

New Quickscan method for prevention of groundwater pollution through stormwater infiltration, XRF as new quick scan method to map heavy metals in Dutch Sustainable urban Drainage Systems

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Sustainable Urban Drainages Systems (SuDS) are designed to collect, store and infiltrate large amount of surface runoff water during heavy rainfall. Surface runoff water is known to transport pollutants such as particle bound heavy metals. Therefore, a build-up of pollutants in the top-soil, of the commonly vegetated filter media is expected in SuDS such as swales.

In the Netherlands the first large scale implementation of swales in a residential area was finished 20 years ago, followed by many municipalities. In 2019 more than 500 locations with swales can be found throughout The Netherlands (www.climatescan.nl). Questions are raised by water authorities, provinces and municipalities how efficient swales are in capturing pollutants from stormwater and if pollution of groundwater can be expected threatening the quality of our drinking water. Previous studies show concerns on heavy metals in stormwater. Knowledge of heavy metal concentration in the top soil is therefore very important for assessing the purity and quality of the soil in an environment and effect on the groundwater. The concentrations of heavy metals from 30 Dutch swales older than 10 years were measured and analysed using a portable X-ray Fluorescence (XRF) spectroscopy instrument verified with soil samples analysed in laboratories with the ICP-MS and XRF methods.

This study developed a new methodology for quick scan in-situ mapping of pollutants in the top soil of SuDS. This method is time and cost efficient, easy to execute and is sufficiently precise to qualify for any known international or national threshold criteria for polluted soils. It makes time-consuming and costly interim analyses by laboratories superfluous and makes it possible to adapt monitoring schemes in the field to more detail when high concentrations are found or prevent unnecessary analyses in unpolluted areas.

The research results show that in 1 out of 5 swales older than 10 years have heavy metal concentrations higher than threshold values. The high concentrations are mostly found near inlets of the stormwater. The results of study are shared in 2 national workshops and valued as of great importance for all stakeholders in (inter)national cities that are involved in implementation of SuDS for climate adaptation. The Dutch research results will be used to update (inter-)national guidelines for design, construction and maintenance of infiltration facilities this year. Stormwater managers are strongly advised to use this quick scan method within the first 10 years after implementation of swales to map possible pollution of the top soil and prevent pollution to spread to the groundwater in urban areas.

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