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 Bas Veendrick (Hydrology)

Dated: 24 November 2021

Reference: JM Appleyard (jo.appleyard@chapmantripp.com)
LMN Forrester (lucy.forrester@chapmantripp.com)

chapmantripp.com
T +64 4 499 5999
F +64 4 472 7111

PO Box 993
Wellington 6140
New Zealand

Auckland
Wellington
Christchurch

chapman tripp

SUMMARY OF EVIDENCE OF BAS VEENDRICK

INTRODUCTION

1 My name is Bas Veendrick and I am a Technical Director of Water Resources at Pattle Delamore Partners Ltd in Christchurch. My experience and qualifications are set out in my primary statement of evidence. I specialise in surface water assessments including surface water – groundwater interaction and have undertaken several assessments on the effects of urban development on spring flows.

2 In this statement I provide a summary of my primary evidence (dated 4 November 2021), which describes two key potential hydrological effects in relation to spring flows resulting from rezoning the land, namely:

- The potential for a decrease in groundwater recharge contributing to spring flow due to an increase in impervious area.
- The potential for re-directing/short-circuiting groundwater flow paths away from springs as a result of hardfill, drains and service trenches.

I also comment on the submitter evidence from **Ms Philippa Aitcheson-Earl** that relates to these topics and have recommended some further monitoring as detailed under heading 'additional considerations' below.

SUMMARY OF EVIDENCE

3 I consider that the change in groundwater recharge due to the subdivision development and contributing to springflow as a result of the plan change is relatively small and unlikely to be an issue of concern. This is based on the available hydrogeological and soil information which indicate a large overall spring capture zone and poorly or imperfectly drained soils on the site. Based on these considerations it is likely that the groundwater recharge from the current (rural) development footprint is relatively small, which in turn means that changes to that recharge due to developing the site is likely to result in only minor changes in spring flow.

4 The proposed re-zoning of the land has the potential to re-direct/short-circuit flow paths away from springs as a result of the construction of drains, service trenches and roads (with underlying hardfill). For example, service trenches backfilled with gravels and hardfill areas can be much more permeable than the surrounding strata and if shallow groundwater (in water bearing seams or layers) is intercepted they may act as preferential groundwater flow paths

lowering the groundwater pressure and/or diverting water away from spring heads. This potentially results in reduced spring flows.

5 I understand from the evidence of **Mr. McLeod** that construction methodologies are available (which have been used in recent subdivisions in Christchurch) to avoid these potential issues. These measures involve ensuring that any groundwater in the water bearing layers will not be diverted to a new exit point through the backfill. These potential measures include the use of backfill material with the same/similar permeability as the surrounding strata, using low permeability backfill material in trenches for underground services to provide a plug that avoids diversion of groundwater into a different catchment and use of directional drilling instead of trench excavation. I understand that, apart from shallow swales, no new drains will be dug on the site. Therefore, there is no risk for drains to intercept groundwater and re-direct this water away from springs.

6 The anticipated excavated depth of service trenches is in the order of 1.0 to 1.2 m and hardfill will only be used under the roads at an excavation depth in the order of 0.6 m. To help inform where groundwater diversion mitigation measures are likely to be required (predominantly for excavation trenches) I recommend that piezometers will be installed to determine the groundwater level range and maximum groundwater levels on the site.

7 The ODP text now includes:

- a requirement to undertake a detailed groundwater level investigation across the site; and
- a requirement to specify construction measures to ensure that shallow groundwater is not diverted away from its natural flow path for those areas where the shallow groundwater is likely to be intercepted by service trenches and hardfill areas. This includes measures to address potential loss of spring flow due to penetration of the confining layer.

8 I consider that with these measures in place, the potential adverse effects of the proposed plan change on spring flows can be adequately mitigated.

ADDITIONAL CONSIDERATIONS

9 Recent discussion with Dr Burrell confirms that he is happy with the updated approach to protect springs on the site, including the monitoring and increased setback distance. Dr Burrell suggested that the ODP text is clear with regard to the proposed monitoring requirements for groundwater levels, spring water levels and spring

flow during and following construction to provide more certainty on the potential lowering of groundwater levels and subsequent potential adverse effects on spring flow. This monitoring is in addition to the recommended groundwater monitoring described in paragraph 6 above which will identify areas of shallow groundwater where groundwater diversion mitigation measures are required.

10 I agree with Dr Burrell and therefore recommend one minor update to clause b (iv) of the ODP text under 'Water Bodies and Freshwater Ecosystems'. I recommend that the following wording will be added to clause b(iv): 'This includes groundwater level, spring water level and spring flow monitoring.'

11 The monitoring will enable the collection of data which can be used to identify the most appropriate management measures to avoid adverse hydrological effects as a result of the rezoning.

COMMENTS ON EVIDENCE OF MS PHILIPPA AITCHISON-EARL

12 Ms Aitchison-Earl has provided evidence on behalf of the Canterbury Regional Council and Christchurch City Council. Her evidence covers the following matters:

- Description of groundwater and springs;
- Impact of construction, excavation and dewatering on springs; and
- Impact of urban development on springs and groundwater

My comments on her statement are set out in the following paragraphs.

