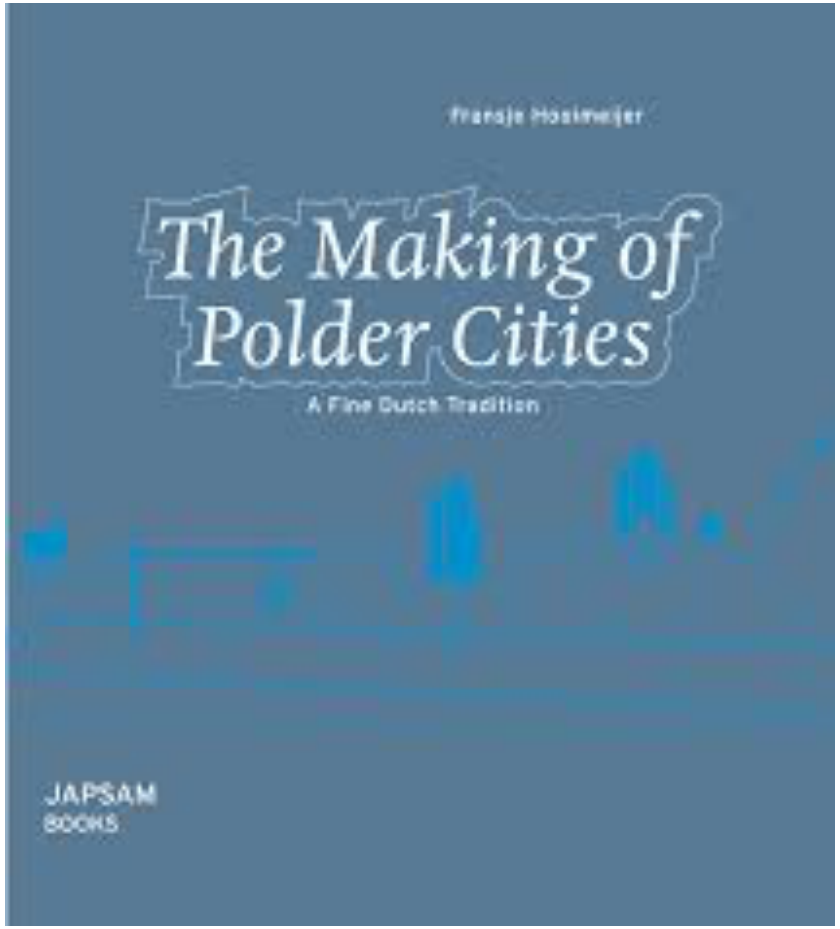
Fransje Hooimeijer

Department of Urbanism

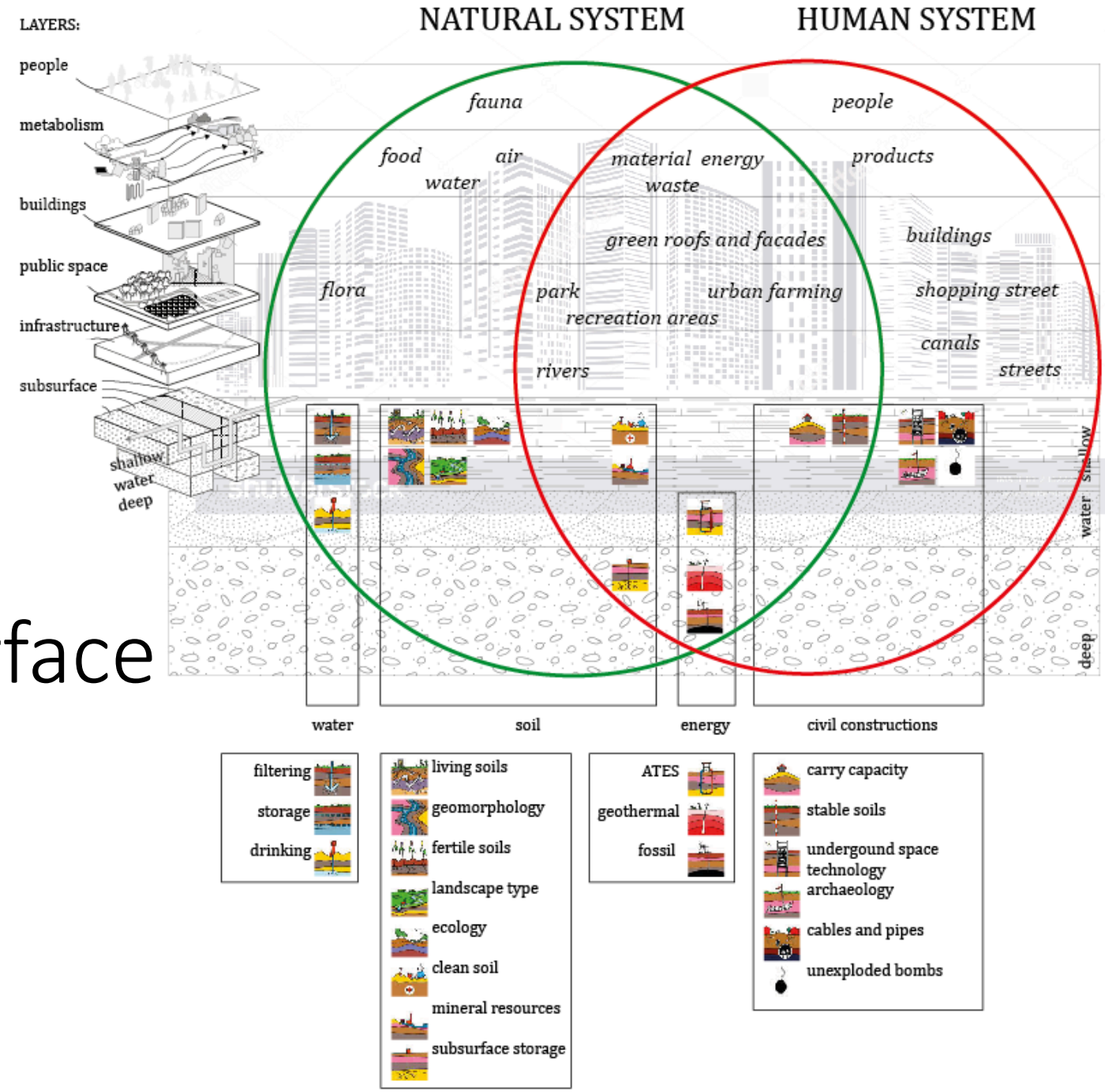
Chair Environmental Technology and Design



TU Delft | Deltas, Infrastructures & Mobility Initiative

Urbanism

Design with the subsurface



Education

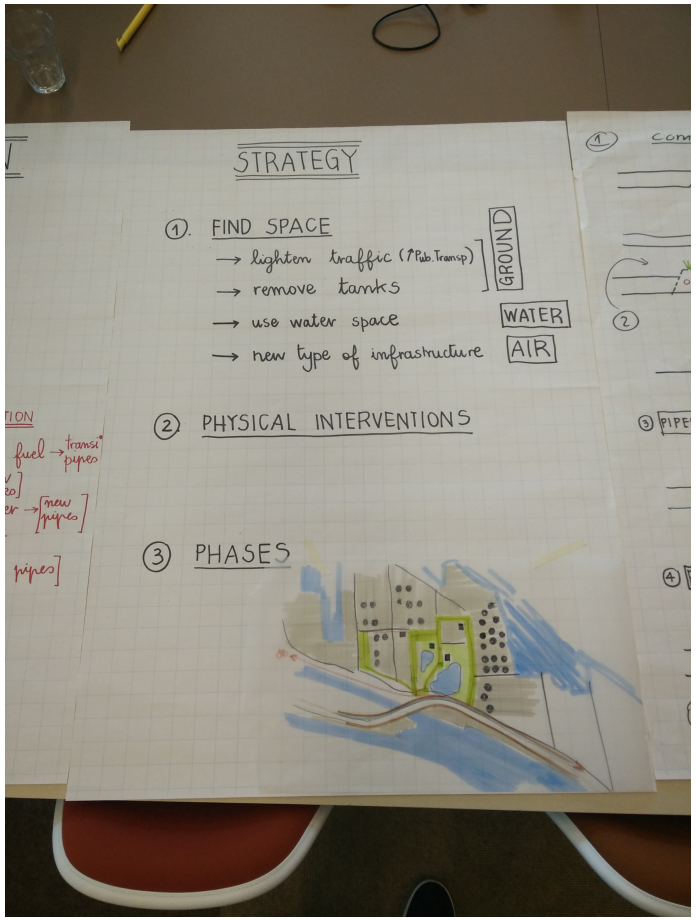
- Sustainable Urban Engineering of Territory (msc 1)
- Infrastructure and Environment Design (msc 2)
- Honours program Infrastructure and Environment Design (+20ects)

ILLUSTRATION: STADSBYGGNADSKONTORET

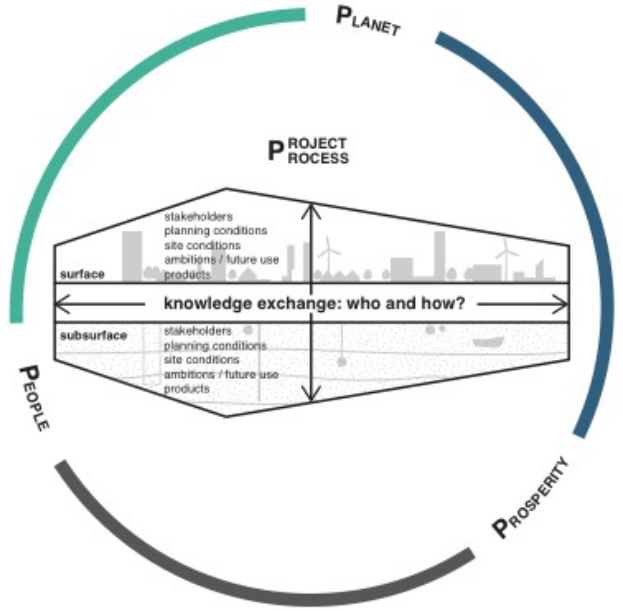
att visas upp på Majornas bibliotek vid Chapmans torg och på
juni hålls öppna hus där programmet kan diskuteras.

FOTOMONTAGE: FELIX VAN ZOEST

KARL JOHANSGATAN 2.0. Även en förändring av Jaegerdorrf-platsen diskuteras i programmet, men det ligger längre fram i tiden.



