“Bio-washing machine and Bio-process monitoring”

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Company	Bioclear
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This project has received European Regional Development Funding through INTERREG IV B.

INTERREG IVB

Presentation

1. Urban area of Utrecht
2. CSM – Bio-washing machine
3. Results of the different lines of research
4. Integrated results
5. Conclusions
6. Questions?

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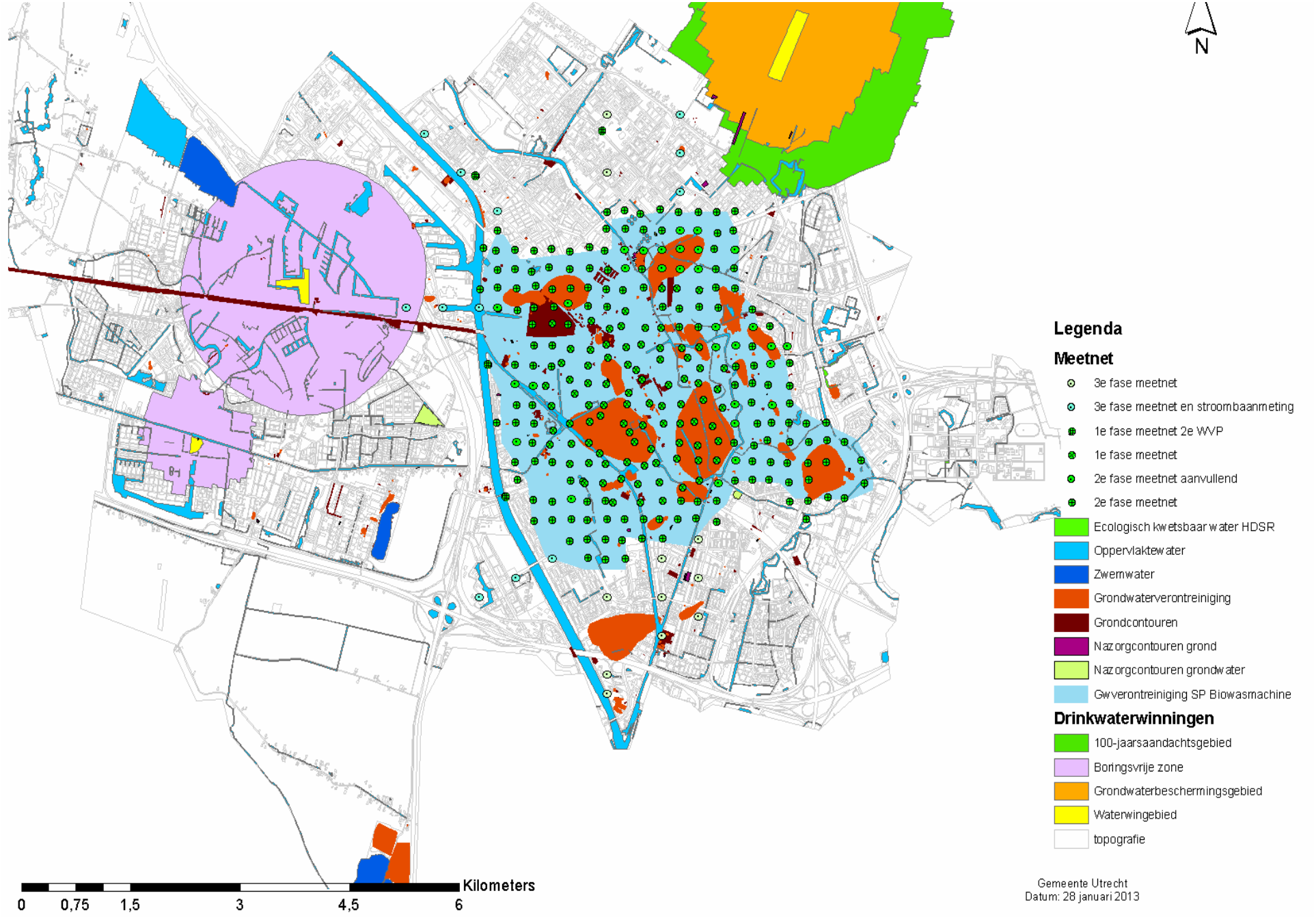
INTERREG IVB

