

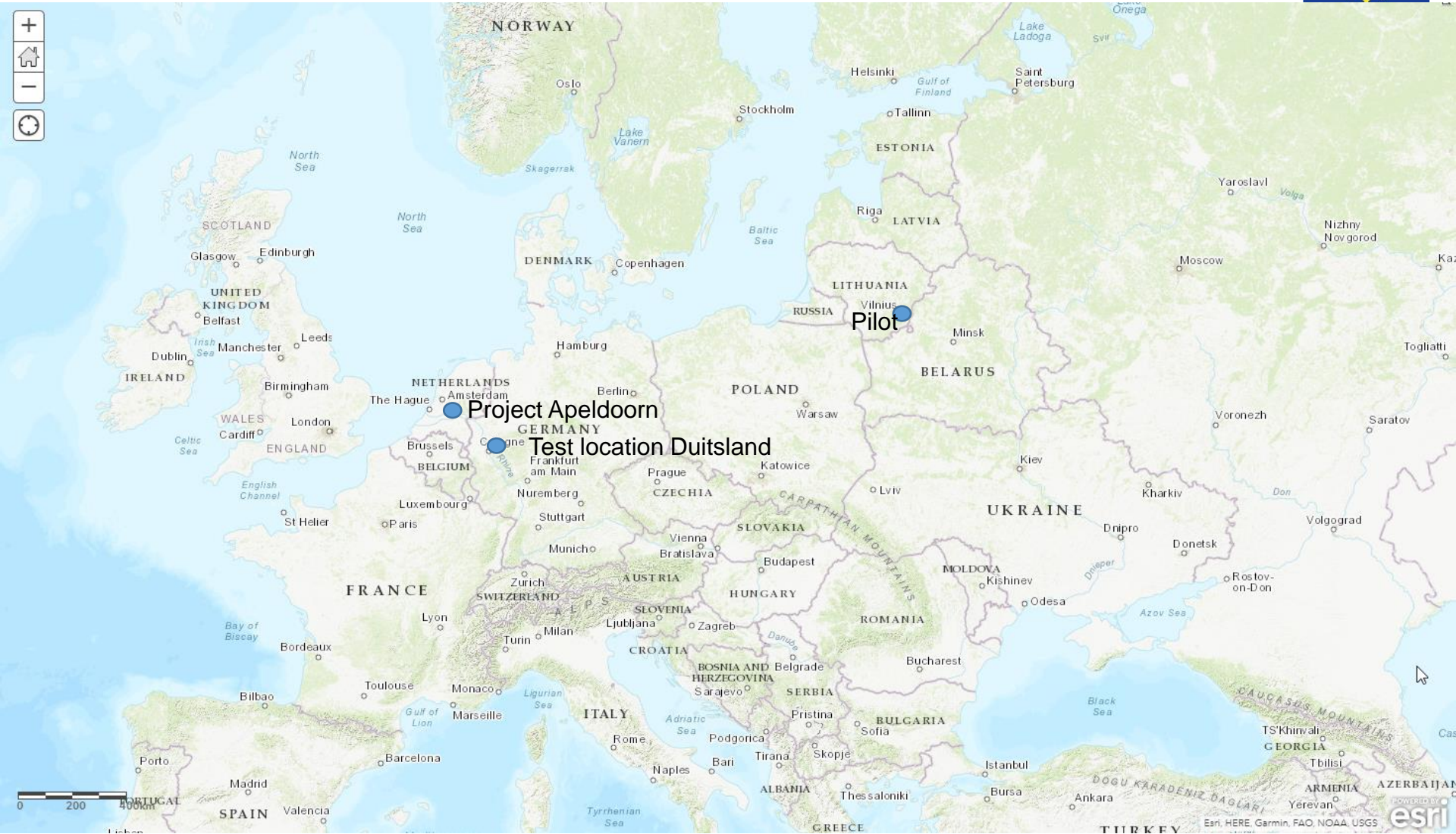
Geen druppel de straat uit

Team AERFIT



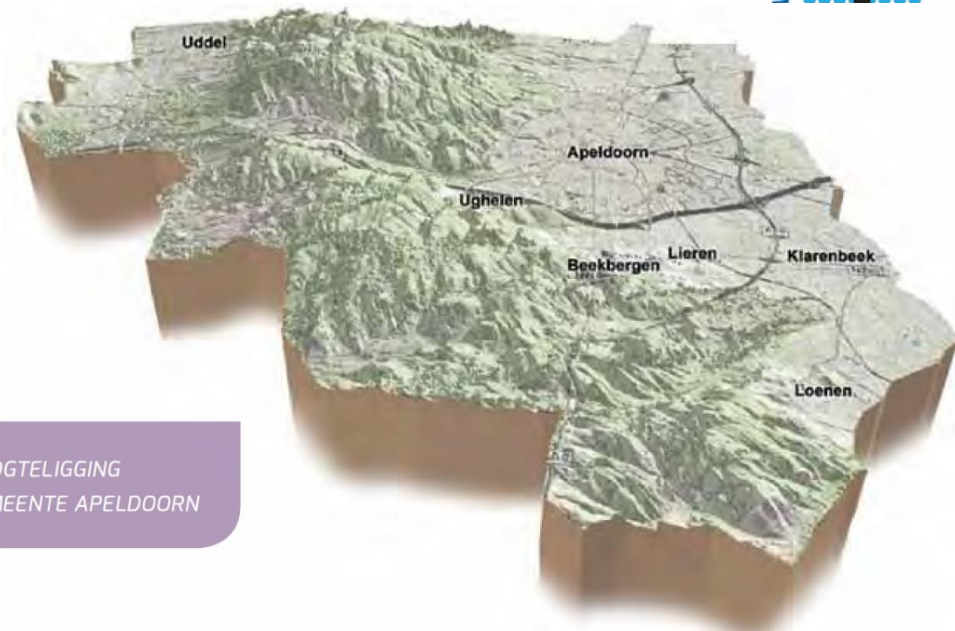
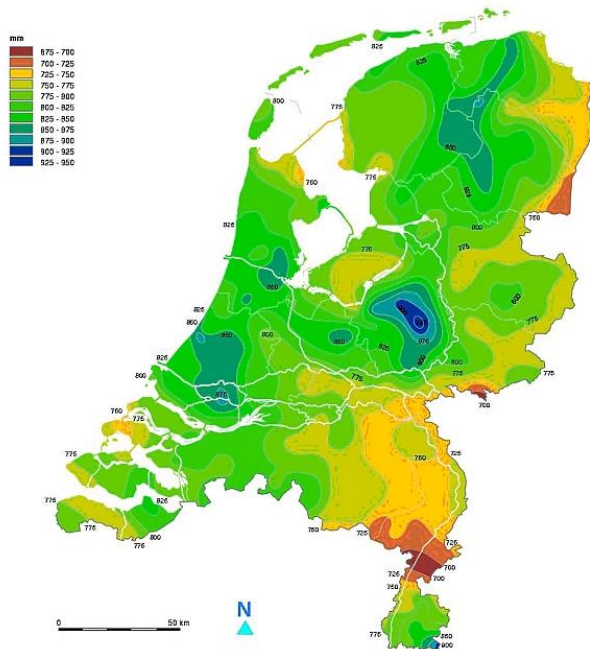
Expert committee





