

# DROWNING DELTAS

A STRATEGICAL SPATIAL APPROACH TO SOIL SUBSIDENCE IN DELFLAND

P5 Presentation

**Teun Claassen**

April 16 2020

**MSc Urbanism**

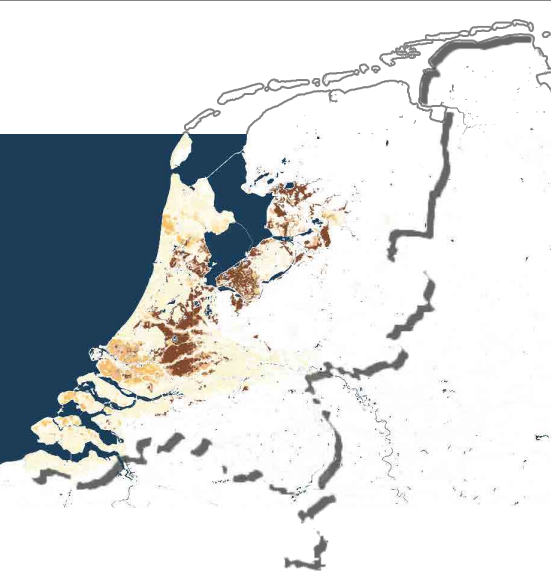
Urban metabolism

**Mentors:**

Dr.ir. Marjolein Pijpers-van Esch

&

Dr. Arie Romein



PROBLEM FIELD

RESEARCH SETUP

ANALYSIS

ACTION ASSESSMENT

DECISION-MAKING

PATHWAY PROJECTIONS

CONCLUSIONS

PROBLEM FIELD

RESEARCH SETUP

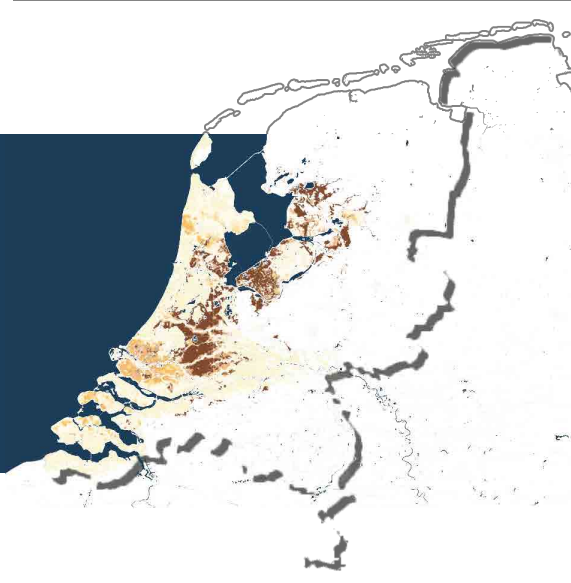
ANALYSIS

ACTION ASSESSMENT

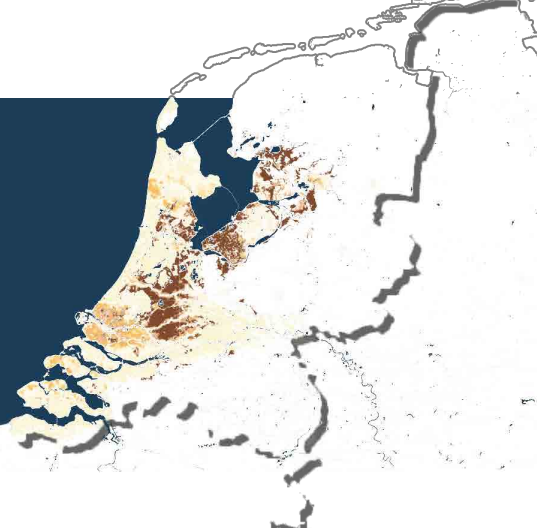
DECISION-MAKING




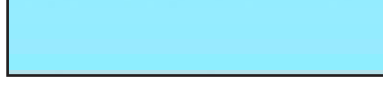
PATHWAY PROJECTIONS

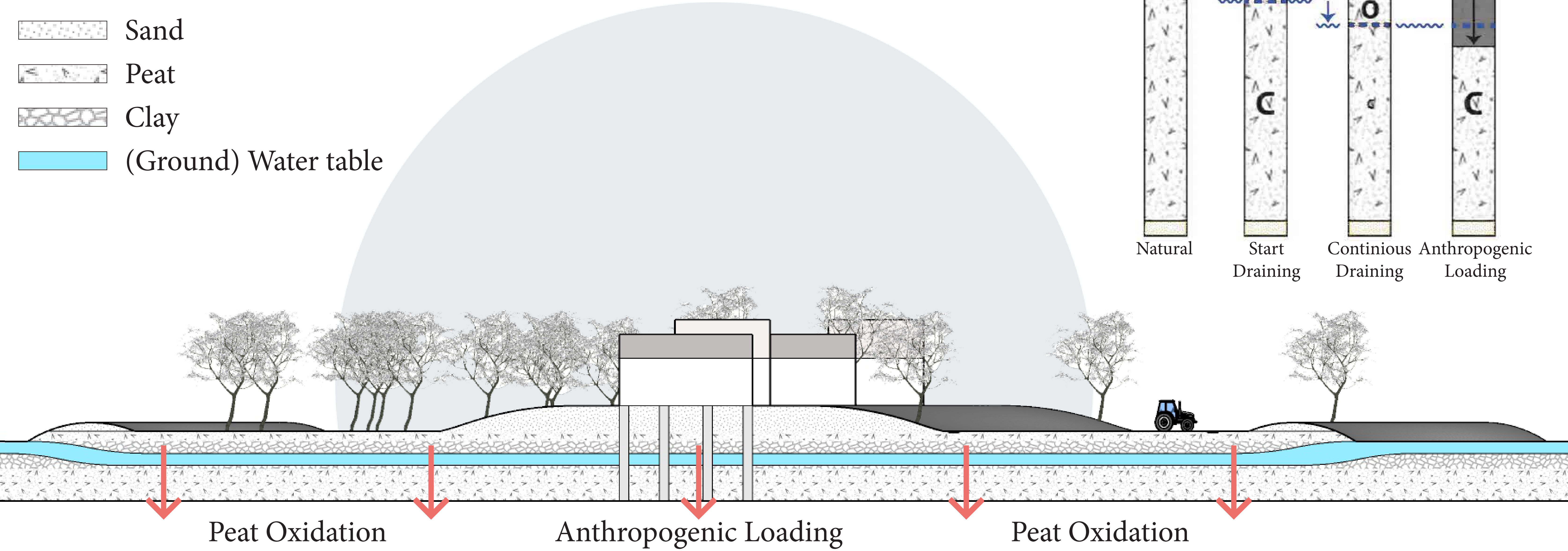
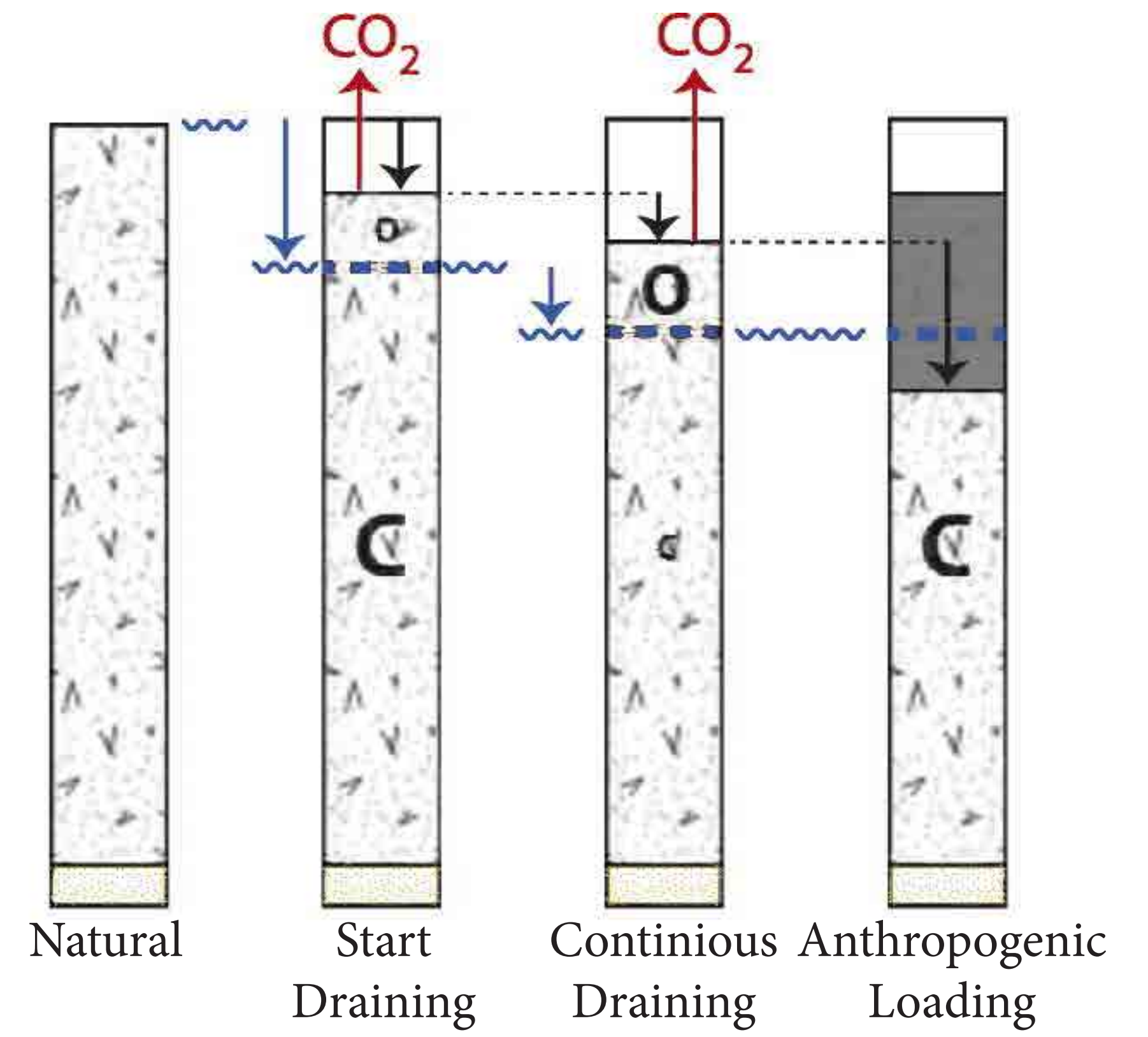
CONCLUSIONS

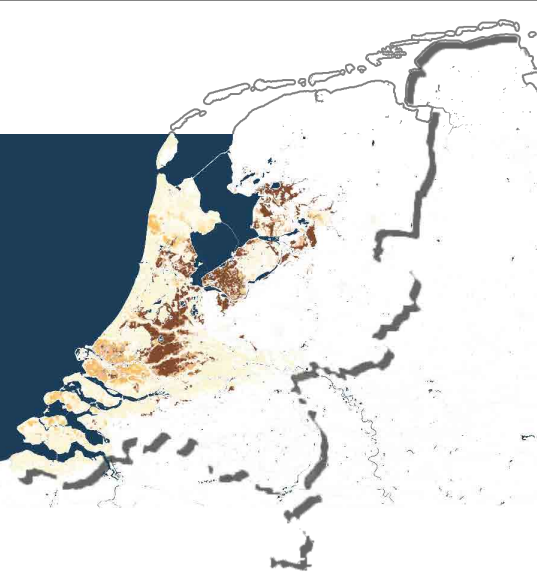




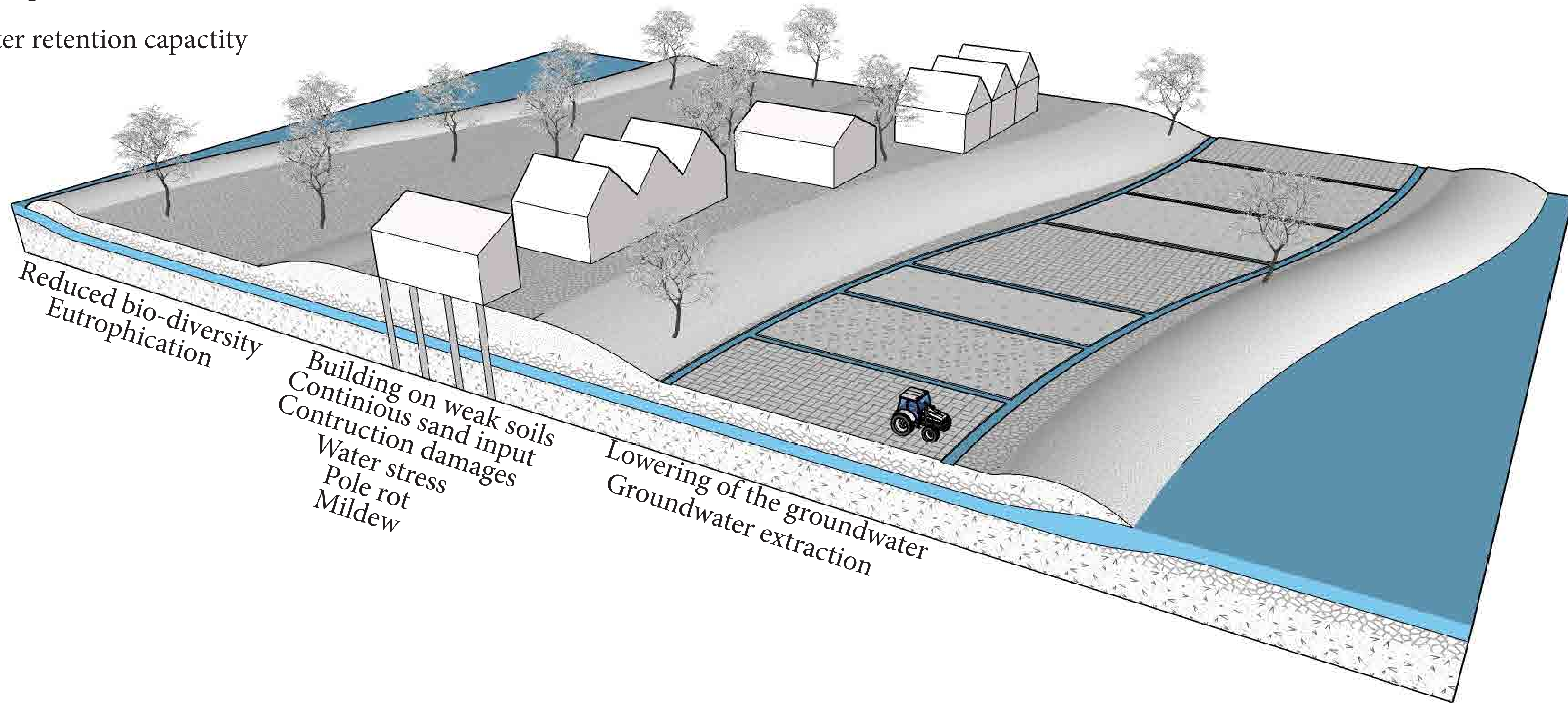


-  Sand
-  Peat
-  Clay
-  (Ground) Water table

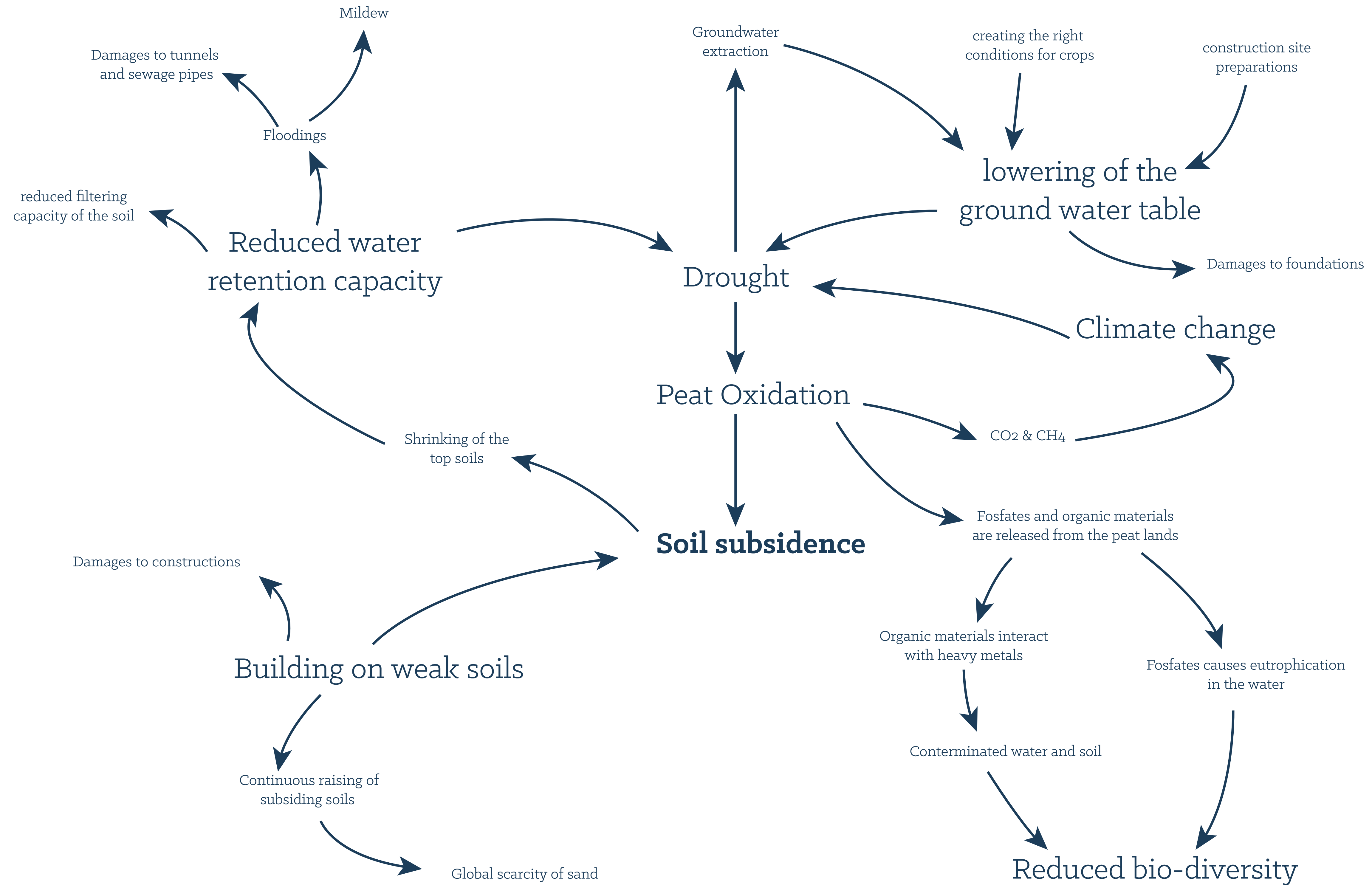
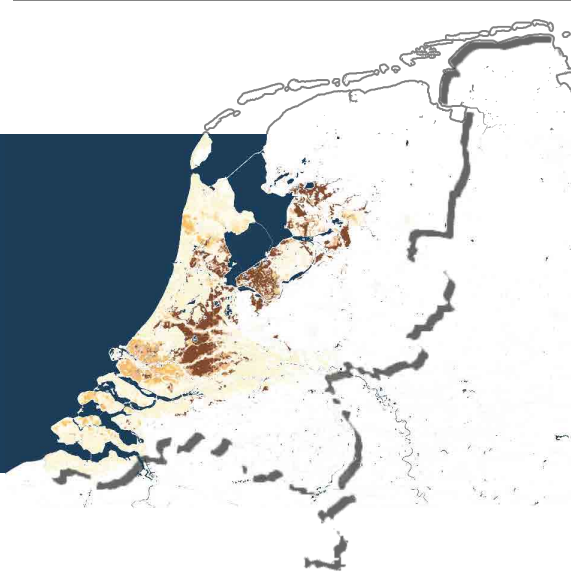


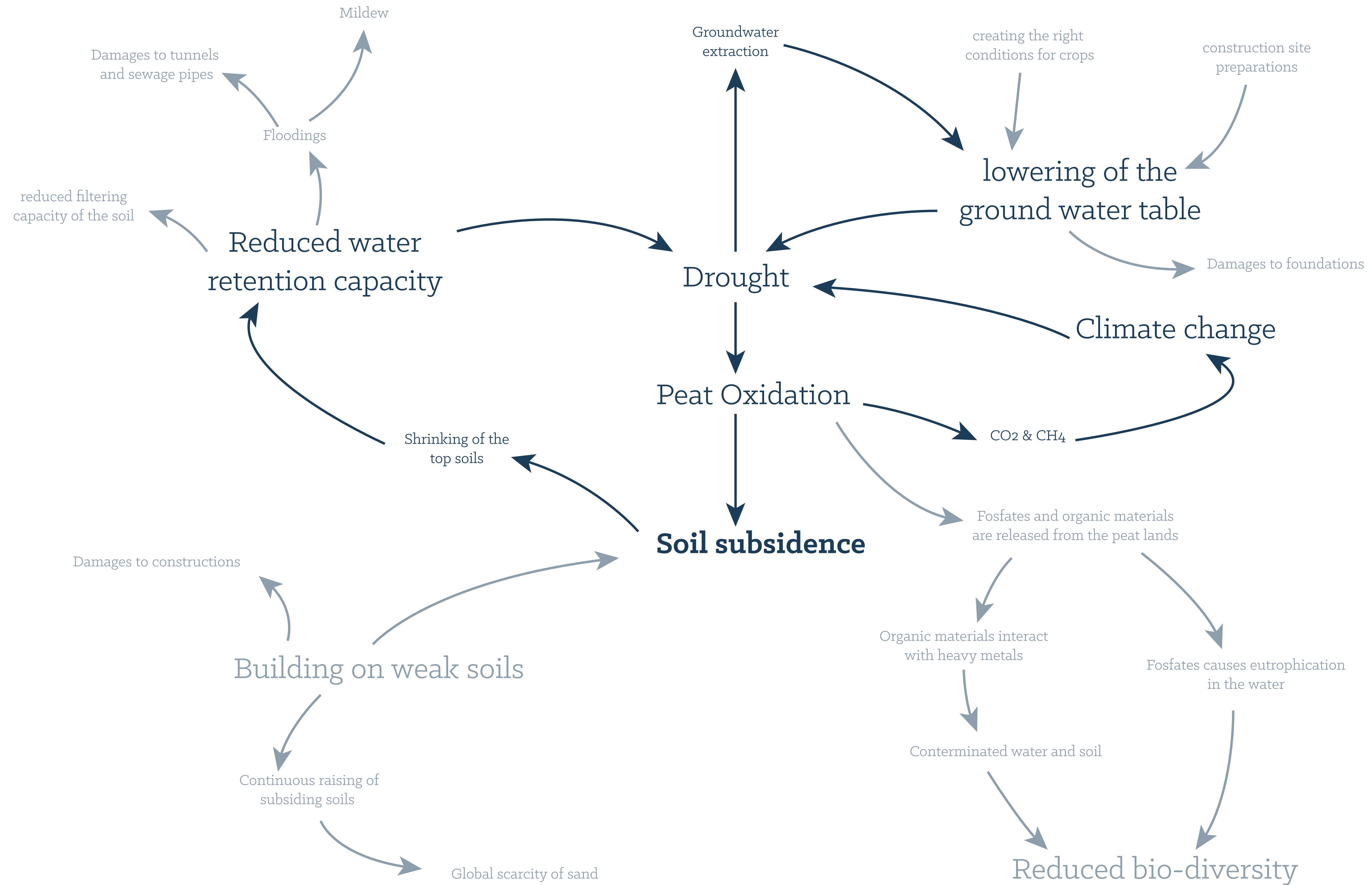
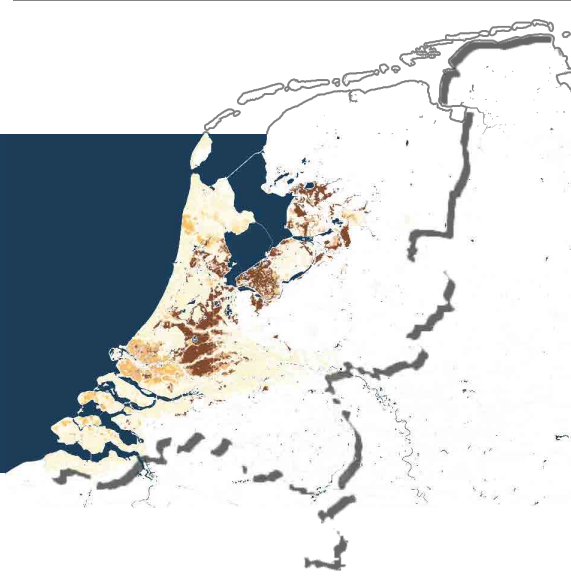


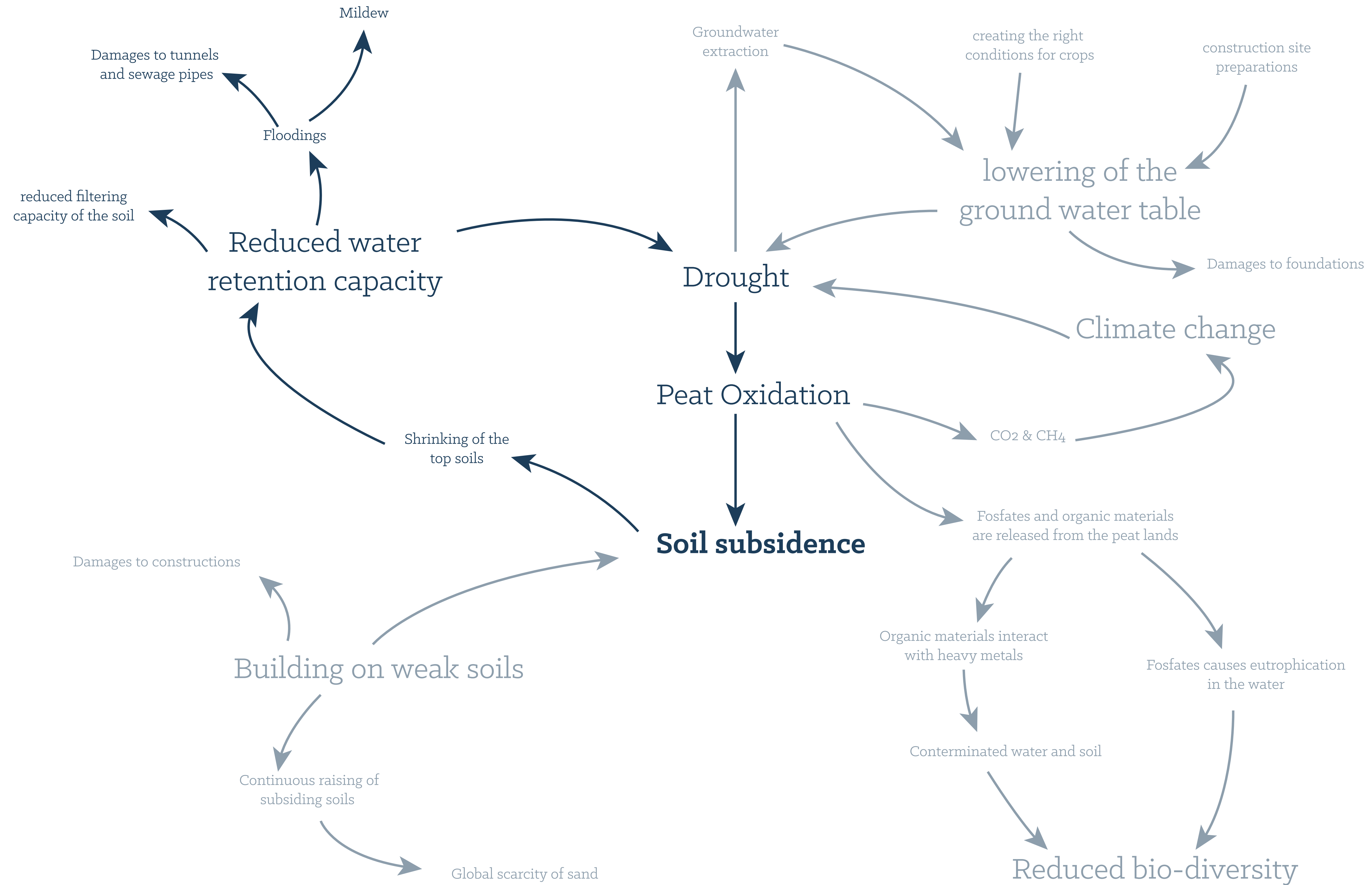
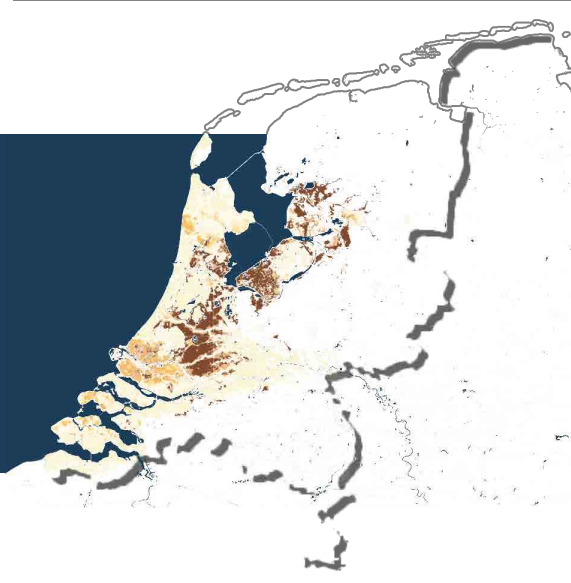
- Peat oxidation
- Shrinking of top soils
- Reduced water retention capacity
- Drought



