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Numerical Modelling of PFAS Transport and Groundwater Flow in the Vreta-Bålsta Esker

Kevin Pettersson¹, Mona Mossadeghi Björklund², and Alexandru Tatomir¹

¹Department of Earth Sciences, Geocentrum, Uppsala University, Villavägen 16, 752 36 Uppsala, Sweden.

(Kevin.Pettersson.3537@student.uu.se)

²Bjerking AB, Sweden.

Per- and poly-fluoroalkyl substances represent a new group of anthropogenic environmental pollutants.

For instance, one of the most commonly used firefighting methods today especially within airports is the use of aqueous film forming foams (AFFFs). AFFFs contain PFAS, which give the foam the ability to easily spread over a large area. Some PFAS species have demonstrated adverse health effects already at low concentrations such as liver damage and reproductive harm. The strong chemical bonding between carbon and fluorine also results in PFAS to being resistant to thermal- and chemical degradation. Thus, they degrade very slowly in nature. In Sweden, the limit for PFAS in drinking water is 90 ng L⁻¹. This means that water needs to be treated for PFAS in the water treatment plants in cases of contamination. where water with a concentration over the limit would be used.

Bålsta is a growing city, with its proximity to Sweden's largest city and capital Stockholm and Sweden's fourth largest city Uppsala. Both located about 50 kilometres away, makes Bålsta an attractive city for people to live in and commute to their job in in the larger cities. With this growth new drinking water sources are required in the future Vreta-Bålsta area is an esker with good aquifer properties. However, it is an industrial area, and in the area lies a landfill which has been used as a training ground for firefighting exercises. During these exercises AFFFs have been used and the area is polluted with an unknown amount of PFAS. As the area is planned to be used for artificial infiltration and extraction of groundwater, it needs to be tested for potential PFAS contamination.

This study aims to investigate by means of numerical modelling different scenarios of PFAS transport from the contaminated. Using data about the topography, soil depth of the area together, hydraulic conductivity, porosity, precipitation and runoff a model of the area was constructed within GMS. The package MODFLOW was used to simulate the groundwater flow. Using the groundwater flow solution, with the PFAS transport is simulated with the package MT3DMS to produce a result of a possible spread of PFAS within the studied area to see which parts that could be contaminated or become contaminated in the future.

The results given from the model was that PFAS from the landfill would transport northeast

bound. With the southern part of the area would stay clear from all contamination from the landfill.