Apeldoorn vulnerable for flooding

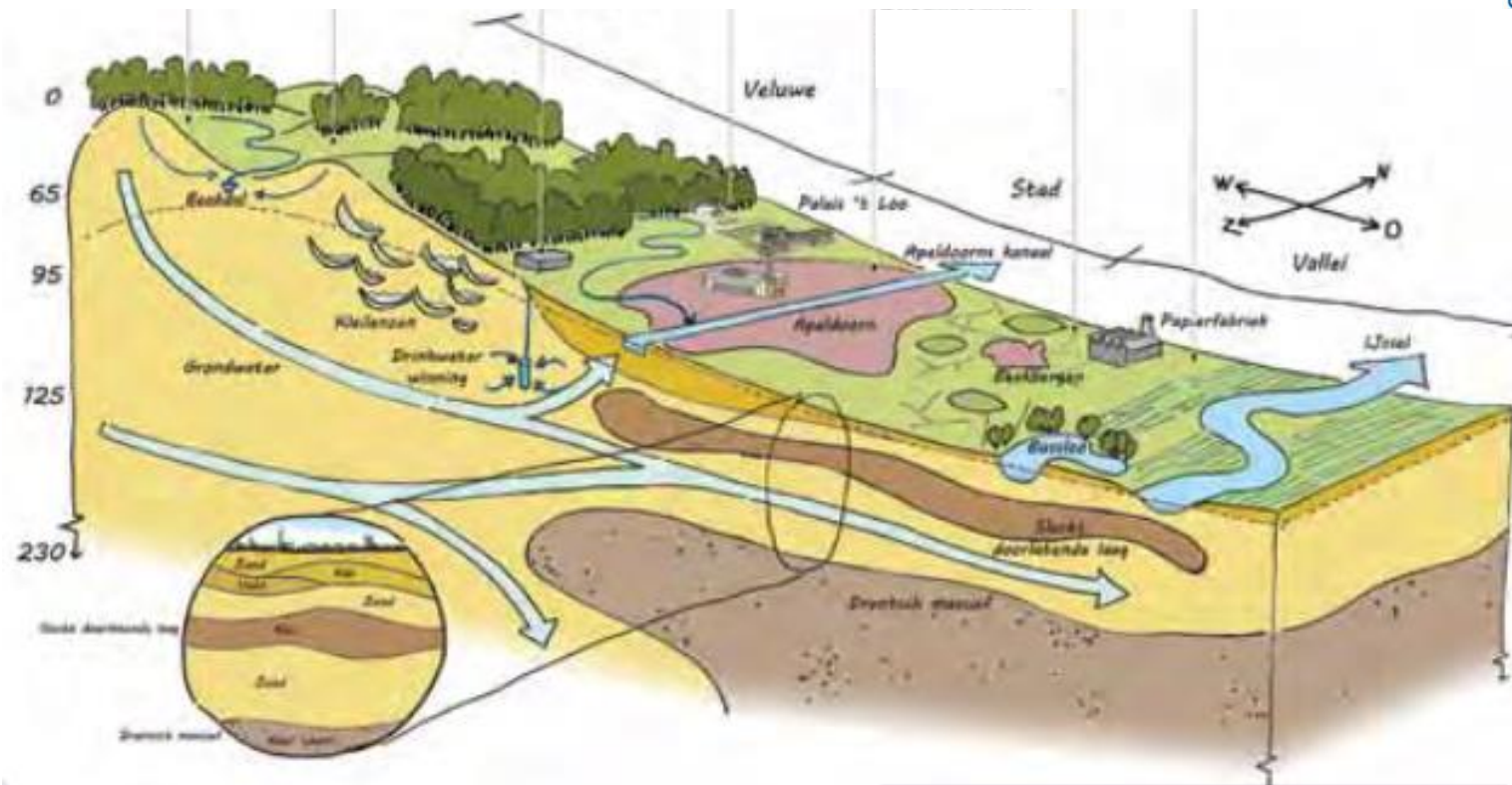
wateroverlast \neq overstrooming

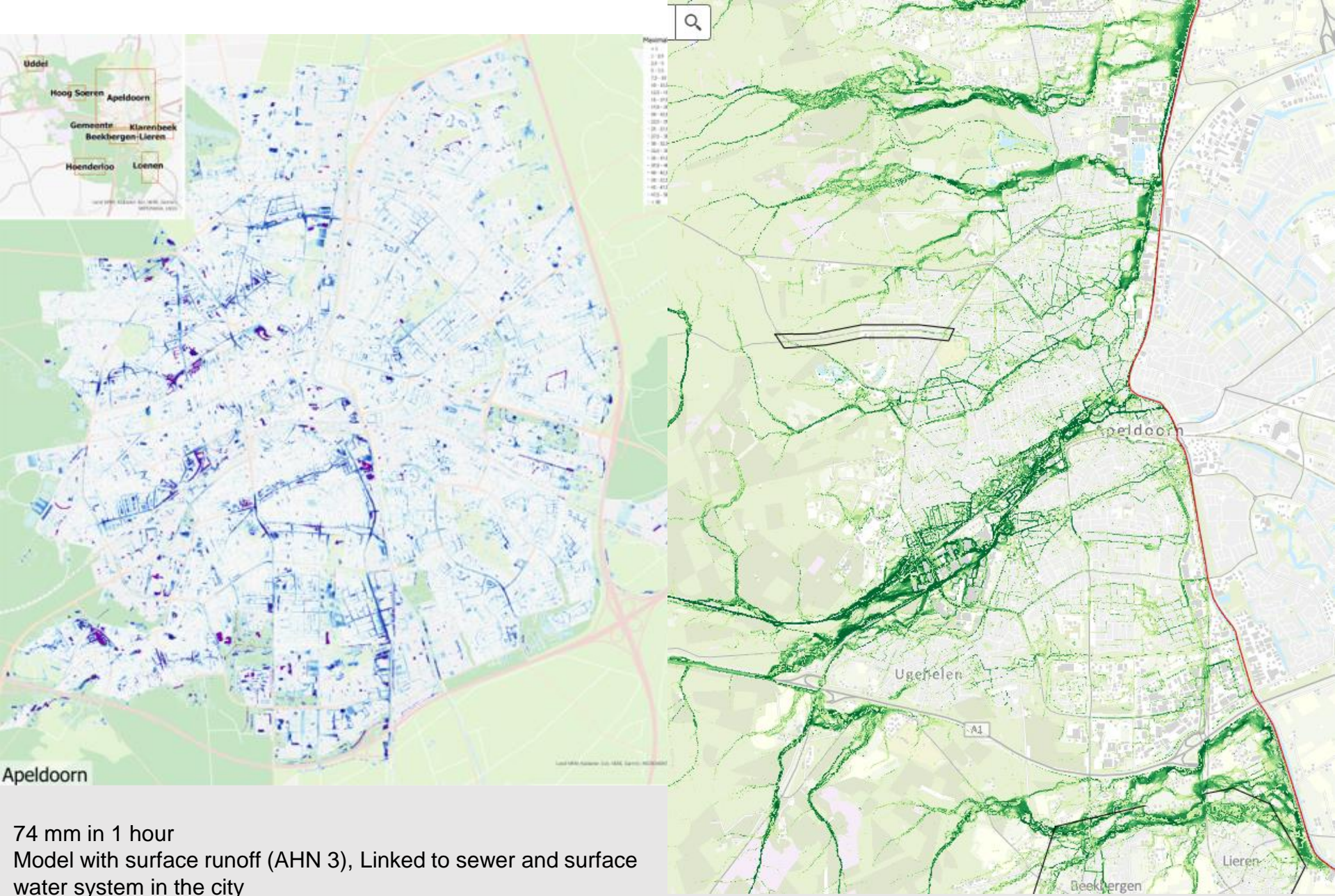


HOOGTELIJGING
GEMEENTE APELDOORN

Kennismaking water- en rioolbeheer Apeldoorn Apeldoorn

water en bodem (wordt) sturend



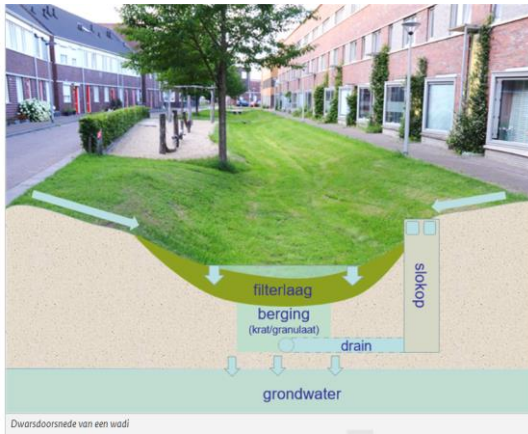


Apeldoorn

74 mm in 1 hour
 Model with surface runoff (AHN 3), Linked to sewer and surface water system in the city

