



# Water & Culture, Adaptation & Integration

Integrated urban transformation for river flood resilience and  
sustainable leisure industry in the city of Maastricht

Danyi Xiang 5465036, P5 Presentation  
1st Mentor: Claudiu Forgaci  
2nd Mentor: Diego Andres Sepulveda Carmona

**Are floods really disasters?**









Lucy Morton & James Knightbridge (2022)

Source: <https://www.newcivilengineer.com/latest/nature-based-solutions-offer-huge-potential-to-manage-flood-risk-and-increase-biodiversity-net-gain-but-who-should-foot-the-bill-06-05-2022/>



# Content

01 Problematization & Research Structure

02 Transformation Opportunities

03 Scenario Experiments of Maastricht City

04 Integrated strategies & implementations

05 Conclusion & Reflection

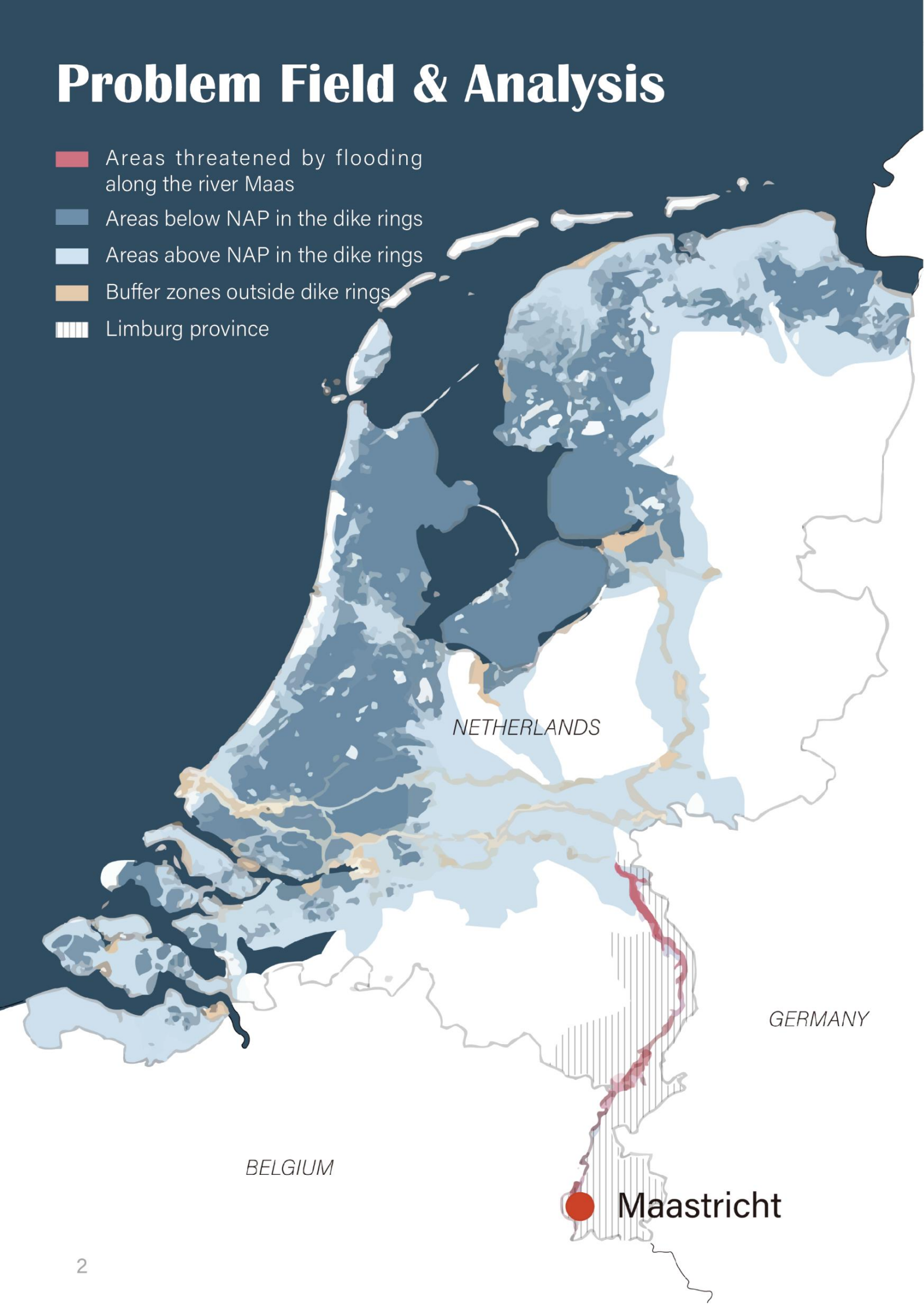
PART  
01

# What's wrong with Maastricht ?

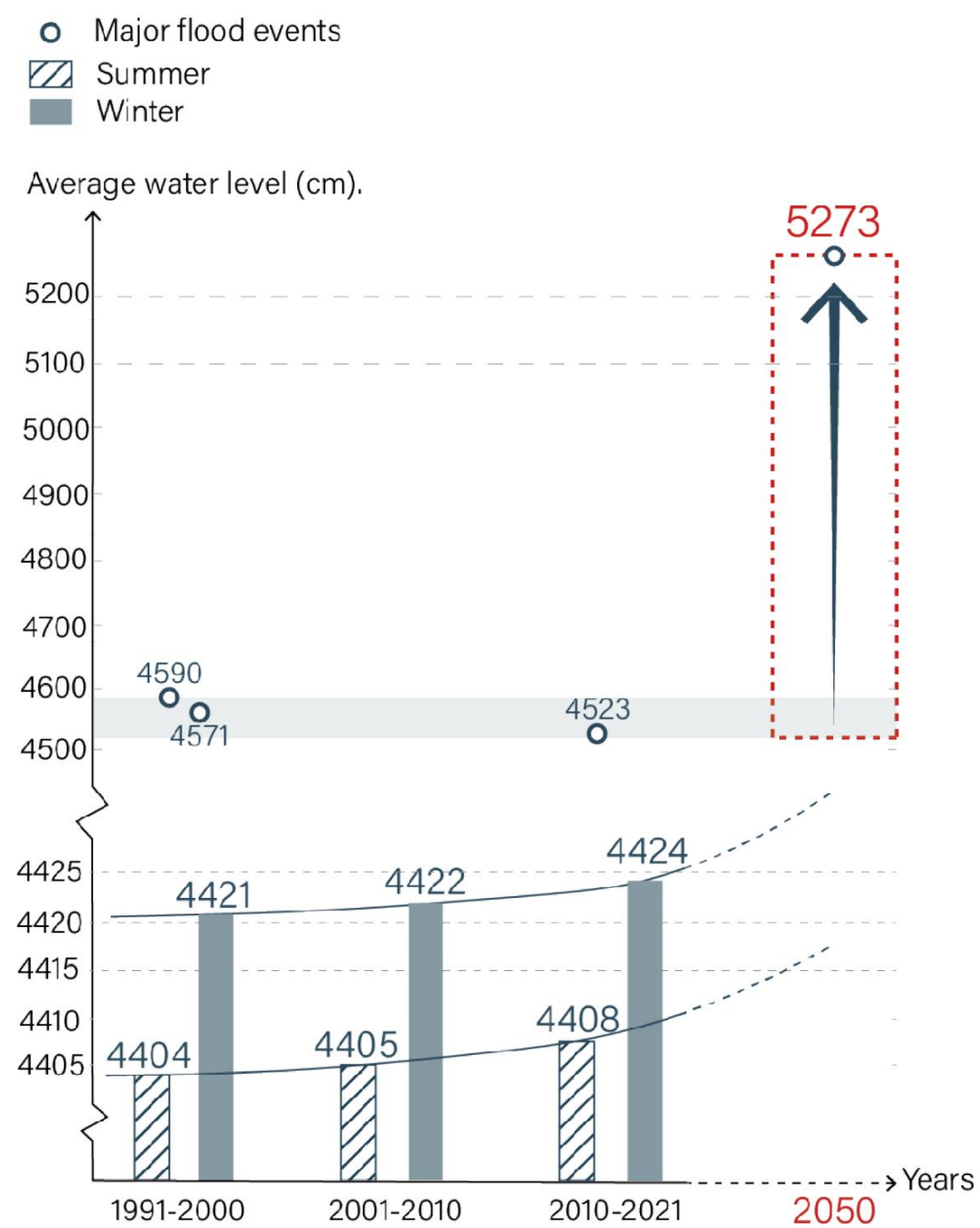


# Problem Field & Analysis

- Areas threatened by flooding along the river Maas
- Areas below NAP in the dike rings
- Areas above NAP in the dike rings
- Buffer zones outside dike rings
- Limburg province



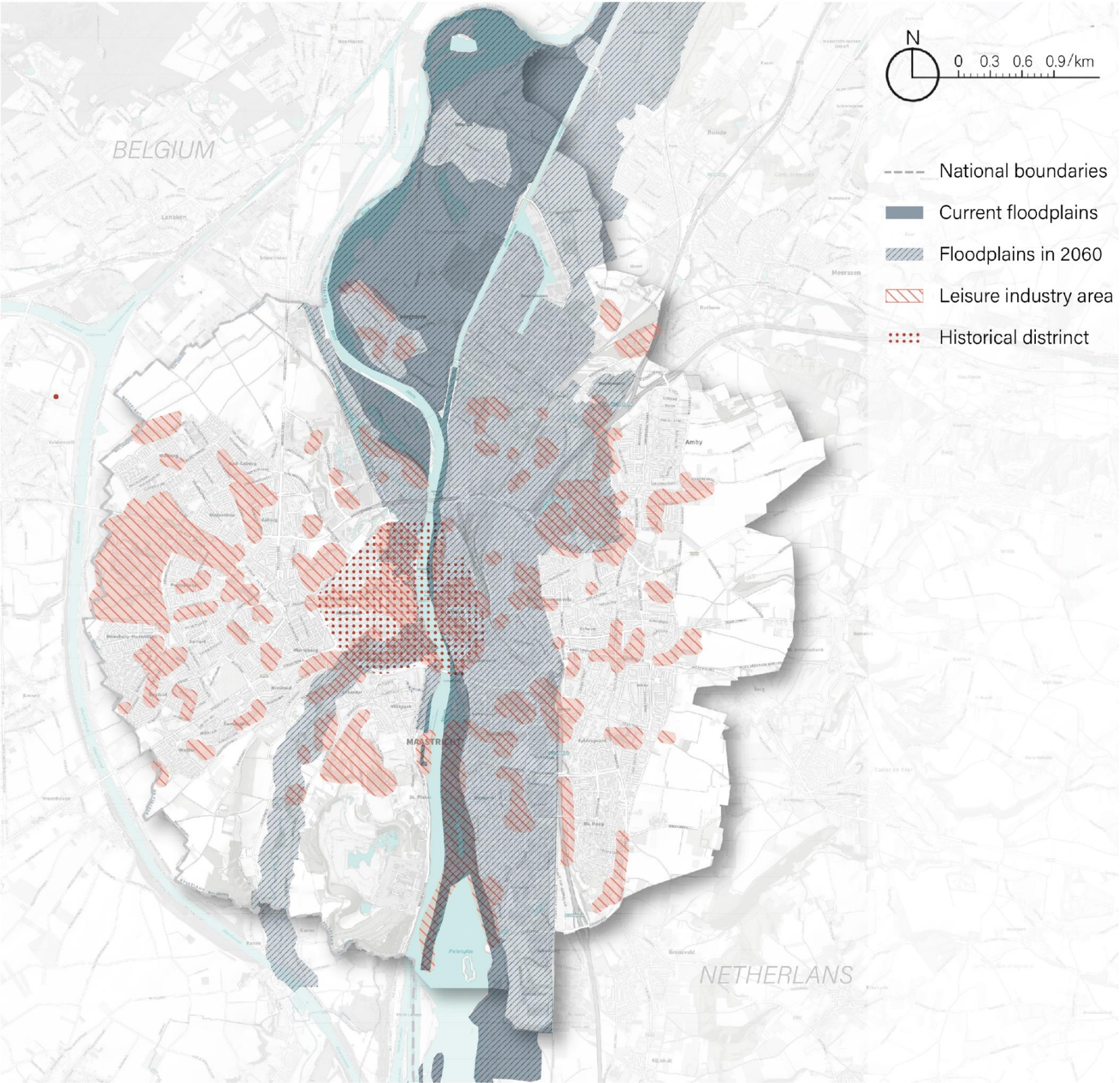
## Susceptibility to fluvial flooding





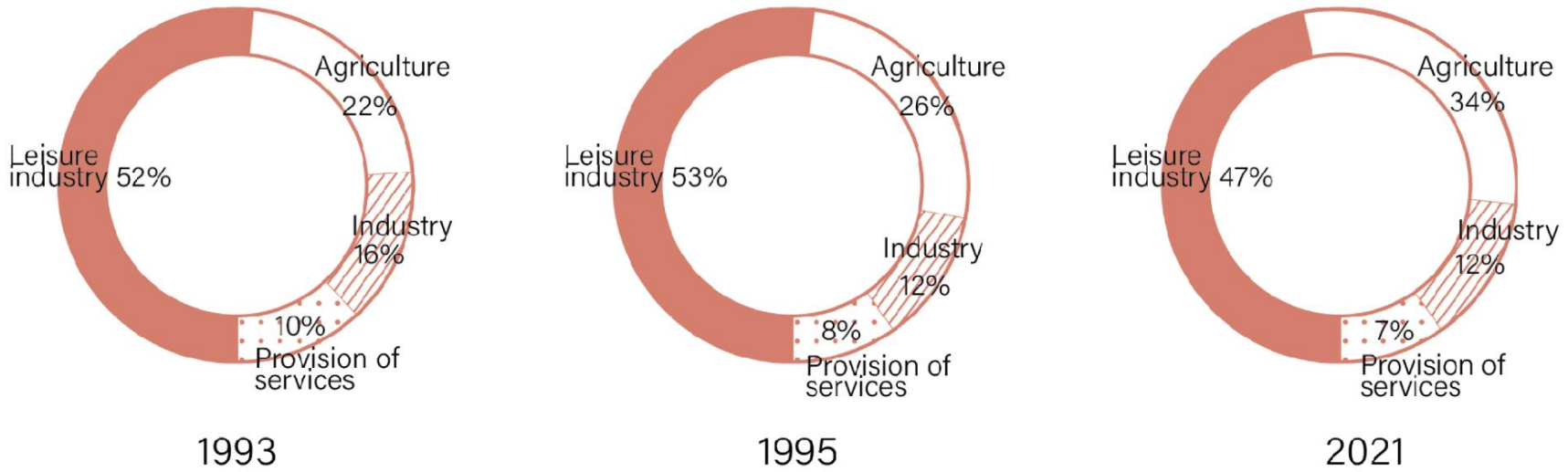
# Problem Field & Analysis

- Physical damage of leisure industry

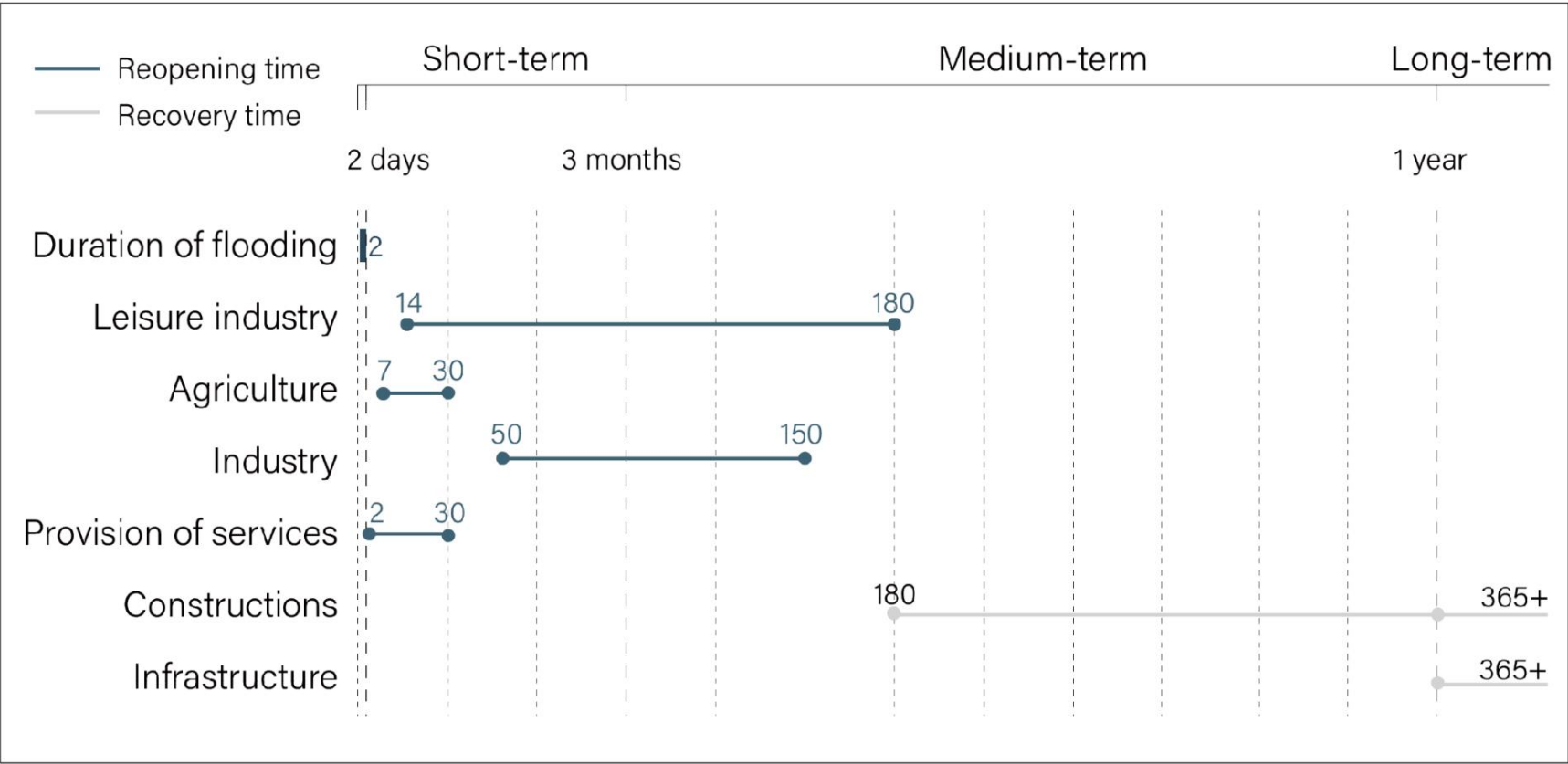


## Vulnerability of the leisure industry to fluvial flooding

- Economic share of losses due to fluvial floods in different sectors in Limburg



- Various types of leisure industry flood recovery time

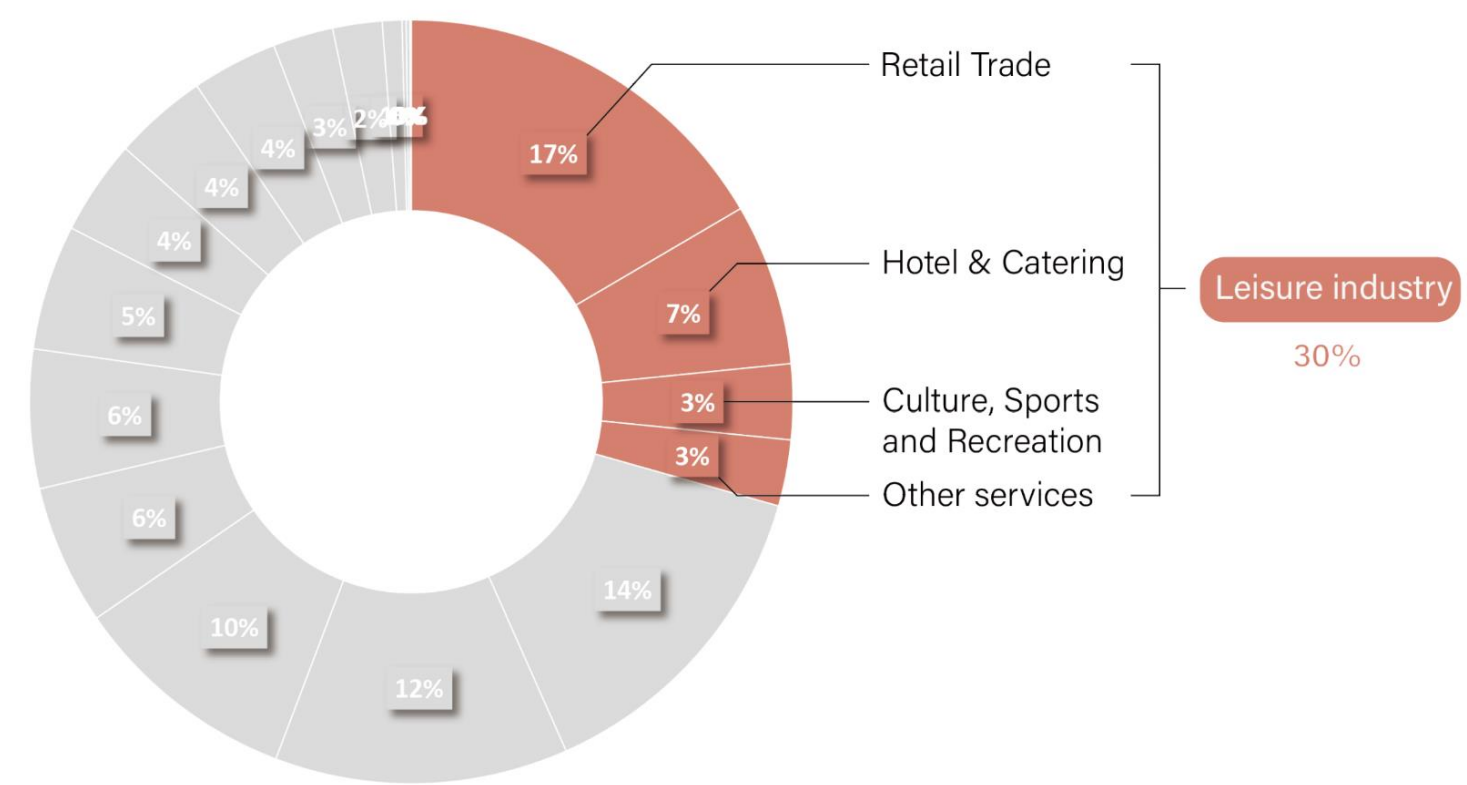




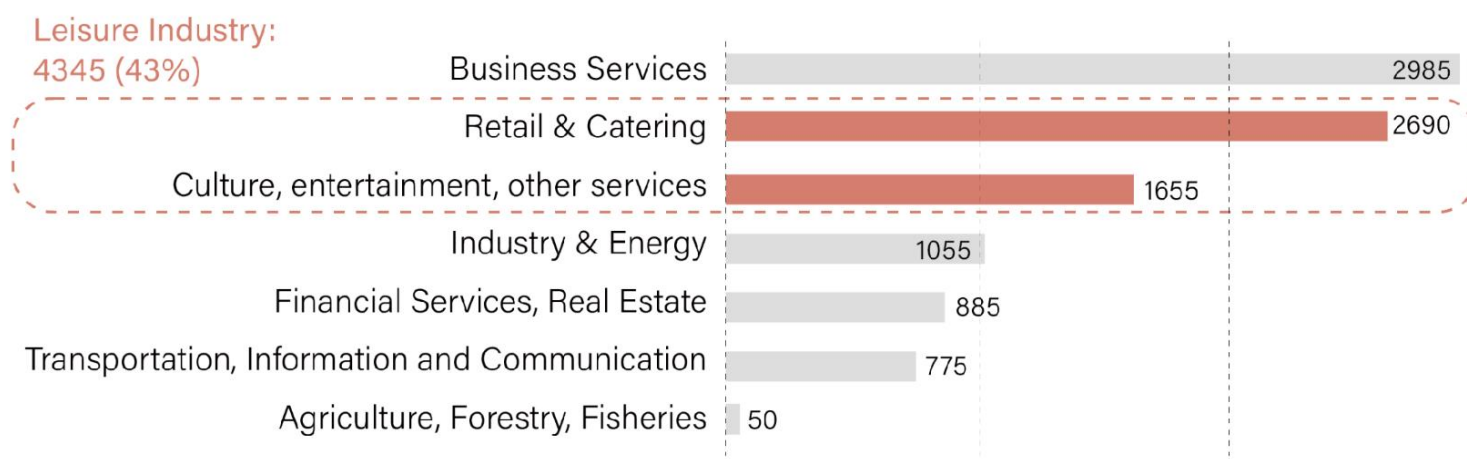
# Problem Field & Analysis

The leisure industry is a significant component of Maastricht's economic landscape

- Proportion of people working in different sectors in Maastricht



- Number of companies in each sector





# Recreational Value of Floods

- Street Boating & Water Games



The recreational value  
of fluvial flooding

- Waterfront Resting



- Backyard Fishing



- Road Picnic





# Problem Statement



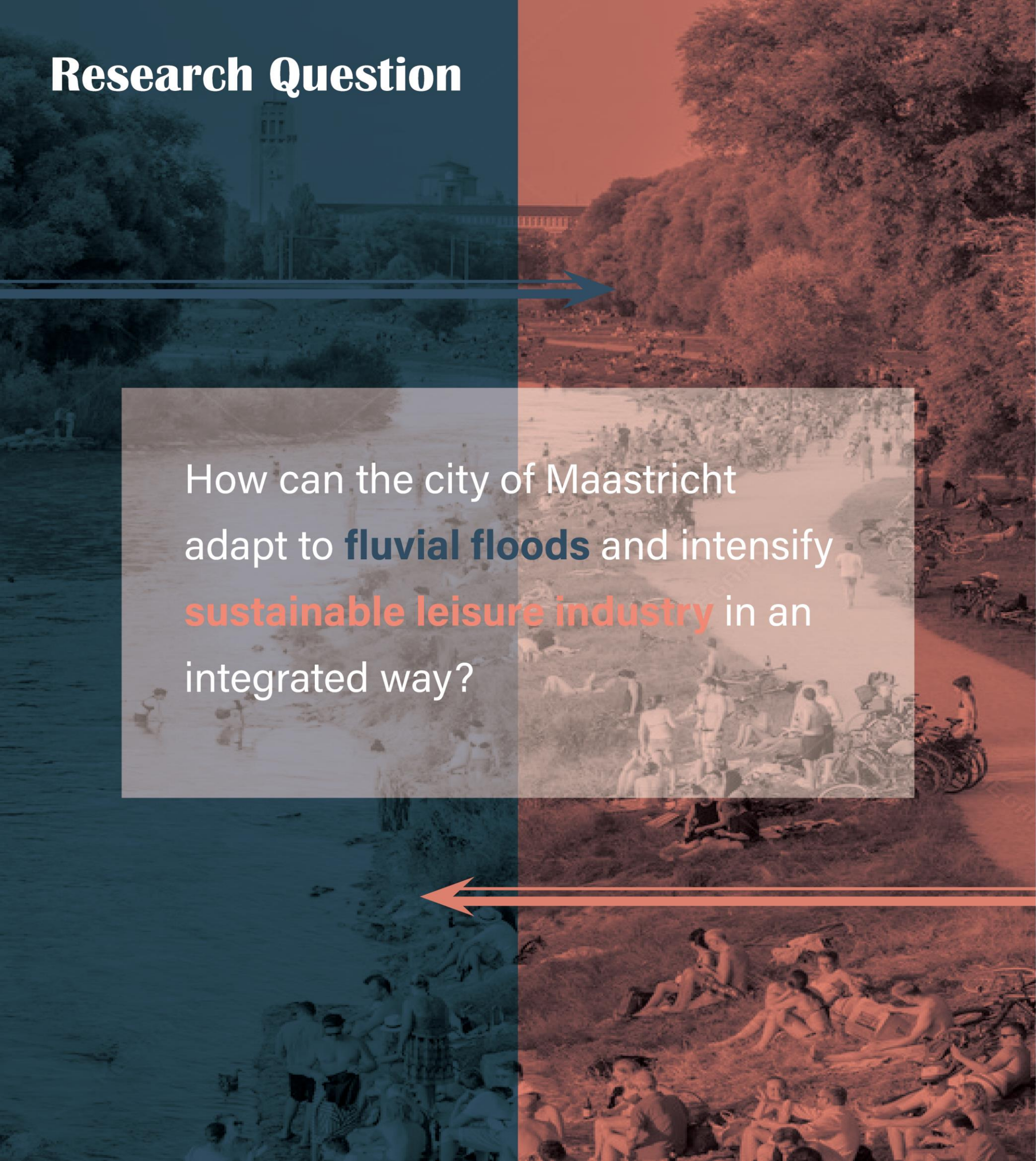
The city of Maastricht is facing a significant threat from increasingly frequent and severe **fluvial floods**, particularly affecting the **vulnerable leisure industry**.

However, by integrating flood management and leisure industry development, the city may **transform these challenges into opportunities** for growth and resilience.





# Research Question



How can the city of Maastricht adapt to **fluvial floods** and intensify **sustainable leisure industry** in an integrated way?

# Research Aim

## ▪ Double benefits

This report explores an **integrated transformation** proposal for Maastricht, focusing on urban design, to **address river flooding** and **promote sustainable leisure industry**. The proposed strategy involves creating an urban fabric that mitigates flooding impacts and utilizes it for leisure industry development.

## ▪ Cross-scale

The approach includes spatial interventions at **regional, city, and neighborhood scales**.

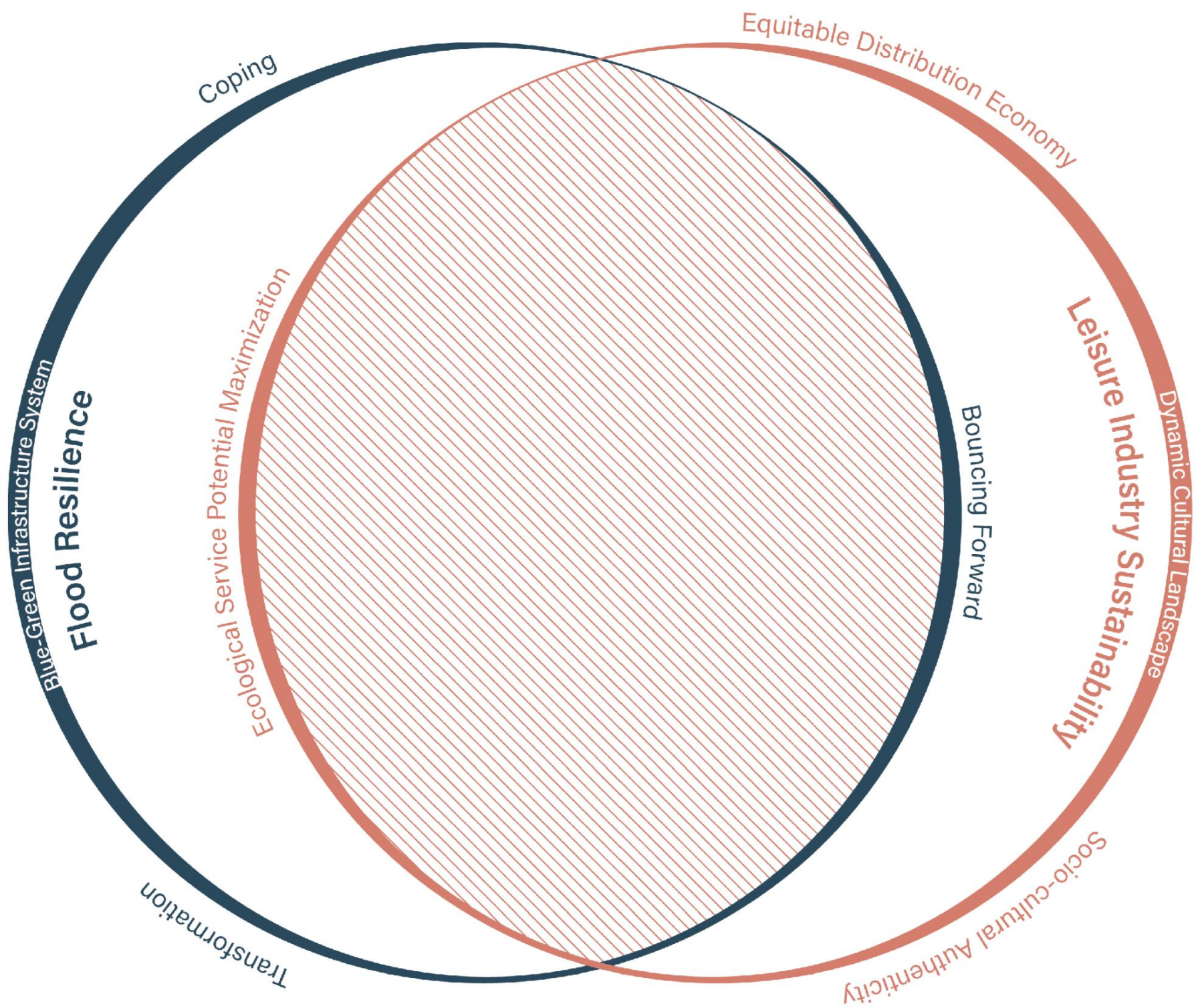
## ▪ Regional effects and transferability

Implementation of this proposal aims to boost the **economic and cultural development** of the entire **Maas Basin's ecology** and offers a **potential blueprint for other fluvial cities**.

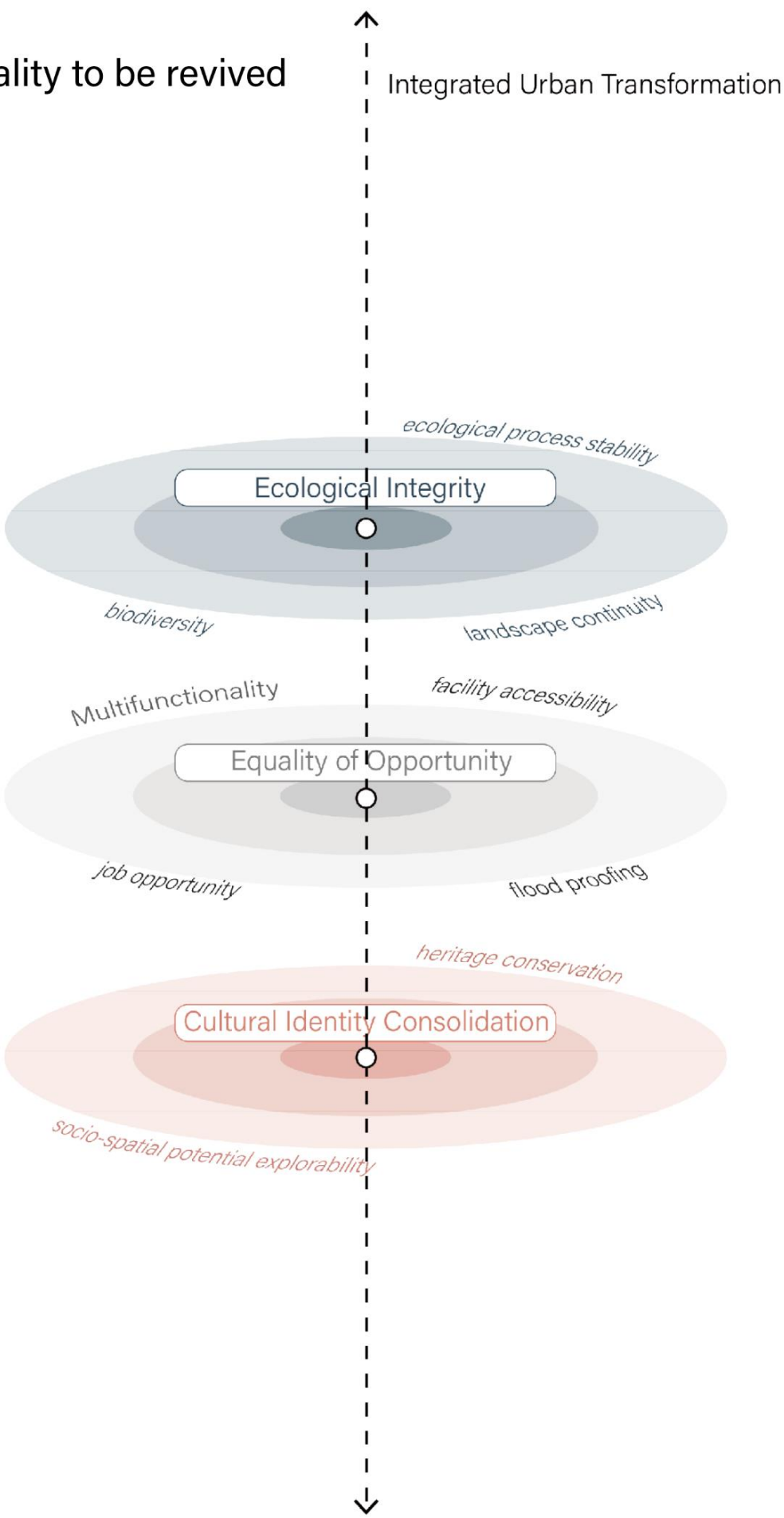


# Conceptual Framework

- Research topic: Urgent issues

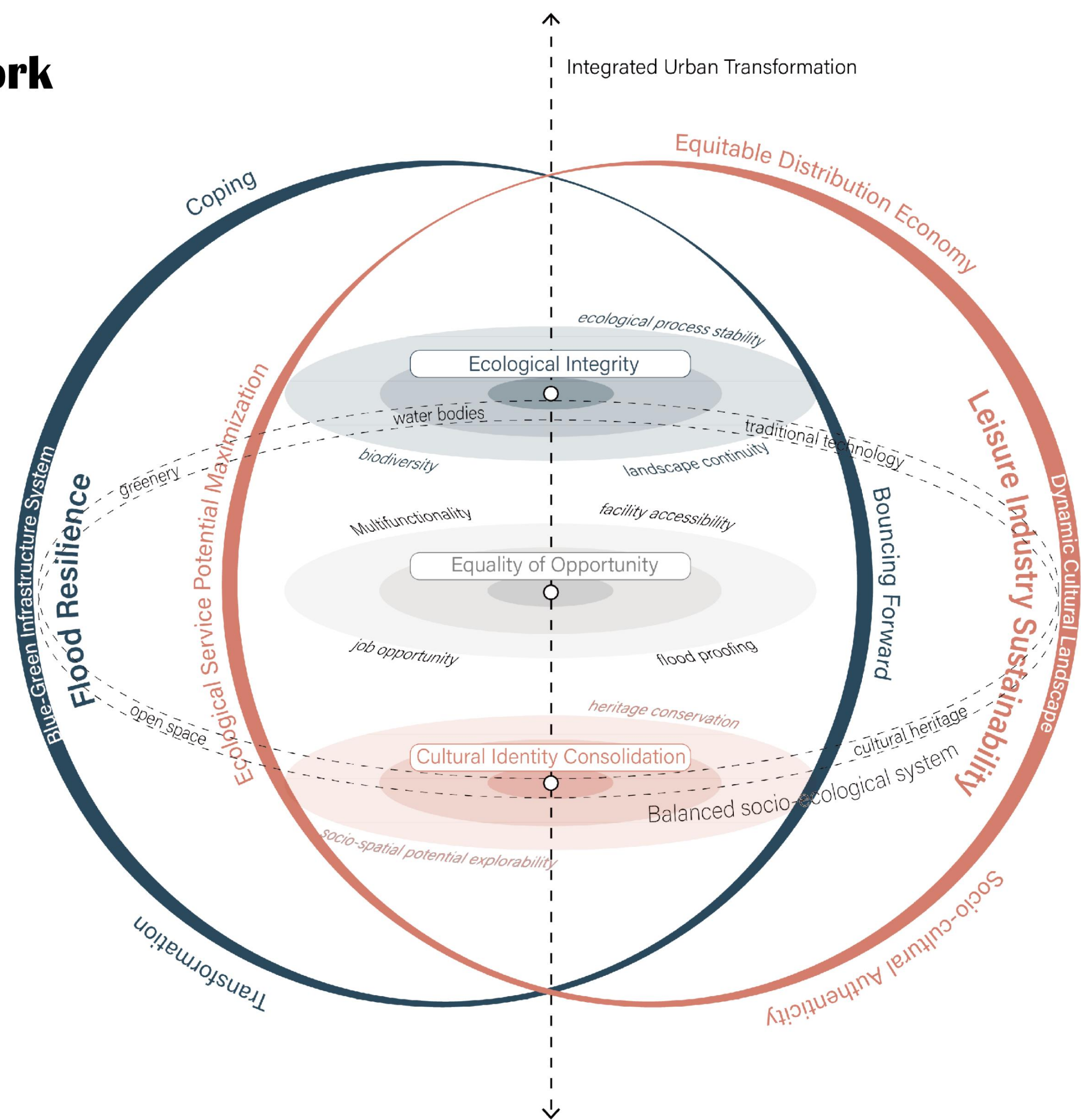


- Design goals: Quality to be revived





# Conceptual Framework



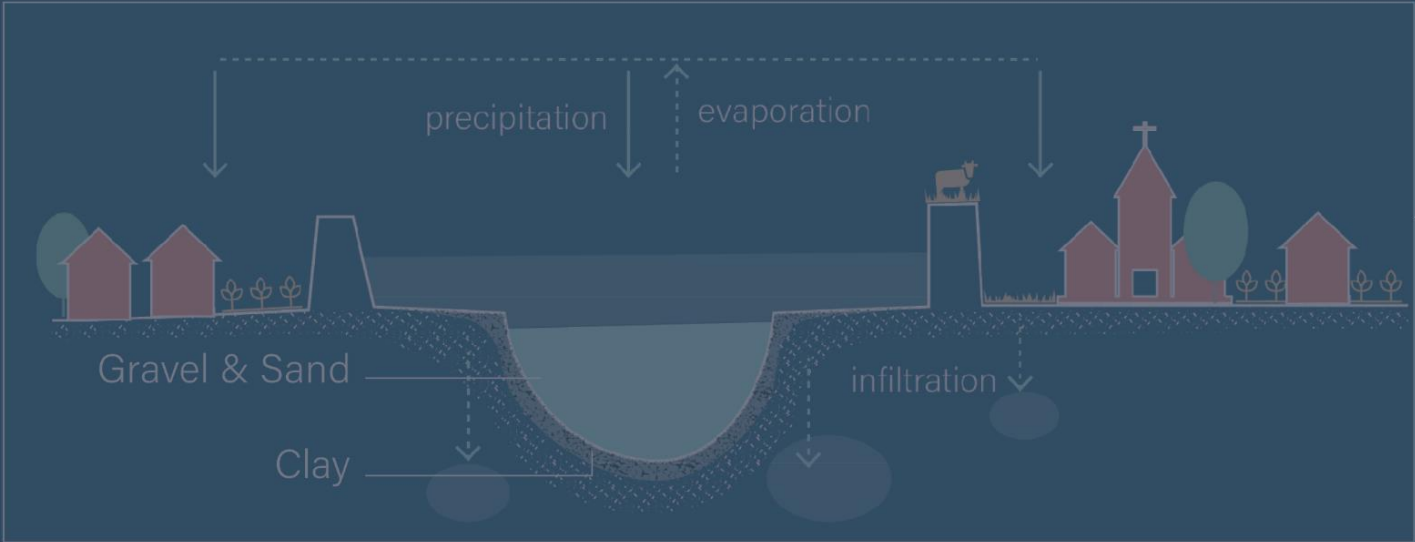
PART  
02

Where should we  
start ?



