BEFORE THE SELWYN DISTRICT COUNCIL

UNDER the Resource Management Act 1991

AND

IN THE MATTER of Private Plan Change 71: Four Stars Development Limited and Gould Developments Limited

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STATEMENT OF EVIDENCE OF VICTOR MKURUTSI MTHAMO ON BEHALF OF FOUR STARS DEVELOPMENT LIMITED AND GOULD DEVELOPMENTS LIMITED

VERSATILE SOILS, WATER SUPPLY & FLOODING

Dated: 24 January 2022

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INTRODUCTION:

1 My full name is Victor Mkurutsi Mthamo.

2 I am a Principal Consultant for the environmental science, engineering and project management consultancy Reeftide Environmental and Projects Limited (Reeftide). I have been in this role for over 9 years. Prior to this I was a Senior Associate with the surveying, environmental science and engineering, and resource management consulting firm CPG New Zealand Limited (now rebranded to Calibre Consulting Limited), where I was also the South Island Environmental Sciences Manager. I have worked in the area of environmental science and engineering for over 26 years.

3 I have the following qualifications: Bachelor of Agricultural Engineering (Honours) with a major in Soil Science and Water Resources (University of Zimbabwe); Master of Engineering Science in Water Resources (University of Melbourne); and Master of Business Administration (University of Zimbabwe). I hold an Advanced Certificate in Overseer Nutrient Management modelling qualification. I am a member of Engineering New Zealand (CMEngNZ) and I am a Chartered Professional Engineer (CPEng) and an International Professional Engineer (IntPE). I am a past National Technical Committee Member of both: (i) Water New Zealand; and (ii) New Zealand Land Treatment Collective (NZLTC).

4 My specific soils experience relevant to this evidence includes:

(a) The design and implementation of numerous on-farm irrigation schemes which involved soil investigations, land use assessments;

4.2 Assessment of large subdivisions in relation to stormwater management, earthworks and the associated actual and potential impacts on soils, groundwater and surface waterways and how to effectively use erosion and management control plans to mitigate the potential impacts that may occur during the construction works. This work is relevant to my input in this hearing as it demonstrates the ability to assess and present soil mitigation strategies associated with earthworks and rehabilitation of sites post development;

4.3 Soils and rehabilitation expert witnessing for the proposed Roydon Quarry in Templeton in 2019 and 2020. Fulton Hogan's proposal was for the establishment of a quarry and extraction aggregate. I provided an assessment of the soils' versatility and the effect of the changes to the land use on the land's productivity potential.

5 My relevant experience in Three Waters and Flooding assessments relevant to my evidence includes:

(a) Water, wastewater stormwater planning, catchment hydraulic and hydrological modelling and design. I am also regularly engaged by Christchurch City Council (CCC) as a Three Waters Planning Engineer. In this role I review water supply, wastewater and stormwater designs and modelling by engineers from various consulting firms. I peer review their reports (concepts, calculations and detailed designs) and provide them with the required guidance for solutions that are acceptable to the CCC; and

(b) Consulting for various Councils that include Selwyn District Council, Hurunui District Council, Horowhenua District. In this role my consultancy covered stormwater, water supply, flooding and wastewater, risk and criticality assessment for Council Three Waters Assets.

6 I have been involved with the proposed:

(a) Plan Change 66 (PC66) as a soil expert witness.

(b) Plan Change 67 (PC67) as a flooding and soils expert. I prepared expert evidence covering these two areas.

(c) Plan Change 75 (PC75) where I prepared expert evidence on the effect of the proposed plan change on the versatile soils and productivity of the land.

7 I have been involved with the proposed Plan Change 71 (PC71) since the beginning of August 2021 when I was engaged by Four Stars Development and Goulds Developments Limited, the *Applicants*) to carry out an assessment of the effects of the PC71 proposal on the potential loss of productive land, flooding and peer reviewing the infrastructure report prepared by Mr Will Salmond (Patterson Pitts Group).

CODE OF CONDUCT

8 I have read and am familiar with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2014, and agree to comply with it. My qualifications as an expert are set out above. Other than where I state that I am relying on the advice of another person, I confirm that the issues addressed in this statement of evidence are within my

area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

SCOPE OF EVIDENCE

9 My evidence is presented on behalf of the Applicant in these proceedings.

10 My evidence addresses the following:

(a) Versatile soils

(b) I assess the effects of the proposed plan change on the land's productive potential.

11 Water Supply

(a) My evidence on this issue addresses the following:

(i) Water supply requirements for the proposed plan change area.

(ii) Existing water supply availability.

(iii) Proposed solutions to meet the Plan Change 71 water supply requirements.

12 An assessment of potential flood hazards within the PC71 area.

13 In preparing my evidence I have reviewed:

(a) Selwyn District Council Rolleston Master Plan 2017-2048 which outlines the proposed future upgrades;

(b) SDC Water Supplies Activity Management Plan Volume 2. 2018;

(c) The Rolleston Structure Plan (RSP);

(d) Section 42A report prepared by the Selwyn District Council officers including that of Mr Murray England; and

(e) Submissions on the proposed plan change relevant to my area of expertise.

14 Work by others with regards to water supply issues. I also relied on some of the preliminary investigative work and liaison with Selwyn District Council which was done under my direction by Mr Will Salmond.

15 From here on my evidence is structured as follows:

(a) Summary of the evidence

(b) Part A - Description of the Plan Change 71 and the Applicant's proposal.

(c) Part B - Versatile Soils

(d) Part C - Water Supply

(e) Part D – Flooding

(f) Parts B-D also include:

(i) Response to the s42A Report in the areas relevant to my expertise.

(ii) Response to Submissions relevant to my area of expertise.

SUMMARY

16 **Versatile Soils**

17 The proposed plan change will be in an area that has 51.85 ha of LUC Class 2 soils and 2.04 ha of LUC Class 3 soils.

18 The predominant soil are the Templeton silty loams. These are over 85.7% of the PC71 area. The remaining 14.3% of the PC71 area is over Eyre silt loams.

19 In general, the soils do not appear to have any issues that could hinder plant growth and hence productivity.

20 However, it is my opinion that use of LUC Class in defining soil versatility is only a first step and where site specific information is available this should be taken into account. This is also confirmed by the proposed National Policy Statement on Highly Productive Land (NPS-HPL) which considers the use of LUC classes as only a starting point pending the availability of site specific information when councils get to it.

21 On consideration of site specific factors, it is my opinion that the effect of the proposed Plan Change on the district and regional agricultural productivity potential is insignificant because:

(a) Soil moisture data shows the area is susceptible to soil moisture deficit. Without water for irrigation the land cannot achieve its full production potential.

(b) The land is currently used for pasture production and is not intensely farmed. Under the Canterbury Land and Water Regional Plan and the provisions in the Selwyn Te Waihora Sub-regional plan, intensive farming may not be possible due to restrictions on nutrient losses.

(c) Assuming there were no other constraints (e.g. water availability), advances in technology and farming techniques over the years have been such that the removal of 53.89 ha is unlikely to result in any significant loss in production as this can be made up for elsewhere in the district and even on soils of lower LUC classes.

(d) The developable area in the context of the total LUC 1 and LUC 2 soils in the district and the regional is very small (0.0064% and 0.038% respectively).

(e) Furthermore, 17 ha of the 51.85 ha has been designated as a FDA which means 31.85 ha of LUC Class 2 soils would be the total new area which would be potentially lost due to the proposed Plan Change. The developable area in the district and on a regional basis becomes 0.042% and 0.025%.

(f) The site is already bound by existing subdivisions and lifestyle blocks. There are potential reverse sensitivity issues associated with intensifying agricultural production in such an area and I have discussed these in detail in Paragraphs 99-107.

22 **Water Supply**

23 A third of the PC71 area is part of the Rolleston Structure Plan (RSP) and Future Development Area (FDA) in the Regional Policy Statement and the potable water requirements associated with this area is included in the Selwyn District Plan's planning.

24 I estimate the potable water requirements for the other two-thirds of the PC71 area as:

(a) 96,360 m^3/year.

(b) 45 L/s instantaneous flow.

25 Firefighting requirements can be met from the potable supply allocation.

26 There are options available or highly likely to be available to meet the demand for the PC71 area including the provision of a new community water supply

take on the land and/or by purchasing and transferring consents from other sites.

27 New takes for community water supplies are a restricted discretionary activity under Rule 5.115 of the Canterbury Land and Water Regional Plan (CLWRP).