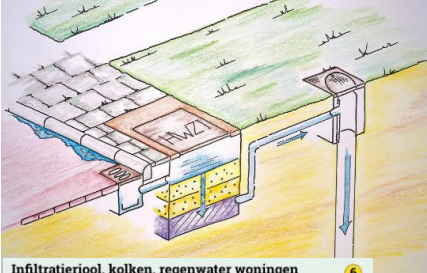
Waterbom 140 mm in 2 hours
 Model with surface runoff (AHN 3)
 Dark green is >50cm water

Decoupling in varying forms

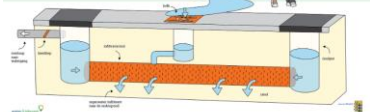


Dwarsdoorsnede van een wof

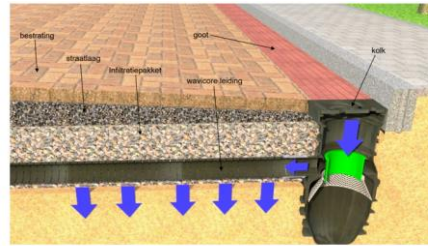
<https://klimaatadaptatienederland.nl/actueel/actueel/interviews/wa>



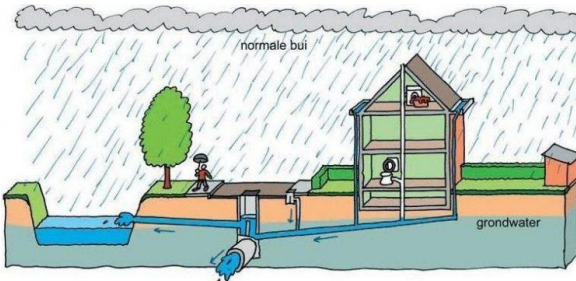
Infiltratieriool, kolken, regenwater woningen



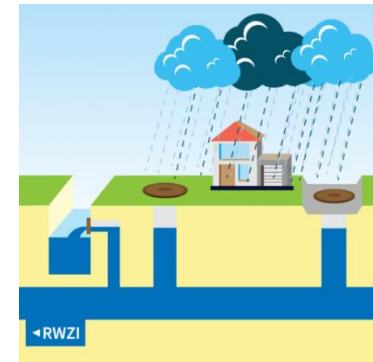
<https://mosgroen-infographics.nl/klimaatproeftuin>



<https://duurzaam.heemskerk.nl/water-en-groen/water-opvangen-onder-de-weg>



<https://www.holtensnieuws.nl/subsidie-voor-eigen-opvang-regenwater/>



<https://www.aquafin.be/nl-be/gemeenten-en-steden/projecten-met-egenwater/wateroverlast-voorkomen/soorten-wateroverlast>

