

MODELLING A COMPLEX MIXTURE OF POINT AND DIFFUSE MICROBIOLOGICAL INPUTS TO HIGH ENERGY AND TURBID ESTUARINE BATHING WATERS: THE SEVERN ESTUARY, UK

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This paper reports on the development of a linked modelling strategy which is being used to predict bacterial concentrations at bathing water compliance points in the Severn Estuary, UK. Hourly bacterial delivery budgets from diffuse and point sources, principally modelled data for rivers and empirical data for waste water treatment works, are used as input data for a two dimensional hydrodynamic water quality model of the estuary containing deposition and re-entrainment components and facilitating 'real-time' estimates of bacterial inactivation (T_{90}).

The 'linked' modelling approach has been developed with support from the UK Environment Agency and the EPSRC-WITE programme. It facilitates examination of alternative remediation strategies balancing diffuse and point source loadings.

A particular focus of this project has been a laboratory-based investigation of the impacts of water quality parameters on the inactivation of faecal indicators in these estuarine waters. Even where waters have been irradiated using light intensities and spectra characteristic of mid-day, high-summer conditions at this latitude, very long T_{90} values have been calculated for intestinal enterococci where high suspended solid concentrations have been observed. It is important to note that elevated suspended solid concentrations are frequently associated with the episodic diffuse source inputs of faecal indicators to coastal waters. Thus, the protection against bacterial inactivation provided by high turbidity suggests that distant diffuse sources of faecal indicators could impact on recreational compliance locations where transport is relatively rapid as is the case in estuarine systems with a high tidal range.

This implies that, under the environmental conditions observed in many high energy estuarine environments, it is vital to build the diffuse source component into a modelling strategy designed to provide reliable information for regulators and infrastructure managers.

Key words: Hydrodynamic water quality modelling, faecal indicators, diffuse sources, T_{90} values.