



LIFE PFASTER project October 2025



Sednet Conference 07/10/2025



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PFASTER =
PFAS systemic regional approach
to **A**ssess **S**patial distribution,
Transfer, **E**xposure and
Remediation of widespread
pollution in Willebroek, Flanders

www.pfaster.be



Project information



01/10/2024 - 30/09/2029

+ After-LIFE



Total: € 4.387.598

60 % Co-funding



PROJECT PARTNERS

Coordination:

Associated partners:

Map from PFAS Verkenner ('Explorer') showing PFAS no-regret Zones (red) and Willebroek site (zoom-in; orange)



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novobiom



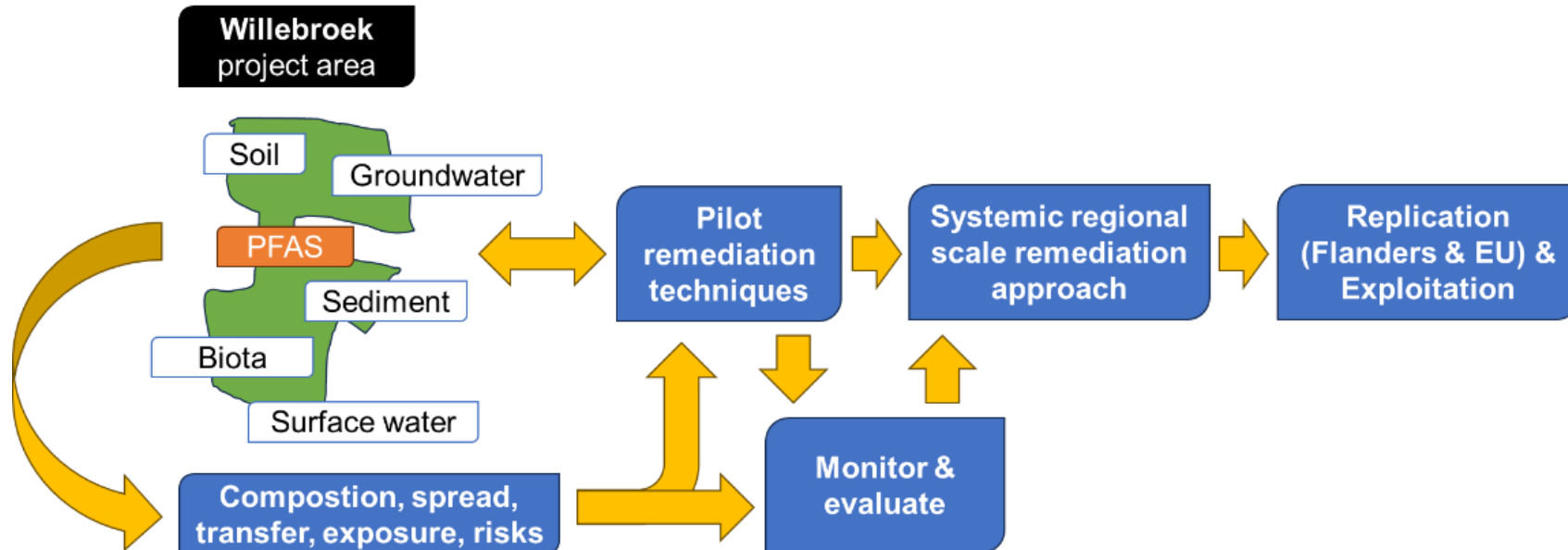
KU LEUVEN





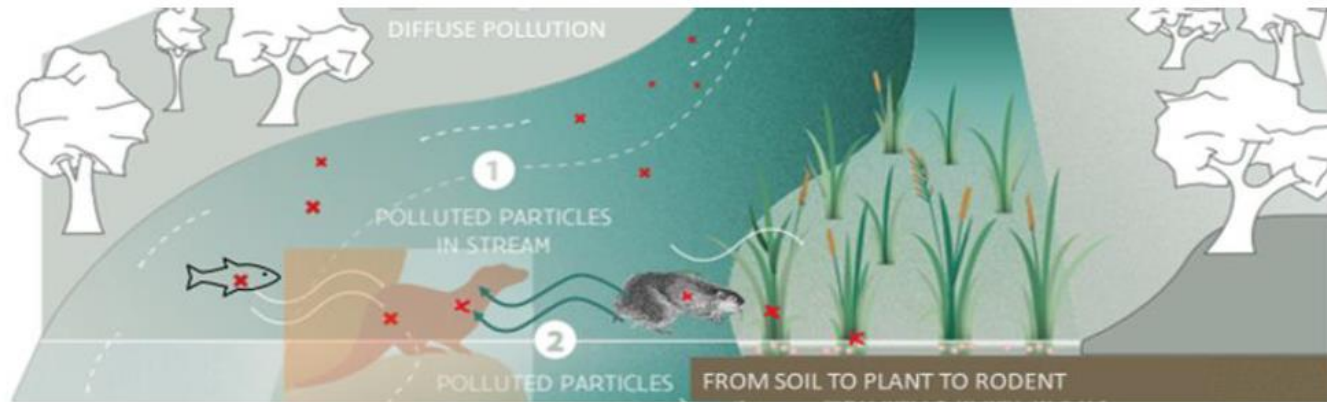
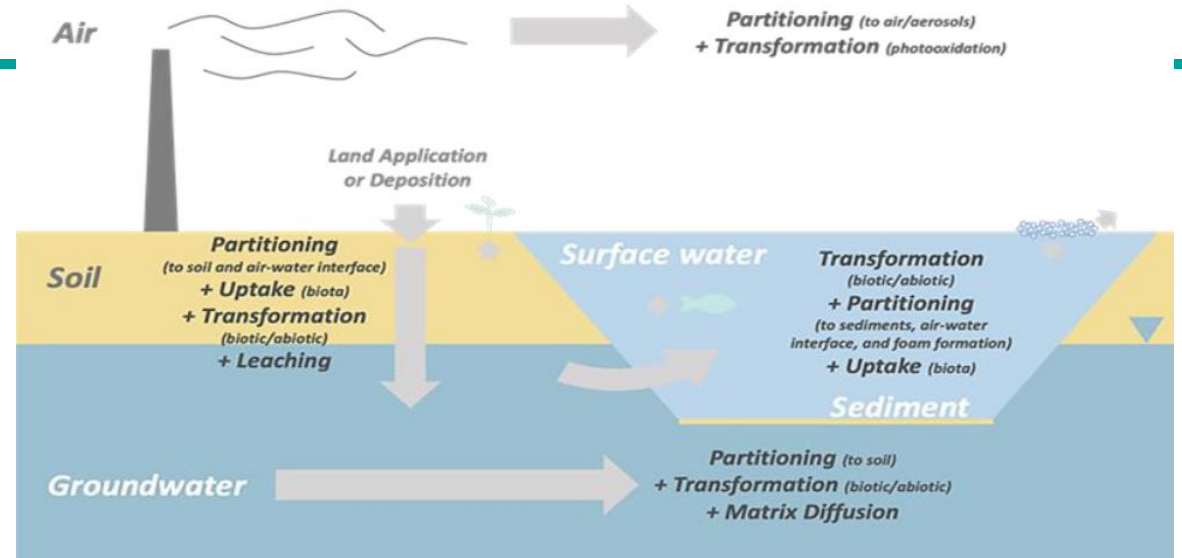
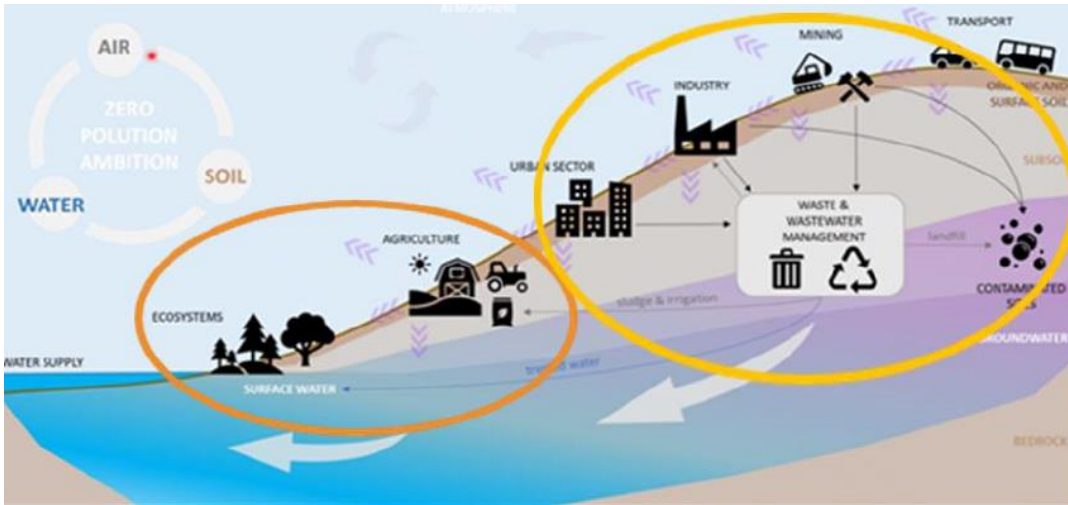
General objective

