

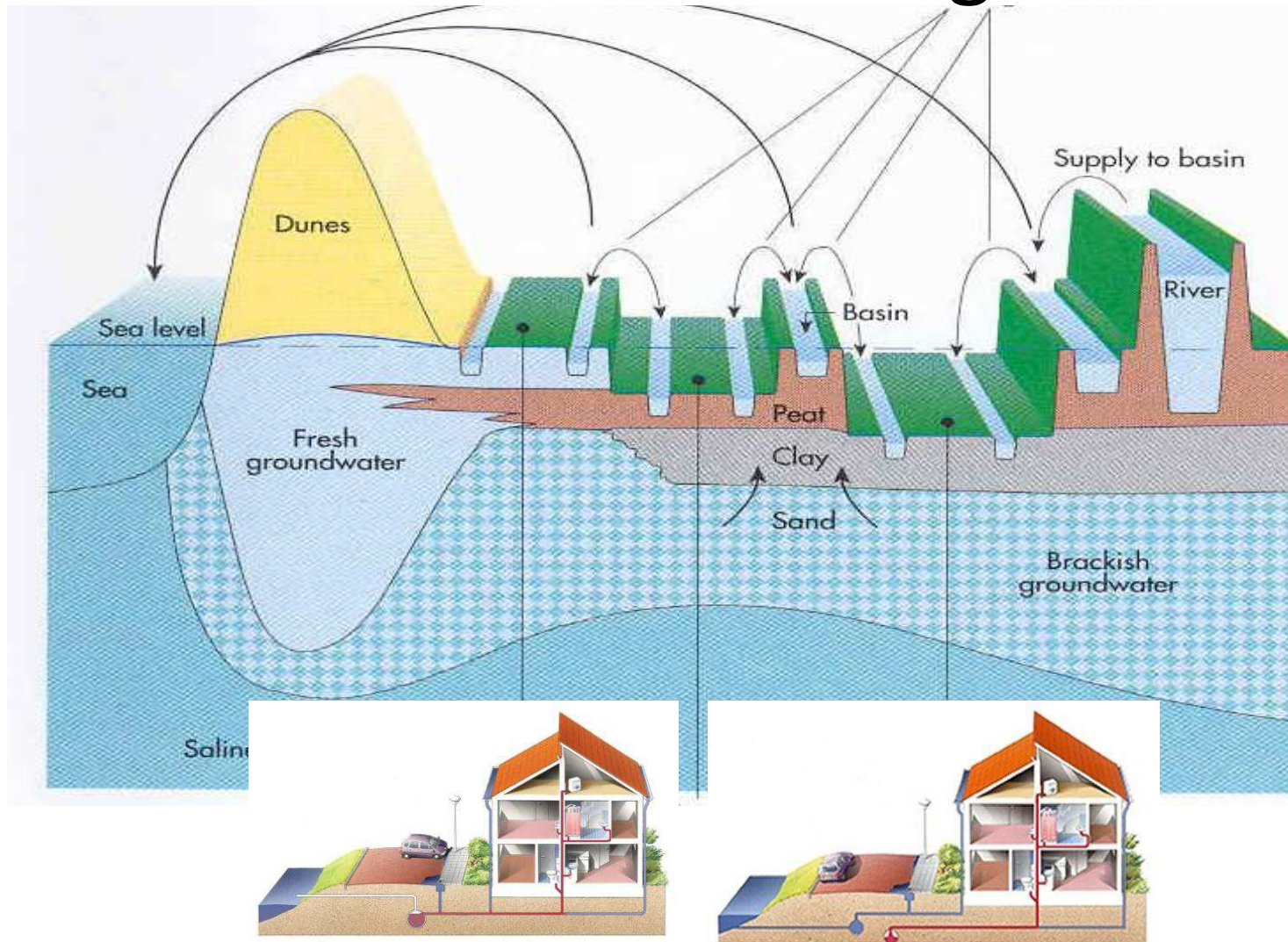
Fransje Hooimeijer



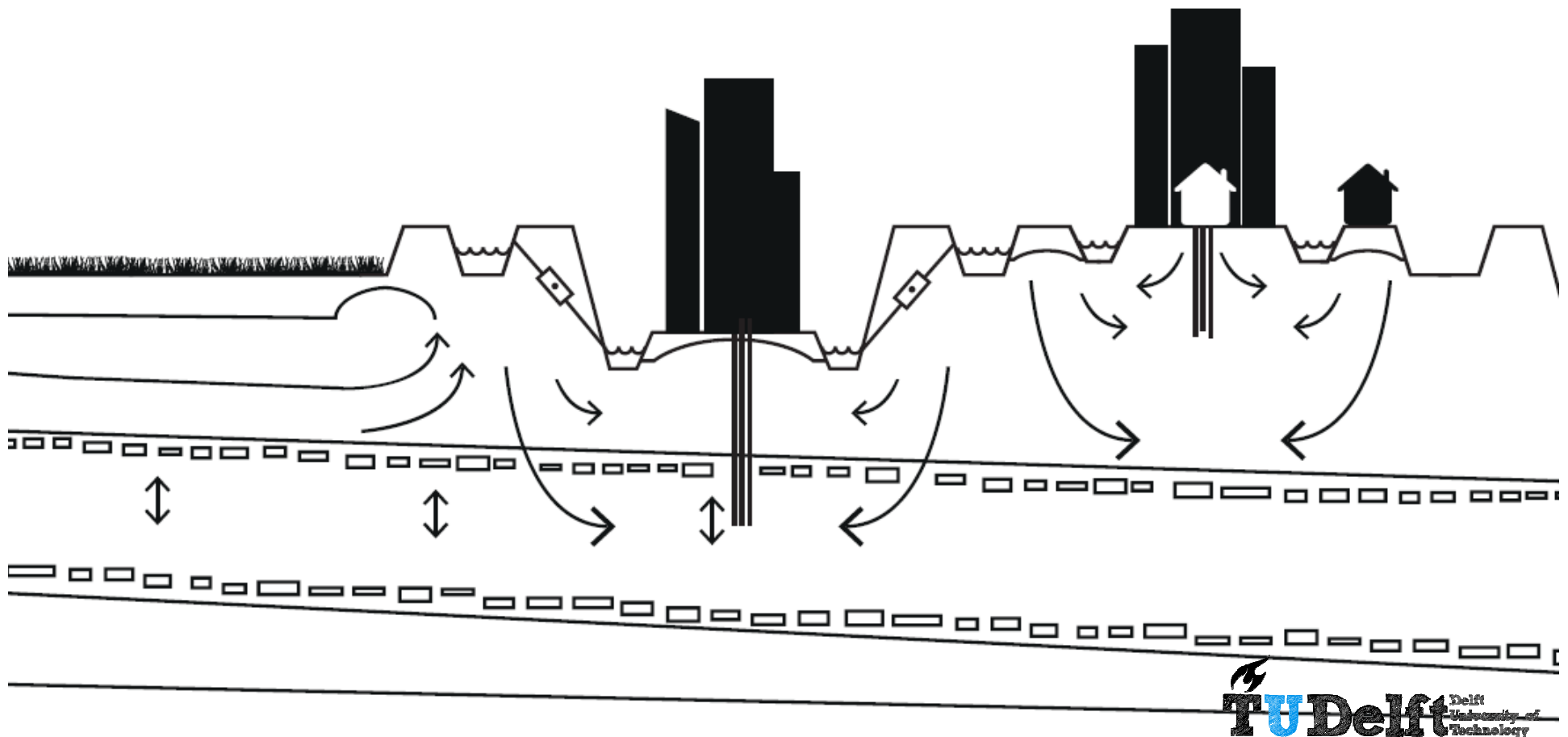
Water Sensitive Rotterdam water en architectuur

