Before the Independent Commissioners

In the Matter of	the Resource Management Act 1991
And	
In the Matter of	the hearing of submissions and further submissions on Proposed Variation 1 to the Proposed Canterbury Land and Water Regional Plan

Evidence in Chief of Stephen John Douglass on behalf of **ANZCO Foods Limited** (Submitter ID 52274)

Dated: 29 August 2014

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Introduction

1. My name is Stephen John Douglass. I am employed by URS New Zealand Limited (URS) as a Principal Hydrogeologist.

2. I have worked for URS in the Christchurch office since 2005. Prior to starting with URS I was employed by Environment Canterbury for approximately 14 months as a consents planner, and for the Ministry of Education as a planner for a period of two and a half years.

3. I hold a BSc (Environmental Science) and an MSc (Geography) from the University of Auckland, and a Graduate Diploma of Engineering in Hydrogeology and Groundwater Management from the University of Technology, Sydney Australia.

4. While at URS, I have undertaken work for ANZCO Foods Limited (**ANZCO**) and its subsidiary companies including Canterbury Meat Packers (now ANZCO Foods Canterbury), CMP Rakaia (now ANZCO Foods Rakaia), and Five Star Beef. As a result, I have a good understanding of the activities undertaken at each site and their respective environmental compliance requirements.

5. While this is a Council hearing, I note I have read the Code of Conduct for Expert Witnesses in the Environment Court Consolidated Practice Note 2006. I have complied with this Code of Conduct. Accordingly, this evidence is within my expertise, except where I state I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

6. In preparing my evidence I have reviewed:

   (a) The evidence of Mr Tim Ensor;

   (b) The Section 32 Report for Variation 1 to the Proposed Canterbury Land and Water Plan (**Variation 1**) (dated February 2014) (**Section 32 Report**); and

   (c) The Section 42A Report for Variation 1 (dated July 2014) (**Officers' Report**).

Scope of Evidence

7. I have been requested by ANZCO to provide evidence in relation to the matters raised in their submission which are within my area of expertise on Variation 1.

8. Mr Tim Ensor has provided evidence which addresses the content and structure of Variation 1 from a planning perspective, specifically addressing those matters that directly affect ANZCOs operations in the Selwyn – Te Waihora Catchment (**Catchment**).

9. I have limited the scope of my evidence to the rules that directly affect industrial and trade waste discharges as they have the potential to affect ANZCOs processing plant within the Catchment (i.e. ANZCO Foods Rakaia). I have not addressed matters relating to water allocation or transfer, leaving these issues to be addressed by Mr Ensor and Counsel.

10. I have **attached** a copy of my evidence presented on behalf of ANZCO during the hearings for the Land and Water Regional Plan (**LWRP**). The broad approach to the management of wastewater produced by the processing plants, including ANZCOs Rakaia operation, is contained in my LWRP evidence. I will represent some of the detail where it assists to illustrate the potential challenges imposed by certain parts of Variation 1.

Summary of Evidence

11. The notified version of Variation 1 together with the accompanying Section 32 analysis signals that the intent of Variation 1 is to set limits on water quality and quantity for the Catchment. Ms Hamilton and Mr Ensor will address the relative merits of imposing these limits across all sections of industry, and outline ANZCOs position on these matters. I have limited the scope of my evidence to those matters that relate to Rules 11.5.25 and 11.5.26, and the corresponding Table 11(i) which includes limits/targets for catchment nitrogen loads.

12. The Officers Report recommends a series of changes that relate to Rules 11.5.25, 11.5.26, and Table 11(i). Some of the recommended changes address the concerns raised by ANZCO. However, I consider that it is

important to understand how the rules in their notified form, and the subsequent changes recommended by the Reporting Officer, affect ANZCOs management of wastewater.

13. In the following sections I will provide the following:

(a) An overview of ANZCOs operations at Rakaia;

(b) Establishing load limits for Point Source Discharges;

(c) Restricting nitrogen losses from new industrial discharges; and

(d) Adopting best management practices.

Overview

14. ANZCO owns and operates two rurally located livestock processing plants at Seafield (Ashburton) and Rakaia. They do not have access to reticulated water or wastewater services. Water is supplied to the processing plants from groundwater while the wastewater is applied to land. There are no alternatives available for ANZCOs two Canterbury plants for the water supply or wastewater disposal.

15. ANZCOs Rakaia site includes the livestock processing plant but it does not own any land for wastewater disposal. Rather, ANZCO has a commercial agreement which provides access to 200 hectares of adjoining land for the purpose of land treatment of the wastewater. Availability of nearby land for the disposal of wastewater is critical to the operation of the Rakaia plant as no other options currently exist for managing their wastewater. The processing of livestock commences from the time that the animals are brought onto the site. Typically, the stock is transferred from the transport trucks into holding pens. The holding pens are situated within the plant and are normally covered to keep the stock dry. From this point forward the plant begins generating animal waste which needs to be collected and disposed of.

16. The liquid component of the waste stream is captured within the processing plant. The liquid waste typically consists of a mixture of blood, effluent, and water. However, the majority of the blood from the slaughtering process is collected and containerised before being removed from the site for further processing.

17. The wastewater and effluent is captured and conveyed via sumps and sealed drainage into a main sump. It is then passed through screens to remove residual solids before being discharged to land. Solid wastes are captured and containerised before being removed from site.

18. The application of the wastewater to land is achieved using spray irrigators, which provide greater control on the depth of wastewater application. The depth of application is designed to be less than half the average water holding capacity of the soil.

19. ANZCO Rakaia operates for up to 11 months of the year. While there are distinct peak processing periods in early spring and late summer, processing typically commences in August and runs through to early June. The volume of wastewater generated from the processing plant varies on a daily basis and is largely determined by the number and type of stock units that are being processed.

20. Wastewater generated from the processing plant is not stored onsite for more than 24 hours before it is discharged to land. This is a condition of consent for ANZCO Rakaia. This method of immediate disposal of the wastewater to land has been preferred in Canterbury, as there is suitable land that can be readily used to provide the necessary treatment of the wastewater.

21. If wastewater is stored for more than 24 hours it can change the wastewater characteristics and make it less suitable for disposal to land without additional treatment. My evidence brief submitted as part of the LWRP hearing process provides more detail on the wastewater characteristics and the preference for a land base disposal system (see paragraphs 40 to 60, **Attachment 1**).

22. ANZCO manages the wastewater generated from the plants to minimise nutrient losses, to maximise soil fertility and plant growth. ANZCO has an environmental management plan for each site, which focuses on wastewater management and environmental monitoring. I consider that these management plans assist the Plants with maintaining good management practices and identifying where improvements to the operations can be made.

23. I note that the nitrogen content in the wastewater is monitored every two months, with the results informing the nitrogen loading rate for individual paddocks. ANZCO also measures the nitrogen content in vegetative matter grown and removed from the discharge area to enable the nitrogen balance to be calculated and reported. This approach enables ANZCO to efficiently manage the wastewater discharge, minimising nutrient losses, improving soil structure, and maximising nutrient uptake. Soil health and groundwater quality is monitored on a regular basis, with the results forming part of the annual reporting requirements.

24. I consider that ANZCO operates a highly efficient operation with an established nutrient accounting system.

Establishing Load Limits for Point Source Discharges

25. The ANZCO submission raised concerns with Rules 11.5.25 and 11.5.26, and sought to amend the proposed rules to better reflect the nature and scale of the industrial discharges within the Catchment, particularly as they relate to livestock processing activities.

26. The replacement of an existing consent, provided that it does not exceed the nitrogen load limit specified in Table 11(i) for industrial and trade processes, is provided by clause 1 of Rule 11.5.25. However, the proposed nitrogen load limit of 106 tonnes of nitrogen per year listed in Table 11(i) is poorly defined.

27. Unlike groundwater abstractions, where each abstraction has been assigned an effective allocation based on 90% of the consented annual volume or the estimated annual volume (in accordance with Schedule 13, pLWRP), the load limit for industrial and trade wastes has no clear basis. Table 11(i) and the supporting documentation does not provide any information to allow ANZCO to understand how much of the 106T/year is attributed to their operation at Rakaia. This poses problems for ANZCO in a number of ways, which I will detail shortly.

28. This shortcoming is also acknowledged by the Reporting Officer in paragraph 11.297, where they state *"Essentially, there is no accounting system or other mechanism in place by which it can be clearly identified when the limits or targets in table 11(i) are reached."*

29. Loe (2013[1]) acknowledges that there is uncertainty with regard to estimating loads from point sources. While Loe (2013) canvased the milk processing operations of Fonterra and Synlait, and the community wastewater schemes operated by the Selwyn District Council, the livestock processing industry was not directly consulted with. This again makes it difficult for ANZCO to understand how the nitrogen loads for their operations were quantified.

