**IN THE ENVIRONMENT COURT**
**I MUA I TE KOOTI TAIAO O AOTEAROA**

**UNDER** of the Resource Management Act 1991

**IN THE MATTER** of appeals under Clause 14 of the First Schedule of the Act

**BETWEEN** **TRANSPOWER NEW ZEALAND LIMITED**
(ENV-2018-CHC-26)

**FONTERRA CO-OPERATIVE GROUP**
(ENV-2018-CHC-27)

**HORTICULTURE NEW ZEALAND**
(ENV-2018-CHC-28)

**ARATIATIA LIVESTOCK LIMITED**
(ENV-2018-CHC-29)

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# AFFIDAVIT OF CAIN ROSS DUNCAN

## TOPIC B2 ISSUES 25, 26, 33, AND 36 – 39 RELATING TO POLICY 17 AND RULES 32B AND 32D

**25 February 2022**

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**WILKINS FARMING CO**

(ENV-2018-CHC-30)

**GORE DISTRICT COUNCIL, SOUTHLAND DISTRICT COUNCIL & INVERCARGILL CITY COUNCIL**

(ENV-2018-CHC-31)

**DAIRYNZ LIMITED**

(ENV-2018-CHC-32)

**H W RICHARDSON GROUP**

(ENV-2018-CHC-33)

**BEEF + LAMB NEW ZEALAND**

(ENV-2018-CHC-34 & 35)

**DIRECTOR-GENERAL OF CONSERVATION**

(ENV-2018-CHC-36)

**SOUTHLAND FISH AND GAME COUNCIL**

(ENV-2018-CHC-37)

**MERIDIAN ENERGY LIMITED**

(ENV-2018-CHC-38)

**ALLIANCE GROUP LIMITED**

(ENV-2018-CHC-39)

**FEDERATED FARMERS OF NEW ZEALAND**

(ENV-2018-CHC-40)

**HERITAGE NEW ZEALAND POUHERE TAONGA**

(ENV-2018-CHC-41)

**STONY CREEK STATION LIMITED**

(ENV-2018-CHC-42)

**THE TERRACES LIMITED**

(ENV-2018-CHC-43)

**CAMBELL'S BLOCK LIMTED**

(ENV-2018-CHC-44)

**ROBERT GRANT**

(ENV-2018-CHC-45)

**SOUTHWOOD EXPORT LIMITED, KODANSHA TREEFARM NEW ZEALAND LIMITED, SOUTHLAND PLANTATION FOREST COMPANY OF NEW ZEALAND**

(ENV-2018-CHC-46)

**TE RUNANGA O NGĀI TAHU, HOKONUI RUNAKA, WAIHOPAI RUNAKA, TE RUNANGA O AWARUA & TE RUNANGA O ORAKA APARIMA**

(ENV-2018-CHC-47)

**RAYONIER NEW ZEALAND LIMITED**

(ENV-2018-CHC-49)

**ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND**
(ENV-2018-CHC-50)

Appellants

**AND** **SOUTHLAND REGIONAL COUNCIL**

Respondent

**I, Cain Ross Duncan, of Invercargill, Sustainable Dairying Manager, solemnly and sincerely affirm:**

1 My full name is Cain Ross Duncan.

2 My qualifications and experience are set out in my statement of Evidence in Chief dated 4 February 2022.

3 In addition to my qualifications and experience outlined in my statement of Evidence in Chief I have over a 9 year period provided one on one advice to farmers on effluent system design, improvements, and resource consenting. With over 1000 Fonterra farms in Otago and Southland I have had experience in dealing with a complete range of effluent system configurations and designs.

4 In 2014, I started a resource consent service for Fonterra suppliers in Southland. This supported farmers through the regulatory process of obtaining resource consents for their agricultural effluent systems and effluent applications to land. I have provided agricultural effluent system training to Fonterra's Sustainable Dairy Advisors across New Zealand and regular training to Southland Regional Council staff. More recently I have also provided Otago Regional Council consents staff with training on the Dairy Effluent Storage Calculator.

**Code of Conduct**

5 While this affidavit in part records the reasoning and conclusion of the experts present at mediation, in places I express my professional opinion. I have read and am familiar with the Code of Conduct for expert witnesses in the 2014 Environment Court Practice Note. I agree to comply with this Code of Conduct when participating in the conferencing. Except where I state that I am relying on the specified evidence of another person, my evidence in this statement is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions which I express.

