



Nitrogen Risk Scorecard Calculations

The Fonterra Nitrogen Risk Scorecard is a farm data driven series of calculations that provides for an objective consideration of the likely scale of manageable nitrogen risk that exists on a farm through a single farming year. This ‘Calculations’ document provides the input data requirements, and the calculations applied to each data point, to generate the risk ratings that are reported to the farmer.

Disclaimer

The Fonterra Nitrogen Risk Scorecard has been referenced in the ‘Proposed Plan Change 1 Waikato and Waipā River Catchments – The Hearing Panel’s Recommendation Report’ as a tool that can be used to produce risk ratings for nitrogen management, and as a calculation tool to produce a “purchased nitrogen surplus” metric. Fonterra has therefore made the Nitrogen Risk Scorecard engine documentation (“**Scorecard Documentation**”), and the calculation algorithms (“**Calculation Documentation**”), available to the Waikato Regional Council for upload to its website. The intended use of the Documentation, and limitations to its usefulness, can be understood from the Scorecard Documentation. Please note that the Calculation Documentation should not be read and interpreted in isolation to the Scorecard Documentation.

While all reasonable care has been taken in the preparation of the Scorecard Documentation and Calculation Documentation (together the “**Documentation**”), none of Fonterra or any of its respective subsidiaries, affiliates and associated companies (or any of their respective officers, employees or agents) (“**Fonterra Group**”) makes any representations, assurances or warranties of any kind, express or implied, in relation to the accuracy or completeness of any information, content, advice or data in the Documentation, or as to the likelihood of outcomes expressed or implied in the Documentation. By making the Documentation available to you, Fonterra is not entering into any business or other relationship with you or any other person.

The Fonterra Group does not accept any liability for any loss or damage of any kind whatsoever which may directly or indirectly result from use or reliance on any information, representations, errors or omissions (whether negligent or otherwise) expressly or impliedly contained in this Documentation (including, but not limited to, decisions in relation to nitrogen management, farm management or farm practice). You are solely responsible for the actions you take in reliance on the content in, or assessment made by, the Documentation. Any information, data or assessment provided by this Documentation is based on your data and other information you provide, and is not intended to be a substitute for your own judgment or any advice provided by your own consultants or experts. Fonterra is under no obligation to update the Documentation for any information which we become aware of following the date the Documentation is provided.

This Calculation Documentation provides written reference for each of the calculations that are contained within the Nitrogen Risk Scorecard engine.

Metric	Data points required	Calculation or Equation
Effective farm area (Ha)	1. Total farm area 2. Total non-effective areas	<i>Total farm area - non effective blocks</i>
Purchased nitrogen (N) surplus Kg/Ha	3. Total N fertiliser applied kg/ha 4. Imported supplements kg/ha <ul style="list-style-type: none"> a. Total tonnes imported by type b. N content of each supplement type 5. Total Production (milk, meat and supplementary feed exported off farm) 6. Amount of N contained in productive outputs	$N_{fertiliser} + N_{supplement} - N_{production}$ $/ \text{effective farm area}$ $= \text{Purchased Nitrogen Surplus Kg/Ha}$
Total energy requirements on farm (MJME)	7. Stock on farm <ul style="list-style-type: none"> a. Monthly stock numbers, b. Age and breed 8. Energy requirements per animal <ul style="list-style-type: none"> a. Maintenance b. Pregnancy c. Production 	Breeding Stock example <i>Maintenance energy requirement per animal + energy for productive output + pregnancy requirements x number of animals</i>
Dry matter eaten (KgDM/Ha)	9. Total dry matter (DM) from imported supplements	<i>Sum Kg DM from each supplementary feed consumed.</i>
	10. Total DM from crops	<i>Crop area x Crop yield x % of the crop eaten by animals x percentage crop fed this season</i>

Metric	Data points required	Calculation or Equation
Dry matter eaten (KgDM/Ha)	11. Total DM from pasture a. calculated based on the amount of energy required to maintain the animal, + production, and pregnancy demands.	<p style="text-align: center;">Total DM from pasture¹</p> $\frac{(\text{lactation} + \text{daily maintenance} + \text{pregnancy} - (\text{imported feed} \times 8) - (\text{fodder crops} \times 8))}{10.5}$
Stocking rate	12. Monthly stock numbers	<p style="text-align: center;">Dairy example</p> $\text{Highest monthly cow numbers} / \text{effective farm (ha)}$
Wintering off May - Aug	13. Monthly stock numbers a. Wintering off May – Aug is the percentage difference in monthly cow numbers between April and each of the winter months (May – Aug). Therefore, reporting a reduction in number of animals on farm over winter from the month prior to winter	$\frac{\text{April monthly cow numbers} - \text{May monthly cows}}{\text{April monthly cows}}$ $\frac{\text{April monthly cow numbers} - \text{June monthly cows}}{\text{April monthly cows}}$ $\frac{\text{April monthly cow numbers} - \text{July monthly cows}}{\text{April monthly cows}}$ $\frac{\text{April monthly cow numbers} - \text{Aug monthly cows}}{\text{April monthly cows}}$
Wintering practices (percentage of winter period animals spend on either crops, structures or pasture)	14. Number of animals on farm	<p style="text-align: center;">Time on crops =</p> $\frac{\text{Number of cows on crops} \times \text{hours on crop} \times \text{number of days on crop}}{\text{number of cows on farm} \times \text{total winter hours (2952)}}$
	15. Number of animals on off-pasture facilities or crops over winter months.	<p style="text-align: center;">Time on structures =</p> $\frac{\text{No of cows on structures (May - Aug)} \times \text{hours on structures ((May - Aug))}}{\text{No of cows on farm} \times \text{total hours May - Aug (2952)}}$
	16. Number of hours animals spend on structures or crops	<p style="text-align: center;">Time on pasture =</p> $\frac{\text{Total hours (May - Aug of 2952)} - \text{total hours on structures (May - Aug)} - \text{total hours on crops (May - Aug)}}{\text{number of cows on farm}}$

