Before the Independent Hearings Panel

under: the Resource Management Act 1991

in the matter of: Submissions and further submissions in relation to the proposed Otago Regional Policy Statement (Freshwater parts)

submitter: **Fonterra Limited**
Submitter ID FPI019

Statement of Evidence of Katherine McCusker

Dated: 28 June 2023

Reference: B G Williams (ben.williams@chapmantripp.com)
K I G Jacomb (Kirsty.jacomb@chapmantripp.com)

chapmantripp.com
T +64 3 353 4130
F +64 3 365 4587

PO Box 2510
Christchurch 8140
New Zealand

Auckland
Wellington
Christchurch

chapman tripp

STATEMENT OF EVIDENCE OF KATHERINE ANN MCCUSKER

INTRODUCTION

1 My full name is Katherine Ann McCusker.

2 I am a Farm Environment Consultant with Pattle Delamore Partners Limited (*PDP*).

3 I hold a Bachelor of Agricultural Science degree and I am a member of the New Zealand Institute of Primary Management. I completed the Massey University Advanced Sustainable Nutrient Management course in 2015. I have over thirty years' experience as a farm consultant and farm environment consultant, much of this has been in the South Island. This work has included working with farmers and irrigation schemes to improve the uptake of good management practices and implementation of regional plans particularly relating to nutrients, soils, effluent, and irrigation management.

4 My relevant experience in wastewater discharges to land and freshwater involves assisting primary processors and city councils in the assessment of effects for consent applications to discharge to land and freshwater and providing technical reviews for regional councils for consent applications.

5 In preparing my evidence I have reviewed:

5.1 the evidence prepared by **Ms Suzanne O'Rourke, Mr Morgan Watt,** and **Ms Susannah Tait**;

5.2 the submission and further submission made by Fonterra in relation to the proposed Otago Regional Council Policy Statement (Freshwater parts);

5.3 the section 42A report prepared on behalf of the Otago Regional Council.

CODE OF CONDUCT

6 Although this is not an Environment Court hearing, I note that in preparing my evidence I have reviewed the Code of Conduct for Expert Witnesses contained in Part 9 of the Environment Court Practice Note 2023. I have complied with it in preparing my evidence. I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where I state I am relying on the opinion or evidence of other witnesses. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

7 I have been asked by Fonterra to provide evidence regarding proposed restrictions on discharging wastewater directly to freshwater, taking into account the limitations that Fonterra has for land-based treatment at the

Stirling site. My evidence highlights that in some scenarios, discharging highly treated wastewater to water is the only practicable option and/or provides the best outcome for the environment overall.

8 This statement of evidence will:

8.1 outline the nature of Fonterra's discharges of treated industrial process water at the Stirling site;

8.2 describe the limitations of discharging wastewater to land;

8.3 explain how and in what circumstances discharging wastewater to water is the most appropriate outcome; and

8.4 briefly address why the PORPS-FW must provide for ongoing discharges of industrial process water to water in some circumstances.

SUMMARY

9 My evidence addresses industrial and trade waste discharges only and does not address the discharge of sewage and domestic wastewater or animal effluent. Fonterra does not discharge any sewage from its Stirling site directly into water.

10 As a matter of good practice, all stormwater and industrial and trade waste should be discharged into a reticulated system or to land, where and when it is available, unless alternative treatment and disposal methods to surface water will result in improved environmental outcomes.

11 The key considerations for when a discharge to water may be appropriate are:

11.1 When the level of treatment and the resulting contaminant loads results in better environmental outcomes for the catchment and rohe.

11.2 If stormwater and wastewater discharges can meet any applicable water quality standards set beyond a reasonable mixing zone.

11.3 The lack of feasible alternatives due to a shortage of land or the suitability of the land to accommodate land discharges. The lack of suitable land may include considerations such as soil characteristics, being flood prone, the slope increasing the risk of erosion, not being suitable for cut and carry operations, proximity to residential housing, and/or the landowners requirements.