## Background

6 As outlined in the Memorandum of Counsel for Southland Regional Council[1], I have been selected to provide technical expert evidence in support of select issues relating to the agreed amended provisions for the all of parties' hearing[2].

## Introduction

7 This affidavit relates to those issues under Topic B2 that are within my scope of expertise and where an outcome has been agreed between the parties, namely in relation to:

(a) Issues 25, 26 and 33 - Policy 17

(b) Issues 36 and 37- Rule 32B

(c) Issues 38 and 39– Rule 32D

8 For clarity and ease of reference back to the related affidavit of Matthew McCallum-Clarke[3] and the Joint Memorandum in support of the consent order[4] for these provisions, the above list sets out the relevant 'Issue' allocation that was attributed to the specific provisions and appeal points to assist with mediation. Throughout the body of my affidavit however, I do away with the 'Issue' classification and focus solely on each specific provision.

9 In this affidavit, I set out my expert opinion in relation to the agreed amended provisions.

## Policy 17 – Agricultural effluent management

10 In areas of New Zealand, such as Southland, regulations have required the adoption of the well-established best practice agricultural effluent irrigation principles developed by AgResearch in the mid to late 2000's as well as construction standards for agricultural effluent storage facilities. In these

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1 Memorandum of Counsel for Southland Regional Council identifying technical evidence required in support of agreed provisions, dated 18 February 2022.
2 The Court directed that the provisions of the pSWLP that have been settled between the parties following mediation and expert conferencing be set down for hearing in the weeks commencing 14 and 21 March 2022 (**all of parties' hearing**).
3 Affidavit of Matthew McCallum-Clark on Topic B2 Issues, dated 2 February 2022.
4 Joint Memorandum in Support of Consent Order on Topic B2 Issues, dated 3 February 2022.

regions the general standard of effluent infrastructure and management is considerably higher, compared to regions where these principles have not been adopted in regulation.

11 Policy 17 requires the management of agricultural effluent to avoid adverse effects on water quality, where this is reasonably practicable, otherwise adverse effects need to be remedied or mitigated. Parts (a) and (b) of the Policy focus on utilising best practice guidelines to design, construct and locate new agricultural effluent systems and for the maintenance and operation of existing systems.

12 Parts (c) and (d) of Policy 17 require the effects of poorly managed agricultural effluent applications to be avoided, such as overland flow, ponding and contamination of water. This is generally achieved by implementing parts (a) and (b) of the Policy.

13 The fundamental principle of best agricultural effluent management is the ability to apply effluent to land when soil and climatic conditions allow it to be retained within the root zone of the soil. The longer the effluent resides in the soil's active root zone, the greater the opportunity for the soil to physically filter the effluent whilst attenuating potential contaminants and making nutrients available to plants. This is commonly known as "deferred irrigation".

14 To be able to apply agricultural effluent in accordance with the principles of deferred irrigation, a farm needs the ability to store effluent when soil and climatic conditions are unsuitable and the ability to apply effluent to land in a way that accounts for a farm's soils and topography.

15 There are several well established best practices for ensuring agricultural effluent storage facilities are sized correctly, at low risk of structural failure or leakage and that other smaller components of an agricultural effluent system are a low risk. There are similar well established practices for ensuring agricultural effluent is applied to land at an appropriate depth, rate, and time to avoid losses to water. On this basis, it is appropriate that Policy 17 requires the adoption of best practice guidelines that have been well established and proven to avoid overland flow, ponding and contamination of water, both in Southland and throughout New Zealand.

16 Policy 17 references IPENZ Practice Note 21: Farm Dairy Effluent Pond Design and Construction (**PN21**) and IPENZ Practice Note 27: Dairy Farm Infrastructure (**PN27**). These practice notes are regarded as industry best practice for the design and construction of new effluent system infrastructure and were recently adopted as part of the Environment Court's decision on Plan Change 8 in Otago.

