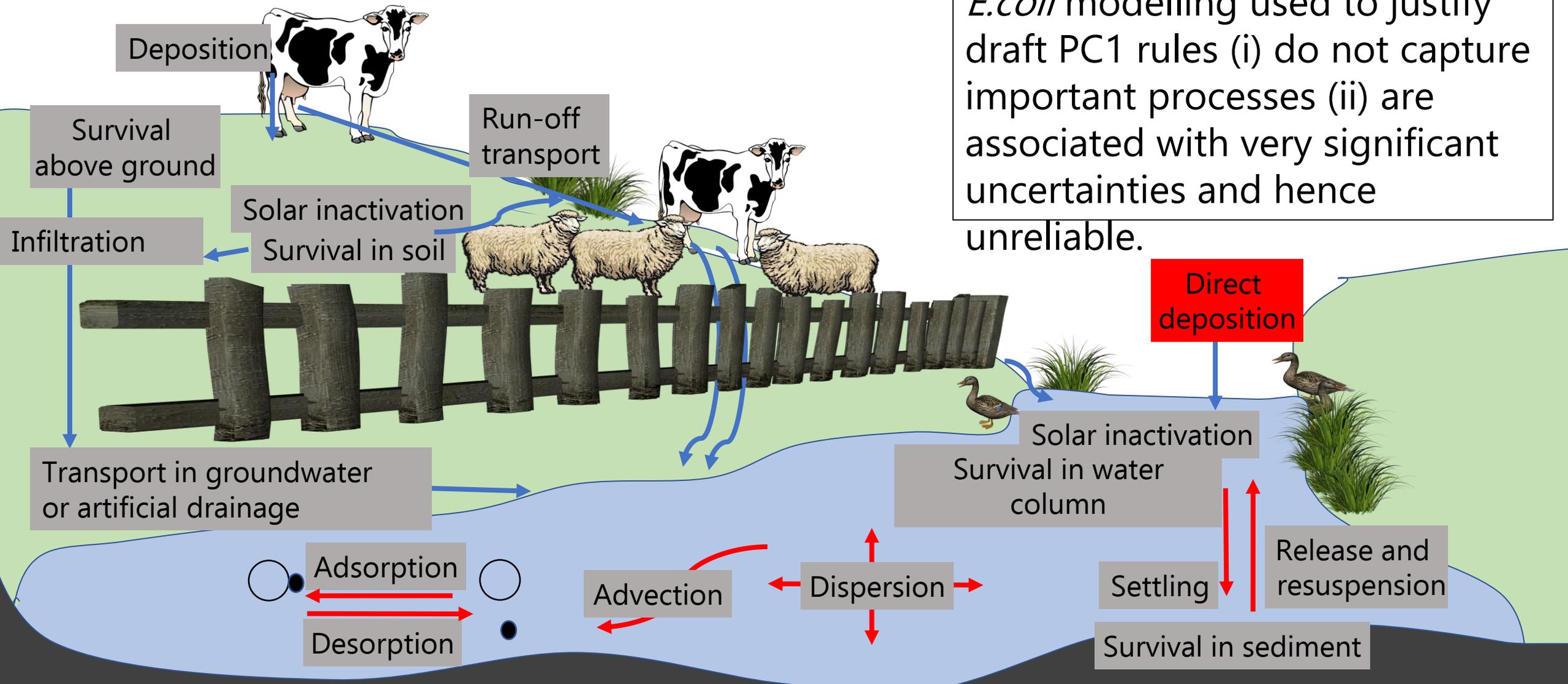