Virtual Co-learning Lab (VCL):

Soesterberg application

ISLANDR Team Deltares

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Objectives this presentation

- Showcasing a 3D decision-support interface/boundary object* – specifically aimed at the link between soil contamination and spatial strategies.
- To discuss with you what can we learn by applying this kind of boundary objects – specifically in the context of sustainable risk-based land management?

**Boundary object: (material or conceptual) that is interpreted differently by different groups, yet remains sufficiently robust to maintain a shared identity and enable collaboration across those groups.*

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology,translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. Social studies of science, 19(3), 387-420.

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Content of the presentation

- Flash introduction Soesterberg ITA
- Intro on the Virtual Co-learning Lab (VCL)
- Application of the VCL on the Soesterberg case.

VCL – Design team, Deltares

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01 | Flash introduction Soesterberg case

ITA Soesterberg, former military base…

Soil and water pollution due to former military activities:

- PFAS contamination (firefighting foams used during military training released)
- Military legacy pollutants (e.g. hydrocarbons, heavy metals, and other military-related substances)
- Groundwater risks, due to closeness to groundwater extraction areas.

Remediation

- Challenges due to insufficient knowledge about PFAS and technologies to remediate its contamination
- Cleanup adds significant financial and logistical burdens.

Air force base Soesterberg in 1934. Source USINE

Control tower and surroundings. Source Provincie Utrecht

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...future residential and nature development

hart van de heuvelrug

Visualization of the new residential development de Vliegbasis. Source Hart van de Heuvelrug website

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03 | Short intro in the Virtual Co-learning Lab

A scaled 3D model with interactive geo-referenced data

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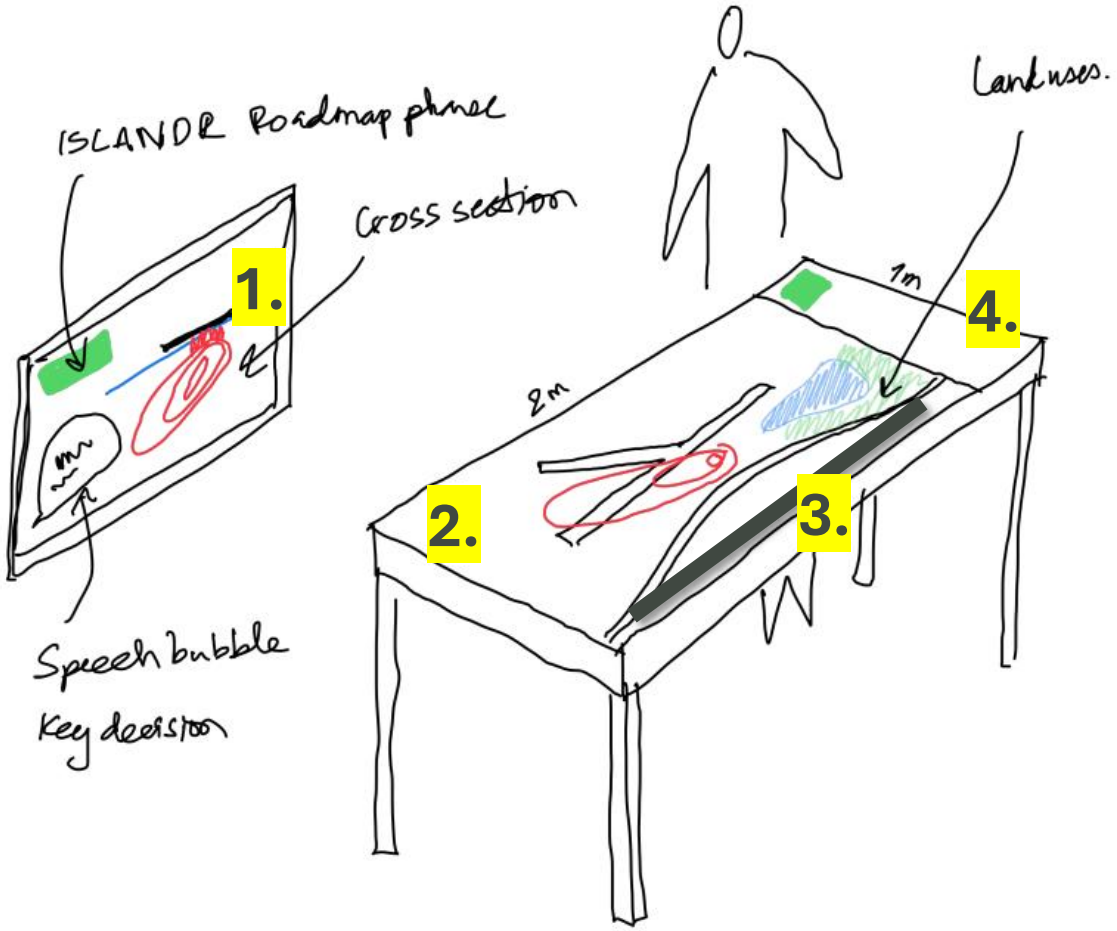
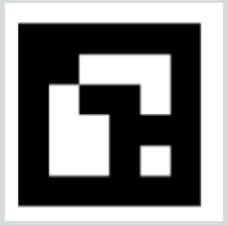
VCL : Components