30. I understand that Loe (2012[2], 2013) assumed that for wastewater discharges with net loading rates, the net loading rate was potentially available to be leached. However, the reports do not define the proportion of the net loading rate that was used to calculate the nitrogen leached from the soil for livestock processing facility. Loe (2013) estimated the leaching loss for nitrogen discharged to land via spray irrigation of sewage treatment ranges between 20% to 40% for a cut-and-carry operation. However, there is no corresponding estimate for livestock processing wastewater provided.

31. The Section 32 analysis (page 112) acknowledges that the contribution of community sewage systems and industrial and trade processes to the nitrogen load is less than 5% of the total load. Furthermore, I note that the estimated nitrogen load in the catchment from industrial wastewater is approximately 2% of the estimated load from farming activities (based on 106 Tonnes/year compared to 4,830 Tonnes/year). This percentage is even smaller for meat and food processing, which was estimated by Loe (2013) to be 35 Tonnes/year, which equates to <1% of the total estimated nitrogen load from farming activities.

32. On a catchment scale the contribution of the industrial and trade waste processes to the overall catchment nitrogen load is very small. Many of the industrial and trade waste operations are already operating in a manner to minimise nitrogen losses from the soils. The systems operate within limits already, with loading rates restricting the mass of nitrogen that can be applied to the soils.

[1] Loe, B. (2013): Selwyn – Waihora Catchment. Estimating nitrogen and phosphorus contributions to water from discharges of sewage effluent from community sewage systems, and milk processing wastewater. Report No. R13/8. Environment Canterbury, ISBN 978-1-927195-80-2.
[2] Loe, B. (2012): Estimating nitrogen and phosphorus contributions to water from discharges that are consented and permitted activities under NRRP. Report No. R12/18. Environment Canterbury, ISBN 978-1-927195-80-2.

33. I consider that there is considerable uncertainty in the estimates of nitrogen loading from the industrial and trade waste sources, but the magnitude of the uncertainty is not defined in the supporting documentation. For example, the estimates of nitrogen lost from the Fonterra Darfield plant provided by Loe (2012) were reviewed by Fonterra. Appendix 3 of Loe (2013) contains some correspondence from John Russell (21/12/12) who commented on the nitrogen loss estimated produced by Loe (2012). The review stated that approximately 19 Tonnes of nitrogen was estimated by Loe (2012). Mr Russell revised this number down to approximately 8 Tonnes for the nitrogen lost from the wastewater, increasing to 11 Tonnes for the entire farming operation over 611 Ha. This is a difference of approximately 42%.

34. The uncertainty associated with the nitrogen lost from the industrial and trade waste processes is a clear concern for ANZCO, particularly given the intention of the Variation 1 as detailed in the Section 32 report. Limiting current nutrient losses with the objective of reducing total nutrient loads over the longer term is supported. However, to apply limits across all sectors is, in my view, unnecessary.

35. The focus of the LWRP is on addressing nutrient losses from farming activities. Farming activities collectively contribute the vast majority of the nutrients to the groundwater and surface water systems, which until now have not been actively managed by the Regional Council. I consider that Variation 1 should maintain the focus on the farming activities, whilst enabling the industrial and trade waste activities to continue to operate in accordance with good management practices. New industrial and trade waste discharges should be considered, irrespective of the modelled nitrate-nitrogen leaching loss or the farm type it is replacing, provided that the operation is undertaken in accordance with good management practices.

Officers Report

36. The Reporting Officer raises a number of concerns regarding the discharge of industrial and trade wastes and the accounting of nutrient losses. In paragraph 11.293 the Reporting Officer states that there are difficulties in determining nutrient losses from primary processing operations where the discharges are irrigated to pasture and crops. This statement appears to

support my view that the estimate of nutrient losses from these types of activities is just a broad estimate. The supporting technical documents themselves indicate that the estimates of nutrient losses contain uncertainty, but there is no error margin given or no tabulated accounting for each discharge.

37. In the following paragraph (para 11.294) the Reporting Officer accepts that there is a degree of uncertainty associated with the nutrient loss calculation. However, in my view the Reporting Officer incorrectly attributes the large part of the uncertainty to the leaching loss estimate having not accounted for the underlying land use. Rather, the uncertainty lies with the lack of understanding associated with the nitrogen leaching losses from wastewater discharges to land.

38. Loe (2012, 2013) undertook a desktop exercise to estimate nutrient losses from the industrial activities. In discussing his findings, Loe (2012) noted that to establish and implement catchment limits for nitrogen and phosphorus from point source discharges, a more specialised assessment procedure would be required, particularly for meat processing and centralised wastewater systems.

39. Loe (2013) noted that estimating the nutrient load "*from smaller-scale point source discharges relies on generalised estimates...*" and notes that *"this report does not attempt to revise estimates of nitrogen and phosphorus contributions from on-site sewage, farm dairy effluent (FDE) ponds, or the nine small to medium-sized meat and other food processing plants...".* In my opinion, this provides no certainty for ANZCOs operation at Rakaia as to the baseline nitrogen load and how this is to be managed in the future.

40. The Reporting Officer recommends that the specific Industrial and Trade Waste nitrogen load limit is removed from Table 11(i). I support this recommendation. It reflects the level of uncertainty that exists in establishing the nitrogen load limit for these types of activities. Furthermore, the simplification of the rule as described in paragraph 11.303 of the Officers Report is generally supported, with the exception of restricting nitrogen losses to being no more that the estimated loss from the previous land use. I will discuss my concerns with this restriction below.

Restricting new industrial discharges to be no more than 15kgN/ha/yr

41. Clause (2) of Rule 11.5.25 states that where the discharge replaces an existing land use, the discharge cannot result in a loss of nitrogen of more than 15kg/ha/yr. I understand that the restriction is based on the permitted activity leaching loss from farming activities, which seeks to limit further nutrient loading from new farming activities.

42. I note that the Section 32 Report provides no analysis on whether or not this target would be achievable for industrial and trade waste activities. However, I consider that the proposed nitrogen loss limit of 15kg/ha/yr would not be achievable for ANZCOs consented operation at Rakaia. This is largely due to the operational requirements of the plant to discharge wastewater during periods where the soils are saturated and plant uptake of nitrogen is low.

43. I also consider that calculating the loss rate from the soils under meat processing wastewater using Overseer could result in erroneous results and conclusions. My understanding is that Overseer has not been specifically developed to model the high organic nitrogen concentrations contained within the livestock processing wastewater.

44. While I note that Overseer models organic nitrogen as a slow-release fertiliser (i.e. from Dairy Factory wastewater), I have not encountered any literature that supports its application to the management of wastewater from livestock processing facilities. I consider that further research should be undertaken to ascertain if the model can adequately calculate nitrogen loss from soils that are applied with wastewater from the livestock processing facilities.

45. While Overseer has been extended to determine nitrogen losses from soils applied with dairy factory wastewater, I note that the composition of the wastewater is different to the livestock processing wastewater. Typically, the total nitrogen load from dairy factory effluent is less, particularly when it is associated with the condensate, as detailed in Russell (2011[3]). In

[3] Russell, J. (2011): Statement of Evidence of John Michael Russell. Applications by Fonterra Co-operative Group to Selwyn District Council and Canterbury Regional Council for consents relating to the construction and operation of the Stage 2 Milk Powder Plant at Darfield. CRC120180.

addition, the organic nitrogen fraction is also significantly less than that found in livestock processing wastewater, with Russell (2010[4]) stating that typical wastewater (excluding condensate) has a TKN concentration of 60 mg/L and a Nitrate – N concentration of 50 mg/L. This compares to the typical wastewater characteristics measured in the wastewater at Rakaia of 90-220 mg/L TKN and 1-5 mg/L Nitrate – N. The difference in composition and concentration does influence how the wastewater is applied to land and managed.

46. Nevertheless, using Overseer as a tool to limit the rate that nitrogen is lost from the soil to no more than 15 kgN/ha/yr would require that minimal wastewater is discharged to land during periods when soil moisture is high and pasture growth is low. I consider that this is not a practicable option for ANZCO, as wastewater from livestock processing plants cannot be stored for long periods of time.

47. Rather than relying on Overseer to model the average nitrogen loss from the soils, which has not been developed to model wastewater from meat processing plants, I consider that the use of a net loading rate is currently the best method for managing the discharges from livestock processing facilities. While Overseer can be used to estimate nitrogen lost from the soil, even in its organic form, it should be used only as a broad indicator of losses until such time that research validates its use for managing livestock processing wastewater.