Run off dirt e.o. particles

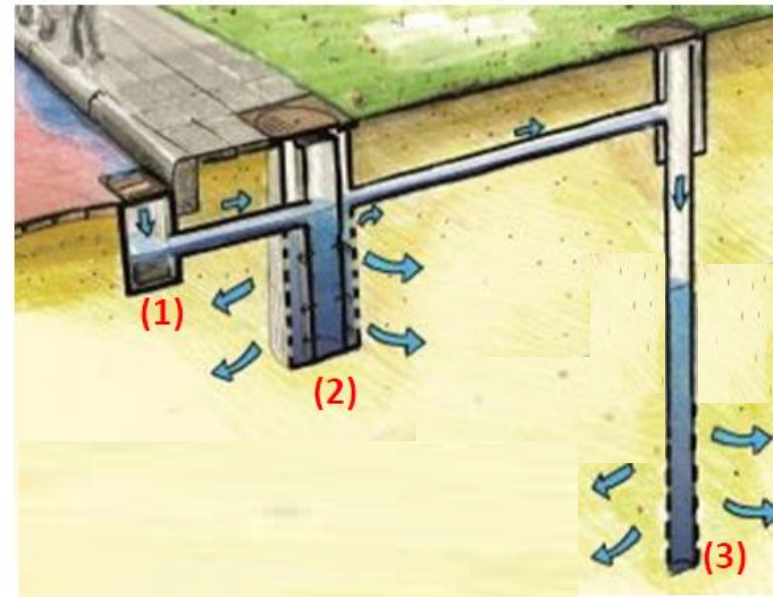


Goals of the project

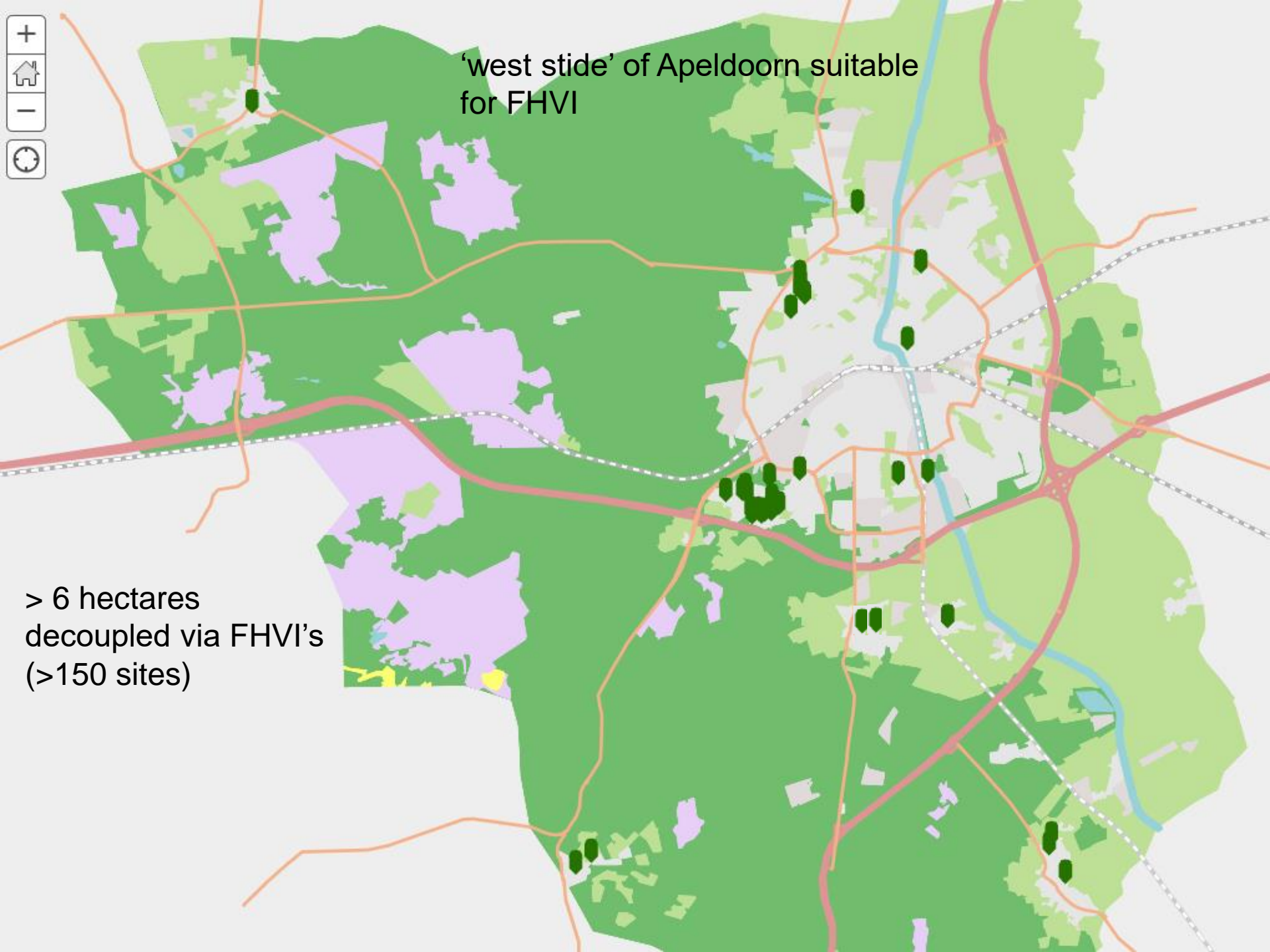


- Successful demonstration of the FHVI technique for prevention from pluvial flooding
- Target to effectively deal with a T10/bui10/36mm event with a peak intensity of 210 l/sec*ha.
- Resilience to spills (demonstration of ecological benefits)
- Provide a blue print facilitating rapid replication and transferability

End of project: Q1 2024



Figuur 2: Bergend vermogen binnen een FHVI-systeem



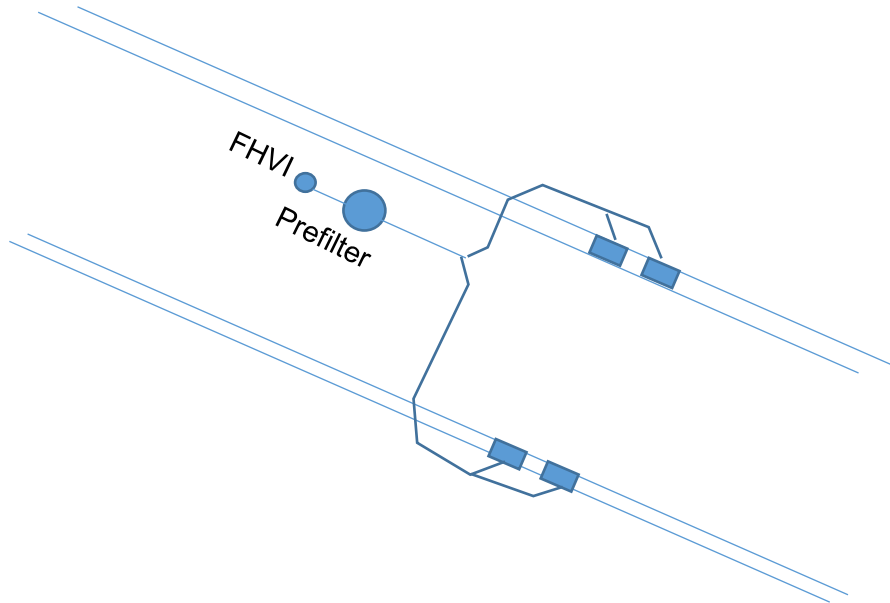
'west stide' of Apeldoorn suitable for FHVI

> 6 hectares decoupled via FHVI's (>150 sites)

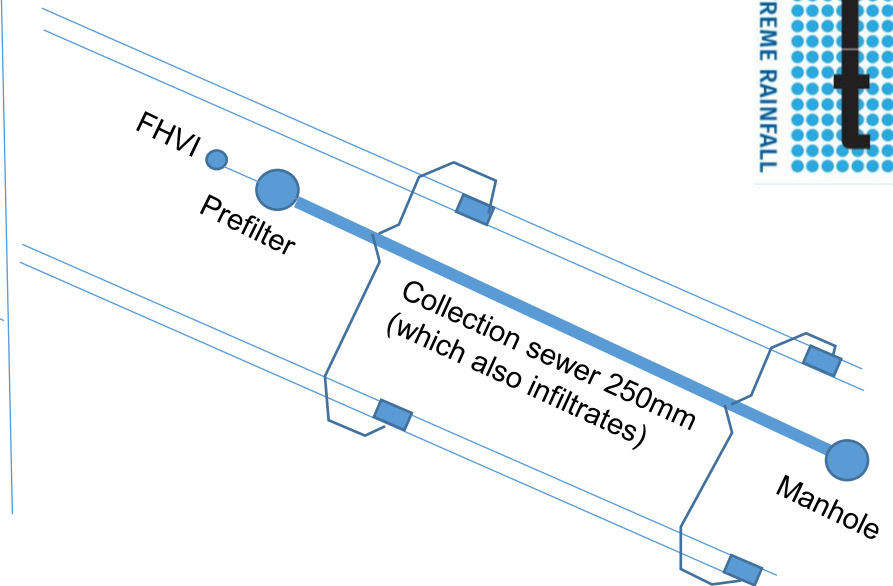
Design at streetlevel



Slope road >5 promille
Flow via gutters



Slope road <5 promille
In combination with infiltration sewer



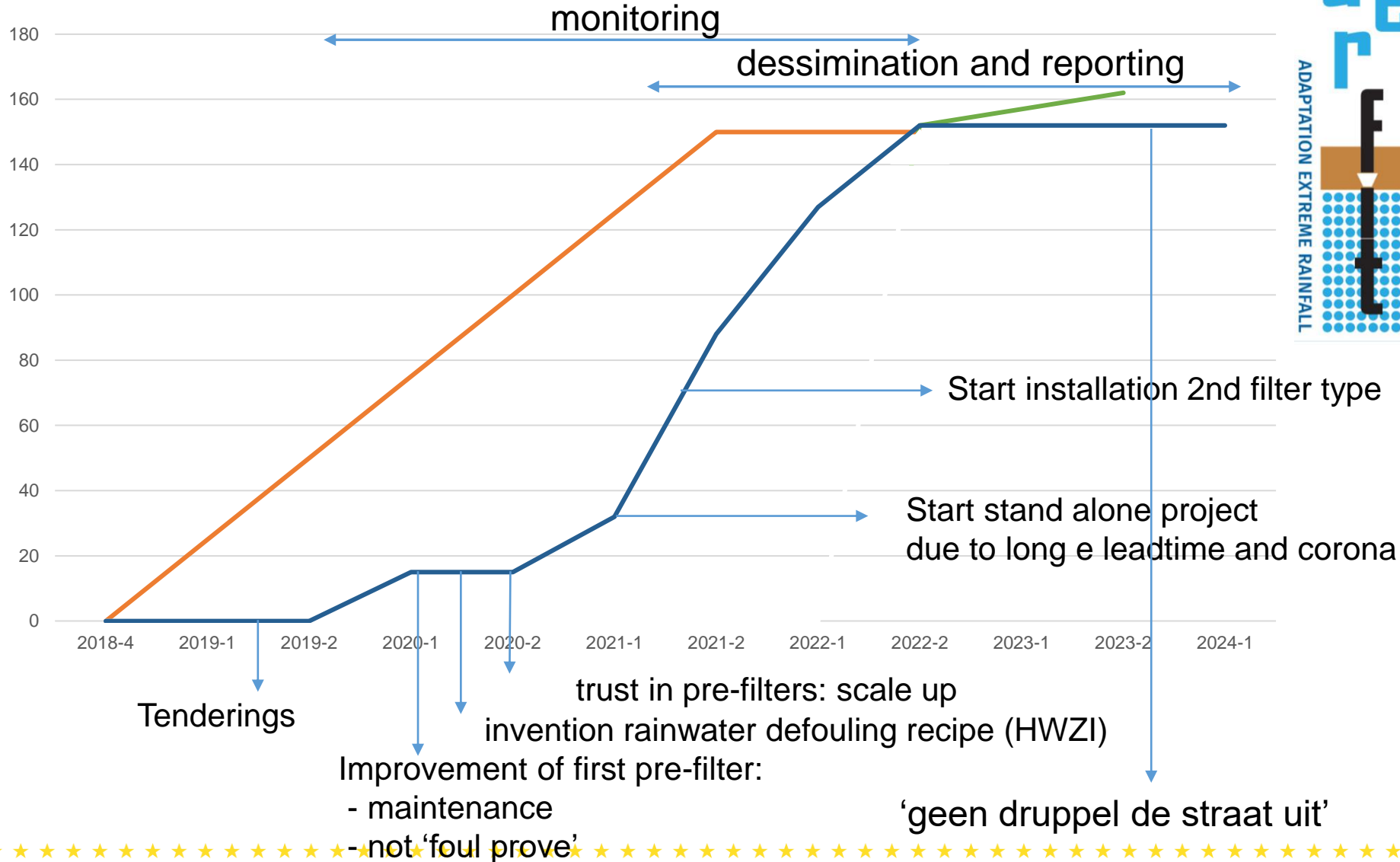
1 system = 400m² / FHVI, if flow is 5-10m³/h or higher
Discharge 3,5-5m²/h: 2x FHVI per system