12 A discharge that occurs solely to land will typically increase the time soils are saturated. This increases the risks to soil structure and of leaching and run off, which in turn increases the contaminant load to groundwater and other watercourses (such as streams and drains).

13 Heavy hydraulic loading of a soil with wastewater for a prolonged period can lead to damage the soil structure, making it less suitable for stock or for cut and carry operations.

NATURE OF FONTERRA'S DISCHARGES OF TREATED INDUSTRIAL PROCESS WATER

14 Fonterra's Stirling milk processing plant is located within the Clutha River catchment. The wastewater generated at this site is pre-treated in a Dissolved Air Flotation (DAF) unit, and then goes through a biological wastewater treatment system which provides significant removal of nutrients and microbiological contaminants prior to discharge into the Clutha River.

15 Fonterra have provided median data based on quarterly river sampling for 2022 and 2023, it is in **Appendix 1** of my evidence. The monitoring includes samples taken upstream and 300m and 600m downstream of the discharge of wastewater from Fonterra Stirling. The data suggests that there is no impact on total nitrogen (*TN*), nitrate-N, total phosphorus (*TP*), and total biochemical oxygen demand (*BOD*) from Fonterra's wastewater discharge from its Stirling site. The use of this wastewater treatment technology results in discharges to the Clutha River that meets the river National Bottom Line (NPS-FM) when it is mixed with the river water.

16 The wastewater sources for the Stirling processing site are food processes with extremely high hygiene requirements. The source of pathogens in wastewater from dairy processing is from the contamination of milk during the collection process and is likely limited to raw milk separation processes. The pathogen levels are therefore much lower than for other surface water discharges including municipal sewage or industrial meat-works or rendering processes where animal carcasses are handled.

17 Prior to surface water discharge, the treated wastewater is disinfected by membrane filtration, to significantly reduce microbiological contaminants to a level below the detection limit for the 2022 and 2023 water quality monitoring and puts it in the excellent band for human contact during the bathing season in the NPS-FM[1].

18 The wastewater treatment plant removes 37% of the phosphorus, 80% of the nitrogen and 97.5% of the BOD.

19 The Stirling site holds two consents to discharge to land for dairy liquids and whey and this is feasible due to the smaller volume involved that requires less land. Stormwater is discharged via a constructed wetland.

20 All domestic wastewater at the processing site is managed completely separately to wastewater and is discharged to the local Council scheme.

[1] Table 22 National-Policy-Statement-for-Freshwater-Management-2020.pdf (environment.govt.nz)

LIMITATIONS OF LAND-BASED DISCHARGE

21 As a matter of good practice, stormwater and industrial and trade waste should be discharged into a reticulated system or to land, where and when it is available, unless alternative treatment and disposal methods to surface water will result in improved environmental outcomes.

22 As far as practicable, irrigation of land for agricultural production uses deficit irrigation, which involves only applying water when there is a soil moisture deficit. In deficit irrigation, application depths and frequency are adjusted to minimise the risk of soils becoming saturated. When hydraulic application rates are kept within the measured water holding capacity of soils the risks of nutrient leaching, ponding, and runoff are minimised.

23 The Stirling plant has wastewater that needs to be discharged throughout the year except in June and July. NIWA calculate daily soil moisture content using a simple water balance model and Virtual Climate Station data to provide the long-term average first and last dates for when a soil moisture deficit (SMD) exists. For flat farmland near Stirling the typical SMD onset and termination dates are 16 December to 1 March.[2]

24 I understand from Mr Watt's evidence that the Stirling site produces an up to of 3700 m^3 of wastewater per day. It is not practicable to store the wastewater and defer its application to when there is a soil moisture deficit, due to the volume of wastewater generated and the shortage of suitable land for wastewater storage.