Snowman: Balance 4p (SE, BE, NL)



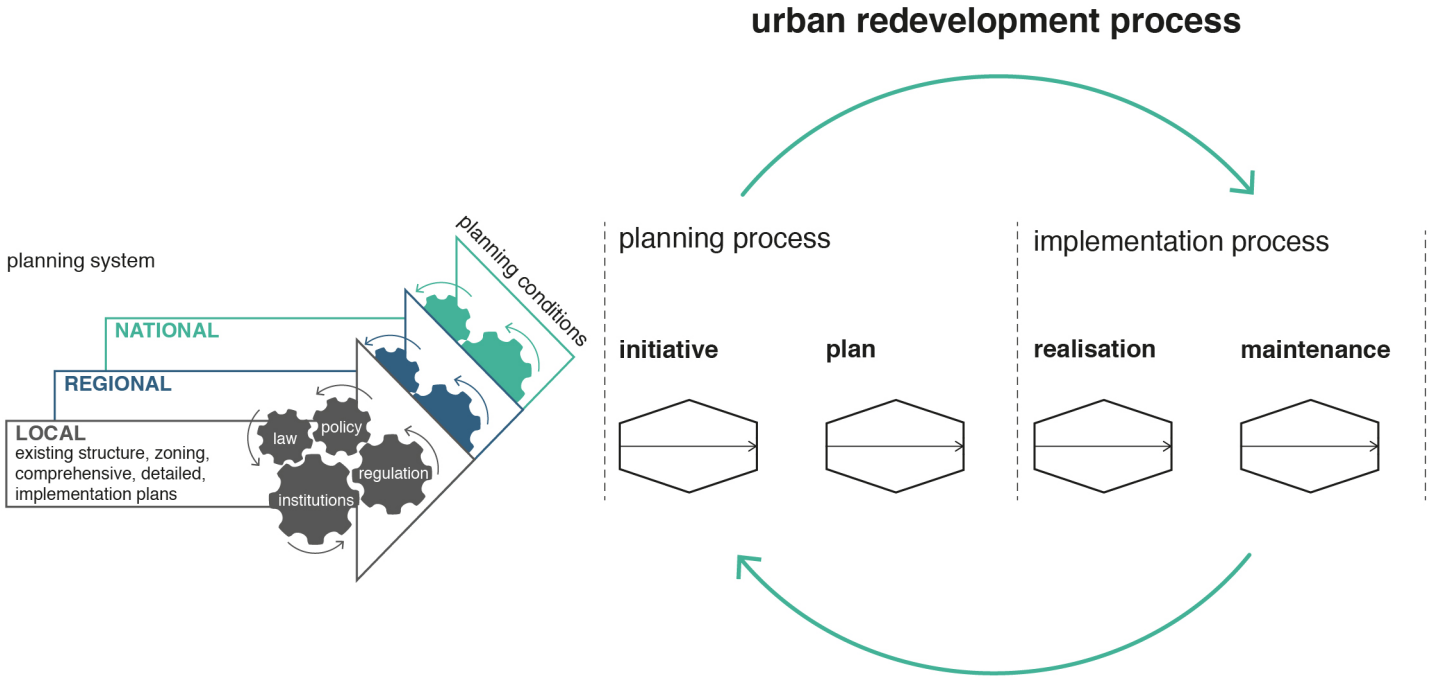
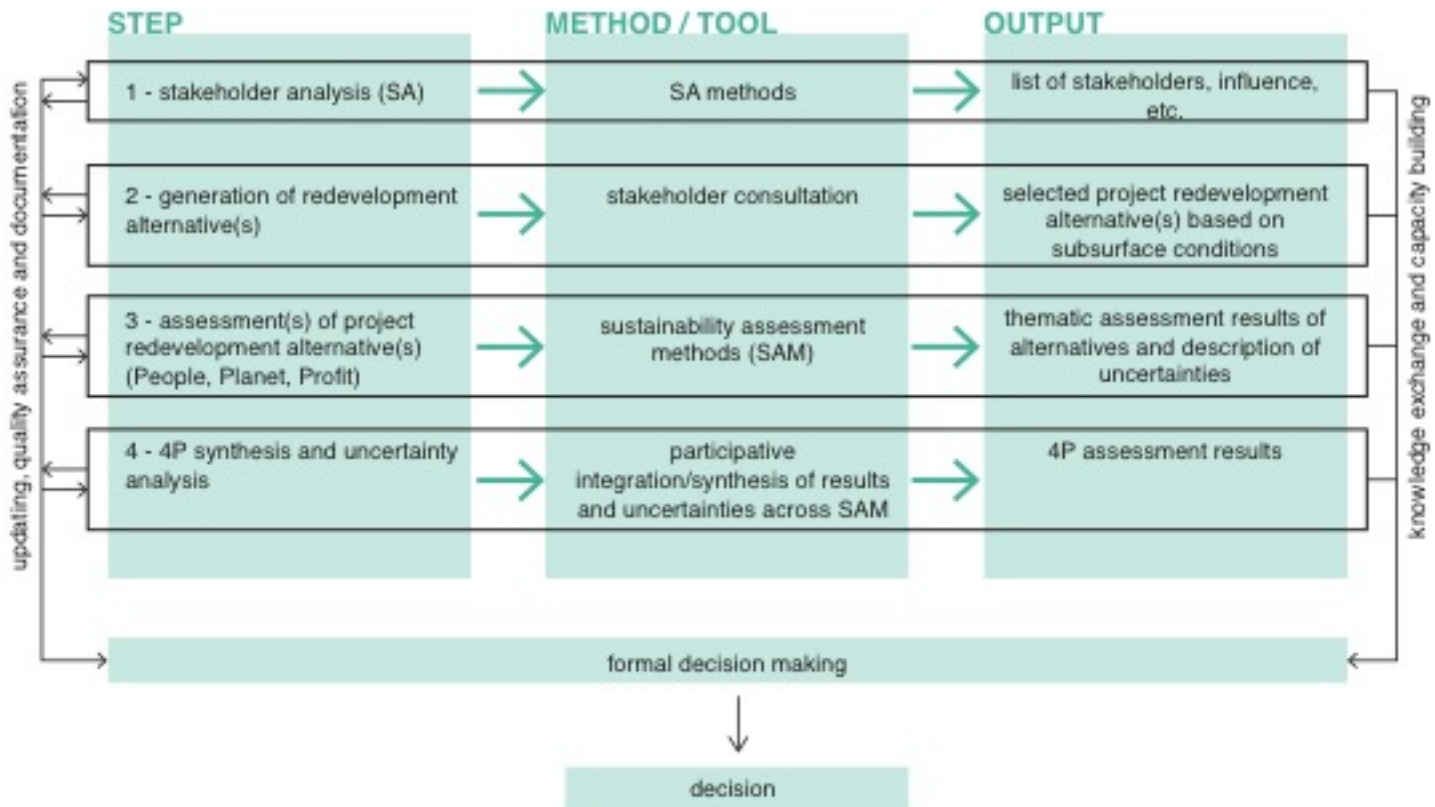


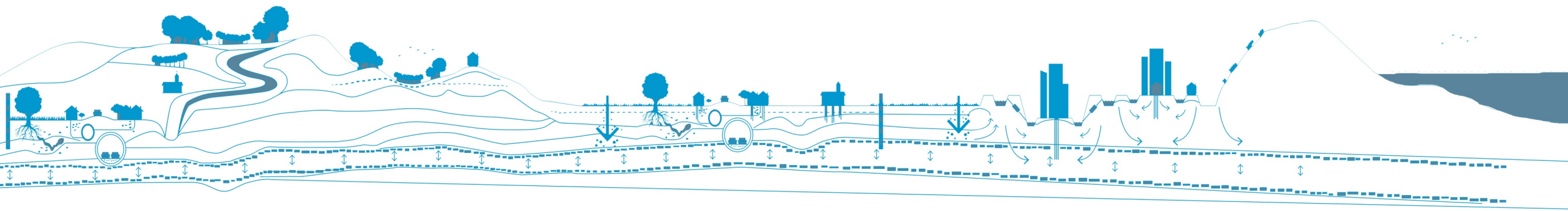
Table 2. Summary of subsurface management (Hooimeijer and Tummers, 2015)

	The Netherlands	Sweden	Flanders
National	Subsurface policy and regulations: National Structure Vision Subsoil (STRONG) soil covenant; SV shale gas; basis registration subsoil (EU INSPIRE). National responsibility is >500 m, mostly considering oil and gas winning. For cables and pipes there is KLIK info-system. Archaeology is also steered on a national level	Subsurface policy and regulations: (*a*) 'soil and ground water quality': Environmental Code; (*b*) 'archaeology': Heritage Conservation Act of 1988; (*c*) 'use of natural resources': Water Act of 1983, Mineral Act of 1991, Peat Deposits Act of 1985, and Continental Shelf Act of 1966; and (*d*) 'underground installations': Pipelines Act of 1978, the Water and Sewerage Act of 1970, Public Heating System Act of 1981, Electrical Installations Act of 1985, and Telecommunication Ordinance of 1985	Subsurface policy and regulations: Brownfield Decree (Ovam, 2007) and Covenant promote co-operation and synergy between the various stakeholders and provide some financial (tax) benefits for redevelopers Additionally, a 'brownfield cell' was installed in 2008. This is a board advising the Flemish Government. Archaeology and KLIP registration (cables and pipes) are part of planning
Regional	Provinces: Soil Vision; Soil Ladder; extraction permits for ground water; contamination and archaeology. Water boards are responsible for water management	The archaeological and soil remediation procedures are coordinated by the County Administration Boards. The County Administration Boards also oversee hazardous activities, such as energy facilities, quarries and mines	Provinces have supervision over extraction permits for ground water, contamination and archaeology. Water boards are responsible for water management
Local	Through the Zoning Plan some categories of the subsurface are touched on at the municipal level. However, next to water, remediation, archaeology and cables and pipes there is no active management or vision. Rotterdam is working on a Master Plan for the subsurface	Archaeological concerns are integrated into the planning process (early stage); soil remediation also integrated (late stage). Contaminated soil related issues are handled on both municipal and regional levels. There are special regulations in the detailed plan defining land reserves for jointly owned facilities, easements and utility easements	Through the RUP (spatial implementation plans) some categories of the subsurface are touched on at the municipal level. Next to water, soil remediation, archaeology and cables and pipes there is no active management or vision. 'Wateringen' are water boards on municipal level
Building practice	There is now no common practice concerning introducing the subsurface into development, this works through experts who enter late in the process	There is now no common practice concerning introducing the subsurface into development, this works through experts who enter late in the process	There is now no common practice concerning introducing the subsurface into development, this works through experts who enter late in the process


STEP
METHOD / TOOL
OUTPUT
1 - stakeholder analysis (SA)
SA methods
list of stakeholders, influence, etc.
2 - generation of redevelopment alternative(s)
stakeholder consultation
selected project redevelopment alternative(s) based on subsurface conditions
3 - assessment(s) of project redevelopment alternative(s) (People, Planet, Profit)
sustainability assessment methods (SAM)
thematic assessment results of alternatives and description of uncertainties
4 - 4P synthesis and uncertainty analysis
participative integration/synthesis of results and uncertainties across SAM
4P assessment results
updating, quality assurance and documentation
knowledge exchange and capacity building
formal decision making
decision