28 With respect to the transfer option:

28.1 SDC is happy with a consent transfer as a solution for meeting the water demands for the PC71 area.

28.2 The CLWRP has rules which enable consents to be transferred from site to site. Therefore, there is no statutory reason the proposed solution cannot be implemented.

29 Currently SDC has a total consented volume for the Rolleston scheme of 7,183,440 m^3/year. Over the last three years the average annual use has been 3,300,000 m^3/year. The difference between the consented volume and the demand is 3.88 Mm^3/year, which is a significant existing surplus.

30 While SDC prefers the Applicant to provide either: (i) consents and the new community supply; or (ii) a purchase and transfer and establish the water supplies outright, there is a possibility that the surplus capacity of 3.88 Mm^3/year can be used to meet the 96,360 m^3/year required for the two-thirds of the PC71 area outside the FDA. This arrangement will require the "Applicant" to fund the future replacement of this water when it is required.

31 I recommend further future discussions with the Council on the two options relating to the timing of the water supply to the development.

32 Overall, it is my view that the balance of the PC71 outside of the FDA can be provided with a potable water supply at the time of development.

33 In her Section 42A report, Ms. White recommends a rule that will restrict subdivision until a water supply is provided. Given my opinion that potable water can be provided to the PC71 area, I do not see the need for the proposed rule. The applicant should just be able to demonstrate at the subdivision stage that each stage submitted for subdivision consent can be supplied with potable water to meet the requirements.

34 **Flooding Assessment**

35 Rainfall run-on and run-off within the plan change area is the only source of potential flooding.

36 There are no definite flow paths from neighbouring properties into the PC71 area. Therefore, the PC71 area does not serve as a flood flow path. Its development will not compromise flood flows from neighbouring upgradient properties.

37 Large rainfall events produce small depths of water inundation. I expect any standing water to soak through the permeable soils within a few hours unless a particular spot has compacted soil. Historically, flooding has been observed primarily in existing low points within the site.

38 Development of the area to avoid large inundation depths can readily be managed through detailed engineering design.

39 In summary:

(a) My assessment shows there are no areas of high flood hazard within the site boundary which would be inappropriate for development; and

(b) The statutory requirements relating to flood hazards in the proposed District Plan and the Canterbury Regional Policy Statement will be achieved.

PART A – DESCRIPTION OF THE SITE

DESCRIPTION OF THE SITE AND THE PROPOSED PLAN CHANGE

40 Plan Change 71 seeks to amend the operative Selwyn District Plan (OSDP) to enable development of the 53.89 ha site ('the Site') for residential purposes, including some medium density lots. The rezoning will accommodate a further 660 dwellings.

41 Land uses within the PC71 area includes:

(a) Horse training throughout the Levi Road section; and

(b) Rural lifestyle blocks with houses, axillary buildings, swimming pool and associated small paddocks.

42 Topographically the site generally slopes from Levi Road in a southeast direction towards the intersection of Lincoln Rolleston Road and Nobeline Drive. Overall, there is a height difference of 9.5 m, this equates to a grade of 1:140 as depicted on the Preliminary Contour Plan and Canterbury Maps Lidar Contours which I have appended as **Attachment 1**.

43 The site lies over the unconfined/semi-confined gravel aquifer system. Groundwater levels recorded on nearby bore logs are between 9.30 m and 15.30 m deep.

PART B - VERSATILE SOILS

DISCUSSION OF THE CONCEPT OF HIGHLY PRODUCTIVE LAND OR VERSATILE SOILS

Introduction

44 The primary purpose of this section of my evidence is to discuss the effect of the proposed plan change on the land's productive potential. Land productive potential encompasses many facets of which soil is one of them.

45 Most discussions on soils that relates to its ability to support a multitude of productive uses refer to the soils as being versatile. The words high productive land/soil, high class land/soils, versatile soils/land are always used interchangeably (though there could be some technical differences between them). In my evidence, I have adopted the general approach where the words are used interchangeably.

46 High productive land or versatile soils are regarded as the best possible land or soils for agricultural production because of their properties. Various documents and statutory planning tools in New Zealand provide definitions of versatile soils. Therefore, it is necessary to provide a common understanding of what versatile soils are. Some of the most pertinent definitions are discussed in the following sections.

New Zealand Land Resource Inventory

47 The Land Use Capability (*LUC*) classification system is described by Lynn et al. (2009).[1] It is a general purpose, qualitative evaluation system which has been widely applied in New Zealand for land use planning, especially for management and conservation.

(a) According to the LUC Class system:

(b) Land can be divided into 'classes' depending on its suitability for different land uses. The Land Use Capability (LUC) assessment ranks land

[1] *Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF 2009. Land Use Capability survey handbook: a New Zealand handbook for the classification of land, 3 rd ed. Hamilton, Agresearch; Lincoln, Landcare Research; Lower Hutt, GNS Science. 163 p.*

according to its long-term productive ability. Class 1 land is highly suitable for agriculture, while Class 7 or 8 land is better suited for conservation; and

48 Versatile soils are defined as Class 1, 2, or 3. Figure 1 shows the potential land uses and the relationship between the versatility and LUC classes.

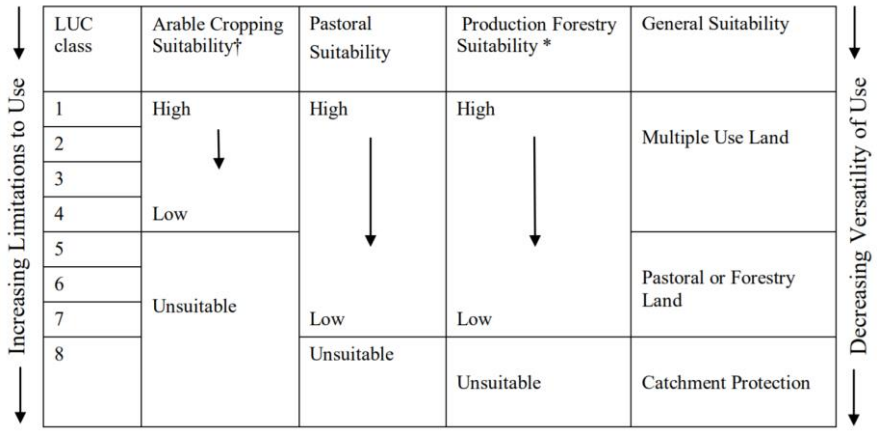

Figure 1 – Relationship between the Versatility and LUC Classes (Lynn et al, 2009[2])

Canterbury Regional Policy Statement (CRPS)

49 The Canterbury Regional Policy Statement (CRPS) states that "*Soil versatility is an expression used to describe the land use capability of soils. A highly versatile soil has few limitations for use, that is it will be suitable for primary production with few inputs such as additional water or nutrients. Less versatile soil will need more inputs to achieve similar production or will simply be unsuitable for agriculture or forestry. In the Canterbury Regional Policy Statement, versatile soils are those soils that are classified as Land Use Capability I or II in the New Zealand Land Resource Inventory*".[3]

(a) The explanation and reasons for Policy 5.3.12 in Chapter 5 of the CRPS notes *"Different soils are valued for different reasons. Versatile soils (Classes I and II under the Land-use Capability Classification System) are that part of the soil resource that will support the widest range of productive uses with the least inputs. Soils with lower versatility can be valued for other rural productive activities, such as vineyards".*

[2] http://envirolink.govt.nz/assets/Envirolink/83-mldc7-MarlboroughSoilsAdvice.pdf
[3] Chapter 15 RPS, at P.205

(b) In summary, the CRPS defines versatile soils as those that are in LUC Classes 1 and 2. Class 3 is not included. The total area in LUC Classes 1 and 2 in Canterbury is 293,700 ha[4].

Selwyn District Council

50 Various SDC statutory documents make reference to versatile soils. For example, in the Township Volume of the Operative Selwyn District Plan (OSDP):

(a) Objective B1.1.2 seeks to ensure that the Plan achieves s.5(2) of the RMA by ensuring that new residential or business activities do not create shortages of land or soil resources for other activities in the future;

(b) Policy B1.1.8 seeks to avoid rezoning land which contains versatile soils if the land is appropriate for other activities and there are other areas adjoining townships which are appropriate for residential or business development which do not contain versatile soils;

(c) The current Rural Volume of the district plan is concerned with the irreversible use of versatile soils; and

(d) The OSDP definition of versatile soils or highly productive land relies a lot on the definition in the CRPS (Paragraph 49). Therefore, versatile soils are those soils that are in LUC 1 and 2 as per the RPS. According to SDC,[5] there are 6,522 hectares of Class 1 land and 46,111 hectares of Class 2 land giving a total of 52,633 ha that are classified as versatile soils in the Selwyn District.

