Before a Hearings Panel appointed by Manawatū District Council

In the matter of	the Resource Management Act 1991 (RMA)
And	
In the matter of	a request by Te Kapitī Trust to change the Manawatū District Plan under clause 21 of Schedule 1 of the RMA (Private Plan Change 1)

Statement of evidence by Mr. Sharn Bernard Hainsworth

Soils

Dated 11 May 2023

Introduction

1. My full name is Sharn Bernard Hainsworth. I am Director and Principal Pedologist at the Palmerston North branch of LUC Assessments Ltd.

2. I have the following qualifications and experience relevant to my evidence:

   (a) I am an independent scientist, a senior pedologist, with 24 years of professional experience;

   (b) I hold a Graduate Diploma and Bachelor of Earth Science (Massey University)

   (c) I hold a Master of Earth Science (Waikato University). My thesis topic was devoted to mapping using S-map and Land Use Capability (LUC) methods (according to the Land Use Capability Survey Handbook, 2009).

   (d) I have been member of NZ Society of Soil Science since 2009

   (e) I have been a Member of NZ Association of Resource Management since 2002

3. A significant component of my work has involved authoring LUC and S-map. I am a member of the inter-agency LUC Governance Group. This group advises the Government on matters associated with LUC and highly productive land (HPL) in NZ. I was the author of LUC maps and S-map for Manaaki Whenua Landcare Research as a pedologist from 2012-2019. I am the primary author and correlator of S-map for the Hawke's Bay region, and have produced regional-scale S-map coverage in Southland, Tasman, Wairarapa, Manawatu, Taranaki, Waikato, and Auckland and Northland. I have also produced paddock-scale S-map and LUC maps (mainly for farm plans) in Horizons, Hawke's Bay, Waikato, Wairarapa, and Tasman between 2002-2023.

4. As one of about a dozen pedologists in New Zealand, and one of a handful of practicing senior pedologists with an understanding of both S-map and LUC in NZ, I am regularly called on for advice from territorial authorities, Regional Councils and Crown Research Institutes for assistance in matters of LUC and the New Zealand Land Resource Inventory (NZLRI).

5. My site-specific soil and LUC mapping is sought after by regional councils, such as Horizons Regional Council, as a means to make their mapping of HPL more accurate.

6. I have been engaged by Te Kapitī Trust (Applicant) to provide pedological advice in relation to the request to change the Manawatū District Plan to enable residential rezoning of land at Rongotea, known as Private Plan Change 1 (PPC1). I prepared the Site-Specific Assessment of the Properties and Distribution of Versatile Land report submitted as part of the application.

7. In preparing this statement of evidence I have read the section 42A report prepared by Daniel Batley, the reporting officer for Manawatū District Council (MDC), the peer review by Esther Dijkstra from EcoAgriLogic Ltd dated 24 January 2023 and the submissions which are relevant to my area of expertise.

8. I am familiar with the application site and environs and describe my site visit further below.

Code of Conduct

9. I confirm that I have read the Expert Witnesses Code of Conduct contained in the Environment Court of New Zealand Practice Note 2023. My evidence has been prepared in compliance with that Code in the same way as I would if giving evidence in the Environment Court. In particular, unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Scope / Summary of Evidence

10. My evidence addresses the pedology aspects of the Proposal and responds to issues raised by the s 42A report and submissions. For the purposes of brevity, I do not repeat matters that I consider have been adequately addressed in the section 42A report. Similarly, I will refer to the contents of my report which formed part of the plan change request where appropriate.

11. My evidence addresses the following matters:

    (a) LUC Class of the subject site

    (b) The productive capacity of the subject soils

    (c) A comparison of these soils in relation to other soils in the Manawatū district

    (d) Conclusion.

12. By way of summary, I have carried out more detailed mapping of the subject sites using the LUC classification system. Based on that more detailed mapping, my professional opinion is that the sites are appropriately classified as LUC 4w. That classification better reflects a number of inherent characteristics which indicate it is not 'highly productive'.

13. In terms of the subject sites' productive capacity, this type of land (classified as Class 2s2/hor3s4/nz3s27 and Class 3e4/nz3e16 in the S-Map online / NZLRI) in Manawatu District grows grass and forestry trees quickly but is constrained in terms of the range of land uses that it can support. It is also constrained by environmental and management issues related to its propensity for droughtiness and waterlogging. The land under the site and across this predictable and uniform

landscape of 25,610 ha of such land is non-floodable and of low Productive Capacity. This land is not scarce or of High Productive Capacity and requires more energy, risk and cost to produce from than the alluvial Class 1 (14,297 ha) and Class 2 (59,278 ha) land in the Manawatū District. Compared to those Class 1 and 2 soils, which should be the primary focus of protections afforded by the NPS-HPL 2022, the subject sites have significantly lower productivity.

