



Preliminary development of a GIS-tool to assess threats to shallow groundwater quality from soil pollutants in Glasgow, UK (GRASP).

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The protection of groundwater and related surface water quality is a key aspect of the European Union Water Framework Directive and environmental legislation in many countries worldwide. Globally, the protection of urban groundwater resources and related ecosystem services is of growing concern as urbanisation increases. Although urban areas are often where groundwater resources are most in need of protection, there is frequently a lack of information about threats to groundwater quality. Most studies of soil and groundwater contamination, although detailed, are site-specific, and city-wide overviews are generally lacking. The British Geological Survey (BGS) is currently undertaking the Clyde Urban Super-Project (CUSP), delivering multi-disciplinary geoscience products for the Glasgow conurbation. Under this project, a GIS-based prioritisation tool known as GRASP (GROUNDwater And Soil Pollutants) has been trialled to aid urban planning and sustainable development by providing a broad-scale assessment of threats to groundwater quality across the conurbation. GRASP identifies areas where shallow groundwater quality is at greatest threat from the leaching and downward movement of potentially harmful metals in the soil. Metal contamination is a known problem in many urban centres including Glasgow, which has a long industrial heritage and associated contamination legacy, notably with respect to Cr. GRASP is based primarily upon an existing British Standard – International Standards Organisation methodology to determine the leaching potential of metals from soils, which has been validated for 11 metals: Al, Fe, Cd, Co, Cr, Cu, Hg, Ni, Mn, Pb and Zn (BS-ISO 15175:2004). However, the GRASP tool is innovative as it combines assessments of soil leaching potential with soil metal content data to highlight threats to shallow groundwater quality. The input parameters required for GRASP (soil pH, clay, organic matter, sesquioxide and metal content) are based upon a systematic geochemical dataset of 1600 soils (4 per km²) collected across Glasgow as part of the BGS Geochemical Baseline Survey of the Environment (G-BASE) project. These parameters are combined with assessments of climate, groundwater levels and the leaching potential of unsaturated Quaternary deposits to produce maps that prioritise the likely threats to shallow groundwater quality. Data processing for the GRASP methodology is carried out in five steps in Microsoft Excel®, using Visual Basic® programming language, and ArcGIS® software. The GRASP prioritisation tool is in the process of development; however, the rationale and initial derivation of the methodology for the city of Glasgow will be presented.