RIPARIAN BUFFERS GUIDELINE FOR DAIRY FARMERS

PART 2

Part 1 of this article introduced the guidelines for improved management of watercourses and implementation of riparian buffers for the dairy sector in South Africa. The first article covered aspects such as the objectives, sector-specific threats to water resources, the benefits of buffer zones, and a broad overview of the content. Part 2 of this article provides more detail as to the specific guidelines for the implementation and management of buffer zones as determined through two case study farms in KwaZulu-Natal and the southern Cape.

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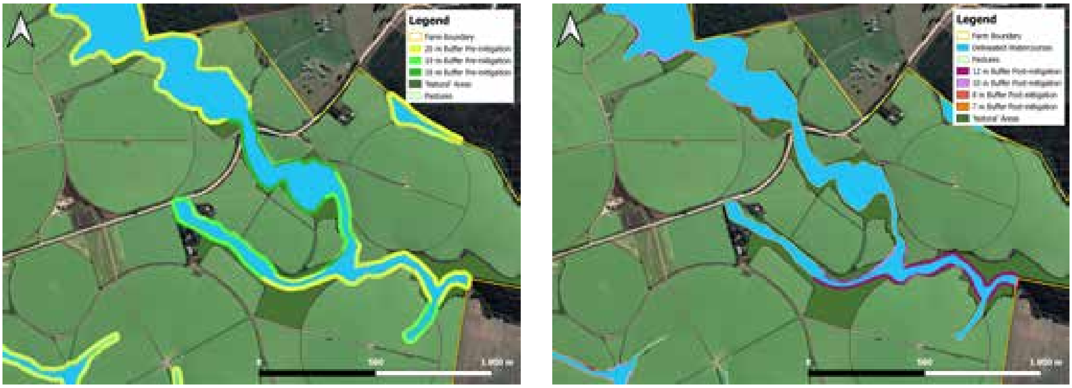
How wide should a buffer zone be?

Buffer zone width is determined through application of the existing spreadsheet-based buffer delineation tool developed by Macfarlane and Bredin (2017). A range of generic operational threats associated with dairy farming produce a buffer width that varies based on inherent environmental site-specific features. These features include watercourse classification, mean annual rainfall and rainfall intensity, runoff potential and erodibility of soils, average slope of the catchment, retention time, vegetation characteristics of the buffer, irrigated or dryland pasture, and habitat for sensitive species. It makes sense that a buffer would need to be wider on steeply sloping irrigated lands with high runoff rates and soil erodibility along with low soil permeability when compared to a flat area of dryland pasture with highly permeable soils. Buffers are not a one-size fits all.

Results of the buffer tool were presented under a low-mitigation and high-mitigation scenario, assuming minimal or maximal application of best practice guidelines, respectively.

Farm	Threat mitigation level	Range of buffer widths	Total pasture on-farm (ha)	Pasture area loss due to buffer overlap (ha)
Southern Cape Farm	Low	19–21 m	736,24	34,48
	High	5–12 m		12,09
KwaZulu-Natal Farm	Low	20–30 m	549,71	26,12
	High	5–10 m		11,28

Figure 1 Enlargement of a portion of the southern Cape farm indicating buffers under a low-mitigation (left) and high-mitigation (right) scenario.



Calculated buffer widths differed substantially between low and high mitigation levels. Buffer areas intersected with both non-pasture as well as pasture areas, so the wider the buffer, the more pasture must be retired from productivity. The high-mitigation scenario is achieved through implementation of mitigation actions explained in the next section.

Threat mitigation to reduce buffer widths

Dairy-sector specific generalised and region-specific threats were identified and refined in the riparian buffer tool. Thus, ensuring the full range of interconnected land uses that potentially occur on dairy farms were accounted for when riparian buffers were determined. A range of threat mitigation actions were identified that directly reduce the generic threats (impacts) highlighted for dairy farming by the buffer tool. Detailed explanations and examples are provided in the guideline, which are summarised below.

Several scenarios exist where buffer zones offer limited protection including poor water quality from upstream users, watercourses under pivots, and linear agricultural drains. Recommendations to address these and other general threats to aquatic ecosystems are included in the guidelines

Generic operational threat	Mitigation examples
Alterations to flow volumes and alterations to patterns of flows	• Use precision farming practices (e.g. soil moisture probes) to inform irrigation scheduling and reduce wastage. • Install variable speed drives and trim pump impellers to ensure efficient irrigation at the correct pressure. • Disperse stormwater runoff to avoid concentrated flow paths. • Control alien vegetation; this lowers the water table and abstracts high water volumes. • Improve water infiltration in pastures through planting of multi-species perennial pastures. • Implement the ecological reserve to ensure sufficient water is present to sustain the aquatic ecosystem.
Sediment inputs and turbidity	• Practice minimum tillage. • Use slotting to reduce compaction instead of ripping. • Sow cover crops on maize lands to improve flow interception. • Fence watercourses to exclude cattle; provide drinking water troughs on hardened surfaces. • Control alien vegetation by ring-barking along riparian zones. Alien trees may have rooting patterns that promote channel incision. • No burning in areas which runoff to watercourses as this increases turbidity. • Manage stormwater runoff to streams using vegetated swales.