Officers Report

48. The Reporting Officer in paragraph 11.298 states that permitting a load of up to 15 kgN/ha/yr would not provide any assistance to the majority of the industrial and trade waste discharges in the catchment, as the Reporting Officer notes that the majority of the discharges are in areas where more intensive production is occurring and the threshold is already passed.

49. While I agree with the thrust of the Reporting Officers' statement in paragraph 11.298, it is more accurate to state that the current discharges from industrial and trade waste processes are unlikely to meet the 15 kgN/ha/yr regardless of the underlying land use.

[4] Russell, J. (2010): Statement of Evidence of John Michael Russell. Applications by Fonterra Co-operative Group to Selwyn District Council and Canterbury Regional Council for consents relating to the construction and operation of a Milk Powder Plant at Darfield.

50. Paragraph 11.302 states that Overseer can be used to estimate losses from industrial and community wastes, noting a degree of uncertainty. I understand that Overseer can predict nitrogen leaching from farming activities, which includes the application of fertilisers, Dairy Factory wastewater, and farm dairy effluent (FDE), to within a +/- 20% error (Ledgard, 2009[5]).

51. I note that Overseer was not developed to be used to model livestock processing wastewater discharges to land. While Overseer may be improved in the future, the current purpose of the model is to model farm nutrient inputs and outputs and not industrial wastewater. In my view, this creates a fundamental flaw with the approach contained in Variation 1 and the amendments suggested by the Reporting Officer.

52. The clause may also pose significant problems for ANZCO if it needed to acquire new land to discharge livestock processing wastewater to. As Overseer is not currently suitable for modelling wastewater discharges from livestock processing facilities, comparison between leaching rates modelled for existing farm use and future wastewater disposal is likely to be erroneous.

53. Alternatively, adopting the range of nitrogen leached from spray irrigated sewage treatment system of between 20-40% (Loe, 2013), the potential loss from livestock processing facilities would be in the order of 30-60 kgN/ha/yr. This rate of nitrogen loss is similar to an irrigated dairy farm or irrigated beef unit on light to extra light soils as defined in Lilburne *et. al.* (2010[6]). This approach could restrict ANZCOs ability to expand the wastewater discharge if the surrounding land is not currently used for dairy or intensive beef farming.

54. Instead, if restricting nitrogen loss from industrial activities is critical to meeting the water quality outcomes for the zone I consider that managing the discharge of wastewater using a net loading rate of 150 kgN/ha/yr, averaged over two years, is a more appropriate method. To avoid the doubling up of nitrogen losses associated with the dual use of land (i.e.

[5] Ledgard, S. F. (2009): Section 42A Report of Dr Stewart Francis Ledgard on behalf of Horizons Regional Council Concerning Water Quality.
[6] Lilburne, L., Webb, T., Ford, R, and Bidwell, V. (2010): Estimating nitrate – nitrogen leaching rates under rural land uses in Canterbury. Report NO. R10/127. Environment Canterbury. ISBN 978-1-927137-76-5.

stocking and industrial discharges), new areas for wastewater disposal could be restricted to a cut-and-carrying operation only, with no stocking. This would likely form part of the good management approach to managing the discharge of wastewater from these activities.

55. Adopting a net loading rate limit of 150 kgN/ha/yr averaged over two years for industrial wastewater is consistent with the limit already imposed on ANZCOs Rakaia operation and that of other meat processing facilities in the Catchment. However, I note that the rate is less than the typical loading rate associated with dairy factory wastewater, which manages nitrogen applications based on a net loading rate of 200 kgN/ha/yr.

56. It may be more appropriate for the net loading rate to be determined through a case by case evaluation at the time an application is made, subject to the discharge being undertaken in accordance with good management practices. This would also require a thorough assessment of the environmental effects associated with the discharge, including the effects on groundwater quality and down-gradient receptors.

Best practicable option is used.

57. Clause 3 of Rule 11.5.25 states that the best practicable option is used for the treatment and disposal of wastewater. I support this clause as it reflects ANZCOs current practice at Rakaia.

Conclusions

58. The Reporting Officer recommends that industrial and trade waste nitrogen load limit is removed from Table 11(i). I support this amendment as I consider it better reflects the relative scale of the estimated nitrogen losses from these operations compared with the aggregated loading from farming activities. It also indirectly addresses my concerns with the initial estimates of nitrogen losses from the industrial and trade waste process, which cannot be reconciled based on the supporting documentation.

59. Variation 1 effectively limits any expansion of processing plants to be no more than 15 kgN/ha/yr, while the Officers Report recommends that it should not exceed the "*lawfully permissible nitrogen loss*" from the farming activity that is being replaced.

60. I consider that it is not feasible for ANZCOs operations to meet the 15kgN/ha/yr losses based on a consented net loading rate of 150 kgN/ha/yr, averaged over two years.

61. Furthermore, using Overseer to provide a comparative analysis of nutrient losses from existing farming operation and the discharge of livestock processing wastewater would introduce significant uncertainty, given the limitations of the model and its applicability to model wastewater discharges. While I have concerns with using Overseer to model the nitrogen lost from soils associated with the livestock processing wastewater, the simple fact is that the limit of 15 kgN/ha/yr would preclude any new industrial or trade waste discharges in the Catchment.

62. In my view, Variation 1 would be better served to exclude industrial and trade waste processes from the nutrient loss limits, instead requiring the operations to produce a management plan and to adopt good management practices to avoid nutrient losses from the soils. This would allow for some future land use change to enable these operations to continue in the Catchment and respond to the primary land use change anticipated, subject to those conditions.

63. In addition, any new or expanding activities that discharge wastewater to land would still be required to provide a thorough assessment of effects to support the consent application. I consider that any such application would need to consider the direct effects of the discharge on groundwater quality and down-gradient receptors, while not being restricted by a Catchment nutrient cap.

Stephen John Douglass

29 August 2014

Attachment 1 – PLWRP Hearing Evidence (dated 4 February 2013)

Before the Independent Commissioners

In the matter of	the Resource Management Act 1991
And	
In the matter of	the Proposed Canterbury Land and Water Regional Plan

Statement of Evidence of Stephen Douglass on behalf of ANZCO Foods Limited, CMP Canterbury Limited and Five Star Beef Limited

Dated: 4 February 2013

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Introduction

1. My name is Stephen John Douglass. I am employed by URS New Zealand Limited (**URS**) as a Senior Associate Hydrogeologist.

2. I have worked for URS in the Christchurch office since 2005. Prior to starting with URS I was employed by Environment Canterbury for approximately 14 months as a consents planner, and for the Ministry of Education as a planner for a period of two and a half years.

3. I hold a BSc (Environmental Science) and an MSc (Geography) from the University of Auckland, and a Graduate Diploma of Engineering in Hydrogeology and Groundwater Management from the University of Technology, Sydney Australia.

4. While at URS, I have undertaken work for ANZCO Limited and it's subsidiary companies including Canterbury Meat Packers, CMP Rakaia, and Five Star Beef. As a result, I have a good understanding of the activities undertaken at each site and their respective environmental compliance requirements.

5. While this is a Council hearing, I note I have read the Code of Conduct for Expert Witnesses in the Environment Court Consolidated Practice Note 2006. I have complied with this Code of Conduct. Accordingly, this evidence is within my expertise, except where I state I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

6. In preparing my evidence I have reviewed:

   (a) The evidence of Mr Tim Ensor and Mr Michael Copeland, and had discussions with Mr Andy Macfarlane and Mr Mark Clarkson;

   (b) The Section 32 Report; and

   (c) The Officers' report.

Scope of Evidence

7. I have been requested by ANZCO Foods Limited, Canterbury Meat Packers, and Five Star Beef Limited (together referred to as **ANZCO**

unless otherwise specified) to provide evidence in relation to the matters within their submission which are within my area of expertise on the proposed Land and Water Regional Plan (**pLWRP** or **Plan**).

8. Mr Tim Ensor has provided evidence which addresses the content and structure of the Plan, including the status of meat processing and other rural secondary producers within the Plan's objectives, policies, and rules.

9. My evidence describes the water resource use and waste disposal methods associated with the meat processing industry.

10. I have separated my evidence into three sections, namely:

    (a) Background;

    (b) Wastewater Disposal; and

    (c) Water Access and Use.

BACKGROUND

11. I provide a brief overview of the water and wastewater requirements at ANZCO's meat processing plants and its intensive feedlot operation (Five Star Beef) in this section of my evidence.

Meat Processing Plants

12. Canterbury Meat Packers (**CMP**) have two rurally located livestock processing plants at Seafield and Rakaia. They do not have access to reticulated water or wastewater services. Therefore, they need obtain water from groundwater and use surrounding land to meet their resource needs.