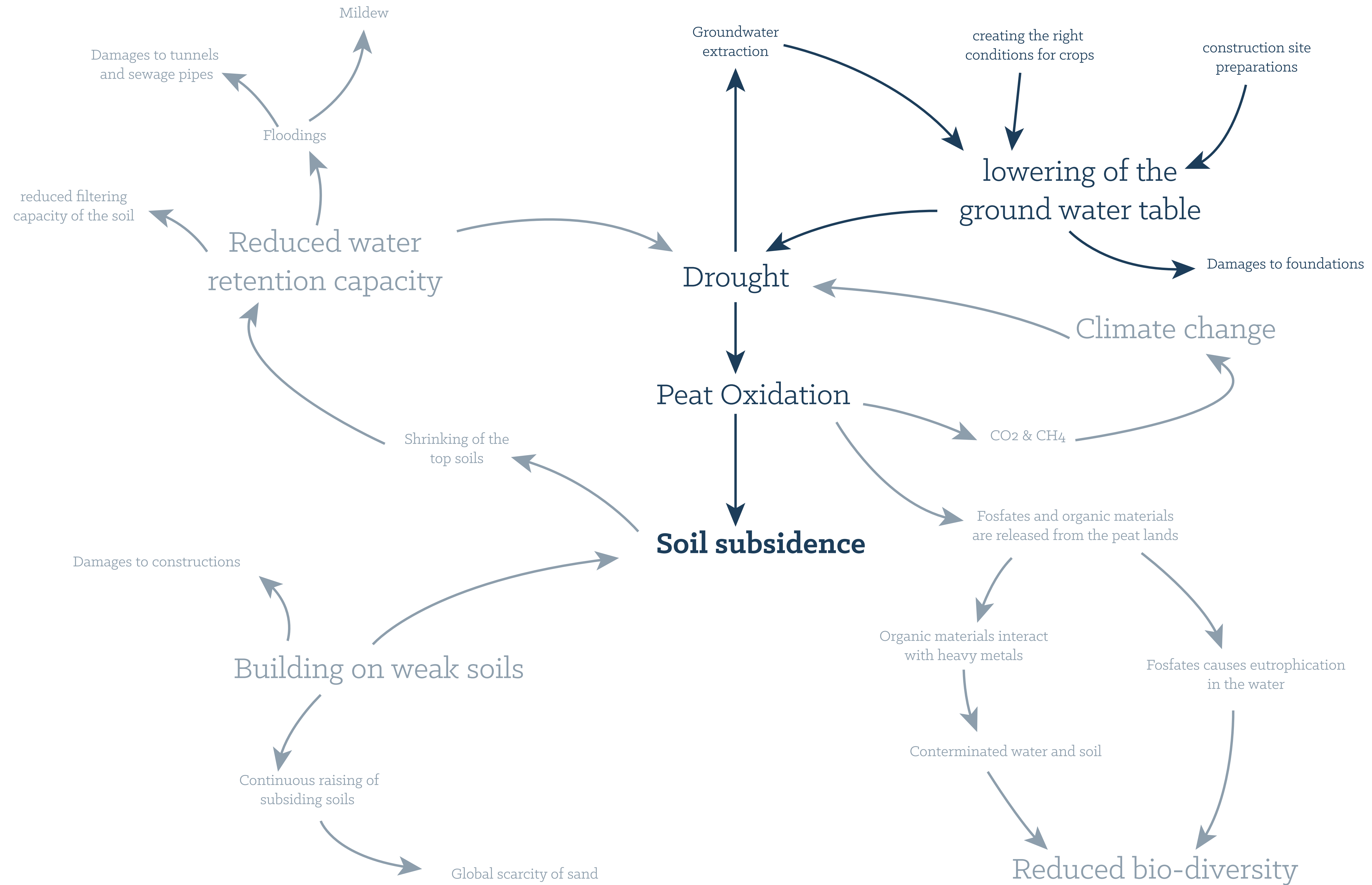
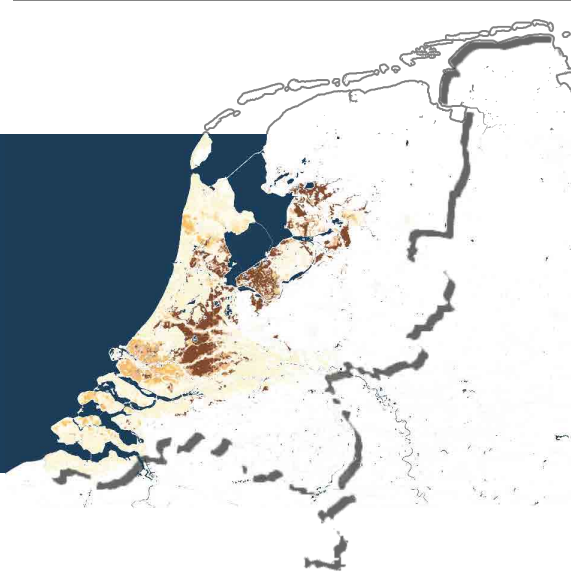


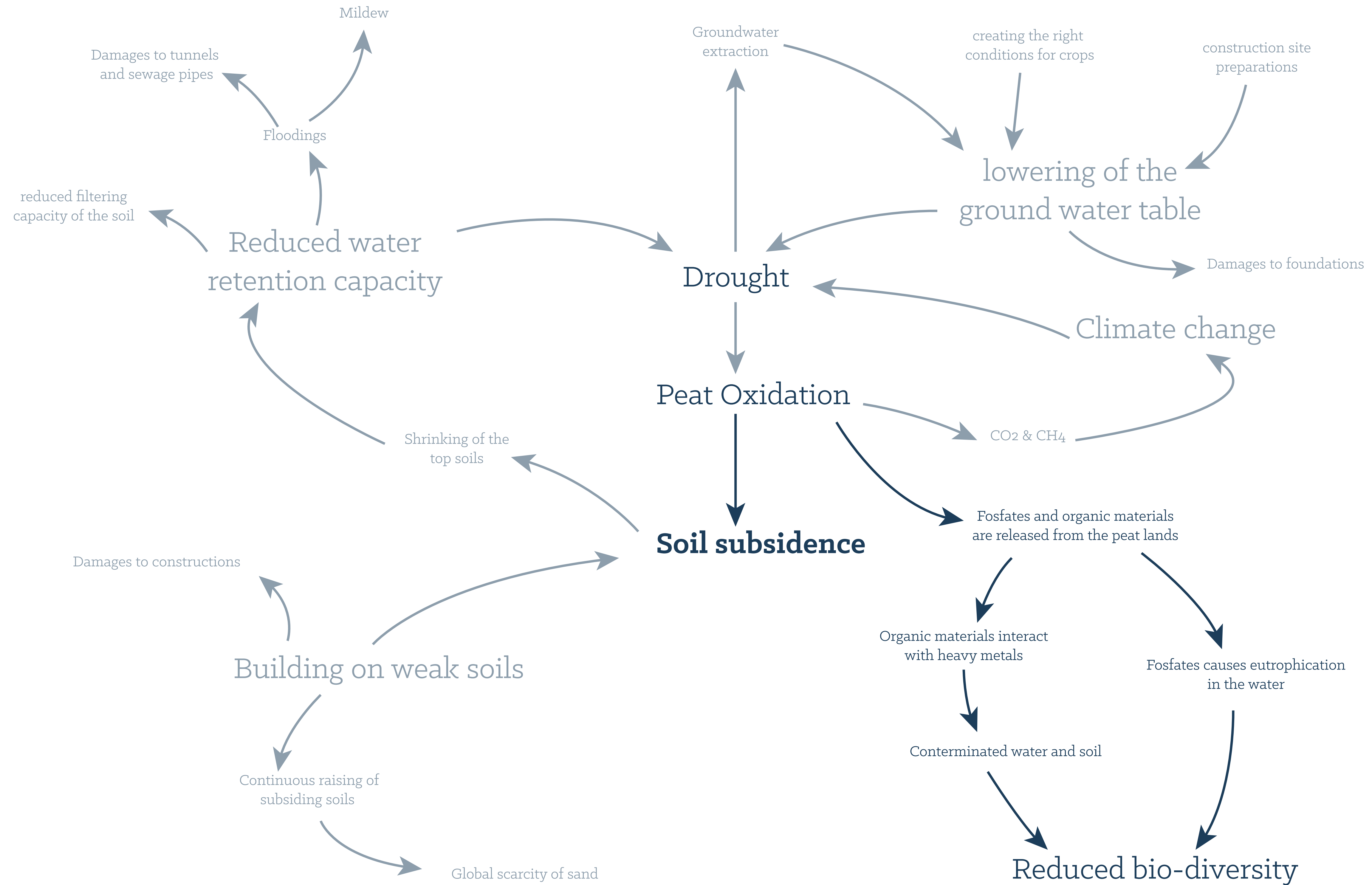
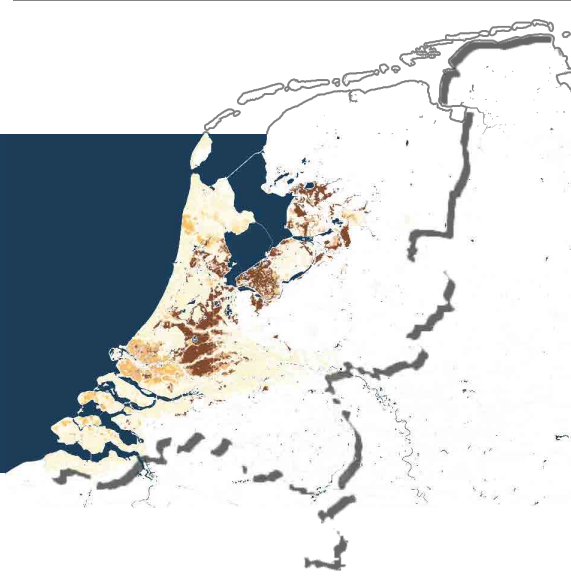


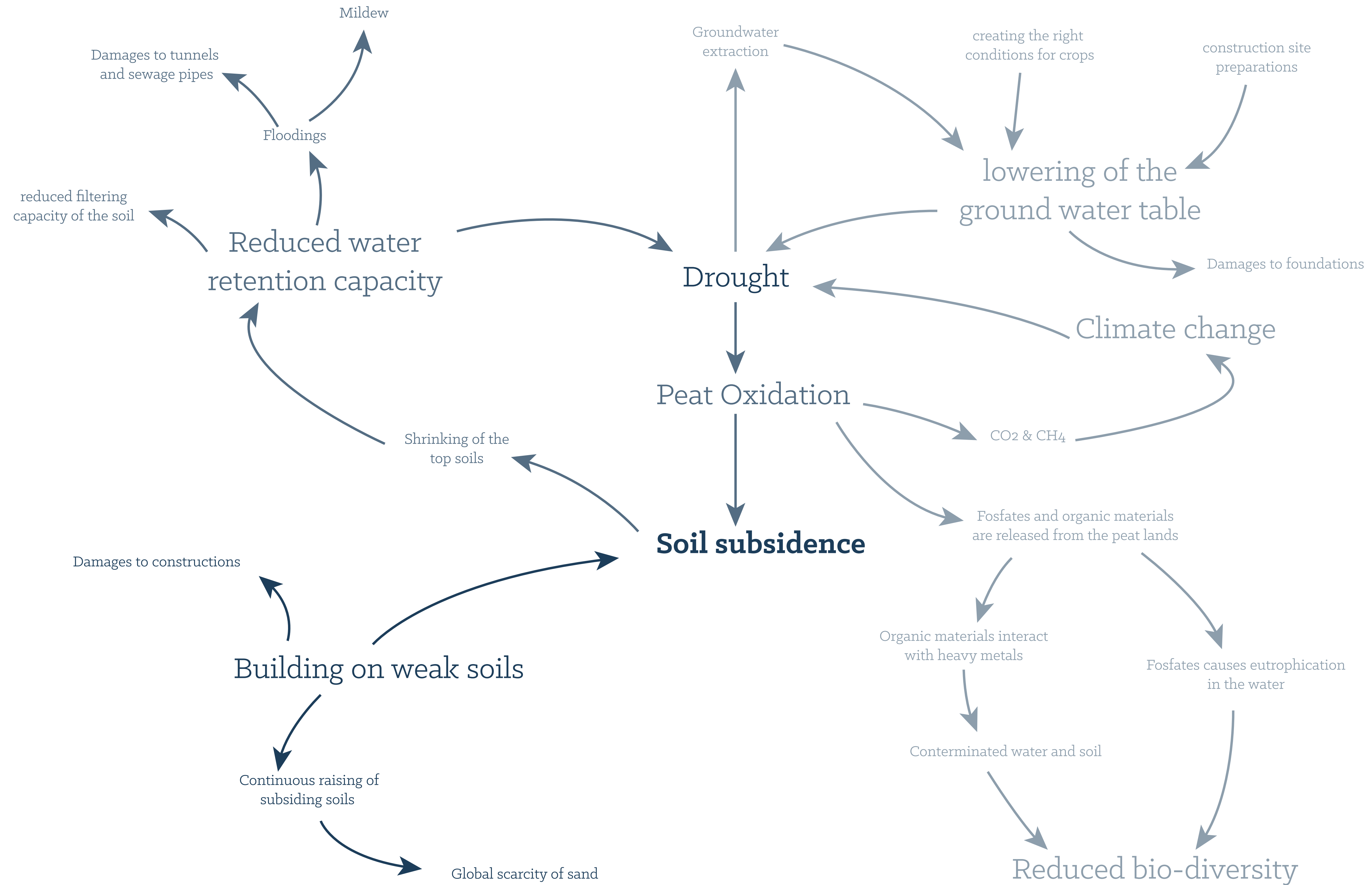
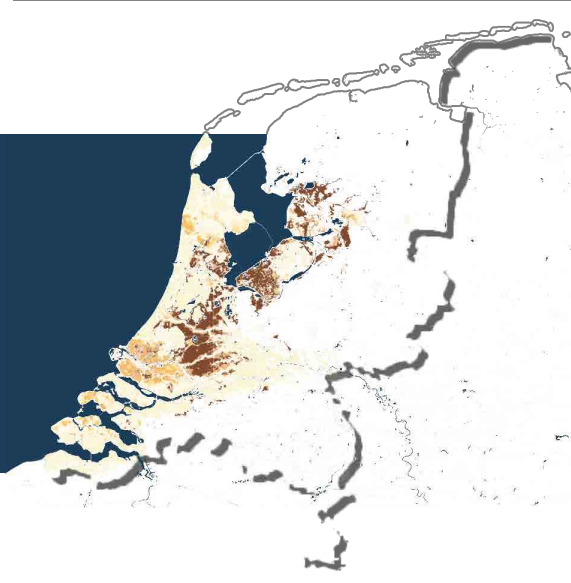


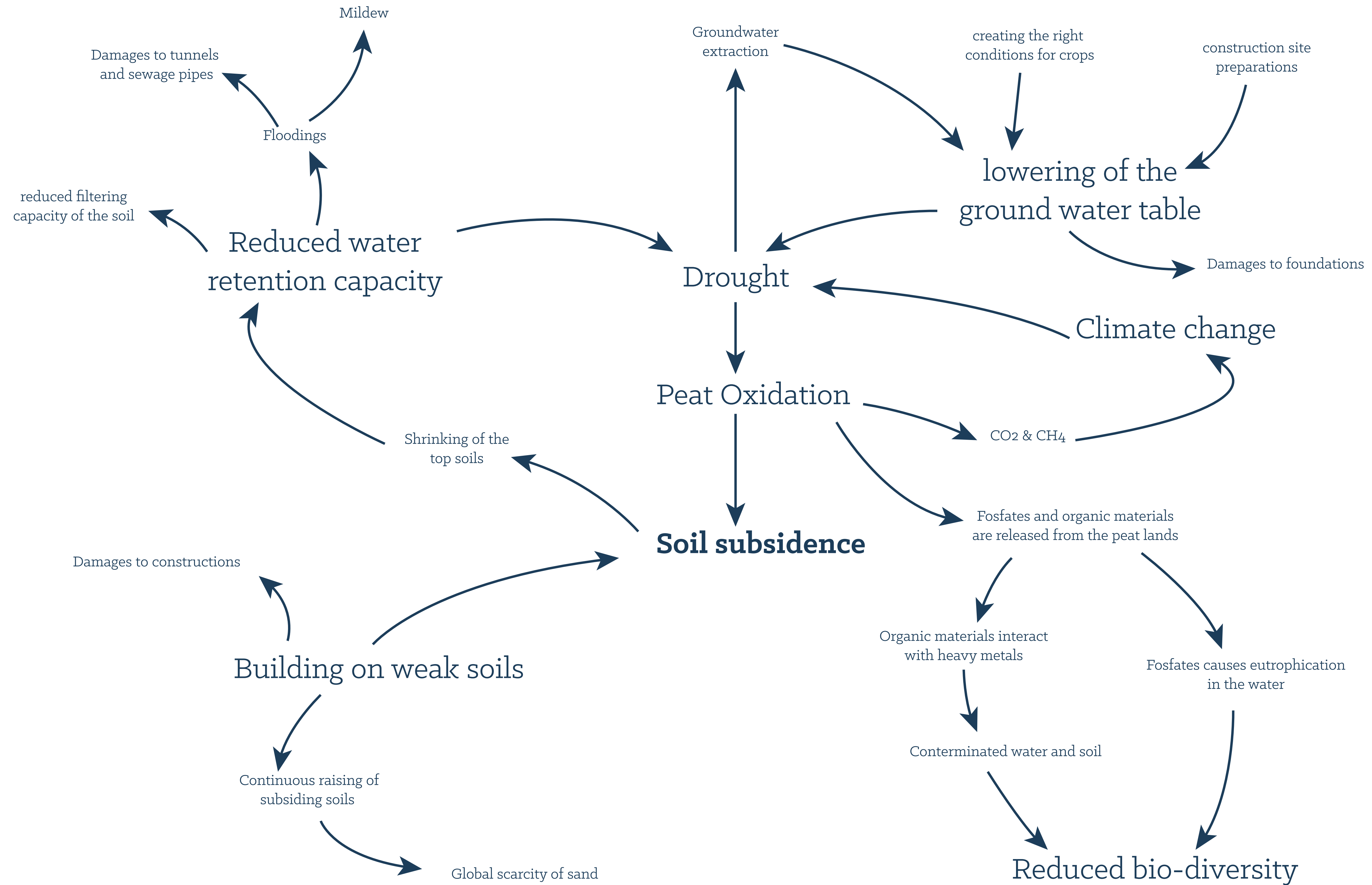
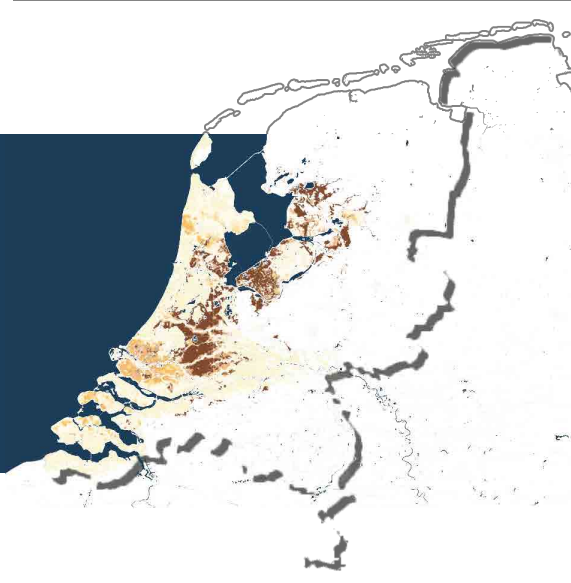
















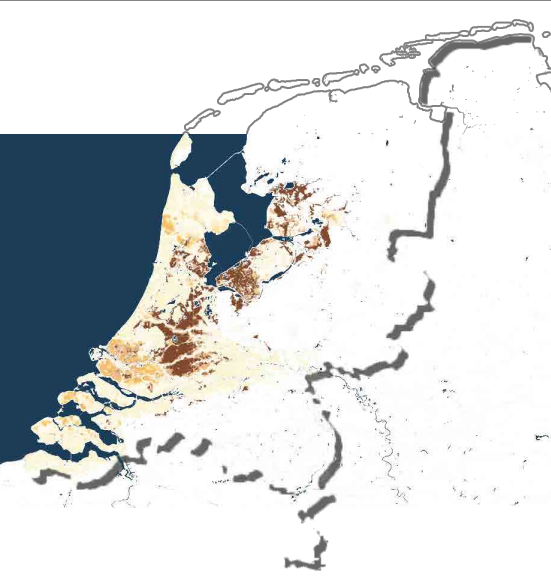
DEFLAND



# DELFLAND







SPATIAL  
URBAN & ENVIRONMENTAL

STRATEGICAL  
UNCERTAINTY & STAKEHOLDERS

PROBLEM FIELD

RESEARCH SETUP

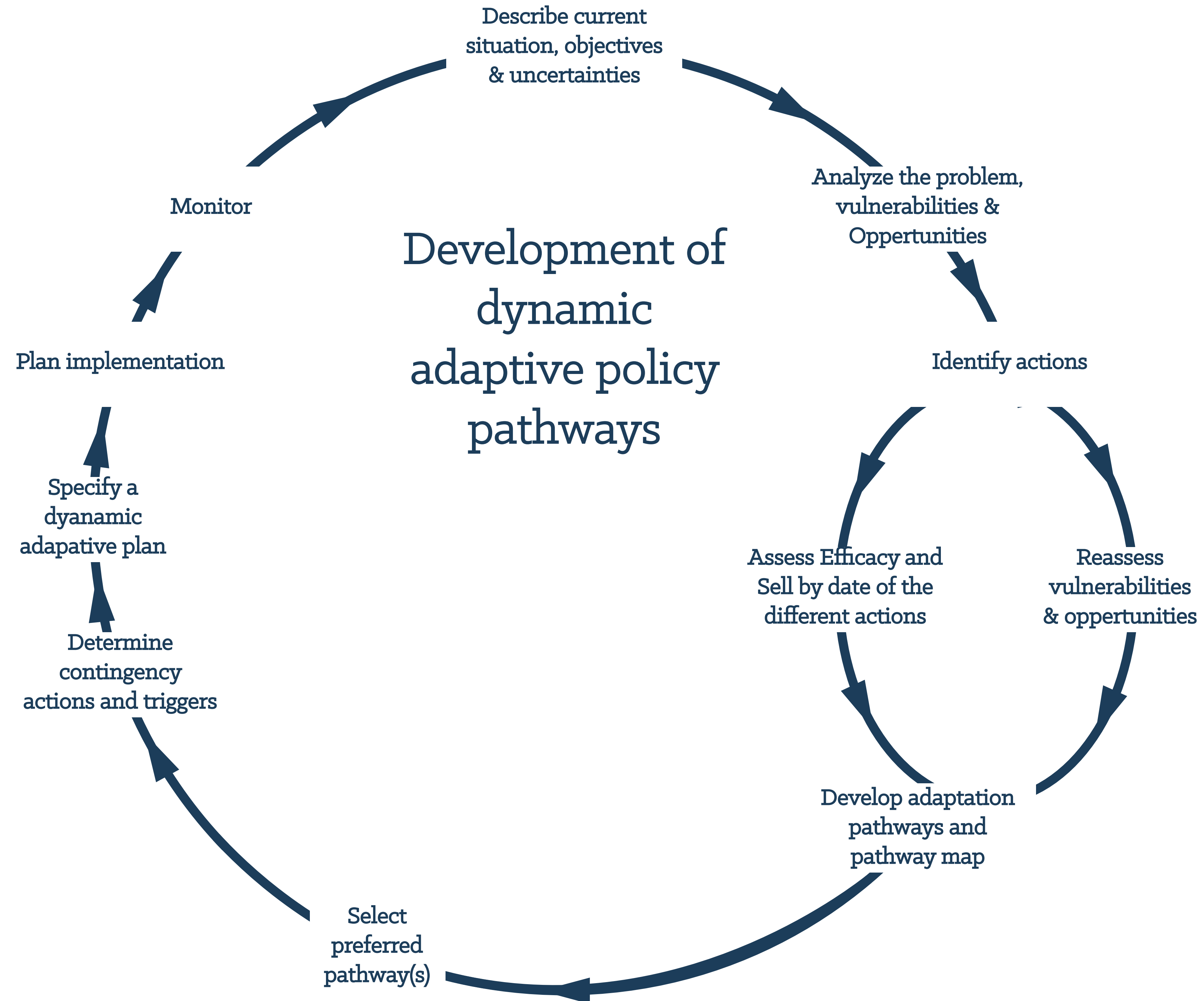
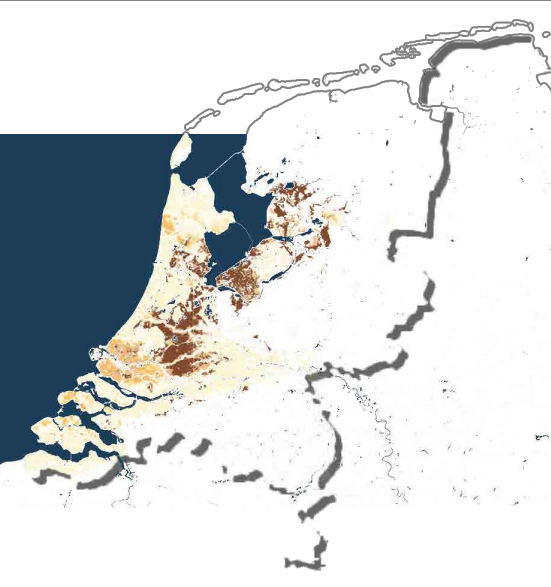
ANALYSIS

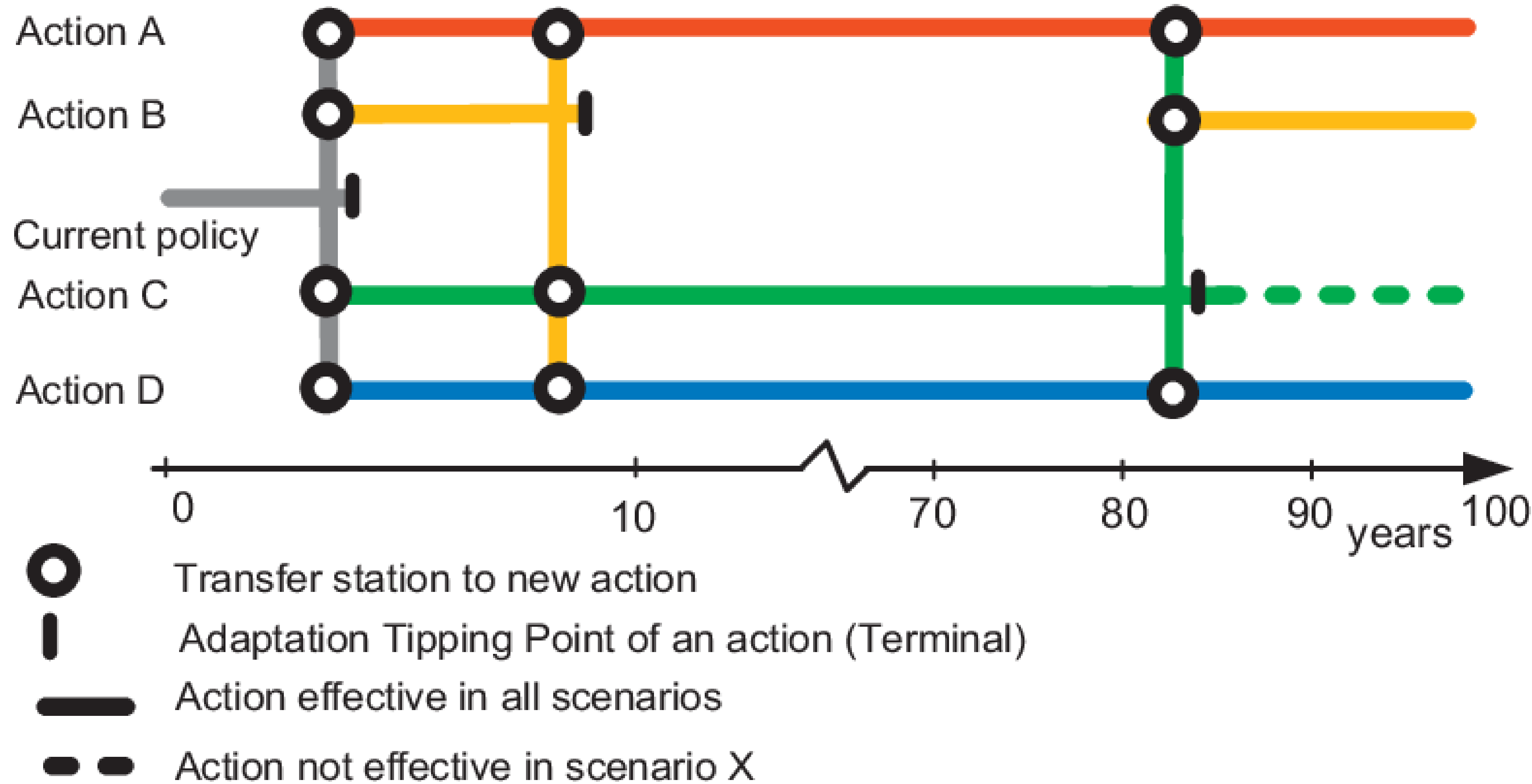
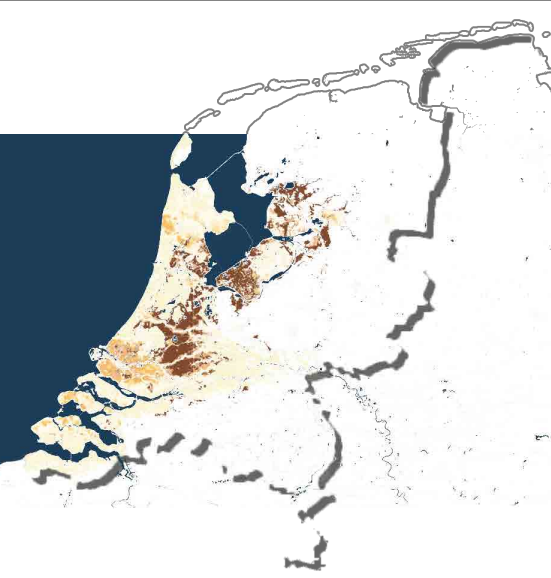
ACTION ASSESSMENT

DECISION-MAKING

PATHWAY PROJECTIONS

CONCLUSIONS

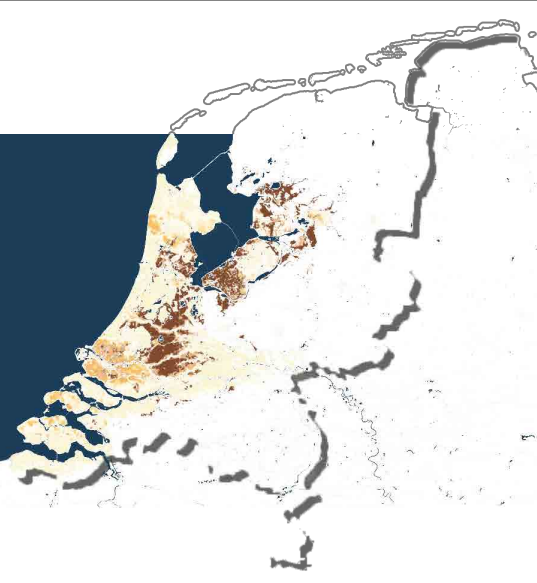




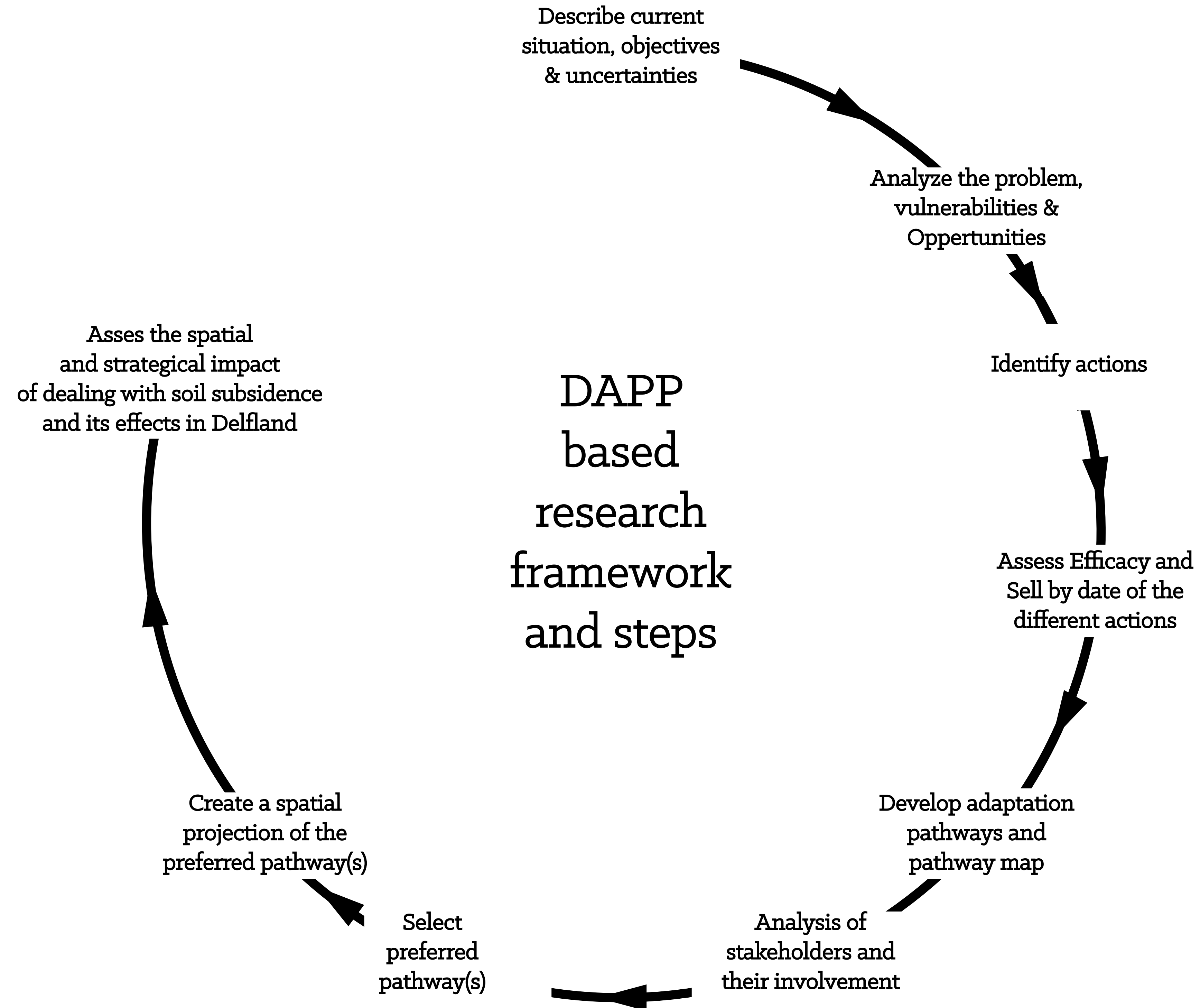
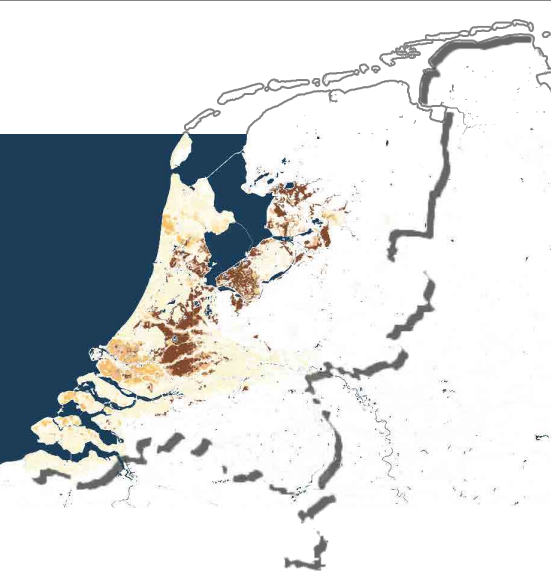
Path	actions	Relative Costs	Target effects	Side effects
1	○	+++	+	0
2	○ ○	+++++	0	0
3	○ ○	+++	0	0
4	○ ○	+++	0	0
5	○	0	0	-
6	○ ○	+++++	0	-
7	○ ○	+++	0	-
8	○ ○	+	+	- - -
9	○	++	+	- - -

Scorecard pathways





What are the **spatial consequences** and **decision-making requirements** of dealing with soil subsidence, its effects, and the **uncertainties** that come with them, within the Delfland region?