17 PN21 is specific to the construction of earthen effluent storage ponds, other than Part 4 of the practice note, which specifically deals with ponds and tanks on peat soils. PN27 provides engineering guidance on the design and construction of dairy farm infrastructure (solids separation, underpasses, feedpads and concrete structures) and like PN21, has limited relevance to above ground tanks (unless they are of a concrete construction, which is rare). On this basis, the "note" in Policy 17 has been made clearer by stating PN21 and PN27 are not applicable to all above ground tanks.

18 For completeness, above ground storage tanks with a volume capacity greater than 35,000 litres require a building consent through the Territorial Authority. The building consent process requires oversight by an engineer to ensure the ground the tank is sitting on is suitably prepared and the structure meets the relevant New Zealand Standards for structural design and durability.

**Rule 32B - Construction, maintenance and use of new agricultural effluent storage facilities**

19 While there are different types of effluent storage facilities, the key requirements are the same for all of them, being that they are:

19.1 sealed to prevent effluent leakage;

19.2 structurally sound; and

19.3 appropriately sized.

20 Larger agricultural effluent storage facilities (volume greater than 35,000 litres) are a higher risk component of an agricultural effluent system due to the potential volumes of effluent that are stored, the hydraulic head/pressure

this creates, and the potential environmental impact of a significant effluent storage facility failure.

21 For new agricultural effluent storage facilities, with a storage volume above 35,000 litres, risks are appropriately mitigated by design and construction occurring in accordance with a relevant professional standard. PN21 specifies a range of standards that need to be met (such as embankment compaction requirements, groundwater levels and synthetic liner specification) to ensure an effluent storage pond is appropriately engineered to prevent leakage or structural faults.

22 As discussed in paragraph 17 of my affidavit, above ground storage tanks are not generally covered by IPENZ Practice Notes but require a Building Consent through the Territorial Authority.

23 Certification by a Chartered Professional Engineer of new agricultural effluent storage facilities with a storage volume greater than 35,000 litres, against the relevant design standards, and the ability for the Council to oversee the process and require ongoing maintenanceof the storage facility is deemed best practice for the design and construction of these new agricultural effluent storage facilities. This process ensures new, larger scale agricultural effluent storage facilities pose a low environmental risk while providing a significant benefit in allowing deferred irrigation to occur.

24 Rule 32B(a) classifies smaller components of an agricultural effluent system, that only have the capacity to store small volumes of agricultural effluent (up to 35,000 litres) as a permitted activity, assuming parts 32B(a) (ii)-(vi) are also met.

25 The reason for the 35,000 litre storage capacity threshold, before moving to a controlled activity status, is risk based and aligns with the provisions of the Building Act 2004. To provide some context, 35,000 litres is a tank that is 4 metres in diameter and 3 metres in height and a standard domestic water tank has a capacity of 25,000 – 30,000 litres.

26 The primary function of these smaller components of an agricultural effluent system is to remove solid material and transfer agricultural effluent to a larger effluent storage facility. As an example, a pump sump, while having a

capacity of 25-35m$^3$ is pumped down as the sump fills and generally less than ¼ of the sump has effluent in it for an extended period of time.

27 Due to the small size of these structures and the small volumes of effluent they hold, they pose a lower environmental risk. Today, these smaller structures are almost entirely specialised pre-cast concrete components made off-site, in a quality-controlled environment. This achieves more efficient consolidation and curing of the concrete than historic cast in situ concrete and results in a more durable final product with a lower risk of failure/leakage.

**Rule 32D – Existing agricultural effluent storage facilities**

28 Most farms producing agricultural effluent in Southland already have existing effluent storage facilities that were installed in accordance with a resource consent (required from March 2009 for structures with a capacity over 22,500 litres) or lawfully constructed without a resource consent.

29 Most of the structures that were built lawfully and without a resource consent, have not been certified against a recognised engineering standard. Retrospectively assessing an existing effluent storage facility against an engineering practice guide, such as PN21, is not possible due to the requirements to undertake testing and investigations prior to and during the construction process.

30 Different methodologies have been developed to provide a level of assurance that existing effluent storage facilities are not leaking and are not at risk of significant structural failure. The permitted activity conditions under Rule 32D(a)(iii) appropriately require the use of nationally recognised methodologies to assess whether existing agricultural effluent storage facilities (with a storage volume greater than 35,000 litres) are suitable for ongoing use.