13. Water is supplied to the processing plants from groundwater while the wastewater is applied to land. There are no alternatives available for ANZCO's two Canterbury plants for the water supply or wastewater disposal. Indeed, this is the case for nearly all of the existing meat processing plants in Canterbury. The exception being the Silver Fern Farms plant in Belfast, which used to discharge to the Waimakariri River but now discharges into the Christchurch City Council's Bromley treatment plant.

14. The CMP Seafield site includes the processing plant and approximately 500 hectares of land. The CMP Rakaia site includes the plant but it does not own any land for wastewater disposal. However, CMP Rakaia has a commercial agreement which provides access to 200 hectares of adjoining land for the purpose of disposing of the wastewater. Without this land, the processing plants would not be able to operate as there would be nowhere to dispose of the wastewater.

15. The processing of livestock commences from the time that the animals are brought onto the site. Typically, the stock is transferred from the transport trucks into holding pens. The holding pens are situated within the plant and are normally covered to keep the stock dry. From this point forward the plant begins generating animal waste which needs to be collected and disposed of.

16. The liquid component of the waste stream is captured within the processing plant. The liquid waste typically consists of a mixture of blood, effluent, and water. However, the majority of the blood from the slaughtering process is collected and containerised before being removed from the site for further processing.

17. The wastewater and effluent is captured and conveyed via sumps and sealed drainage into a main sump. It is then passed through screens to remove residual solids before being discharged to land. Solid wastes are captured and containerised before being removed from site or undergo further processing (i.e. rendering).

18. The application of the wastewater to land is typically achieved using spray irrigators, which provide greater control on the depth of wastewater application. The depth of application is generally designed to be less than half the average water holding capacity of the soil. Application of wastewater via flood irrigation still occurs in Canterbury, but is less common. Recent consents for discharging wastewater issued by the regional council require spray irrigation methods to be used to apply the wastewater to land.

19. When the application of the wastewater to land is undertaken in a controlled manner, it maximises nutrient recycling and limits nutrient leaching. I discuss this aspect of the land treatment process in more detail shortly.

Groundwater

20. ANZCO also relies on groundwater for the operation of its processing plants, as they are located in rural areas and do not have access to a reticulated town supply.

21. The groundwater used in the processing plants is typically abstracted from wells located in close proximity to the plant. When required, ANZCO also uses additional water to irrigate the pasture and crops which are grown within the disposal area.

22. This additional irrigation water improves the health of the pasture/crop between applications of wastewater to maximise plant growth and hence nutrient uptake. The healthier the plants are, the more potential for nutrient uptake.

23. Irrigation water also maintains soil moisture which is beneficial to microbial activity in the soil and reduces soil fissures developing (i.e. macropores). This reduces the potential to lose nutrients below the rooting zone.

24. The irrigation water is critical to the effective treatment of wastewater application. ANZCO's processing plants in Canterbury have access to sufficient irrigation water to meet the current demands of the disposal areas. CMP Seafield has consent for the irrigation of crops and pasture, while CMP Rakaia has a commercial agreement which ensures the disposal land is irrigated to maintain pasture growth.

25. Without water for supplementary irrigation the land treatment process would be less effective and leaching of nutrients would result.

Five Star Beef

26. Five Star Beef is an intensive feedlot farm located at Wakanui, Canterbury. Beef stock are contained in unlined pens with a semi-impermeable base of compacted aggregate and limestone.

27. The feedlot has been constructed to direct effluent into effluent ponds. Effluent from the ponds is sprayed onto surrounding land in accordance with the conditions of the discharge consent. Solid waste is collected directly from the feedlot is applied to land as a solid fertiliser.

28. The volume, rate, and area of the effluent discharge are defined by the resource consent conditions. In addition, the effluent discharge is required to be managed to minimise leaching of nutrients from the soil.

29. The disposal of the effluent wastewater to land is achieved using spray irrigators. The characteristics of the wastewater are considered to be similar to the dairy shed effluent. The following discussion of wastewater discharge is focused on the meat processing discharge, but can equally be applied to the discharges that occur from Five Star Beef.

Wastewater discharge – Meat Processing Plants

30. I will provide a brief overview of the typical characteristics of meat processing wastewater, and how the nutrient component of the wastewater is managed through the land application process. Understanding this information is critical as it highlights ANZCO's management approach that is currently utilised to address nutrient loading, and why this approach, in my opinion should continue into the future.

31. ANZCO's meat processing plants in Canterbury are operative for up to 11 months of the year. While there are distinct peak processing periods in early spring and late summer, processing typically commences in August and runs through to early June. The volume of wastewater generated from the processing plants varies on a daily basis and is largely determined by the number and type of stock units that are being processed.

32. Wastewater generated from the meat processing plants is not stored onsite for more than 24 hours before it is discharged to land. This is a condition of consent for CMP Seafield and CMP Rakaia. This method of immediate disposal of the wastewater to land has been preferred in Canterbury, as there is suitable land that can be readily used to provide the necessary treatment of the wastewater.

33. If wastewater is stored for more than 24 hours it can change the wastewater characteristics and make it less suitable for disposal to land

without additional treatment. This is because the wastewater may become anaerobic as a consequence of the microbial activity consuming all of the available oxygen in the wastewater. This in turn can lead to the conversion of organic nitrogen into more readily leachable forms of nitrogen (i.e. nitrate – nitrogen). As wastewater becomes anaerobic, it also results in the production of adverse odours associated with the decomposition of the wastewater.

34. Where storage ponds are used, it usually involves two wastewater treatment ponds. The first is an anaerobic pond, which uses the microbial activity to consume the organic matter, leading to less organic nitrogen and more ammoniacal-nitrogen. The wastewater is then transferred into a secondary pond which is aerated, converting the ammoniacal-nitrogen into oxygenated nitrogen (i.e. nitrate nitrogen). The wastewater is then applied to land in a form that is more readily available for plant uptake. However, it is also in a form that is more readily leachable.

35. The benefit from the pond system is that is reduces the land area required for disposal. However, there are management issues associated with a pond treatment system, including increased production of gases (i.e. methane) and odour, costs of maintenance of the ponds to remove sludge and the sensitivity of the microbes in the wastewater to temperature (i.e. the anaerobic pond needs to be kept at a constant temperature to maximise biological activity. Significant changes in temperature can lead to microbial mortality and the collapse of the treatment system).

36. Where there is limited land available to discharge the wastewater then the introduction of secondary treatment may become more widely used.

37. Given the availability of suitable land for disposal of wastewater in Canterbury the use of ponds or other secondary treatment systems are less common.

38. Disposal of wastewater in this way (i.e. to land) has the advantage of creating significant benefits for soil health. The characteristics of the processing plant wastewater, which are discussed below, increases the organic matter of the soil which directly increases water holding capacity and soil depth.

39. ANZCO regularly tests the health of the soils where the wastewater is applied to ensure that the soils are able to treat and remove the contaminant. Regular testing of the soils within the disposal areas at the two ANZCO Canterbury sites indicates that the disposal of wastewater is having no detrimental effects on soil health. Conversely, the discharge has been shown to improve organic matter and fertility of the soils.

40. I have provided a brief overview of the typical wastewater characteristics from the meat processing plants in the paragraphs that follow. The purpose of the overview is to describe the relative concentration and form of nitrogen in the wastewater from the meat processing plants, and how this compares to other wastewater sources.

41. The nitrogen content in the wastewater is primarily organic nitrogen (i.e. is carbon based). When wastewater is sampled the organic content is tested and reported as Total Kjeldahl Nitrogen (TKN). TKN also includes ammoniacal-nitrogen. The remaining nitrogen component in the wastewater is in oxidised form (Total Oxidised Nitrogen – TON), and is more commonly known as nitrate–nitrogen and nitrite-nitrogen. When combined, the concentrations of TKN and TON sum to the Total Nitrogen (TN).

42. The concentration of TKN in meat processing wastewater typically ranges between 75-200 g/m^3. TKN is the main nitrogen component in the wastewater, typically comprising more than 90% of TN. The TON concentrations in wastewater make up the remainder of the nitrogen content.

43. When applied to land, the majority of organic nitrogen (TKN) is retained within the soil. The TON content of the wastewater is readily available to the plants to be taken up. However, it can also be leached through the soil profile or be converted to gaseous forms through the denitrification process.

44. The nitrogen that is retained in the soil adds to the soil organic matter. Overtime the nitrogen in the soil is converted into forms that are available for plant uptake. This process is called mineralisation and nitrification and converts organic nitrogen into ammoniacal-nitrogen, which is readily

converted into nitrate-nitrogen. Both of these forms of nitrogen can be taken up by plants.

