



PFAS-CONTAMINATION MANAGEMENT GEILENKIRCHEN-TEVEREN

Commissie AWACS Limburg, 28 June 2023

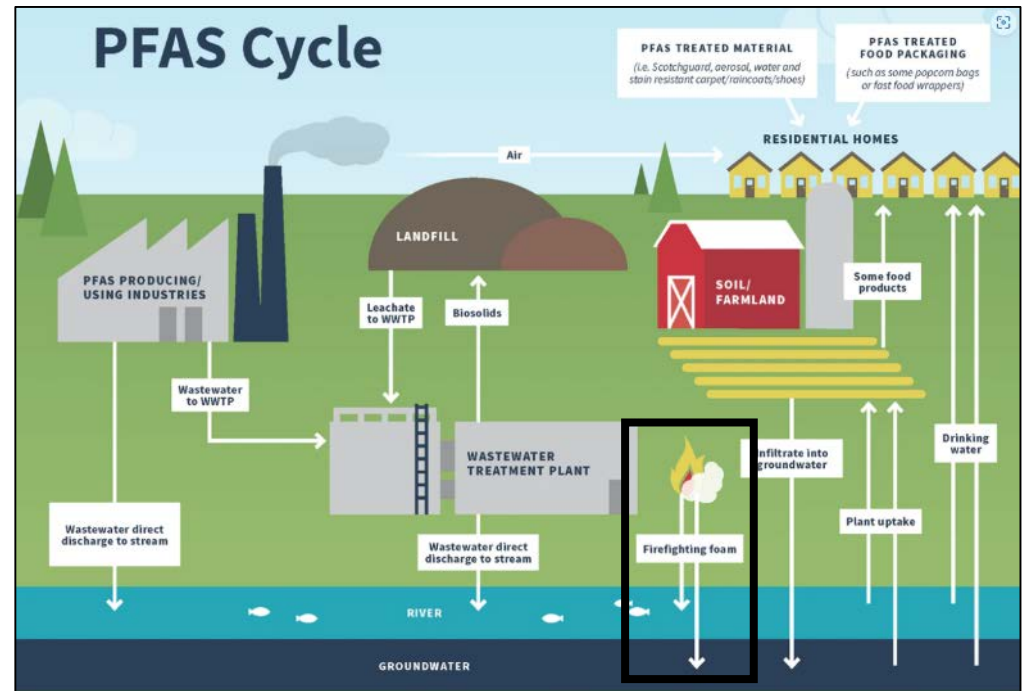
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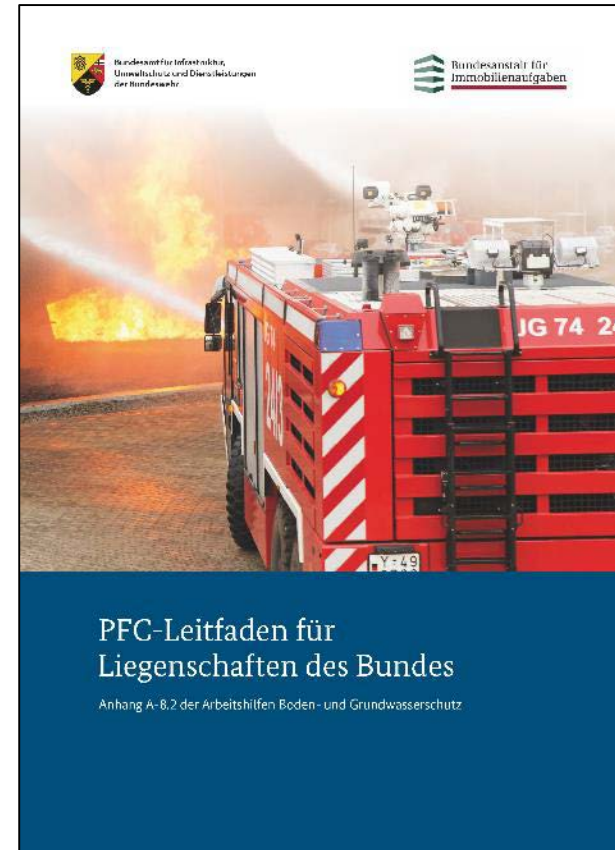
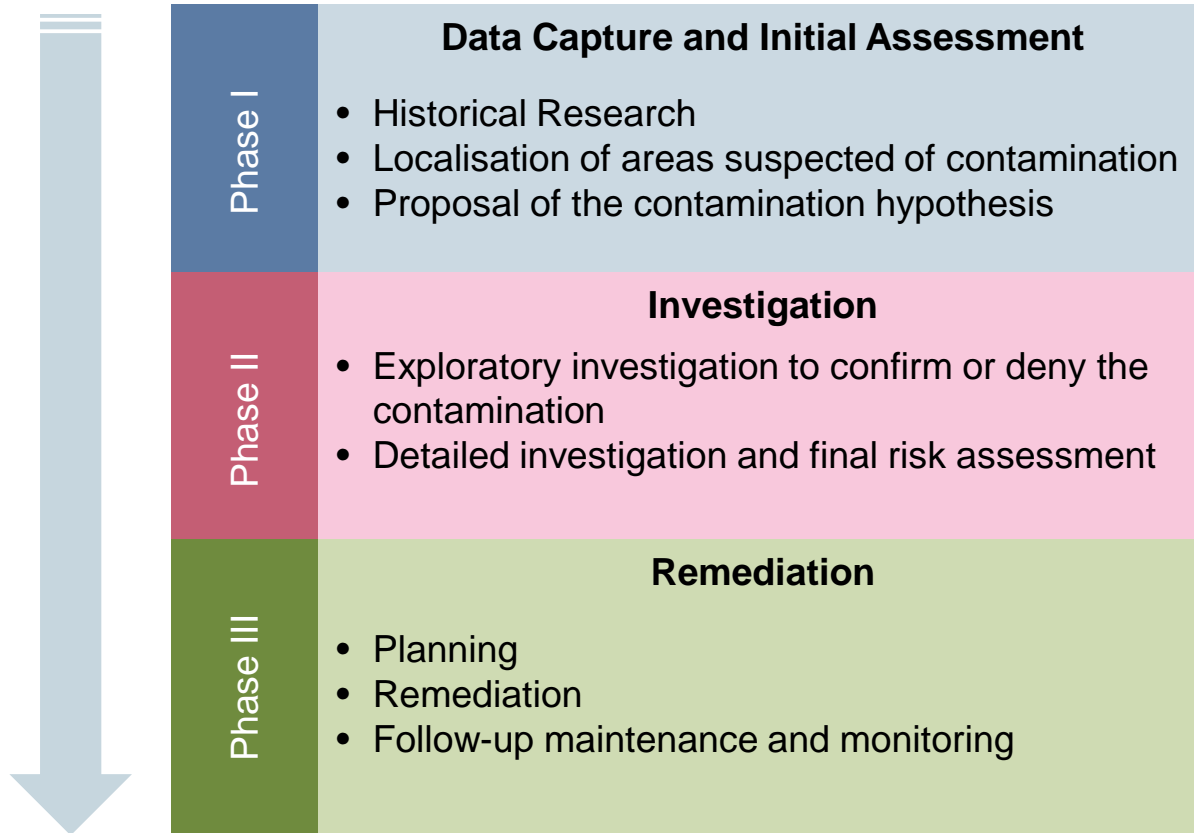
PFAS