Proposed National Policy Statement for Highly Productive Land (proposed NPS-HPL)

51 The overall purpose of the NPS-HPL is to improve the way highly productive land is managed under the RMA.

52 Under the proposed NPS-HPL:

(a) Highly productive land means it has been designated Class 1, 2 or 3 by default.

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[4] *https://www.tandfonline.com/doi/full/10.1080/00288233.2015.1092996*
[5] *https://www.selwyn.govt.nz/__data/assets/pdf_file/0006/288312/Versatile-Soils-Baseline-Report.pdf*

(b) The objective is not to provide absolute protection for highly productive land.

53 Councils will then be able to consider a number of other factors to exclude some of this land, or to identify other highly productive land. Examples of these other factors are: the suitability of the climate for primary production; the size of land properties to support primary production; water availability; and access to transport routes and appropriate labour markets.

54 I note the proposed NPS-HPL is still at the consultative stage and has no legal effect yet, and the provisions will likely change to some extent at least.

55 In summary, the proposed NPS-HPL considers land in LUC classes 1-3 as highly productive land or versatile soils by default until such a time Councils are better able to decide on what other factors should be considered to define the productive potential of specific pieces of land.

Case Law

56 In *Canterbury Regional Council v Selwyn District Council* [W142/96], Environment Court Judge Treadwell[6] preferred evidence to the effect that the term versatile soils/land should not be based just on the soils inherent properties (which is the LUC approach) but must be defined based on broader considerations than the land use capability. The comprehensive list of factors suggested by Judge Treadwell when defining versatile soils is provided in Table 1 below.

[6] *Canterbury Regional Council v Selwyn District Council [1997] NZRMA 25, Judge Treadwell presiding.*

Table 1 – List of Factors Determining Versatility (Treadwell, 1997[6])

Soil texture	Soil structure	Soil water holding capacity
Soil organic matter stability	Site's slope	Site drainage
Temperature of the site	Aspect of the site	Stormwater movements
Floodplain matters	Wind exposure	Shelter planted
Availability of irrigation water	Transport, both ease and distance	Effect of the neighbours on the use
Access from the road	Proximity to airport	Proximity to port
Supply of labour	Previous cropping history	Soil contamination
Sunlight hours	Electricity supply	District scheme
Economic and resale factors		

57 I agree with the Court that the productive potential of the land should not be based on the LUC classes alone but should take into account other factors relevant to the overall success of a particular farming enterprise.

58 I also agree with the NPS-HPL proposal (Paragraph 53) that consideration of other site-specific factors should be made in determining the productive potential of land beyond the default LUC Classes 1-3.

Summary Commentary of the Definitions of Soils Versatility

59 Under the CRPS and Operative Selwyn District Plan highly productive soils are soils in LUC Classes 1 and 2. In summary:

(a) Selwyn District has 6,522 hectares of Class 1 land and 46,111 hectares of Class 2 land giving a total of 52,633 ha (Paragraph 50(d)).

(b) Canterbury Region has 293,700 ha (Paragraph 49(b)) of Class 1 and 2 soils.

60 Under the proposed NPS-HPL default highly productive soils are soils in LUC Classes 1, 2 and 3. However, the proposed NPS-HPL suggests that rather than rely on the default classifications Councils will need to do further work to define what highly productive soils are taking into account site specific environmental, climatic, geographic, economic and social factors. Added to the Class 1 & 2 totals above:

(a) Selwyn District has 87,927 hectares of Class 3 soils giving a total of 140,560 ha[7] of Classes 1-3 soils.

(b) Canterbury Region has 543,000 ha[4] of LUC Class 3 soils giving a total of 836,700 ha of Classes 1, 2 and 3 soils.

LUC CLASSES AND VERSATILITY OF THE SOILS IN THE PC71 AREA

61 S-Maps Online, Canterbury Maps and the Land Resource Inventory (LRIS) Portal provide details of the default LUC Classes within the PC71 area.

62 The LUC Classes of the PC71 soils are mapped on Canterbury Maps, S-Maps and LRIS Portal.[8] I have attached (**Attachment 2**) an image showing the LUC Classes under the PC71 area. In Table 2 below I provide details of the areas under each LUC Class.

Table 2 – LUC Classes within the PC71 Area

LUC Class	**Area (ha)**	**%age**
LUC 2	51.85	96.2%
LUC 3	2.04	3.8%
Total	**53.89**	**100%**

MY THOUGHTS REGARDING THE USE OF LUC CLASSES IN DEFINING LAND/SOIL PRODUCTIVITY

63 The use of the LUC based on information from S-Maps, NZLRI and Canterbury Maps provides a high-level description of the land and soils. While this is a good planning tool, it is important to note:

(a) The NZLRI LUC map information should be treated with caution due to the scale (which can be up 1:50,000 scale), especially with regard to the accuracy of LUC map unit boundaries. Applying regional scale LUC (and soil) map information at property scale should only be used as a guide rather than assumed to represent the definitive soils and LUC map units for the property.

(b) The LUC classes are based on high level soil properties to ascertain productivity potential and these do not necessarily drive land and soil quality. Soil properties such as physical limitations, land use suitability, slope limitations, characteristic soil stoniness, depth and workability, texture, drainage salinity and elevation, can change over very short

[7] https://www.mpi.govt.nz/dmsdocument/36624/direct
[8] *https://soils.landcareresearch.co.nz/soil-data/the-lris-portal/*

distances. Therefore, wholly relying on the LUC classes in determining a particular piece of land can be misleading.

64 Therefore, in my opinion:

(a) The areas in Table 2 are just the default LUC classes and should not be used to describe the productive potential of the PC71 land. I noted in Paragraphs 48 to 58 above that the soils' productive potential is not based just on the LUC classes; and

(b) There are other factors that must be taken into account such as those in Table 1 or those suggested in the draft NPS-HPL (Paragraph 53).

ASSESSMENT OF SITE-SPECIFIC FACTORS AFFECTING THE PC71 SOILS' PRODUCTIVE POTENTIAL

Introduction

65 In this section, I discuss site specific considerations necessary to understand the soils productivity potential beyond the assumptions drawn from use of the default LUC classes (Paragraphs 53, 57, 58 and 64).

Site Specific Soil Properties

66 S-Maps Online[9] and Canterbury Maps[10] provide details of the soils under the PC71 site. The soil type is predominantly Templeton silt loam. Table 3 summarises the soils types, the area over each type and the drainage and permeability characteristics.

Table 3 – Overview of Soils at the PC71 Site

Soil Type	Texture	Area (ha)	% Area	Permeability	Drainage
Templeton Soils					
S-Map Name					
Temp 1a.1	Silty Loam	45.4	85.7	Moderate over slow	Moderately Well drained
Temp 2a.1	Silty Loam				
Temp 1a.2	Silty Loam				
Temp 3a.1	Silty Loam				
Temp 4a.1	Silty Loam				
Eyre Soils					
S-Map Name					

[9] https://smap.landcareresearch.co.nz/
[10] https://canterburymaps.govt.nz/

Soil Type	Texture	Area (ha)	% Area	Permeability	Drainage
Eyre 1a.1	Silty Loam	7.6	14.3	Moderate over rapid	Well drained
Totals		**53**	**100%**		

67 The Templeton soils:

a) Are deep > 100 cm.

b) Have a Profile Available Water – 56.3-157 mm.

68 The Eyre soils:

a) Are shallower – 25-45 cm.

b) Extremely gravelly.

c) Have a profile available water of up 118 mm.

69 The site-specific soil information seems to confirm the LUC Class 2 and 3 soils in Table 2. However, note Templeton soils make up all of the LUC 3 Class soils and the Eyre soils are all in LUC Class 2 soils.

70 More importantly, as I noted in Paragraph 64 there are other factors that should be considered to define the soil productivity. I now discuss these in subsequent paragraphs.

Soil Moisture Deficits

71 The Selwyn District climate can be very hot and dry during in spring and summer at a time when most agricultural production needs moisture the most.

