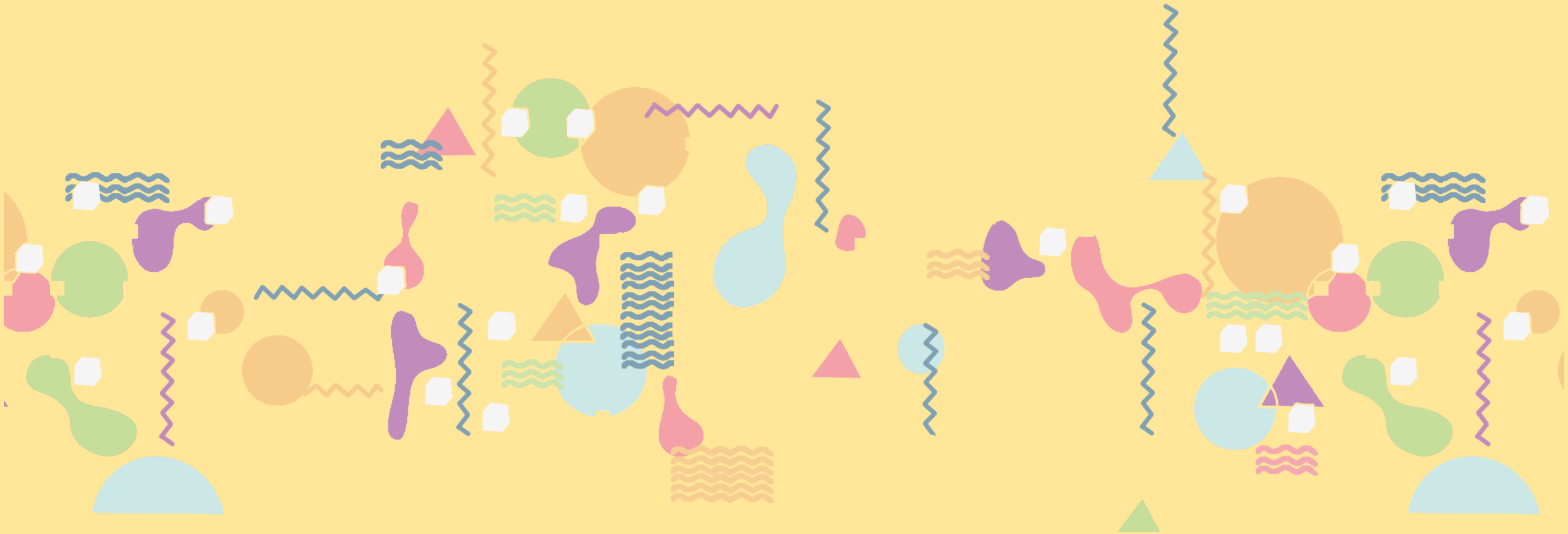


BIODIVERSE. RESILIENT. PLAYSCAPE.

Design of an ecological TU Delft campus which is adaptable to climate change through playful design.

Liaw Suxin
P5 25th June 2021 | Graduation Lab AR3U100
Flowscapes: Urban Ecology & Eco-cities

First Mentor: Nico Tillie
Second mentor: Andy van den Dobbelsteen

1
Introduction

Fascination

2
Defining

Problem
Research question
Sub-question and approach
Theory
Framework

3
Analyse

Understanding TUD
Challenges and opportunities

4
Explore

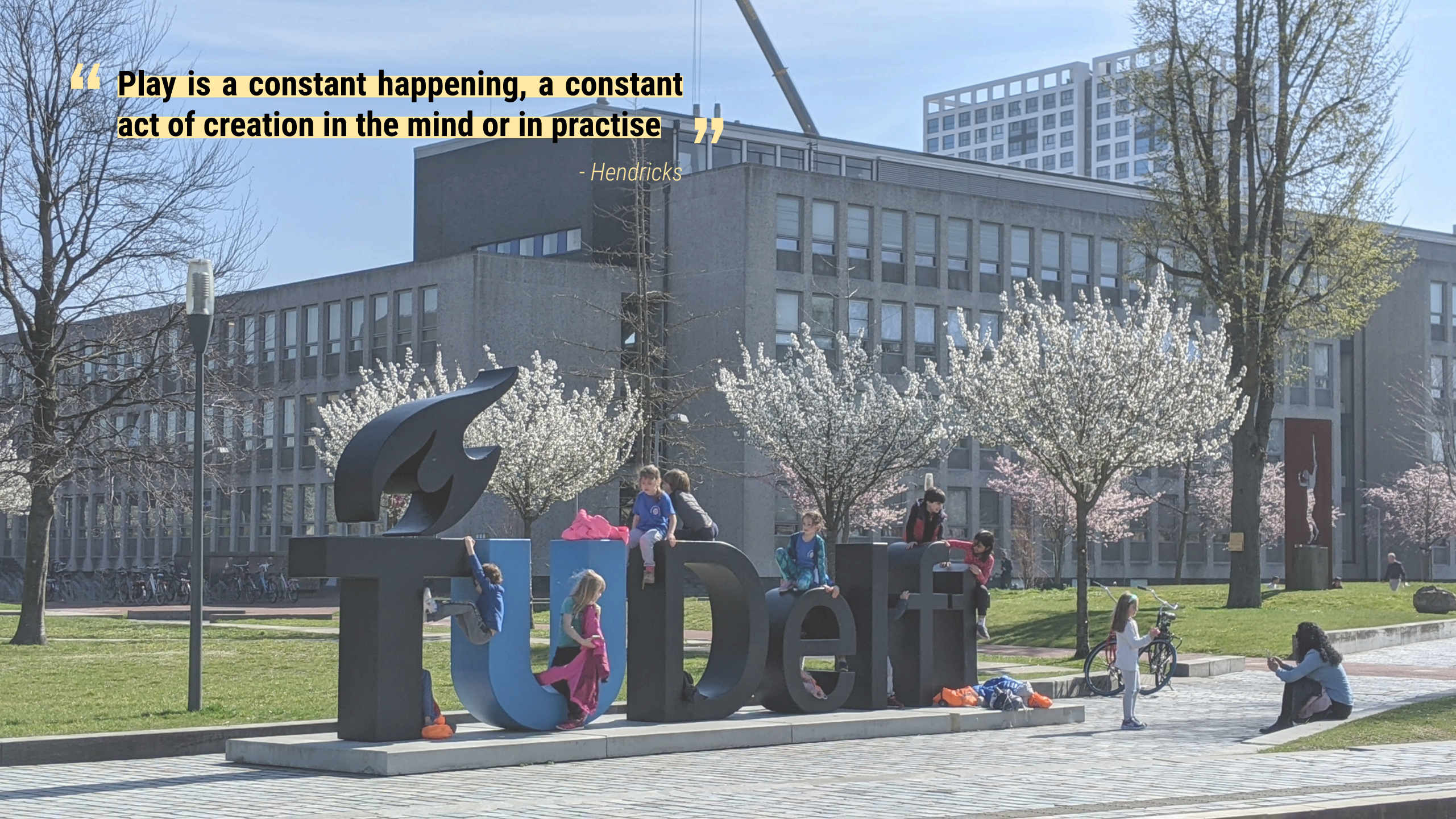
Regional vision design
Campus masterplan design
Site design

5
Conclusion

Reflection
Next step

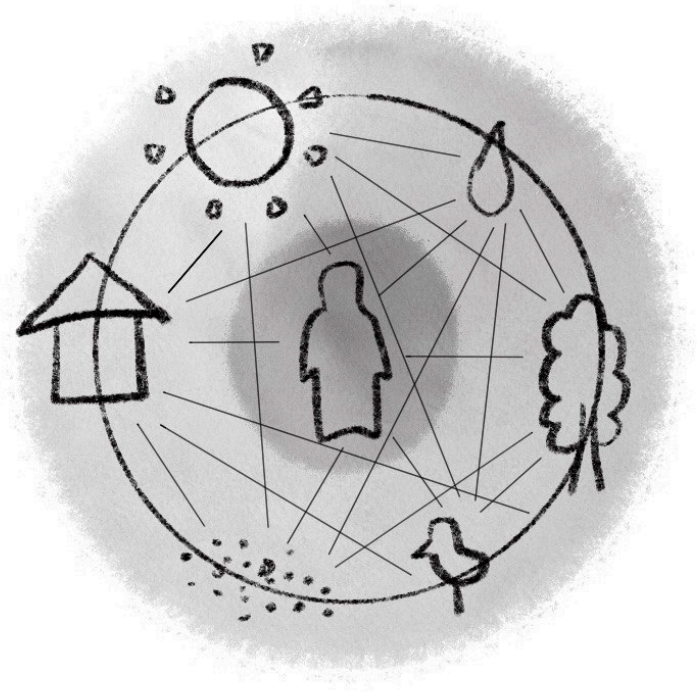
Design by Research

Research by Design


“Play is a constant happening, a constant act of creation in the mind or in practise”
- Hendricks


“Play is a natural instinct for humans”
-Huizinga

Play
play is for all



1.PLAYFUL HUMANS

A playful human interacts with his environment through his own interpretative manner that activate his 5 senses or curiosity.

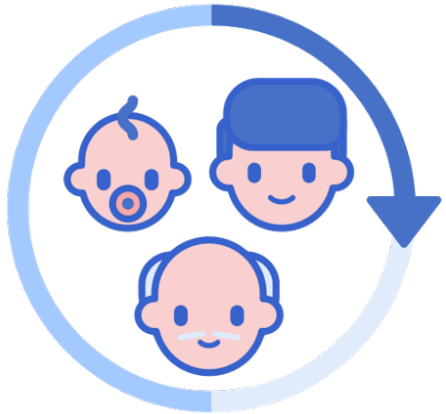
2.PLAYFUL LANDSCAPE

A playful landscape evokes a playful human by crafting a stimulating interaction experience with man.

3.PLAYFUL CITY

A playful cities rethink the relationship of its building blocks.

Benefits of Play
fascination



PLAY IS FOR ALL AGES

health benefit

stress relief, well-being, happiness

social interaction

psychomotor skills

affective abilities

cognitive abilitie

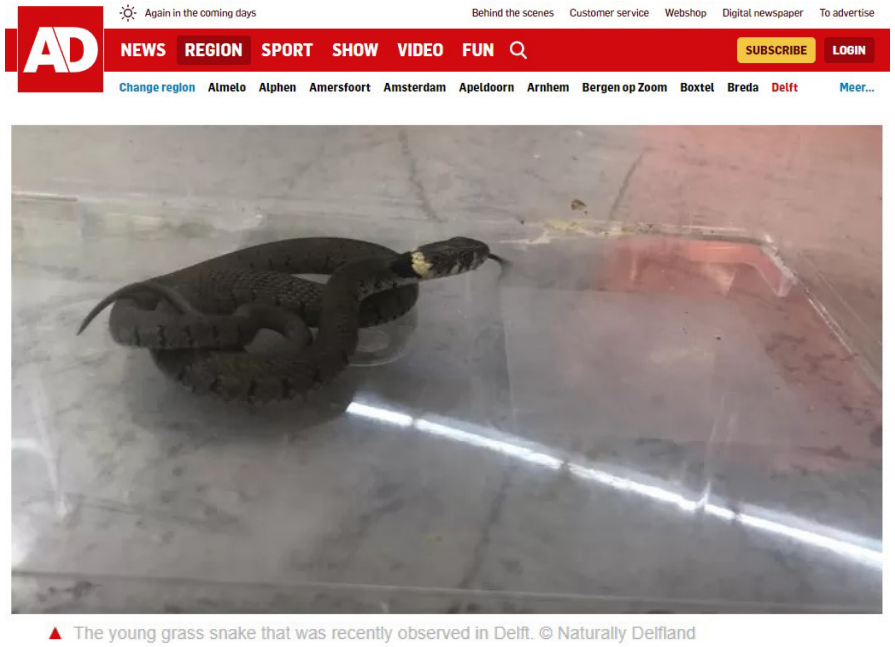
2

Defining

Problem
Research question
Sub-question and approach
Theory
Framework

Biodiversity in The Netherlands and Delft

problem: declining biodiversity



▲ The young grass snake that was recently observed in Delft. © Naturally Delfland

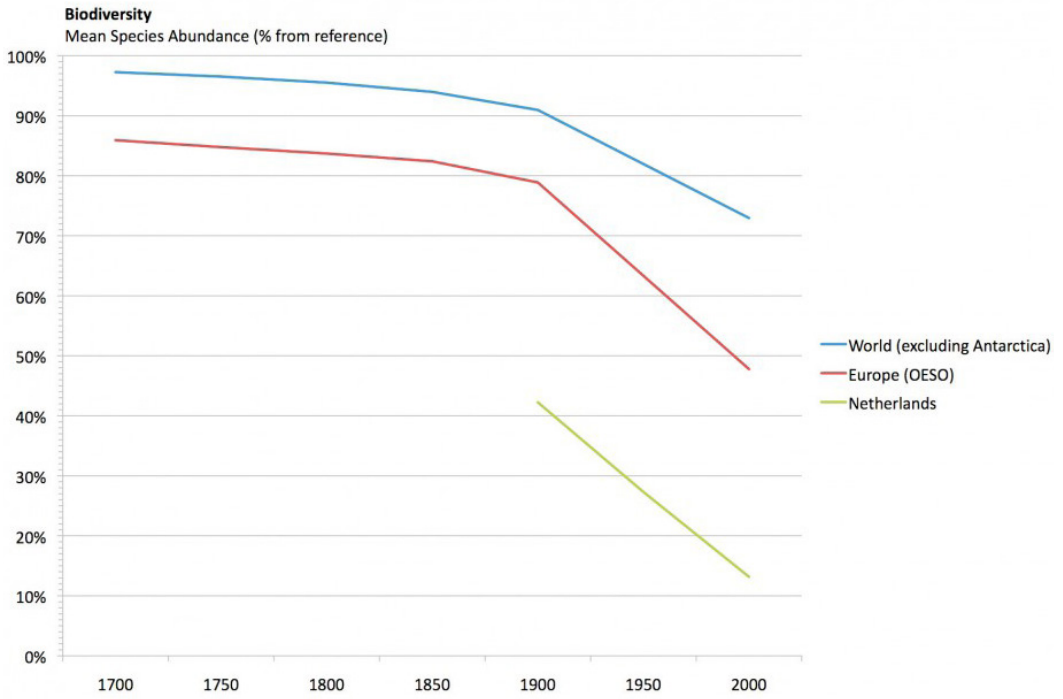
Sensational news: after fifty years, the grass snake is back in Delft

The swampy low moor area in Delft and its surroundings has long been the natural habitat of the grass snake. So did the beaver and the otter, two other endangered animals that have been retreating in recent decades. "The intensification of agriculture was the main cause," says Van Poelgeest. "As a result, the water level was lowered. And due to the intensive mowing, the grass snakes no longer found a place to lay their eggs. They made heaps of dredge and horse manure, but these were often destroyed by the agricultural machinery. "

Carel van der Velden 11/13/20, 16:19 **Last update:** 11/13/20, 5:26 PM

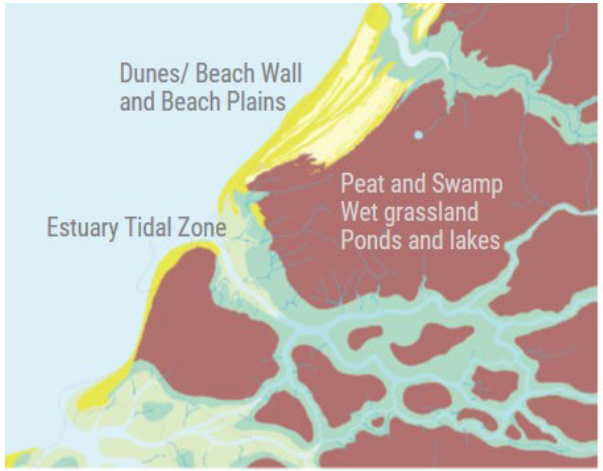
otter

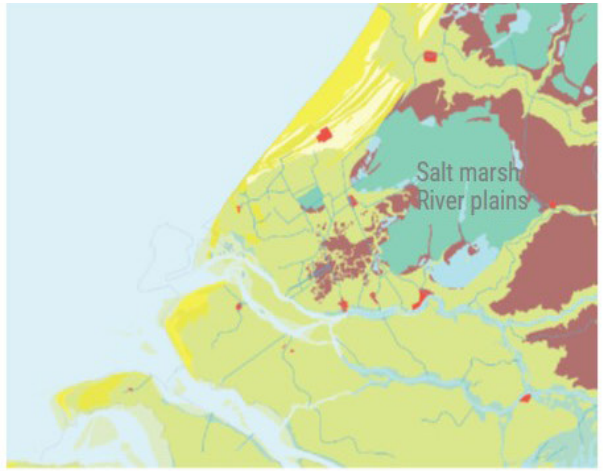
beaver

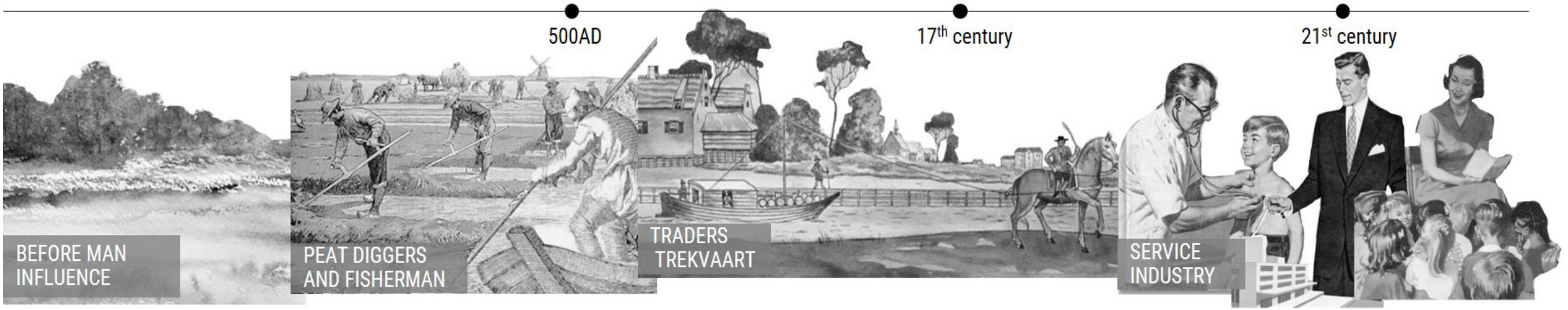


Development of landscape

problem: weakening relationship between man and environment

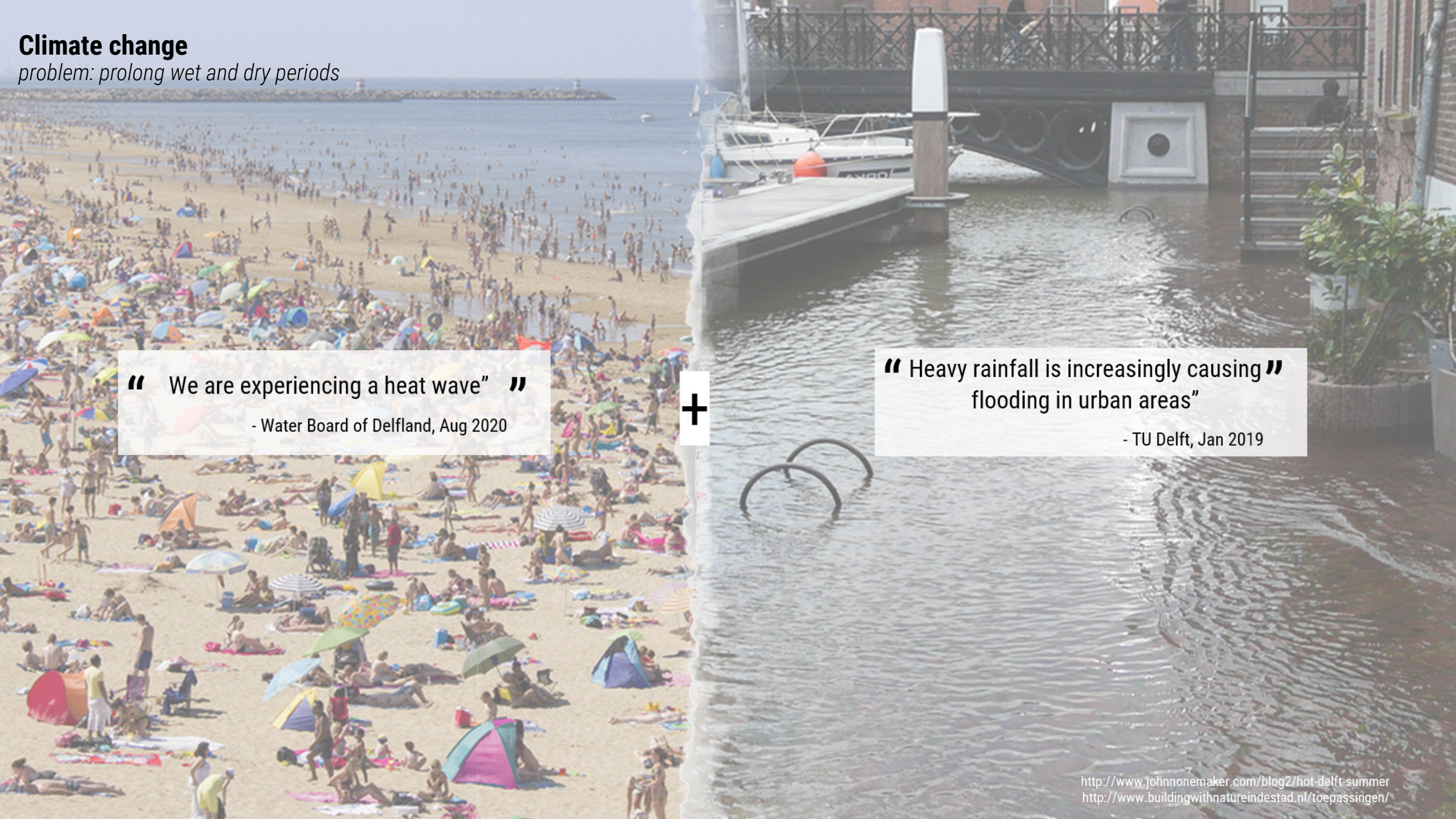






Climate change

problem: prolong wet and dry periods



“ We are experiencing a heat wave” ”

- Water Board of Delfland, Aug 2020

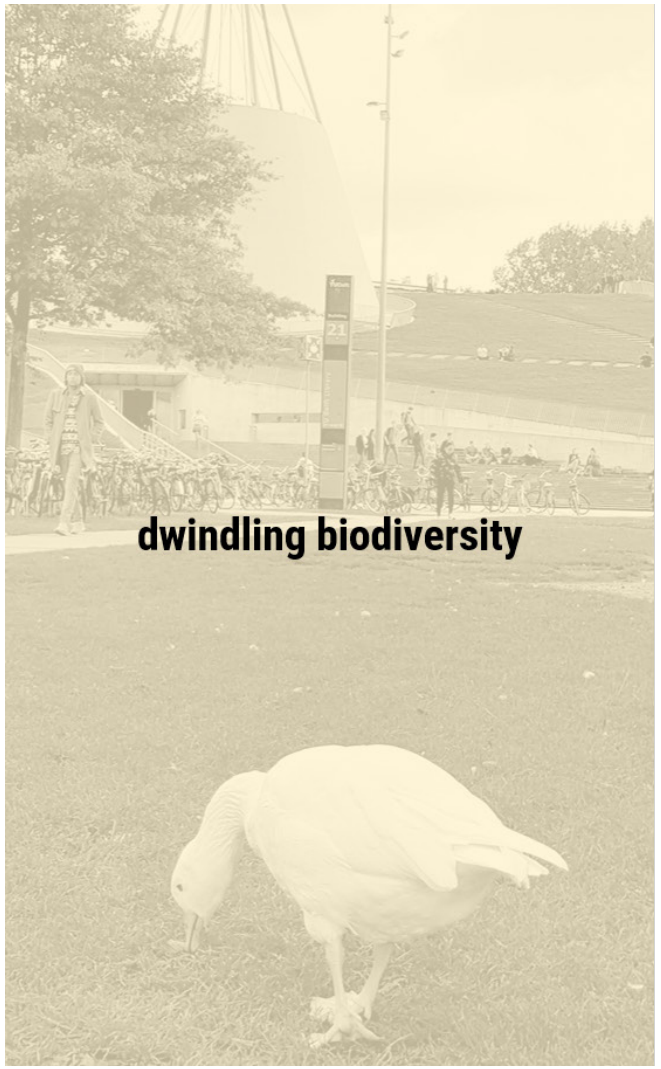
+

“ Heavy rainfall is increasingly causing ” flooding in urban areas”

- TU Delft, Jan 2019

http://www.johnnonemaker.com/blog2/hot-delft-summer
http://www.buildingwithnatureindestad.nl/toepassingen/

Problems



https://www.tudelft.nl/en/sustainability/campus/biodiversity-on-campus/
https://humanityhouse.org/en/rampen-conflicten-nederland-watersnoodramp-1953/

Research Question

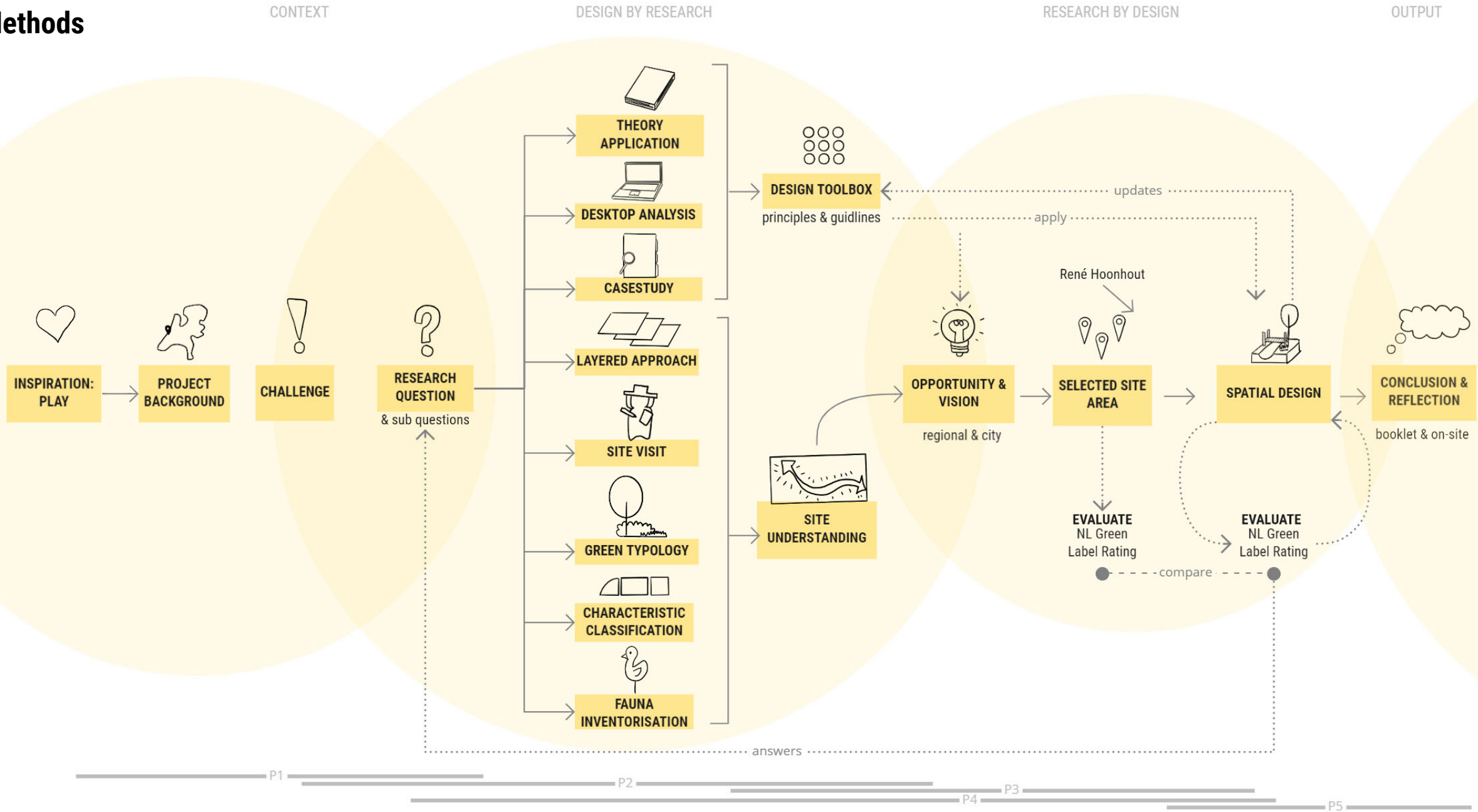
“What is a possible **spatial framework** to
(what)
create a **biodiverse**, **climate resilient TU**
(what)
Delft campus using **‘playful’ design**?”
(where) (how)

Sub-question
and approach

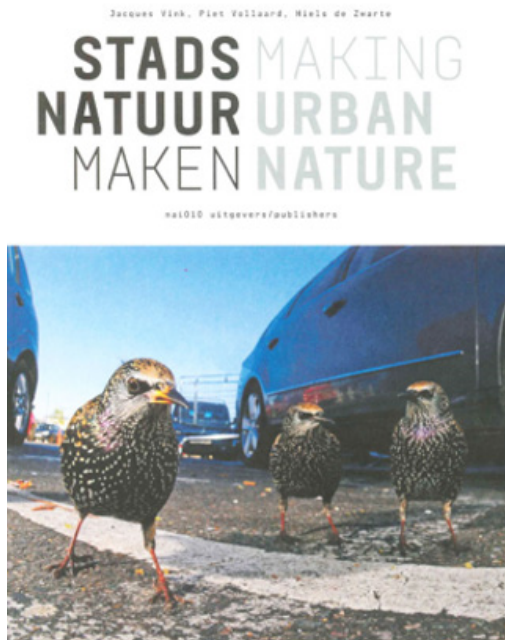
> “What is a possible **spatial** (what) **framework** to create a **biodiverse, climate resilient** (what) **TU Delft campus** (where) using **‘playful’ design**? (how)”

SUB QUESTION	METHOD	APPROACH
1. What are the **principles/ theories** concerning resilience and biodiversity?	Literature review and research to formulate guiding principles	• Importance of urban ecology and ecosystem services, (Stads Natuur Maken) • Matrix-Patch-Corridor Theory (Forman, 1995) • Ecological Resilience Theory, (Wu & Wu, 2013)
2. What is **play**? **Why** should we have ‘playful’ design?	Literature review and research to formulate guiding principles	• Literature review of Homo Ludens and Aldo van Eyck • Understand Urban Play design through journal of The playful city constructing a typology for urban design interventions, (Gabrielle Donoff & Rae Bridgman, 2017) • Manifesto for a Playful City (Carma Masson, n.d.) • Benefits of play (Gordon, 2014)
3. How can **‘playful’ design** bring about **biodiversity and climate resilience**?	Case study analysis and data inventorisation Research by design	• Case study of playful, ecological and resilient design • Form tool kit from the case studies • Classification of helophytes design based on spatial form types and 5 senses
4. What is the **current situation** in **TU Delft**?	Research Site Observation Data inventorisation Evaluation	• Readings to understand the historical context of Delft • Layered approach- Dirk Harmen Frieling • Macro regional scale mapping • Meso Delft city scale mapping • Flora and fauna inventorisation • Habitats • NL Green Label Scoring
5. How do we **apply** landscape architectural frameworks to TU Delft? How would a biodiverse, resilient and playful campus look like?	Scenario building Design experiment Feedback	• Research by design: Scenario-based design, Design through scale • Engage stakeholders

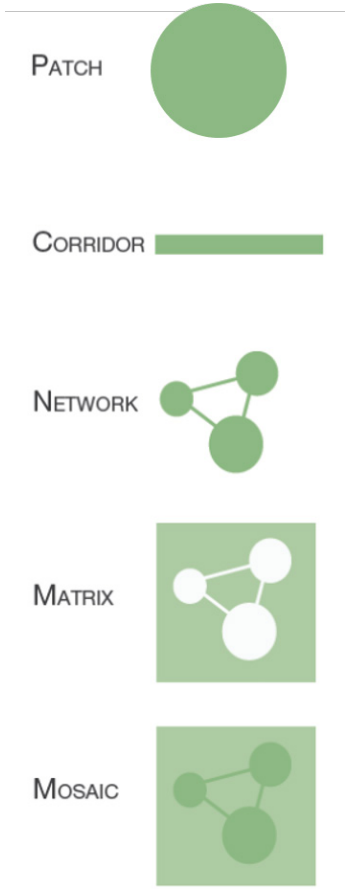
Methods


CONTEXT
DESIGN BY RESEARCH
RESEARCH BY DESIGN
OUTPUT
INSPIRATION: PLAY
PROJECT BACKGROUND
CHALLENGE
RESEARCH QUESTION
& sub questions
THEORY APPLICATION
DESKTOP ANALYSIS
CASESTUDY
LAYERED APPROACH
SITE VISIT
GREEN TYPOLOGY
CHARACTERISTIC CLASSIFICATION
FAUNA INVENTORISATION
DESIGN TOOLBOX
principles & guidlines
updates
apply
SITE UNDERSTANDING
OPPORTUNITY & VISION
regional & city
René Hoonhout
SELECTED SITE AREA
SPATIAL DESIGN
CONCLUSION & REFLECTION
booklet & on-site
EVALUATE
NL Green
Label Rating
EVALUATE
NL Green
Label Rating
compare
answers
P1
P2
P3
P4
P5

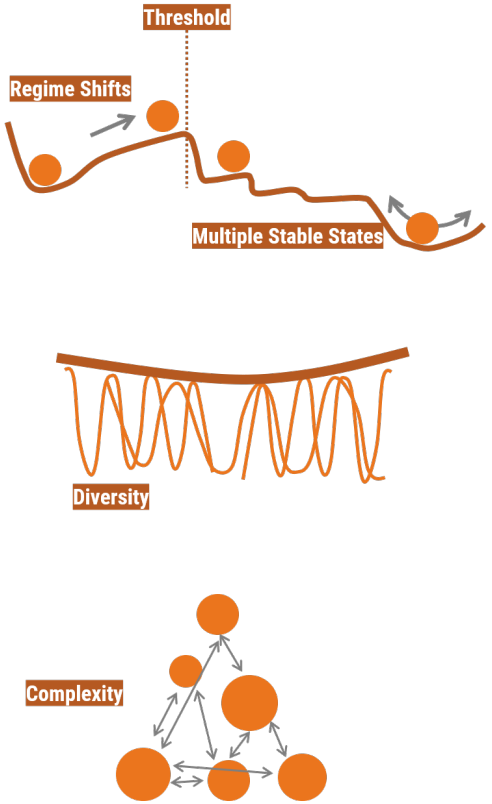
Theory
literature review



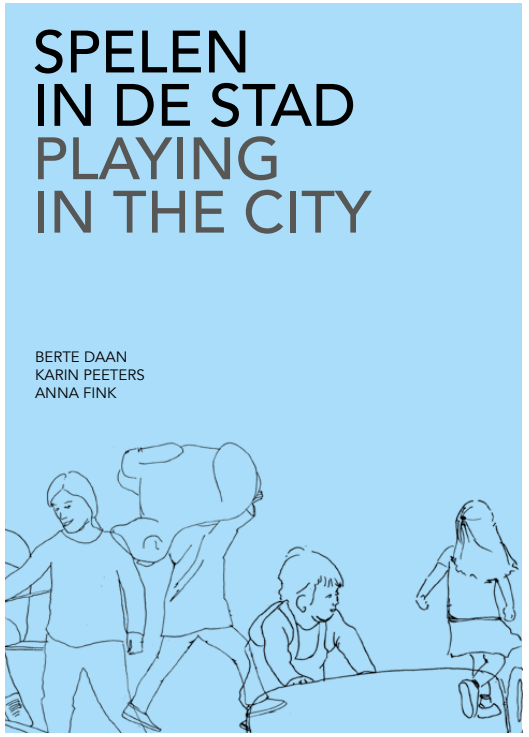
Theory 1- Urban Ecology and Ecosystem Services



Theory 2- Matrix-Patch-Corridor



Theory 3- Ecological Resilience



Theory 4- Exploratory Play and Affordance

Design toolbox
for application

1. Guideline

2. 5 Key Principles

3.Design Catalogue

4. Research by Design Experiments

Design toolbox
for application

1. Guideline

5 Key Principles

Design Catalogue

Research by Design Experiments

CLARIFY MOTIVATION	- State inspiration and have a supporting ideal image visualisation
UNDERSTANDING CURRENT SITUATION	- **Landscape historical development.** Mapping the evolution of the greater region (Hague-Rotterdam region) to understand the changes in landscape type and the human relation to their surroundings. - **Site historical development.** Mapping the history of site (TU Delft) to understand the significant moments that shaped the campus to what it is today. - **Layered approach** on (Delft) city level and (campus) site level. Understand the workings of different components: Historic alignment, historic creek feature, soil type, transit mobility, built structure, green structure, water management - **Mapping Ecology (environment)** Landscape types & habitat mapping in the regional and city scale. To identify existing habitats and potential network connection. Mapping of different green types and trees in the site to have a richer understanding of the green infrastructure in site. - **Mapping Ecology (species)** Inventorisation of 20 fauna species, their habitat types and food web for selected species. - **Site typology**: Landscape characteristics classification of site. To simplify the site into a set of main features - **Categorisation of built environment.** Evaluation of buildings in (campus) site based on their contribution to green and blue structure - **Mapping of spatial quality and experience.** To understand how people interact with their environment. - **Creating design principles & toolbox.** The design principles are generated from case studies and literature reviews. The toolbox is a set of spatial design from small to regional scale influenced by the different typologies of the site. - **NL Green Label rating** of a selected area. To identify areas for improvement.
SYNTHESISING CURRENT SITUATION	- Map out the opportunities and challenges of the site
GOAL AND VISION SETTING	- Selection of **opportunities and challenges** to work on - State **vision** for the broader context and also the aim of project
DESIGNING	- **Vision mapping exploration** for regional scale and campus with consideration of design principles - **Scenario-based design exploration** (diverging) by prioritising certain design principles. Choose and refine an overall masterplan. - **Selected site area and engagement of stakeholders**. Specific area in the campus is identified with stakeholder, Rene Hoonhout the Green Manager of TU delft. - **Consideration of site specificity.** React to the abiotic and biotic factors on site. - **Application of design principles & toolbox** and appropriate **iteration.** - **Resilience evaluation**. Evaluation of ability to cope with extreme heat and water stress. Explained with flow diagrams and plans. - Consider the **4Vs for ecology**: voedsel, veiligheid, voortplanting, variatie (food, safety, breeding, variety). - **Use natural and existing materials onsite** for design to activate the five senses. - **Get users response**. To understand if design creates a ludic and stimulating environment, get users input through design implementation and observation and if not possible, a survey using before and after images. - **NL Green Label rating**. Evaluate performance of design intervention

Design toolbox
for application

Guideline

2. 5 Key Principles

Design Catalogue

Research by Design Experiments

INTERCONNECTEDNESS
-Increasing patch area and corridor network
-Habitats of differest sizes and types
-Different forms of connection- stepping stones, tree line, narrow stretched habitat
-Respond to surrounding landscape or draw inspiration from the past

INCLUSIVE
-Accomodate other species, especially local ecology
-Provide for their needs (food, shelter, and nesting place)
-Reduce threats (eg. bird-safe windows)
-Consider the biotic and abiotic factors
-Capitalise on opporunities to integrate species into urban fabric (eg. depaving)
-Multi-functional urban infrastructure (building, streets, poles)
-Allow natural development and succession

ADAPTABILITY
-Mutiple stable states
-Sponge concept (store, filter, release)
-Climate resilient species
-Scenarios for different time frame
-Make use of ecosystem services to clean water
-Redundance/ Capacity for change/ adaptive capacity to accommodate disruptions
- Diversity builds resilience. Diversify choice of plant species and for larger areas, types of ecosystems.