# Transformation Opportunities at Maas Basin Scale

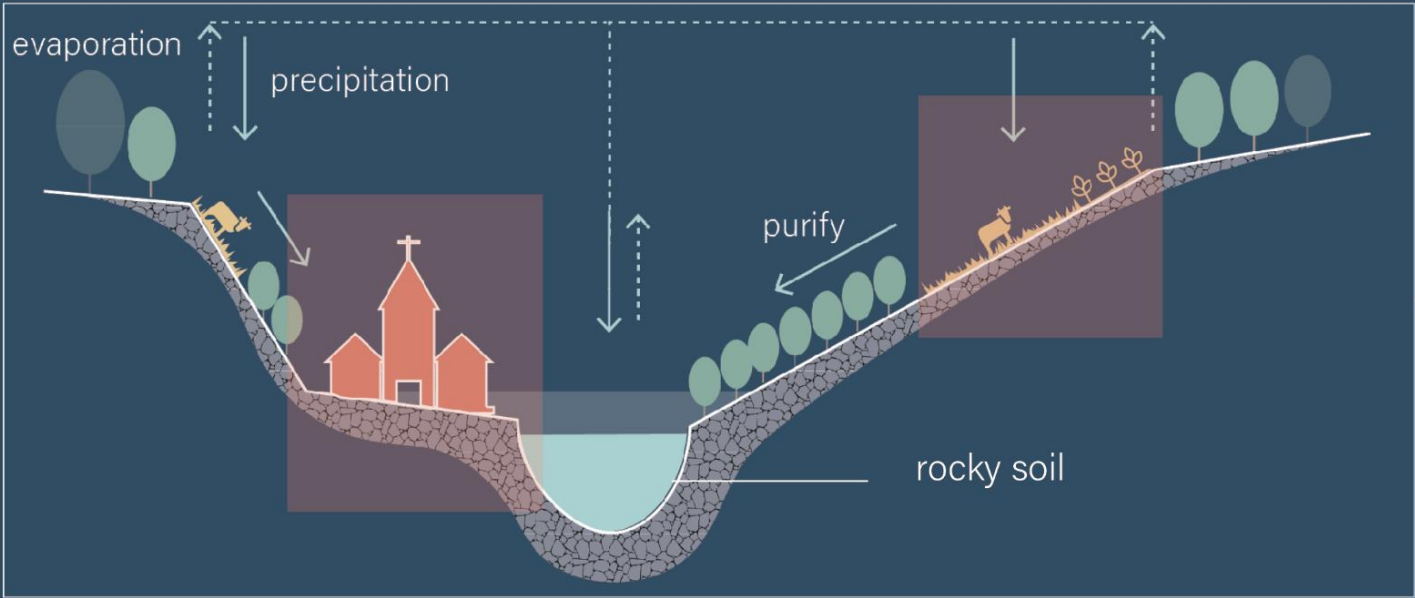
- Downstream



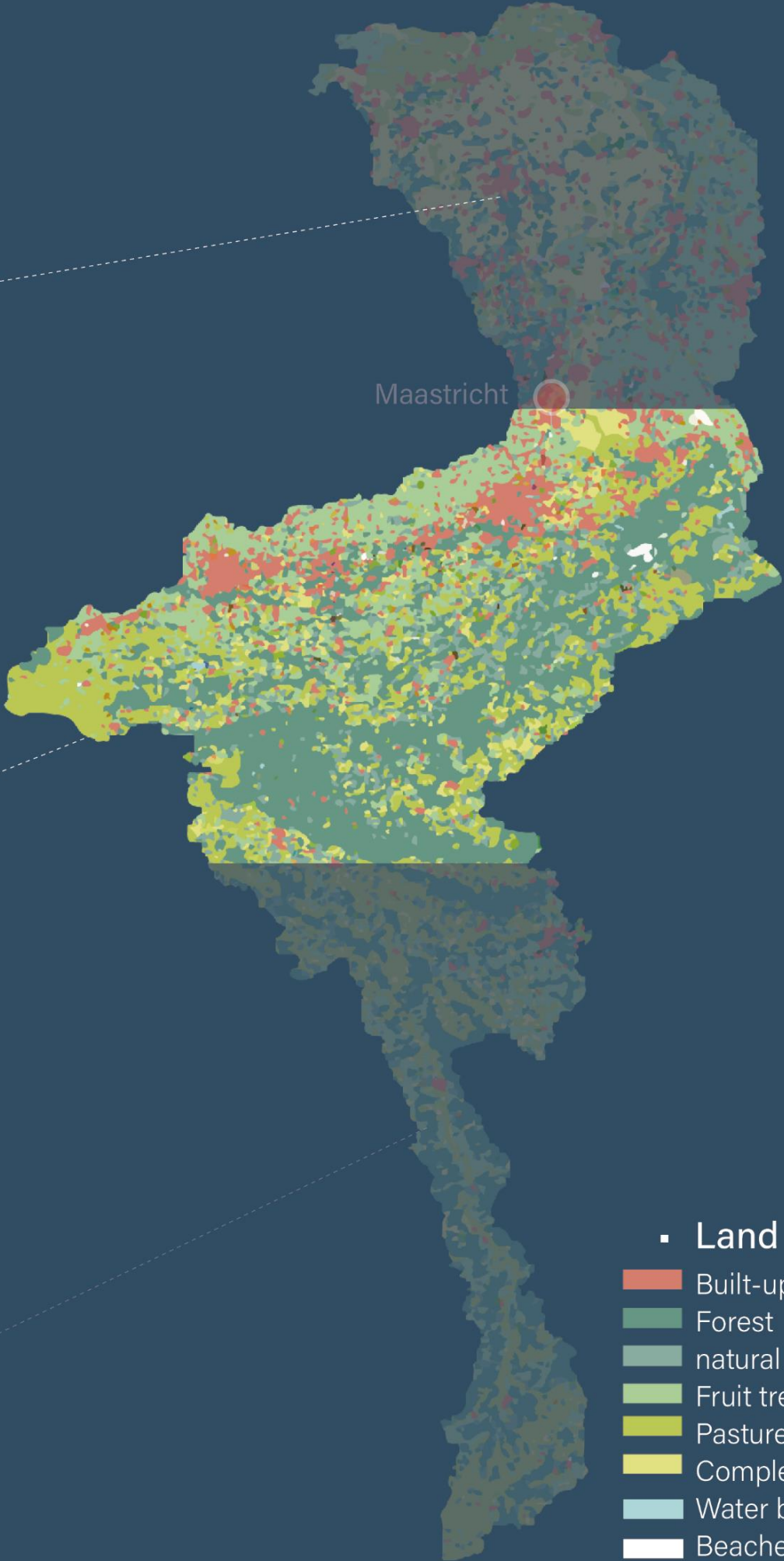
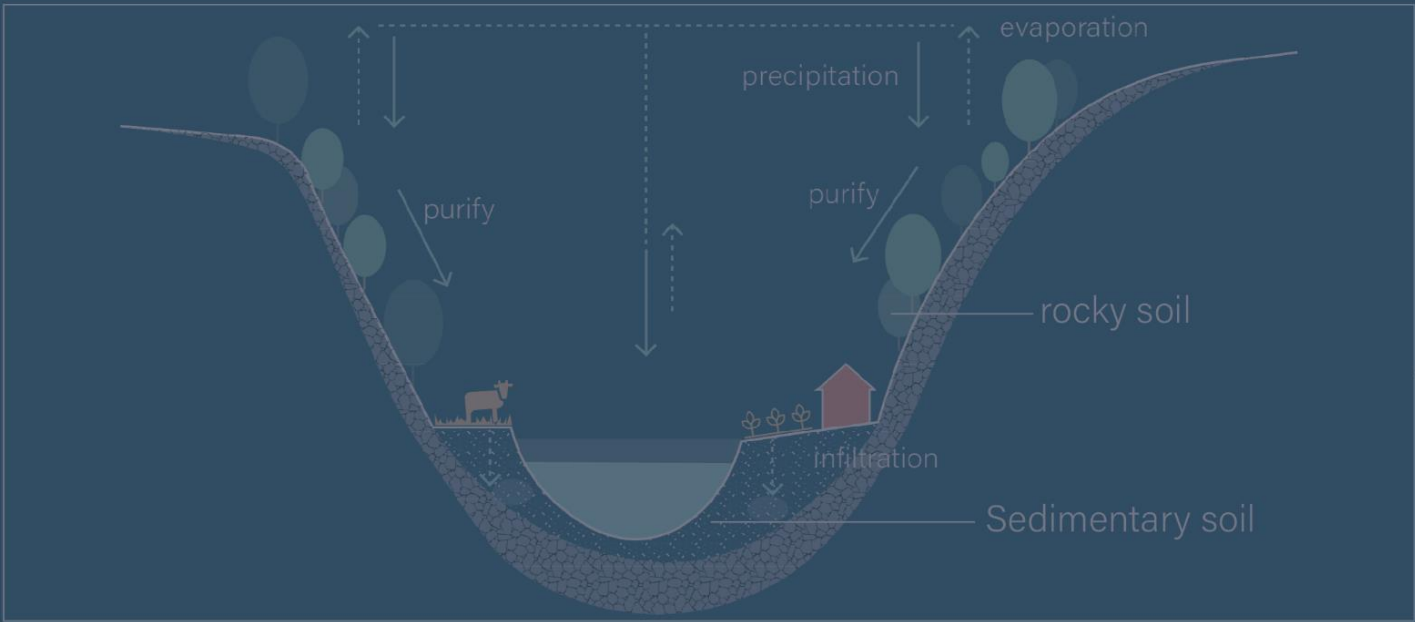
- Midstream

A significant contribution to the high water level: canalization, damming and urbanization.

Agricultural areas on high ground have certain retention capacity.



- Upstream



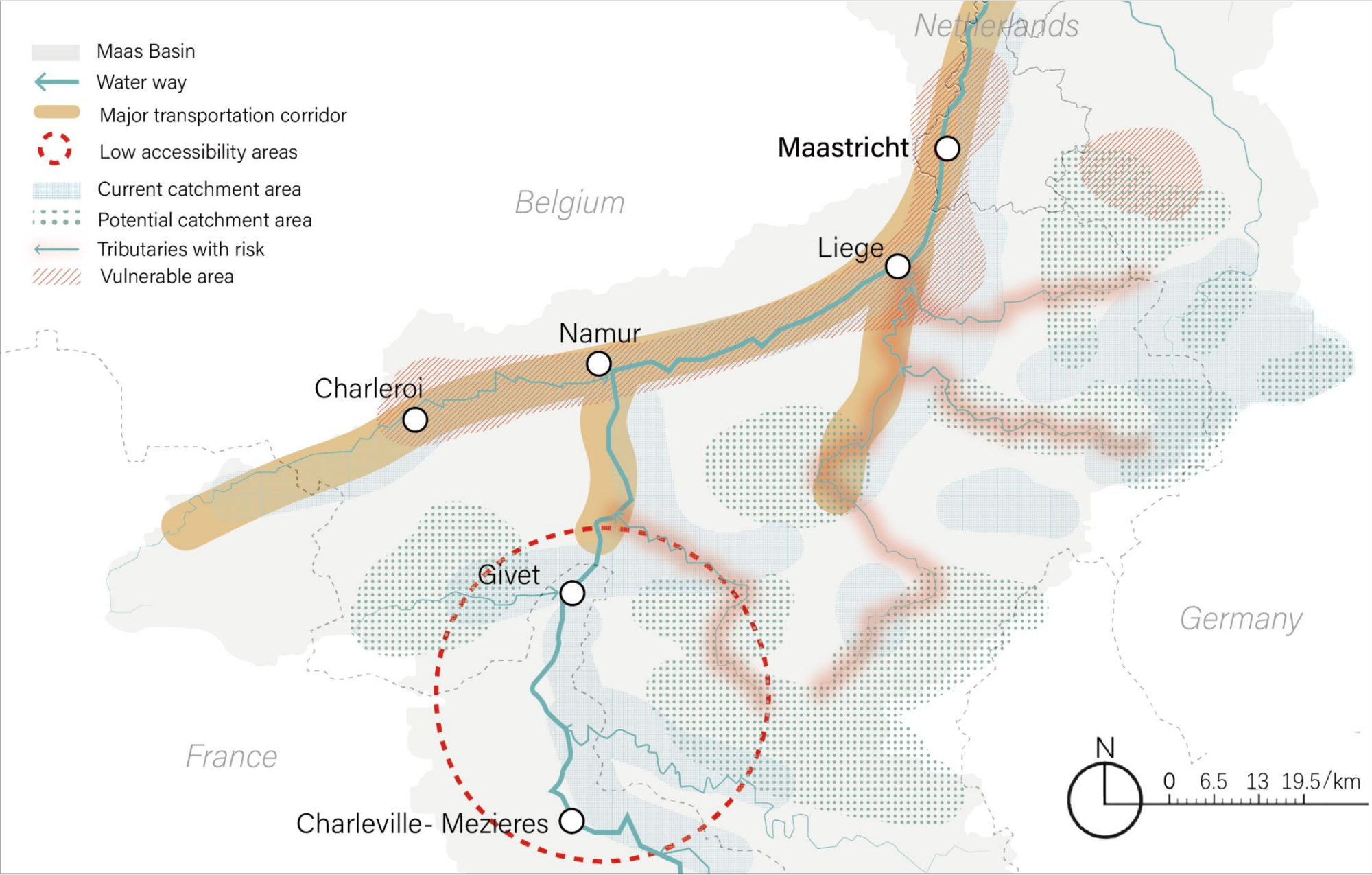
- Land cover

- Built-up area
- Forest
- natural vegetation
- Fruit trees & arable land
- Pastures
- Complex cultivation
- Water bodies
- Beaches/ dunes/ sand

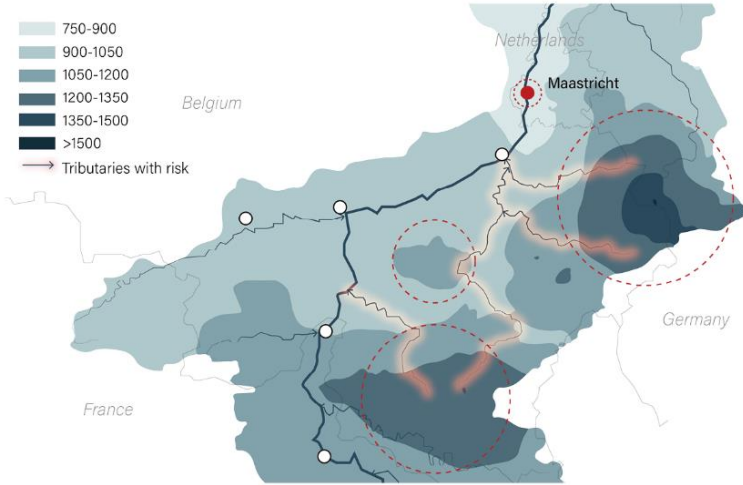


# Scope of Integrated Opportunities at Maas Basin Scale

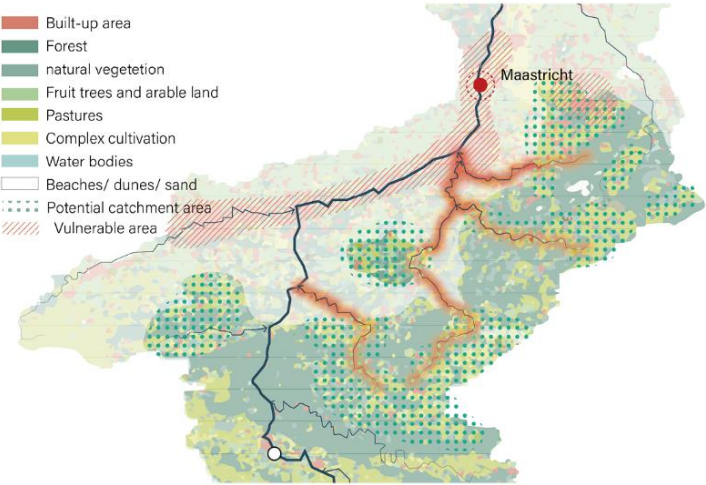
## Midstream of Maas Basin Spatial Potential Context



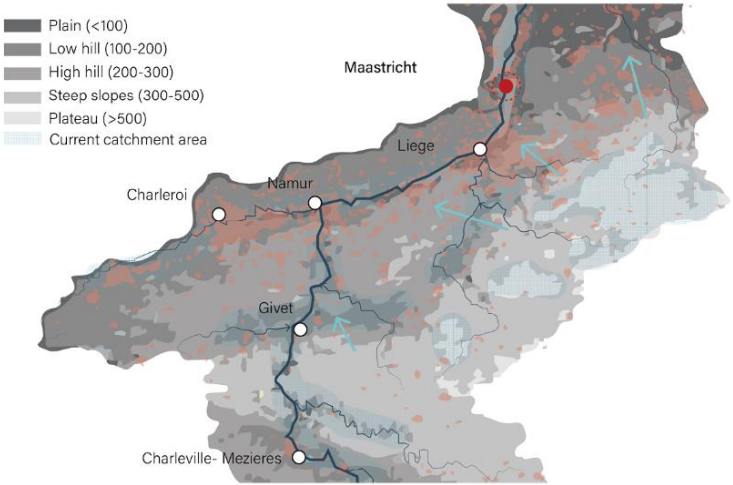
### Average annual precipitation



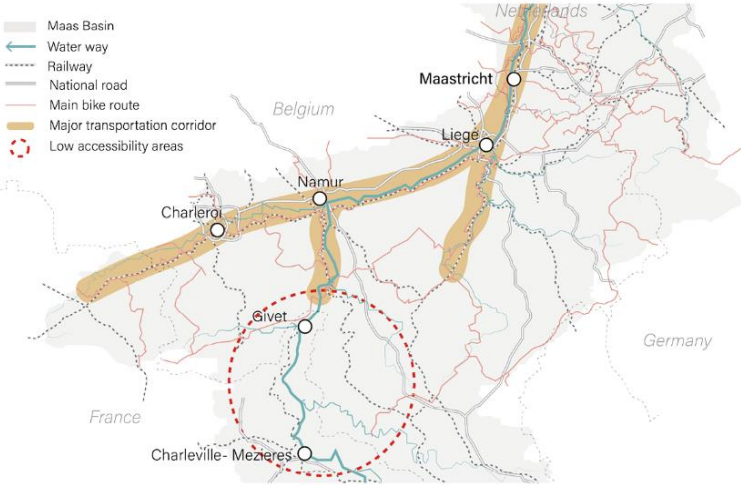
### Land cover



### Topography



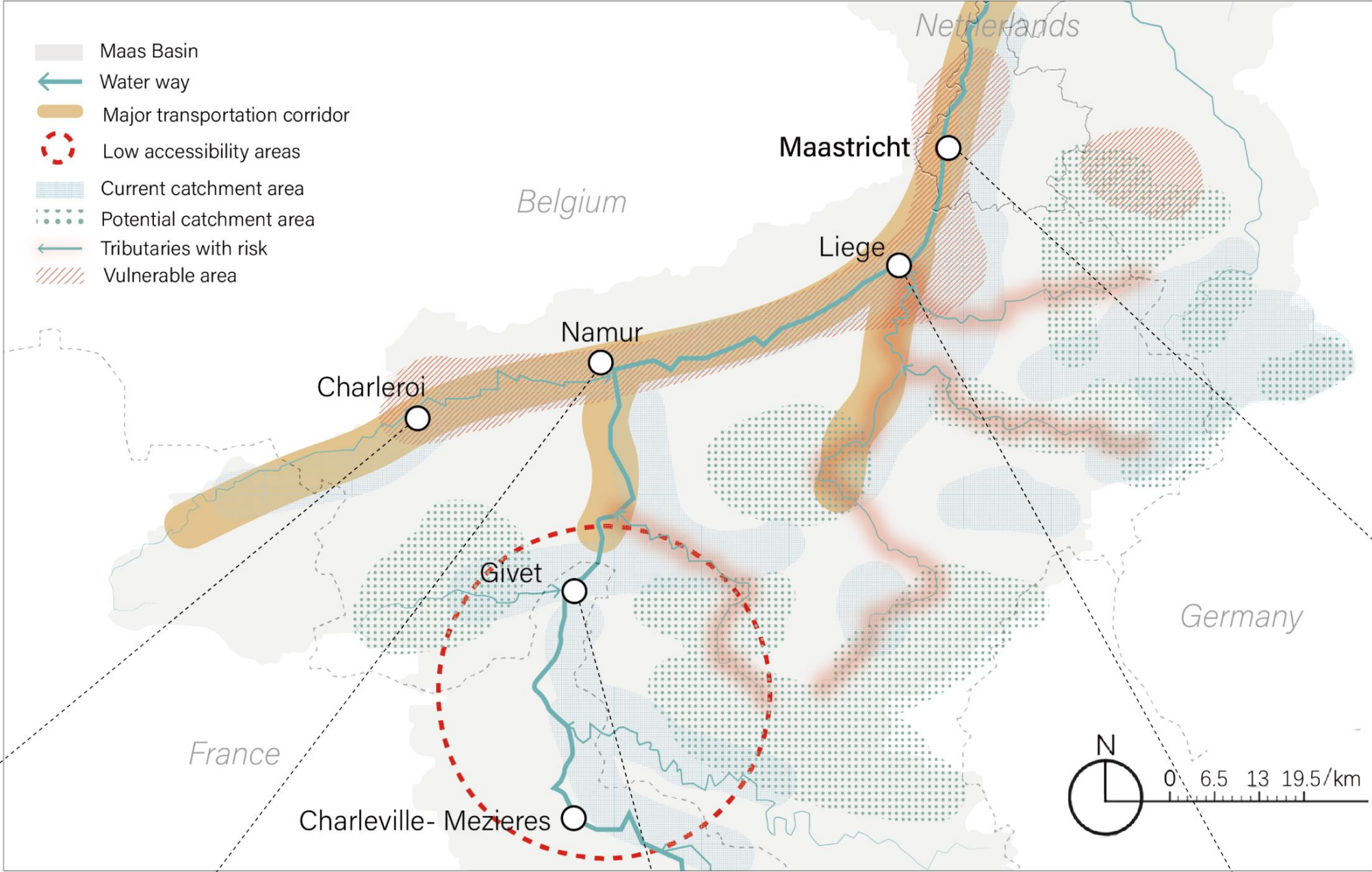
### Public transport





# Scope of Integrated Opportunities at Maas Basin Scale

Midstream of Maas Basin Spatial Potential Context

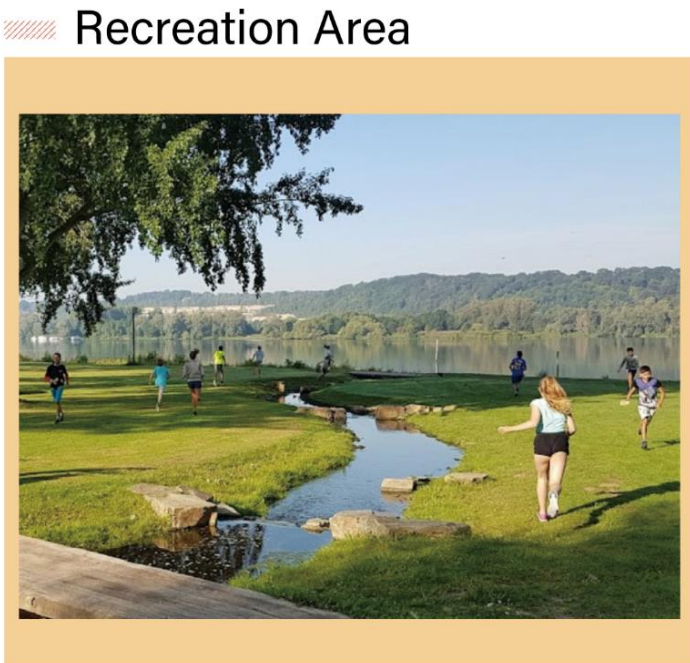
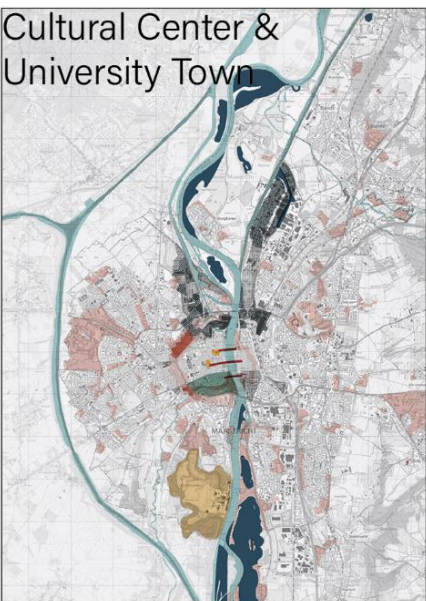
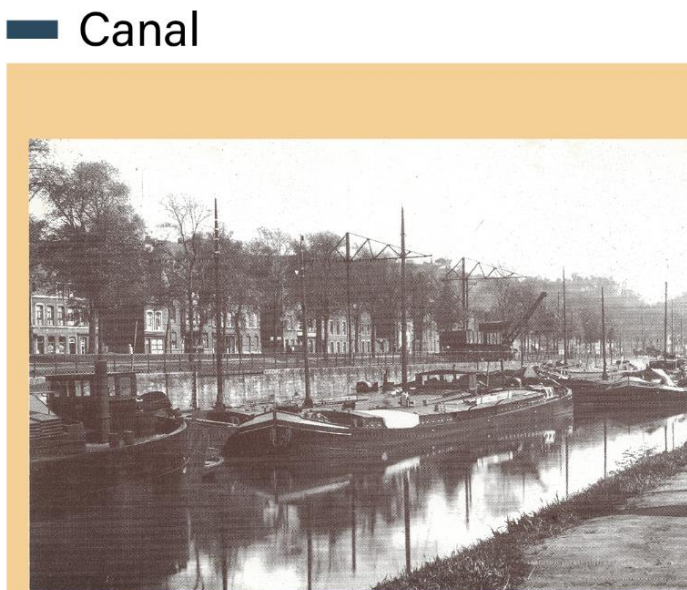
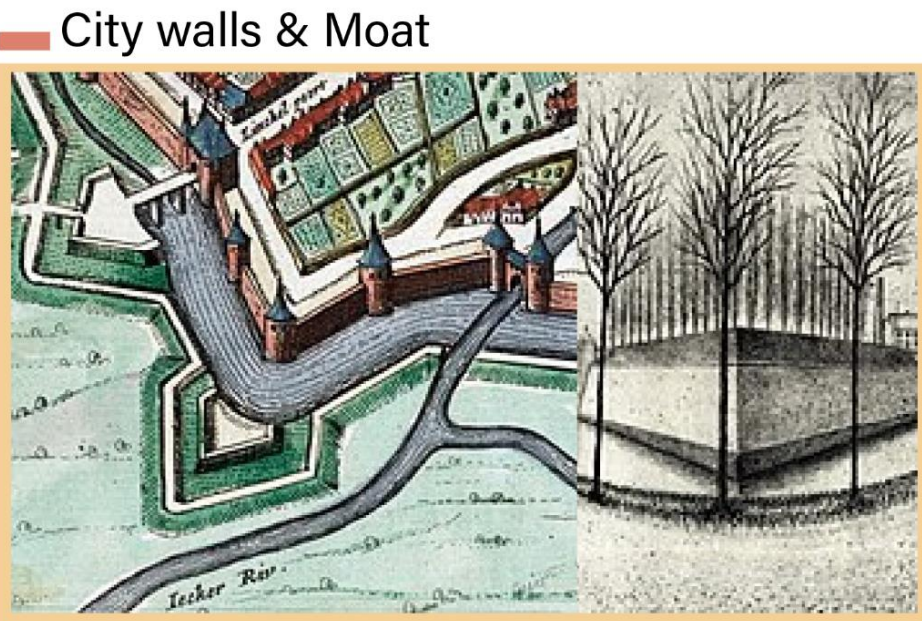
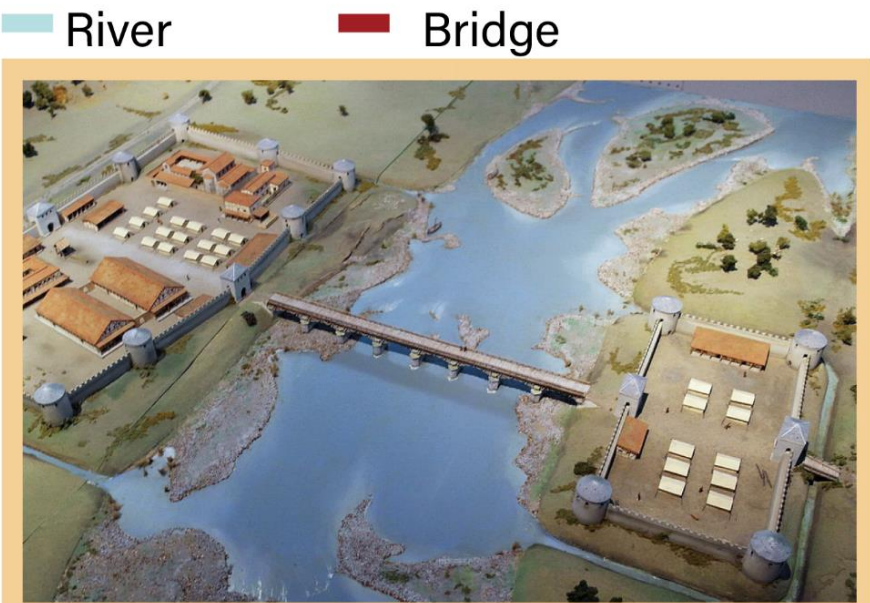
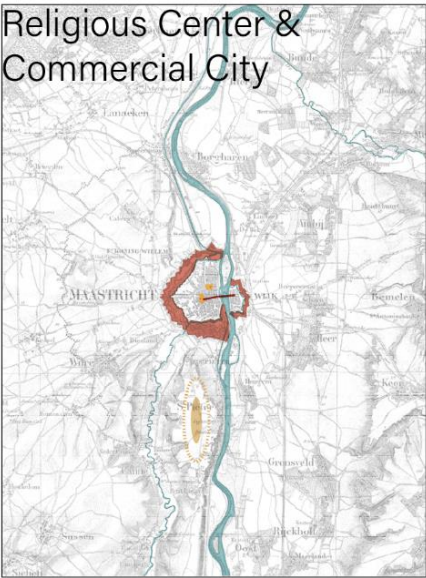


Diverse Culture



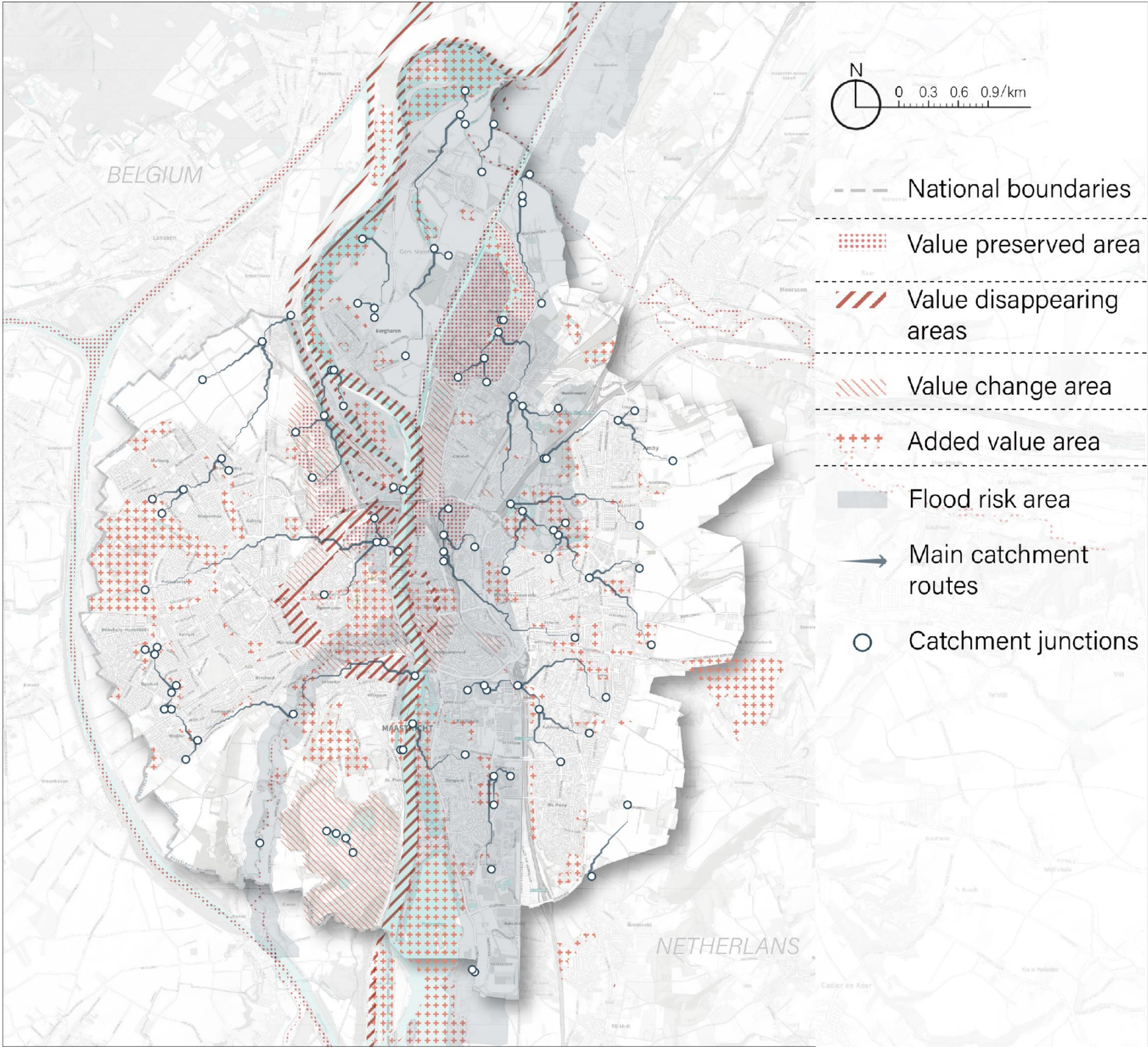


# Elements of the Cultural Landscape of Maastricht in Different Periods





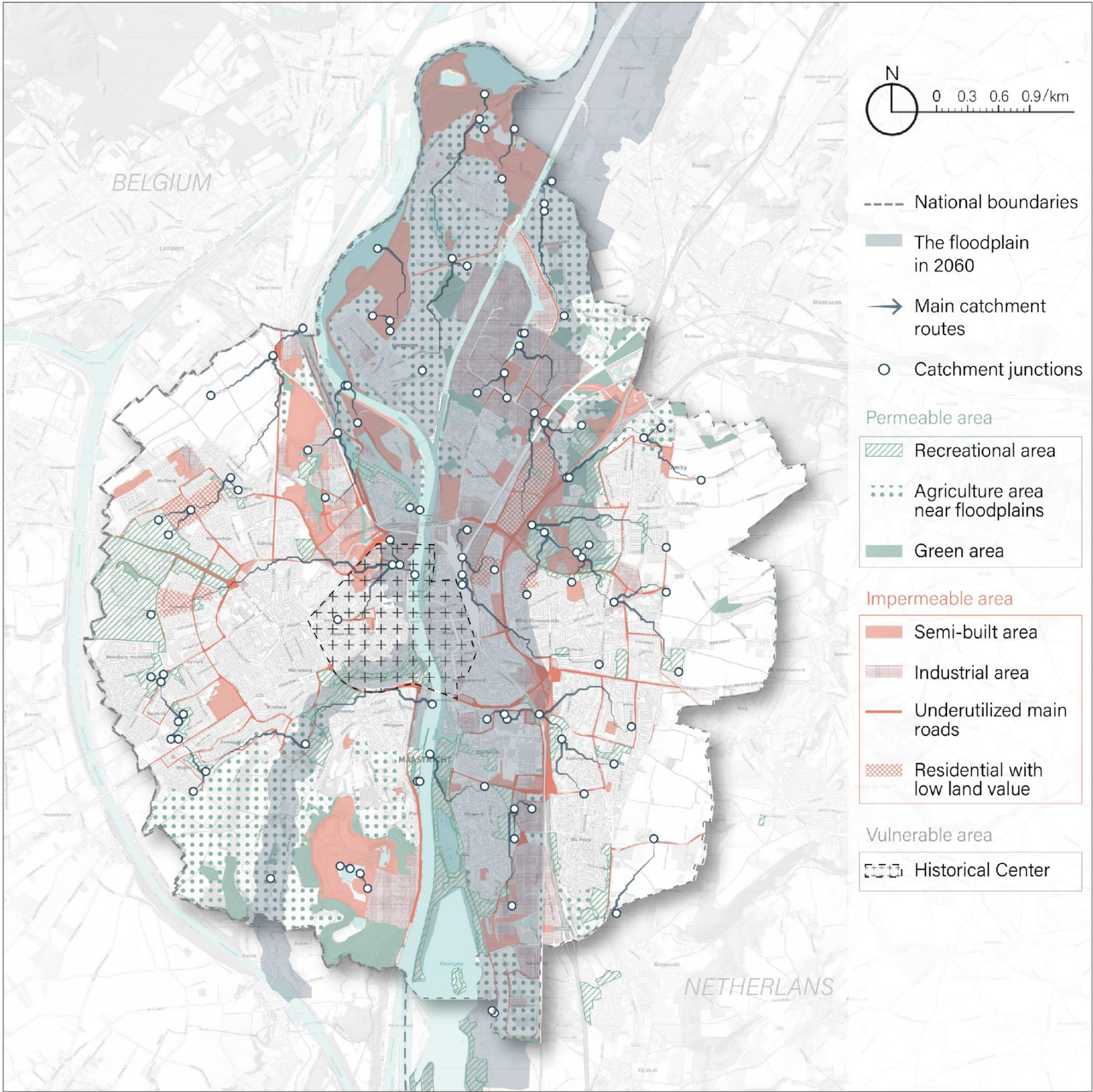
# Value Dynamics Of The Maastricht Cultural Landscape Key Areas



Value Assessment Framework			
Functionality	Historical memory	Ecological service	Flood proofing potential
preserve/change	preserve	preserve/increase	Current urgent needs in Maastricht
lost	lost	lost	
change	preserve	preserve/increase	
new		increase	

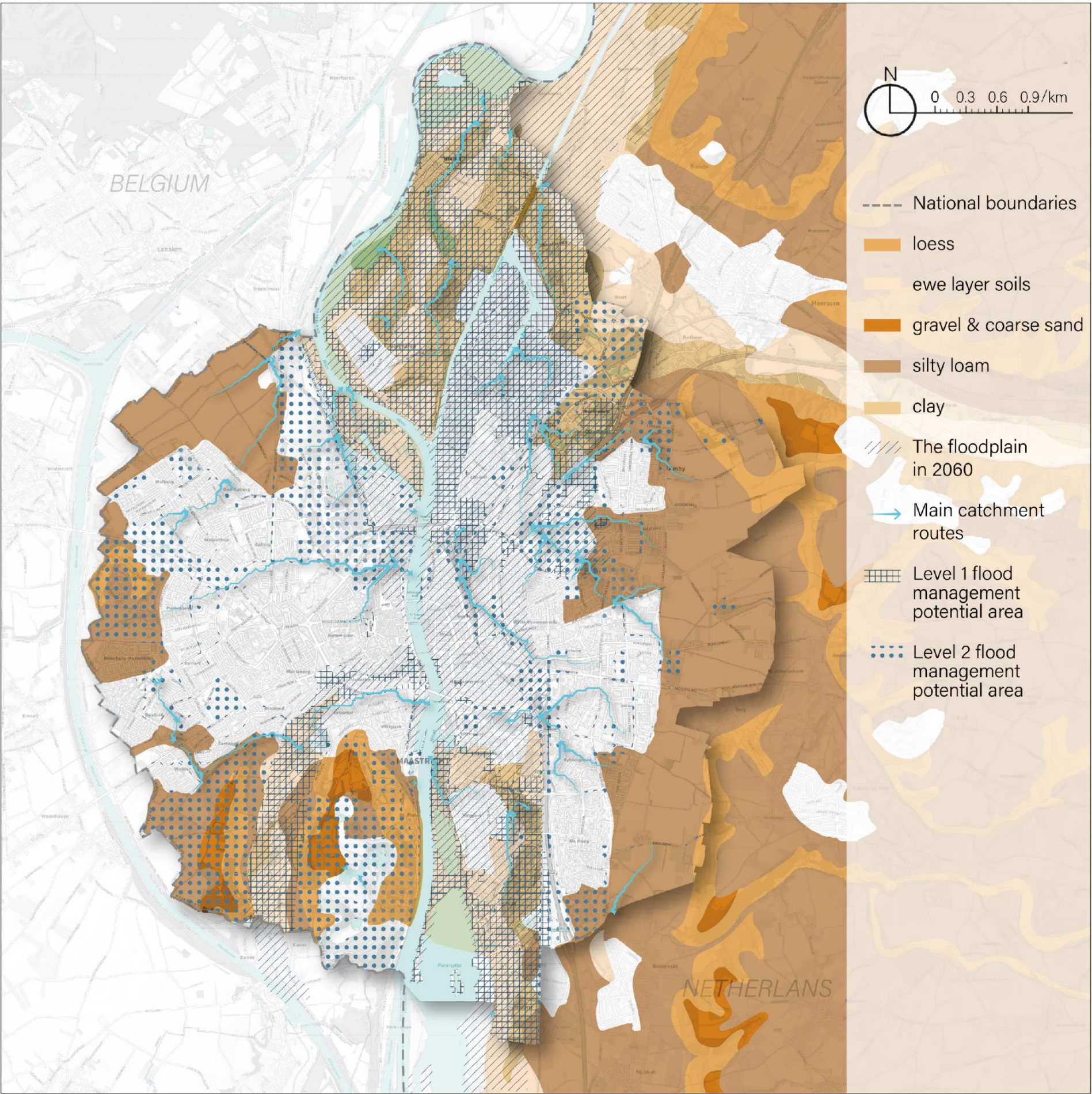


# Potential Space to Expand the Value of Maastricht





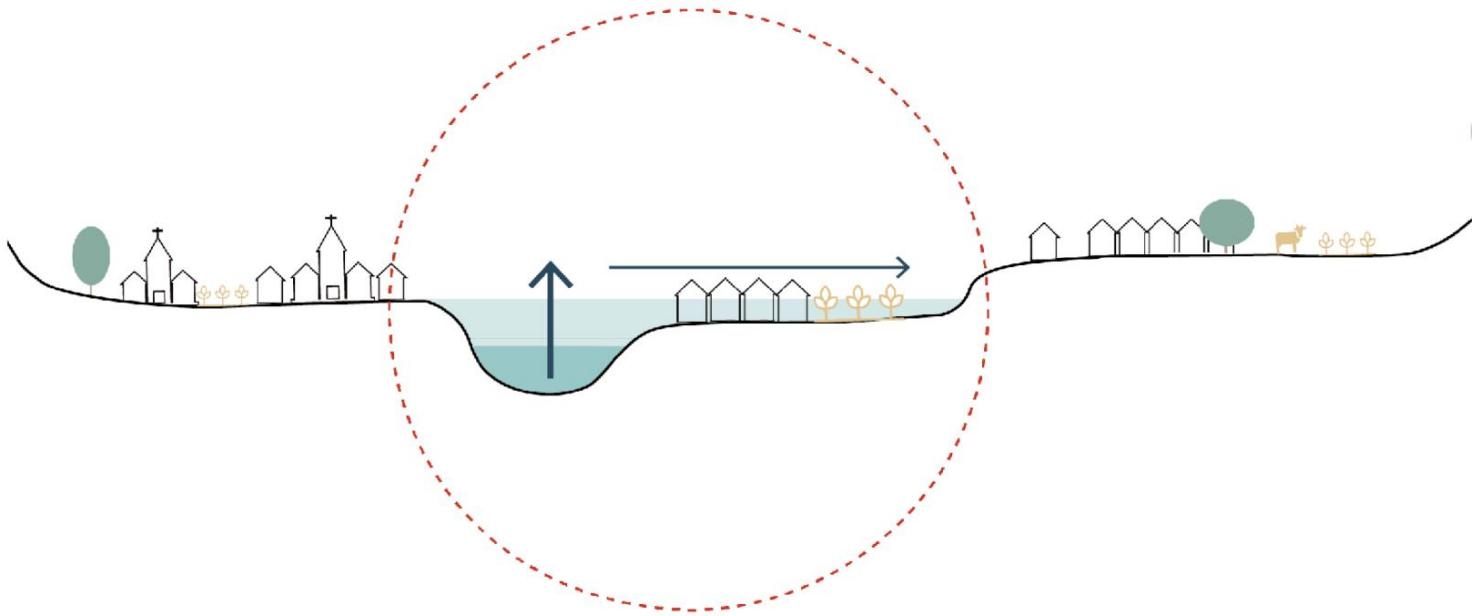
# Flood Water Management Potential Assessment



