Before the Selwyn District Council

under: the Resource Management Act 1991

in the matter of: Proposed Private Plan Change 69 to the Operative District Plan: Lincoln South

and: **Rolleston Industrial Developments Limited**
Applicant

Summary of Evidence of Katherine McCusker (Versatile soils)

Dated: 22 November 2021

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SUMMARY OF EVIDENCE OF KATHERINE MCCUSKER
INTRODUCTION

1 My full name is Katherine Ann McCusker and I am a Farm Environment Consultant with Pattle Delamore Partners Limited. My experience and qualifications are set out in my primary statement of evidence. I have particular experience in improving farm productivity while mitigating the environmental effects that can arise from that land-use change. I have worked with both dairy and mixed cropping farmers in the Selwyn District for nearly 30 years.

2 In this statement I provide a summary of my primary statement of evidence dealing with:

2.1 The quality of soils for agricultural production at the proposed Lincoln South Development; and

2.2 The areas of Highly Productive Soils within the Selwyn - Waihora catchment.

2.3 I also comment on submitter evidence that relates to the use of soils on the PC69 site.

2.4 In preparing my evidence I reviewed and considered information on the quality of the soils for agricultural production, from four sources:

(a) Soil types based on Landcare Research S-map database
(b) Soil information provided by an electromagnetic (EM
(c) Auger and soil inspection
(d) Land Use Compatibility (LUC) mapping

These sources provide very comprehensive information on the soils, particularly in relation to the quality of the soils for agricultural production for the PC69 site.

2.5 In addition, I visited the site on 13 May, and met with the Greenslade family who own the majority of the 190 ha proposed site. During this visit I undertook field observations of the site.

SUMMARY OF EVIDENCE

Soils within the subject property

3 Detailed soil information for the property has been determined using an electro-magnetic (EM) survey carried out by Agri-Optics (now Vantage NZ) on 18-19 July 2014. It provides information for 79% (152 ha) of the property at 1491 Springs Road (the PC69 site). An EM survey measures and maps the variability in apparent electrical conductivity within the soil profile using sensors. The readings use GPS to an accuracy of 2 cm^1 and provide comprehensive data on the soil characteristics, including soil texture and moisture.

4 The remainder of the soils on the property (21%, 38 ha) have been assessed using S-Map and a visual/physical inspection using a soil auger taken by Arron Stafford in 2014, as part of a Massey University research project. During the auger and soil inspection mapping, coarse distinct soil mottles were identified in a number of samples and these provide additional evidence that the soils are regularly waterlogged.

5 The EM and physical mapping show the area of Templeton soil as 4.6 ha, 2% of the property, which is the better soil for agricultural production. For comparison, t-map shows 11 ha of Templeton soils, however approximately 5 ha of this has been disturbed by quarrying in 2013.

6 The EM and physical mapping also shows that 83.1 ha (43%) has poorly drained soils that are vulnerable to waterlogging and has severe limitation for agricultural production and 105.3 ha (55%) is Wakanui soil that is imperfectly drained and with areas of wet or waterlogged soil, when surveyed in July 2014, providing limitations for agricultural use.

7 Land Use Capability (LUC) classifications of the PC69 land are based on the New Zealand land Resource Inventory (NZLRI) (Ministry of Works and Development 1979) land resource database. The LUC maps show that the property is good multiple-use land (i.e. LUC Classes 1-3). However, the LUC classifications on this property have a dominant limitation of wetness except for the Templeton soils.

8 The Land Use Capability mapping uses the Fundamental Soil Layers (FSL), whereas the more modern S-map provides more detailed information on water holding capacity of soils and drainage classes and some of the soil boundaries were recently updated. A 2020 comparison of S-map information with the older fundamental soil layers showed the area of highly productive land in the Canterbury region derived from the two data sources differs by 116,912 ha · This comparison showed there were differences between FSL and S-Map in the drainage class for most of the area between Lincoln and Te Waihora, where this site is located.

9 In my opinion, the 1979 LUC mapping is likely to be the least accurate source of soil information for the PC69 site, particularly as this farm has detailed soil information provided by EM mapping, auger and visual observations and S-map information.

10 The farm environment plan for the PC69 property and my discussions with Mr and Mrs Greenslade who farm the property, confirm that they actively manage and mitigate issues that arise from farming poorly drained soils that are vulnerable to phosphorus leaching and runoff, sediment loss and compaction. Figure 2B of my report attached as **Appendix 1** to my statement of evidence shows the areas identified as poorly drained soils. Mr and Mrs Greenslade confirmed to me that these areas are very rarely cultivated, so are not suitable for crops and the soils must be carefully managed for dairy farming due to the wetness. This careful management involves use of direct drilling in dry periods to avoid soil compaction and no winter crops are grown to avoid the risk of pugging.