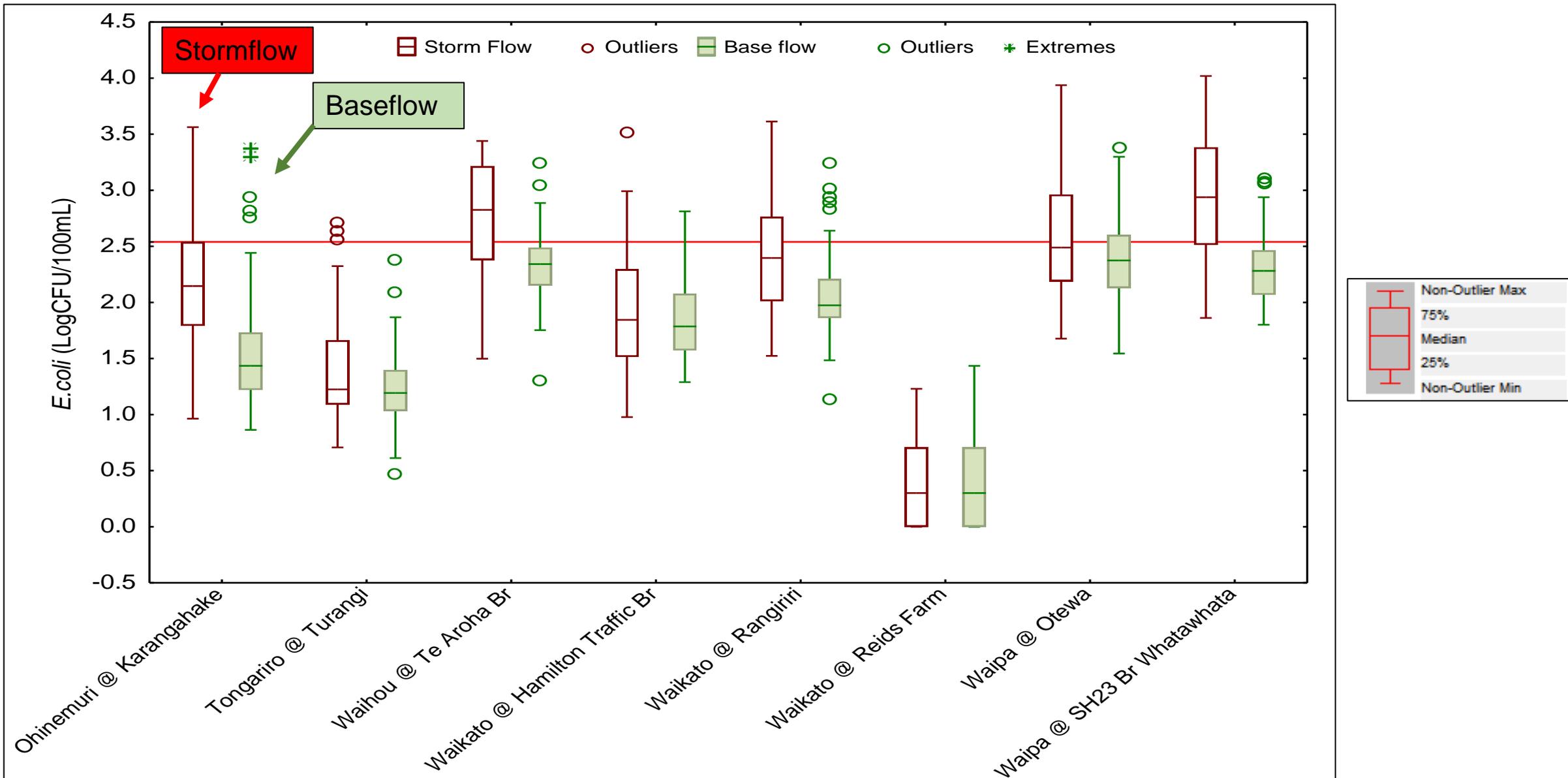Streamlined
ENVIRONMENTAL