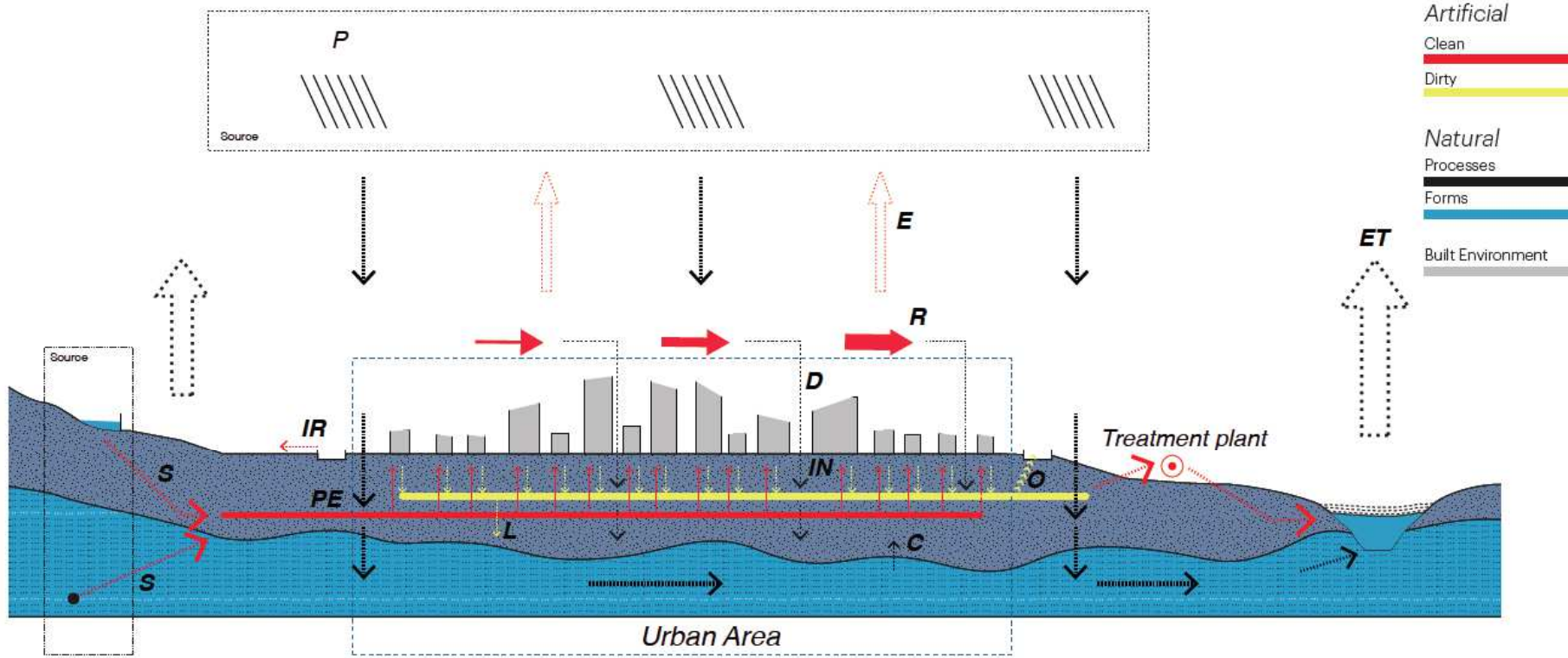


Watersysteem door de schalen heen: van rivier tot gebouw

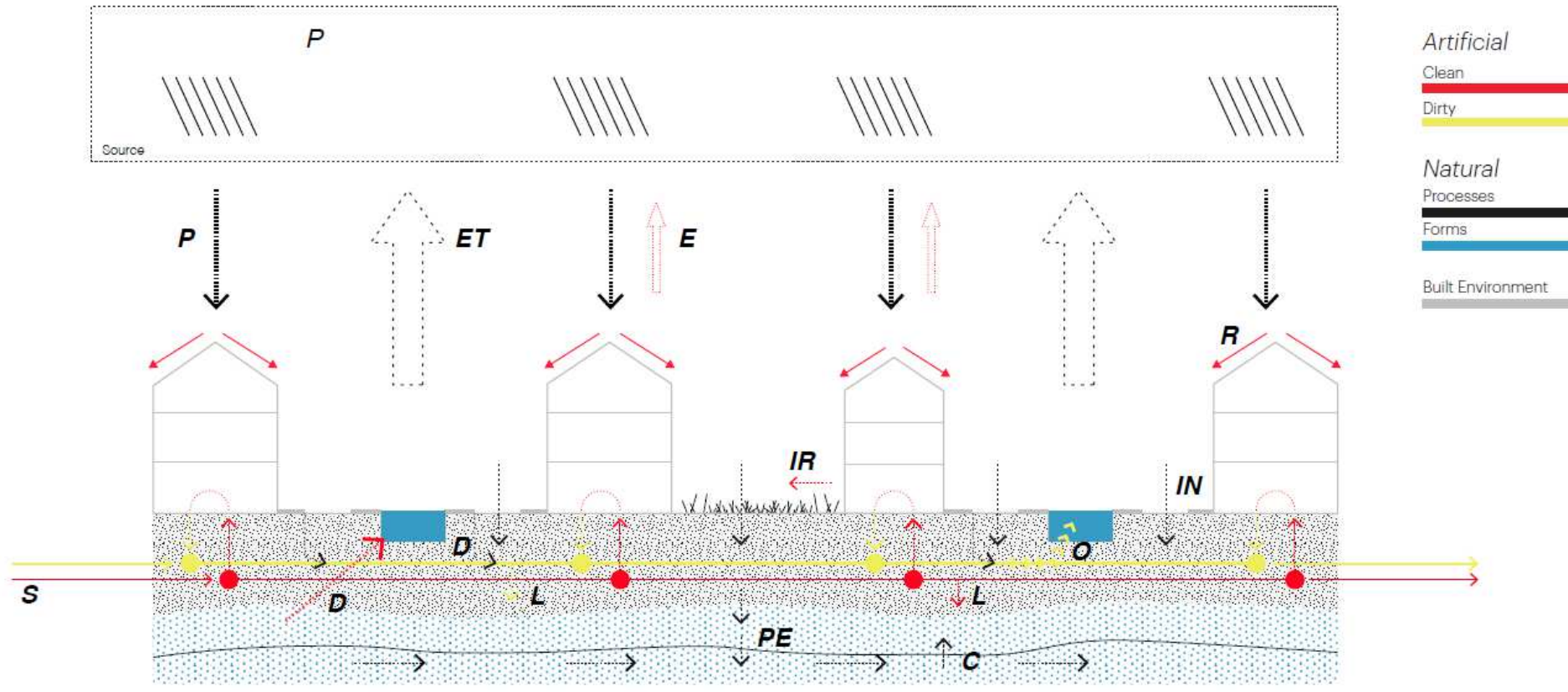


Watersysteem door de systemen heen: funderen en grondwater





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 through combined 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



Artificial

Clean

Dirty

Natural

Processes

Forms

Built Environment

C : Capillar flow

↑
water flow From saturated to unsaturated zone

O : Overflow

→→→→→
Water flow Exceeding drainage capacity of engineered system

PE : Percolation

↓
Water flow from unsaturated to saturated zone

P : Precipitation

↓
Rain + Snow

S : Supply

↗
Groundwater reserves
Sweet water reserves

E : Evaporation

↑
State change of water from liquid to gas.

IR : Irrigation

←
Agriculture

Et : Evapotranspiration

↑
Evaporation + transpiration of plants.

D : Drainage

—
Drainage of rainwater / groundwater through combined sewer pipe.

L : Leakage

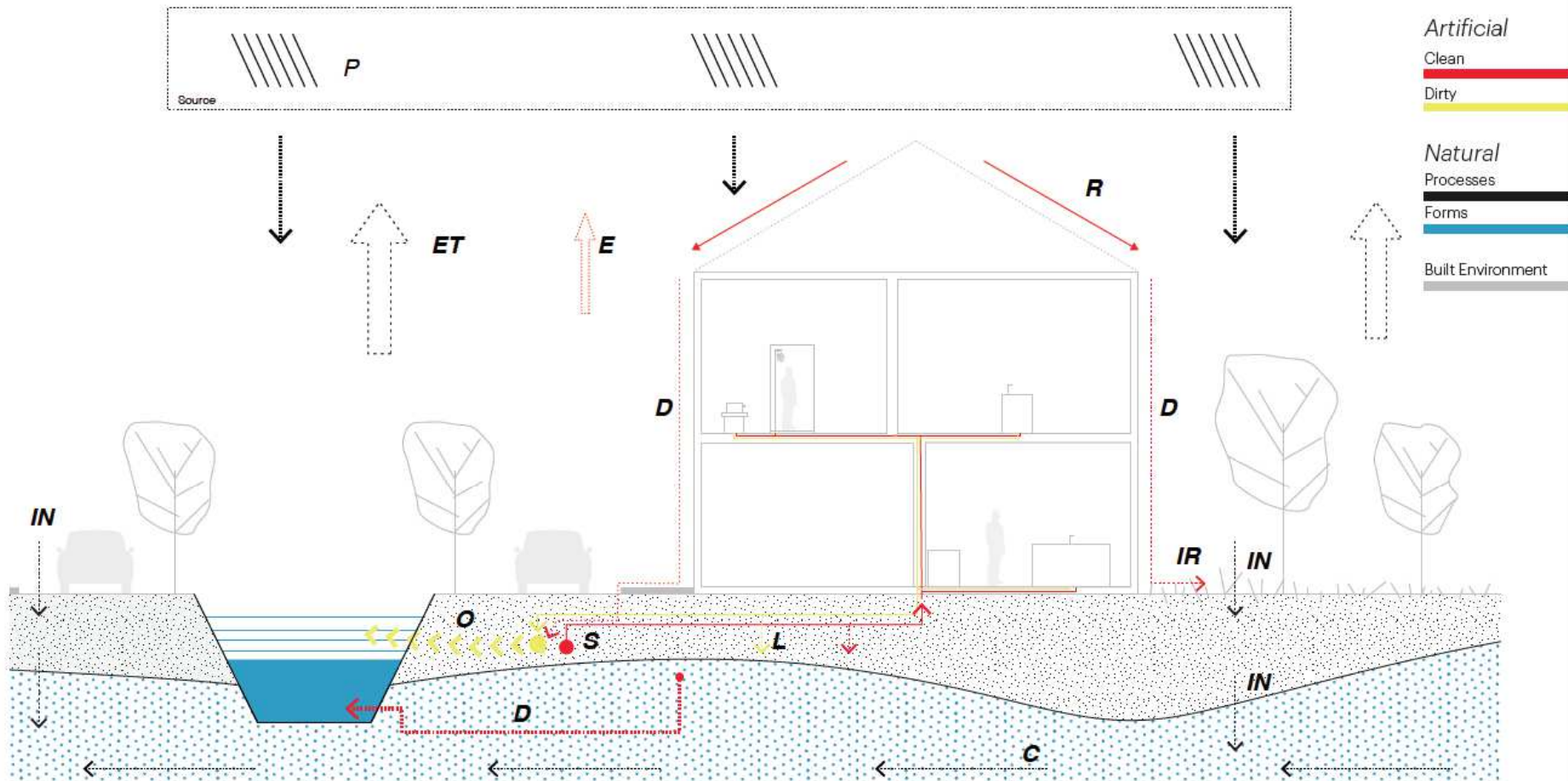
↓
Loss of water from the drainage system into unsaturated zone

IN : Infiltration

↓
Water movement through open soil into groundwater layer

R : Runoff

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



Artificial

Clean

Dirty

Natural

Processes

Forms

Built Environment

C : Capillar flow

↑ water flow From saturated to unsaturated zone

O : Overflow

Water flow Exceeding drainage capacity of engineered system

PE : Percolation

↓ Water flow from unsaturated to saturated zone

P : Precipitation

Rain + Snow

S : Supply

Groundwater reserves Sweet water reserves

E : Evaporation

State change of water from liquid to gas.