¹ Estimated grazed pasture intake is expressed in MJME, this is divided by 10.5MJME/kg DM to obtain KgDM per farm. For all crops & supplementary feed consumed a utilisation factor of 80% has been applied.

Metric	Data points required	Calculation or Equation
Total N fertiliser applications	17. Effective farm area 18. Total fertiliser applied 19. Percentage of N in commercial fertiliser products	<i>Total tonnes of all N fertiliser product(s) x N content of product(s) / effective farm area</i>
N fertiliser conversion efficiency	20. Total tonnes of N applied 21. Total production achieved (milk solids, meat, wool, velvet, crops etc)	<i>Total tonnes of all N fertiliser product(s) x N content of product(s) / total N in productive outputs</i>
N fertiliser highest application rate Kg N/Ha	22. All fertiliser applications	<i>Select the highest application rate from all applications</i>
Feed budget	23. Data to indicate that a feed budget is used to plan N fertiliser use	
Total N imported from feed (Kg/Ha)	24. All imported supplementary feed fed to animals within the season	<i>Total tonnes of DM from imported supplement x N content of each feed type / effective farm area</i>
Average N content (%) of imported supplement	25. N content of supplements	<i>Total Kgs of N imported from supplement / total Kgs of imported supplement x 100</i>
Conversion efficiency of N from imported supplementary feed to productive output²	26. Total Kg of production 27. Total N from imported feed	<i>Total Kg milk solids / total Kg N from imported supplement</i>
Cropping & cultivation	28. Total area cultivated 29. Cultivation method	<i>Total area cultivated (conventionally) / effective farm area</i> <i>Total area cultivated (minimum tillage) / effective farm area</i> <i>Total area cultivated (direct drilled) / effective farm area</i>

² In this case it calculates the conversion efficiency to Kg milk solids. This could equally be changed to other singular productive outputs or to total farm outputs.

Metric	Data points required	Calculation or Equation
Season of harvest	30. Crop harvest date	<i>If crop's harvest date falls in April, May, June, July, August or September the farm will fall in the Winter Harvest category, otherwise considered as Summer Harvest</i>
Timing of fertiliser application	Timing of fertiliser applications to crops	<i>N fertiliser was applied to crops during the high-risk months of May, June, July and August = 'Yes' then High Risk</i>
Effluent irrigation area <i>(thresholds being considered against ;4ha/100 cows without structures, or 7ha/100 cows with structures)</i>	31. Off pasture facilities 32. Effluent block size 33. Peak cows	<i>Peak cows/ disposal area</i>
Effluent discharge method & application depth	34. Effluent discharge method 35. Maximum application depth of irrigation	<i>Methods in order from lowest risk are: Discharge to land, Discharge to land (non-optimal storage), Discharge to land and water, Discharge to water</i>
Freshwater irrigation method, <i>(proportion of each method as a % of the total irrigation area)</i>	36. Total irrigated area 37. Irrigation method(s) 38. Irrigation area per method	<i>Irrigation method 1(ha) / total irrigation area = The % of irrigation area allocated to method 1. This is repeated for each irrigation method to determine the percentage of each irrigation method on farm</i> <i>Risk is then attributed on a pro rata basis by irrigation method</i>
Scheduling irrigation	39. Questions: How do you decide when to start and stop irrigating? 40. Answers: (a) When water is available or water budget or (b) Soil moisture meters, or (c) visual assessment	<i>Risk is attributed on a pro rata basis to each scheduling option based on the % of the total irrigated area the method covers</i>

Metric	Data points required	Calculation or Equation
Application Method	<p>41. Question: How do you decide how much water to apply?</p> <p>42. Answers: (a) Irrigation is applied at a fixed depth and return period (b) adjusted to achieve deficit irrigation (c) Variable rate irrigation</p>	<p><i>Risk is attributed on a pro rata basis to each application method based on the % of the total irrigated area the method covers</i></p>