1. Screen
2. VCL
3. Sliding bar
4. Assessment panel

VCL : Components

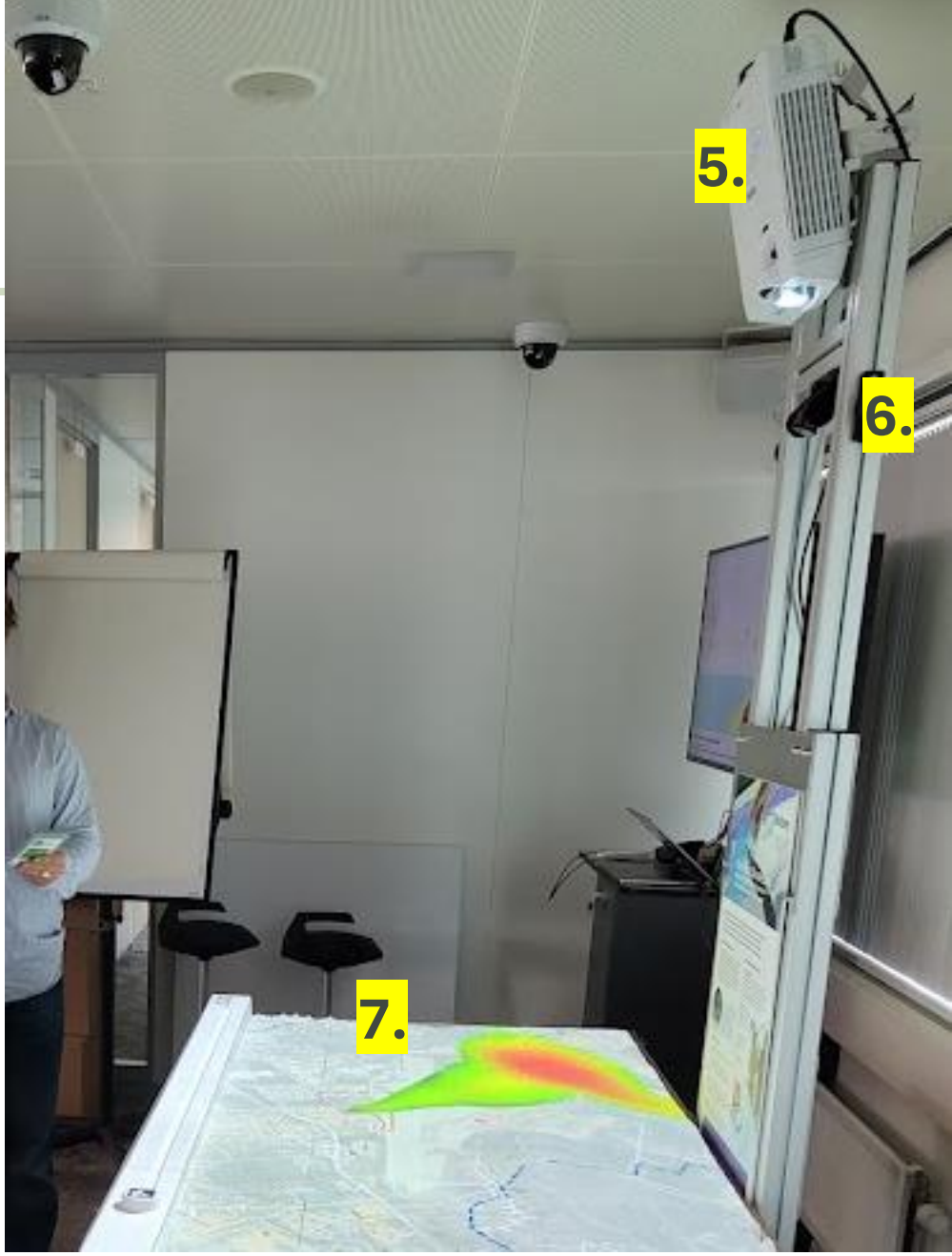
5. LCD Projector
6. Camera
7. 3d printed base model
8. QR code interactive data Cards with measures & Spatial scenarios



