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CATCHMENT SURVEILLANCE FOR WATER RESOURCES RISK ASSESSMENT AND MANAGEMENT

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Abstract

In developed countries the application of surveillance principles for hazard identification and operational quality control have achieved a generally high standard of service for water supply in the built, water industry environment e.g. Annual reports of the Drinking Water Inspectorate for England and Wales (1991-2007). However world-wide, land abuse and pollution of water resources continue to pose significant threats to health when water flow becomes unreliable and pollutants go undetected and untreated. Risk assessments for the water supply industry are embodied in water safety plans promoted by (WHO, 2006) and these have been adopted by the UK water industry in an attempt to improve the safety of water supply from source to the end-user's tap. The Environment Agency (EA) for England and Wales has achieved a considerable degree of control over point source polluting discharges but remains concerned about the risks associated with diffuse sources of pollution. Furthermore, the European Water Framework Directive (2000) has imposed a more holistic methodology for assessing and managing water resources, requiring the harmonisation and integration of hydrological, quality monitoring and ecological assessments.

The assessment of vulnerability to surface water and groundwater resource pollution is usually dealt with separately. At first sight it would appear that greater progress has been made with assessing the vulnerability of aquifers than surface water systems to diffuse and point sources of pollution. Hydrogeological assessment of aquifers has led to the publication of dozens of methods (e.g. Aller et al., 1985, Foster and Hirata, 1985) for determining their vulnerability and, in the case of the UK, the development of a national groundwater planning and protection zone policy (Foster and Skinner, 1995). General aquifer vulnerability maps have been published by the British Geological Survey for England and Wales, and specific vulnerability to nitrate pollution by DEFRA (2008). There is no comparable methodology or policy for surface water systems. However, Fedra & Jamieson (1996) developed a GIS based decision support system WATERWARE, for integrated river-basin planning under the EU funded EUREKA programme, but this did not specifically focus on risk assessment. Therefore this presentation is concerned with the development of a general catchment surveillance methodology to locate risk hot spots to guide land use planning and regulation. Where terrain is permeable the risk of groundwater pollution is increased. Conversely where the land is impermeable, run-off and hence the likelihood of surface water pollution is increased. However, the probability of pollution occurring in either case is controlled by many different factors. The investigation of all the factors which influence the risk to which a water resource is exposed requires a multi-disciplinary approach in order to assess the interactions between factors.

This paper draws on experience from research projects in Southern England, temperate lowland river catchments (Matthews & Lloyd, 1998, Gardner, 2008), and in the Caribbean, sub-tropical mountainous river catchments (Lloyd & Thorpe, 1997) in order to present a methodology for risk assessment and management. The presentation is primarily concerned with surface waters since groundwater assessments are widely published and applied, and available from the author on request. Therefore this presentation includes the following sections:

1. Problem identification; summarising the evidence for deterioration of water resources and their principal causes.

2. Historical evidence; classical paired river basin studies. Lessons learned.

3. Case history; justification for development of catchment surveillance and outline methodology.

4. Preliminary sub-catchment risk assessment; from walk-over surveys and desk study.

5. Catchment surveillance methodology and data collection

6. Calibration of hazard factors using an Interaction Matrix

7. Application of GIS rasterised thematic overlay to identify pixel level risk hot spots.

8. Application of map outputs to develop conservation policy and regulate land use.

The overall objective of catchment surveillance is the conservation and protection of surface and groundwater sources to ensure that they may be used safely and sustainably. At the end of the presentation the benefits and limitations of the overall strategy and methodology will be discussed.