- PFAS are a group of synthetic chemicals that are very effective at resisting heat, stains, grease and water
- Because of their unique properties, they have been used in industry and consumer products since the 1940s
- They are also used in fire extinguishing foam (AFFF)
- Some PFAS break down very slowly and can build up in people, animals, plants and the environment over time
- Because some PFAS are also highly mobile, they are potentially distributed over the groundwater
- The authorities in Denmark, Germany, the Netherlands, Norway and Sweden submitted a restriction proposal under REACH to ban at least 10.000 PFAS in the EU on 13. January 2023




U.S. Department of Health & Human Services, U.S. Environmental Protection Agency and Michigan Department of Environmental Quality

Contamination management flow chart

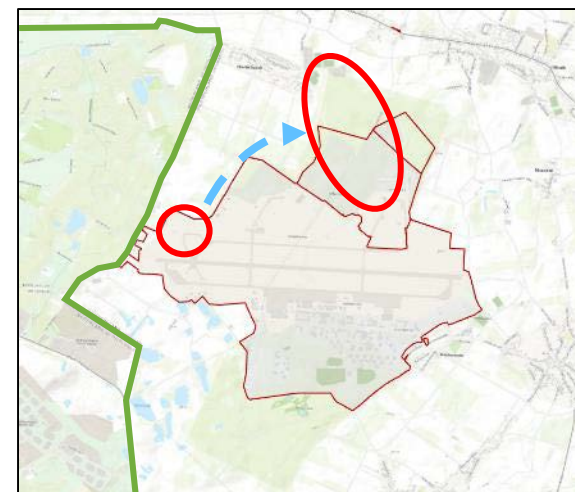
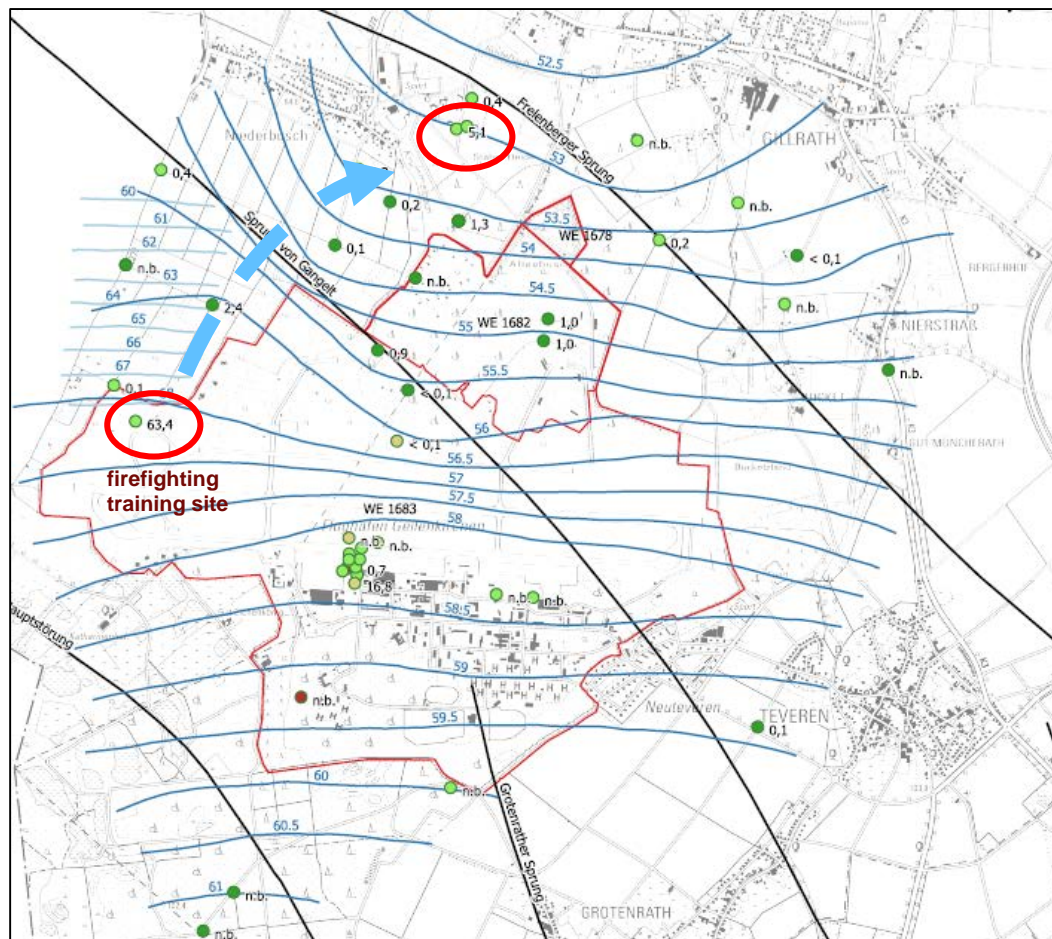


Contamination management at Geilenkirchen-Teveren - History

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- **2012** PFAS detected ($\sim 1 \mu\text{g/l}$) in the groundwater at Geilenkirchen Air Base,
 - **2013-20** repeated groundwater sampling and, starting in 2017, monitoring at selected groundwater monitoring wells (GMW) in coordination with the Lower Water Authority Heinsberg
 - **2020** PFAS detected in waterworks wells and other close by wells
 - **2021** survey and initial assessment (Phase I) of suspected contamination sites (KVF) → 26 KVF were identified (Air Base and training ground)
 - **2021-23** immediate action necessary at the former firefighting training site, extensive soil and groundwater investigations (Phase IIa-IIIa) → currently a hydraulic protection of the groundwater and its purification via activated carbon is being implemented
 - **2022/23** exploratory investigations (Phase IIa) of the other KVF, confirmed an sufficient suspicion of a harmful soil change for 11 sites → detailed investigation and a final risk assessment
 - **2022/23** hydrogeological site model to clarify the complex geological and hydrogeological situation.

