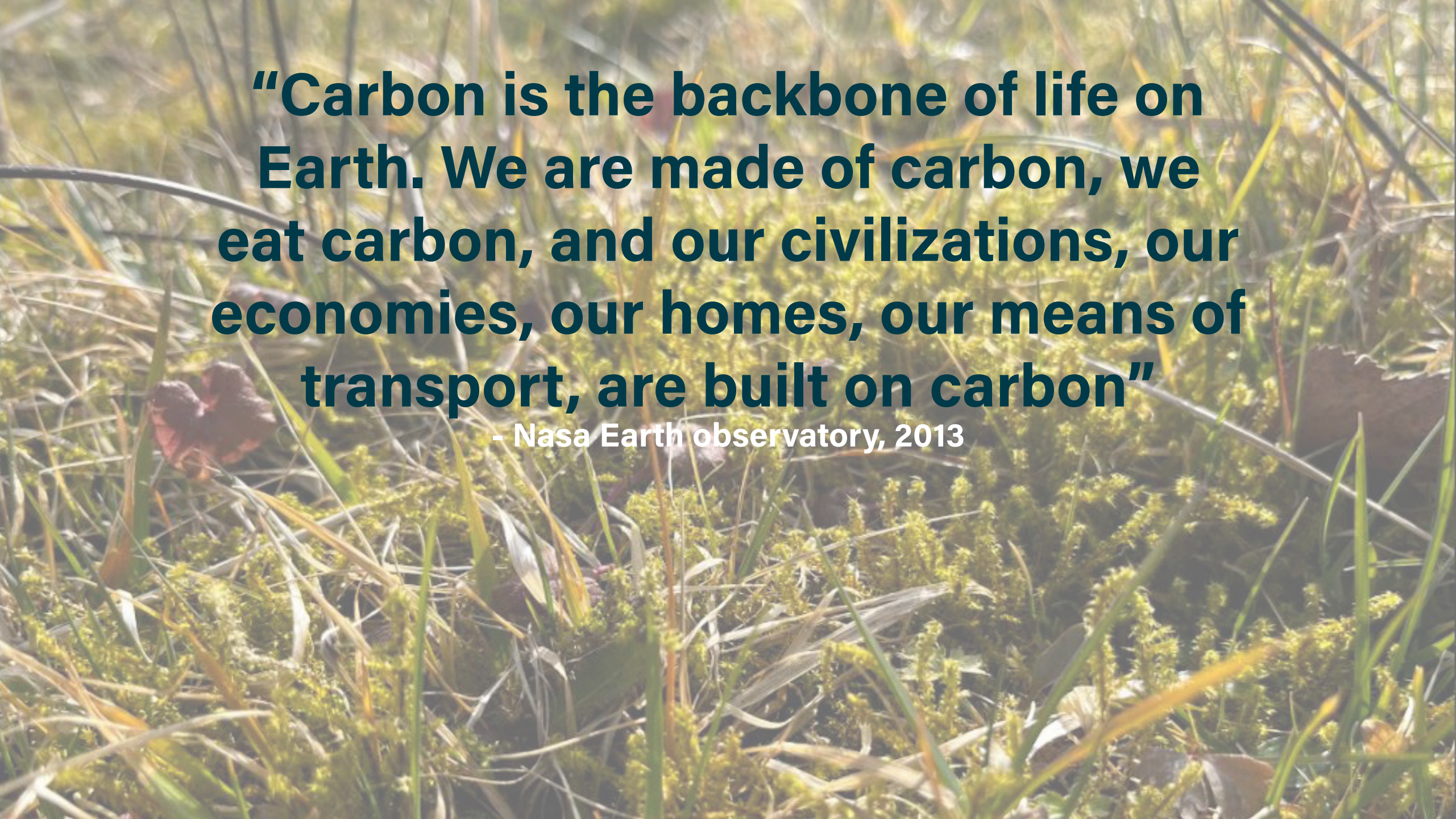
relevant Staatsbosbeheer properties

## LEGEND

- Water
- Province border
- Inland water
- 1. Carbon preservation urgency
- 2. Low land urgency
- 3. Housing pressure urgency
- SBB property within or near urgency areas 1. and 2.



introducing - framing - analyzing and designing - strategizing - **transferring**



**“Carbon is the backbone of life on Earth. We are made of carbon, we eat carbon, and our civilizations, our economies, our homes, our means of transport, are built on carbon”**

