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Innovative Technologies for Fit-For-Purpose Water Production
C1.2 Cities as Water Supply Catchments
Risk and Health: Understanding Stormwater Quality Hazards
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Pathogenic bacteria in stormwater runoff

Factors influencing presence and potential human health risks

Introduction

Communities can increase their resilience to the impacts of climate change and population growth by utilising stormwater as a resource. Harvesting and reusing stormwater runoff provides a range of ecosystem services including increased water security. In Australia, the paucity of knowledge regrading human health hazards in stormwater has been a barrier to the rate of uptake of stormwater reuse schemes, and to the range of end use scenarios adopted for implemented schemes.

Aims

This research seeks to characterise potential health risks associated with pathogenic bacteria present in untreated stormwater runoff. Specific attention is paid to identifying bacteria individuals may be exposed to via ingestion, inhalation or dermal contact during the reuse of harvested stormwater. In addition this research seeks to increase knowledge regarding the role of catchment characteristics and storm sewer infrastructure in influencing the presence or absence of pathogenic bacteria in stormwater.

Methods

A mixed methods approach was utilised collecting quantitative water quality data and qualitative and quantitative catchment characteristics data through catchment audits. The water quality monitoring program had two distinct sampling stages. In Stage 1 culture based methods were used to identify and enumerate *Campylobacter spp.* in runoff from three (3) Melbourne drains collected during wet and dry weather. Stage 2 uses culture and molecular methods to determine the presence of *Campylobacter jejuni, Legionella pneumophila* and *Staphylococcus aureus* in rainfall event samples from ten (10) catchments across four states (QLD, NSW, VIC & SA) with differing land uses and climatic conditions.

Results

Campylobacter spp. were detected in 84 percent of dry weather samples (n=94) and in all but one wet weather sample (n=38) in samples from the Stage 1 campaign. Highest counts were observed in rainfall event samples, detections ranged from 1-160 MPN/L compared to dry weather, where detections ranged from 1-43MPN/L. Detections were highly variable during both rainfall events and dry weather conditions at all sites across the six month period (see Figures 1-3). Median *Campylobacter* spp. detections were significantly different for rainfall events compared to dry weather/base flow conditions at two of the three sites, HMD East (Wet *Mdn* = 11.0, Dry *Mdn* = 3.2, *U* = 95, *p*=0.007) and PMD (Wet *Mdn* = 14.0, Dry *Mdn* = 1.55, *U* = 38.5, *p*=0.001) (see Figure 4).

Conclusions

Results from Stage 1 indicate *Campylobacter spp*. may be present in higher numbers in stormwater than previously reported and more prevalent in wet weather samples compared to dry weather. This suggests that sewage ingress into stormwater occurs more frequently than previously anticipated. Stage 2 sampling results will be analysed in conjunction with catchment characteristics data to increase knowledge of the range of pathogenic bacteria in untreated stormwater and the influence of catchment characteristics in determining the microbial quality of stormwater runoff. Knowledge gained in this study will inform the development of guidelines and future strategies for managing human health risks associated with stormwater harvesting and reuse.