11 The current farming operation creates a risk of sediment, faecal coliforms and phosphorus runoff to the drains and creeks that flow into the Ararīri/LII River, which has poor water quality and flows into Te Waihora (Lake Ellesmere). This property is located within the Selwyn Te Waihora Phosphorus zone, so needs to manage soil Olsen P (soil indicator of plant available phosphorus), and phosphate fertiliser use to reduce phosphorus runoff and leaching. Changing the land use to cropping that requires increased cultivation and periods of bare soil would also risk the loss of nutrients and sediment to Lake Te Waihora.

Soils within the Selwyn Waihora catchment

12 Only about 4.6 ha (2%) of the property's soils are classified as having medium soil water holding capacity, are moderately well drained and are suitable for multiple land uses. These better soils occupy a very small part of the proposed development area.

13 The most versatile soils in the Selwyn Te Waihora catchment are those that are classified as deep soils (1% of the Selwyn Waihora catchment soils), followed by soils that have a medium water holding capacity and are moderately well drained. With irrigation these soils are suitable for multiple land uses with very few limitations. There are approximately 95,690 ha (34%) of these medium soils in the catchment. The property has 4.6 ha of soils that are in this category, which is equivalent to 0.005% of medium soils in the Selwyn Te Waihora catchment. Figure 3 of my report shows a map of these areas.

RESPONSE TO SUBMITTERS

14 Many of the submitters are concerned about the loss of Highly Productive land that would occur if Plan Change 69 rezoned land from Rural (Outer Plains) to Living Z, Living X (Lincoln) and Business 1. The submitters have based their concerns on the Selwyn District Council's Baseline Assessment (DW015) and the Land Use Capability maps of the area.

15 Associate Professor Peter Almond has said that I incorrectly assigned the area of LUC 3s (soil limitation) as 3w (wetness limitation), and that clouded my view, however, that is an incorrect assumption. Throughout my evidence I have identified the Templeton soils on that area as the most highly productive and versatile soils within the PC69 site. From my experience gained from working with Canterbury farmers, Templeton soils are a versatile soil suitable for vegetable and arable production. I did think that S-Map information was more useful for assessing this property than the 1979 LUC mapping for the following reasons: the LUC maps(Figure 4 in my report) identified the area of Wakanui soils to the east of the property as LUC 1w1, the most productive/versatile soils in the proposed PC69 area, however these soils have a high water table and are wetter than the soils west of Springs Road that were classified as 3s1 (Templeton) and 2w1(Wakanui); the Flaxton/Temuka soils were classified as 2w1 the same as the Wakanui soils to the west of Springs Road. My site visit, the information provided S-Maps and the EM mapping all identified the Flax_4a/Tem_18 soils as having significantly more limitations than the Wakanui soils due to wetness and being prone to waterlogging.

16 The updated unpublished LUC map derived from S-Map, provided in Peter Almonds evidence appears to better represent the area in PC69 than the original LUC map. I did not have access to this map while preparing my submitted evidence, but I now consider this map to represent the land use capability of the PC69 site.