GRADIENTS
-Intermediate disturbance theory
-Expand range of possible conditions
-Between habitat types
-Layered vegetation structure

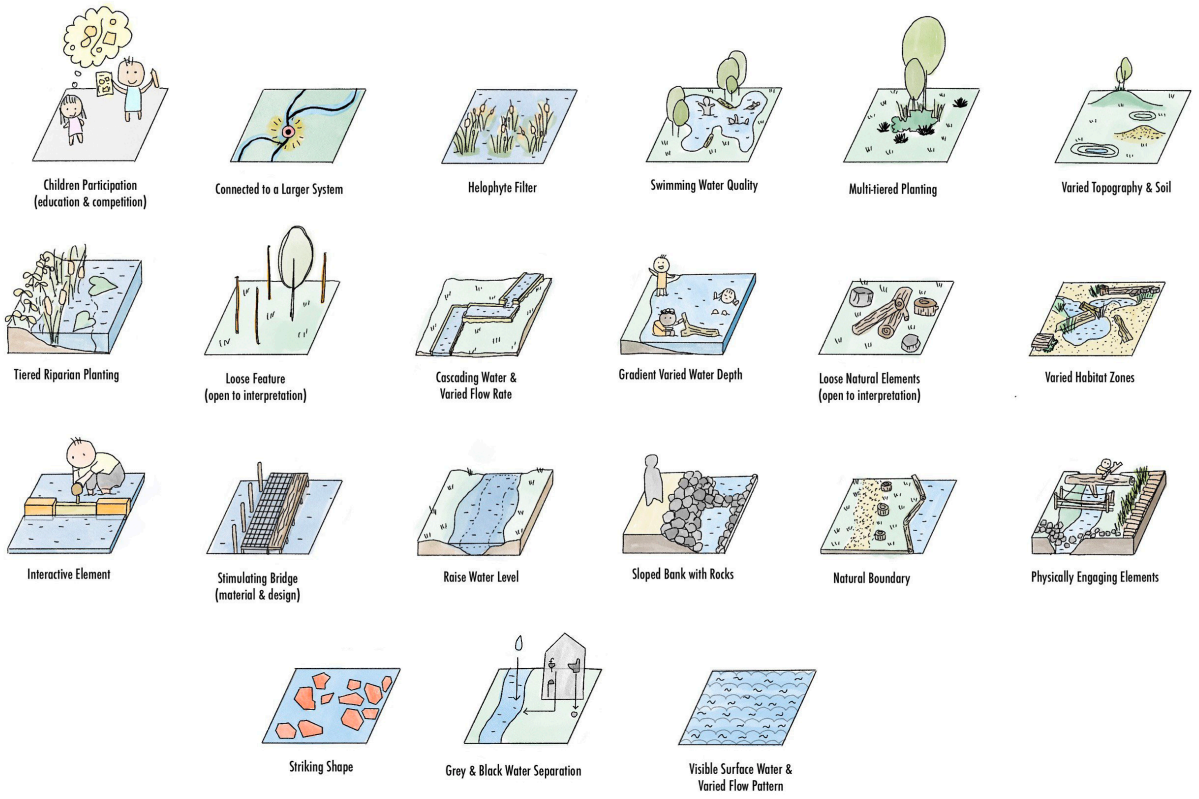
PROVOCATIVE AFFORDANCE
-Afforfance, strip down to basic quality, opportunity for action
-5 senses, provocative
-Experiential, vertigo
-New perspective, provides a frame for landscape process

Design toolbox
for application

Guideline

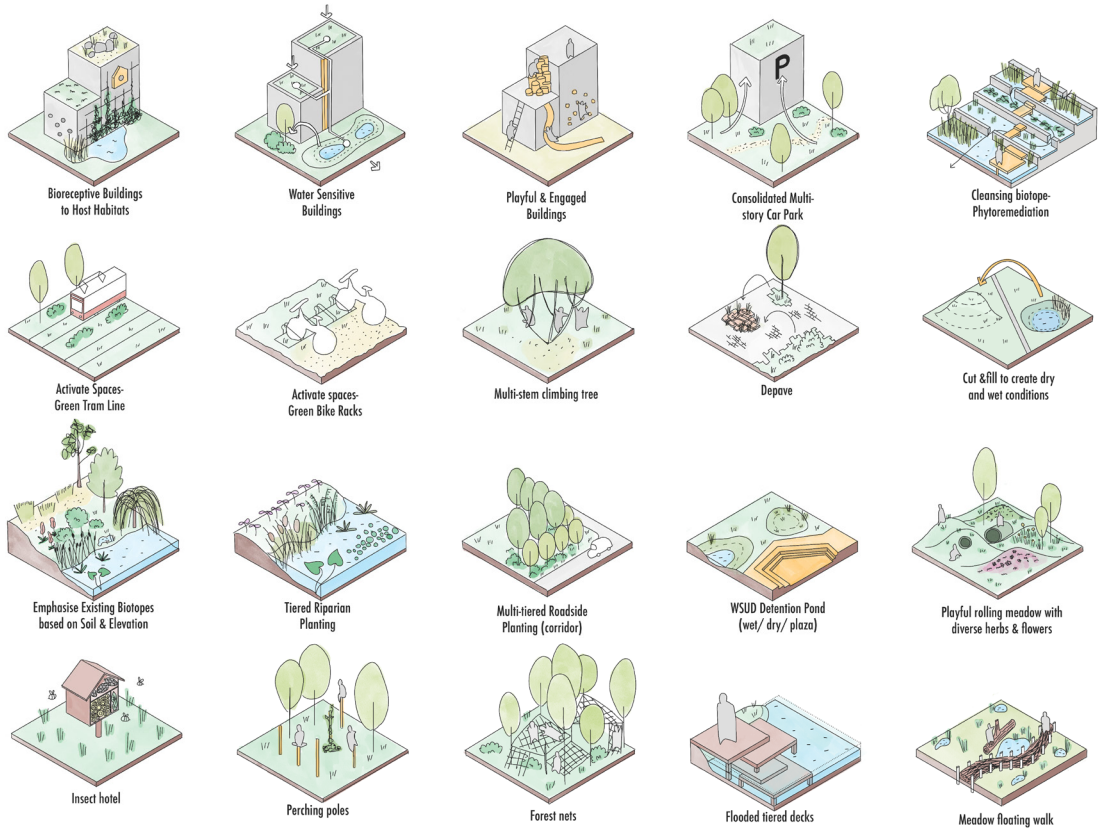
3. Design Catalogue

5 Key Principles



From Case Study

Research by Design Experiments

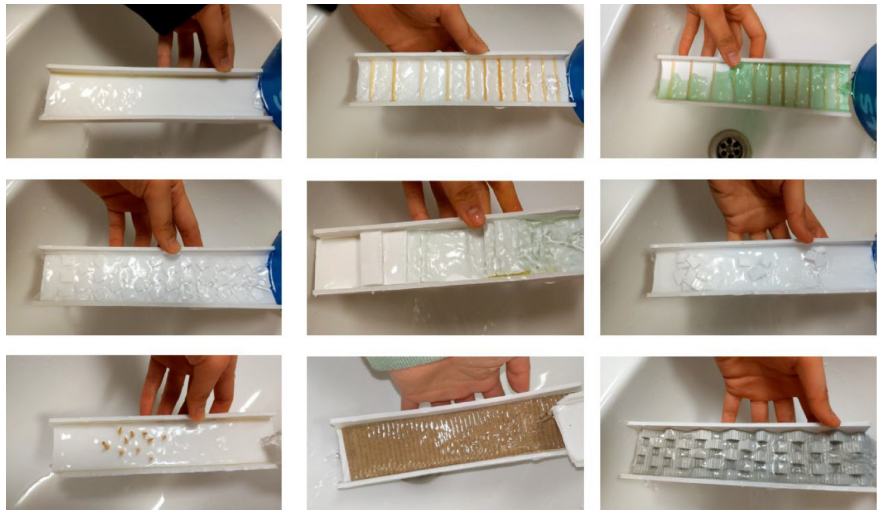


From Campus Research by Design

Design toolbox
for application

Guideline

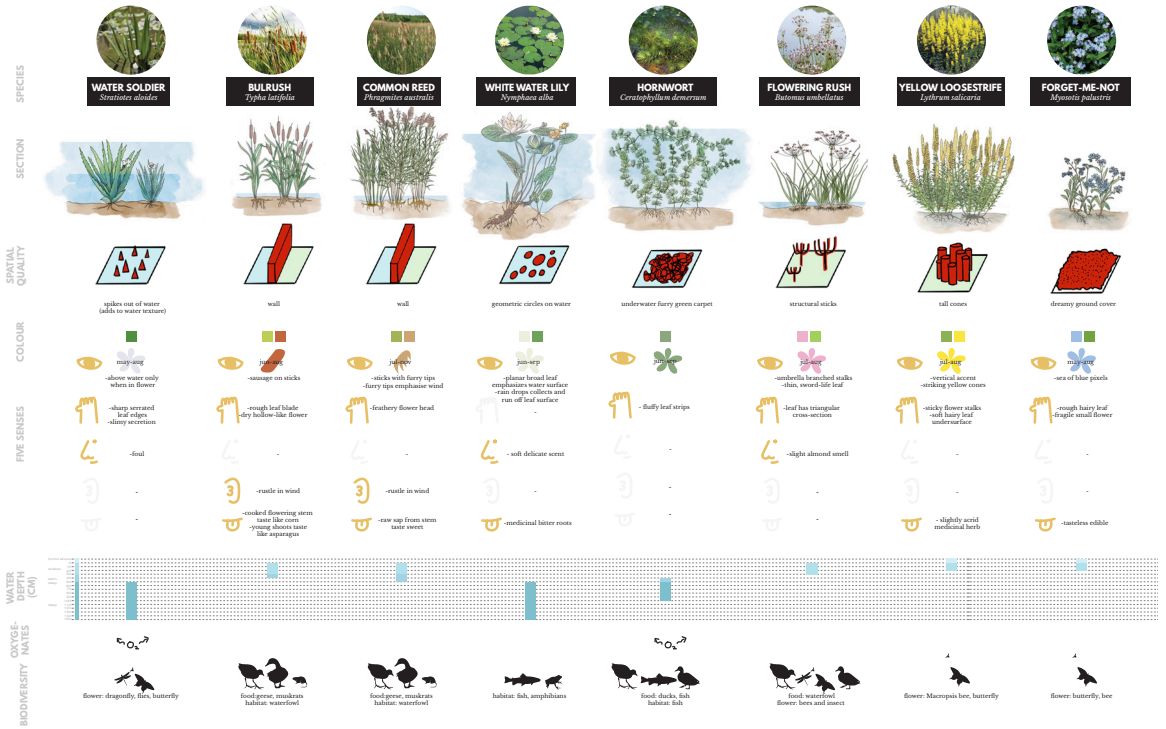
5 Key Principles



Water Patterns

Design Toolbox

4. Research by Design Experiments



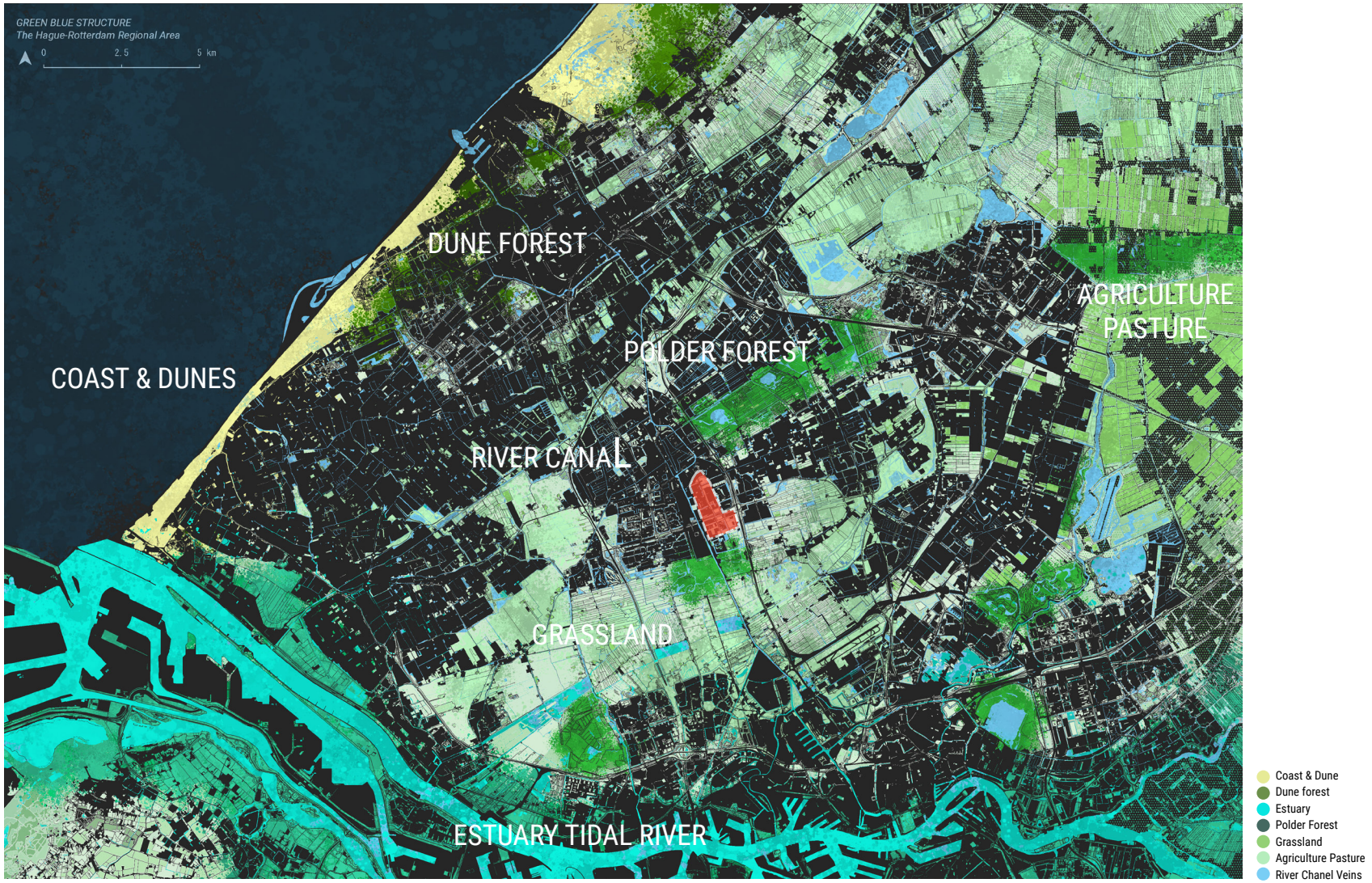
8 Sensorial Helophytes

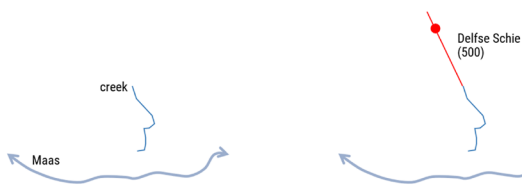
3
Analyse

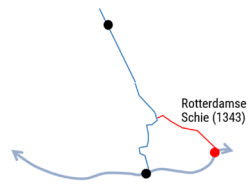
Understanding TUD
Challenges and
opportunities

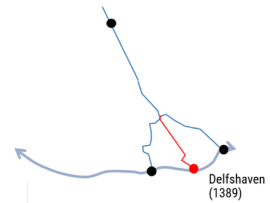
Natural landscape of metropolitan region

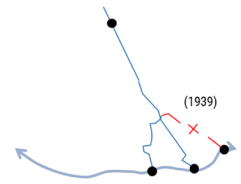
understanding TU Delft

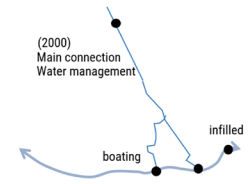


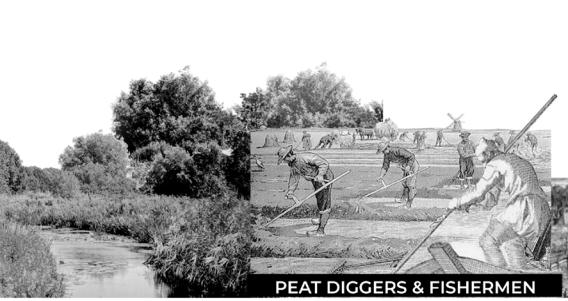




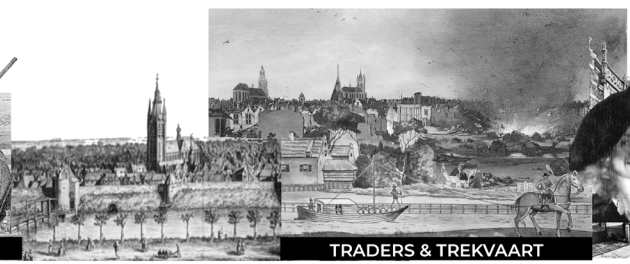




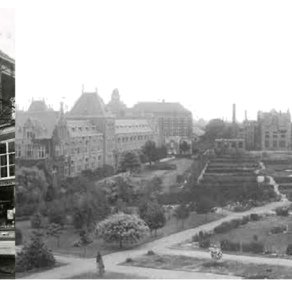




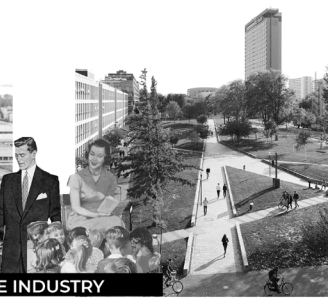
PEAT DIGGERS & FISHERMEN



TRADERS & TREKVAART



SERVICE INDUSTRY



500 PRE-URBAN PHASE

PEATLAND CITY

DELFT VILLAGE FORMED ALONG SWAMPY CREEK

1075

COUNT ESTABLISHED HIS MANOR

1230

SCHIE RIVER DAMMED

1280

TRADE FLOURISHED. IMPORTANT MARKET TOWN.

1300 TOWN FORMATION

HOOGHEEMRAA DSCHAP VAN DELFLAND

1389

DELFSHAVEN BUILT FOR ACCESS TO SEA. DUTCH EAST INDIA COMPANY (VOC)

1560

VIBRANT CITY

2ND LARGEST CITY. 14,000 INHABITANTS

1581 GOLDEN AGE BOOM

UNOFFICIAL CAPITAL OF NETHERLANDS

1644

THUNDERCLAP

1675

SCIENCE & ARTS. JOHANNES VERMEER

1700

1795 STAGNATION

FRANCE INVASION. ANNEXATION.

1842

INDUSTRIALISED CITY

TUD START IN CITY CENTRE

1869 REVIVAL EXPANSION

4 ECONOMIC PILLARS: YEAST, OIL, PRINTING, GLUE & GELATINE

1895

ON CITY EDGE

1917

BOTANIC GARDEN

1945

POST-WAR UNIVERSITY DISTRICT

1953

OUTDOOR SPACE DESIGN BY J. BIJHOUWER

1995

TECHNOLOGY CITY

OWNED REAL ESTATE FROM TU

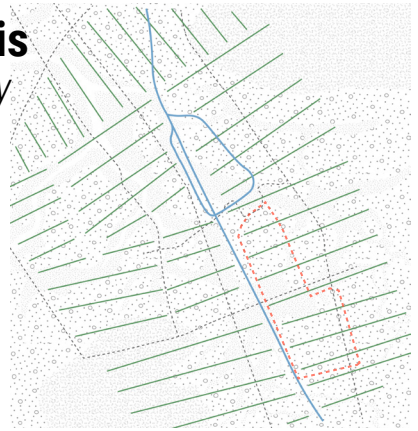
2010

MEKELWEG TO MEKELPARK

2020

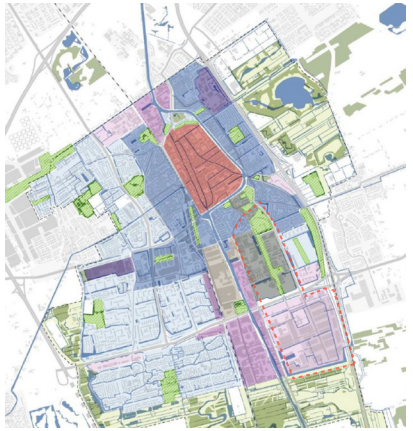
PRESENT DAY CAMPUS

Basic layer analysis
understanding Delft city



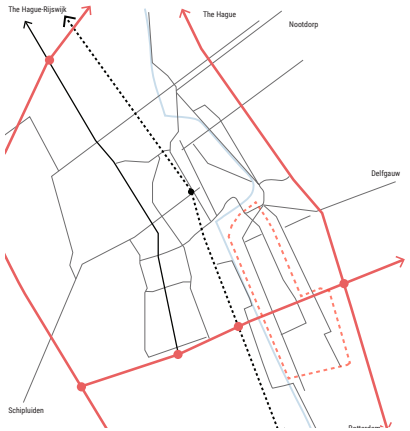
Historic alignment
&Soil type

- Water canal
- Polder lines
- Road infrastructure
  250 BC soil type
- Peat
- Heavy clay (river plain)
- Sandy clay (mudflat)



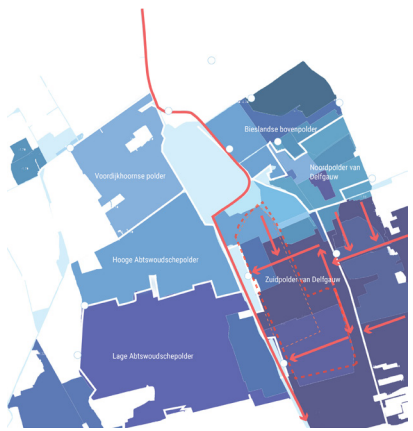
Building Types
from ("Nota Groen Delft",2013)

- Park
- Peat meadow
- Forest
- Historic city centre
- Urban work zone
- Green urban transformation
- Urban residential
- Green urban residential
- Care area
- Education campus



Transit Orientation

- Highway
- Provincial road
- Minor road
- Train route



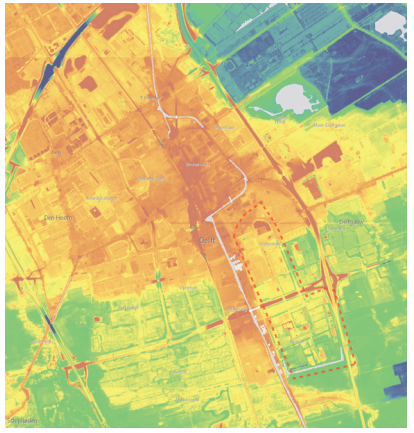
Water Management

- Water pump

Waterboard NAP Level

- -0.4
- -1
- -1.3
- -1.6
- -2.0
- -2.9
- -3

Districts



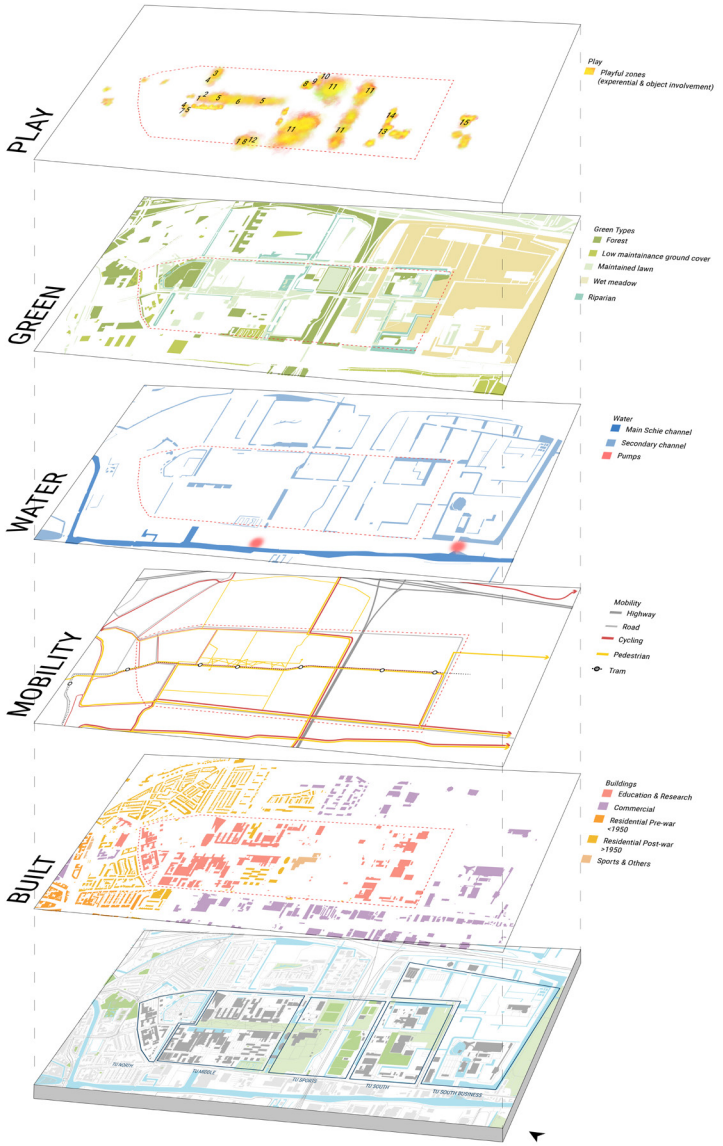
Height
from ahn

Green Structure

Historic creek 250BC
Paleogeografischekaarten from RCE, Redrawn by author

Basic layer analysis
understanding TU Delft

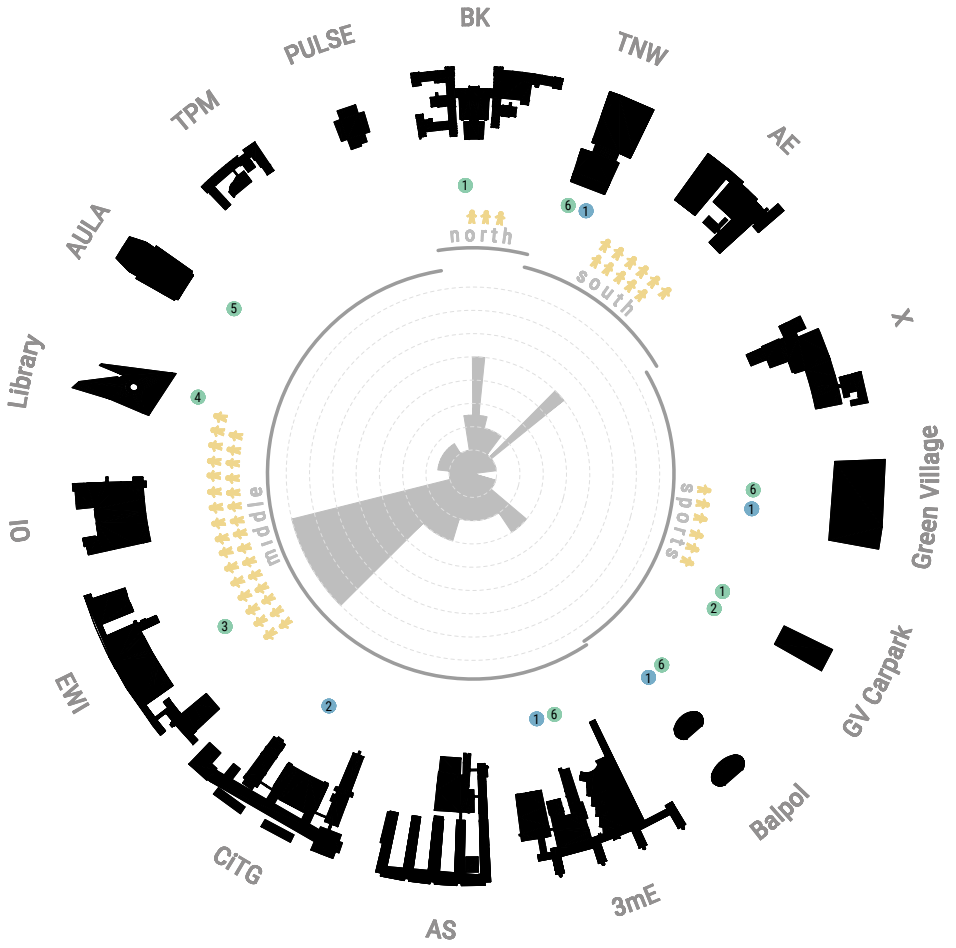
Research area of TU Delft, map from google.



Exploded axonometry of layers of TU Delft Campus,
Data from Qgis, Delfland Water Board, Drawn by author.

Eco-engagement analysis of buildings

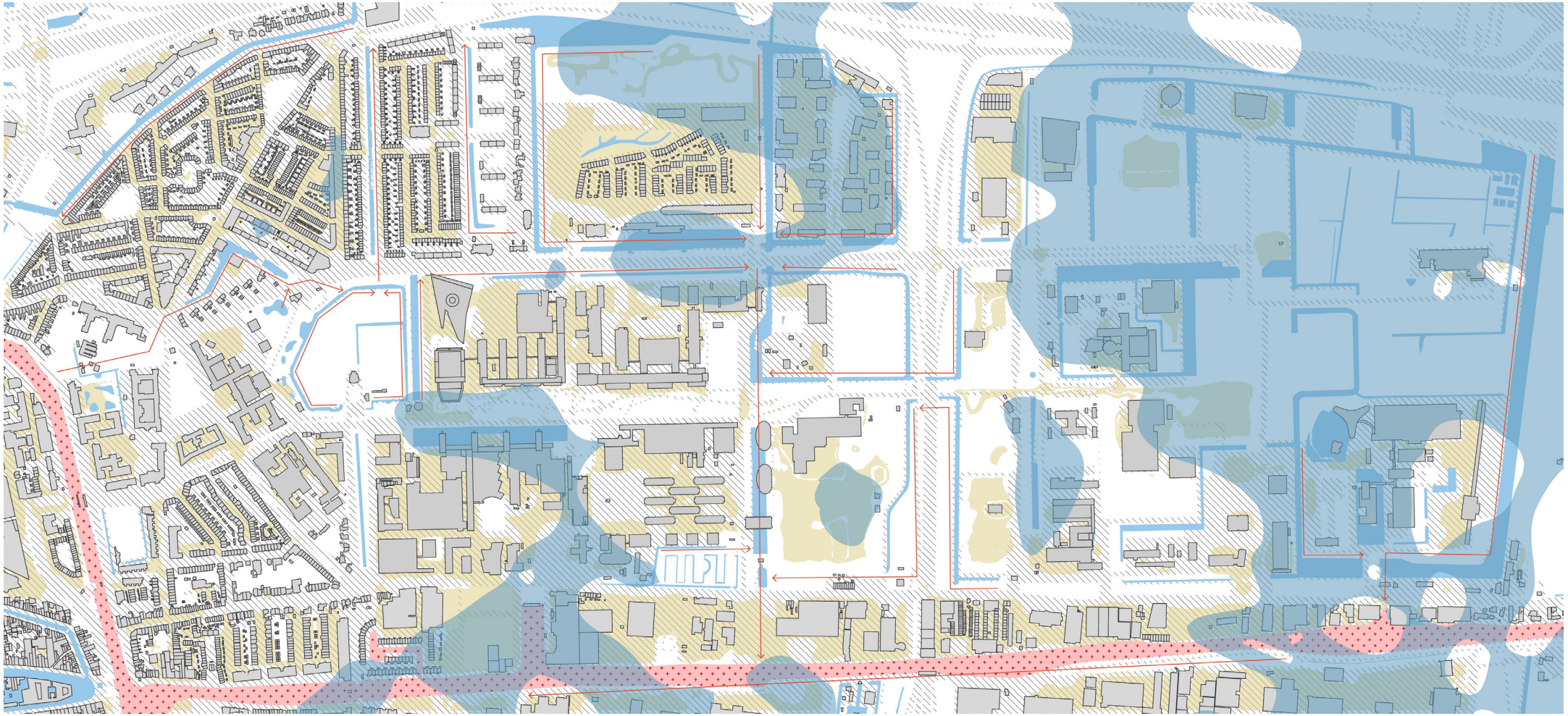
understanding TU Delft



Building classification according to its characteristics and involvement with its environment. Drawn by author.