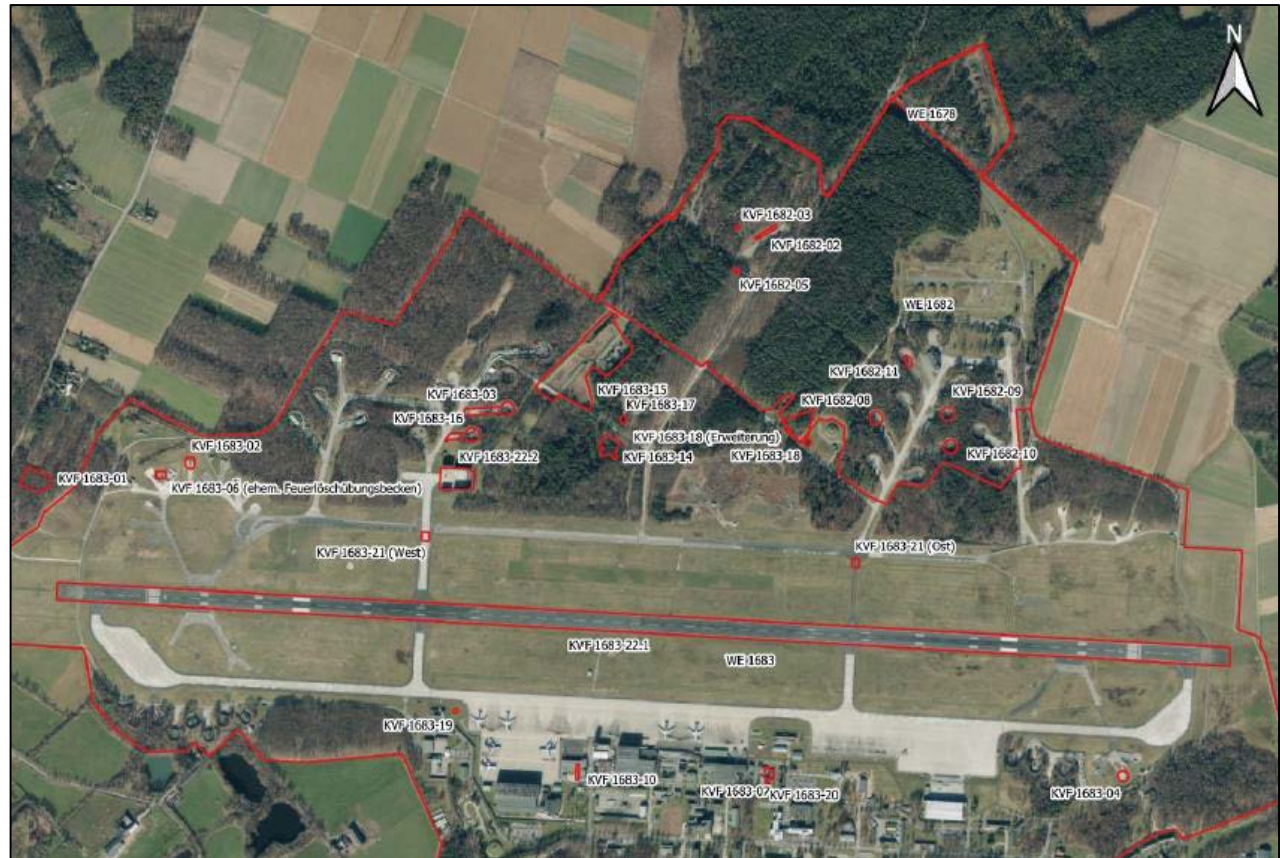
INTRODUCTION

PFAS Groundwater analysis



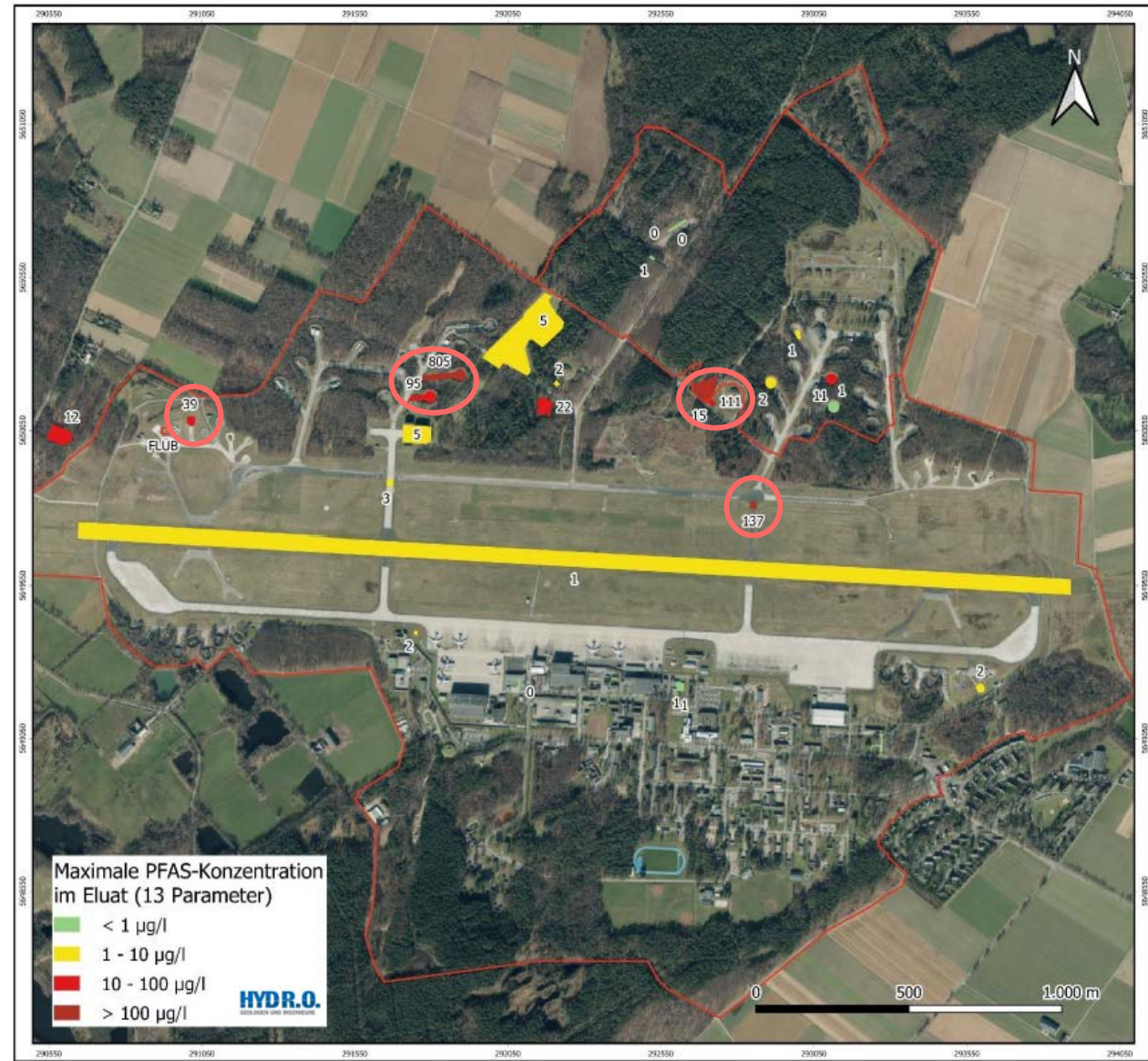
Scope of investigation

- 27 suspected contamination sites were identified in Phase I (18 Air Base and 9 Training Ground)
- Soil investigations:
 - 188 small ramm drillings
 - 5 sediment samples