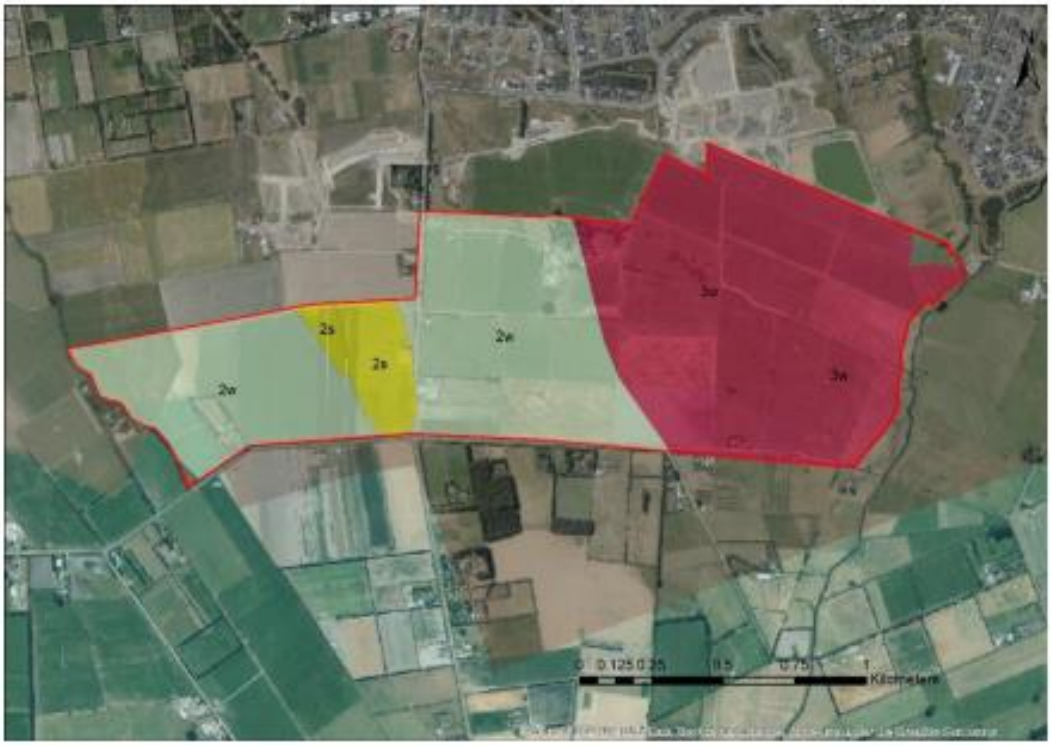

Figure 1: update LUC map from Peter Almond's evidence

17 This updated map has: LUC 3w (95 ha), LUC 2w (87 ha) and 2s (11 ha less 5ha that has had the soil removed).

18 Peter Almond's evidence provided historical imagery via google Earth of the site and neighbouring properties. He used the frequency of cultivation as a proxy for versatility of land, however there is a flaw in this evidence. The Google Earth images show a snapshot on a single day and between 1 and 3 days in a year, so it is not possible to count the number of cultivations in a year. He appears to have counted the number of times a paddock appears to have bare soil. For example, on the property identified as a market garden in Apr -17, May-17 and Aug-17, all the images have bare soil. It is highly likely the soil was bare throughout this period and was not three cultivation events. The same occurs in autumn/winter of 2013 and 2015. Google Earth shows no crops growing in winter 2011, 2013, and 2015, only 1 paddock out of 4 had crop in winters 2014, 2016 and 2020, 3 paddocks in crop/grass in 2018 and no information available for the other 3 years. This indicates there is very limited cropping over the April to August period. In contrast, the most versatile and productive soils in Selwyn grow two and sometimes more vegetable or arable crops in a year.

19 The onion farm further west also has limited cropping over the winter and there is evidence of water ponding. Prolonged ponding reduces crop yields and can result in crop failure. Under good management practice the time soils are left bare is minimised. Having bare soil for 5 -6 months of the year greatly increases the risk of nutrient and sediment loss to Lake Te Waihora.

Figure 2: Water ponding on the Onion Farm

20 Peter Almond's Figure 5 also identifies that within the PC69 area shown as block 37, 40 and 41 on his figure 5 as having 16 cultivation events, however when I view these images it shows an absence of green grass due to being rank brown grass, dryness, recently mown hay/silage paddocks or waterlogging and only one image had evidence of cultivation. This indicates that counting the number of times a paddock is brown is not a good proxy for the versatility of the soil. Springs and ponding are visible on these paddocks throughout the spring and summer months limiting the ability to crop those paddocks.

Figure 3: Springs and ponding on paddocks 40 and 41 in September 2018

21 Professor Keith Cameron provided evidence that the Wakanui soils are suitable for arable and horticultural production, however he fails to recognise this site has high groundwater and numerous springs on the eastern side of Springs Road limiting use.

22 The evidence of Bas Veendrick provides evidence on the groundwater levels collected for the site. Shallow groundwater levels (< 1 m below ground level) have been observed in CPT logs across the eastern part of the site, and some bores located across the eastern low-lying part of the site indicate groundwater levels as shallow as 0.2 m below ground level. Data collected in summer shows that the groundwater levels, under the area with Wakanui soils, east of Springs Road range from 1.48 to 2.58 m below groundwater and there will be some fluctuations. Even with drainage, this limits what arable and horticultural crops can be grown as many crops yield less if their roots are in saturated soils and it limits the timing of cultivation and harvesting. Across the western half of the site (48ha), observed groundwater levels are deeper, at 2 m – 3.5m below ground level and the depth to groundwater increases for sites further west and north.

