Canterbury Land and Water Regional Plan
Plan Change 7

Evidence of

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Submitter Id 172

Concerns with Plan Change 7

- The use of GMP N loss rates in Plan Change 7
- The use of GMP N loss rates in the modelling leading to the policies which Plan Change 7 aims to implement
- The impact of uncertainty in the policy development
- Changes to the winter grazing thresholds
- Changes eliminating policy related to the Orange Nutrient Allocation Zone for the Ashley River catchment

- Focus of evidence for most submitters has been on the Nitrate Priority Area, resulting in less consideration of other aspects of the plan change
- Lack of evidence for nitrate effects on *Phormidium* cyanobacteria
- Evidence related to the significance of nitrate in groundwater

Concerns with GMP N loss rates

- Introduced in Plan Change 5, based on proxies for use in Overseer for Good Management Practice for N fertiliser, Irrigation and other farm management practices
- Concerns raised about the basis for the proxies and farm portal results
- Implementation Working Group and Technical Working Group established by Ecan
- Proxies declared erroneous by Council
- Recommendation from Implementation Working Group
  "It would not be responsible to notify Plan Change 7, given the Technical Working Group's advice has significant implications for catchment models used to assess effects and determine appropriate reduction regimes."

Use of GMP proxies in Plan Change 7

- Plan Change 7 has not removed the erroneous GMP proxies
- Extensive use of GMP proxies in the catchment scale modelling leading to PC7
- This has compromised a substantial part of the basis of the Plan Change, especially in relation to the proposed N reduction targets in the Nitrogen Priority Area of the Waimakariri Zone.
- This has increased the uncertainty in the modelled estimates
- Proposed reductions in N leaching are from a GMP baseline incorporating the erroneous proxies

Use of GMP proxies in Plan Change 7

- It is my submission that all references to GMP loss rates be removed from the Plan and be replaced by Baseline Loss rates

OR

- That the Plan Change adds a clause to specifically remove the Schedule 28 fertiliser proxies and modify the irrigation proxy in line with the Technical Working Group recommendations.

Uncertainty

- Expert panel assessed the uncertainty and potential bias in the nitrogen load estimates for the catchment scale modelling of N loss to water
- 5 components of uncertainty in the modelling system

