

Solving nutrient problems in Canterbury agricultural waterways

Mr. Brandon Goeller¹, Dr. Catherine Febria¹, Dr. Helen Warburton¹, Ms. Hayley Devlin¹, Prof Jon Harding¹, Prof Angus McIntosh¹

¹*University Of Canterbury*

A vast network of surface- and subsurface drains supports agricultural production on the Canterbury Plains, South Island, New Zealand, but those drains can be thought of as 'leaky plumbing' because they often transport leached nutrients downstream, circumventing riparian protection networks. A multi-scale spatial approach within the Canterbury Waterway Rehabilitation Experiment (CAREX) was used to quantify the export of nitrate-nitrogen in small agricultural headwaters <2 m wide to identify leaky plumbing and trial stream rehabilitation tools. Water quality parameters, including nitrate-N concentrations, were continuously measured and supplemented with grab samples to characterize nitrate-N fluxes. Between-stream differences accounted for 94% of the variation in nitrate-N concentrations across the nine waterways studied, but inclusion of nutrient 'hotspots' accounted for 11% of the variation in nitrate-N concentrations within the 1-km study reaches. The daily flux of nitrate-N ranged from <1 to >50 kg/day at the bottom of study reaches with <0.01 to >5 kg/day from tile drain 'hotspots'. To complement existing stock exclusion and riparian planting measures, edge-of-field denitrifying bioreactors and in-stream additions of labile carbon were trialled to reduce downstream export of nitrate-N. Early results show that bioreactors could reduce downstream nitrate-N export during all seasons without impeding the drainage function of agricultural waterways; however, in-stream solutions are needed to address the large downstream flux of nitrate-N that is not removed by edge-of-field and riparian nutrient tools. This emphasizes the need for a toolbox-based stream rehabilitation approach which addresses the scale and source of nutrient problems in agricultural waterways. Practical, cost-effective stream rehabilitation tools are recommended to address downstream nutrient export while catchment-scale nutrient plans are developed to address losses from land.