Intelligent SubSurface Quality *001*

Intelligent use of subsurface infrastructure for surface quality



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Urbanism

Involved specialists

- Water Management & Building site preparation - Frans van de Ven
- Urban Drainage - Francois Clemens
- Bio geo engineering - Suzanne Laumann
- Undergroud Space Technology - Wout Broere
- Urbanism

Taal van de stedelijk water manager

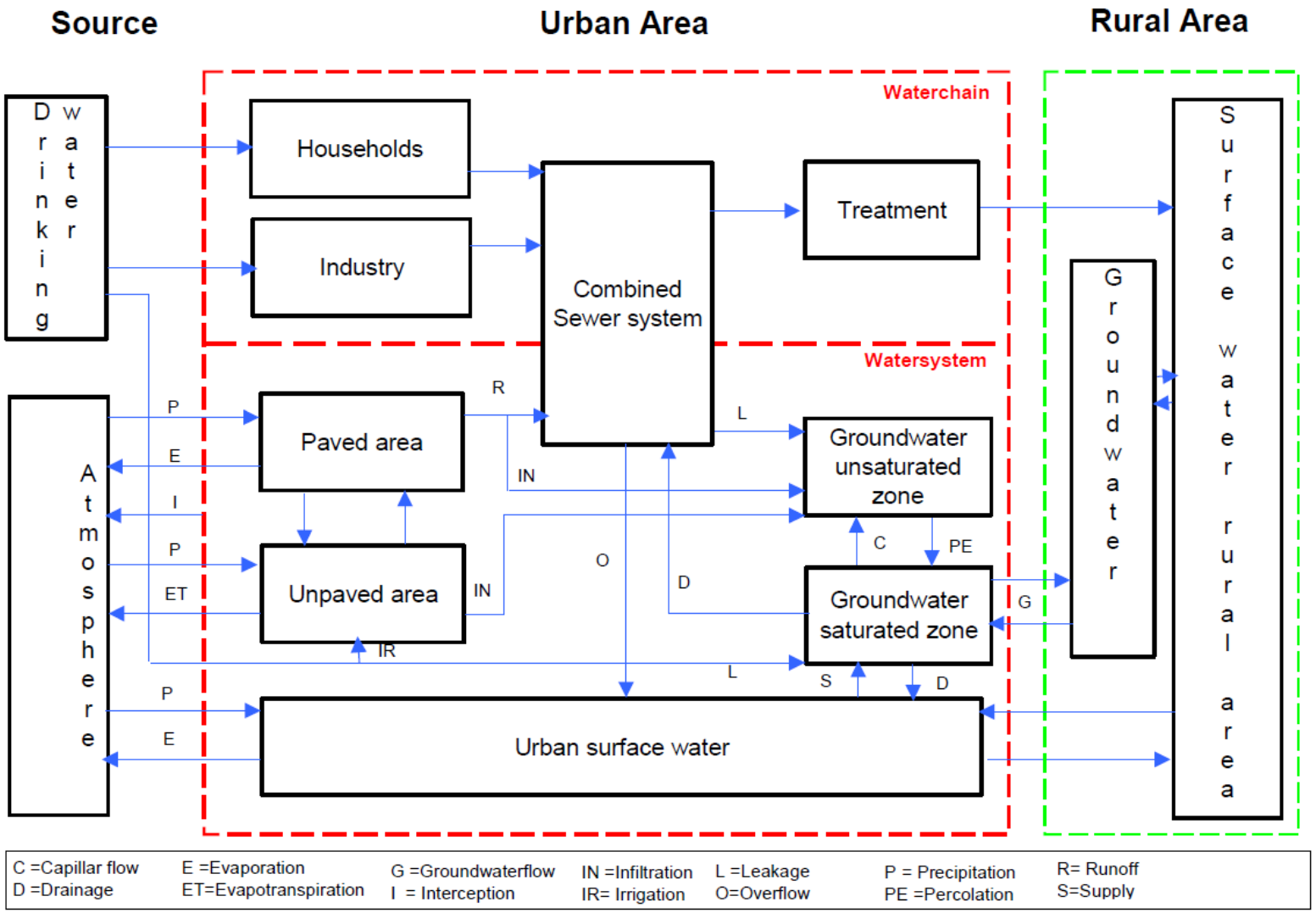
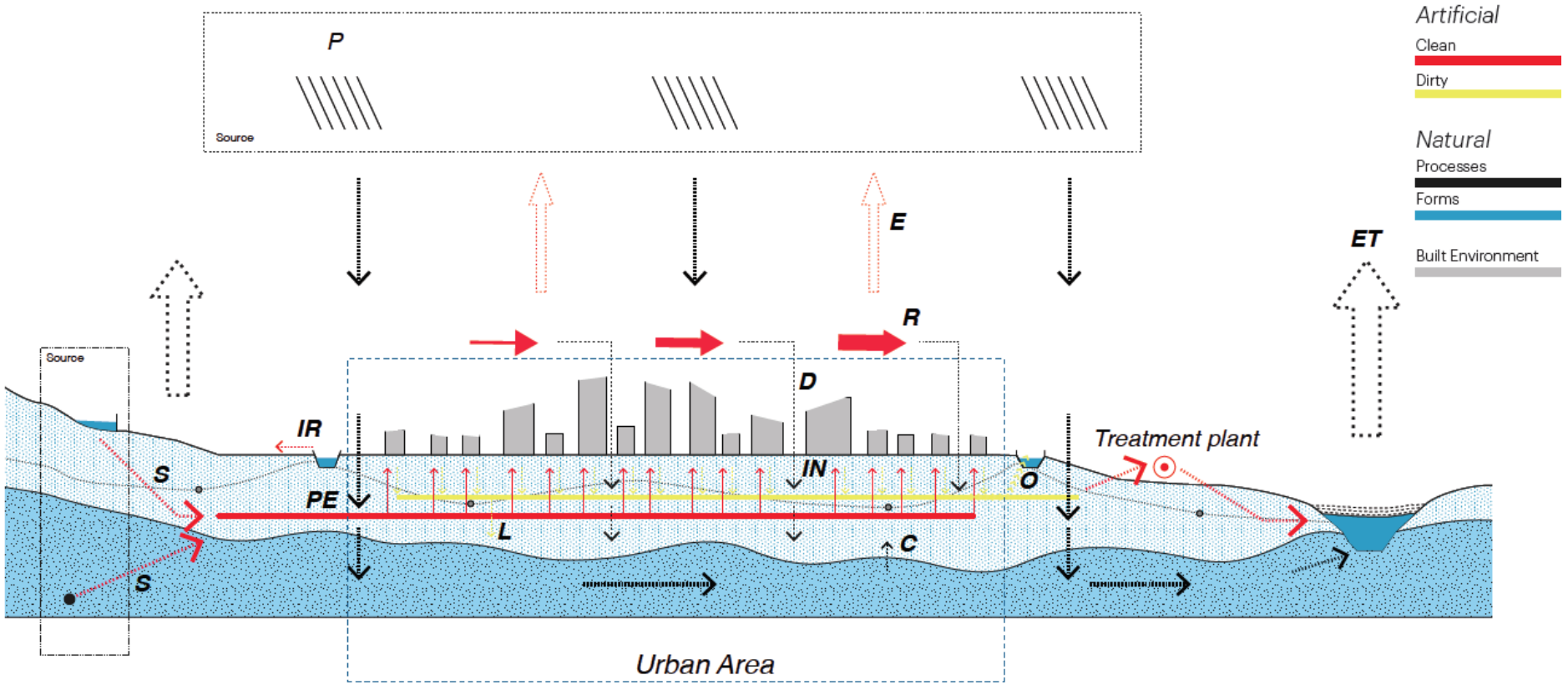


Figure 4-2: Schematisation of the urban water system with a combined sewer system

Visualiseren van data



C : Capillar flow
water flow From saturated to unsaturated zone

PE : Percolation
Water flow from unsaturated to saturated zone

S : Supply
Groundwater reserves
Sweet water reserves

IR : Irrigation
Agrioulture

D : Drainage
Drainage of rainwater through oombined sewer pipe.

IN : Infiltration
Water movement through open soil into groundwater layer

O : Overflow
Water flow Exceeding drainage capacity of engineered system

P : Precipitation
Rain + Snow

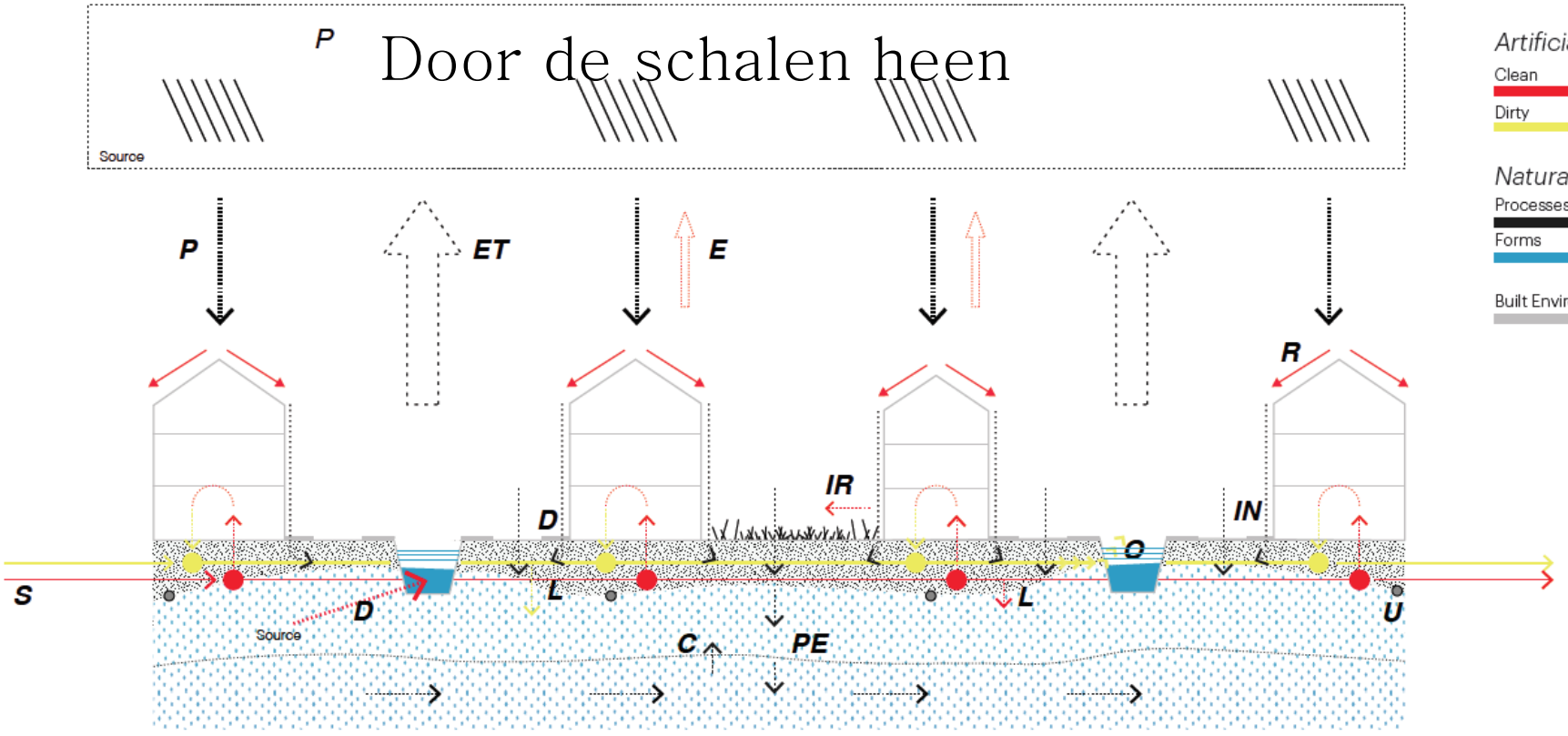
E : Evaporation
State change of water from liquid to gas.

