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# Monitoring Groundwater Contaminant Plumes Using Airborne Geophysical Data

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Under the European Union Water Framework Directive, Member States are required to assess water quality across both surface water and groundwater bodies. Subsurface pollution plumes, originating from a variety of sources, pose a significant direct risk to water quality. The monitoring and characterisation of groundwater contaminant plumes is generally invasive, time consuming and expensive. In particular, adequately capturing the contaminant plume with monitoring installations, when the extent of the feature is unknown and the presence of contamination is only evident from indirect observations, can be prohibitively expensive. This research aims to identify the extent and nature of subsurface contaminant plumes using airborne geophysical survey data. This data was collected across parts of the island of Ireland within the scope of the original Tellus and subsequent Tellus Border projects. The rapid assessment of the airborne electro-magnetic (AEM) data allowed the identification of several sites containing possible contaminant plumes. These AEM anomalies were assessed through the analysis of existing site data and field site inspections, with areas of interest being examined for metallic structures that could affect the AEM data. Electrical resistivity tomography (ERT), ground penetrating radar (GPR) and ground-based electromagnetic (EM) surveys were performed to ground-truth existing airborne data and to confirm the extent and nature of the affected area identified using the airborne data. Groundwater and surface water quality were assessed using existing field site information. Initial results collected from a landfill site underlain by basalt have indicated that the AEM data, coupled with ERT and GPR, can successfully be used to locate possible plumes and help delineate their extent. The analysis of a range of case study sites exhibiting different geological and environmental settings will allow for the development of a consistent methodology for examining the airborne data for the detection of groundwater contaminant plumes. This will provide a basis for assessing the influence that drift and bedrock geology exert on the feasibility of using Tellus airborne data as a plume monitoring tool. This research will facilitate a conjunctive approach for the detection and monitoring of pollution sources adversely affecting water bodies, as well as improve the targeting of costly intrusive monitoring and restoration efforts.