 - analysis of 13 different PFAS substances (2:1 leachate) in 373 soil samples



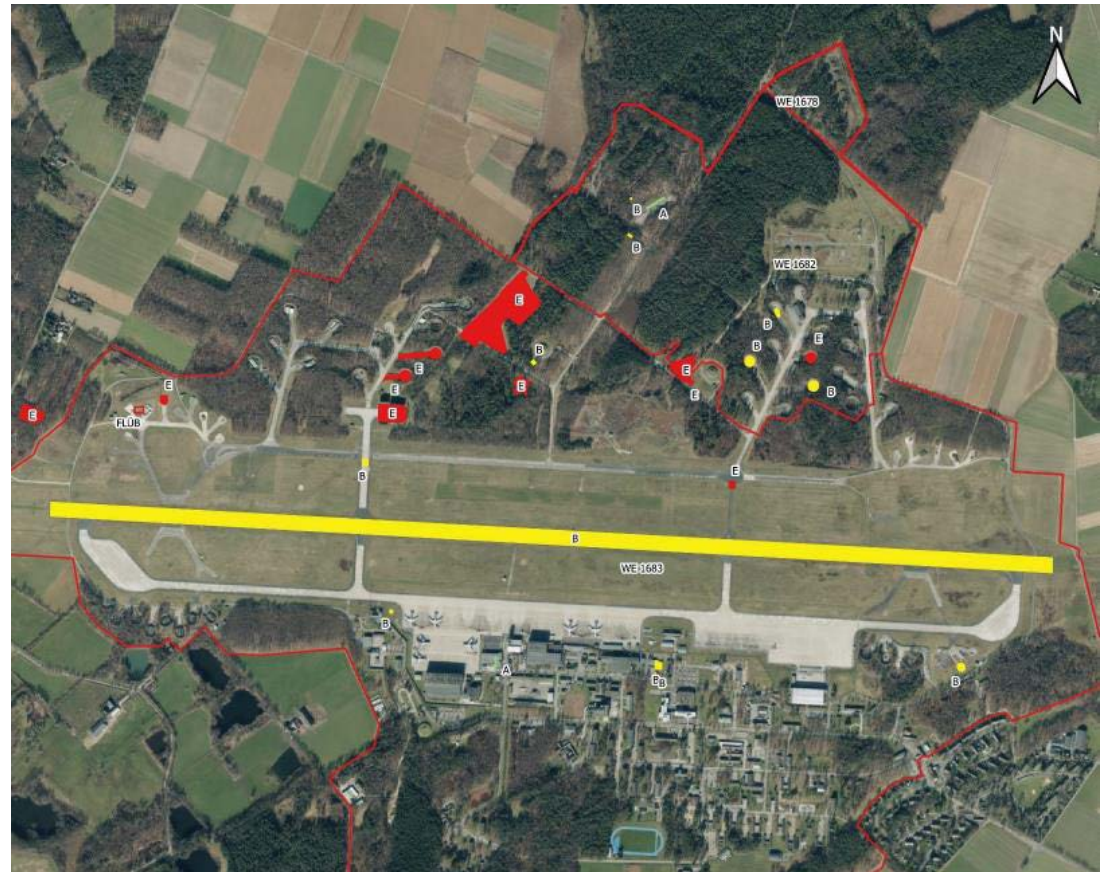
Results

- PFAS confirmed in varying concentrations in the majority of soil samples
- five contamination sites identified as potential hotspots
 - firefighting training areas
 - fire pond
 - stand-by area firefighters
- Main pollutant: PFOS