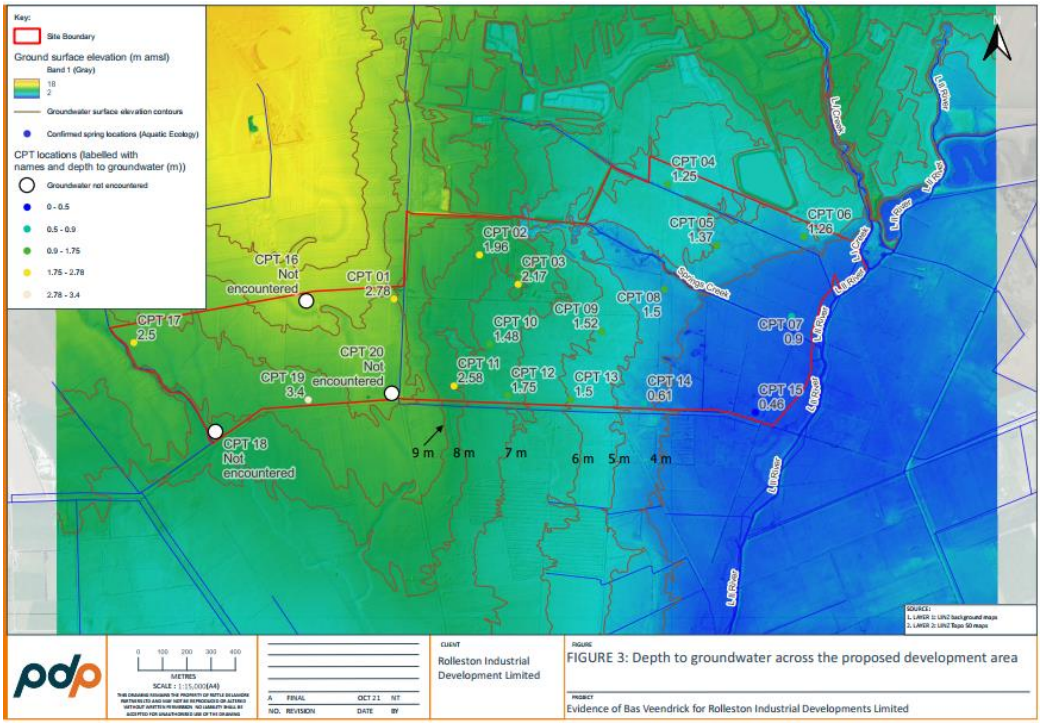

Figure 4: Depth to groundwater

23 The vegetable production site photographed by Keith Cameron, as an example of the crop production on Wakanui soils is southwest of the site, therefore has deeper groundwater and less limitations. Although on this site wetness still appears to limit crop production in winter and early spring and is managed by leaving the ground fallow for prolonged periods as shown in the Google Earth images referred to in paragraph 19 above. The Lincoln University cropping farm and the research sites are north of Lincoln and have far greater depths to groundwater and less limitations so although they are on the same soil type they are much easier to manage.

COMMENTS ON THE SECTION 42A REPORT

24 I have read the s42A report. Regarding paragraph 64, I agree that the soils within PC69 area are heavier and poorly drained compared with other areas containing Class 1 and 2 soils around Lincoln, including those to the northwest that have been recently developed for residential purposes. In general, I agree with the section on versatile soils in the section 42A report. The Officer has commented that PC69 would represent a moderate loss of the overall Class 1 and Class 2 versatile soils around Lincoln. However, that statement fails to acknowledge the difference in productive land use options arising from the drainage limitations. As noted earlier in my evidence, there is only 4.6 ha of highly productive land LUC 2s1 and the loss of that land from agricultural development is of a minor scale for the Lincoln area.

CONCLUSION

25 The area of Templeton soil that is the better soil for agricultural production is 4.6 ha (2%) of the soils on this property, under the updated LUC provided by Peter Almond, this is LUC 2s land. Using the S-Map data the remaining 87 ha are imperfectly drained, LUC 2 with wetness limitations and 95 ha are poorly drained soils (LUC 3w). The imperfectly or poorly drained nature of these soils provides limitations for agricultural use particularly those located east of Springs Road (152 ha). This description of the difficult soil and water conditions that exist on the property are consistent with the experiences of the Greenslades who currently farm most of the property.

Dated: 22 November 2021

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Katherine McCusker