Flow <3,5 m³ = no go





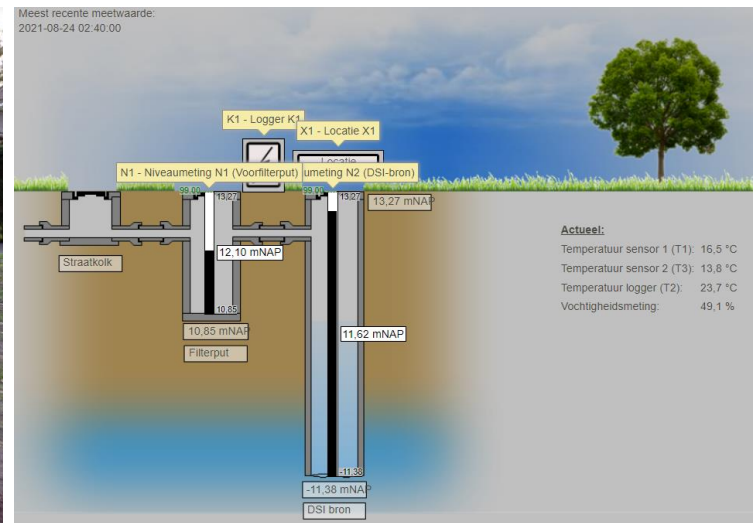
Planning



Monitoring

Parameters

1. Rainfall and events (radar and crosscheck two sites with pluviual sensor)
1. The level of water in the pre-filter:
 - Indication for water on streetlevel
2. The (ground-)water level in the FHVI
3. Water quality in the FHVI
4. Maintenance sequence of pre-filters



Water quality

Two types of quality

1. Particles which can block the possibility of infiltration.
2. Substances which can pollute the groundwater.



WHY DOES A FHVI LOSE INFILTRATION CAPACITY?

Clogging of FHVI due to particles

Size of particles

Amount of particles

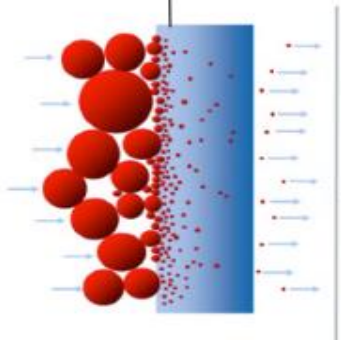
Particles that can enter the filter medium

Static storage

Connected hard surface

unpaved roadside

Amount of trees





The number of particles in the system is related to the unpaved roadside's

Voshuizen te Lieren

- Sand flows directly into street gully
- Maintenance conducted once a year



The number of particles in the system is influenced by the quantity of trees

Hoenderloseweg te Ugchelen

- Leaves from trees
- Tree algae and other microorganism



Boomalg



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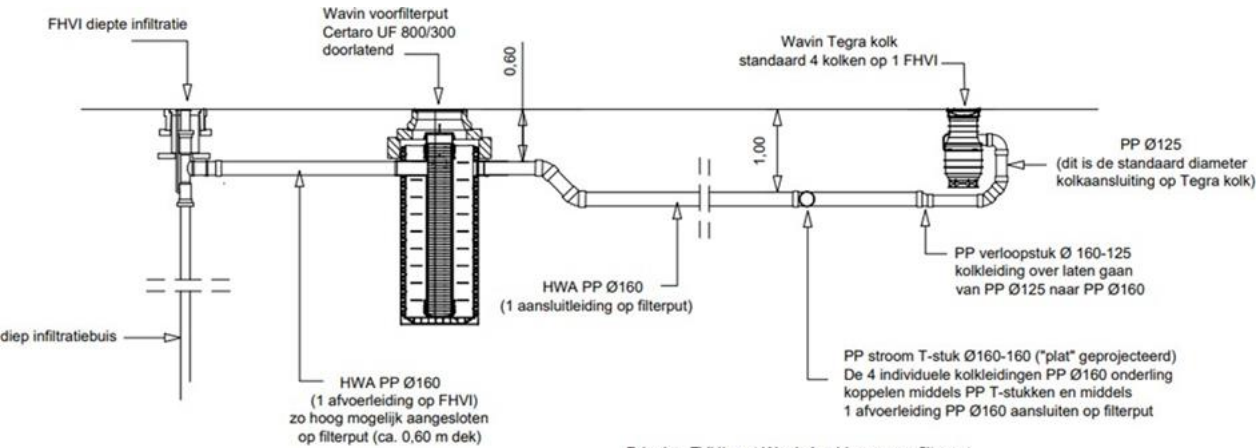
The number of particles in the system is influenced by the paved surface

Hoenderloseweg in Ugchelen

- More paved surface equals more rainwater
- This also means more particles will reach the FHVI



Types of prefiltration



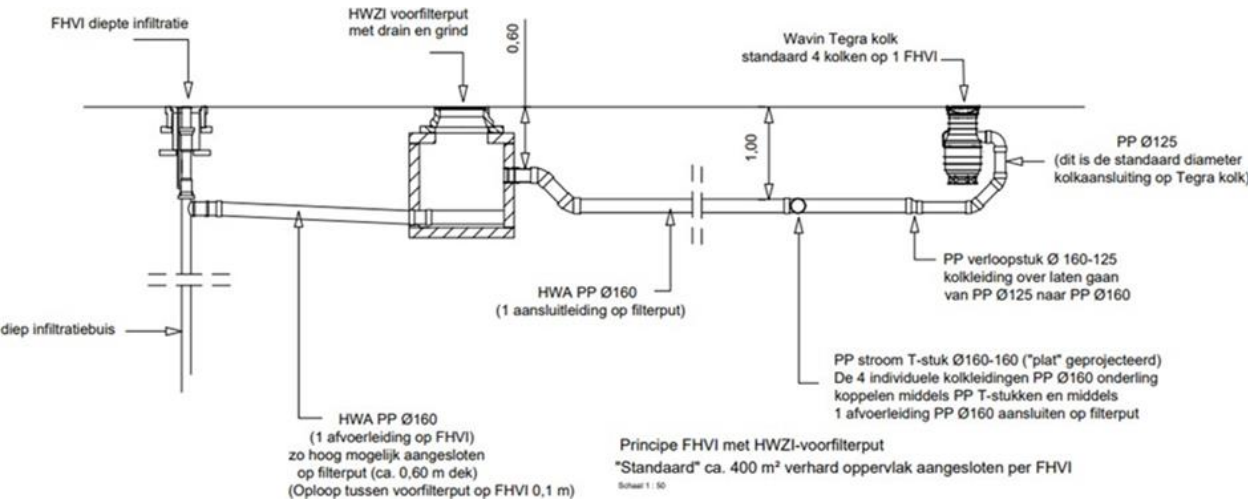
WavinApeldoorn

- Filter: 450 μm
- Discharge pipe at the top

Principe FVHI met WavinApeldoorn-voorfilterput
 "Standaard" ca. 400 m² verhard oppervlak aangesloten per FHVI
 Schaal 1 : 50