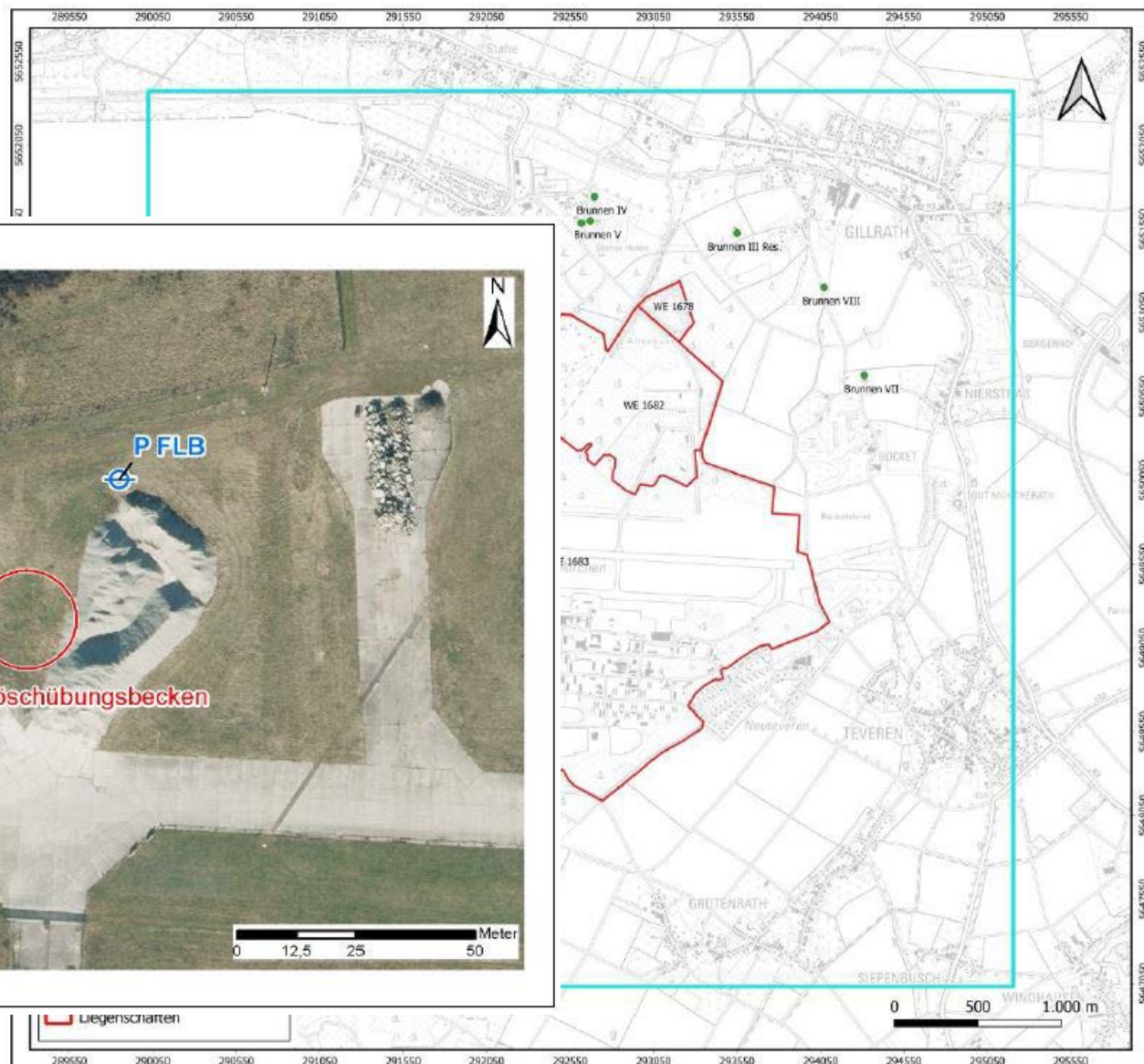
Results and further action

- sufficient suspicion of a harmful soil change for 11 sites
- highly probable that the observed PFAS groundwater pollution originates from the air base or training ground
- still a lack of sound data for final risk assessment and hence, for a weighed decision on possible source remediation
- detailed investigation of the contaminated sites in category E is planned in the near future, i.e.,
 - extent of contamination
 - risk assessment for the impact pathway soil-groundwater



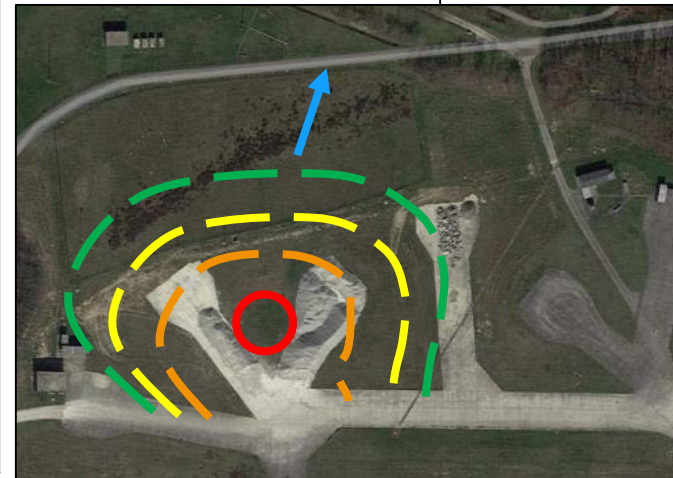
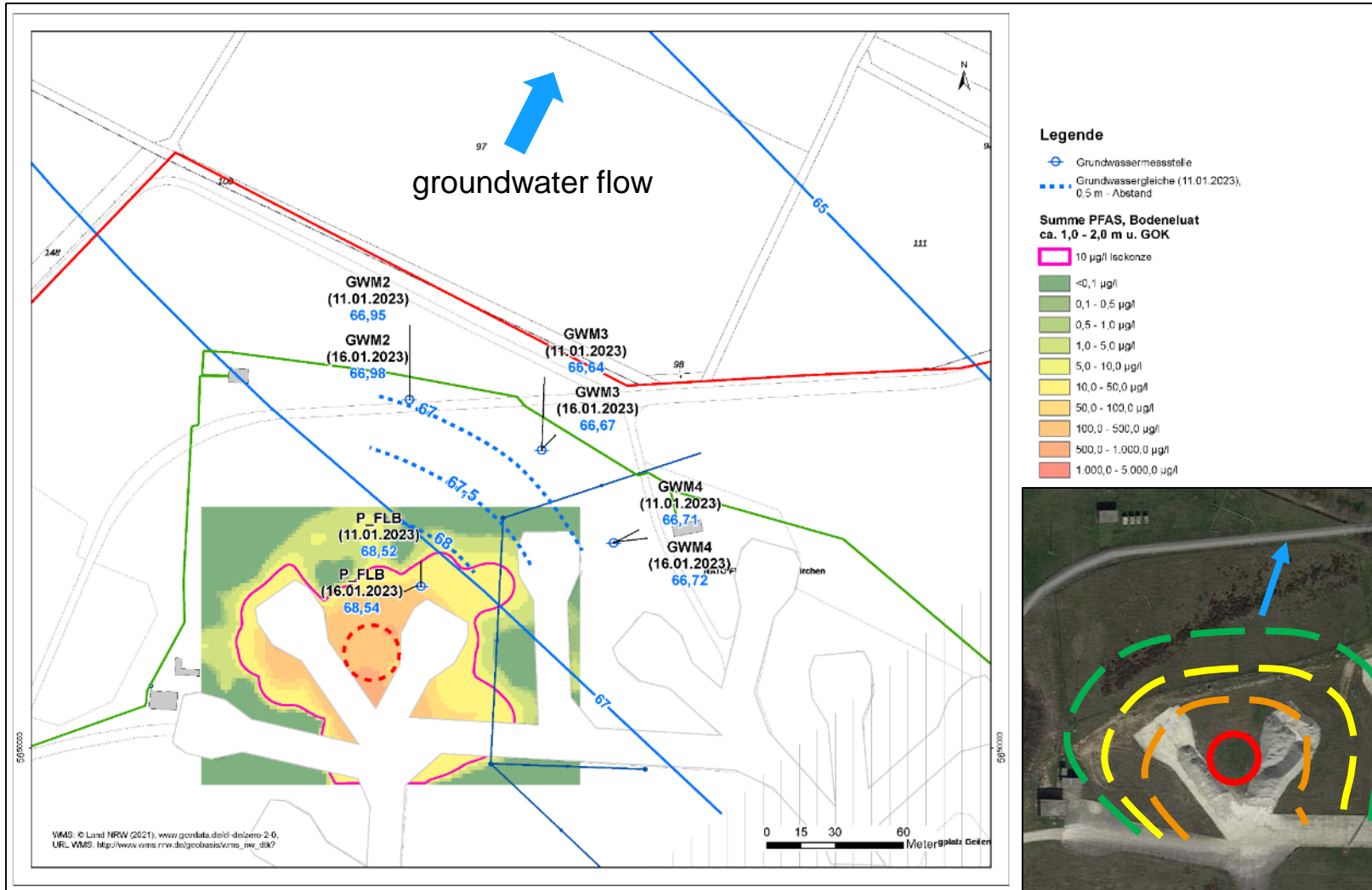
IMMEDIATE MEASURES AT THE FIREFIGHTING TRAINING SITE