**- Nasa Earth observatory, 2013**

## WHY SHOULD WE DO THIS?

Carbon reservoirs on  
earth

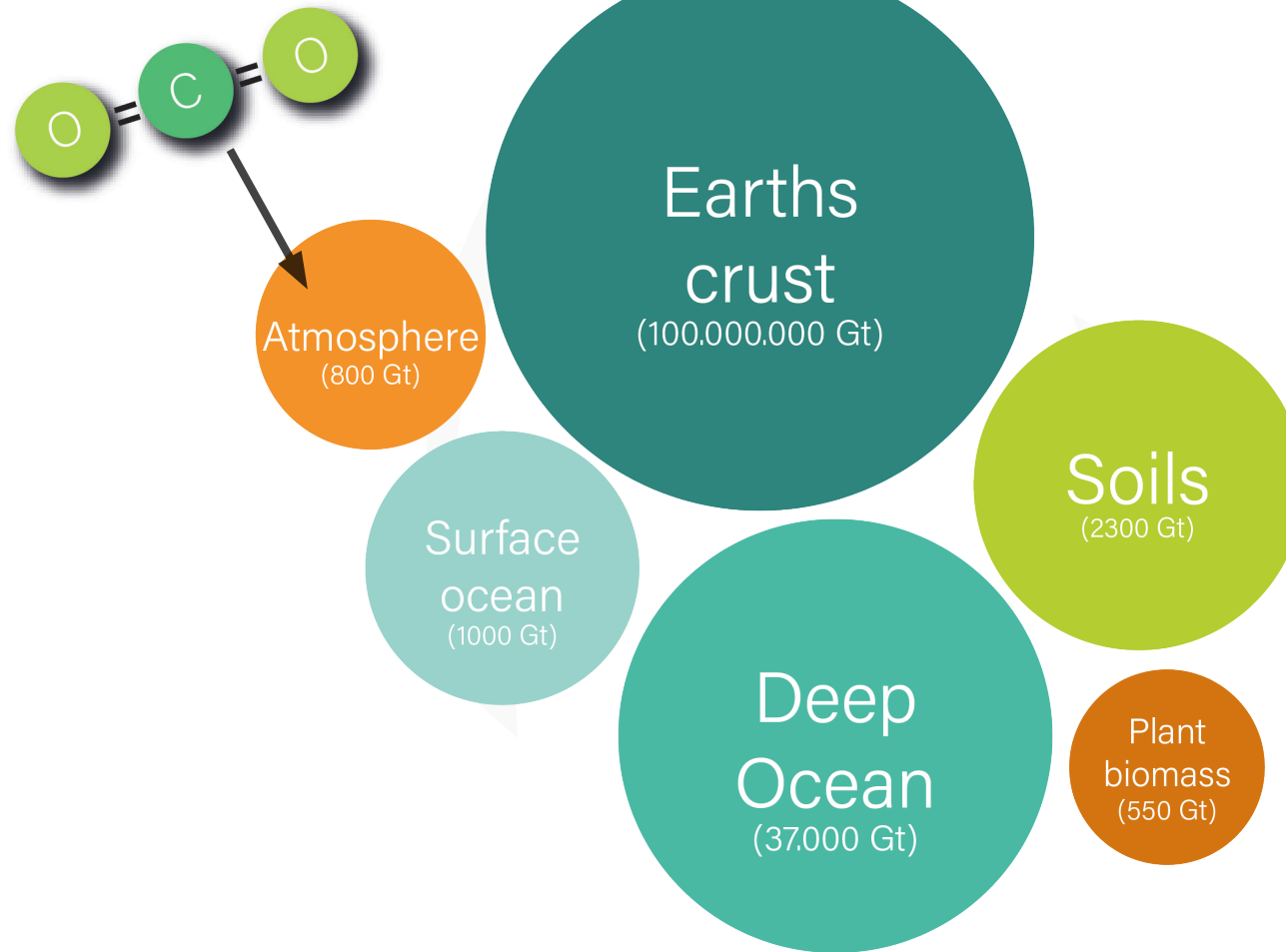


figure 3.2.2 Earth's carbon reservoirs (in gigatons) from "cropwatch.unl.edu" by author based on illustration Earth's carbon reservoirs (in gigatons),2021, (<https://cropwatch.unl.edu/2019/cover-crops-and-carbon-sequestration-benefits-producer-and-planet>)