Improve soil and water quality by developing a systemic risk management approach on a regional scale to reduce diffuse PFAS pollution in soil, sediment, water and biota, including innovative, cost-efficient methods to assess the spatial distribution and identification of exposure routes of the contaminants, and the design and piloting of a replicable remediation approach beneficial for biodiversity and health.





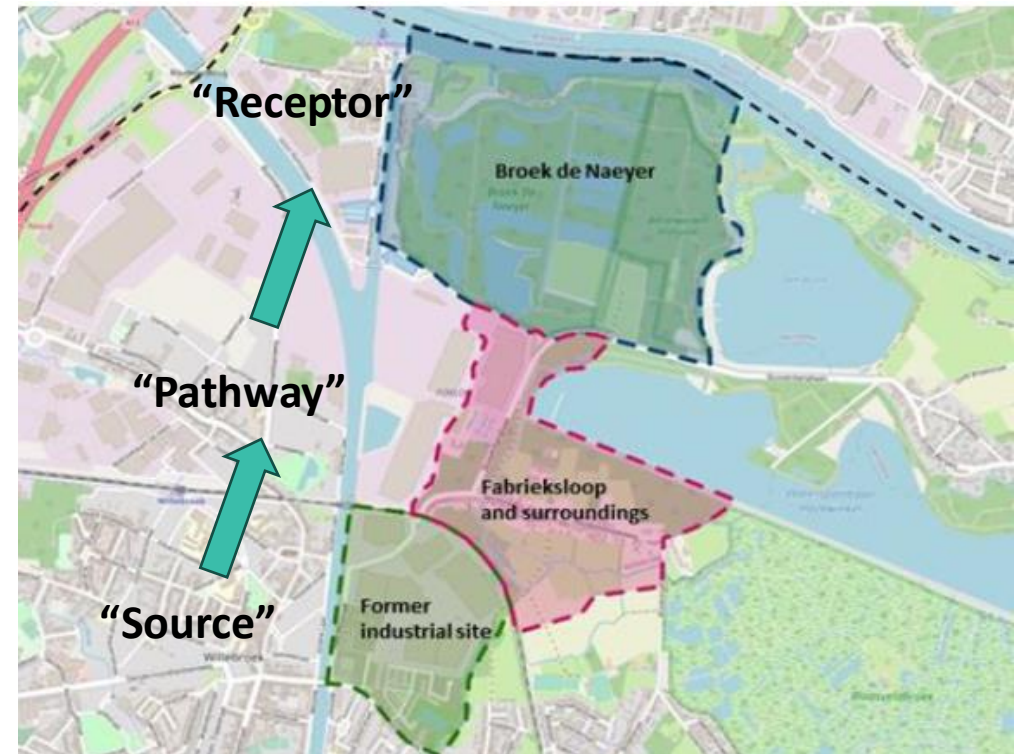
General objective





Willebroek site

- **Former industrial site:** former paper factory 'De Naeyer'. Currently, the area is redeveloped into a residential area
- **Fabrieksloop and surroundings:** in the past, this area was used to discharge a part of the wastewater of the paper factory. Currently, the land use of this area is mainly urban, with some farming and nature.
- **Broek de Naeyer:** this wetland area in the north has a high natural value. It bears traces of several human activities which started with the extraction of peat and ended with the construction of an open sewer and the dumping of industrial waste in settling lagoons.

