Wongan Hills Ltd

Change of conditions in relation to Intensive farming operation

(Consent RMA/2021/1675)

297 Kaituna Valley Road

Change of Conditions Application to the Christchurch City Council

May 2022

Planz Consultants

Quality Assurance Statement:

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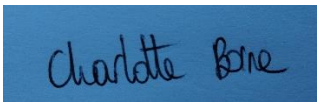

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Project Number:	**16158**
Document Status:	**Final**
Date:	**May 2022**

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TABLE OF CONTENTS

APPENDICES:

APPLICATION FOR CHANGE OR CANCELLATION OF RESOURCE CONSENT CONDITIONS

SECTION 127 OF THE RESOURCE MANAGEMENT ACT 1991

To: Christchurch City Council

1. **Wongan Hills Ltd** apply to change the conditions of a resource consent.

2. The application relates to the following resource consent:

   Consent RMA/2021/1675 which authorises Wongan Hills Ltd to establish an intensive farming activity, including the construction of two composting feed barns and other ancillary sheds/structures. A copy of Consent RMA/2021/1675, which contains all the relevant conditions is contained in Appendix 1 of this application.

3. The application relates to the following specific conditions of **Resource Consent RMA/2021/1675**:

   Wongan Hills Ltd, in accordance with Resource Consent RMA/2021/1675, will establish an intensive farming operation at its site at 297 Kaituna Valley Road. This resource consent was granted on 13 August 2021.

   Condition 1 of consent RMA/2021/1675 provides for the development to proceed in accordance with the plans submitted with the application (recorded in Council records as RMA/2021/1675 – Approved Plans). These plans provide for the establishment of two composting feed barns designed to compost 80% of animal effluent, with the remaining 20% being collected in concrete wash lanes and run through an effluent processing system.

   Condition 2 of consent RMA/2021/1675 provides landscaping to proceed in accordance with the Landscape Plans contained at Page 12 of the Approved Plans.

   In the period between being consent being granted and now, Wongan Hills Ltd has undertaken extensive research on the composting design initially proposed (i.e. 80% composting) and a 100% composting systems, the latter not requiring concrete wash lanes for effluent nor an effluent processing system. Furthermore, Wongan Hills Ltd has researched ways to reduce building height and width, adapting the design of the feed barns so to reduce building costs. This research has resulted in the proposal of a new design, which provides for four 100% composting feed barns rather than the two previously consented ones, but still within the 24,000m^2 footprint enabled by the consent. The new barns (shown in Appendix 3 below) will be a maximum of 9m high rather than the 15m consented and positioned in the same location as consented. While no changes are proposed in terms of landscaping, the landscape plans have been amended to include the new proposed feed barn design (Appendix 3).

   The new proposed system and design provides the following advantages:

   - **There is no need for internal feed lanes and wash lanes, resulting in a smaller building height and width, while allowing for a similar building footprint.**
   - **There is no need for effluent disposal.**
   - **There is a reduction in building costs.**

- **Animal health is improved due to reduced risk of slipping in concrete wash lanes.**

Therefore, this application seeks to amend Condition 1 and Condition 2 to implement the proposed amended plans contained in Appendix 3.

4. The proposed changes are as follows:

The proposed changes, shown in tracked changes (~~strikethrough~~ text for deletions and <u>underline</u> text for additions), being sought by this application are outlined below.

The proposed changes to Conditions 1 of Consent RMA/2021/1675 are as follows:

The development shall proceed in accordance with the ~~information and plans submitted with the application, recorded in Council records as RMA/2021/1675 – Approved Plans (12 pages)~~ <u>amended plans provided with the s127 application, providing for the establishment of four composting cattle feed barns and other ancillary sheds/structures.</u>

The proposed changes to Conditions 2 of Consent RMA/2021/1675 are as follows:

The proposed landscaping shall be established in accordance with the ~~Landscape Plan labelled RMA/2021/1675 Page 12 of the Approved Plans.~~ <u>amended plans provided with the s127 application.</u>