PROBLEM FIELD

RESEARCH SETUP

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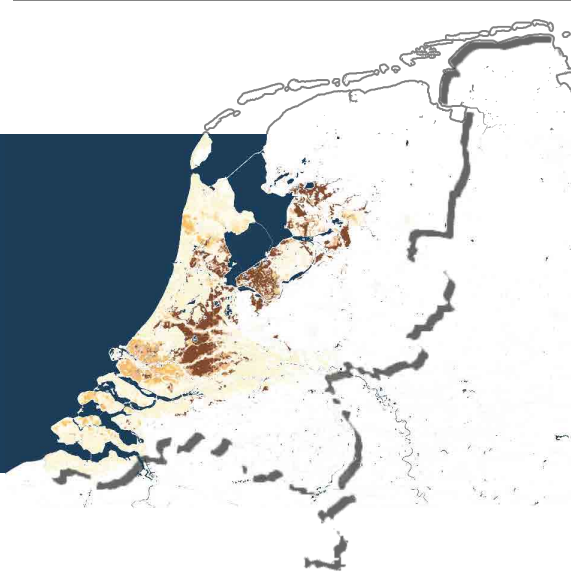
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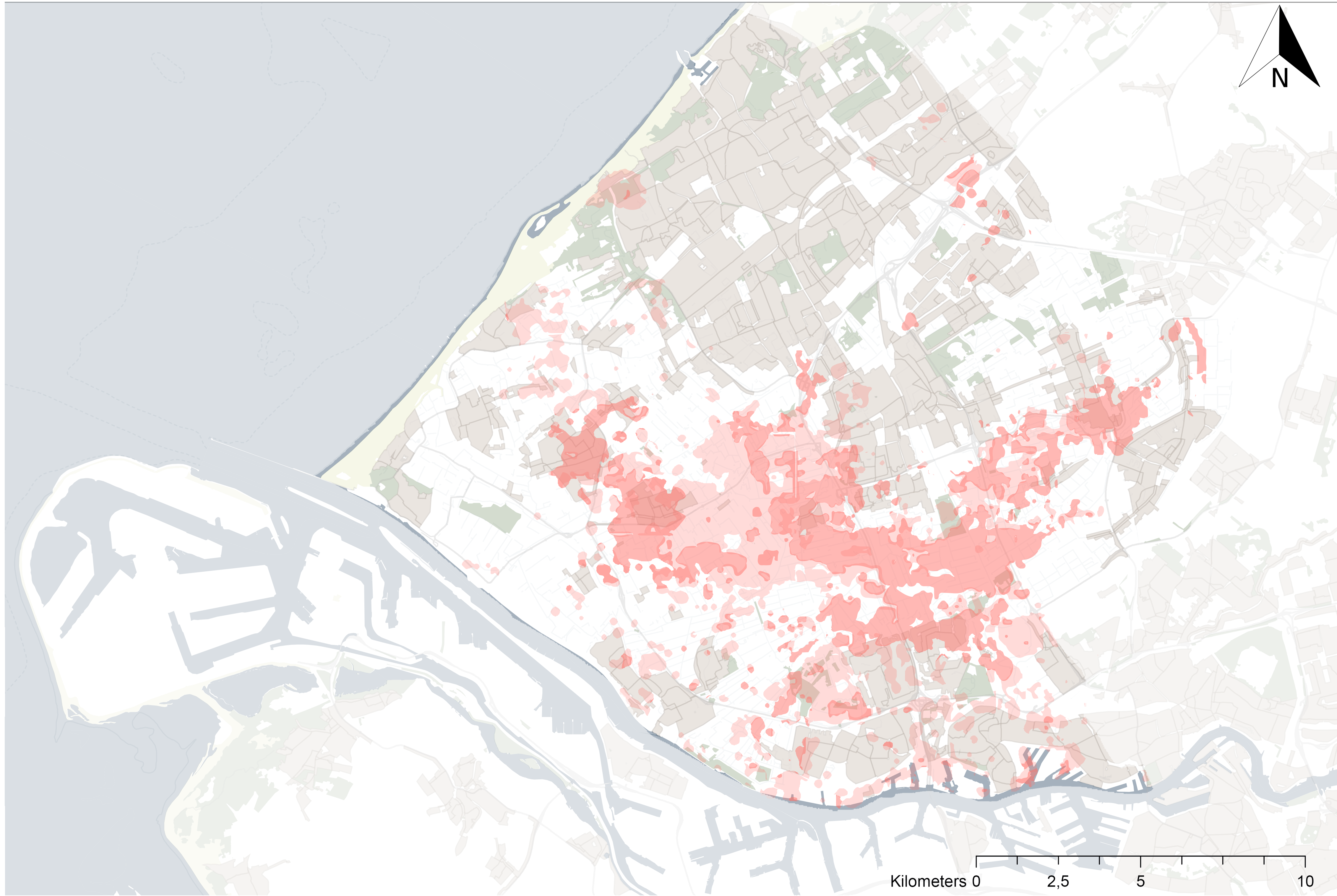
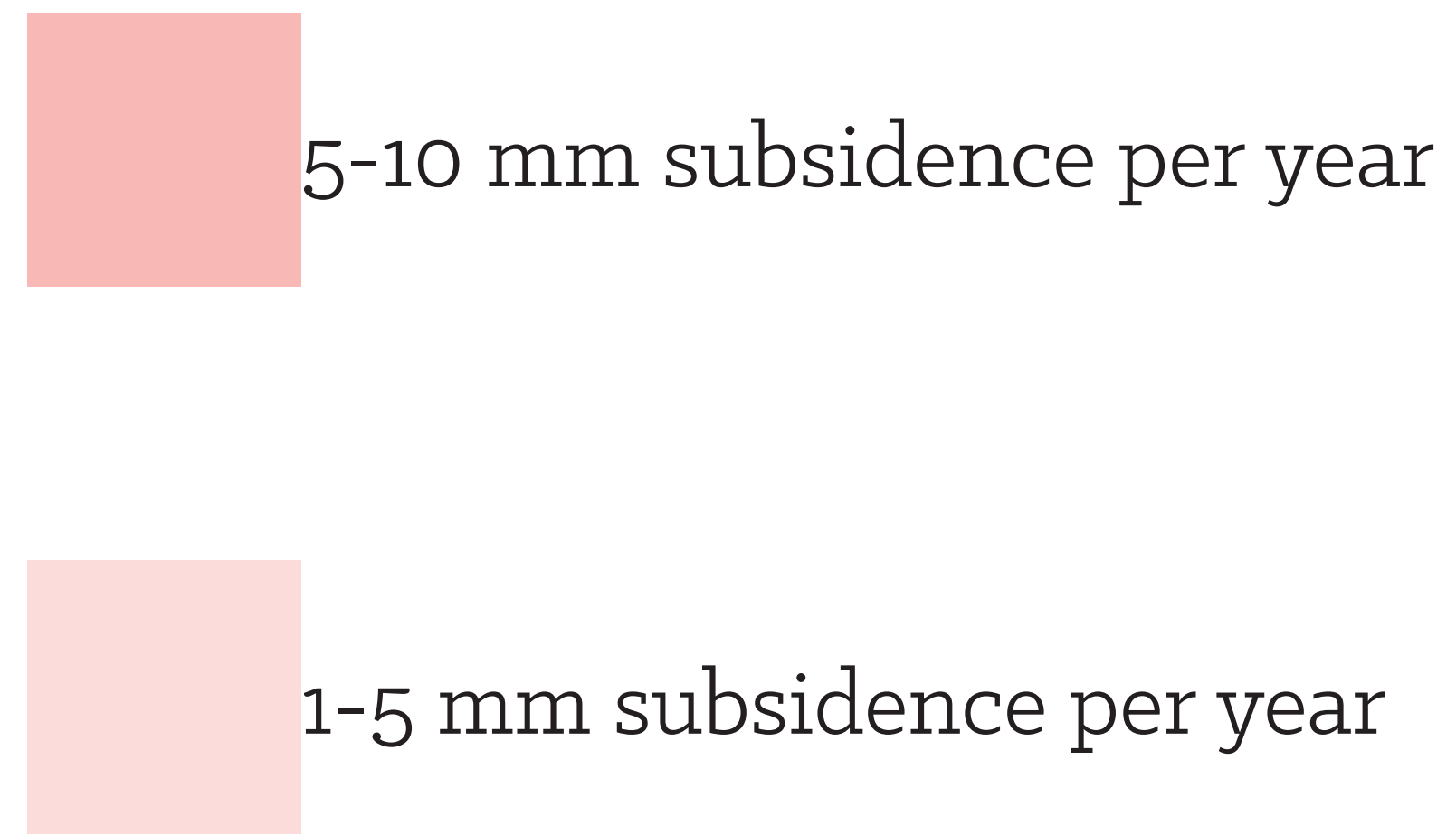
PATHWAY PROJECTIONS

CONCLUSIONS

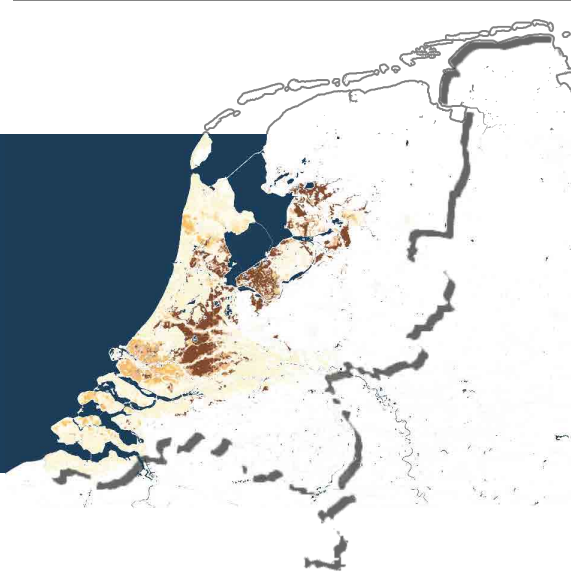




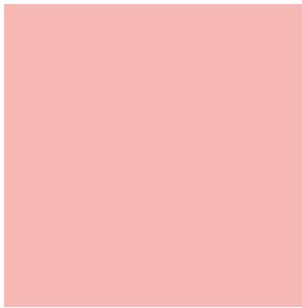
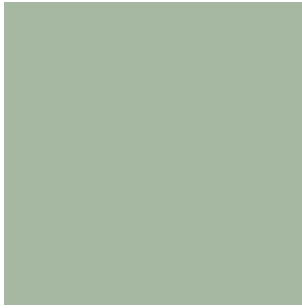
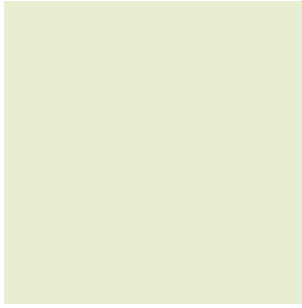
# SUBSIDENCE IN DELFLAND

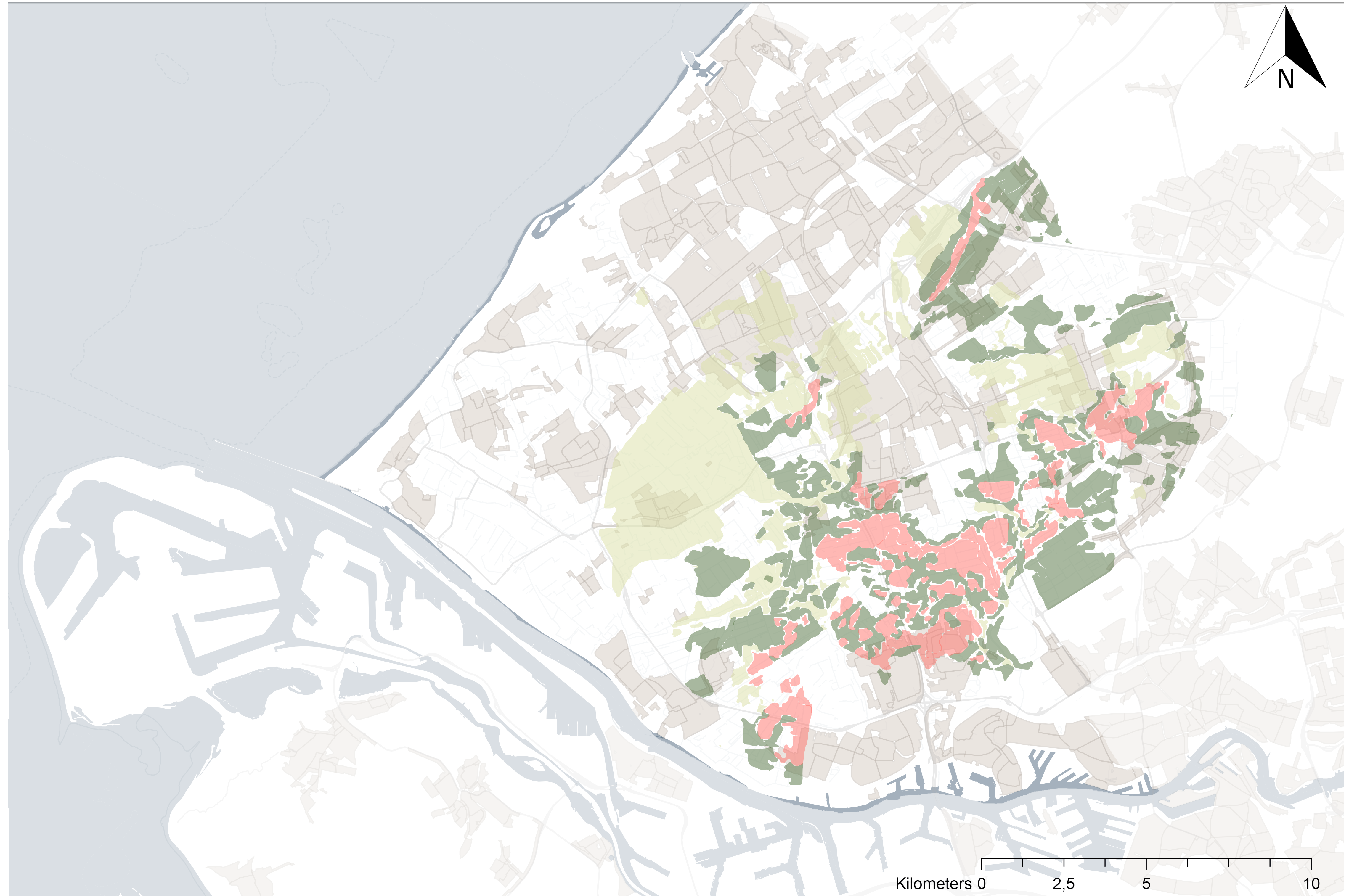




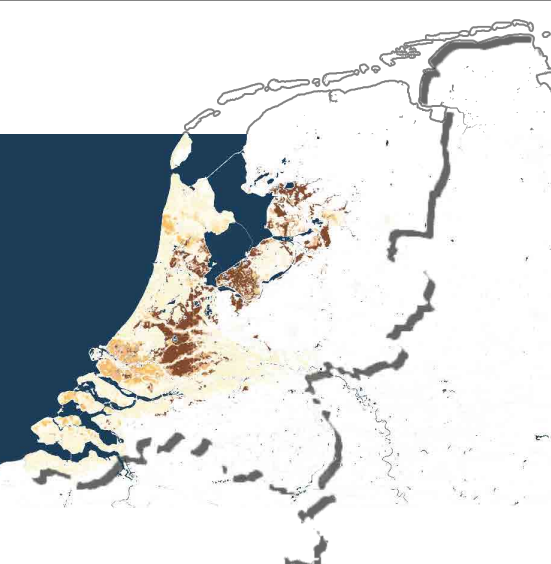


# SUBSIDENCE IN DELFLAND

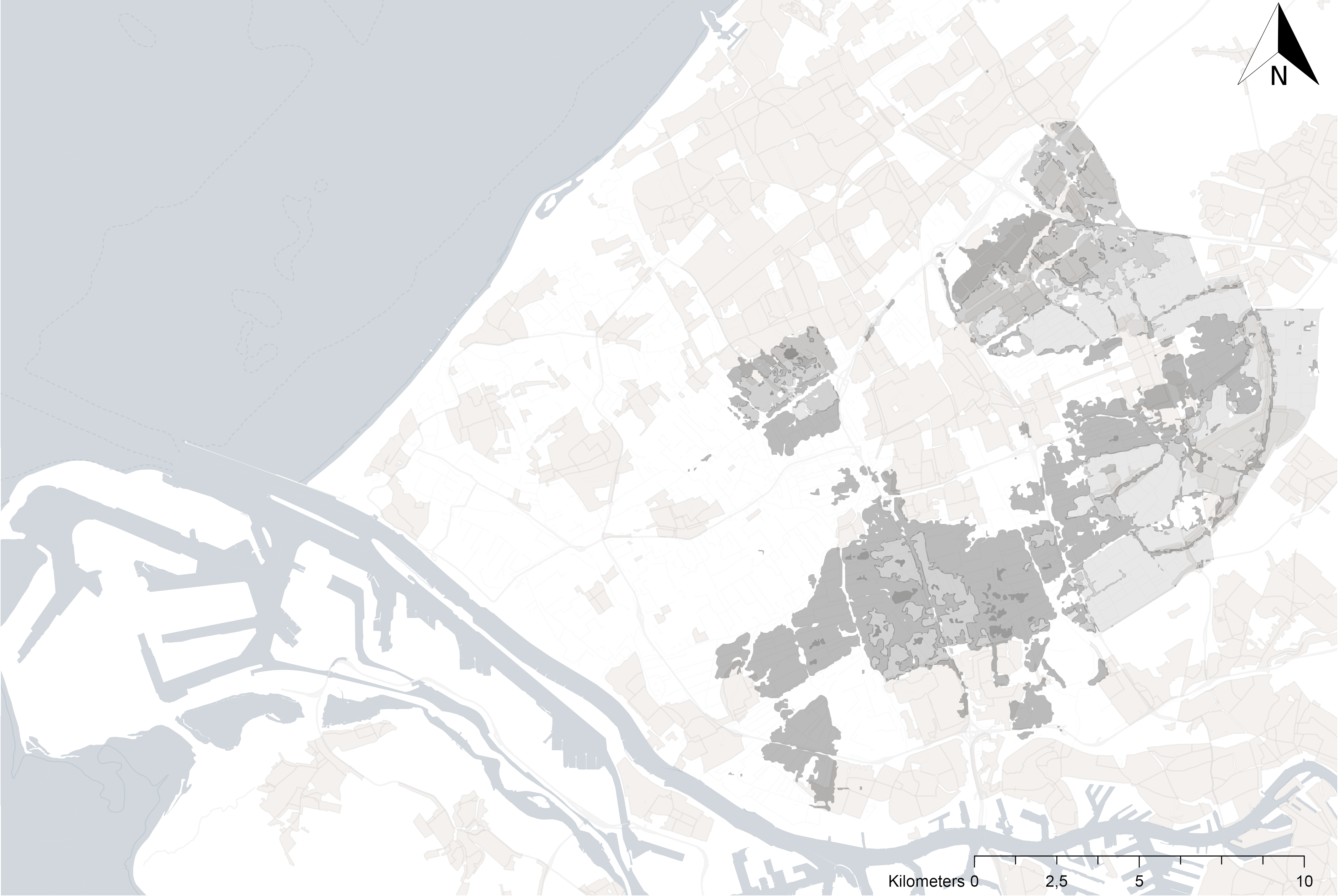
-  Peat on clay soils
-  Clay on peat soils
-  Mixture of peat, clay and other soils



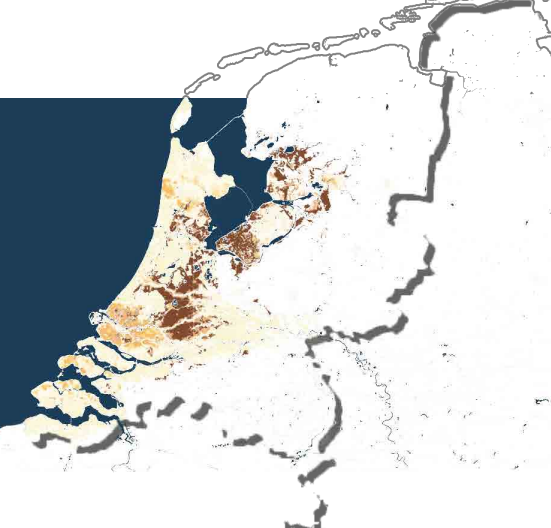




# SUBSIDENCE IN DELFLAND





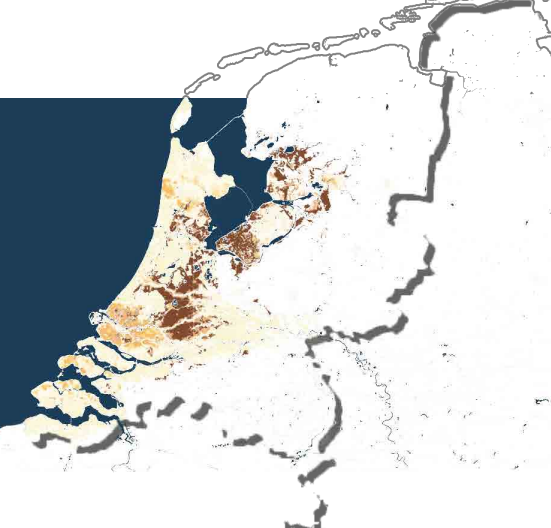


# SUBSIDENCE IN DELFLAND

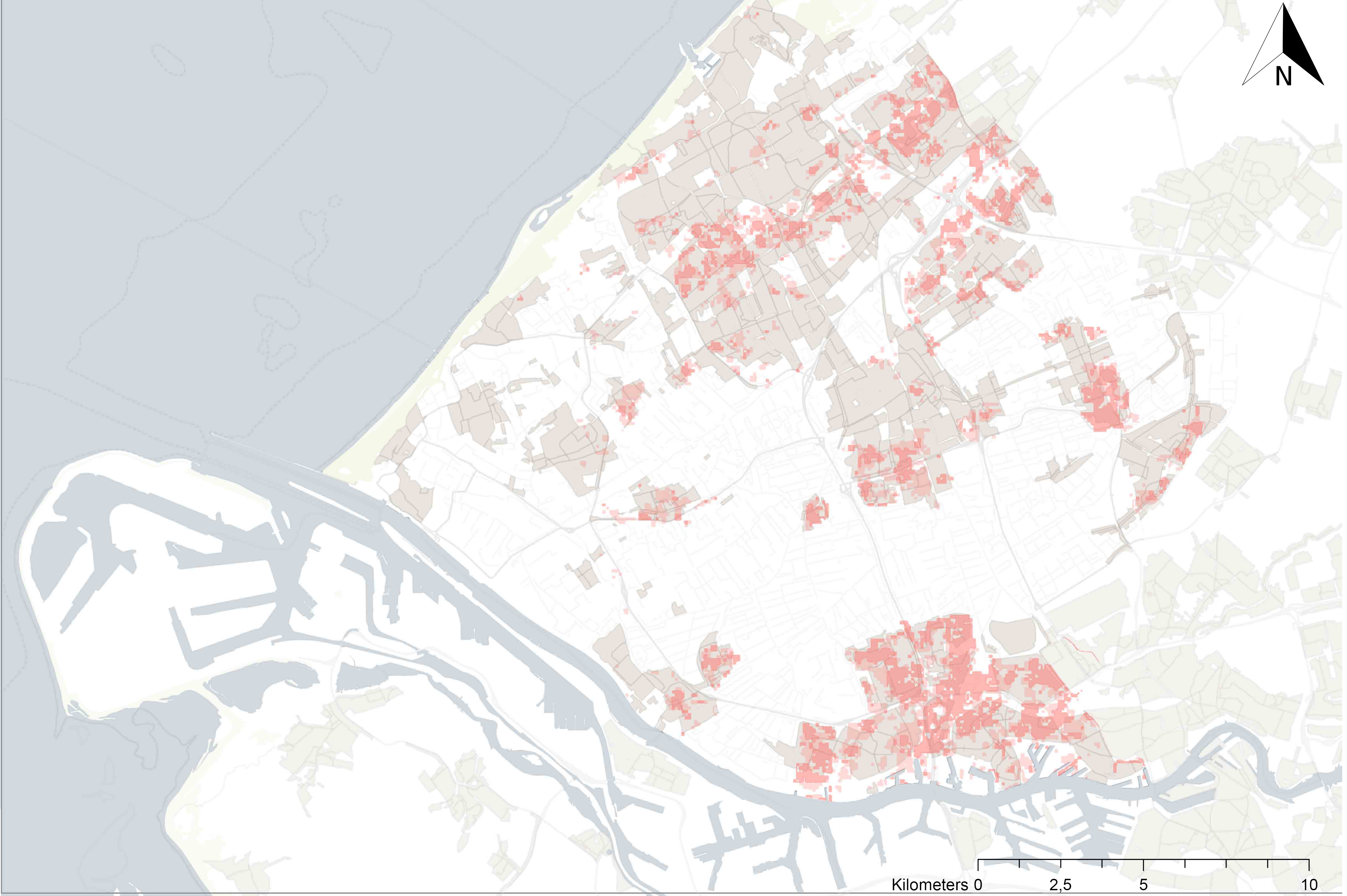
-  Agricultural grass lands
-  Fields with crops








