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WATER QUALITY MONITORING AT LOVEDAY DISPOSAL BASIN DURING THE WETTING AND DRYING CYCLE

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Executive Summary

Loveday Disposal Basin is a River Murray wetland near Barmera, South Australia, that was used as a disposal basin for excess irrigation drainage between 1970 and 2000. Loveday Basin has been targeted by the Murray-Darling Basin Commission and the SA Department of Water, Land and Biodiversity Conservation (DWLBC) as the test case for the rehabilitation of disposal basins located on floodplains. In collaboration with DWLBC, CRC LEME and CSIRO Land and Water initiated a water quality monitoring program between May 2005 and March 2007 to follow the changes in water quality in the wetland during a wetting and drying cycle.

Loveday consists of two shallow basins (North and South) connected by several culverts, with each basin having a controlled inlet connecting them to the River Murray. For the purpose of the experiment, the culverts were blocked, isolating the basins. Prior to flooding, the North Basin was saline (Total Dissolved Solids = 40 – 80 g L⁻¹) and partially dry while the South basin was saline and ephemeral. In addition to drainage discharge (North Basin only) and rainfall, the basins are also a groundwater discharge zone (North) or a groundwater flowthrough zone (South Basin) for a groundwater mound under nearby irrigated crops.

Filling of the basins was initiated in May (North) and June (South) 2006 and both basins were filled by the end of August 2006. Salinity decreased in both basins but remained saline (7 – 9 g L⁻¹). Despite the shallow depth of the basin (~1.2 m), freshwater inputs to Loveday North did not immediately mix with the resident saline water. The resulting density stratification persisted for a month. No evidence of density stratification was found in the South Basin. Despite large concentrations of sulfides in sediments, which had been exposed to the atmosphere prior to flooding, the wetlands remained neutral to alkaline throughout all phases of the wetting and drying cycle. This is consistent with the presence of a large quantity of acid buffering capacity stored as sedimentary carbonates in this disposal basin.

The reduction in salinity observed in both basins was short-lived. Once the inlets were closed, water level in the wetlands quickly receded and salinity increased. This process was accelerated by high evaporation rates during December 2006 to March 2007, when a drought prevailed in the Murray-Darling Basin. Because it is shallower and had a larger surface area once flooded, evaporative losses were especially large in the South Basin relative to its volume. A decline in the regional water table fostered by the drought may have also contributed to the volume loss, especially in the South Basin. By the end of the monitoring program (March 2007), the two basins had returned to pre-flooding salinities and water levels.

A preliminary salt balance of the North Basin suggests that wetting and drying cycles can focus floodplain salt storage in the water column of disposal basins. This would occur because floodwaters pick-up salt from surface salt efflorescences, saline vadose zone water, or shallow saline groundwater from previously dried wetland

areas. This process may in turn favour salt export from the wetland by increasing the potential for groundwater convection (i.e., the “sinking” of brines in aquifers).

Overall wetting and drying cycles by themselves bring limited environmental benefits to floodplain disposal basins because the decrease in salinity is too small and temporary to re-establish freshwater aquatic communities. By concentrating salts in the water column, wetting and drying cycles may be beneficial to help export salt from floodplains when combined with periodic flushing of disposal basins.