# THE BIOTOPES OF WESTERGOUWE



introducing - **framing** - analyzing and designing - strategizing - transferring

# SCENARIO DESIGN HOUSING TYPES

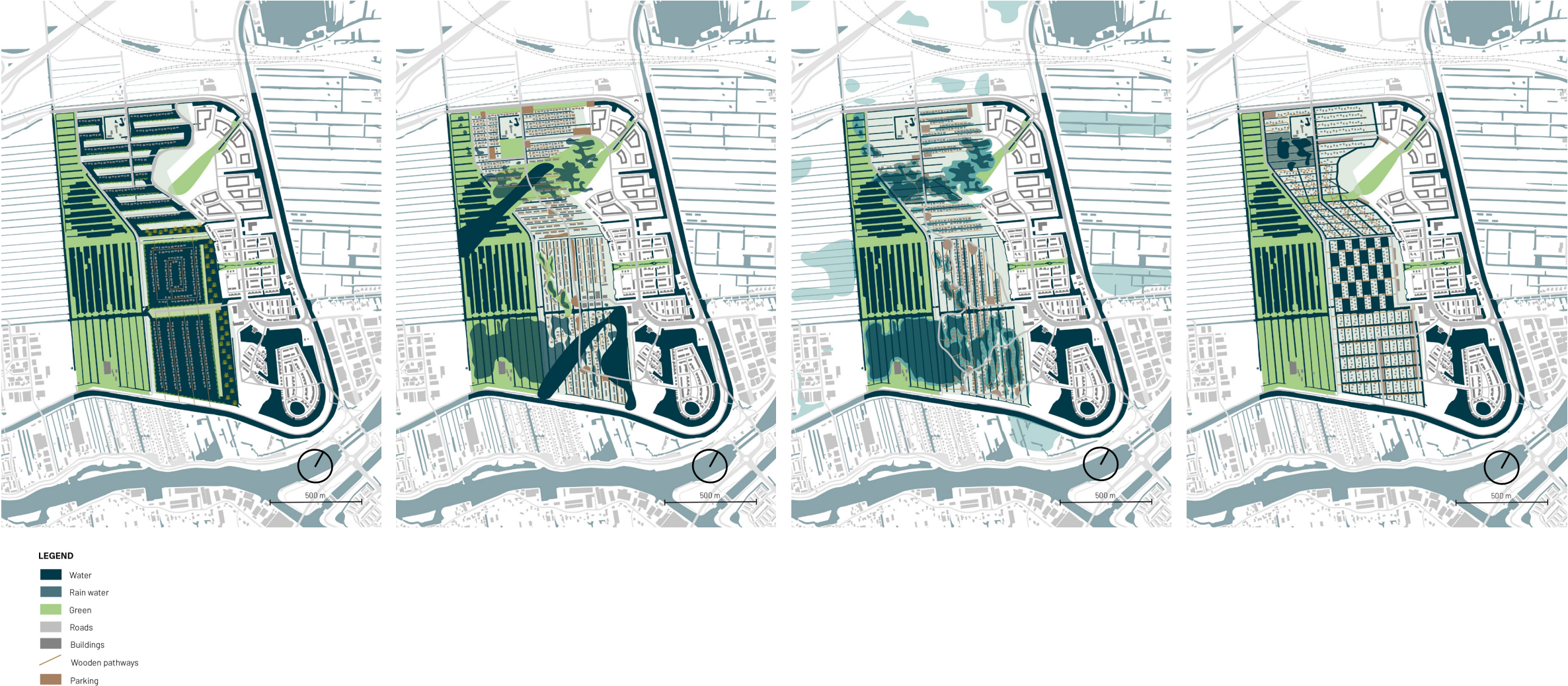
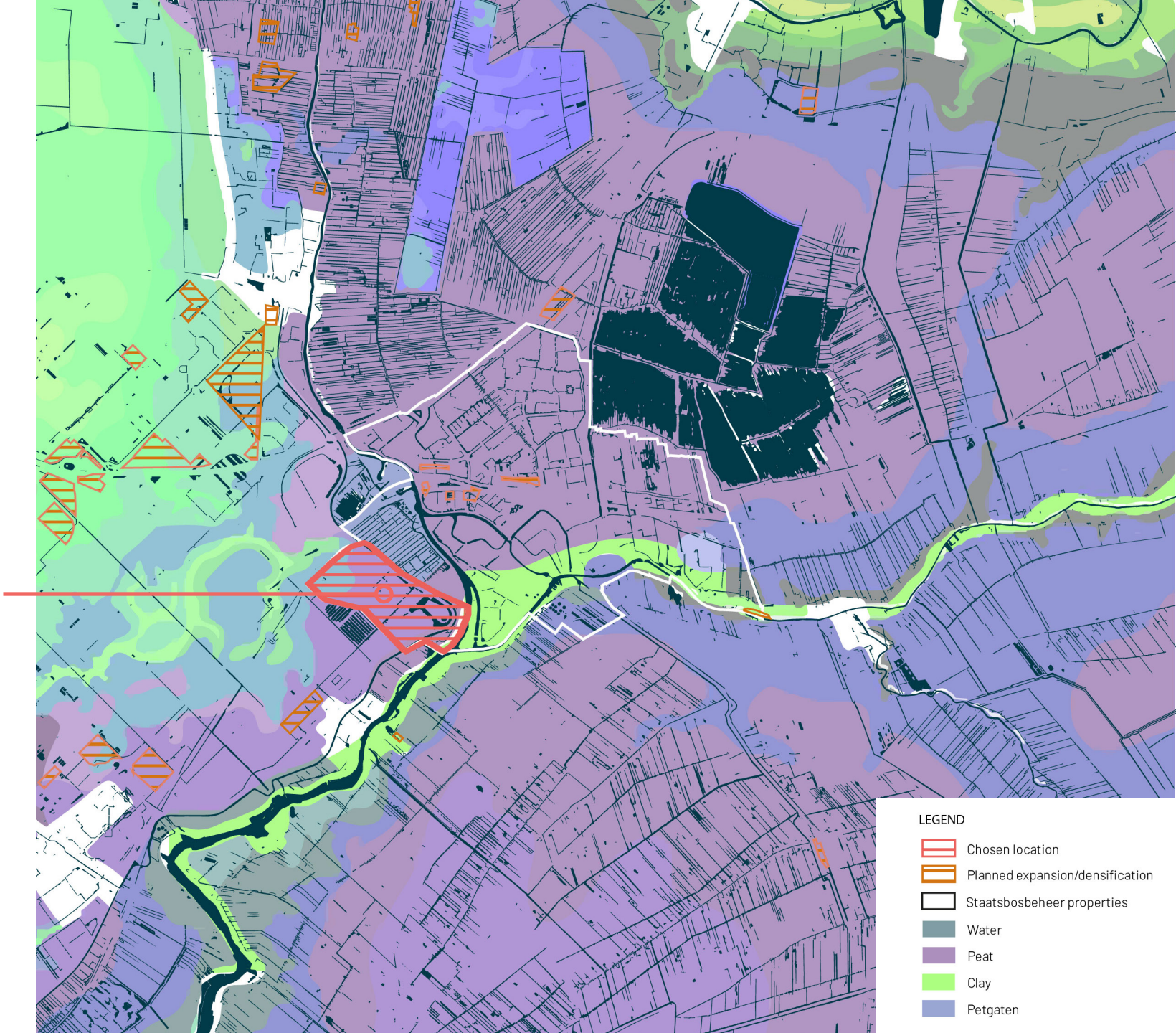