5. The site that the resource consent relates to is as follows:

The site associated with the application is described as follows:

Address:	**297 Kaituna Valley Road**
Legal Description:	**Pt Lot 2 DP 1631**
Valuation Number:	**24010-10302**
Total Site Area:	**28.0703ha**

6. There are no other activities that are part of the proposal to which this application relates.

7. No additional resource consents are needed for the proposal to which this application relates.

8. We attach an assessment of the proposed change's effect on the environment that—

   (a) includes the information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and

   (b) addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and

   (c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

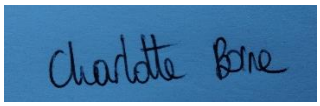
9. We attach an assessment of the proposed change against the matters set out in Part 2 of the Resource Management Act 1991.

10. We attach an assessment of the proposed change against any relevant provisions of a document referred to in section 104(1)(b) of the Resource Management Act 1991, including the information required by clause 2(2) of Schedule 4 of that Act.

11. We attach the following further information required to be included in this application by the district plan, the regional plan, the Resource Management Act 1991, or any regulations made under that Act:

The statutory planning documents, assessed in the attached AEE and relevant to this application, are the Christchurch District Plan, the Canterbury Regional Policy Statement and the Mahaanui Iwi Management Plan.

The required deposit will be paid upon receipt of the invoice.



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* Planz Consultants Limited accepts no liability for any Council costs or charges. Invoices for all such work, beyond the initial deposit paid by Planz, are to be sent to the Applicant's address above for billing.

Resource Management Act 1991

Fourth Schedule

Assessment of Effects on the Environment

1 Introduction

1.1 Overview and Background

Wongan Hills Ltd (the Applicant) has been granted resource consent RMA/2021/1675 (**Appendix 1**) to establish an intensive beef farming operation on part of their farming property located at 297 Kaituna Valley Road. This consent approved the establishment of intensive farming, including the construction of composting cattle feed barns and other ancillary sheds/structures. The proposal relates to the next stage of proposed farm development, by constructing composting feed barns on the property for the finishing of wagyu beef, primarily for the high-end export market.

This application is seeking a change to Condition 1 and Condition 2 of resource consent RMA/2021/1675 (**Appendix 1**), pursuant section 127 of the RMA. The purpose of this report is therefore to provide Christchurch City Council (CCC) with the information it requires to make a decision on the change to the conditions being sought by this application.

1.2 The Site

A description of the existing environment was provided in the combined section 95A, 95B and 104/104C Report (**Appendix 1**), prepared by the CCC and dated 30 June 2021, for resource consent RMA/2021/1675. It is considered that this description does not need to be repeated within this application.

The establishment of the composting cattle feed barns and other ancillary sheds/structures, which is effectively the subject of this application, will occur within Wongan Hills' Kaituna Valley site. The site, which covers some 28ha, is located on the west side of Kaituna Valley Road, approximately 2km from the Christchurch-Akaroa Highway. The application site is a relatively flat piece of land on the valley floor at the foot of the hills, and surrounded by mature poplar trees. The area is currently irrigated by a single centre pivot, but divided into relatively small paddocks. The pasture is improved, and no indigenous vegetation species are present given the long history of agricultural development of this more productive land in the Valley.

2 Proposal Description

2.1 Reasons for Condition Change

Resource Consent RMA/2021/1675, granted to Wongan Hills Ltd on 13 August 2021, provides for the establishment of an intensive beef farming operation based around two composting feed barns of a maximum of 12,000m^2 and 15m of height for each barn, each capable of accommodating around 800 to 1000 cattle.

In the period between being granted consent and now, Wongan Hills Ltd has undertaken extensive research on the composting design initially proposed (i.e. 80% composting) and a 100% composting systems, the latter not requiring concrete wash lanes for effluent nor an

effluent processing system[1]. While not part of the land use consent application the proposal will now not include effluent disposal.