Manage nutrient and pathogen inputs	• Use precision farming practices to apply fertilisers considering the plant growth stage, physico-chemistry of soil, season, and potential impacts to water quality. • Avoid irrigating waste water onto areas sloping towards watercourses. • Use biocatalysts to accelerate decomposition of solids in slurry dams. • Separate solid and liquid wastes to reduce storage volumes required in slurry dams. • Ensure slurry dams have a clay or plastic liner to avoid contamination of groundwater. • Prevent instream defecation by livestock in watercourses by fenced exclusion.
Toxic organic contaminants	• Avoid use of pesticides during windy conditions or prior to rainfall, as spray drift or runoff can enter watercourses. • Only use pesticides according to instructions in terms of volumes and mixtures. • Do not spray pesticides in riparian zones. To kill alien tree stumps, apply a gel-based herbicide or preferably ring-bark large alien trees. • Vehicle refuelling, fuel stores, and maintenance areas must be located well away from watercourses.
Alteration of acidity (pH)	• Apply calcitic lime (or dolomitic lime in KwaZulu-Natal) based on precision farming methods considering all aspects of the plant growth stage, soil chemistry, season, and potential impacts to watercourses.
Increased inputs of salts	• Use fertilisers less likely to leach salts, e.g. chloride is more rapidly leached from soil than sulphate making potassium sulphate the preferable form of potash compared to potassium chloride. • Use gypsum in well-drained soils as waterlogging concentrates sodium in the soil, which can then be leached to watercourses. • Included deep-rooting plants in pasture mixes and irrigate to saturate the full soil profile less frequently than more frequent, shallow irrigation which leads to high sodium in soil due to evaporation.
Elevation of water temperature	• No heavy machinery permitted in riparian zones. Alien vegetation must be controlled in a manner which preserves shade e.g. ring-barking) or shaded sections. Blocks can be selectively cleared. • Riparian zones cannot be deliberately burnt to control aliens.

through the creation or enhancement of wetlands and other best practice interventions.

The guidelines aim to empower those involved in dairy farm operations with the knowledge required to improve riparian zones and buffers, while focusing on sustainable pasture management practices aimed at reducing impacts to water resources. Farms may not meet all the recommended practices at present, but by implementing a plan with realistic timeframes and prioritised interventions, sustainable management of water resources is achievable.

It will be available off websites for INR, MilkSA and Confluent from January 2024. TDM

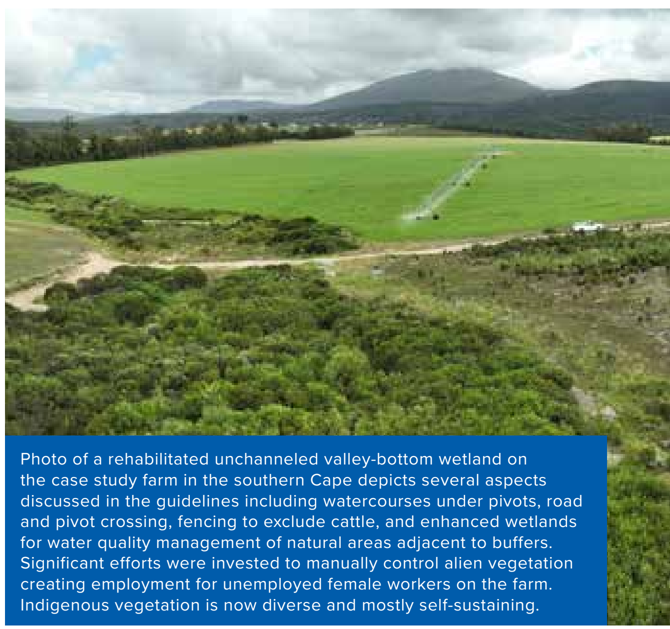


Photo of a rehabilitated unchanneled valley-bottom wetland on the case study farm in the southern Cape depicts several aspects discussed in the guidelines including watercourses under pivots, road and pivot crossing, fencing to exclude cattle, and enhanced wetlands for water quality management of natural areas adjacent to buffers. Significant efforts were invested to manually control alien vegetation creating employment for unemployed female workers on the farm. Indigenous vegetation is now diverse and mostly self-sustaining.