Former firefighting training site



IMMEDIATE MEASURES AT THE FIREFIGHTING TRAINING SITE

Soil contamination and local groundwater situation



Groundwater investigations



Immediate measure: Hydraulic containment at the point of entry

- Hydraulic containment
 - suitable and technically proven method
 - as a temporary containment measure until other ready-to-use (economical) remediation methods are available.
- Continuous seepage water flow within the unsealed area and thus, enhanced displacement of PFAS, which are then “collected” by the hydraulic backup and cleaned up by the remediation system.
- Use of the three newly constructed groundwater monitoring wells in the downstream of the former firefighting training site to monitor plant operation and the effectiveness of the measure.
- Additional measures (e.g. covering the contaminated area with landfill foil) if the hydraulic measure is not sufficiently effective.

Hydraulic containment at the contamination source

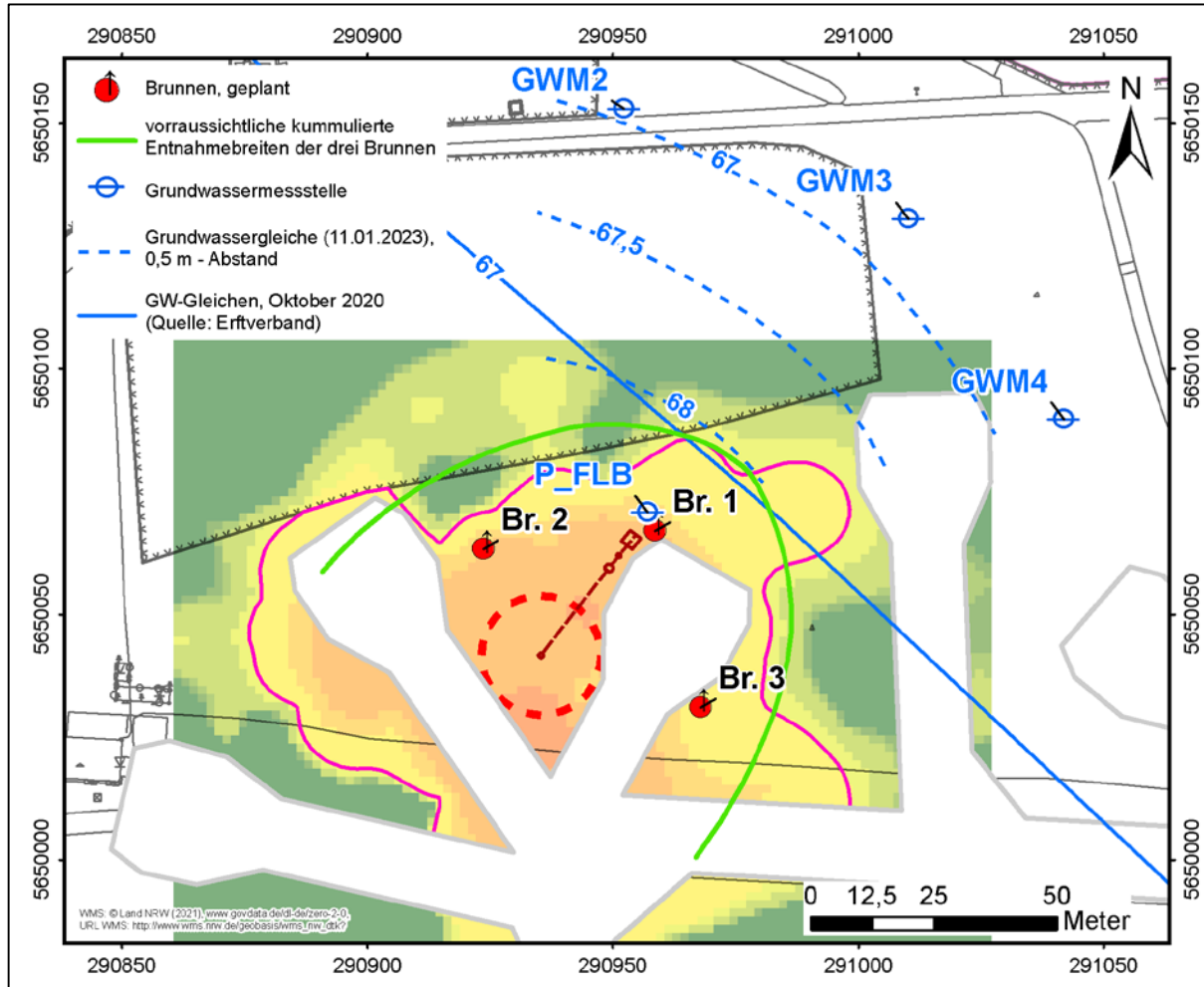
Construction of

- three wells (●) and
- Groundwater treatment plant (Q_{\max} approx. 6 m³/h)
- Commissioning planned:
End of 2023