Et :Evapotranspiration
Evaporation + transpiration of plants.

L : Leakage
Loss of water form the drainage system into unsaturated zone

R : Runoff
surplus of water that couldn't infiltrate in the open soil

Door de schalen heen



Artificial
Clean
Dirty

Natural
Processes
Forms

Built Environment

U: Underground drainage

C : Capillar flow
water flow From saturated to unsaturated zone

PE : Percolation
Water flow from unsaturated to saturated zone

S : Supply
Groundwater reserves
Sweet water reserves

IR : Irrigation
Agriculture

D : Drainage
Drainage of rainwater / groundwater through combined sewer pipe / surface water.

IN : Infiltration
Water movement through open soil into groundwater layer

O : Overflow
Water flow Exceeding drainage capacity of engineered system

P : Precipitation
Rain + Snow

E : Evaporation
State change of water from liquid to gas.

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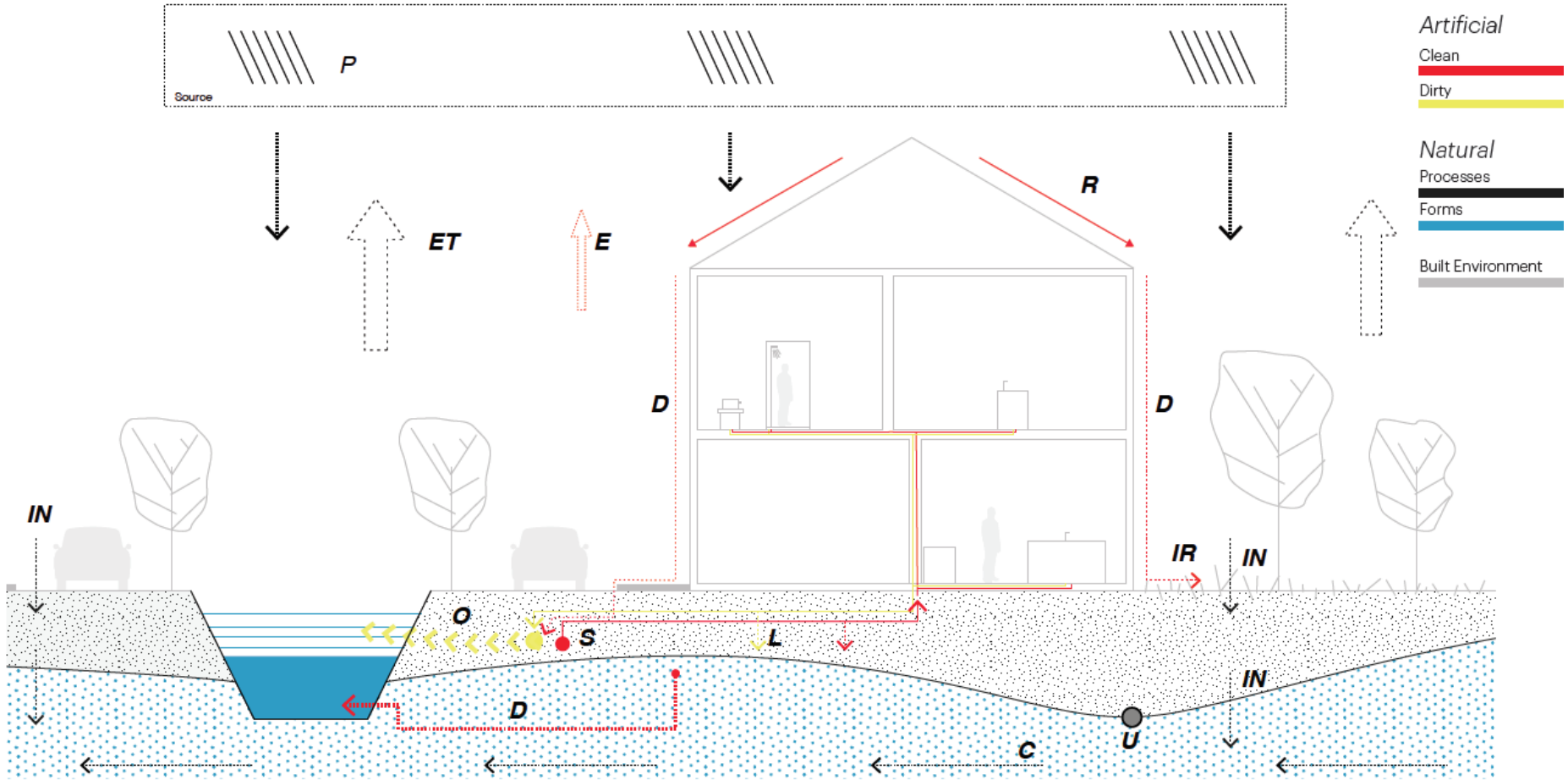

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Water flow from unsaturated to saturated zone

S : Supply
Groundwater reserves
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Evaporation + transpiration of plants.

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Loss of water form the drainage system into unsaturated zone

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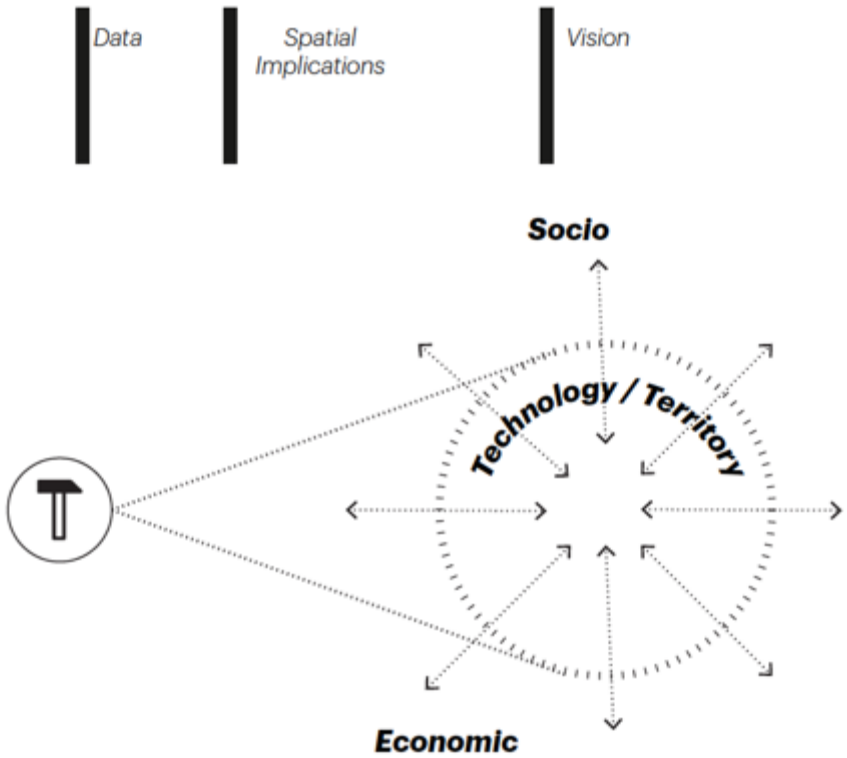
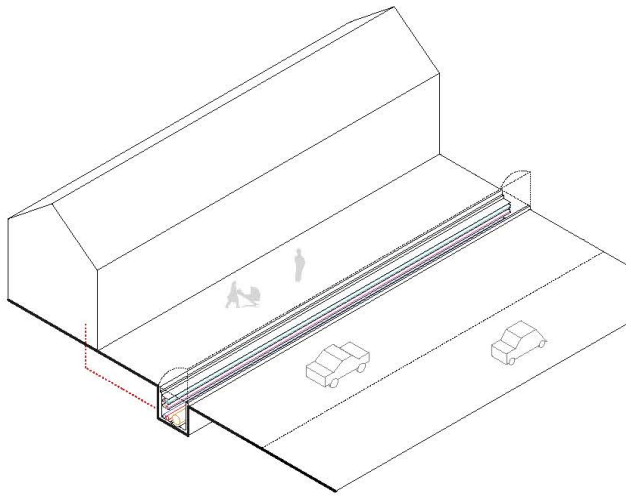
surplus of water that couldn't infiltrate in the open soil