Using a ArUco marker to detect:

- Position
- orientation (rotation)

8.



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Enabling decision-making

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Applied previously for:

- **Greater North Sea Initiative (spatial planning)**
- **Island of Terschelling (Groundwater, sea-level rise)**
- **Area near the Rotterdam harbour (Flood risk)**

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Virtual Co-learning Lab

For ISLANDR:

- Simulates interaction between soil remediation, spatial planning and risk management.
- Supports risk-based decision-making
- Enables stakeholder co-learning and dialogue
- Brings areas to life through scenarios

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04 | Application of the Virtual Co-learning Lab in Islandr

DISCLAIMER

- The model focuses on PFOS contamination within Soesterberg. There are also other contaminants which are *not* addressed here.
- The future scenarios tested in this model are speculative in nature and do not intend to represent the reality of ongoing work, latest data and developments on the site.

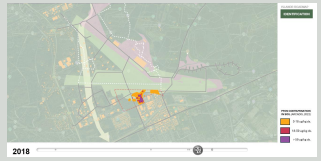
Steps in using the Virtual Co-learning Lab

1

Step 1: Introduction (time and place – past and present)

2

Step 2:Showing remediation and strategies (present and future)



3

Step 3: Introduction into the spatial planning strategies (future) + relation with remediation.

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Step 1: Introduction (time and place – past, present and future)