WRPC1 Microbial Evidence
Chris Dada (PhD)

On-land and In-stream processes that drive variabilities of *E.coli* concentrations in pastoral catchments

E.coli modelling used to justify draft PC1 rules (i) do not capture important processes (ii) are associated with very significant uncertainties and hence unreliable.

Deposition

Survival above ground

Infiltration

Run-off transport

Solar inactivation

Survival in soil

Transport in groundwater or artificial drainage

Adsorption

Desorption

Advection

Dispersion

Direct deposition

Solar inactivation

Survival in water column

Settling

Release and resuspension

Survival in sediment

Box plots of *E.coli* concentrations during baseflow and storm flow conditions, Waikato Region waterways, 2007-2013.
Red horizontal line is the 540 CFU/100mL *E.coli* threshold

Table : *E. coli* and faecal source tracking results for Karapiro, Komakorau, Mangaone, Mangaonua and Mangawhero Streams (5 PC1 streams)

Discharge condition	Faecal Pollution Source	No. of samples positive for marker	Total No. of observations	Prevalence (%)
Low flow	Wildfowl	11	14	78.6
Low flow	Cattle	6	14	42.9
Rainfall-impacted	Wildfowl	15	15	100
Rainfall-impacted	cattle	11	15	73.3

(adapted from Moriarty, 2015)

Key Highlights from the Moriarty study
- only 5 out of 61 PC1 streams were included in the study
- High prevalence of wildfowl markers during conditions of low flow (the most critical times for public exposure to health risk) coupled with the comparatively low prevalence of cattle markers during conditions of low flow
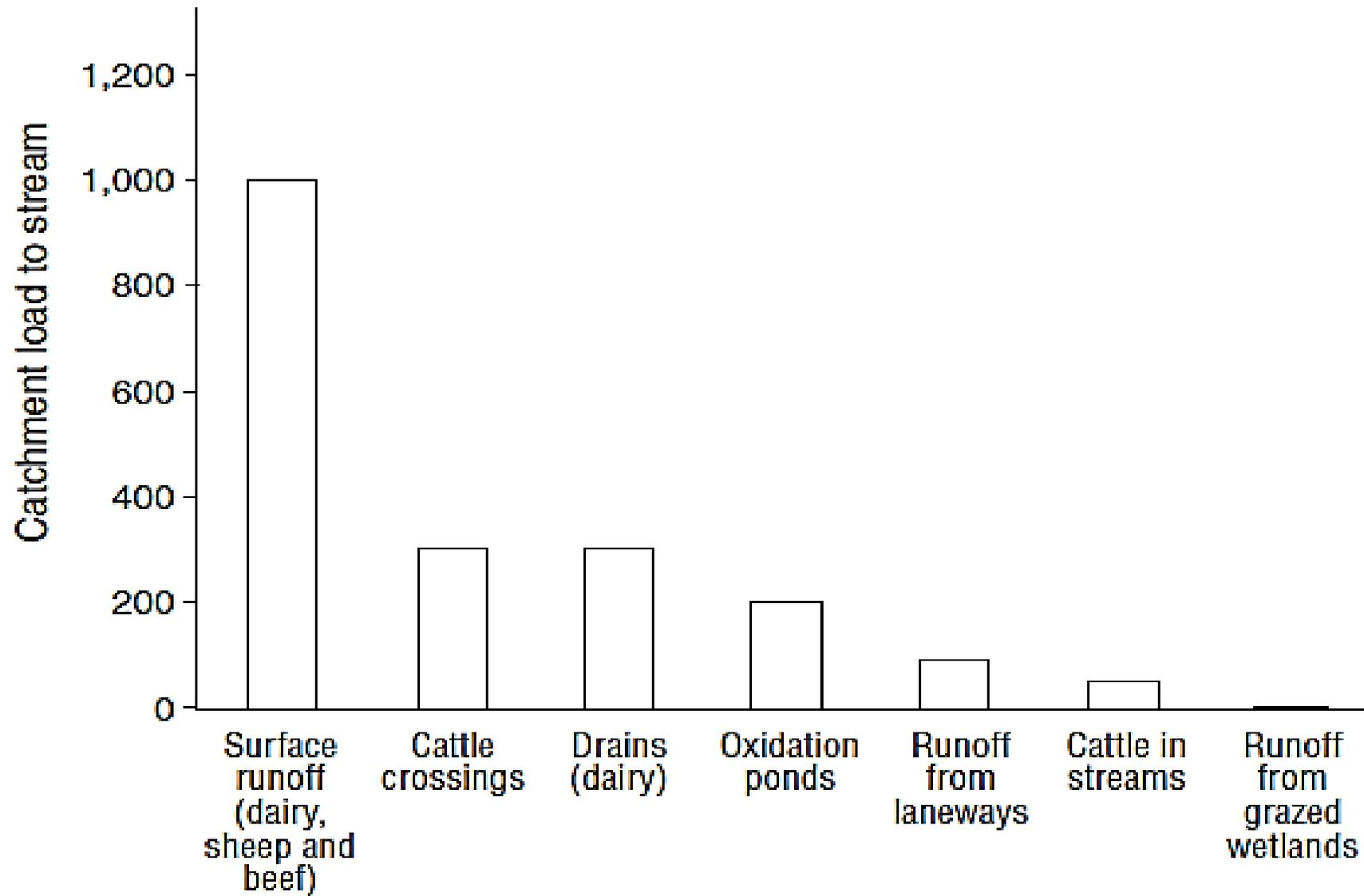
Streamlined
ENVIRONMENTAL

