

INTEGRAL MONITORING OF REMEDIAL MEASURES EFFICIENCY IN STUTTGART FUA (DE)

Output factsheet: Pilot action (including investment)

Project index number and acronym	CE32 AMIIGA
Lead partner	Central Mining Institute
Output number and title	O.T2.7.1 Integral monitoring of remedial measures efficiency in Stuttgart FUA (DE)
Investment number and title (if applicable)	I2 Installation of integral monitoring wells in Stuttgart FUA (DE) to achieve efficient monitoring of remediation activities
Responsible partner (PP name and number)	PP3 State Capital of Stuttgart
Project website	www.interreg-central.eu/Content.Node/AMIIGA.html
Delivery date	06.2019

Summary description of the pilot action (including investment, if applicable) explaining its experimental nature and demonstration character

All available data on flow and contamination were collected and assessed. All data gained were imported into the database. In order to develop a conceptual model, the following investigations were performed: (i) measurements of groundwater level on 227 monitoring wells, (ii) sampling and analyzing CHC concentrations on 55 monitoring wells, (iii) 15 isotopic analysis on 10 monitoring wells, (iv) BMT groundwater analysis on 9 monitoring wells and (v) 10 BMT carrier analysis on 5 monitoring wells. Furthermore, within the investment activities, three additional monitoring wells were constructed:

- (i) AMIIGA 1 with a depth of 32 m in order to check the vertical percolation of CHCs in the area of depression, built in the major groundwater aquifer BH,
- (ii) AMIIGA 2 with a depth of 94 m in order to extend the monitoring network in deep mineral water aquifer, built in the mineral water aquifer Upper Muschelkalk and
- (iii) AMIIGA 3 with a depth of 22 m to capture the northeastern gradient and to describe, evaluate and quantify a possible vertical transfer of CHCs to deeper aquifers, built in the major groundwater aquifer BH.

The evaluation of all results enabled the development of the conceptual models for shallow and deep aquifers, describing the flow and contaminant situation in FUA Stuttgart-Feuerbach. Based on the conceptual models and previous investigations, a 3D transient groundwater model was developed. The model included seven aquifers from the quaternary to the limestone mineral water aquifer Muschelkalk. Flow and transport of CHC were calculated between 2007 and 2017 for each aquifer. The results were essential for the development of the Management plan.

An efficient monitoring network (IMN) for Stuttgart-Feuerbach was designed. The wells of the IMN were selected to capture and describe the integral contaminant situation in the major aquifer BH. One sampling campaign has been performed, which confirmed that IMN is efficient, enables further reduction of long-term monitoring costs and is easily transferable to other FUAs.

NUTS region(s) concerned by the pilot action (relevant NUTS level)

DE11 Stuttgart
DE111 Stuttgart - city region

Investment costs (EUR), if applicable

The municipality of Stuttgart spent for the investment 136,990.05 EUR.

Expected impact and benefits of the pilot action for the concerned territory and target groups and leverage of additional funds (if applicable)

AMIIGA project enabled the City of Stuttgart and the Regional Council Stuttgart to address the issue of the existing mixed CHC-plumes in public areas and their potential threat to deep aquifers. Performed integral investigations in pilot action and investments enabled to update and improve the knowledge about groundwater flow and transport of CHCs in complex hydrogeological conditions. By identifying one major groundwater aquifer (Bochinger Horizont - BH) out of seven, it was possible to design an integral monitoring network (IMN), which was tested and proved to be effective for description of the integral contaminant situation in Stuttgart-Feuerbach. The obtained findings helped establishing a groundwater Management plan for the working area Stuttgart-Feuerbach as well, aiming at a reduction of groundwater contamination and ensuring the good groundwater status.

Target groups were reached: Municipal political boards, municipal and state authorities in charge, companies dealing with groundwater contamination and/or owning groundwater monitoring wells.

Additional municipal funds were ensured.

Sustainability of the pilot action results and transferability to other territories and stakeholders.

The project demonstrated that the tools are transferable to other territories, hydrogeological conditions, types of contaminants, and administrative structures.