Water & Heat

Challenge and Opportunities

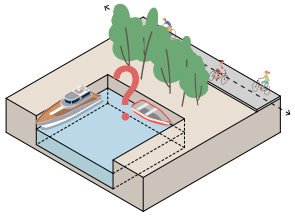


PROBLEM

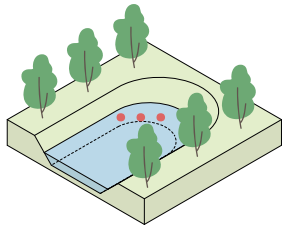
Polluted Schie | Flood prone areas | Disengaged profiles | Paved

OPPORTUNITY

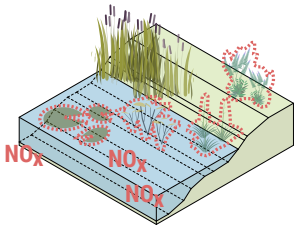
Living Machine | Retention Squares | Reuse water| Activation | De-pave



Forgotten Harbour



Generic profile

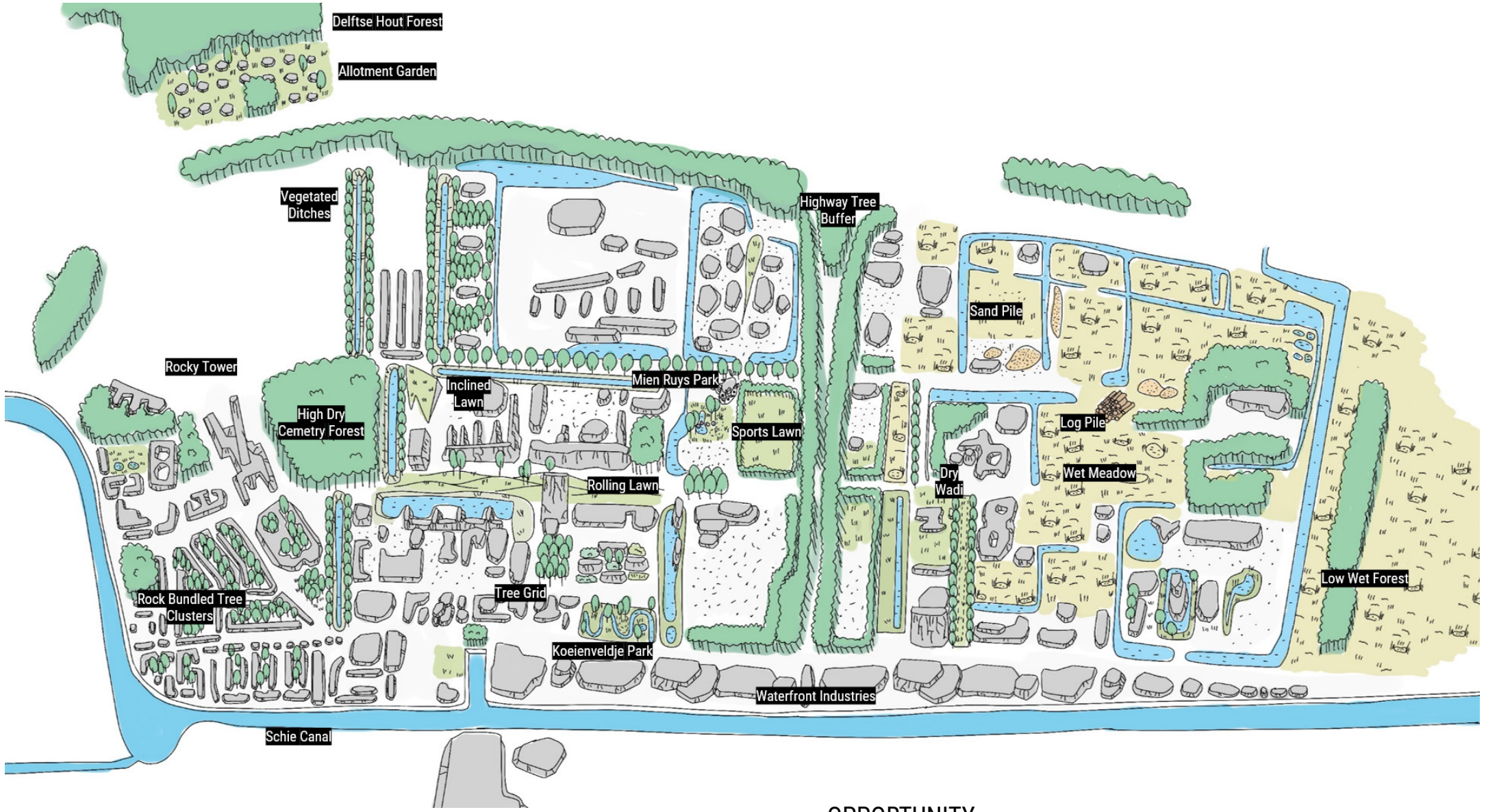


Polluted water

- Water flow direction
- Flood zones
- Surface water
- Heat stress
- Paved areas
- nitrogen 3x normal value (6mg/l)

Biodiversity

Challenge and Opportunities

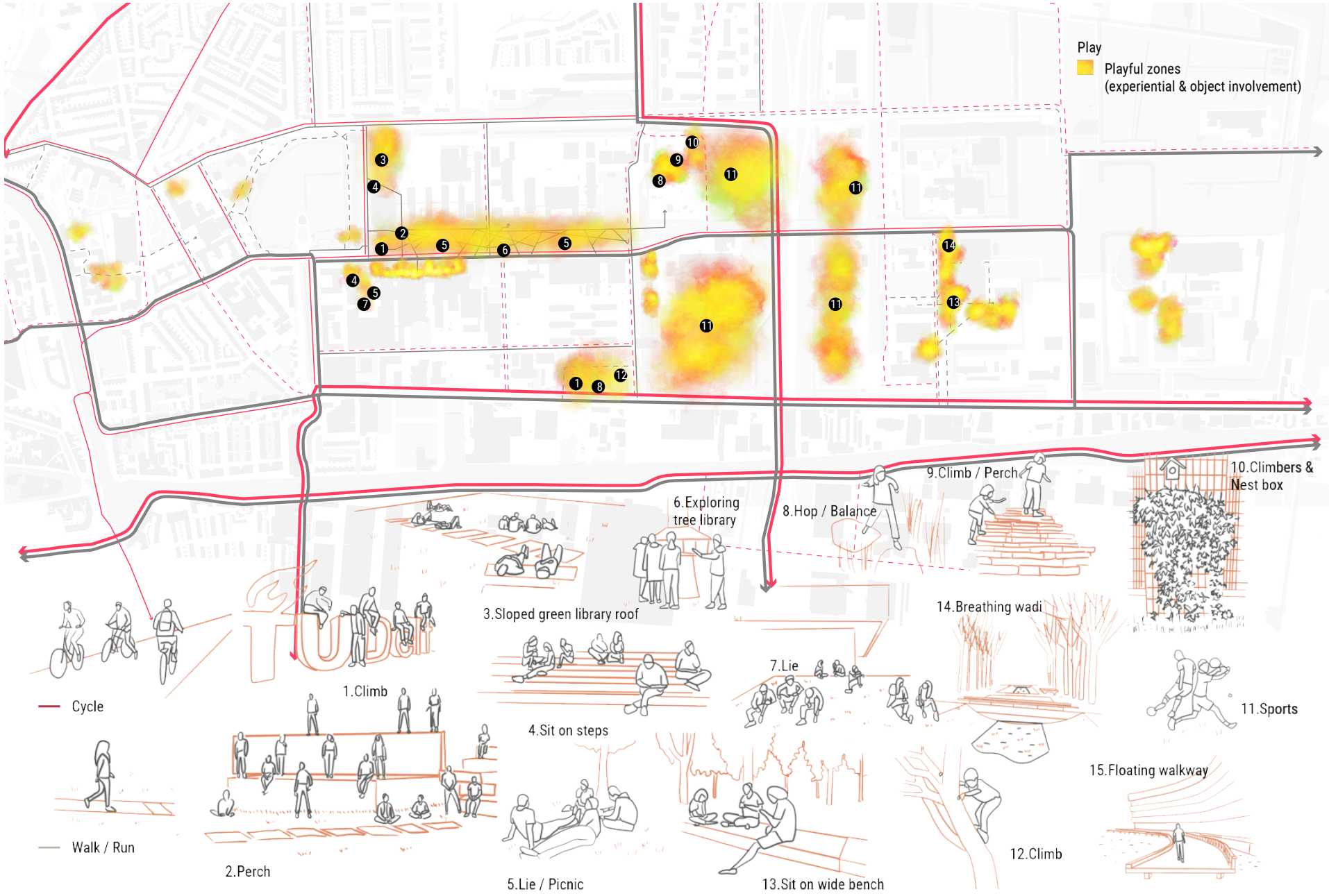


PROBLEM

Stony sterile buildings | Paved areas | Limited habitat opportunity

OPPORTUNITY

Activate areas to host nature | Expand river biotope | Gradient | Green buildings | Patches and corridors | Accommodate more species | Improve aquatic plants



PROBLEM

Play concentrated at sports fields | Limited playful opportunities | Buildings can be more involved in play

OPPORTUNITY

Vibrant campus | New area for play | Play network

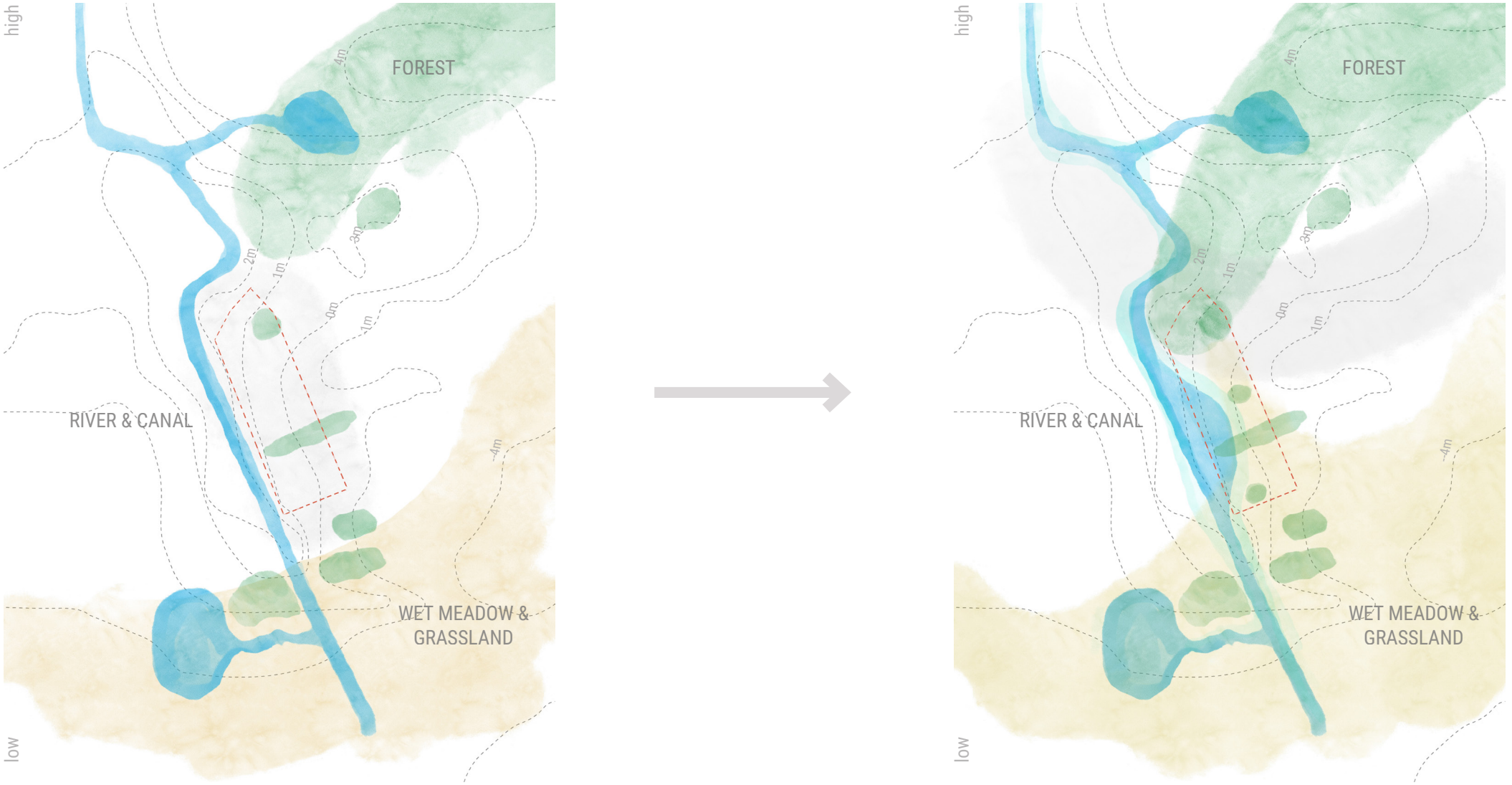
4

Explore

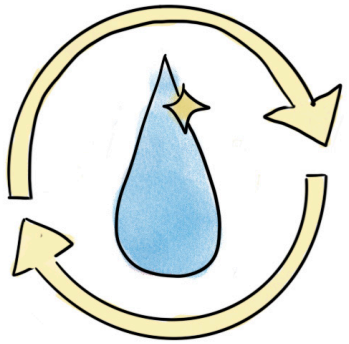
Regional vision design
Campus masterplan design
Site design

Potential of TUD within Delft City

regional vision

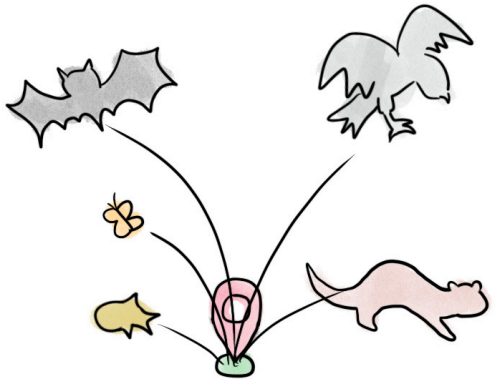


KEY CONCEPT



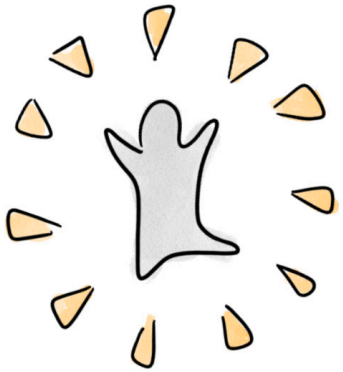
Resilient water system.

Mitigate heat stress, heavy rainfall and provide good quality water.



Ecological hotspot.

Habitat condition for bank martin, water bat and otter



Engaging play.

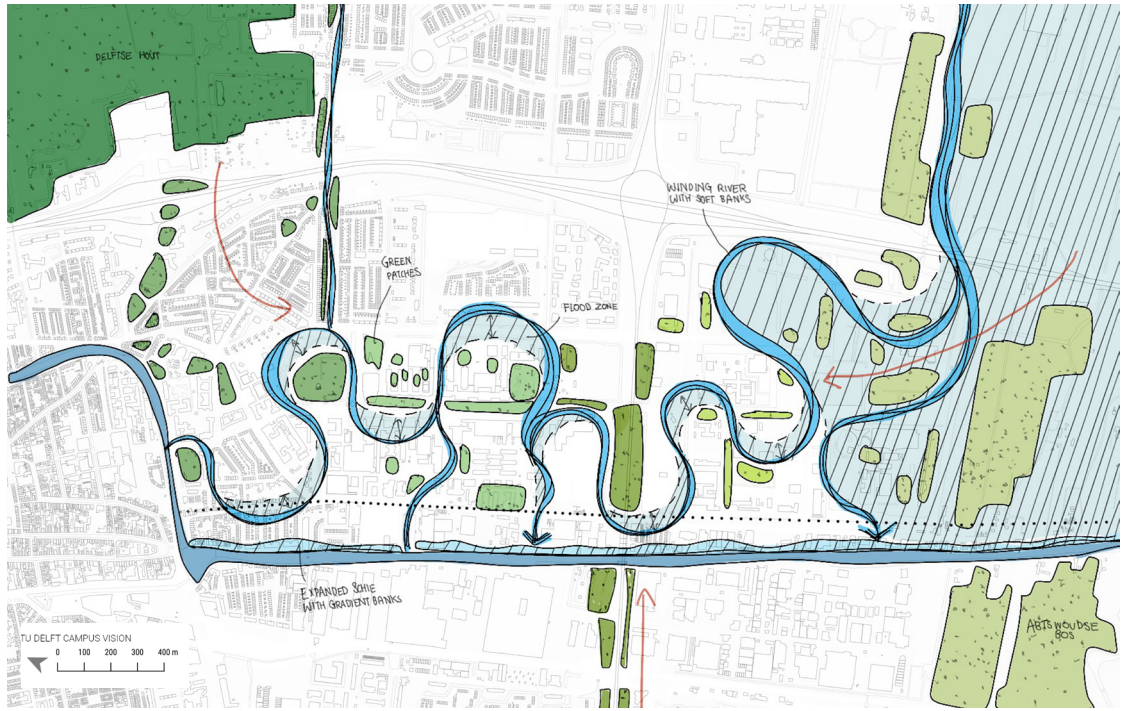
Engagement amongst humans, the built environment, plants and animals

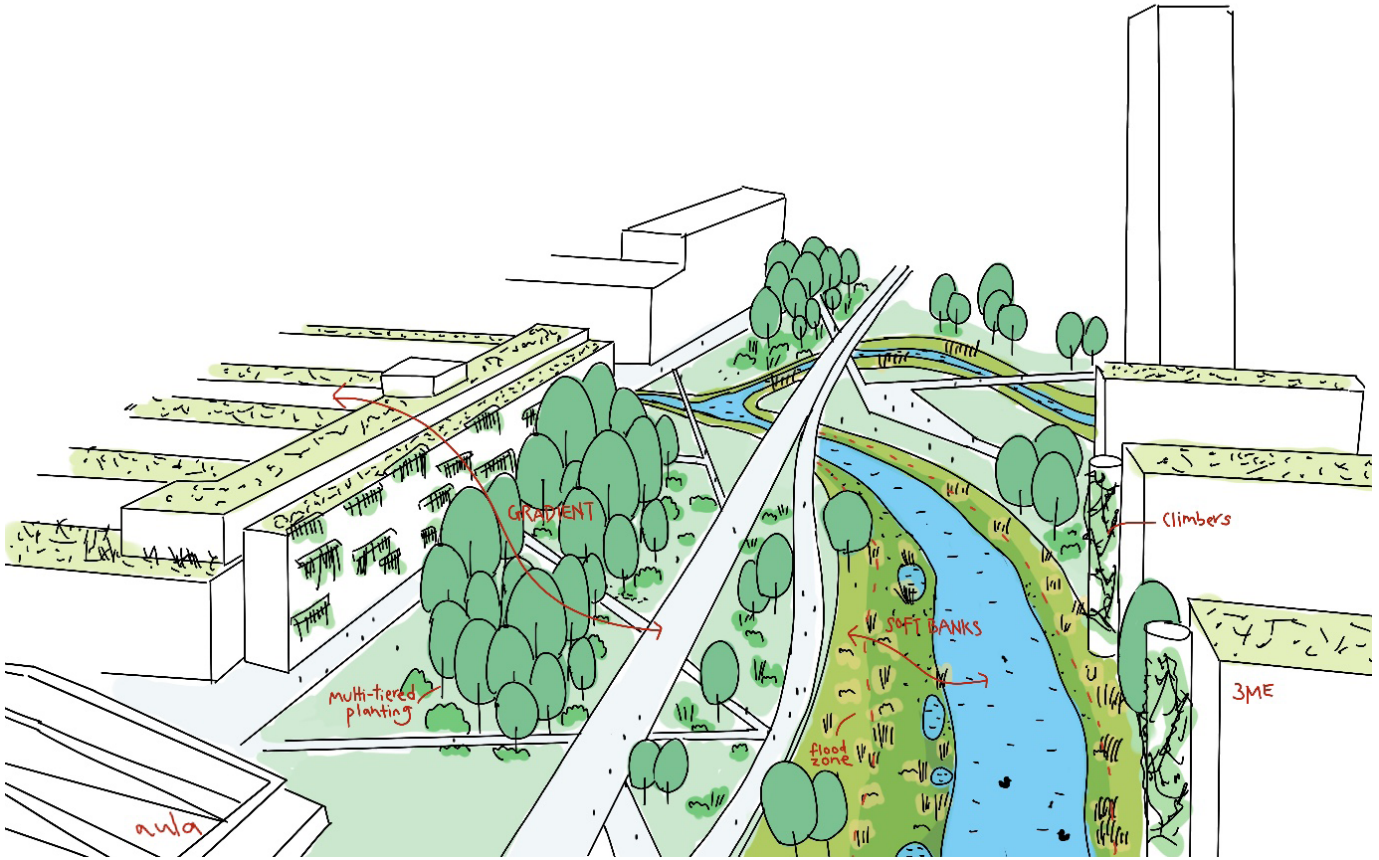
Research by Design Scenario 1

The River Campus

CONNECTED

GRADIENT



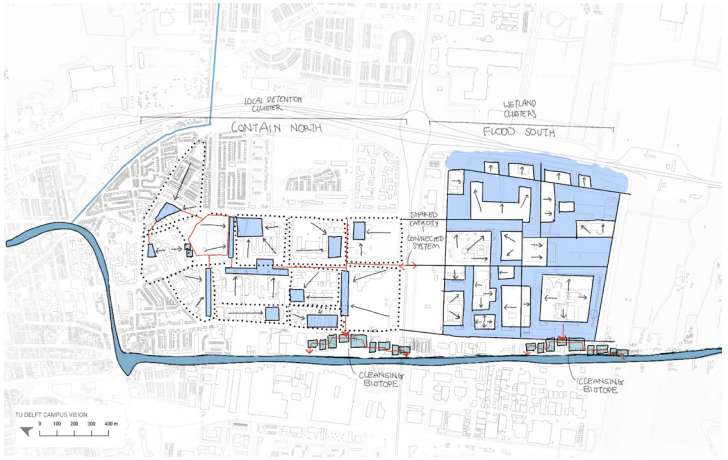


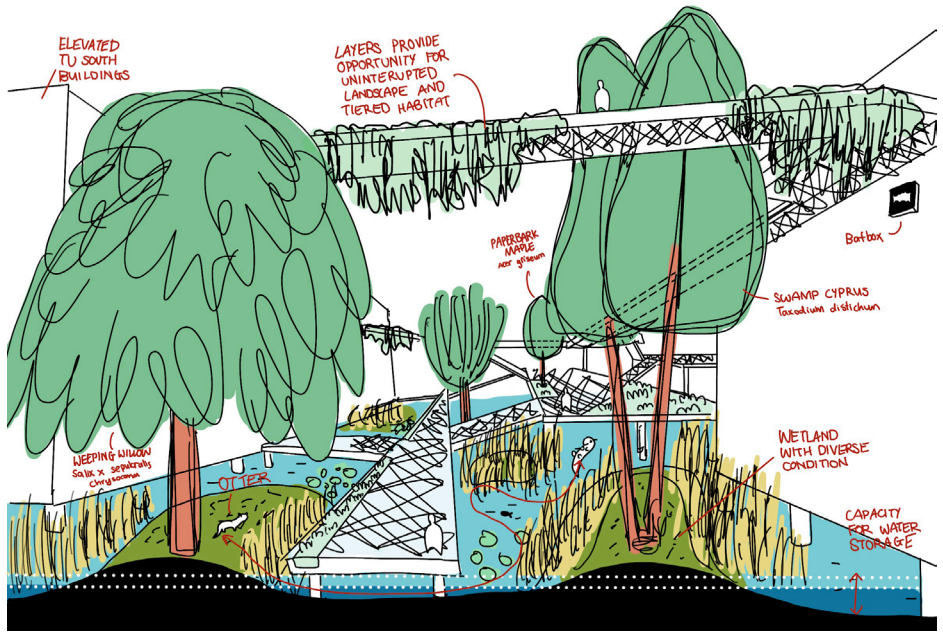
Research by Design Scenario 2

The Elevated Flooded Campus

RESILIENT

INCLUSIVE



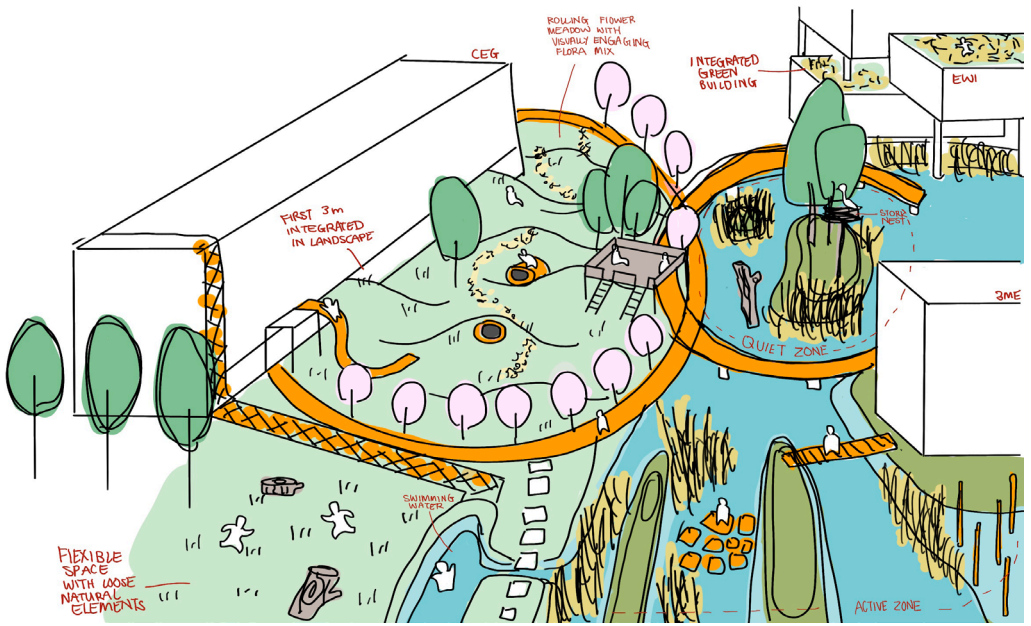


Research by Design Scenario 3

The Fun Campus

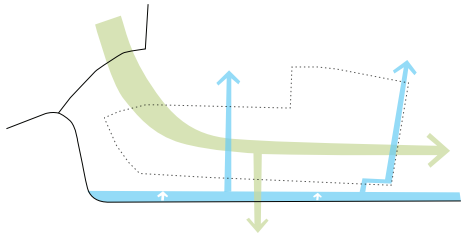
AFFORDANCE

INCLUSIVE

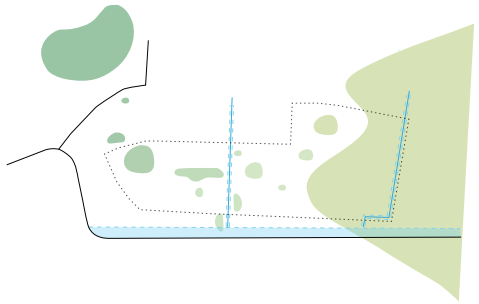


Building blocks for campus vision

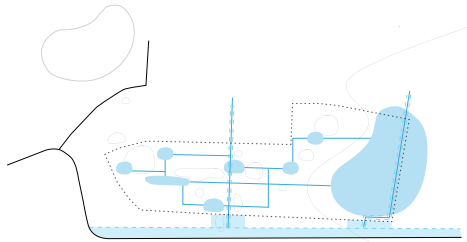
1. Connected & expanded



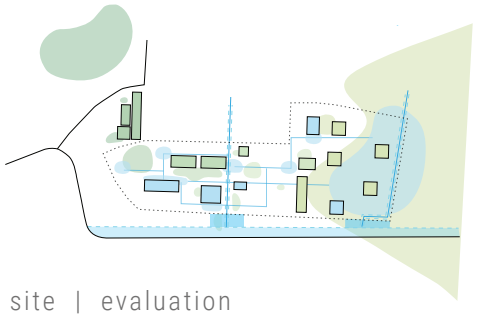
2. Gradient soft banks & patch type

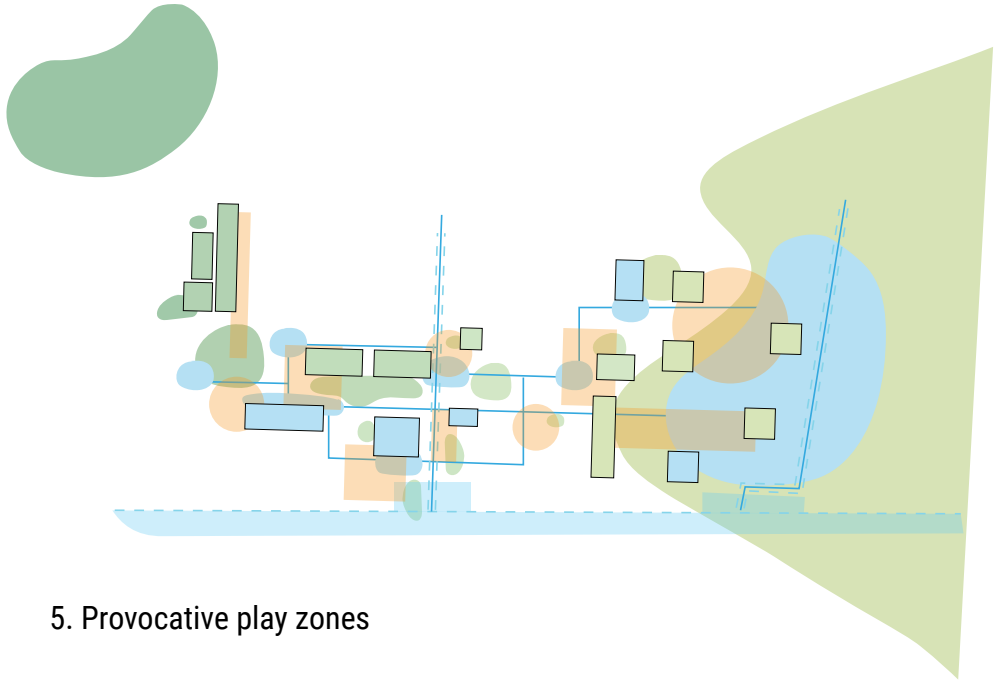


3. Connected local detention & purify



4. Buildings involved with habitat creation

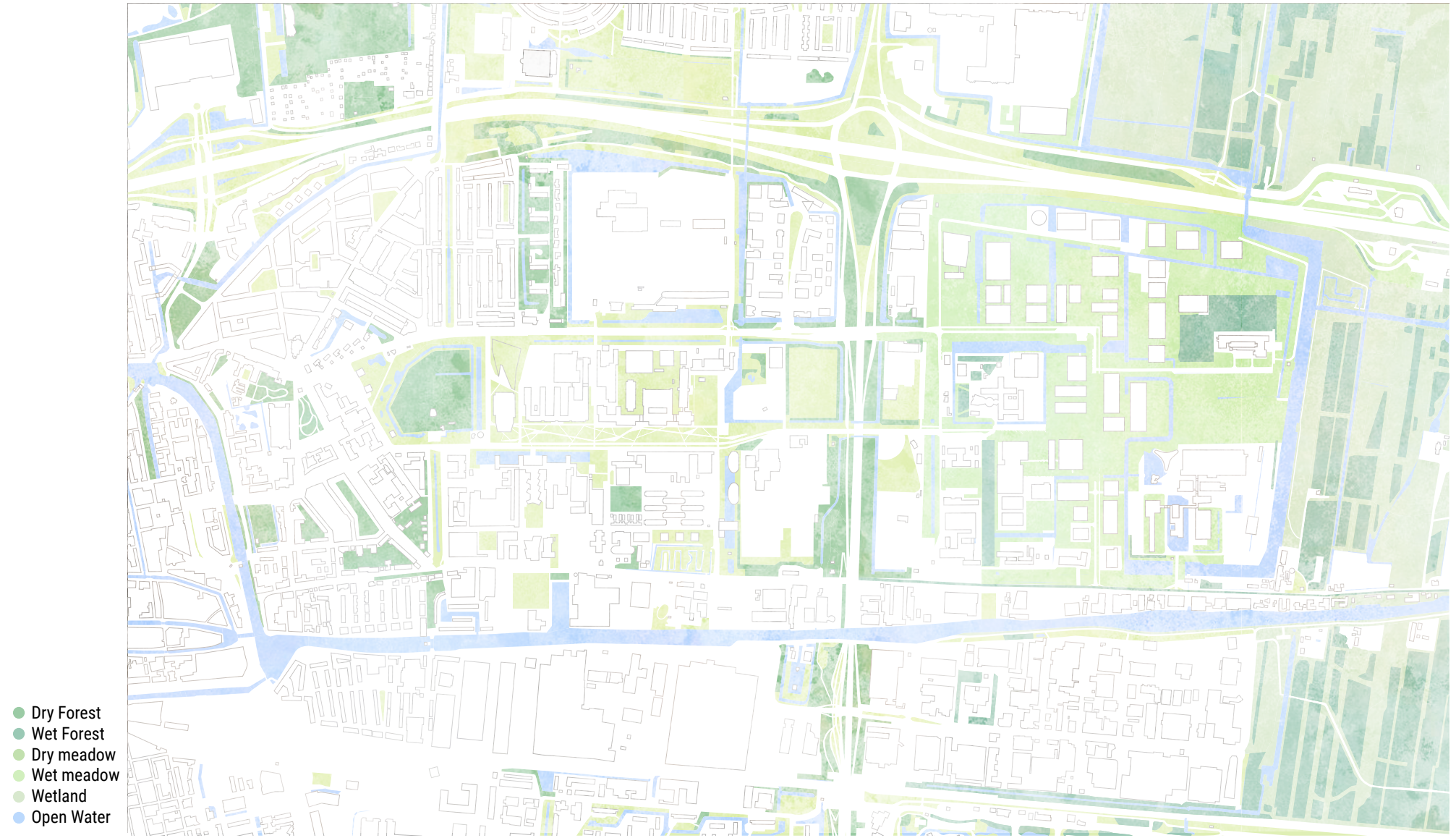




5. Provocative play zones

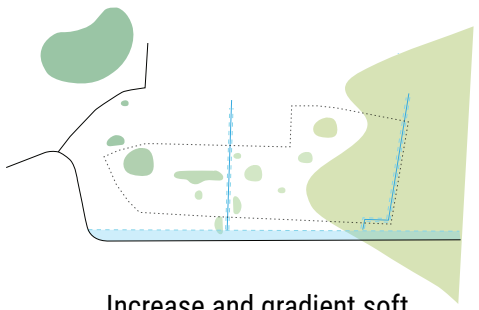
Current situation

Current Green and Blue Types

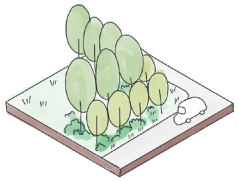


1. Expand and Create New Patches

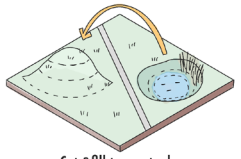
proposed steps for campus masterplan



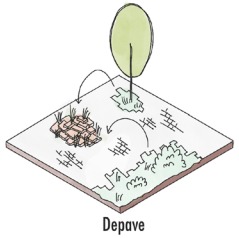
Increase and gradient soft banks & patch type