72 These weather conditions significantly affect crop production and ultimately compromises the soil's natural capital or productive potential as it will not matter how inherently fertile or productive the soils are because moisture or irrigation is critical to support crop growth.

73 To better understand the soil moisture deficits and the need for irrigation in the PC71 area, I assessed the soil moisture deficits using data from the NIWA climate database (Cliflo[11]). The nearest (to the proposed plan change area) climatic data available is from the Selwyn District Council Burnham Wastewater Treatment Plant (Agent No 4880). This station has data from 1953 to 2020. Tables 4, 5 and 6 provide summaries statistics on:

[11] https://cliflo.niwa.co.nz/

(a) Moisture deficit days.

(b) Mean moisture deficits.

(c) Maximum moisture deficits.

Table 4 – No of Monthly Deficit Moisture Days

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
Mean	21	18	14	9	3	0	0	0	1	6	15	19	109
Min	7	5	0	0	0	0	0	0	0	0	0	1	62
Max	30	26	30	28	21	1	8	0	18	28	28	31	167

74 Table 4 shows there was an average of 109 and a maximum of 167 days per year when soil moisture deficits were experienced. Most of these deficits were from later in spring and throughout the summer months. For some crops peak growth occurs in the December, January and February which is when soil moisture is most limiting to crop growth. The average number of deficits in January is 21 days out of 31 days in the month. There were a few times over the years when deficits were experienced every day in January.

Table 5 – Monthly Mean Moisture Deficits (mm)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	122	123	109	91	62	29	13	11	27	57	94	113
Min	60	44	35	18	2	1	0	1	2	8	26	55
Max	146	142	143	143	124	104	66	63	87	129	133	138

Table 6 – Monthly Maximum Moisture Deficits (mm)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	135	135	127	112	84	47	23	21	45	81	115	129
Min	101	75	61	46	5	2	2	4	6	23	56	86
Max	149	147	146	146	144	112	88	74	105	142	140	146

75 The monthly soil moisture deficits in the summer months ranged from 113-149 mm per month as shown in Tables 5 and 6. These deficits explain the low intensity production within the proposed plan change land.

76 Due to climate change, I also expect the soil water deficit will continue to increase to a point that even dry land farming could become unsustainable.

77 Paragraphs 71-75 demonstrate the critical need for irrigation water if agricultural productivity on the PC71 land is to be maximised as these soil moisture deficits stunt crop growth regardless of the soil's natural capital.

78 Therefore, the soil's versatility or production potential is lower than what the LUC classes suggest unless irrigation water is applied to compensate for the deficits.

Irrigation Water Availability

79 If the land is to be used productively, the soil moisture deficits I discussed in Paragraphs 71-77 need to be compensated for by providing irrigation. For example, the average deficit of 122 mm in January would need at least an equivalent amount of irrigation water to ensure that the soil moisture stayed between field capacity and the allowable depletion point.

80 I used IrriCalc[12] to estimate the irrigation requirements in 9 out of10 years for pasture assuming an irrigation system with an 80% efficiency.

81 IrriCalc is a tool for calculating irrigation water demand. It is an approved method and meets the Canterbury Land and Water Regional Plan Schedule 10 requirements.

82 The annual irrigation volume estimated using IrriCalc is 350,595 m^3 (using one soil profile available water depth). This volume is based on pasture. Volumes for other crops (arable and horticultural) will be 90-110% of the pasture volumes). **Attachment 3** is the IrriCalc output.

83 Table 7 summarises the monthly irrigation application depths based on long term climatic data.

Table 7 – Irrigation Requirements for Pasture in the Plan Change Area

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	119	92	54	24	7	0	0	0	8	56	760	117
90%tile	132	132	88	44	44	0	0	0	44	88	132	132

84 Table 7 shows 119-132 mm of irrigation is required in January to maintain a good pasture system. These irrigation requirements are consistent with the moisture deficits in Tables 5 and 6 with any differences due to the range of climatic data used by the different tools.

[12] http://mycatchment.info/

85 I interrogated the Canterbury Maps GIS[13] to check for consents to take water for irrigation. There are no existing consents to take water for irrigation within the proposed plan change area. This means soil moisture deficits cannot be mitigated using irrigation. In turn, this means agricultural production will only be constrained.

86 The PC71 site is within the Selwyn-Waimakariri Groundwater Zone. This zone is over-allocated and applications for new consents to take groundwater for irrigation are prohibited.

87 The only other possible option to acquire water for irrigation would be to buy and transfer an existing consent to the PC71 site. Transfer of consents has the following challenges:

(a) I have looked at the trading history at Hydrotrader[14] – a groundwater consent and water trading website. There are no readily available consents for purchase and transfer within the zone. Historically, consents traded are usually for smaller volumes.

(b) The Canterbury Land and Water Regional Plan requires 50% of any volume transferred be surrendered where the transfer is for irrigation, as opposed to community water supply. That is, a consent with an annual volume of 701,190 m^3/year would have to be purchased to provide for the annual volume of 350,595 m^3/year.

(c) The average price of water is \$1.05/m^3 which means if a consent (for 701,190 m^3) this would cost \$736,250 to get a net volume of 353,595 m^3. This is a prohibitive cost. For low margin crops it will take several years to recoup this cost this is even before the opportunity cost is taken into account.

(d) The \$736,250 cost of water is a huge initial cost that has to be incurred even before a well or wells are drilled to take the water and for the irrigation equipment.

(e) The unavailability of irrigation water or its high cost were this to be found makes the economics of irrigated production a hindrance to intensive production.

88 This means that the high evapotranspiration rates, low rainfall and the accompanying moisture deficits significantly reduce the productive potential of the land.

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[13] https://canterburymaps.govt.nz/
[14] http://hydrotrader.co.nz/trade-history

89 Without adequate irrigation water, I conclude only dry land production can be carried out. The PC71 area will never be fully productive regardless of the fact that the soils are in LUC Classes 2 and 3.

90 Therefore, the PC71 soils are not highly productive soils based on the inadequacy of water for irrigation necessary to meet the moisture deficit and meet the crop demand. Crops grown in the area will not fully achieve the maximum possible yields as long as water is lacking.

Statutory Planning Tools and Compliance

91 The CLWRP's Selwyn Te Waihora Sub-regional plan has limits on the discharge of nitrates and phosphorus from various farming activities. The CLWRP Plan Change 7 also limits some farming activities (e.g. commercial vegetable growing operations) due to the proposed nutrient limits.

92 The CLWRP requires that baseline nutrient budgets be established based on the farming activities during the period 2009-2013. As the productivity of the PC71 Site has always been low due to lack of irrigation water then the baseline nitrogen leaching rates are also very low.

93 Future nitrogen leaching rates are required not to exceed the baseline rates. Where they exceed the 15 kg N/ha/year, the plan requires reductions be implemented by 2022 on the following basis:

(a) *30% for dairy; or 22% for dairy support; or 20% for pigs; or 5% for irrigated sheep, beef or deer; or 2% for dryland sheep and beef; or 7% for arable; or 5% for fruit, viticulture or vegetables; or 0% for any other land use.*

94 For the proposed Plan Change 71 area I could not find the nitrogen budgets. However, given the low intensity production system, based on horse training and lifestyle blocks, I expect the nitrogen leaching levels to be at the lower end of the scale i.e. they are closer to 15 kg N/ha/year. Which means that there is not much opportunity to increase N application rates to increase productivity. However, if the leaching rates are >15 kg N/ha/year, the reductions in Paragraph **Error! Reference source not found.** would be required.

95 From my experience reducing nitrogen applications is accompanied by a decrease in yields, revenues and profitability. There is literature that supports this. A few examples of such literature are:

(a) A Landcare Research study called "*Modelling Economic Impacts of Nutrient Allocation Policies in Canterbury: Hinds Catchment*" in 2013 prepared for the Ministry for the Environment concluded loss in productivity could result in revenue reductions of up to 41% with an average of 14% across the farming systems studied. [15]

96 Reports prepared by the Agribusiness Group (2014)[16,17] on behalf of Ministry for Primary Industry found significant reductions in yield and profitability resulting from nutrient reductions.

(a) I have extracted Figure 2 below from the Agribusiness Report[17] reports. It shows the corresponding yield reductions associated with reductions in nitrogen.

Appendix One: Average Estimated Reduction in yield with reduction in applied N.