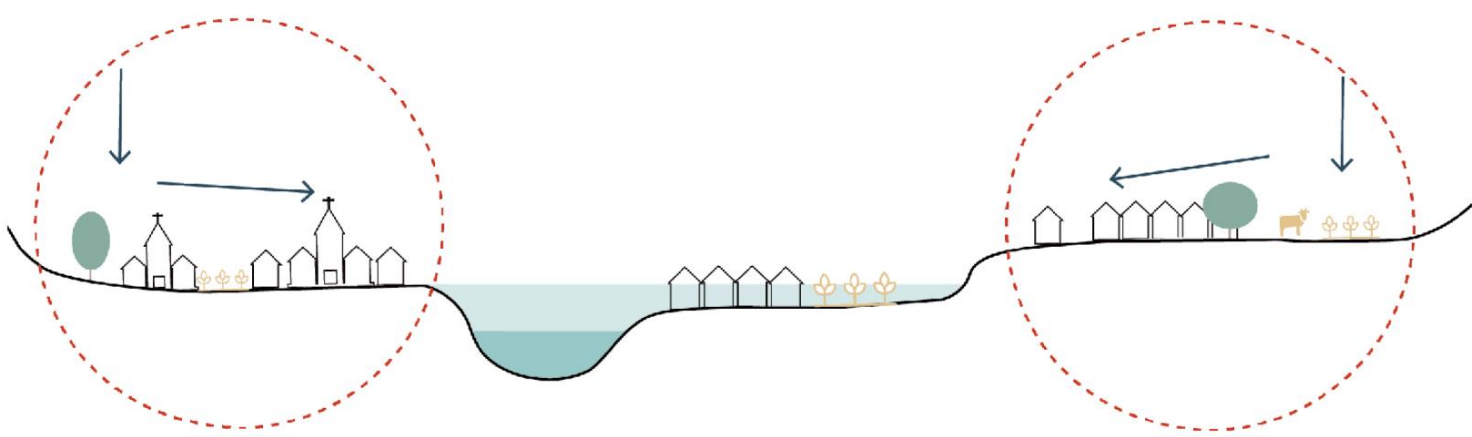
Soil flood management potential assessment

	Water holding capacity	Drainage capacity	Permeability
loess	• • •	• • •	• • •
ewe layer soils	• • •	• •	• •
gravel & coarse sand	•	• • •	• • •
silty loam	• • •	• •	• •
clay	• • •	•	•

Level 1 flood management potential area--- deal with fluvial flood

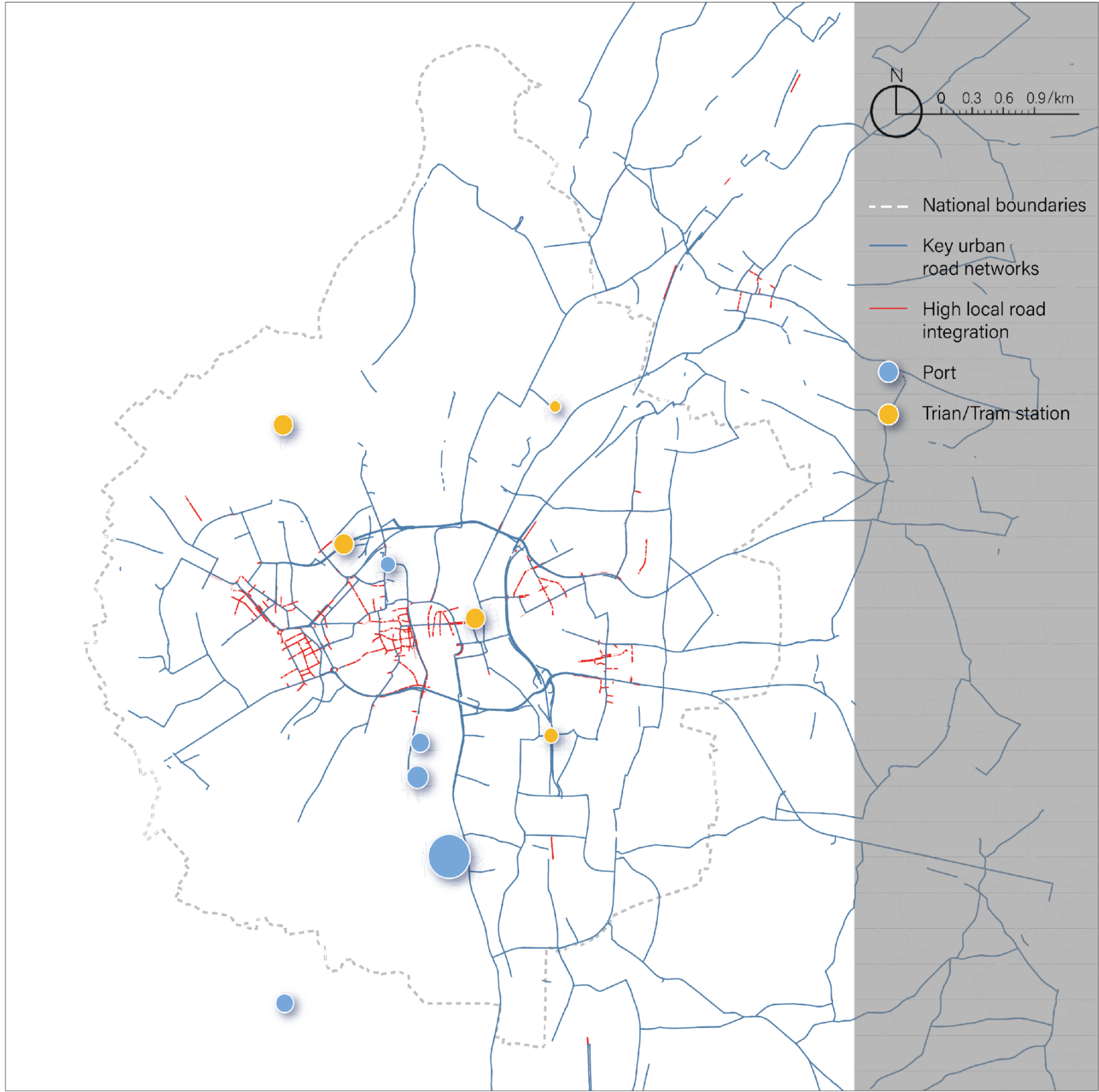


Level 2 flood management potential area--- deal with rain flood





# Accessibility Potential Assessment at City Scale



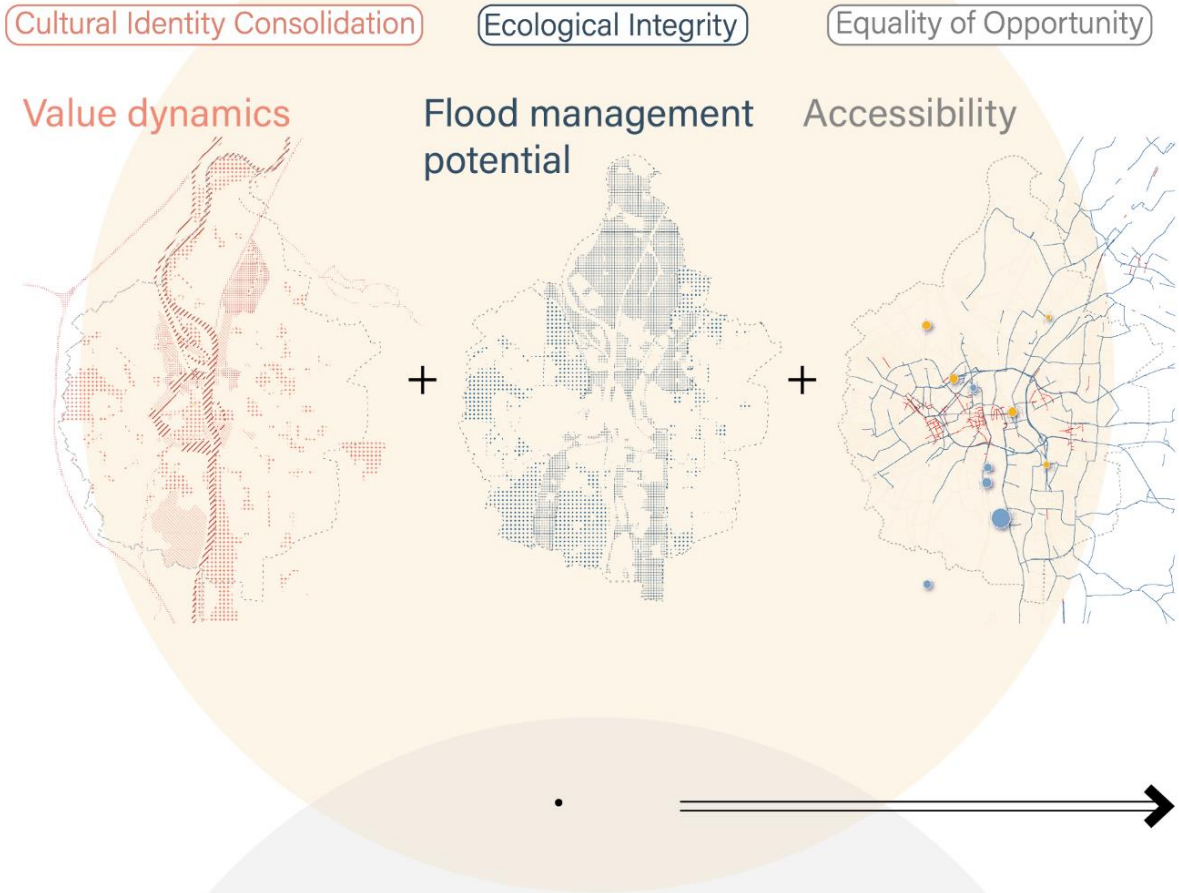
▪ Accessibility potential assessment framework

Key urban road networks	X	✓	X	✓
High local road integration	X	✓	✓	X
Potential for accessibility improvement	Low	Low	Medium-low	Medium-high
Near port/stations	Bonus points (level +)			

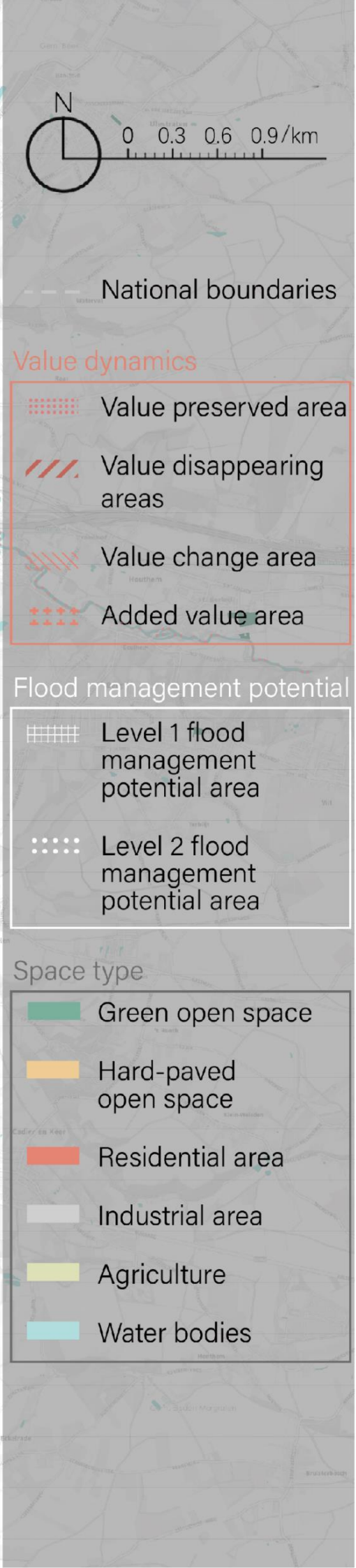
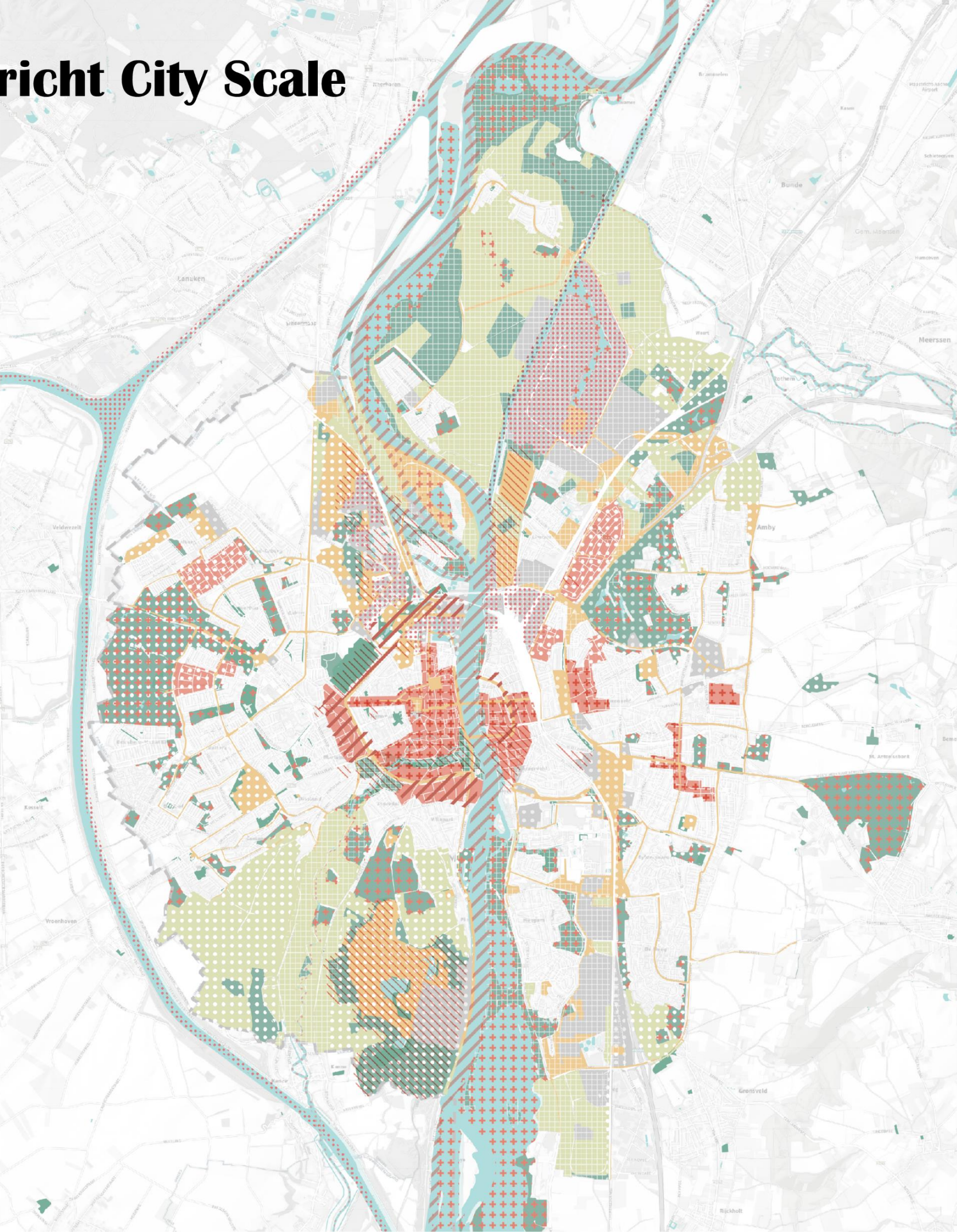
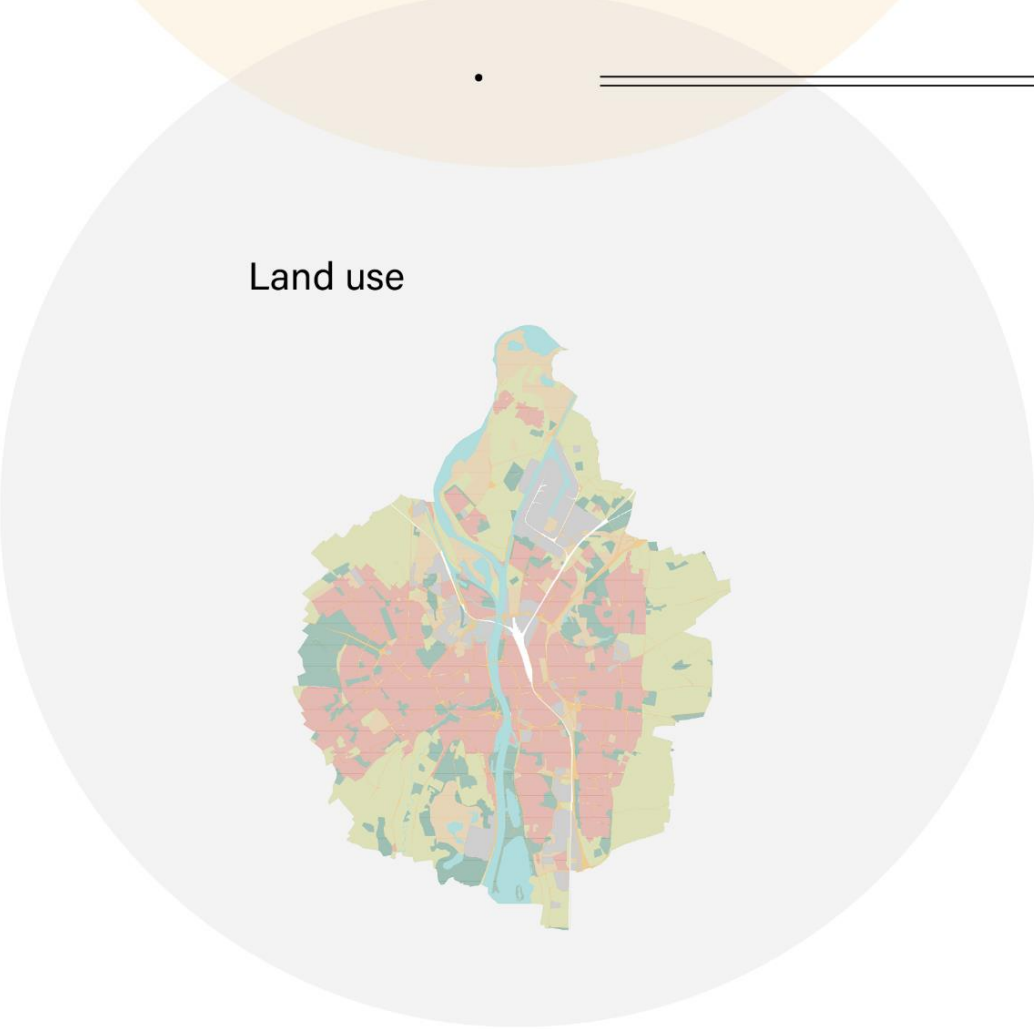


# Potential for Transformability at Maastricht City Scale

Potential For Three Design Goals:



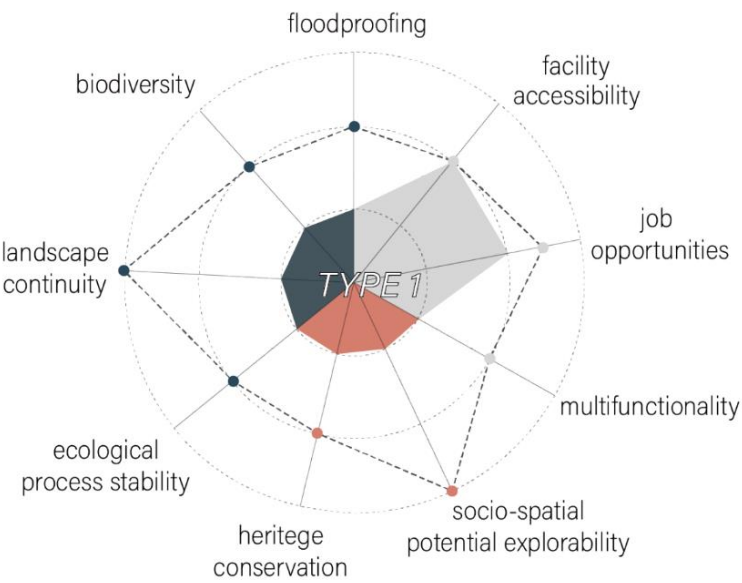
Current Conditions:



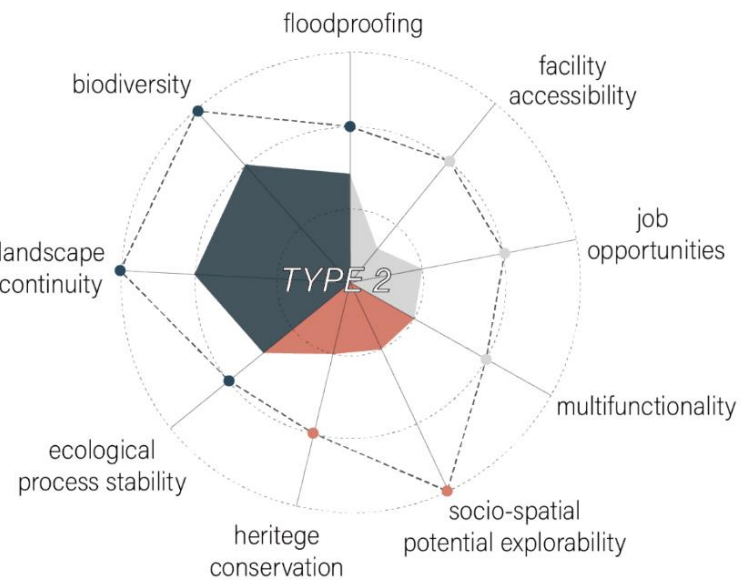


# Potential Analysis of the Spatial Types at Neighborhood Scale

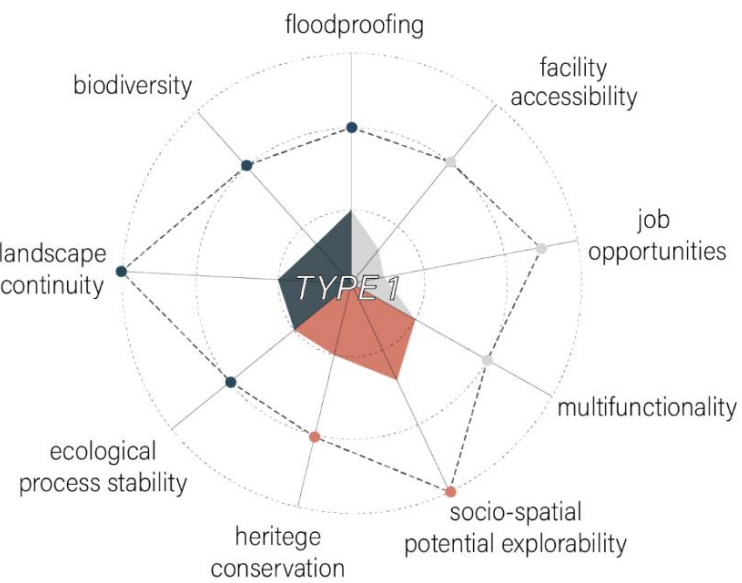
Value changed industrial area with level 2 flood management potential



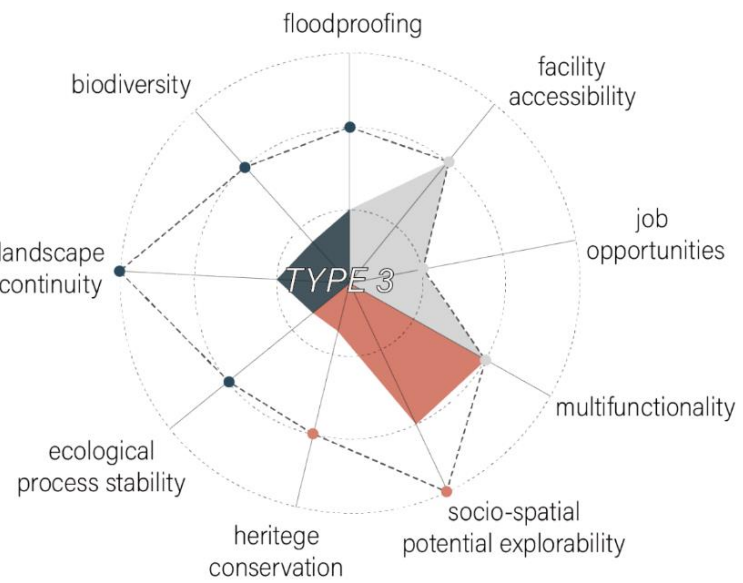
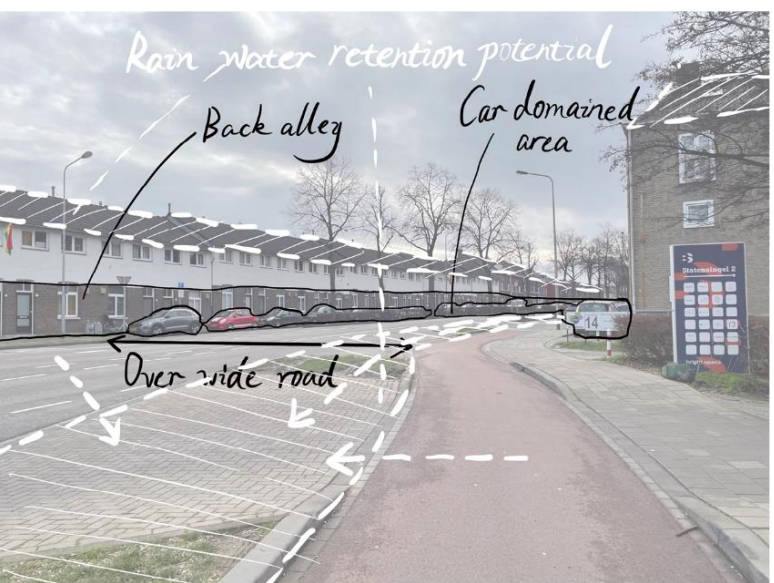
Agriculture with level 2 flood management potential



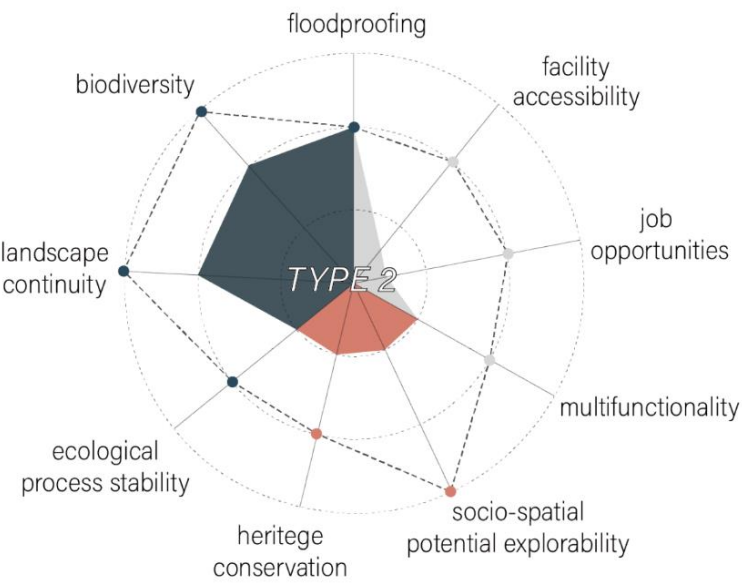
Residential area with level 1&2 flood management potential



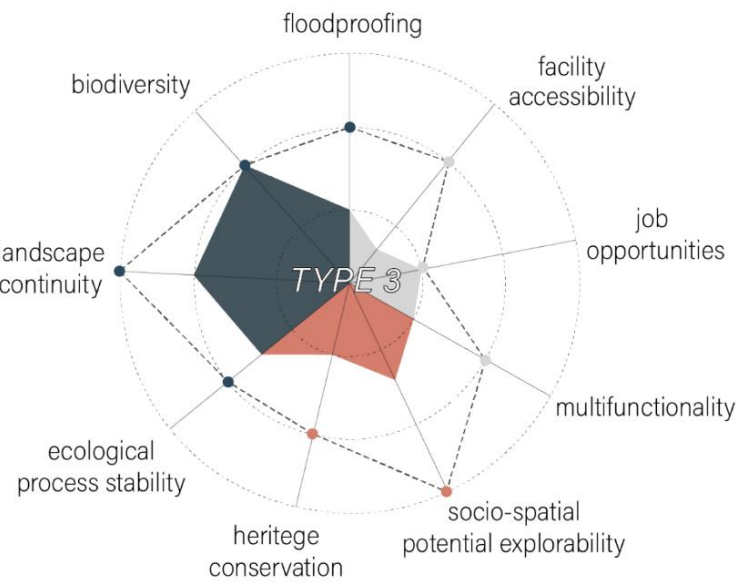
Hard-paved open space with level 2 flood management potential



Value added green open space with level 2 flood management potential

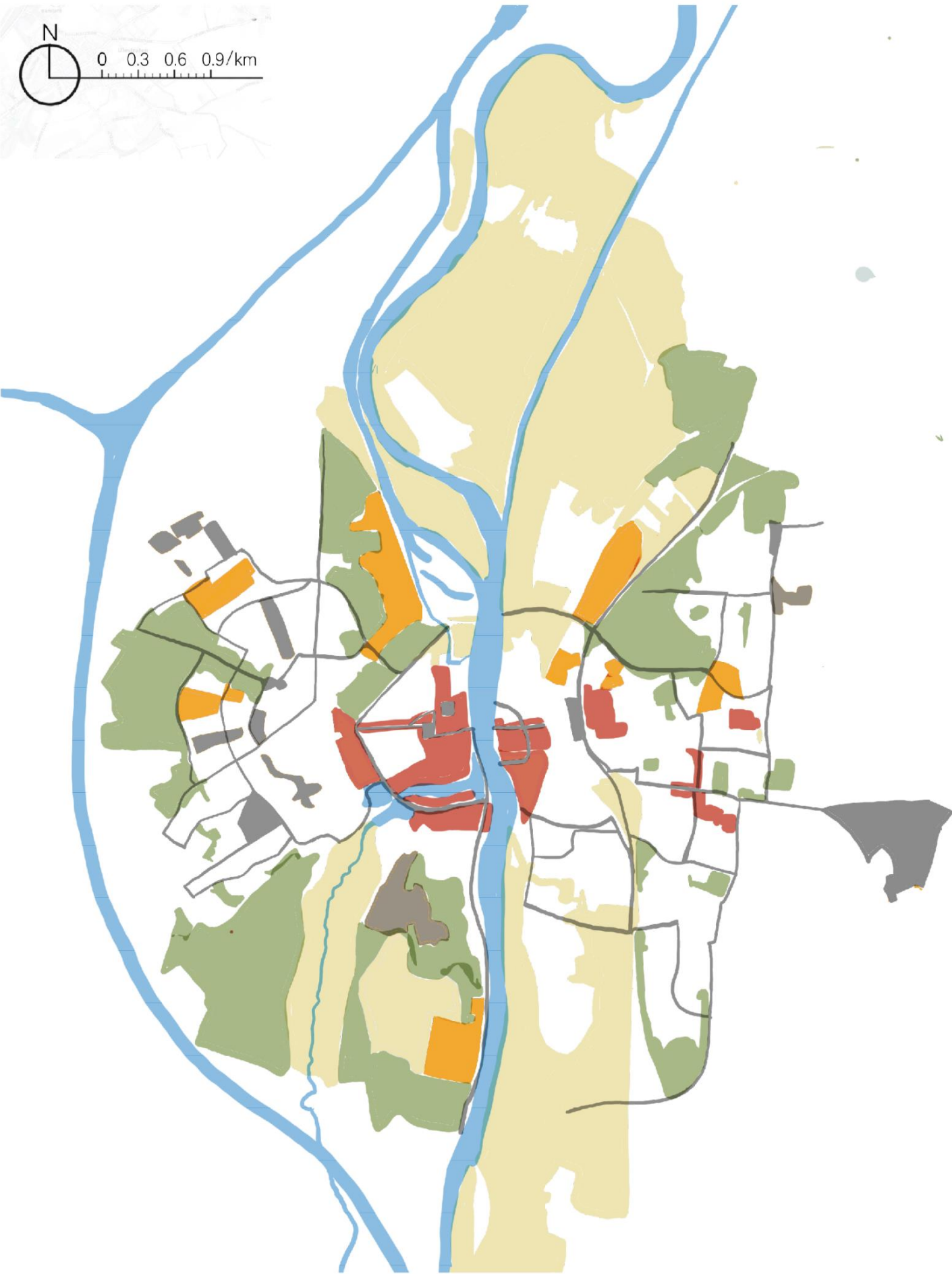


Value added green open space

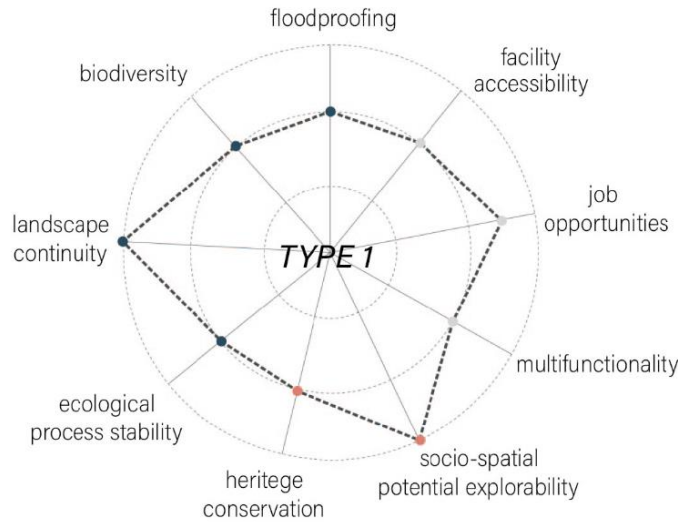




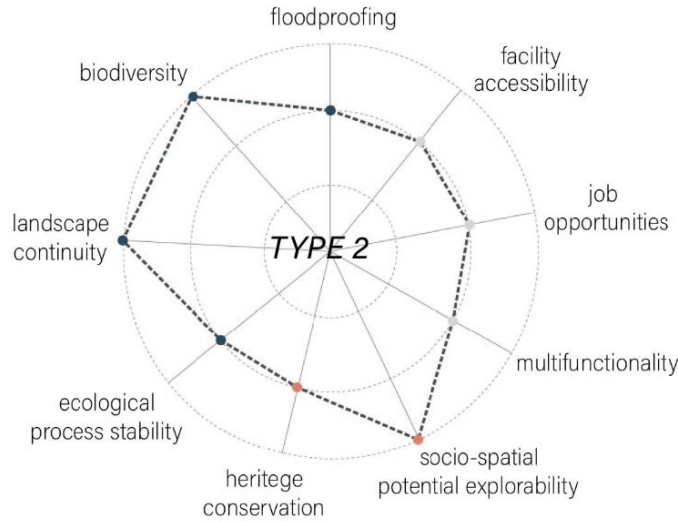
# Potential Space Types at City Scale



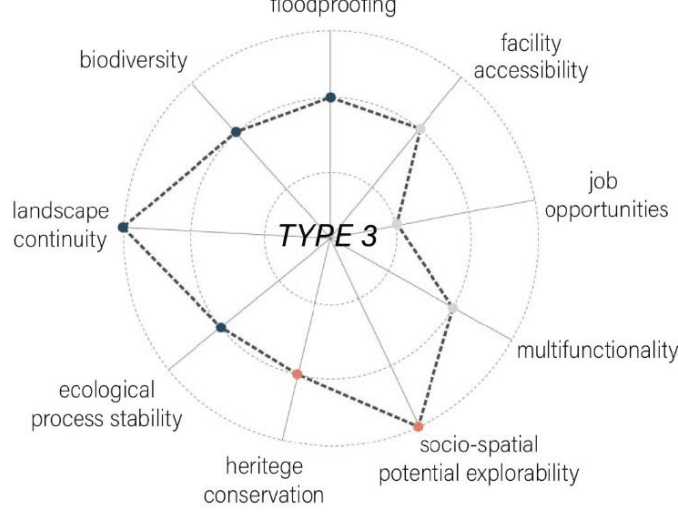
Type 1



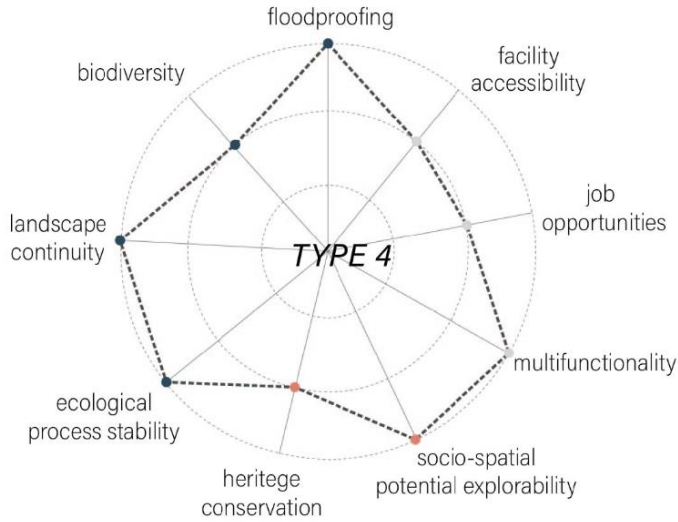
Type 2



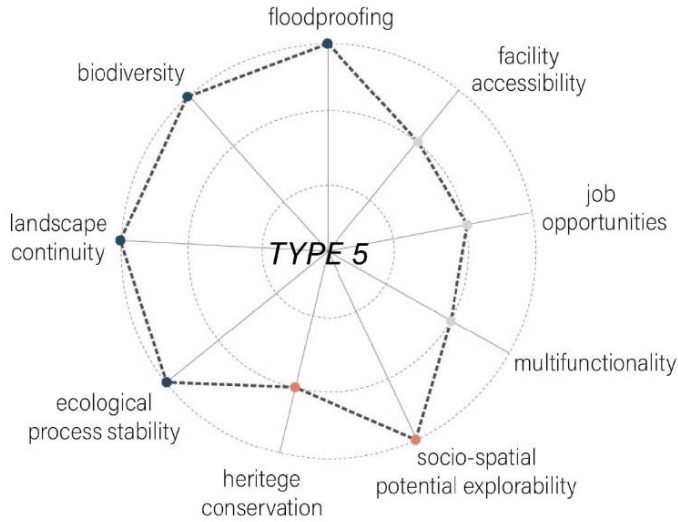
Type 3



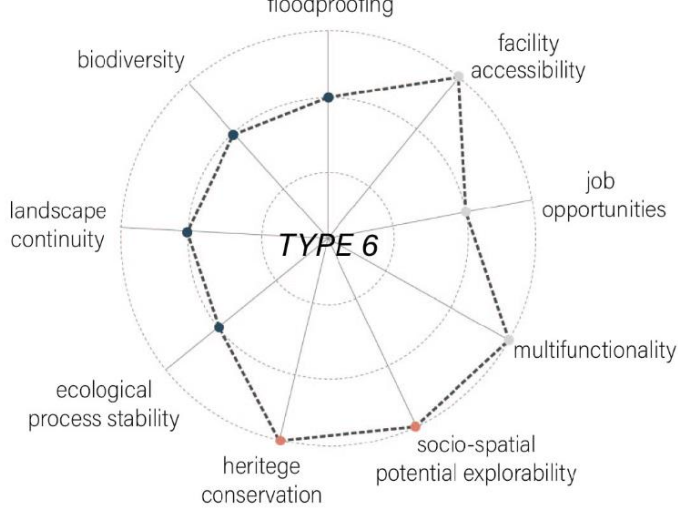
Type 4



Type 5



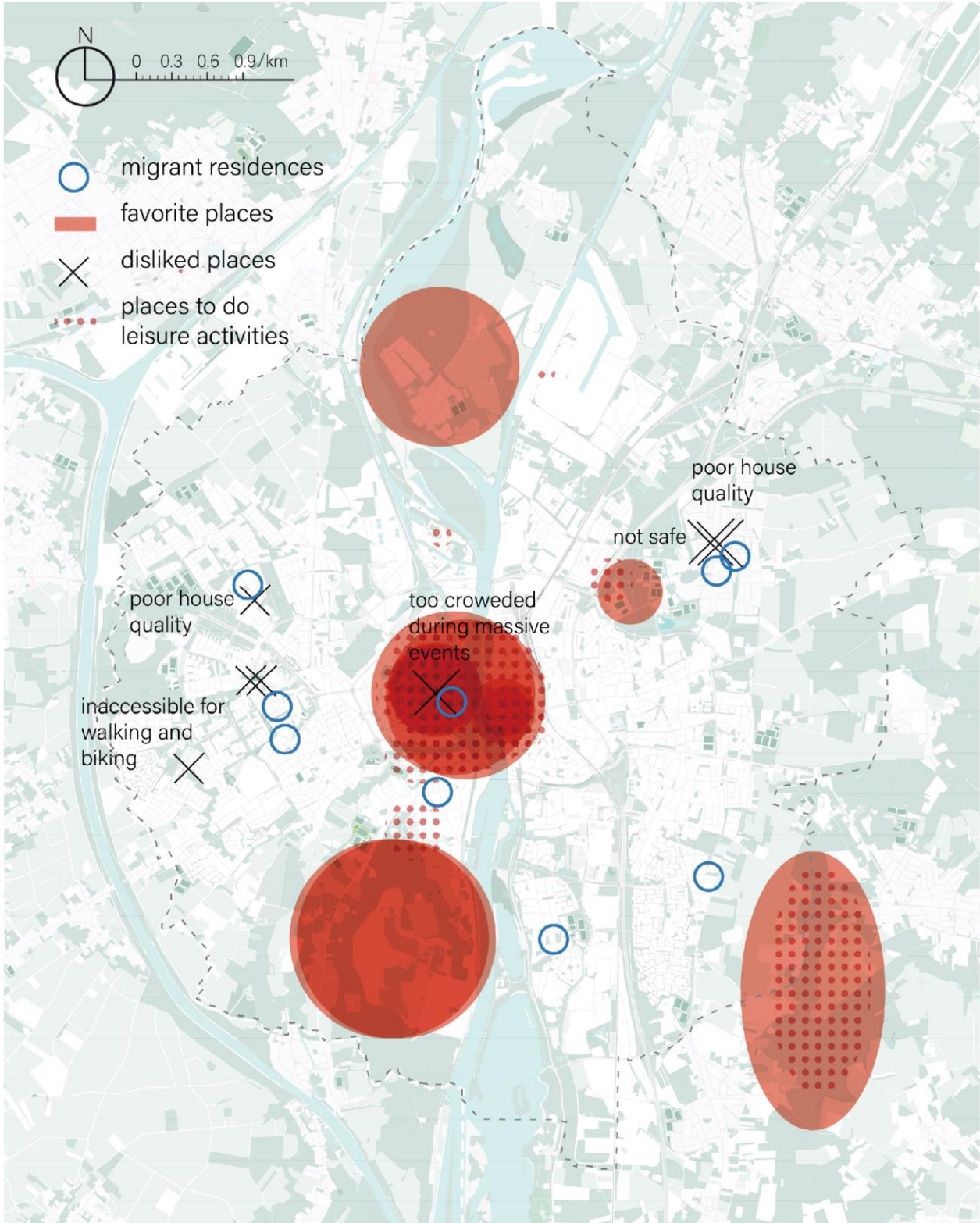
Type 6



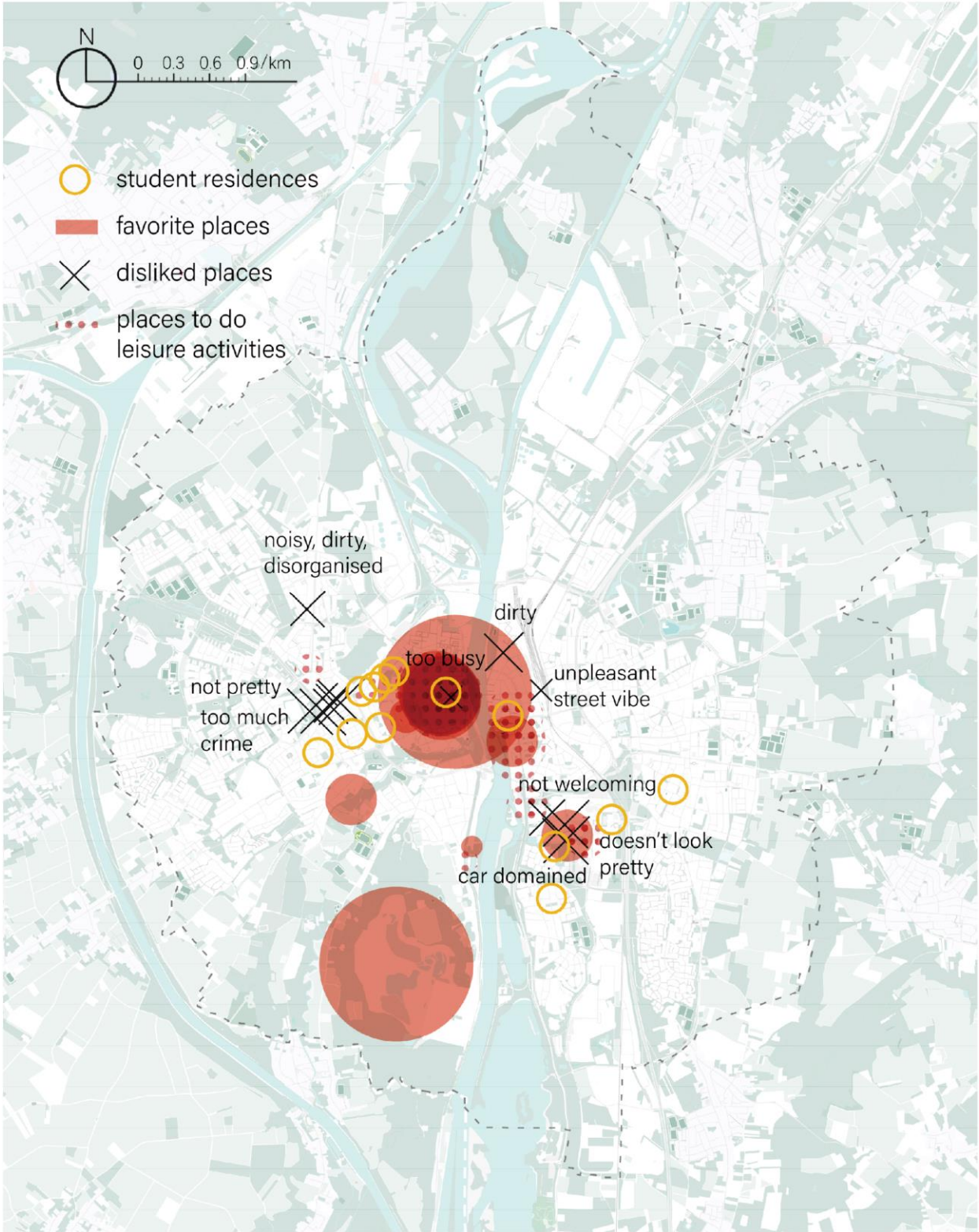


# Transformation Opportunities from Residents' Perception

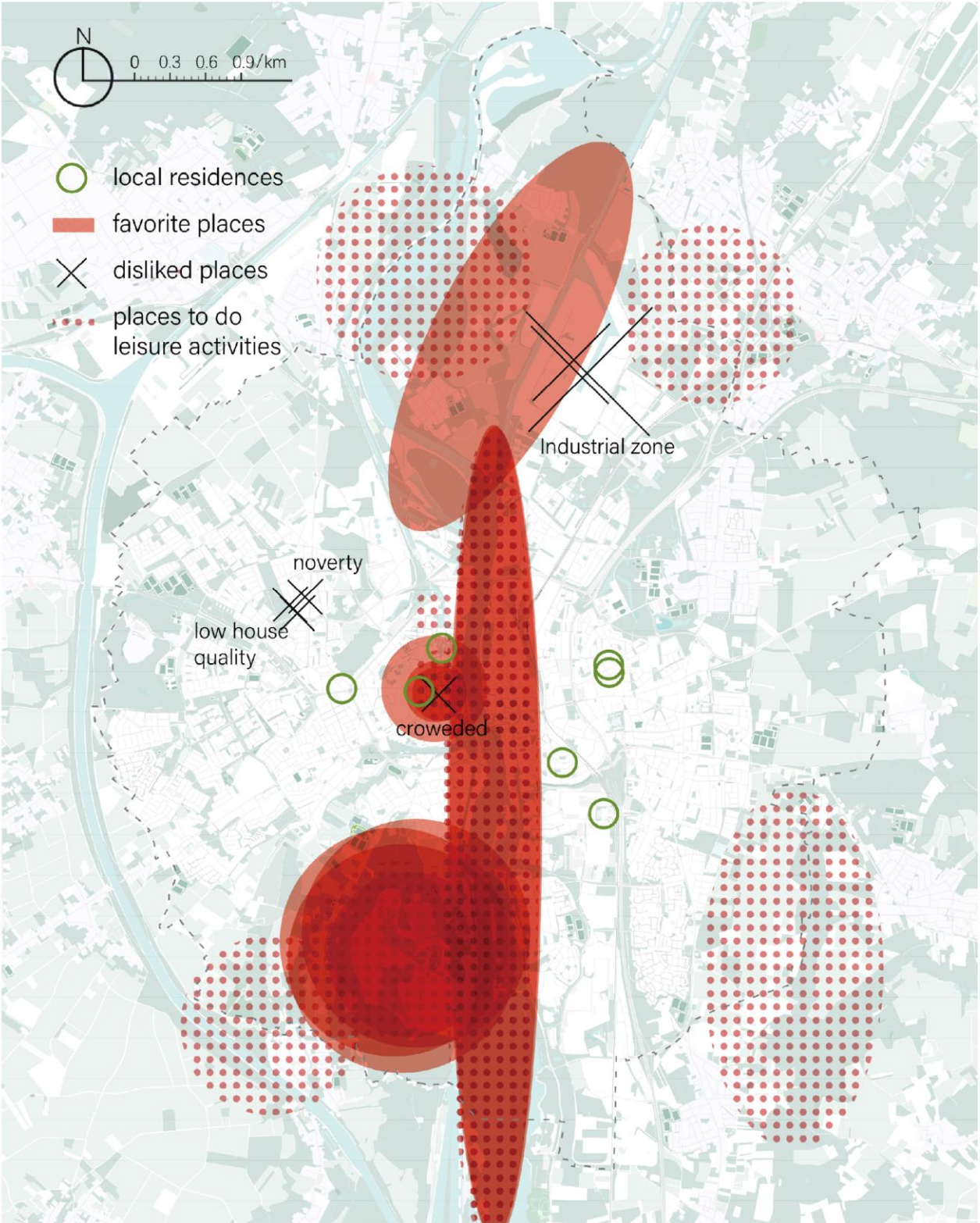
Migrants



International students



Locals



Improving the quality of suburban neighborhoods  
(accessibility and mixed use)