45. Di and Cameron (2002[1]) provide a relevant discussion of the nitrogen leaching potential from a range of land uses, including the application of various effluent types to land. Their work is relevant here as it provides results of nitrate leaching losses associated with wastewater/effluent applications from trials conducted in Canterbury. More recent work in this area (Lilburne *et al*, 2010[2]; Bidwell *et al*, 2009[3]; Green & Clothier, 2009[4]; Snow *et al*, 2008[5]; and Webb, 2009[6]) has tended to focus on losses from farming systems (i.e. diffuse source discharges). Di and Cameron (2002) also provide a comparison of nitrate concentrations and forms contained in common wastewater types, which is useful to consider here.

46. The nitrogen concentrations presented by Di and Cameron (2002) for meat processing effluent ranged between 40-200 mgN/L, while dairy shed effluent nitrogen concentrations ranged between 140-670 mgN/L. The nitrogen concentration range for the meat processing effluent reported in Di and Cameron (2002) are consistent with the wastewater sample results obtained from ANZCO's processing plants. It was also noted that the nitrogen content of the wastewater was predominately in an organic form.

47. The final step in the management of the nutrients applied to the land is to remove vegetative matter. This process is commonly referred to as a 'cut and carry' operation. Mr Macfarlane will provide further detail on the typical rotation of crops and pasture that are used by ANZCO.

48. Undertaking a cut and carry operation will remove nitrogen from the property and enable further reductions in nitrogen stored in the soil to

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[1] Di, H.J. and Cameron, K.C. (2002): Nitrate leaching in temperate agroecosystems: sources, factors and mitigating strategies. *Nutrient Cycling in Agroecosystems*, Vol 46: pp 237-256, 2002. Kluwer Academic Publishers, Netherlands.

[2] Lilburne, L., Webb, T., Ford, R., Bidwell, V. (2010): Estimating nitrate-nitrogen leaching rates under rural land uses in Canterbury. Environment Canterbury Report No. R10/127. September 2010.

[3] Bidwell, V. Lilburne, L., Thorley, M., Scott, D. (2009): Nitrate discharge to groundwater from agricultural land use: an initial assessment for the Canterbury Plains. Technical report commissioned by the Canterbury Water Management Strategy steering group.

[4] Green, S. and Clothier, B. (2009): Nitrate leaching under various land uses in Canterbury. Environment Canterbury Report No. R09/86, September 2009. Plant & Food Research Limited.

[5] Snow, V. Bryant, B. Monagahan, R. Campbell, J., Scott, K. (2008): Steady state nitrate leaching: Predictions for selected Canterbury Plains soil types, climates and farm systems. A report prepared by Agresearch for Environment Canterbury, September 2008.

[6] Webb, T. (2009): Nitrate leaching predictions: assessment of results from modelling work undertaken for ECan in 2008-09. A report prepared by Landcare Research. Environment Canterbury Report No. R09/12, October 2009.

occur. This process can be highly effective in removing nitrogen from the site. These points are important to recognise as they form the basis for the use of land to treat the wastewater produced by the processing plants and effluent ponds.

49. Di and Cameron (2002) also state that cut grassland (e.g. a 'cut and carry' system) is one of the less 'leaky' agricultural systems with regard to nitrate leaching, with a large amount of nitrogen being removed from the system (300-400 kgN/ha/yr) in harvested pasture. Furthermore, Di and Cameron (2000[7]) state that where nitrate is applied in organic forms to soil it is not readily leachable, with nitrogen being released over subsequent years as part of the nitrogen mineralisation process.

50. This is important to recall, as the majority of the nitrogen that is applied to land as part of the wastewater from the processing plants is in organic form as opposed to other effluent sources which contain higher concentrations of mineral-N (e.g. piggery effluent and cow urine patches)

51. The ability of pasture and crops to remove nitrogen from the soils is a critical component of the land treatment process. Applying the wastewater in a controlled manner reduces the potential for leaching. When supported by irrigation with 'clean' water, the pasture/crops will use the nutrients applied to the land to support growth. Therefore, the management of the application process, supported by the ability to irrigate crops when needed, are probably the most important factors in minimising nitrate leaching from the soils.

52. Mr Macfarlane will provide further details on the cut and carry operation that is undertaken by ANZCO. He will comment on the trials of nitrogen inhibitors, which are used (up until recently) to minimise the nutrient loss from the soils by controlling the microbial activity.

Management of Wastewater Application

53. The application of raw wastewater and effluent to land requires careful management to limit the potential for nutrients to be leached to groundwater. The management approach used has been informed by the

[7] Di, H.J. and Cameron, K.C. (2000): Calculating nitrogen leaching losses and critical nitrogen application rates in dairy pasture systems using a semi-empirical model. *New Zealand Journal of Agricultural Research*, Vol 43, pp13-147. The Royal Society of New Zealand.

understanding of the wastewater characteristics and the nitrogen cycle as discussed above.

54. Mr Macfarlane will provide a description of the management approach used by ANZCO at its meat processing plants. Central to wastewater management is the removal of nitrogen from the soils.

55. The primary mechanism used by the Regional Council to manage the wastewater discharge is a restriction on the annual loading rate of nitrogen. The nitrogen loading rate typically includes a gross and net loading rate to reflect the mass of nitrogen applied to the land and the amount of nitrogen that is removed in the vegetative matter.

56. It is current best practice to require the application of wastewater to land to be managed in such a way as to provide a complete nutrient budget for each application area. The nutrient budget includes:

    (a) the concentration of nutrients in the wastewater established from samples of the wastewater;

    (b) the application rate and depth of the wastewater (i.e. 30mm per application);

    (c) the hours of application;

    (d) the area where the wastewater has been applied (i.e. paddock or run number);

    (e) the date of the application;

    (f) the mass of herbage removed from the area; and

    (g) the mass of nitrogen contained in the herbage removed from the site.

57. The information recorded for each block/paddock that receives wastewater is used to calculate the nutrient budget. The nutrient budget is typically calculated using Excel spreadsheets for each block.

58. This approach is employed by ANZCO and enables them to readily demonstrate how much nitrogen was applied to a given block, how much was removed by cut and carry, and what the potential remaining nitrogen

mass is. Mr Macfarlane notes that ANZCO has also measured nitrogen in the drainage water below the rooting zone for nearly 20 years. This provides site specific information on the magnitude of nitrogen leaching from the soil and enables ANZCO to continually improve their wastewater management.

59. This nutrient balance approach is a common consent requirement for wastewater discharges associated with meat processing plants. I consider that this approach provides a sound method for determining the nutrient balance for the wastewater discharge. It is conservative in terms of determining the net loading rate as it does not account for volatilisation or de-nitrification. It also provides for variation in wastewater quality and quantity to be recognised and managed.

60. On that basis I consider that this method of monitoring the nutrient balance associated with the wastewater disposal should continue to be used.

Feedlot Effluent Discharges

61. Five Star Beef is an intensive feedlot operation which captures all animal waste and discharges the waste to land. The application of both solid and liquid waste to land is undertaken in a controlled manner. Similar to the process used in the meat processing industry, the loading rates of nutrients is carefully managed to ensure that the loss of nutrients to groundwater is minimised.

Land Use and Discharge Policies and Rules

Wastewater Discharges

62. ANZCO's meat processing plants are considered to be industrial activities which require access to groundwater and produce wastewater which requires access to land.

63. I will now provide my thoughts on specific policies and rules that are relevant to ANZCO's operations. This will include my interpretation of the new policies that relate to farming activities, and how these policies relate to ANZCO's meat processing operations.

64. The proposed plan states that there are to be no direct discharges of untreated industrial wastewater to surface water bodies or groundwater

(refer Policy 4.9). This is consistent with the preference for land based disposal and treatment of the wastewater. This policy is supported as land is the best receptor for the type of wastewater that is produced by meat processing plants.

65. Policy 4.11 is a broad policy that relates to the discharge of contaminants (including nutrients) to land where it may enter groundwater. I support the intention of the policy. However, it is unlikely that the discharge of wastewater from the majority of the meat processing plants in Canterbury will be able to satisfy all of the clauses contained in Policy 4.11, due to the practicalities of managing the wastewater generated from livestock processing, regardless of whether there are any significant environmental effects.

66. That is, there will be times where wastewater will be applied to soils which have limited capacity to store water. This is a consequence of the year-round need to process livestock which will inevitably mean having to deal with wastewater during periods where pasture growth is slow and soil moisture content is high.

67. It is generally recognised that at certain times of the year wastewater will be applied to land under these conditions, as it is not practical to discharge it elsewhere. Storing wastewater for longer periods to avoid the discharge to saturated soil will result in changes to the wastewater characteristics. This (as explained above) is generally not supported as the best management approach.

68. I consider that the Plan should recognise that the discharge of wastewater from the meat processing plants can practically only occur to land.

69. The pLWRP also contains a number of new policies that relate to the use of land and the loss of nutrients to groundwater and surface water. Most of the new policies and rules relate to farming activities and the diffuse source discharges that arise from these farming activities.