Furthermore, Wongan Hills Ltd has researched ways to reduce building costs by adapting the design of the feed barns so as to reduce building height and width. This research has resulted in the proposal of a new design, which provides for four 100% composting feed barns rather than the two previously consented ones, but still within the 24,000m^2 footprint enabled by the consent (see **Figure 1** below). The new barns will have a total combined footprint of 16,640m^2 (**Appendix 3**). Additionally, the new barns will be a maximum of 9m high rather than the 15m consented and positioned in the same location as consented (see **Appendix 3**). While no changes are proposed in terms of landscaping, the landscape plans have been amended to incorporate the new proposed feed barn design (**Appendix 3**).

An explanation of the 100% composting barn system has been provided by Wongan Hills Ltd in the letter dated 25 March 2022 (**Appendix 5**). In summary, the new proposed system and design provides the following advantages:

- There is no need for internal feed lanes and wash lanes, resulting in a smaller building height and width, while allowing for a similar building footprint.
- There is no need for effluent disposal, therefore there is a reduction in costs associated with the building of a concrete area and effluent processing system.
- There is a reduction in building costs.
- Animal health is improved due to reduced risk of slipping in concrete wash lanes.

Overall, the 100% composting system is considered superior to the consented 80% composting barn system, and the new design will allow for four 100% composting barns to be established within the consented footprint.

a)  b) 

Figure 1. a) Consented buildings as for resource consent RMA/2021/1675 and b) Proposed changes to the built form of the feed barns (feed barns in blue).

[1] Durie, R., Woodford, K., and Trafford, G., 2019. Modelling of nitrogen leaching within farming systems that incorporate a composting barn: a case study of the Lincoln University Dairy Farm. In: Nutrient loss mitigations for compliance in agriculture. (Eds L.D. Currie and C.L. Christensen). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 32. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand. 7 pages.

2.2 Change of Condition Required

For the reasons outlined above in Section 2.1 of this application, Condition 1 and Condition 2 require amendment to enable Wongan Hills Ltd to implement the proposed revised approach providing for four 100% composting feed barns at its Kaituna site. This application therefore seeks to change Condition 1 and Condition 2 to provide for the amended plans contained in **Appendix 3**.

The proposed changes to resource consent RMA/2021/1675 (**Appendix 1**) being sought by this application in accordance with section 127 of the RMA are shown in tracked changes (strikethrough text for deletions and underline text for additions) below.

The proposed changes to Conditions 1 of Consent RMA/2021/1675 are as follows:

The development shall proceed in accordance with the ~~information and plans submitted with the application, recorded in Council records as RMA/2021/1675 – Approved Plans (12 pages)~~ amended plans provided with the s127 application, providing for the establishment of four composting cattle feed barns and other ancillary sheds/structures.

The proposed changes to Conditions 2 of Consent RMA/2021/1675 are as follows:

The proposed landscaping shall be established in accordance with the ~~Landscape Plan labelled RMA/2021/1675 Page 12 of the Approved Plans.~~ amended plans provided with the s127 application.

3 Statutory Framework

3.1 Introduction

The provisions of the RMA which are relevant to this application are Part 2 and sections 104, 105, 107 and 127. Part 2 of the RMA contains sections 5 to 8 which define the purpose and principles of the RMA, while section 104 identifies the matters that should be considered in relation to any resource consent application (including applications to change consent conditions). Sections 105 and 107 identify specific matters that must be considered in relation to discharge activities, including coastal permits, and therefore is relevant to this application. An assessment of these provisions of the RMA, where relevant to this application, is provided below.

Section 127 of the RMA relates to applications to change conditions of consents and therefore applies to this application. This provision of the RMA is not specifically assessed below, although the processing guidance provided by section 127 is acknowledged where relevant. It is important to note that section 127(3) states that sections 88 to 121 of the RMA apply to applications to change conditions of consents, the activity status of such applications is discretionary (section 127(3)(a)) and in considering the effects, only the effects of the change being sought are to be considered (section 127(3)(b)).