Lessons learned and added value of transnational cooperation of the pilot action implementation (including investment, if applicable)

The implementation of the pilot actions including investment proved the transferability to other conditions, giving a benefit to investigation measures. We demonstrated how to use the tool of integral monitoring network as a strategic instrument.

Contribution to/ compliance with:

- relevant regulatory requirements
- sustainable development - environmental effects. In case of risk of negative effects, mitigation measures introduced
- horizontal principles such as equal opportunities and non-discrimination

We proved the need for additional regulations, to fill the gap between existing regulations for site scale (too small) and water body scale (too large). The scale of several sites is not covered by existing regulations. On the other hand, the interaction between different aquifers could only be clarified by working in two scales: working scale (several sites) and FUA scale (regional scale, city and urban fringe). To ensure sustainable remediation concepts, a two-scale approach is needed. Otherwise, the impact of measures cannot be justified in an adequate way.

The equal opportunities principle was respected.

References to relevant deliverables (e.g. pilot action report, studies), investment factsheet and web-links

If applicable, additional documentation, pictures or images to be provided as annex

- Hydraulic characterization of shallow and deep aquifers (DT2.7.1, DT2.7.2)
- Contamination characterization of shallow and deep aquifers (DT2.7.3, DT2.7.4)
- Report on hydrogeological modelling of shallow aquifers (DT2.7.5)
- Report on numerical flow and transport models (DT2.7.6, DT2.7.7)
- Report on evaluation and selection of IMN for shallow aquifer (DT2.7.8)
- Hydrogeological model for deep aquifers and selection of IMN (DT2.7.9)
- Documentation on procurement procedure for new GW-wells (DT2.7.10)
- Report on installation of shallow wells (DT2.7.11)
- Report on installation of deep wells (DT2.7.12)
- Documentation on practical implementation of IMN (DT2.7.13, DT2.7.14)
- Final brochure (DC5.2) [Download](#)
- Investment fact sheet I2

All mentioned deliverables have been uploaded to the eMS and can be requested at: sandra.vasin@stuttgart.de

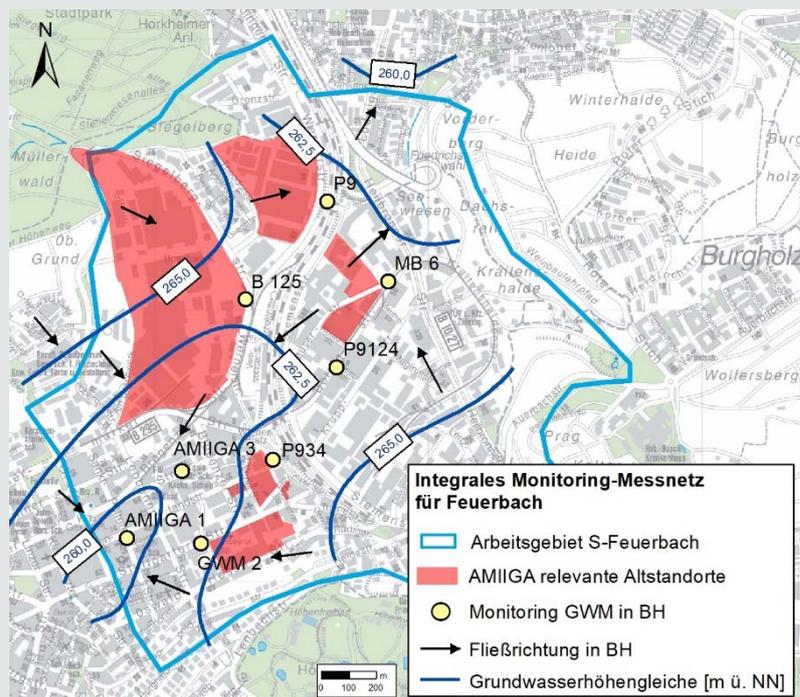


Figure 1: Integral Monitoring Network for Stuttgart-Feuerbach.