Reduction in N	Potato (Summer), Onions, Carrots,	Squash, Broccoli, Lettuce,	Cabbage, Spinach, Cauliflower	Potato (Winter)	Barley
10%	10%	15%	15%	25%	25%
20%	20%	25%	30%	35%	35%
30%	30%	40%	40%	50%	45%

Figure 2 – Yield Reductions Due to Reductions in N Applications

(b) The Agribusiness reports also include budgets showing losses for some crops with the conclusion that *"At the 10% reduction in the amount of N applied the Gross Margin result is reduced to approximately one third to a half of that under the Status Quo situation and from there it dips towards a close to breakeven scenario which means that it would not be economic to grow the crop. This reflects the relatively tight margins which these crops are grown under"*.

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[15] *Landcare Research (2013). Modelling Economic Impacts of Nutrient Allocation Policies in Canterbury: Hinds Catchment. Prepared for the Ministry for the Environment.* https://environment.govt.nz/assets/Publications/Files/modelling-economic-impacts-of-nutrient-allocation-policies-canterbury.pdf

[16] *The Agribusiness Group (2014). Nutrient Performance and Financial Analysis of Lower Waikato Horticulture Growers. Prepared for MPI.* https://www.horizons.govt.nz/HRC/media/Media/One%20Plan%20Documents/Nutrient-Performance-and-Financial-Analysis-of-Horticultural-Systems-in-Horizons-Region-2014.pdf?ext=.pdf.

[17] *The Agribusiness Group (June 2014). Nutrient Performance and Financial Analysis of Horticultural Systems in the Horizons Region. Prepared for MPI.*

97 Samarasinghe et al (2011)[18] carried out research in Hurunui District and concluded that reduction in nutrients below the baseline levels resulted in >5% loss in revenue. For some enterprises this would be a net economic and financial loss.

98 Therefore, any natural capital that the 53.89 ha of LUC Class 2 and 3 soils in the PC71 area is negated by the statutory constraints imposed by the statutory planning rules.

Effects of the Surrounding Environment – Reverse Sensitivity

99 The PC71 area is adjacent to existing developed urban land and lifestyle subdivisions. To make the most of any highly productive soils agricultural production has to be intensified. This involves:

(a) Increased of fertilisers and chemicals with potential effects on air and water quality (within the statutory limits such as those I have discussed in Paragraphs 91-98).

(b) Increased use of machinery and equipment and the accompanying noise effects. However, use of these would be subject to the noise standards and operating hours to comply with the district planning requirements. This limits or affects the productivity on the land.

(c) Dust pollution associated with the cultivation of land and harvesting of crops.

100 In the judgement in *Canterbury Regional Council vs Selwyn District Council*[6] the Court acknowledged that low productivity can arise because of reserve sensitivity effects from residential neighbours.

101 The effects above impact what is required to work the land productively because of the adverse reverse sensitivity effects on the urban development. Therefore, while the land has default LUC Classes 2 and 3, its actual productive potential will be hindered by its proximity to an existing urban development.

Effects of the Surrounding Environment – Fragmentation

102 Land fragmentation is defined as "*division of a land resource that changes the current or future range of possible activities and thereby alters the actual or potential uses of that land resource across a number of scales*".[19]

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[18] *Samarasinghe , O. Daigneault A, Greenhalgh, S, Sinclair , R (2011) Modelling Economic Impacts of Nutrient Reduction Policies in the Hurunui Catchment, Canterbury. https://www.nzae.org.nz/wp-content/uploads/2011/Session4/42_Samarasinghe.pdf*

[19] *Hart, G., Rutledge, D., Price, R. (2013) Guidelines for monitoring land fragmentation: review of knowledge, issues, policies and monitoring. Landcare Research, New Zealand.*

103 The Plan Change 71 site is bound by the existing subdivisions (Paragraph 99) and smaller land parcels (mostly 4-5 ha lots) which are part of the Nobeline subdivision. These small lots are owned by different individuals and entities which means consolidating ownership to create a large contiguous block that can be farmed intensely, will be difficult.

104 It is my conclusion that based on the characteristics of land fragmentation and the existing location and land surrounding the PC71 site that land around the PC71 site is fragmented. This is supported by considerable literature on the impact of fragmentation on agricultural productivity.

105 Fragmented ownership is well documented as a hindrance for intensive land use productivity. On this basis, it is unlikely that the productive potential of the LU Class 2 and 3 soils will ever be realised even if other constraints such as lack of irrigation water are addressed.

106 The fragmentation of ownership and size of the land parcels around the PC71 area means it will be nearly impossible for large contiguous blocks (>50-100 ha) to be available for crop and/or pastoral agriculture.

107 I discussed the issue of reverse sensitivity in Paragraphs 99-101. I also consider the fragmented ownership of the small blocks of land around the PC71 area to impact negatively on any potential future large scale or intensive farming activities within the PC71 area. This, therefore, will adversely affect the productive potential on the LUC Class 2 and 3 soils.

108 Therefore, because of the land fragmentation, the PC71 area is not as highly productive as the default LUC classes imply.

Agricultural Technological Advancements

109 Agricultural technology and farming techniques which include precision farming, soil management, improved plant/crop varieties and cultivars have improved immensely over the last two decades. This now enables a range of pastoral and arable activities to be undertaken and successfully managed for high productivity on a range of soils.

110 These advances in agricultural production are largely about removing limitations to plant growth or increasing it. For example, irrigation, drainage and slope angle are all technologies which remove a limitation and contribute to changes in the manageable properties of the soil, but do not change the inherent attributes of that soil.

111 Therefore, soils in LUC Classes >3 can achieve productivity potential greater than that in soils with LUC Classes ≤3 by applying one more technological advances (e.g. cultivation, irrigation, fertiliser uses, better crop cultivars etc).

112 In summary, because of technology there is now more land potentially available as high value land i.e. land that is in the higher LUC Classes can produce high yields when appropriate agricultural practices are in place. Therefore, the proposed change of the 51.85 ha (LUC 2) and 2.04 ha (LUC 3) to residential within Selwyn District and Canterbury in general will not necessarily reduce the district's or the region's agricultural productivity or output.

Understanding the Scale of Change in LUC Class Due to the Land Use Change

113 In Paragraph 60, I discussed the area of land that falls in LUC Classes 1-3 within Selwyn and Canterbury.

114 In Table 8 below, I have attempted to give a sense of the proportional loss of highly productive soil as a result of the proposed plan change under the NPS-HPL definition.

Table 8 – Potential Loss in HPL As a Result of the Proposed Plan Change

LU Class	Canterbury (ha)	Selwyn (ha)	Plan Change Area (ha)	Percentage of HPL Loss	
				Canterbury	Selwyn
LUC 1	23,200	6,522	0	**0.0064%**	**0.038%**
LUC 2	270,500	46,111	51.85		
LUC3	543,000	87,927	2.04		
Total Area	**836,700**	**140,560**	**53.89**		

115 If the NPS-HPL definition is adopted the reduction in highly productive land in the district and region would be 0.0064% and 0.038% respectively.

116 I understand at least one-third of the PC71 is identified as a Future Development Area (FDA) in the Regional Policy Statement.

117 This FDA is over LUC2 soils and covers an area of approximately 17 ha. This would mean in terms of the NPS-HPL, approximately 17 ha is land which has been "*..subject to a strategic planning process".* The clear implication being that rezoning this part of the Site is directly contemplated by the NPS-HPL.

118 This further reduces the proportional loss of versatile soils presented in Table 7, as a result of the Plan Change. Table 8 below shows the proportional loss

of highly productive land when the 17 ha of FDA is excluded from the total plan change area.

Table 9 – Potential Loss in HPL in the Plan Change Area After Excluding the 17 ha of FDA Land

LU Class	Canterbury (ha)	Selwyn (ha)	Plan Change Area (ha)	Percentage of HPL Loss	
				Canterbury	Selwyn
LUC 1	23,200	6,522	0	**0.0042%**	**0.025%**
LUC 2	270,500	46,111	34.85		
LUC3	543,000	87,927	0		
Total Area	**836,700**	**140,560**	**34.85**		

119 These potential reductions in the area of highly productive land are important given recent case law. In *Gock v Auckland Council* [2019] NZHC 276, the High Court found the Environment Court had erred in:

> [93] … (b) *its assessment of whether the relevant areas of premium soils were significant for their ability to sustain food production (to the extent undertaken) proceeded in error of law by:*
>
> *(i) failing to take into account the insignificant area concerned* [100ha] *in the context of the total area of such soils in the Auckland region* [63,000ha].