3.2 Part 2 of the RMA

Part 2 of the RMA sets out the purpose and principles of the Act, being *"to promote the sustainable management of natural and physical resources"* which is defined to mean:

> *"managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety while –*

(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and

(c) Avoiding, remedying or mitigating any adverse effects of activities on the environment."

This application has been prepared after the Court of Appeal's consideration of the High Court Decision of *R J Davidson Family Trust v Marlborough District Council* [2017] NZHC 52 (**Davidson Decision**). The Court of Appeal's decision means that once again recourse to Part 2 of the RMA is appropriate, particularly in circumstances where the relevant higher order policy documents are unclear or outdated in addressing the matters pertinent to the application.

Section 6 sets out matters of national importance, being the natural character of the coastal environment, protection of outstanding natural features, protection of areas of significant indigenous vegetation and habitats of indigenous fauna, maintenance and enhancement of public access along coastal marine areas, lakes and rivers, and the relationship of Māori and their culture and traditions. As assessed in resource consent RMA/2021/1675 (**Appendix 1**) and the Landscape Assessment (**Appendix 4**), the matters of national importance above will not be put at risk by the proposal.

Section 7 requires particular regard to be had to 'other matters.' Of relevance to this application are:

(b) the efficient use and development of natural and physical resources;

(c) the maintenance and enhancement of amenity values; and

(f) maintenance and enhancement of the quality of the environment;

The proposed activity is considered to be an efficient use of the land resource as it will enable more intensive use of this existing farm land. As assessed in resource consent RMA/2021/1675 (**Appendix 1**) and the Landscape Assessment (**Appendix 4**), the proposal will maintain amenity values in the surrounding area.

Section 8 requires the principles of the Treaty of Waitangi to be taken into account. There are also no known cultural values that need to be taken into account in respect of this proposal.

Given the above and as assessed in **Section 4** of this application, it is considered the effects associated with the proposal will be less than minor. It is therefore considered that the proposal is consistent with the requirements of Part 2 of the RMA.

3.3 Section 104 of the RMA

Section 104 of the RMA provides the statutory requirements for the assessment of the application and sets out those matters that CCC must have regard to when considering the application. Relevant matters for the assessment of this application include:

- Any actual or potential effects on the environment of allowing the activity (section 104(1)(a));
- The relevant objectives, policies, rules and other provisions of national environmental standards, other regulation, national policy statements, regional policy statements (proposed and operative), proposed plans and plans (section 104(1)(b)); and
- Any other matter that the Council considers relevant and reasonably necessary to determine the application (section 104(1)(c)).

The potential effects of accommodating the four 100% composting feed barns at the Kaituna site, which is the subject of this application, have been assessed in **Section 4** (section 104(1)(a)). The assessment concludes that the potential adverse effects associated with the change of conditions being sought will be less than minor.

Given the requirements of section 104(1)(b), the applicable provisions of the relevant statutory planning documents also need to be assessed in relation to the change of conditions which is the subject of this application. Accordingly, the relevant objectives and policies of the Christchurch District Plan, the Canterbury Regional Policy Statement 2013 and the Mahaanui Iwi Management Plan are assessed in **Section 5** of this application. There are no other matters that are considered relevant to this application.

As a discretionary activity in accordance with section 127(3)(a) of the RMA, under section 104B the CCC may grant or refuse this application, and if it grants the application, may impose appropriate conditions in accordance with section 108. Conditions to manage and mitigate the potential effects associated with the establishment of an intensive farming activity at the Kaituna site are already attached to resource consent RMA/2021/1675 (**Appendix 1**).