IR : Irrigation

← Agriculture

Et : Evapotranspiration

Evaporation + transpiration of plants.

D : Drainage

Drainage of rainwater / groundwater through combined sewer pipe.

L : Leakage

Loss of water form the drainage system into unsaturated zone

IN : Infiltration

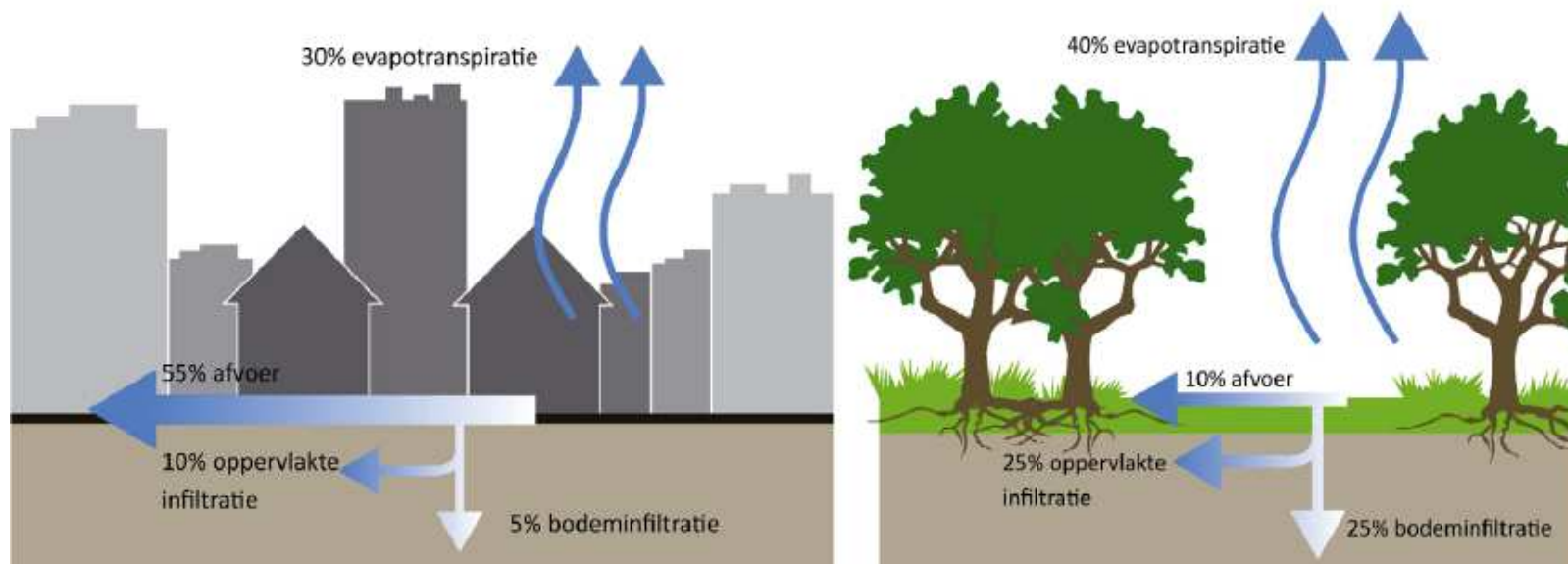
Water movement through open soil into groundwater layer

R : Runoff

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

Ontwerpen en ontwikkelen met het watersysteem

Waterbalans en hitte in de stad in relatie tot groen



Hoeveel water er valt er in het gebied in een regenbui van twee uur waarbij 30 mm water valt?

$$(0,03\text{m regen} - (\text{tijdelijke berging in mm} * 0,001)) - (2 * \text{infiltratie verlies in mm/u} * 0,001) * \text{opp m}^2$$