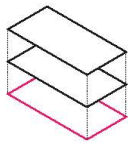
Van data naar visie





Densification

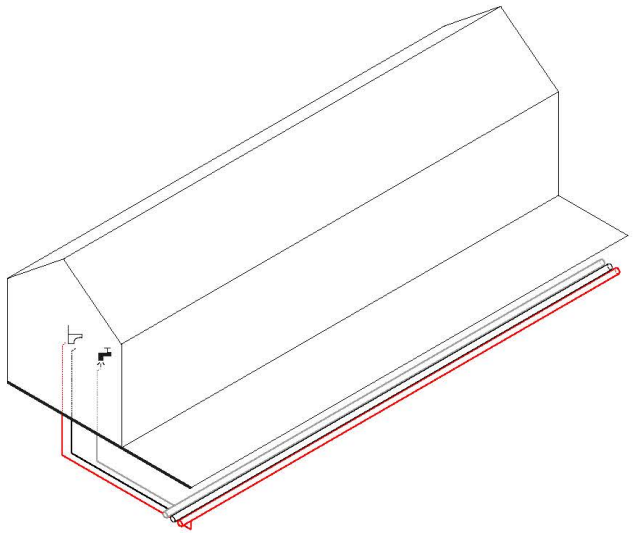
Facts



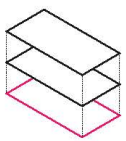
Surface

Subsurface

Public / Private



Facts



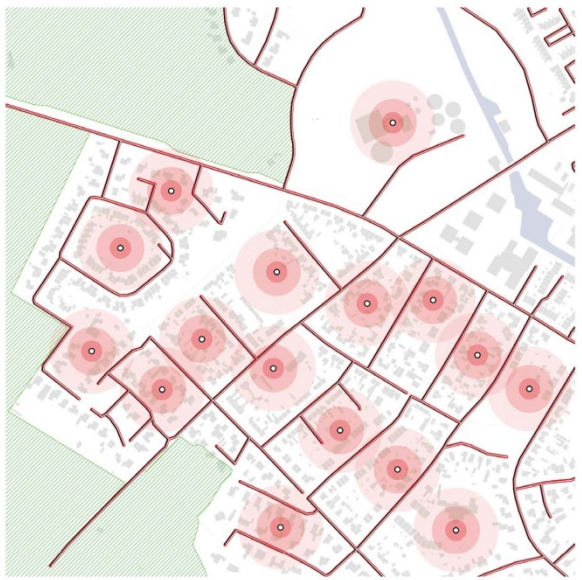
Surface

Subsurface

Public / Private

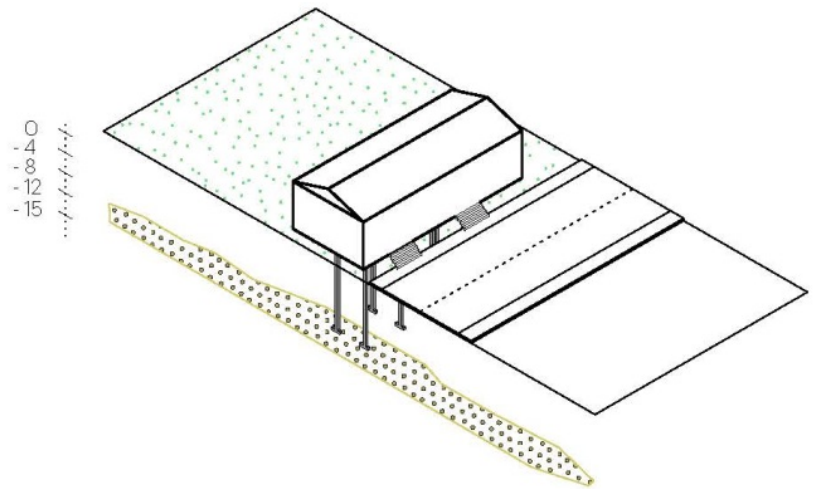
Densification

Shrinkage

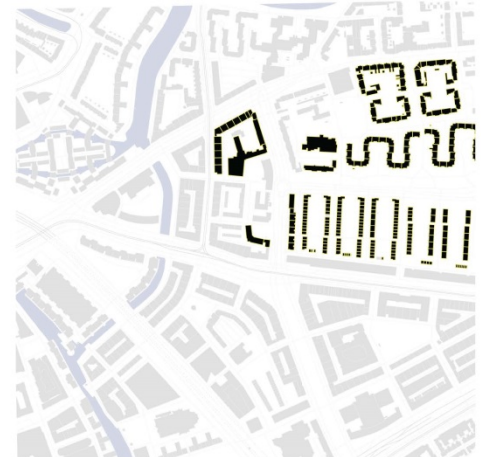


Local Treatment plant

Source Separation

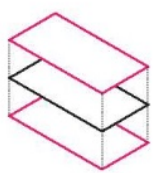


Densification



Shrinkage

Facts

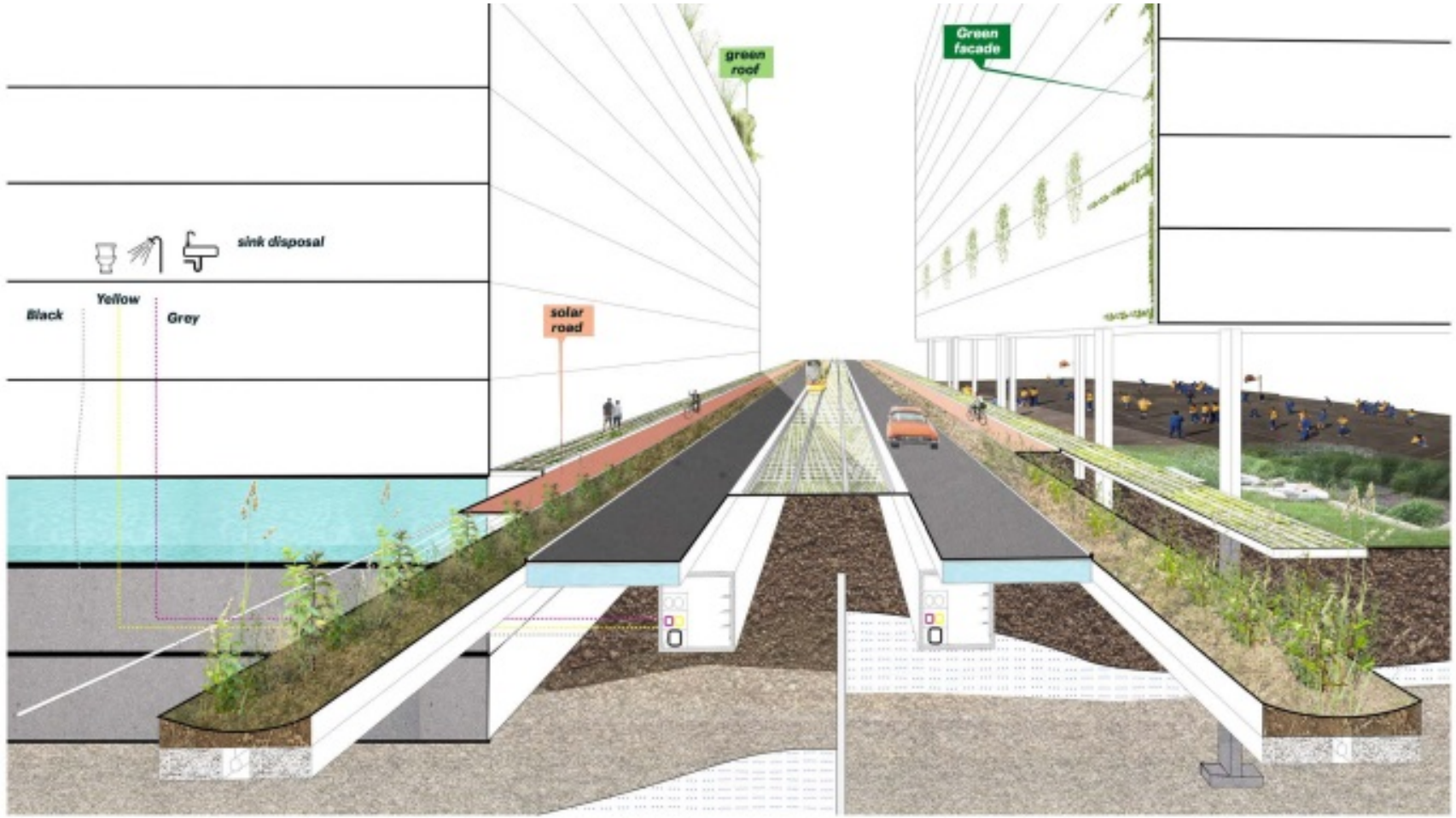


Surface

Subsurface

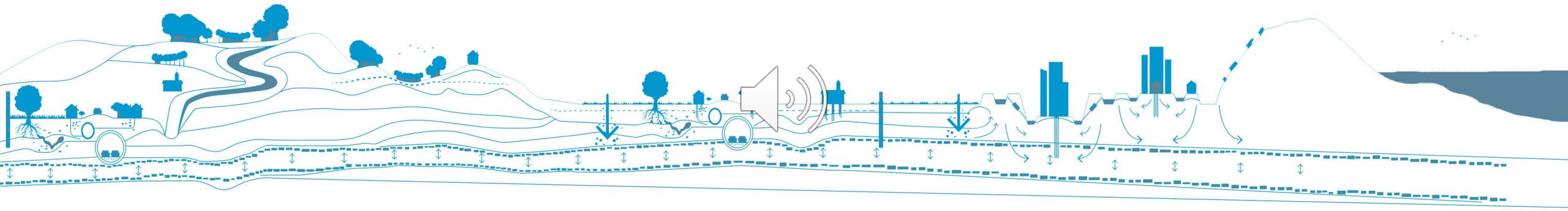
Public / Privat

New Architectural Typologies


green roof
Green facade
sink disposal
Black
Yellow
Grey
solar road

Intelligent SubSurface Quality *002*

Architectonic Representation of the subsurface for urban quality



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Urbanism

symposium bodem breed

expertise bodem en ondergrond

Technical Profile

Rotterdam Bloemhof Zuid

Authors:
dr. F.L. Hooimeijer
ir. Filippo Lafleur

Drawings:
ir. Filippo Lafleur
Jesse Dobbelsteen
Enzo Yap

Cartographic indication

Underground Depth
NAP levels
m / cm / mm
Active items (Legend)
Scale
Geographical coordinates
Zoom in
Direction Sign

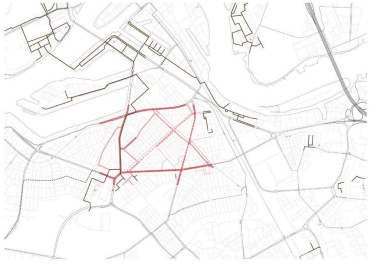
TUDelft | Deltas, Infrastructures & Mobility Initiative | Urbanism