3.4 Section 127

Section 127 of the RMA states:

> *"127. Change or cancellation of consent condition on application by consent holder*
>
> *(1) The holder of a resource consent may apply to a consent authority for a change or cancellation of a condition of the consent (other than any condition as to the duration of the consent).*
>
> *....*
>
> *(3) Sections 88 to 121 apply, with all necessary modifications, as if –*
>
> *(a) the application were an application for a resource consent for a discretionary activity; and*
>
> *(b) the references to a resource consent and to the activity were references only to the change or cancellation of a condition and the effects of the change or cancellation respectively.*
>
> *(4) For the purposes of determining who is adversely affected by the change or cancellation, the local authority must consider, in particular, every person who*
>
> *(a) made a submission on the original application; and may be affected by the change or cancellation."*

Consent RMA/2021/1675 authorises the establishment of an intensive farming activity at Wongan Hills Ltd's Kaituna site.

Pursuant to Section 127(4), the need to obtain affected parties' approvals as a consequence of the change of conditions is driven by whether the change will cause any material increase in adverse effects beyond that caused by the approved development. In this regard it is considered that, for the reasons outlined in **Section 4** below, any adverse effects on the environment will be less than minor and less than those caused by the approved development.

4 Assessment of Effects on the Environment

Section 127(3)(b) of the RMA states that when applying to change the conditions of resource consents, only the effects of the changes being sought need to be assessed, not the activity as a whole. This change of conditions application seeks to amend Condition 1 and Condition 2 of resource consent RMA/2021/1675 to provide for the establishment of four composting feed barns, rather than the two specified in the plans referenced in Conditions 1 and 2. Accordingly, the effects associated with this proposed change in conditions solely relates to the potential landscape and visual effects of the amended built form. Therefore, given the requirements of section 127, the following assessment of effects only considers the effects of the change being sought.

4.1 Effects of the proposed variation

The potential effects resulting from the establishment of composting feed barns at the site have been assessed in consent RMA/2021/1675, deeming any effects on the environment to be less than minor. The proposed amendments seek to provide for the establishment of four composting feed barns on the site, rather than the two previously consented. No changes are proposed in terms of landscaping, although landscape plans have been amended to incorporate the new proposed built form of the feed barns (**Appendix 3**). Given the amendments only relate to the built form and not to the scale of the activity or landscaping, the potential adverse effects resulting from the amendments are considered to relate solely to landscape and visual effects.

The amendments have been reviewed by a landscape architect, with the landscape assessment attached in **Appendix 4**.

The attached landscape assessment provides an assessment of the proposed design when compared with the consented design, stating that:

- The proposed reduction in building height results in reduced overall bulk and scale of built form.
- The amended plans result in the footprint of the buildings being some 7,360m^2 less than the 24,000m^2 enabled by consent RMA/2021/1675, thus the hillsides providing a backdrop to the north and west continue to assist in absorbing the scale of the buildings into the landscape.
- The proposed buildings new footprint will not change any of the vegetation that is used for visual screening purposes. In fact, the visual screening provided by the proposed vegetation will come into effect much sooner, due to the reduction in the buildings height, thus positively reducing temporary visual effects.
- The proposed reduced building height will also assist in reducing the visual prominence of the buildings when seen from the southern and northern part of Kaituna Valley Road, although building length will be increased. Despite this, the overall degree of adverse visual amenity effects will continue to be, at most, very low from southern viewpoints, while the potential degree of adverse visual amenity effects are considered to be reduced when seen from the northern stretch of Kaituna Valley Road.

The landscape assessment confirms that the reduction in the building height and the reduction in overall footprint (less that what previously consented) will not result in additional adverse landscape or visual effects. In fact, in some instances, these adverse effects are reduced.

The proposed changes will result in the scale of the activity being reduced from that consented and in no new non-compliances occurring. Indeed, the proposed 100% composting feed barns will not require the building of internal feed lanes and wash lanes, allowing for the building

footprint and height to be reduced, and no need for an effluent treatment system. Thus, the proposed change is effectively the increase from two to four barns, but with reduced height and footprint.

Overall, it is considered that any adverse effects associated with the proposed change of condition will be **less than minor.**

5 Objectives & Policies

While consideration of objectives and policies is not pertinent to a decision on whether or not to notify a proposal, it is relevant in terms of the Council's consideration under section 104 of the RMA.