Utrecht, overview contamination and monitoring network Bio-washing machine

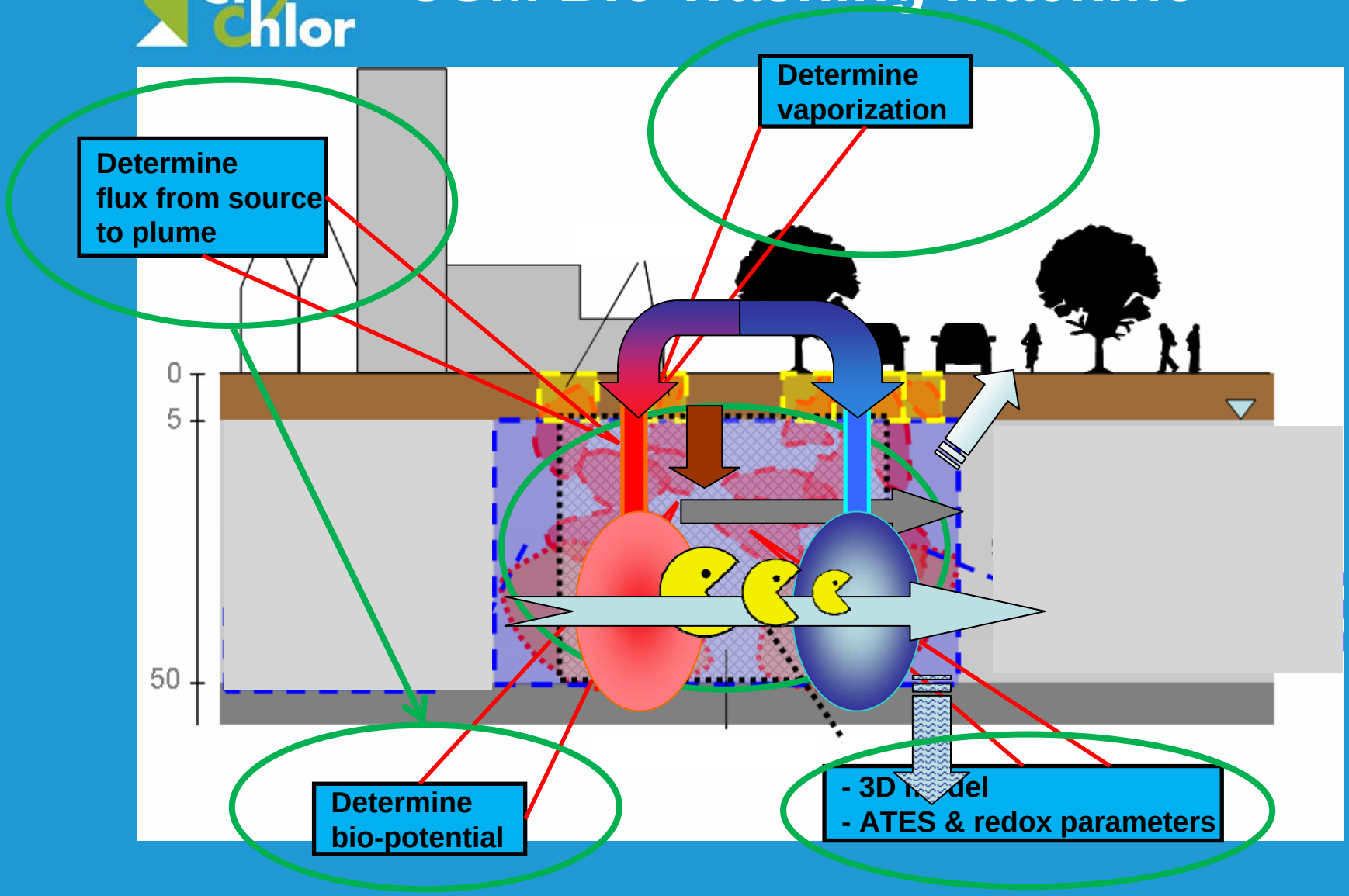


Think tank

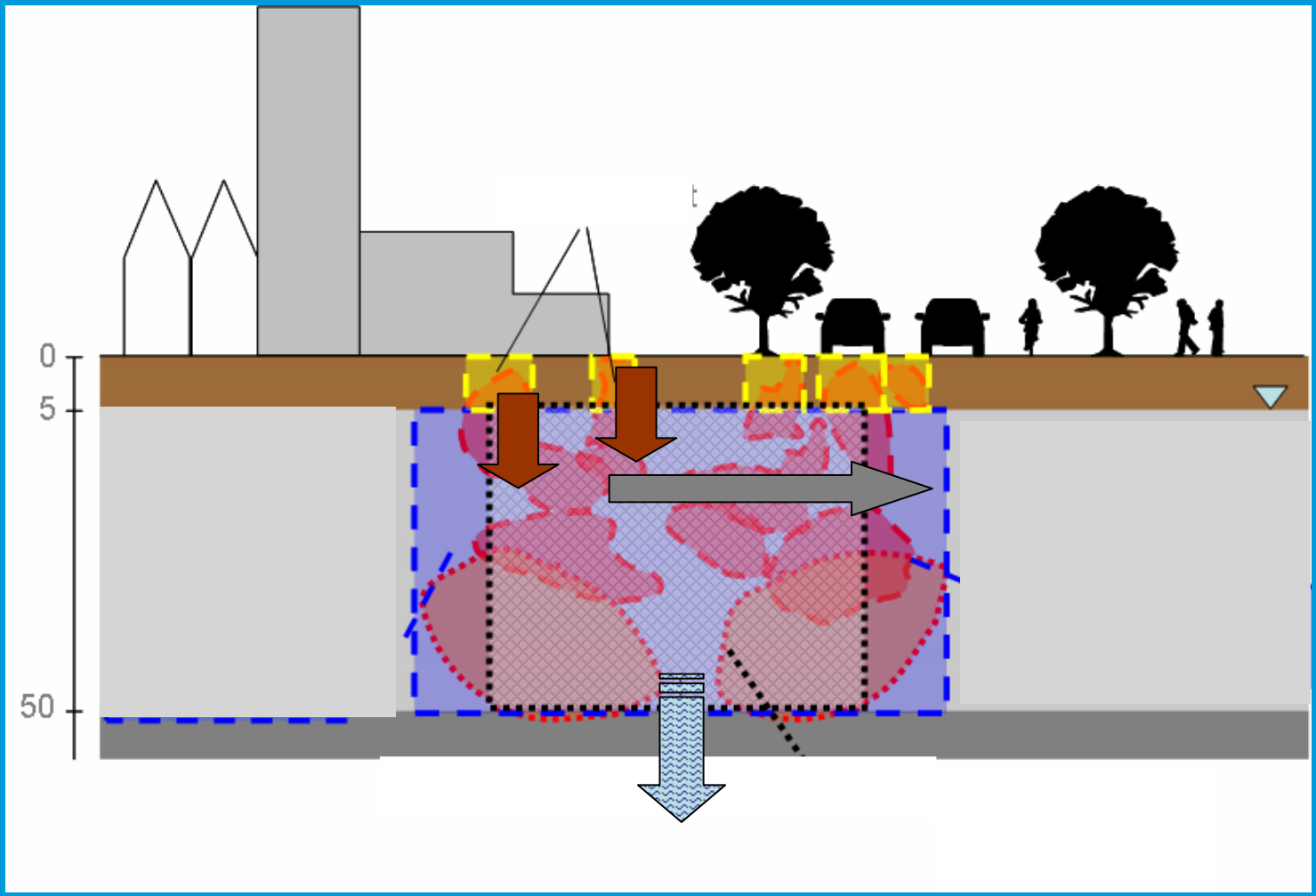
- Expert panel: steer on content and interpretation of the different lines of research
- Coordinate and participate on integration of the lines of research