LUC Class of the land on the subject site

14. The subject sites are classified as Class 2s2/hor3s4/nz3s27 and Class 3e4/nz3e16 based on the S-map Online and the NZLRI. These maps are currently presented online at a scale of 1:50,000 and are discussed further below.

15. The soil information I provided in my report titled "*Site-Specific Assessment of the Properties and Distribution of Versatile Land*", submitted as part of the application, was prepared in accordance with S-map protocols and the LUC Survey Handbook (2019), but at a more detailed scale than is available through S-map Online or the NZLRI. The information in that report reclassifies the land as Class 4w.

16. By way of context to that finding, I note that the shallow Perch-Gley Pallic Soils in the Horizons region that were classified in the Taranaki-Manawatu NZLRI worksheets as LUC Class 2s2 land now also have a classification from Harmsworth (2009). Dr Harmsworth reclassified Class 2s2 land as Class 3s4 land. This downgrade reflected the severity of the limitations of this LUC unit according to Dr Harmsworth. The Harmsworth (2009) version of the NZLRI is known as HorCorr (the correlation for Horizons Regional Council). This was conducted in the same year that the Land Use Capability Survey Handbook (2009) was published.

17. In circa 2018, Mr Ian Lynn conducted a desktop correlation of all LUC units nationwide, and in this correlation 2s2/hor3s4 was classified as nz3s27. Class 3e4 was classified as nz3e16. These LUC units 2s2/hor3s4/nz3s27 and 3e4/nz3e16 are therefore Class 3 in the NZLRI. As such these LUC units reside within Classes 1-3 in the NZLRI and could therefore be considered HPL under the NPS-HPL (2022). It is important to note, however, that the physical constraints of this land imbue it with low Productive Capacity compared with other Highly Productive Land.

18. When the LUC Survey Handbook (2009) was published, controversy amongst pedologists arose based on an argument about how much weight to apportion to the descriptions of common limitations relating to wetness for Class 3 and Class 4 on pages 56 and 58, and the further description of wetness in Section 3.3.2 on page 78.

19. There is a reasonable prospect that these LUC units can be reclassified as Class 4w land according to the LUC Survey Handbook (2009). Thus I have recommended in my report that the land that contains shallow Perch-Gley Pallic Soils on the site be classified as Class 4w land. I make this call as an expert based on the following attributes of the subject sites:

    (a) Propensity for droughtiness and waterlogging;
    (b) Propensity for leaching through bypass flow, loss of soil and contaminants to waterways via runoff;
    (c) Limited land use options on this land compared with other LUC Class 1-3 land, which leads to a low Productive Capacity relative to other Class 1-3 land.

20. The constraints to this land are so severe that they are akin to Class 4w land more so than they are to Class 3 land.

21. I state the above as an independent soil expert not to assist one developer and perpetuate ad hoc development amongst large swathes of HPL, but because I believe the inherent characteristics of the 2s2/hor3s4/nz3s27 and 3e4/nz3e16 land in the Horizons Region are such that the land has a low Productive Capacity. Those characteristics make it more aligned with a Class 4 classification than with the LUC 1-3 classification captured by the NPS-HPL. In my professional opinion, detailed site mapping supports a classification of 4w for the subject sites.

The relative Productive Capacity of 2s2/hor3e4/nz3s27 and 3e4/nz3e16 LUC units

22. Notwithstanding the decision as to whether the land on the site is considered HPL for the purposes of the NPS-HPL, the Productive Capacity of the 2s2/hor3s4/nz3s27 and 3e4/nz3e16 land on the site is considerably lower than that of the most versatile soils in the district where subdivision pressure is high e.g. between Colyton

and Taonui aerodrome. The dense, slowly permeable, droughty, loessial soil underlying this site covers 25,610 ha of the rural land in Manawatū district. If this site, and others like it, were to be subdivided, it would not substantively decrease productivity in the district in the way that productivity would be adversely impacted if the same was to occur on the deep, friable, alluvial Manawatu, Kairanga, Karapoti or Te Arakura Soils. The detrimental impact on primary production in the district would be significantly higher if development occurred on these more versatile soils than on the subject sites. I note that there has been subdivision occurring on the higher value soils in the recent past, despite the existing rules of the Manawatu District Plan around Versatile Land.

23. Firstly, the soils mapped on the majority of the subject site are shallow Perch-Gley Pallic Soils. They are underlain by a dense subsurface pan called a fragipan that does not let water drain through it, creating poor drainage in the soil profile in winter and the risk of ponding at the soil surface during prolonged wet periods. This greatly increases the risk of runoff of water, sediment, phosphorus and bacteria from the soil surface into drains and waterways.