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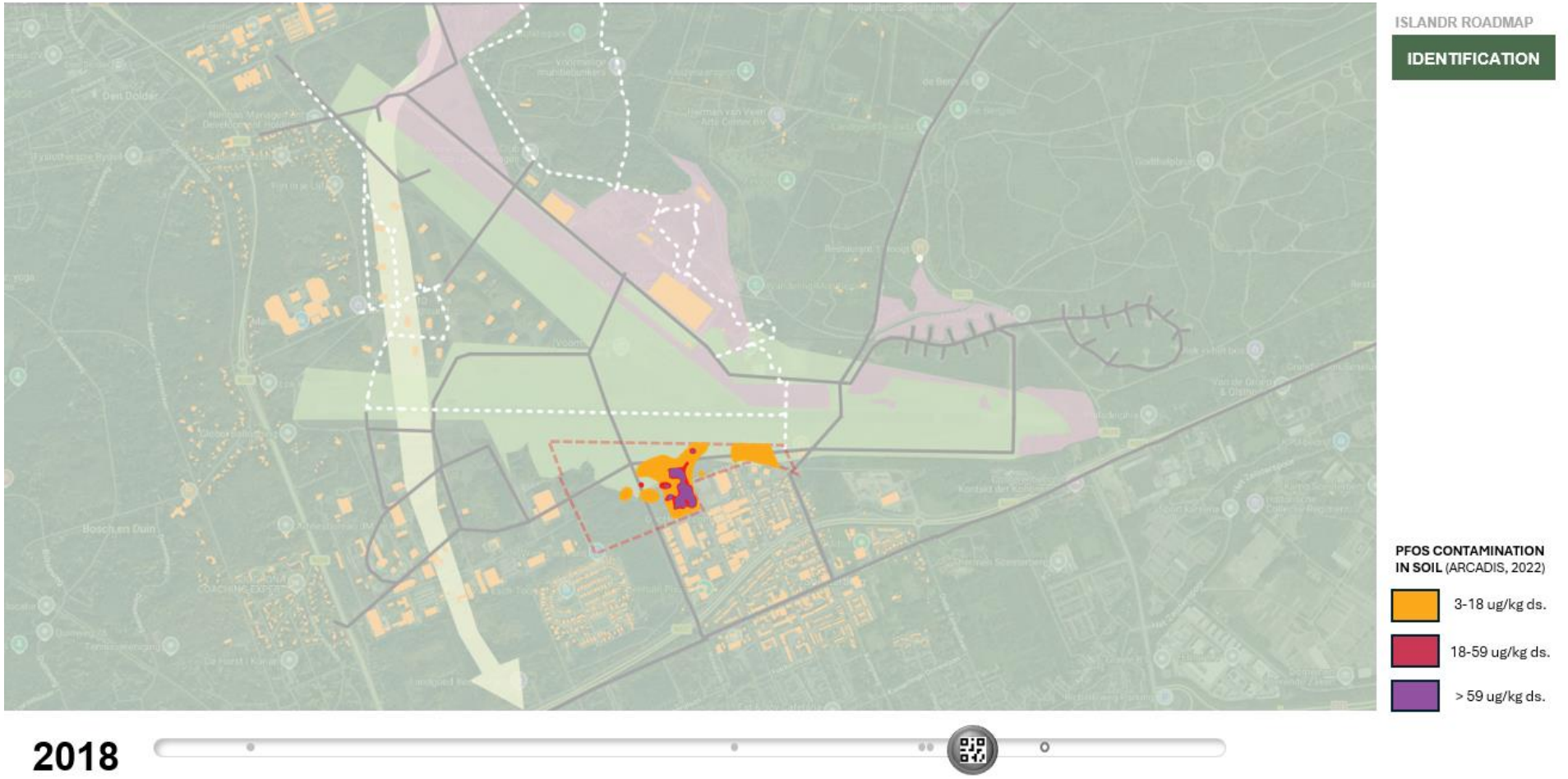
Step 1: PFOS contamination in soil