➔ INTEGRATED REPORT of the CSM Bio-washing machine

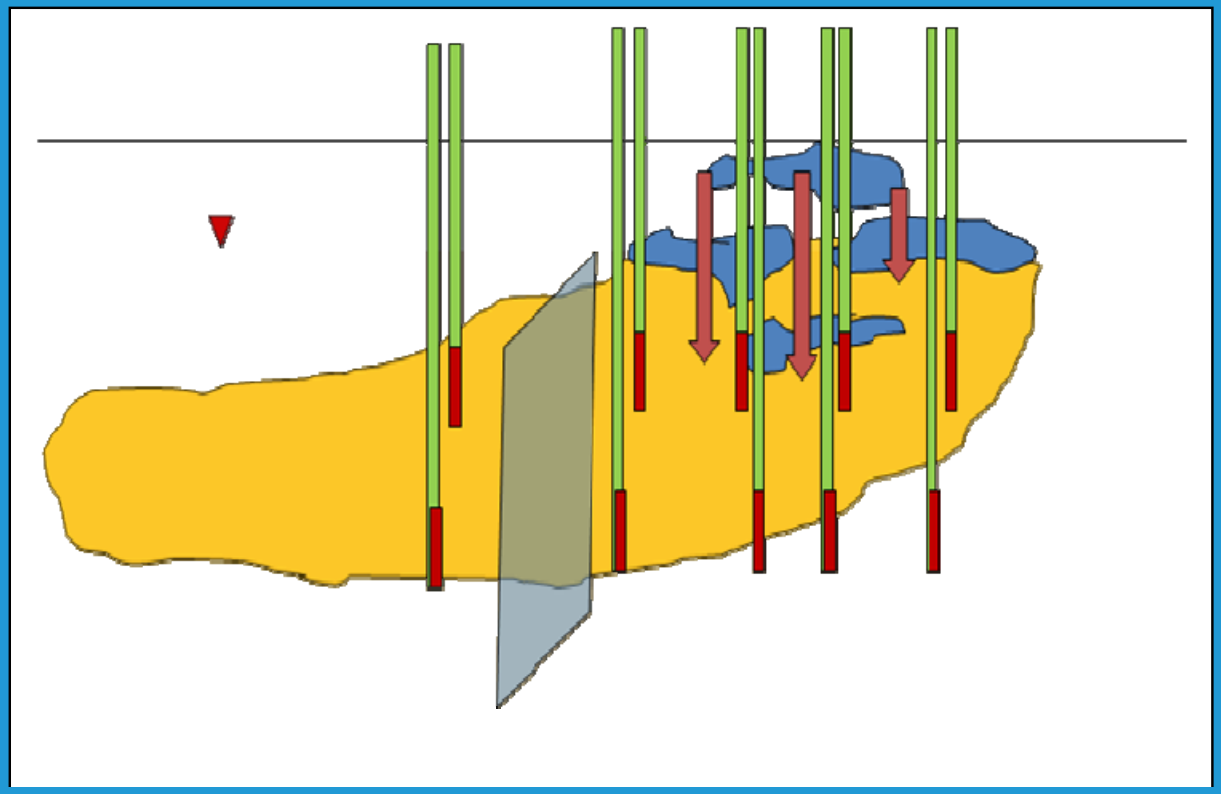
CSM Bio-washing machine



Research aspect : Flux



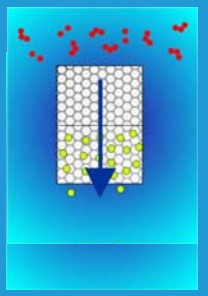
Research set up : Flux measurements

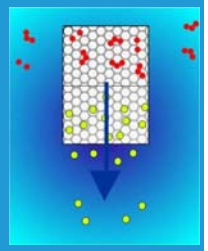


Flux measurements

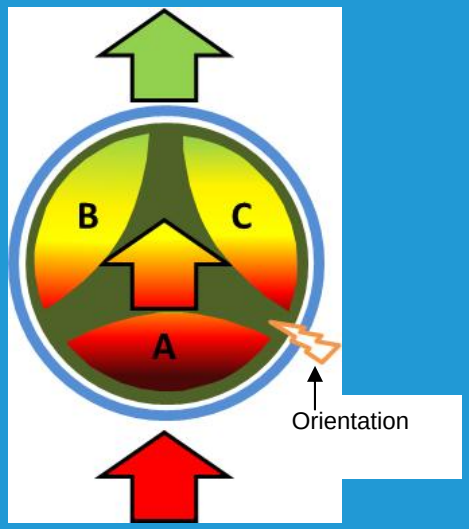
Geoflo: direction and flowrate

Sorbicell: time-average conc





Sorbiflux: direct flux measurement

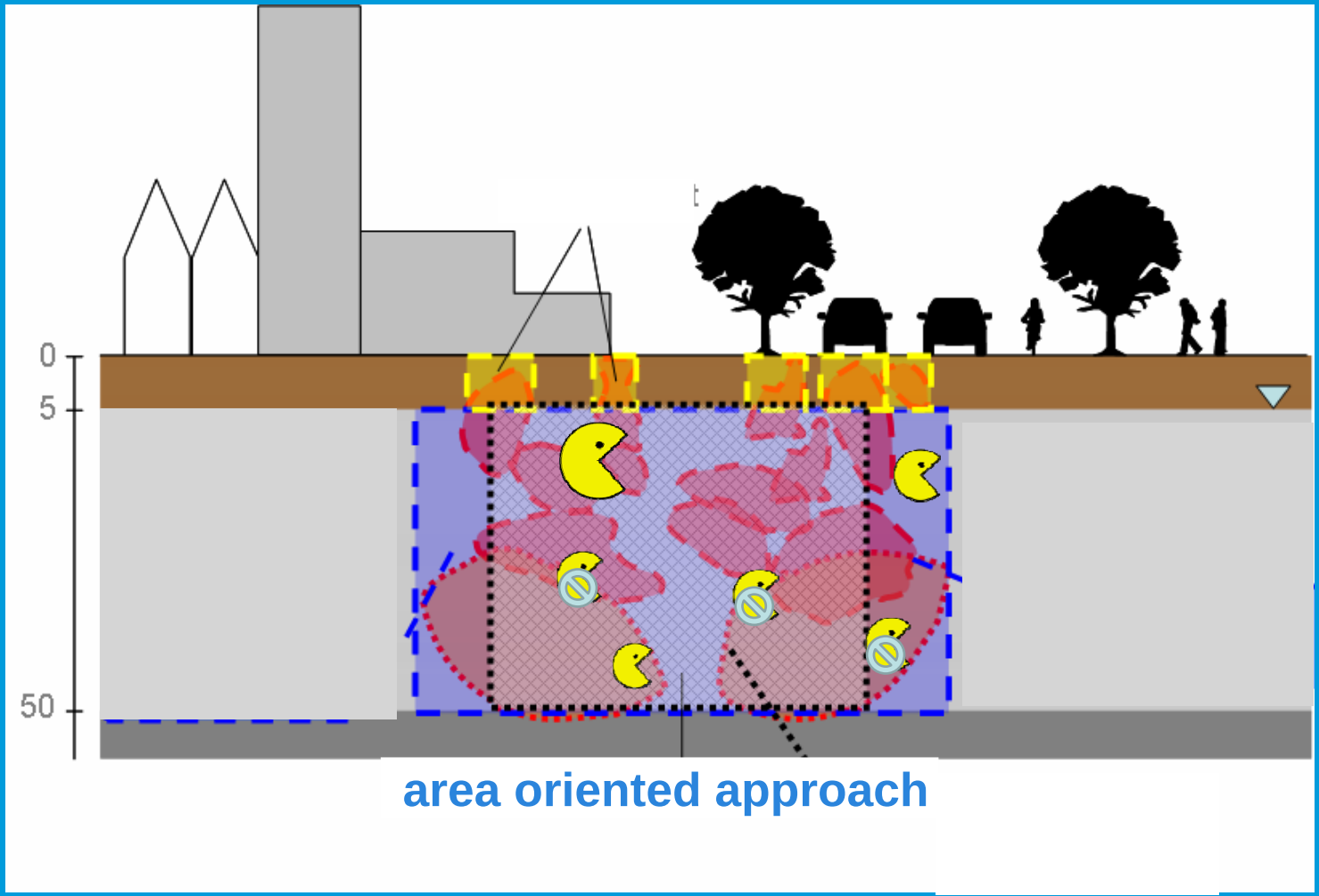


PFM: direct flux measurement

Results : Mass flux (J in mg/m²/day) and M_d (in mg/day)

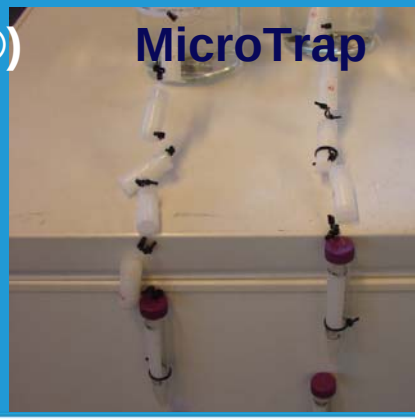
Depth (m-gl)	Plane (m^2)	J_{PCE}	M_{PCE}	J_{TCE}	M_{TCE}	J_{DCE}	M_{DCE}	J_{VC}	M_{VC}
Amsterdamsestraatweg									
6-12	150 (6 x 25)	472	70,800	116	17,400	496	74,400	5.5	825
12-20	200 (8 x 25)	0.3	60	0.15	30	4.1	820	1.8	360
Total plane (m^2)	350								
Total mass discharge (mg/day)			70,860		17,430		75,220		1,185
Nachtegaalstraat									
5-8	120 (3 x 40)	2.9	348	3.4	408	7.1	852	4.4	528
8-12	160 (4 X 40)	0.5	80	0.8	128	8.7	1,392	6.8	1,088
12-15	120 (3 X 40)	0	0	0		5.6	672	4.4	528
Total plane (m^2)	400								
Total mass discharge (mg/day)			428		536		2,916		2,144