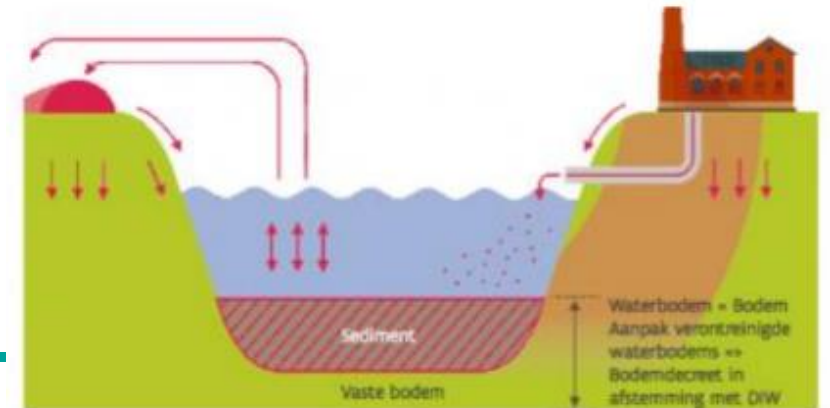


Exemplary case for (former) industrial site with PFAS contamination and migration in nearby surface water system



Role of sediment

- Link in entire system
- Distribution of PFAS contamination from and to sediment:
 - Via hydrological network: wastewater discharged in mainstream
 - Sediment removal and disposal on different river banks
 - Peat pits used as settling basins for paper mill (Broek de Naeyer)
- Relevant posed risks and characterisation of contamination
- Nature Based Remediation Techniques





Willebroek site





Work packages (WP)

WP	Activities	Lead	2025	2026	2027	2028	2029
1	Project management						
2	Determine and monitor composition and spatial distribution of PFAS in the project area						
3	Determine exposure to PFAS contamination and risk assessment						
4	Pilot remediation techniques for (diffuse) pollution with PFAS						
5	Evaluation and design of a systemic regional-scale remediation approach for the Willebroek area						
6	Sustainability, replication and exploitation of project results						



WP 2: Determine and monitor composition and spatial distribution of PFAS in the project area

- Monitoring plan
 - soil, groundwater, sediment, surface water and biota
- Determine spatial distribution of PFAS in the water-sediment-soil:
 - › Start of baseline monitoring for water&sediment
 - › Start of baseline monitoring soil & groundwater (June 2025)
- Measuring (eco)toxicity with PFAS Calux bioassays
- Measuring PFAS in biota (plants, aquatic, terrestrial): baseline monitoring:
 - › 2025: aquatic (May 2025) and plants (June 2025)
 - › 2026: terrestrial
- In depth characterising PFAS components/agents including new PFAS fingerprinting approach VITO
 1. Initial screening: AOF (water) EOF (soil/sediment) or DART MS
 2. Samples with high fluor content
 3. Target & Ultrashort PFAS
 - I. TOPA
 - II. Non target screening with UPLC-MS (identify ionic PFAS)





WP 3 : Determine exposure to PFAS and risk assessment

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- Transfer of PFAS via:
 - › Aquatic route
 - › Terrestrial route
- Vertical transfer and uptake by plants/consumption crops -> derive plant uptake model
- Ecological and human health risk assessment
 - › Comparison of measured concentrations in different matrices with thresholds
 - › Risk modelling
 - › Refine PFAS input parameters (e.g. BCF plants) risk models (S-Risk, F-leach)

Aquatic route	Terrestrial route
Water/sediment	Soil
Plants and phytoplankton	Plants
Macro invertebrates	Worms
Bivalves	Isopods
Small fish	Snails
Large fish	Caterpillars/spiders
Cormorant	Small mammals
Otters	Songbirds





WP 4: Pilot remediation techniques for (diffuse) PFAS pollution

Lead:  **vito**
vision on technology

Physical chemical extraction, removal and destruction of PFAS from soil & groundwater