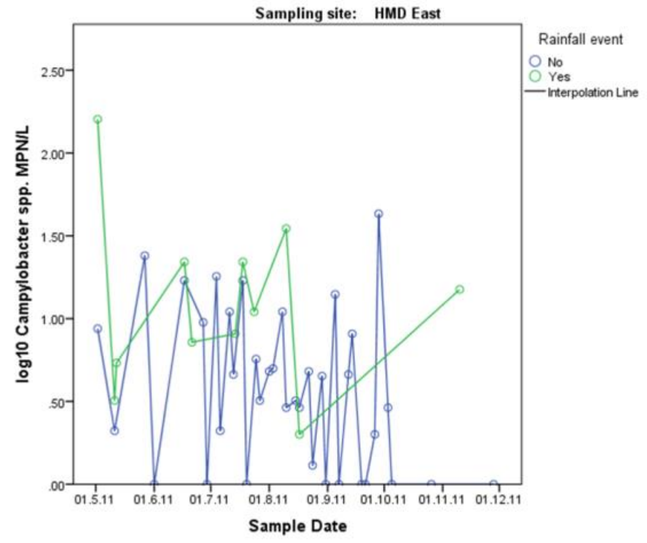

Figure 1. *Campylobacter* spp. detections HMD East May-Nov 2011

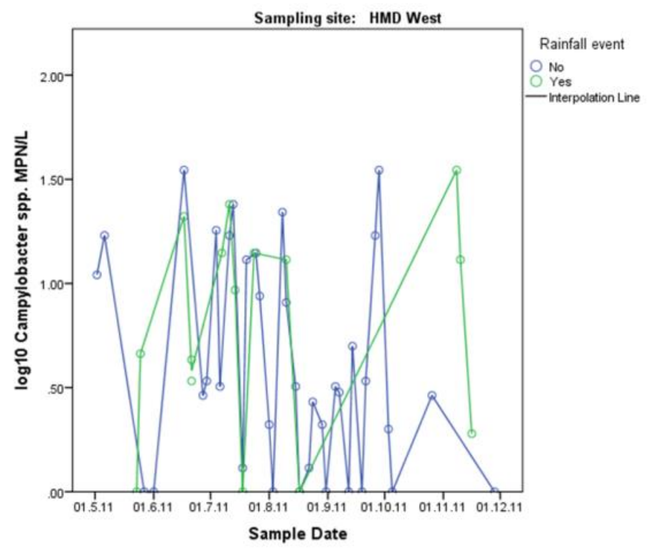

Figure 2. *Campylobacter spp*. detections HMD West May-Nov 2011

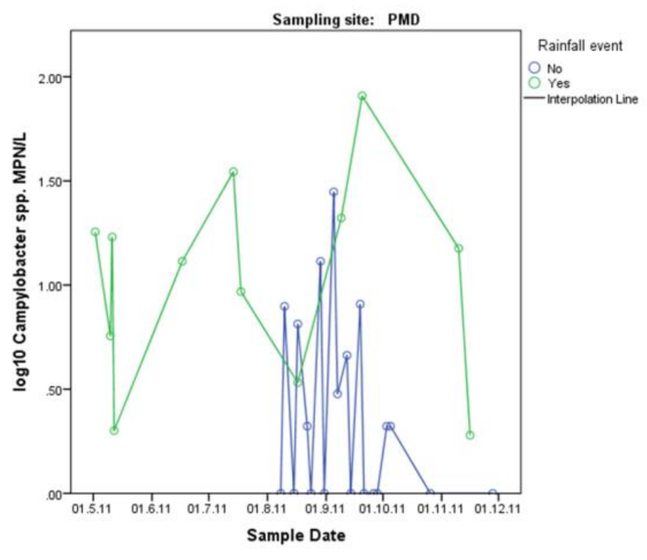

Figure 3. *Campylobacter* spp. detections PMD May-Nov 2011

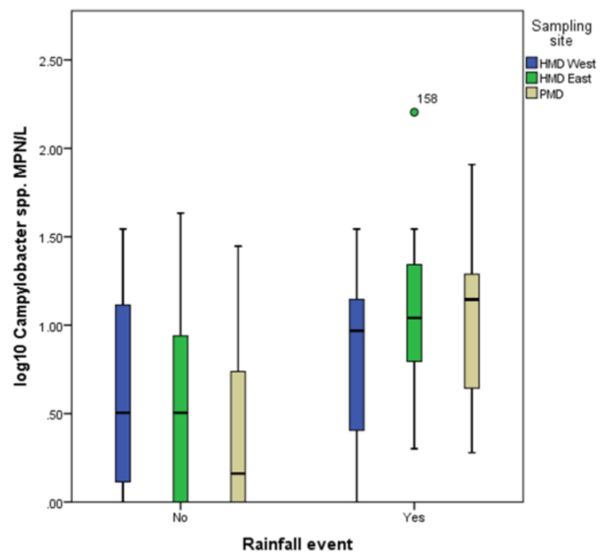

Figure 4. Detections of *Campylobacter* spp. in three Melbourne stormwater drains May-Nov 2011

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