

**BEFORE THE HEARING PANEL OF SOUTHLAND REGIONAL COUNCIL**

**In the matter** of sections 88 to 115 of the Resource Management Act 1991

**And**

**In the matter** Applications for resource consents by:

**T J AND J A DRISCOLL,**

Applicants

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**EVIDENCE OF DR MICHAEL FREEMAN**

**20 January 2020**

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## **QUALIFICATIONS AND EXPERIENCE**

- 1 My full name is Michael Conrad Freeman. I am a Senior Scientist and Planner at Landpro Limited a firm of consulting planners, scientists, surveyors and engineers. I have been in this role since January 2018.
- 2 I have approximately 35 years' experience in environmental science and regulatory processes. My previous relevant work experience includes roles as a water quality research scientist, water quality scientist, pollution control manager, regional council director, environmental consultant, and soil and water impact leader. A significant proportion of my current work relates to providing technical input to the preparation of applications for land use consents, discharge permits and water permits relating to dairy farms in Southland. I have prepared a significant number of reports on water quality and related contaminant loss mitigation in Southland as well as reports on water resources including stream depletion and groundwater interference effects.
- 3 I hold the qualifications of BSc (Environmental Science, University of Warwick) and PhD (Periphyton and Water Quality, Massey University). I have both the Intermediate and Advanced Sustainable Nutrient Management Certificates from Massey University.
- 4 I have authored or co-authored scientific and technical papers on the role of nutrients in the growth of periphyton and aspects of Overseer Nutrient Budgets (Overseer), particularly as it can be used in water quality management under the Resource Management Act.
- 5 I have read, and agree to comply with, the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. Other than where I state that I am relying on the evidence of another person, I confirm that the issues addressed in this evidence are within my area of expertise. I have not omitted to consider material facts known to me that alter or detract from the opinions that I express. In addition, where appropriate I go further than this expert witness code of conduct requires in that I make "... clear the sources and extent of uncertainty, including assumptions, and alternative scenarios and data interpretation<sup>1</sup>."

## **SCOPE OF EVIDENCE**

- 6 I do not consider that there are many remaining significant water quality-related issues and this evidence does not repeat or summarise the existing technical information in the updated Assessment of Environmental Effects submitted on 13 September 2019. I also note that I

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<sup>1</sup> United Kingdom Office of Science and Technology's "Code of Practice for Scientific Advisory Committees, December 2007. Refer: Freeman (2011) The resource consent process: Environmental models and uncertainty, RMLA, August 2011.

largely agree with S42A report conclusions of reporting officers, Ms Abigail Lovett and Mr Alex Erceg. This evidence addresses the following issues:

- 6.1 Assessment of effects of the increased abstraction of water,
- 6.2 Soil moisture and effluent application management,
- 6.3 Implications for registered drinking water supplies,
- 6.4 Groundwater quality monitoring and appropriateness of bores,
- 6.5 Ministry of Education request for assurances and proposal to require a management plan, and
- 6.6 The likelihood that contaminant losses would decrease

7 The evidence that I will give on these issues is within my area of expertise.

## BACKGROUND

### Site visit

8 On 17 December 2019, I visited the site and discussed the proposal with Tim and Jocelyn Driscoll and with Mr Erceg. We visited the property and in particular saw the effluent infrastructure associated with the farm, the location and orientation of the property and in particular the creeks and topography associated with the land to obtain a first-hand understanding of the direction of surface water flows, particularly for the East Block.

## COMMENTS ON SIGNIFICANT MATTERS RAISED IN S42A REPORTS

9 I have endeavoured to identify all the remaining significant concerns identified in the S42A reports and provide a response to each specific concern.

**Table 1 List of remaining significant matters raised in S42A reports**

Concern identified in S42A reports/ evidence	Response to those concerns
(a) Clarity about the increase in water applied for and an assessment of effects for the increased abstraction of water	<p>The AEE and the S42A report of Mr Erceg note that there are no allocation, stream depletion, or bore interference issues with the proposed abstraction. A minor error in the AEE meant that the small increase in the water take/use was not acknowledged.</p> <p>The increased amount (72,000L/day to 81,600 L/day) is not material in the context of the very low level of aquifer allocation and lack of any significant stream depletion or well interference effects.</p>

