Nutrient removal from agriculturally-impacted streams using floating treatment wetlands

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Agricultural land-use is a major contributor to diffuse water pollution and the consequent eutrophication of inland and coastal waters around the globe. Interception of diffuse agricultural run-off using constructed and restored wetlands can complement improved source control measures to reduce nutrient losses from agricultural landscapes and buffer impacts on receiving waters (Mitsch et al. 2000, Tanner and Sukias, 2011). The ability of conventional wetlands to remove nutrients from diffuse flows from agricultural land is now reasonably well established, with practical guidelines now emerging.

Floating treatment wetlands (FTWs) are an innovative new wetland type with significant potential for nutrient management in ponds, lakes and slow-flowing waters (Headley and Tanner 2011). They involve emergent wetland plants growing on tethered buoyant mats or rafts on the water surface (Figure 1). The plant roots grow through the floating mat and into the water below. As well as assimilating nutrients directly from the water column (rather than the bottom sediments), the roots provide a large surface area for adsorption and biofilm attachment. Because FTWs can tolerate deep and fluctuating water levels, they can be used in situations where use of conventional surface-flow wetlands with bottom-rooted emergent aquatic macrophytes would be precluded. They therefore expand the range of situations where wetland treatment can be applied for water quality enhancement. At present there is little reliable quantitative information available on the nutrient removal performance of FTWs, and what is available is from relatively small-scale and short-term mesocosm studies for urban stormwaters (Tanner and Headley, 2010) or higher strength wastewaters (Van de Moortel et al. 2010).

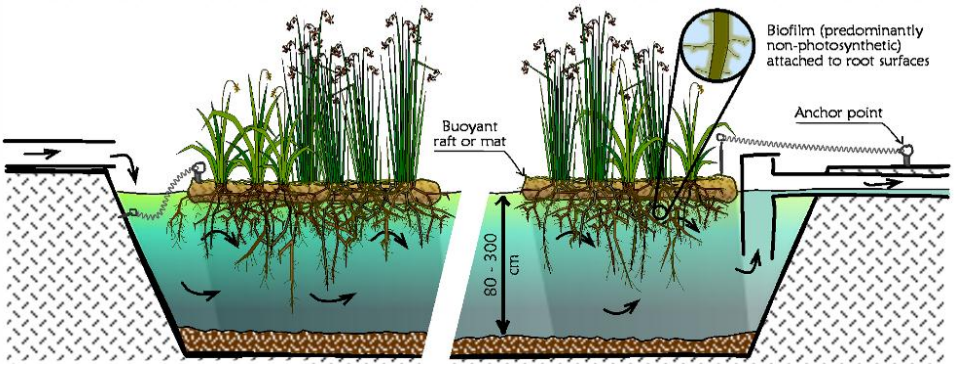

Figure 1: Cross-section of FTWs from Headley and Tanner (2011).

This paper briefly introduces the key elements of this novel new ecotechnology and reports nutrient removal rates recorded over 9-12 months in two recent pilot-scale field trials carried out in New Zealand to evaluate nutrient removal performance from streams impacted by diffuse agricultural pollution. The first trial involved off-channel FTWs receiving two different flow rates of water from the Maero Stream

before it enters Lake Rotoehu, Rotorua. An example of data for two key forms of available nutrients is shown in Fig. 2. The second trial was carried in-channel in a small tributary entering the Tukipo Stream in Hawkes Bay (Fig 3).

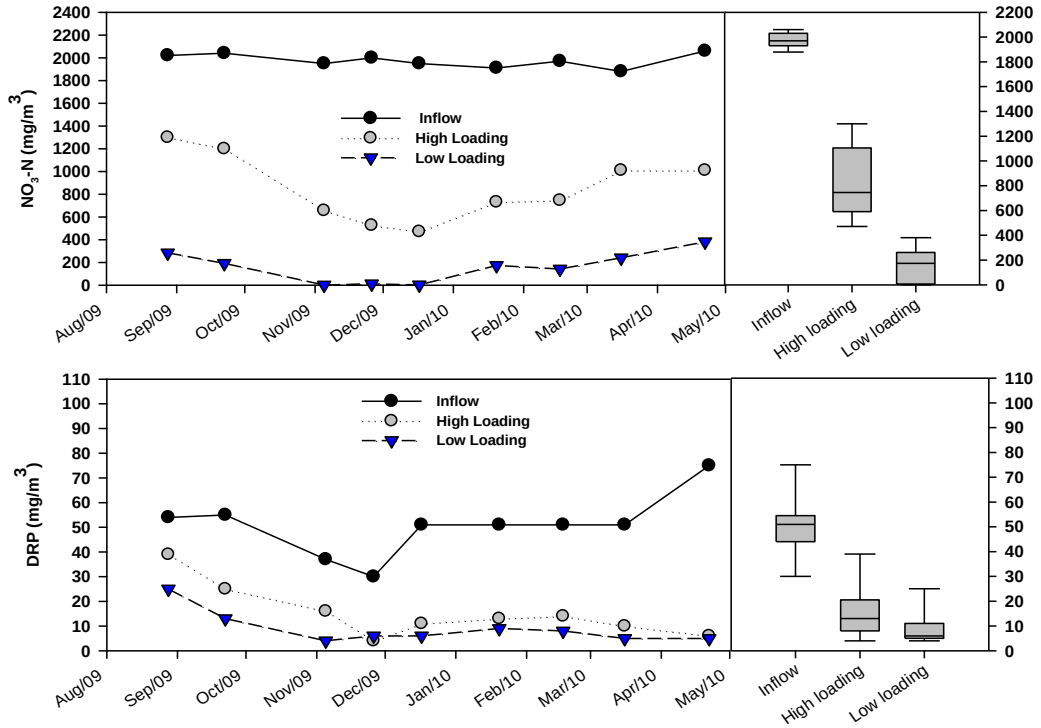

Figure 2. Nitrate-N (top) and DRP (bottom) concentrations measured in the inflows and outflows of the high- and low-loaded off-channel FTWs at Rotoehu.

Figure 3. In-channel application of FTW for treatment of agricultural drain-flows into the Tukipo River, Hawkes Bay.

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