Distribute the population pressure in the city  
center and reduce its perceived density

Improving accessibility to natural areas and  
enhancing natural systems



# Transformation Opportunities from Residents' Perception

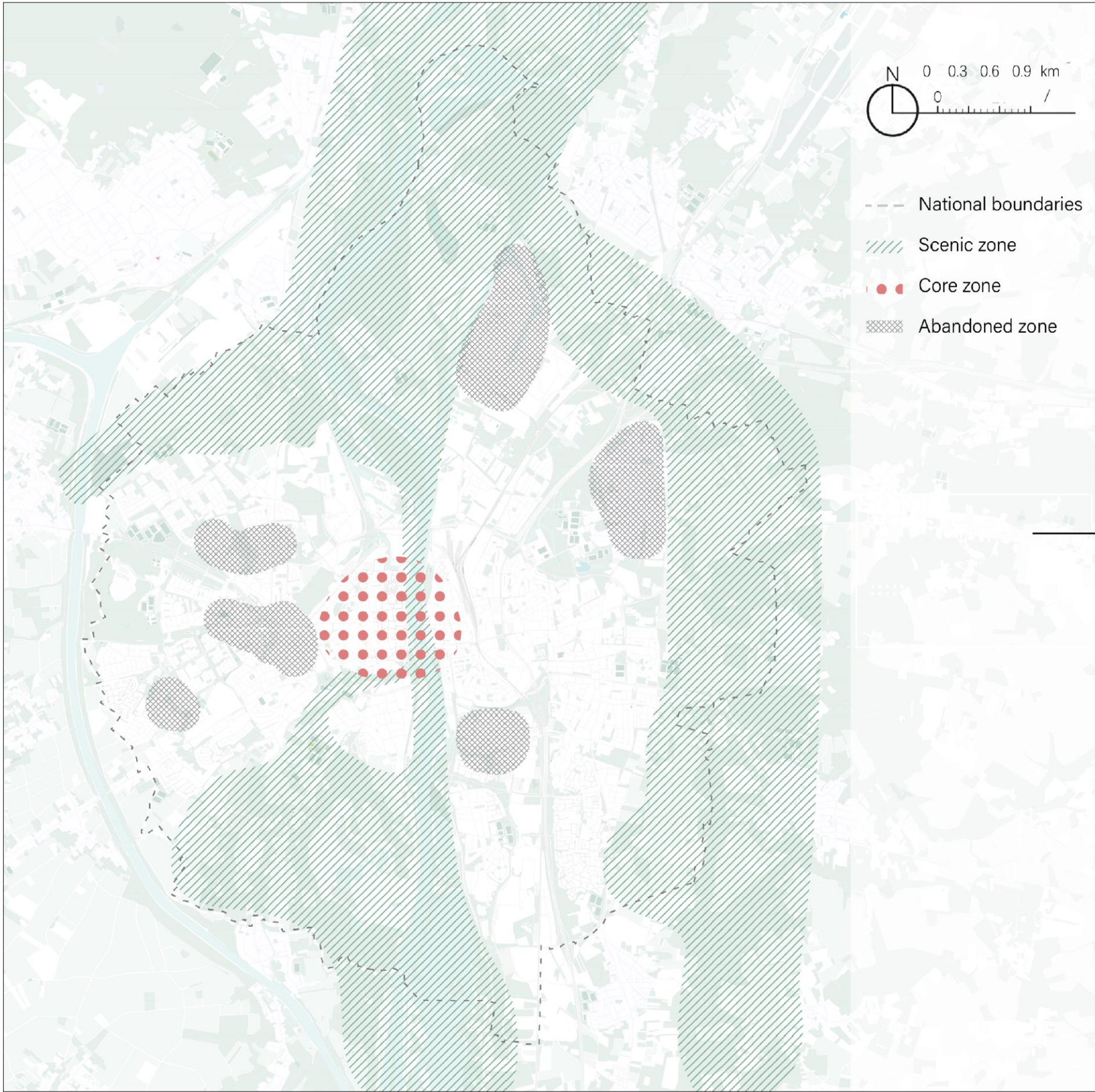
*Maastricht residents' general demands*



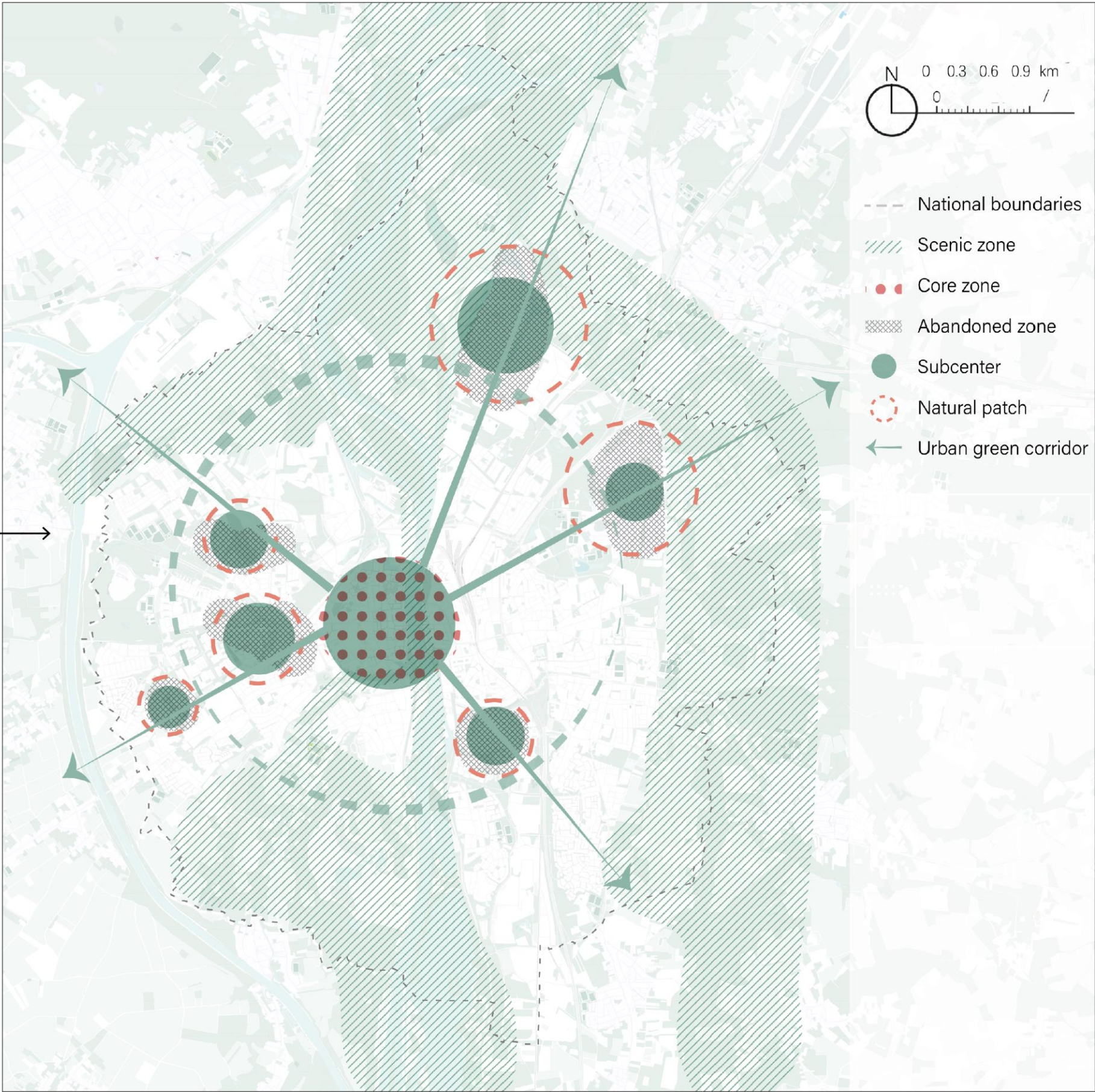


# Transformation Opportunities from Residents' Perception

The Maastricht Landscape Structure As Perceived By The Residents

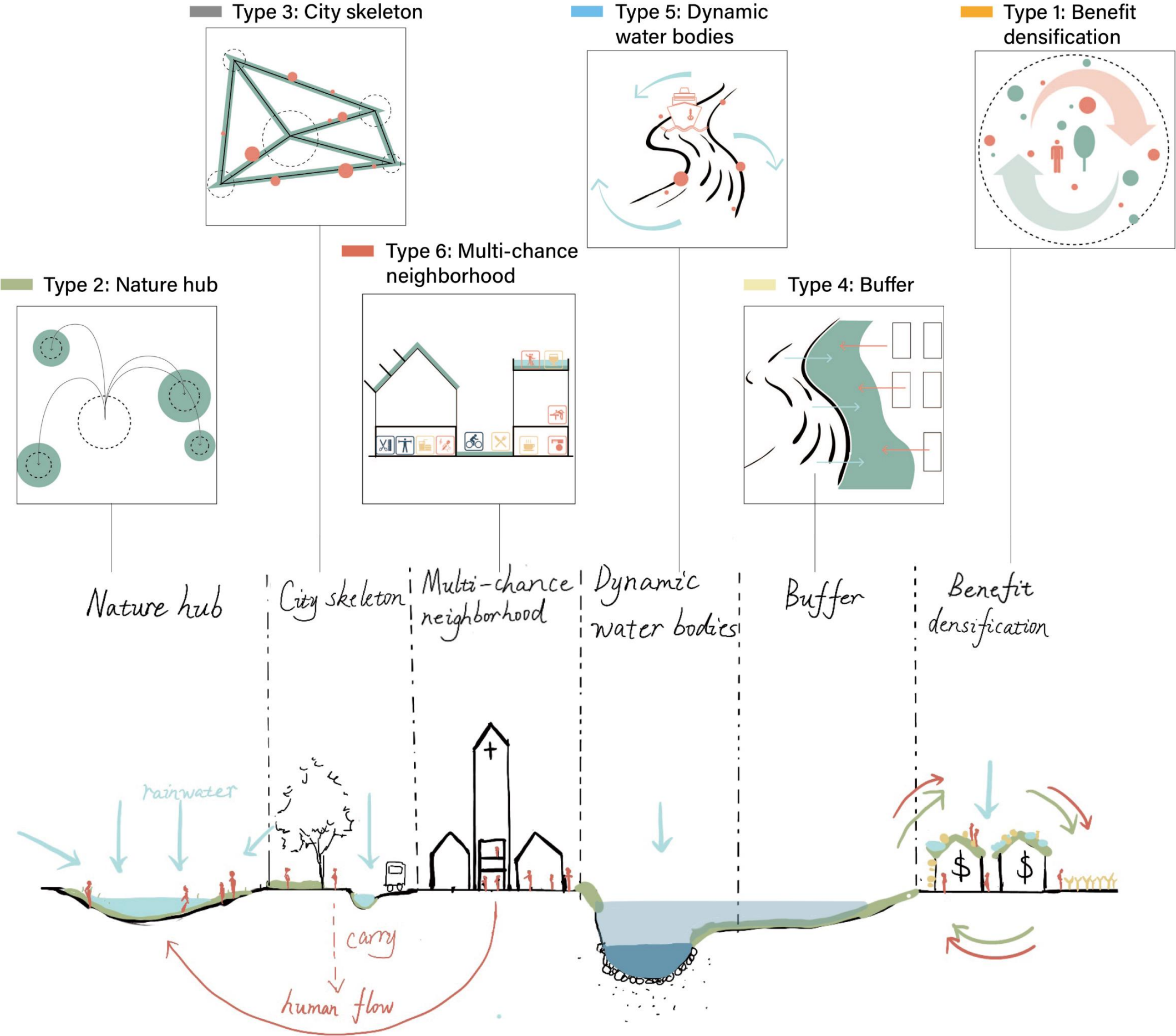
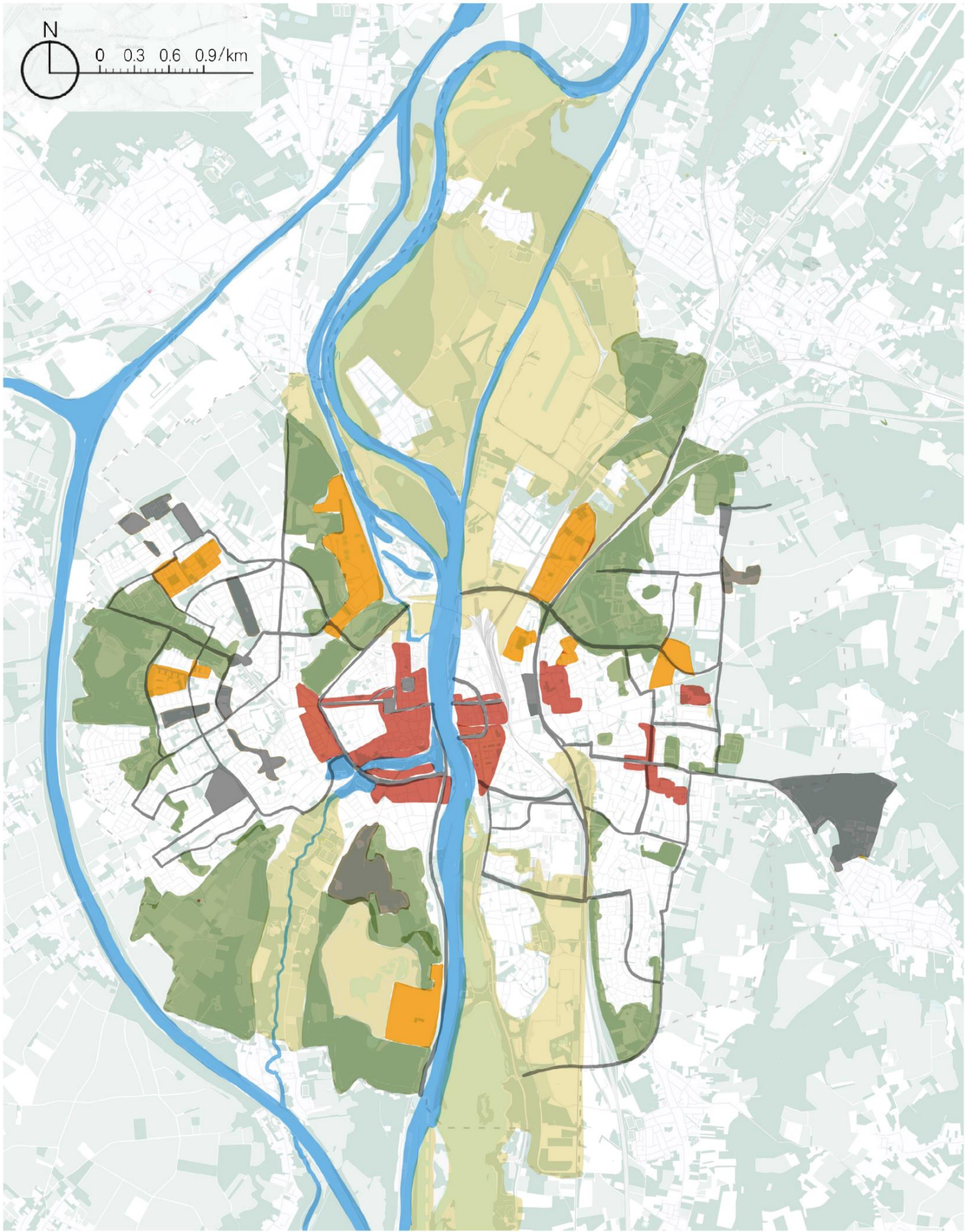


The Visioning Maastricht Landscape Structure



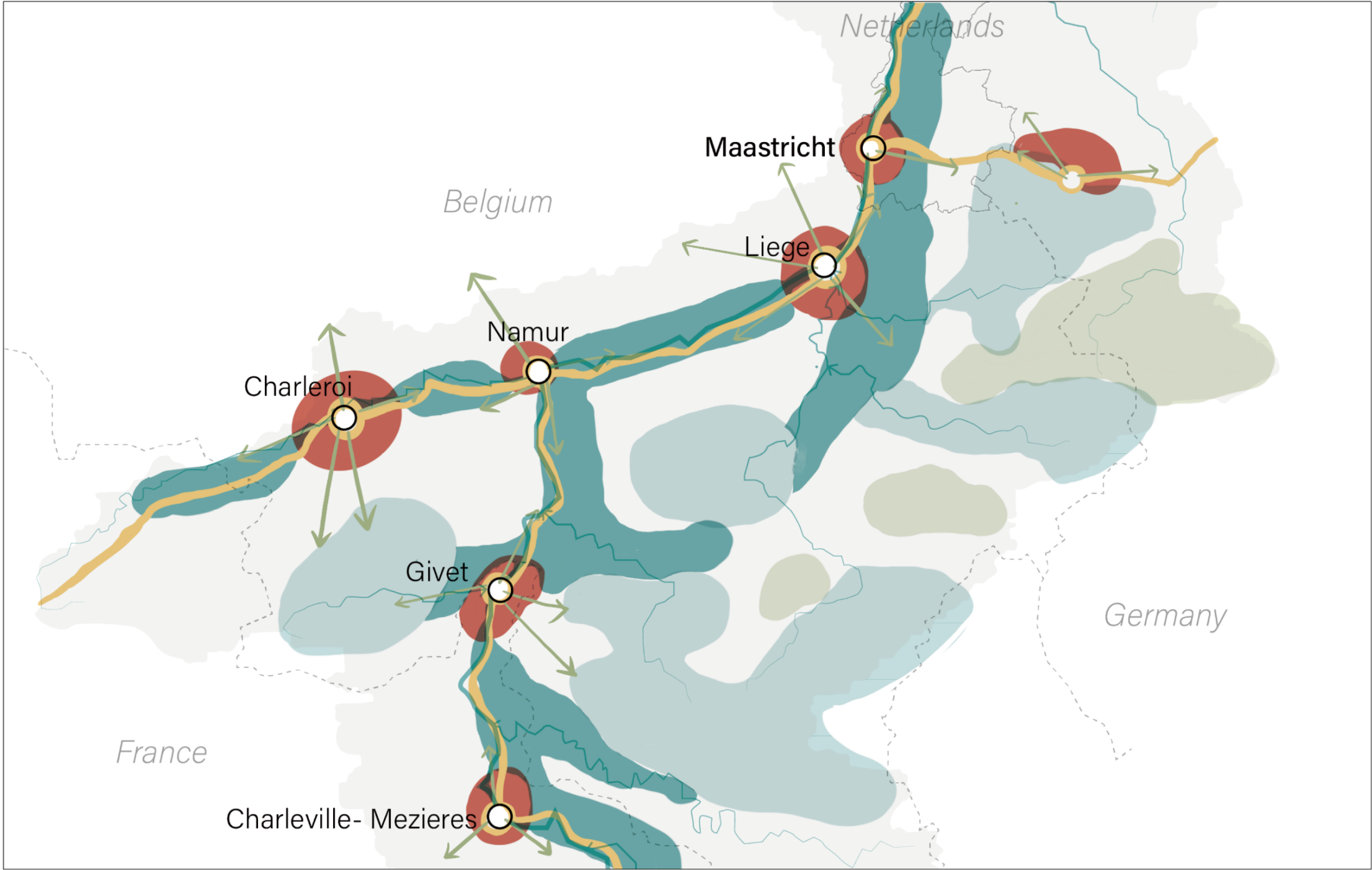


# Visioning Typology Map at City Scale



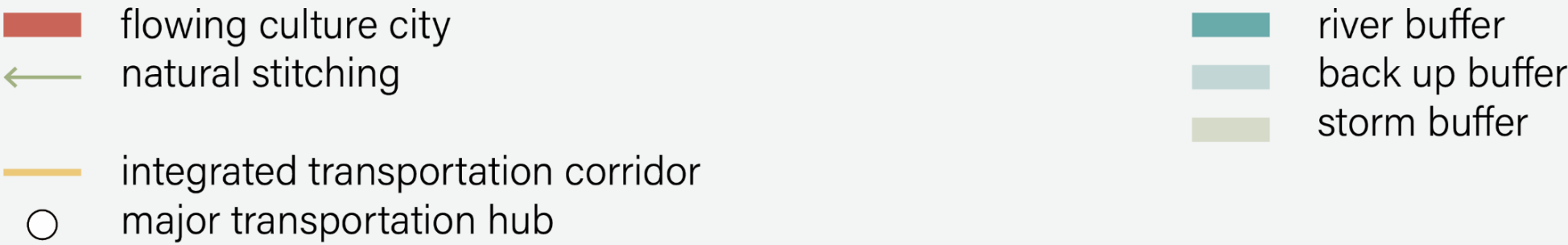


# Visioning Cooperation at Regional Scale



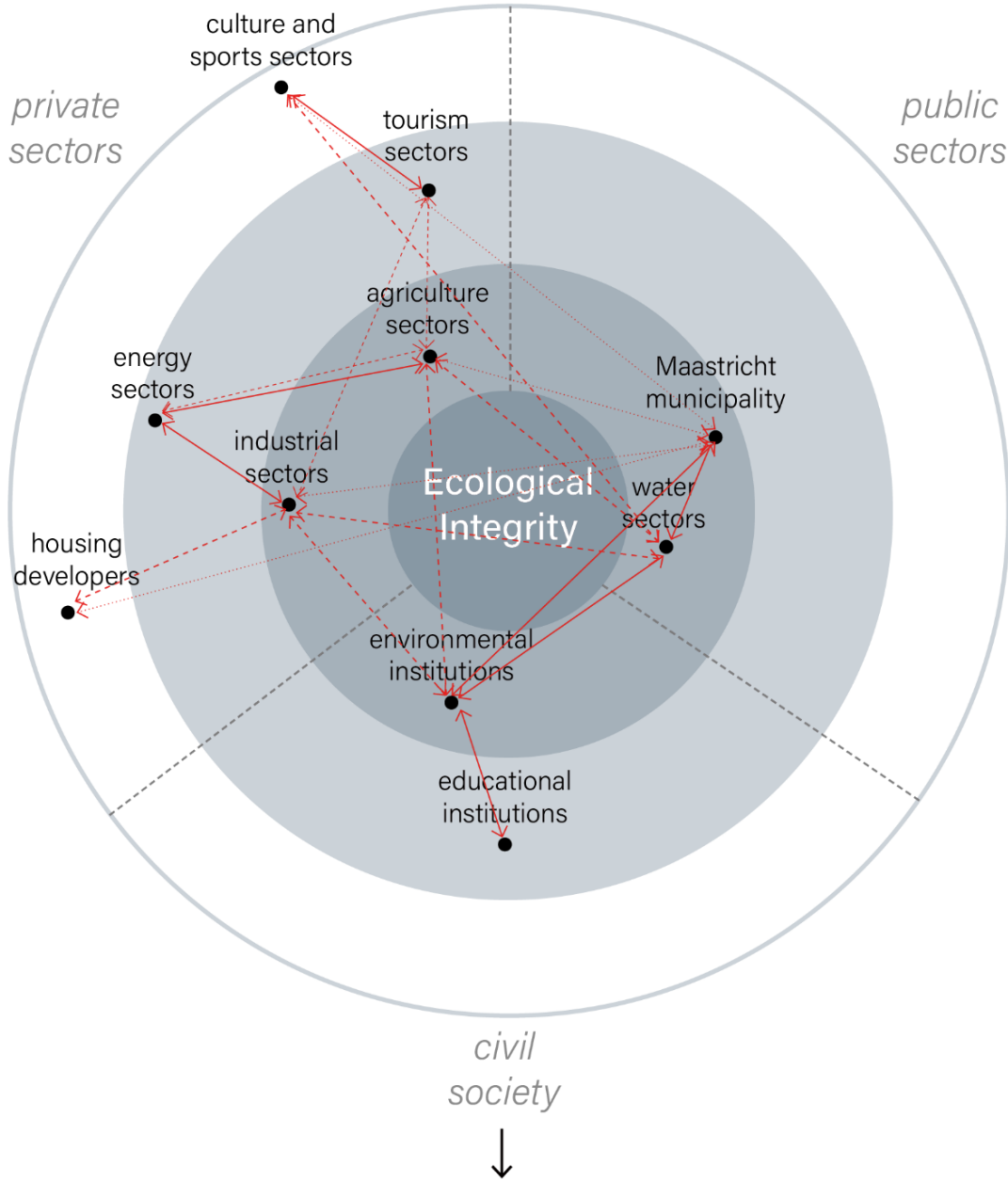
## Main fields of cooperation:

- Culture core enhancement
- Transportation connectivity
- Natural structure reinforcement



# Stakeholder Analysis at City Scale

- Primary stakeholder
- Secondary stakeholder
- Wider enviroment stakeholder
- Conflict of interest
- Synergy of interest
- Coordination of interest

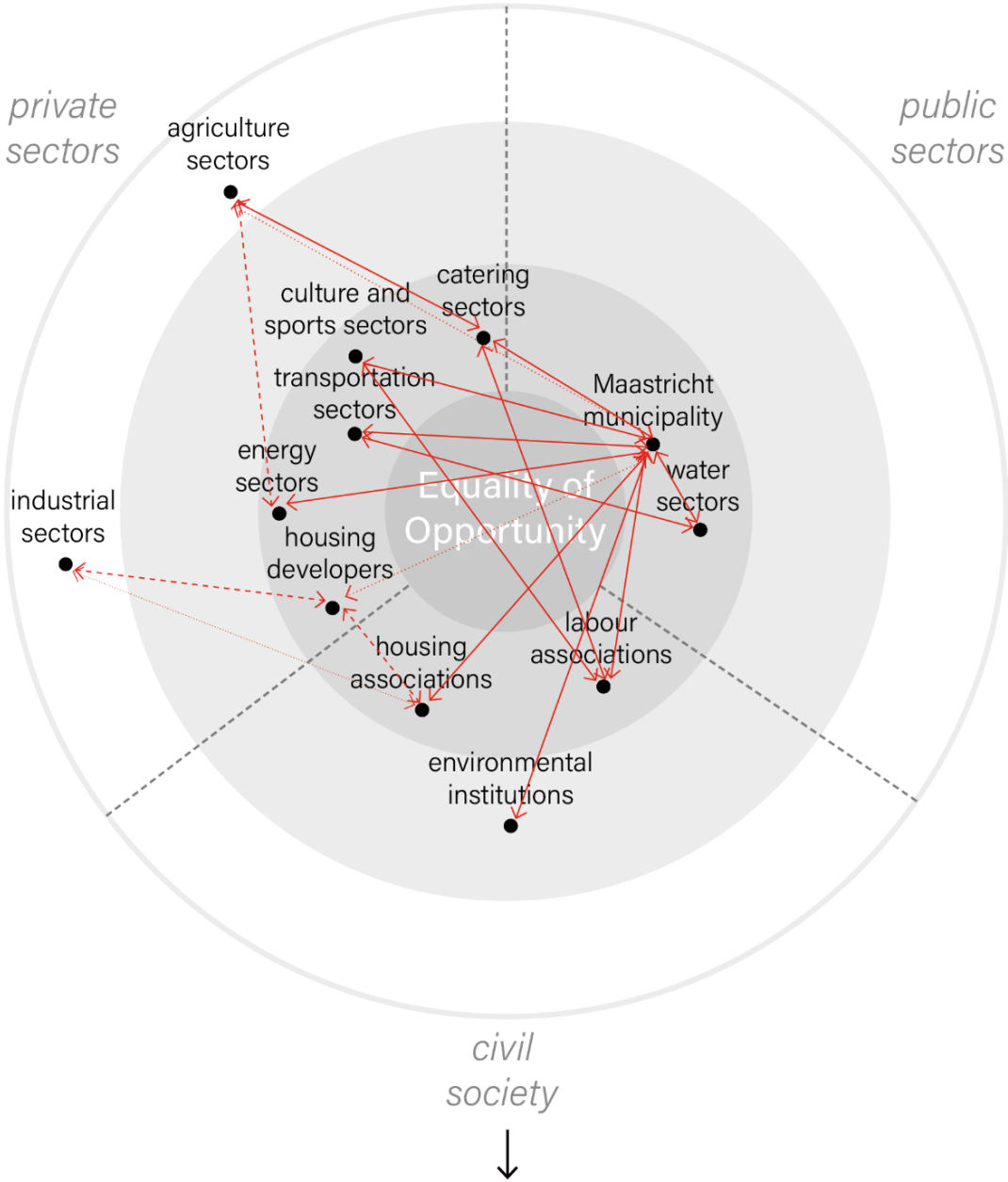


**programe:**

The municipality provides **subsidies** for agriculture, industry and other sectors involved in ecological conservation.

**plan:**

Creating retention areas along the Maas River balances effective **flood management** with the preservation of original land functions.



**programe:**

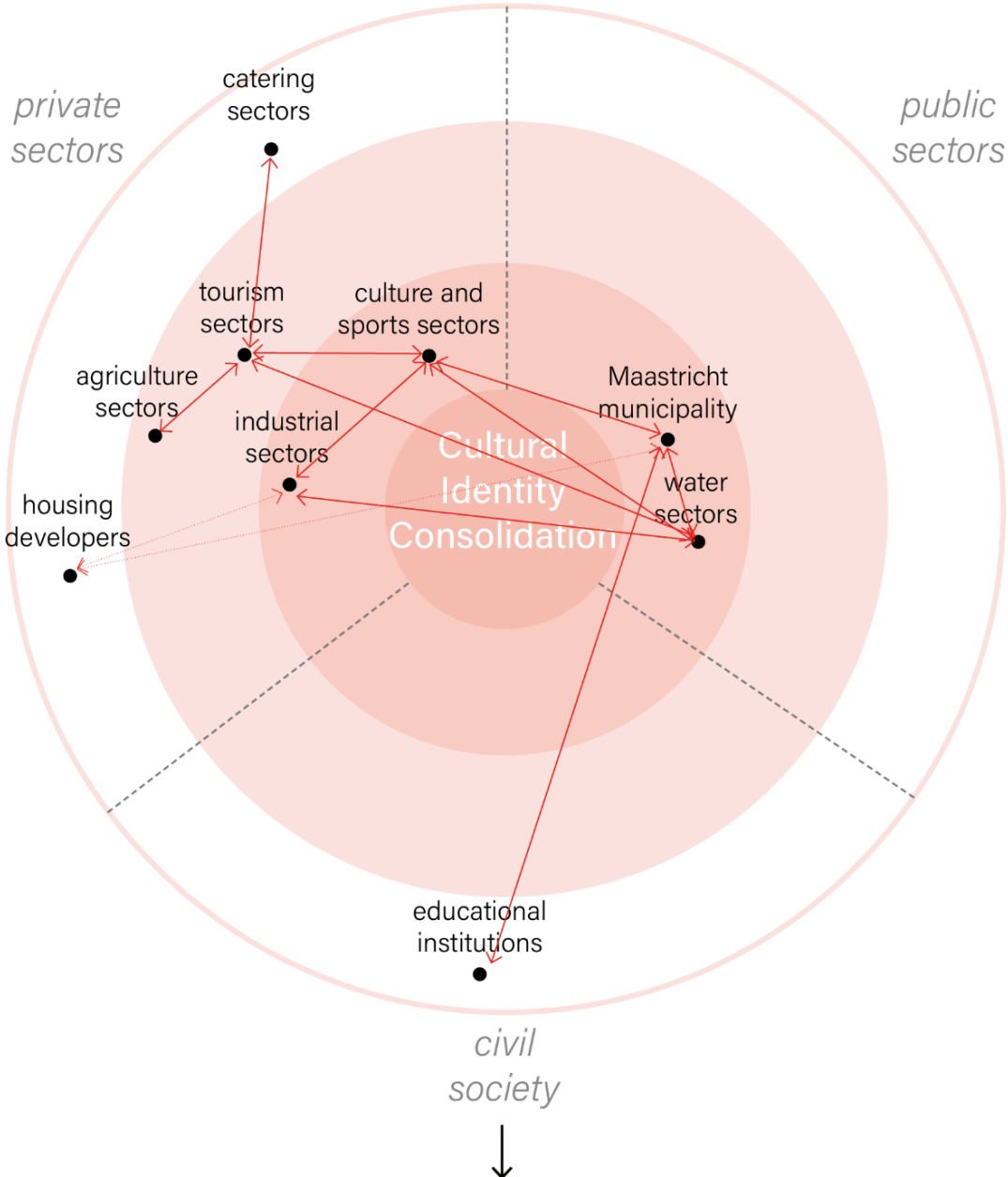
Municipality offers **subsidies** to residents and businesses for installing new energy equipment.

**project:**

Establish a **densification model** of cooperation between factories and real estate developers to promote the use of construction waste materials and limit the price of housing.

**plan:**

**Stabilizing the water level** of the Maas River in different seasons to ensure **navigation**.



**project:**

Establish **an information sharing platform** for residents to become tour guides and leisure business operators through simple registration.

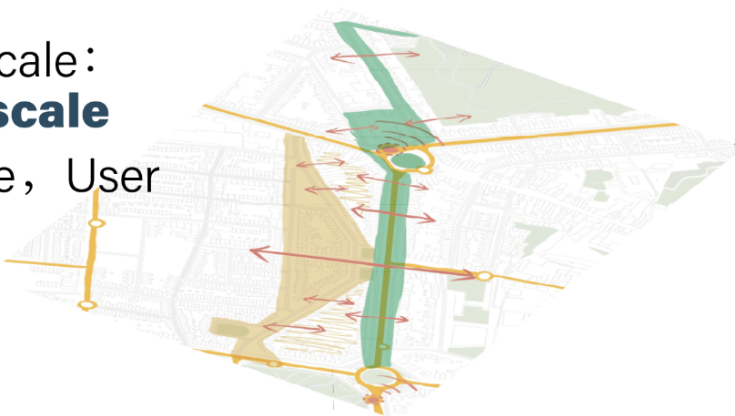
**plan:**

Establish **a regional leisure chain** to expand the advantages and involve more stakeholders in the pursuit of more leisure opportunities and related benefits.