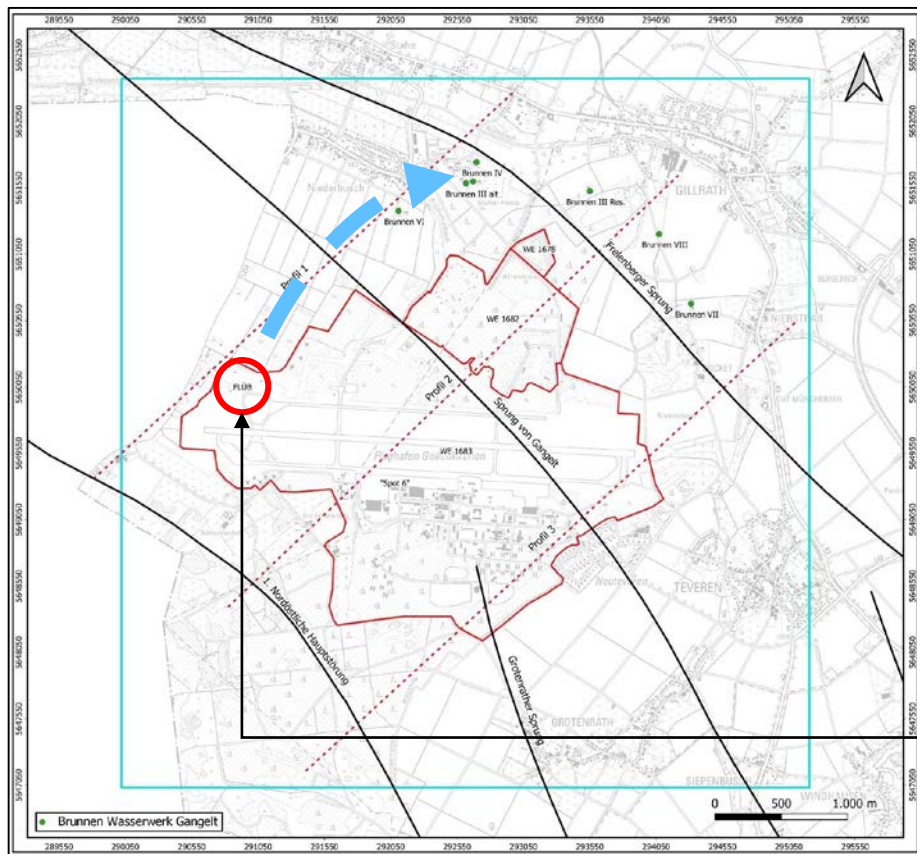


IMMEDIATE MEASURES AT THE FIREFIGHTING TRAINING SITE

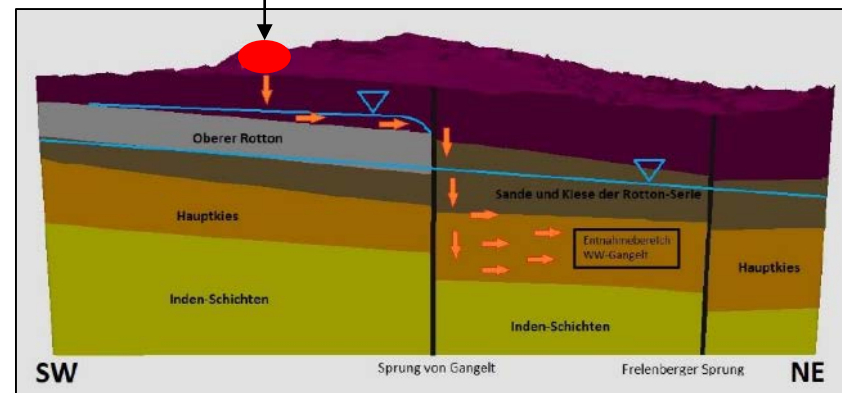
Hydraulic containment at the contamination source