70. For example, policies 4.30 through to 4.34 discuss nutrient discharges from farming activities. I consider that the 'Farming' policies do not relate directly to industrial discharges, including the wastewater applied to land. To avoid any doubt, I consider that the wastewater generated from the

meat processing plants, and the land that receives the wastewater, is classified as an industrial waste and waste treatment system.

71. Mr Ensor provides additional comment on the relevance of the farming centric policies. I will now focus my discussion on the discharge rule as it applies to industry, and the supporting information contained in the Section 32 report.

72. The Section 32 (S.32) report is largely silent on meat processing plants within the discussion of discharges from industrial and trade waste premises, despite the activity clearly falling within the definition of an industrial or trade waste premise and process in the pLWRP.

73. The S.32 report states that most industrial and trade wastes will not comply with Rule 5.69 and therefore will require a consent as a discretionary activity (Rule 5.70). This is true for ANZCO's meat processing operations.

74. The cost-benefit evaluation provided on page 81 of the S.32 report is very broad and does not specifically recognise the wastewater discharges from meat processing plants. However, as previously stated there are limited options for the discharge of wastewater from these industries.

75. The S.32 report identifies meat processing wastewater as a point source discharge (page 64), and notes that when combined with all other point source discharges *"comprise less than 10% of the nitrogen load from consented and permitted discharges".* This indicates that these point source discharges are towards the minor end of the spectrum in terms of contribution to nutrient load. I agree with this statement. On page 66 of the S.32 report it is noted that *"point source discharges from rural land uses (e.g. fertiliser applications, offal pits, and dairy shed effluent) would be controlled by rules based on section 15 of the RMA".*

76. Table 2 contained in Appendix 1 of the S.32 report identifies the estimated total annual loads of nitrogen and phosphorus that are applied to land from authorised discharges. The S.32 report states that of these point source discharges approximately 60% of the load is from meat, food, and milk processing industries. The table is based on a report prepared by Loe

(2012[8]). I have read the report and have some concerns regarding the methodology used to determine the nutrient losses from the meat processing wastewater. I will provide a brief overview of my concerns now.

(a) I consider that the report does not accurately represent the management practices employed as part of the meat processing wastewater application process. In fact, the report does not recognise the potential sorption of nutrients to soil or the contribution made to organic profile in the soil. It considers that where there is a net loading rate specified on a consent, the whole of that amount is available for leaching and therefore the full net rate has been assumed to be leached from the soil.

(b) This is not accurate and does not reflect the investigations undertaken by Di and Cameron (2000, 2002). In addition, Loe (2012) considered that where meat processing wastewater is applied via flood irrigation (i.e. border dyke) the total nitrogen load will be leached. This is, in my view, an over-estimation of the likely losses from this application method, as even with flood irrigation the soil will retain a high proportion the organic matter in the soil profile under ideal conditions.

(c) Therefore, I consider that the contribution from meat and food processing activities to the nutrient load detailed in Table 2 of Appendix 1 is over estimated.

(d) This is important to recognise as Table 2 indicates that the meat, food, and milk processing industries are significant contributors of nutrient losses from point source discharges. However, management of the wastewater discharge and application to land combined with a cut and carry operation seeks to limit the loss of nutrients to groundwater. Mr Macfarlane will provide evidence setting out that that ANZCO's primary objective is to manage the wastewater application to land as it *"can become an asset that generates further capability and lowers risk".*

[8] Loe, B. (2012): Estimating nitrogen and phosphorus contributions to water from discharges that are consented and permitted activities under NRRP. Environment Canterbury Report No. R12/18. Prepared by Loe Pearce & Associates Limited, February 2012.

77. As stated above, the characteristics of the wastewater combined with the management practices as will be detailed by Mr Macfarlane indicates that the wastewater can be managed in such a way as to minimise losses to the groundwater system.

78. ANZCO are seeking clarity in relation to how the Plan will provide for land use changes associated with the discharge of wastewater from their plants. Under Rule 5.70 (relation to industrial and trade wastes) the activity to discharge wastewater is classified as a discretionary activity.

79. ANZCO is concerned that if they seek to increase the consented land area to receive wastewater, either to increase efficiency, respond to demand, or for future planning purposes, that the inclusion of the new land area may trigger the requirement for them to undertake a comprehensive assessment of nutrient leaching for the catchment to address the requirements of Policy 4.34 and Policy 4.1.

80. The lack of clarity is associated with the term "farming activity" and how this will be applied to the land areas used for the disposal of wastewater.

81. I consider the use of land for the disposal of wastewater is not a farming activity. Therefore, changing the land use from a farming activity to receive the wastewater would not be captured by Rules 5.39 to 5.51. On that basis the discharge would need to consider Policies 4.9 to 4.11 (discharges to land), while Policies 4.30 to 4.36 would not apply (which relate to farming activities).

Stock pads and effluent ponds

82. The operations at Five Star Beef are slightly different from the meat processing plants. The wastewater generated is considered to be from a farming activity. The liquid effluent from the feedlot is collected, stored, and discharged in a similar manner as dairy shed effluent.

83. Rule 5.33 classifies the discharge of solid animal waste to land from an intensive farming process or industrial process as a permitted activity, subject to the conditions of the rule.

84. Solid waste from the feedlots is mixed with the bedding material (i.e. straw) and removed from site. It is applied as a solid fertiliser on farms and is

mixed in with the soil to improve organic matter and soil fertility. The solid waste presents a low risk to nitrate leaching. This is reflected in the activity status that has been assigned in Rules 5.33 and 5.34 (Animal and Vegetative waste rules).

85. Rule 5.35 classifies the use of land for the stock holding, effluent collection storage, treatment, and subsequent discharge of animal effluent or water containing animal effluent and other contaminants onto land as a restricted discretionary activity.

86. These two rules capture the activities that occur at Five Star Beef (and as discussed by Mr Ensor, potentially capture livestock processing activities). As previously stated, the application of the effluent to land using spray methods is an effective method of reducing the risk of nutrient leaching from the soil profile. It also has an economic benefit which is described by Mr Macfarlane and Mr Copeland.

87. The management of the collection and discharge of the effluent stream is critical to ensure that the conditions of the rules are met. The S.32 report acknowledges that these activities are able to be controlled to minimise the potential for nutrient leaching, provided there is sufficient storage to accommodate the times where soils cannot hold any more water or there are adverse weather conditions (i.e. frozen ground).

88. Five Star Beef has two storage ponds which provide sufficient storage to meet the conditions of the rule. Any future developments or new intensive feedlots should also be required to provide for onsite storage. This is considered the best management approach and would limit the potential for leaching of nutrients to groundwater. However, as previously stated, I consider that this approach would not be suitable for the wastewater that is generated from the meat processing plants.

WATER ALLOCATION

89. Meat processing plants require access to water that is of potable standard to meet the required food and hygiene food standards for the processing of food products. Mr Macfarlane will describe the importance of ANZCO in terms of providing an essential service to the rural sector, especially in times of water shortages.

90. ANZCO's processing plants utilise groundwater as a source of water for its processing needs. Water is also required for irrigation of crops/pasture to support plant growth during periods where wastewater is not being applied to the land.

91. Therefore, water is essential to livestock processing and the resulting wastewater treatment process. This is not recognised in the pLWRP or in the S.32 report.

92. The proposed policies and rules in the pLWRP do not enable ANZCO to make an application for new water.

93. While the pLWRP seeks to achieve better land management and water quality outcomes, the proposed policies and rules may also create a situation where increased demand for meat processing facilities could arise. The pLWRP creates the potential for conversion from irrigated cropping, dairy, dairy support, or beef farming, to irrigated sheep farming. This is due to typical nitrogen leaching rates under irrigated cropping, dairy, dairy support, and beef farming being more than irrigated sheep farming. The S.32 does not consider this outcome.

Allocation Limits

94. The groundwater allocation zones and limits that were within the NRRP have largely been inserted into the pLWRP. These limits were considered to be interim limits in the NRRP, with the relevant rule (WQN13) of the NRRP classifying a proposed take in an over-allocated zone as a non-complying activity. However, the pLWRP classifies any proposed take in an over-allocation groundwater zone as a prohibited activity under Rule 5.104.

95. The S.32 report contains very little additional information as to why these limits should be considered to be sufficiently progressed to deem them to be 'final' limits.

96. The majority of groundwater allocation zone limits specified in the pLWRP have been set based on land surface recharge modelling that was undertaken in 2004 (Scott, 2004[9]). In many cases the modelling has not

[9] Scott, D. (2004): Groundwater allocation limits: land-based recharge estimates. Report U04/97. Environment Canterbury

been updated to reflect the additional irrigation development in these zones since that time, which may increase land surface recharge and hence allocation limits.