25 The soils in the vicinity of the Stirling site range from well drained close to the Clutha River to very poorly drained in areas to the north and east of the site. The well drained soils tend to have medium nitrogen leach susceptibility and will lose nitrogen to groundwater. The poorly drained soils have a low nitrogen leach susceptibility due to the attenuation of nitrogen through denitrification associated with anaerobic conditions. These poorly drained soils have a higher risk of water ponding and run off to drains and streams.

26 The proximity to residential housing also limit the land that is suitable for land discharge.

Environmental impact of discharging wastewater to saturated soil

27 Irrigation of wastewater onto land requires careful management to match both the hydraulic and nutrient loading rates to the characteristics of the soil.

28 If the Stirling plant discharged all their wastewater to land, they would be applying large volumes of wastewater to land that does not have a soil moisture deficit for most of the year. As provided above it is not feasible to store the wastewater so wastewater would be applied to saturated soils particularly after heavy rain and in spring.

[2] See Average soil moisture deficit onset and termination maps | NIWA).

29 There are various environments impacts that result from discharge of wastewater to land that does not have a soil moisture deficit. When large volumes of wastewater are applied to soil that is above its field capacity[3], the water:

29.1 drains through the soil profile causing leaching; or

29.2 has overland flow to nearby waterways and drains; or

29.3 ponds on the surface reducing pasture/crop growth.

30 Heavy hydraulic loading of a soil with wastewater for a prolonged period can lead to damage the soil structure, making it less suitable for stock or for cut and carry operations.

31 When water drains through the soil profile under saturated conditions it carries nitrates into the groundwater which can then migrate to surface water. Such nitrate leaching is sourced from a variety of agricultural activities, in addition to wastewater irrigation, resulting in a higher concentration of nitrates than the wastewater. Nitrate-Nitrogen poses acute and chronic toxicity risks to sensitive aquatic species when present at high concentrations in waterways, and the groundwater seepage component can be particularly significant for small streams and drains. High nitrates in groundwater are associated with human health problems when present in groundwater used for drinking water.

32 Agricultural intensification, and especially the application of fertilisers, feed supplements and irrigation, increase leaching of nitrogen. Any leaching from wastewater irrigation will add to these other land use impacts.

33 The Stirling wastewater treatment plant removes 37% of the phosphorus in the wastewater resulting in low levels in the discharge. Phosphorus tends to bind to soil particles and is in animal dung. Losses of phosphorus on farms is closely linked to losses of sediment and faecal matter to waterways. As soil saturation increases the risk of run-off of phosphorus, sediment, and faecal matter increases. To reduce the risk of runoff of contaminants to water, land discharge systems usually have setbacks from drains and waterways which increases the area of farmland needed for the discharge system.

34 Plant available nutrients (dissolved reactive phosphorus (*DRP*) and dissolved inorganic nitrogen (*DIN*)) can negatively impact the aquatic environment particularly in small waterways by encouraging high rates of growth in undesirable species and/or at undesirable levels. This nuisance aquatic species growth can rapidly consume dissolved oxygen (*DO*) resulting in low DO levels that suffocate other species present, and certain species can be toxic (i.e., toxic algal blooms). If Fonterra was limited to a land based discharge system for the Stirling plant, then there is a risk that the levels of both DRP and DIN would increase in the nearby drains due to

[3] Field capacity is the water content held in the soil after excess water has drained away.

the processes listed above. This would likely be a worse environmental outcome than the discharge to the Clutha River.

Practical limitations of discharging to land

35 I understand from Morgan Watt's evidence that Fonterra would require 370 ha of land to treat 3,700m^3 of wastewater per day. Furthermore, Mr Watt's evidence states that there is a limited availability of agricultural land suitable for wastewater discharge close to Stirling and a reluctance from some farmers to receive industrial discharges on land. The land currently used for irrigation of Fonterra's discharge is not owned by Fonterra. Its use is therefore dependent on each farmer agreeing to receive the wastewater. I do not consider it feasible for all wastewater from Stirling to be discharged to land, as farms would be subject to winter irrigation which presents unacceptable risk to farming operations. The farms would have saturated soil for a prolonged period, increasing the risk of nutrient leaching, soil pugging and compaction. This would affect both their environmental footprint and management options.