Research aspect : Biodegradation capacity

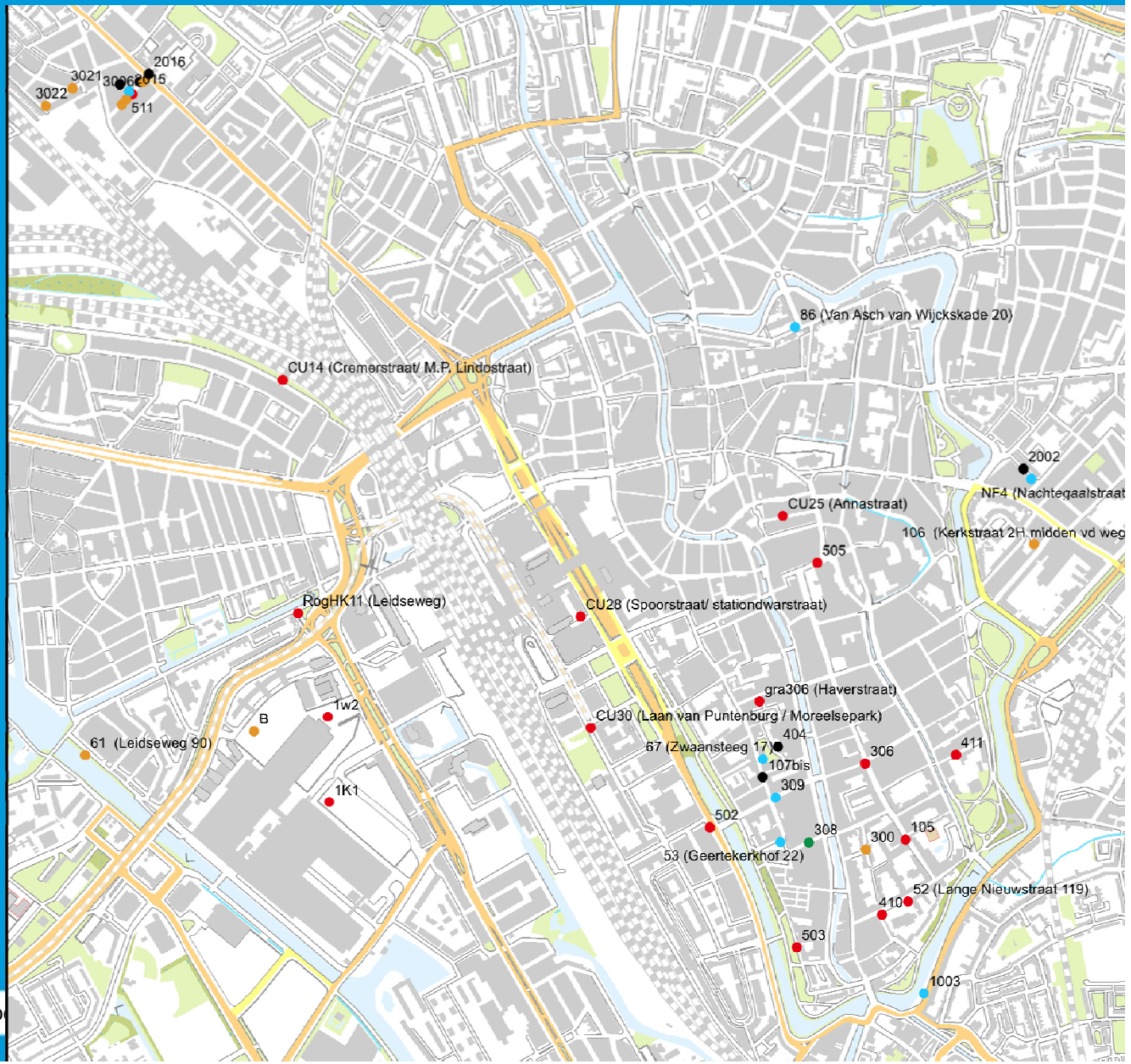


Research set up: biodegradation capacity

1. Lab degradation tests
2. Molecular analyses
3. In-situ measurements



Results Biodegradation capacit



Legenda

- micro aerofiel
- micro aerofiel / reductieve dechlorering
- reductieve dechlorering
- niet aangetroffen, wel geanalyseerd
- niet op geanalyseerd

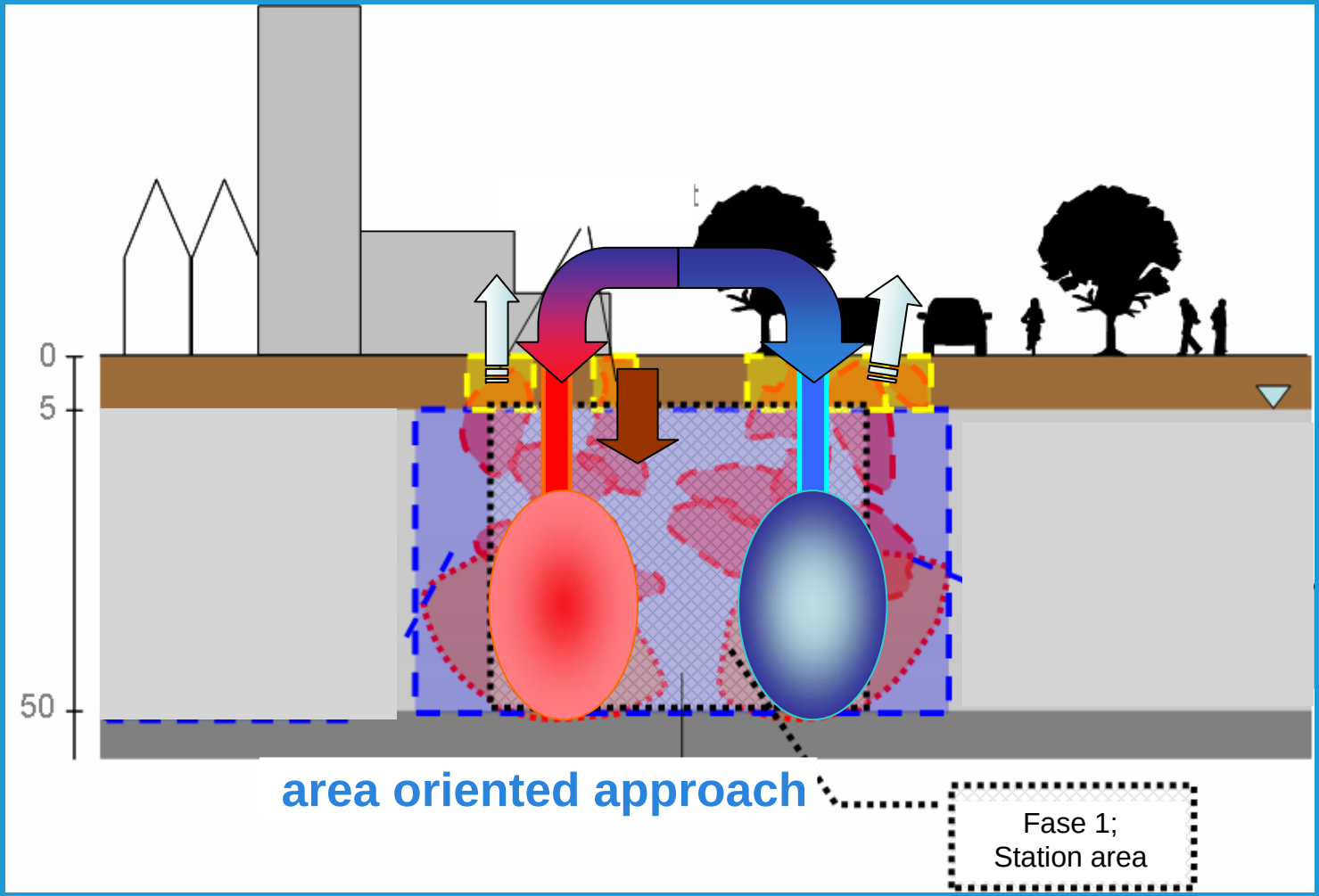
Project: CityChlor			
Opdrachtgever: Gemeente Utrecht			
Omschrijving: locaties peilbuizen en aangetroffen biocapaciteit			
bioclear	A3	Projectcode: 20103770	Datum: 4-4-2013
		Schaal: 1:10.000	