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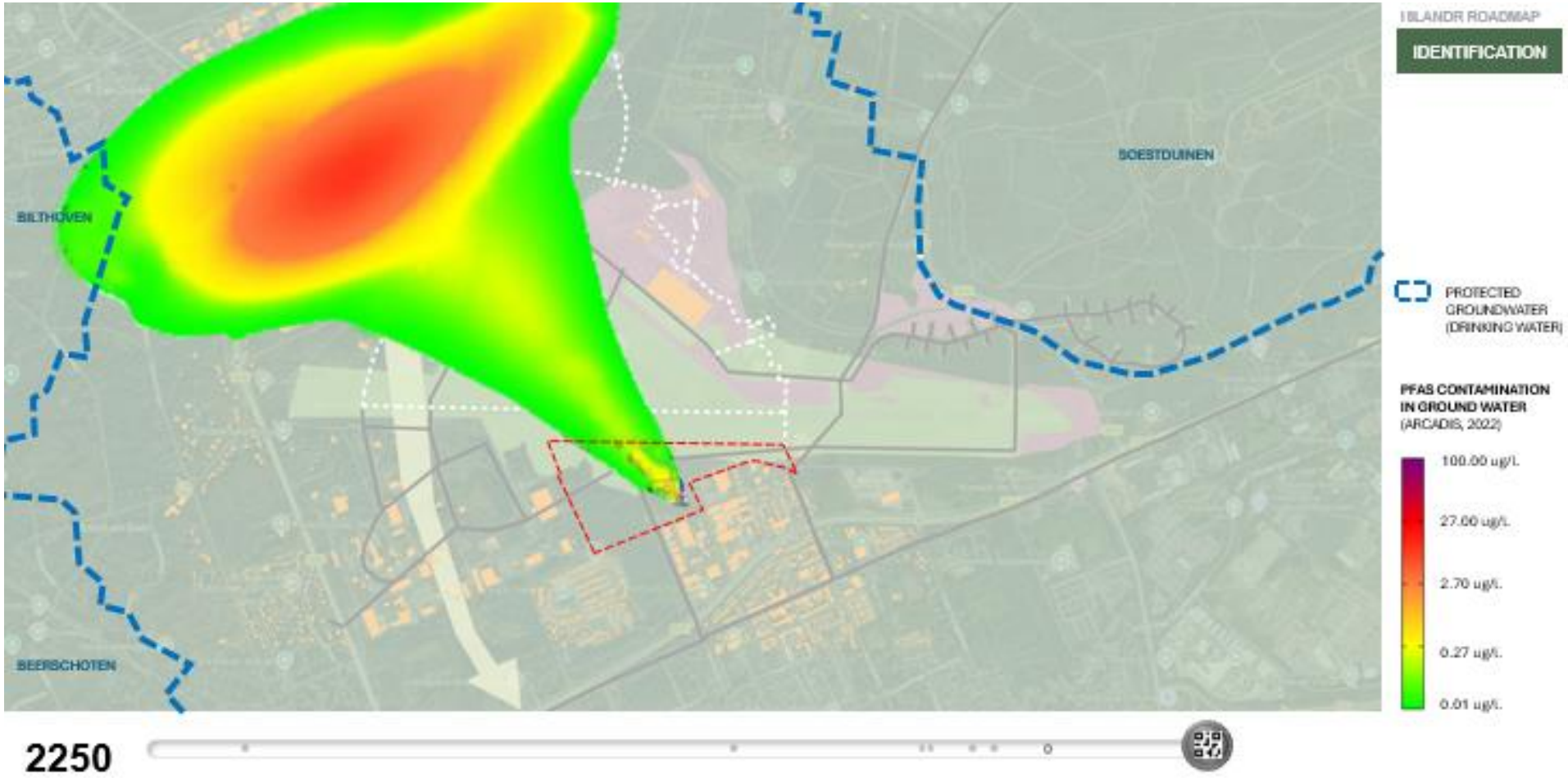
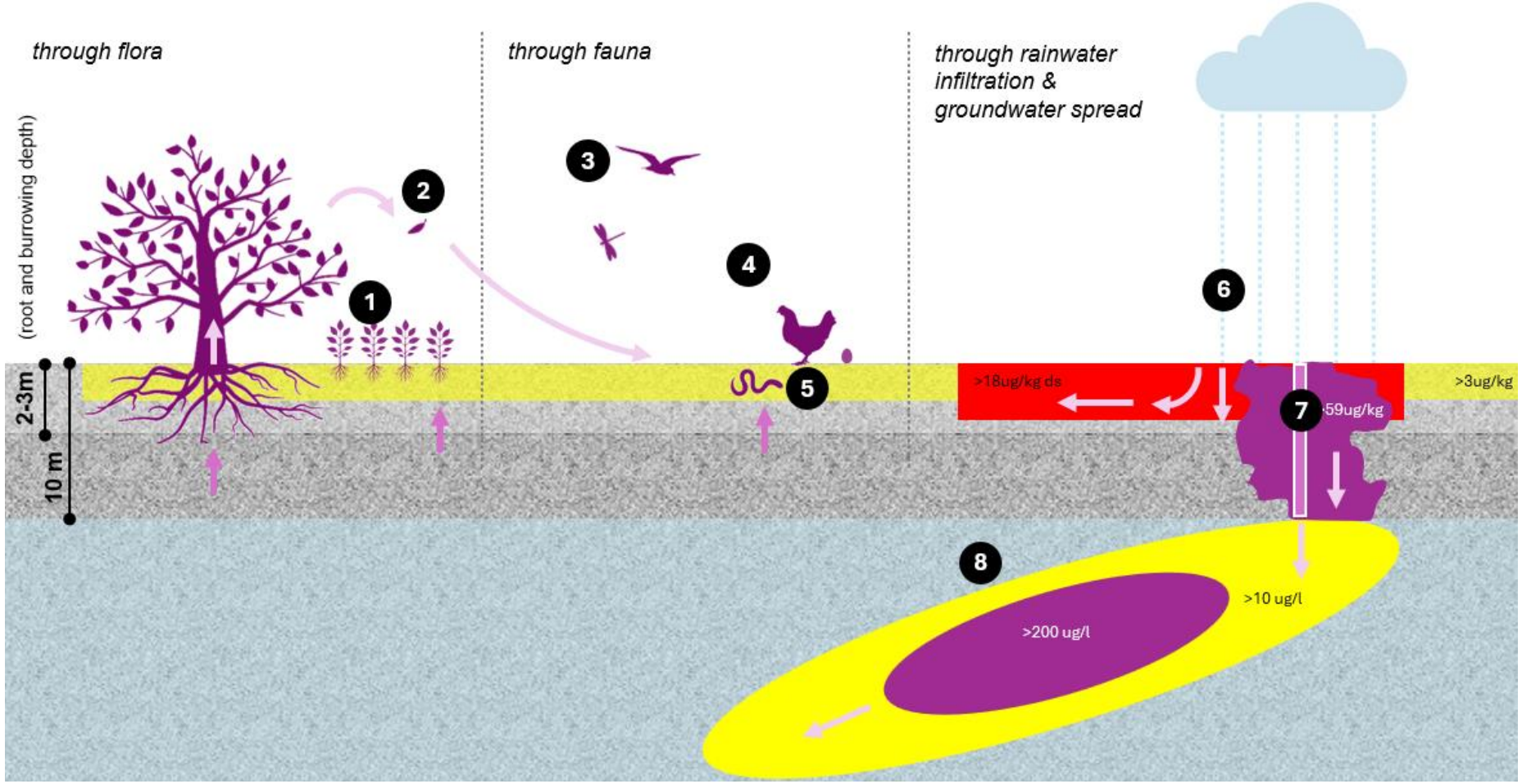
Step 1: Spread of PFOS through groundwater



