Fluxes and transformations of treated sewage effluent recharging a coastal aquifer

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Over 80% of Australia's population inhabit coastal regions due to climatic conditions and resource availability. Urban populations along the coastline have increased significantly over recent decades in response to population growth, tourism and the 'sea change' phenomenon. This places pressure on existing sewerage infrastructure. Disposal of treated sewage effluent to meet the requirements of increasing and highly fluctuating seasonal populations occurs via several pathways including exfiltration ponds and trenches excavated in marine sands immediately behind beach dune systems. The treated effluent infiltrates the sands and recharges local aquifers.

The pathways, fluxes and transformations of treated effluent have been investigated at an exfiltration pond in Merimbula, on the Far South Coast of NSW, Australia. Localised mounding of the watertable, and consequent changes in hydraulic gradient, impose different flow directions for groundwater, along which O_2 – NO_3 and Fe-Mn redox, and pH, boundaries are intercepted. The groundwater concentrations of redox sensitive elements H_2S, SO_4, Fe^{2+}, Mn and NO_3, vary according to position relative to these redox and pH boundaries, and distance from the exfiltration ponds. There is also evidence of attenuation of PO_4^{3+} in groundwater compared with treated effluent, due to adsorption to Fe coated sands, co-precipitation with Fe and Ca, and uptake by vegetation.