Macro scale: Territorial condition

75 375 750 m

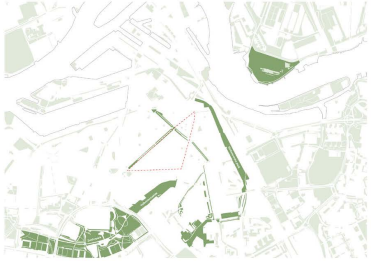
N

Infrastructures



Water

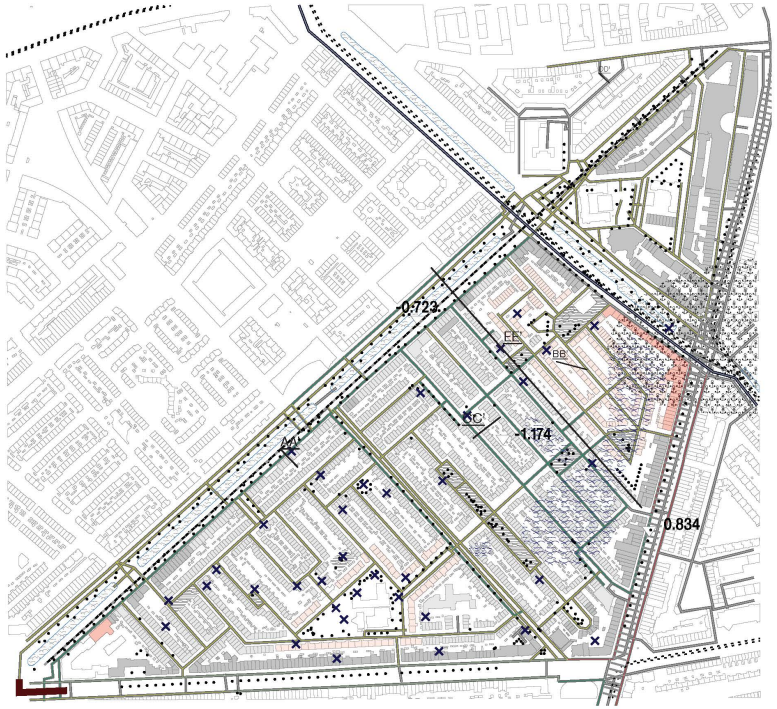
Landscape structure



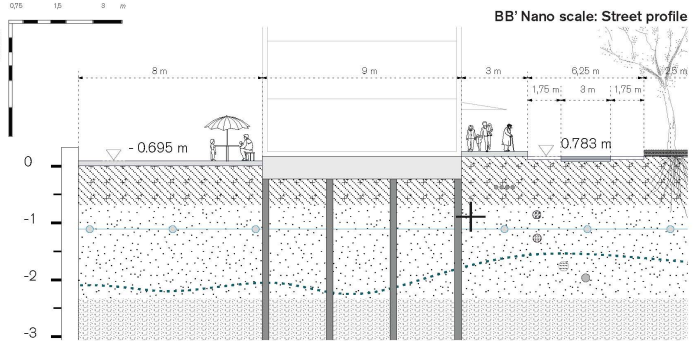
Meso scale: Plan, site investigation

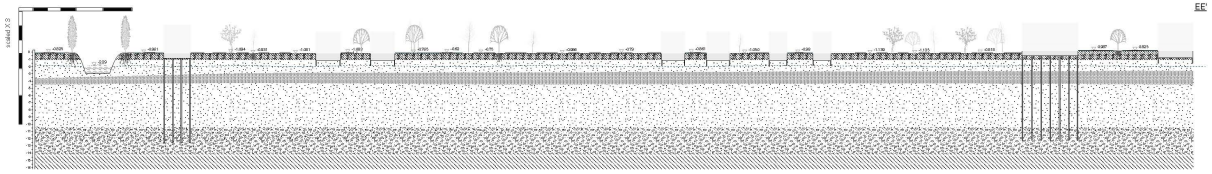
25 100 250 m

N

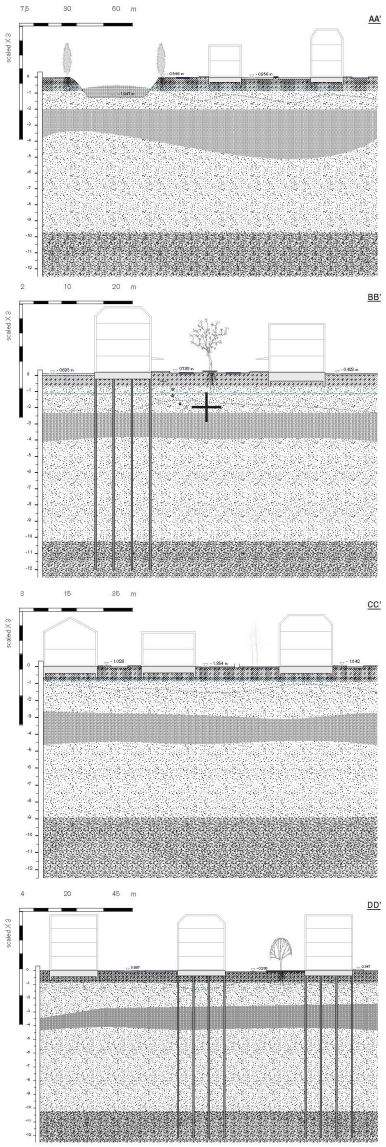


BB' Nano scale: Street profile





Micro scale: Technical profile,



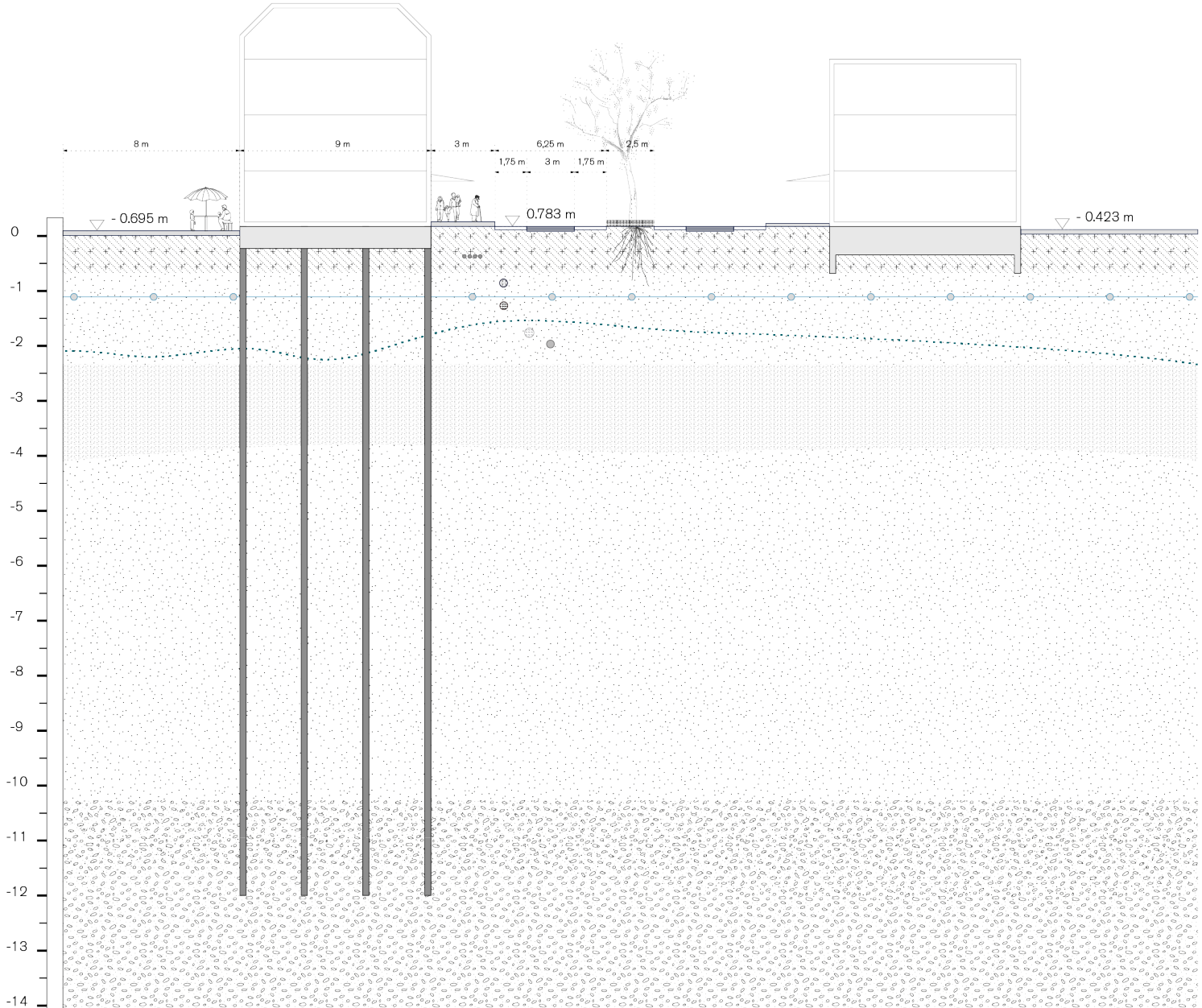
The legend: Reading sites and territories

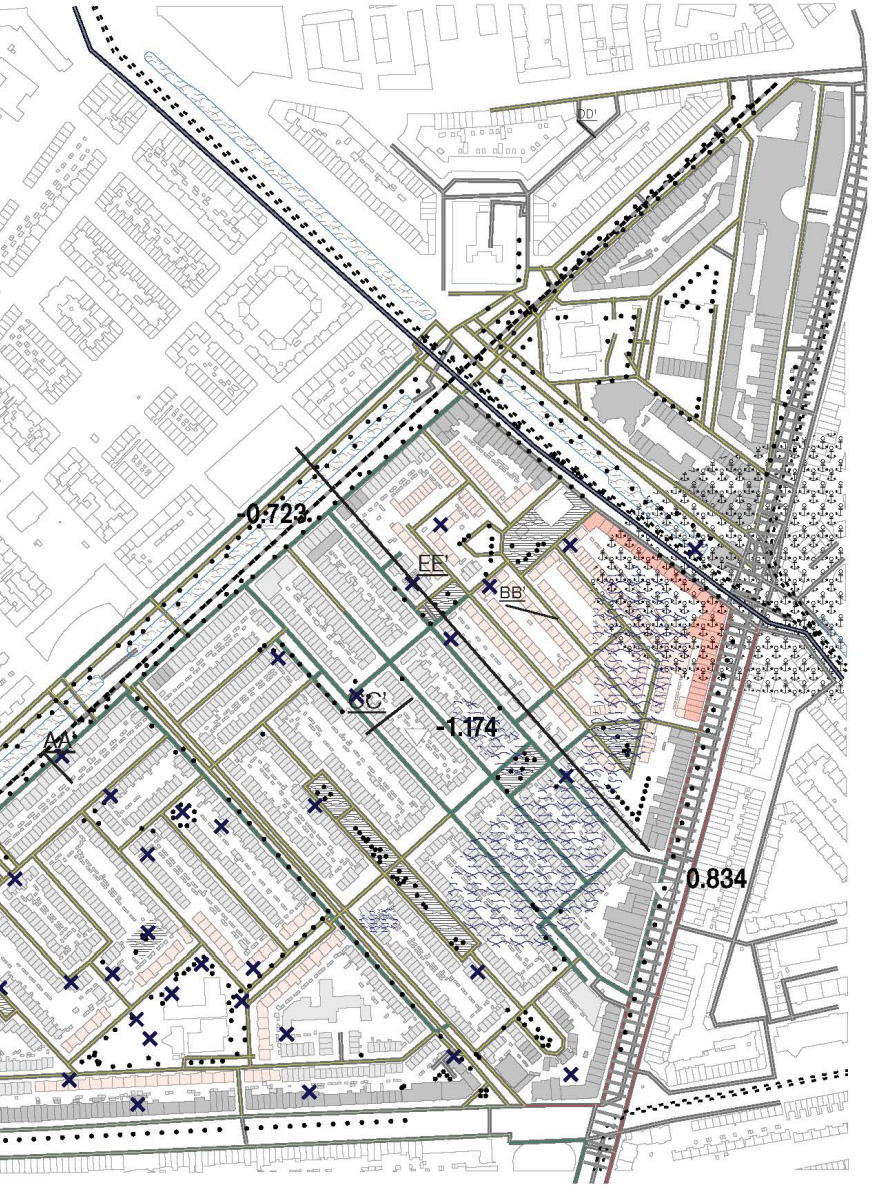
Conditions present in the area

- Subsidence: "Land subsidence in peat areas in the Netherlands damages housing and infrastructure. In other countries where peat areas are located on the coast, these areas are increasingly being submerged due to land subsidence, with all the inevitable harmful consequences". Deltares, 2018
- Oxidation: Oxidation is the biogeochemical process that leads to subsidence. Various interrelations between anthropogenic and natural dynamics might effect or speed up this process.
- Polluted soil: Soil pollution is the so called immobile pollution. In this particular case is believed that the contaminants came with sand from the harbour needed to make 'building site preparation'.
- Monuments on slabs: The colour shows the combination of buildings on slabs foundations and their legal and cultural condition as monuments.
- Monuments on wooden piles: The colour shows the combination of buildings on wooden piles foundations and their legal and cultural condition as monuments.
- Seepage: Seepage, in soil engineering, movement of water in soils, often a critical problem in building foundations. It depends on several factors, including permeability of soil and other factors. Encyclopædia Britannica, 2008 In the area is 1 to 0,1 mm/day
- NBW norm: The area is not in line with NBW norm regarding the height of gorundwater level.