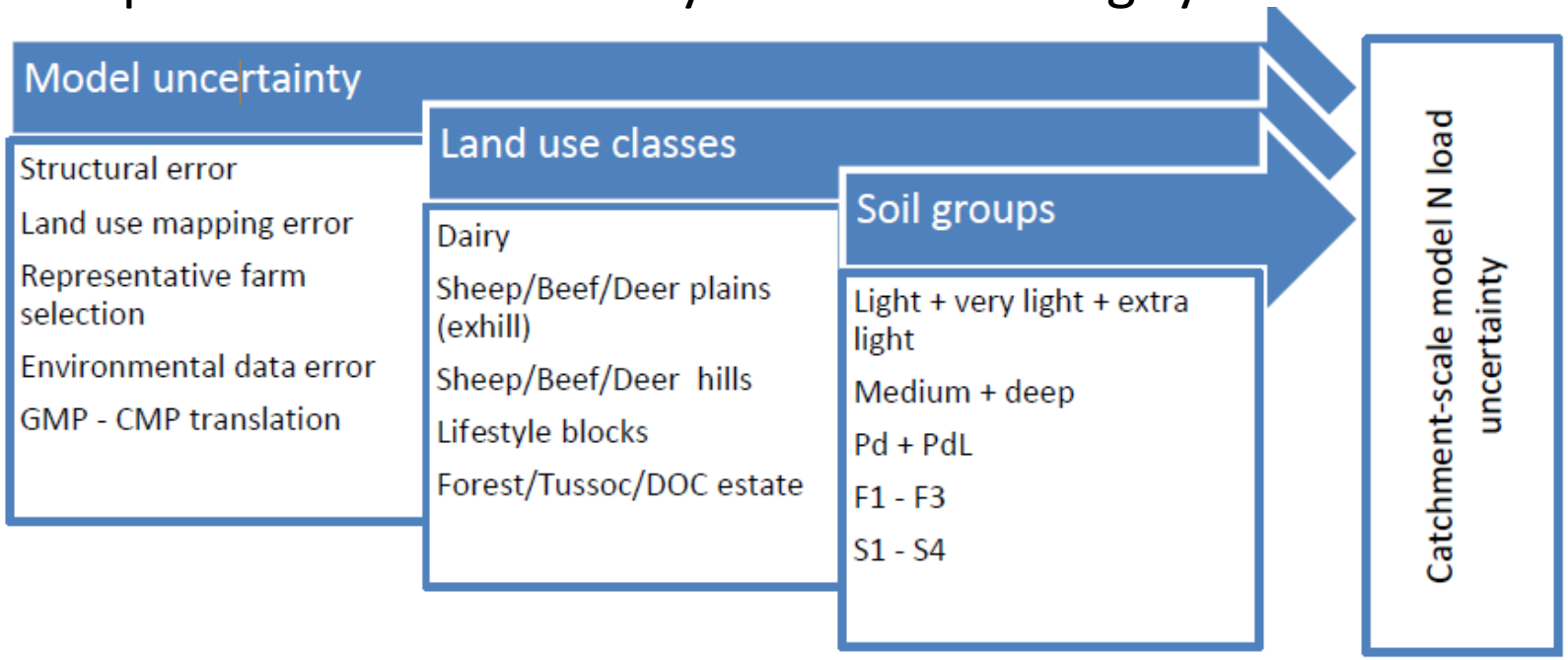

Figure 1 Elaboration of modelled N load uncertainty

Etheridge et al (2018)

http://flrc.massey.ac.nz/workshops/18/Manuscripts/Paper_Etheridge_2018.pdf

Structural Error - Overseer®

- Uncertainty associated with the ability of the Overseer model to predict N leaching losses for different land use classes on each group of soils
- PCE report (2018) - many issues relating to uncertainty and lack of documentation and transparency in key aspects of the Overseer model
- Almost total lack of Overseer validation data for most land uses apart from dairy farms and very limited validation data for light soil groups.
- Modelling approach – e.g. fixed synthetic climate regime
- Known bugs and weaknesses in the model, especially in relation to modelling non-pastoral management and landuses
- Overseer default values, especially in relation to pasture quality

GMP – Current Management Practice (CMP) translation

- The base Overseer modelling scenarios assumed the use of Good Management Practices with the application of the PC5 Schedule 28 fertiliser and modelling proxies
- “For the CMP N loss data a set of coefficients were developed to back-translate N losses under GMP to CMP, with a single coefficient used for each broad land use class (cropping, dairy, dairy support, sheep & beef). These factors were derived by estimating the average effect of MGM GMP proxies using a sample of local and regional OVERSEER® nutrient budgets.” (Etheridge et al, 2018)
- As noted above the use of the erroneous GMP modelling proxies has greatly increased the uncertainty in the N loss estimates

Groundwater modelling

- Did not consider attenuation of nitrate by denitrification. Although this is considered to be low for most of the catchment it should at least have been included in the eastern part of the Waimakariri Zone with a similar uncertainty estimation.
- The Waimakariri Zone groundwater modelling showed that under current land management there is likely to be a small increase in median equilibrium nitrate concentrations in comparison to current measured nitrate concentrations.
- The analysis also shows that there is a very high level of uncertainty in the projected equilibrium nitrate-N concentrations with the 95% confidence interval spanning a range from very low to about 9 mg/l.
- All these concentrations are below the drinking water limit of 11.3 mg/L, even under the highly conservative 99% confidence model results. Furthermore, the median levels are less than half the drinking water standard.
- Given the very high level of uncertainty in the projected values it is not appropriate to set in place policies which are increasingly restrictive on land management without having an adaptive management framework based on on-going research and monitoring.

Danish nitrate study

IJC
International Journal of Cancer

Nitrate in drinking water and colorectal cancer risk: A nationwide population-based cohort study

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Nitrate in drinking water may increase risk of colorectal cancer due to endogenous transformation into carcinogenic *N*-nitroso compounds. Epidemiological studies are few and often challenged by their limited ability of estimating long-term exposure on a detailed individual level. We exploited population-based health register data, linked in time and space with longitudinal drinking water quality data, on an individual level to study the association between long-term drinking water nitrate exposure and colorectal cancer (CRC) risk. Individual nitrate exposure was calculated for 2.7 million adults based on drinking water quality analyses at public waterworks and private wells between 1978 and 2011. For the main analyses, 1.7 million individuals with highest exposure assessment quality were included. Follow-up started at age 35. We identified 5,944 incident CRC cases during 23 million person-years at risk. We used Cox proportional hazards models to estimate hazard ratios (HRs) of nitrate exposure on the risk of CRC, colon and rectal cancer. Persons exposed to the highest level of drinking water nitrate had an HR of 1.16 (95% CI: 1.08–1.25) for CRC compared with persons exposed to the lowest level. We found statistically significant increased risks at drinking water levels above 3.87 mg/L, well below the current drinking water standard of 50 mg/L. Our results add to the existing evidence suggesting increased CRC risk at drinking water nitrate concentrations below the current drinking water standard. A discussion on the adequacy of the drinking water standard in regards to chronic effects is warranted.

https://onlinelibrary.wiley.com/doi/full/10.1002/ijc.31306

This paper has been quoted in this hearing in the evidence of Dr Chambers, Dr Rankin and others, and has been widely quoted in the NZ media.