Multi-tiered Roadside Planting (corridor)



Cut &fill to create dry and wet conditions



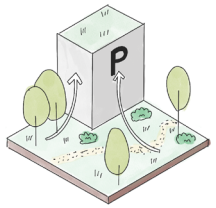
Depave

- Dry Forest
- Wet Forest
- Dry meadow
- Wet meadow
- Wetland
- Open Water

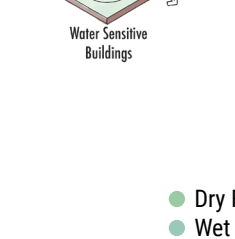
2. Involve Built Environment

proposed steps for campus masterplan

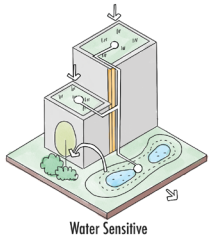
Buildings involved with habitat creation



Consolidated Multi-story Car Park

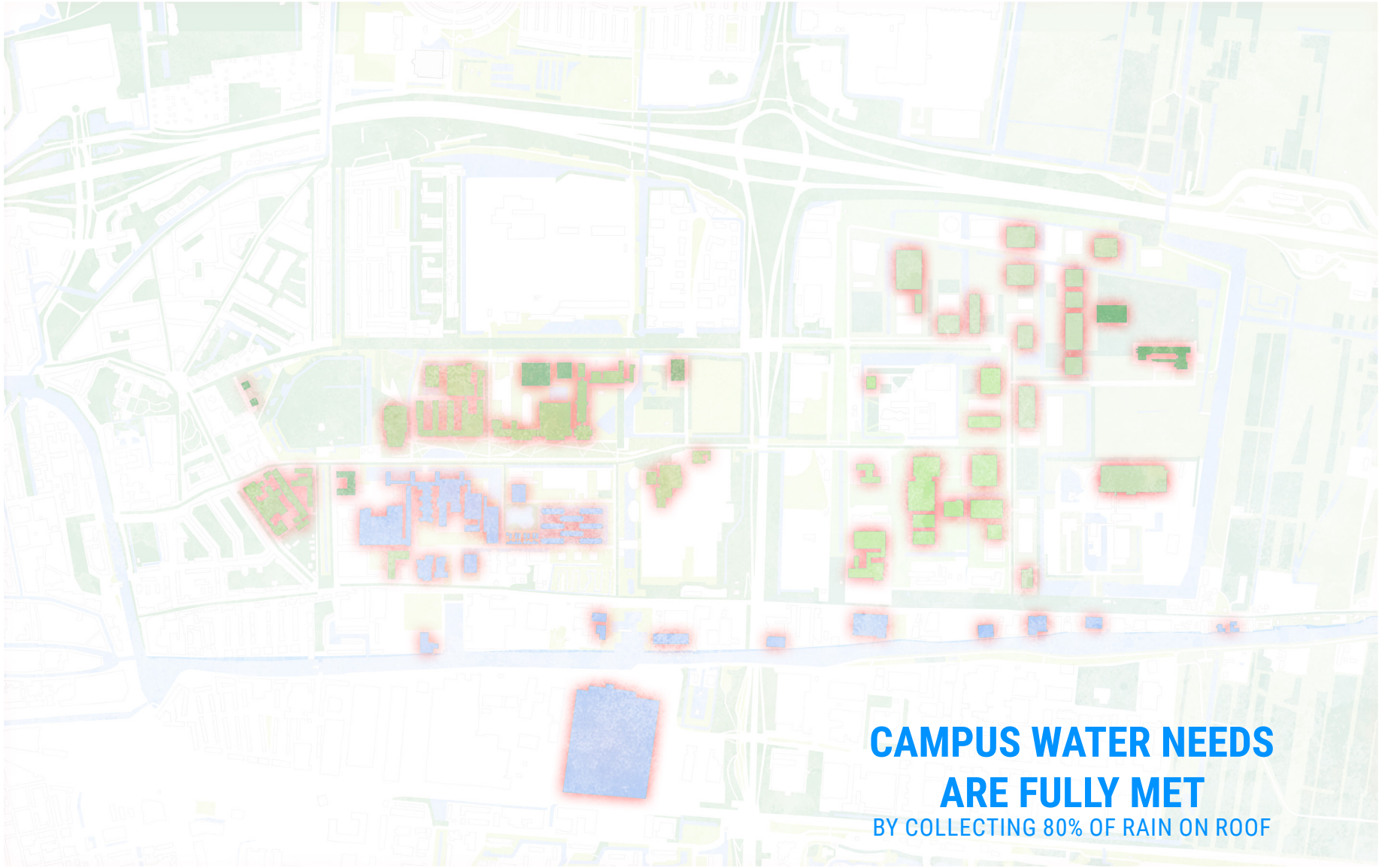


Bioreceptive Buildings to Host Habitats



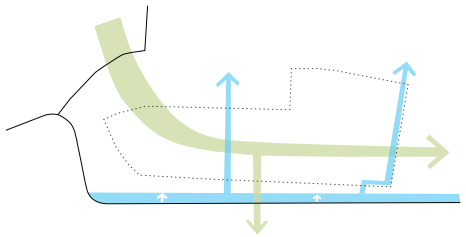
Water Sensitive Buildings

- Dry Forest
- Wet Forest
- Dry meadow
- Wet meadow
- Wetland
- Open Water

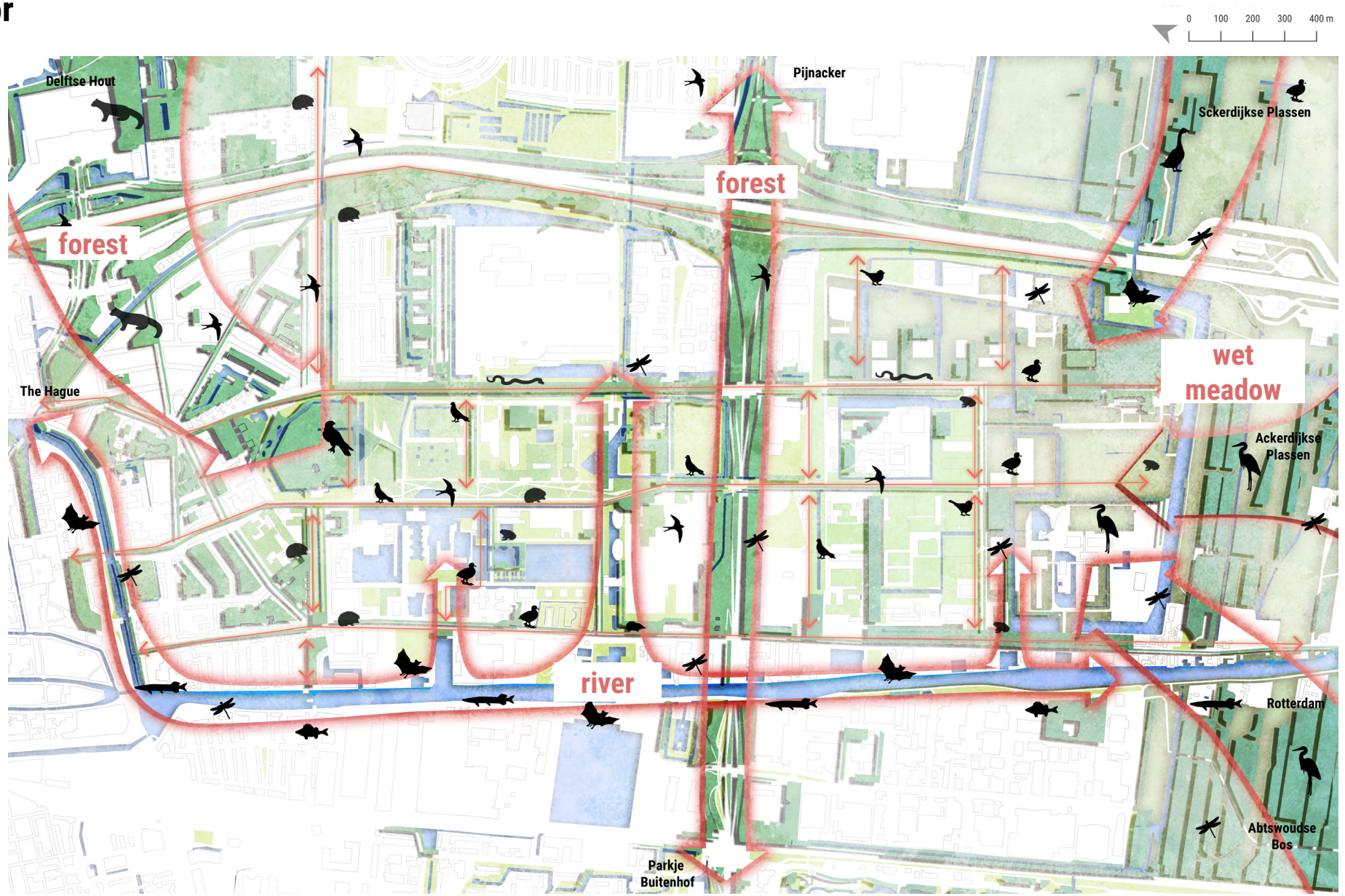


3. Green Blue Connection Corridor

proposed steps for campus masterplan

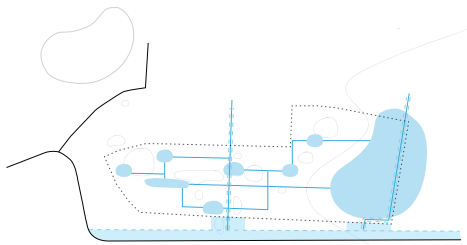


Connected to and integrate with surrounding landscape

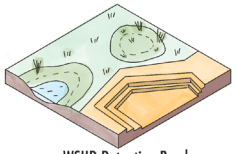


4. Resilient Water System

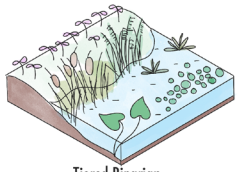
proposed steps for campus masterplan



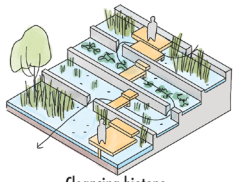
Local detention and puricfication



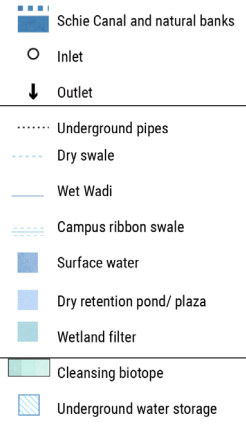
WSUD Detention Pond
(wet/ dry/ plaza)

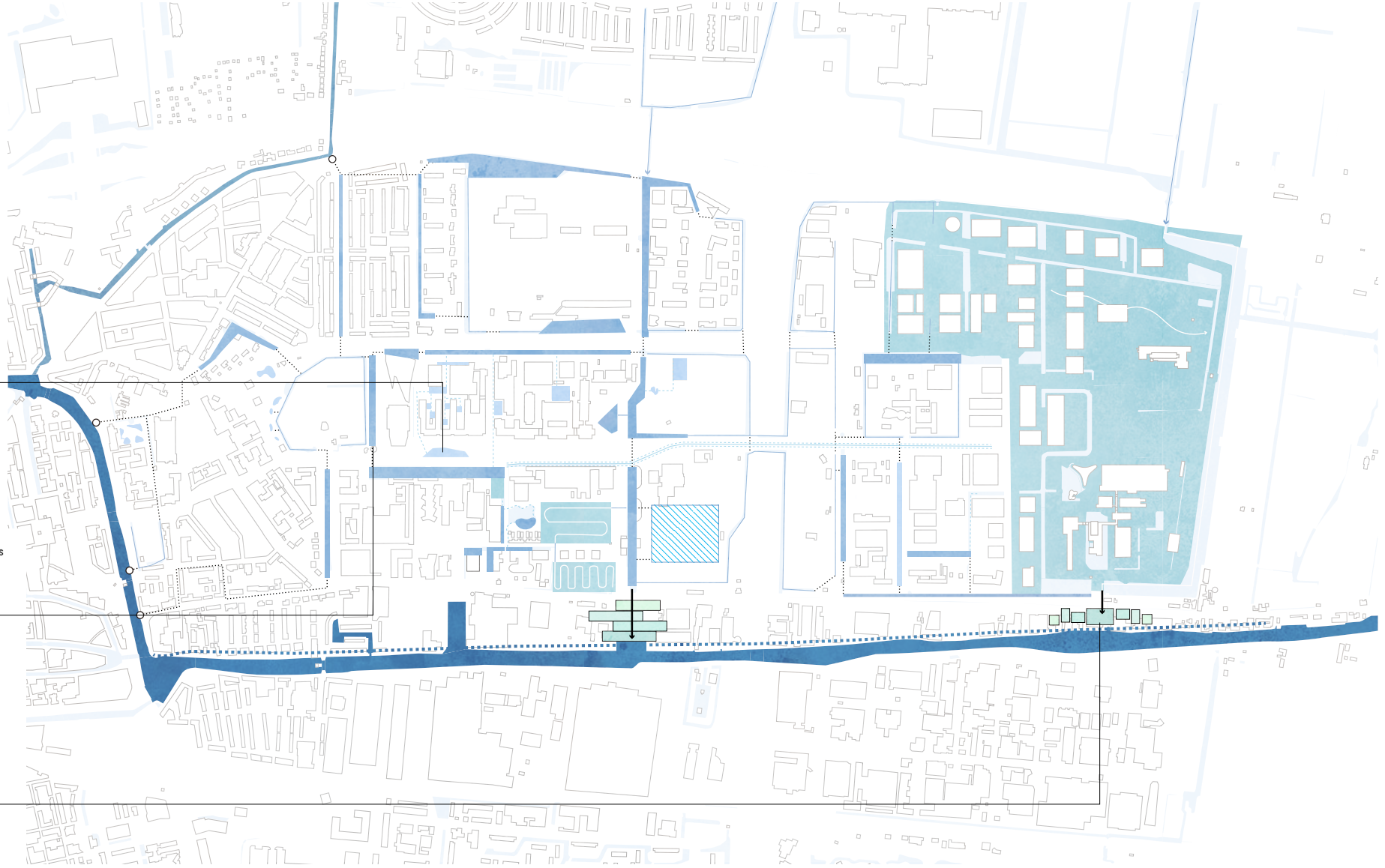


Tiered Riparian
Planting



Cleansing biotope-
Phytoremediation





Resilient Water System

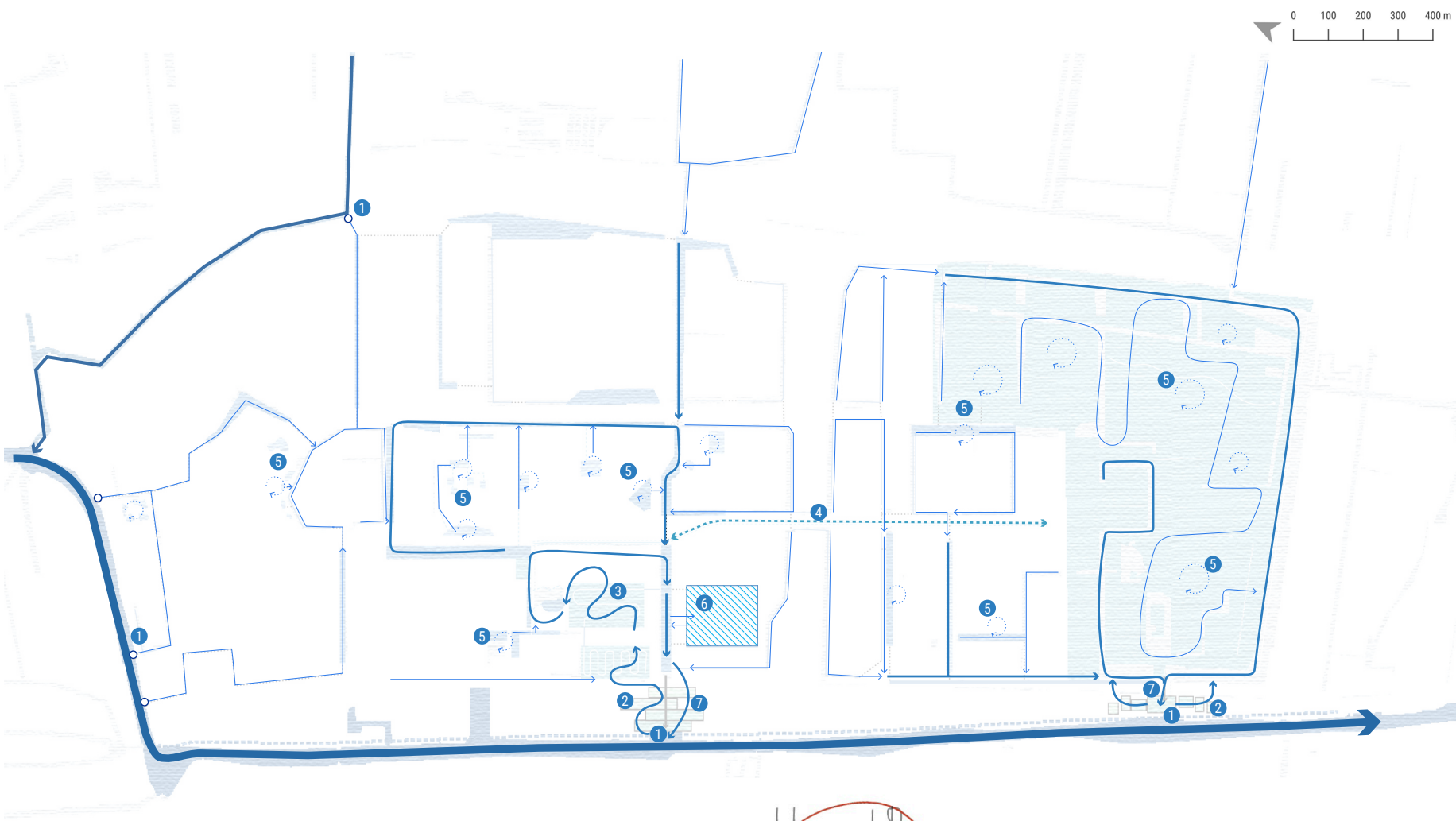
proposed steps for campus masterplan

aug rainfall volume on TU Delft campus:

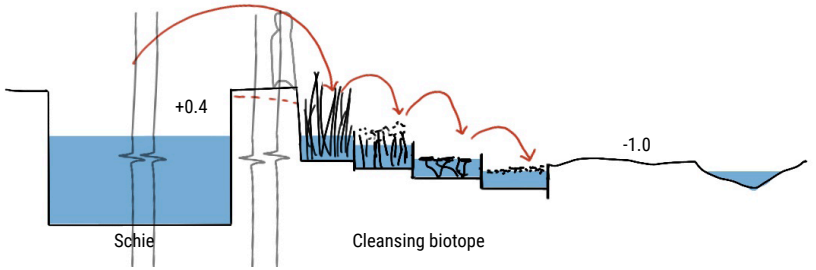
179,759m3

assuming 30 cm allowance of fluctuation depth, additional storage capacity with new design:

297,616m3

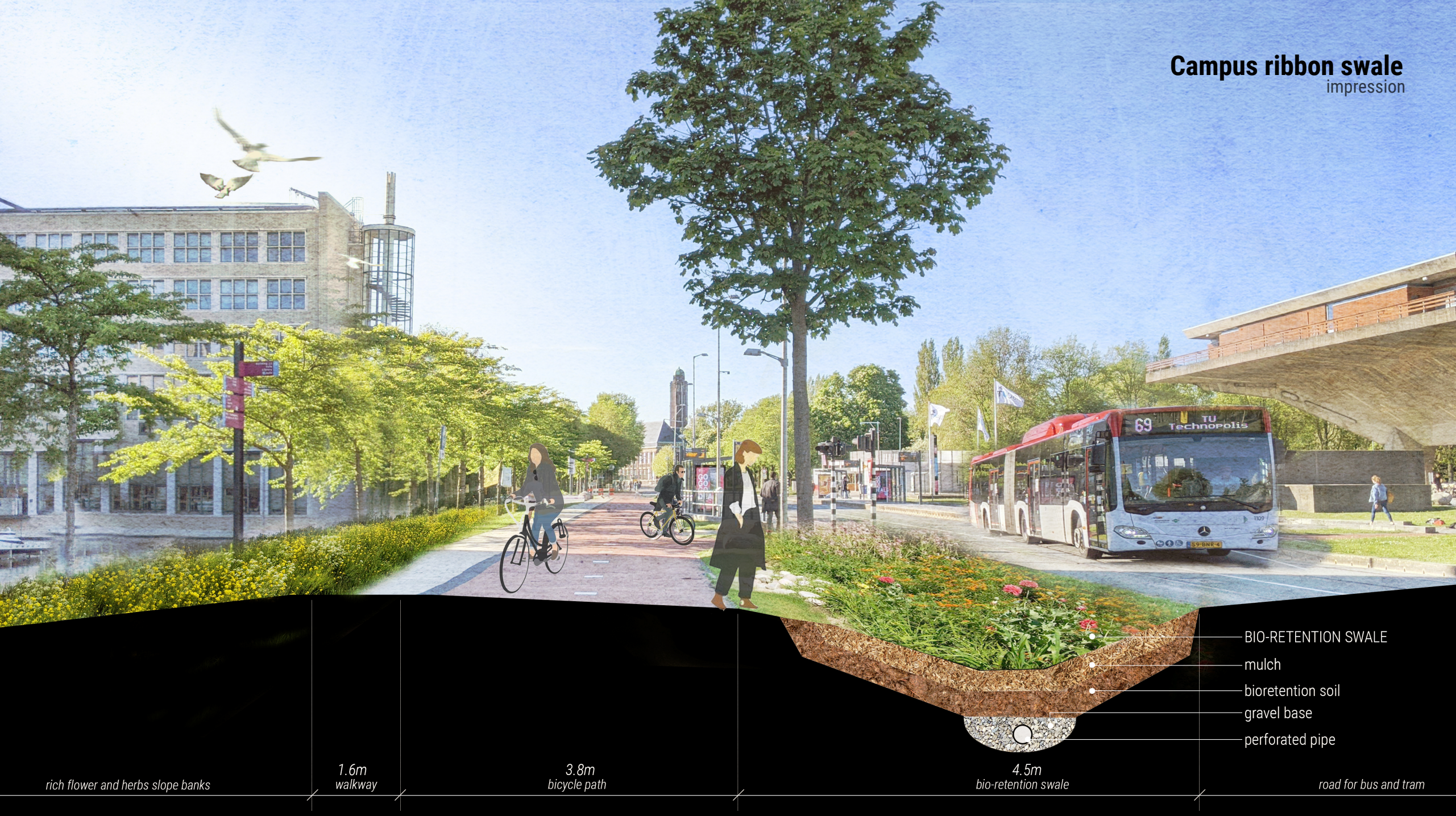


1. Inlet flow from Schie (during dry season)
2. Cascading helophyte filter
3. Meandering flow in wetland for water cleansing
4. Connected to have shared detention capacity (especially during wet season)
5. Local collection, detention and infiltration
6. Underground storage below sports fields
7. Pump out to Schie



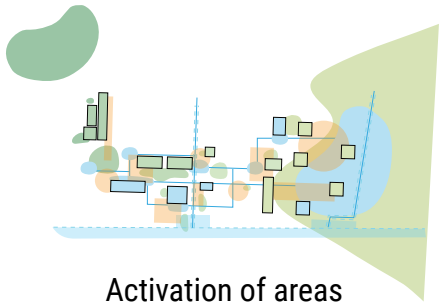
Campus ribbon swale

impression

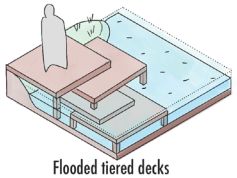


5. Inject Provocative Playful Areas

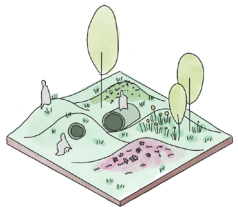
proposed steps for campus masterplan



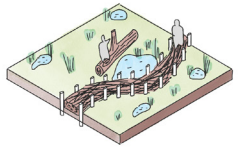
Activation of areas



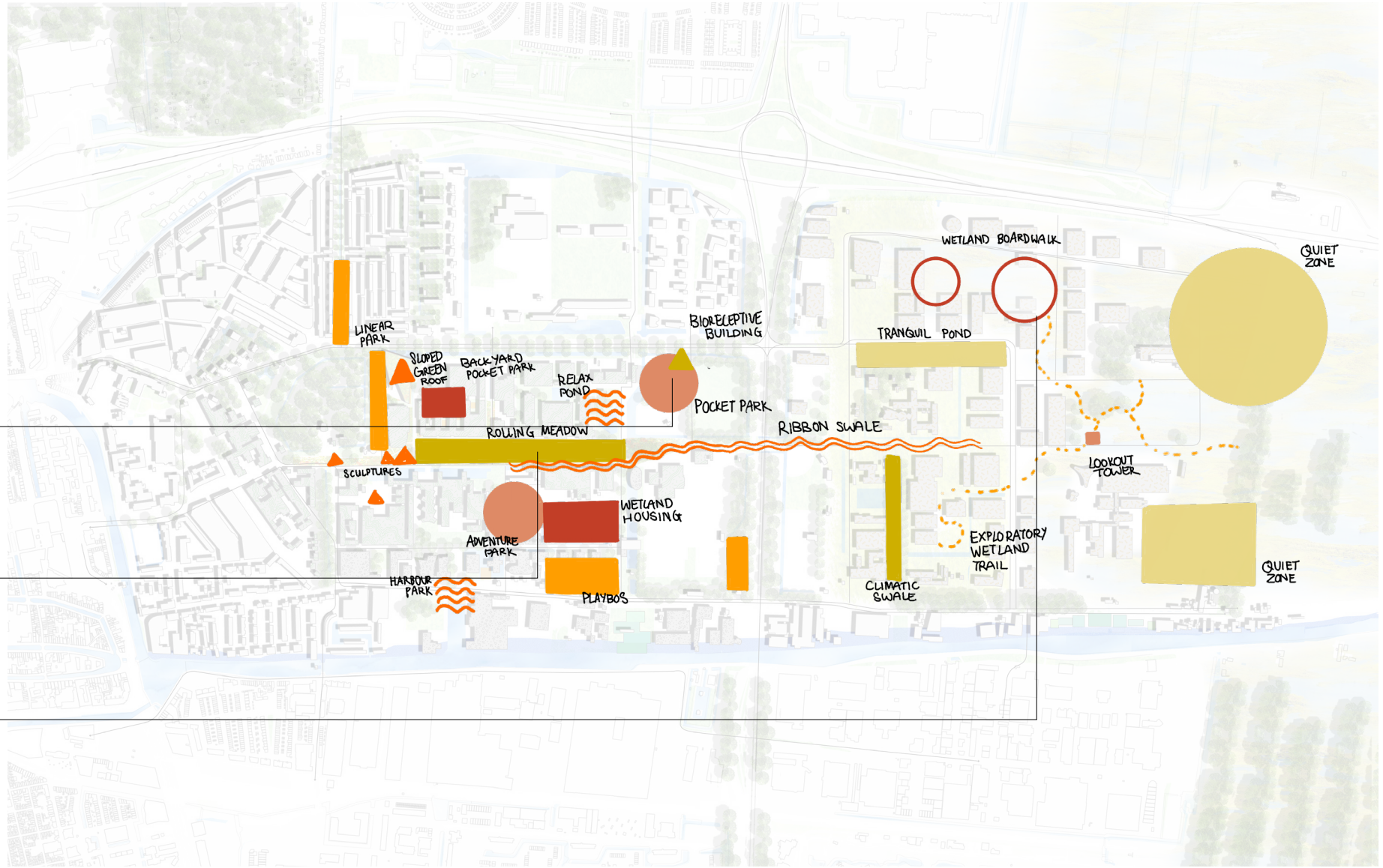
Flooded tiered decks



Playful rolling meadow with diverse herbs & flowers



Meadow floating walk



TU Delft Vision

proposed campus masterplan

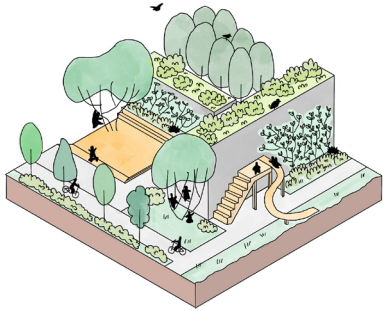
Campus Clusters

landscape type zoning

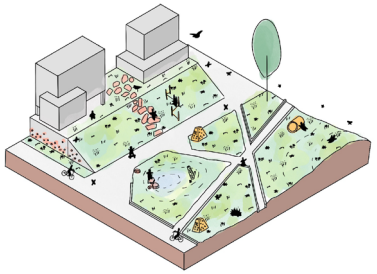
Framework application

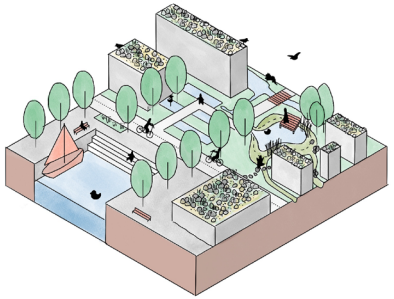
strategy for campus clusters

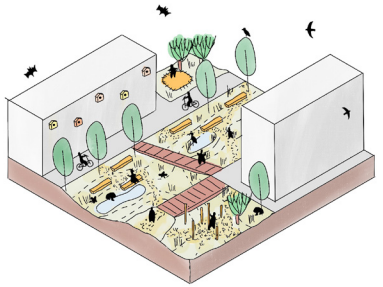
TU North



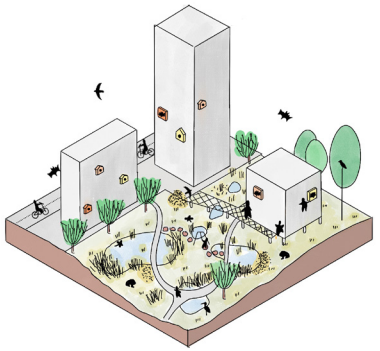
TU middle





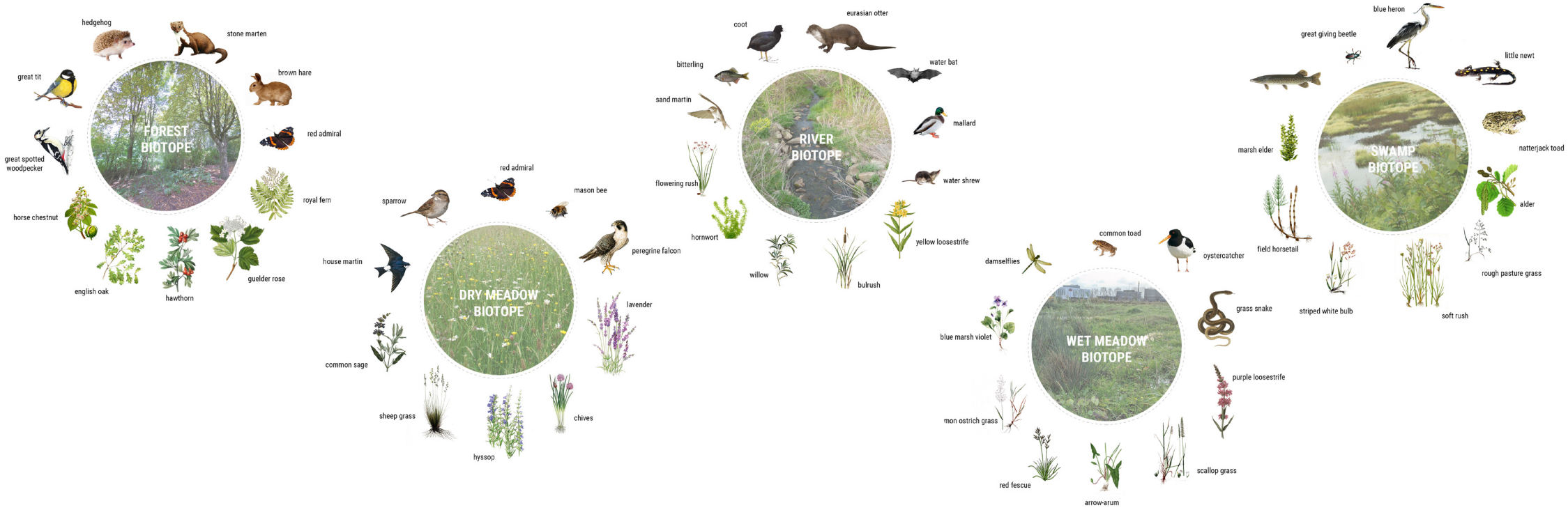


TU South

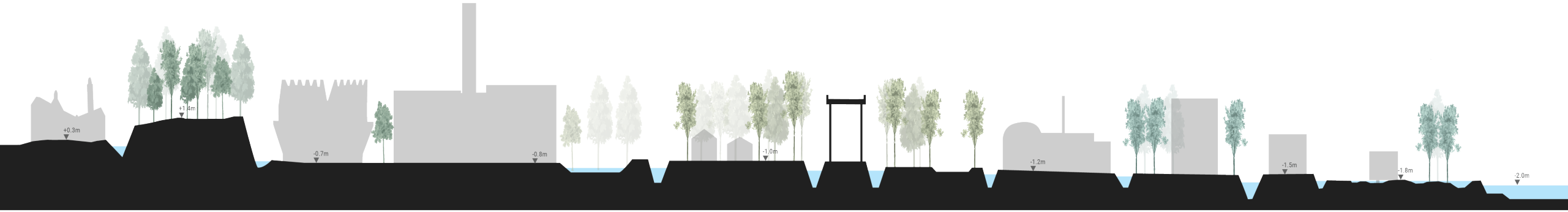


	Urban Woodland	Urban Dry Meadow	Urban River	Urban Wet Meadow	Urban Wetland
Biodiversity	-Diverse tree species -Mulit-layer planting -Continuous hedge row -Organic debris pile (nesting) -Bird box (nesting)	-Mixed flower and herb ground cover -Insect hotels (nesting) -Periodic mowing -Sloped green roof	-Gradient banks -Good water quality -Sand piles (nesting)	-Consolidated buildings to free up space for open wet meadow -Water tolerant trees, shrubs and ground cover	-Consolidated buildings to free up space for wetland -Smaller blocks on stilts
Resilience	COLLECT → CLEAN → STORE				
	-Local detention plaza or ponds -Dry swales	-Local detention plaza or ponds -Dry swales	-Flood plain zone -Helophytes -Cleansing biotope	-Ability to flood -Capacity to account for ground water level fluctuation	-Ability to flood -Wetland filter
Affordance	-Climbable multi-stem trees -Vertigo -Ascend, descend	-Rolling topography -Colour -Openness	-Approach to water -Connected linked system -Water patterns -Swimming water	-Haptic pleasures of soft bouncy ground-feel	-Openness -Vantage point

