Otago Regional Council

Document Id:

MEMORANDUM

To:	**Dolina Lee Policy**
From:	**Mark Crawford Land and Soil Scientist**
Date:	**3/11/2023**
Re:	**Feedlot Standoff pads –Impermeable layer and setback distances**

Name	Role	Date Completed
Ben Mackey	Reviewer 1	15/11/2023

Purpose

Off paddock facilities such as standoff and feed pads are often used to reduce paddock treading and pugging and provide shelter for animals during extreme weather conditions and particularly when conditions are wet. They are often cited as a way to reduce nutrient leaching, in particular Nitrogen and are seen as a good management practices (GMP) tool.

Greater intensification on dairy farms has led to an increased reliance on these types of facilities (Laurenson, Weerden, Beukes, & Vogeler, 2017, Vol 60), however these facilities also cause increased capital and operating expenses, with increased labour and need for a supply of quality feed.

A key management consideration arising from the use of land for standoff pads, feed pads and wintering pads is the high concentration of nutrients and pathogens and the potential for these to be lost to surface water or groundwater through runoff or leaching (Officers reply, 2017) .

The purpose of this memo was to assess the comparability of carbon-based wood material as a feed lot layer when compared to an impermeable base layer. The definition of what an impermeable layer as defined by the draft Land and Water Plan was also assessed for its suitability.

In addition, the appropriateness of the setback distance from these structures was also requested.

These requests were to provide directions for the amendments of the Draft Land and Water Plan for Otago.

Data and Methods

To interrogate the Environment Southland rules on feed pads and wintering pads, an email was sent to their team leader for Land and Soils. The outcome was to read the section 42A report plus the Officers reply to their proposed Water and Land Plan, dated 3 November 2017, which relied on guidance from DairyNZ. Further information was supplied by Policy with respect to the Environment Court decisions with respect to the partially operative Southland Water and Land Regional Plan (poSWLRP). Further google searches were done and revealed a technical report done for the Waikato Regional Council and two papers were downloaded and reviewed given their importance to the report. Further referenced research papers were also accessed.

Discussion

Feed pads and Standoff pads:

Feed pads, Stand-off pads, Calving pads, and Winter pads are terms which are used interchangeably and are structures which are all intended to be used to prevent damage to pasture and soils by reduced stock treading over unfavourable (wet) soil conditions (Environment Southland, 2017). These Off-paddock facilities allow for removal of cows from pastures onto that facility. As farms intensify the use of these types of structures increase (Laurenson, Weerden, Beukes, & Vogeler, 2017, Vol 60). Assuming best practice effluent management (storage and application back to land at appropriate rates when conditions allow), farm systems utilising these structures can have a large impact on N leaching, especially when targeted at the higher risk autumn and winter periods. (DairyNZ, 2015) Removing animals from pasture onto a feed/standoff pad between autumn and calving (c. 4 months) can reduce nitrogen (N) loss by 27-60% and reduce phosphorus (P) and E. coli loss. (Fenton, 2011). They were modelled as a GMP scenario in the Otago Regional Council modelling in preparation for the proposed Land and Water plan economic work programme (E Moran, June 2023).

They are however sources of contaminants on farm and in cases are of higher loadings than winter forage crop grazing (Fenton, 2011). This is dependent upon the type of material used on the pads, the stocking rate and length of time. In general, the quality of runoff and leachate from these pad systems can be similar in character to average farm dairy effluent (Fenton, 2011). The benefits for contaminant loss offered by pad systems are driven by less urine patches on wet soils and less contaminant loads in runoff from saturated or disturbed soils. These benefits can however be reduced if the accumulated effluent from a pad system is not managed with the same attention that is required of the farm dairy effluent.

The losses of N in drainage effluent and runoff from a poorly constructed and managed stand-off pad can represent a significant portion of the annual losses from a farm. Potential benefits from stand-off pad use (40% less loss) can be reduced by about a third if the effluent drainage is not managed correctly. Stand-off pads with no effluent management could potentially increase whole farm losses by up to 35% (Fenton, 2011). Potential losses are less if they spend less time than the modelled continuous 3 months in this report and are based on a sealed pad with no absorbent material and no containment system. Stocking rates on the pad were based on recommended values for each system, ranging from 3.5m^2/cow for feed pad/laneway to 15m^2/cow for a wintering pad, with a standoff pad at 5m^2/cow.