Step 1: Contamination pathways



Step 2 & 3: Remediation and spatial planning strategies.

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Step 2 & 3: Remediation and spatial planning strategies.

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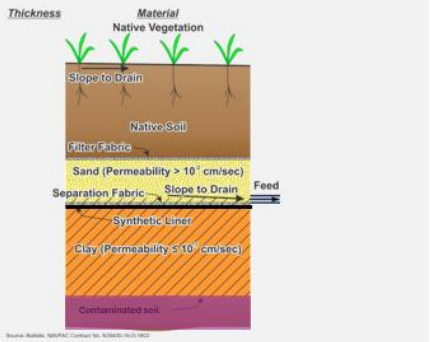
Remediation measures

REMIDIATION MEASURE

SOIL CAPPING

A 50cm - 200cm layer of new soil and impermeable membrane cover the contaminated soil. The rainwater on the new soil is collected and drained.



☐ Existing trees will need to be removed.

☐ Rainwater will be connected to general rainwater drainage system.

☐ Setting up the soil cap with drainage may be a technical challenge.

REMIDIATION MEASURE

SOIL CAPPING

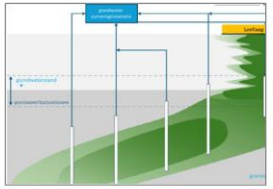
A 50cm-2m layer of new soil and impermeable membrane cover the contaminated soil. The rainwater on the new soil is drained at safe distance from the contaminated soil.