Conclusions – Flux & degradation

- Estimated mass flux Utrecht sites varies between
  - Total M_d= 165 g/day (Amsterdamsestraatweg) over 350 m^2 surface
  - Total M_d= 6.0 g/day (Nachtegaalstraat) over 400 m^2 surface

- Biology
  - Both reductive as wel as oxidative processes occur
  - Reductive degradation potential low in plume, higher in source
  - Low degradation potential needed for bio-washing machine approach

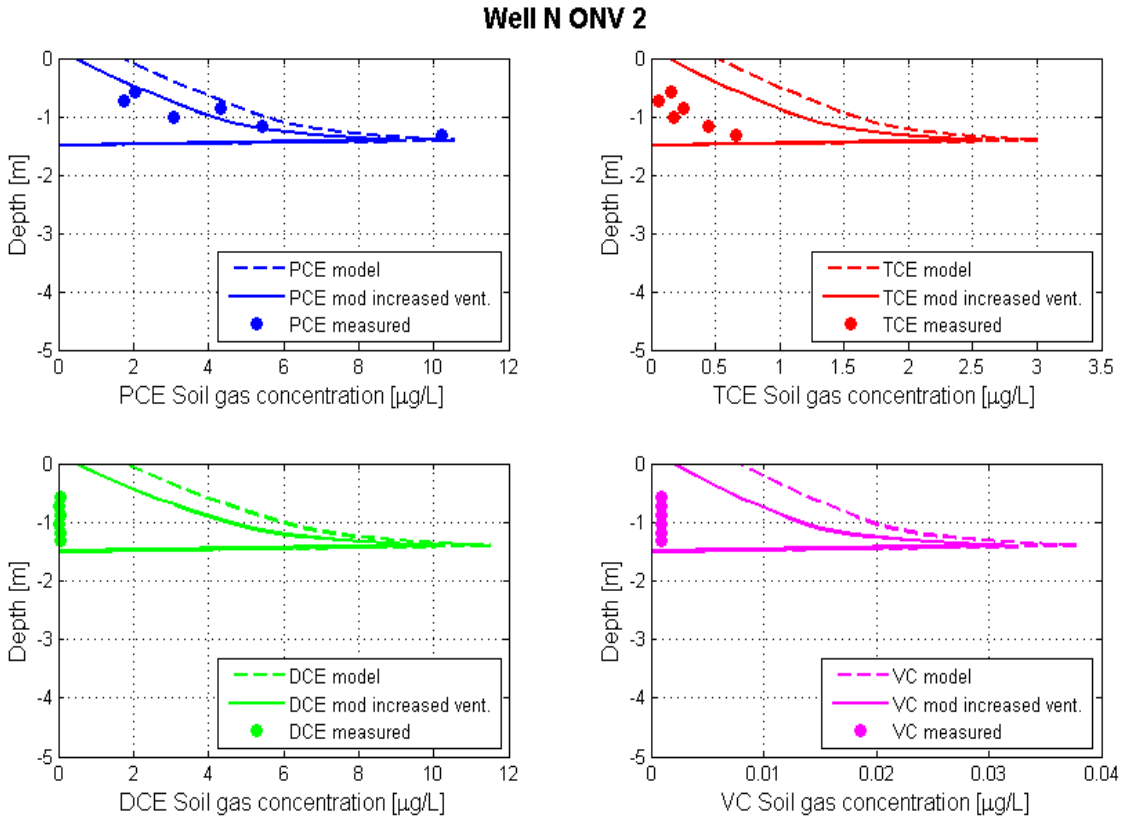
Research aspect: Vapour intrusion & ATES