Pad layers and Permeability

Both the review above and a review of woodchip pads in Britain both arrive at the conclusion that the collection and managed removal of effluent from such pad would appear to be justified not only on environmental grounds, to protect ground and surface waters, but also on technical and logistical grounds, to minimise the risk of pad failure. Once it is accepted that pads must be lined, with effluent collection and management as part of the design, it follows that any 'treatment' effect and, hence, the depth of the woodchip, is of lesser importance (Smith, Chadwick, Dumont, Grylls, & Sagoo, 2010).

The layer often used there was 500mm of depth, which is a similar thickness as DairyNZ guidelines of 500-1000mm (Fenton, 2011). Higher losses are associated with shallower woodchip depths, due to the decline in the ability of the original bark and/or woodchip to act as both a biofilter and a bulking agent which helps in maintaining porosity and aerobic conditions which inhibit the composting process. Well-constructed pads with appropriate effluent collection and management systems lessen this decline and result in the ability to require less woodchip/bark depths at the start (Smith, Chadwick, Dumont, Grylls, & Sagoo, 2010).

Published design criteria from New Zealand, Ireland and Scotland for woodchip pads essentially promote similar guidelines. The subsoil is ridged, with drains installed in the base between the ridges. These are overlain with permeable fill onto which the woodchip layer, of variable type and depth is placed. Whether a liner is recommended depends on subsoil texture (Smith, Chadwick, Dumont, Grylls, & Sagoo, 2010).

With regards to the use of the 10^{-9} m/s impermeability layer, this effectively is a soil permeability measure which is used to define an impermeable soil. Most soil permeability scales place 10^{-9} m/s as a pure clay and practically impermeable.

Setback Areas for Feed pads and Standoff pads

The location of the pad is a key aspect to mitigate potential adverse effects (Officers reply, 2017). Given this their location to waterways is critical. The location of these infrastructural pad areas must also be taken into account as with the estimates of the polluting potential of a poorly managed pad or sacrifice paddock will depend somewhat on soil type, rainfall and the proximity of the pad or sacrifice paddock to drains, aquifers and surface waterways (Fenton, 2011). The receptors in the receiving environment which may be sensitive to the presence of stand-off pads, feed pads/lots, calving pads or wintering pads (such as drinking water supply sites, surface water bodies and critical source areas) need to have recommended setback distances relative to each receptor (Officers reply, 2017).

Given the severity of the loading, especially if there is a containment failure then a precautionary approach should be taken and a 20 m setback would be advocated as recommended by the Envirolink report for Tasman District Council, however 50 metres is advocated for full ecosystem benefits (Fenemor & Samarasinghe, 2020). The DairyNZ standoff pad resource also advocates for 50m (DairyNZ, July 2021).

However, the full 50m setback may not be necessary if a properly designed, constructed and maintained pad with an impermeable layer, with an adequate and appropriate effluent capture and discharge system, then the lesser setback area of 20 m would be advocated.

Conclusion

The use of standoff or calving pads typically consists of lower stocking rates for shorter periods of time resulting in reduced probability of adverse environmental effects, however the use of feed pads and wintering pads are often over longer periods and have the greater potential to cause adverse effects. Given the interchangeability of these structures, plus they are a result of greater intensification, any proposed rule will need to include both scenarios.

These structures should be constructed to ensure both the effluent is collected and managed appropriately. All soft pad surfaces such as woodchips and bark should still have an impermeable layer below the surface with drains linked to an effluent collection system and the edges bunded (DairyNZ, July 2021) as best practice.

A minimum depth of woodchip bark of 500 mm is advocated as per industry guidelines plus a 50m from drinking water supply, waterbody, drain, spring, well or borehole. This may be reduced to 20m if the pad system is properly designed, constructed, and maintained with an impermeable base layer with an adequate and appropriate effluent capture and discharge system in place.

References:

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