# SUBSIDENCE IN DELFLAND



 Subsidence as a result of anthropogenic loading



PROBLEM FIELD

RESEARCH SETUP

ANALYSIS

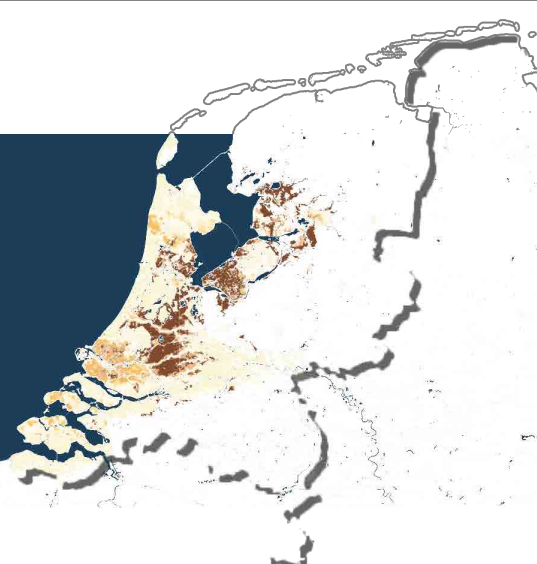
ACTION ASSESSMENT

DECISION-MAKING

PATHWAY PROJECTIONS

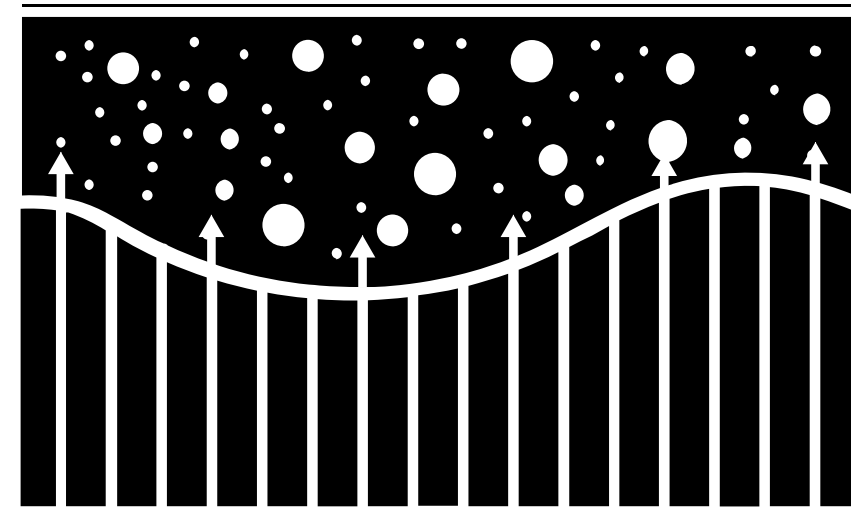
CONCLUSIONS & RECOMMENDATIONS



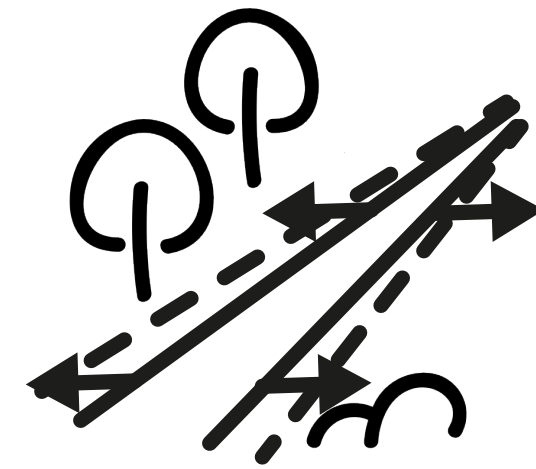


## Water Management

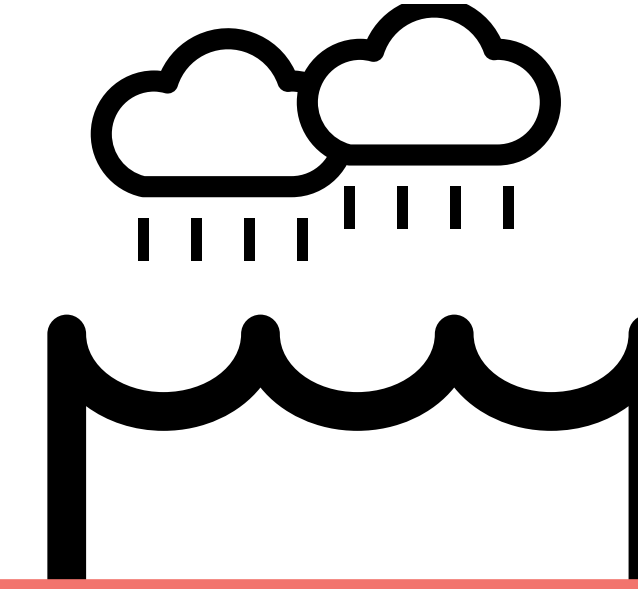
passive waterlogging



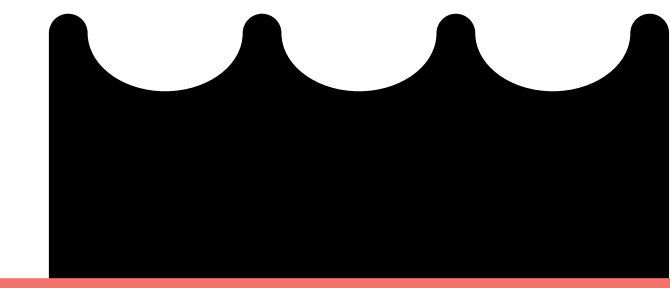
Broaden watercourses



Peak storage

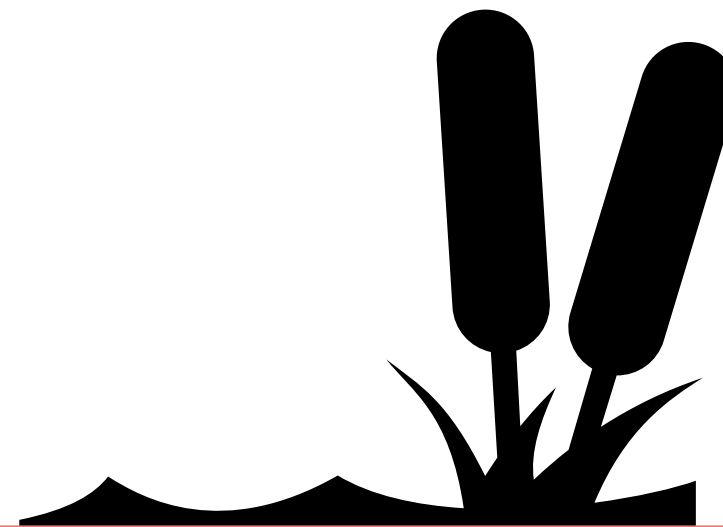


Seasonal storage



## Agricultural

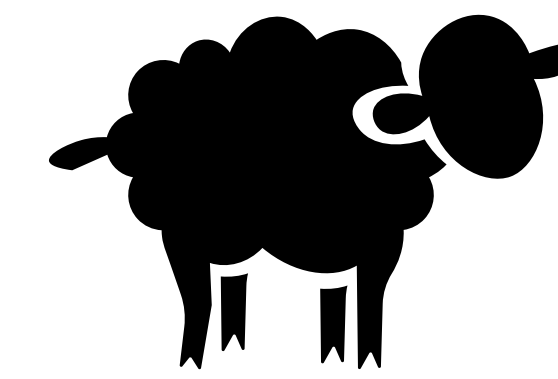
Paludiculture



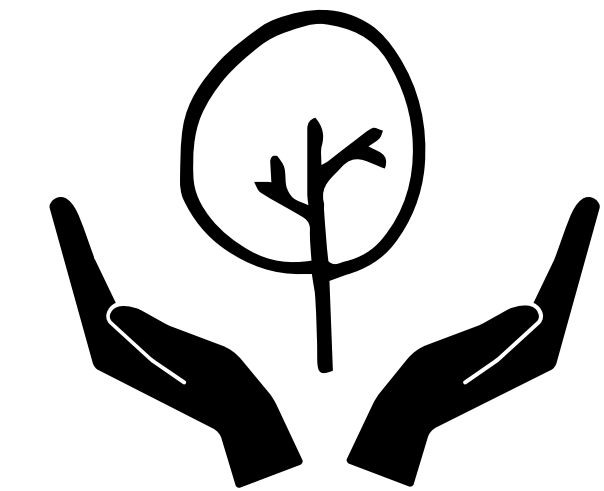
Sphagnum tillage



Low weight land cultivation

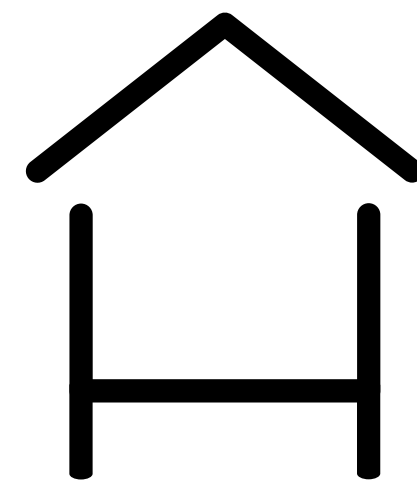


Permaculture

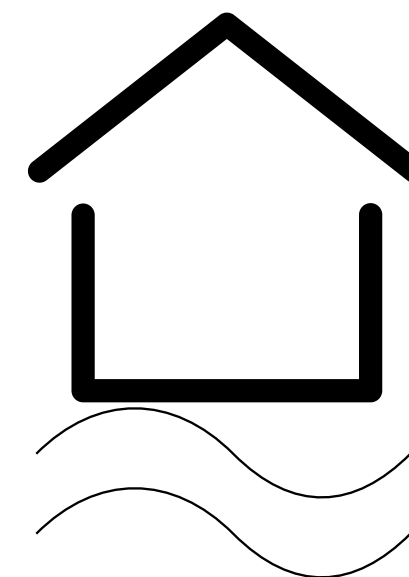


## Constructional

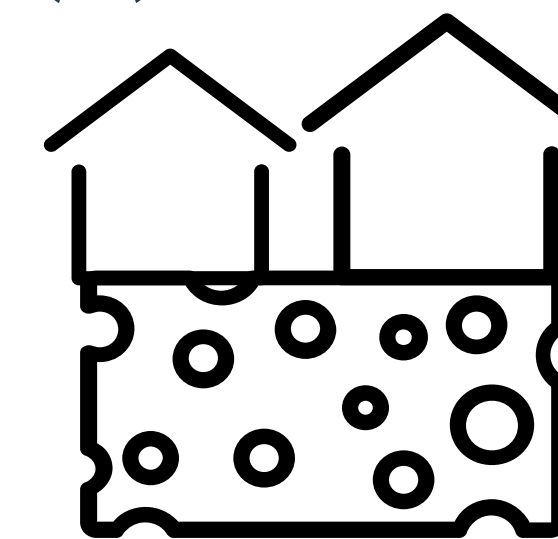
Lifted buildings



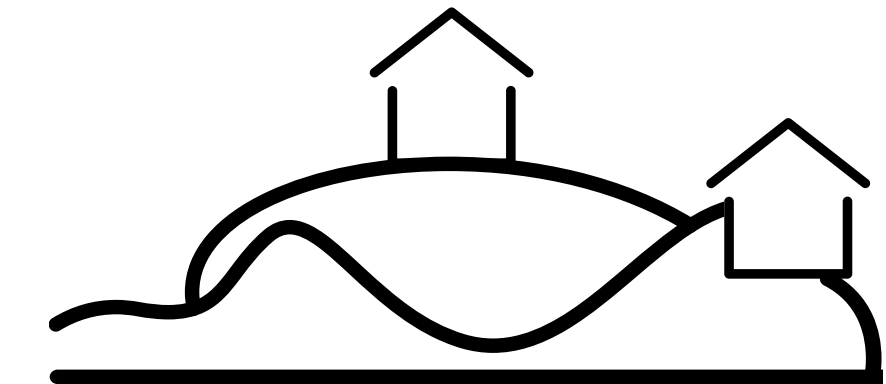
Floating constructions



Low pressure (re)construction

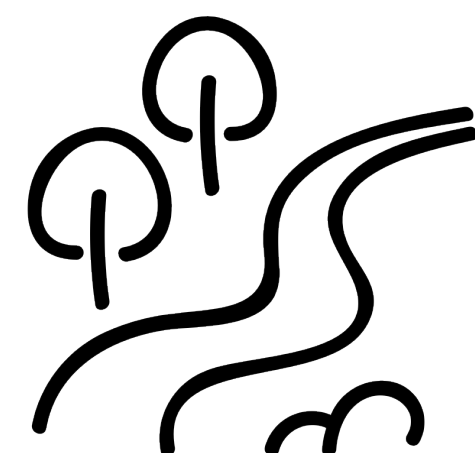


Soil and height orientated planning



## Ecological

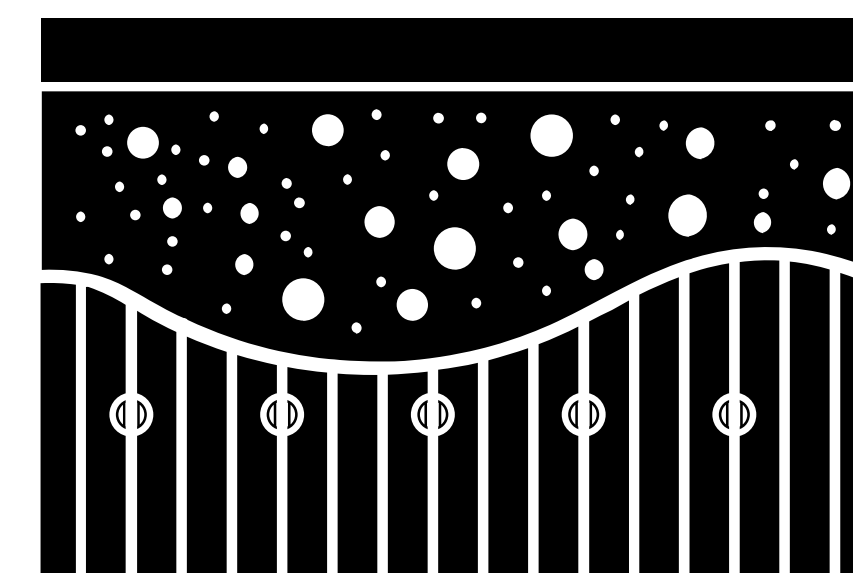
Unrefined watercourses



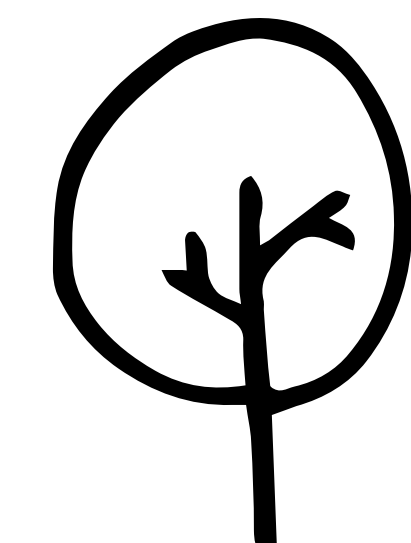
Decentralized water treatment



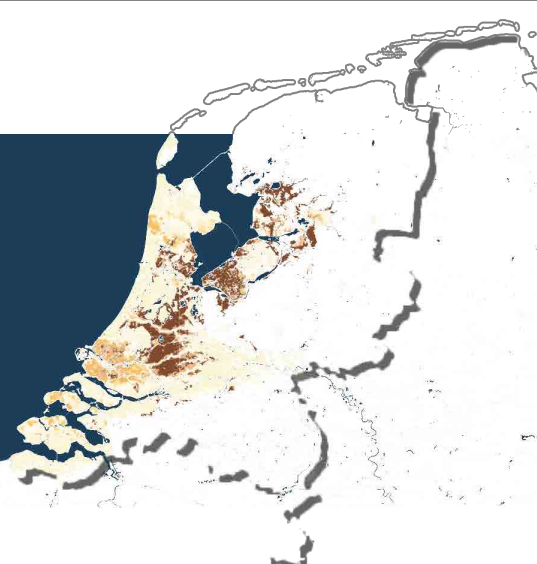
Underwater drainage



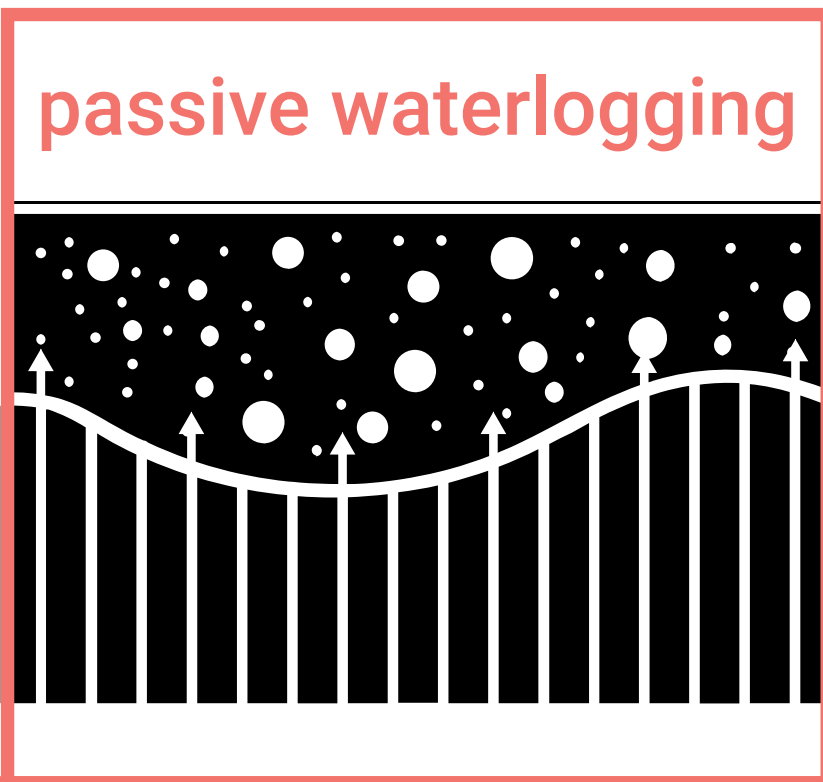
Environmental protection & conservation



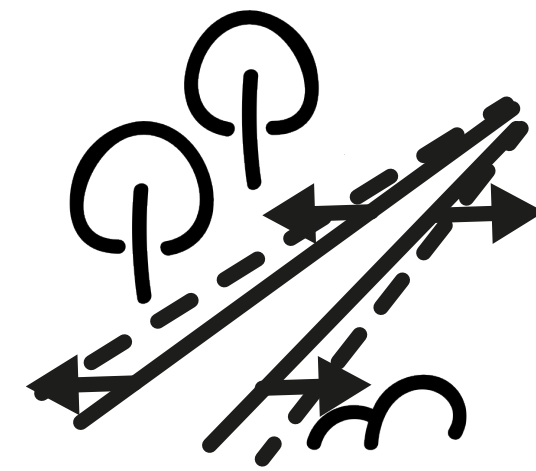




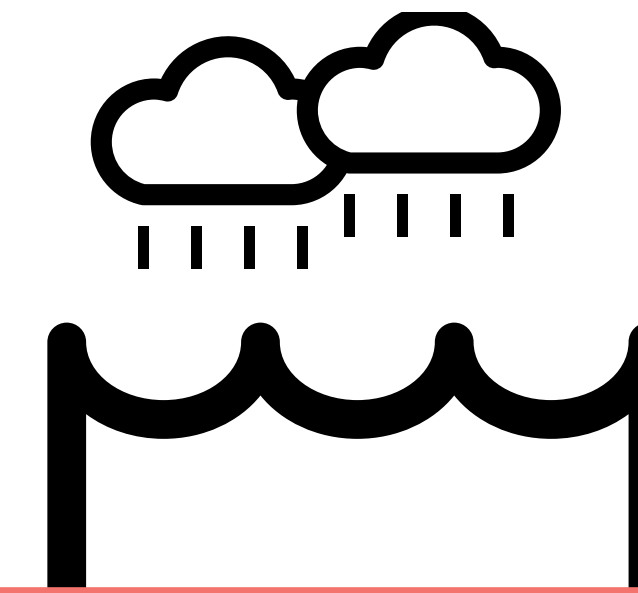
## Water Management



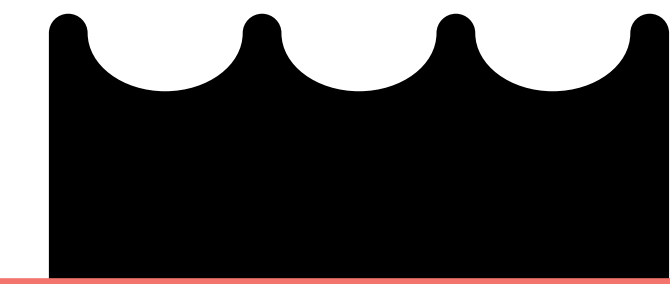
Broaden watercourses



Peak storage



Seasonal storage



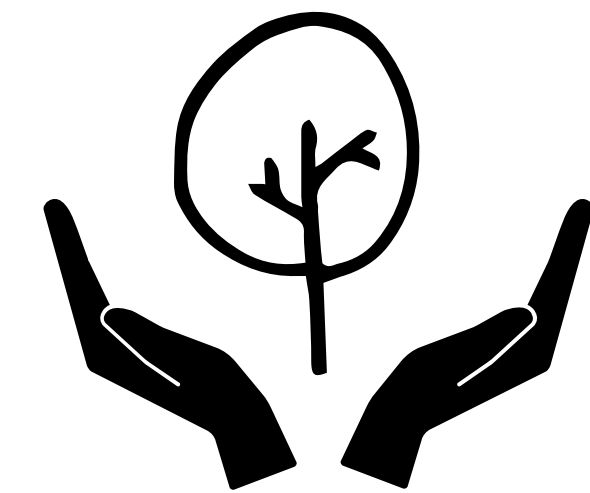
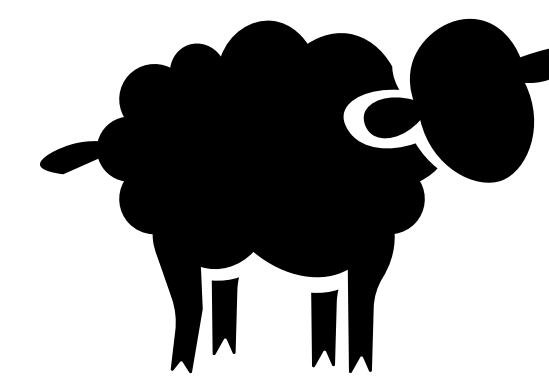
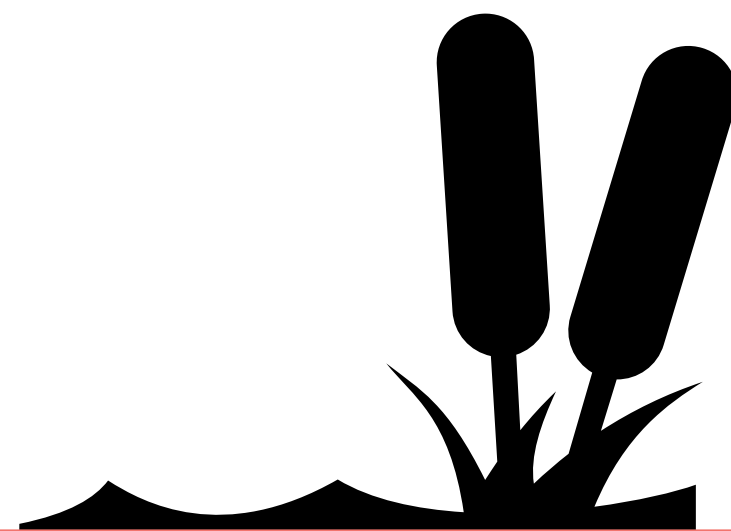
Paludiculture

Sphagnum tillage

Low weight land cultivation

Permaculture

## Agricultural



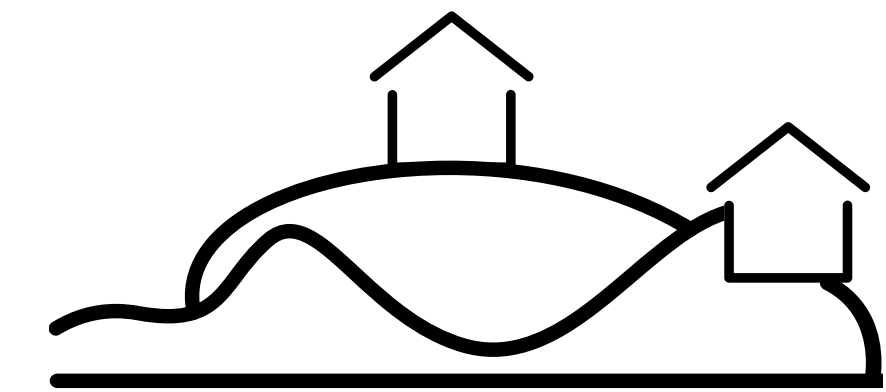
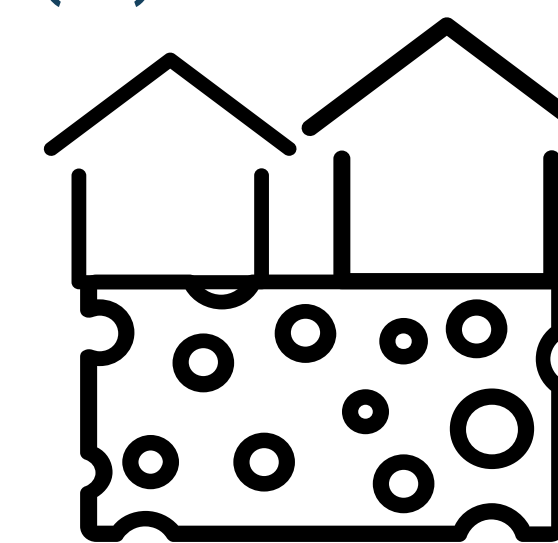
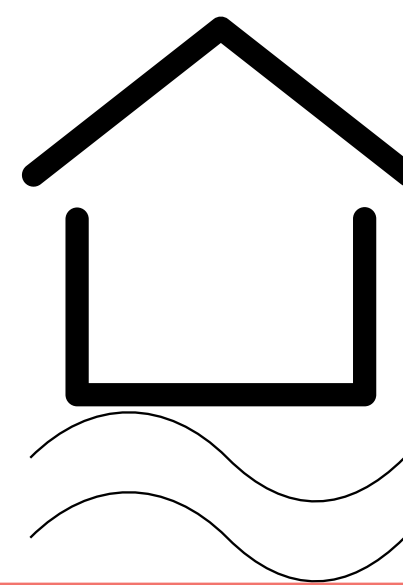
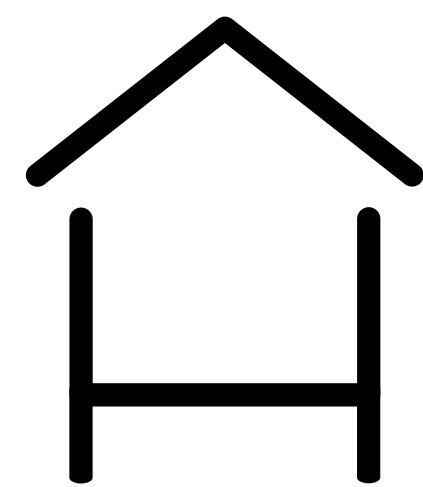
Lifted buildings

Floating constructions

Low pressure (re)construction

Soil and height orientated planning

## Constructional



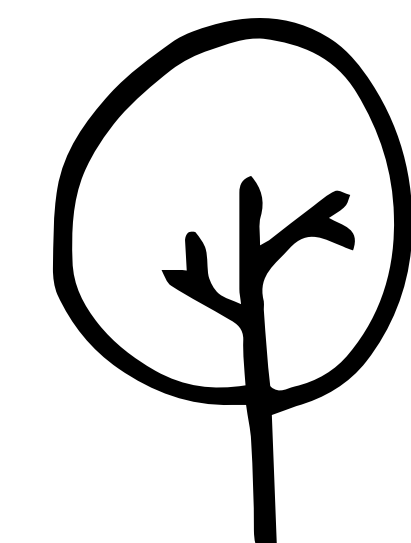
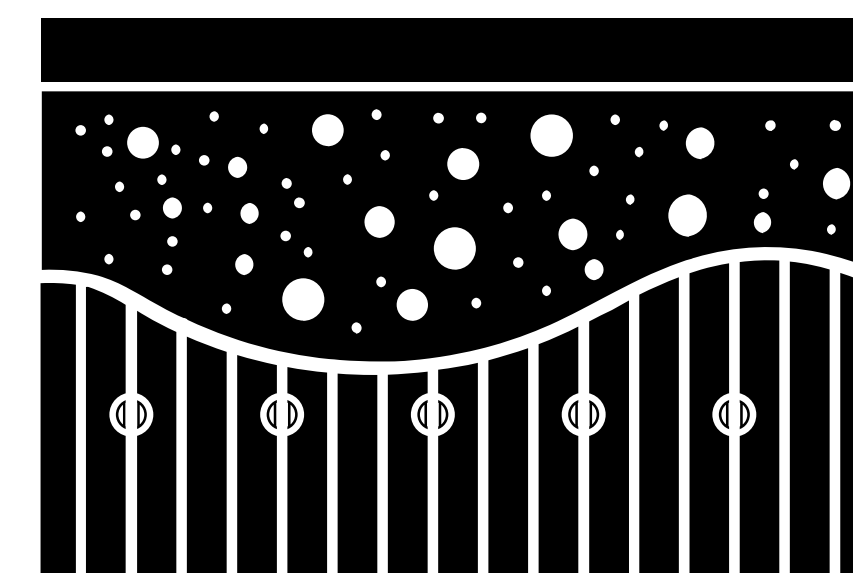
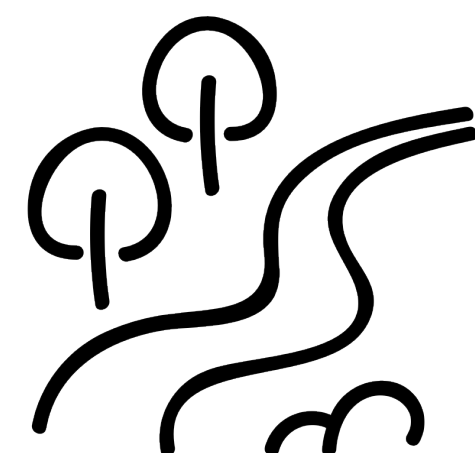
Unrefined watercourses