However the data in the Supplementary Material published with this paper do not support the conclusions reported in the paper.

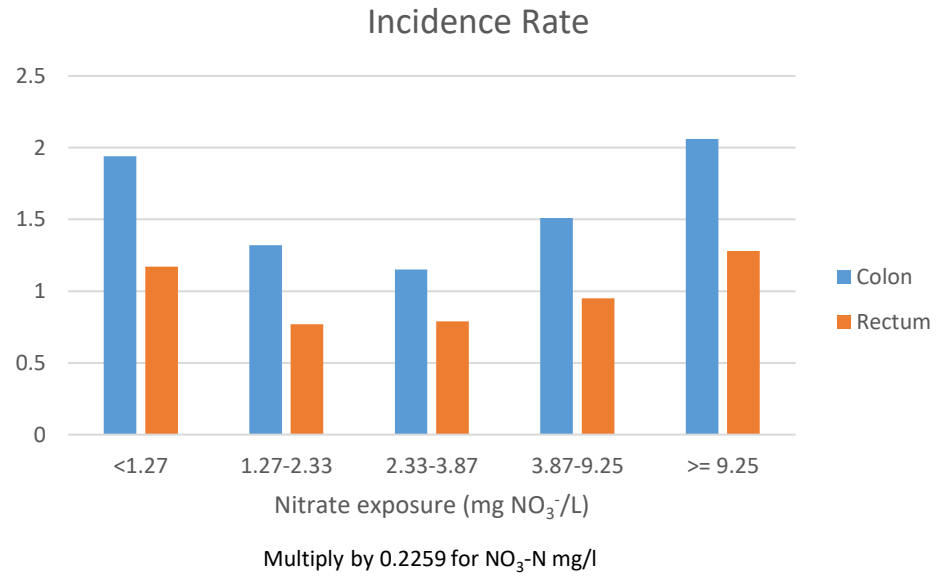
Danish nitrate study

Nitrate in drinking water and colorectal cancer risk: a nationwide population-based cohort study: Supplemental Material

Table S1. Characteristics of the study population for colon and rectal cancer: incident cases, follow-up time, and incidence rates by nitrate exposure quintile, sex, previous cancer diagnoses, year of birth, and highest attained education. Main analyses (only high exposure assessment quality).

	Colon			Rectum		
	Cases	Follow-up time (years)	Incidence rate[a]	Cases	Follow-up time (years)	Incidence rate[a]
Total	3,700	22,826,298	1.62	2,308	22,832,684	1.01
Nitrate exposure quintiles (mg/L)						
< 1.27 (ref)	788	4,071,980	1.94	478	4,073,460	1.17
1.27 - 2.33	517	3,917,230	1.32	303	3,918,455	0.77
2.33 - 3.87	478	4,169,923	1.15	331	4,170,779	0.79
3.87 - 9.25	777	5,146,393	1.51	491	5,147,663	0.95
≥ 9.25	1,140	5,520,772	2.06	705	5,522,327	1.28
Sex						
female	1,866	11,328,546	1.65	930	11,332,646	0.82
male	1,834	11,497,752	1.60	1,378	11,500,039	1.20
Previous cancer diagnoses						
no	3,187	21,448,726	1.49	2,084	21,449,628	0.97
yes	513	1,377,571	3.72	224	1,383,056	1.62
Education						
primary school	1,056	5,525,789	1.91	696	5,527,528	1.26
shorter education	1,710	11,010,147	1.55	1,137	11,012,641	1.03
medium long education	624	3,949,449	1.58	319	3,950,955	0.81
long education	256	1,961,706	1.30	113	1,962,397	0.58
Missing	54	379,207	1.42	43	379,163	1.13

[a]per 10,000 person-years



Multiply by 0.2259 for NO_3-N mg/l

There is no difference in colo-rectal cancer incidence between the lowest level of nitrate exposure and the highest.

https://onlinelibrary.wiley.com/action/downloadSupplement?doi=10.1002%2Fijc.31306&file=ijc31306-sup-0001-suppinfo01.docx