Concern identified in S42A reports/ evidence	Response to those concerns
	<p>Ms Lovett has suggested that a specific assessment of the effects of increased abstraction should be undertaken. I don't consider such an assessment is needed when the outcome is known in advance, the situation has been accepted by an experienced reporting officer and the amounts of water (increase from 0.83 to 0.94 L/s) are both well below the Environment Southland guideline (2 L/s) for undertaking stream depletion assessments.</p>
(b) A description of how soil moisture management will be implemented	<p>The AEE made it clear that to date the nearby Environment Southland soil moisture monitoring site information would be used but that the applicant was planning to install soil moisture probes. However, given the proximity of the monitoring site and the soil type is the same at both locations it does not appear necessary to have on-site soil moisture monitoring. Therefore, the applicant prefers to continue using the data from that monitoring site. This is reflected in the proposed changes to the conditions proposed by Mr Erceg.</p>
(c) Implications for registered drinking water supplies	<p>The reporting officers have highlighted that in addition to the Lochiel School water supply, there are some registered drinking supplies over 12 kilometres down-gradient of the land that take water from the Oreti River, groundwater or use roof water. These specific water supplies were not explicitly considered in the AEE because of the significant distances involved and/or the lack of a pathway.</p> <p>I did not include those registered drinking water supplies sourced from roof water (e.g., Wallacetown School) in the AEE because of the obvious lack of any possible linkage between the resource consents sought and that supply.</p> <p>Because of the significant distances involved both for the surface water and groundwater sourced drinking water supplies, these were not explicitly mentioned in the AEE. For completeness, the conclusions that it is very likely that there will be a reduction in contaminant</p>

Concern identified in S42A reports/ evidence	Response to those concerns
	<p>losses to water will also mean that there will be an almost insignificant reduction in contaminant loading in the relevant catchments for these quite distance water supplies.</p>
<p>(d) Groundwater quality monitoring and appropriateness of bores</p>	<p>Mr Erceg has recommended the establishment of an unspecified number of shallow monitoring bores at locations not specified on the property. Apart from the lack of clarity about the number and location of bores I have a number of technical concerns about the purpose of such bores and their utility to assist either to understand the effects of effluent disposal and/or the wider effects of farming. I have suggested that an additional S42A report be provided by an appropriate Environment Southland groundwater scientist. In the meantime, my views are that one or two shallow, temporary (limited to the duration of a relatively short-term resource consent) are highly unlikely to provide useful long-term information to indicate either the specific effects or the status of wider regional groundwater quality. This is because to establish the specific effects of effluent disposal on groundwater quality normally requires an array of upgradient (&gt;2) and down-gradient monitoring bores (&gt;3). The use of short-term shallow monitoring bores that are often abandoned after the expiry of the relevant resource consent and historically many of them have not been installed with adequate wellhead protection that has led to many of them providing a conduit for contaminants to enter groundwater.</p> <p>I consider that a more prudent long-term approach to monitoring the effects of land use on groundwater quality is to monitor groundwater quality using long-term professionally developed bores such as those used to provide stock or domestic water supplies. These bores are much more likely to have adequate wellhead protection and can provide long-term information on groundwater quality.</p>

Concern identified in S42A reports/ evidence	Response to those concerns
<p>(e) Ministry of Education request for assurances and proposal to require a management plan</p>	<p>The Ministry seeks that the application is refused unless:</p> <p>“-the applicant establishes that the water quality of Lochiel School will not be adversely affected or likely to be adversely affected by the discharge of contaminants from the proposed operation. This could include appropriate monitoring of the applicant’s discharged in which the location, proposed depth and frequency of sampling and testing and the proposed trigger levels are specified.</p> <p>The modelling and associated mitigation commitments strongly support the conclusion that the proposal is highly likely to result in an extremely small improvement to the quality of groundwater in the area. However, this is not the same as establishing that the groundwater-sourced Lochiel School water supply would not be adversely affected. Therefore I don’t consider that it is technically feasible to provide the assurances that the Ministry of Education representatives appear to be seeking.</p> <p>“In an email to various parties dated 20 December 2019, the Ministry of Education representative has proposed the following additional condition be added to the condition suite proffered by the applicants (detailed above and provided in advance to the Ministry of Education representatives):</p> <p>“g) The applicant shall submit a management plan for the approval of Environment Southland which shall include but not be limited to;</p> <ul style="list-style-type: none"> <li>i. The monitoring regime as described in Conditions 61-63</li> <li>ii. Appropriate trigger levels for the measurements of the samples</li> <li>iii. Further actions to be taken if the trigger levels are breached. Such actions may include further sampling, notification of any affected parties, and</li> </ul>