- Highly contaminated source area (former industrial site)
 - Soil: $> 1.000 \mu\text{g/kg dw } \Sigma\text{PFAS}(20)$
 - Groundwater: max. $73.000 \text{ ng/L } \Sigma\text{PFAS}(20)$
- Combination of lab and field pilots
 - In-situ soil flushing using biosurfactants
 - › Groundwater from soil flushing $\rightarrow$ Foam fractionation and mycofiltration as a polishing step $\rightarrow$ exploiting fungal biomass as active biofilter
 - Removal and destruction of PFAS from extracted groundwater
 - › Several treatment trains with direct nanofiltration, cold plasma destruction and polishing by adsorption



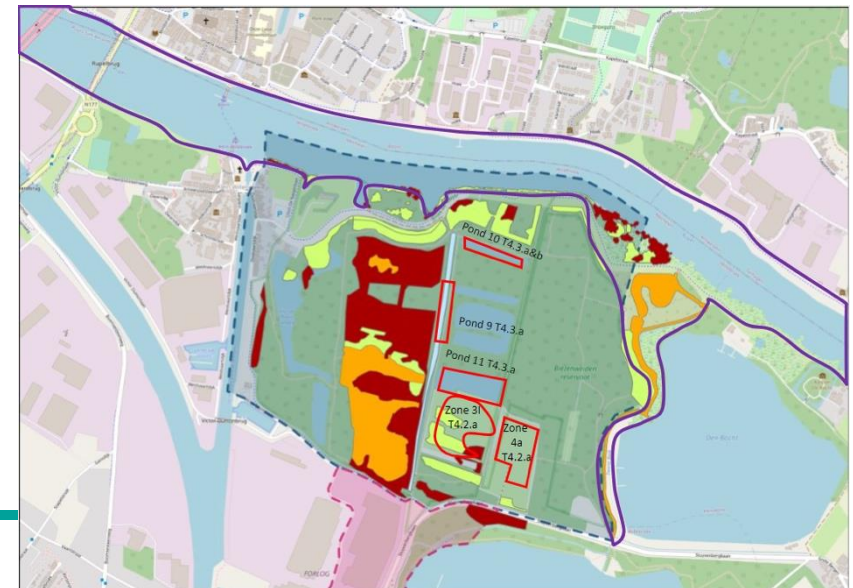


WP 4: Pilot remediation techniques for (diffuse) PFAS pollution

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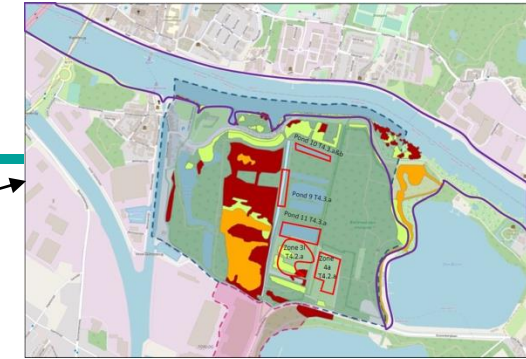
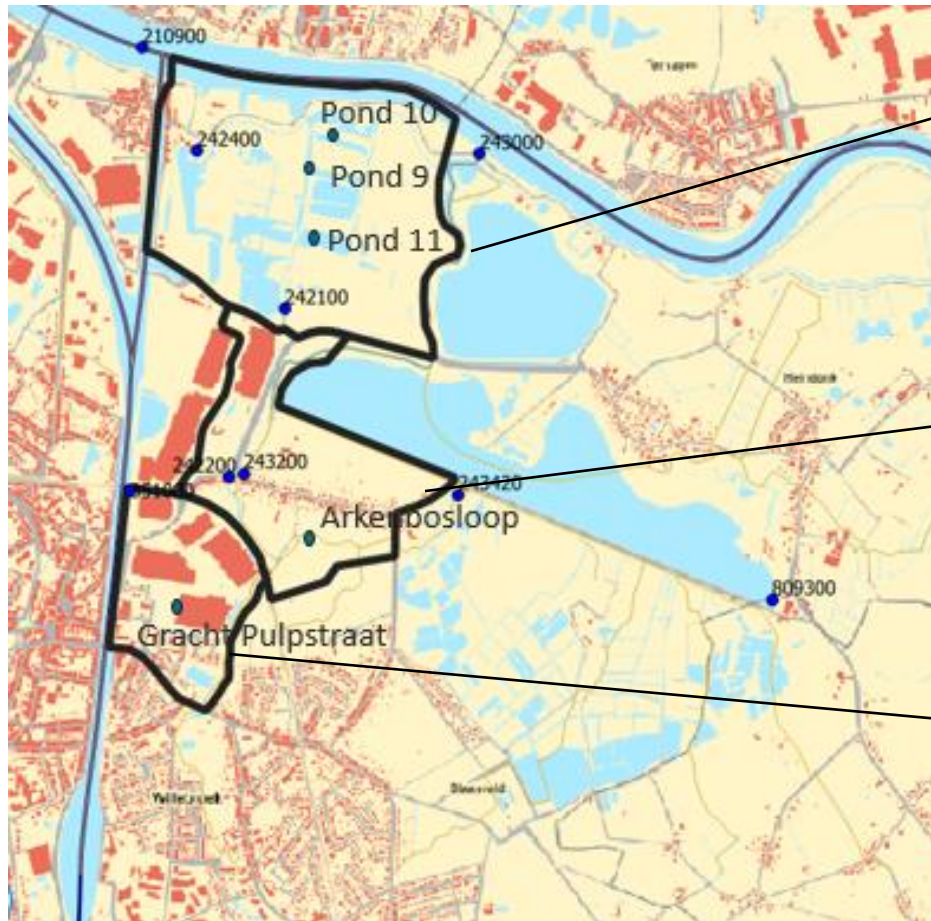
Nature-based solutions