Types of prefiltration



HWZI

- Gravel = filter
- Drain with cloth: 450 μm 'safety slot'.
- Discharge pipe at the bottom



Water quality (results)

Two types of quality

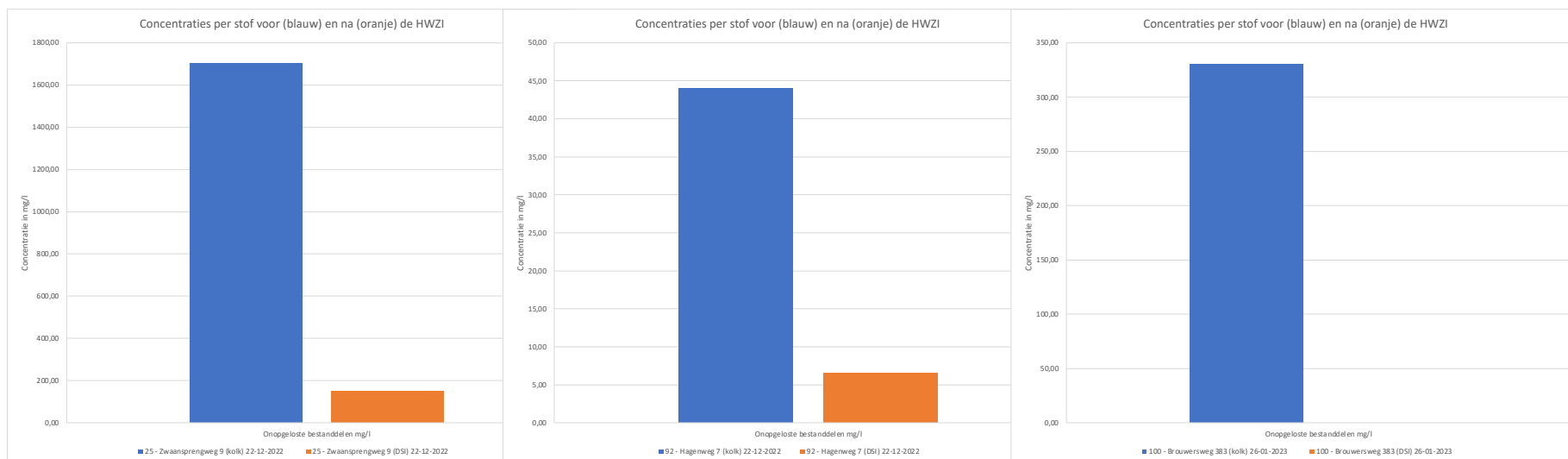
1. Particles which block the possibility of infiltration.
2. Substances which can pollute the groundwater.