Decentralized water treatment

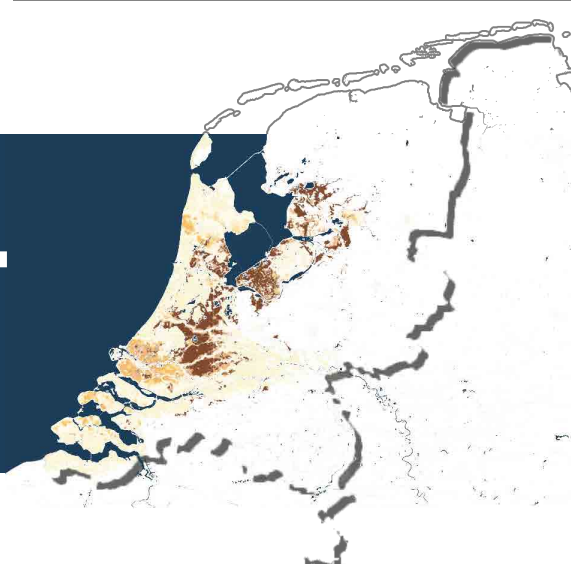
Underwater drainage

Environmental protection & conservation

## Ecological

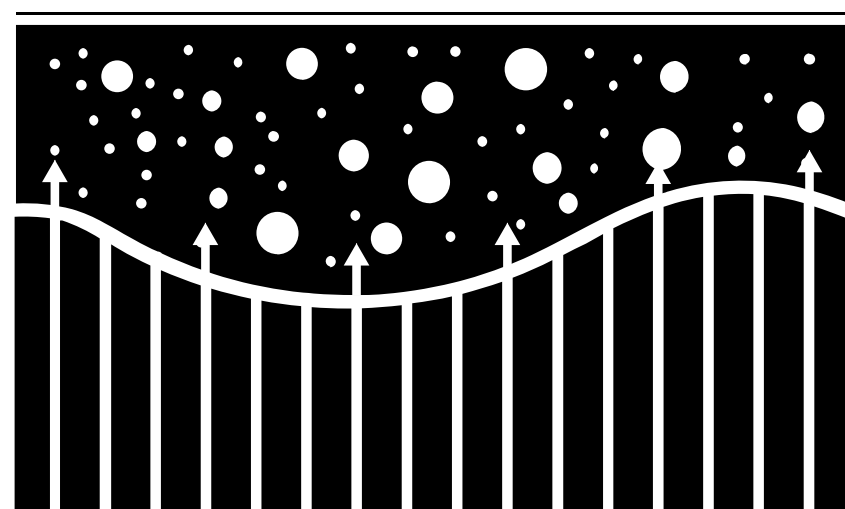




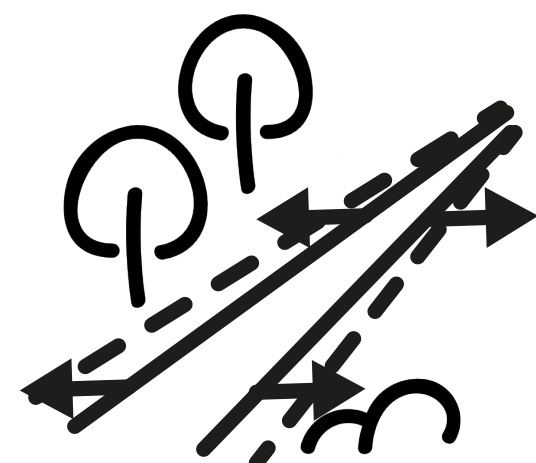


## Water Management

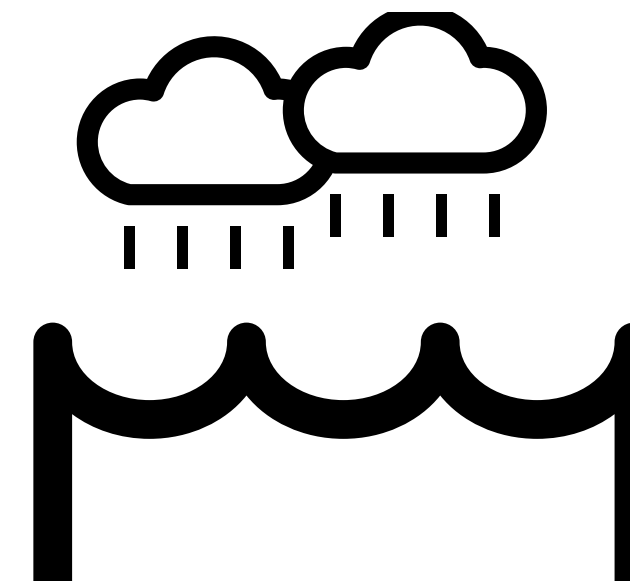
passive waterlogging



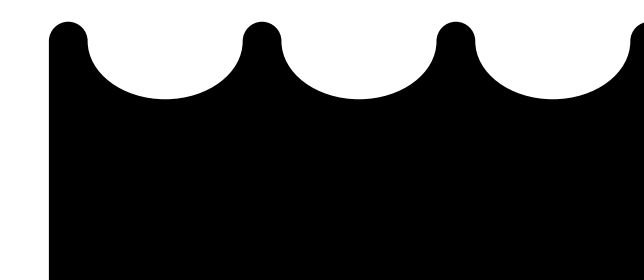
Broaden watercourses



Peak storage

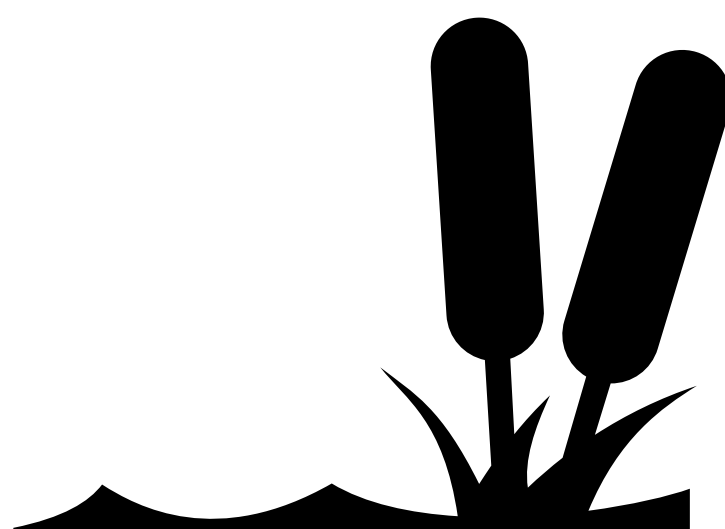


Seasonal storage



## Agricultural

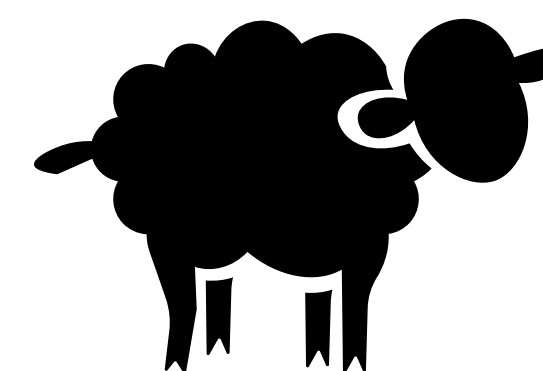
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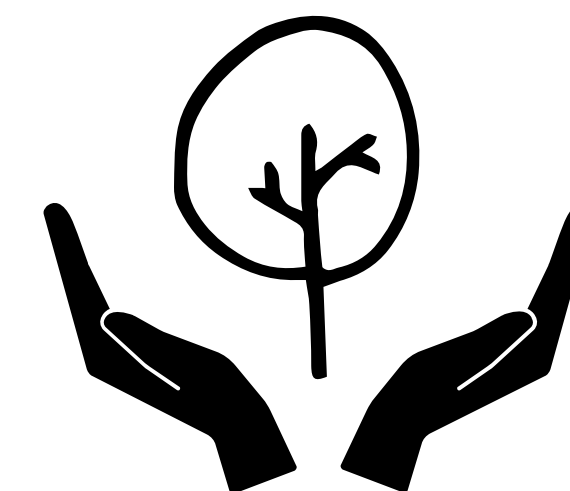
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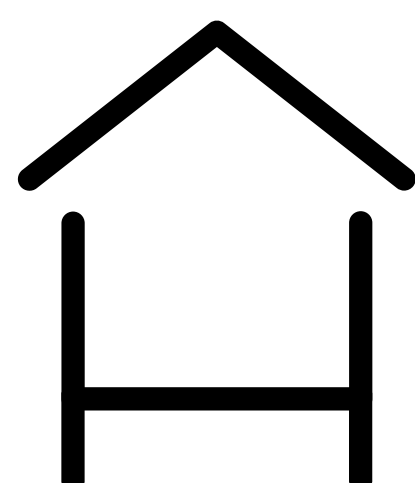


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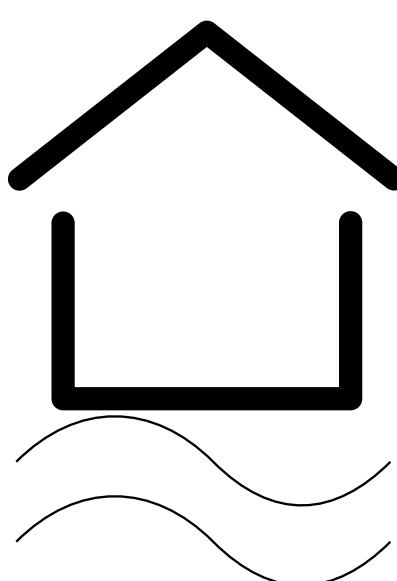


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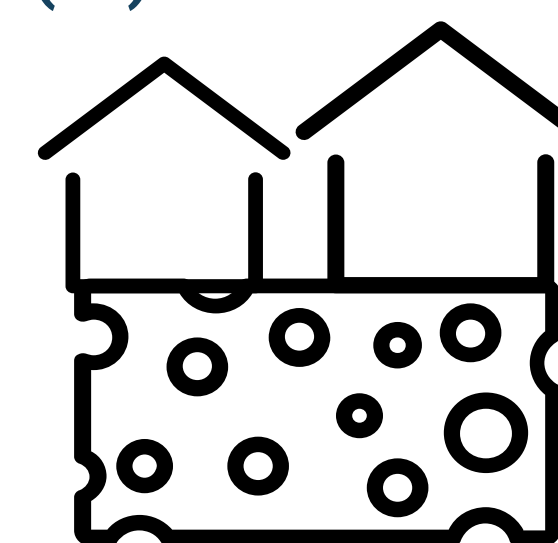
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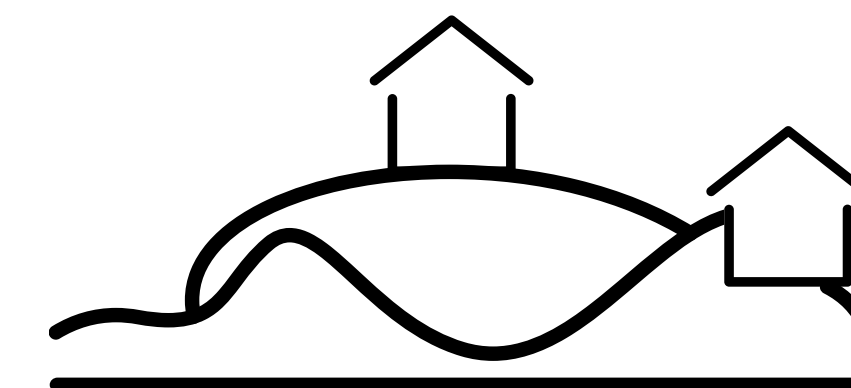
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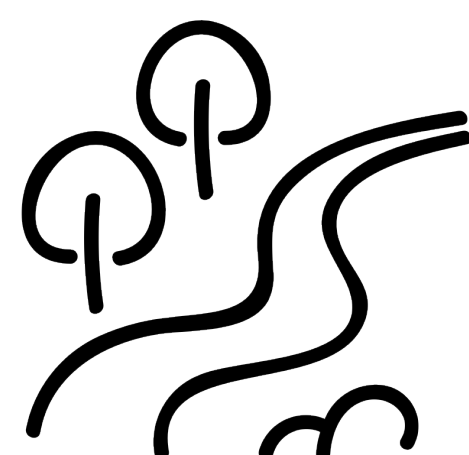