Figure 6.2.4 systemic

LOCATION

Westergouwe, Gouda

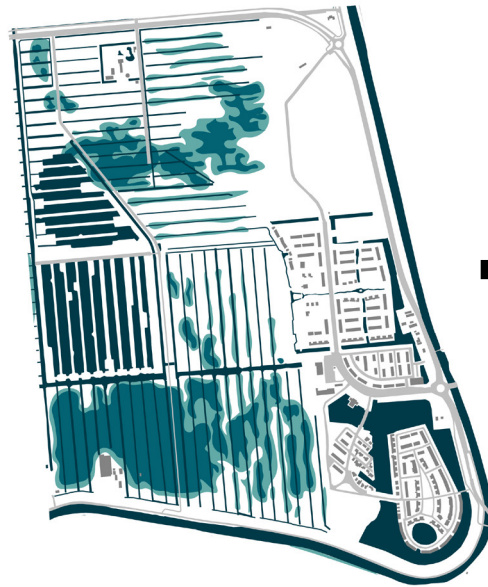


# WATER DESIGN

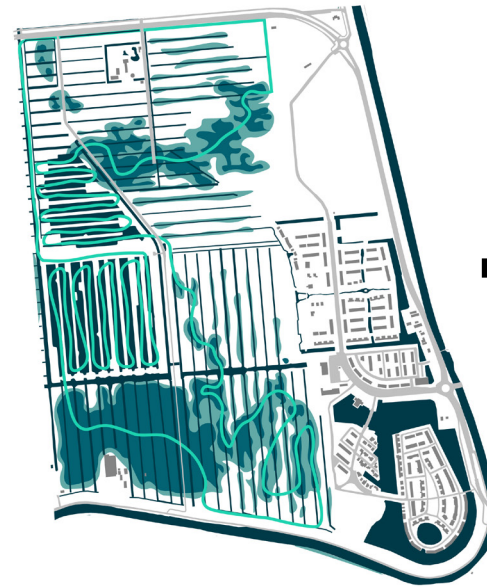
*Raise groundwater levels*



*Take rainwater into account*



*Create deeper connected water-system to ensure water quality*



*Create waterbuffer and pockets, helofytenfilter and rainwater of traditional neighbourhood*