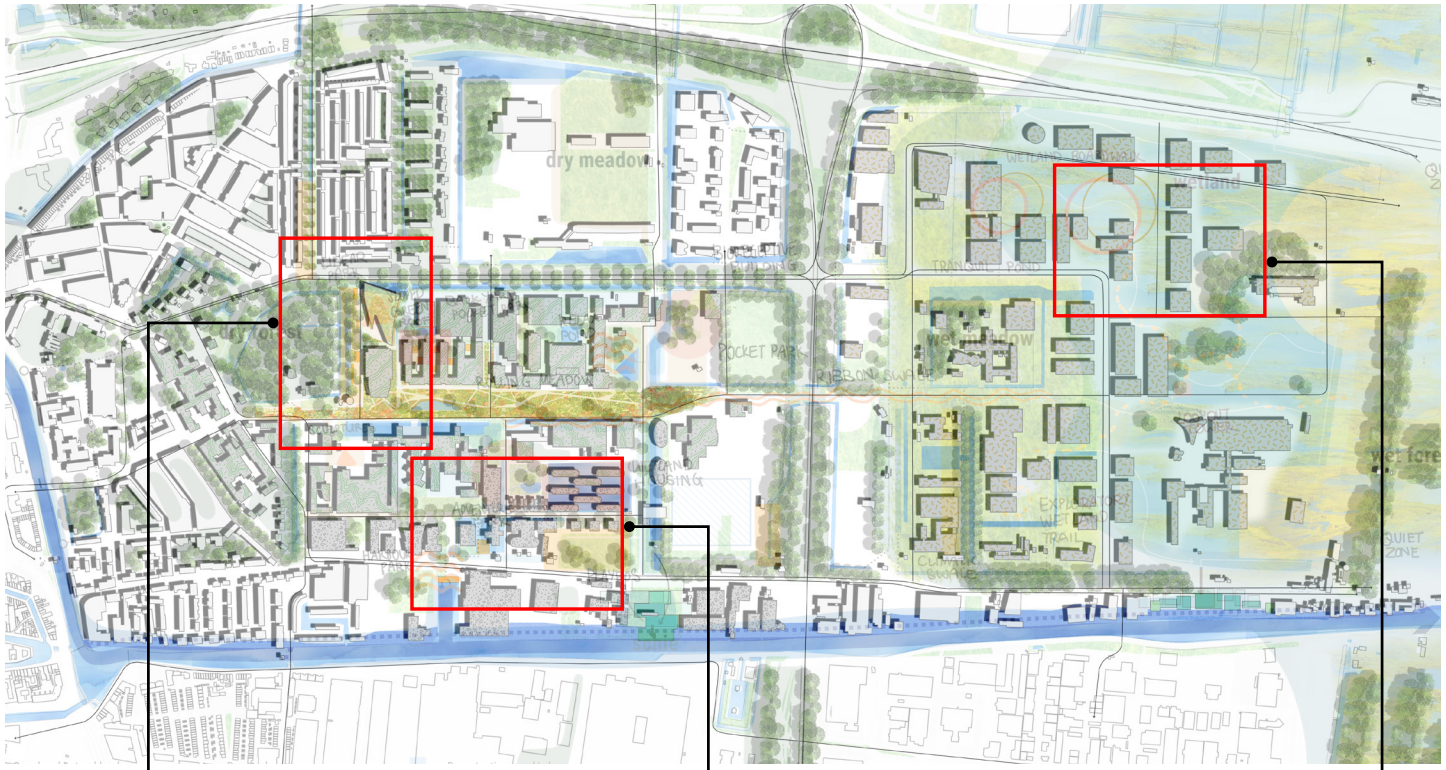
Framework application
strategy for campus clusters

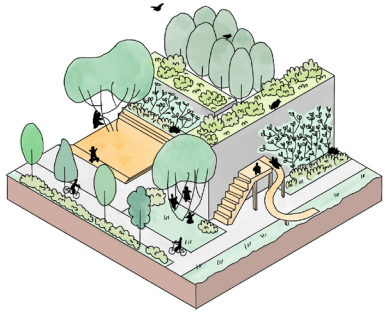


FOREST | DRY MEADOW | RIVER | WET MEADOW | WETLAND

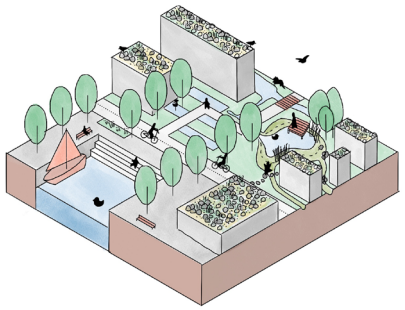


3 Sites
design elaboration

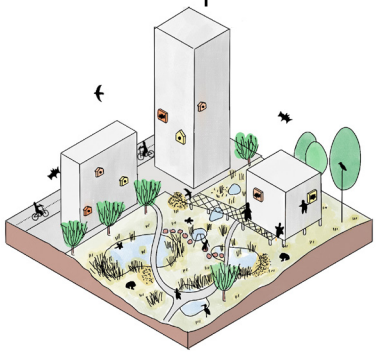




Woodland Cluster

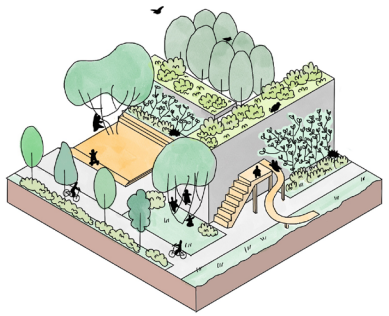


River Cluster



Wetland Cluster

3 Sites
design elaboration



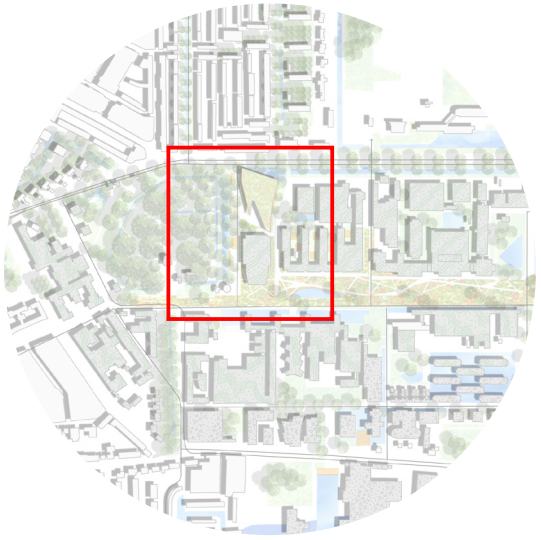
Woodland Cluster

River Cluster

Wetland Cluster

Proposed plan

linear park & backyard rain garden



1. Library
2. Aula
3. CEG
4. New multi-story carpark
5. Residential housing

6. Jaffa cemetery
7. Linear park
   - Expanded nature friendly banks
   - Mounds
   - Step sitting
   - Play features
8. Park extension
9. Backyard garden
   - Dry detention pond
   - Dry swale
10. Mekelpark
11. Water detention plaza

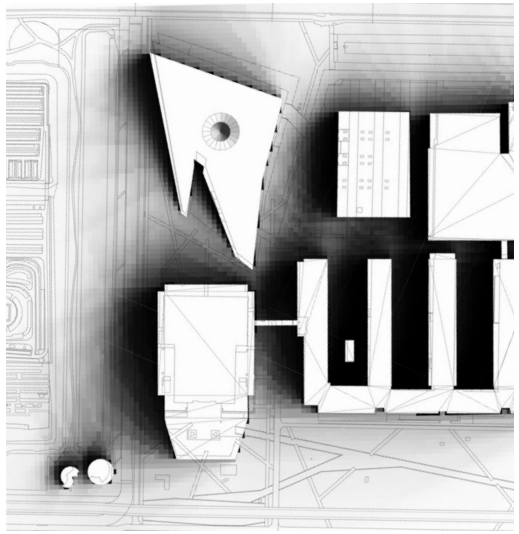
11. Drop-off round about & Proposed car mobility

0 20 40 60 80m

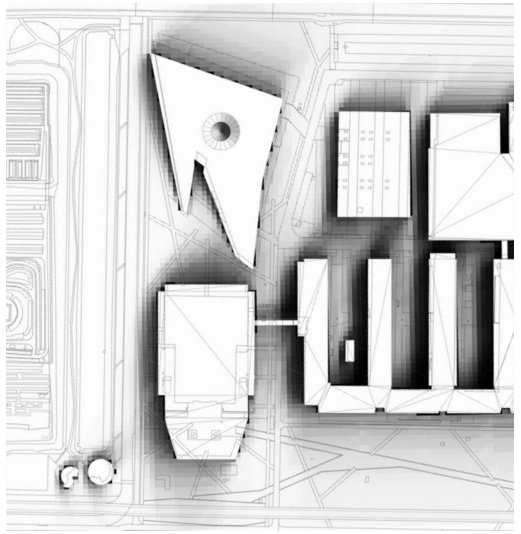
Annual shadow analysis

ladybug simulation

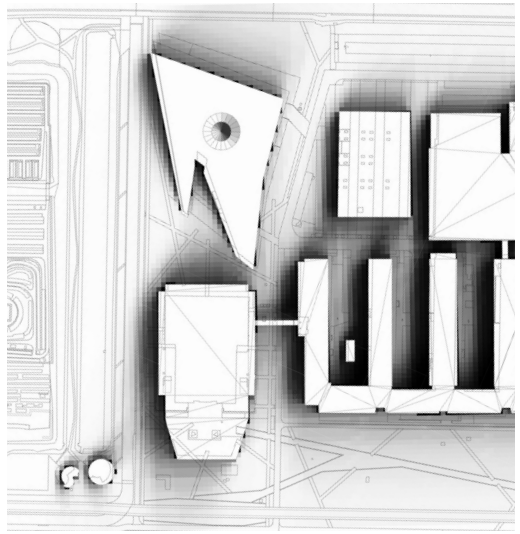
This shadow analysis is generated with the Grasshopper and Ladybug plug-in from the 3D Rhino model. It makes use of the Amsterdam weather data from Energy Plus to generate the sun path for the duration of 24 hours over a year in 3 months periods. The resulting shadow is generated with the sunlight hour analysis battery with a grey scale chart.



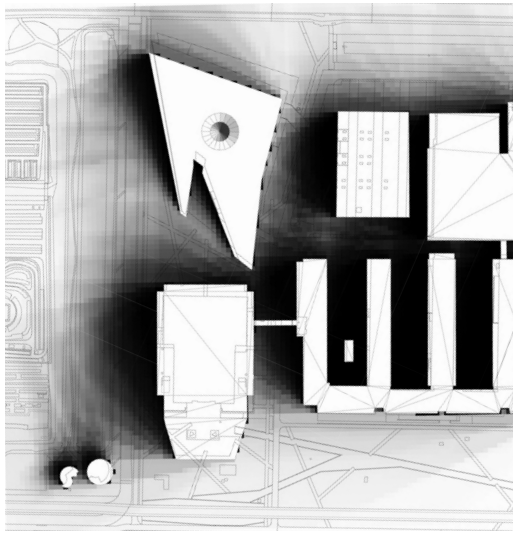
Jan-Mar



Apr-Jun



Jul-Sep



Oct-Dec

Planting plan

vegetation types

- Shade tolerant eco trees
- Eco trees
- Shade tolerant shrubs and ground cover
- Flower and herb meadow
- Helophyte riparian plants

SHADE TOLERANT ECO TREES


Acer campestre
(Field maple)


Aesculus flava
(Sweet buckeye)


Celtis 'Magnifica'
(Hackberry)


Tilia cordata
(Little-leaf Linden)

ECO TREES


Acer platanoides
(Norway maple)


Alnus glutinosa
(Common alder)


Prunus avium
(Sweet Cherry)


Fraxinus excelsior
(Common ash)

SHADE TOLERANT SHRUBS & COVER


Crataegus monogyna
(Common Hawthorn)


Ilex aquifolium
(Holly)

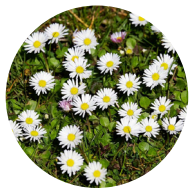

Osmunda regalis
(Royal Fern)


Viburnum opulus
(Cranberrybush)

FLOWER AND HERB MEADOW


Allium schoenoprasum
(Chives)


Hyssopus officinalis
(Hyssop)


Bellis perennis
(Daisy)


Salvia officinalis
(Sage)

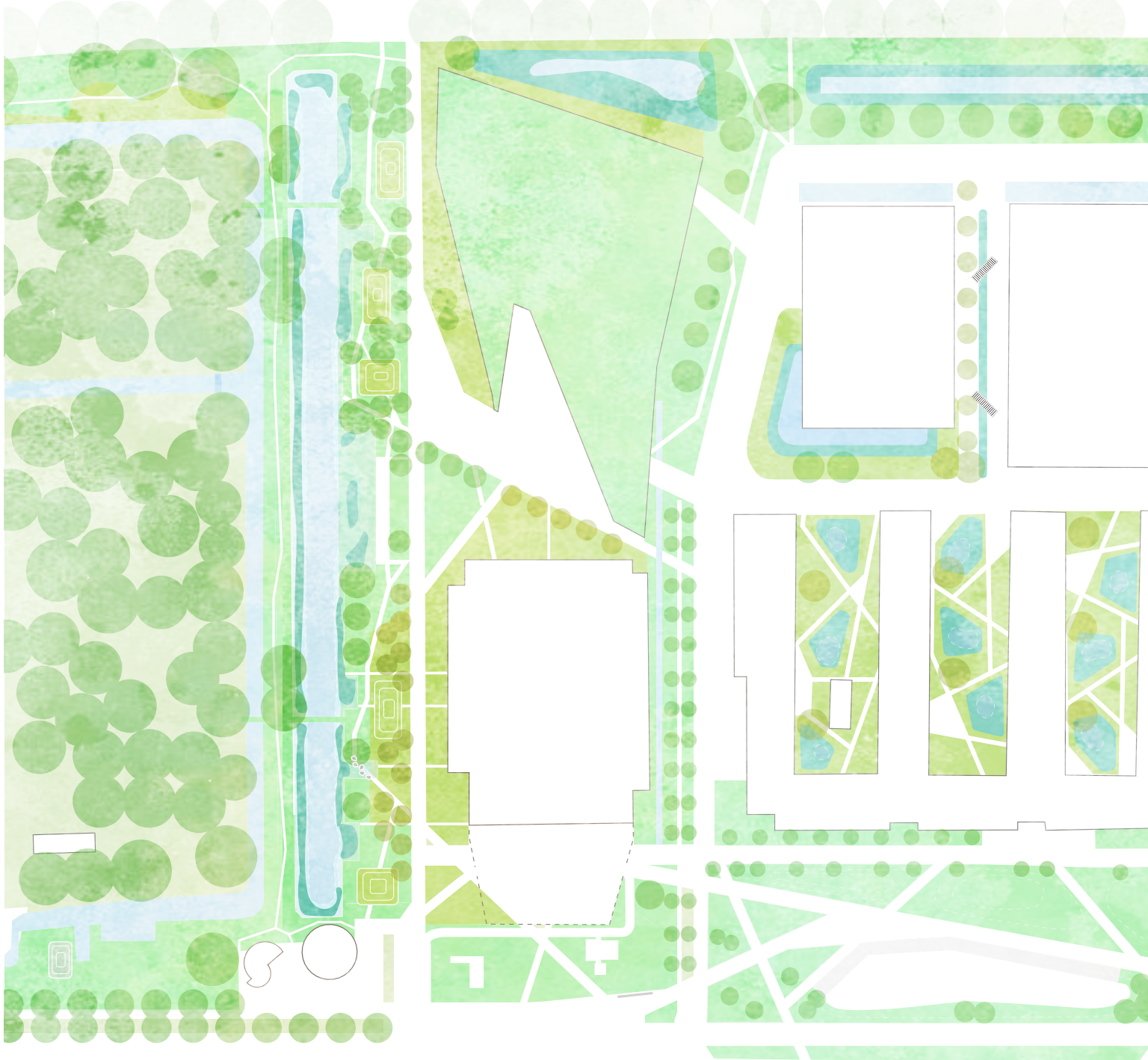
HELOPHYTE RIPARIAN PLANTS


Butomus umbellatus
(Flowering Rush)


Peltandra sagittifolia
(Arrow Arum)


Lythrum salicaria
(Purple Loosestrife)


Lysimachia punctata
(Yellow Loosestrife)



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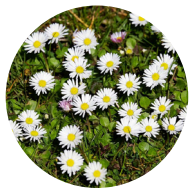
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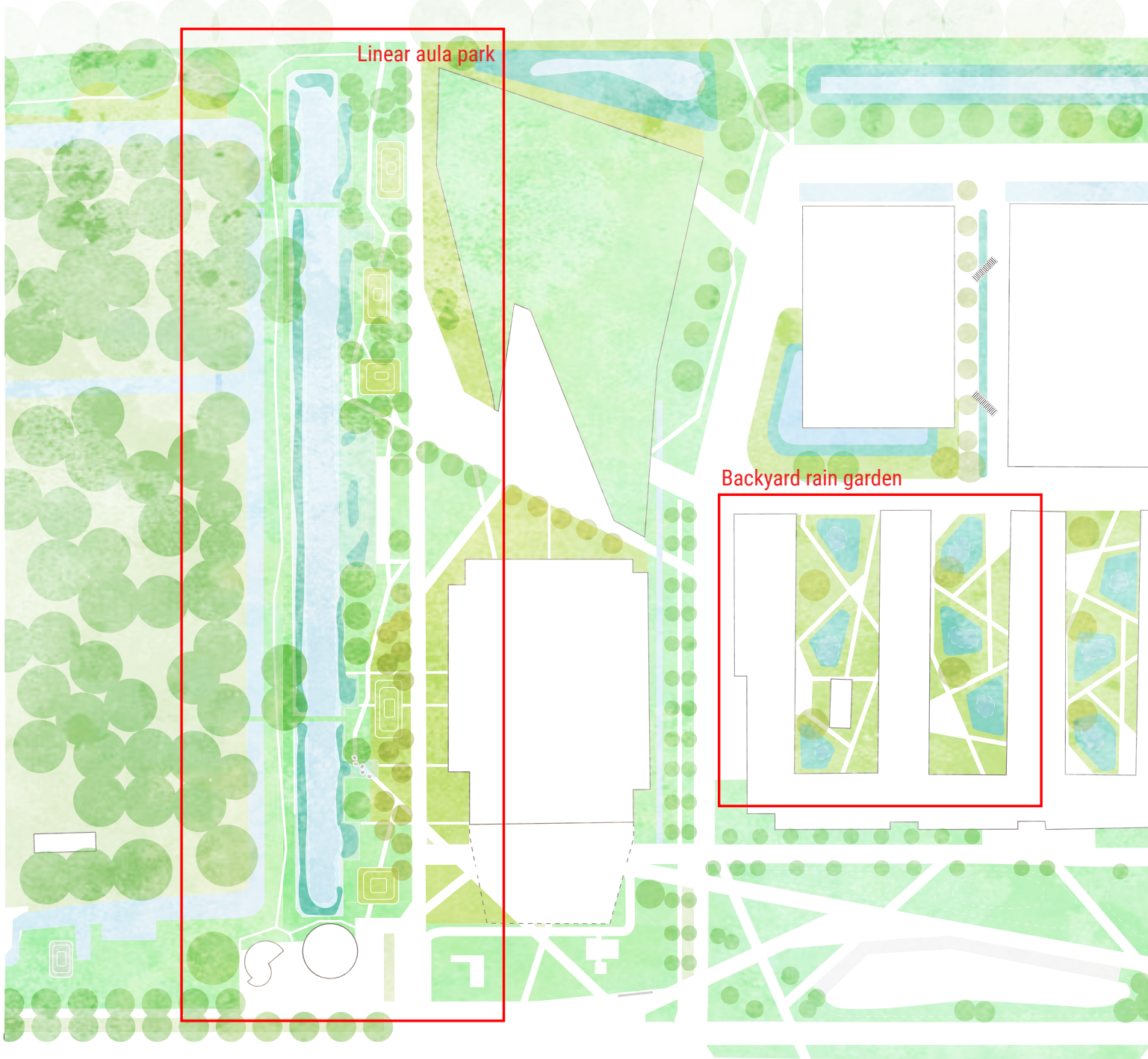
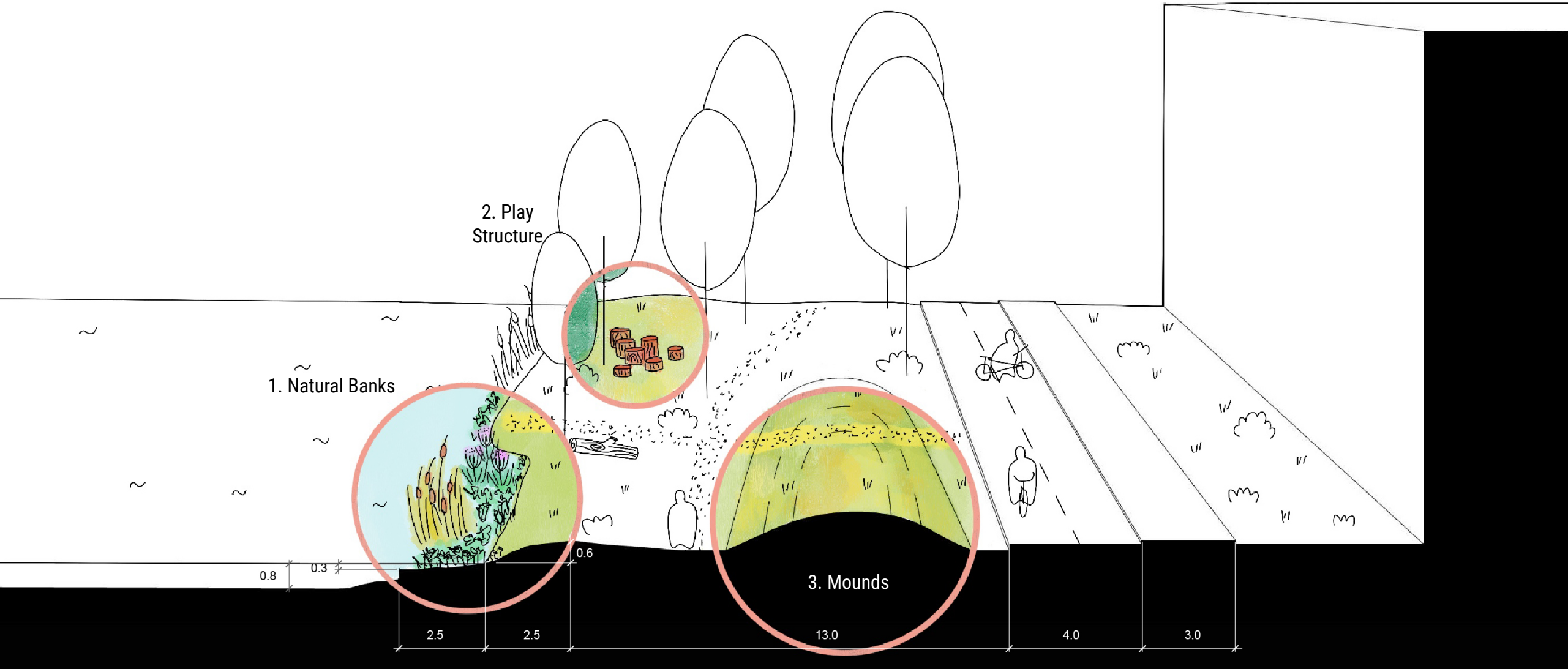