97. There are a number of reports (Thorley *et al*, 2010[10]; Gabites and Williams, 2010[11]; Williams, 2009[12], SKM, 2009[13]) which have been issued by the Regional Council in recent years which provide new information which could support a change in the allocation status or zone boundary for a given area.

98. Thorley *et. al.* (2010) provides a detailed investigation of the land surface recharge in the Rakaia - Ashburton plains, specifically accounting for the additional recharge provided by the Ashburton Lyndhurst Irrigtion Scheme (ALIS). The report states that *"further groundwater development coastwards of SH1 is expected to have less of a cumulative effect on piezometric levels than development up-plains".* It also notes that *"groundwater abstraction could be increased from the status quo coastward of State Highway 1 on the condition that further irrigation development above about State Highway 1 is primarily sourced from surface water..."*

99. CMP Seafield is located in the area which, according to Thorley *et. al.* (2010), groundwater abstraction could be increased. While I accept that further work would be required to demonstrate that the effects of new abstraction would not result in any significant adverse cumulative effects, the report does recognise that further allocation is a possibility. I note that the S.32 report does not comment on this report.

100. Williams (2009) defines the Rakaia River riparian sub-area (RRSA) as a unique groundwater environment that differs from the larger Rakaia – Selwyn Groundwater Allocation Zone (RSGAZ). Douglass (2009[14]) presented evidence which supported the work undertaken by Williams (2009), albeit with slightly different sub-area boundaries. Williams (2010)

[10] Thorley, M.J.; Bidwell, V.J.; and Scott, D.M. (2010): Land-surface recharge and groundwater dynamics – Rakaia – Ashburton Plains. Report No. R09/55, ISBN 978-1-86937-995-7. Environment Canterbury.
[11] Williams, H. (2010): Groundwater resources in the Te Waihora/Lake Ellesmere catchment: management issues and options. Report No. 10/05, ISBN 978-1-877542-63-3. Environment Canterbury.
[12] Williams, H. (2009): Groundwater resources associated with the Rakaia riparian sub-area: assessment of technical and allocation issues. Report No. R09/43. Environment Canterbury.
[13] SKM (2009): Managed aquifer recharge feasibility study; Unpublished technical report prepared by Sinclair Knight Mertz for Environment Canterbury, Project AE03788. Environment Canterbury.
[14] Douglass, S. (2009): Statement of Evidence in the Matter of Applications for resource consent by CMP Rakaia to take and use groundwater (CRC062093, discharge wastewater (CRC082192, and discharge stormwater to ground (CRC084651).

provided information regarding the various water management options available for the Te Waihora/ Lake Ellsemere catchment. In regard to the RRSA, Williams (2010) states:

> *"I recommend keeping the south-western margin of the RSGAZ, the Rakaia riparian sub-area, distinct from the remainder of the RSGAZ for the reasons described in Williams (2009a)"*

101. The CMP Rakaia plant is located near the boundary of the Rakaia River riparian sub-area as defined by Williams (2009). In 2010 URS presented evidence at a hearing for CMP Rakaia which provided a slightly different view on the boundary of the sub-area, which recognised the piezometric contours, the influence of the surface water irrigation schemes (Northbank Irrigation Scheme – NIS), and the flows of the lowland streams. Despite the differences of opinion on the boundary of the sub-area it was recognised that there was sufficient hydrological evidence to differentiate this area from the larger groundwater zone.

102. The commissioners (Milne and Heller) agreed that this area was hydraulically different to the larger Rakaia Selwyn Groundwater Allocation Zone and granted the application (CRC062093) to take and use groundwater, subject to adaptive management conditions. The commissioners stated:

(a) *"Given the degree of uniqueness in the identified sub-area, and the relatively small volume of take, we are satisfied that with the combination of the NIS and the consistency of the Rakaia River boundary effect, the proposed activity will have a less than minor impact upon the receiving environment." (paragraph 12.22[15])*

103. As the pNRRP classified the take as a non-complying activity it enabled ANZCO to provide evidence which supported the unique hydrological environment that surrounded the CMP Rakaia plant. The rules as set out in the pLWRP would not have allowed this application to be made. Therefore, the required water supply for the plant would not have been secured despite there being water available and the take having less than minor adverse effects .

[15] Milne, P., and Heller, T. (2010): Final Decision of independent hearing commissioners Milne and Heller. Environment Canterbury hearing in the matter of applications for resource consent by Canterbury Meat Packers (Rakaia) to take and use groundwater (CRC062093), discharge wastewater to land (CRC082192) and discharge stormwater into land (CRC084651).

104. SKM (2009) provide an initial evaluation of the potential to recharge the central plains aquifers with surface water during the winter periods. This process is commonly referred to as Managed Aquifer Recharge (MAR). Williams (2010) states that recharging the groundwater system during the winter months at a rate in the order of 10 m^3/s would more than account for the over allocation in the central plains groundwater allocation zones. While further work is required on this option, it is noted that the Central Plains Irrigation Scheme could enable this recharge to occur (either as part of the scheme losses or through use of the headrace canal for a MAR scheme).

105. The S.32 report does not comment on the Rakaia River riparian sub-area, the work presented by Williams (2009 and 2010), nor the decision of Milne and Heller for CRC062093 (or other similar cases). It is silent on the potential for additional water to be granted from east of SH1 in the Rakaia – Ashburton plains (nor other areas which may have similar characteristics), and does not provide for alternative groundwater management strategies such as MAR to be considered.

106. The S.32 states that the NRRP approach was less effective at dealing with cumulative effects, particularly over the wider groundwater allocation zone. It also states that prohibiting any new takes from an over allocated zone is primarily in response to the Freshwater National Policy Statement and the Canterbury Regional Policy Statement. Furthermore, the S.32 states that it is also in response to the multitude of applications that have been received to exceed the existing NRRP limits as non-complying activities.

107. I consider that there is nothing within the Freshwater NES or the CRPS which requires the council to prohibit water takes in an over allocated catchment. These documents seek to avoid further over allocation on the basis of managing cumulative adverse effects on the environment.

108. I consider that there is sufficient information available which indicates that further allocation could be justified in some areas. I also consider that the allocation limits or zones could change with new information. While the S.32 report states that any changes to allocation zone limits are best dealt with through the plan change process, there are exceptions to this and the above information shows that, at least for some areas, there is already robust information out there, available for consideration now.

109. The approach set out in the pLWRP would prevent ANZCO from making an application for new water in an over allocated groundwater zone even where there is new information (such as additional recharge from surface water schemes), or alternative mitigation (ie. trigger levels and adaptive management – rainfall recharge model), which would result in the effects on the environment from the proposed take being considered acceptable.

110. Given the above, Mr Ensor considers that the objectives of the Plan are better achieved by classifying the activity as a restricted discretionary activity rather than a prohibited activity. I support Mr Ensor's conclusions (to the extent that I can), noting that the water requirements of the meat processing industry differ from those of the primary agricultural industry. Mr Ensor's approach also recognises the uncertainty regarding some the groundwater allocation limits and zone boundaries.

Water Transfers

111. I now discuss the approach of 'clawing' back water that is associated with a transfer of water from site to site, as detailed in Rule 5.107 and Policies 4.71 to 4.73. If new water is unable to be applied for then operators like ANZCO will need to acquire groundwater from an existing authorised consent. Given that the meat processing activity will use water for longer periods than a typical irrigation season, it may need to obtain a large allocation of water at considerable cost, knowing that up to half of it may be removed from the consent.

112. I am uncertain as to the basis for the 50% of water transferred to be surrendered. I accept that the intention is to reduce the volume of water allocated to be no more than the allocation limits. However, the rational for achieving this objective is not well defined in the S.32 report. Mr Ensor provides additional comment on this matter.

113. Mr Ensor states that there are a number of approaches to address the over allocation issue. These include consent reviews, assessing resource use at times of consent renewal, and requiring a smaller proportion of water to be surrendered for transfers. He considers that this combined approach would have less immediate economic impact and yet still achieve the outcome sought. I consider that Mr Ensor's proposition is likely to provide a better balance than the proposed rule in the Plan. Mr Ensor's approach

focuses on promoting efficient use of the resource while achieving the objectives of the NPS and RPS of reducing over allocation of the water resource.

114. I also have concerns regarding the equity of requiring the large proportion of the water transferred to be surrendered in 'over-allocated' zones.

115. In those circumstances where groundwater has been allocated above the allocation limit, the consents have "adaptive management conditions" (commonly referred to as the 'Daveron' approach). These consents were granted on the basis that they would have no significant adverse cumulative effects on the environment. Given the adaptive management conditions associated with these consents, they are considered to be less reliable than those issued below the allocation limit.