1. Preventing blockage

Using pre-filtration necessary to guaranty infiltration capacity of FHVI



Undissolved components



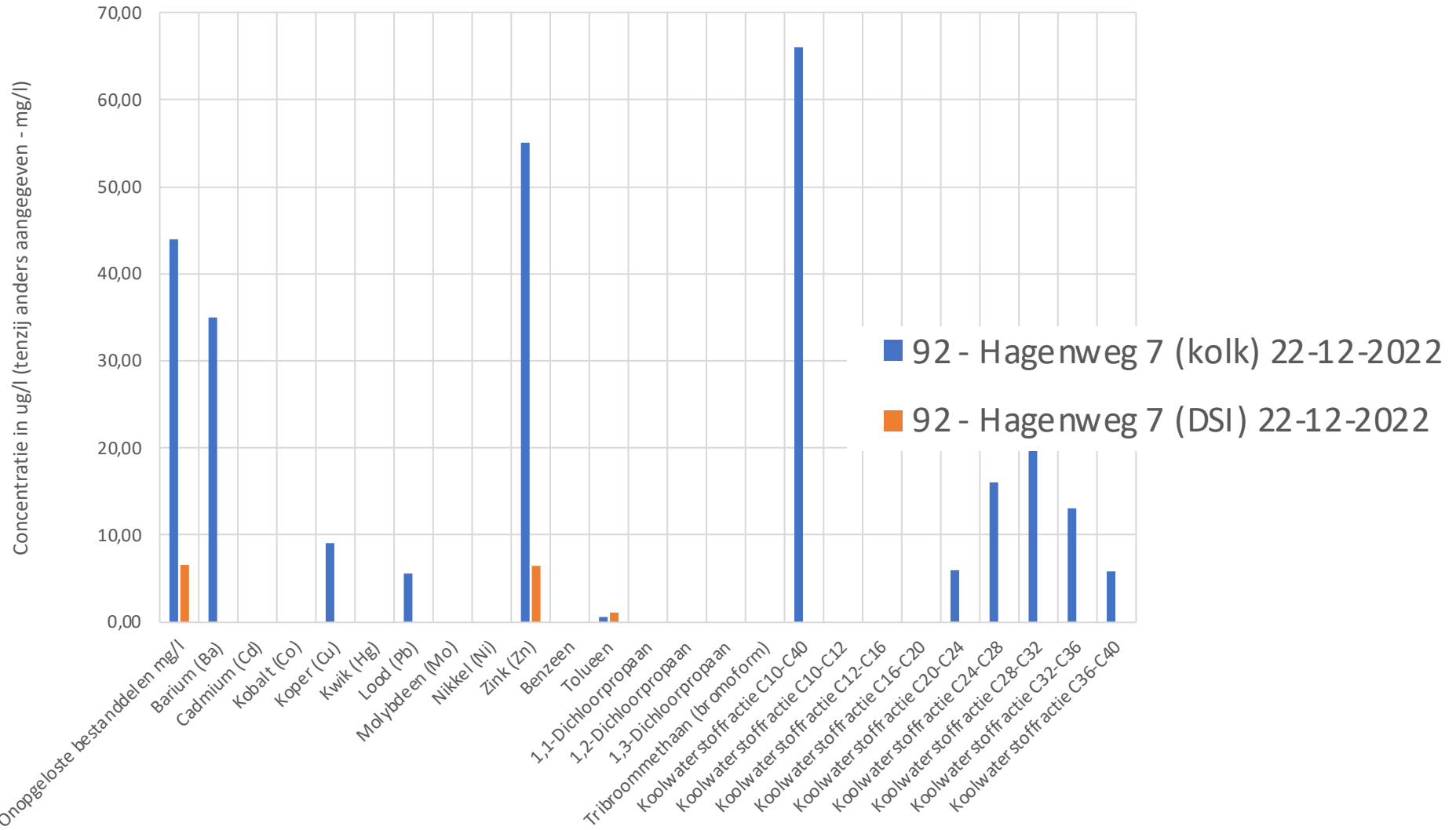
Zwaansprengweg

Hagenweg

Brouwersweg



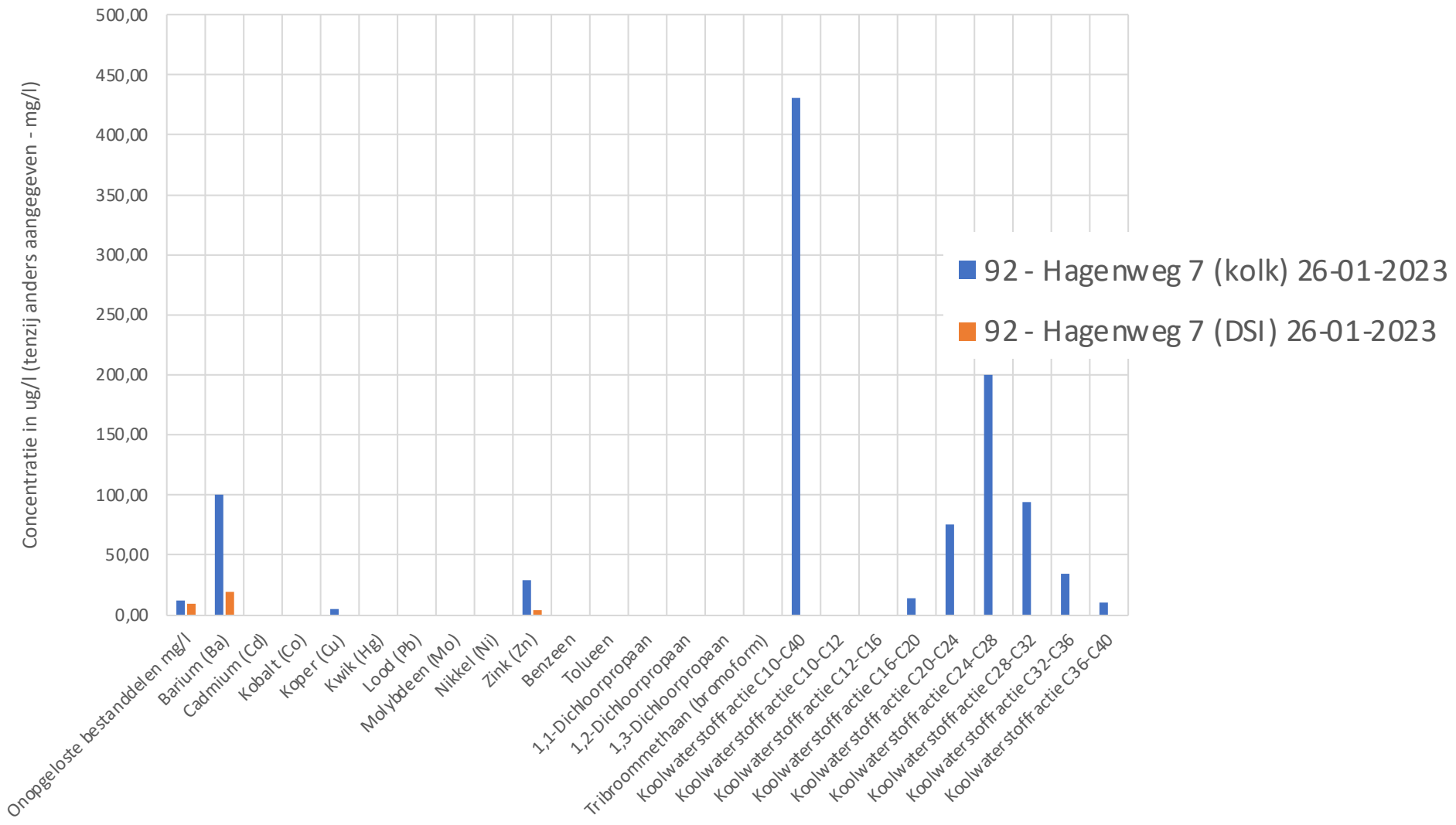
Concentraties per stof voor (blauw) en na (oranje) de HWZI



Double check!