24. If dairy farmed, these soils would be considered High Risk Category B soils for the application of Farm Dairy Effluent, and large effluent storage ponds would need to be installed. These ponds typically cost around $150,000 to install and for this reason dairy farmers routinely pay pedologists like me to search for low-risk soils (e.g. soils like Manawatū and Karapoti Soils), to decrease the cost of storage for their enterprise. Such soils would not be available in the middle of this large loessial terrace where the subject sites are located at Rongotea.

25. Perch-Gley Pallic soils are also susceptible to nitrate leaching via bypass flow through subsurface cracks in the soil when used intensively. Apart from spreading the timing of nitrogen fertiliser applications, there is no other way to mitigate for this other than minimise the degree of intensification on this land and thus decrease the amount of available nitrogen in the soil.

26. Shallow, Perch-Gley Pallic Soils need frequent irrigation in dry periods, or plants growing on them quickly go into water stress, because the shallow soils can only hold low amounts of plant available water (Available Water Capacity).

27. Shallow Perch-Gley Pallic Soils stay wet for a long time into the spring growing season. This makes cultivation without causing soil structure damage more difficult, and uniform seed germination can be less certain.

28. The land mapped on the site is fertile because of the silty texture of the soil and the presence of potassium-rich vermiculite clay in the soil. The land also has a relatively warm and stable climate with no snow and minimal frosts.

29. The 2s2/hor3s4/nz3s27 and 3e4/nz3e16 land in and around the site can sustain occasional potato, cereal or maize crops, berries, pastoral land uses (potential of 26 su/ha) and some forms of forestry using trees that can cope with shallow roots, droughts, high winds and waterlogging during winter (Pinus radiata Site Index: 29-34m). It can grow grass or trees rapidly, but it has numerous limitations and environmental risks and risks of crop failures or variable yield are higher than on alluvial soils because of the underlying pan and severe wetness limitations.

Comparison of the Productive Capacity of soils on the subject site, in relation to LUC 1 and 2 soils present within the Manawatū District

30. There is no LUC Class 1w1 land mapped on or around the subject site, but I will describe them here to show the relative differences in Productive Capacity between the soils and land found at and around the subject site, and the HPL with high Productive Capacity in the Manawatū district. The alluvial soils on Class 1w1 land in Manawatū district (Manawatu silt loam, Manawatu fine sandy loam, Karapoti black silt loam) are suitable for growing bulbs, flowers or for market gardening. These soils are moderately well to well drained, deep and friable. They do not have a high risk of ponding or runoff and can be cultivated quickly after rain and early in the spring. They do not suffer from droughty conditions every summer like the 2s2/hor3s4/nz3s27 land. Class 1w1 land is considered Elite land with a potential stocking rate of 30 su/ha and a Site Index for Pinus radiata of 33-34m and numerous options for high value floriculture, market gardening, and horticulture. It is the most highly productive land in the Manawatū District.

31. The real risk for Class 1w1 land in Manawatū District is that occurs in a small area (14,297 ha, 5.6 % of the total area of Manawatū District). This is by far the most versatile and productive land in the district, and it mainly occurs close to the markets, but this is where the greatest pressure for peri-urban growth also occurs.

Class 1w1 land is Manawatu's elite land for primary production. There is not much of it, and a high priority should be placed on protecting it from urban development, so it is available for land based primary production for future generations.

32. There is no LUC Class 2 land mapped on or around the subject site, but I will describe them here to show the relative differences in Productive Capacity between the soils and land found at and around the subject site and the HPL with high Productive Capacity in the Manawatū district.

33. The Class 2 land on alluvial soils in Manawatū district includes Class 2w1 land (Manawatu sandy loam, Manawatu mottled fine sandy loam, and Karapoti sandy loam). This land needs more irrigation than Class 1w1 but can grow the same crops. Class 2 on the alluvial soils also includes Class 2s1 (Manawatu sandy loam and Karapoti sandy loam). With irrigation, Class 2s1 can be used for dairying, market gardening and nurseries, asparagus, pip and stone fruits, berries, kiwifruit, maize, barley, lucerne and root and green fodder crops. When artificially drained, the wetter Class 2w2 land, containing Kairanga and Te Arakura soils, can be suited for market garden crops, wheat, barley, maize, potatoes, process peas, beans, sweetcorn, grass seed, root and green fodder crops). There is 59,278 ha, 23.1% of the Manawatū District's total land area, in LUC Class 2.

34. LUC Class 1 and 2 land is not only versatile, fertile and highly productive, but you can produce from it cheaply with limited risks. Both Class 1 and Class 2 land should be protected from development to ensure that it is available for land based primary production for future generations. This land is covered by the Versatile Land definition in the operative Manawatū District Plan for a good reason.