Soil and height orientated planning



## Ecological

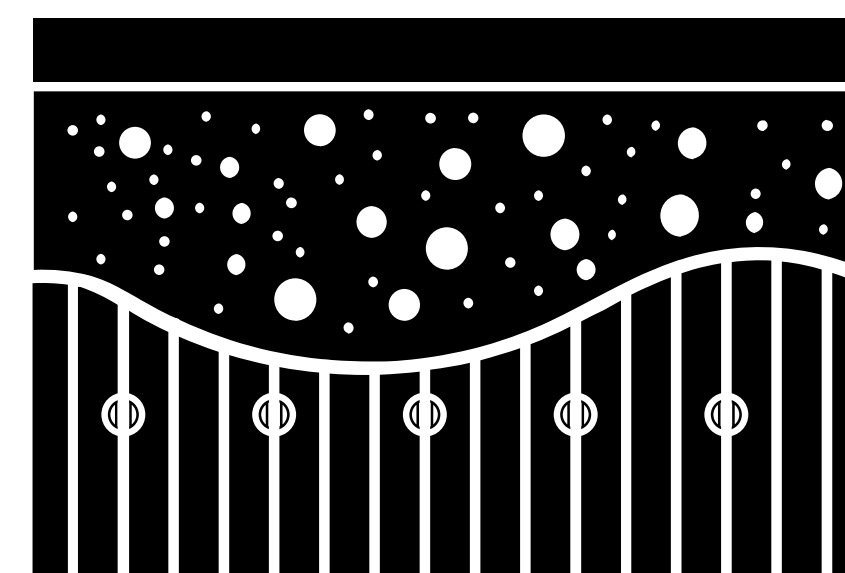
Unrefined watercourses



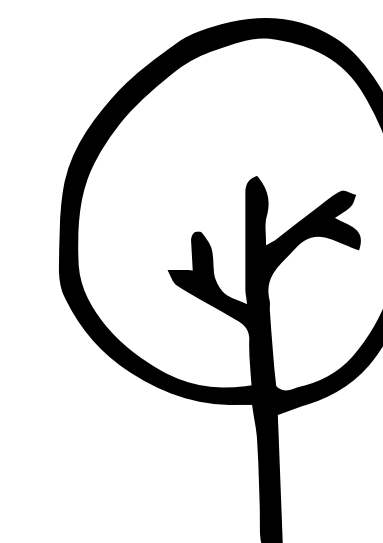
Decentralized water treatment



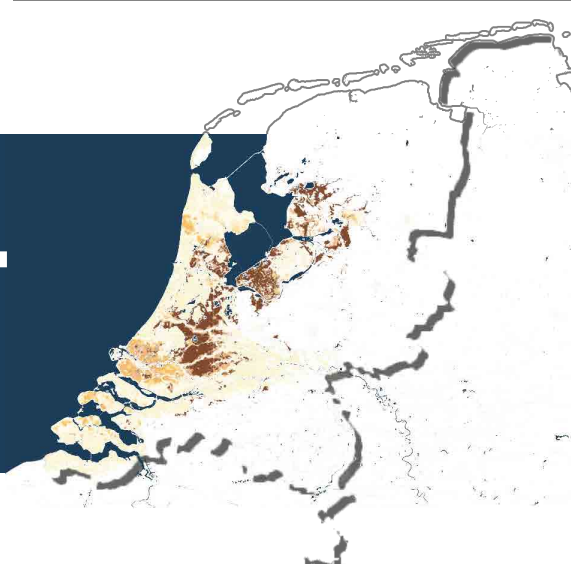
Underwater drainage



Environmental protection & conservation

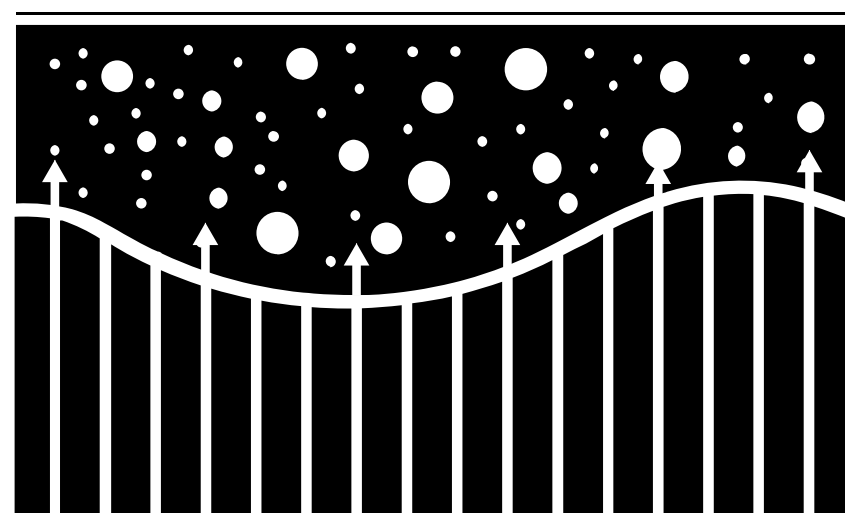




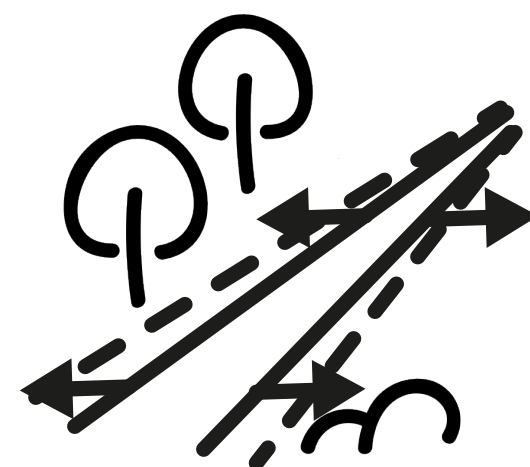


## Water Management

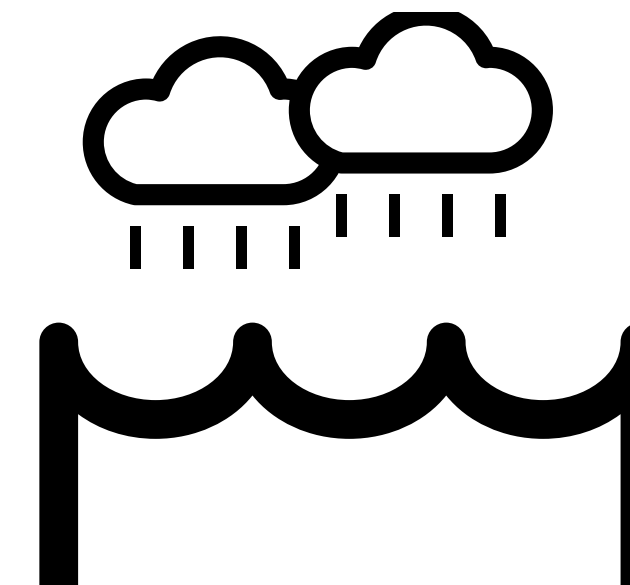
passive waterlogging



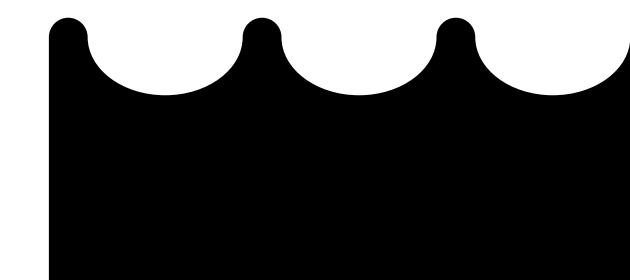
Broaden watercourses



Peak storage

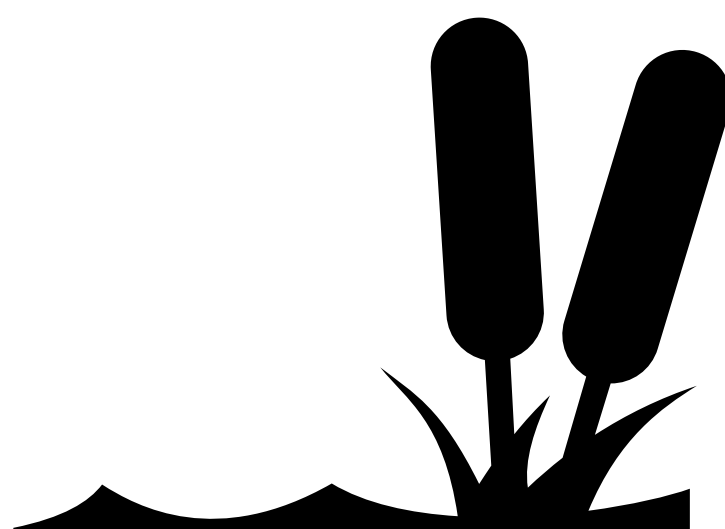


Seasonal storage



## Agricultural

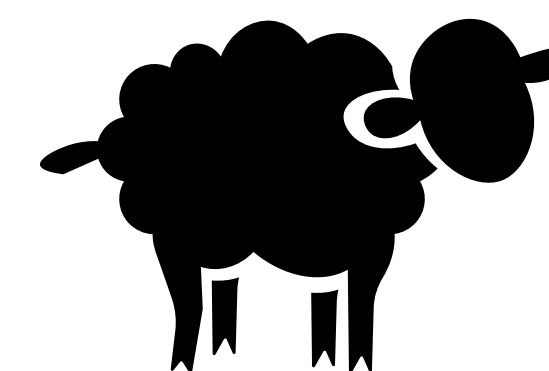
Paludiculture



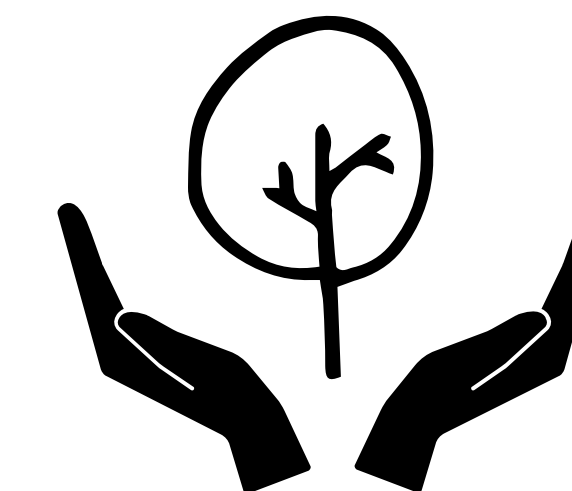
Sphagnum tillage



Low weight land cultivation

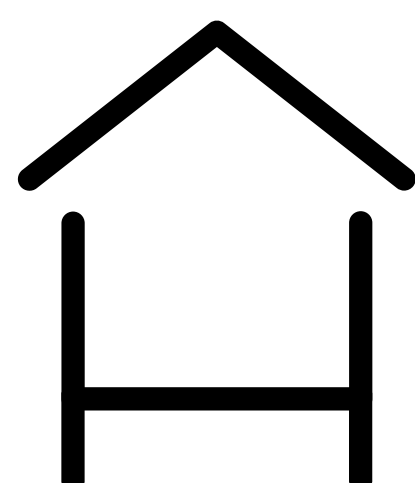


Permaculture

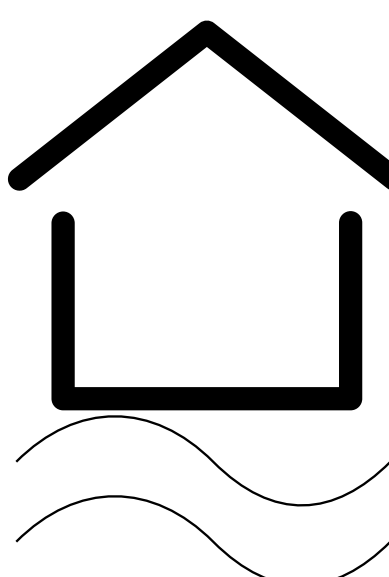


## Constructional

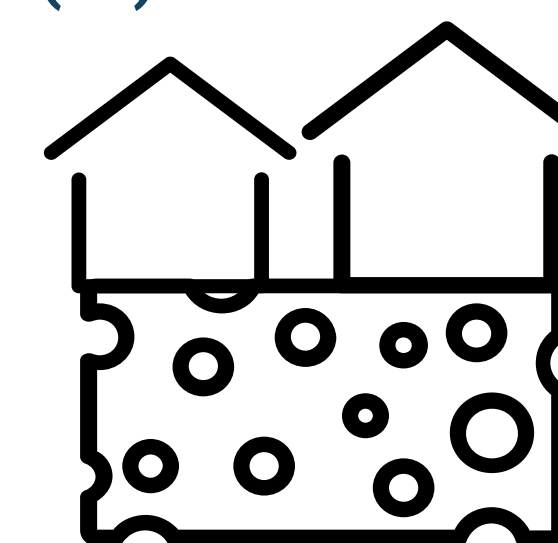
Lifted buildings



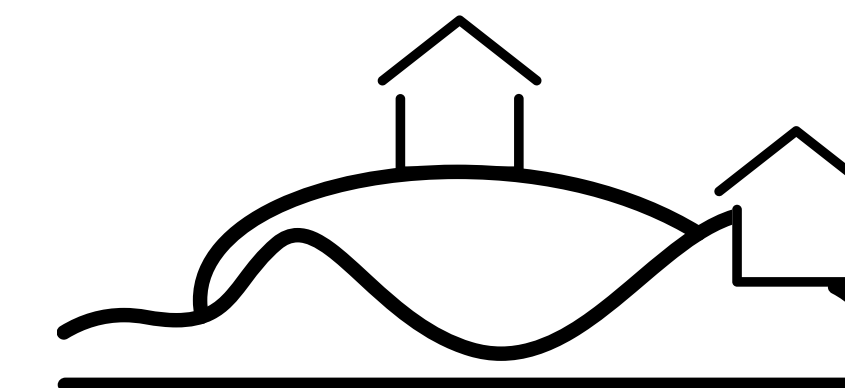
Floating constructions



Low pressure (re)construction

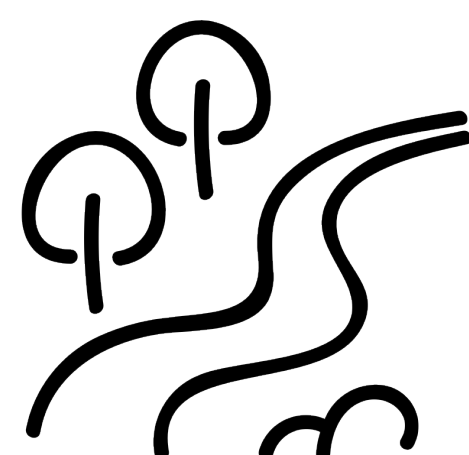


Soil and height orientated planning



## Ecological

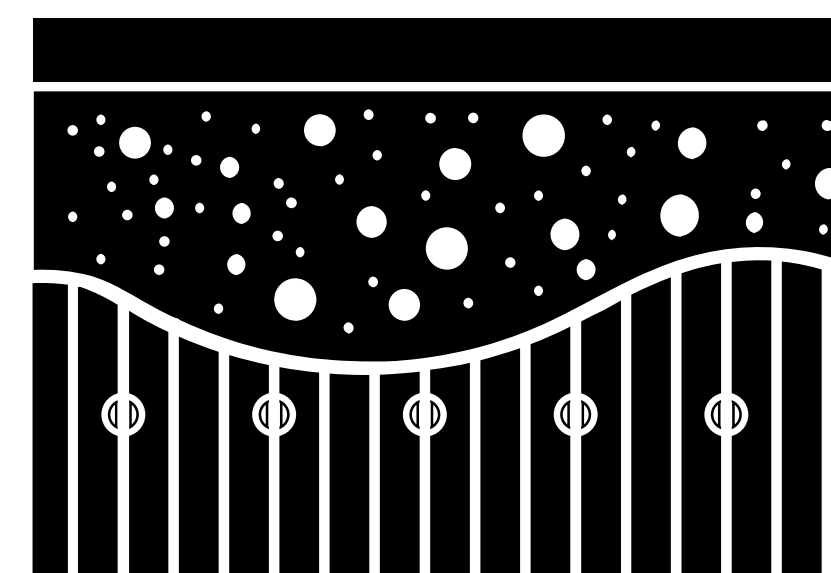
Unrefined watercourses



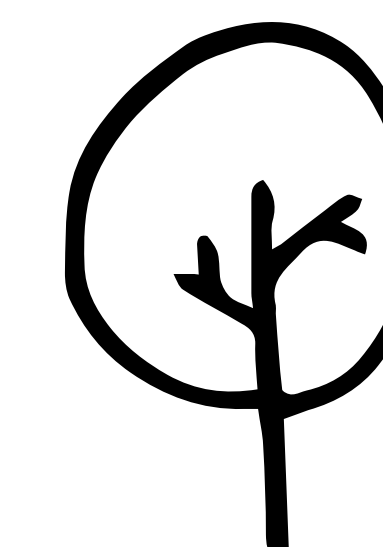
Decentralized water treatment



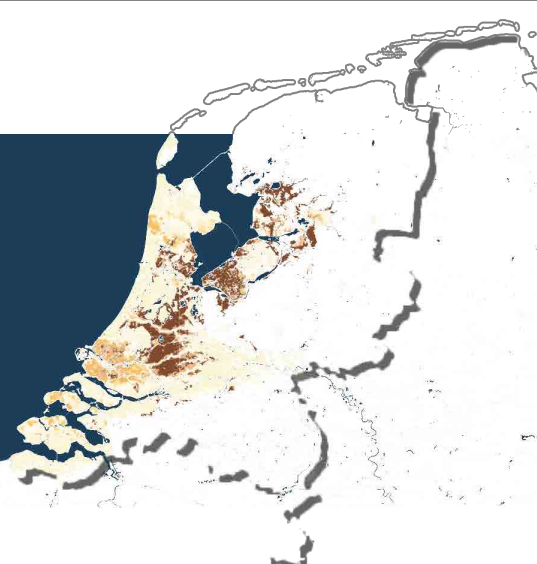
Underwater drainage



Environmental protection & conservation

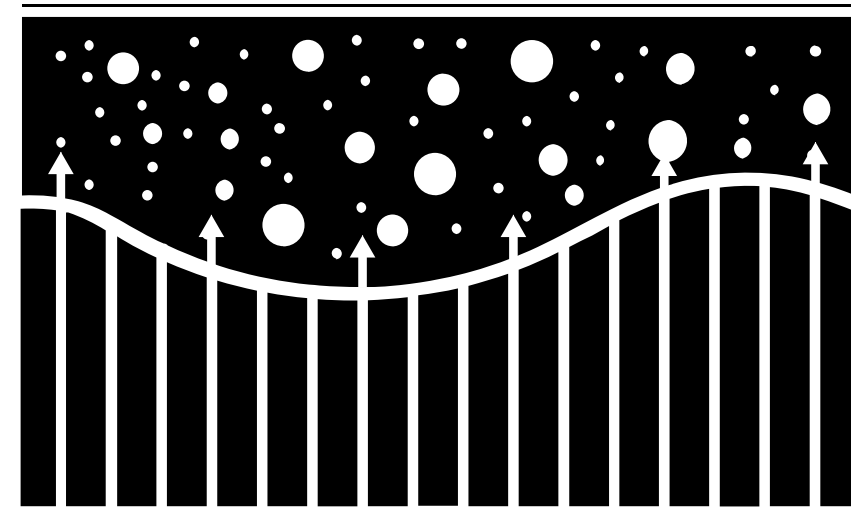




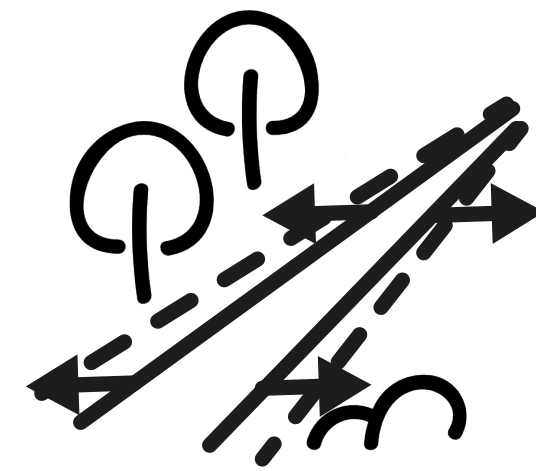


## Water Management

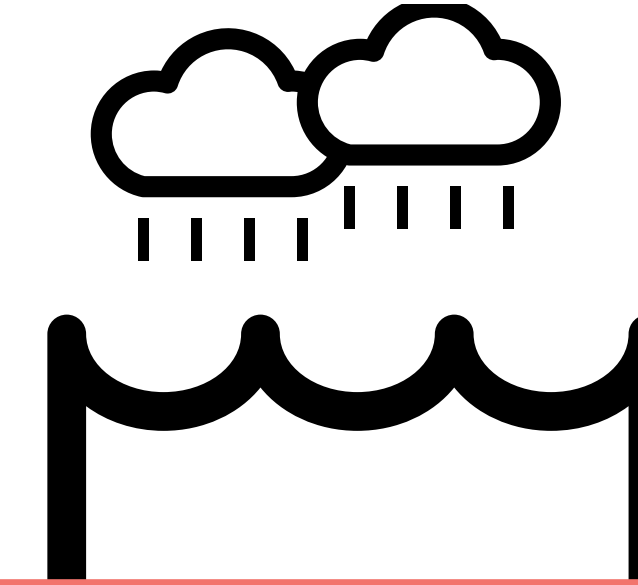
passive waterlogging



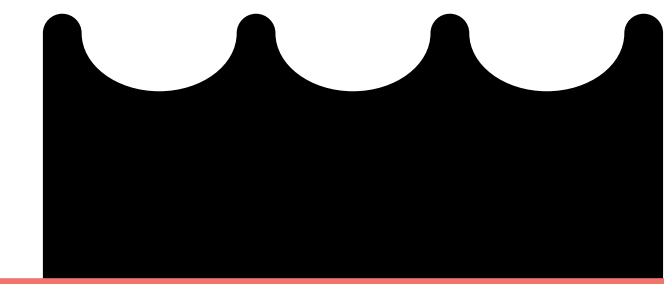
Broaden watercourses



Peak storage

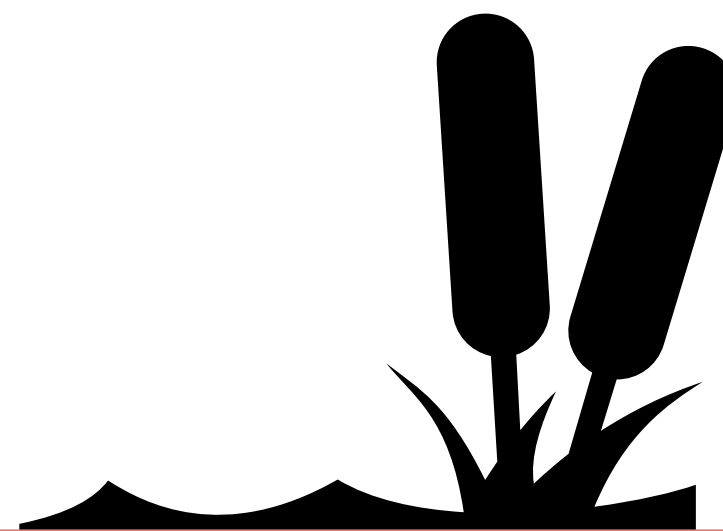


Seasonal storage



## Agricultural

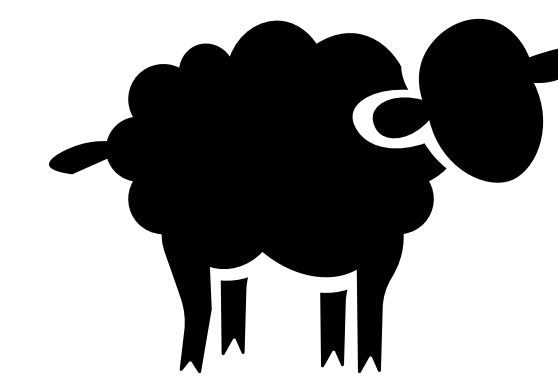
Paludiculture



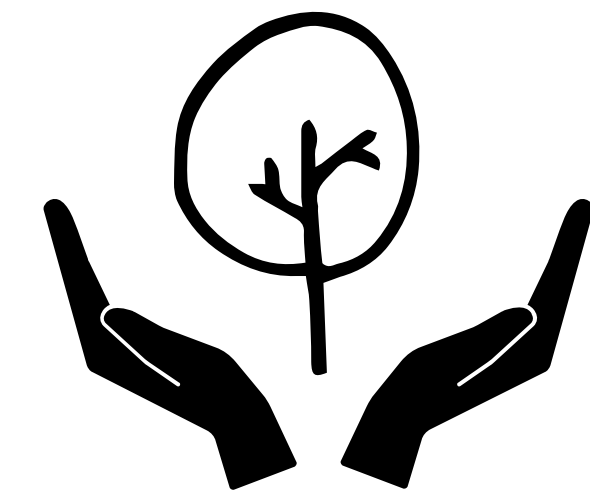
Sphagnum tillage



Low weight land cultivation

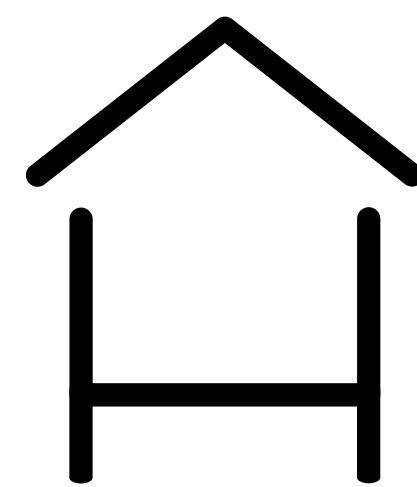


Permaculture

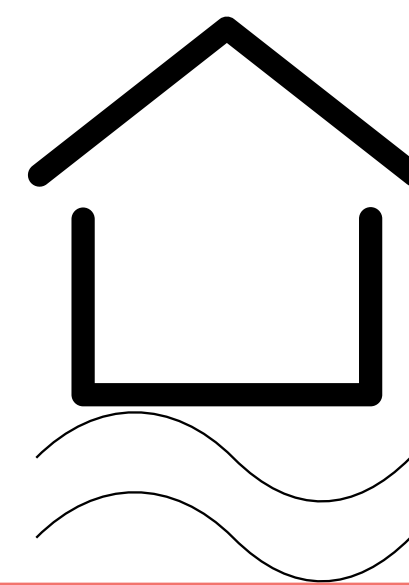


## Constructional

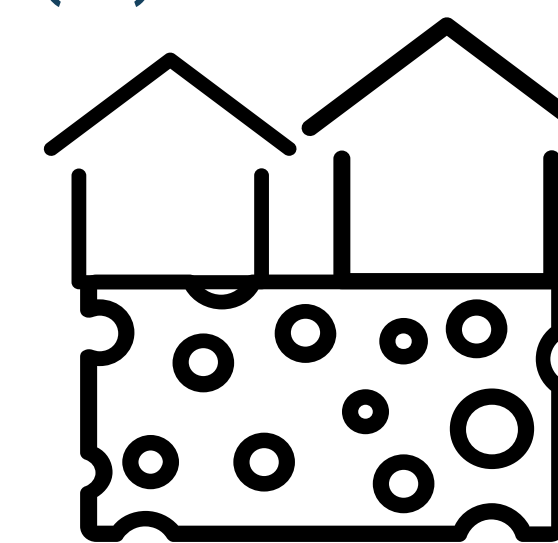
Lifted buildings



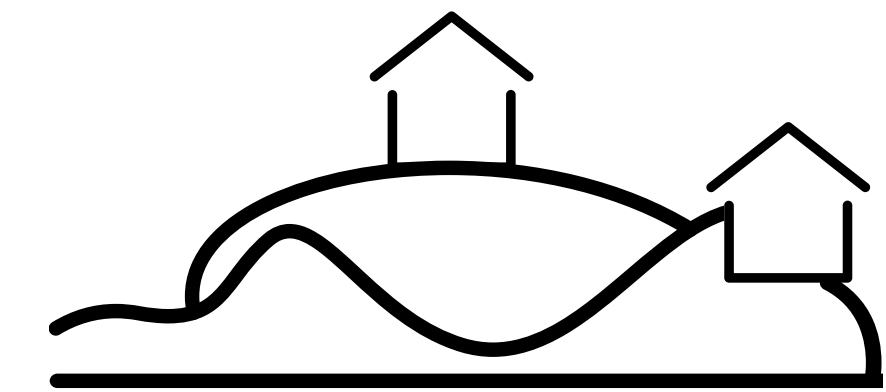
Floating constructions



Low pressure (re)construction

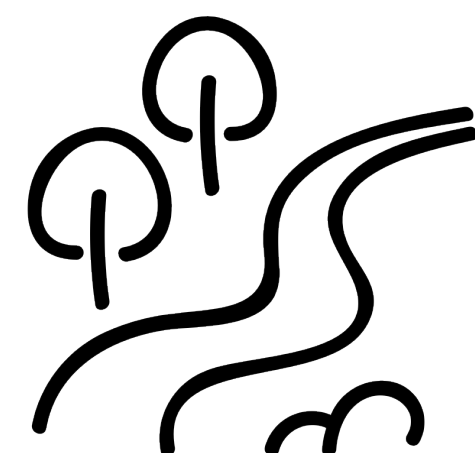


Soil and height orientated planning



## Ecological

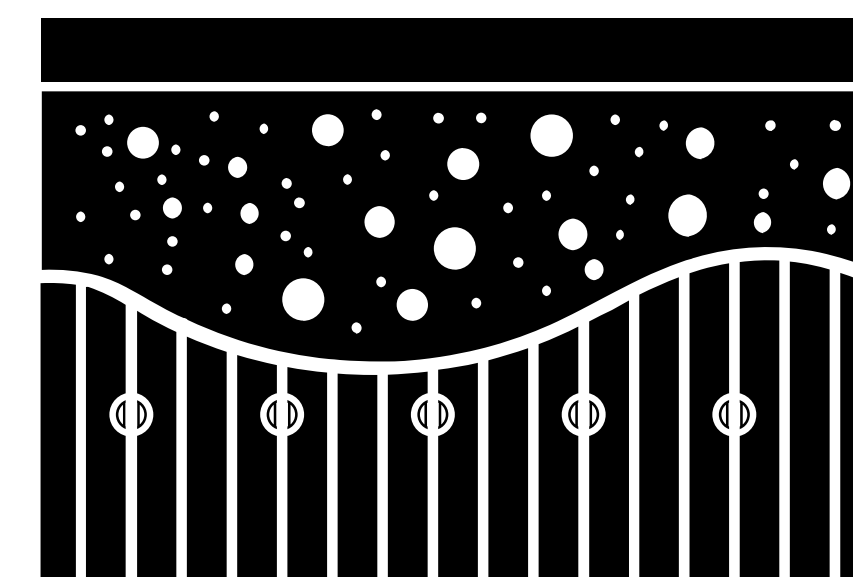
Unrefined watercourses



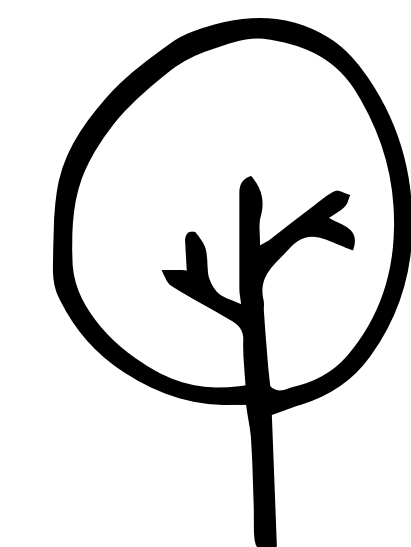
Decentralized water treatment



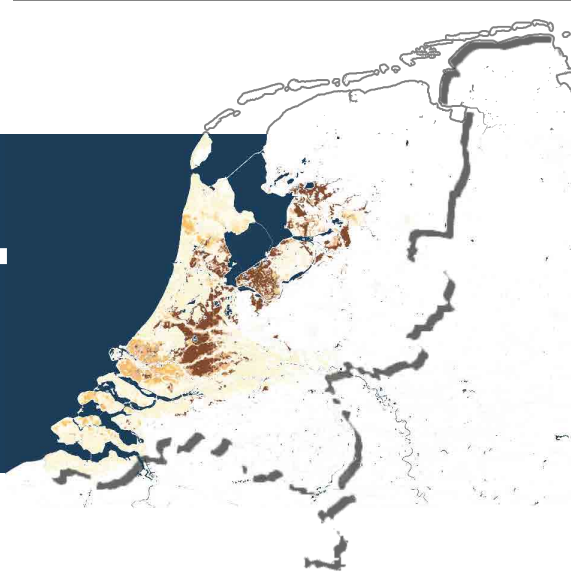
Underwater drainage



Environmental protection & conservation







## Subsidence

Soil subsidence

## Climate

Emissions

Heat

Drought

Water

## Environment

Location impact

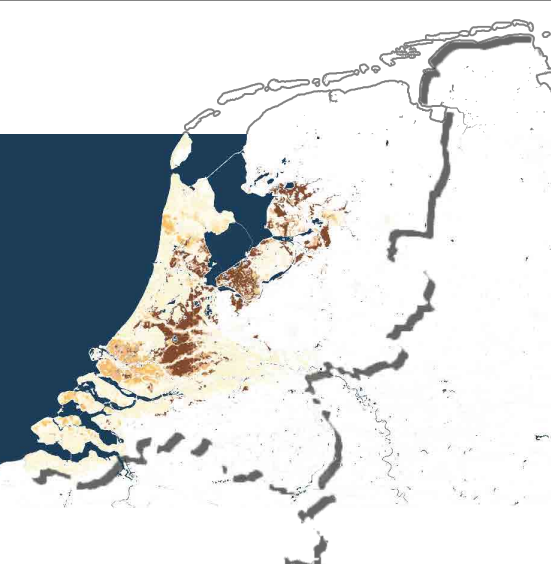
Ecological

## Expediency

Financial

Start date

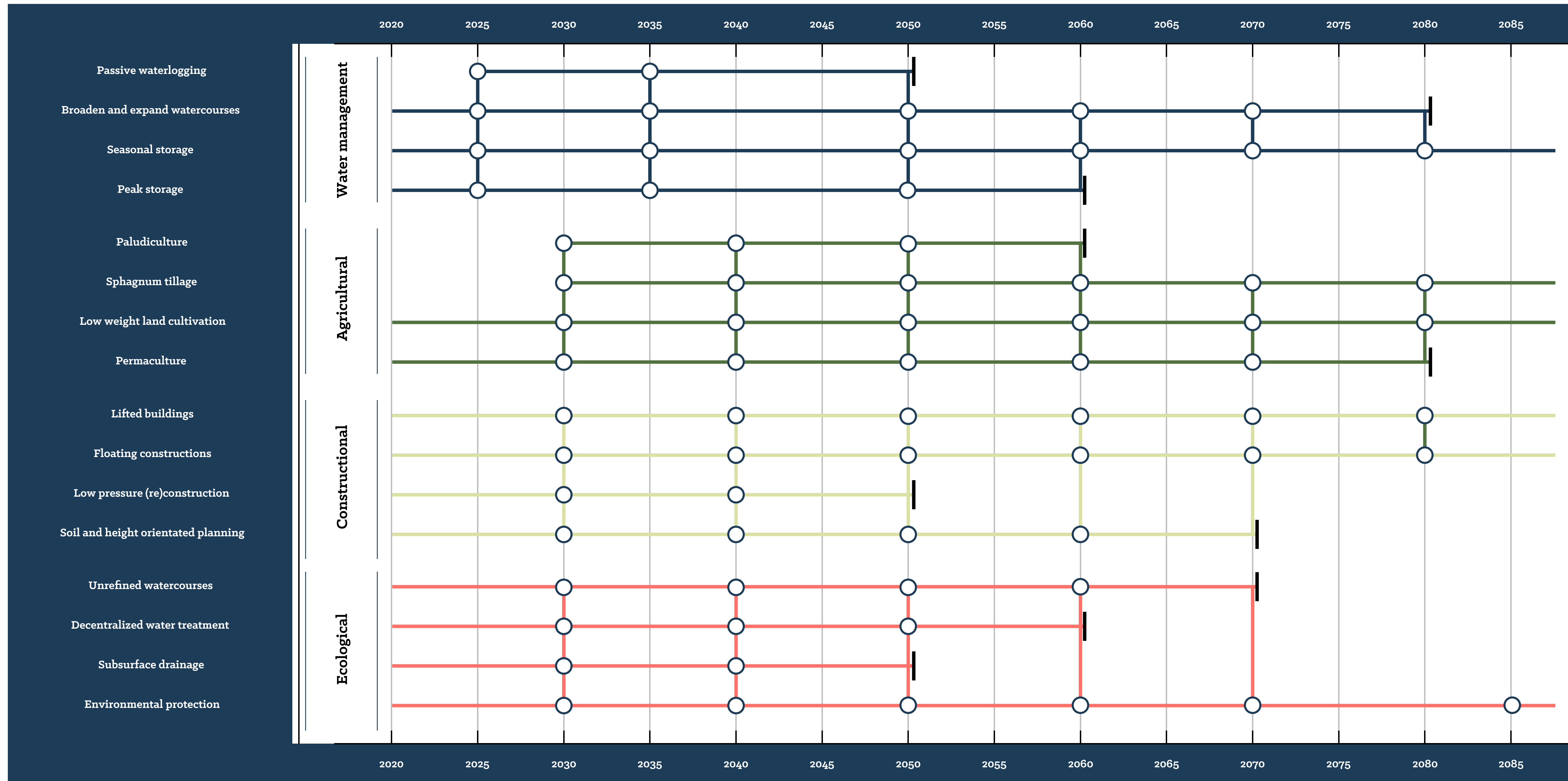
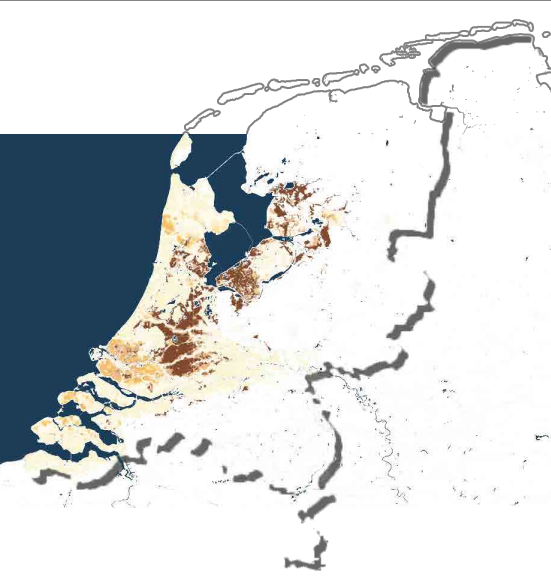
End date



Action	Effect	Subsidence	Climate				Environment		Expediency		
		Soil subsidence	Emissions	Heat	Drought	Water	Location impact	Ecological	Financial	Start date	End date
Water management	Passive waterlogging	++	0	+	++	0	--	+	0	2025	2050
	<i>broaden and expand watercourses</i>	+	0	++	++	++	-	+	--	2020	2080
	Seasonal storage	0	0	++	+	+	--	+	--	2020	~
	Peak storage	0	0	+	+	++	-	0	-	2020	2060
Agricultural	Paludiculture	+	+	++	++	++	0	+	--	2030	2060
	Sphagnum tillage	++	++	+	++	+	0	++	--	2030	~
	Low weight land cultivation	+	+	0	0	0	0	0	-	2020	~
	Permaculture	0	0	+	+	+	-	++	-	2020	2080
Constructional	Lifted buildings	++	0	++	+	++	-	+	-	2020	~
	Floating constructions	+	+	++	++	++	0	+	0	2020	~
	Low pressure (re)construction	+	0	0	0	0	0	-	-	2020	2050
	Soil and height orientated planning and development	+	0	+	+	+	-	0	0	2020	2070
Ecological	Unrefined watercourses	0	0	++	+	+	-	++	--	2030	2070
	Decentralized water treatment	0	0	0	0	0	0	++	-	2020	2060
	Underwater drainage	+	0	0	+	+	0	+	-	2020	2050
	Environmental protection and conservation	0	+	+	+	0	--	++	--	2040	~

- Mitigating
- Adaptating
- Mitigating and Adaptating





PROBLEM FIELD

RESEARCH SETUP

ANALYSIS

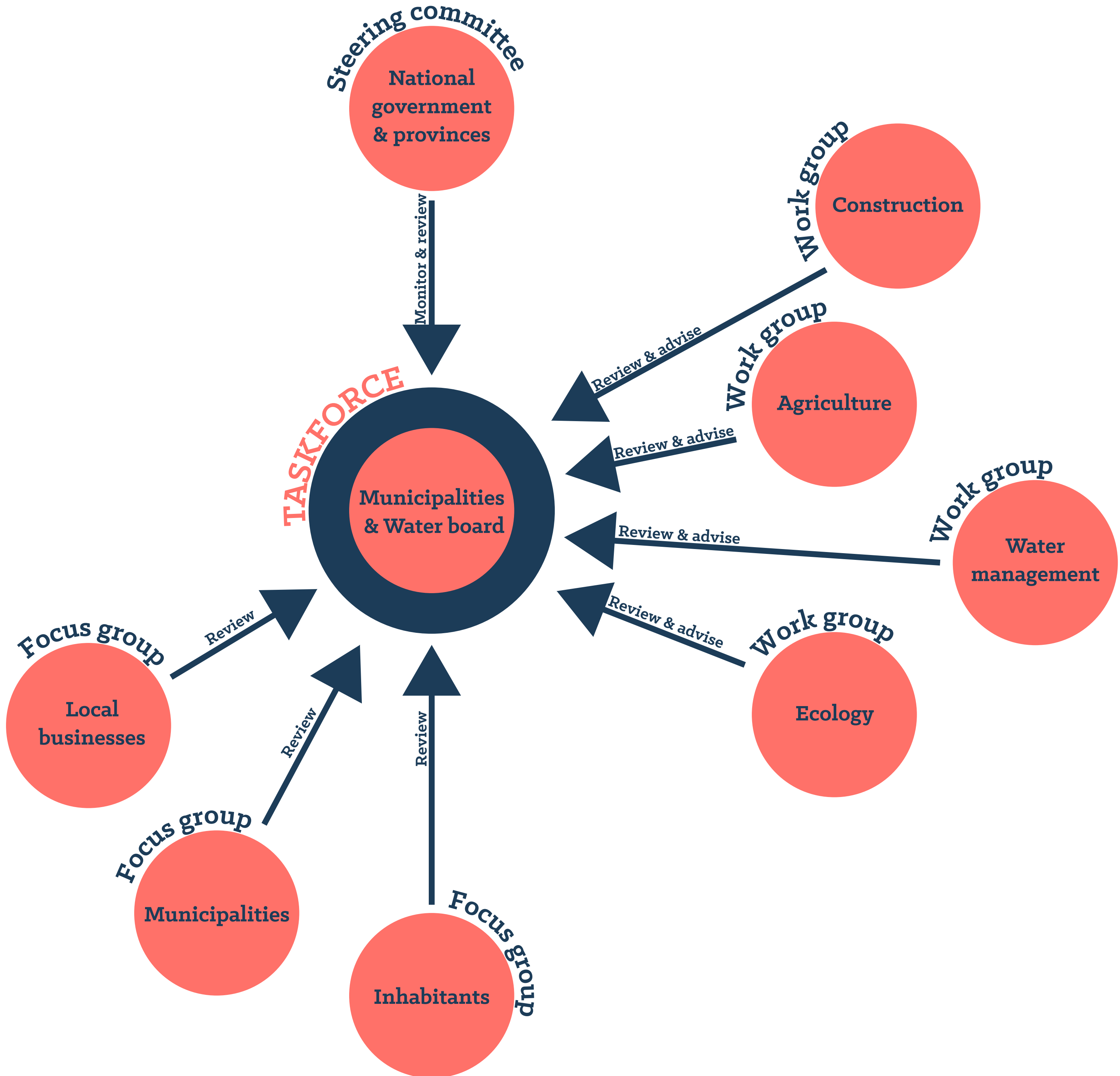
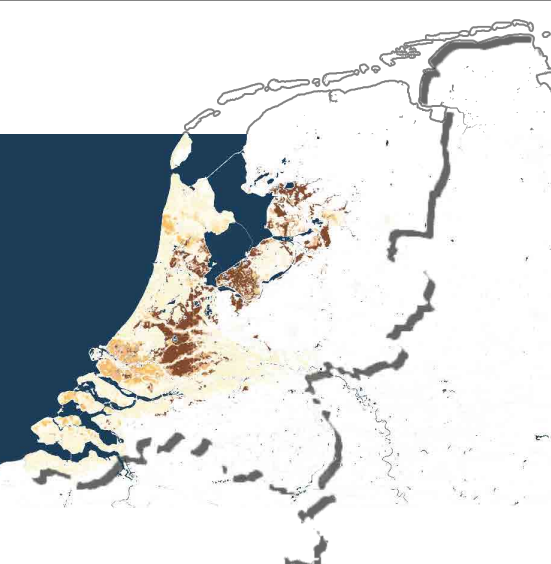
ACTION ASSESSMENT