# Transscalar Framework

Implementation Scale:  
**Neighborhood scale**

Space atmosphere, User perception



Key scale

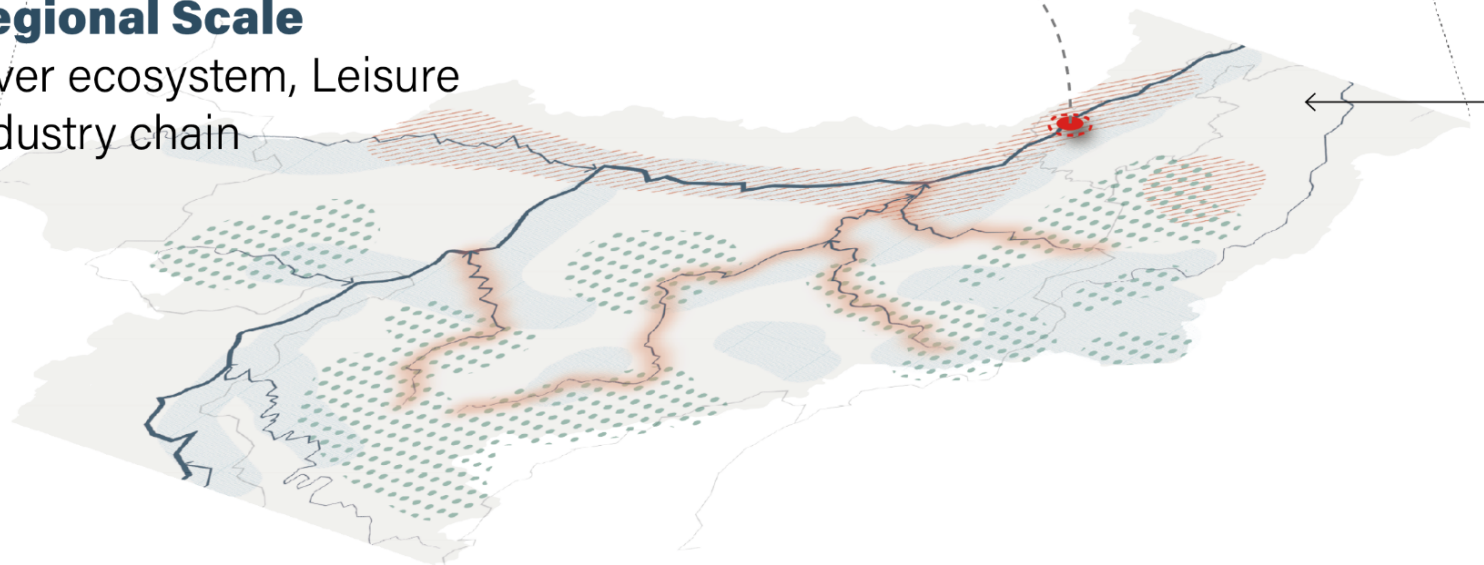
Design Scale:  
**City scale**

Spatial morphology, Land use



Strategic Scale:  
**Regional Scale**

River ecosystem, Leisure industry chain



Location

- Benefit densification
- Buffer
- City skeleton

Size

10ha

Main mission

project

Stakeholders

- Maastricht municipality
- leisure business
- transportation companies
- energy companies
- contractors
- factories
- locals
- international students
- migrants
- tourists

Composition and configuration of Maastricht's potential urban landscape

60km<sup>2</sup>

plan

programme

- Maastricht municipality
- water sectors
- tourism sectors
- catering sectors
- transportation sectors
- agriculture sectors
- industrial sectors
- energy sectors
- culture and sports sectors
- housing developers
- educational institutions
- environmental institutions
- housing associations
- labour associations

Transitional areas in the middle and downstream of the Maas Basin

1000km<sup>2</sup>

plan

policy & strategy

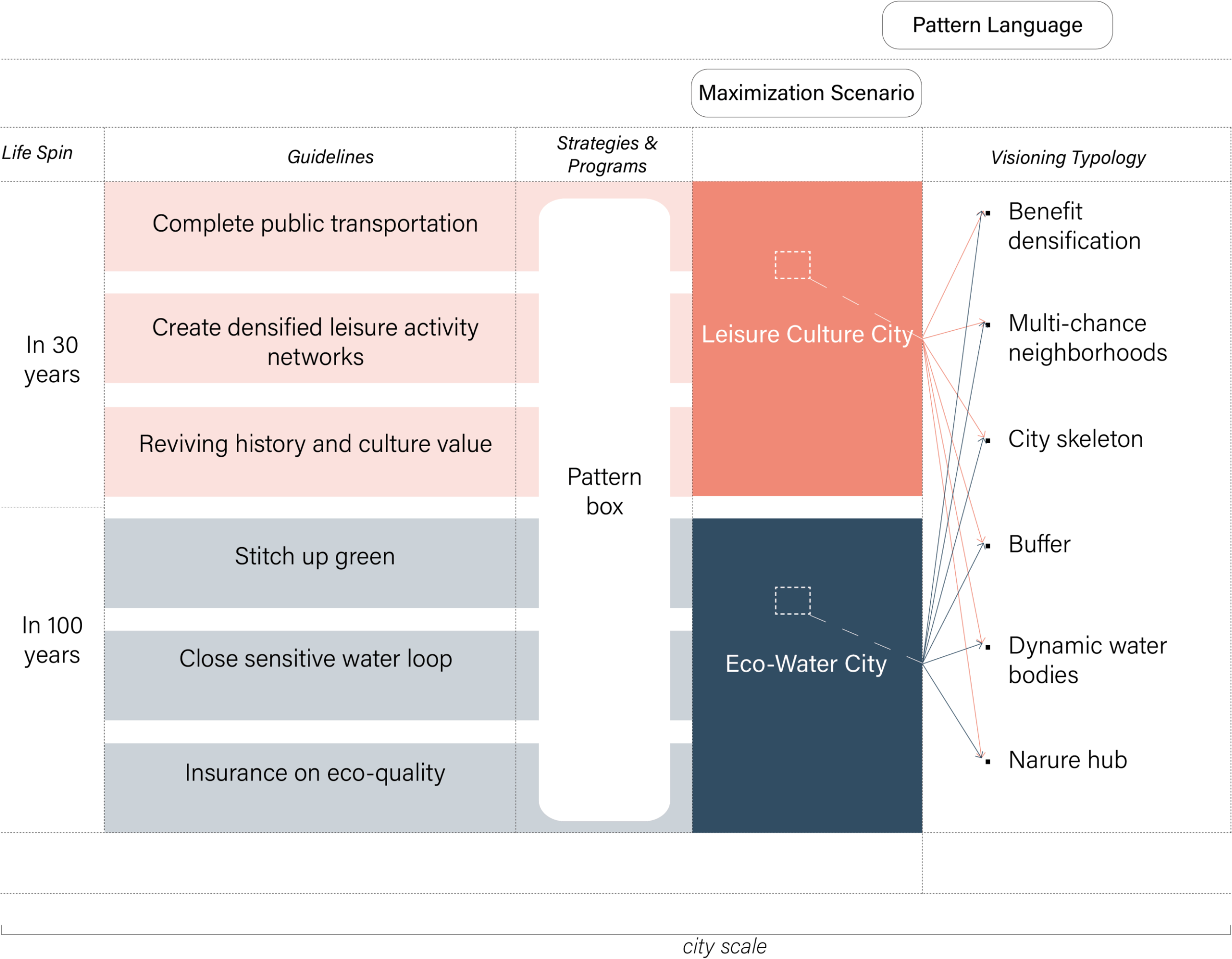
- international governments
- Province of Limburg
- Rijkswaterstaat & Water boards
- international transportation companies
- non-government organizations

PART  
03

# Scenario Experiments of Maastricht City

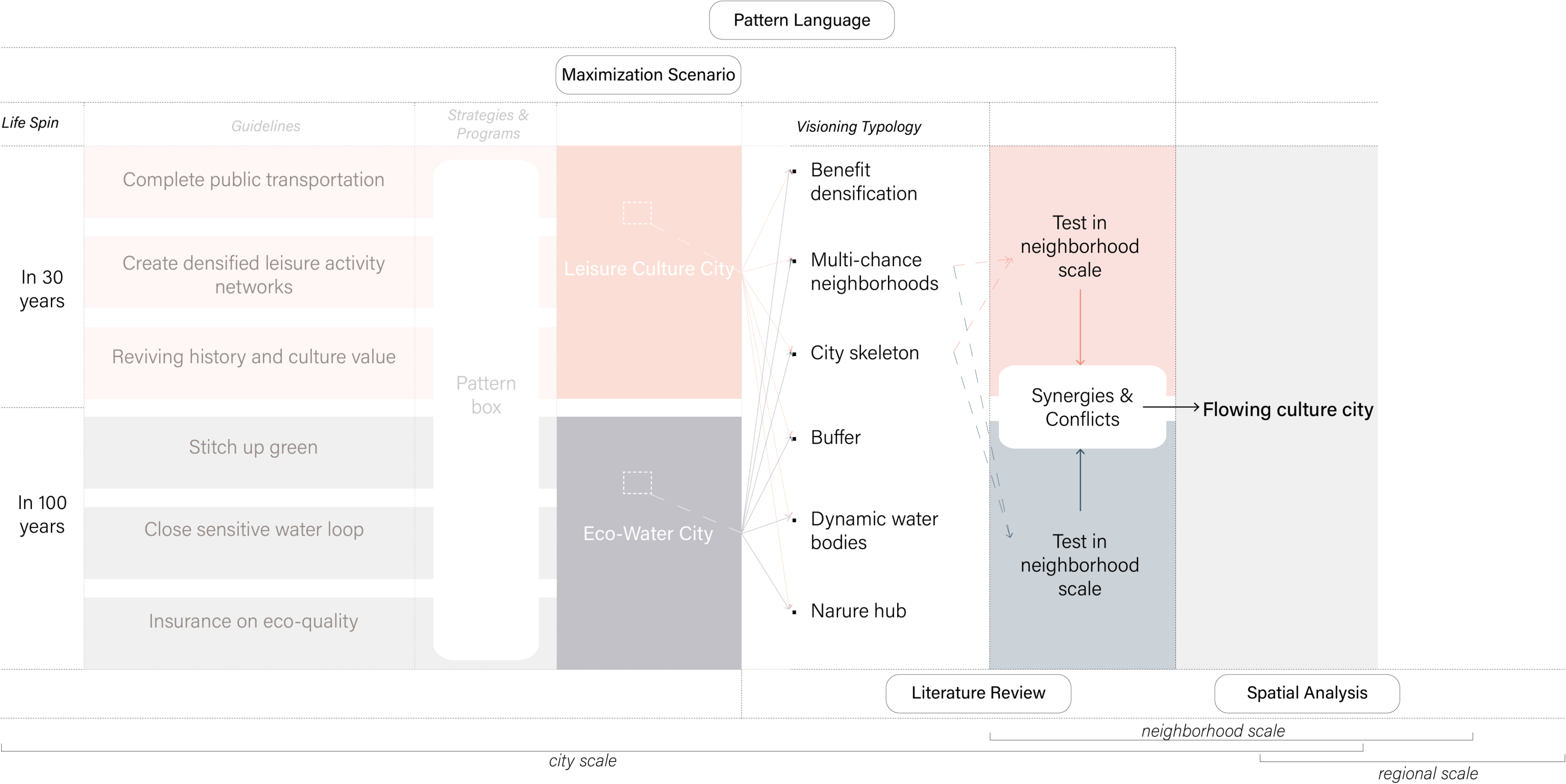


# Design Methodology



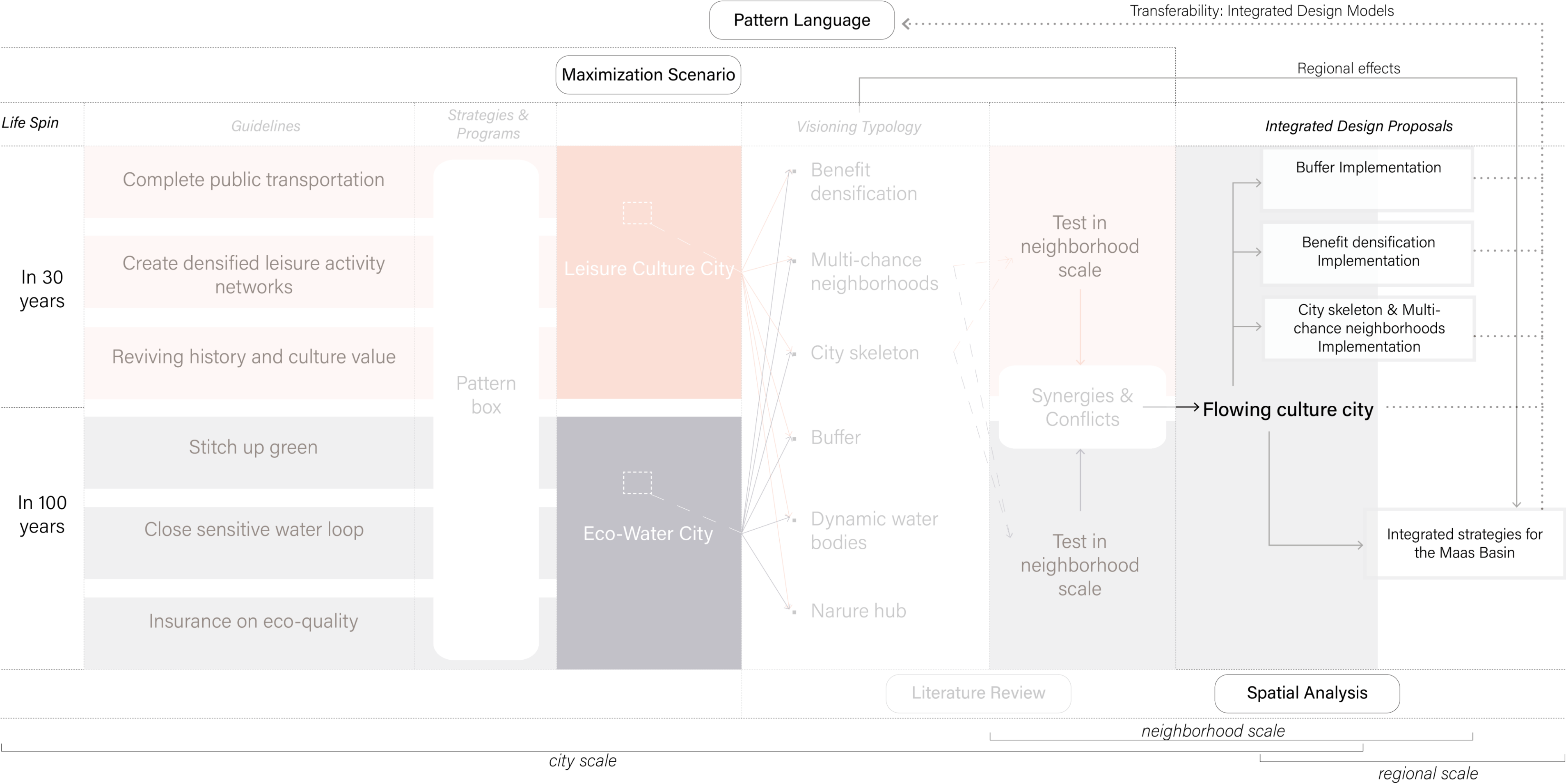


# Design Methodology



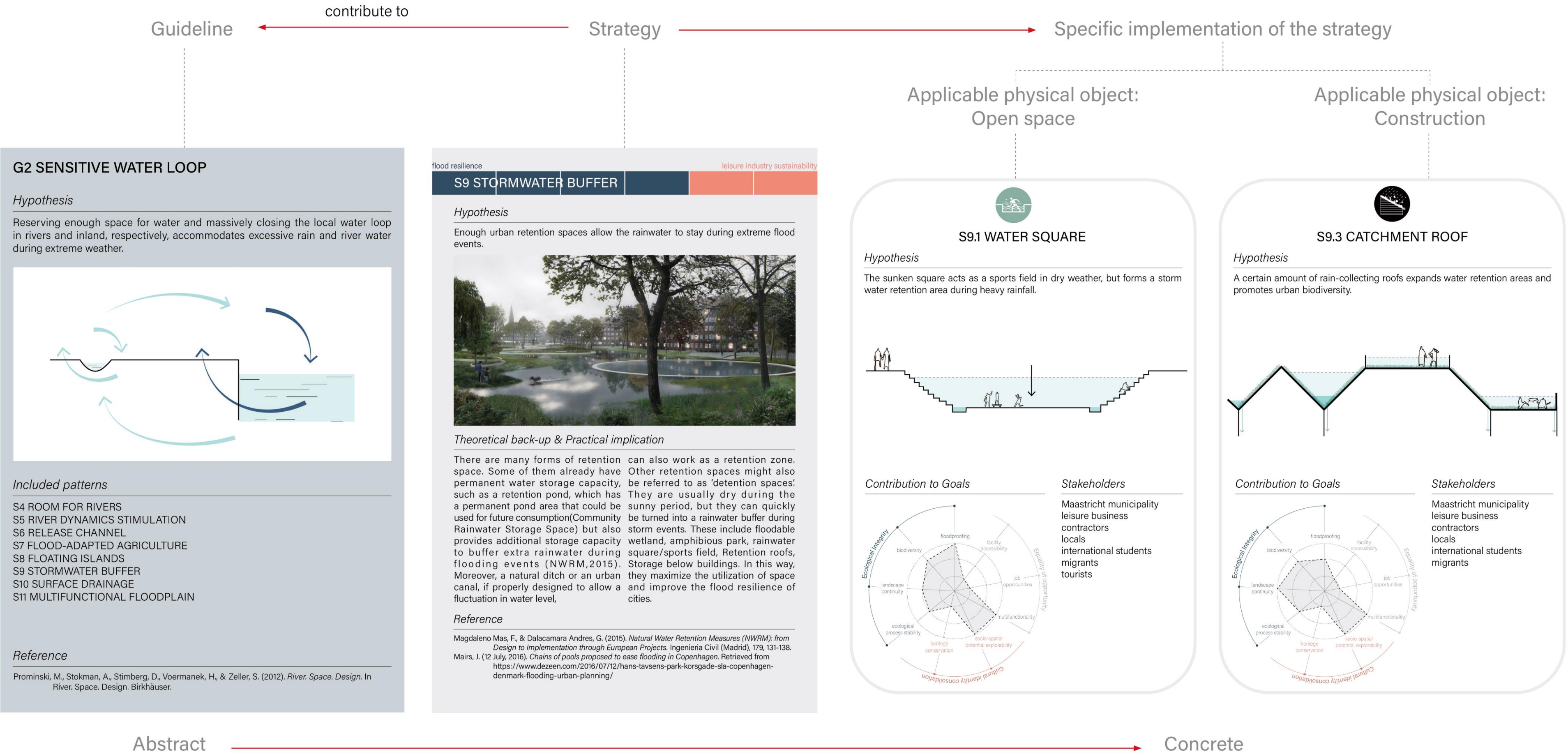


# Design Methodology



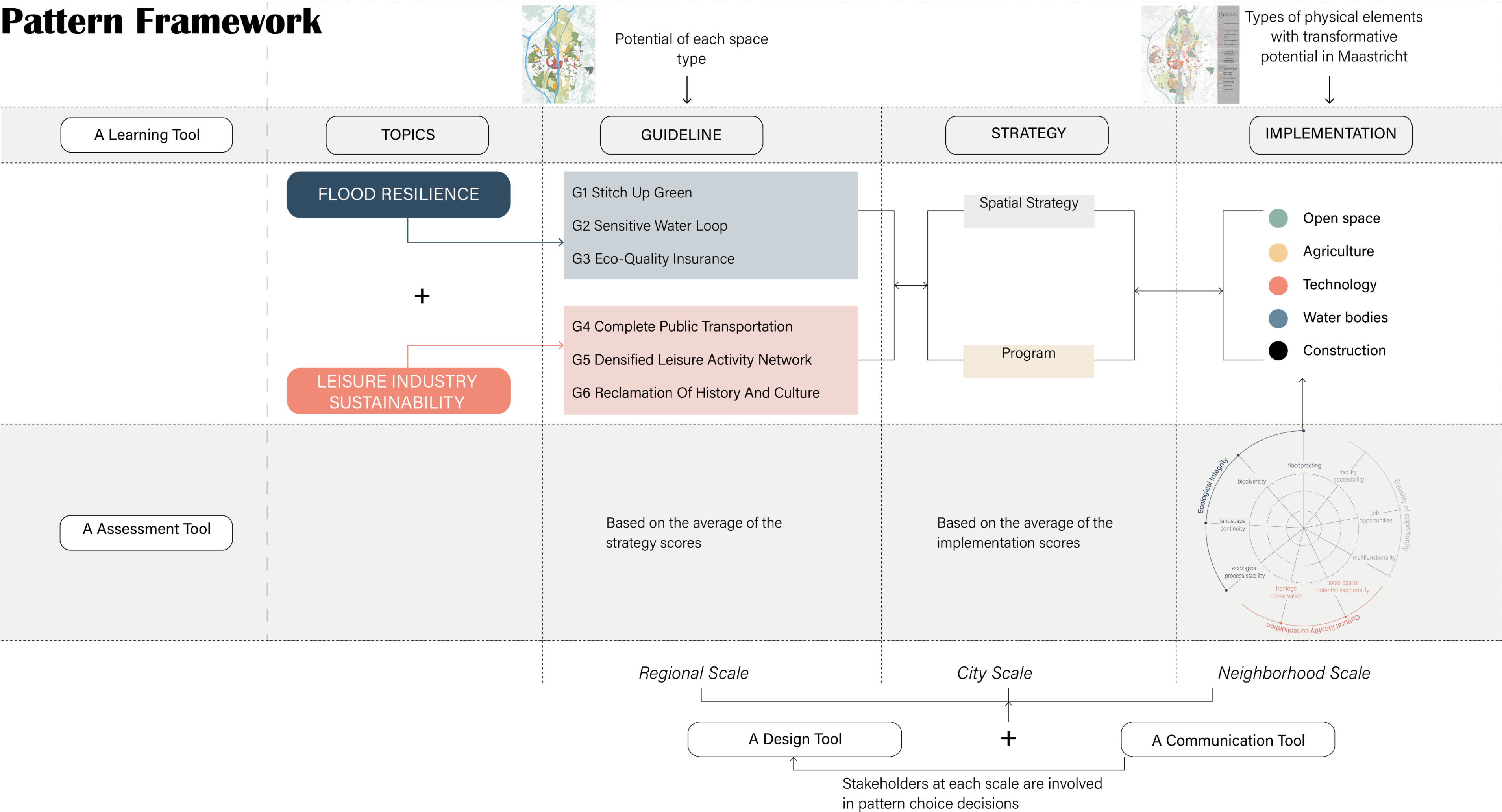


# Example Pattern



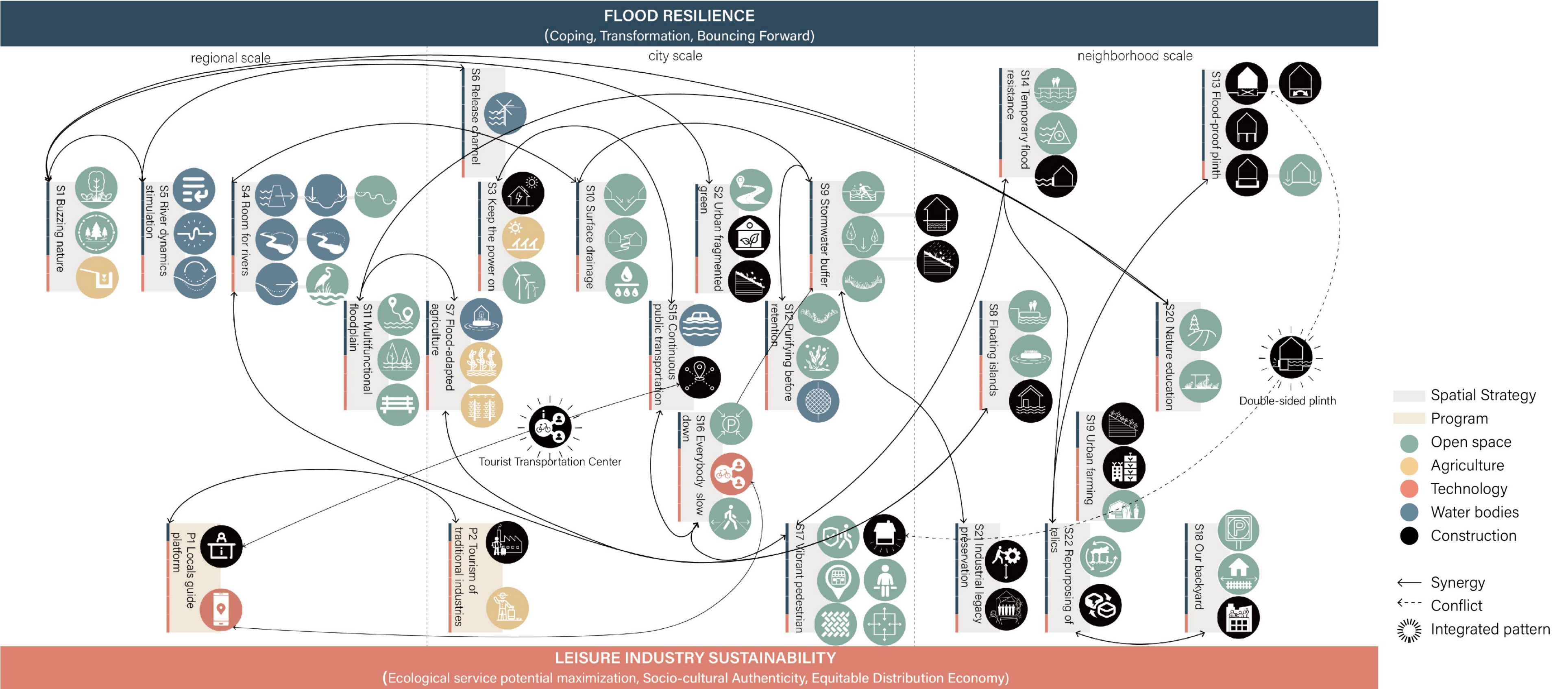


# Pattern Framework



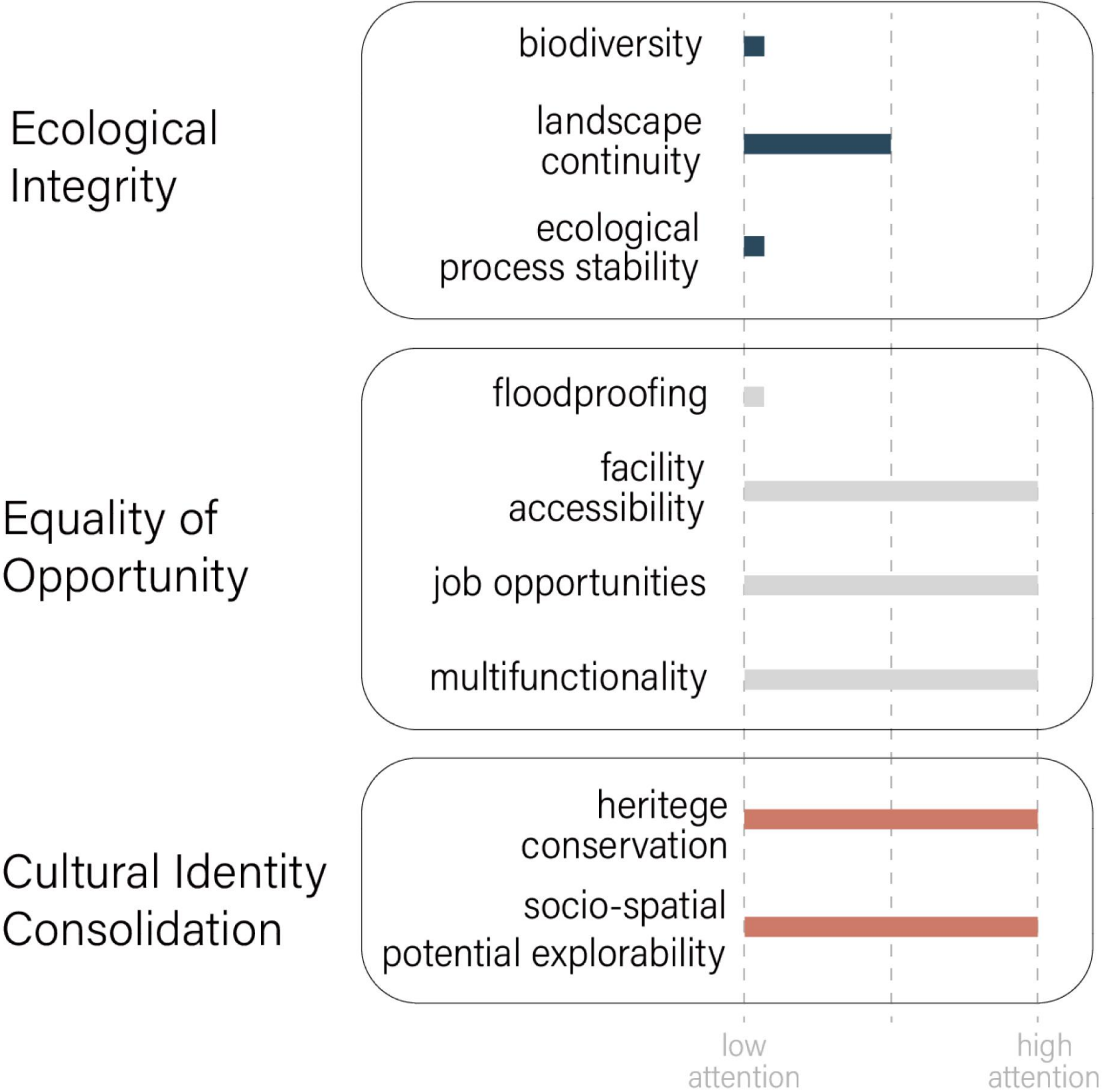


# Pattern Network





# Maximization scenario: leisure culture city



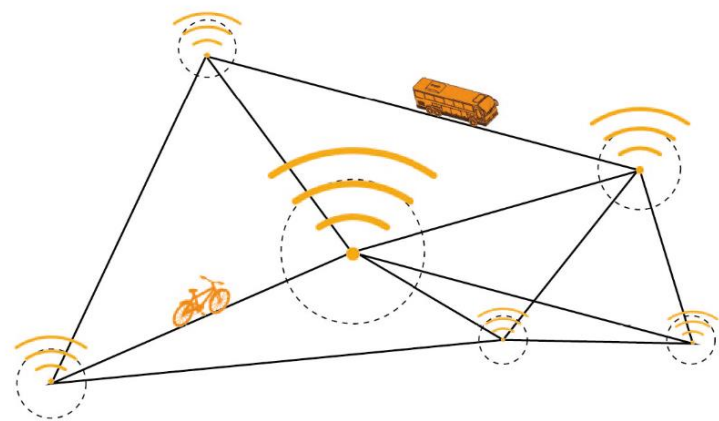
A city that can fully exploit its socio-spatial potential to promote the development of its **leisure industry** and reveal its **cultural heritage**.



# Maximization scenario: leisure culture city

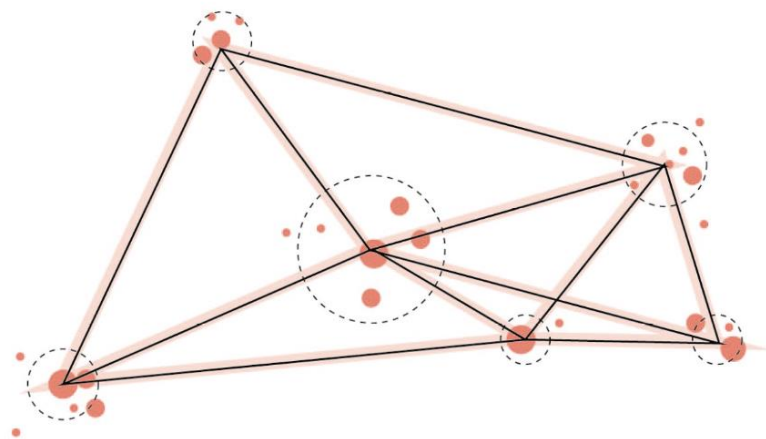
- Complete public transportation

by diverse transportation options and shared mobility systems.



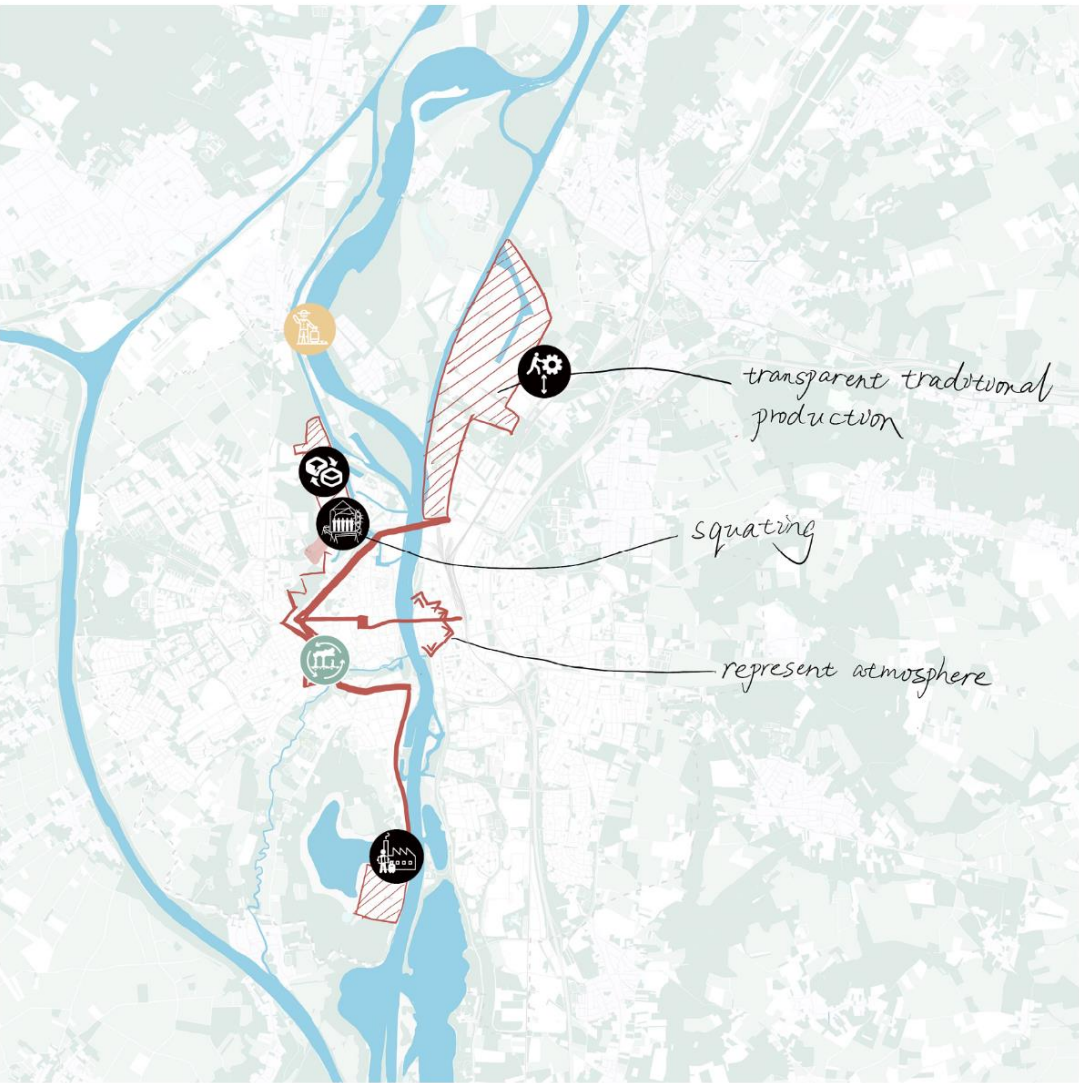
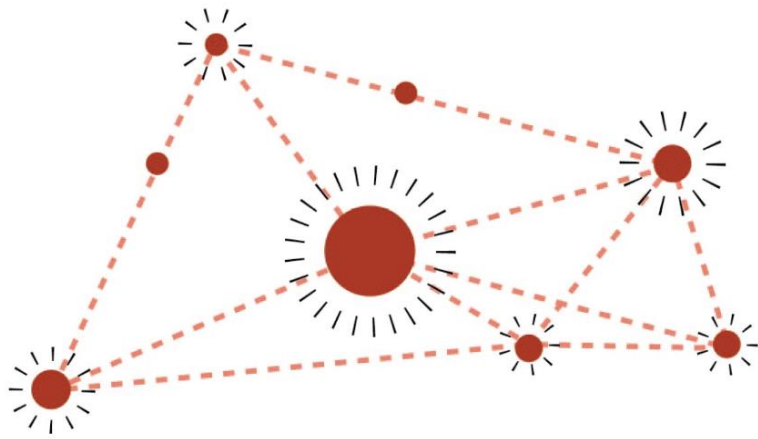
- Create densified leisure activity networks

by vibrant pedestrian areas and accessible natural landscapes.



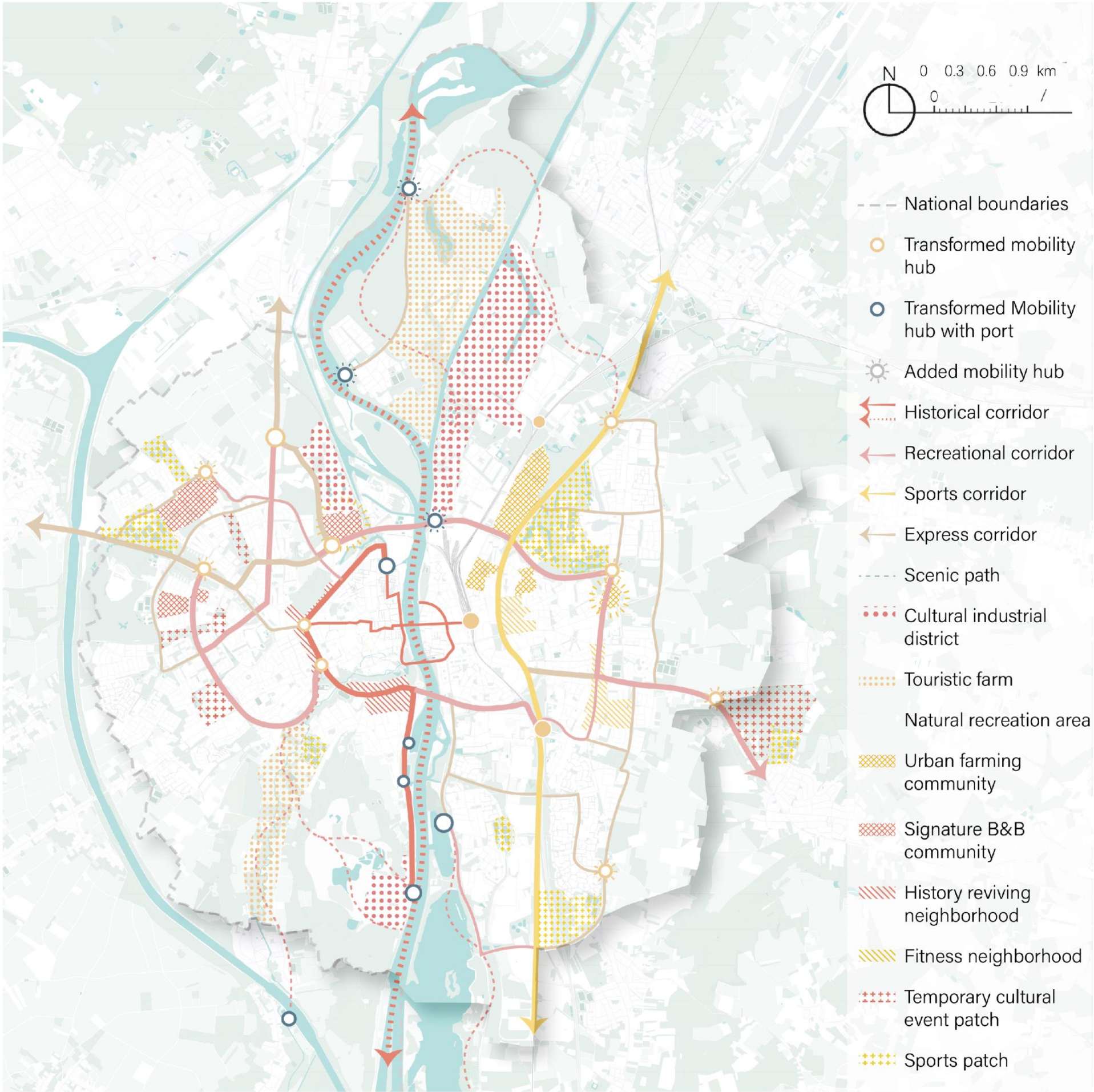
- Reviving history and culture value

by reconnection of cultural landscape and inspiring past behaviors.

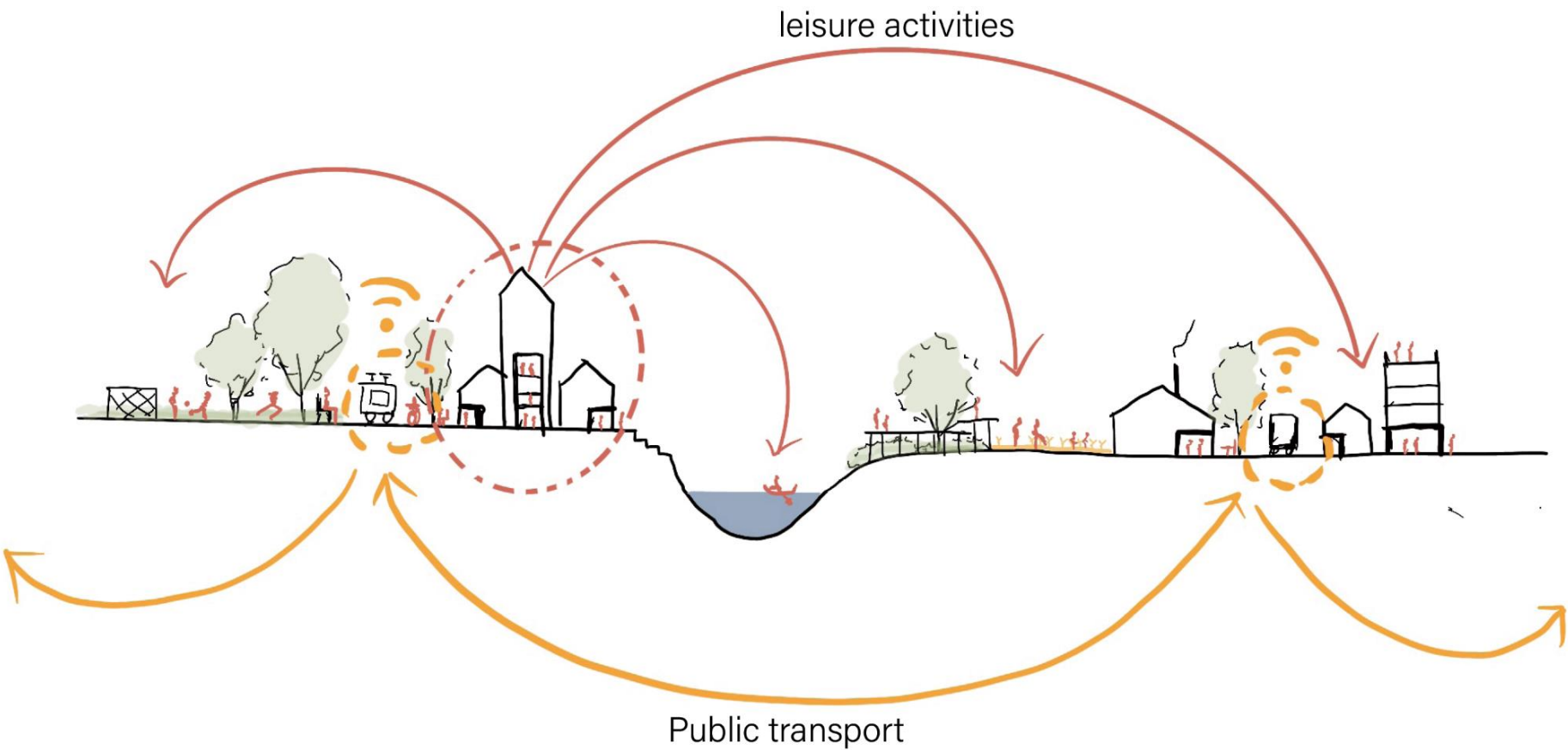




# Maximization scenario: leisure culture city



## Systemic Section

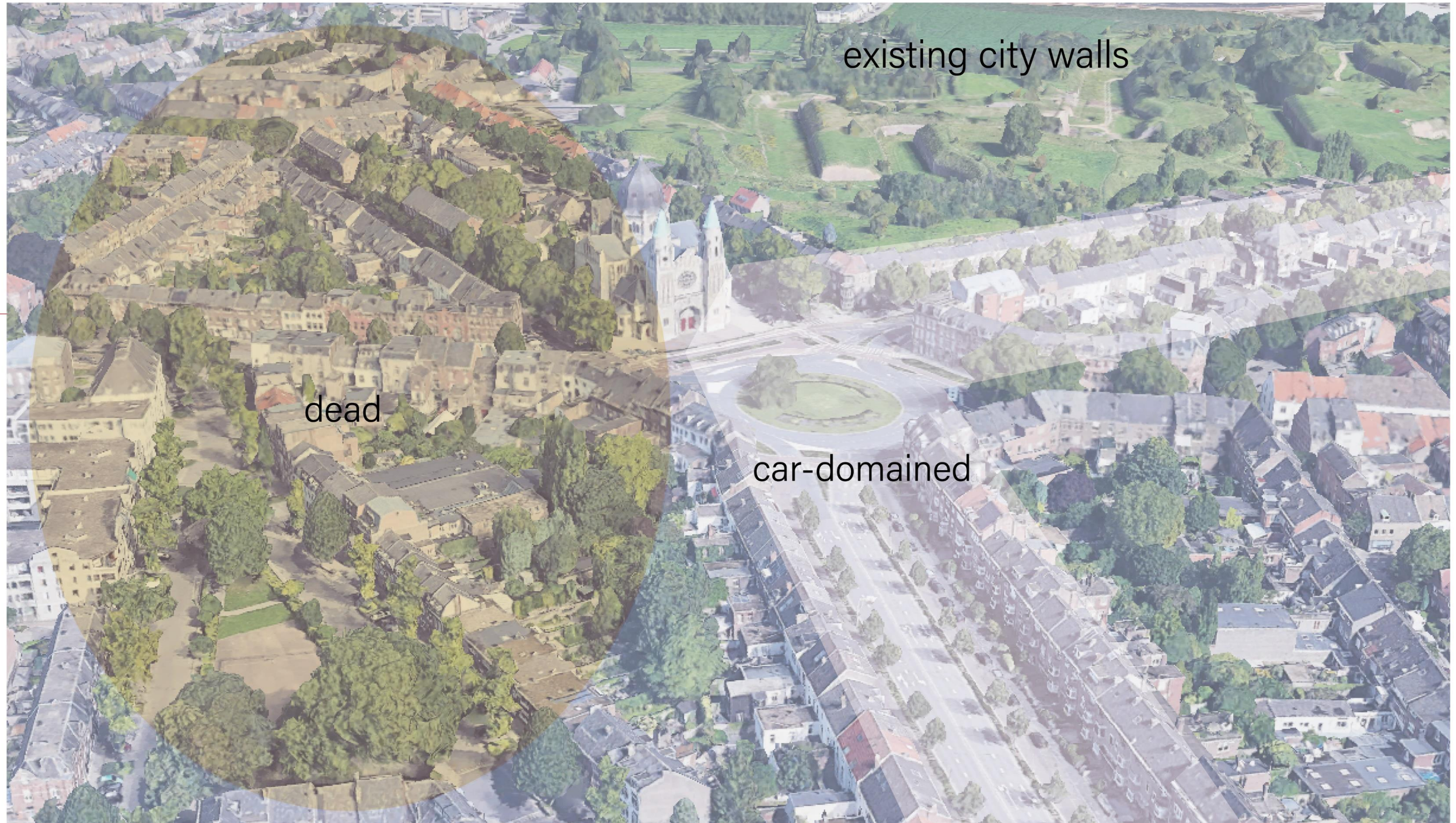
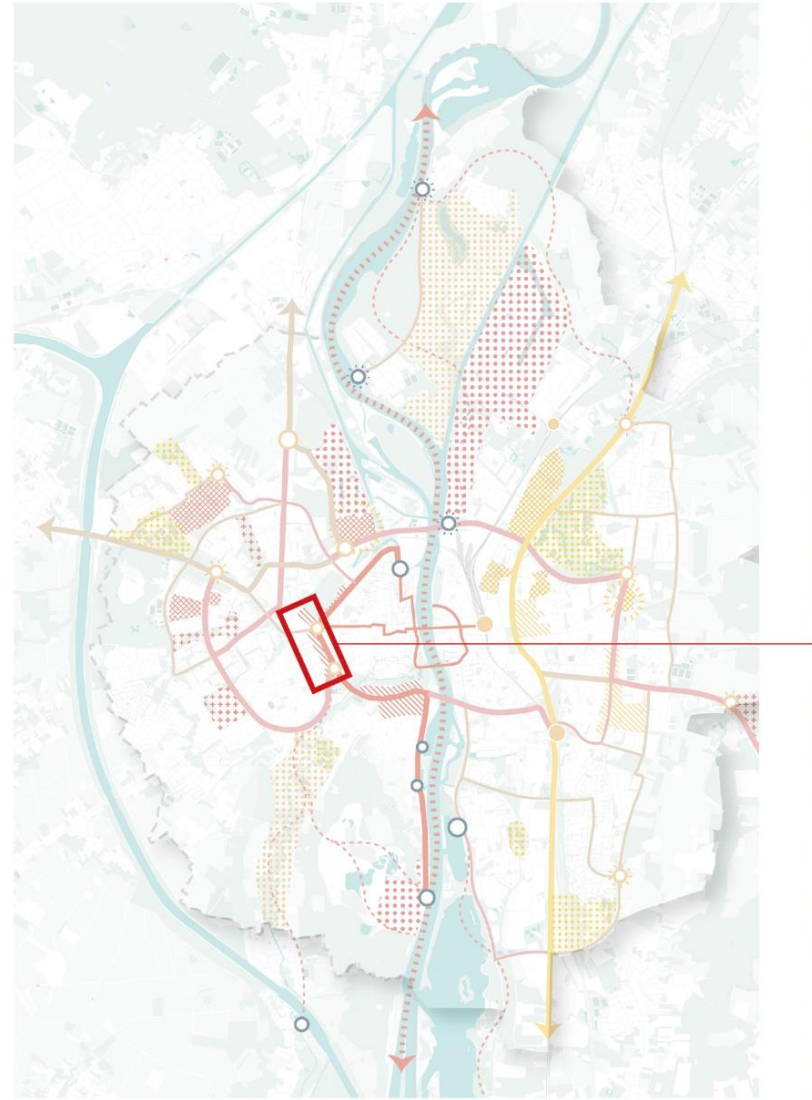