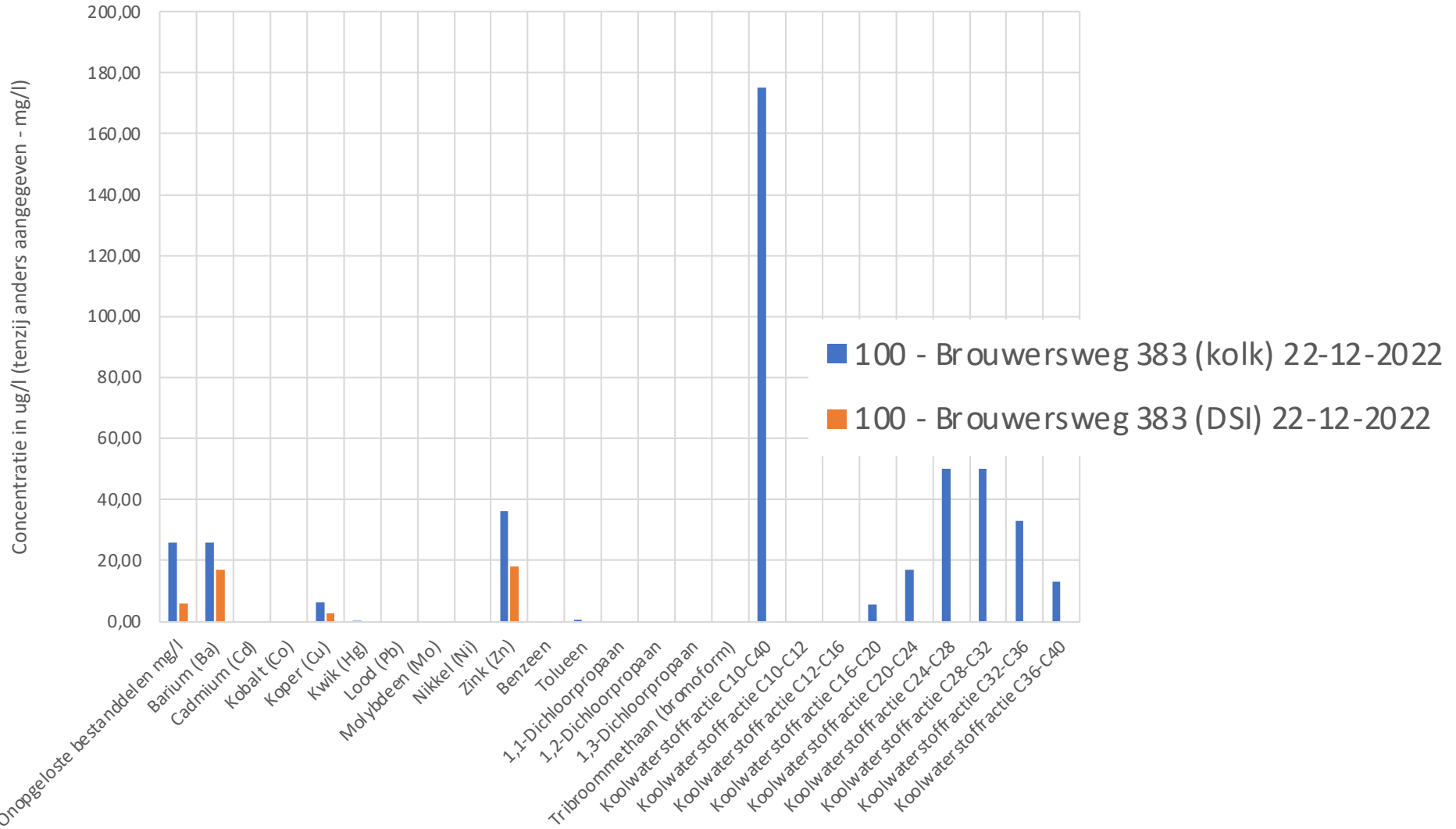


Concentraties per stof voor (blauw) en na (oranje) de HWZI





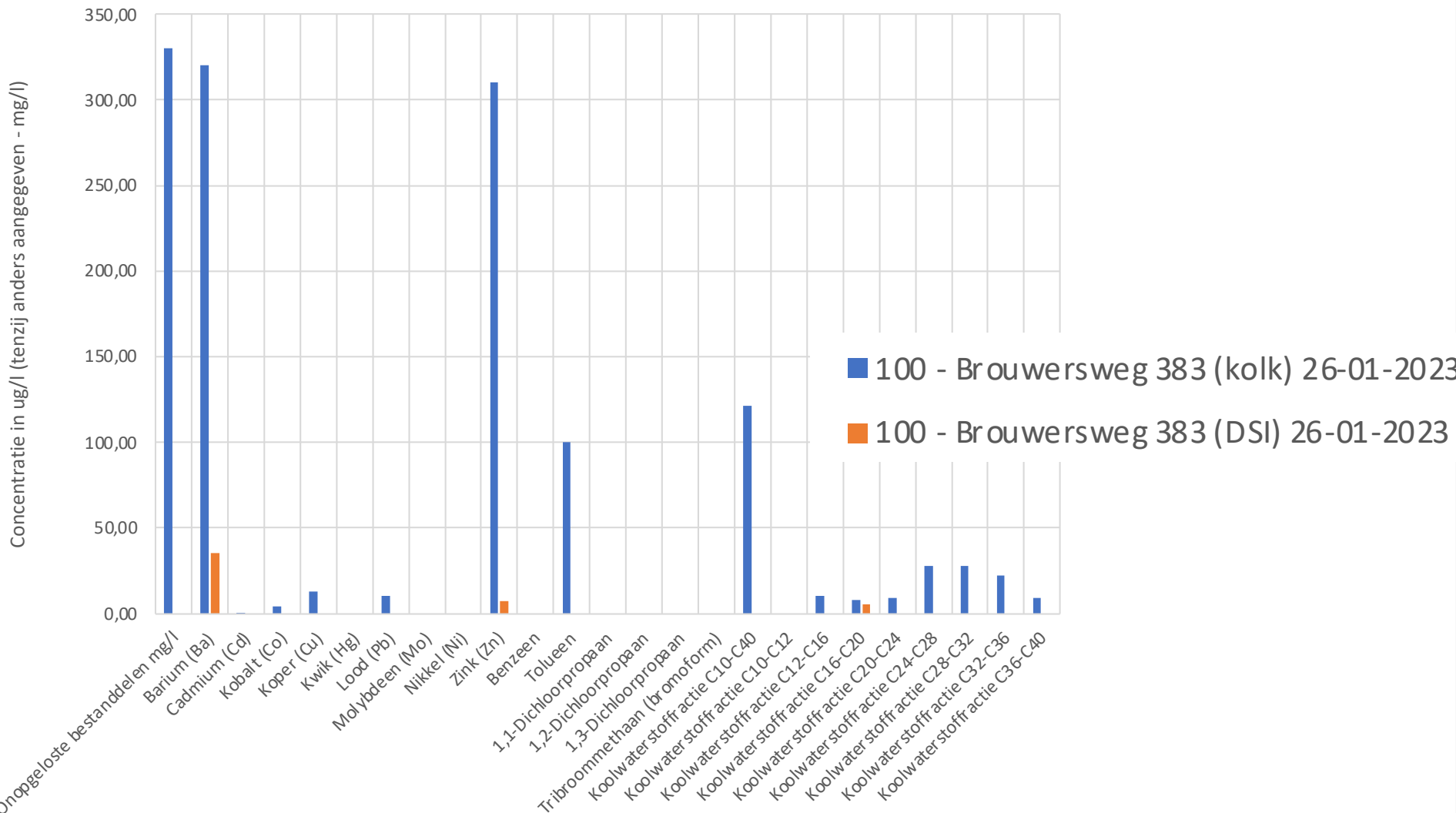
Concentraties per stof voor (blauw) en na (oranje) de HWZI



Double check!



Concentraties per stof voor (blauw) en na (oranje) de HWZI



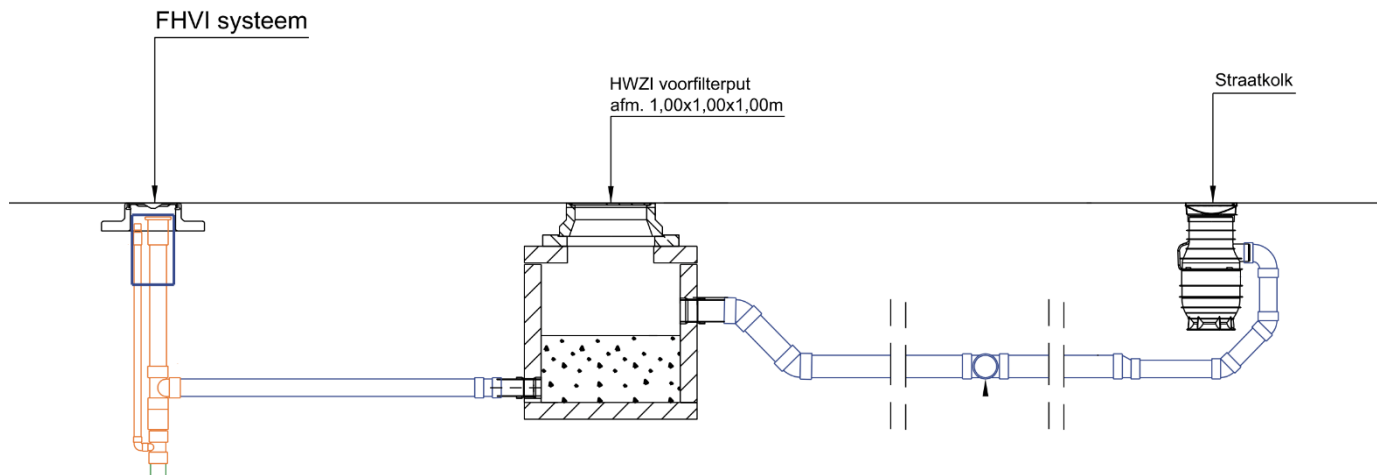
Conclusions

Two types of quality

1. Particles which block the possibility of infiltration.
2. Substances which can pollute the groundwater.

1. Preventing blockage ✓

- When installing the HWZI as a prefiltration, FHVI will keep its infiltration capacity.
- The HWZI protects the infiltration-system and moves the risks of blockage to a location which is easier to access. Footnote: the HWZI seems (relatively) not vulnerable for blockage.



Conclusions

Two types of quality

1. Particles which block the possibility of infiltration.
2. Substances which can pollute the groundwater.

2. Preventing pollution ✓

- The quality of the water after the HWZI never exceeds the intervention values, which are used for remediation of groundwater or to determine if remediation is necessary.
- More research is needed and maybe additional monitoring methods.
- It seems that HWZI acts as a soil passage. But easy to access and to clean. Without causing soil pollution.
- Additional purification methods will be tested. Like adding biochar to the sand and gravel mix in the HWZI.
- Footnote: almost every infiltration method has currently the potential to pollute.

“HWZI is more a recipe than a product”



After LIFE



Extra testing and monitoring water quality

- Type of filtermedium of influence on lifespan of the FHVI?
- Effectiveness other filtermedia of influence on water quality?

Hybrid solutions for FHVI and/or HWZI

- FHVI as emergency overflow with traditional solutions
- HWZI in combination with horizontal infiltration
- HWZI to defoul water from rainwater sewage system with runoff to surface water

