The built environment

Urban geochemical mapping

Essential information for redevelopment

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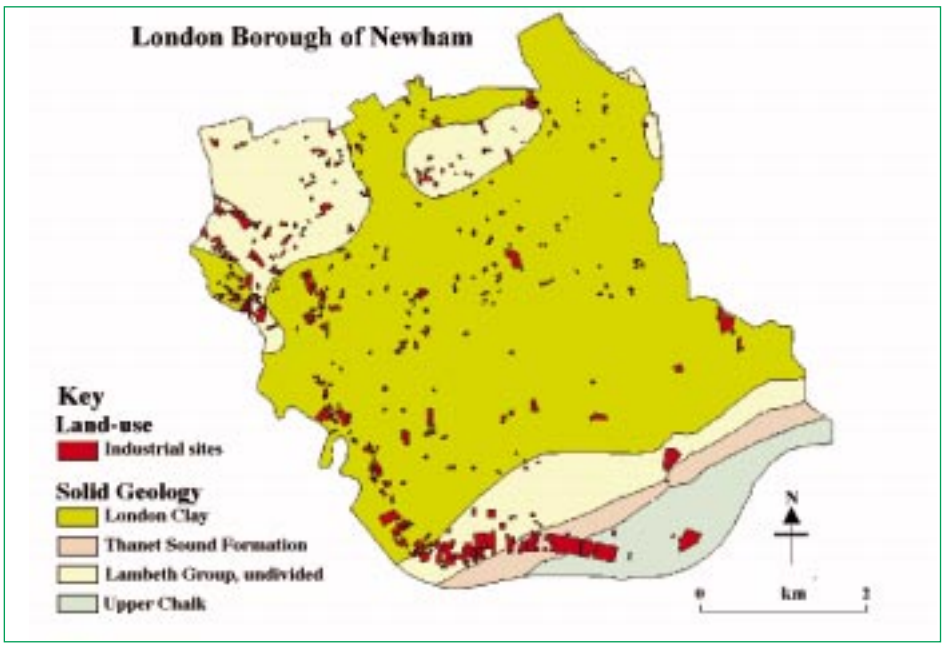
Cost-effective fit-for-purpose redevelopment of brownfield sites requires both regional and local information on the physical and chemical state of the near-surface environment. The BGS G-BASE programme is providing baseline and benchmark geochemical data for both rural and urban areas based on the collection of stream sediment, stream water and soil samples. Regional soil data provide information on the natural background levels of potentially harmful elements to which contaminated sites may be most appropriately returned. For example, studies in Wolverhampton (carried out in collaboration with Imperial College, London) show that levels of lead in top soils in the surrounding rural areas range from 23 – 129 micrograms per gram whereas levels within the city range up to 14 900 micrograms per gram. Urban soil samples provide a city-wide assessment of potentially harmful element levels and indicate areas requiring more detailed investigation. By combining these with other datasets in a GIS it is now feasible to guide brownfield reclamation on the basis of the geochemical risks to the environment and human health. Example applications include assessing the risk of groundwater contamination, distinguishing between industrial and traffic pollutant sources and the derivation of maps showing human exposure to risk.

Geochemical data have also proved useful in the identification of previously undocumented contaminated areas. Elevated concentrations of copper, lead and tin in regional soil samples occur over a documented waste disposal site to the west of Manchester. However, an apparently similar contaminant signature was identified in an area of intensive market gardening to the north of Liverpool where no waste disposal was recorded. Further investigations suggest this area was also in-filled in the past for agricultural production and has a geochemical signature consistent with foundry waste.

In areas where no geochemical information is available, a land use register (LUR) can be constructed using a GIS to deliver integrated information on contamination potential. As well as historic land use information, the LUR typically has attributed map layers of solid geology, superficial geology, artificial deposits, water abstractions and water courses and borehole catalogue. Detailed Ordnance Survey mapping of many UK cities commenced in the mid 19th century and has been updated frequently. These maps provide a considerable amount of information on the development of urban areas. A GIS with digital map layers allows the rapid assessment of the development history of a site. Knowledge of past industrial uses enables assessment of potential contamination to be made and assists in the planning of site evaluation and remediation requirements. If geochemical and related data are available the value of the LUR GIS is enhanced.

The BGS has recently completed a LUR GIS for the London Borough of Newham. The GIS combines land use layers from the mid-19th century to the present day with background information including solid geology, drift and groundwater contours. It also displays site specific information such as groundwater extraction wells, boreholes, landfill sites, areas subject to previous geotechnical investigations and geochemistry for part of the borough. A simple combination of solid geology with heavy industry enables at-a-glance assessments of which industrial sites have the highest potential to affect the Upper Chalk aquifer and highlights these areas for further investigation.



GIS generated map of major geological units and industrial land-use in the London Borough of Newham.