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	<p>practicable measures to address any breaches of the trigger levels.”</p> <p>Pastoral agriculture results in adverse effects on water quality. The real issue is are the adverse effects acceptable. For example, can we demonstrate with a reasonably high likelihood (e.g., greater than 90% probability) that there will be a reduction in contaminant loss to the catchment(s)?</p>																				
<p>(f) The likelihood that contaminant losses would decrease</p> <p>Mr Erceg concluded that: “...the modelled reduction in losses will more likely than not be achieved in reality.”</p> <p>Ms Lovett states that “...it is continually overstated in the application as being “...a significant reduction” when more appropriate terminology should have been used in the application (e.g., possible, or likely).”</p>	<p>It may not have been Mr Erceg’s intention but the expression “more likely than not” technically provides a relatively low level of assurance. I consider that the combination of modelling, auditing of modelling, proposed conditions, and history of compliance all combine to provide a high level of assurance that the estimated reduction in contaminant losses would occur. The following is the most recent IPCC<sup>2</sup> quantitative definitions for likelihood:</p> <table border="0"> <thead> <tr> <th data-bbox="751 1111 1018 1144"><b>“Term</b></th> <th data-bbox="1027 1111 1366 1144"><b>Likelihood of the outcome</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="751 1167 943 1200"><i>Virtually certain</i></td> <td data-bbox="1027 1167 1230 1200">&gt;99% probability</td> </tr> <tr> <td data-bbox="751 1223 943 1256"><i>Extremely likely</i></td> <td data-bbox="1027 1223 1230 1256">&gt;95% probability</td> </tr> <tr> <td data-bbox="751 1279 879 1312"><i>Very likely</i></td> <td data-bbox="1027 1279 1230 1312">&gt;90% probability</td> </tr> <tr> <td data-bbox="751 1335 831 1368"><i>Likely</i></td> <td data-bbox="1027 1335 1230 1368">&gt;66% probability</td> </tr> <tr> <td data-bbox="751 1391 991 1424"><i>More likely than not</i></td> <td data-bbox="1027 1391 1230 1424">&gt;50% probability</td> </tr> <tr> <td data-bbox="751 1447 1007 1480"><i>About as likely as not</i></td> <td data-bbox="1027 1447 1273 1480">33 – 66% probability</td> </tr> <tr> <td data-bbox="751 1503 847 1536"><i>Unlikely</i></td> <td data-bbox="1027 1503 1230 1536">&lt;33% probability</td> </tr> <tr> <td data-bbox="751 1559 975 1592"><i>Extremely unlikely</i></td> <td data-bbox="1027 1559 1214 1592">&lt;5% probability</td> </tr> <tr> <td data-bbox="751 1615 1007 1648"><i>Exceptionally unlikely</i></td> <td data-bbox="1027 1615 1214 1648">&lt;1% probability”</td> </tr> </tbody> </table> <p>My opinion is that there is a greater than 90% likelihood that the estimated reduction in contaminant losses will occur over the long-term and therefore the appropriate terminology to reflect this confidence would at least be “very likely” as defined by the IPCC.</p>	<b>“Term</b>	<b>Likelihood of the outcome</b>	<i>Virtually certain</i>	>99% probability	<i>Extremely likely</i>	>95% probability	<i>Very likely</i>	>90% probability	<i>Likely</i>	>66% probability	<i>More likely than not</i>	>50% probability	<i>About as likely as not</i>	33 – 66% probability	<i>Unlikely</i>	<33% probability	<i>Extremely unlikely</i>	<5% probability	<i>Exceptionally unlikely</i>	<1% probability”
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<sup>2</sup> Australian Department of the Environment (2013) Confidence and Likelihood in the IPCC Fifth Assessment Report, Fact Sheet

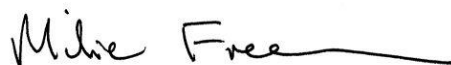


Concern identified in S42A reports/ evidence	Response to those concerns
	I emphasise that these conclusions are based on the whole proposal which is the combination of modelled nutrient loss targets and specific mitigation measures that would be required to be implemented via consent conditions.

## CONCLUSIONS

- 10 I have carefully considered the Section 42A report comments made by Ms Lovett and Mr Erceg and Ms Lovett's evidence. I consider that I have satisfactorily addressed the remaining relatively minor technical concerns.
- 11 I acknowledge that when considering the effects of farm system changes and new mitigation practices there will always be some uncertainty about the level of effectiveness. However, I am confident with the evidence provided by Ms Topham, the research that I am familiar with and my knowledge of the specific measures that the applicant has agreed to be bound to via resource consent conditions that it is very likely that they would result in a significant reduction in contaminant loss to groundwater and surface water.
- 12 The evidence of Ms Topham together with the proposed modifications to Mr Erceg's proposed conditions provides sufficient evidence for me to conclude that the proposal would make a real but very small contribution to improving water quality in these catchments.
- 13 Measurable improvements in water quality in these catchments will only occur through comprehensive catchment management plans that require appropriate contaminant loss reduction measures across the catchments.

Dated 20 January 2020




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Dr Michael Freeman