Impact on human exposure within site	Impact on human exposure beyond site
High impact. Eliminates contact with contaminated soil.	**Medium impact** Reduces further spread of PFAS from soil to ground water, through rainwater infiltration. Limited spread through ecological pathways connected to contaminated soil (burrowing animals)

REMIDIATION MEASURE

GROUND WATER PURIFICATION

Contaminated groundwater is extracted, treated, and re-injected or discharged to reduce PFAS concentrations and limit the spread of contamination.



☐ Technical feasibility and effectiveness is being developed

☐ High costs of remediation anticipated

REMIDIATION MEASURE

GROUND WATER PURIFICATION

Contaminated groundwater is extracted, treated, and re-injected or discharged to reduce PFAS concentrations and limit the spread of contamination.

Impact on human exposure within site	Impact on human exposure beyond site
No impact. Groundwater contamination is 10m below ground	High impact Prevent contamination from entering protected groundwater zones (drinking water)

REMIDIATION MEASURE

DESTROY CONTAMINATED TREES & PLANTS

Including cutting, transport and safe incineration and disposal of ashes.

☐ Lack of legal permit in Netherlands to incinerate trees with PFOS.

☐ Zone within the nature reserve zone (*ecologische hoofdstructuur*).

☐ Environment protection groups need to be engaged in the process.

REMIDIATION MEASURE

DESTROY CONTAMINATED TREES & PLANTS

Including cutting, transport and safe incineration and disposal of ashes.

Impact on human exposure within site	Impact on human exposure beyond site
High impact. Eliminates contact with contaminated plants and biomass	**Medium impact** Limited spread through ecological pathways

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Spatial Planning Scenarios

SPATIAL PLANNING SCENARIO

HOUSING

A neighborhood of 450 new houses consisting of apartments, row houses and free-standing houses. Open spaces include private backyards and communal parks. Note: By law houses Private houses and backyards require soil capping.

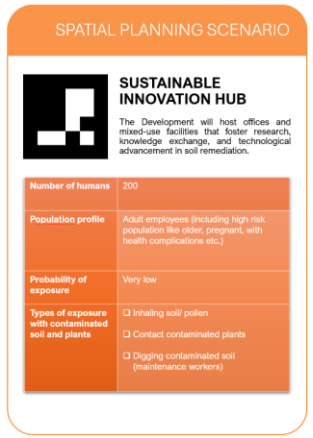
☐ Moderate outdoor activity anticipated.
☐ Limited control of restrictive measures/ protocols because of domestic use.
☐ Excavation tasks for foundations and underground infrastructure in contaminated soil will require specialized protocol.

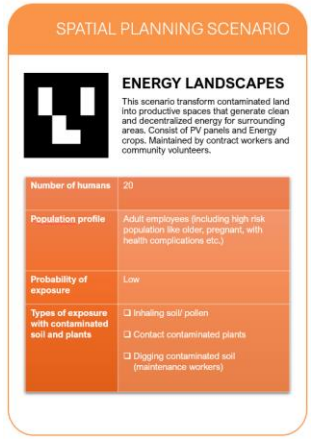
SPATIAL PLANNING SCENARIO

HOUSING

A neighbourhood of 450 new houses consisting of apartments, row houses and free-standing houses. Open spaces include private backyards and communal parks. Note: By law houses Private houses and backyards require soil capping.

Number of humans	1000
Population profile	Residents (Adult, child including high risk population like older, pregnant, with health complications etc.)
Probability of exposure	Medium
Types of exposure with contaminated soil and plants in contaminated soils in public spaces	❑ Digging contaminated soil ❑ Inhaling soil/ pollen ❑ Consuming/ contact contaminated plants/ eggs ❑ Contact with pets exposed to PFAS





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Next steps

- A first prototype which will be developed further in future projects focused on soil remediation
- We invite you to experience this in Deltares.
- Questions & Suggestions

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