# Stream Buffers: performance & design for water quality.

Research Note

## Background

Vegetated buffer strips on streams and gullies provide a range of benefits to farms, including shelter for stock, reduced channel erosion, reduced growth of weeds and algae, enhanced amenity, provision of dedicated stock watering, and enhanced land value. Buffer strips also help to improve the water quality in streams, which is the focus of this Research Note.

In the Tarago reservoir catchment, Melbourne Water has worked for years in partnership with land owners to mitigate the impacts of rural runoff on waterways. While buffers positively influence water quality via a number of processes, some uncertainty remains about how best to design them. The main aim of this project was to better understand the processes that may limit, or enhance the effectiveness of fenced, vegetated buffers installed on grazed agricultural land.

## Methods

1. To address the capacity of buffers to reduce the export of sediment, nutrient and faecal pollutants, monitoring of concentrations and loads was undertaken in catchments where buffers were established, and those where cattle were allowed to freely graze the riparian area.
2. To better understand the impact of cattle exclusion, a field experiment was conducted which coupled high frequency turbidity measurement with cattle behaviour monitoring.

## Key findings

- Buffers reduce pollutant generation and availability in the riparian zone (Fig. 1).

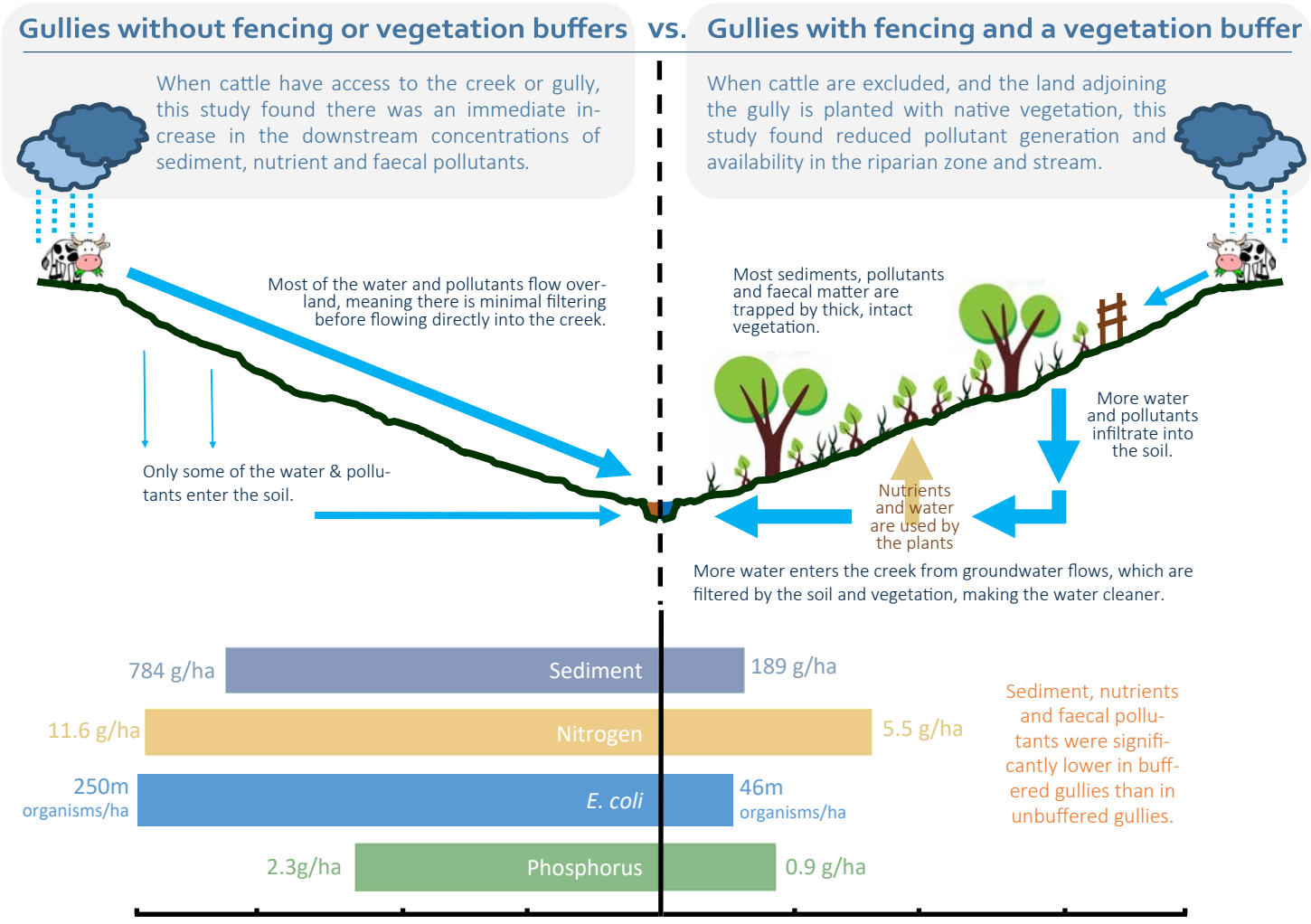
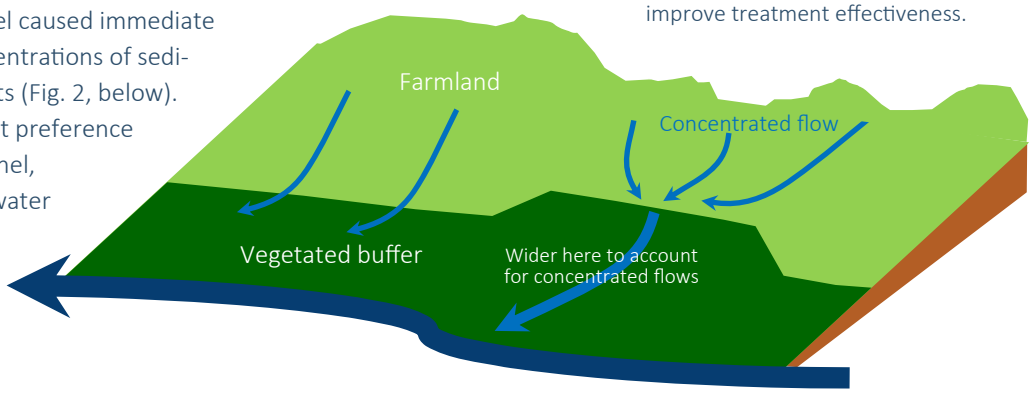