# (DE)POLDERING

Now



After

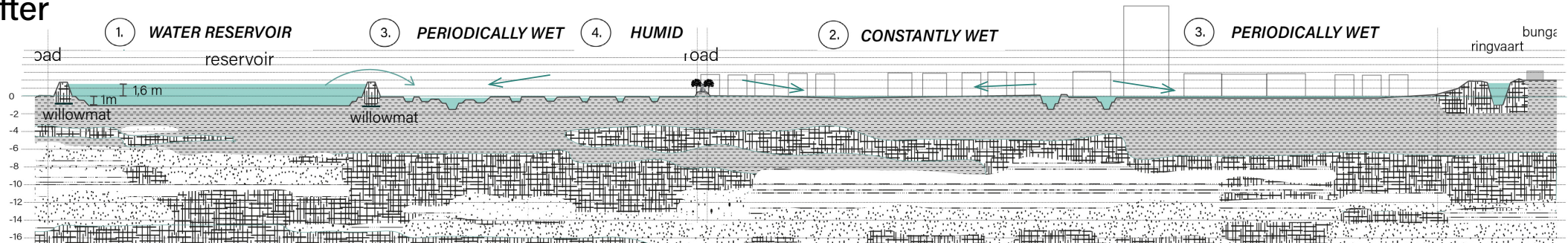


Figure 6.3.2 Watersystem section now and after realisation