*Visual Inspections*

31 The visual inspection of an agricultural effluent storage facility is a common methodology for determining whether there are any visible defects in a structure that would impact its ongoing structural integrity. For smaller structures or above ground agricultural effluent storage facilities, the visual

assessment will also highlight any significant defects that would be likely to cause the structure to leak or fail.

32 On larger, in-ground agricultural effluent storage facilities, the visual assessment is generally used to identify any visible structural issues that would likely compromise the ongoing integrity of the pond or cause leakage in the future. An example of this could be the side wall of a pond being scoured or part of a pond embankment beginning to collapse.

*Pond drop tests and leak detection systems*

33 A leak detection system is installed at the time of pond construction or during the retrofitting of a synthetic pond liner. A leak detection system is situated under the liner of an effluent storage facility and consists of a drainage network (generally perforated pipe wrapped in geotextile with an impermeable base-layer overlain with drainage metal/gravel), which drains to an inspection chamber. Liquid collected by the drainage network can easily be inspected or collected to check for effluent contamination. An effective leak detection system will provide an early indication of leakage from an effluent storage facility.

34 A pond drop test is an alternative method for determining whether an effluent storage facility is leaking. The modern pond drop test methodology was developed by Opus (now WSP) International Consultants in 2015 and has subsequently been added to PN21 and adopted by most regional councils in New Zealand.

35 The pond drop test uses electronic sensors to measure any drop in the effluent level of the pond and compares this to a control sensor on the side of the pond to correct for rainfall and evaporation during the resting period.

36 These testing methodologies are regarded as best practice for determining leakage from an effluent storage facility.

*Agricultural effluent storage facilities with a capacity of 35,000 litres or less*

37 As outlined in paragraphs 25-27 of my affidavit, agricultural effluent storage facilities with a storage capacity of 35,000 litres or less, present a lower environmental risk than larger capacity effluent storage facilities. Rule 32D(a)(iii)(1) appropriately recognises this lower risk profile when small

storage facilities are constructed out of appropriate materials and have no defects that would cause leakage.

38 Given the small size of these structures and the small volumes of effluent they hold, I do not consider additional requirements are necessary to manage the risk associated with these storage structures. Engineering expertise is also not generally required to be able to identify defects or failures in these small structures as cracking or damage is generally clearly visible.

*Existing above ground storage tanks*

39 The permitted activity requirement for existing agricultural effluent storage facilities constructed in accordance with a resource consent (Rule 32D(a)(i)) has no additional conditions associated with it.

40 Rule 32D(a)(iii)(3) provides a permitted activity pathway for existing above ground storage tanks that were constructed lawfully without a resource consent but in accordance with a building consent. The building consent process requires oversight by an engineer to ensure the ground the tank is sitting on is suitably prepared and the structure meets the relevant New Zealand Standards for structural design and durability. This provides a similar (potentially greater) level of oversight that an above ground tank has been appropriately designed and installed, when compared to the resource consent process that existed under the Regional Water Plan for Southland.

41 Despite a building consent providing a similar level of surety on the design and durability of an above ground tank to that of a resource consent, Rule 32D(a)(iii)(3) has an additional condition specifying that existing above ground effluent storage tanks need to have an external visual inspection, within the last 5 years, to remain a permitted activity. This is appropriate as an above ground tank is a free standing structure and a significant structural defect could cause the tank to fail. Undertaking regular visual assessments, by a suitably qualified person minimises any risk of this occurring.

*Replacement or Installation of Synthetic Liners*

42 Rule 32D(c) resolves an identified gap in the decisions version of the proposed Southland Water and Land Plan whereby it did not adequately provide for the installation or replacement of synthetic liners in existing

agricultural effluent storage facilities. The use of synthetic liners is common throughout New Zealand and their installation (or replacement) provides an additional level of leak protection for most agricultural effluent storage facilities. The caveat to this is that the liner must be manufactured using quality materials and workmanship (as detailed in PN21) and designed and installed correctly.

43 Rule 32D(c) provides a controlled activity pathway that balances the environmental benefits of the installation or replacement of a synthetic liner with appropriate design, installation, and quality controls.

**Affirmed** at Invercargill )
This 25th day of February 2022 )
before me: )

Cain Ross Duncan

Solicitor of the High Court of New Zealand

Henry Joseph Christopher Muskee
Solicitor
Invercargill