36 Much of the flat land close to the Stirling site is flood prone land (see Appendix 2, Figure 1). The Otago Flood Hazard Map (Otago Natural Hazards Portal (orc.govt.nz)) indicates that the low lying areas close to Stirling have had a series of notable floods and modelling by NIWA shows this area continues to be at risk.[4] If there is a flood there is a risk that above ground wastewater irrigation infrastructure could be damaged. In addition, if there is prolonged ponding of floodwater, wastewater cannot be discharged.

37 The area to the north of Stirling has slopes ranging from 4 to 15 degrees. On slopes of 4 – 7 degrees soil erosion begins to be a problem and some heavy agricultural machinery is restricted. Irrigating wastewater to these areas would increase these issues. Slopes of 8 – 15 degrees have greater risks of soil erosion, wastewater run-off and increased risk when operating machinery for a cut and carry operation, which is the most common type of operation for farmland that receives treated industrial process water.

APPROPRIATENESS OF DISCHARGE TO WATER

38 In my opinion the key considerations for when a discharge to water may be appropriate is when the level of treatment and the resulting contaminant load result in better environmental outcomes for the catchment and rohe compared to potential alternatives. Therefore, one of the considerations in assessing this criterion is whether other feasible alternatives are available.

39 As Ms O'Rourke's evidence explains, Fonterra prefers to discharge to land but also recognises that in some instances there are limitations that mean discharges to land are not practicable. The Stirling site has limitations as discussed above. For these reasons the site is unable to discharge all its wastewater to land and requires the option to discharge wastewater to water to enable its operations to continue.

[4] Natural-hazards-on-the-clutha-delta.pdf (orc.govt.nz)

40 When wastewater is highly treated it can result in improved environmental outcomes by discharging water that is lower in nitrates, phosphorous, sediment and pathogens than the background levels in the river and the water quality standards.

41 Treated wastewater is discharged to the Clutha River/Mata-Au under consent number 2007.636.V1. The biological treatment plant provides a high level of nitrogen and phosphorus removal from the wastewater. This means that the resulting potential for the growth of periphyton in the river is small. The consent requires an on-going monitoring programme to ensure water quality standards are met.

42 Before applying for their discharge to water consent Fonterra evaluated a range of options for the discharge.[5] A key consideration was that Fonterra has limited space available in the vicinity of the plant for the construction and ongoing operation of a wastewater treatment facility to land. As explained above the Fonterra Stirling site operates approximately 10.5 months per year but the surrounding area as a long-term average only has soil moisture deficits in summer. This means that a land discharge system must either operate as a non-deficit system with saturated soils or have sufficient storage for a deficit discharge to land system with a very large storage pond. In my view, that would not be feasible.

IMPORTANCE OF ENABLING ONGOING DISCHARGES

43 I recognise the impact of discharges of stormwater and wastewater on freshwater bodies is a significant issue for mana whenua and has contributed to water quality issues in some Otago water bodies.

44 Wastewater discharges to water, when treated, can result in better environmental outcomes in terms of concentrations of contaminants compared to a discharge to land. Wastewater discharges that involve high volumes of water to saturated soils can result in high nitrate leaching or loss of other containments to water by overland flow or soil erosion if suitable land is not available.

45 A key consideration is that stormwater and wastewater discharges meet any applicable water quality standards set after reasonable mixing.

46 Due to the risks discussed above if Fonterra could not discharge to water and had to move to a land discharge system for all wastewater at Stirling, soil quality would be reduced due to saturated soil conditions, the risk of pugging and soil compaction would be increased. As a result, it may not meet the intention of LF-LS-P16 to "*maintain soil quality by managing both land and freshwater resources, including the interconnections between soil health, vegetative cover and water quality and quantity*".