# DESIGN THROUGH TIME

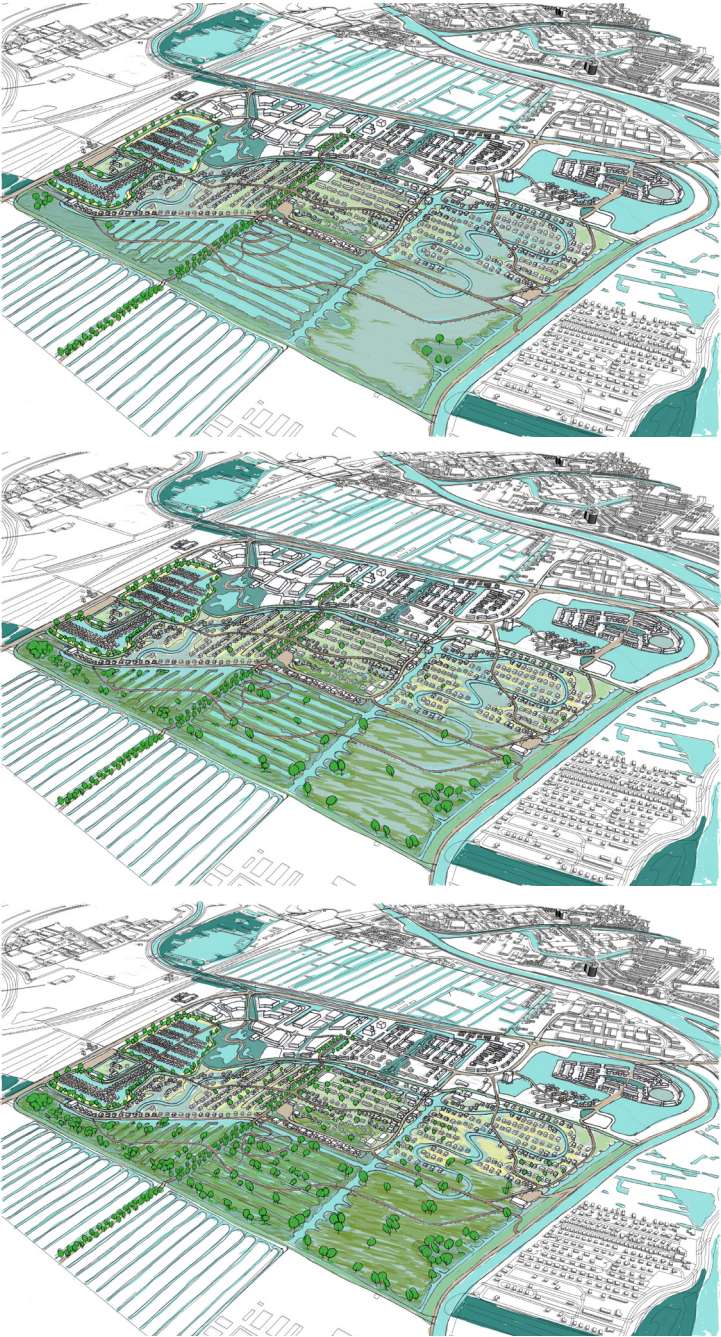
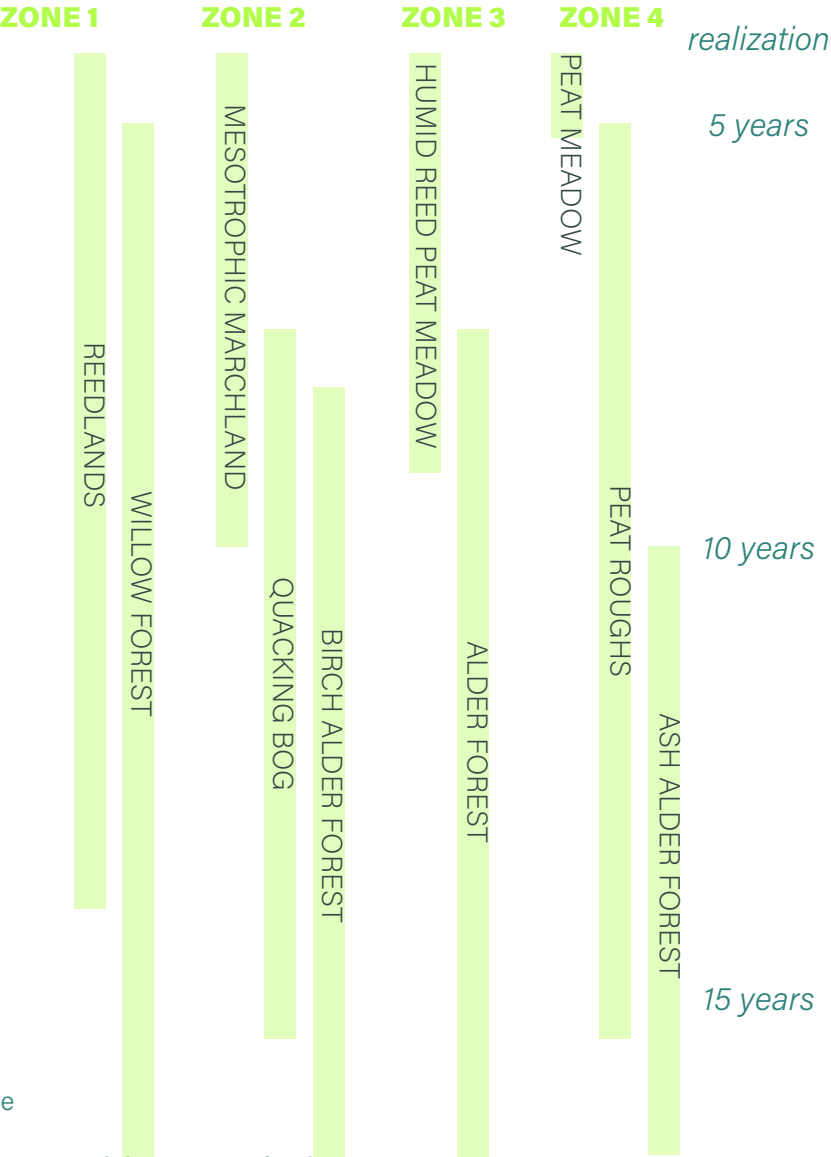


Figure 6.71 Design through time