Enhance regional connectivity (in terms of transportation, social and cultural aspects)



# Leisure culture Scenario Experiment at Neighborhood Scale

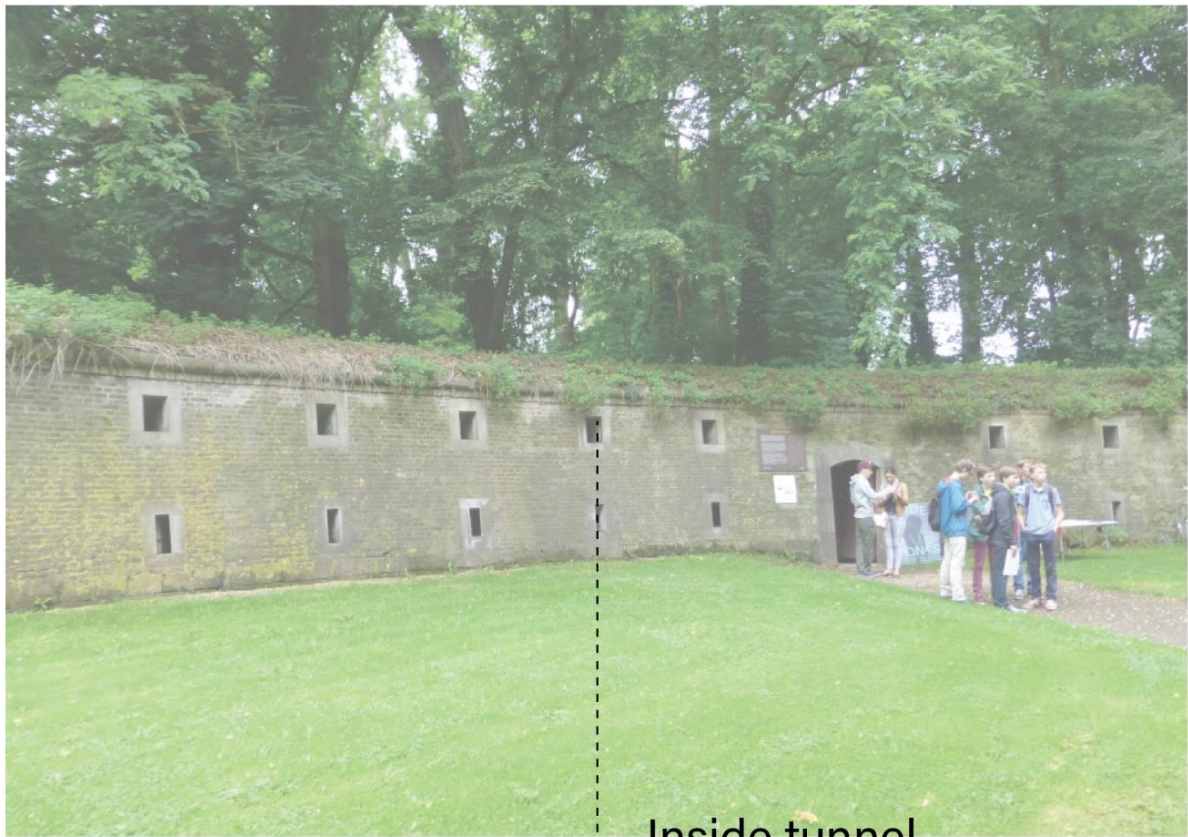
*Current situation*



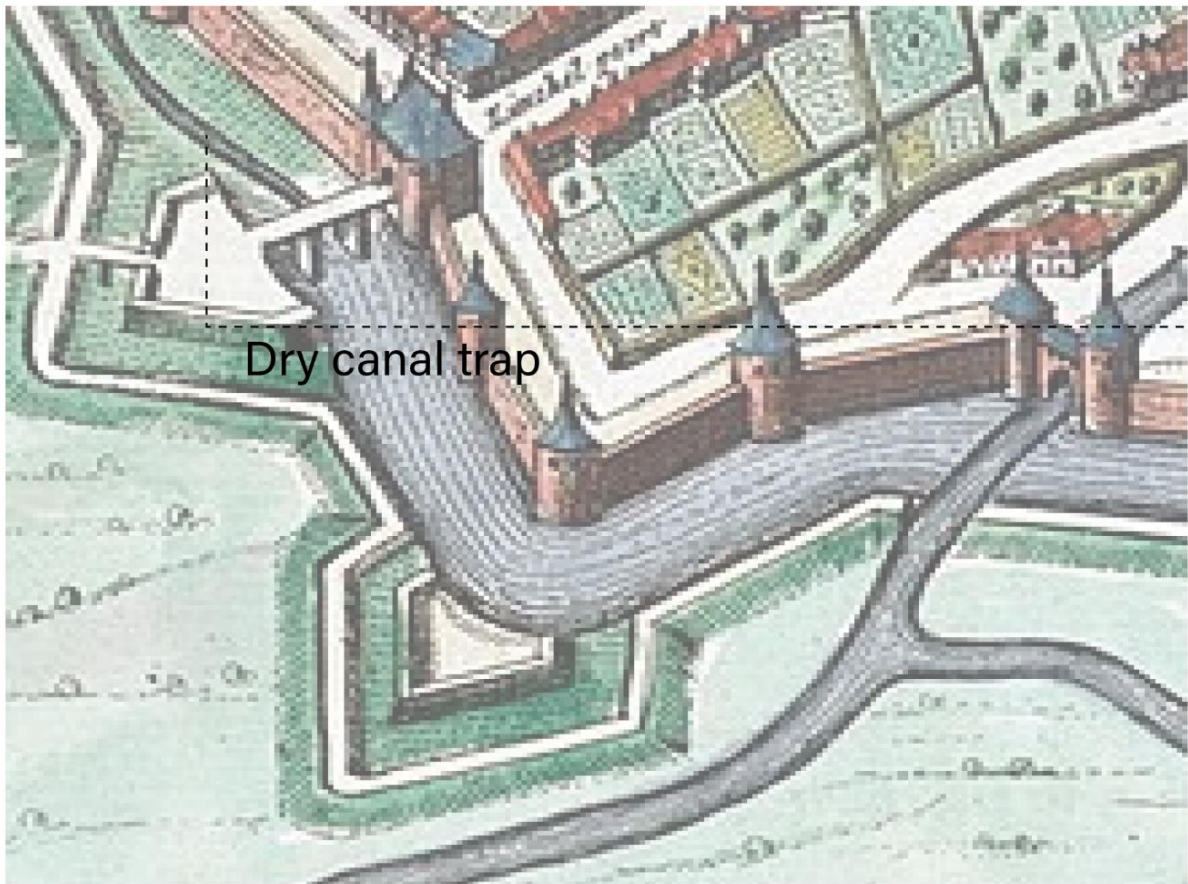


# Leisure culture Scenario Experiment at Neighborhood Scale

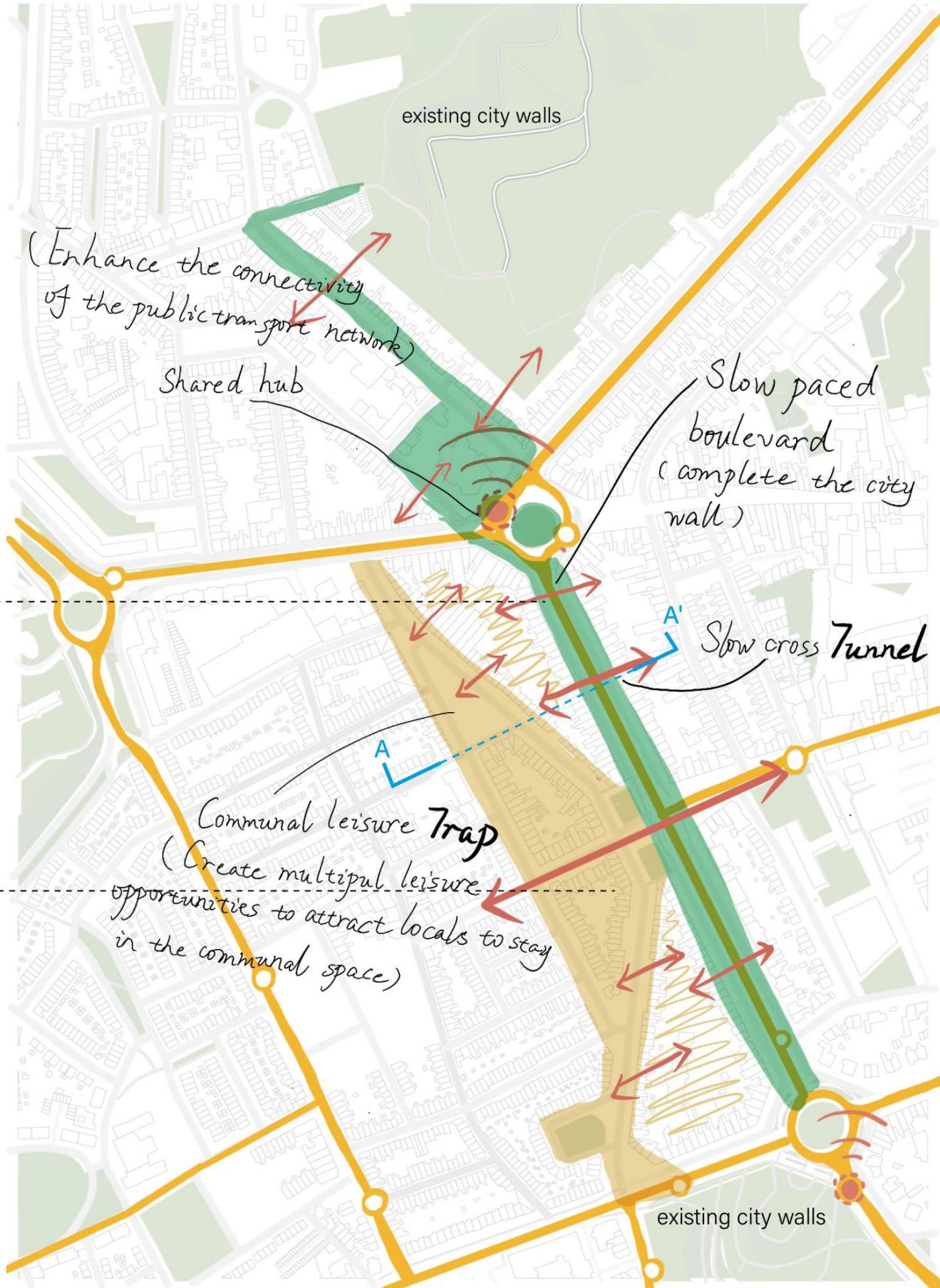
Concept: Reconnect the historical city wall



Inside tunnel

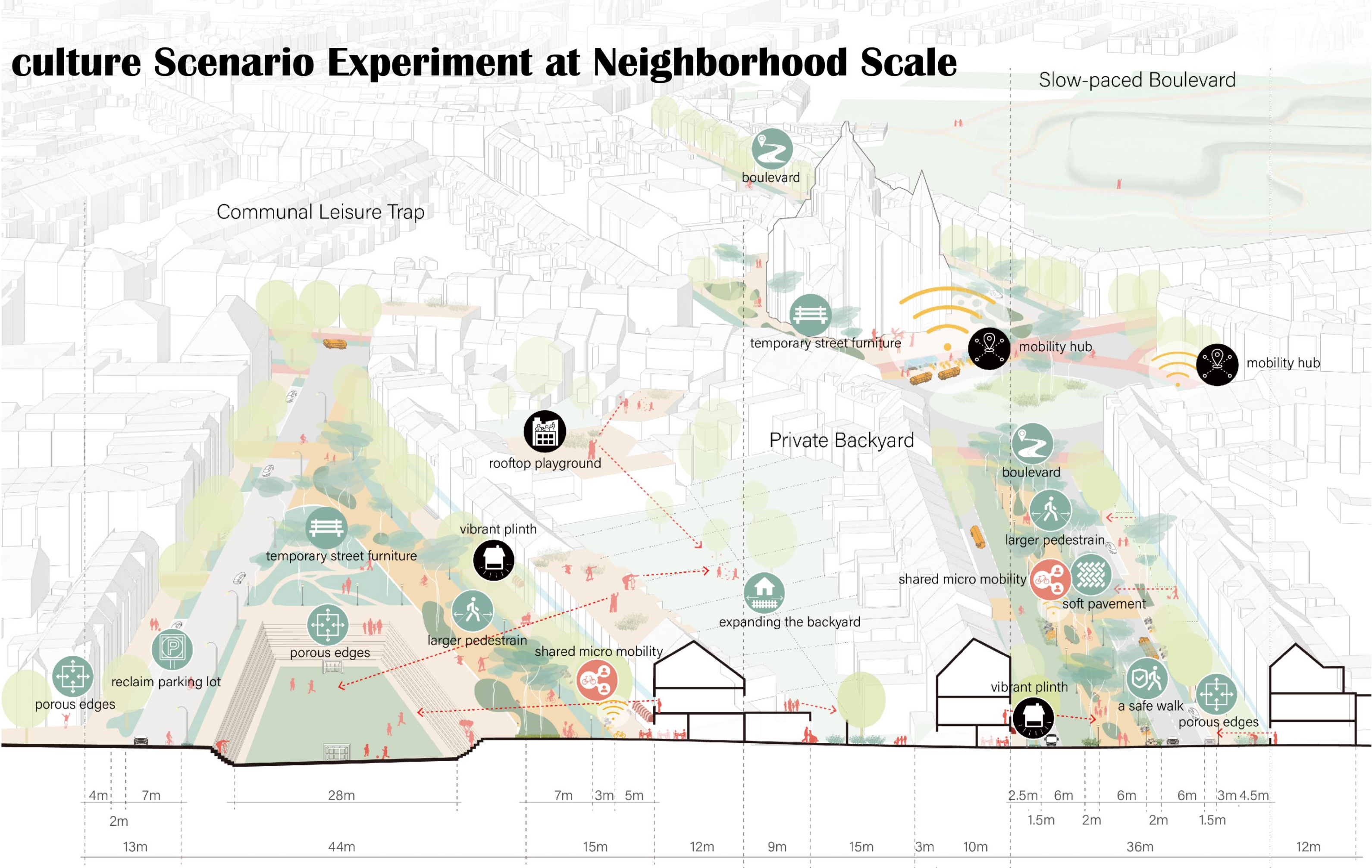


Dry canal trap





# Leisure culture Scenario Experiment at Neighborhood Scale

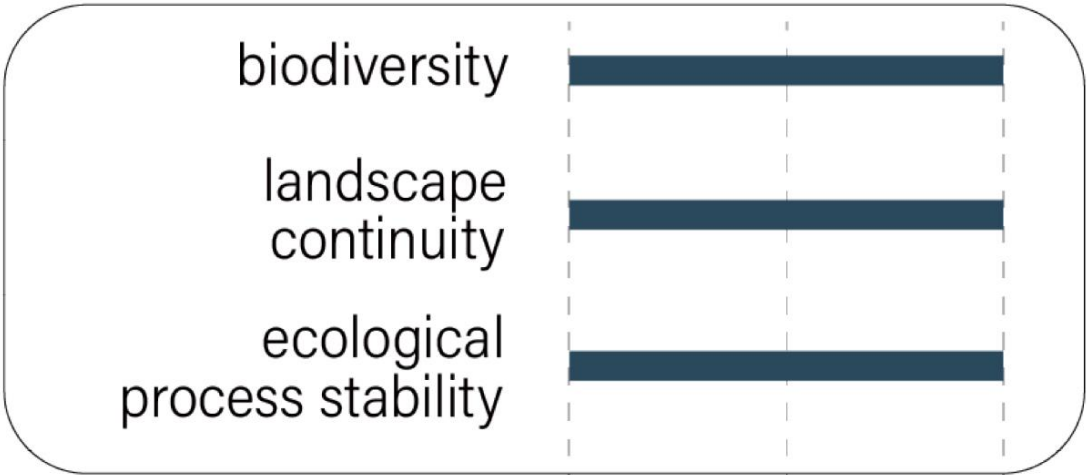


Perspective section AA' 1: 450

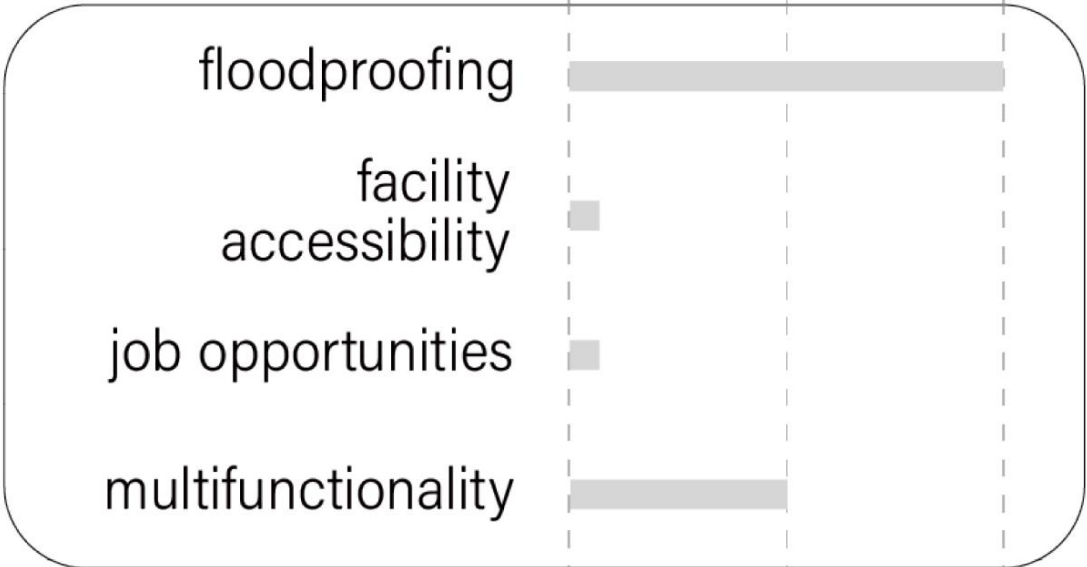


# Maximization scenario: eco-water city

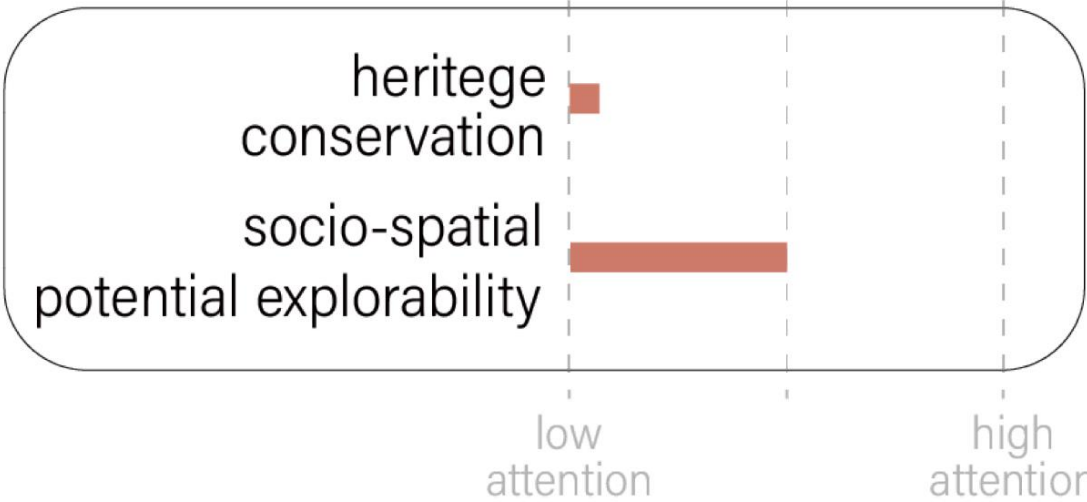
Ecological Integrity



Equality of Opportunity



Cultural Identity Consolidation



A city retains the maximum amount of **water** and respects the **ecological integrity** of the territory.



# Maximization scenario: eco-water city

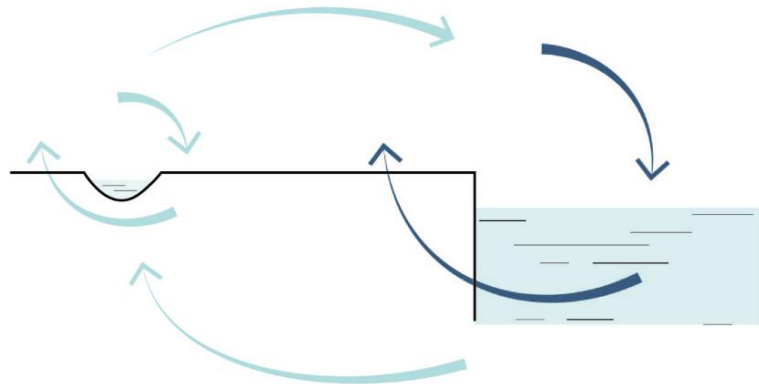
- Stitch up green

by urban ecological corridors and natural patches.



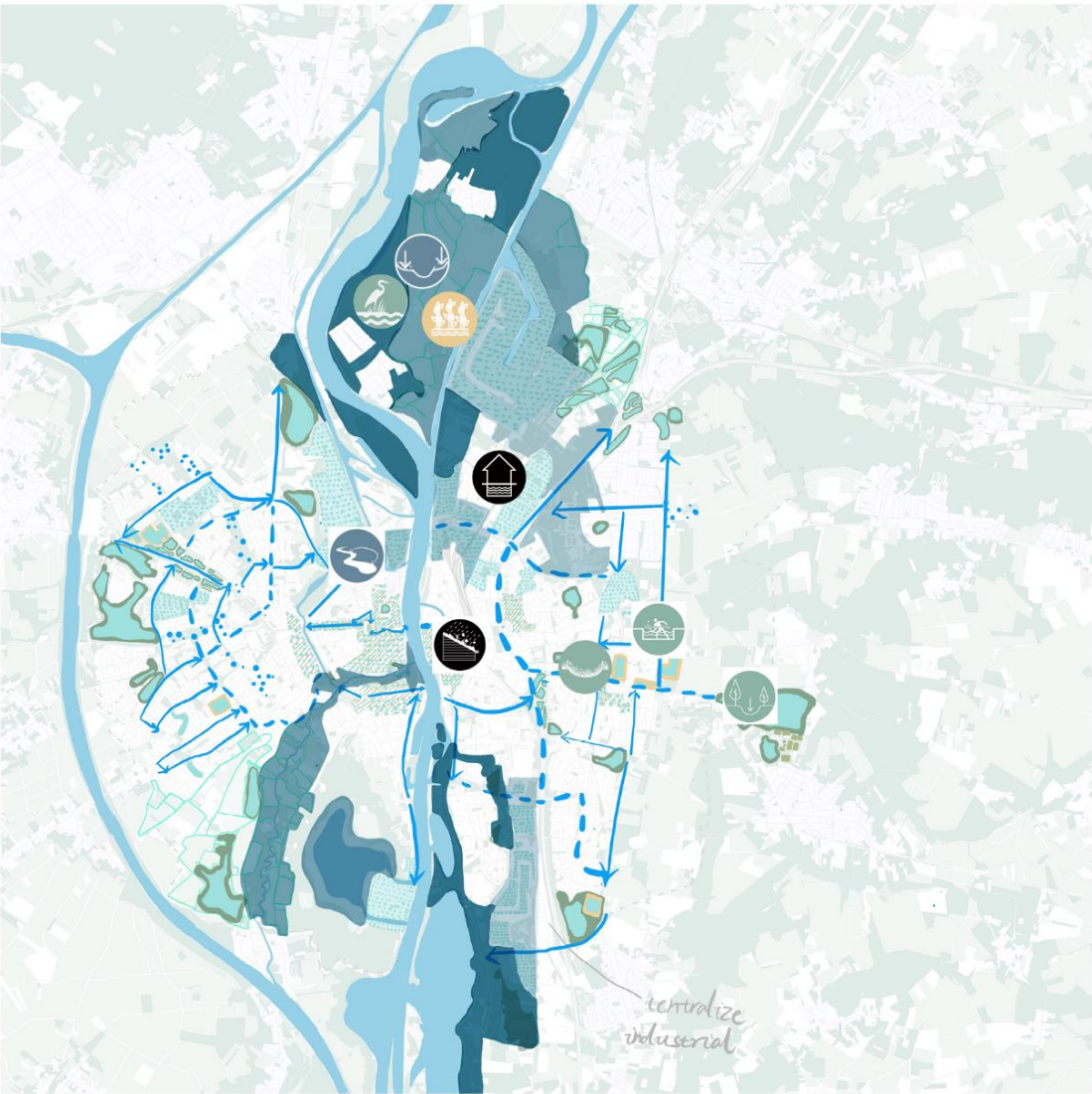
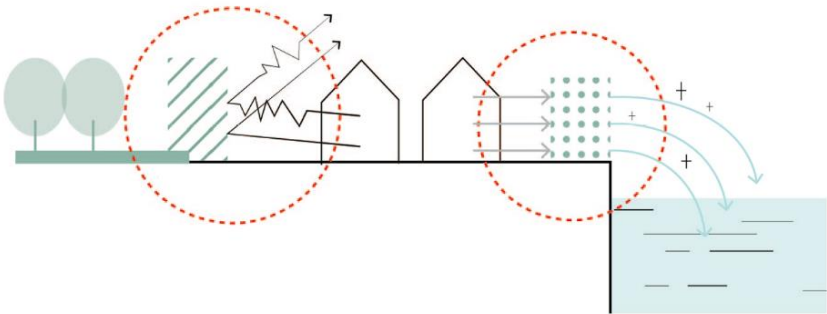
- Close sensitive water loop

by highly water-sensitive public spaces with connected water systems.



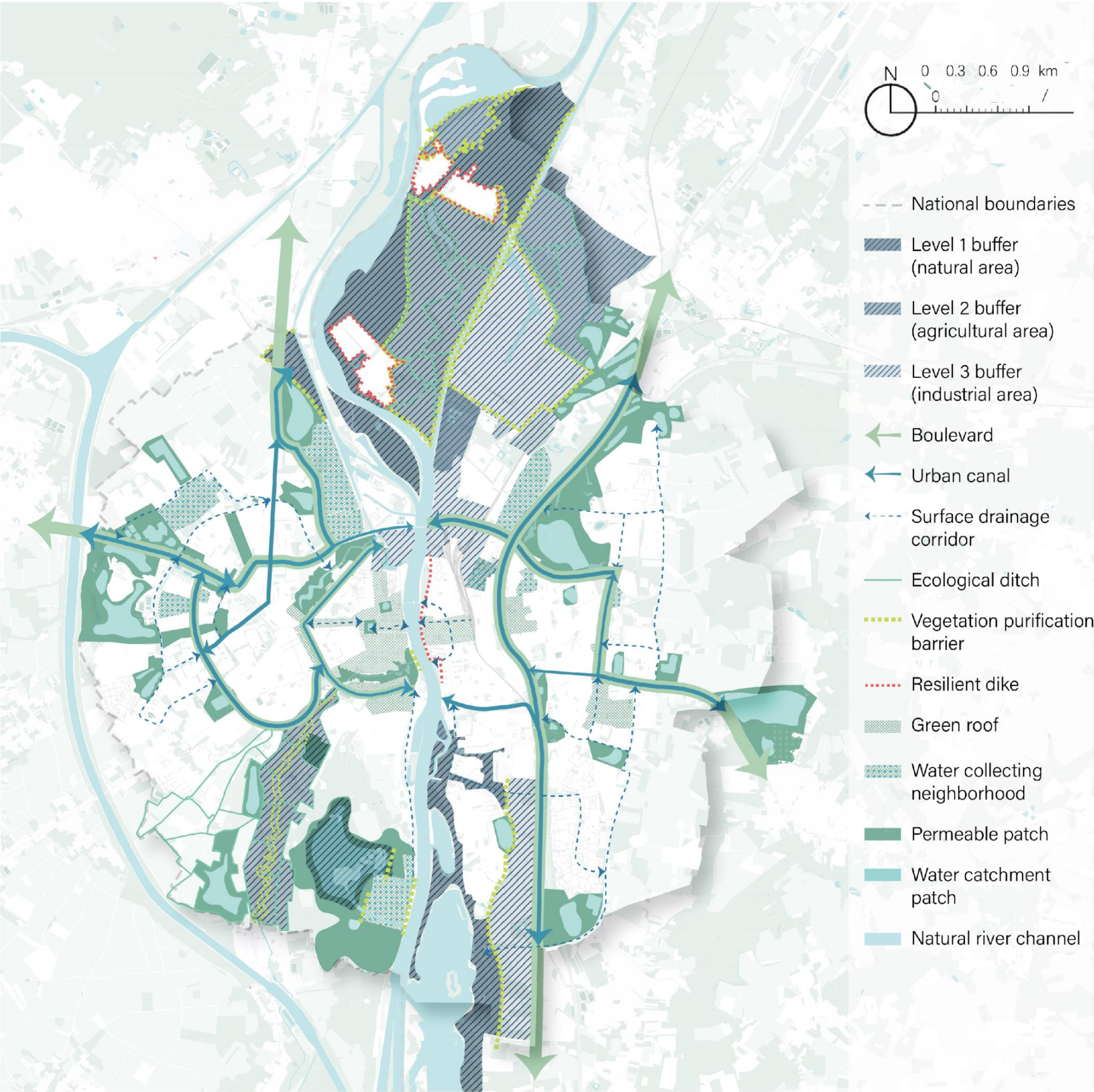
- Insurance on eco-quality

by purification and isolation systems at the urban interfaces

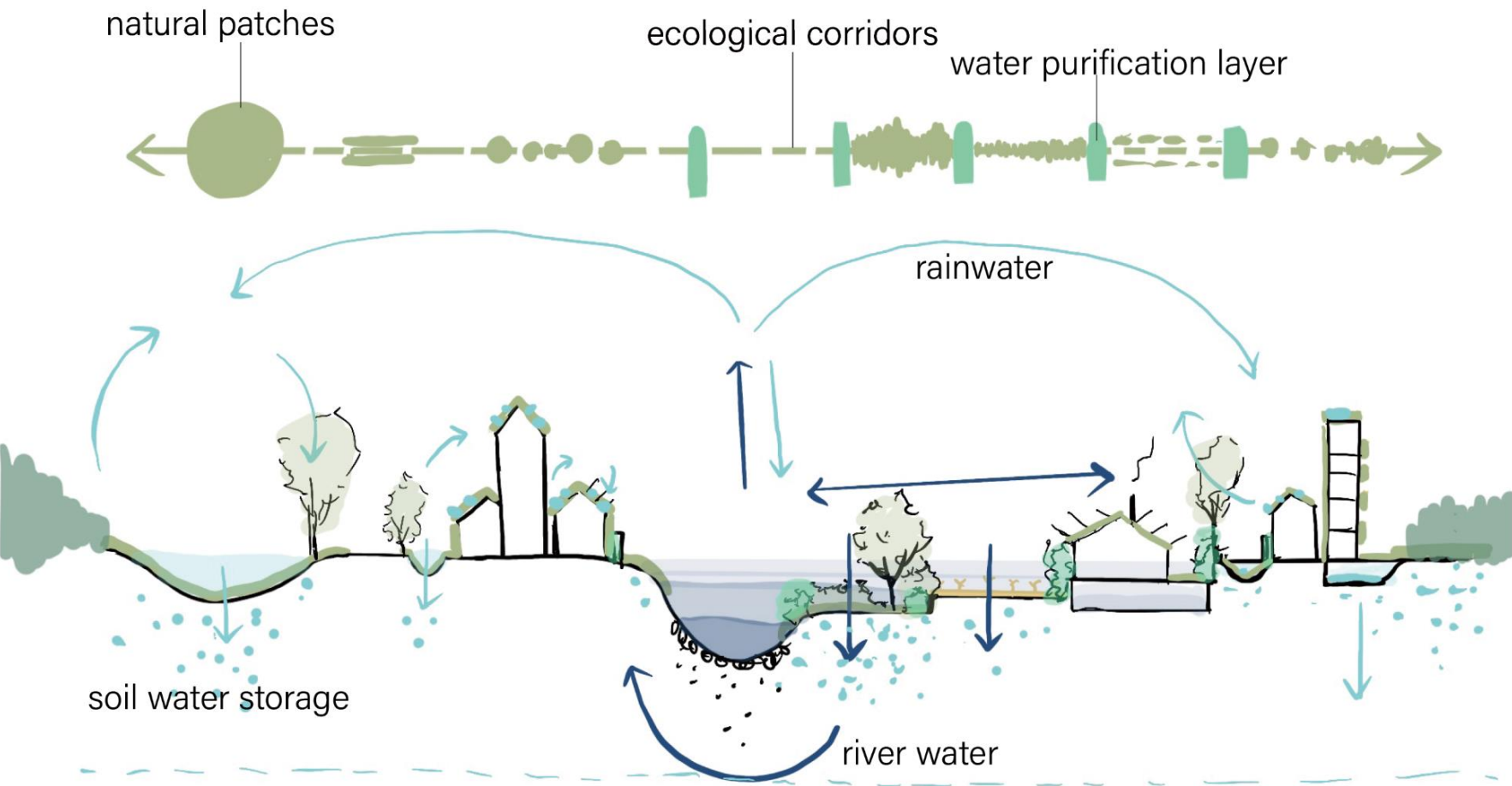




# Maximization scenario: eco-water city



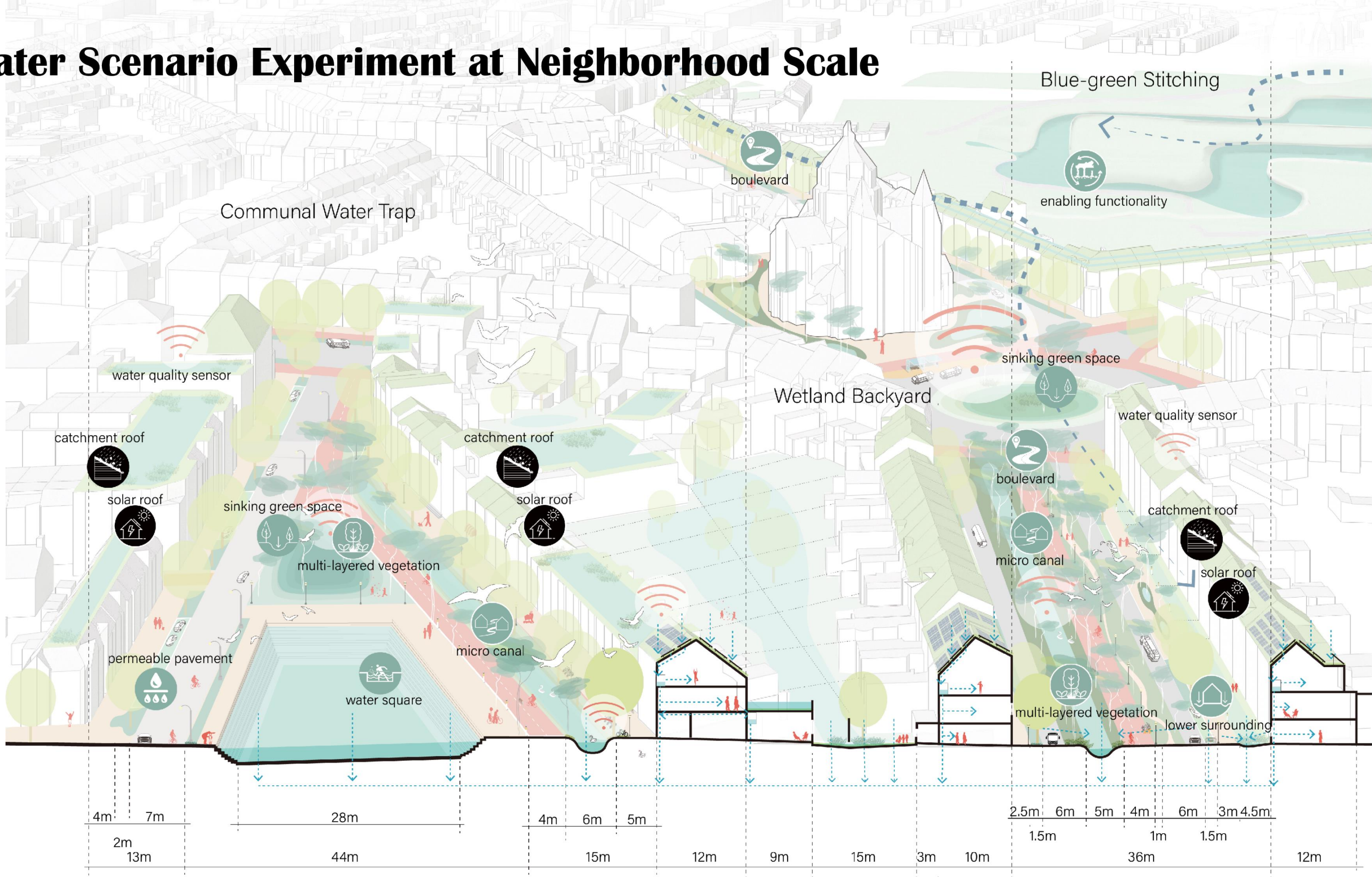
## Systemic Section



Enhancing regional connectivity (in terms of ecosystem, water circulation, urban interface)



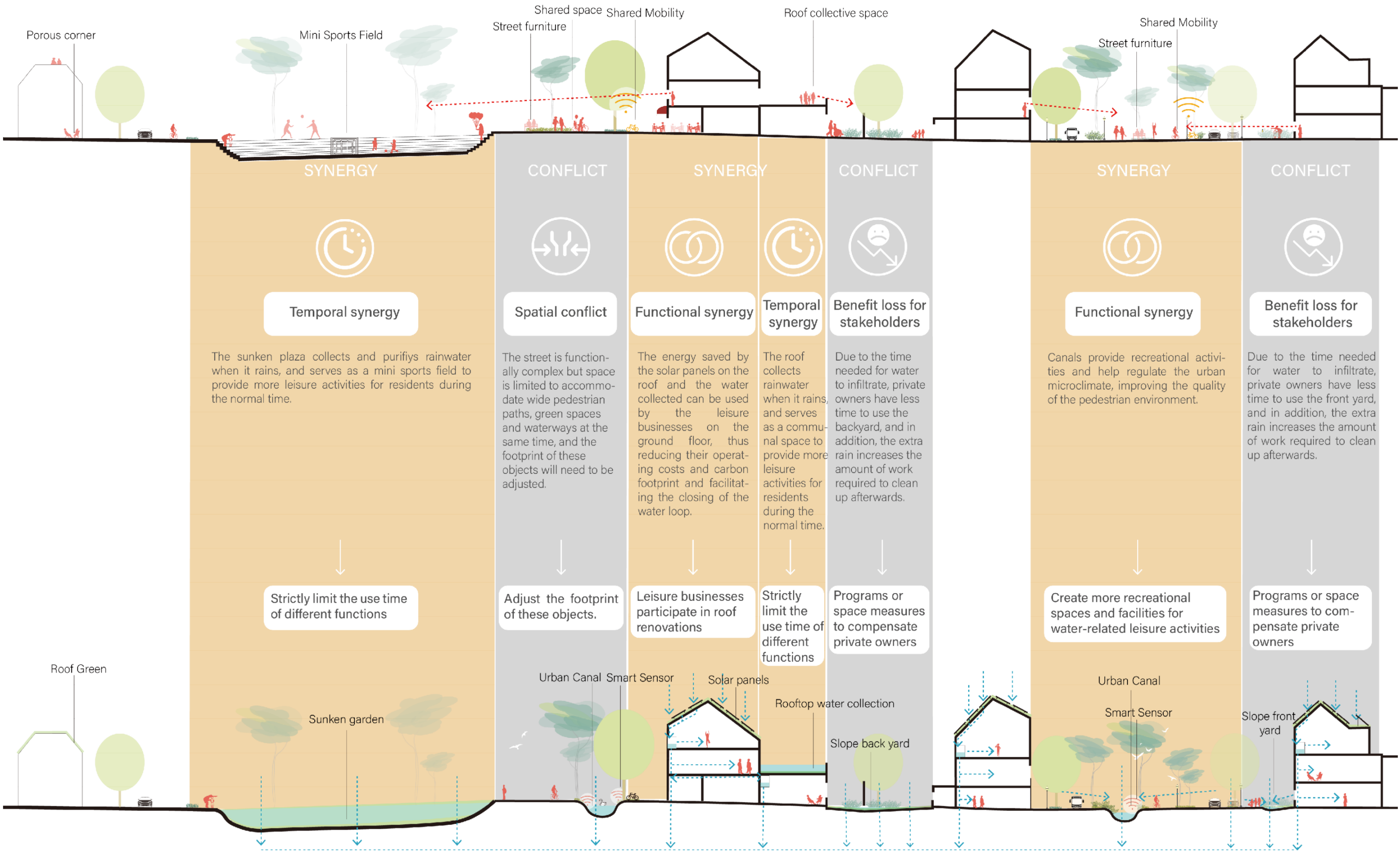
# Eco-water Scenario Experiment at Neighborhood Scale