This application has been assessed against the following statutory documents:

- Christchurch District Plan
- Canterbury Regional Policy Statement
- Mahaanui Iwi Management Plan (IMP)

5.1 Christchurch District Plan Objectives and Policies

5.1.1 Strategic directions

Objective 3.3.5 Business and economic prosperity recognises the critical importance of business and economic prosperity to Christchurch's recovery and community wellbeing and resilience and seeks to provide for a range of business activities to establish and prosper.

Objective 3.3.9 seeks a natural and cultural environment where important natural resources are identified, and their recognised values as appropriately managed.

Objective 3.3.16 seeks a productive and diverse rural environment that primarily enables rural productive activities and contributes to maintaining the values of the natural and cultural environment.

The proposal is consistent with these overarching strategic directions. The proposal will establish a productive rural activity, which will contribute to the District's economic prosperity. The proposed changes will not result in any adverse effects other than those addressed in consent RMA/2021/1675, and landscaping mitigation will be undertaken in accordance with the original consent, to ensure that the natural and cultural values associated with the surrounding rural environment will be maintained.

5.1.2 Natural and Cultural Character

Objective 9.2.2.1.3 is to maintain the District's rural amenity landscapes. **Policy 9.2.2.5** recognises the qualities of identified rural amenity landscapes and seeks to maintain them, including by avoiding visually prominent development, requiring development to be separated from important ridgelines, and enabling farming activities that contribute to landscape character.

The general location of the proposed buildings is the same as that consented in RMA/2021/1675. As outlined in the Landscape Assessment (**Appendix 4**) and in **Section 4.1** of

this report, the proposed changes will not result in additional adverse landscape or visual effects, in some instances, reducing these effects.

Overall, the proposal will maintain the qualities of the surrounding rural amenity landscape.

5.1.3 Rural

Objective 17.2.1 is that rural land is used and developed in a manner that supports and maintains rural productive activities and rural function, character and amenity, and maintains a contrast with the urban environment. This objective is supported by several policies.

Policy 17.2.2.1 provides for the economic development potential of rural land by enabling a range of activities including those that have a direct relationship with, or are dependent on, rural resources or rural productive activities or have a need for a rural location. The proposed intensive farming operation is a rural productive activity which requires a rural location and is therefore consistent with this policy.

Policy 17.2.2.2 is to ensure that activities using rural resources avoid, remedy or mitigate effects on rural character and amenity values. The visual effects of the proposed buildings on the rural character and landscape values in the surrounding area will be mitigated. The proposed mitigation includes finishing the building exteriors in a recessive green colour designed to blend with the surrounding landscape and retaining the existing planting around the perimeter of the site, to provide visual screening. Other aspects of the proposal with the potential to adversely affect amenity values, including noise, odour and traffic generation, will be consistent with the anticipated in the rural environment. Overall, the adverse effects on rural character and amenity will be mitigated and will be appropriate in a working rural environment.

Policies 17.2.2.3, 17.2.2.4 and 17.2.2.8 address the impact of activities in the rural zones on the values associated with the rural environment including rural character and amenity.

Policy 17.2.2.3 recognises the key elements that characterise rural areas, which include an open, vegetated landscape with buildings integrated into a natural setting, where appropriate. This policy also recognises that productive rural activities can produce adverse effects consistent with a rural working environment that may be noticeable to residents and visitors.

Policy 17.2.2.4 is to ensure that the nature, scale and intensity of activities recognises the natural and physical resources and the character and amenity, conservation and Ngai Tahu values of rural land. The policy lists specific resources and values including the integrated management of rural productive activities on Banks Peninsula with maintaining and enhancing landscape values.

Policy 17.2.2.8 is to ensure that activities in Rural Banks Peninsula maintain and where practicable enhance the quality of the rural working environment. The policy seeks to achieve this by maintaining built form that is not visually dominant and does not detract from cultural landscapes or natural landforms, encouraging the protection, maintenance and enhancement of natural features and landscapes and open space and encouraging public walking and cycling access connections where appropriate.