35. LUC Class 3 land has less versatility and higher risks. More energy and cost is also required to produce from Class 3 land. Unlike Class 1 and Class 2, Class 3 contains a wide spectrum of versatility, productivity and risks/complexity for management. Class 3 land close to the threshold of being Class 4 land is significantly more constrained than Class 3 land on the border of being Class 2 land. LUC Class 4 land is also considered arable, but this land is considerably more limited and complex to farm than Class 1 and 2 land. Incidentally, for this reason the land originally classified as 2s2, now also called hor3e4 and nz3s27 is excluded from the Versatile Land definition in the operative Manawatū District Plan. This is because Manawatū

District Council has previously recognised that this land has lower Productive Capacity than alluvial soils in the district. There is no disagreement between pedologists that 2s2/nz3s27 land is on the border of being Class 4 land. Regardless of whether it falls on the side of Class 3 or Class 4, there is no disagreement that its Productive Capacity is significantly constrained.

36. By saying that the Productive Capacity of the land on this site is equivalent to a good Class 4 land unit or the very low end of Class 3 land, this indicates that the Productive Capacity of the site is considerably less than LUC Class 1-2 land on alluvial soils in the district. A classification on the border between Class 3 and 4 is also an indication of the increased environmental risk and risk to long term economic viability of a land based primary production enterprise on the site compared with undertaking such an activity in Class 1 or 2 alluvial soils elsewhere in the Manawatū District.

37. The loess-based Class 2s2/hor3s4/nz3s27 land on the site land does not support the wide range of land uses that the alluvial soils in the area do. Crops in the soils on this site are likely to fail periodically due to waterlogging or droughts. Productive Capacity is closer to Class 4 than Class 3, a long way from the Productive Capacity of the alluvial soils, despite the high stocking rate and Pinus radiata site index. Combined with the increased risk of droughtiness and need for irrigation, the increased risks of leaching, ponding and runoff into waterways of contaminants, the higher rate of structural degradation than on Class 1 or 2 land in the alluvial landscapes in the area, and the more constrained range of potential land uses that can be supported, 2s2/hor3s4/nz3s27 land has a considerably lower overall Productive Capacity and a propensity for a higher environmental risk than Class 1 and 2 land on the alluvial areas.

38. Allowing development in Class 2s2/hor3s4/nz3s27 and Class 3e4/nz3e16 land (25,610 ha) will not detrimentally impact on overall Productive Capacity in the Manawatū District to the same extent as if development was to continue to be allowed on the alluvial Class 1 and Class 2 land in the district. It also makes sense to focus on allowing development on soils and land in loessial landscapes from a flood-risk and managed retreat perspective. LUC Class 2s2/hor3s4/nz3s27 land occurs above flood-level.

Comment on Officer's Report

39. I have reviewed and considered the s42A report. I note the author does not appear to dispute the site specific mapping undertaken, but relies on legal advice that the subject sites must be treated as HPL for the purposes of the NPS-HPL. I understand the Panel will consider this issue as one of interpretation. I note that there is no evidence referred to in the s 42A report to rebut my findings as to the classification of the subject sites, but only as to whether those findings can be relied upon in relation to the definition of HPL in the policy document.

Comment on Submissions

40. I have considered submission S08 from the lessee of the subject site that that states the land is difficult to farm due to the soil conditions being heavy and difficult to drain away excess moisture.

41. The submission aligns with my observations as set out above. In particular, I have noted that the range of land uses possible on this land is constrained by the presence of a subsurface pan which makes the ground droughty in summer and waterlogged in winter. This land suffers from a wide range of environmental constraints and sustainable production is severely limited because of risks posed to differential crop success at germination time and the risk of variable ripening and variable yields at harvest time. As such, it has a low productive capacity compared to other production land within the district.

Conclusion

42. Productive capacity of the 2s2/hor3s4/nz3s27 and Class 3e4/nz3e16 land on the subject sites is the primary issue. This land can grow grass or forest quickly, but the range of land uses possible on this land is constrained by the presence of a subsurface pan which makes the ground droughty in summer and waterlogged in winter. This land suffers from a wide range of environmental constraints and sustainable production is severely limited because of risks posed to differential crop success at germination time and the risk of variable ripening and variable yields at harvest time. This land is part of a 25,610 ha resource that is of substantially lower Productive Capacity than the other 73,575 ha of land with higher Productive Capacity on alluvial soils in the Manawatū District. This entire

landmass (including the 2s2/hor3s4/nz3s27 and Class 3e4/nz3e16 land on this site) has an LUC Class of 4w, the land sits on the borderline between LUC Class 3 and LUC Class 4. Regardless of whether the land is classified as LUC Class 3 on the border of Class 4, or if it LUC Class 4, this land has low Productive Capacity, akin to LUC Class 4w land.

43. Prior to the publication of the NPS-HPL 2022, 2s2/hor3s4/nz3s27 and Class 3e4/nz3e16 land was excluded from the definition of Versatile Land by the operative Manawatu District Council District Plan because of its lower Productive Capacity.

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Mr. Sharn Bernard Hainsworth MSc
11 May 2023