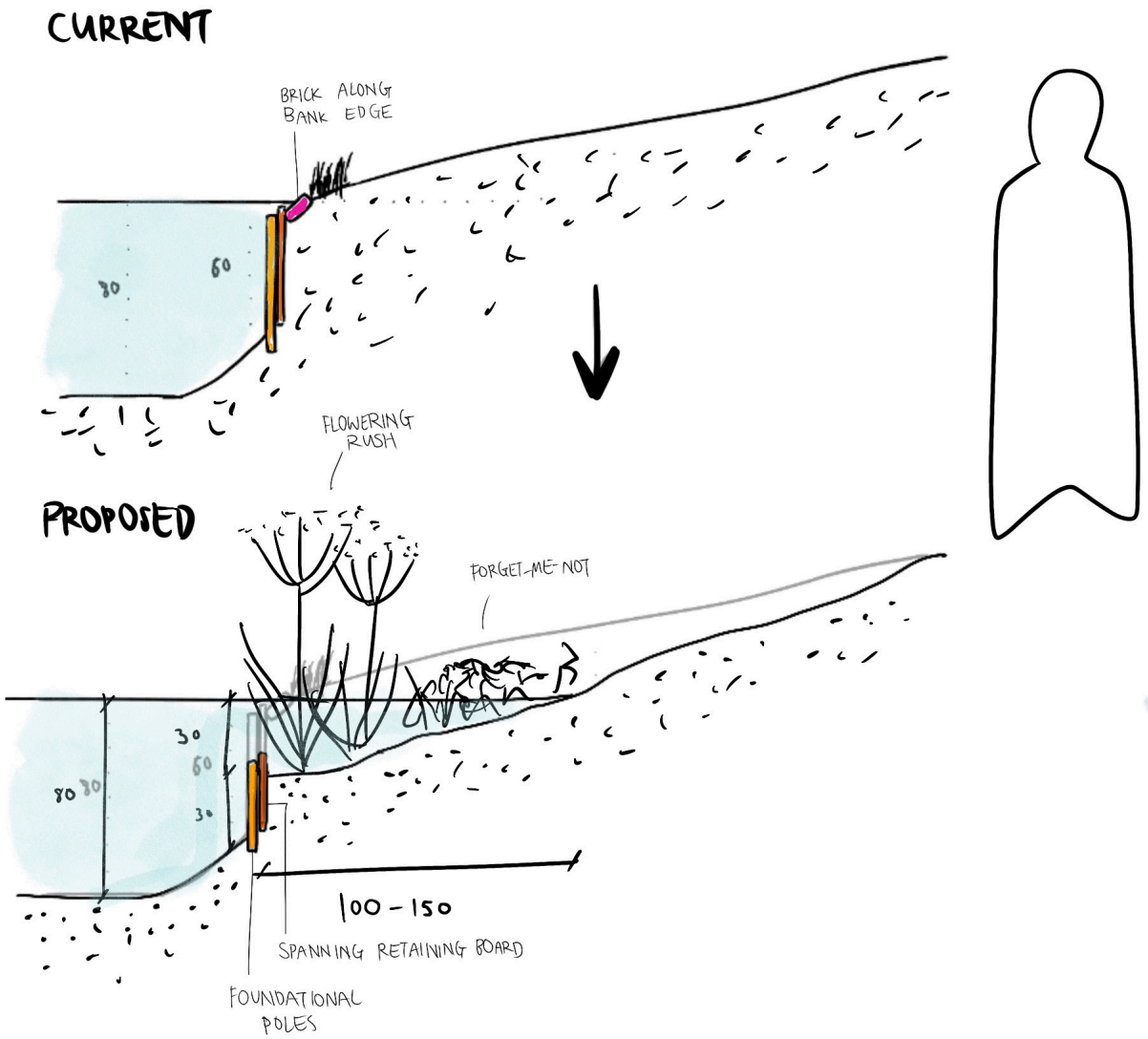
Linear park elaboration

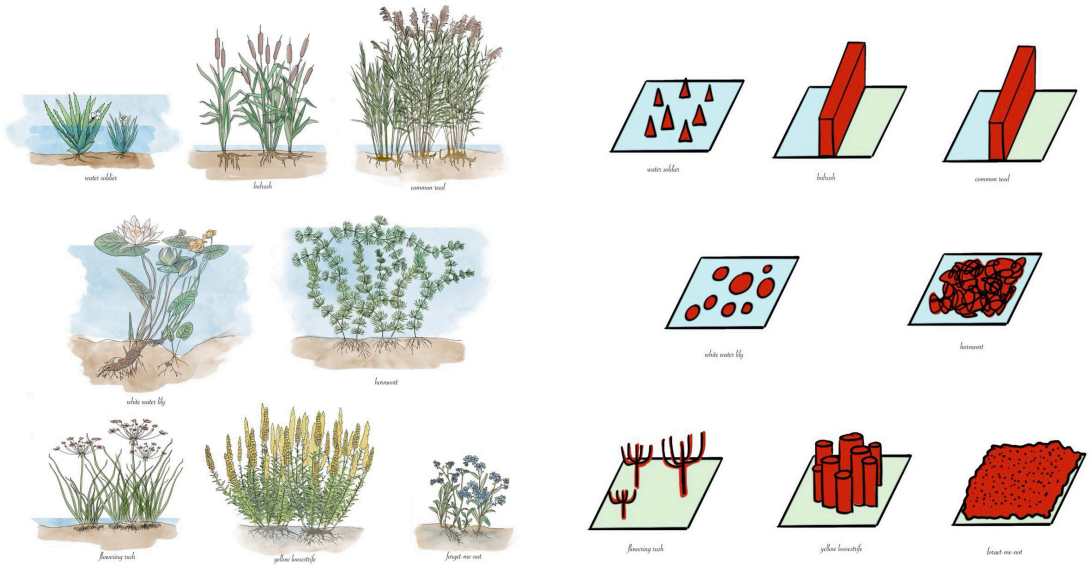
forest cluster landscape elements



Linear park elaboration

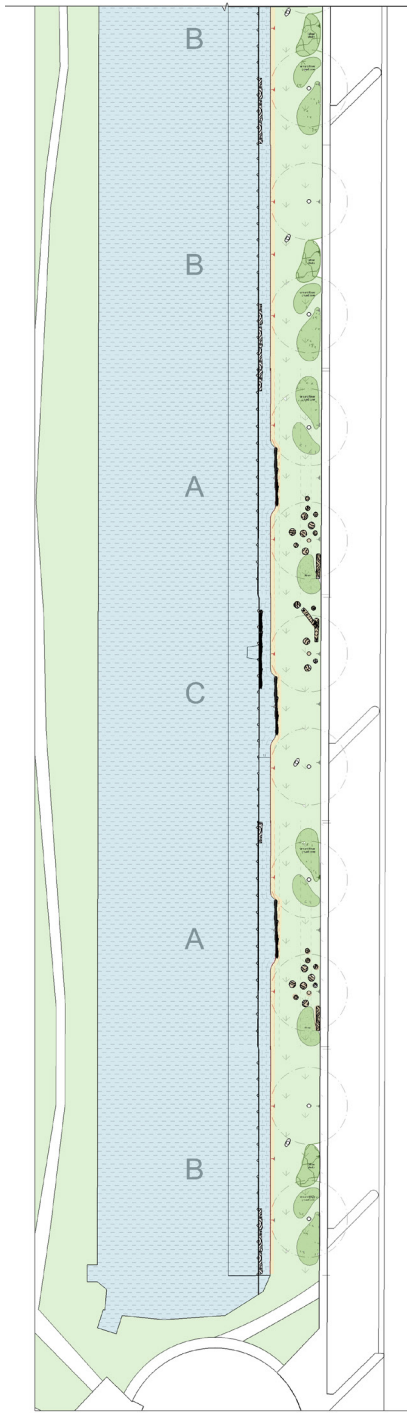
1. natural banks

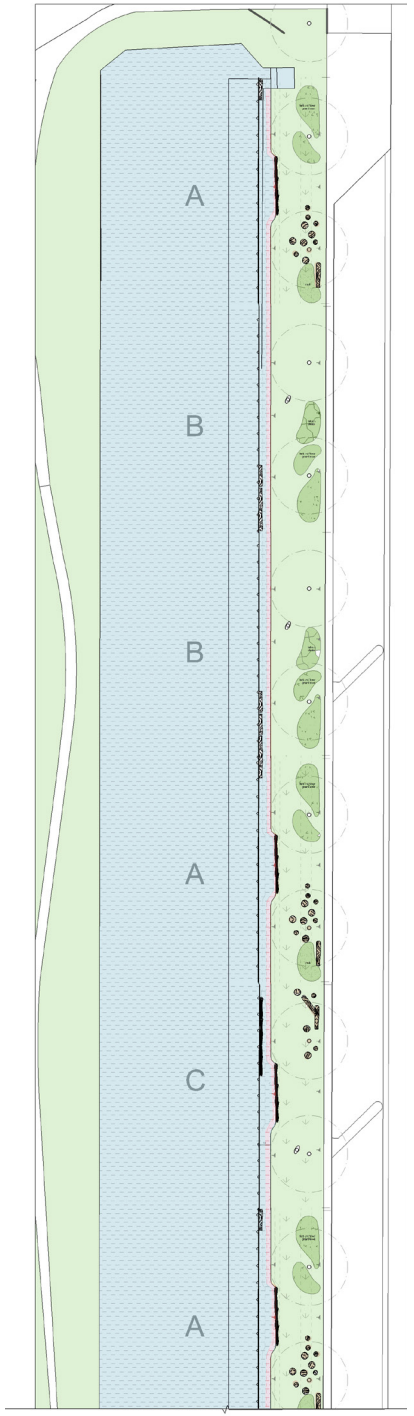




Huygensweg bank improvement plan

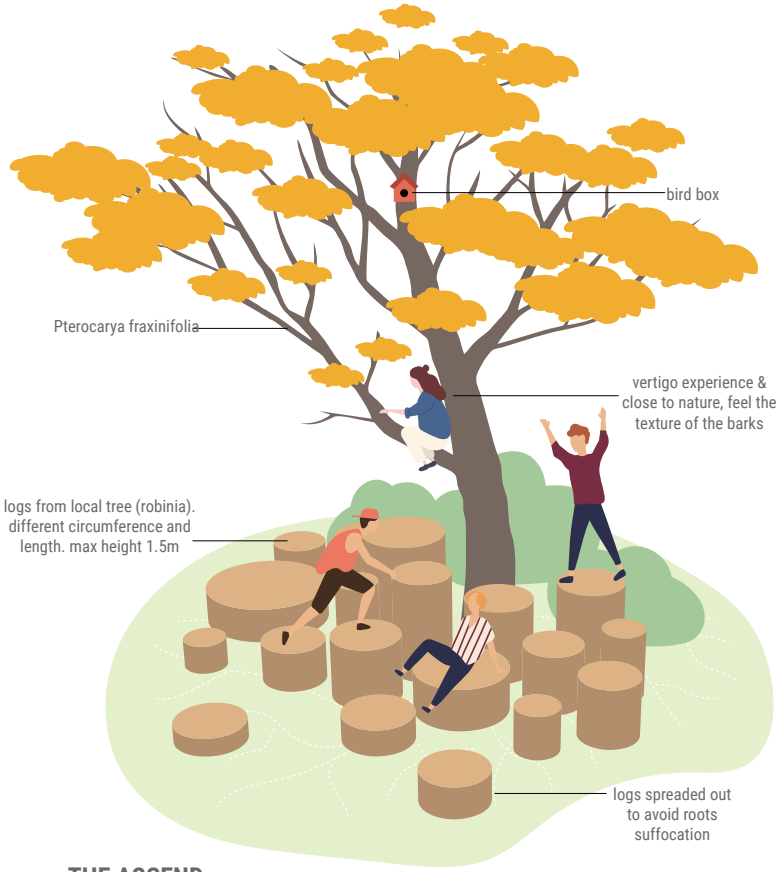
ONSITE plan with Rene Hoonhout



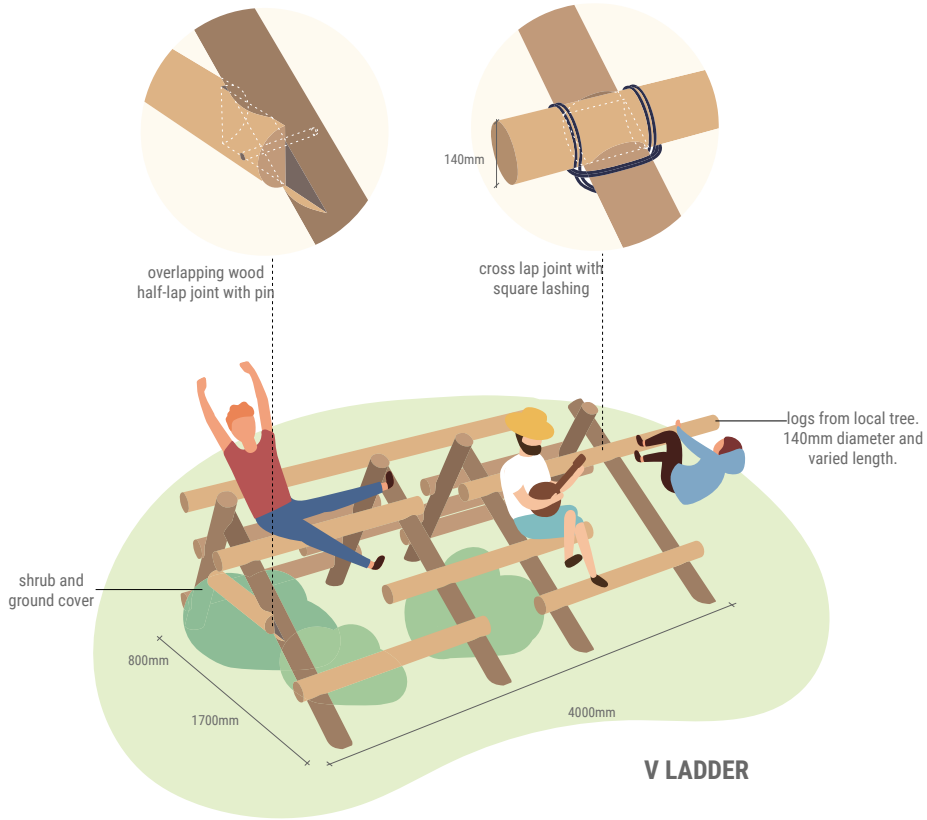


Linear park elaboration

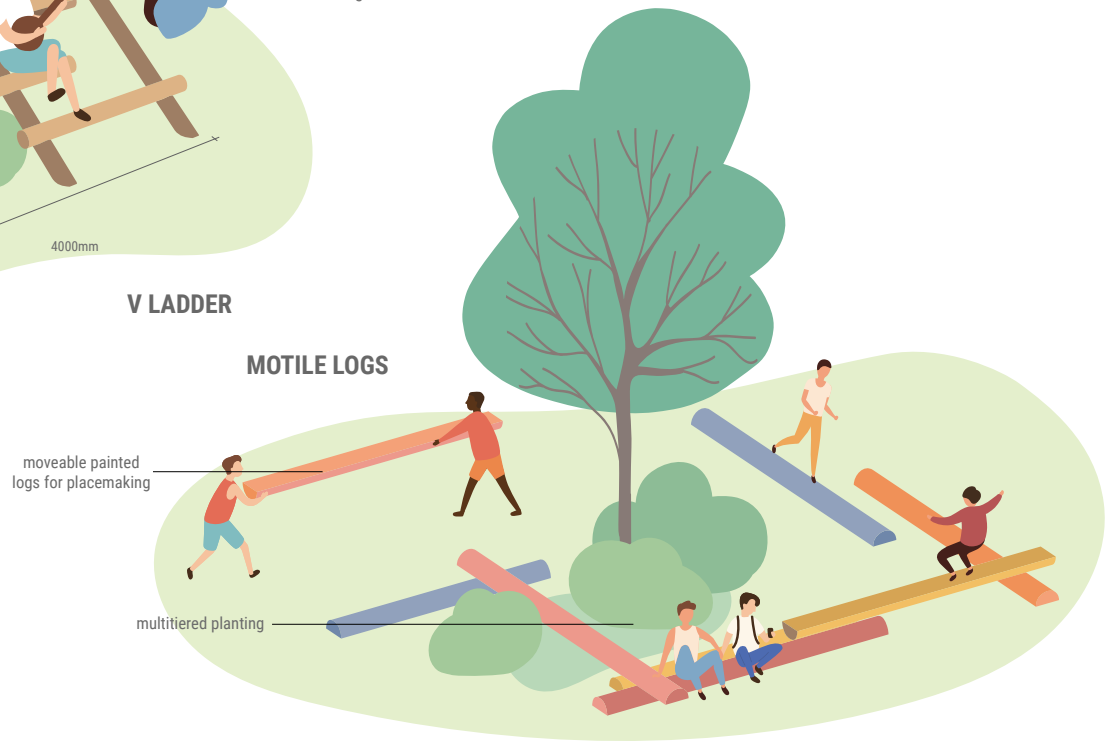
2. play structure



THE ASCEND



V LADDER

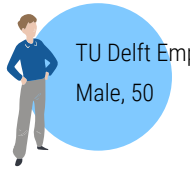


MOTILE LOGS

Linear park elaboration

2. play structure

Survey feedback



TU Delft Employee
Male, 50

Nature enthusiast
Female, 24

Dutch student
Male, 24

International student
Female, 30

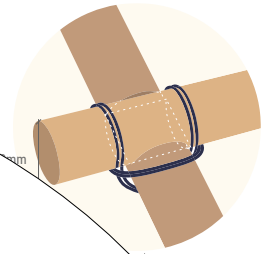
rating

like

more green less paving. big green connection. forest vibes. coloured logs. .

dislike

too few structures to sit on. moving logs might be a lot of work and maybe dirty. regularity.



logs from local tree. 140mm diameter and varied length.

LADDER

MOTILE LOGS

moveable painted logs for placemaking

multitiered planting

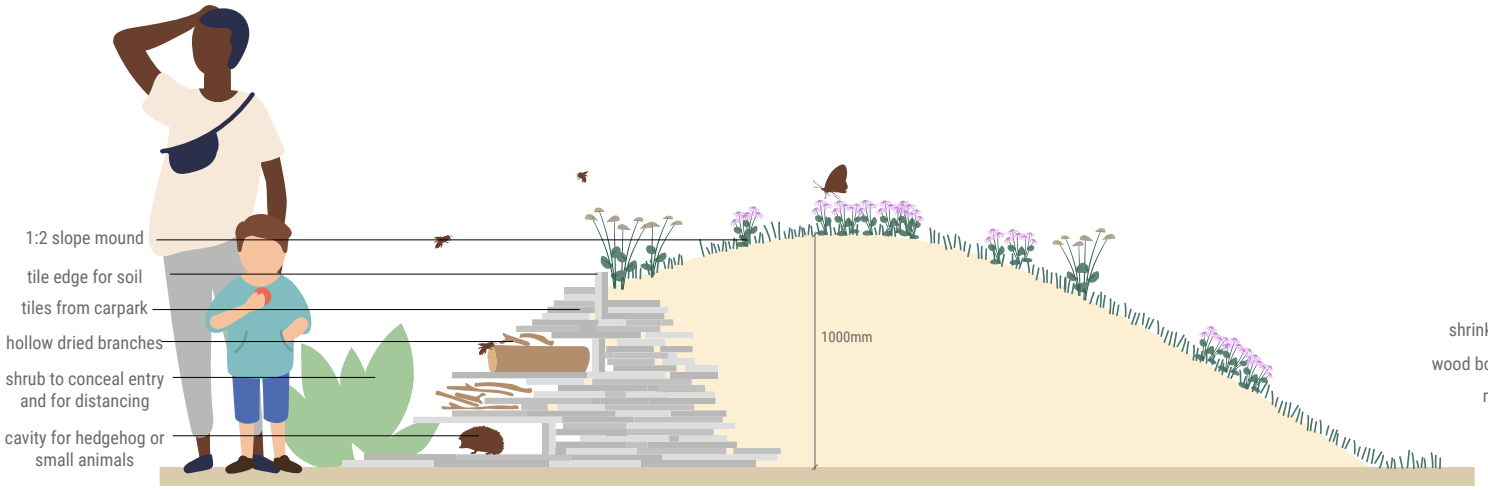
logs from local t
different circumfe
length. max height

logs spreaded out to avoid roots suffocation

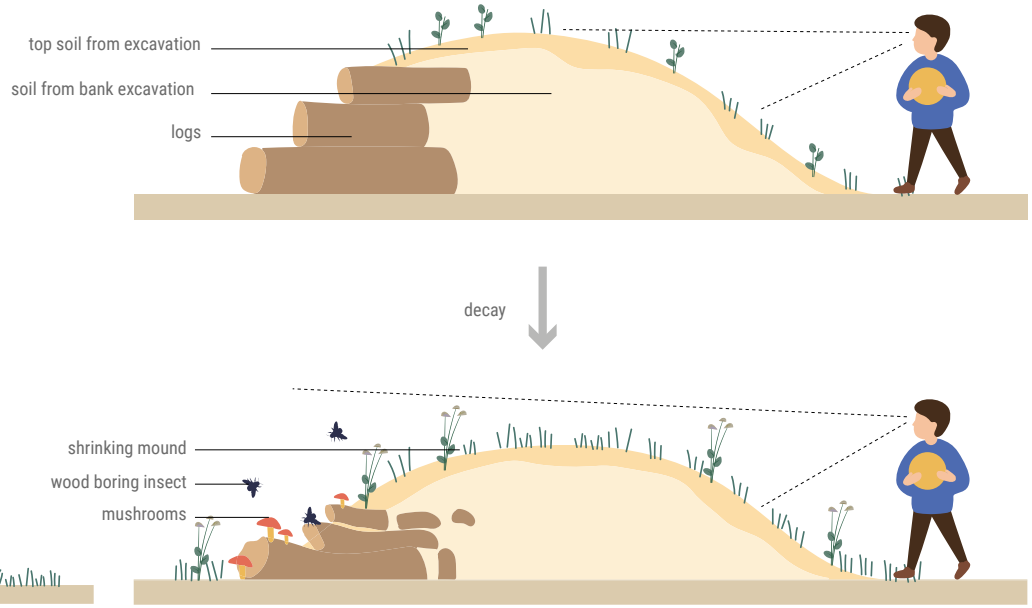
THE ASCEND

Linear park elaboration

3. mound



HABITAT MOUND



ORGANIC LIVING MOUND

Mound model










AS building backyard garden

current situation

AS building backyard garden

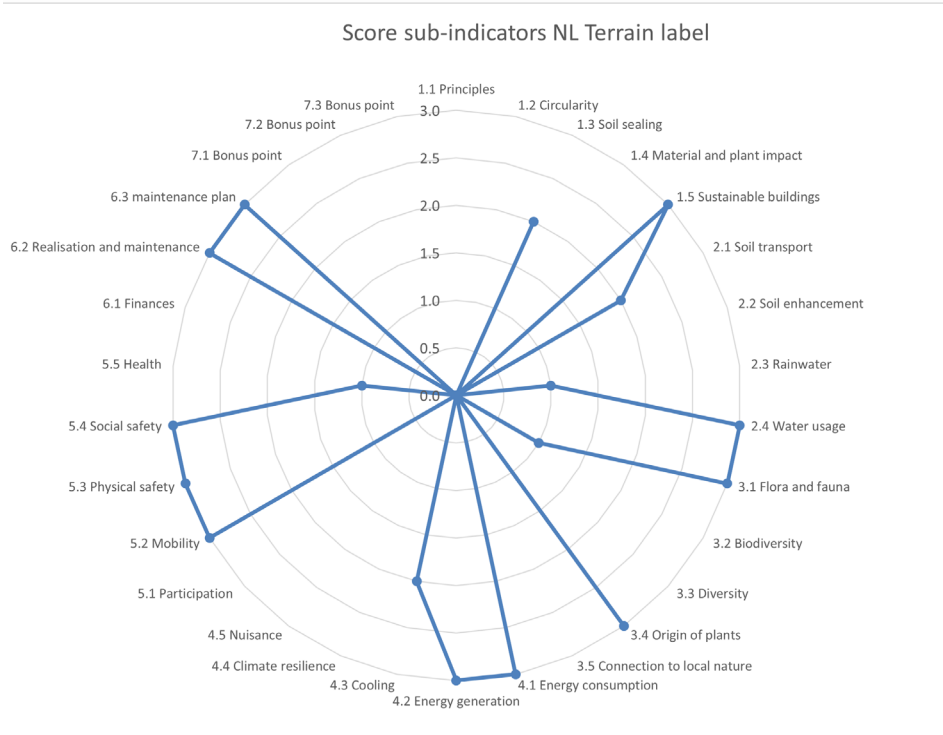
impression of rain rain gardens and green buildings

AS building backyard garden

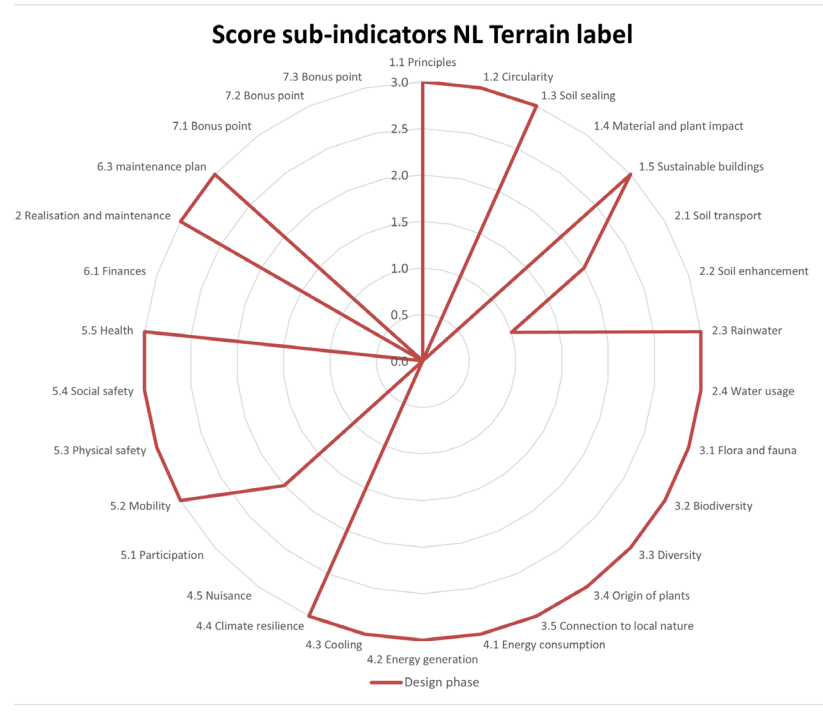
impression of rain rain gardens and green buildings

NL Green Label Rating

before & after design evaluation



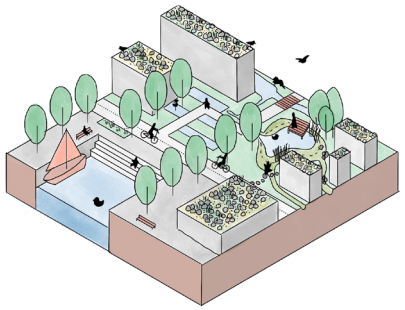
current



design rating

3 Sites
design elaboration

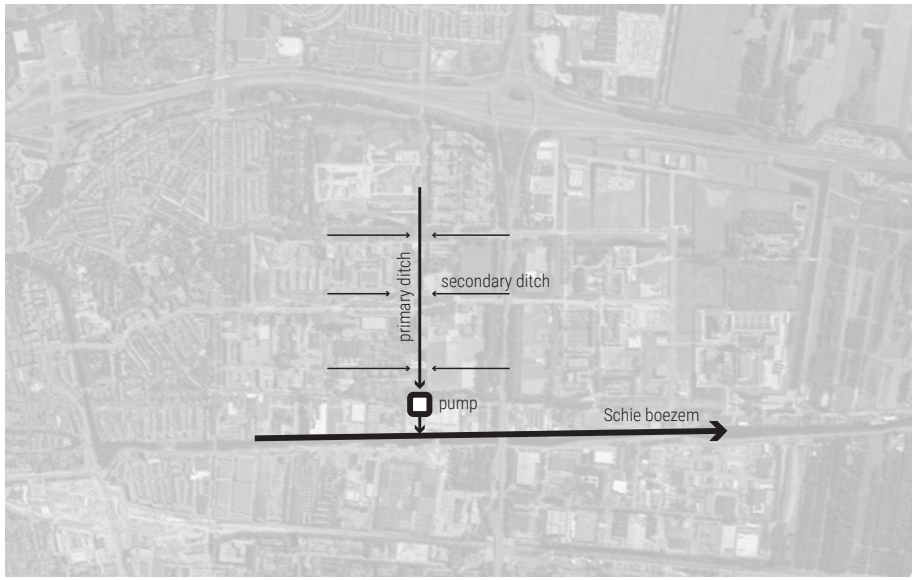
Woodland Cluster

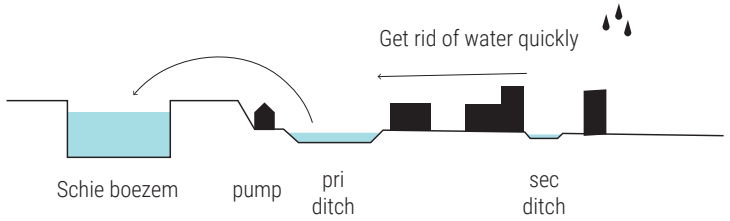


River Cluster

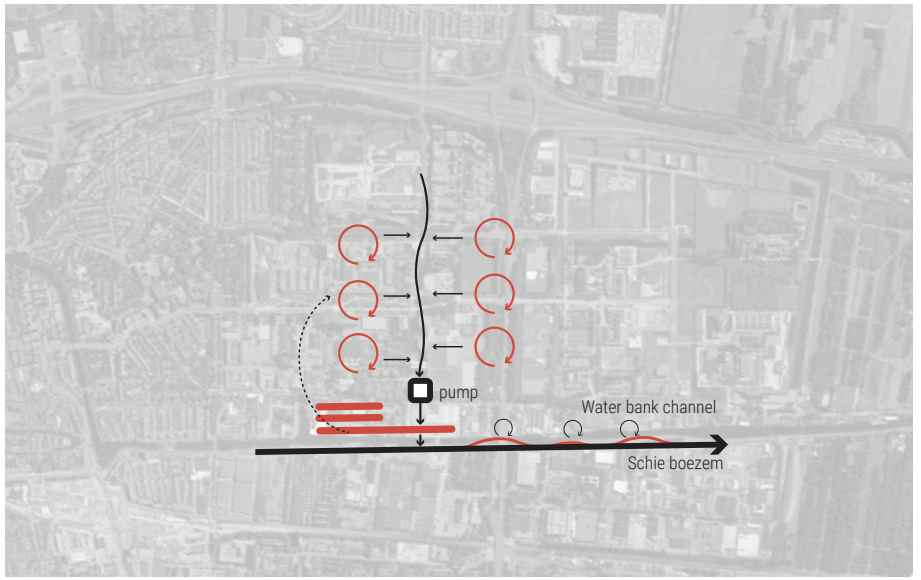
Wetland Cluster

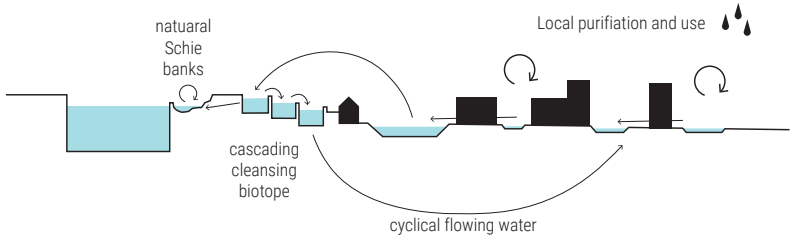
Polder water system





Circular water system





Historic creek 250BC

River cluster design
proposed design

For river cluster area,

Current water storage capacity
(assuming surface water depth is 0.4m):

4,800m3

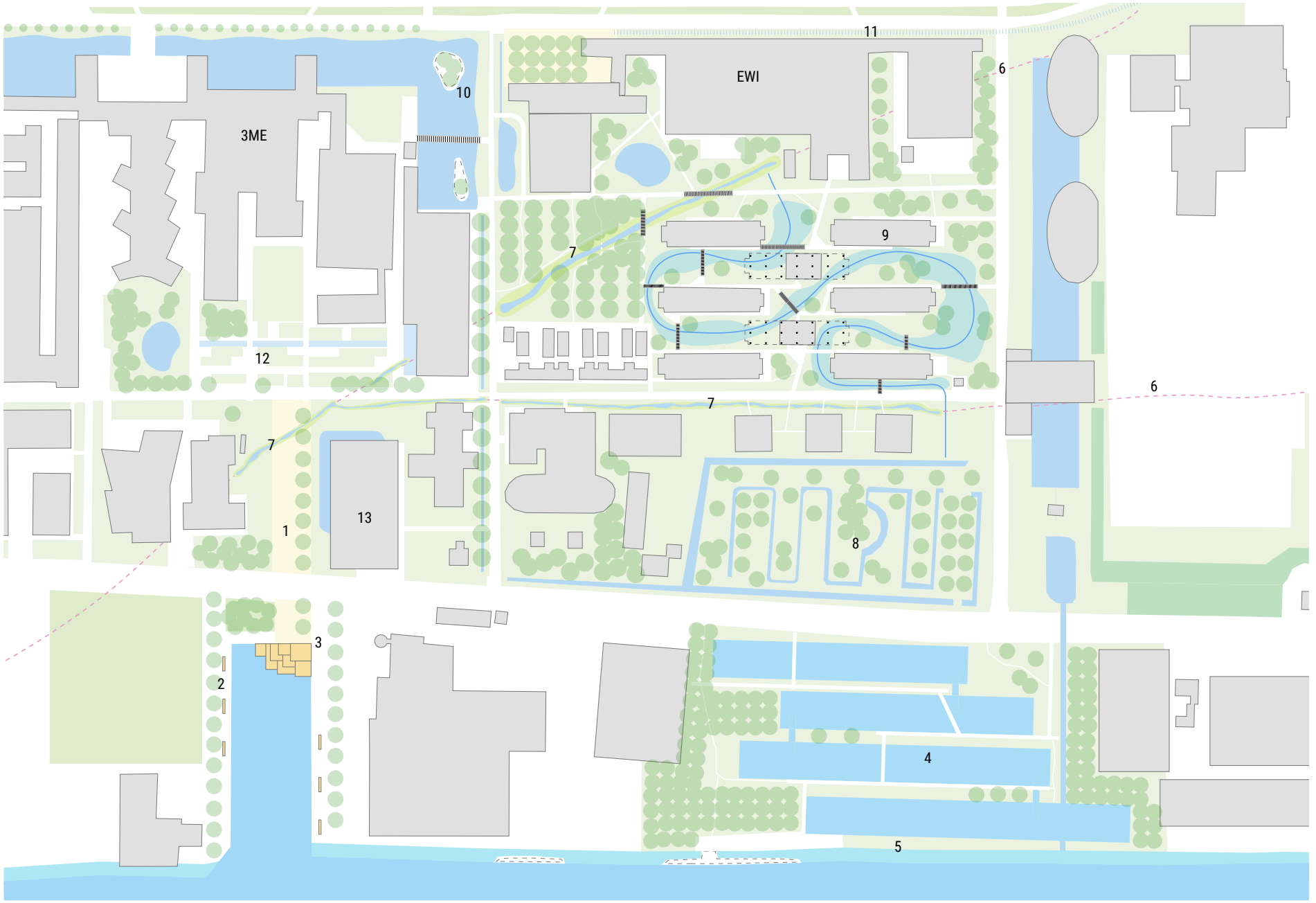
Additional storage and cleansing
capacity with new design:

+ 16,000m3

|

+ 27,000m3

floodzone activated during heavy rain



1. Continuous plaza connecting harbour to TU Campus
2. Habour tiered platform
3. Benches

4. Cleansing biotope park
5. Expanded Schie with eco-friendly banks (shallow depth and island)

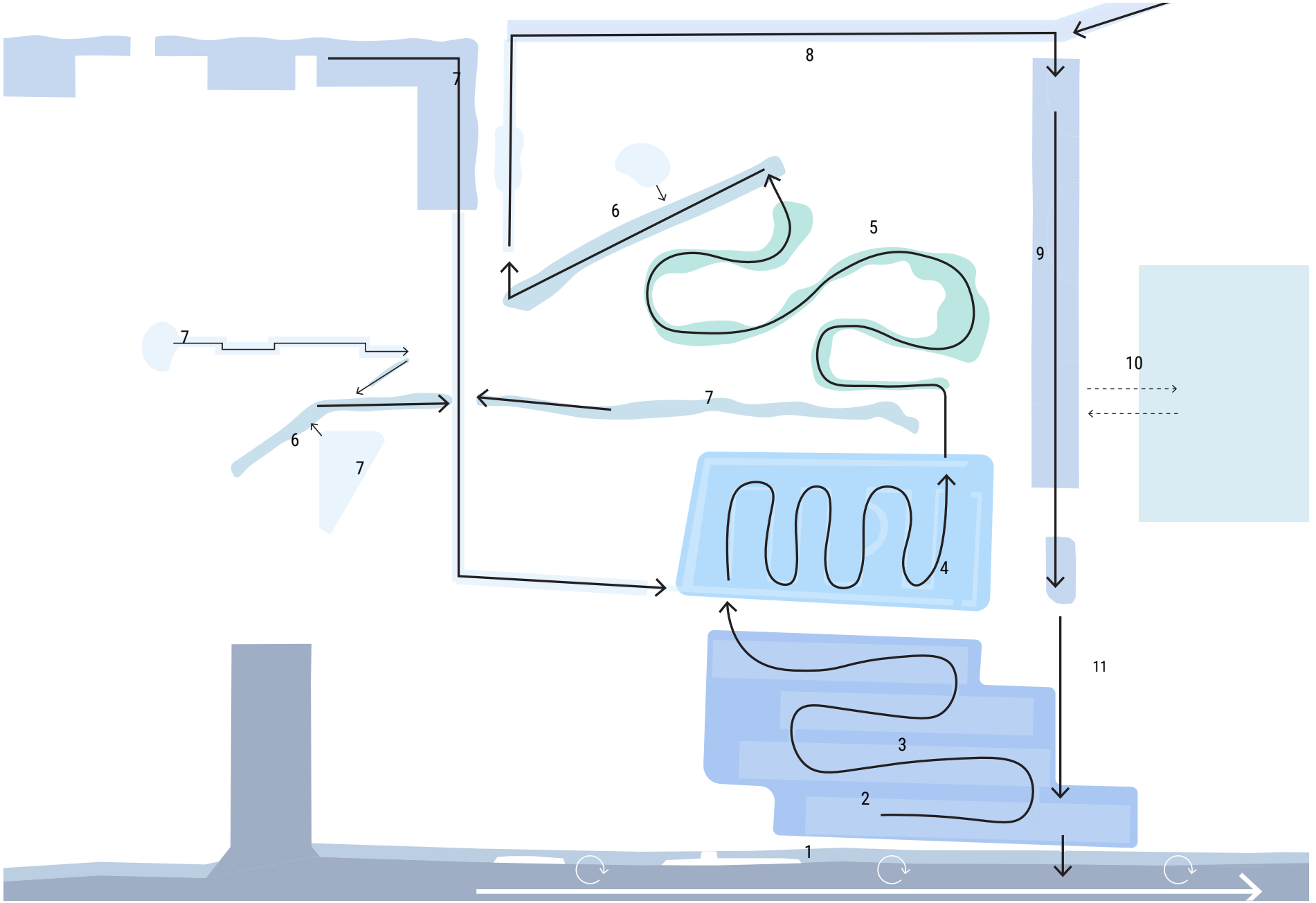
6.Historic creek lines
7. Resurfaced creek
8. Speelbos
9. Wetland housing
10. Quiet island zone
11. Dry swale
12. Depave carpark pattern for planting

13. New multi-story carpark

River cluster water system

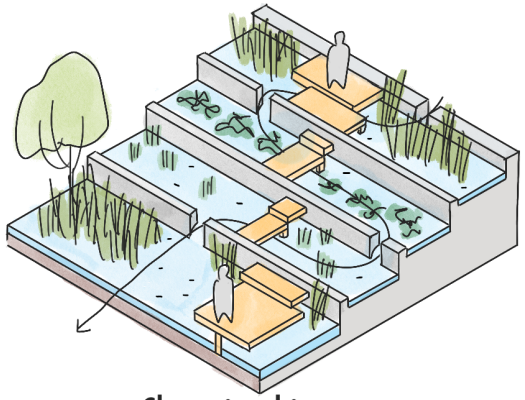
proposed design

RESILIENT

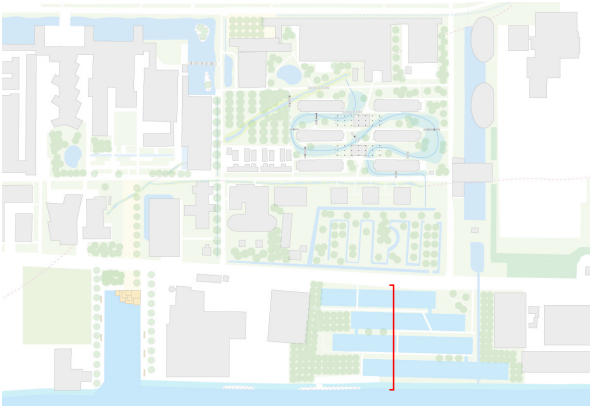


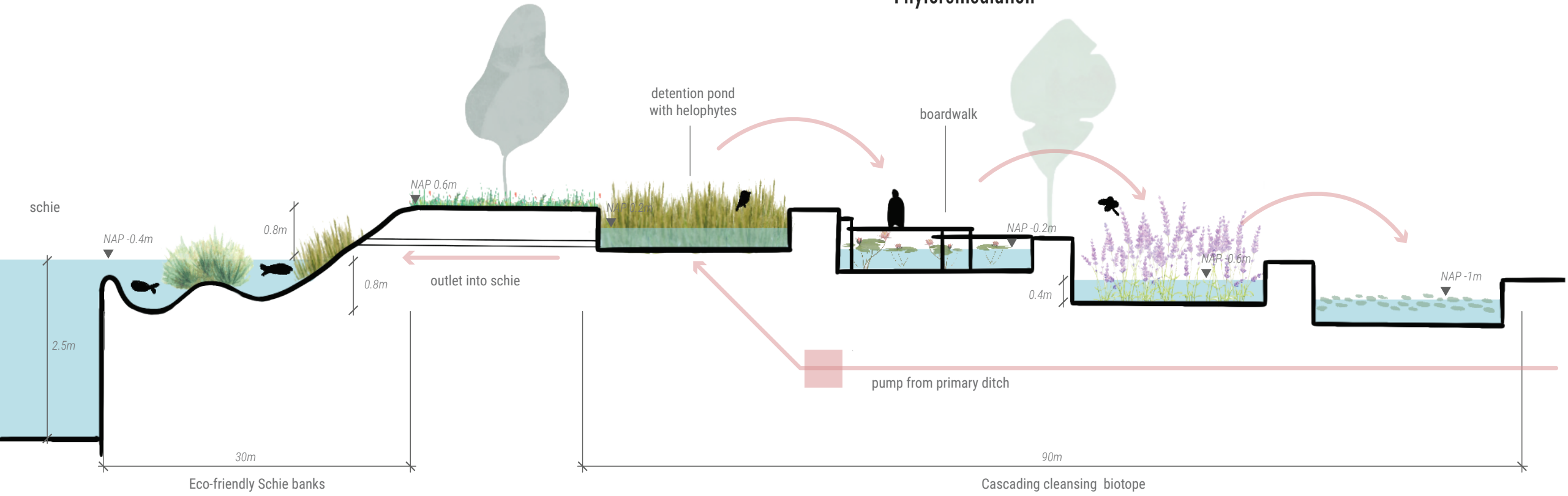
1. Eco-friendly Schie banks with helophytes for water purification
2. Open inlet gates (during dry season)
3. Natural gravitational flow down cleansing biotope compartments
4. Water purification in Speelbos
5. Water purification in meandering wetland (floodplain area activated during heavy storm)
6. Water conveyance along resurfaced creek
7. Local water detention
8. Water conveyance along swale
9. Primary polder ditch
10. Underground water storage/ release below sports fields
11. Pump out to highest cleansing biotope compartment and out into Schie