Perspective section AA' 1: 450

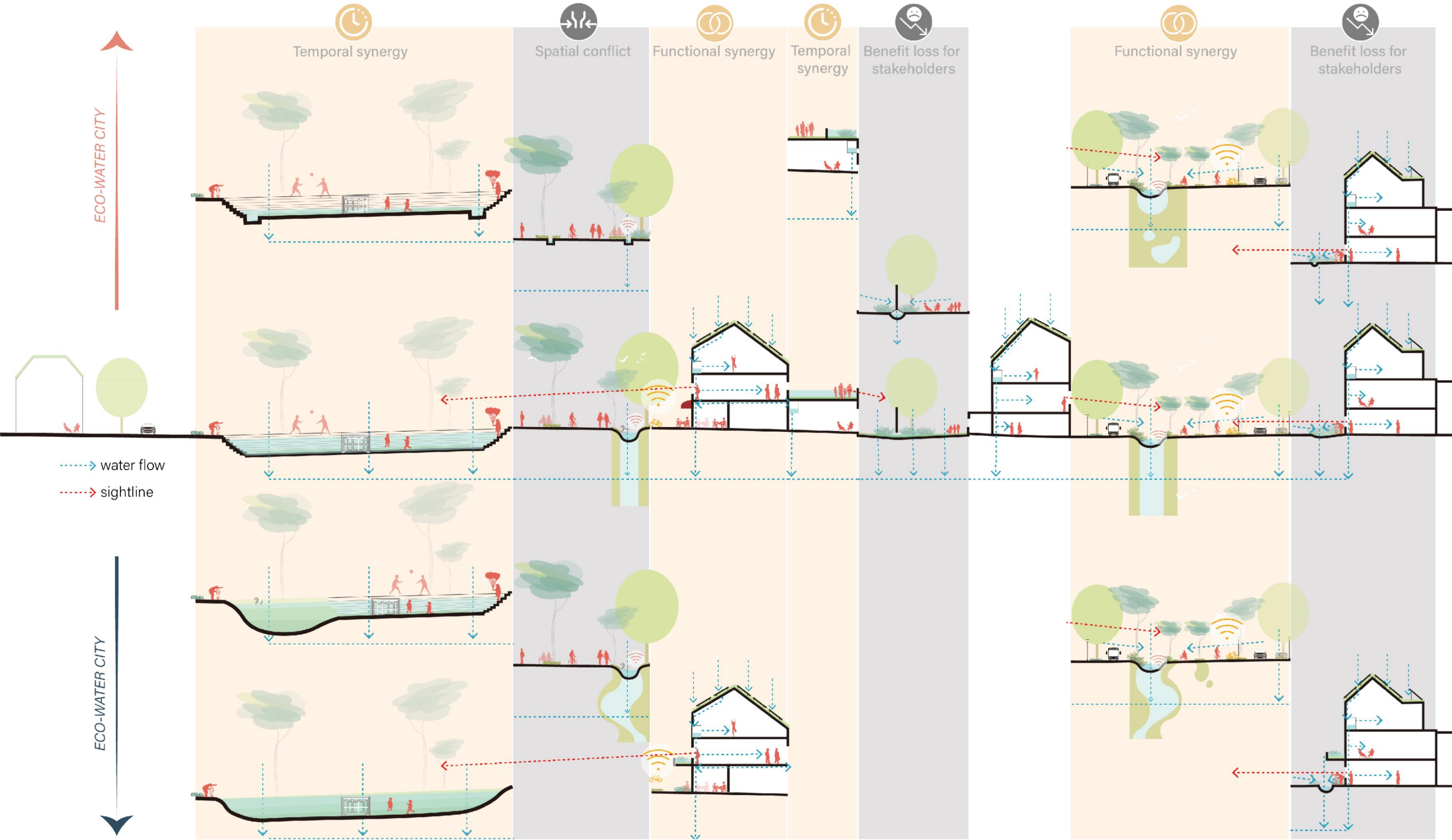


# Conflicts and Synergies at Neighborhood Scale



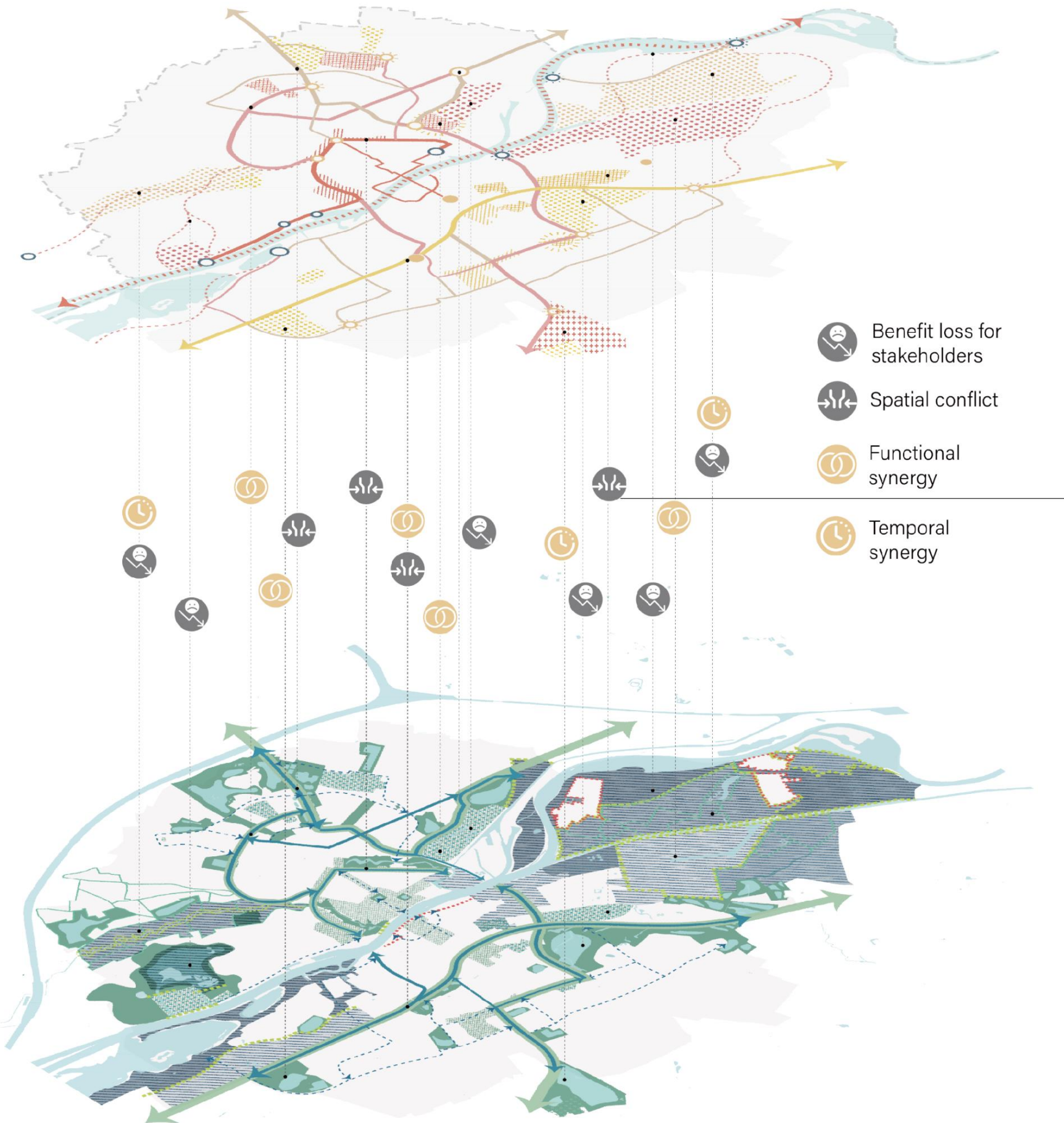


# Variation in Design at Neighborhood Scale

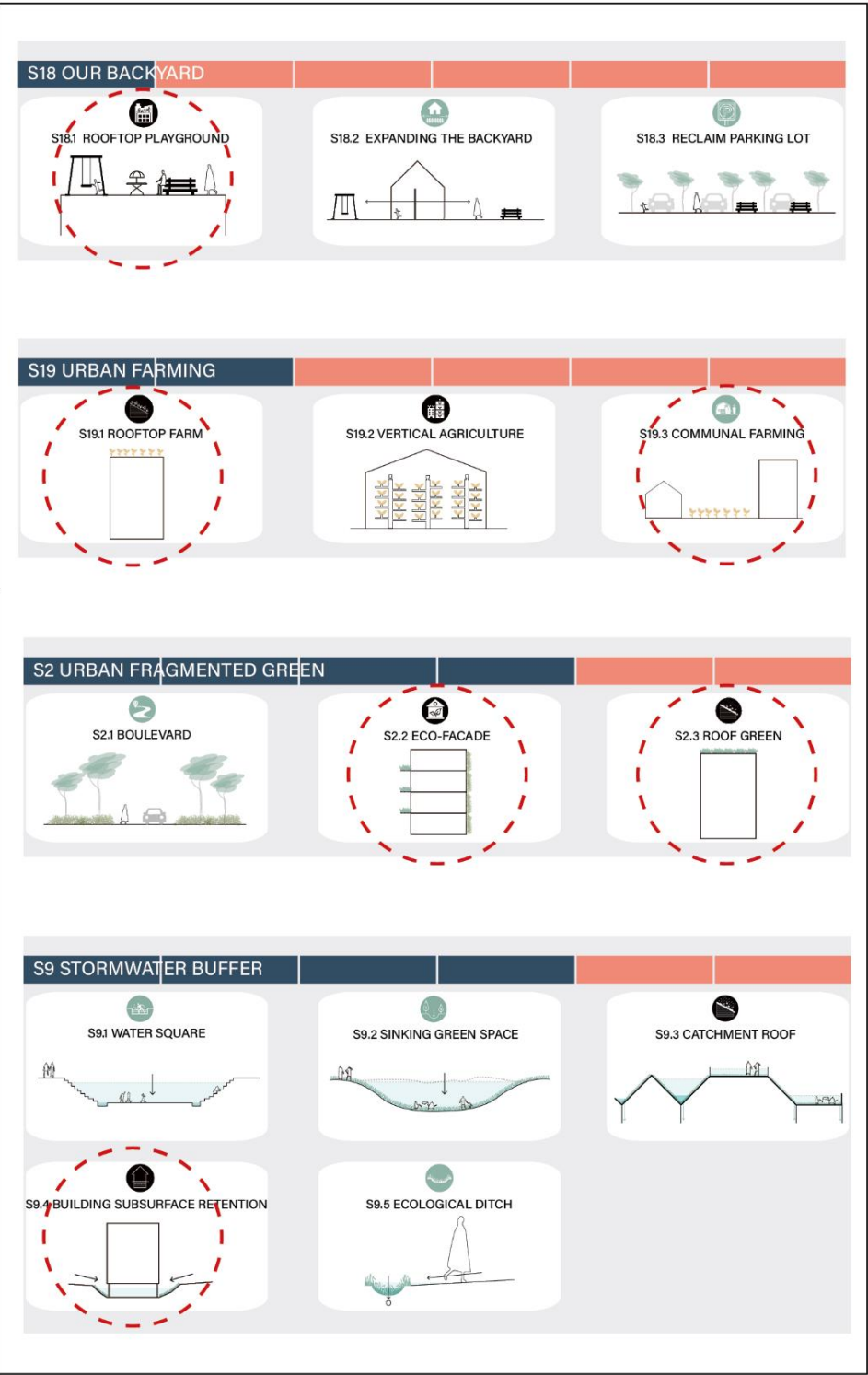




# Decision Making



Eg:



- Communicate the patterns



Source: Meyer, H. (2020). Cities of Making. [urbandesigntudelft.nl/research/cities-of-making/](https://urbandesigntudelft.nl/research/cities-of-making/)

- Apply the patterns




Source: Meyer, H. (2020). Cities of Making. [urbandesigntudelft.nl/research/cities-of-making/](https://urbandesigntudelft.nl/research/cities-of-making/)



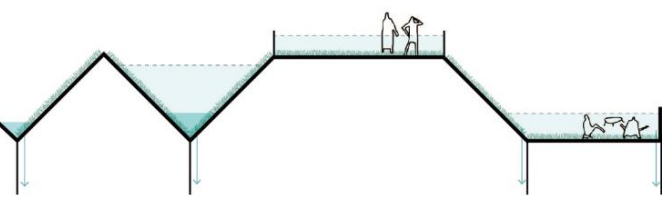
# Flowing Culture City

Assessed by the patterns

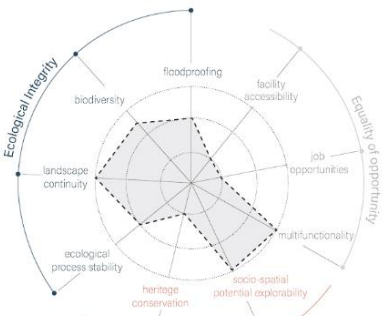


### S9.3 CATCHMENT ROOF

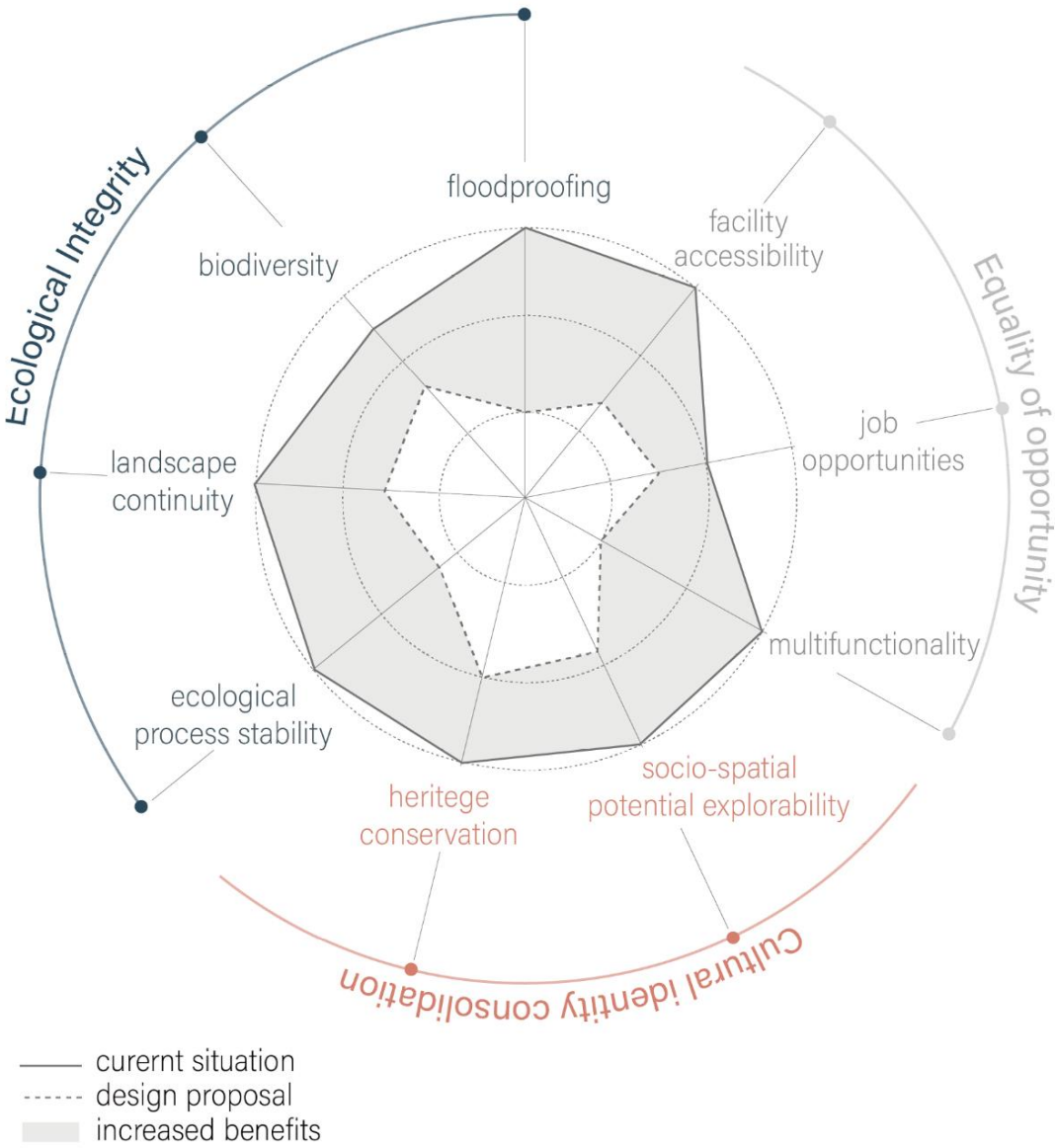
**Hypothesis**  
A certain amount of rain-collecting roofs expands water retention areas and promotes urban biodiversity.



**Contribution to Goals**



**Stakeholders**  
Maastricht municipality  
leisure business  
contractors  
locals  
international students  
migrants



--- National boundaries

Express corridor  
Key mobility hub  
Mobility hub

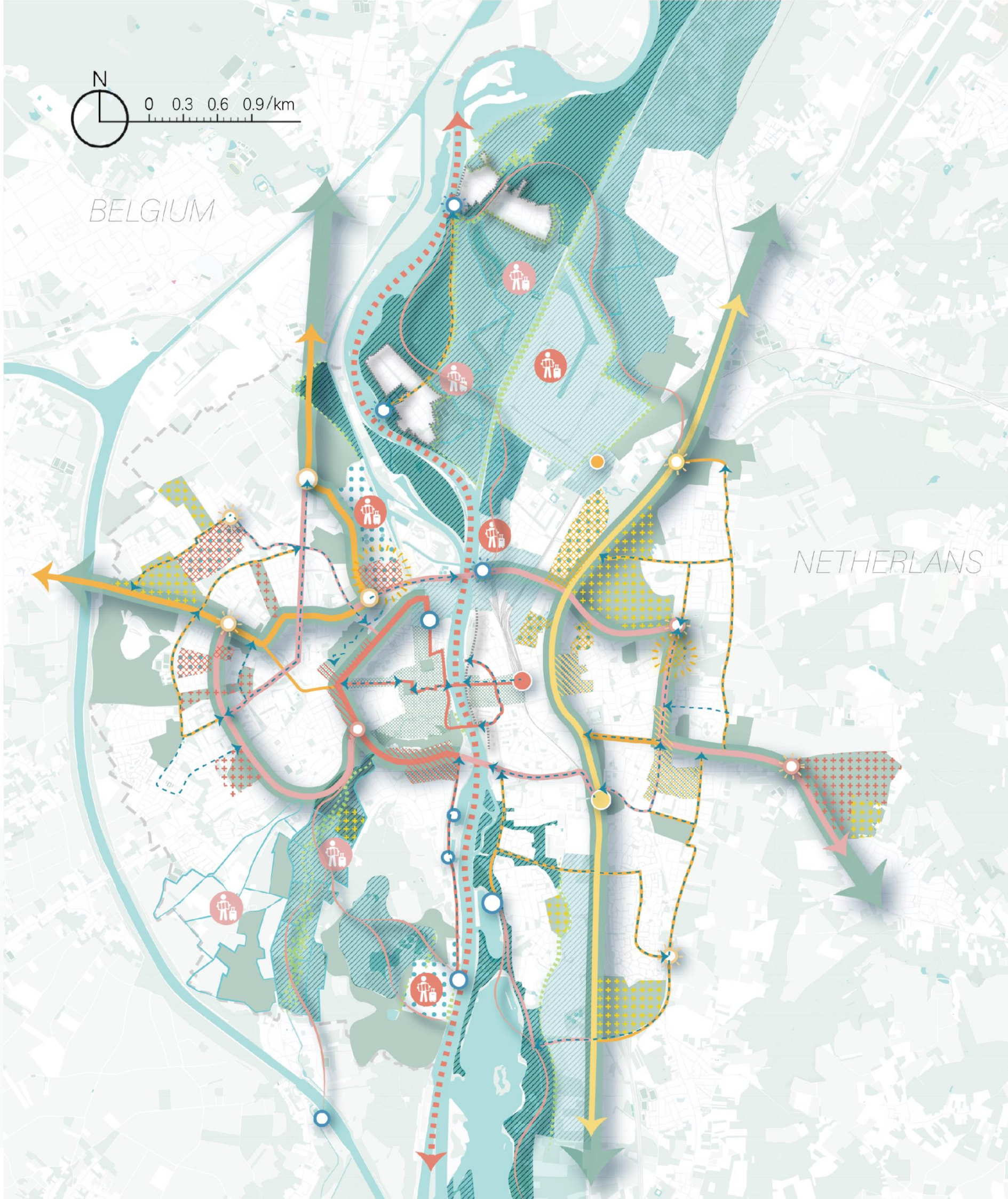
Historical corridor  
Historical mobility hub  
Historic scenic neighborhoods  
Temporary cultural event hub  
Industrial culture tourism

Recreational corridor  
Sports mobility hub  
Water-sensitive urban farming neighborhood  
Water-sensitive B&B community  
Agritourism  
Scenic path

Sports corridor  
Sports mobility hub  
Water Fitness Neighborhood  
Sunken sports green hub

Natural river channel  
Level 1 buffer (natural area)  
Level 2 buffer (agricultural area)  
Level 3 buffer (industrial area)  
Vegetation purification barrier  
Ecological ditch  
Resilient dike

Canal Boulevard  
Surface drainage corridor  
Water mobility hub  
Green roof  
Water-sensitive industrial area  
Catchment green hub



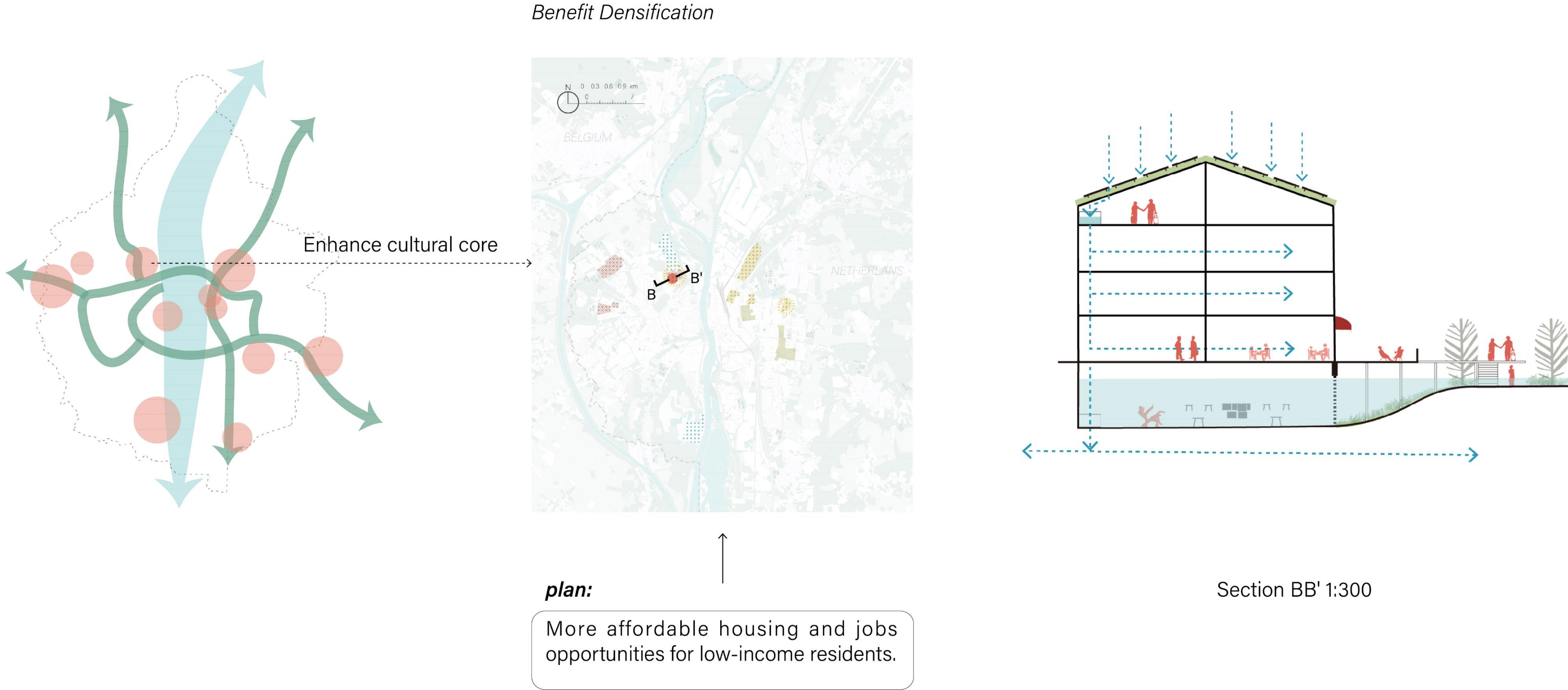


PART  
04

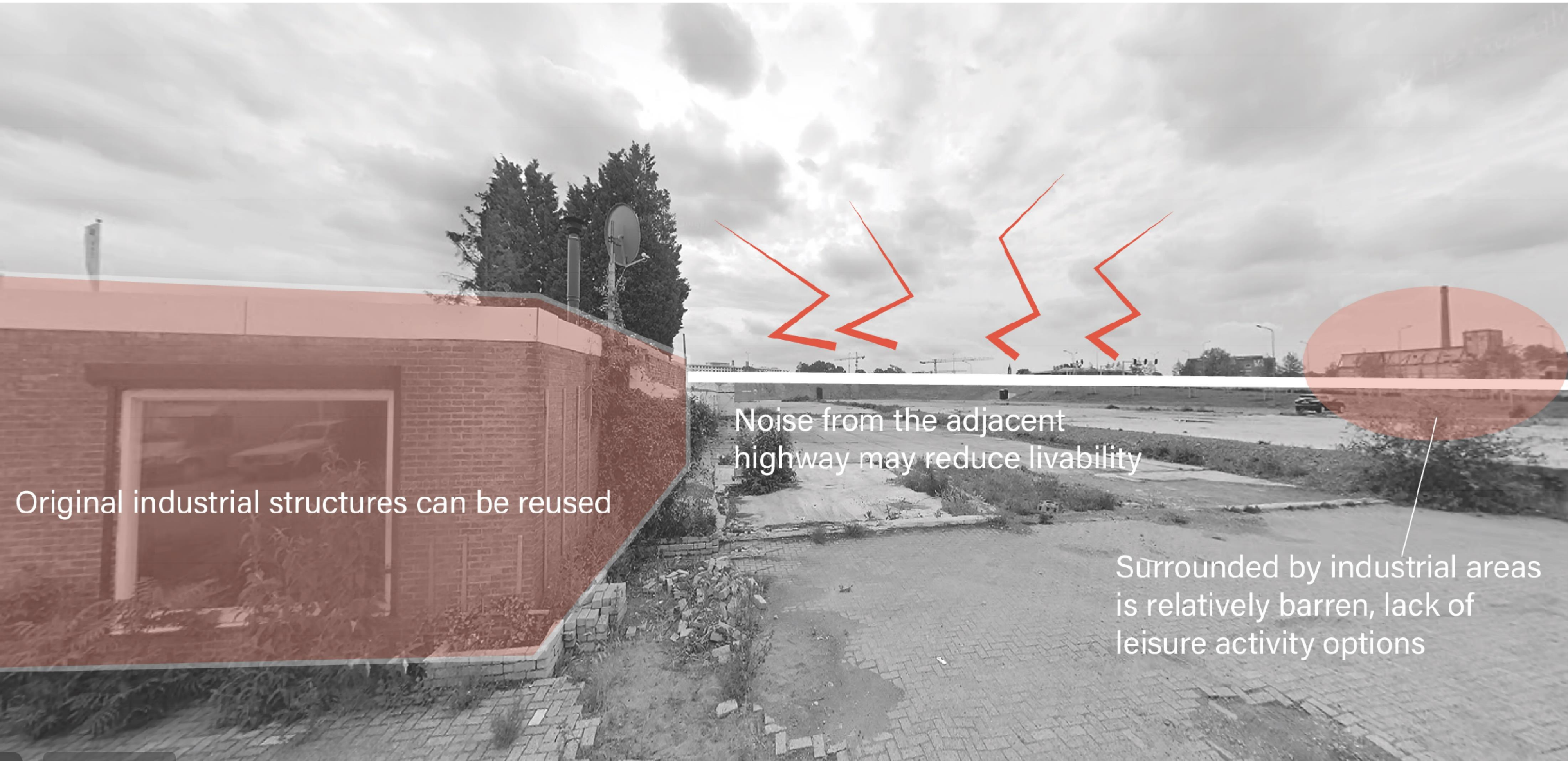
# Integrated strategies & implementations



# Integrated Implementations of the Neighborhood Scale







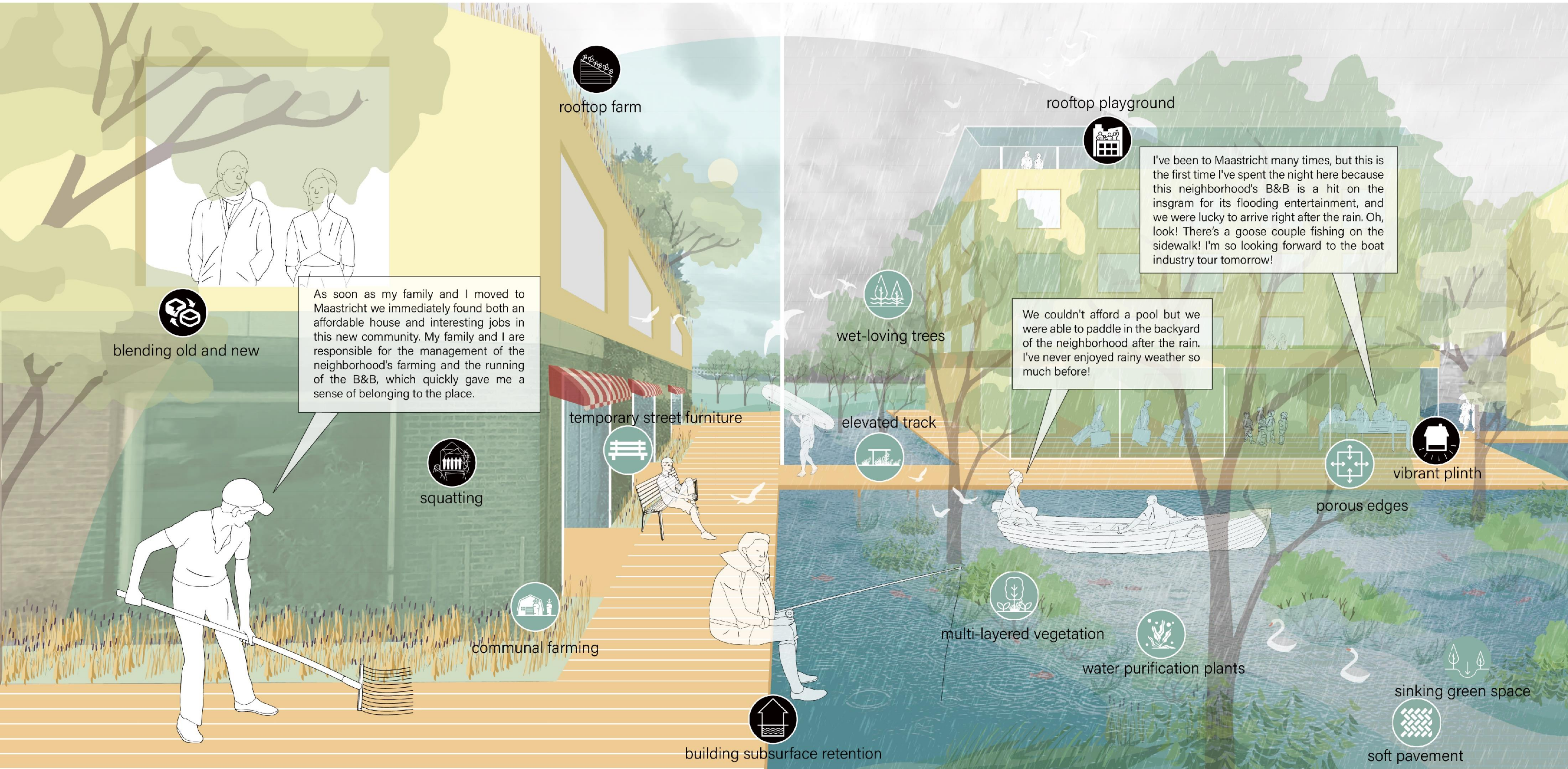
Noise from the adjacent highway may reduce livability

Original industrial structures can be reused

Surrounded by industrial areas is relatively barren, lack of leisure activity options

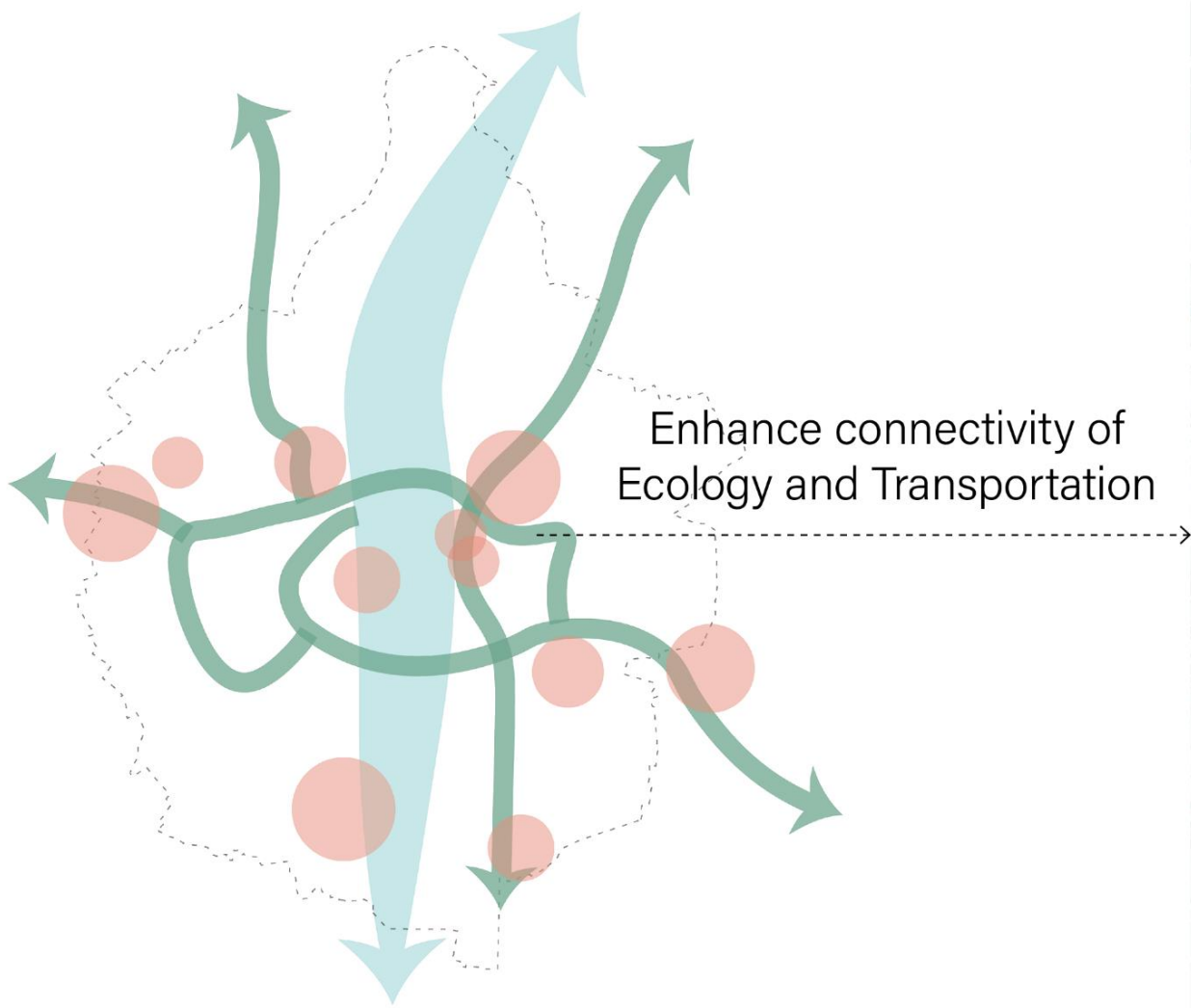


Benefit Densification: after

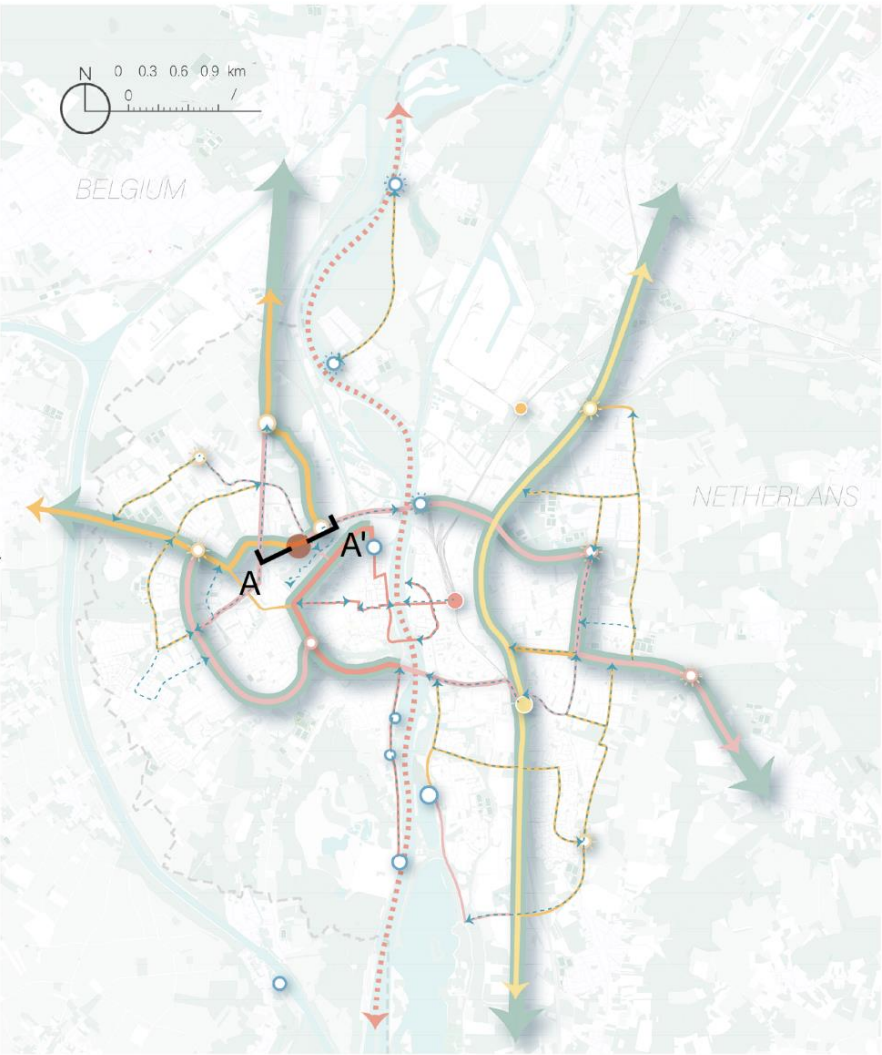




# Integrated Implementations of the Neighborhood Scale

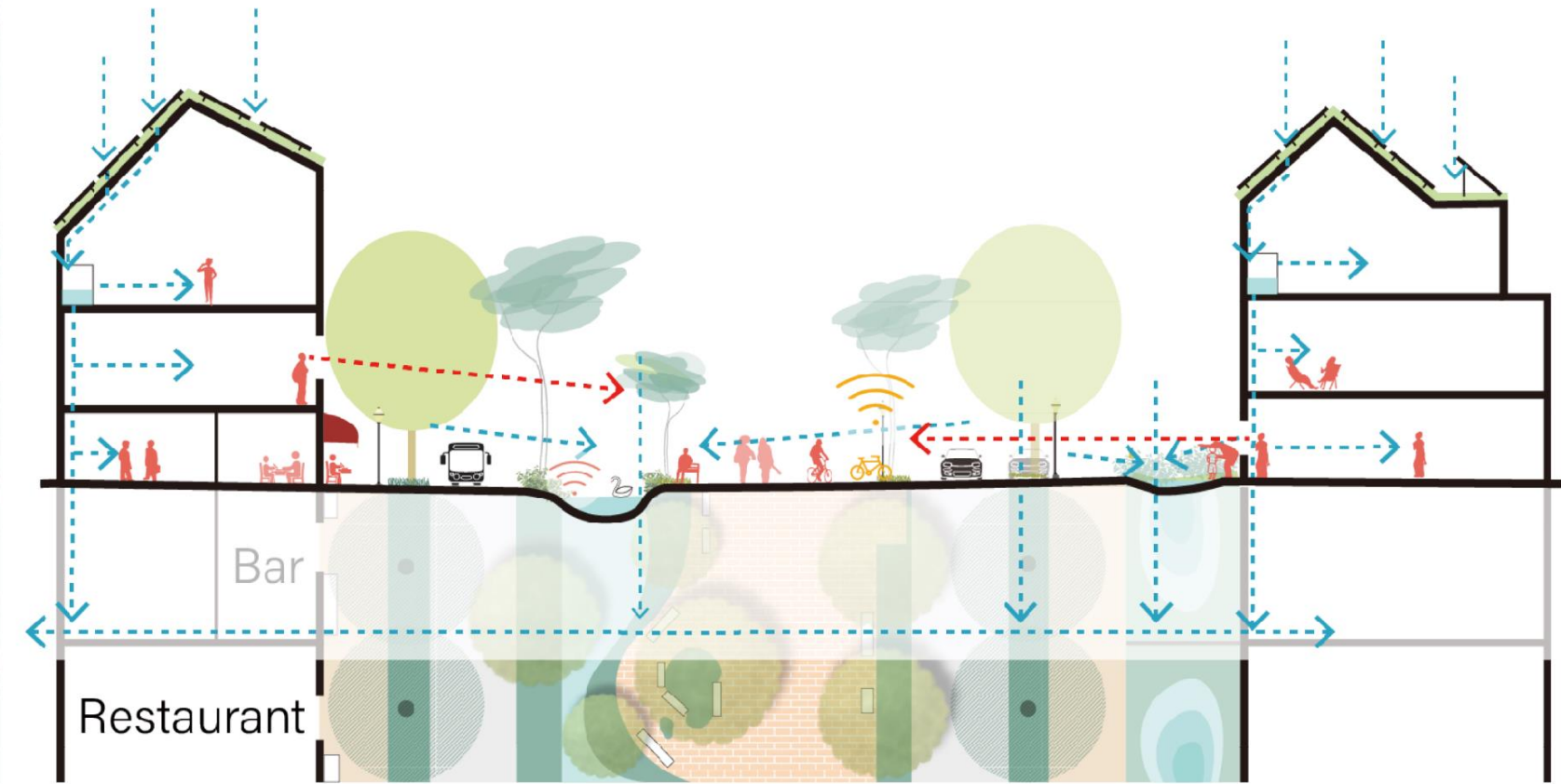


City Skeleton



**plan:**

Establish a regional leisure chain to expand the advantages and involve more stakeholders in the pursuit of more leisure opportunities and related benefits.