47 It is important to enable ongoing treated storm and wastewater discharges. I consider environmental outcomes can be met by reducing or otherwise

[5] Evidence of Morgan Watt dated 28 June 2023.

managing the adverse effects of direct and indirect discharges of contaminants to water.

CONCLUSION

48 As a matter of good practice, stormwater and industrial and trade waste should be discharged into a reticulated system or to land, where and when it is available, unless alternative treatment and disposal methods to surface water will result in improved environmental outcomes.

49 The key considerations for when a discharge to water may be appropriate are:

49.1 When the level of treatment and the resulting contaminant load results in better environmental outcomes for the catchment and rohe.

49.2 The lack of feasible alternatives due to a shortage of land when large volumes of wastewater are involved and the suitability of the land to for land discharges. The lack of suitable land maybe due to soil characteristics, being flood prone, the slope increasing the risk of erosion, not being suitable for cut and carry operations.

50 If the Stirling plant discharged all their wastewater to land, they would be applying large volumes of wastewater to land that does not have a soil moisture deficit for most of the year.

51 There are various environments impacts that result from discharge of wastewater to land that does not have a soil moisture deficit. When large volumes of wastewater are applied to soil that is above its field capacity[6], the water:

51.1 drains through the soil profile causing leaching; or

51.2 has overland flow to nearby waterways and drains, resulting in increased the nutrient and sediment load; or

51.3 it ponds on the surface reducing pasture/crop growth.

52 Heavy hydraulic loading of a soil with wastewater for a prolonged period can damage the soil structure, making it less suitable for stock or for cut and carry operations.

53 I consider environmental outcomes can be met by reducing or otherwise managing the adverse effects of direct and indirect discharges of contaminants to water.

[6] Field capacity is the water content held in the soil after excess water has drained away.

Dated: 28 June 2023

Katherine McCusker

Appendix 1: Median water quality data based on six quarterly samples from 2022 to 2023

Parameters (g/m^3)	**Upstream**	**Discharge**	**300m Down Stream**	**600m Down Stream**	**NPS-FM 2020 Limits**	**Clutha/ Mata Au[2] Limits and Targets**
Total Suspended solids	2.25	1.5	2.25	5		
Total Nitrogen	0.07	6.75	0.07	0.07		0.075[4]
Nitrite	0.05	0.08	0.05	0.05		
Nitrate	0.05	5.65	0.05	0.05	2.4[5]	
Total Phosphorus	0.007	9.65	0.0055	0.00065		0.01[3]
Total BOD	1	1	1	1		
E. coli cfu/100mL	71.5	1	29.5	94.5	130[1]	260

Notes

1 E.coli median concentration/100mL for Human contact Lakes and Rivers

2.Otago Regional Plan – Water 2022 (updated September 2022)