DECISION-MAKING

PATHWAY PROJECTIONS

CONCLUSIONS & RECOMMENDATIONS





PROBLEM FIELD

RESEARCH SETUP

ANALYSIS

ACTION ASSESSMENT

DECISION-MAKING

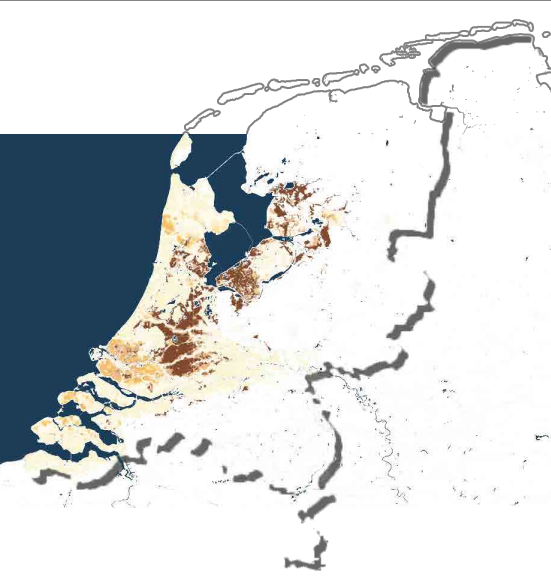
PATHWAY PROJECTIONS

CONCLUSIONS & RECOMMENDATIONS

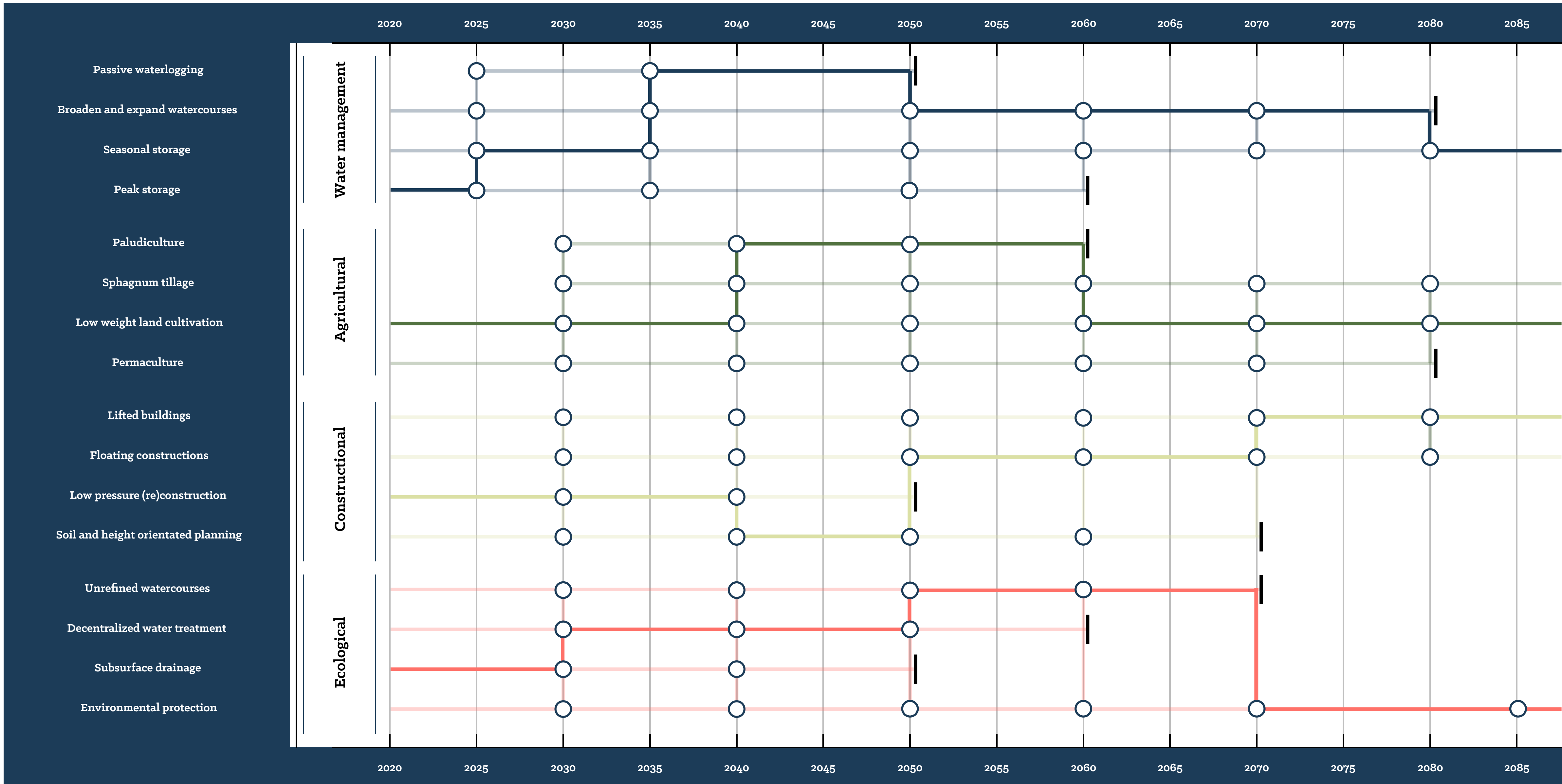








## ADAPTATION PATHWAY



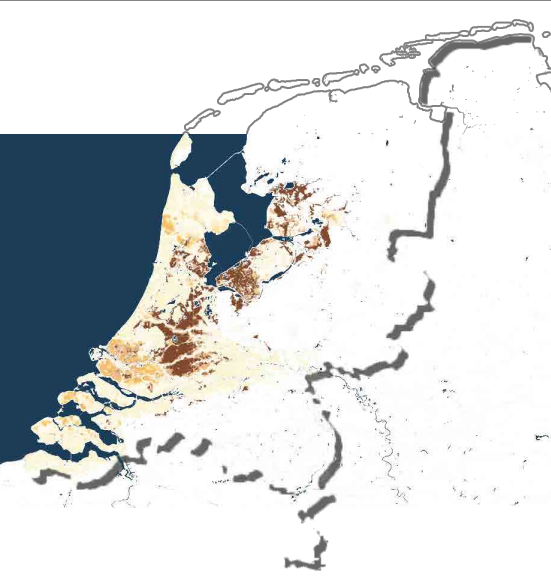


# ADAPTATION PATHWAY

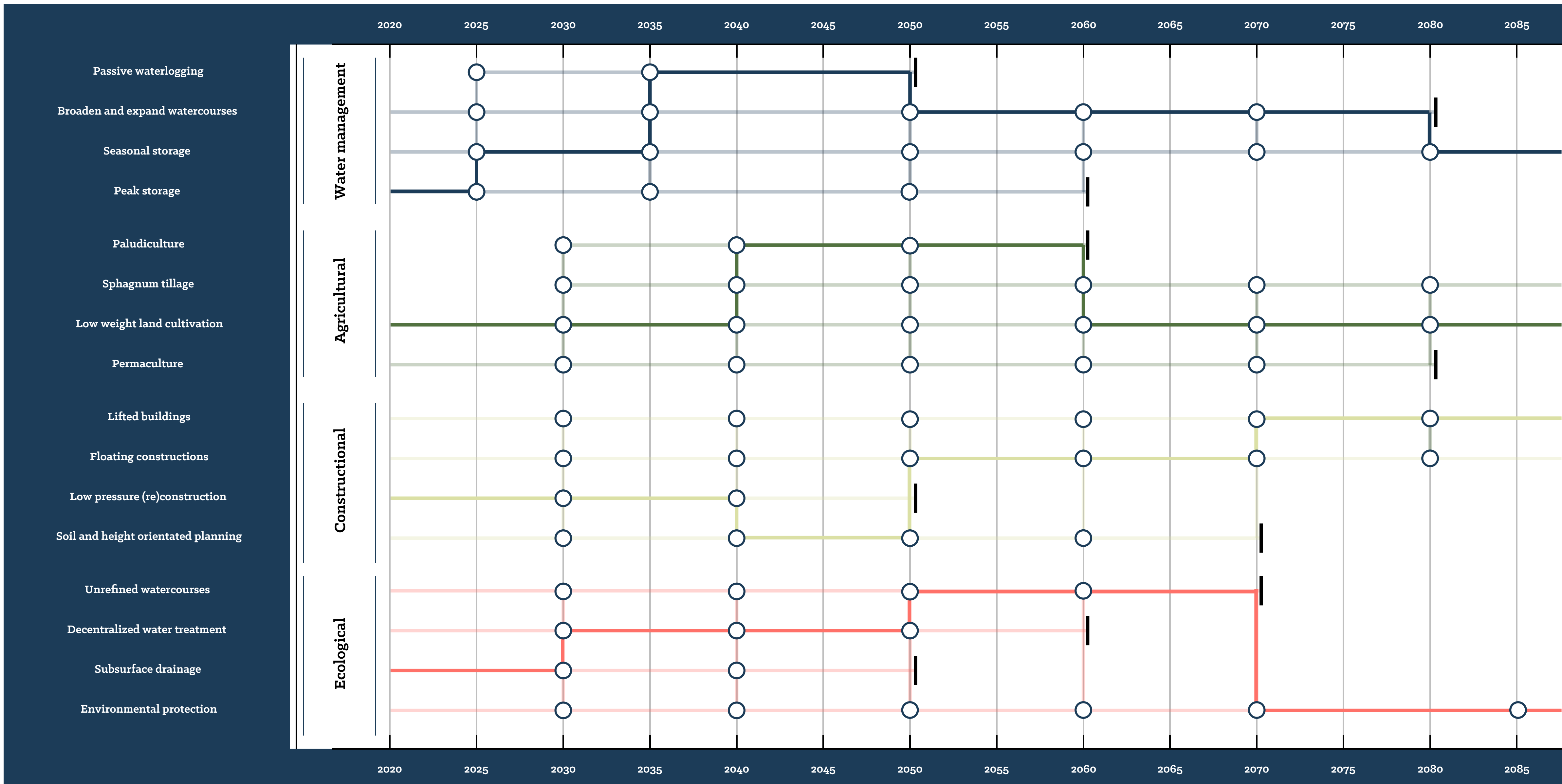
2085







## MITIGATION PATHWAY



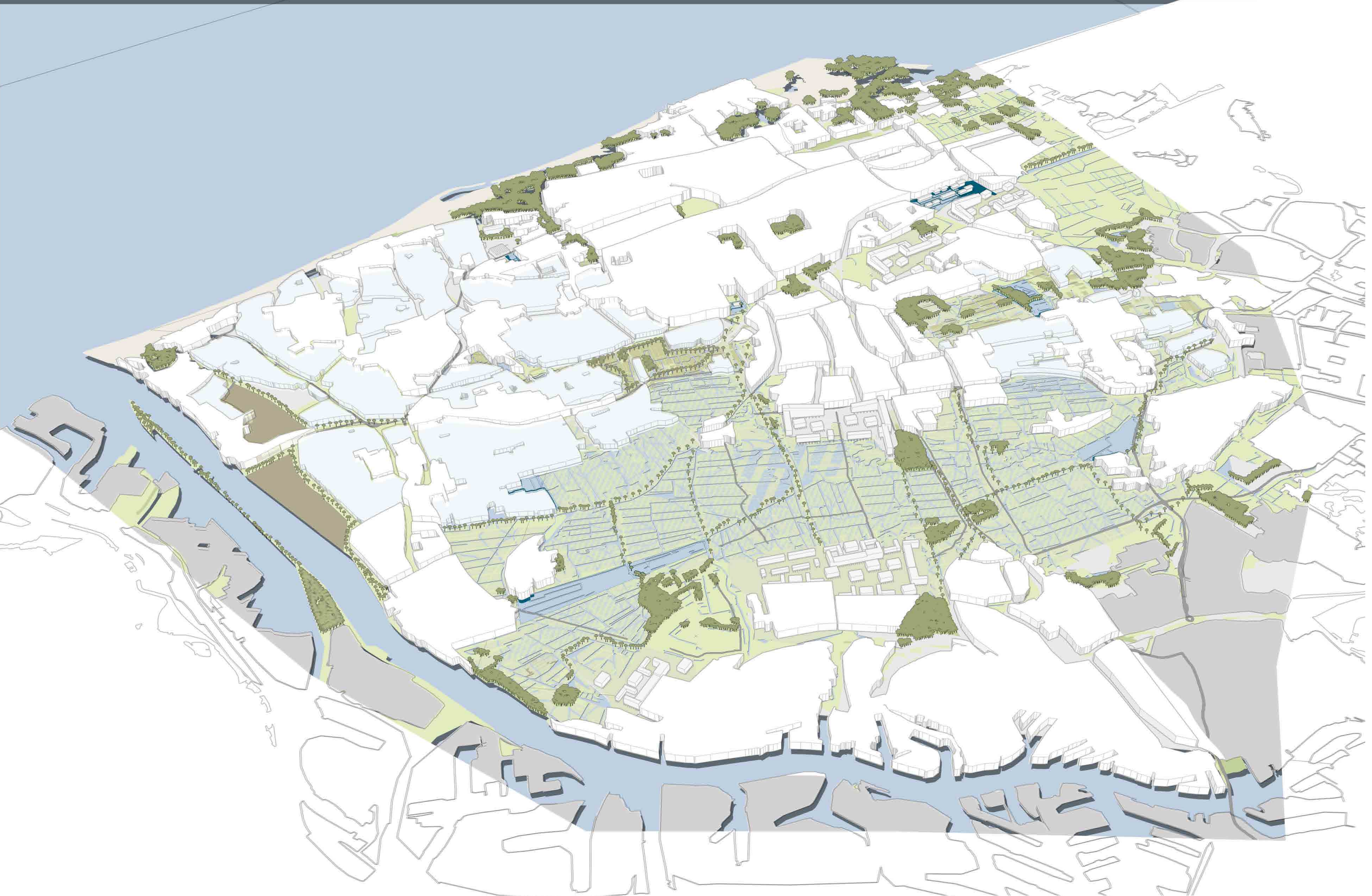
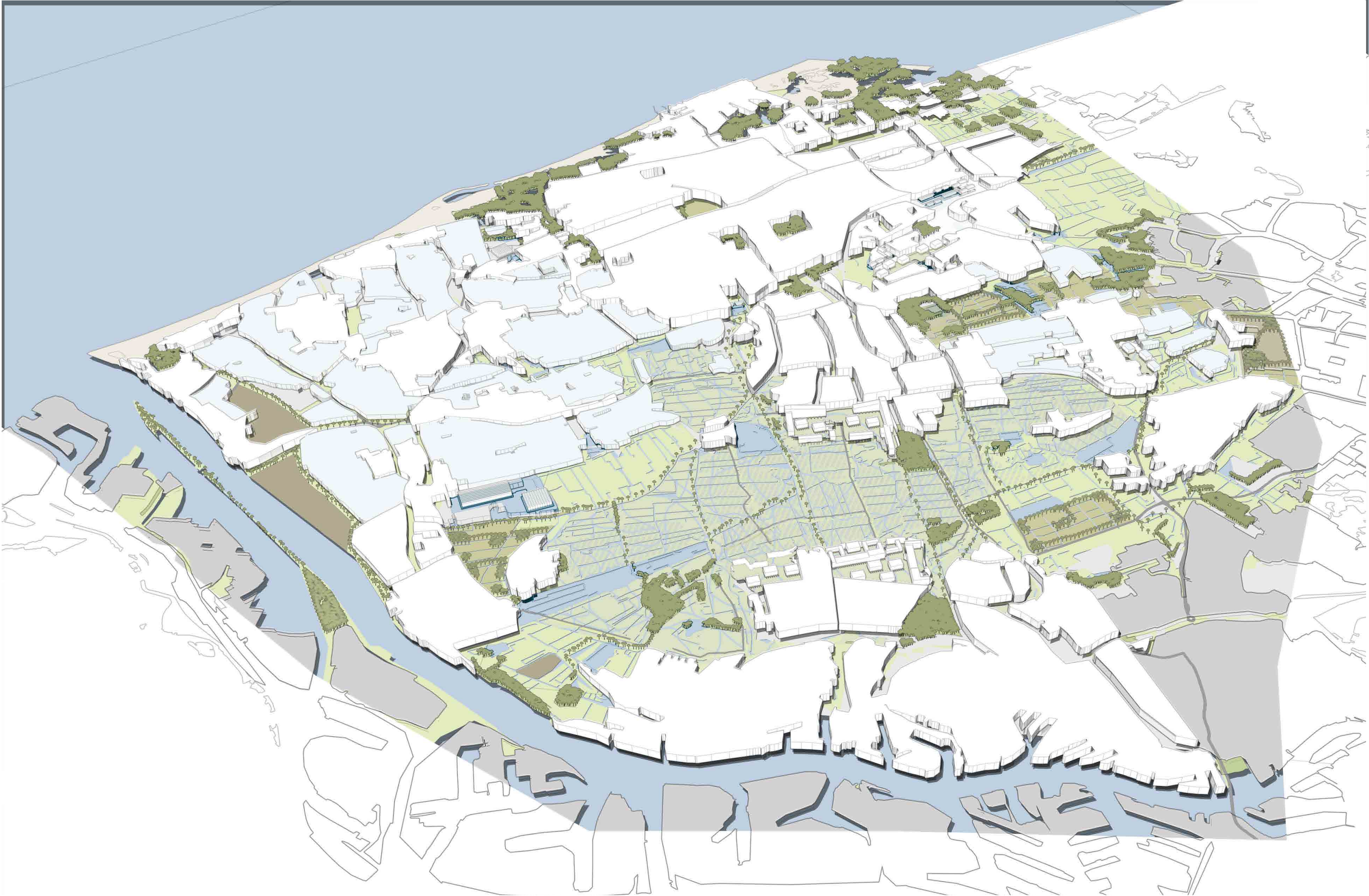
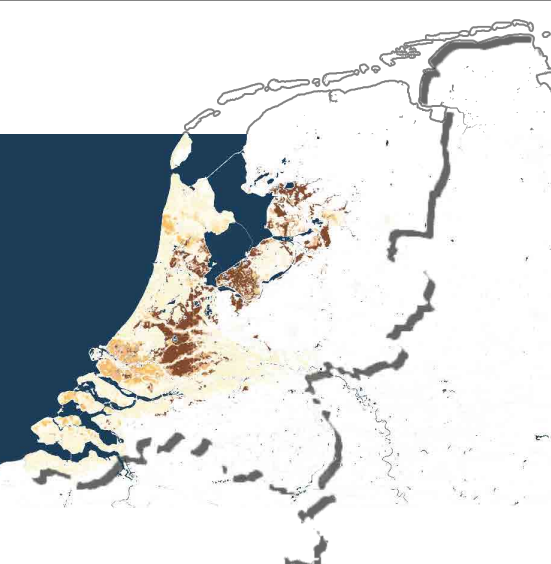