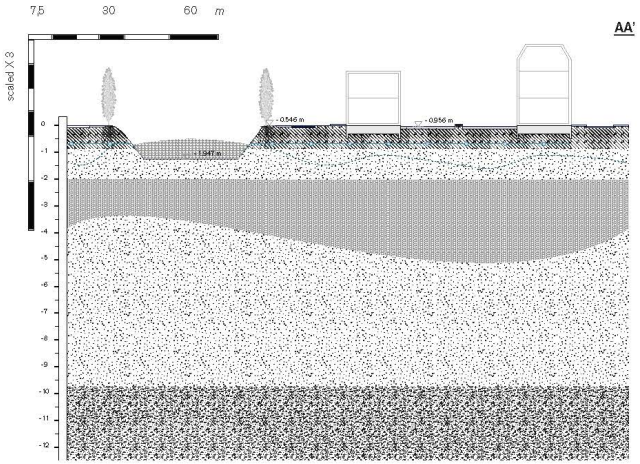
Static and dynamic conditions

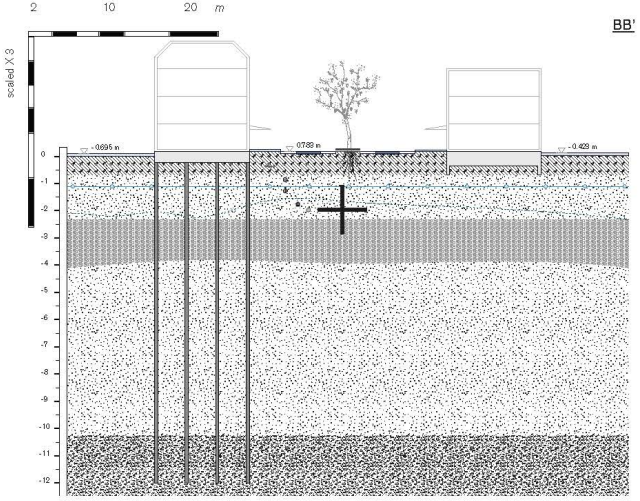
	Solid \ static conditions	Processes
People		
Metabolism		Energy, Water, Waste, Material, Food, Soil, Air
Buildings	Footprint; Rooftop orientation; Monument	Programmatic change
Public space	Open soil; Grass; Low medium vegetation; High vegetation	Biota Flows; Growth / succession
Infrastructure	Asphalt; Permeable pavement; Road; Public transport	Movement - flows
Civil constructions	Underground Building; Utilities: Cables and Pipes; Archaeology; Explosives; Dike	Partial filling; Site Grading; Integral filling; Combined Utilities; Sewer Age <=25, 25 - 40, 41-50, >50
Energy	Fossil Fuel Energy; Geothermal Energy; ATES (Aquifer Thermal Energy)	Electricity; Heat
Water	GroundWater; Drinking water resources; Open Water; Rain; Underground drainage; Macro map; Water Input/output Connection; Water level district	Rainfall return period: 1/year; Euthrophication; Infiltration; Runoff; Drainage; Evapotranspiration
Soil / ecology	Sand; Silt; Peat; Mulch; Gravel; Clay; Humus; clean soil; Bedrock; Polluted soil; Height difference; Trees; Macro map; Main green structure; Secondary green	Subsidence mm/year; Oxydization; Crop Capacity; Rhizosphere processes; Contaminants; Subsoil Life (microorganism)

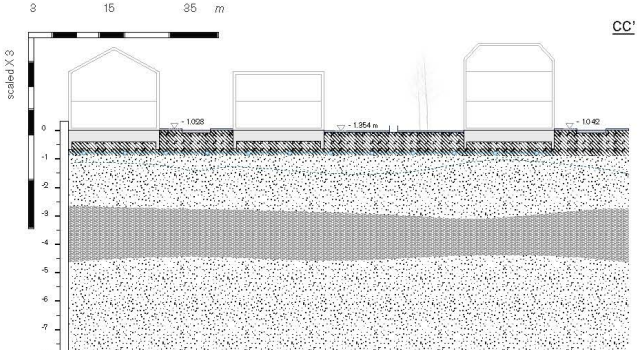

8 m
9 m
3 m
6,25 m
2,5 m
1,75 m
3 m
1,75 m
- 0.695 m
0.783 m
- 0.423 m
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14



Micro scale: Technical profile,







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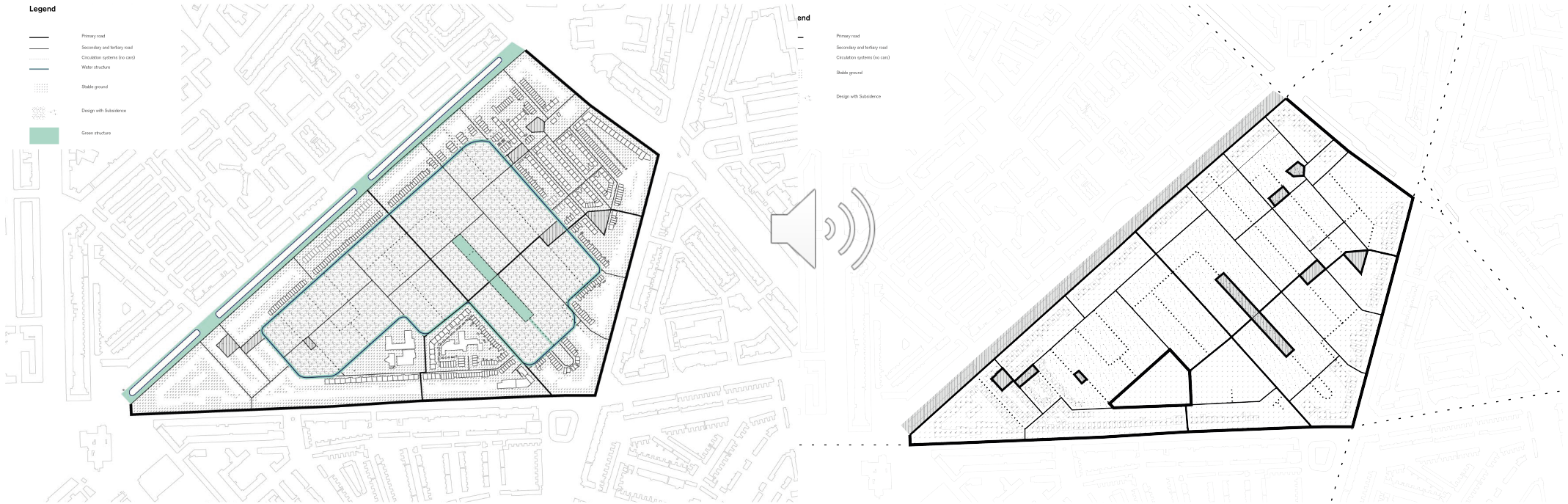
Buildings	Footprint Rooftop orientation Monument	Programmatic change
Public space	Open soil Grass Low medium vegetation High vegetation	Biota Flows Growth / succession
Infrastructure	Asphalt Permeable pavement Road (Highways, Primary, Secondary, Tertiary) Public transport (Train, Tram, Bus, Stop)	Movement - flows
	Underground Building (Concrete slabs foundation, Wooden piles foundation)	Partial filling Site Grading