3.Dissolved reactive phosphorus

4 Nitrate-nitrite nitrogen

5 National bottom line

Appendix 2 Figure 1: Flood Prone Land near Stirling

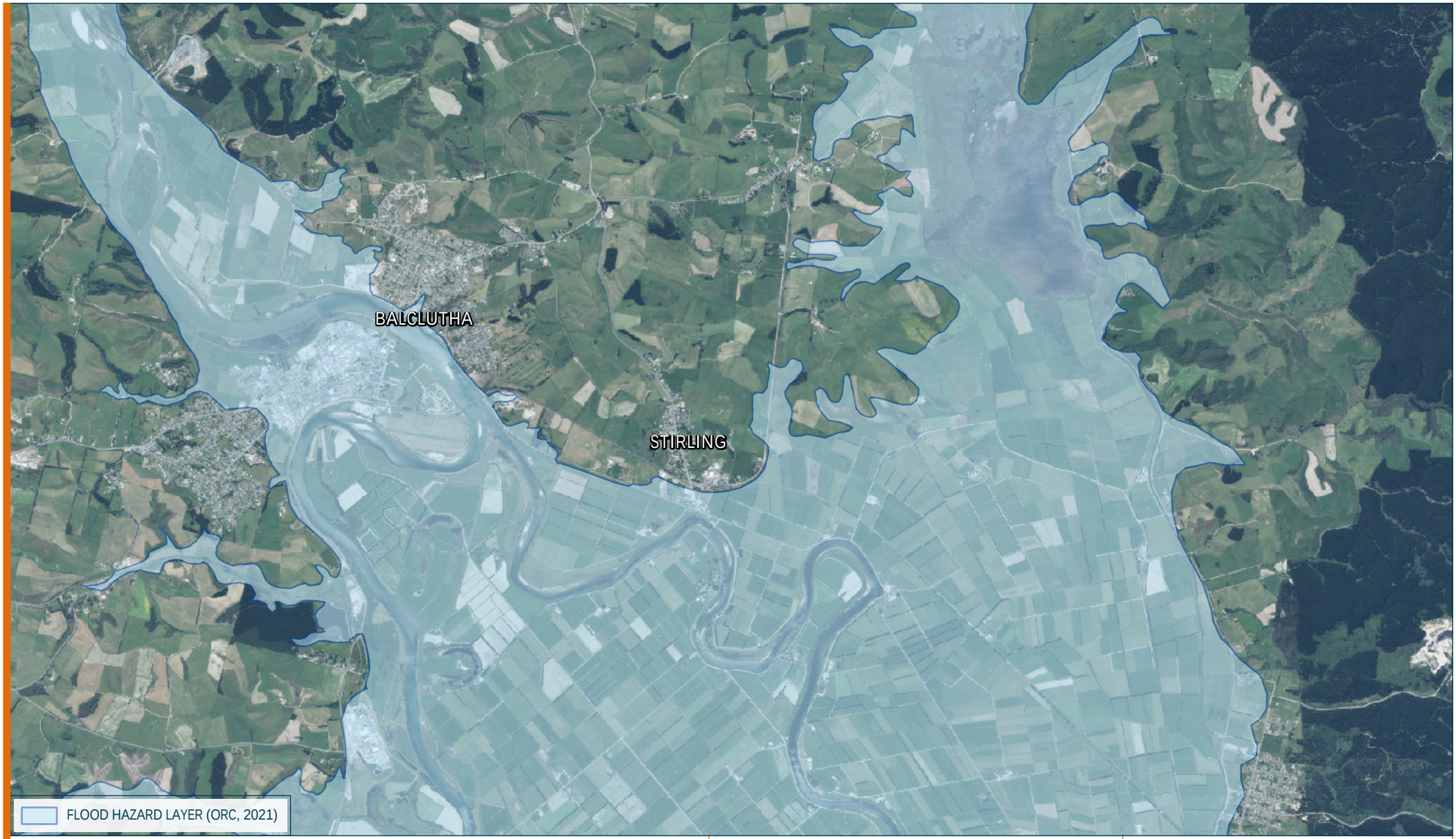

FIGURE 1: FLOOD PRONE LAND NEAR STIRLING

STATEMENT OF EVIDENCE OF KATHERINE MCCUSKER

SOURCE:
1. AERIAL IMAGERY: EAGLE TECHNOLOGY, LAND INFORMATION NEW ZEALAND, GEBCO, COMMUNITY MAPS CONTRIBUTORS.
2. FLOOD HAZARD LAYER DERIVED FROM OTAGO REGIONAL COUNCIL ONLINE GIS PORTAL (27/06/2023)

0 500 1000
METRES

N

SCALE : 1:50,000 (A4)
REVISION: 01 | DATE: JUN 23| BY: CF
CLIENT: FONTERRA LIMITED

C04888500_FIGURE1