Description of groundwater and springs

13 I agree with the description of groundwater and springs by Ms Aitchison-Earl which is generally consistent with my description of the hydrogeology as described in section 7 to 16 of my primary statement of evidence.

Impact of construction, excavation and dewatering on springs

14 In paragraph 19 to 23 Ms Aitchison-Earl comments on the potential 'Impacts of construction, excavation and dewatering on springs'. I agree that there is the potential for earthworks or construction to penetrate the confining layer, intercepting shallow groundwater (in water bearing layers) and diverting flow away from existing springs. I note that this risk is reduced by:

- Avoiding development in the eastern part of the site (below the 4.0 m RL contour) where groundwater is close to the surface as detailed in the updated ODP and ODP text.

- The increased buffer distance from 30 meters to 100 meters between the developed areas and the springs as outlined in the updated ODP text.

15 I consider that the potential for re-directing shallow groundwater flow away from springs can be adequately mitigated through appropriate design and construction of underground services in areas where they are likely to intercept shallow groundwater (also refer to my primary evidence). Identification of these areas will be informed by the groundwater level monitoring I have recommended. I note that Mr. Morris in reviewing the application on behalf of Selwyn District Council (SDC) agrees with me on these matters.

16 There are two other matters raised by Ms Aitchison-Earl related to the construction phase of the plan change area. This includes the potential for cone penetration tests (CPT) and bridge pilings to penetrate the confining layer allowing groundwater to discharge to the surface and the potential for dewatering (if required as part of construction) to lower groundwater levels.

17 I understand from her evidence that in the 'Main North Road' case the CPT puncturing the confining layer was extremely hard to remediate. **Mr. Thompson**, providing geotechnical evidence on behalf of the applicant, has indicated that this is a rare occurrence and that artesian conditions have not been encountered to date on the Lincoln South site. He further comments that '*If artesian conditions are encountered in a CPT, with a quick response, the majority can be sealed / grouted relatively simply.*'

18 With regard to dewatering, I agree that dewatering has the potential to temporarily reduce groundwater pressure and affect flow to springs. Dewatering may be required in areas with relatively shallow groundwater. These areas are relatively close to the springs and in these situations the typical approach would be to discharge the water back to surface water where the springs naturally discharge to, resulting in no net loss in flow.

Impact of urban development on springs and groundwater

19 In paragraph 24 Ms Aitchison-Earl comments on the potential for increased impervious areas (such as pathways, roads and housing) to decrease the amount of local land-surface recharge which has the potential to reduce spring flows. I agree that this is a potential effect of the rezoning but, as detailed in paragraph 18-20 of my primary evidence, I consider that the change in groundwater recharge contributing to spring flows as a result of the plan change is

relatively small and unlikely to be an issue, due to the much larger spring recharge area coming via groundwater throughflow from the north-west.

20 With regard to the comments on reticulated service pipes for wastewater being in direct contact with groundwater in areas of shallow groundwater (paragraph 26 Ms. Aitchison-Earl's evidence) I understand from Mr. McLeod's evidence that these areas are likely to have a sealed low pressure sewer system which will avoid deep excavations for sewer lines and pump stations and minimise the risk of groundwater contamination. Identification of these areas will be informed by the recommended groundwater level monitoring. In addition, I note that there are no shallow community drinking water supplies in the vicinity (and down-gradient) of the site.

CONCLUSION

21 I have considered the key potential hydrological effects in relation to spring flows as a result of the plan change and conclude that:

- The potential for puncturing the confining layer and re-directing shallow groundwater flow away from springs can be adequately mitigated through the appropriate design and construction of underground services in areas where they are likely to intercept shallow groundwater in water bearing layers. In these areas, appropriate mitigation measures are available to ensure spring flows are not adversely affected. The updated ODP avoids development in areas of shallow groundwater and a significantly increased buffer distance of 100 meters between the developed areas and the springs is proposed. This further reduces the risk of any potential adverse hydrological effects on spring flows. I have also recommended groundwater level monitoring, spring water level monitoring and spring flow monitoring to help inform the management measures in order to avoid adverse hydrological effects during and following construction.

- Potential adverse effects on spring flows due to construction dewatering can be avoided by discharging the water back to surface water where the springs naturally discharge to, resulting in no net loss in spring flow.

- Engineering solutions are available to avoid groundwater contamination from sewer systems in areas with shallow groundwater (as detailed in the evidence of Mr McLeod).

- The potential decrease in groundwater recharge contributing flow to springs due to an increase in impervious areas is unlikely to be an issue of concern. I note that the Ecology

Report prepared for Selwyn District Council by **Dr. Burrell** agrees with this conclusion.

22 I am happy to answer any questions concerning my evidence or the proposed conditions.

Dated: 24 November 2021

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Bas Veendrick