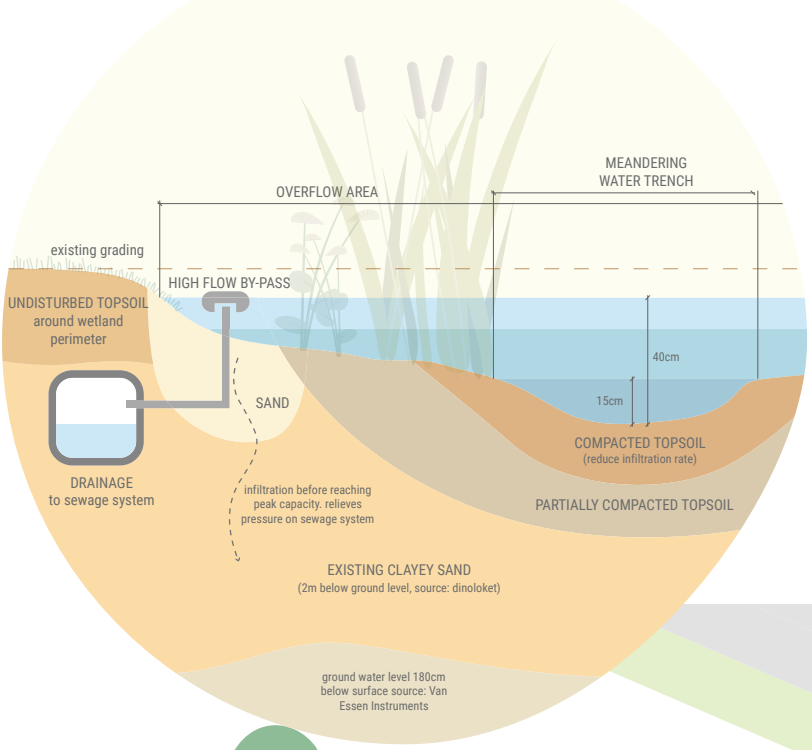
Cleansing biotope
section

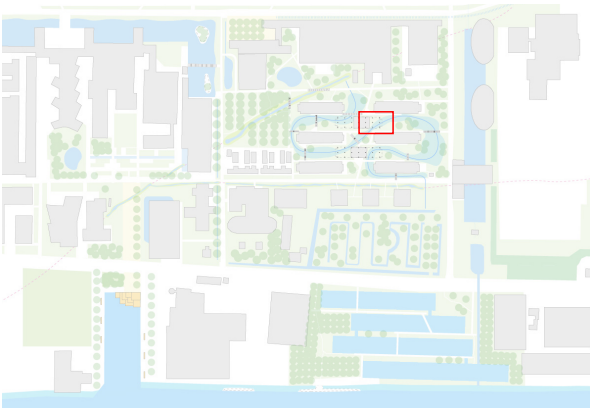


Cleansing biotope-
Phytoremediation



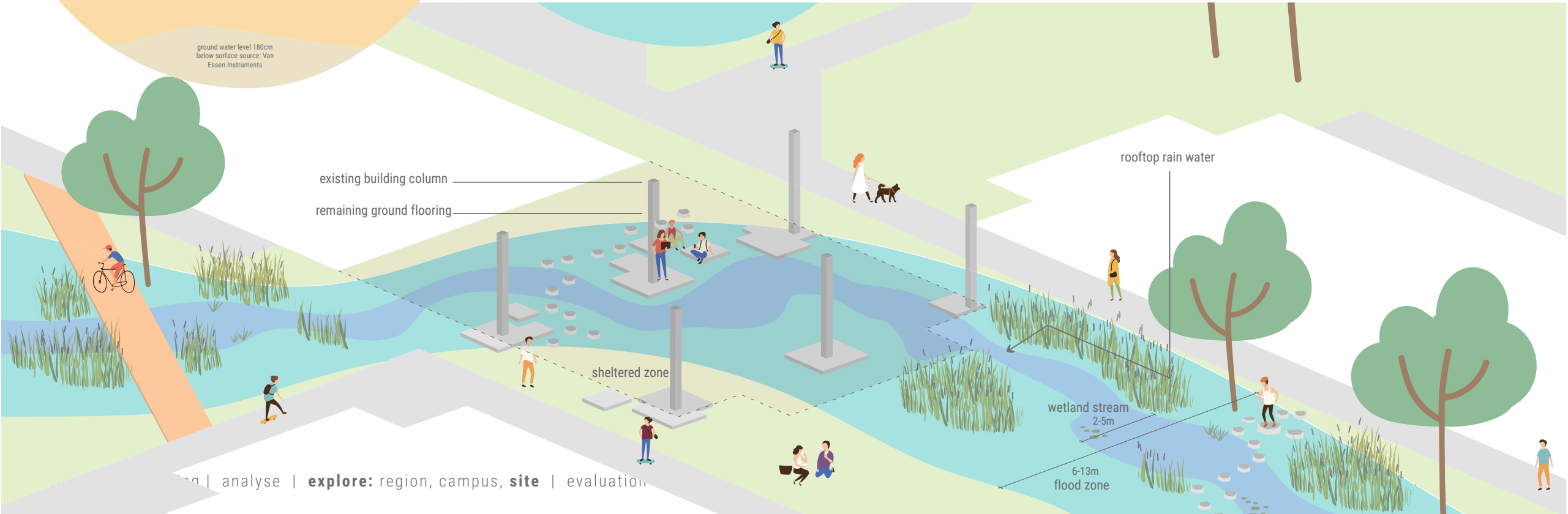






Wetland hostel

design elaboration and detail



Korvezeestraat Student Housing

current situation

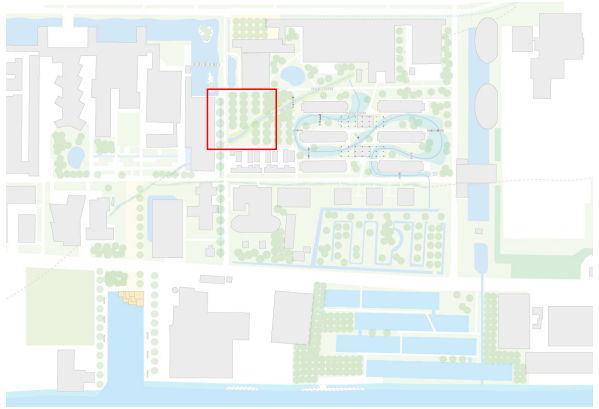
Korvezeestraat Student Housing

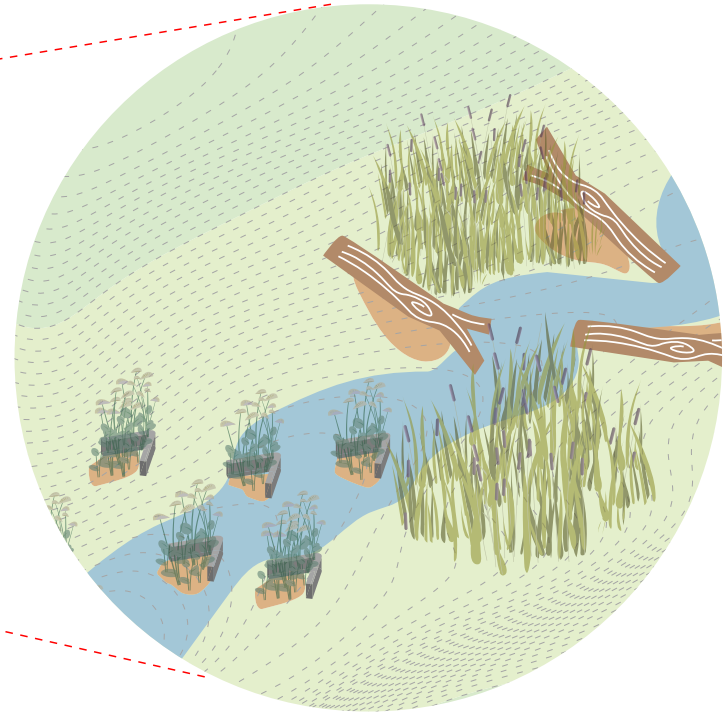
impression of integrated wetland hostel

Korvezeestraat Student Housing

impression of integrated wetland hostel

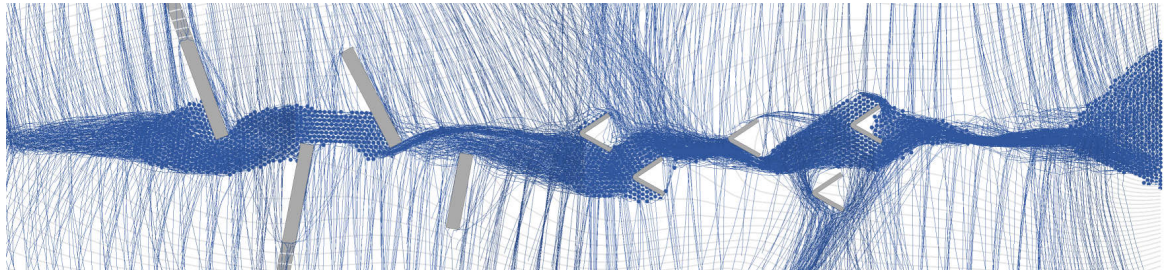
Creek park design
plan

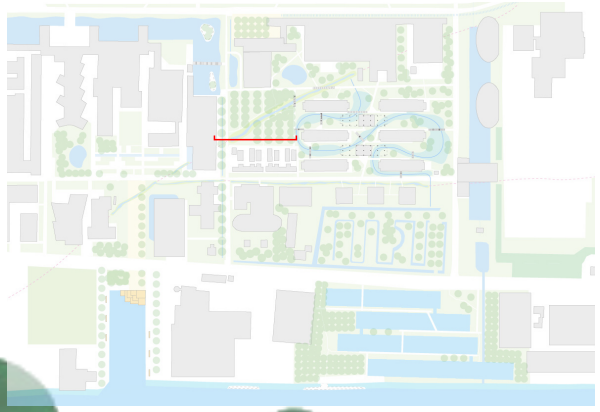


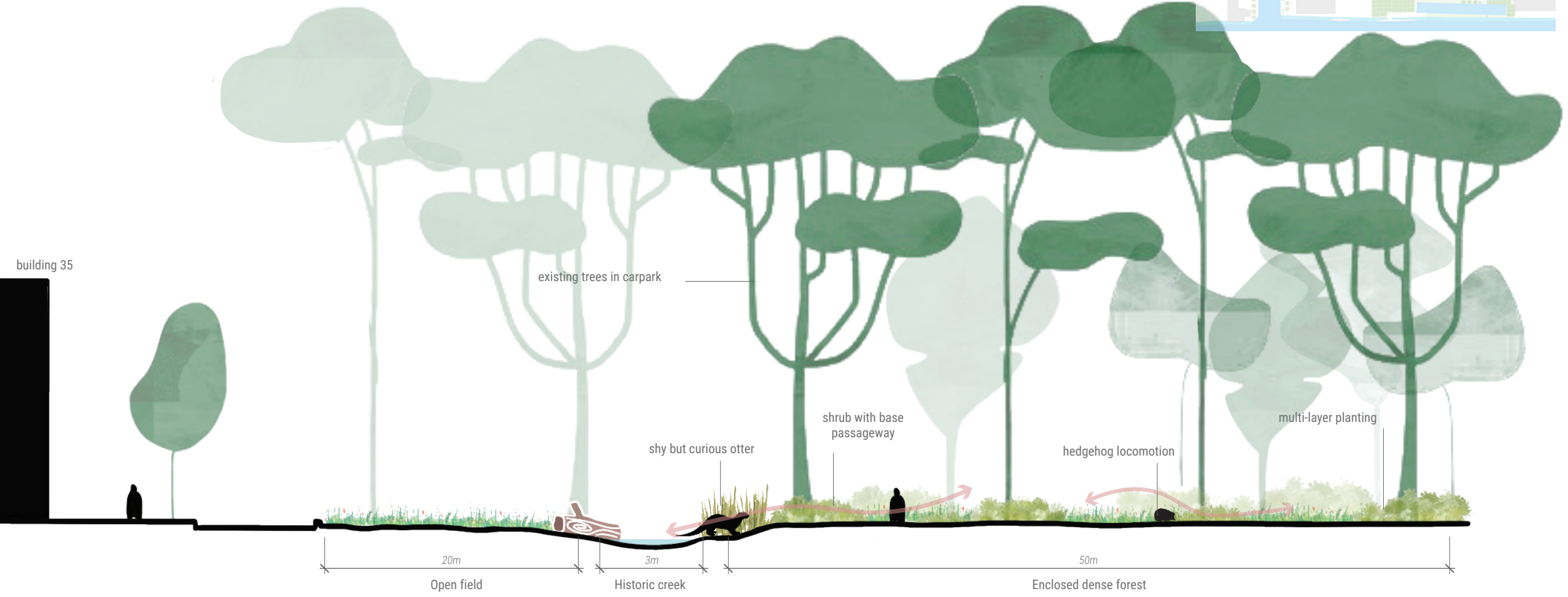


Creek park section

water patterns and section

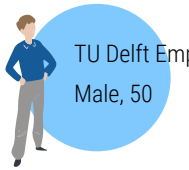







Creek park
impression

Survey feedback



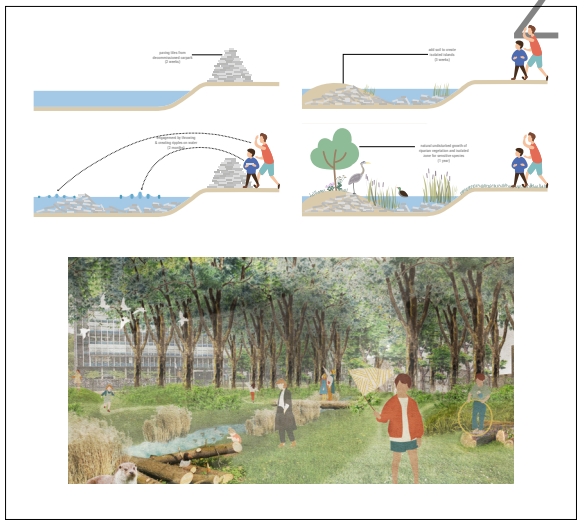
TU Delft Employee
Male, 50

Nature enthusiast
Female, 24

Dutch student
Male, 24

International student
Female, 30

2



rating

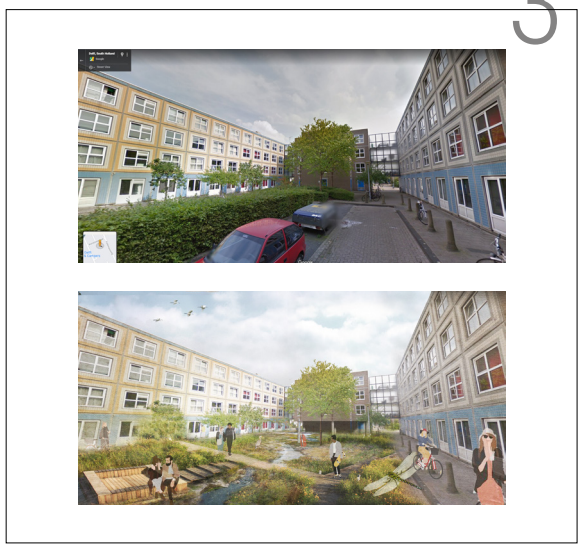
like

historical creek. tall trees and board walk. art and sculptural value. experience being close to water

dislike

not sure if allowed or illegal to throw tiles. mosquito.

3



rating

like

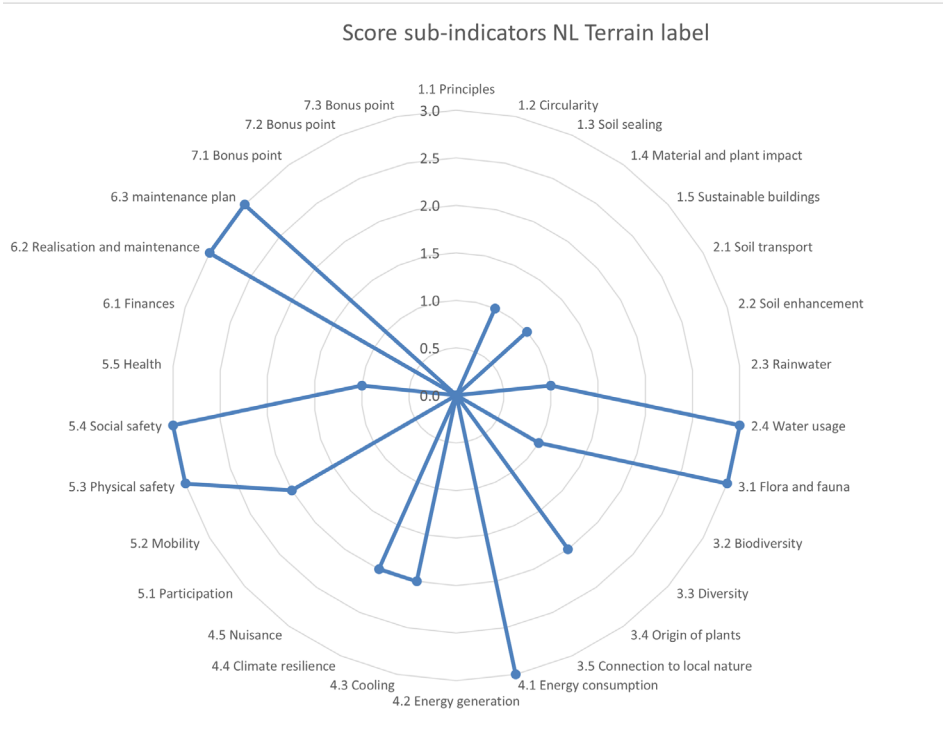
green at proximity of door. pleasant environment. greenery good for eye and health.

dislike

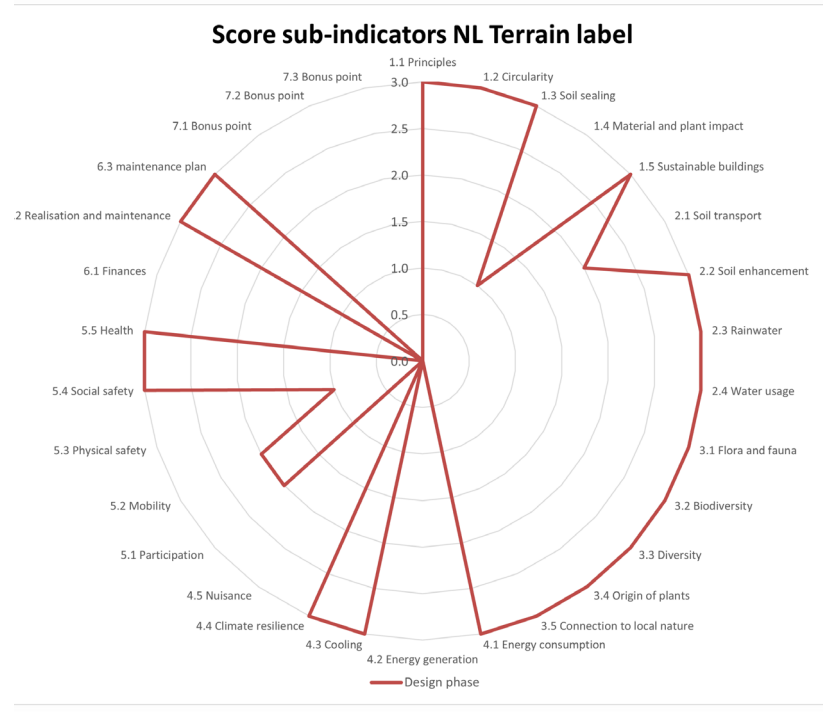
safety with loiterers. no place for sports activity (badminton, volleyball, frisbee)

NL Green Label Rating

before & after design evaluation

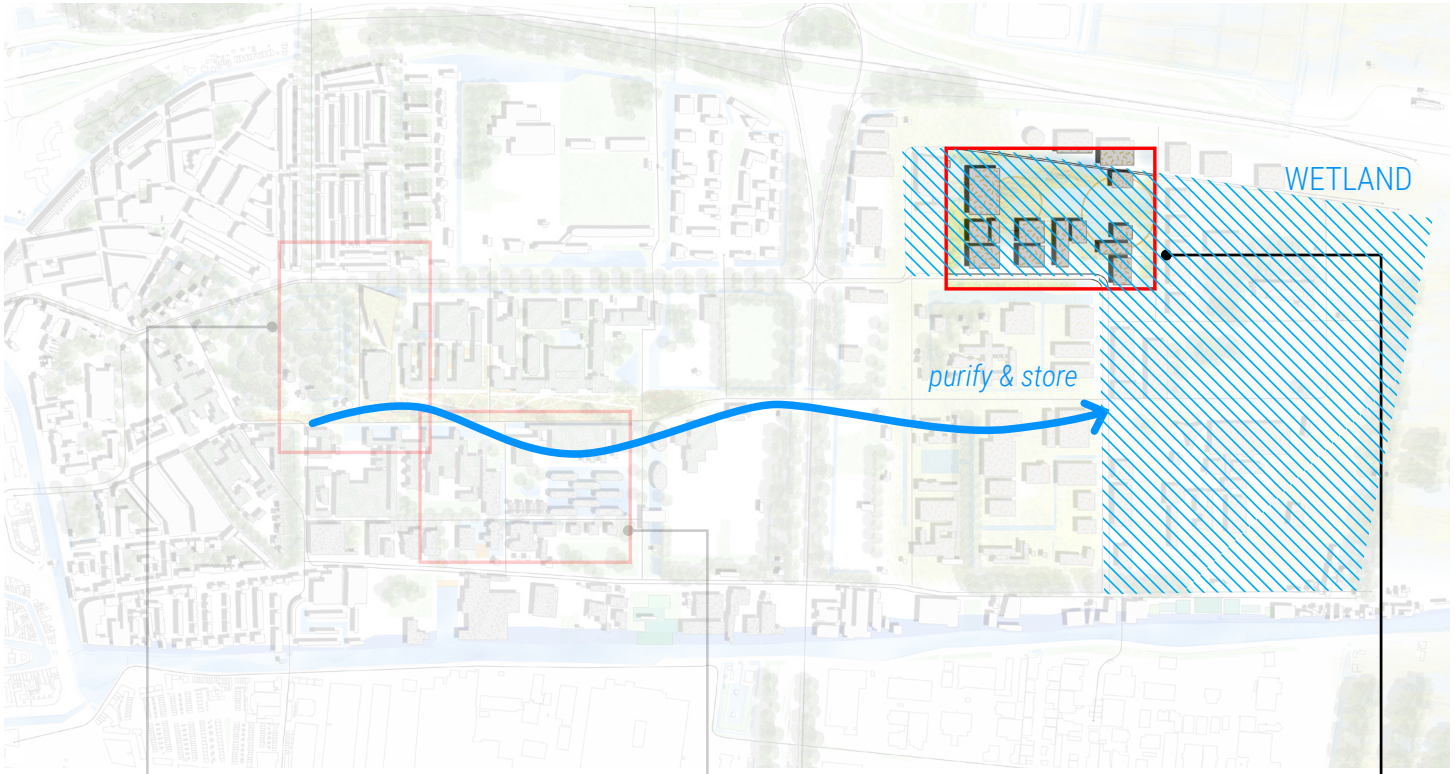


current



design rating

3 Sites
design elaboration



area of wetland:
710,000m2

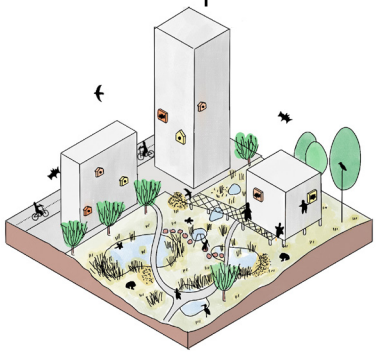
Amount of water stored in wetland:
(assuming water depth 0.1 - 0.3m)

70,000m3
|
210,000m3

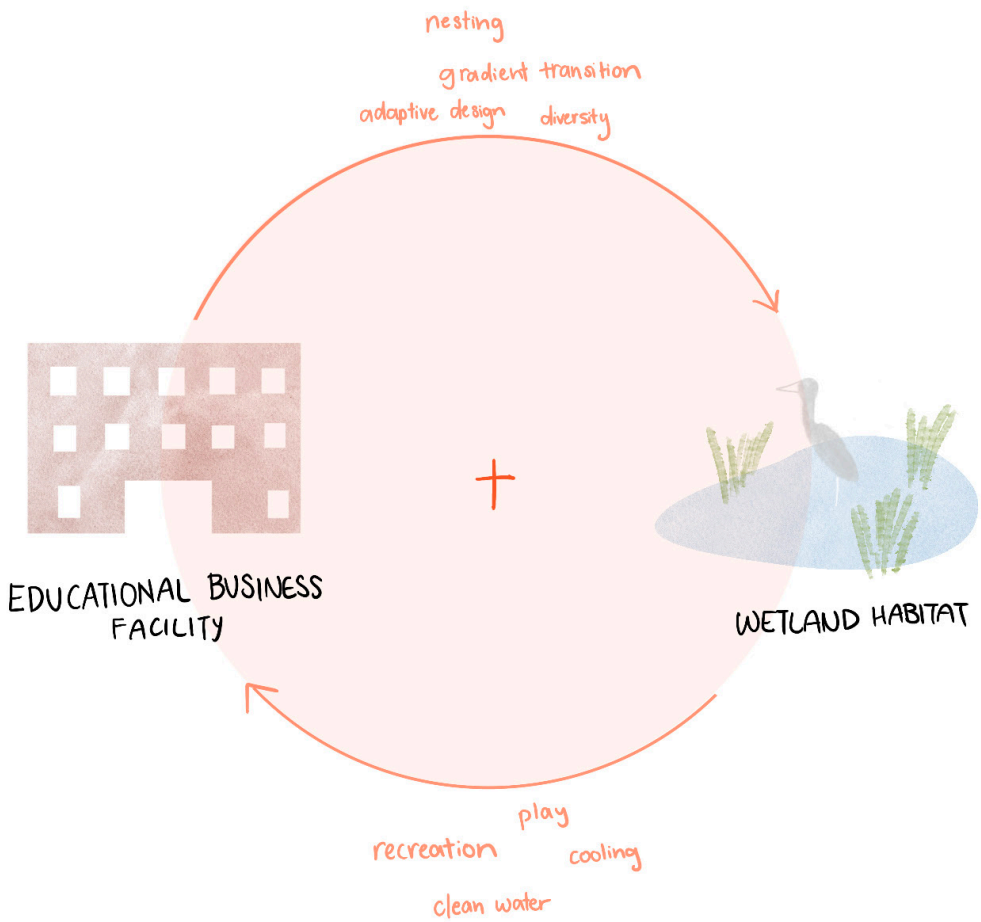
55% CAMPUS WATER STORAGE CAPACITY

Woodland Cluster

River Cluster



Wetland Cluster


nesting
gradient transition
adaptive design
diversity
EDUCATIONAL BUSINESS FACILITY
WETLAND HABITAT
play
recreation
cooling
clean water

Wetland cluster design

proposed design

1. Wetland
2. Wetland forest
3. Infinity boardwalk
4. Existing river pond

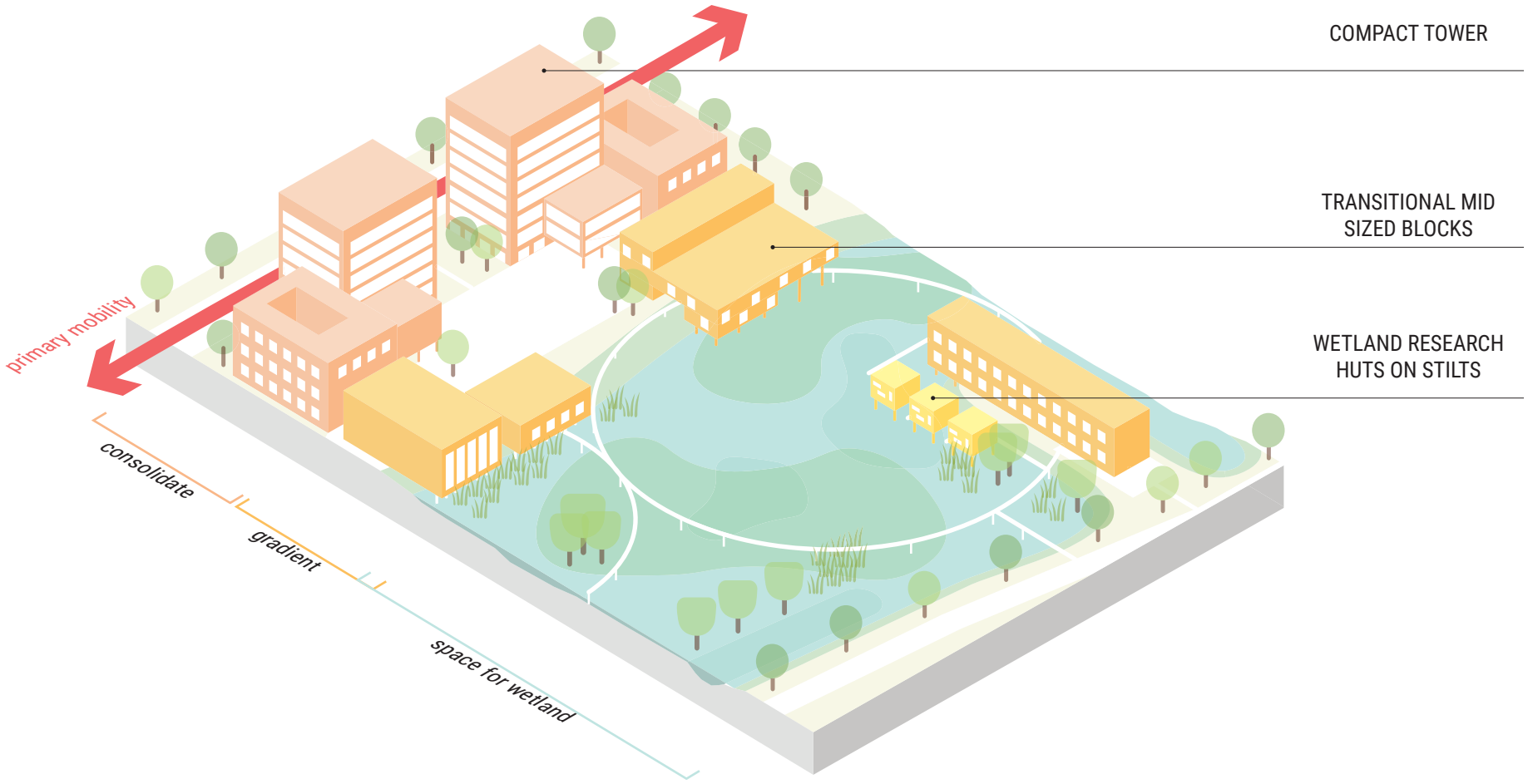
5. Cluster Plaza
6. Consolidated towers
7. Adaptive buildings on stilts
8. Green village south

Existing buildings
New buildings

0 20 40 60 80m

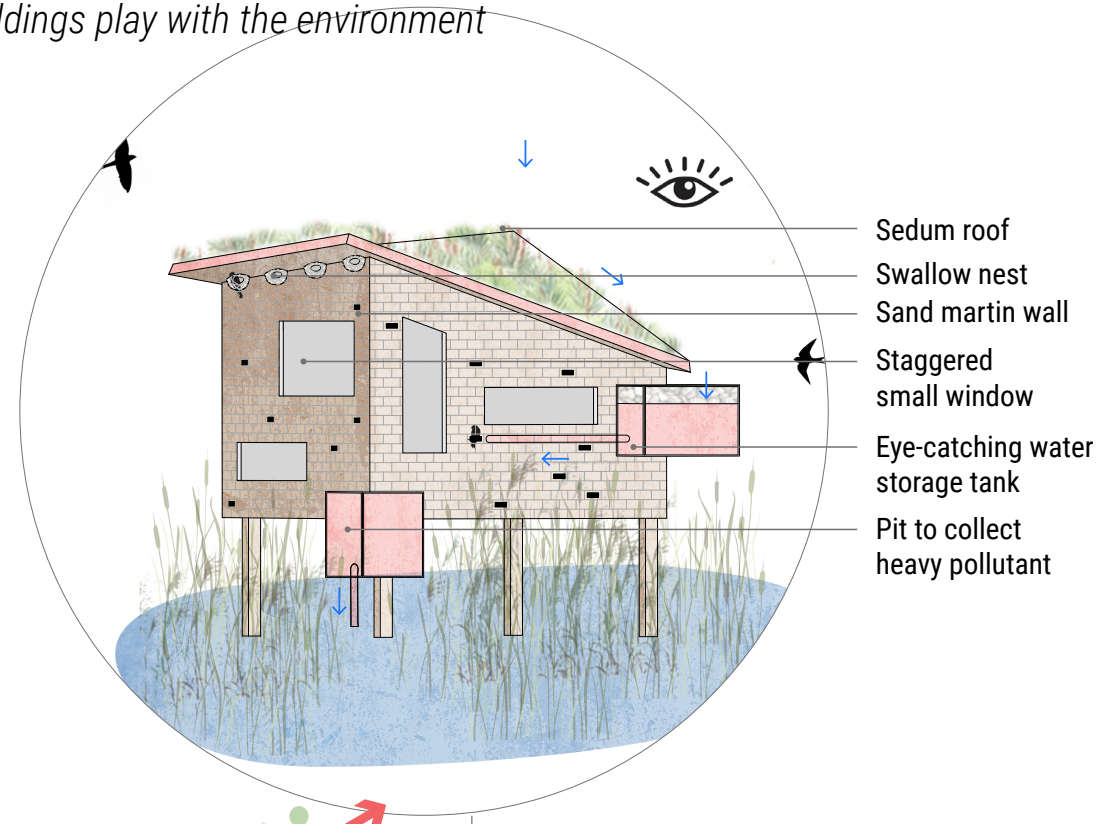
Delfgauw Ruyven
3M
4
Exact
YES!Delft
7
8
6
3
1
4
1
N470 forest buffer
7
7
5
6
6
RID
2
Abtswoudsehoeve

Wetland cluster building strategy

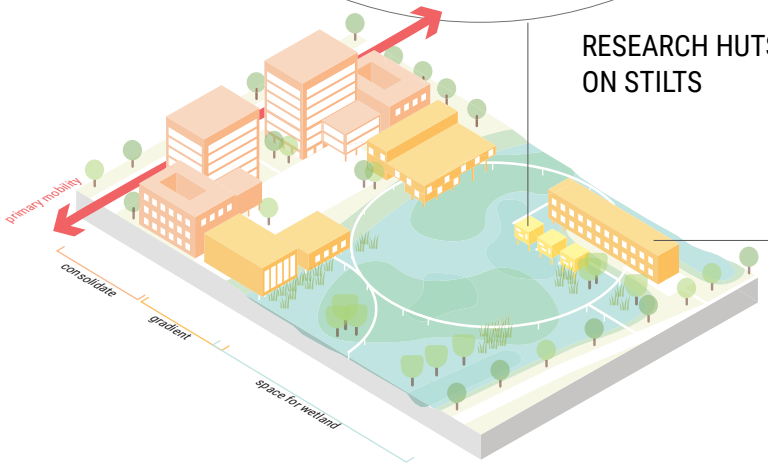


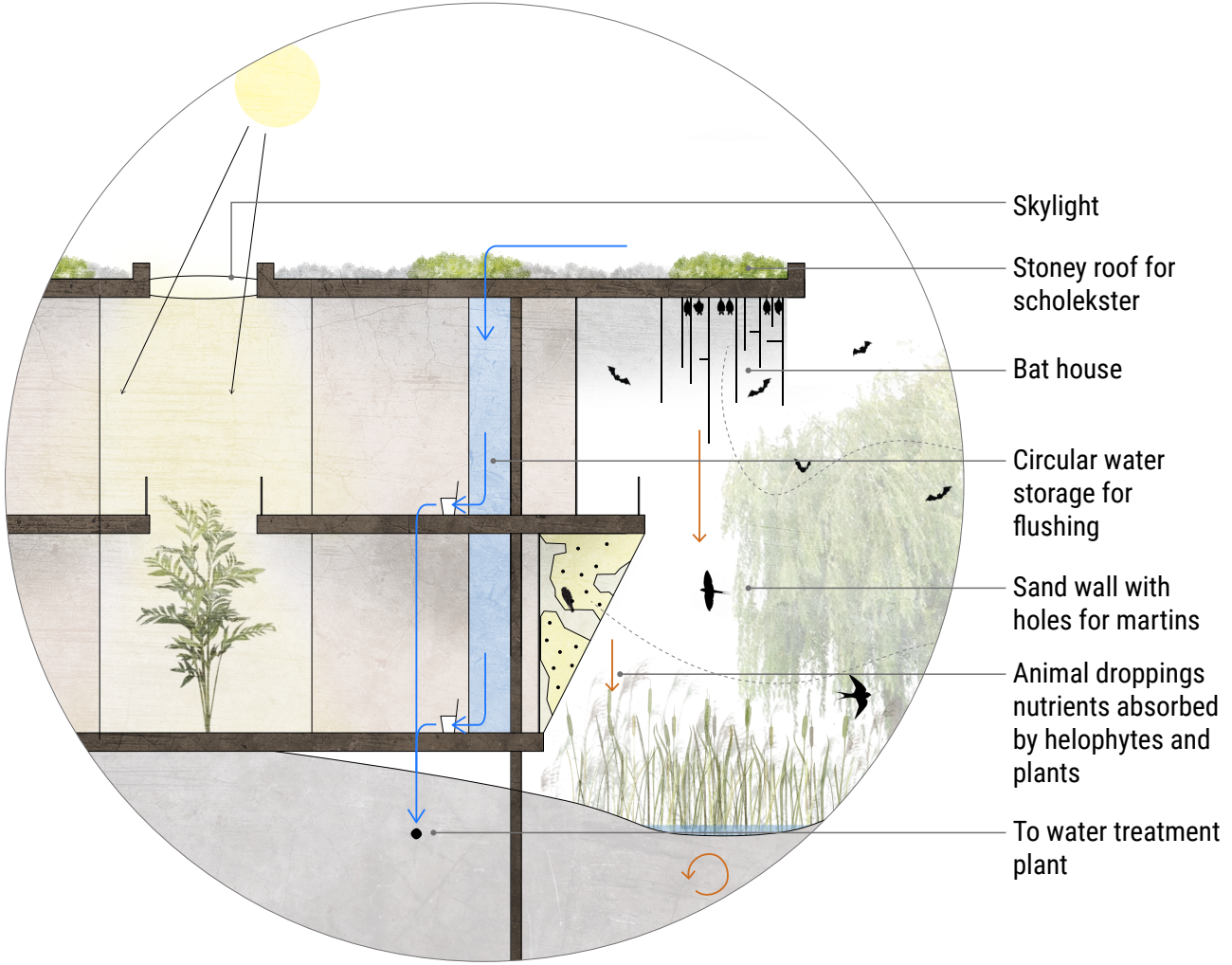
Wetland cluster buildings

buildings play with the environment



RESEARCH HUTS ON STILTS

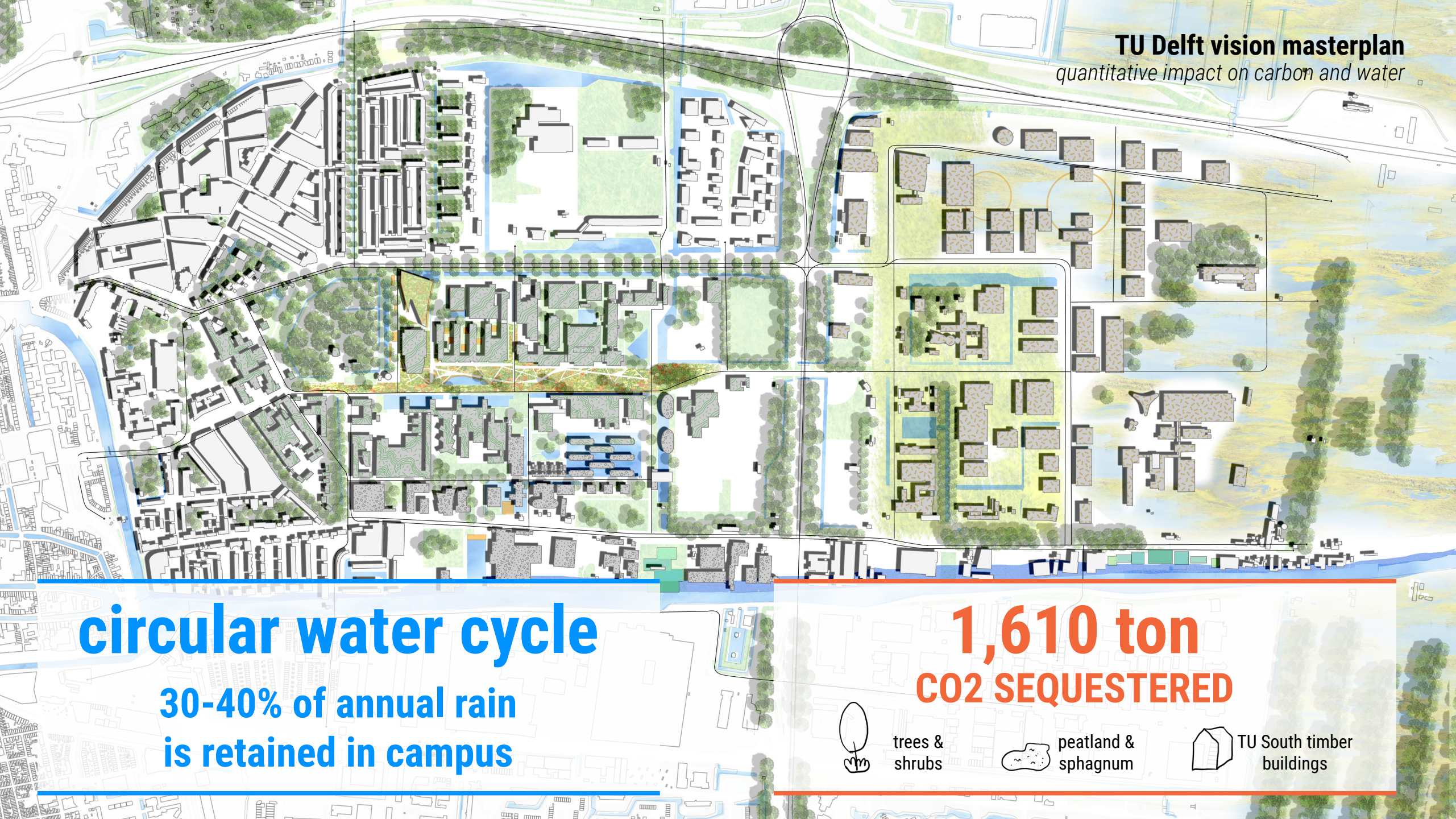




TRANSITIONAL MID-SIZED BLOCKS

Transitional eduational-business block

impression of integrated wetland cluster


TU Delft vision masterplan
quantitative impact on carbon and water
circular water cycle
30-40% of annual rain
is retained in campus
1,610 ton
CO2 SEQUESTERED
trees & shrubs
peatland & sphagnum
TU South timber buildings