120 The issue of proportionality in my opinion, should also be taken into consideration for the PC71 application.

CONCLUSION ON VERSATILE SOIL ISSUE

121 The proposed Plan Change will be in an area that has 51.85 ha of LUC Class 2 soils and 2.04 ha of LUC Class 3 soils. 17 ha of the 51.85 ha has been designated as a FDA which means 31.85 ha of LUC Class 2 soils would be the total new area that would be potentially lost due to the proposed Plan Change.

122 In my opinion, use of LUC Classes in defining soil versatility is only a first step and where site specific information is available, this should be taken into account. This is confirmed by:

(a) The proposed NPS-HPL which recognises the use of LUC classes is only as a starting point pending the availability of site-specific information when councils get to it; and

(b) A High Court decision in *Canterbury Regional Council v Selwyn District Council* (Paragraph 56 above) which recommended consideration of a wide range of factors beyond the LUC classification.

123 On consideration of site-specific factors, it is my opinion that the effect of the proposed Plan Change on the district and regional agricultural productivity potential is insignificant. This is because:

(a) The soil moisture deficits are significant. There is no available water to meet the crop water requirements.

(b) Statutory planning rules affect the use of nitrogen fertilisers to enhance productivity. Yield reductions as high as 50% are possible depending on the nitrogen reductions.

(c) There are reverse sensitivity issues arising from the presence of existing surrounding subdivisions and fragmentation of land.

SECTION 42A REPORT

124 I read the s 42A Report prepared by Ms Liz White. Paragraphs 70-76 provide an analysis of the effect of the proposal on versatile soils. In Paragraph 76 Ms White concludes that:

125 *Overall, I therefore consider that expansion of the residential area onto Class 2 land is a relevant matter to consider in weighing up whether the plan change is the most appropriate way to achieve the objectives of the District Plan; but it is not the sole determining factor and needs to be considered in conjunction with other matters*.

126 I agree with Ms White that other factors need to be taken account. I have discussed in Paragraphs 56-58 and 63-64 the importance applying site specific factors in determining the soil versatility. The proposed NPS-HPL also emphasises the importance of site-specific factors (Paragraph 58).

127 It is my conclusion that on consideration of site-specific factors, the effect of the proposed Plan Change on the district and regional agricultural productivity potential is insignificant.

RESPONSES TO THE ISSUES RAISED BY SUBMITTERS

128 I have reviewed the various submissions in particular the submission from Environment Canterbury. The main concern by Environment Canterbury relates to the loss of "*productive land and versatile soils"* and how the proposal is inconsistent with the CRPS. My comments in relation to this submission are:

(a) Chapter 15 of the CRPS notes that *"A highly versatile soil has few limitations for use, that is / it will be suitable for primary production with few inputs such as additional water or nutrients. Less versatile soil will*

need more inputs to achieve similar production or will simply be unsuitable for agriculture or forestry". This statement from CRPS is very general and does not consider other factors that affect the land and soils' productivity.

(b) I discussed the advancement in technology in Paragraphs 109-111 and demonstrating that productive activities can successfully yield high productivity on a range of soils.

(c) The lack of water for irrigation within the PC71 area affects the productivity potential of the land. Without water for irrigation, the PC71 area will never be as productive as land in the district and region that is LUC Class 4 (and even LUC Class 5) land that has water available for irrigation. I also discussed in Paragraphs 79-90 how difficult it is get water for irrigation under the Canterbury Land and Water Regional Plan.

(d) The CLWRP requires that nutrient applications and the resulting leaching below the root zone be controlled to meet the targets set in the plan. I have discussed this in detail in Paragraphs 91-98. My conclusion was that the land's productivity potential will be constrained by these statutory objectives.

(e) In addition to the statutory matters, I have highlighted in above, other factors affecting productivity potential include reverse sensitivity matters (Paragraphs 99-101) and land fragmentation (Paragraphs 102-107).

PART C – WATER SUPPLY

PC71 WATER SUPPLY REQUIREMENTS

Potable Water Demands

129 Part 7 of the Selwyn District Council's Engineering Code of Practice outlines the peak living zone design flow rates based on the number of connections. For 660 lots:

(a) The peak design flow rate is approximately 0.13 L/s/connection.

(b) The total peak design flow rate is 85.8 L/s. I note:

(i) This is an instantaneous rate required for short periods during the peak demand periods. The average daily demand is much lower than this.

(c) In Paragraph 7 of Mr England's Officer's Report, the maximum instantaneous flow rate for all of Rolleston is noted as 573 L/s. This leads me to conclude that the peak living zone design flow rate of 0.13 L/s/connection from the SDC Engineering Code of Practice is on the high side.

130 I contacted SDC to confirm the number of connections in order to adjust or rationalise the peak living zone design flow to match the peak demand in the township.

(a) I was advised that "*as at February 2020 there were 7,587 connections to the network with a population of 18,550 – since then approximately 1100 new houses have been connected to the water network".*[20]

(b) Applying 7,587 connections to the 573 L/s instantaneous flow yields a peak flow of 49.8 L/s for the 660 PC71 lots.

(c) Applying 8,687 (7,587 + 1,100) connections to the 573 L/s instantaneous flow yields a peak flow of 43.5 L/s for the 660 PC71 lots.

131 Therefore, the peak design flow for the PC71 area is likely to be 43.5-50 L/s. The water source has to be able to yield up to 50 L/s.

132 Various other Council documents outline the historical demand in Rolleston and Selwyn District in general. For example:

(a) SDC Development Contribution Policy is based on 545 Litres/day.[21]

(b) The 2021/21 Annual Report states 425 Litres/day per person or 1,145 Litres/day. This is, however, calculated not just including potable supplies but supplies such as parks and reserves. [22]

133 SDC implements a demand management strategy. In discussions, Mr England advised that the Council's target demand is 600 Litres/day/property.

134 As the PC71 area will yield 660 lots, based on 600 Litres/property/day. The demand for the entire PC71 area will be:

(a) 396 m^3/day or;

(b) 144,540 m^3/year.

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[20] *Ms Marcia Jones. Selwyn District Council Water Engineer". Personal Communication. 19 January 2022.*
[21] *Long-Term-Plan-2021-2031_Document_WEB.pdf (selwyn.govt.nz) Page 250*
[22] SDC-Annual-Report-2021-Doc_WEB.PDF (selwyn.govt.nz)

Fire Fighting Requirements

135 Part 7 of the Selwyn District Council's Engineering Code of Practice also outlines the design basis for fire-fighting supplies. The Code states:

The water supply reticulation should comply with the Fire Service Code of Practice.

In particular, the reticulation must meet the requirements for firefighting flows, residual fire pressure and the spacing of hydrants. Location of hydrants shall comply with SNZ PAS 4509: 2008 with minimum hydrants spacing of 135 metres. Blue RRPM"s (cat eyes) shall be installed to offset from the road centreline adjacent to all hydrants. Hydrant Marker posts are to be installed to comply with Section G3.4 of the NZ Fire Service Code of Practice.

136 In compliance with the SDC Engineering Code of Practice, I estimated the fire requirements using the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice (SNZ PAS4509:2008).

137 The firefighting classification will be FW2. This recommends either an on-demand flow of 12.5 L/s within 135 m of a hydrant and 25 L/s within 270 m of two hydrants.

138 It is my conclusion that this firefighting capacity can be accommodated within the 43.5-50 L/s (Paragraph 131) required for potable supply.

AVAILABILITY OF WATER SUPPLY IN THE EXISTING NETWORK TO SERVICE THE PC71 AREA

Availability of Water Supplies to Service the PC71 Area

139 The infrastructure servicing report was prepared after the initial meeting held with SDC.

140 At the meeting, SDC advised that the planned water supply upgrades (trunk watermain upgrades along the frontage of Levi Road and Lincoln Rolleston Road) were on track and would be completed in time to service the PC71 area.

141 The Council later advised that the planned upgrades were going to cater for only that part of the PC71 area within the FDA.

142 This leaves the other two-thirds of the PC71 area without a confirmed water supply source. The potable water demand for this are:

(a) 264 m^3/day; or

(b) 96,360 m^3/year.