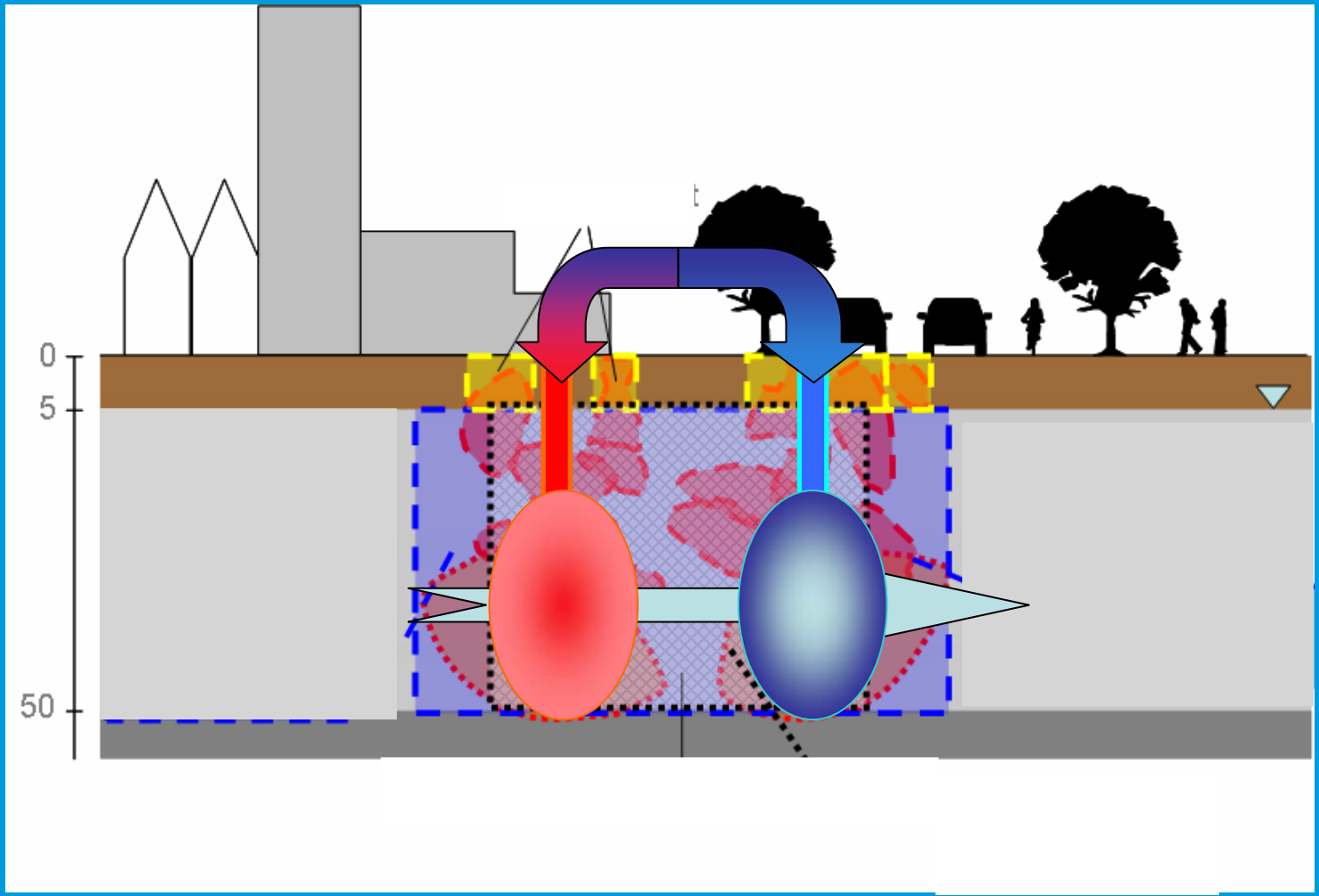
Results Vapour Intrusion

Indoor air risk reduction:

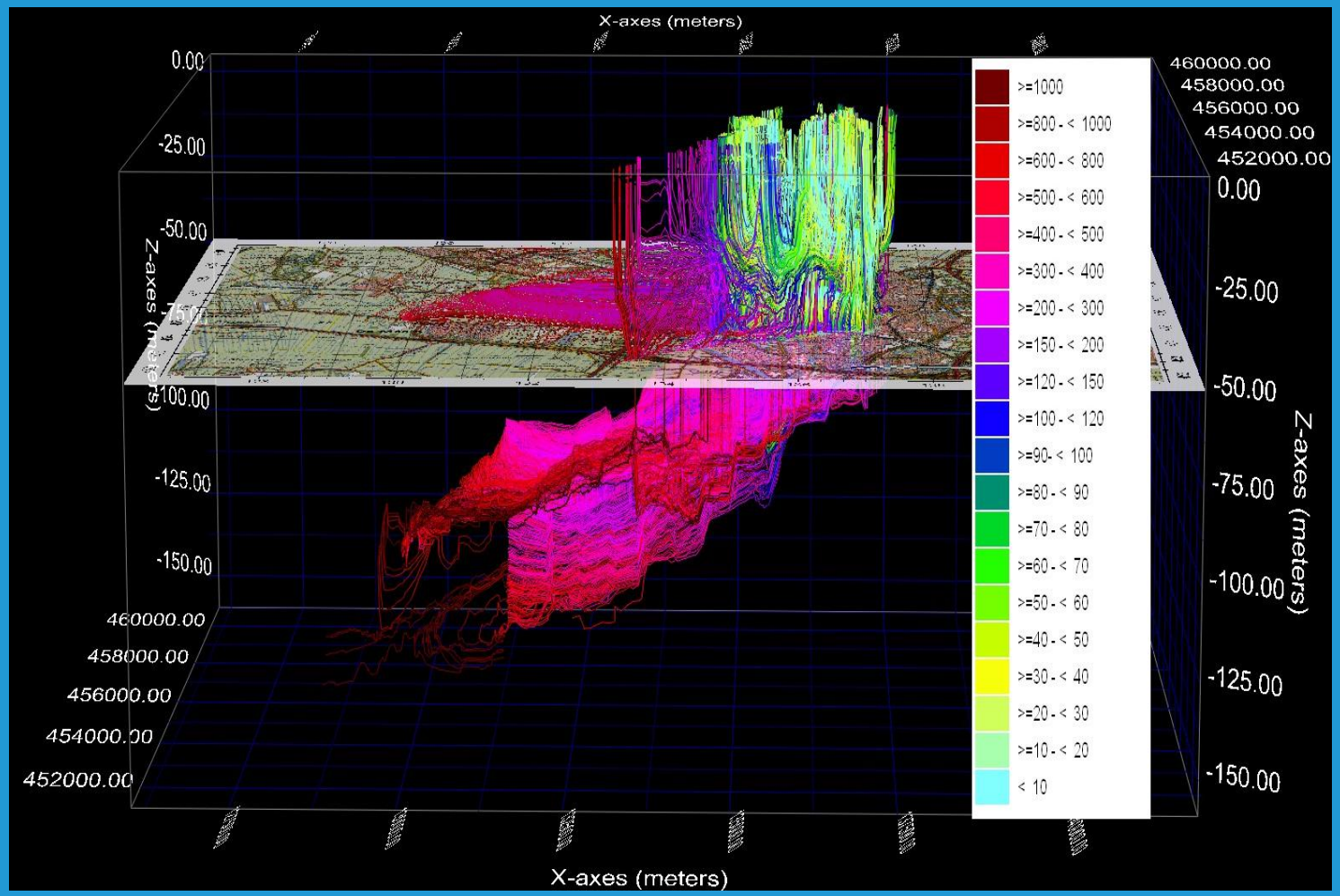
- (50 cm) clean groundwater → order of magnitude
- Aerobic degradation in vadose zone



Research aspect: 3D model subsurface



3D transport: pathlines starting at different depths



Characteristics – long term ATES

Groundwater (> 20 years ATES):

- Groundwater quality: homogeneous character
- Almost no CIS present & continuously slow decrease of VC

