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Reducing Nutrient Loads in Northern Irish Catchments: A Modelling Approach Based on Load Apportionment and Flow Pathway Identification

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Northern Ireland has been somewhat overlooked in terms of water quality modelling in the past. Many of its catchments have consistently failed to meet Water Framework Directive targets especially due to high levels of dissolved nutrients and poor ecological status. A catchment based modelling study to address this issue has not been undertaken here previously and the approach described here uses two water quality models to achieve this aim. The objectives of the modelling were firstly to identify the total load reductions (in terms of Phosphorus (P)) required to reduce in-stream loadings sufficiently for concentrations of soluble reactive P (SRP) to be reduced to achieve the WFD "Good" status levels, and secondly to split these loadings into diffuse and point components. The third objective was to identify the most likely flow pathways for the transport of the diffuse component of P to the watercourses particularly for the agricultural (mostly intensive grassland farming) land use which dominates in almost all NI catchments.

The first model applied is the Source Load Apportionment Model (SLAM) developed by the Irish EPA. This model provides a large-scale assessment of the point and diffuse load components across catchments where multiple pressures are occurring. The second model us the Catchment Runoff Flux Assessment Tool (CRAFT) which is able to back-calculate nutrient loads associated with three major flow pathways. SLAM is a static model which uses averaged loadings from diffuse agriculture and non-agricultural land uses, and point sources (where information can be obtained from various sources) to calculate N and P exports. For P, the agricultural diffuse load component uses an enhanced version of the export coefficient approach based on combining the sources of P from applied nutrients (slurry and fertiliser) and soil P. A modelling tool allows the user to evaluate load reduction scenarios where one or several components of P (both point and diffuse) are adjusted downwards to achieve the catchment's required load reduction. The CRAFT model works on a dynamic (daily) modelling scale and has simulated sub-catchments where the SLAM model has identified the need for significant load reductions. It identifies the different reductions (P export) that are required for each flow pathway, which will then inform on the type of additional measures (e.g. sediment traps, riparian buffer strips and wetlands) that may also be required.

The initial aim of this study is to complete a pilot application to the trans-border (UK and ROI) Blackwater catchment (1360 km^2). Through a review of alternative modelling options for the whole

area of NI, an assessment of whether this approach is suitable for application to the entire territory can be made.