=

Hoeveelheid te bergen of in riool af te voeren water

naar meters brengen

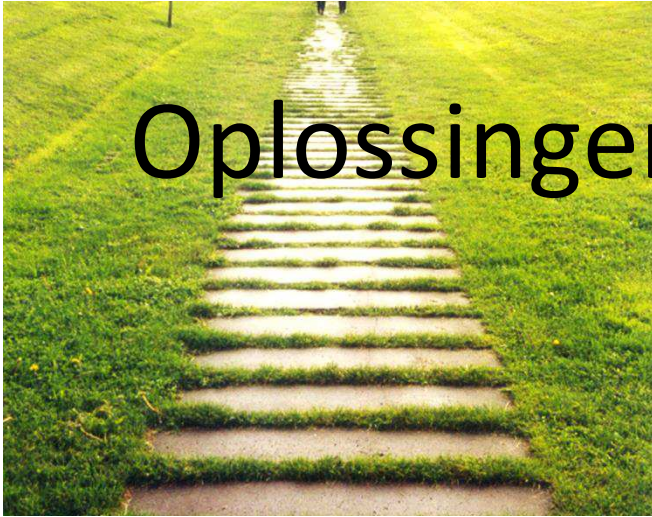
hoeveelheid water in twee uur

per uur dus moet keer 2

per type oppervlakte verschillend

Oppervlakte (voor zover van toepassing op je kavel opmeten en invullen):	(30 mm water - (tijdelijke berging*0,001) - (2 uur*infiltratie verlies*0,001))*m 2 oppervlakte type	M3 water (geen negatieve getallen, dan maak je er nul van!)
Open water	wanneer er open water is in je gebied kun je 0,5 m3 per m2 bergen	0
Infiltratie tuin	(0,03-(25*0,001)-(2*75*0,001))*oppervlakte	
Infiltratie plantsoen en park	(0,03-(15*0,001)-(2*50*0,001))*oppervlakte	
Infiltratie speeltuin	(0,03-(5*0,001)-(2*5*0,001))*oppervlakte	
Wadi	(0,03-(10*0,001)-(2*10*0,001))*oppervlakte	
Zadeldak	(0,03-(1*0,001)-(2*0*0,001))*oppervlakte	
Plat dak	(0,03-(5*0,001)-(2*0*0,001))*oppervlakte	
Groen dak extensief	(0,03-(10*0,001)-(2*0*0,001))*oppervlakte	
Groen dak intensief	(0,03-(25*0,001)-(2*0*0,001))*oppervlakte	
straat of parkeerplaats van asfalt	(0,03-(1*0,001)-(2*0*0,001))*oppervlakte	
straat van poreus asfalt	(0,03-(1*0,001)-(2*40*0,001))*oppervlakte	
straat of parkeerplaats van steen	(0,03-(3*0,001)-(2*10*0,001))*oppervlakte	
straat of parkeerplaats half verhard	(0,03-(3*0,001)-(2*40*0,001))*oppervlakte	
Stoep	(0,03-(3*0,001)-(2*8*0,001))*oppervlakte	
Totaal:	Totaal van M3 water dat of in het riool verdwijnt of geborgen moet worden:	