**Figure 1:** Comparison of the pollutant loads recorded by this research in streams and gullies fenced and vegetated, compared to stream and gullies in which stock had free access. The geometric mean of loads exported during rainfall events is reported.

## Key findings (con'd)

- Cattle activity in the stream channel caused immediate increases in the downstream concentrations of sediment, nutrient and faecal pollutants (Fig. 2, below).
- Cattle were found to have a distinct preference for some areas of the stream channel, which may have ramifications for water quality management.
- Buffers can also reduce the contribution of cattle faeces to the microbial community of agricultural streams.
- Stream buffers can achieve an immediate improvement in water quality following the establishment of stock exclusion fencing.

**Figure 3:** Buffers should be wider where surface and inground flows are concentrated, to improve treatment effectiveness.




## What does this research mean for land managers and the design of stream buffers?

### Install fencing to provide water quality benefits

- Excluding cattle activity from the stream bed and adjacent banks will benefit water quality, irrespective of buffer widths.
- Where stock exclusion is not possible, rotational grazing management can improve sediment, nutrient and microbial water quality.

### Address concentrated surface flow pathways by changing buffer shape and diverting track drains

- Avoid drainage or channelization of wetland areas, to ensure flow stays diffuse.
- Expand the buffer area to surround natural topographic depressions, avoiding concentrated flow from paddock to stream (see Fig 3).
- Divert discharge from track drains over a broader area of enclosed buffer zone before it reaches the stream.

### Maintain dense vegetation at the ground surface to reduce riparian erodibility and improve flow interception

- Maintain the greatest possible surface vegetation cover in riparian areas, through permanent stock exclusion if possible, followed by either active or passive vegetation establishment.
- Monitor surface vegetation density within buffers, particularly in established buffers where canopy shading may reduce surface vegetation density, or where concentrated flow is likely to occur.
- Consider re-planting low-density surface vegetation areas, with shade-tolerant species if under canopies.

### Employ fit-for-purpose pollutant control methods

- Buffers must be sized so they have capacity for water treatment. Buffers should be wider in areas where higher flows are expected, e.g. where flows are concentrated by convergent topography (see Fig. 3).
- In steep areas with narrow buffers, pollutants borne by groundwater are unlikely to be significantly mitigated by buffers.

Turbidity was found to increase in response to both a rainfall event (as indicated by the raincloud) and direct stream access by stock animals (indicated by cows).

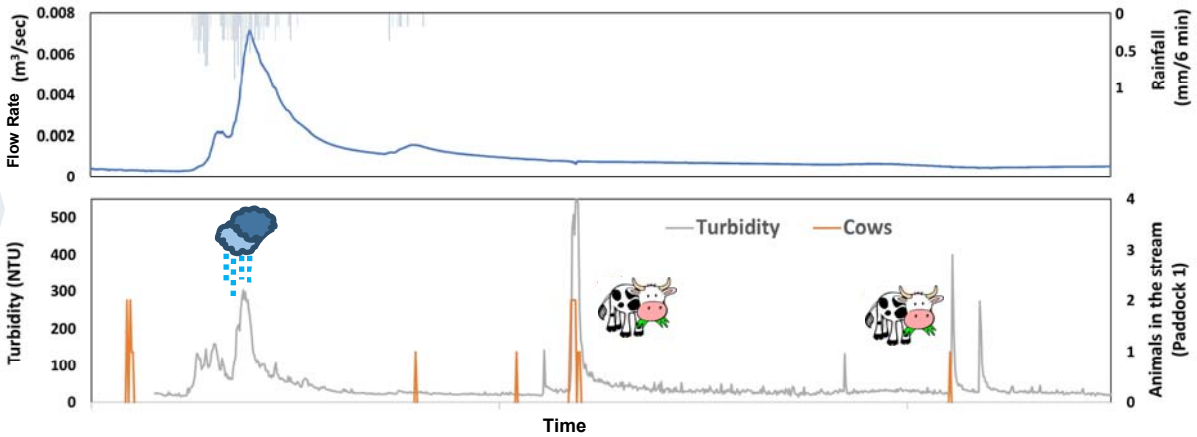



**Figure 2:** A timeseries of high-frequency turbidity (grey line), flow rate (blue line), rainfall and a record of cattle access to the stream.

Melbourne Water Enhancing Life and Liveability
Waterway Ecosystem Research Group
MONASH University
Rob Sargent, Tim Fletcher & Dave McCarthy