SOLUTIONS TO ADDRESS THE GAP BETWEEN POTABLE WATER SUPPLY AVAILABILITY AND DEMAND

Options to Address the Demand-Supply Gap

143 To address the difference between the potable supply requirements and the existing Council supplies or available future supply (after upgrades), I and/or people working under my direction looked at a number of options. These options included:

(a) Improving demand management in FDA which has guaranteed supplies. The intention was to improve efficiencies with the view to reducing the water use per property from the Council's targeted 600 Litres/day/property and then use the efficiency gains to increase the number of lots that can be supplied from the Council network;

(b) Use of rainwater harvesting tanks and using the harvested water for potable and non-potable uses; and

(c) New bores or new water supply sources to meet the demand required for the two-thirds of the Plan Change 71 area.

144 I discounted the first two options on the following basis:

(a) The only way the first option would really work was if the network supply was changed from an on-demand water supply system (existing Rolleston system) to a restricted supply system (where each property as allocated a small amount a day). This would not be in keeping with an urban development. Restricted supplies are for rural supplies.

(b) The second option would not be reliable and depends considerably on rainfall. Furthermore, roof water is susceptible to contamination from birds etc. Where this option is used in an urban setting it is for stormwater attenuation but with full potable supplies coming from the Council mains.

Preferred and Recommended Option

145 The preferred and recommended option is the third option. With this option:

(a) The Applicants would either provide a new water supply on a new or existing bore on the PC71 site or seek, buy and transfer a consent or

consents to take water and use groundwater either within the PC71 site or anywhere within Rolleston.

(b) The total volume bought and transferred would be enough to meet the demand shortfall outlined above.

(c) The "new" water would be taken either from existing Council wells or new wells and these wells could be near the PC71 site or anywhere within Rolleston. This decision would be made in consultation with the Council.

146 The proposal for new additional water supplies was presented to Mr England. He confirmed that the Council was agreeable to it.

Statutory Feasibility of Purchasing and Transferring Consents

147 The Canterbury Land and Water Regional Plan (CLWRP) has policies, objectives and rule relating to new community supplies or the transfer of consents from one site to another.

148 Rule 5.115 governs the taking of water for community supply and requires that a water demand strategy be submitted when an application for a new community water supply is submitted.

149 Rules 11.5.38-11.5.41 address the transfer of water permits within the Selwyn-Waihora Zone.

150 While Rule 11.5.38 requires a 50% reduction in allocation volume during transfers for most uses, transfers for community water supplies are not subject to a volume reduction (Rule 11.5.38(4)(a)).

151 In liaising with Environment Canterbury over the feasibility of community water supplies or transfer of water for community supplies there were no concerns raised and the advice received was that as long as the relevant rules and conditions were met water for community water supply would be granted.

152 I, therefore, conclude that:

(a) A consent for a new community water supply can be sought from Canterbury Regional Council as a restricted discretionary activity under rule 5.115.

(b) The purchase and transfer of water to meet the PC71 demand is another strategy. I elaborate on the feasibility of this option in more detail in the following paragraphs.

Availability of Consents to Purchase and Transfer Water

153 To confirm whether the option to purchase and transfer consents is feasible, I have looked at the trading history at Hydrotrader[23] – a groundwater consent and water trading website. At the time of writing this evidence, there were no consents to transfer within the zone.

154 My colleague, Mr Salmond, contacted Hydrotrader to see if any consents would be available in the near future. Advice from Mr Warwick Pascoe was that:

(a) There was "a good chance" the volume required for PC71 would become available for purchase within the next 12 months (**Attachment 4**).

155 In a telephone conversation with Mr Salmond, Mr Pascoe also noted that the Selwyn-Waimakariri Ground Allocation Zone was one of the most traded zones and opportunities to purchase consents to transfer regularly come up all the time.

156 For completeness I also looked at the likely cost of purchasing the required volumes.

157 Historically the average price of water on Hydrotrader is $1.05/m^3.

158 Therefore, for the volume of water required (96,360 m^3), the total costs would be $101,178 at the current average rate.

159 Therefore, I conclude in addition to the option of applying for new consents and establishing new wells, it is feasible to purchase and transfer consents to the PC71 area.

Summary of the Water Supply Solutions

160 From the foregoing discussion, it is clear that the proposed Plan Change 71 is able to be supplied with adequate water supply to meet the development's requirements.

TIMING OF ACQUIRING NEW CONSENTS OR TRANSFERING CONSENTS

Surplus Water

161 Paragraph 7 of Mr England's report states the total consented volume for the scheme is 7,183,440 m^3/year. Paragraph 8 states over the last three years

[23] http://hydrotrader.co.nz/trade-history

the average annual use has been 3,300,000 m^3/year. The difference between the consented volume and the demand is 3.88 Mm^3/year.

162 At first glance there appears to be a surplus capacity of 3.88 Mm^3/year which would be more than enough to meet the 96,360 m^3/year required for the two-thirds of the PC71 area outside the FDA.

163 I asked Mr Salmond to discuss the "surplus" with Mr England. Mr England advised that the "surplus" was all already accounted for as it was reserved for land that had already been rezoned or included in the FDAs.

164 Mr England also advised the reserved water (3.88 Mm^3) would be utilised over time – possibly in the next 5-10 years as the FDA areas are developed.

165 For example, in his evidence Mr. Ballingall refers to a significant area of FDA land (173ha) which is unlikely to be developed in this medium-term timeframe. This land is instead considered to provide for long term capacity.

166 The water supply designated for this land could be made available for the PC71 to be replaced as and when it is needed.

167 Given the above, it would be feasible to have a commercial agreement with SDC to take and use the required 93,360 m^3 from the "surplus" 3.88 Mm^3/year. This will allow the PC71 area to be developed without constraints. The Applicants would then have the flexibility as to the timing of when a new or transferred consent would be obtaining depending on the rate of the FDA development. In my view, this would be an efficient use of the surplus water.

168 Discussions with the SDC would be necessary to ensure an equitable arrangement for the Council.

169 Both options (provision of consents for new takes or transfers and drawing on the "surplus" water in the short term then replacing it in future) been presented to Mr England. SDC is not opposed to either option. However, Mr England's preference would be the first option i.e. the Applicants acquiring consents (new takes or purchasing and transferring the consents) from the start. **Attachment 5** is a copy of the correspondence with Mr England.

170 In summary, there are timing options for supplying the PC71 area with water. These would involve further future discussions with the Council. These discussions can be done as part of the subdivision development staging.

SECTION 42A REPORT

171 I read the s 42A Report prepared by Ms Liz White. I agree with Ms White's comment at Paragraph 53 that:

(a) The funding of any infrastructure upgrades necessitated by the plan change are not an impediment to the rezoning.

(b) Upgrades will either be undertaken by the developer or via a cost share arrangement with the Council if they will benefit other development.

172 In Paragraph 149-150 Ms White discusses the provisions of the Regional Policy Statement and the water supply constraints. In Paragraph 150 she notes that "*other consented water would need to be made available to service the demand from the Site. Should this not be feasible, I consider rezoning of the whole Site would be in conflict with the provisions of the CRPS outlined above"*.

173 Ms White states in Paragraph 55 that a new rule can be included that restricts subdivision of the northern part of the site until a potable water supply is available. Ms White proposes in Paragraph 176 a new rule to Standards and Terms (12.1.3) in Section C12 LZ Subdivision of the Plan. The proposed rule reads:

(i) 12.1.3.52A In the Living Z Zone within ODP Area 14 as shown in Appendix 38: (a) no subdivision of land shall take place until a potable water supply is available which is capable of serving any lots within the subdivision that are identified within ODP Area 14 as 'Water Supply Required Area'

174 I have discussed the timing and sequencing of the acquisition of consents or use of the "surplus" water above. Water supply can be provided as and when required or as any necessary upgrades are undertaken. For this reason, it is my opinion that with respect to water supply the Applicants can comply with Policy 6.3.5 of the Regional Policy Statement.

175 I have demonstrated in the preceding sections that potable water can be provided to the PC71 area. Therefore, I do not see the need for the proposed rule. The applicant should just be able to demonstrate at the subdivision stage that each stage submitted for subdivision consent can be supplied with potable water to meet the requirements.

RESPONSES TO THE ISSUES RAISED BY SUBMITTERS

176 Submission PC71-0001 by Paula asks "*Would having a lot of houses being built would it effect our water well*". The CLWRP has rules relating to the effects of proposed new wells on existing neighbouring wells. Any new wells which are installed to serve the PC71 area will only be granted consent if the well interference effects on neighbouring bore is less than minor. Therefore, I do not expect Paula's wells to be impacted.