# MITIGATION PATHWAY

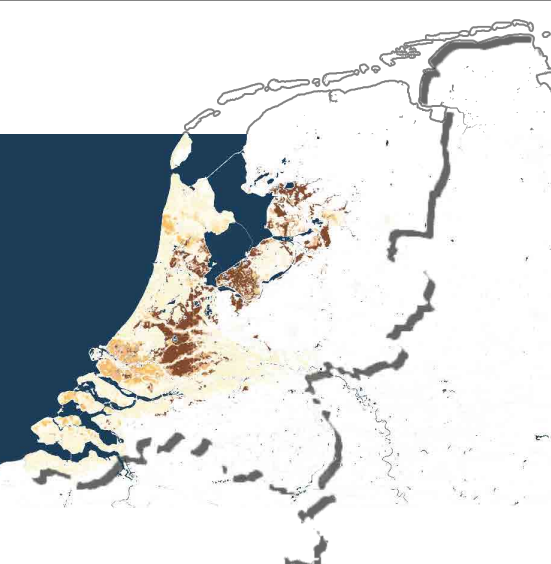
2085



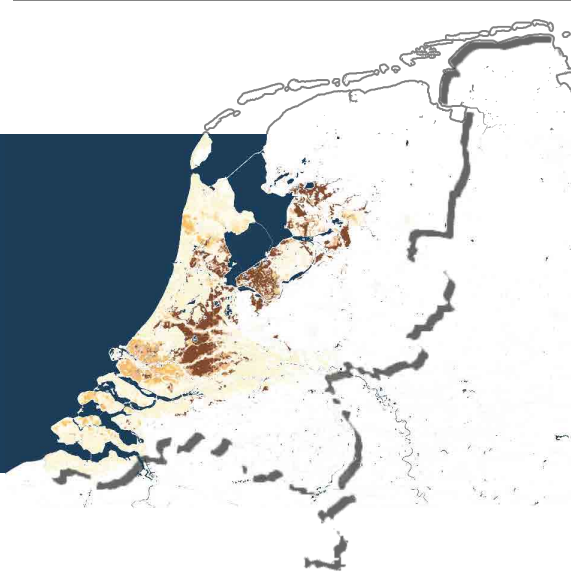




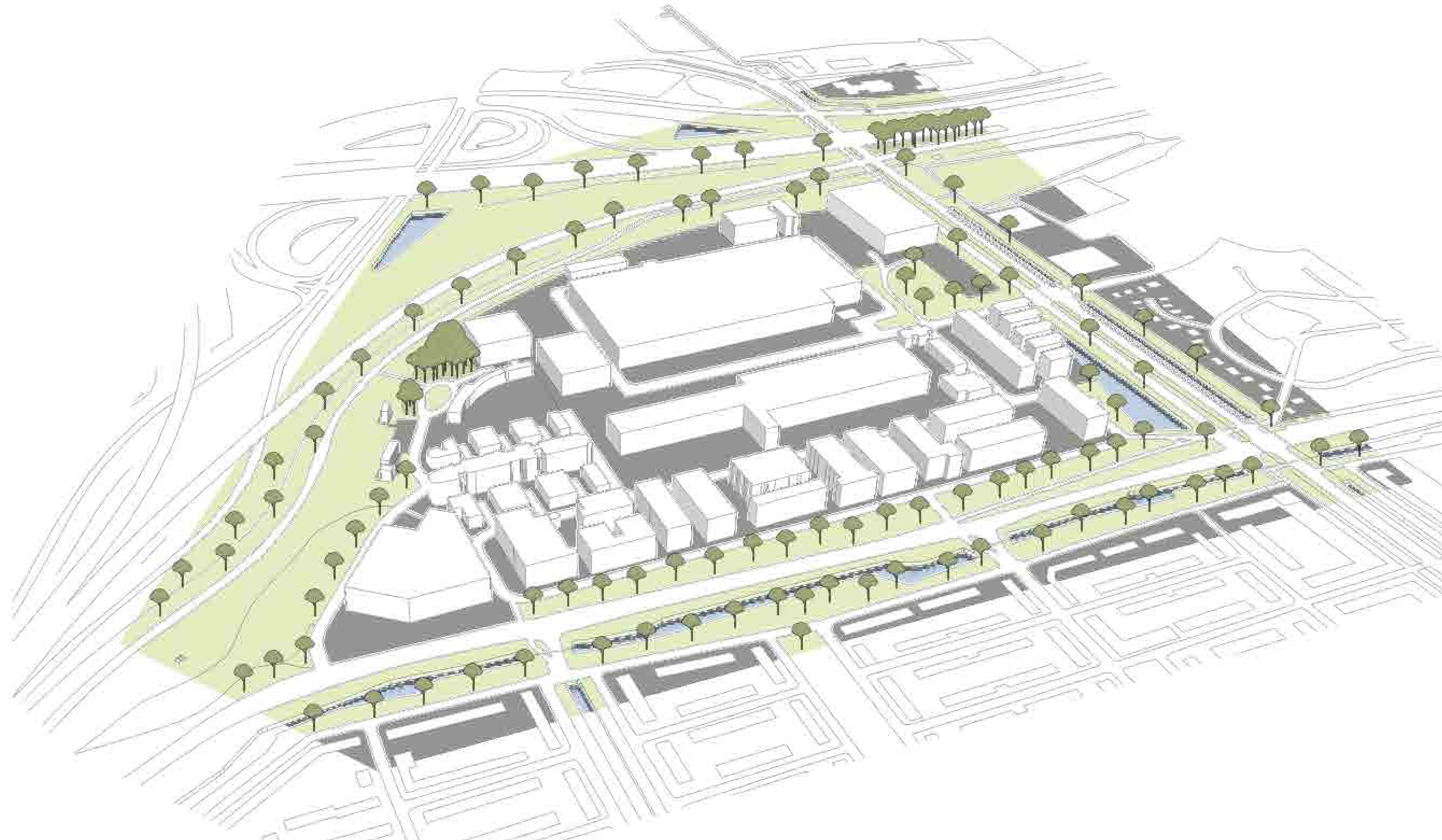




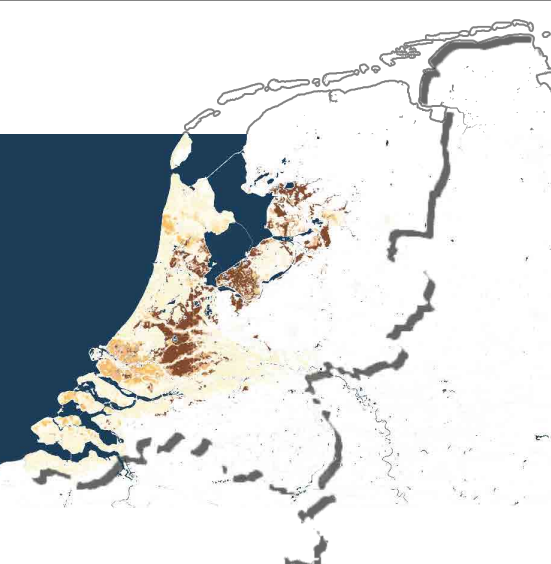




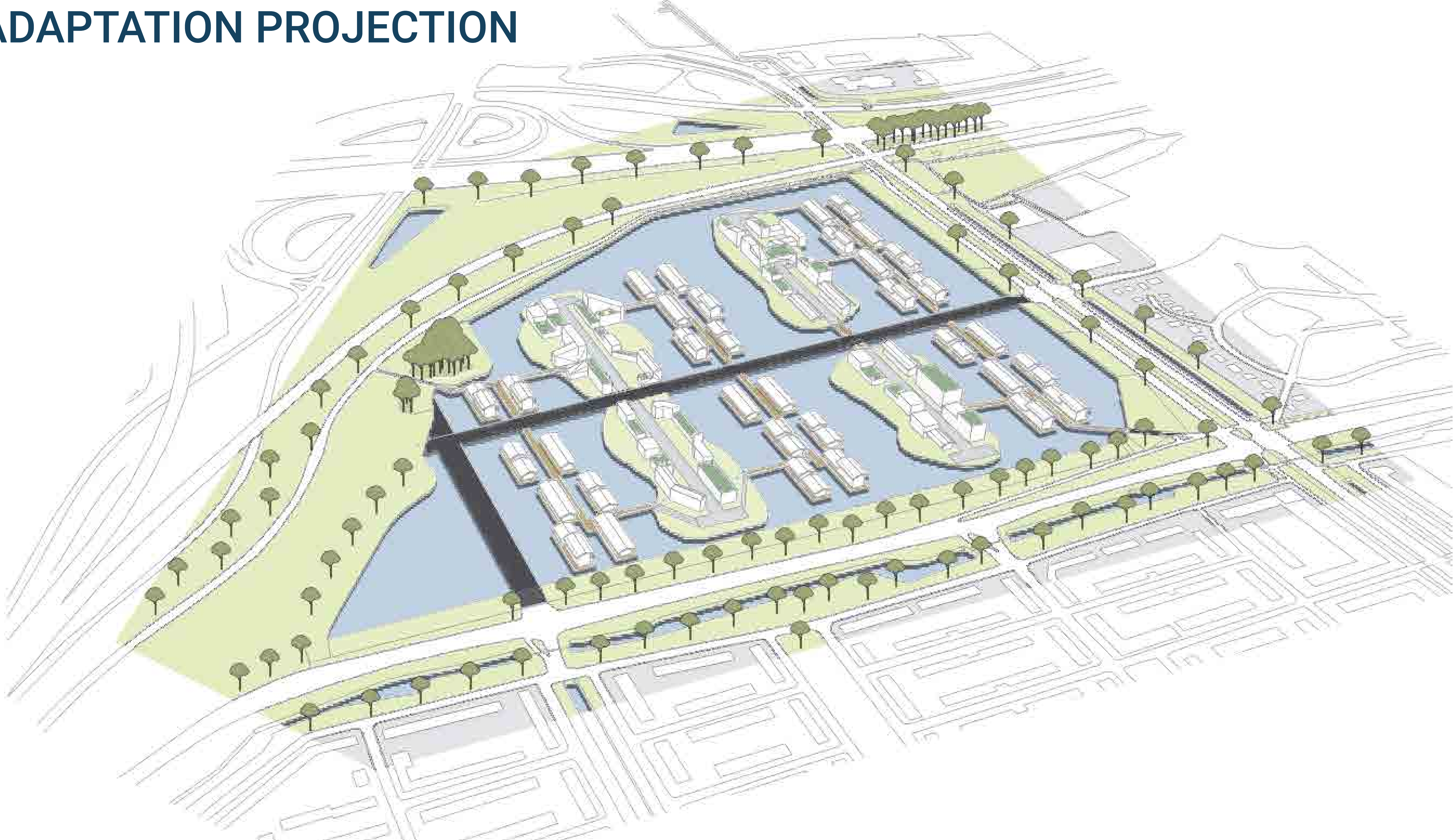
URBAN



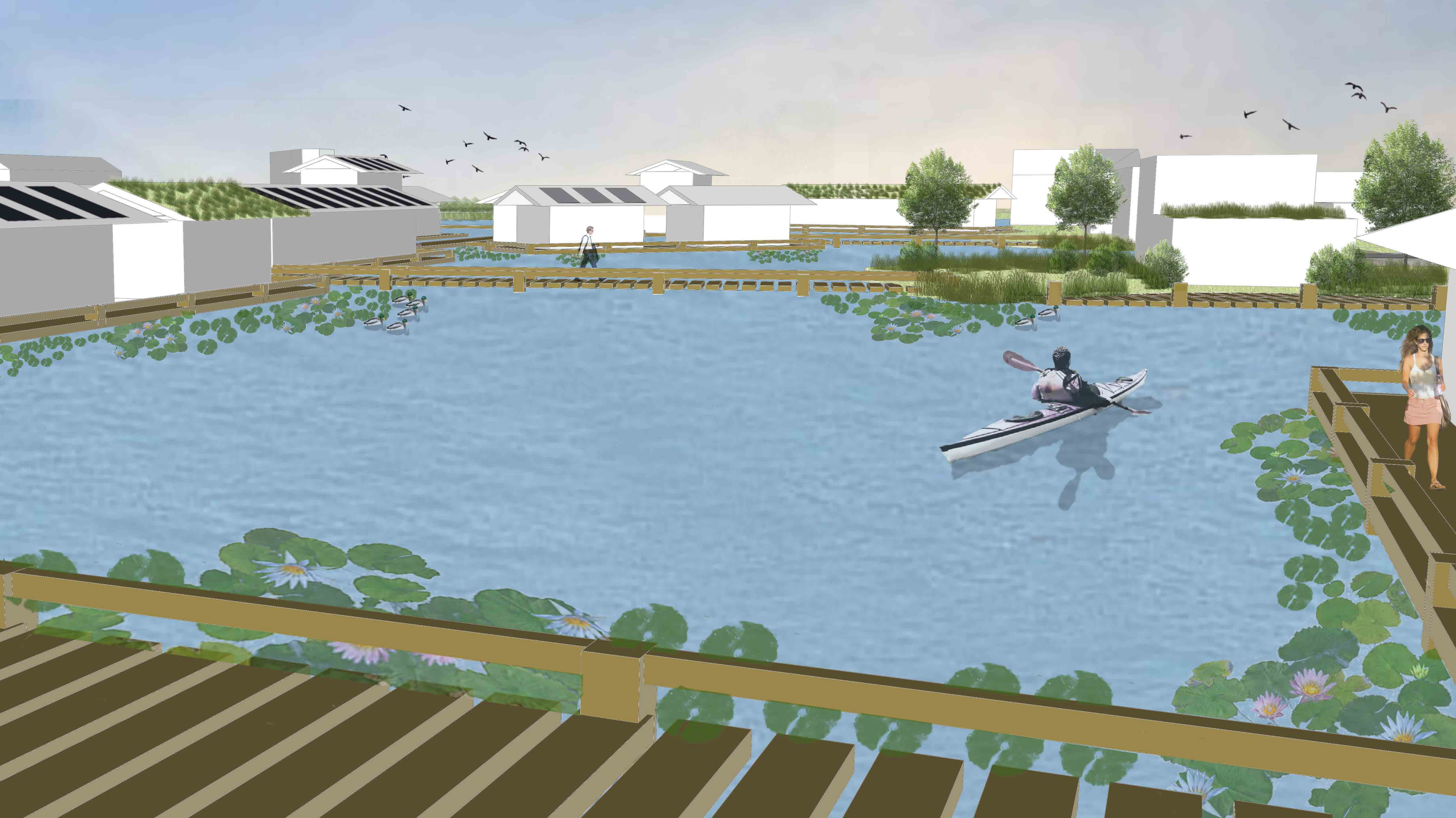




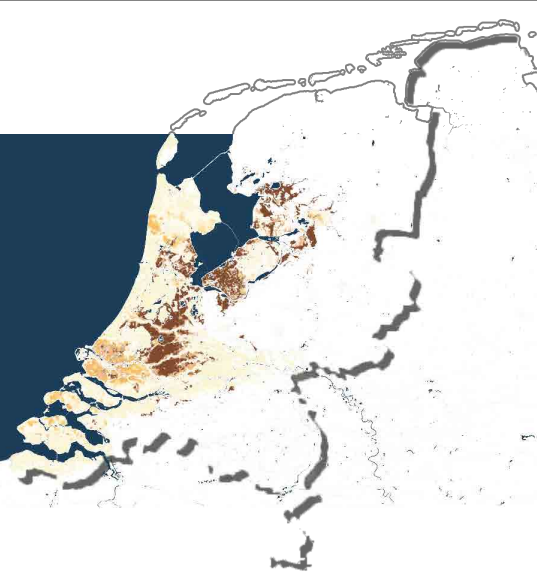
# URBAN ADAPTATION PROJECTION



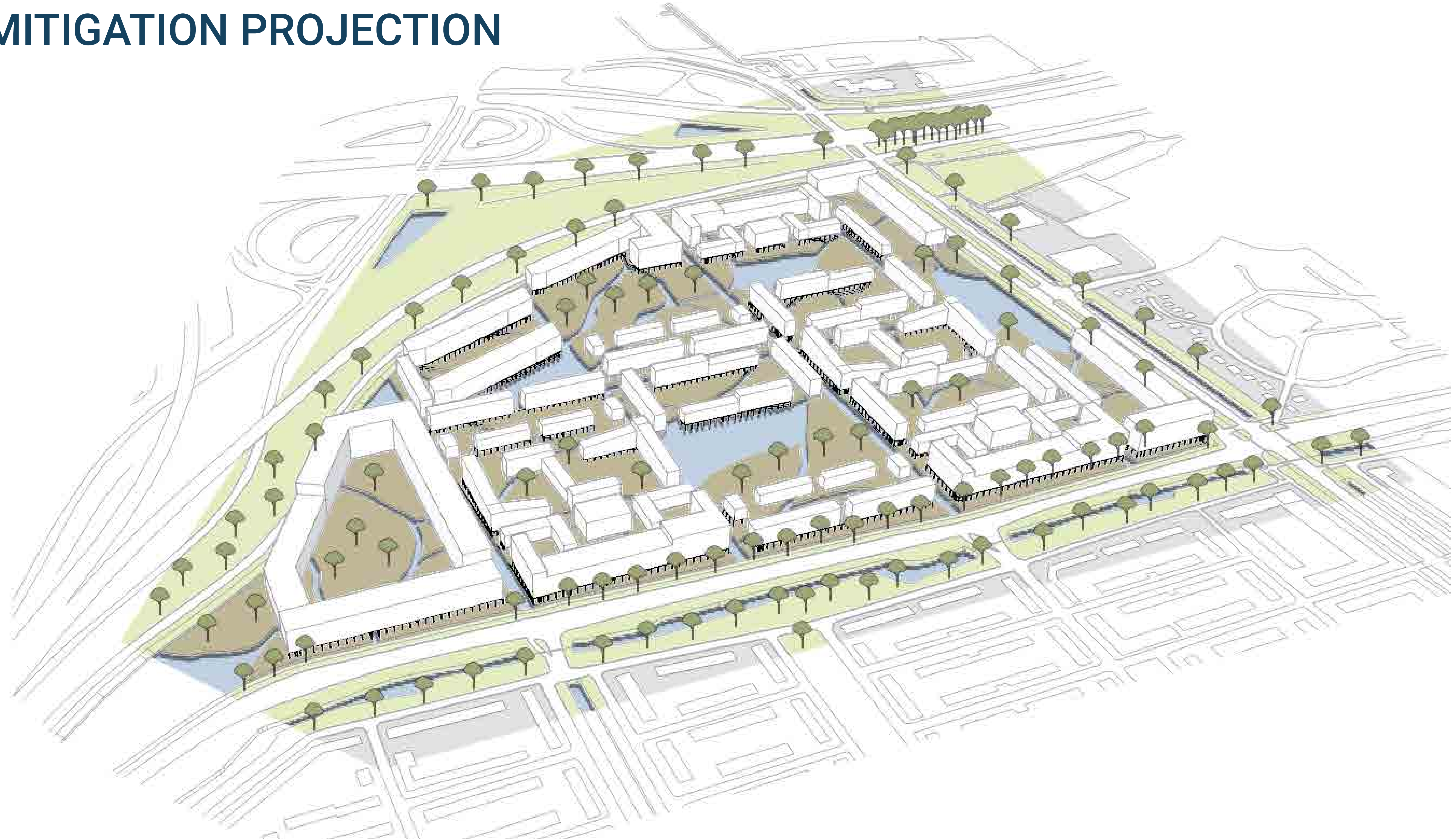








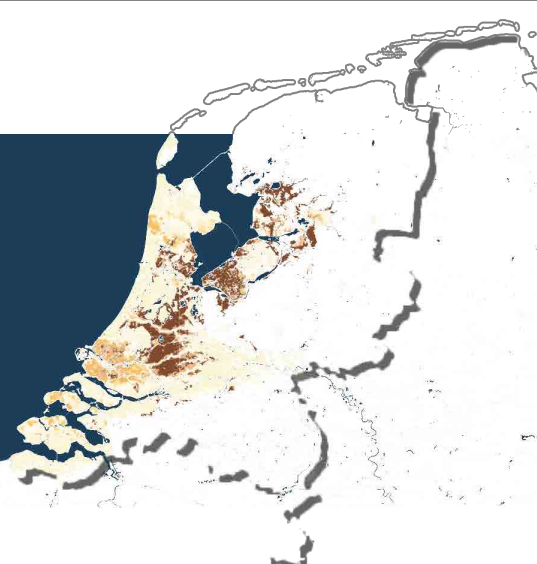
# URBAN MITIGATION PROJECTION



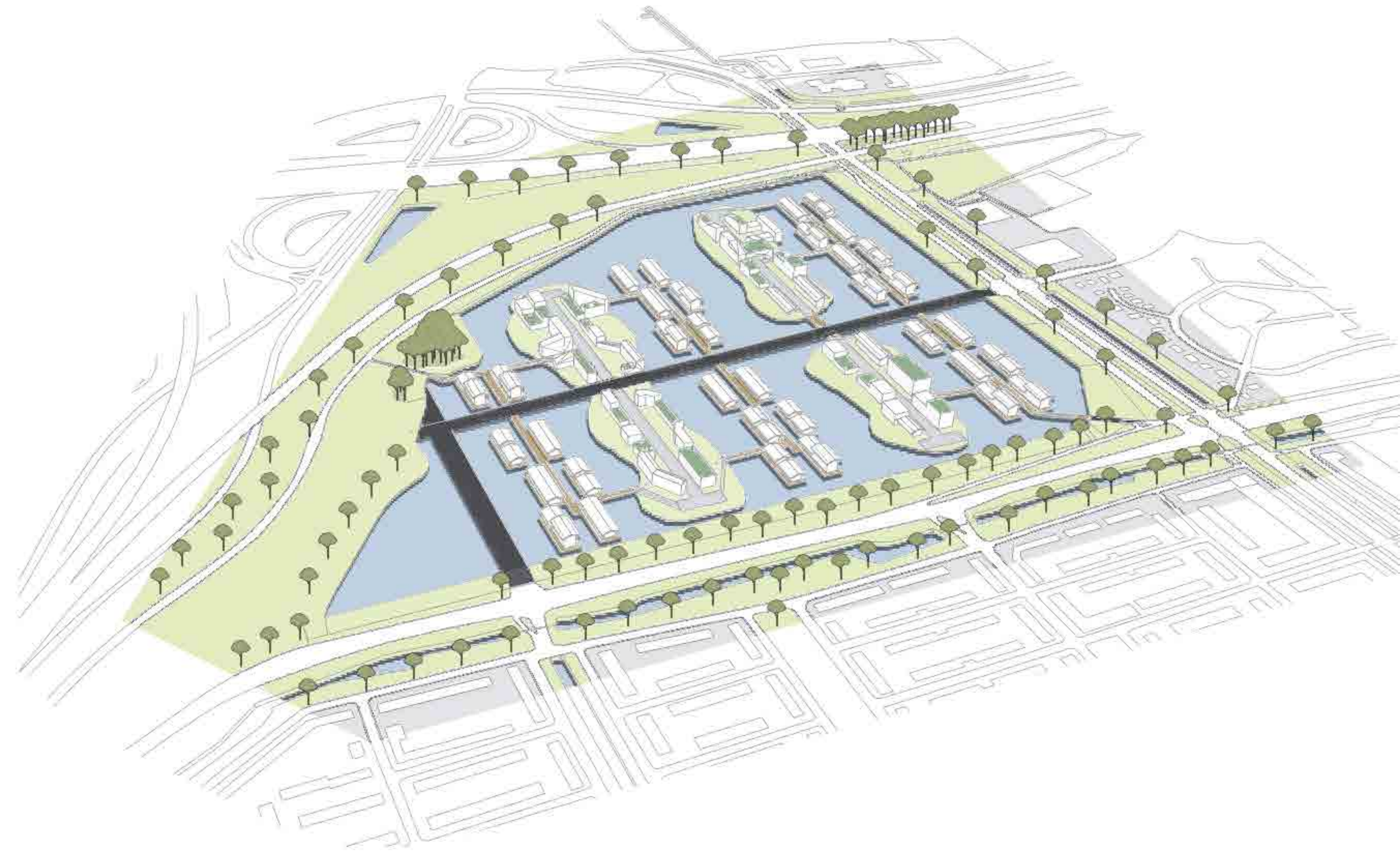
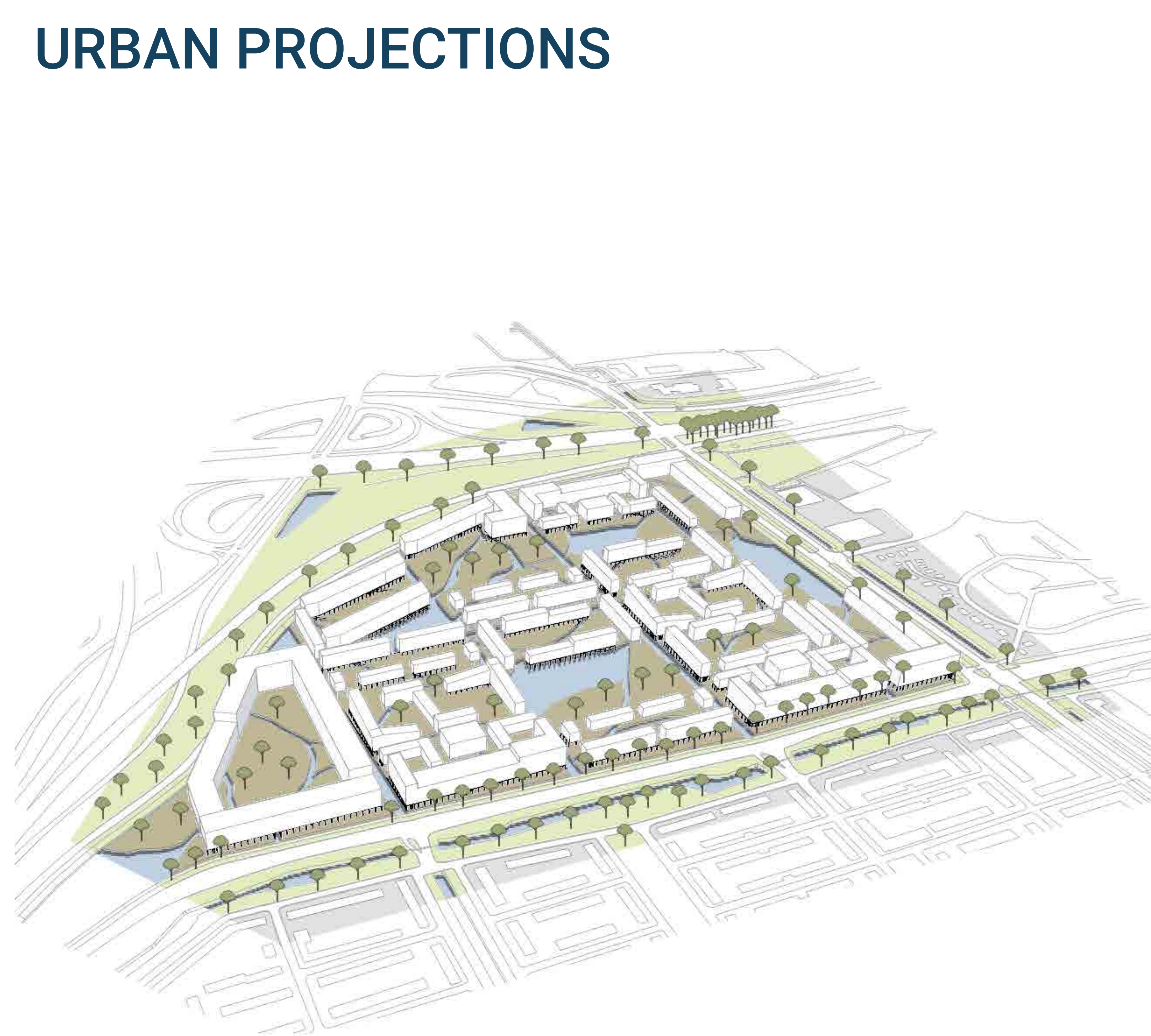




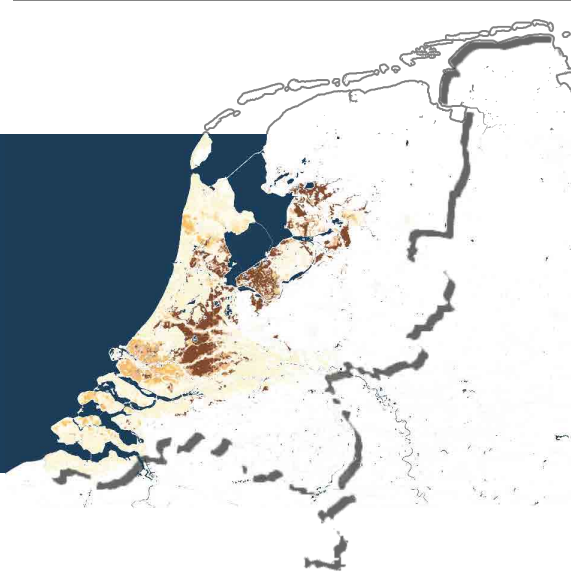




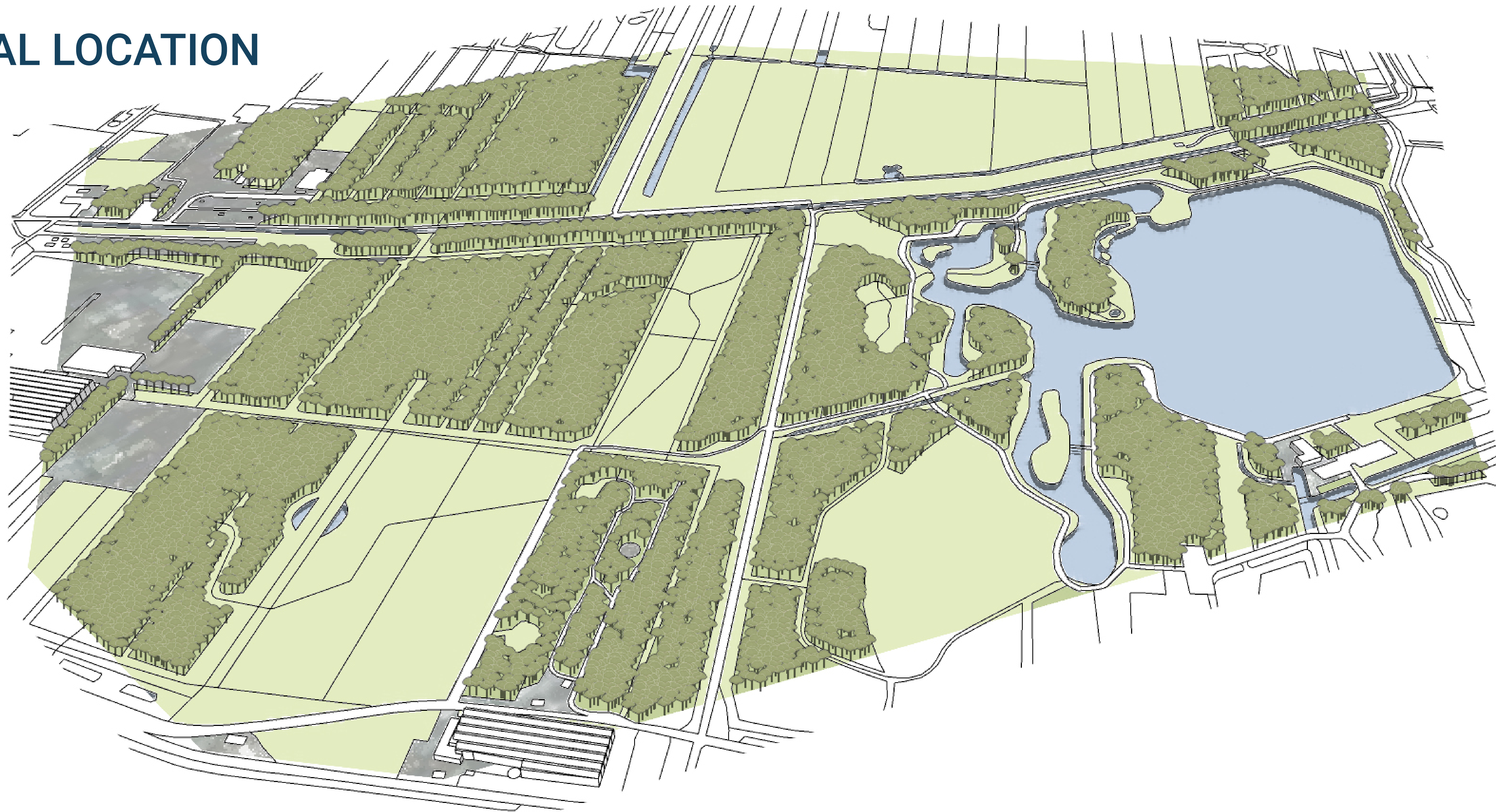
# URBAN PROJECTIONS



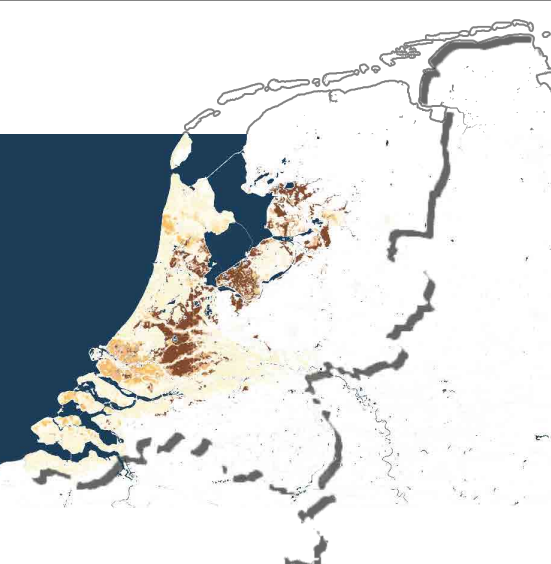




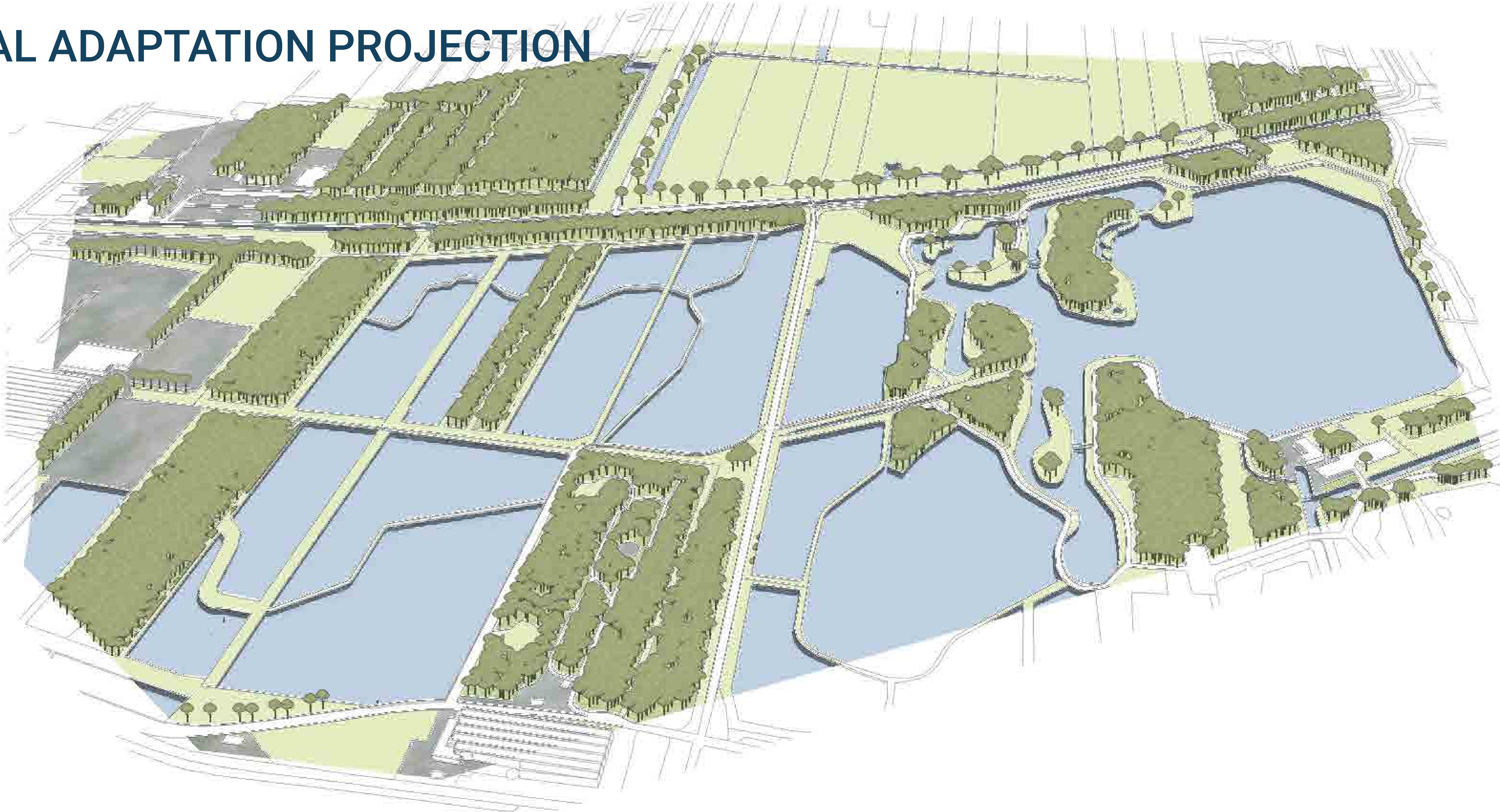
# NATURAL LOCATION







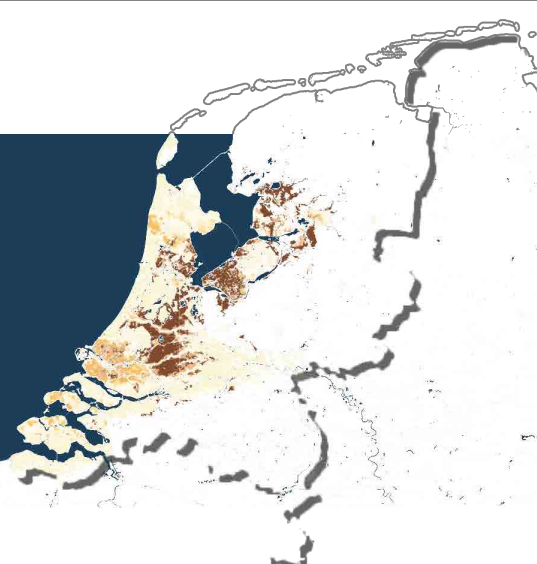
# NATURAL ADAPTATION PROJECTION











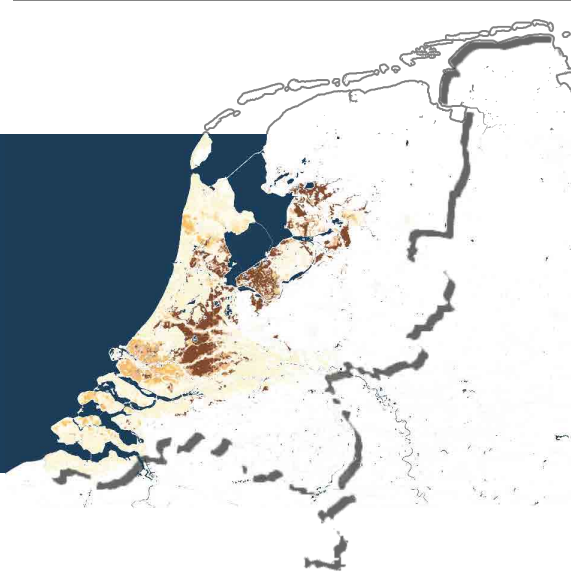
# NATURAL MITIGATION PROJECTION







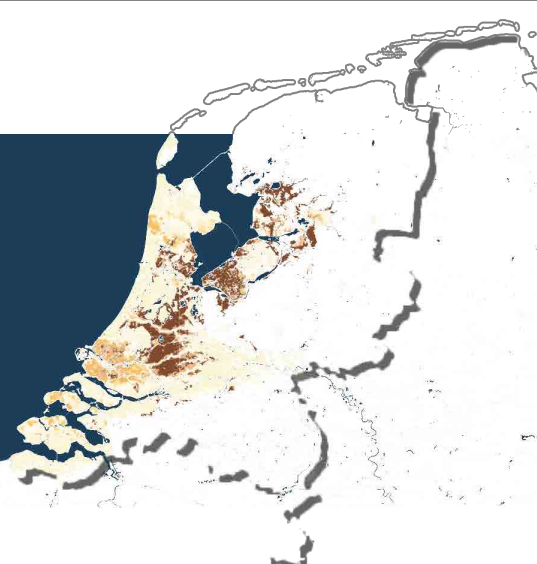




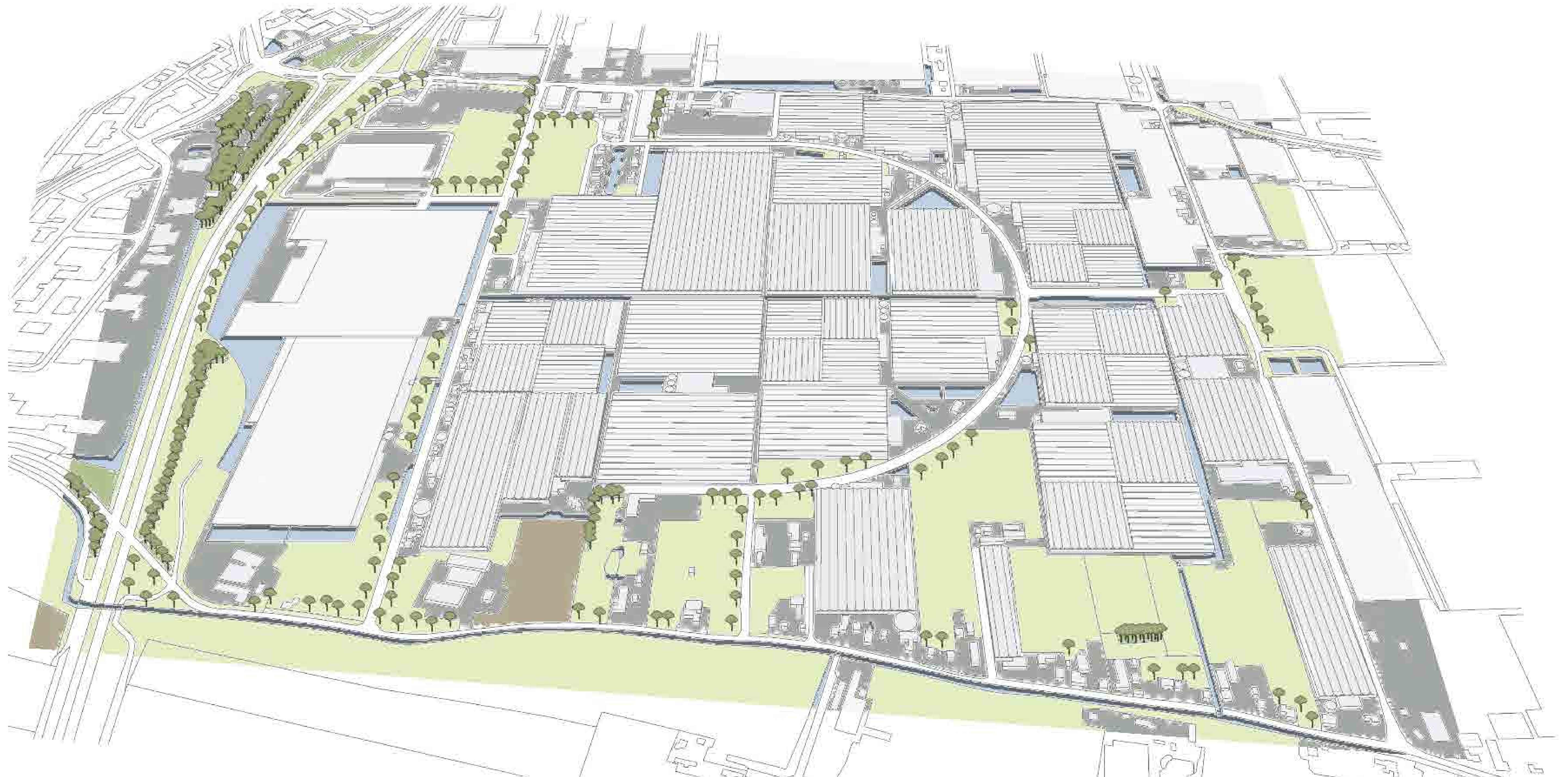
## NATURAL PROJECTIONS



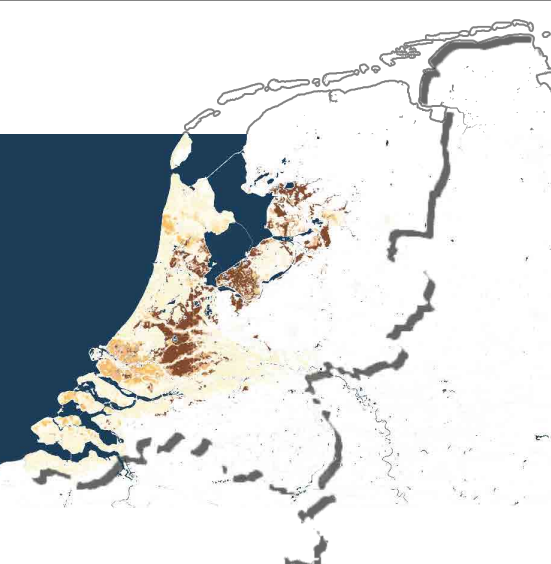




# GREENHOUSES







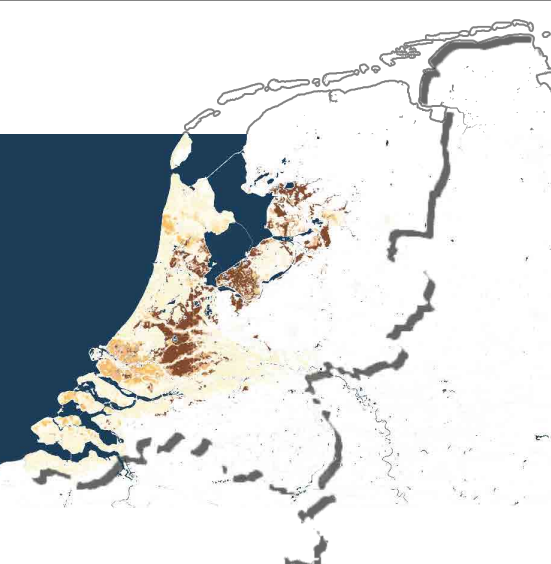
# GREENHOUSE ADAPTATION PROJECTION











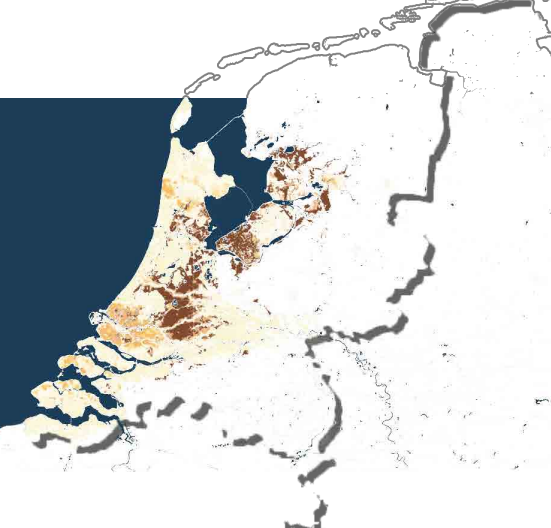
# GREENHOUSE MITIGATION PROJECTION











# GREENHOUSE PROJECTIONS





PROBLEM FIELD

RESEARCH SETUP

ANALYSIS

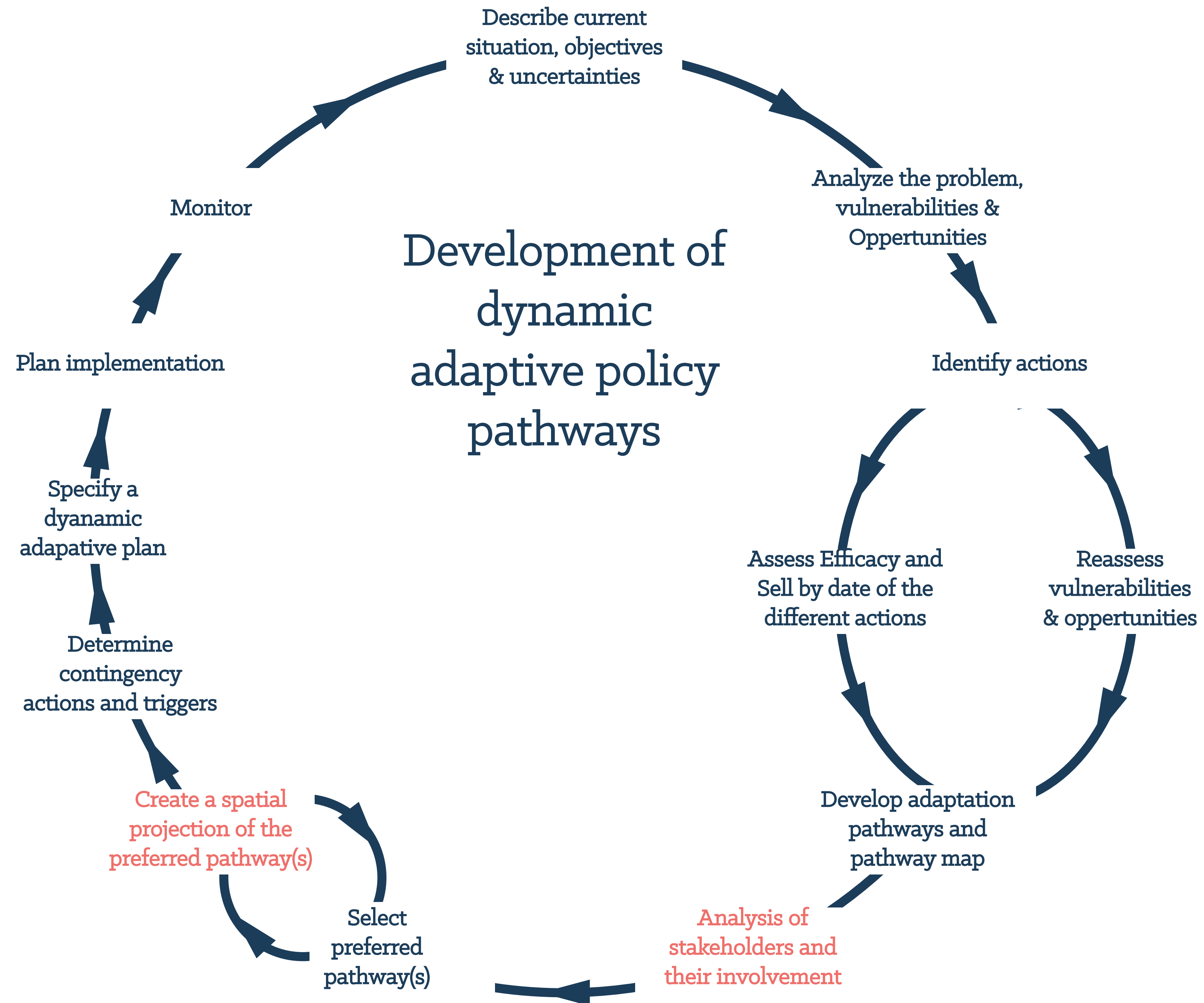
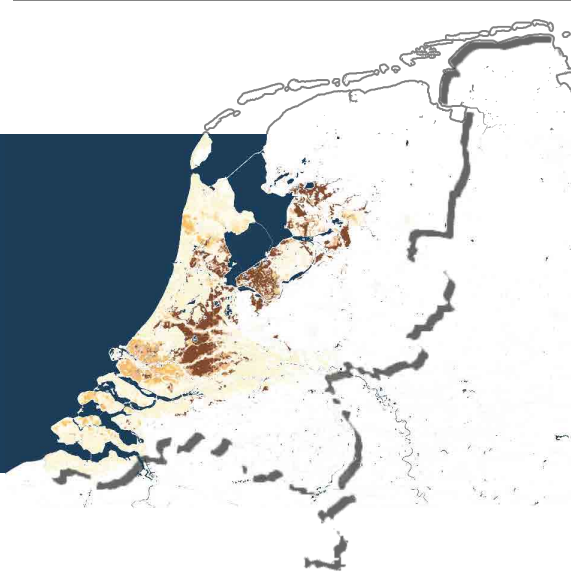
ACTION ASSESSMENT

DECISION-MAKING

PATHWAY PROJECTIONS

CONCLUSIONS & RECOMMENDATIONS







# DROWNING DELTAS

A STRATEGICAL SPATIAL APPROACH TO SOIL SUBSIDENCE IN DELTA REGIONS