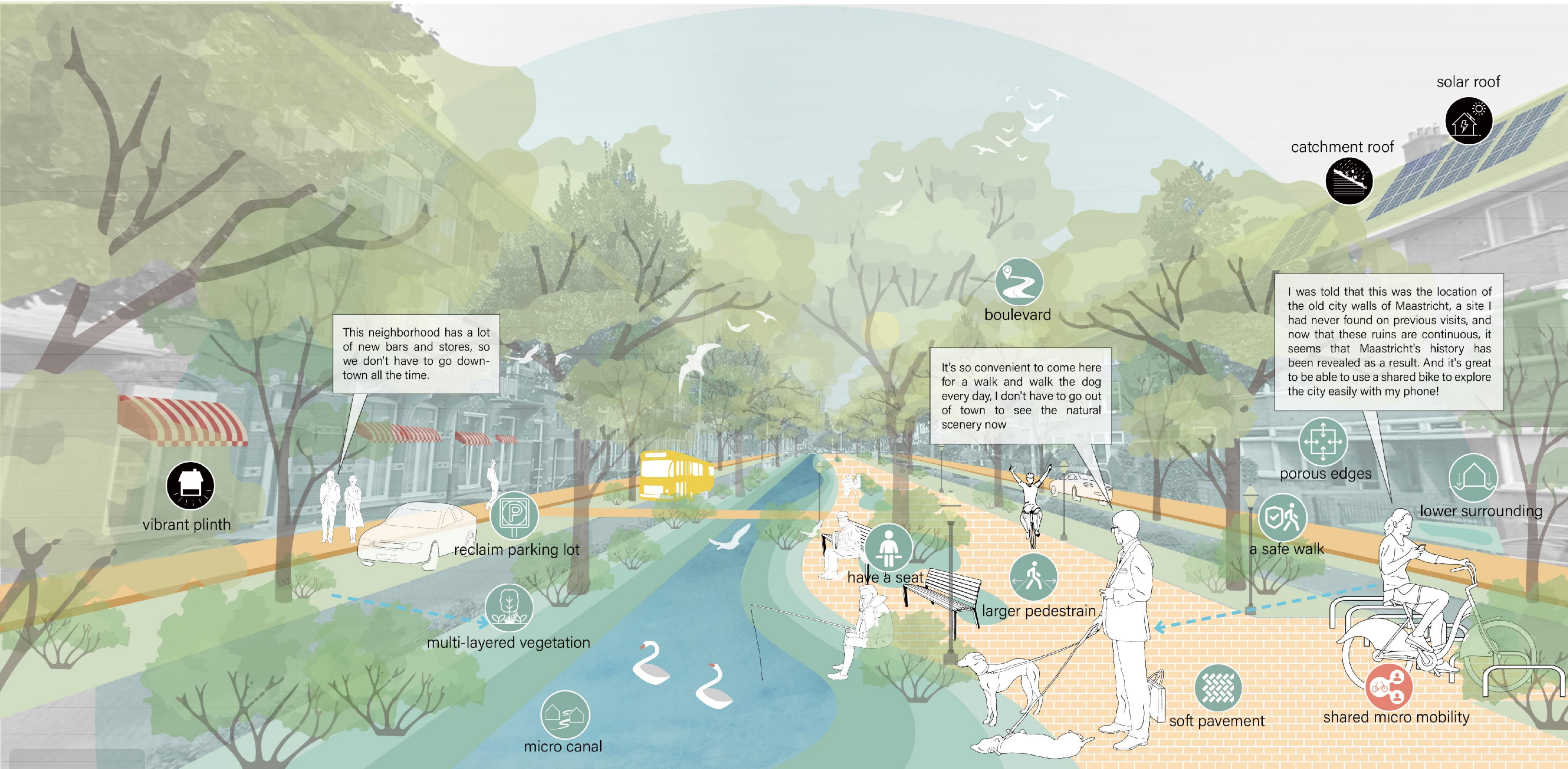


Section AA' 1:300



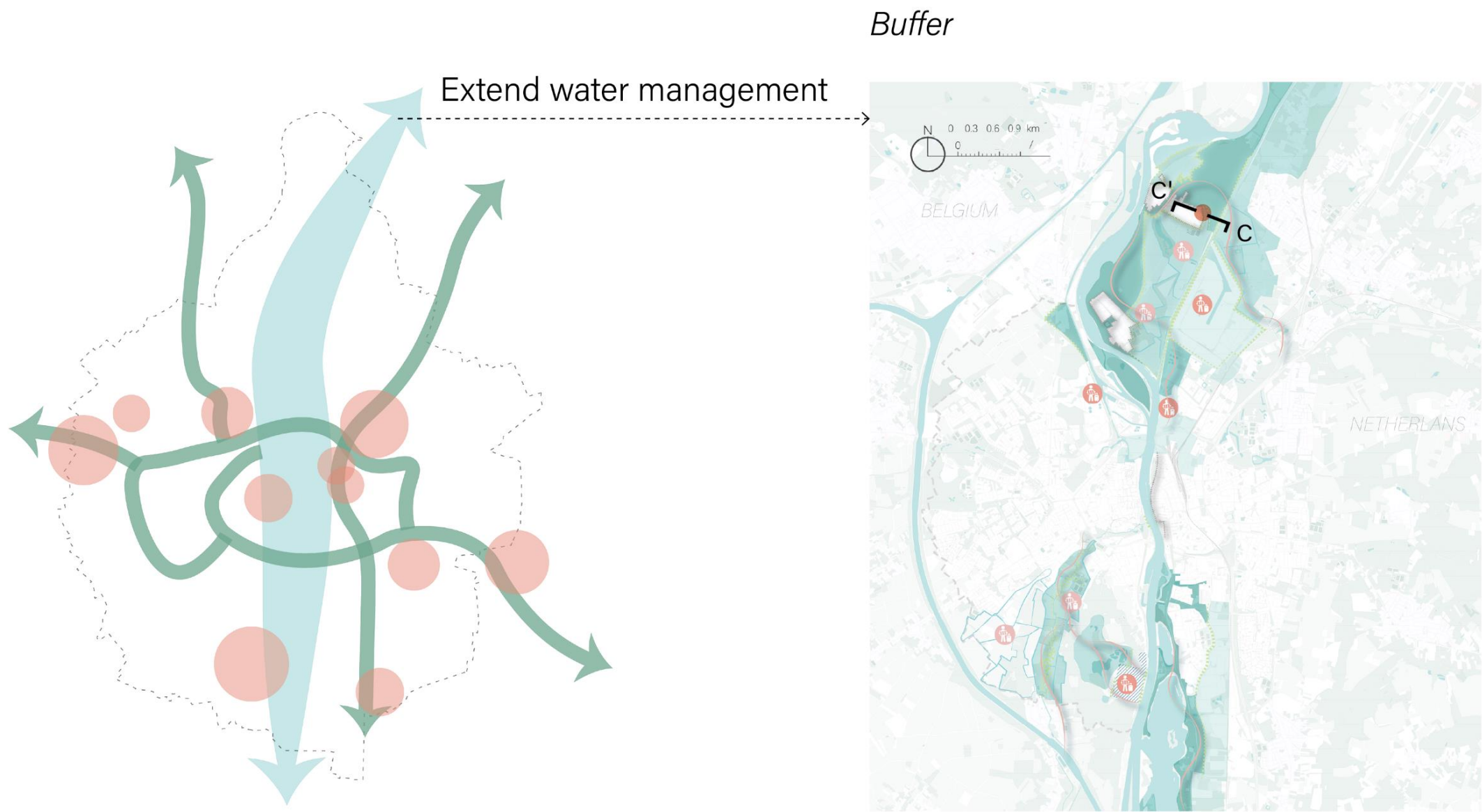






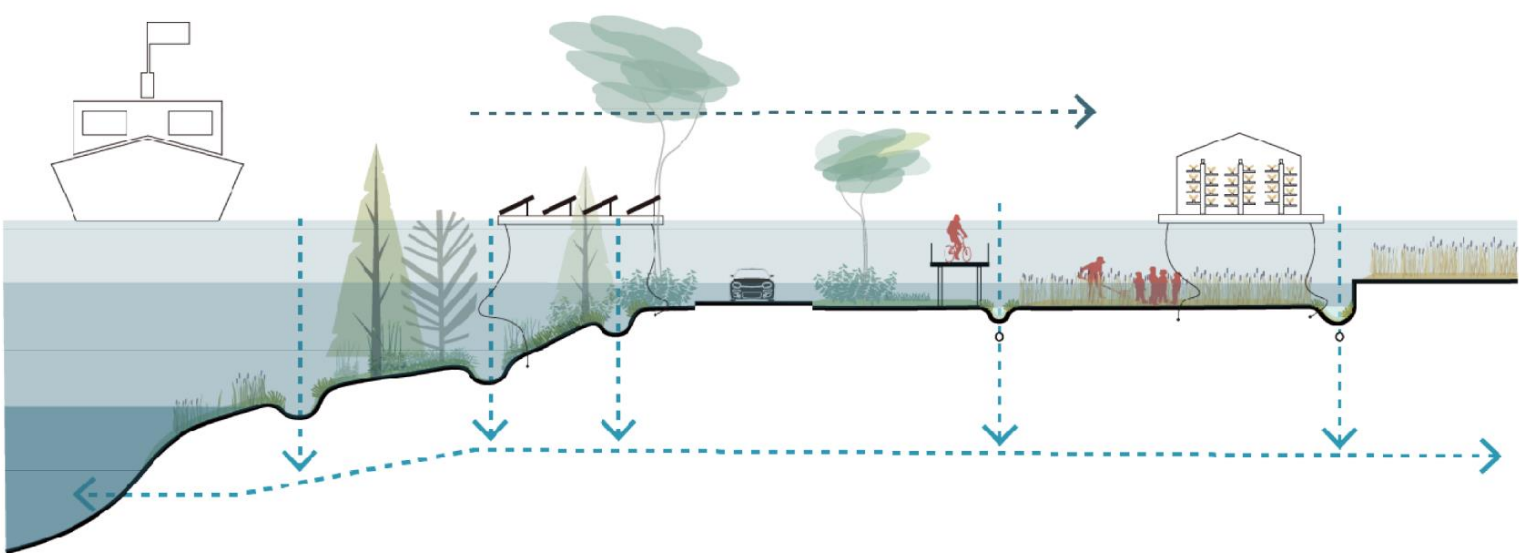


# Integrated Implementations of the Neighborhood Scale



**plan:**

Stabilizing the water level of the Maas River in different seasons to ensure navigation.

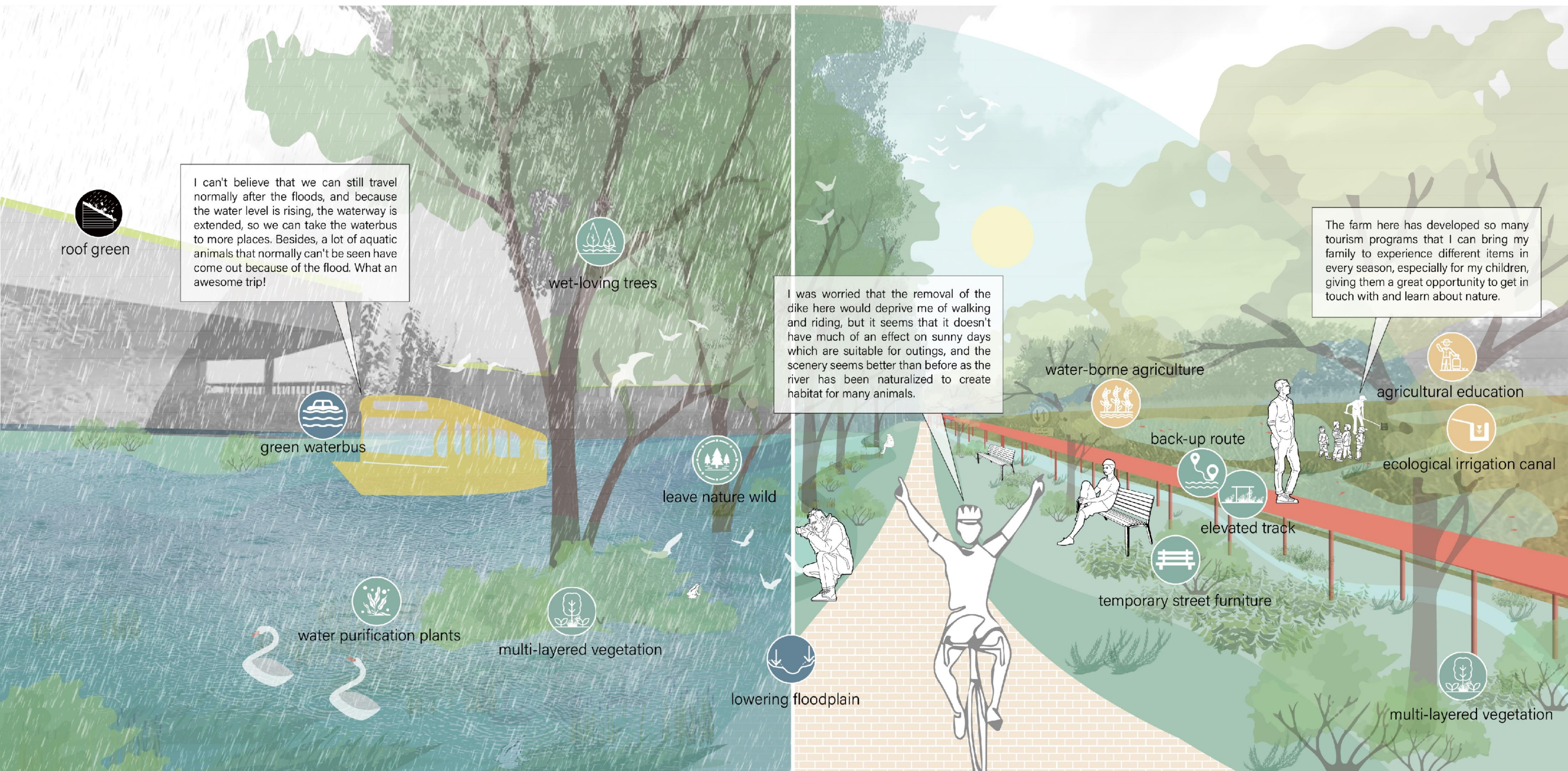


Section CC' 1:300









I can't believe that we can still travel normally after the floods, and because the water level is rising, the waterway is extended, so we can take the waterbus to more places. Besides, a lot of aquatic animals that normally can't be seen have come out because of the flood. What an awesome trip!

I was worried that the removal of the dike here would deprive me of walking and riding, but it seems that it doesn't have much of an effect on sunny days which are suitable for outings, and the scenery seems better than before as the river has been naturalized to create habitat for many animals.

The farm here has developed so many tourism programs that I can bring my family to experience different items in every season, especially for my children, giving them a great opportunity to get in touch with and learn about nature.

roof green

green waterbus

wet-loving trees

leave nature wild

water purification plants

multi-layered vegetation

lowering floodplain

water-borne agriculture

back-up route

elevated track

temporary street furniture

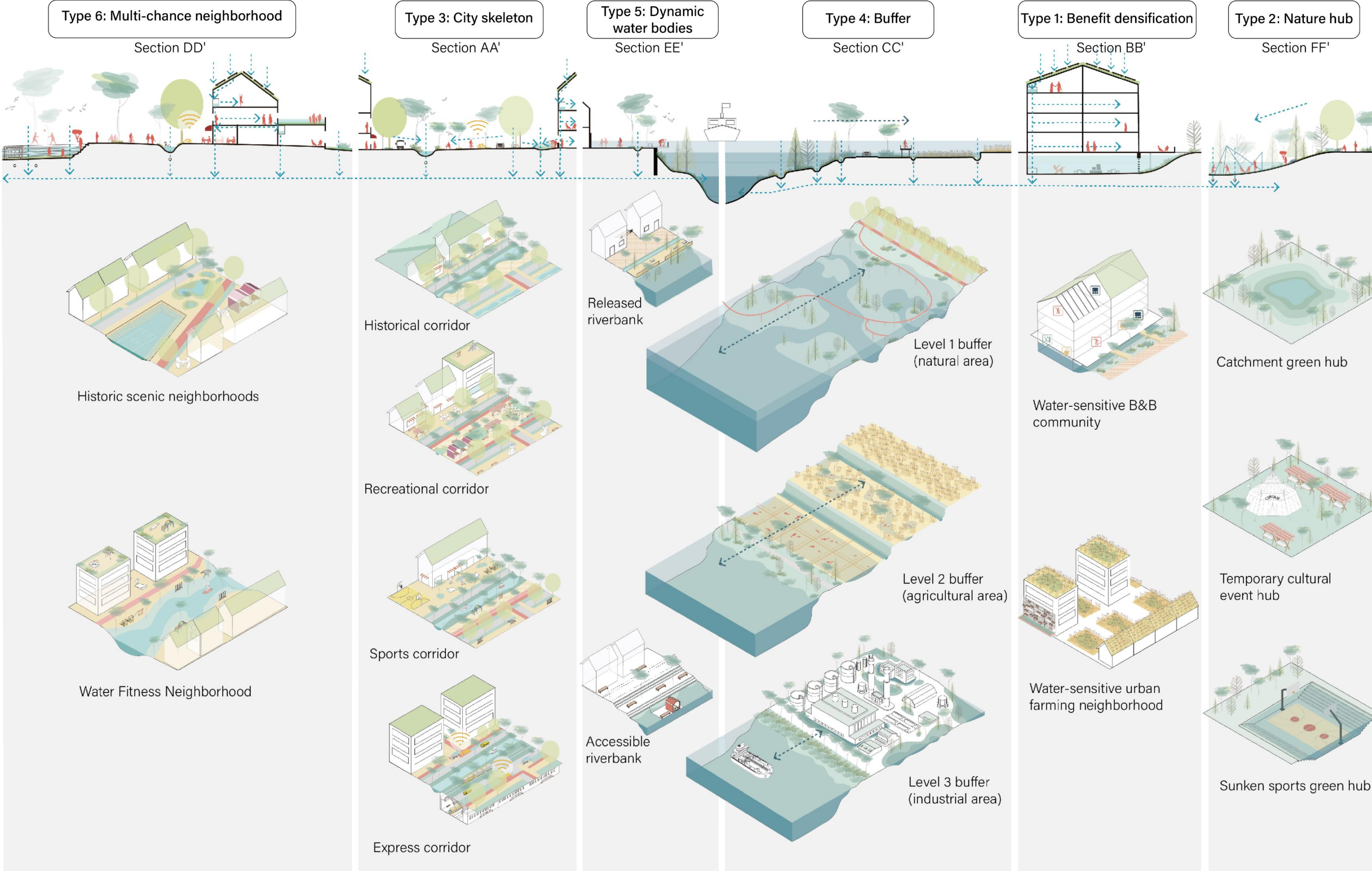
agricultural education

ecological irrigation canal

multi-layered vegetation

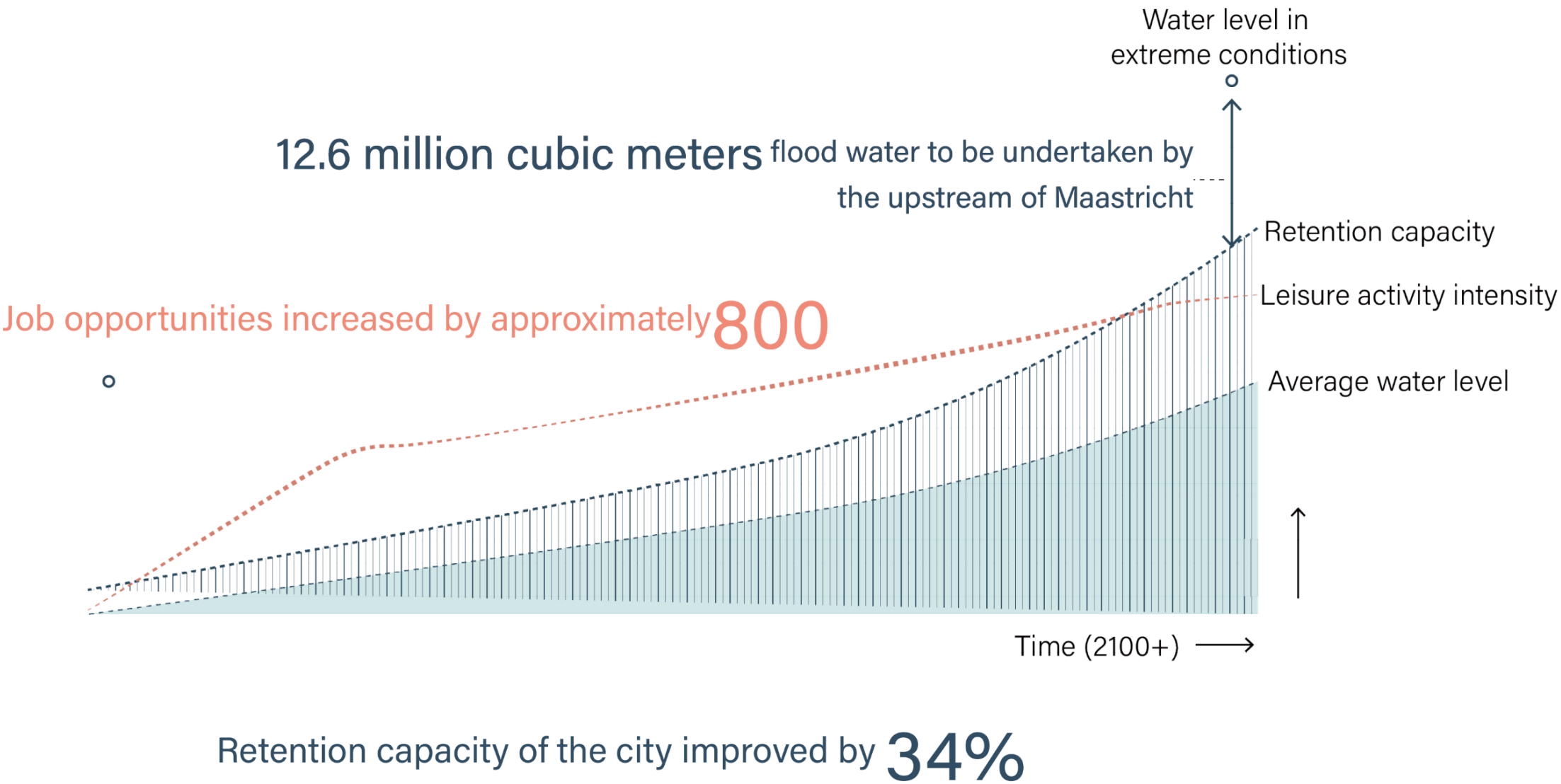
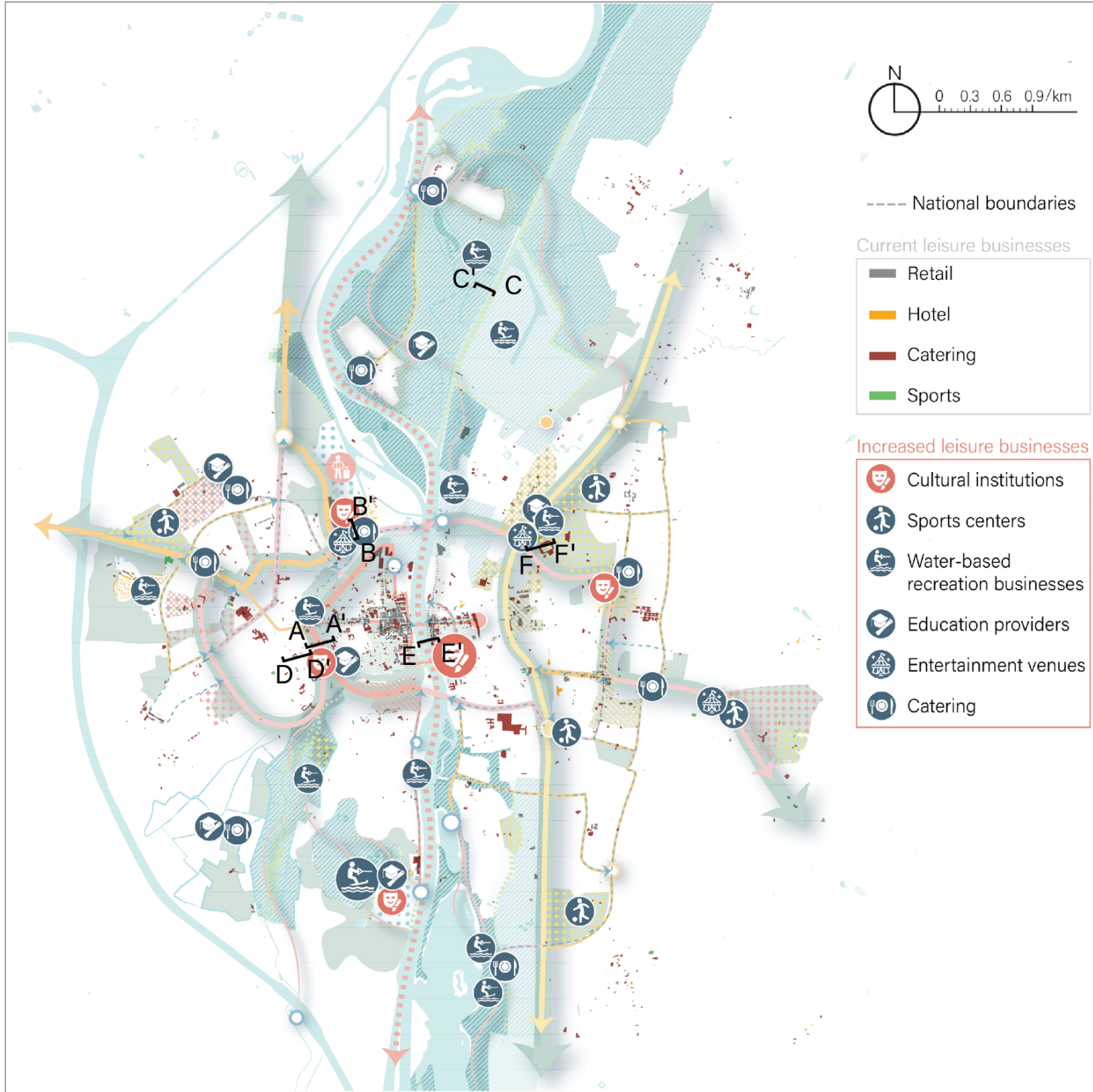


# System Performance of the Flowing Culture City



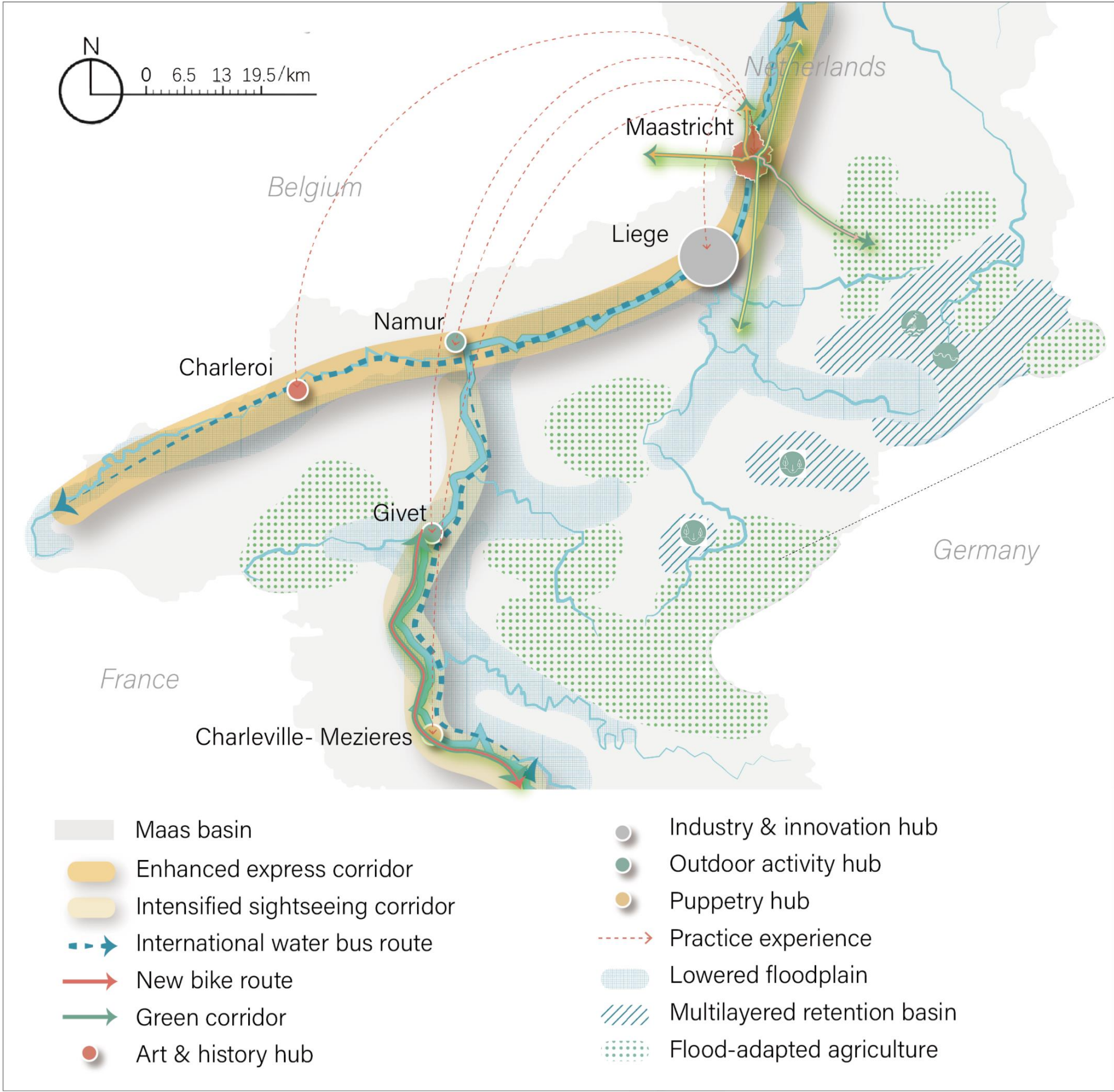


# System Performance of the Flowing Culture City

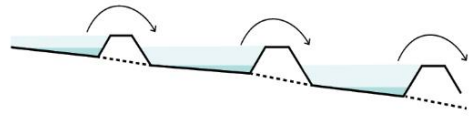




# Connectivity of Maas River Basin



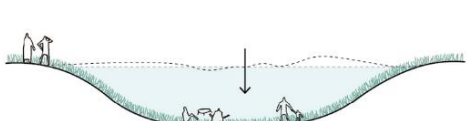
S4.5 MULTILAYERED RETENTION BASIN



S4.7 FLOODABLE WETLAND



S9.2 SINKING GREEN SPACE

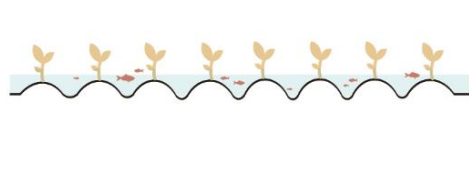


S7 FLOOD-ADAPTED AGRICULTURE

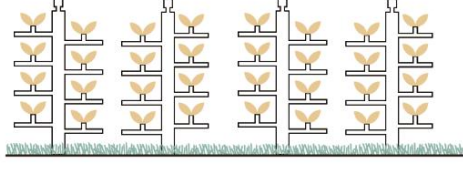
S7.1 FLOATING GREENHOUSE



S7.2 WATER-BORNE AGRICULTURE



S7.3 HYDROPONIC VERTICAL FARMING



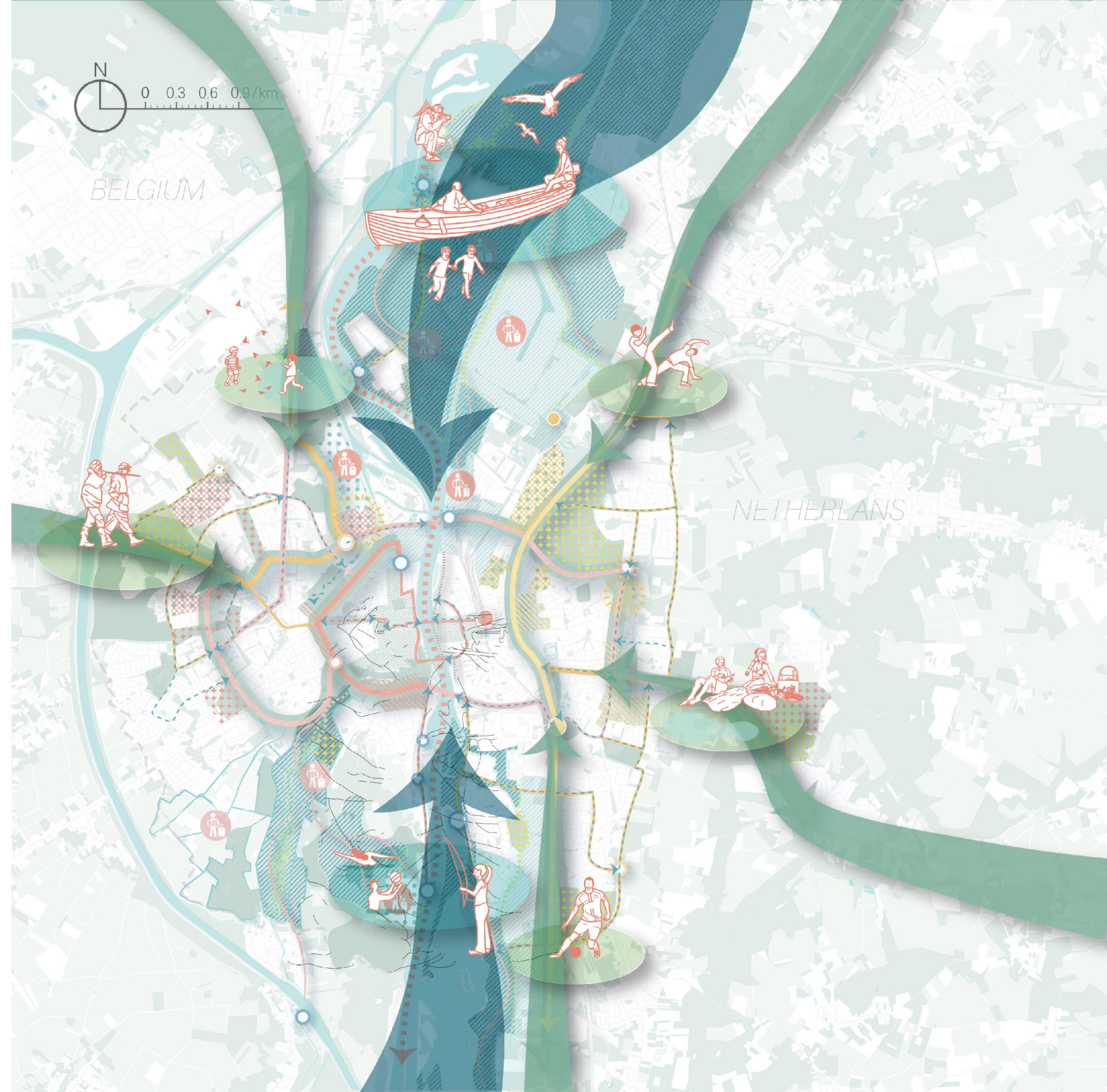
- City-to-City Connectivity
- Urban-Suburban Connectivity



# Connectivity of Maas River Basin

*the Benefits of Regional Connectivity for the City*

- **Stabilize the water level** of the Maas River to **ensure navigability** and reduce flood risk
- Promote **ecological circulation** and **leisure activities** in the suburban interface





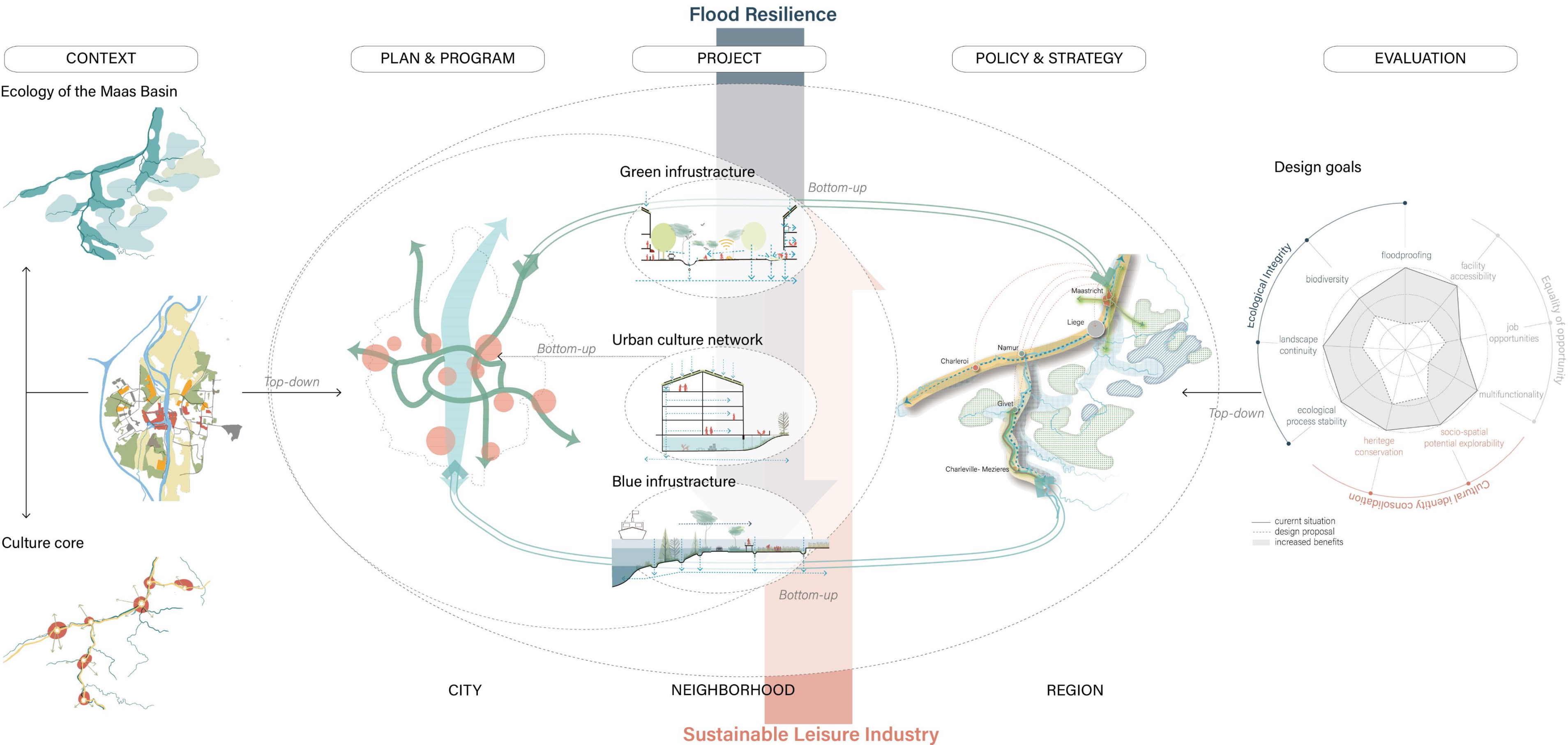
PART  
05

# Conclusion & Reflection



# Integrated Design Models

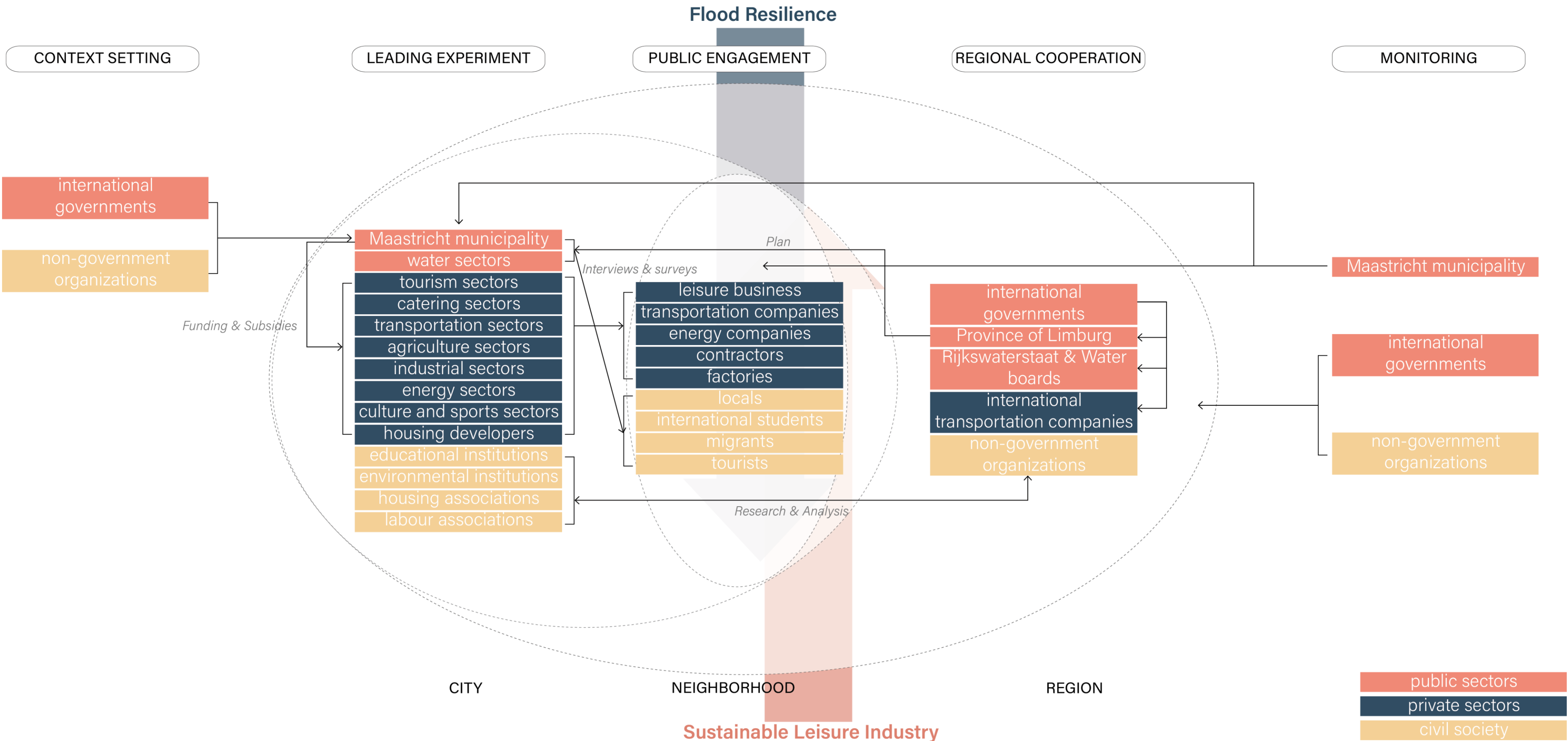
## Spatial Strategies





# Integrated Design Models

## Governance Collaboration





# Transferability

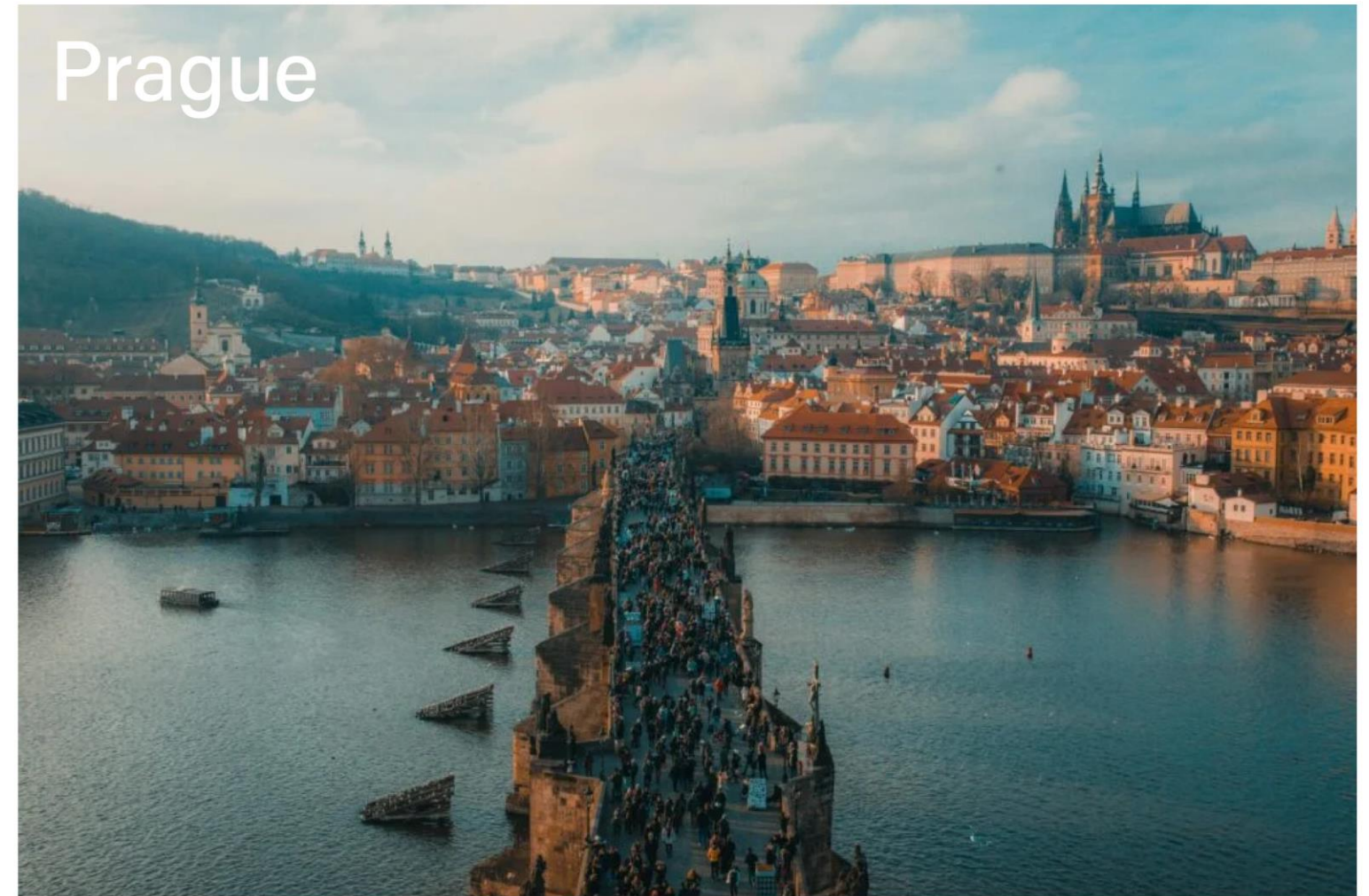
## *Transferable Aspects*

- Similar environmental context
- Shared urban development goals
- Knowledge exchange
- Collaboration and learning networks

## *Non-transferable Aspects*

- Adaptation to local contexts

Prague



Florence







*"You can't stop the waves, but you can learn to surf."*

-Jon Kabat-Zinn

Source: Rob Mulholland (2013)



# Thank you for listening!

Integrated urban transformation for river flood resilience and sustainable leisure industry in the city of Maastricht

Danyi Xiang 5465036, P5 Presentation  
1st Mentor: Claudiu Forgaci  
2nd Mentor: Diego Andres Sepulveda Carmona