177 Environment Canterbury's submission (PC71-0008) states that the application may be inconsistent with Policy 6.3.5(2) of the CRPS, which seeks to ensure that the nature, timing and sequencing of new development is co-ordinated with the development, funding, implementation and operation of transport and other infrastructure. I have discussed this in Paragraph 175 above.

PART D – FLOODING ASSESSMENT

FLOODING HISTORY

178 I have searched for information on the flooding history within the PC71 site. There is no readily available literature online.

179 Based on the site contours and the surrounding roading network it is my considered opinion that:

(a) Most rainfall soaks into the ground. Overland sheet flows occur following the site's contours. **Attachment 1** shows the general surface flow direction in and around the Plan Change 71 area.

(b) Some rainfall collects in some of the low-lying area during heavy events or immediately after such events.

(c) Any standing water or ponding disappears within a short time after rainfall, usually within a few minutes or a couple of hours.

180 Based on my experience with the type of soils found in the PC71 area, the ponding is expected to be in areas where it is more likely for there to be compacted soil. However, these are small areas.

POTENTIAL EFFECTS OF FLOODING

181 I have provided **Attachments 6** and **7** which I extracted from the Environment Canterbury portal for flood data in Selwyn District.[24] **Attachments 6** and **7** show the 1 in 200 Year (0.5% AEP) and 1 in 500-Year (0.2% AEP) pluvial flood depths and the potential for flooding within the Plan Change 71 area.

182 The majority of the PC71 is not affected by large flooding depths. Only one spot or <1% of the area experiences flooding depths of up to 570 mm.

183 Therefore, there is no widespread flooding in the PC71 area. The area is not a high flood hazard area.

184 As the discharge of stormwater will require a consent under the CLWRP the stormwater network will be designed to achieve the 2% AEP. Therefore, there will be no flooding during events up to and including the 2% AEP.

185 Therefore, I am not concerned about the potential for flooding under 2% AEP (50 year) storm events as the associated flows and rainfall depths can be addressed by design at the time of consent.

(a) If mitigation is required, this can be provided at the subdivision engineering stage. Further design considerations at subdivision to ensure house sites are not flooded will include:

(b) The site will be designed to ensure that secondary flow paths for storm events greater than 2% AEP will drain via road and reserves network.

186 The developed lots will either be elevated, or the roads will be lowered or a combination of these strategies to ensure that the roads act as effective secondary flow paths to mitigate the potential effects of floodwaters. The road corridor will serve to convey potential flood flows away from the houses.

(a) Finished house floor levels can be set at appropriate levels to meet any District Plan requirements.

CONCLUSION

187 Most of the modelled flooding points produce small depths of water inundation.

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[24] https://ecanmaps.ecan.govt.nz/portal/apps/webappviewer/index.html?id=57c74073c2f14a85ac0caf30073ae48a

188 In summary my assessment shows that there are no areas of high flood hazard within the site boundary which would be inappropriate for development. Any potential future risk can readily be mitigated by design.

S42A REPORT AND SUBMISSIONS

189 Flooding has not been raised as an issue in the s42 report.

190 There are no submissions on flooding.

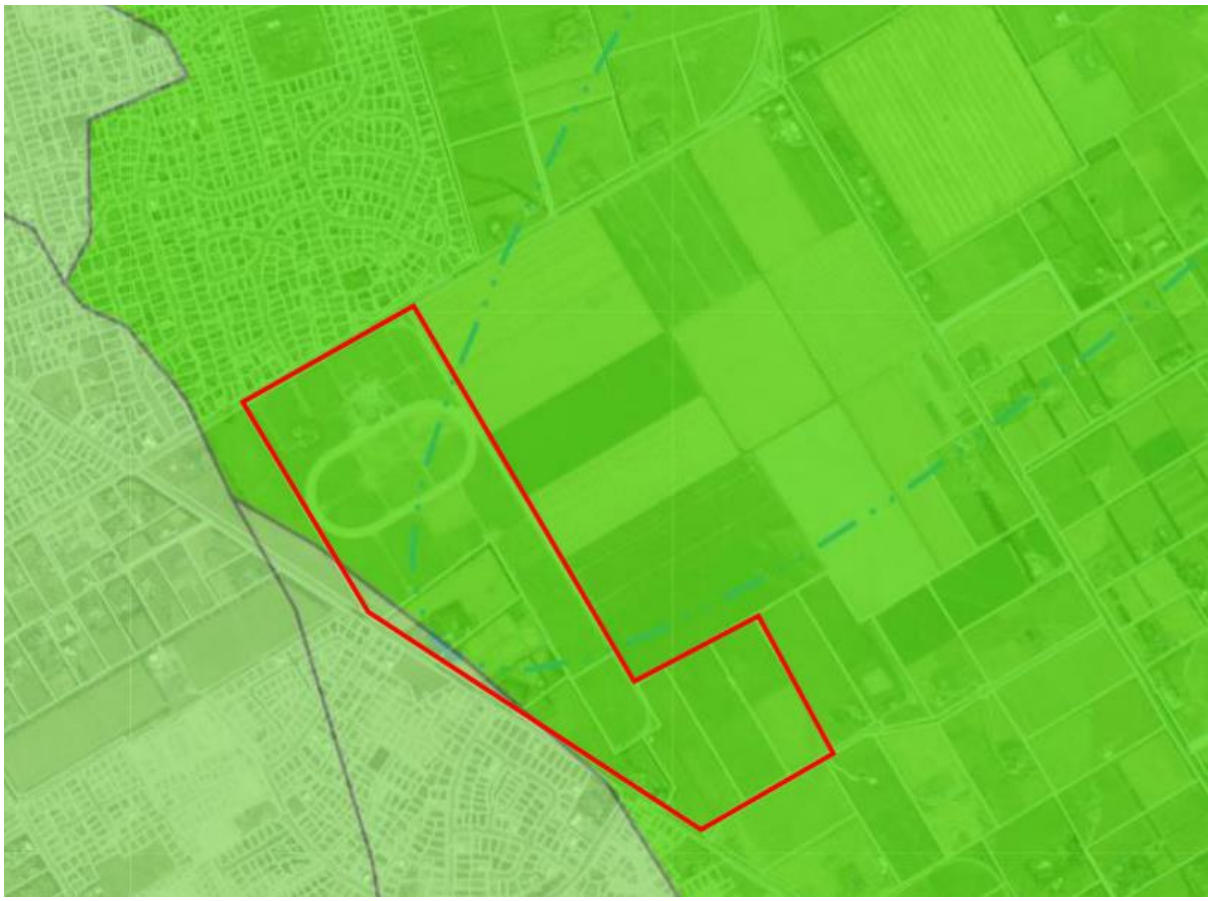
191 In summary flooding is an issue of concern.

Victor Mthamo

24 January 2022

ATTACHMENT 1 – PC71 TOPO MAP (Source Patterson Pitts Group)

ATTACHMENT 2 – LUC CLASSES WITHIN THE PC71 AREA



ATTACHMENT 3 – IRRICALC ANNUAL VOLUME ESTIMATES

Farm Details

Description	
Latitude	-43.599
Longitude	172.401
Council	Canterbury
Climate Site ID	P129081
Distance to Climate Site (km)	3.3
Rainfall (mm)	641

Plant Available Water Details

PAW(mm)	Indicative Likelihood	Area (hectares)
70	46.3	53
		0
		0
		0
		0
Total area =		53

Irrigation Requirements

	Per Hectare		Total Area	
System Capacity	0.51	(l/s/ha)	27.03	(l/s)
System Capacity	4.4	(mm/day)		
Daily Volume	44	(m^3/ha)	2,332	(m^3)
7 Day Volume		(m^3/ha)		(m^3)
28 Day Volume		(m^3/ha)		(m^3)
90% ile Annual Volume	6,615	(m^3/ha)	350,595	(m^3)

These estimates of irrigation requirements are based on the assumption that the crop you selected can be grown and irrigated at the site you have selected. Constraints such as topography and crop-specific climate requirements are not taken into account.

Irrigation requirements may be less than reported here if your soils are poorly drained or the water table is close to the soil surface.

ATTACHMENT 4 – CONFIRMATION OF WATER AVAILABILITY

ATTACHMENT 5 – CORRESPONDENCE WITH SDC

ATTACHMENT 6 – 200 YEAR FLOOD MAP

ATTACHMENT 7 – 500 YEAR FLOOD MAP