Design Provocation

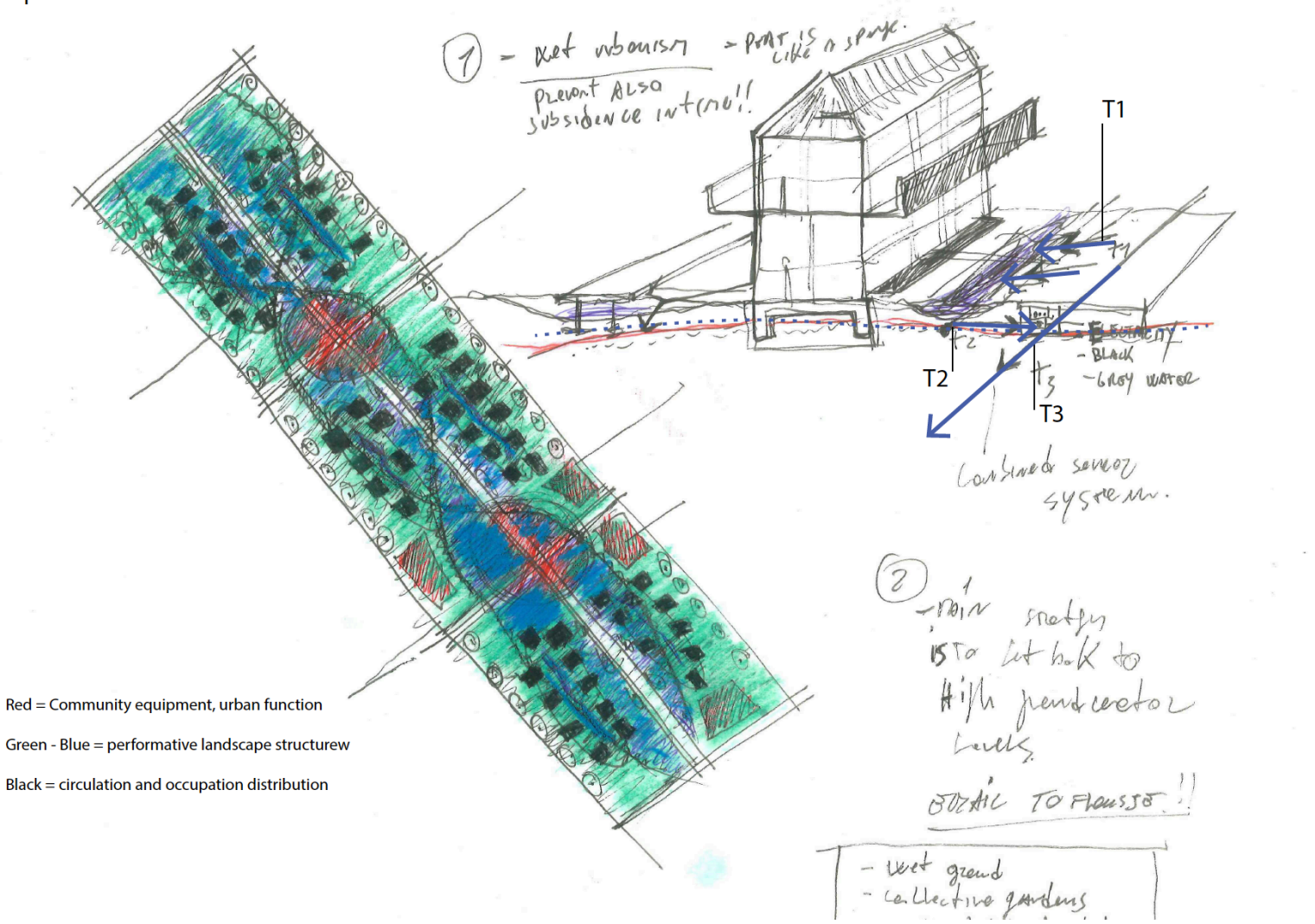


Polder in polder

Extreme Engineering

Scripts

Script 1



Macro scale: Territorial condition

Energy

Water

Landscape structure

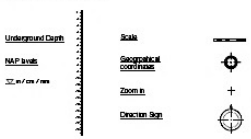
Technical Profile

Leiden

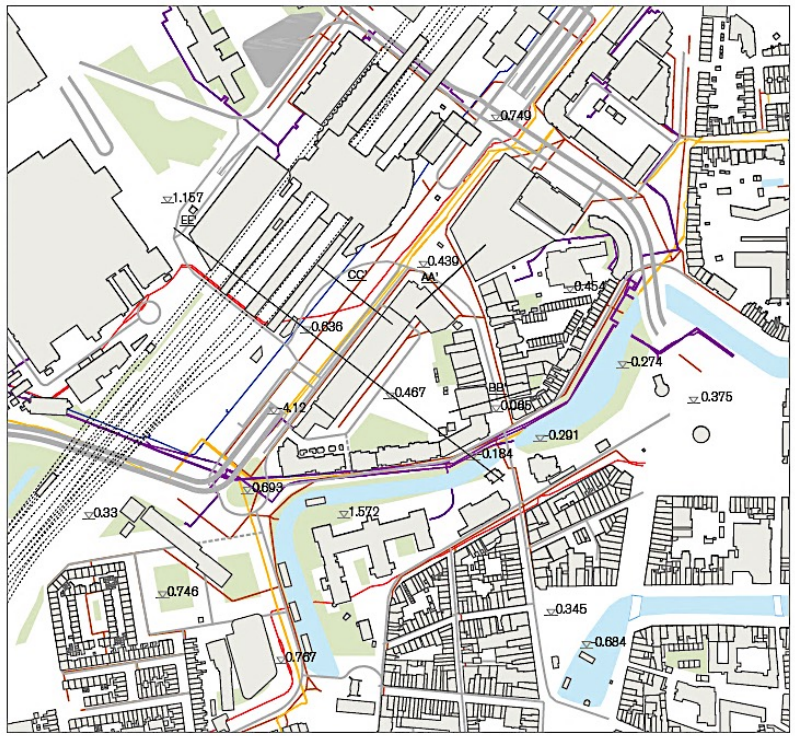
Authors:
dr. F.L. Hoolmeijer
Ir. Filippo Lafleur

Drawings:
Ir. Filippo Lafleur
Jesse Dobbelsteen
Enzo Yap

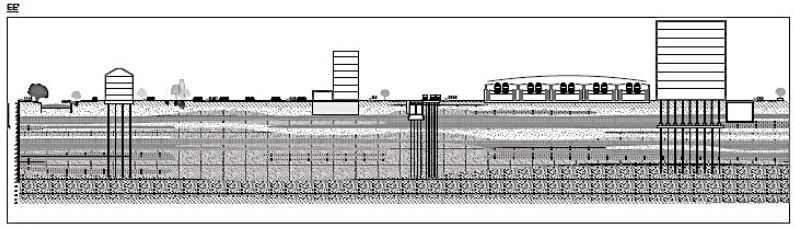
Cartographic indication



Meso scale: Plan, site investigation



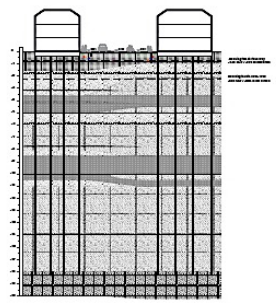
EE'



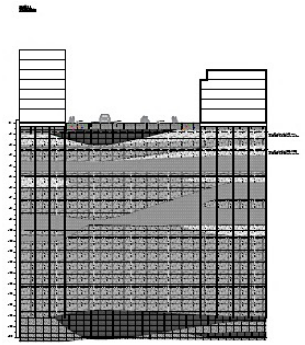
Nano scale: Street profile

Micro scale: Technical Section,

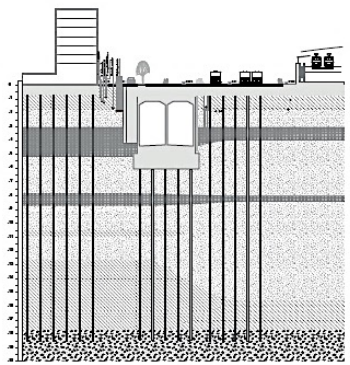
AA'



BB'

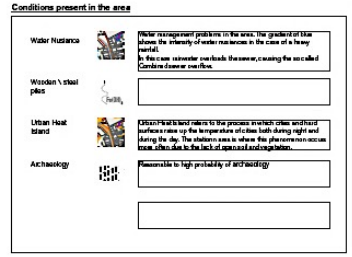


CC'

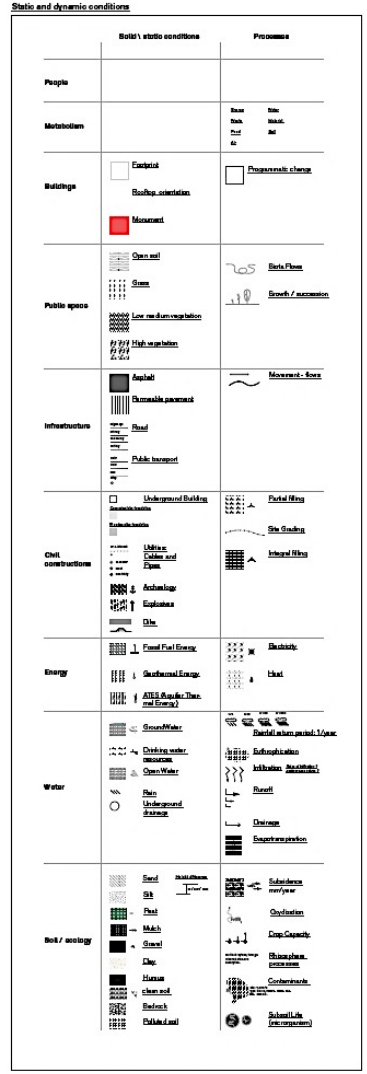


The legend: Reading sites and territories

Conditions present in the area



Static and dynamic conditions



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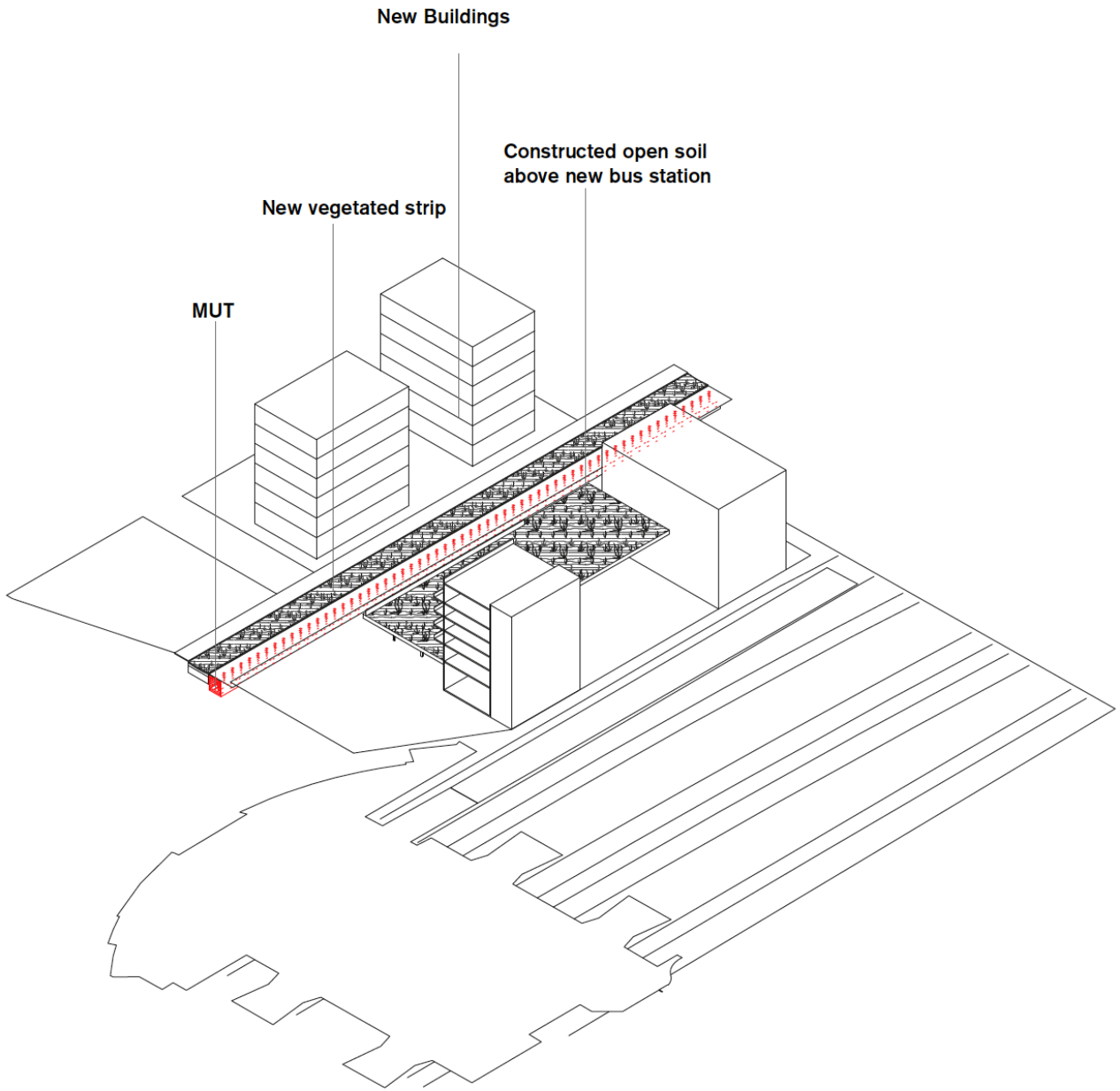
New Buildings
Constructed open soil
above new bus station
New vegetated strip
MUT