116. This is important to recognise. While Rule 5.107 will result in a reduction in the quantum of water allocated, it may increase the reliability of those consents issued above the allocation limit (with adaptive management conditions) to such an extent that those adaptive management conditions could be removed (on the basis that the take would be below the allocation limit and hence, cumulative effects would be considered acceptable). The S.32 report has not considered this outcome.

117. The adaptive management conditions provide a measure of environmental protection. Therefore, I consider that there is no need to require condition 5 of Rule 5.107. In my opinion it would be preferable to differentiate the irrigation consents which were issued above the allocation limits (with adaptive management conditions) by creating a groundwater B permit block. The Plan could then seek to reduce the volume of these B permit consents if transferred. The concept of a groundwater B permit is already contained in the pLWRP, with the allocation of 35 million m^3 of water in the Hakatare/Ashburton River catchment. This approach would not penalise those consent holders with consents that were issued within the allocation limits.

118. Finally, I am also uncertain of the relative merits of applying a lesser percentage (i.e. 25% of water transferred) of transferred water to be surrendered where it is associated with the spatial redistribution of surface water and groundwater abstractions. In my view this may not achieve

more efficient use of the water resources in the region. I consider that the spatial redistribution of water resources should be supported where it is consistent with the CWMS, regardless of allocation status.

Well Interference Effects

119. If groundwater was made available to transfer or as a new take the method for determining the effects of the abstraction on existing users is detailed in Schedule 12 (Well Interference Effects) of the pLWRP. The methodology has been used for a number of years and was part of the NRRP (Schedule WQN10). While it provides a good method for evaluating the direct-cumulative effects from groundwater together with the effects of the new take, the accuracy of the assessment is subject to the assumptions of the analytical model used to determine the effects.

120. It is accepted that the interference effects model requires site specific information to be used to establish the critical aquifer parameters. These parameters are used to model the interference effects on all wells within 2 km of the pumping well. This simplification can result in interference effects being modelled that exceed the actual effects due to the variability of the hydrological characteristics of the aquifer system.

121. By way of example, ANZCO's operations at Five Star Beef in Ashburton introduced a new supply well to their farm in 2008. As part of the application process the new well was drilled and tested. Neighbouring wells were monitored and used to determine the aquifer parameters. All of the information was incorporated into the model by adopting the average from the data obtained. However, when incorporated into the well interference model it over-estimated actual effects on some of the wells that were monitored (the better performing wells).

122. This illustrates how the model can result in an over-estimate of actual effects and indicates a potential limitation of Schedule 12. Mr Ensor provides comments with regard to this issue in his evidence. I consider that where there is additional site specific information that indicates that the modelled interference effects are likely to over-estimate the effect then this information should be considered as part of the well interference evaluation. Where this information is available I consider it should be used in preference to the analytical model output.

123. In addition, the protection of 80% of the available water to the well (as described in Schedule 12), is considered appropriate where limited site information is available. However, where it can be shown that an individual neighbouring well can yield the consented amount without reducing its reliability offered by Schedule 12, the protection of 80% should be able to be revisited. That is, if an abstraction only utilises 50% of the available water due to the well performance and/or a low abstraction rate, the interference assessment should be able to consider this when determining the potential significance of the effect.

Summary

124. It is my view that the method of allocating water in Canterbury under the NRRP has limitations. One of these limitations is the lack of recognition of industry in the rural sectors, where access to reticulated supply is not available.

125. Mr Copeland provides his views on the economic benefits that are associated with the meat processing industry. Mr Ensor discusses the relatively small volume of water that is required to process livestock and maintain healthy pasture. These views highlight the benefits that can be obtained from the allocation of water to industries such as the meat processing sector.

126. I have stated that water is essential for the processing of livestock and for the maintenance of pasture/crops to maximise nutrient uptake. In my view the Plan should recognise this dependence on water for this industry, because unlike farming, livestock processing cannot be undertaken without access to water.

127. Mr Ensor provides comments on this matter, noting that livestock processing should be recognised as 'essential users' of water and not subject to the same allocation rules as the primary sector. I the light of evidence of Mr Ensor I consider that it would be more effective for the Plan to provide for 'essential users' of water for the following reasons, in summary:

    (a) a small overall water user comparatively;

(b) water is essential for the processing of livestock and to maintain healthy plants to maximise nutrient uptake;

(c) application of irrigation water helps plant growth, helps reduce nutrient uptake and therefore reduces leaching;

(d) livestock processors require water all year round and meet an increased demand for livestock processing where pasture growth is low;

(e) land is the best receptor for the wastewater, as it provides the best opportunity to capture and recycle nutrients;

(f) storage of wastewater from the meat processing plants is not preferred given the suitability of the land and the use of best management practices; and

(g) meat processing plants are an industrial activity, which includes the land to which the wastewater is discharged.

128. I consider the pWLRP should therefore provide a mechanism for the further allocation of water from over allocated zones, and where there is sufficient evidence that further allocation would not result in adverse cumulative effects. This is especially so for those essential water users.

129. The transfer of water should be supported where it achieves the CWMS outcomes. It should also be supported where the transfer is associated with an essential use of water. I also consider that condition 5 of Rule 5.107 is unwarranted.

130. Finally, the well interference assessment methodology should be able to be amended to recognise site specific information. This avoids some of the limitations of the analytical model approach.

Conclusions

131. The nature of ANZCO's meat processing operations are not, in my opinion, adequately recognised in the pLWRP.

132. Wastewater from the processing plants is applied to land in accordance with best management practices. Each plant has a comprehensive management plant which includes monitoring and reporting of wastewater, soil, and groundwater conditions associated with the discharge. These plants are considerably more advanced in the application of wastewater than the nutrient management that currently exists for the primary agricultural sector. The evidence that will be provided by Mr Macfarlane further illustrates this point.

133. The application of wastewater to land is the best method for the disposal and treatment, and when combined with a cut and carry operation can result in minimising nutrient losses from the system. Where it can be shown that the effects on water quality and quantity are acceptable I consider that the Plan should provide for these operations to continue, or expand (or at least provide for resource consent applications to be made in respect of new water takes and for associated discharges to be assessed as industrial activities).

134. The use of land for feedlots, and the generation of waste from these operations need to be designed and managed in accordance with best practice methods. The operation at Five Star Beef is an example of such an operation. Again, the management of effluent disposal is undertaken in a controlled manner to ensure that the loss of nutrients from the soil is minimised.

135. The Nutrient Application Zone interim limits are best to control land use intensification and land use change associated with farming activities. However, the discharge of wastewater from a processing plant to land should not be considered a farming activity. Nor should the growing of pasture or crops on the discharge area be considered farming, as a cut and carry operation is an important part of the treatment process and is typically required by consent conditions. I consider the Plan should clarify that the use of land for wastewater disposal is not to be considered farming or use of production land.

136. This differs slightly from the use of land for the effluent disposal from the intensive feedlots. Where land is farmed and effluent is applied to the land from a feedlot, the nutrient budget needs to account for the effluent added

which acts as a fertiliser. This discharge is associated with a farming practice and therefore would be subject to the farming land use rules.

137. It is my opinion that the Plan needs to recognise that the application of wastewater will need to occur to land during times where the soil has limited available water holding capacity. There are no practical alternatives to this. Therefore, the Plan should provide a comment that relates to minimising the potential for nutrients to be lost from the soil during periods of limited soil water capacity by limiting the application depth of wastewater as much as possible. Mr Macfarlane details the management approach, and ANZCO's commitment to minimising nutrient losses.

138. Access to groundwater for the processing needs of the plants is not provided for. This is a significant issue for ANZCO. The pLWRP has elevated the activity status for groundwater in an over-allocated zone to be prohibited for new takes and for transfers there is a requirement to surrender up to 50% of the water in lieu of obtaining a non-complying resource consent.

139. Mr Ensor provides an alternative approach to recognise meat processing plants and other essential users of water, which would not prevent them seeking additional water via a consent application. I support this approach. I also consider that there is sufficient evidence to demonstrate that further groundwater could be allocated from an over-allocated groundwater zone, with no significant effects. I believe that the Plan needs to provide an opportunity for additional allocation to be considered.

140. I consider that condition 5 of Rule 5.107 is redundant and should be removed. The reallocation of resources should be supported where it aligns with the CWMS. Furthermore, the allocation blocks should recognise the consents that were issued for irrigation above the allocation limit as separate from the main block. On that basis the consents that were issued within the allocation limits would have the same security of supply (including transferring) that they had when they were issued.

141. In addition, the evaluation of interference effects should enable site specific information to be used to determine the significance of the effect, where this is available.

142. Mr Ensor provides details how these aspects could be incorporated into the Plan.

S Douglass

4 February 2013