Oplossingen in de publieke ruimte

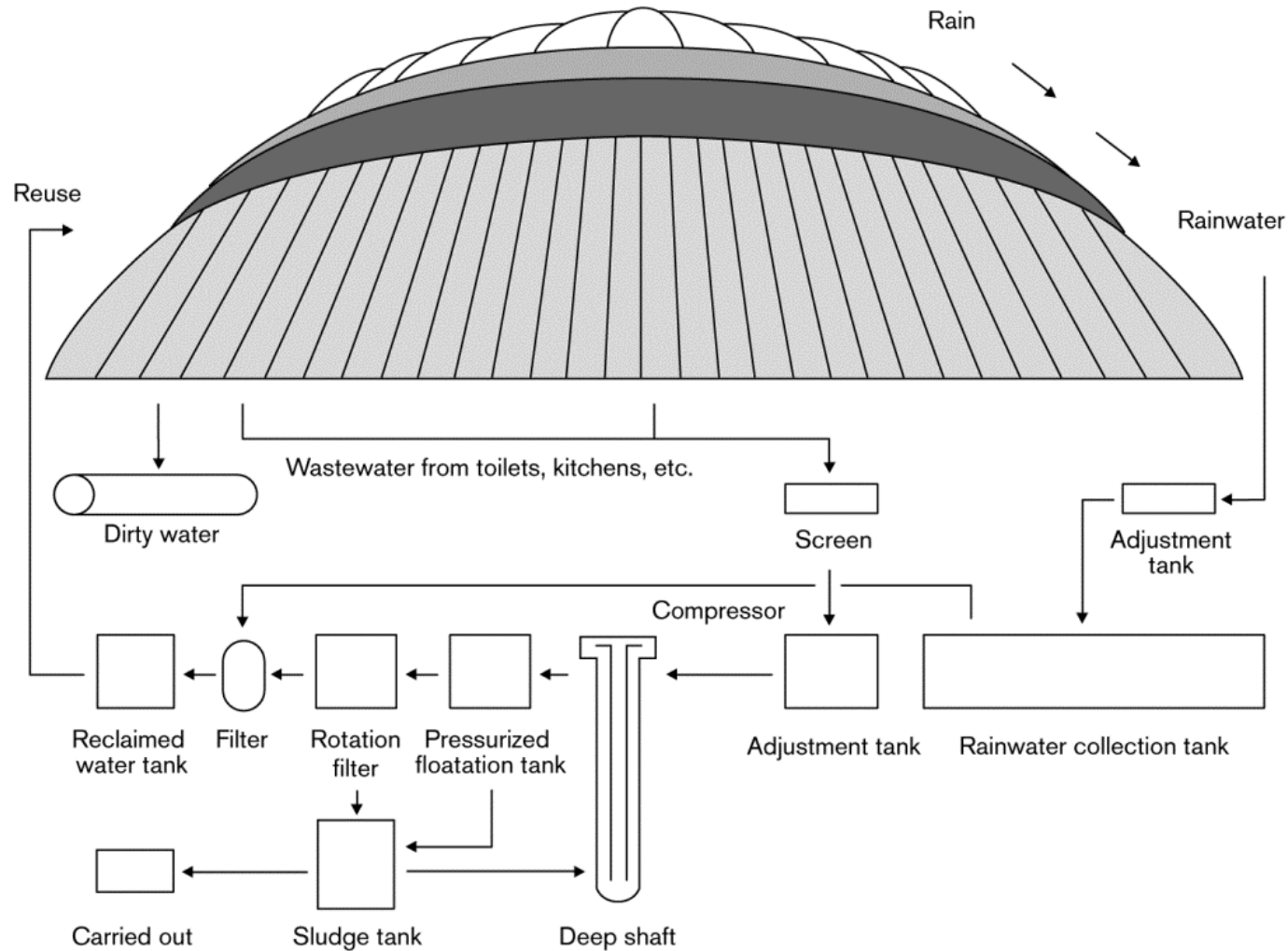


Oplossingen in de private ruimte





Regels voor het bouwen: Japan



Regels voor regenwater: Zwitserland

URBANISATION - TYPLOGIES



Apartment blocks

Public/private open space



Urban Villa