Water retention capacity & adaptability

calculation for new proposed design

WATER USAGE IN CAMPUS

water use on TU Delft campus in 2018:
(Blom & Dobbelsteen, 2019)

167,116m3

annual average rainfall:
800mm

annual rain water amount on campus roof :
211,000m3

80% rain water collected on roof and stored in detention tanks:

176,000m3

WATER USE OF CAMPUS CAN BE FULLY MET BY COLLECTING 80% OF RAINWATER ON ROOF

ANNUAL WATER STORAGE CAPACITY

annual average rainfall in the Delft:
840mm

annual rainfall volume on TU Delft campus:

1,800,000m3

area of surface water and underground storage with new design:
740,000m2

volume, assuming 0.5m depth:
370,000m3

total rain storage volume of proposal,

703,000m3

30% TO 40% OF ANNUAL RAIN IS RETAINED IN CAMPUS

FLEXIBLE CAPACITY DURING HEAVY RAIN EVENT

Delft highest precipitation amount (aug):
83mm

aug rainfall volume on TU Delft campus:

180,000m3

area of surface water and underground storage with new design:
740,000m2

assuming 30 cm allowance of fluctuation depth, additional storage capacity with new design:

222,000m3

able to hold 165% of aug heaviest rainfall

CAPACITY (120%) SUFFICIENT TO PREVENT FLOODING DURING WET SEASON.

Carbon Sequestered in Campus

calculation for new proposed design

CARBON SEQUESTRATION METHODS

Trees and shrubs

current green situation sequest 394 t CO2/ year

Carbon capture factor of:
tree entity- 70kg CO2/ st
trees clusters- 1.3 kg CO2/m2
grass- 0.3 kg CO2/m2
shrubs- 0.3 kg CO2/m2
(Sharma et al., 2020) & (Blom & Dobbelsteen, 2019)

Trees in campus:
2,600 (current) + 800 st (new design)
(238 t CO2)

Forest in campus:
56,000m2 (current) + 6,000m2 (new design)
(80 t CO2)

Shrubs in campus:
8,500m2 (current) + 3,600m2 (new design)
(3 t CO2)

Lawn in campus:
457,000m2 (current) + 60,000m2 (new design)
(155 t CO2)
(source for existing campus data: Groenbeheer plan, 2020)

Total CO2 captured by greenery annually:

477 t CO2

Peatland & peat moss

Globally, 3 million km2 of peatland sequest 0.37 gigatonnes of CO2 a year
(https://www.iucn.org/resources/issues-briefs/peatlands-and-climate-change)
370 t CO2/0.3 km2
1.233 kg CO2/m2

Sphagnum peat moss sequesters 98.7g CO2 / year / m2
(source: nico tillie)

Peat area in TU South:
0.8km2
(100 t CO2)

Assuming peat moss 50% of peat area
0.4km2
(40 t CO2)

Total CO2 captured by greenery annually:

140 t CO2

Timber building material

Metsä Wood building carbon storage:
204 kg/m2 of floor area
(https://www.metsawood.com/global/news-media/articles/Pages/carbon-storage.aspx)

Assuming buildings in TU South are 5 story high:
500,000 m2
(100 t CO2)

Average timber building lifespan is 100 yrs.

Total CO2 captured by building annually:

1,000 t CO2

CARBON SEQUESTERED ANNUALLY: 1,600 t CO2

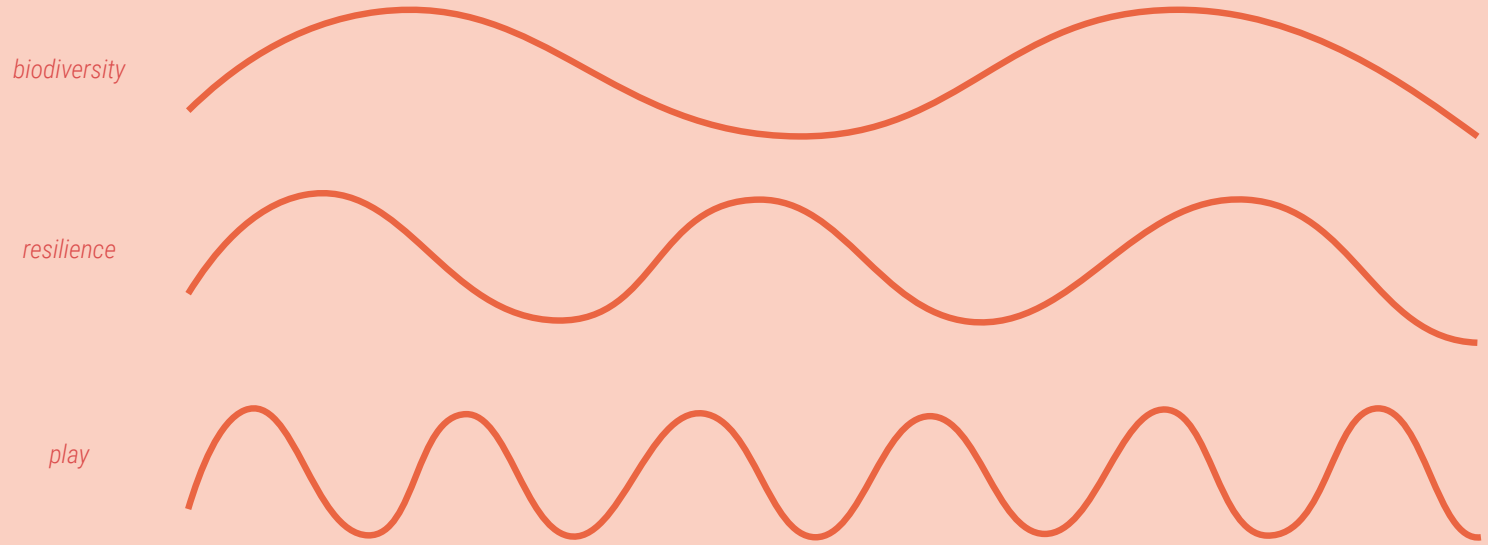
CO2 footprint of campus: 49,000 tCO2

5

Conclusion & Evaluation

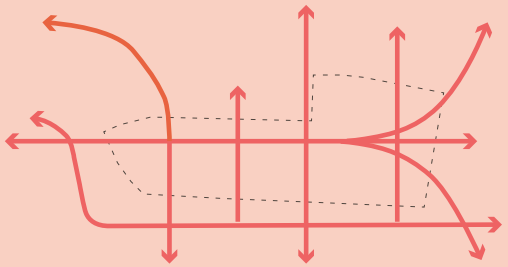
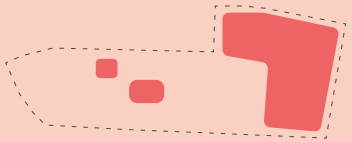
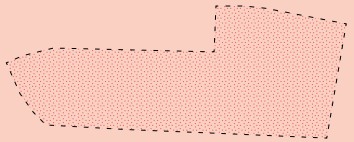
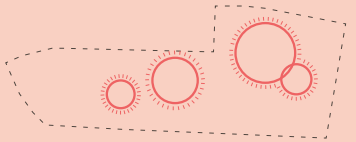
Strategic plan
Bigger implication
Summary

natural cycle



Strategic plan

campus action plan

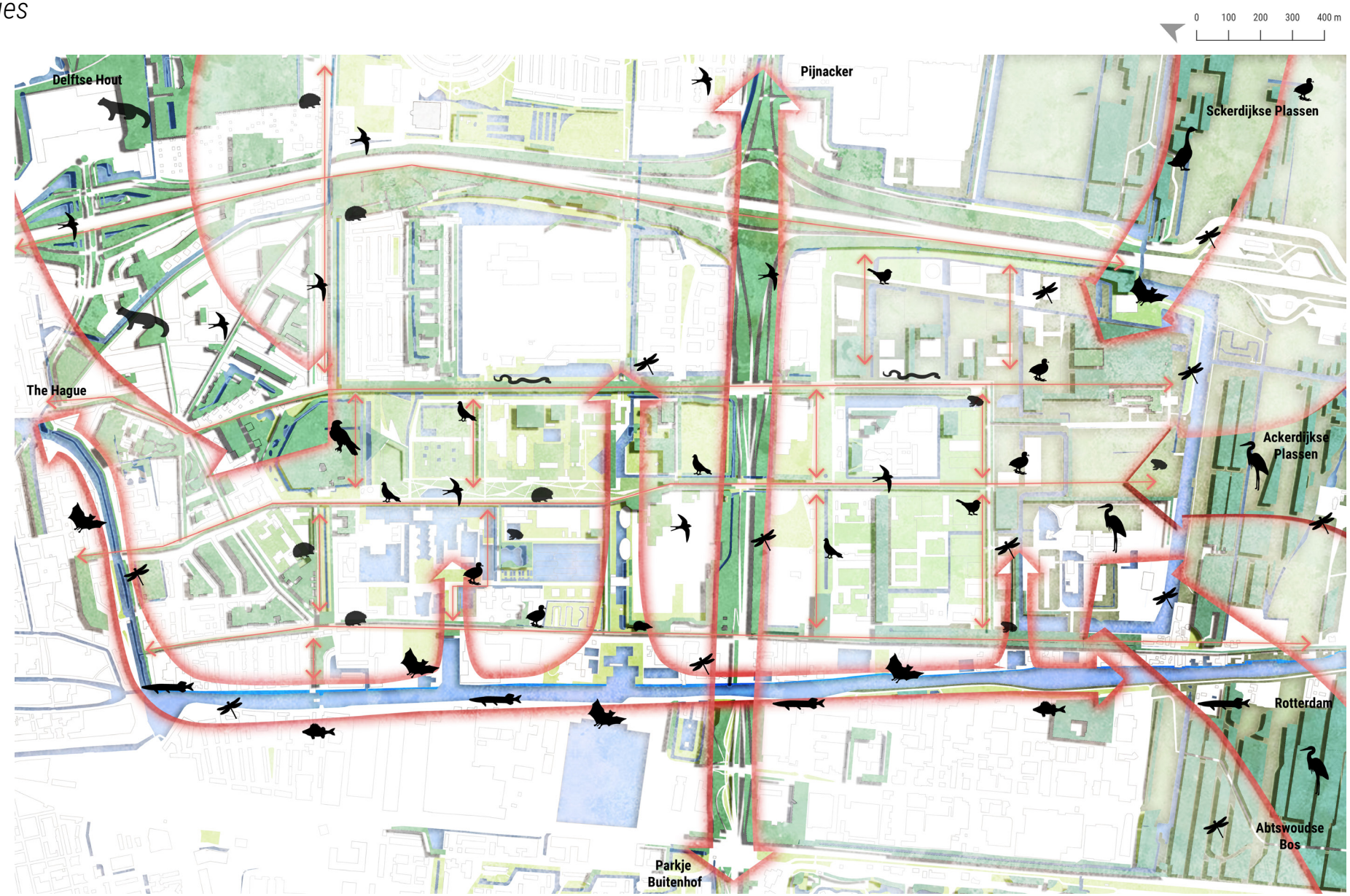
	year 0-2	year 1-3	year 2-5	year 4-10	year 5-30
					
KEY ACTION	**1** Strengthen green-blue corridor **2** Improve water quality (along Schie and within campus)	**3** Flood TU South **4** Create detention pond and rain garden at flood prone areas **5** Transform one building (EWI?) into an eco-building and to collect and reuse rain water.	**6** Enhance planting scheme **7** Depave and soil improvement	**8** Allocate active and quiet zones **9** Localised park design and execution	**10** Sustainable TU South development
STAKEHOLDER	*Delft Municipality*, *TU Delft*	*Delfland Water Board*, *TU Delft*	*TU Delft Green Maintenance*	*TUD Spatial group*, *BK Landscape and Urbanism*, *Design Studio Office*	*Developer*, *TU Delft CRE*
	+ In line with Green Delft memorandum +Quality water is an important basis for habitat creation	+ Wetland takes time to establish + Allow gradual peat formation + Make full use of TU South temporary land: low effort, high reward	+ Benefit of circular water system in building tested and seen + TUD biodiversity assessment to raise support and funds to create patches for next step + Deployable small scale interventions	+ Collaboration for design	+ Motivation for sustainable and eco-friendly building design with precedence of TU Middle + Take inspiration from Green Village projects for TU South

IMPACT

Biodiversity	*connecting and setting the right basic ecosystem requirements*	*creating right conditions*	*improving habitat quality*	*creating new patches*
Resilience	*cleaning water*	*storing water*	*infiltration*	*circular water system*
Play		*temporary design structure*	*temporary design structure*	*participatory design* → *buildings engage with environment*

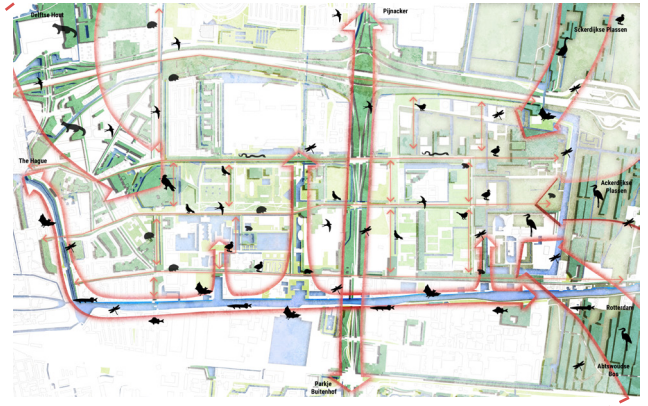
Surrounding landscapes pulled into campus

inclusive for all species



Potential of TUD within Delft City

regional vision



- Polder Forest
- Wet meadow & Grassland
- River Chanel Veins

Implications for metropolitan region

extrapolating design to The Hague-Rotterdam region

A campus functions just like a city. Cities have a lot of potential in becoming biodiverse, adaptive areas through playful design.

Through engaging, and reacting to surrounding landscapes, existing habitats are expanded forming regional connectivity and patches. Major canal water can be cleaned by various cities. The entire Rotterdam-The Hague metropolitan region enjoys flourishing biodiversity that is local and native, giving more opportunities for smaller-scale 'playful' network.
Play strategies are localised according to local characteristics, giving the metropolitan region a unique identity linked to its genius loci.

RESEARCH QUESTION

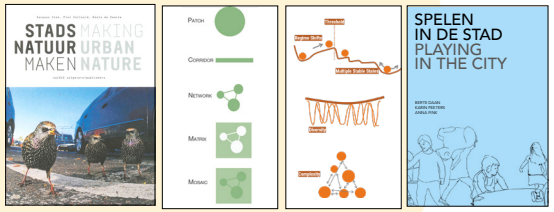
"What is a possible **framework** to create a **biodiverse, climate resilient TU Delft campus** using **'playful' design?**"

SUB QUESTION

1. What are the **principles/ theories** concerning resilience and biodiversity?
2. What is **play**? **Why** should we have 'playful' design?
3. How can **'playful' design** bring about **biodiversity and climate resilience**?
4. What is the **current situation** in **TU Delft**?
5. How do we **apply** landscape architectural frameworks to TU Delft? How would a biodiverse, resilient and playful campus look like?

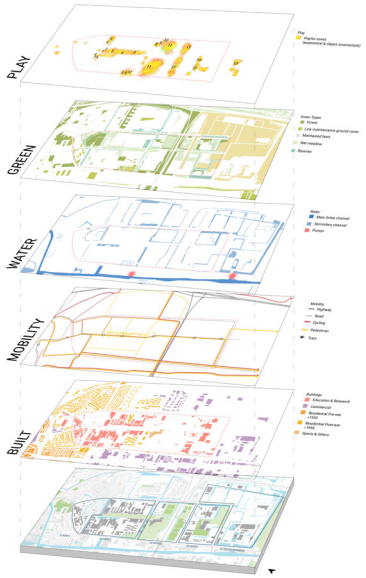
Evaluation

process



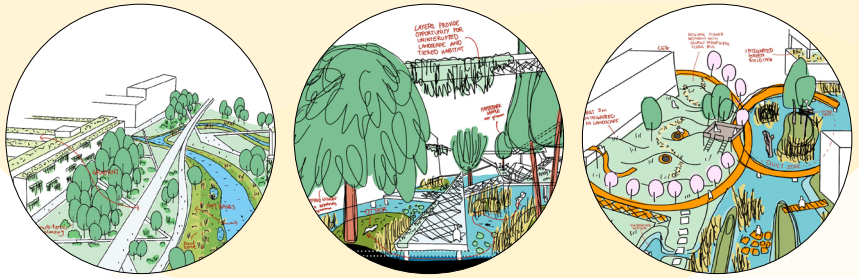
1. THEORY

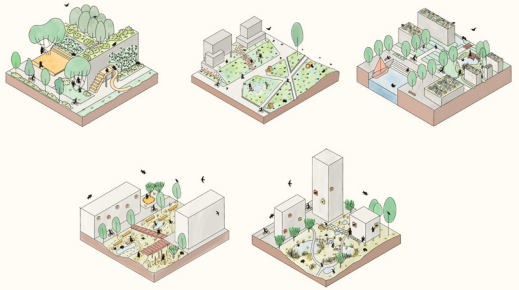
2. FRAMEWORK



3. ANALYSIS

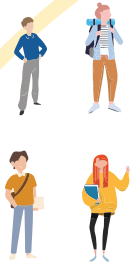
4. EXPLORATION

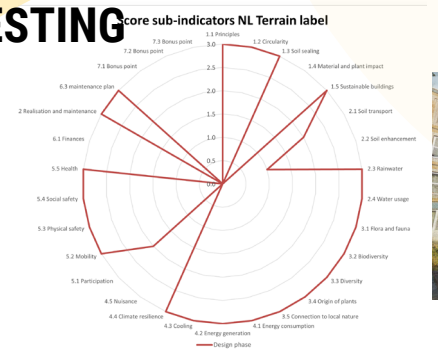




5. DESIGN

6. TESTING

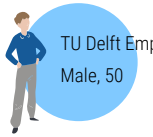




Thats all for P5!
THANK YOU FOR LISTENING :)

Appendix-survey
results

RESPONDENTS


TU Delft Employee
Male, 50


Nature enthusiast
Female, 24


Dutch student
Male, 24


International student
Female, 30

1

first thoughts

family houses nearby with young couples and children. this design not only serve campus but great for others. adventurous equipments available for all.
atractive and i'd like to go out there during lunch breaks if I study at the library.
i love forest. I would sit on the mound and logs to relax after studying.

open air meeting could be conducive for discussion especially with COVID. great place to read in summer.

like

much more green without paving. adds to big green connection across campus to schie. engagement. forest vibe and coloured logs. great place instead of Mekel Park.

dislike

should continue and expand further into surrounding. too few structures to sit on. moving logs might be a lot of work and maybe dirty. area might be too narrow for a park. regularity.

rating

#

#green #connection #adventure #natural #scientific #colourful #log #forest #sitting #shade #gathering #outdoors

first thoughts

good idea.
ecological. take a walk after dinner to watch birds.
walk around and sit. i think the stone throwing is interesting but i would probably not do it myself.
easily executed. great for short term feasibility.

like

historical creek. store more water. connection to city and south. very ecological with green and water. pleasant ambience. tall trees and board walk. has art and sculptural value. experience being close to water

dislike

could have more connections to old farm. tram line might be a barrier to continuity of creek. nothing. tiles might be dirty. not sure if allowed or illegal to throw tiles. mosquito.

#

#creek #connection #ecological #participate #micro-climate #log #water #art #sculpture

2

rating

first thoughts

amazing for students.
this design brings many possibilities to student housing area, more activities and scenery
i like the places to sit, but i am scared loiterers will be smoking near the student housing
i imagine cascading water. currently this area is dull. nice landscape.

like

green at proximity of door. pleasant living atmosphere. water is interesting as water management is a large problem now. pleasant environment. greenery good for eye and health.

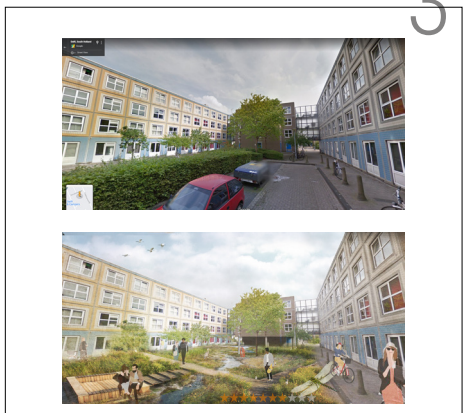
dislike

accessibility to building by vehicles for maintenance. green could be up till door. feasibility. nothing. as it is between building, it is quite closed off, which has its risks. should be well lit. no place for sports activity (badminton, volleyball, frisbee)

#

#lifestyle #natureliving #resilient #palimpsest #neighbourhood-friendly #closed-off #housing #wetland #waterflow #beautiful #well-breing

3



rating

Survey feedback

TU Delft Employee
Male, 50

Nature enthusiast
Female, 24

Dutch student
Male, 24

International student
Female, 30

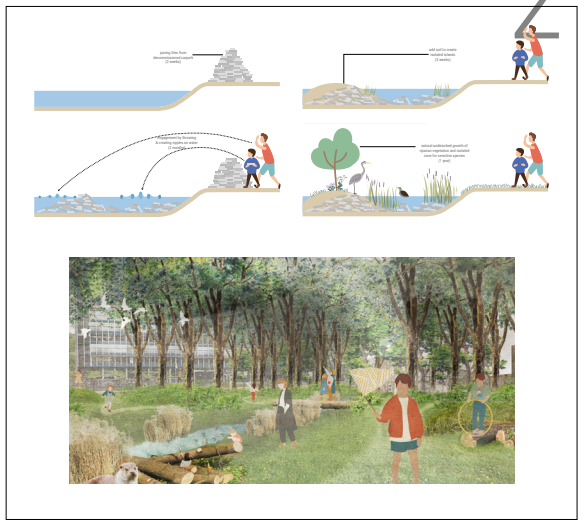
1

rating

like
more green less paving. big green connection. forest vibes. coloured logs. .

dislike
too few structures to sit on. moving logs might be a lot of work and maybe dirty.

2



rating

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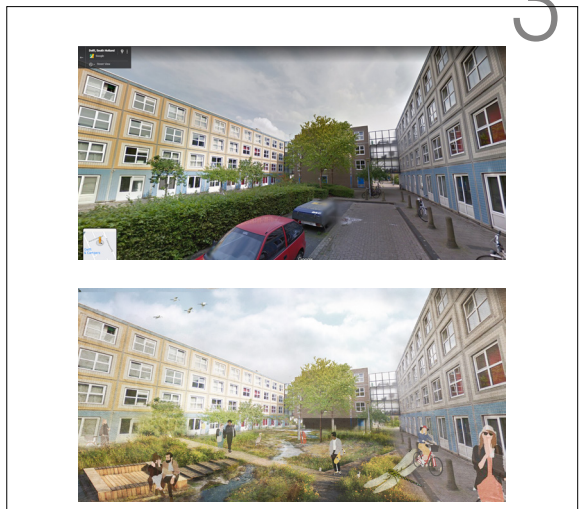
dislike
not sure if allowed or illegal to throw tiles. mosquito.

3



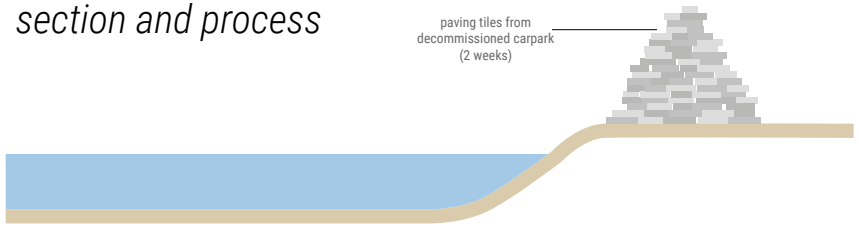
rating

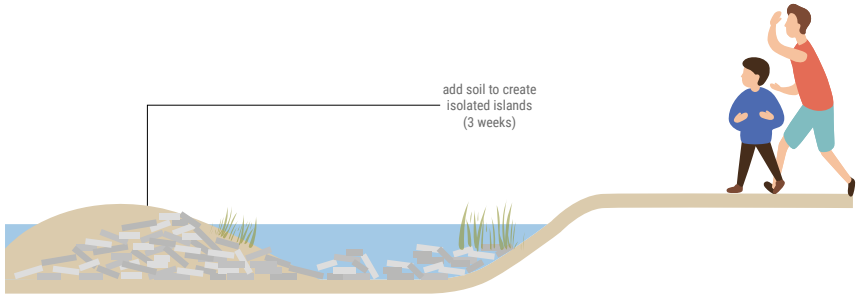
like
green at proximity of door. pleasant environment. greenery good for eye and health.

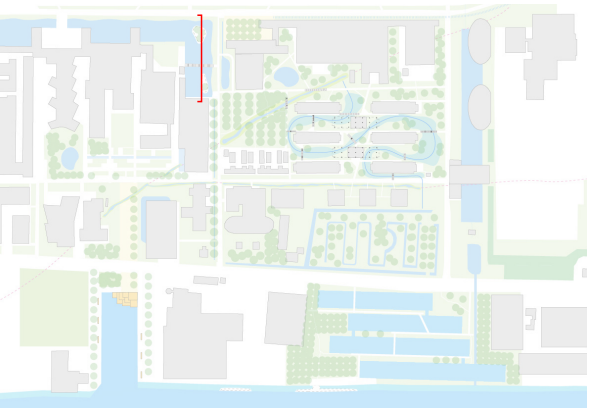
dislike
safety with loiterers. no place for sports activity (badminton, volleyball, frisbee)

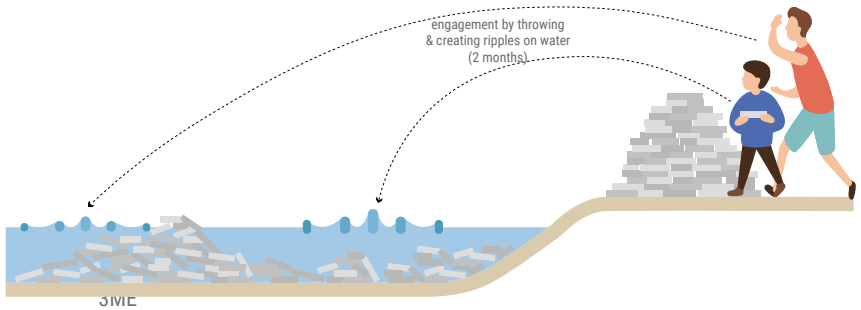
Eco-islands

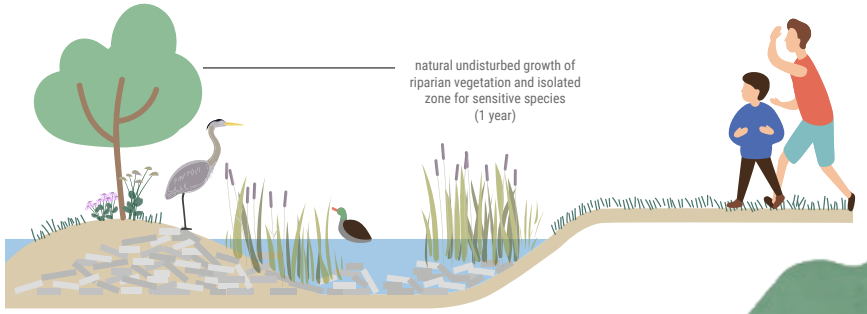
section and process







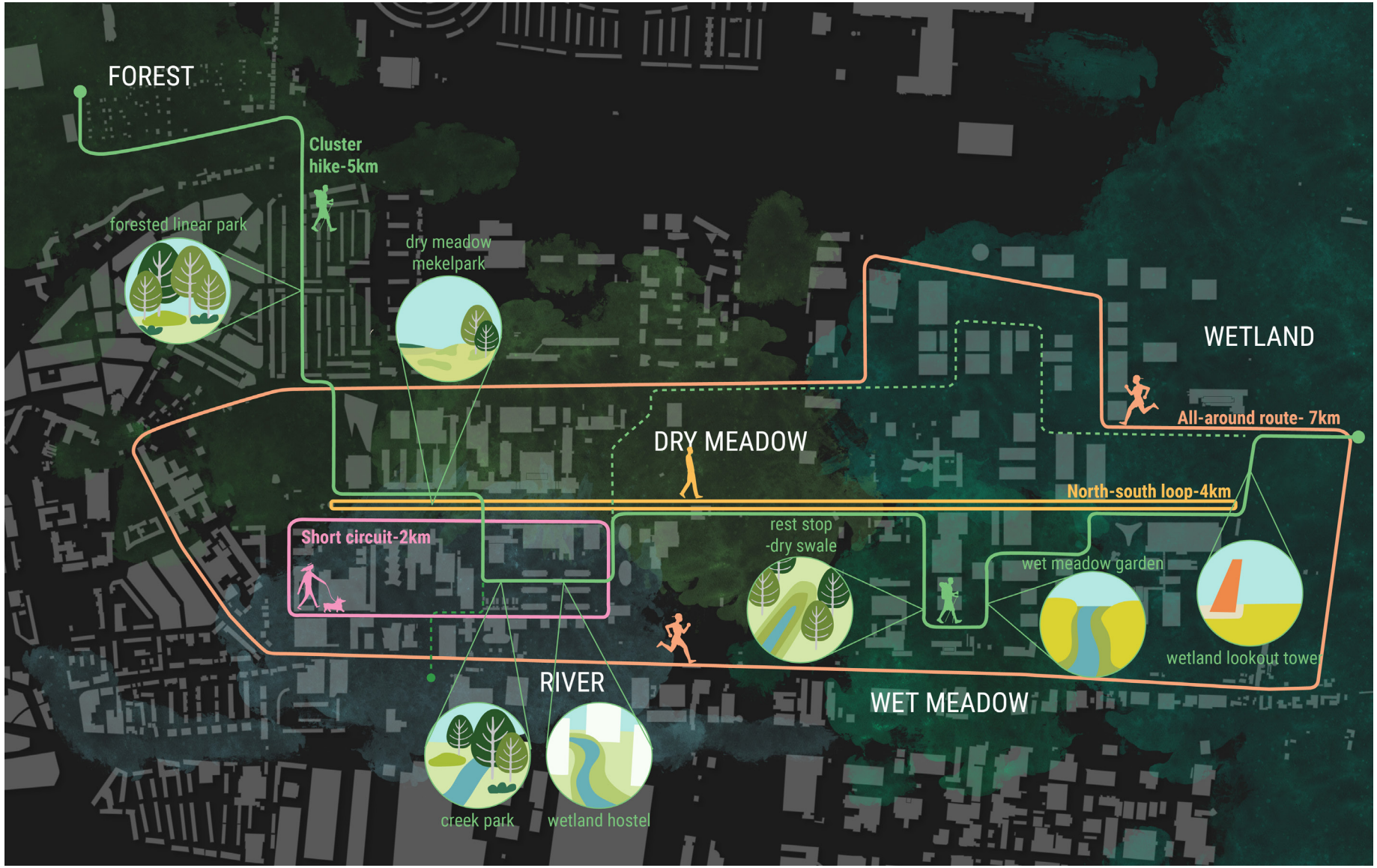




sand martin

Routing

runner, hiker and dog walker



Routing

fun loving explorers