

An Assessment of Soil Contamination by Sewage Leakage from Inspection Hatches in the Manly Dam Catchment

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Sewage disposal poses globally pervasive ecological and human health risks. Freshwater ecosystems are vulnerable to toxicity, eutrophication and pathogen contamination resulting from sewage disposal. Piped sewage is the norm in developed countries, but pipes always leak, and inspection hatches are likely leakage points when rainfall causes pressure increases. The aim of this study was to understand how sewage spills at inspection hatches (IH) along a domestic sewerage line might affect freshwater ecosystems and human health in the Manly Dam catchment. Three inspection hatches were identified and soil was collected from above (at a higher elevation) and below (at a lower elevation). The soil was elutriated and the leachate used as a model for freshwater contamination. Bioassays of the leachate were performed using the native Australian cladoceran *Ceriodaphnia cf. dubia* to indicate toxicity; accelerated growth of the native Australian green alga *Pseudokirchneriella subcapitata* to indicate nutrient enrichment and inhibition of growth to confirm toxicity. Three levels of bioassessment were undertaken. 1) Screening tests included chemical analysis, acute cladoceran tests and undiluted leachate algal growth/inhibition tests. 2) Definitive tests included chronic cladoceran tests and serially diluted leachate growth/inhibition tests. 3) Preliminary scoping microbial faecal contamination tests were used to indicate human health risks. Screening results were ambiguous. Chemical screening indicated elevated zinc and nutrient concentrations below hatches. Bioassay screening confirmed nutrient enrichment with elevated algal growth below hatches (but also above hatches). Elevated algal growth was inhibited below the visually most contaminated site (hatch1) indicating possible toxicity. Cladoceran acute tests detected anomalous toxicity in "above" samples at IH2 and IH3, which is difficult to explain from available data. Definitive testing added some clarity confirming algal toxicity below hatch 1. The chronic cladoceran tests indicated toxicity above and at distances below hatch 1 (but no effect immediately below) and immediately below hatch 2. Microbiological scoping indicated the presence of faecal coliforms below hatch 1. The most consistent evidence is that sewage has contaminated soils below the hatch with the greatest visual evidence. There is also evidence of additional toxic contamination from unknown sources in the area. Overall risk to Manly Dam was qualitatively judged as "low".