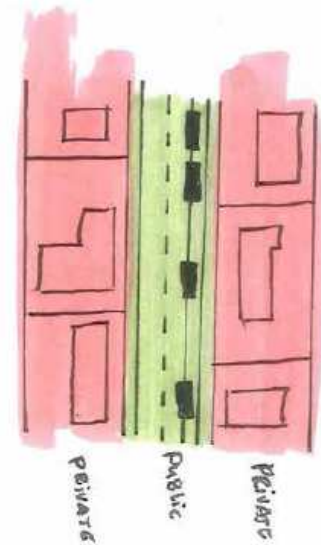
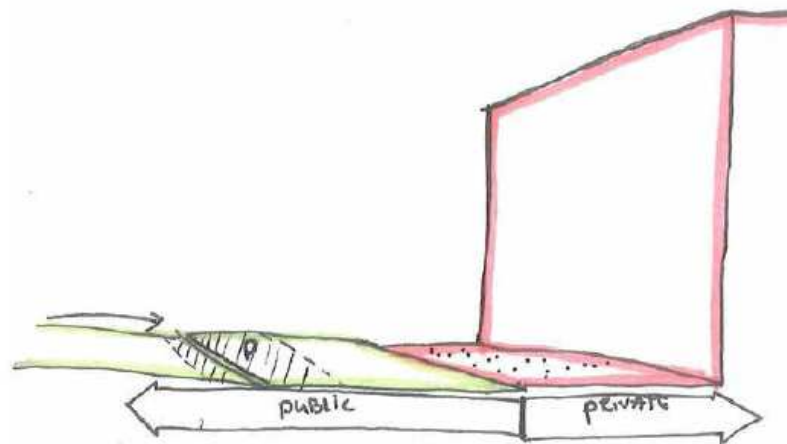
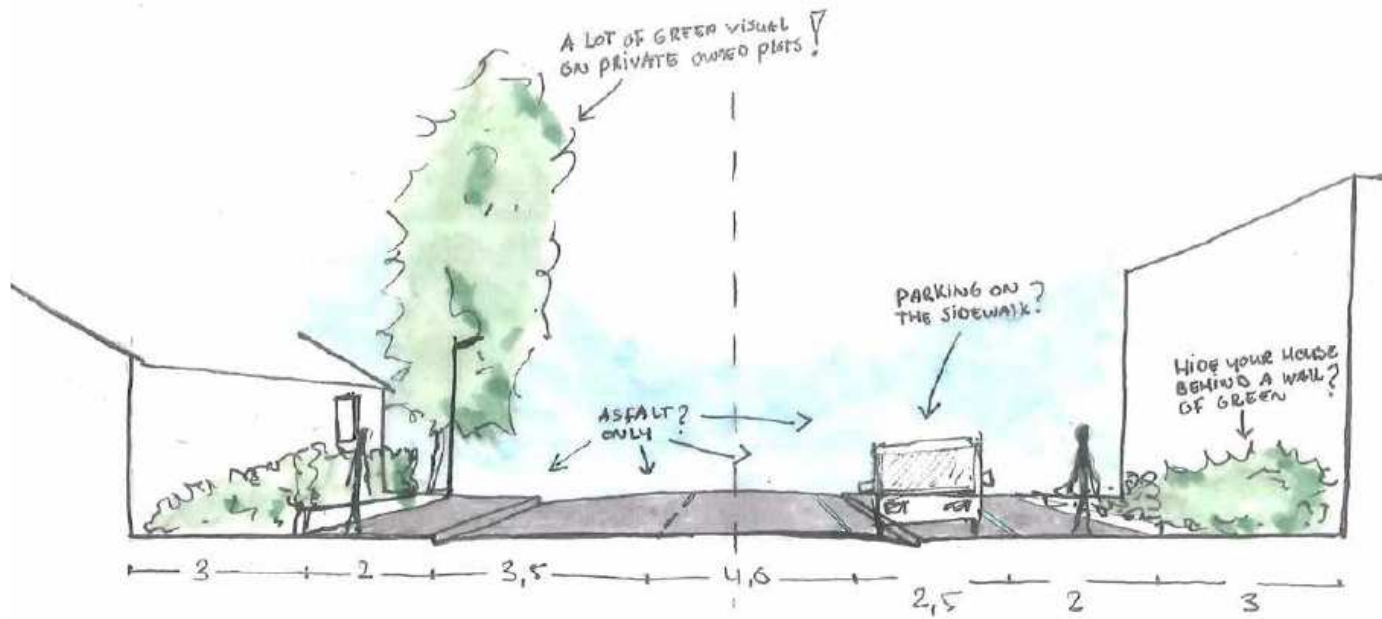


Traditional Urban Villa

Cars outside green space



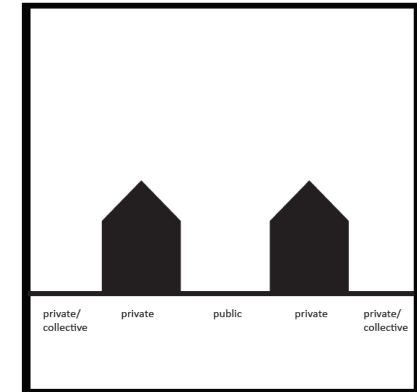
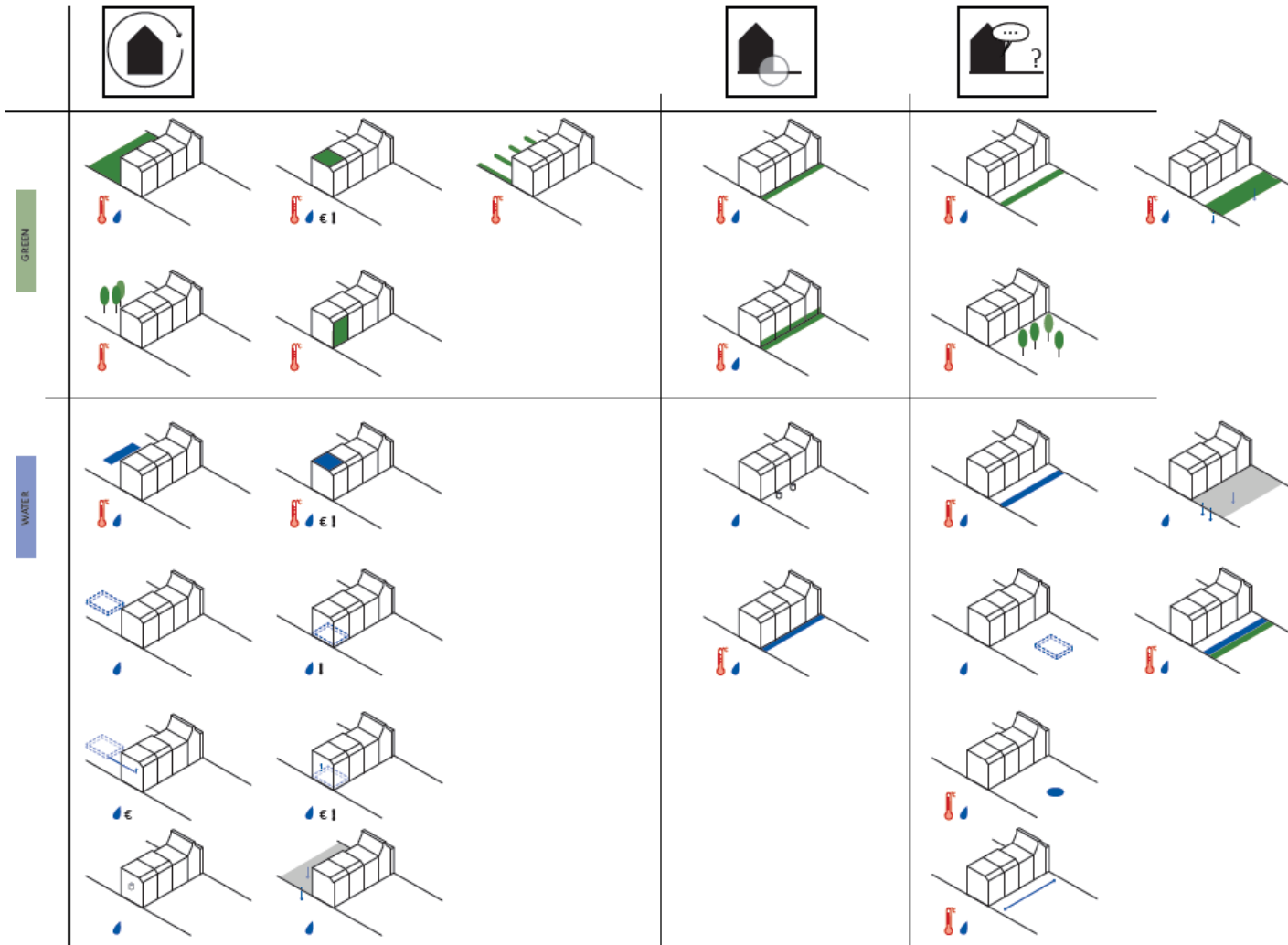
© Kim van Doesburg 2015