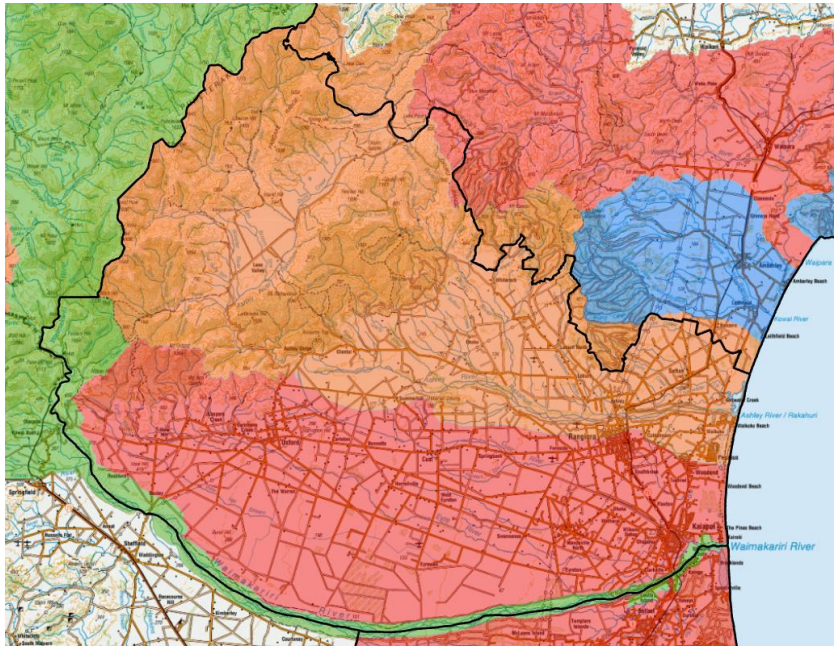
Danish nitrate study

- The validity of the Danish study has been dismissed by Professor Frank Frizelle, medical advisor for Bowel Cancer New Zealand and Dr Deborah Woodley, Ministry of Health deputy director-general population health and prevention
  (NZ Doctor, 14 August 2019 “Nitrates, drinking water and bowel cancer: Worrying link or red herring” by Fiona Cassie)
  https://www.nzdoctor.co.nz/article/news/nitrates-drinking-water-and-bowel-cancer-worrying-link-or-red-herring

Winter grazing threshold

- Plan Change 5 adopted a threshold of 10% of the farm area, for farms between 10 and 1000ha, as being a level at which typical farm management practices would remain as permitted activities.
- However within months of PC5 being made operative on 1 February 2019, Plan Change 7 seeks to change that rule for the Waimakariri Zone, reducing the percentage of the farm area to 5%.
- This was not justified and makes a mockery of the planning process.
- The definition of Winter Grazing should take into account how Winter Grazing is actually managed as there is no differentiation between 24/7 and restricted grazing in conjunction with pastoral blocks which can have a markedly different nutrient loss impact.

Orange Nutrient Allocation Zone



- The area of the Waimakariri Zone in the Ashley River catchment is classified as an Orange Nutrient Allocation Zone
- The use of land for a farming activity is a permitted activity

  provided

  i) the area of the property irrigated with water is less than 50 hectares; and

  ii) the area of the property used for winter grazing is less than:

  a) 10 hectares, for any property less than 100 hectares in area; or

  b) 10% of the area of the property, for any property between 100 hectares and 1000 hectares in area; or

  c) 100 hectares, for any property greater than 1000 hectares in area.
- PC7 changed the thresholds for permitted activities to be equivalent to those of Red Zones with no increase in irrigated area above 10ha
- PC7 put in jeopardy a Loburn Irrigation Company water storage proposal, in conjunction with Melbury Ltd, to increase the reliability of irrigation

Orange Nutrient Allocation Zone

- There is no justification for this change and none was presented in the ZIPA
- “Modelling results for the Ashley River/Rakahuri catchment suggest that nitrate concentrations are unlikely to change significantly under the GMP, PC5PA and Current Pathways scenarios for most watercourses” (Kreleger and Etheridge, 2019)
- The most significant environmental issue in the Ashley River / Rakahuri is the toxic cyanobacteria *Phormidium*
- *Phormidium* levels are greatest at low nutrient levels (McAllister *et al*, 2017)
- Policies to manage nutrients in the Ashley Rakahuri FMU are very unlikely to result in any reduction in toxic cyanobacterial blooms.

Conclusions

- Environmental policy should primarily be based on robust monitoring data rather highly uncertain modelling
- Modelling can assist with policy development and implementation, but it must not use erroneous functions, particularly in this instance the GMP fertiliser and irrigation proxies
- Any future requirements for changes in farm practice should be based an adaptive management framework based on on-going research and monitoring
- Zone based changes to regional and national rules should only be made when there is a very clear requirement based on robust local data

Conclusions

- The purported colo-rectal health risk from groundwater nitrate claimed by some submitters is not supported by the actual data from the Danish study that those submitters quote.
- Localised risks in shallow groundwater drinking water supplies could be managed with a lower economic cost by implementation of a reticulated water supply.
- The main ecological problem in the Ashley River, toxicity from the cyanobacteria *Phormidium*, is not driven by elevated nutrient levels and will not be resolved by planning changes that aim to reduce nutrient levels in the river.