HYDROGEOLOGICAL MODEL FOR GEILENKIRCHEN-TEVEREN



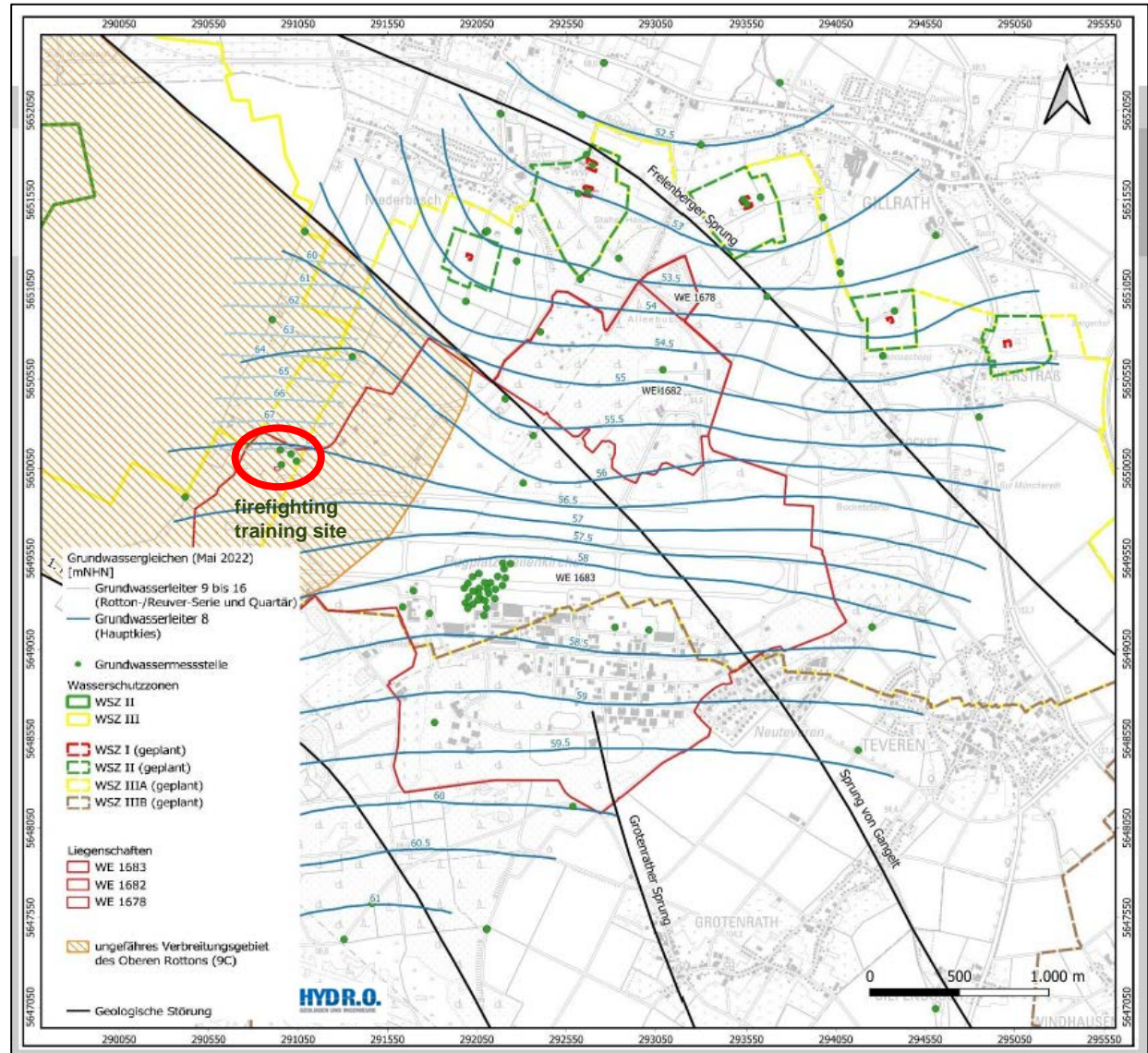
firefighting training site



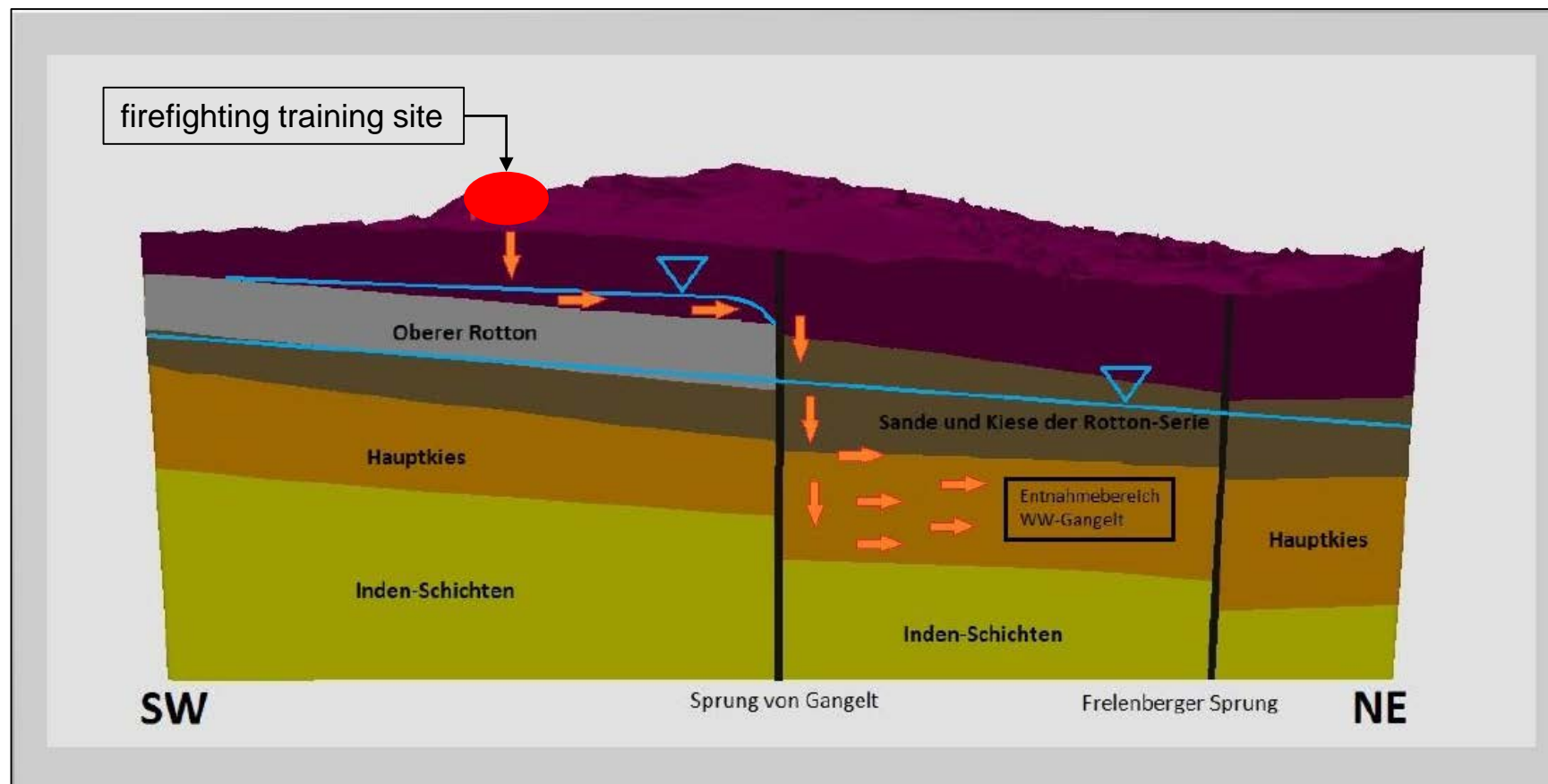
HYDROGEOLOGICAL MODEL FOR GEILENKIRCHEN-TEVEREN

Hydrogeological Conditions

- Main aquifer: main gravel
- mostly no differentiation in different groundwater storeys
- Oberer Rotton acts as an impermeable layer/ aquitard or aquiclude
- within its distribution area presumably two separated aquifers:
 - Hauptkies
 - Quarternary – Reuver-Series



Schematic pathway of PFAS-contaminated groundwater



QUESTIONS



Quelle: shutterstock.com