Privaat of publiek: de tussenschaal

Figure 19: The intermediate scale is an undefined connector between the individual and the municipality.

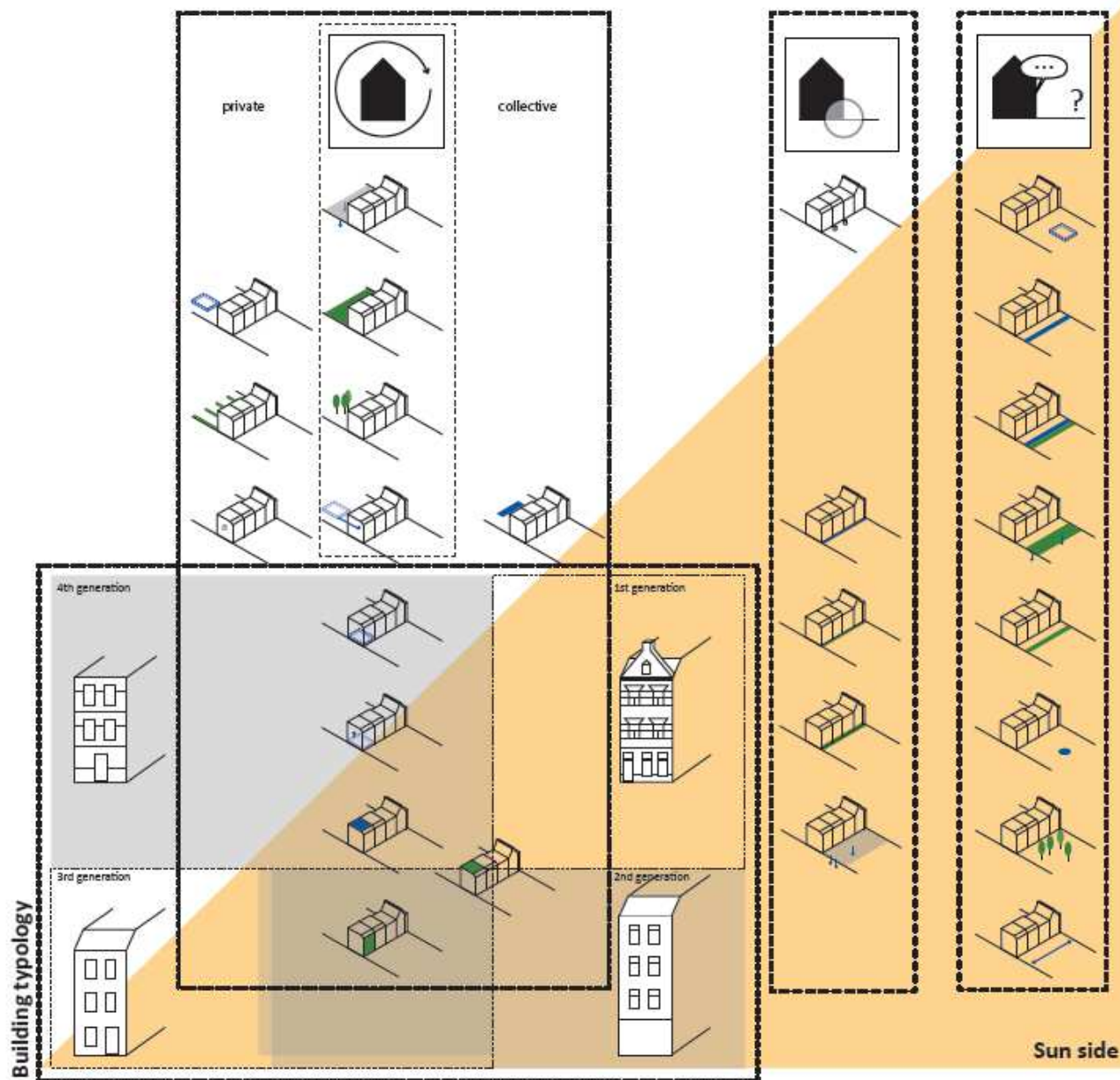


URBAN HEAT
 WATER MANAGEMENT
 FINANCIAL BENEFIT
 CONSTRUCTION LIMITS

© Anne Witteveen 2014

Figure 19: Tool boxes for blue, heat and water.

Collaboration types



© Anne Witteveen 2014

The water system can work optimal when the water can be discharged from the roofs in two directions where it will be transported towards the squares where it can infiltrate, via infiltration fields, into the soil.

