

Groundwater vulnerability assessment of shallow low-lying coastal aquifer in south Finland

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A shallow, unconfined, low-lying coastal aquifer in southern Finland surrounded by the Baltic Sea is vulnerable to changes of groundwater recharge, sea level rise and human activities. Groundwater intrinsic vulnerability assessments were performed for the Hanko aquifer area, south Finland by utilising the integration of 3D geological modelling, groundwater flow modelling and the ArcGIS mapping platform. Three intrinsic vulnerability mapping methods: modified SINTACS, AVI and GALDIT were applied and compared. The rating classification of SINTACS was modified based on the superficial deposit map of Finland to be most suitable for the aquifers deposit from glaciations and deglaciations depositional environments.

The results indicate that groundwater vulnerability in Hanko aquifer to the contaminations from sources on the ground surface and seawater intrusion have greatly affected by the seasonal variations of groundwater recharge and relative changes in seaward groundwater discharge. The potential of high groundwater vulnerability to contaminations from anthropogenic sources on the ground surface occurs during high groundwater recharge after the snowmelt, while the high vulnerability to seawater intrusion could take place during low groundwater recharge in the dry season. In Hanko, AVI gives a higher vulnerability index than SINTACS, while GALDIT provides more insight of the groundwater vulnerability to seawater intrusion of the coastal aquifer, particular the areas that have low hydraulic gradient and cannot be identified by SINTACS or AVI.

The methods described can be used as a guideline for the groundwater intrinsic vulnerability assessment for glacial and deglacial deposits to the contamination from anthropogenic sources and seawater intrusion in the other aquifer areas with similar physical characteristics.