EKETAHUNA WASTEWATER TREATMENT PLANT WETLAND: SUMMARY OF EVIDENCE OF ROGER JOHN MACGIBBON (WETLAND DESIGN) FOR TARARUA DISTRICT COUNCIL

1. The driving purpose behind the wetland proposed for the EWWTP is to address Policy 5-11 in the Horizons One Plan and recognise cultural issues associated with a direct discharge of treated human wastewater to water.

2. Well-designed and well-maintained Surface Flow wetlands have the ability to extract over 90% of the nitrate that enters as discharge or drainage water. Nitrate extraction occurs by a process called denitrification that is driven by naturally occurring denitrifying bacteria.

3. High levels of denitrification occur when water remains in the wetland for prolonged periods (residence time) and the interaction of water and nitrate molecules with organic matter (soil and vegetation) is maximised.

4. Residence time and the rate of denitrification are useful indicators of the effectiveness of land-based treatment of wastewater and therefore useful indicators of the ability of the wetland to 'polish' wastewater and to address Policy 5-11 (in providing for land passage before wastewater is discharged to water).

5. The design requirements to optimise nitrate removal and interaction between water and organic material in SF wetlands are:

    (a) The wetland should be fully covered in sedges, reeds and rushes with no open water areas. Denitrifying bacteria require high levels of organic material to flourish.

    (b) Water levels within the wetland should not exceed 500mm (optimum level is 300mm).

    (c) The wetland should be flat bottomed and have a length to width ratio of between 3:1 and 5:1.

    (d) Only plant species tolerant of permanent immersion in water should be used.

    A sequence of photos demonstrating these aspects of design at some constructed wetland sites are appended at the end of this summary.

6. The proposed location of the Eketahuna WWTP wetland is on the lower terrace of the Eketahuna Golf Course beside the Makakahi River. There is sufficient room at the proposed site to construct a 5500m^2 wetland.

7. The Eketahuna SF wetland has been designed to hold 100% of the volume of the maximum recorded daily discharge (including water arising from stormwater intrusion) for a minimum period of 24 hours.

8. Median flows will be retained in the wetland for over 4 days which should result in nitrate extraction of well over 50% if the wetland is well maintained.

9. While the wetland will be lined with a layer of substrate with a high clay or silt content to reduce the rate of downward percolation of discharge through into the groundwater to no more than 10% of the average daily inflow, slow percolation through the wetland base is desirable because it increases the rate of denitrification and therefore the effectiveness of water treatment.

10. On-going plant maintenance is necessary to ensure the plants retain their vigour and the wetland continues to extract nitrate at optimal levels. All of the sedges, rushes and reeds planted in the treatment wetland will need to be heavily topped approximately every five years to restore vigour, and any gaps filled with replacement plants.

11. The Eketahuna WWTP wetland will, if well-established and maintained, serve to further polish the wastewater discharge flowing from the WWTP and, because of the long median residence time of the discharge in the wetland, adequately meet the Policy 5-11 definition of application to land and overland flow.

Figure 1: Constructed treatment wetland at Putaruru showing shallow, flat-bottomed wetland bays before the wetland has been planted.

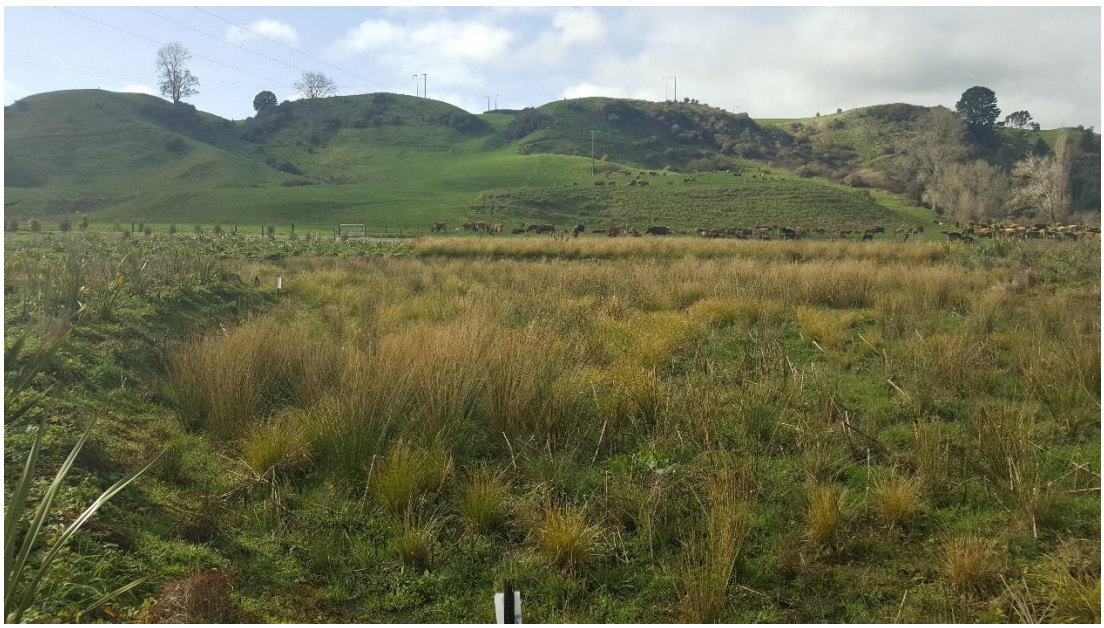

Figure 2: Putaruru wetland 8 months after planting. The wetland bay in view has a 20cm deep cover of water across its width.

Figure 3: Owl Farm wetland Cambridge: Planting of rushes and sedges across the full width of the wetland

Figure 4: Drone view of the Owl Farm wetland bays 8 to 10 months after planting

Figure 5: Well established wetland vegetation at the Ocean Farm (Ashburton District Council) WWTP wetland. Wetland bays are to the left and right of the central grass dividing bund.