- Diffuse contamination:
 - Soil: 200 – 500 $\mu\text{g}/\text{kg dw } \Sigma\text{PFAS}(20)$
 - Sediment: 400 – 1.000 $\mu\text{g}/\text{kg dw } \Sigma\text{PFAS}(20)$
 - Groundwater: 6.000 – 10.000 $\text{ng}/\text{L } \Sigma\text{PFAS}(20)$
 - Surface water: 550 – 1.700 $\text{ng}/\text{L } \Sigma\text{PFAS}(20)$
- Terrestrial (soil) field pilots:
 - Phytoremediation
 - Mycoremediation
- Aquatic (water and sediments) field pilots:
 - Floating wetlands (water)
 - › Added value of inoculating with fungi, bacteria and a combination of fungi and bacteria
 - **Constructed wetland (sediment)**
 - › Native plants and micro-organisms
 - Composting of harvested biomass with fungi inoculation





WP 4: Overview of field pilots



Floating wetlands
Constructed wetlands
Compost
mycoremediation



Phytoremediation
Mycoremediation



In-situ flushing
Removal and destruction



WP 5: Evaluation of outcomes and systematic regional-scale remediation approach for the Willebroek area

Lead:  **TAUW**

- Develop systemic and integral area CSM
 - › apply in Willebroek Explorer
- Evaluation innovative (monitoring, risk assessment and remediation) techniques
 - › Evaluation of innovative techniques using multicriteria assessment:
 - Sustainability & biodiversity loss
 - Applicability
 - Costs
 - › Assess upscaling/replication potential
- Identify lessons learned
- Systemic regional scale remediation approach → framework suitable for other sites/areas