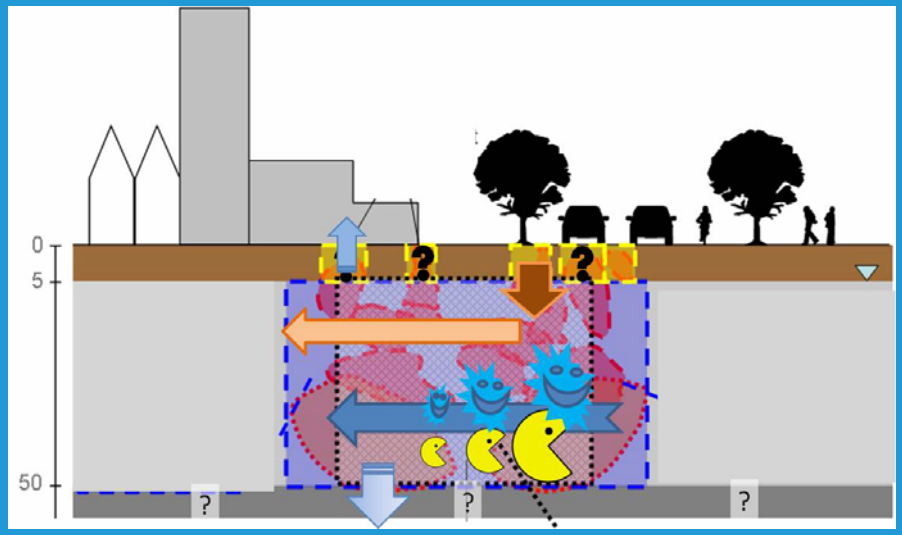
Biology:

- Low amounts of bacteria for reductive degradation (DHC:10 – 200 gene copies/ml): > 65% of the samples
- Bacteria for reductive and oxidative proces can be found in the same soil layer

➔ stimulating effect of ATES or only homogenization?

Integration of results & Bio-washing machine

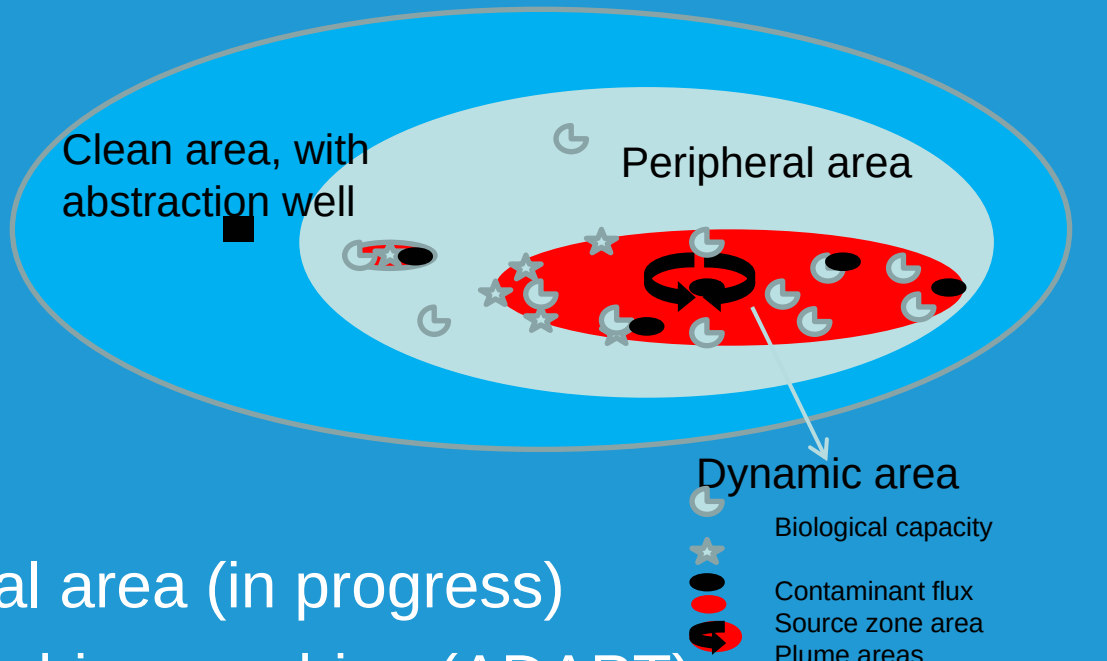
Modified CSM of the Bio-washing machine:



Important aspects (altered view on situation):

- clean groundwater layer enormously reduces risk of vapour intrusion
- confining layer between 1st and 2nd aquifer locally absent
- two degration processes are important. “New” one is quicker.

Recommandations



- Upscale of the total area (in progress)
- Monitoring Bio-washing machine (ADAPT):
  - Dynamic area: overall biodegradation, deep water concentrations and flux measurements
  - Peripheral area: flux at source zones and degradation capacity in plumes

Acknowledgements

bioclear

MWH

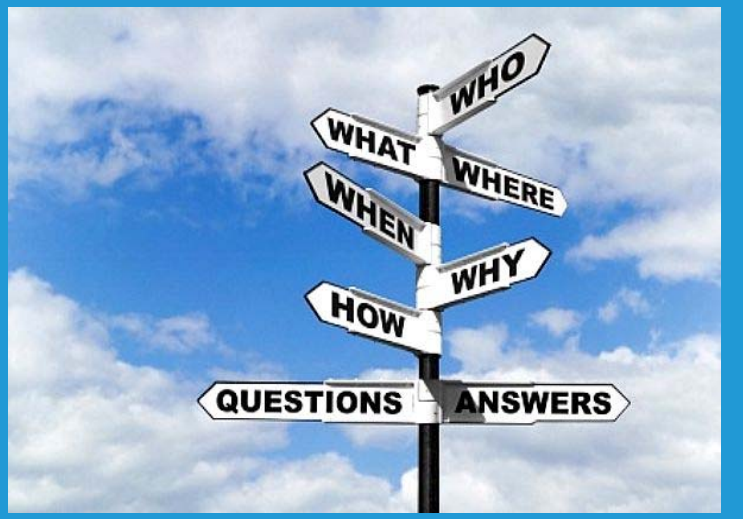
Deltares
Enabling Delta Life

WAGENINGEN UR
For quality of life

NL Agency
Ministry of Infrastructure and the Environment

Universiteit Utrecht

UtrechtseBiowasmachine



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