On-land and In-stream processes that drive variabilities of *E.coli* concentrations in pastoral catchments

Deposition

Survival above ground

Run-off transport
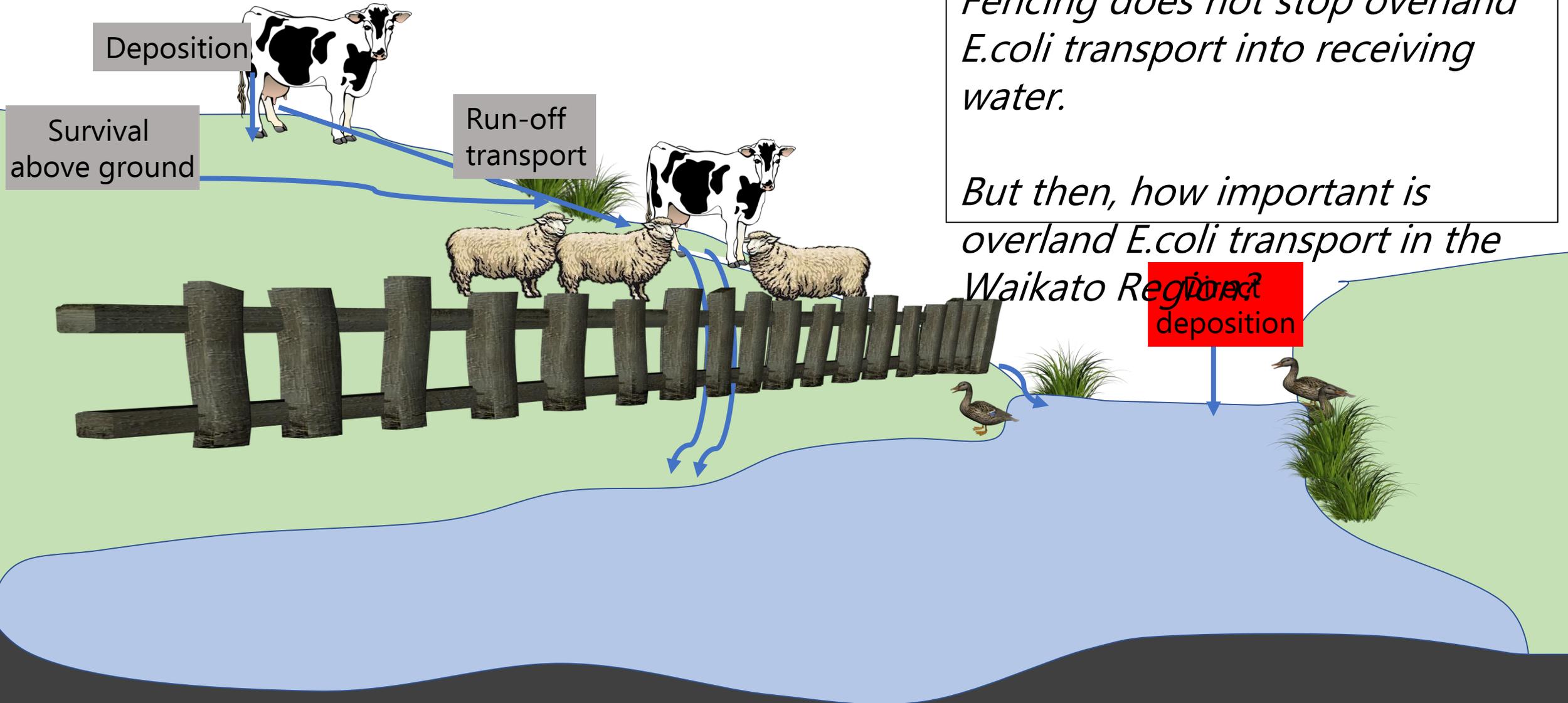
Direct deposition

Fencing does not stop overland E.coli transport into receiving water.

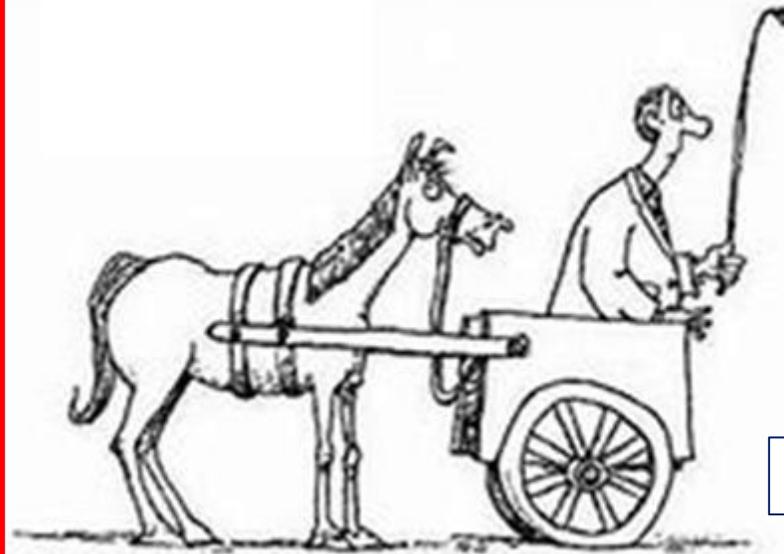But then, how important is overland E.coli transport in the Waikato Region?

Waterway loadings of Escherichia coli (CFU x 108/ha./pasture/year for major sources of faecal matter in the Waikato Region, New Zealand. Source: McDowell and Wilcock 2008)

Issues with monitoring waterborne pathogens in the WRPC1

PC1 *E.coli* management approach

versus

- ❖ Uncertainties about source of faecal pollution in the PC1 streams
- ❖ Management solutions aimed at reducing elevated E.coli levels (and the E.coli targets in Table 3.11.1) are not based on scientific evidence, and are at best 'Blanket' or 'one-cap-fits-it-all' approach

- ❖ Microbial source tracking techniques are applied to identify major sources of faecal pollution in the PC1 streams. Phylogenetic studies applied to distinguish if elevated E.coli for PC1 sites are due to faecal sources or non-faecal environmental *E.coli* from natural stream processes.
- ❖ Management solutions aimed at mitigating E.coli levels are more appropriate, site/catchment-specific, more effective and offer value for resources expended.

Recommendations

I therefore recommend that authorities:

❖ Delete requirements to fence hill country streams, considering that it is a counter-intuitive approach to stopping overland flow

❖ Increase requirements to identify and manage critical source areas and overland flow pathways. This will then lead to catchment-specific management intervention(s) rather than a blanket approach to effect fences for stock exclusion which only stops direct deposition.

❖ Until such time as reliable microbial source tracking is undertaken I propose that long term targets should be deleted from Table 3.11-1. and that the E.coli freshwater objectives be included in Table 3.11-1 in a way that
   ❖ includes consideration for flow or
   ❖ meets the requirements of the NPS-FM.