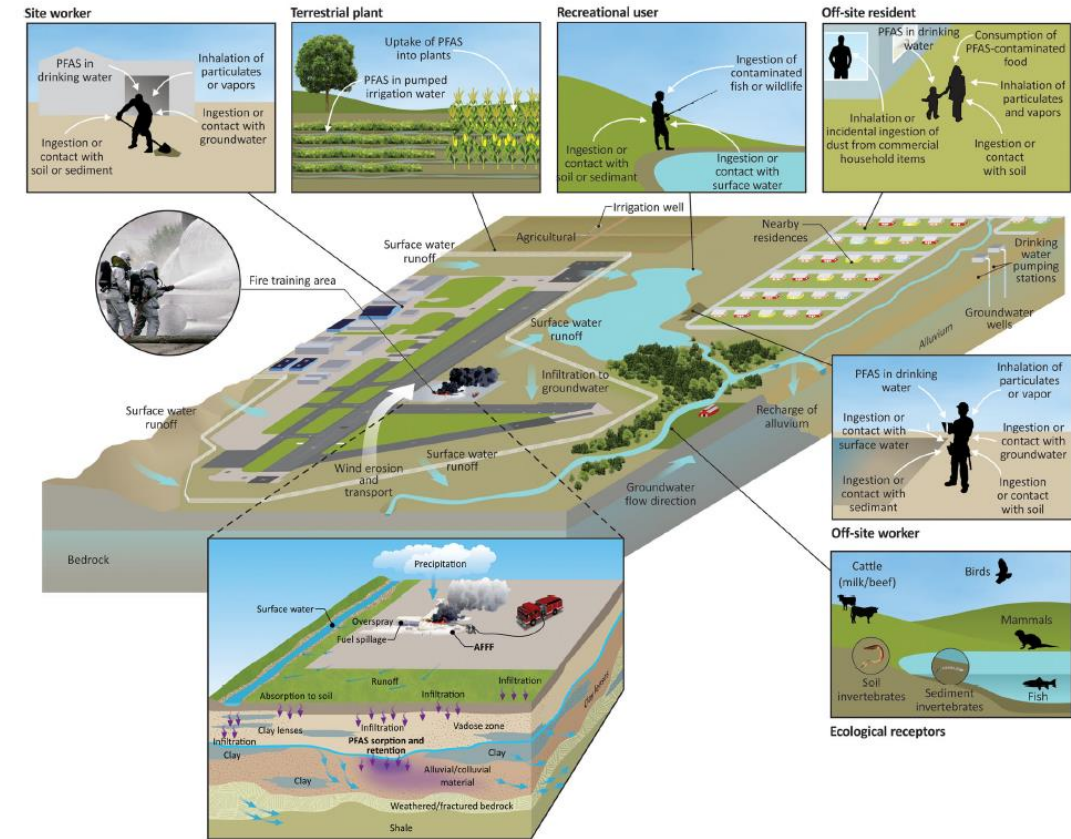


FIGURE 3: Conceptual site model for aqueous fire-fighting foam (AFFF) release and per- and polyfluoroalkyl substances (PFAS) uptake to environmental receptors.



WP 5: Evaluation of outcomes and systematic regional-scale remediation approach for the Willebroek area

Key elements for the systemic approach

- Integral systemic conceptual site model
 - › It starts with insight in the whole system!
 - Identify key transfer/migration routes
 - Identify key species in the different foodchains
 - Integral and balanced reduction objectives for:
 - Human exposure → current and future land-use
 - Transfer/migration in soil/sediment/ground- and surface water system
 - › Targets for key transfer/migration routes
 - Transfer in aquatic and terrestrial foodchains
 - › Targets for key species in the different foodchains
 - Phased approach with clear milestones in time
 - Combination of effective remediation techniques/risk mitigation measures
 - › Technically feasible, sustainable, applicable in land management practices, cost effective and scalable (area and over time)
-



WP 6: Sustainability, replication and exploitation of project results

Lead:  **OVAM**
WE MAKE
TOMORROW
BEAUTIFUL

- Dissemination of results and communication
 - › Different knowledge networks like NICOLE, KIS, SEDNET
- Replication
- After-LIFE plan





Prospects for other PFAS contaminated sites/areas

1. Detailed insights and overview of PFAS transfer in
 - Different matrices -> soil/groundwater/sediment/surface water
 - Plants/crops -> PFAS plant/crop uptake model
 - Common (West-European) aquatic and terrestrial foodchains
2. Framework for systemic conceptual site model (CSM) of PFAS contamination (hotspots and diffuse contamination) in soil/water/sediment system related to (former) industrial sites and extensive migration in nearby surface water system
3. Lessons learned and evaluation of remediation techniques (including nature bases solutions) for (diffuse) PFAS contamination based on (field)pilots
4. Framework for systemic regional scale remediation approach of (diffuse) PFAS contamination -> replicable remediation strategy/approach

Check www.pfaster.be for progress and updates



Thanks for your attention and happy to take any questions!