The amount of soft surface- and permeable surface is increased and the amount of solid surfaces is decreased. The total water assignment of 861m³ is reduced by 36% to an assignment of 553m³.

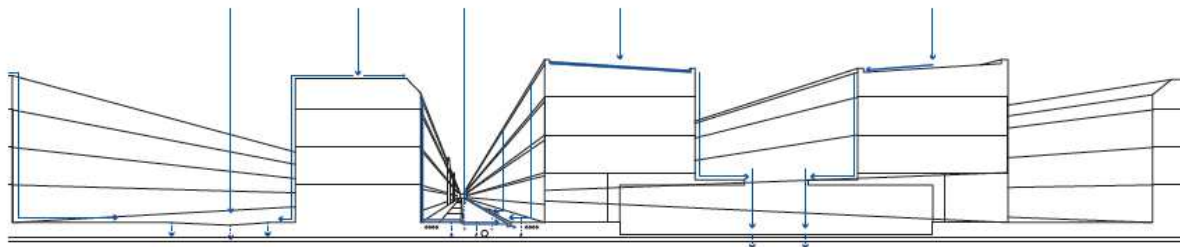
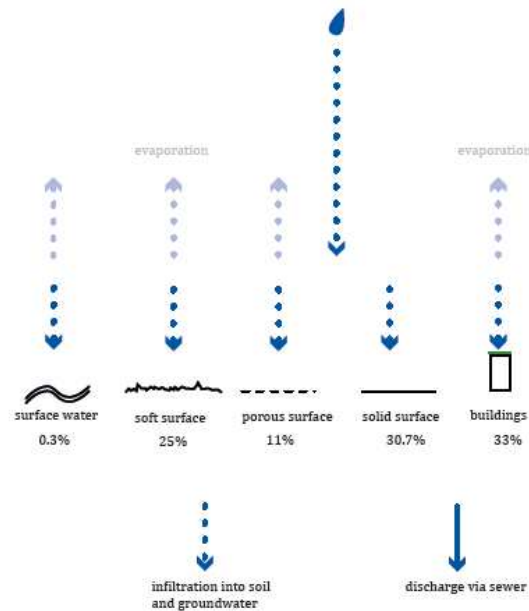
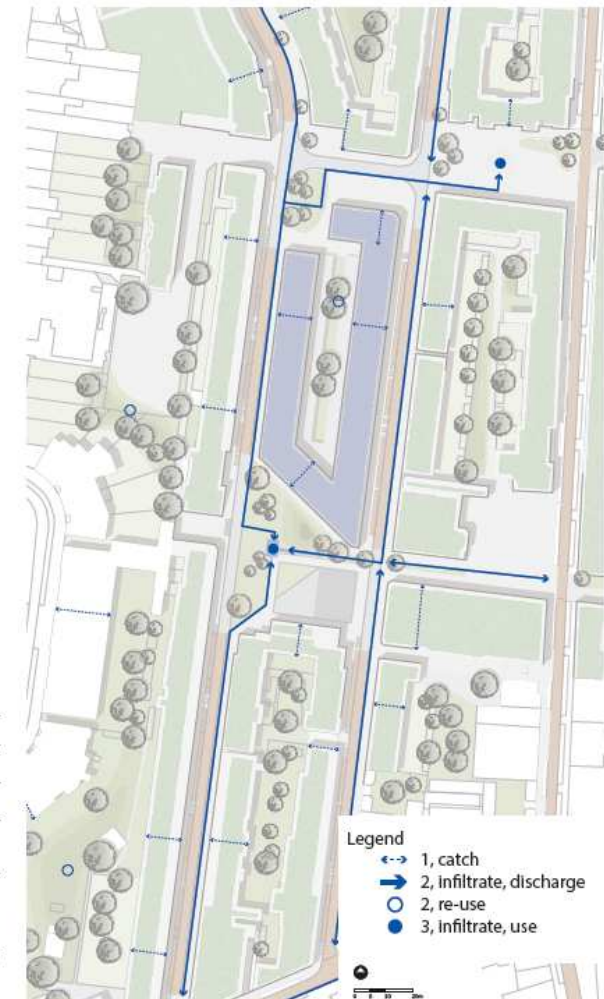


Figure 151: Water system building and public space related interventions.

> Figure 152: Water system building and public space related interventions shown on map.



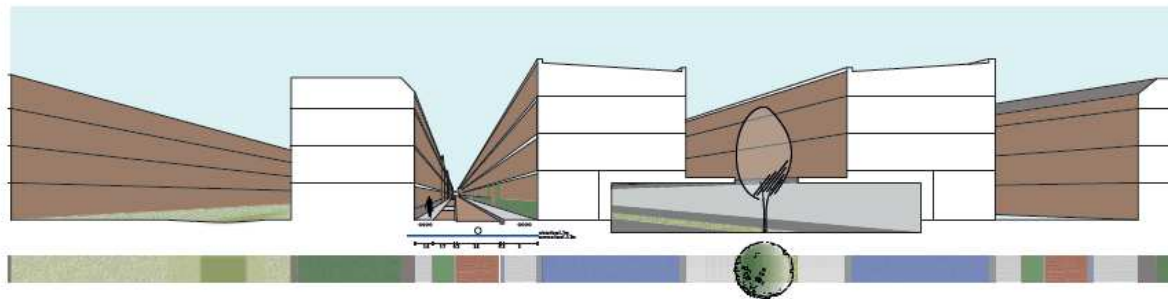
© Anne Witteveen 2014



- Legend
- car lane red brick
 - car lane grey
 - parking red brick
 - pavement
 - grass
 - infiltration field
 - private garden
 - collective garden
 - existing building
 - new building
 - green roof
 - blue roof
 - playground
 - water gutter
 - water element
 - tree
 - flower pot



Building and public space related interventions.
 All surfaces are softer, greener and more permeable.



< Figure 149: Possible outcome of maximum collaboration between all stakeholders on all surfaces.

Figure 150: Section building and public space related interventions.

© Anne Witteveen 2014

Conclusies

Samenwerking publiek en privaat in het oplossen van de wateropgave is noodzakelijk

Dat betekent dat er nieuwe rollen en nieuwe spelregels nodig zijn

Het ook een kans is voor de verbetering van de stedelijke kwaliteit, ruimtelijk maar ook sociaal