Title: Fingerprinting of small point discharges and the impact on receiving waters

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Abstract:

In recent years, discharges of small point sources of pollutants such as septic tanks were recognised as significant contributors to receiving waters' pathogen and nutrient inputs. However there is little data available on which to judge the potential risks that septic tank effluents (STE) pose to water quality and human health. Here, we present a broad analysis of domestic STE discharges and assess their characteristics in terms of management-related risk factors and their potential effect on stream water quality if discharged directly to water courses without treatment. Septic tank effluents from residential households in North East of Scotland were fingerprinted along with receiving waters. Effluents' bio-physicochemical characterisation was conducted and information on tank age, management and number of users were collected. Biological screening revealed that mean total coliforms, faecal coliforms and *E.coli* concentrations were: $2.4x10^7$, $3.2x10^6$ and $1.3x10^6$ MPN/100 ml, respectively. Effluent pH was dominantly neutral, while mean electrical conductivity, turbidity and alkalinity were 866±69 μS/cm, 198±34 NTU and 303±27 mg/L, respectively. Chemical parameters such as total phosphorus (TP), dissolved P (DP), total nitrogen (TN), ammonium-N (NH_4-N) and dissolved organic carbon (DOC) mean concentrations were 14.55±1.46, 9.49±1.18, 68±6, 55±6 and 48±7 mg/L, respectively. The potential enrichment of domestic point source discharges to receiving waters is of concern particularly for faecal coliforms, NH_4-N, DP, soluble reactive P, copper, dissolved N, DOC and potassium since their enrichment factors were >1340, 1651, 213, 176, 63, 14, 11 and 8 times that of stream waters, respectively. Factors such as tank condition, management and number of users had significantly influenced effluent quality ($P<0.05$) particularly for tanks that received dishwasher wastes and roof runoffs. The findings of this study highlighted the potential

impact of STE discharges on receiving waters and call for mitigation strategies to reduce STE discharges to improve water quality.