The application site will remain characterised by large areas of vegetated open space and natural elements. The proposed buildings and structures will be clustered in the northeast portion of the site. The existing poplar trees and the adjoining river and riparian planting are existing natural character elements that will be retained and remain unchanged by the proposal.

While the proposed feed barns are large structures, they will occupy a very small area of the overall farming operation and are sited on the edge of the valley floor at the base of the hills,

which provide a landform backdrop to any views of the operation from public spaces or neighbouring properties. Furthermore, the proposed reduce height will assist in reducing visual prominence, ensuring that the character and amenity of the surroundings, as viewed from these properties, is maintained.

The landscape values associated with the Kaituna Valley will be maintained. The proposed buildings will be viewed against the backdrop of the hills, which are a large scale landscape feature. In this context, the proposed buildings will not be beyond a scale that can be absorbed by the surrounding rural environment, and in fact the reduced height will aid in reducing visual prominence.

The operational effects of the proposal including noise, odour and traffic movements will be generally in keeping with that anticipated in a working rural environment, and no changes are proposed regarding the operation of the activity.

Policy 17.2.2.10 is to ensure that adequate separation distances are maintained between intensive farming and incompatible activities. The proposed intensive farming operation will be located approximately 700m from the nearest residential dwelling on a neighbouring property. This separation distance is considered appropriate to protect against reverse sensitivity effects and is over 3 times the minimum 200m separation distance the District Plan requires between intensive farming activities and sensitive activities on other properties. The proposal is therefore considered consistent with **Policy 17.2.2.10**.

5.1.4 Conclusion

The proposed changes are generally consistent with the relevant strategic directions, rural or landscapes and natural character objectives and policies. It is not contrary to any single objective or policy or to the provisions as a whole.

5.2 Canterbury Regional Policy Statement

Under section 104(1)(b)(v) of the RMA, the consent authority shall have regard to the relevant provisions of a regional policy statement. The Canterbury Regional Policy Statement (CRPS) became operative on 15 January 2013 and provides an overview of the resource management issues in the Canterbury region, and the objectives, policies and methods to achieve integrated management of natural and physical resources. These methods include directions for provisions in district and regional plans.

Pursuant to section 75, the Christchurch District Plan is to give effect to the CRPS. As a higher order document, it is then assumed that the District Plan gives effect to the provisions contained in the CRPS. On that basis no specific assessment of the CRPS is considered necessary for a proposal of this nature.

It is noted that the new 100% composting feed barn design does not require the discharge of effluent, thus avoiding potential adverse effects on water bodies.

5.3 Mahaanui Iwi Management Plan (IMP)

This IMP provides a statement of Ngāi Tahu objectives, issues and policies for natural resource and environmental management in most of the Canterbury Region, from the Hurunui River to the Hakatere River. In that context it must be noted that this is a high level policy document. It is primarily aimed at informing strategic planning in terms of the promulgation of regional and district planning documents, as opposed to guiding assessment of individual resource consent applications.

Part 5 sets out the Regional Issues and Policy relevant to this application, being those relating to Ranginui (Air), Wai Maori (Water) and Papatuanuku (Land).

5.3.1 Ranginui (Air)

Ngā Paetae Objectives

1. *To protect the mauri of air from adverse effects related to the discharge of contaminants to air.*
2. *Ngāi Tahu are involved in regional decision making on air quality issues.*

Issue R1: *The discharge of contaminants to air can have adverse effects on Ngāi Tahu values such as mauri, mahinga kai, wāhi tapu, wāhi taonga and marae, and the health of our people and communities.*

Ngā Kaupapa / Policy

R1.1 To protect the mauri of air from adverse effects associated with discharge to air activities.

R1.2 To require that the regional council recognise and provide for the relationship of Ngāi Tahu with air, and the specific cultural considerations for air quality, including the effects of discharge to air activities on sites and resources of significance to tāngata whenua and the protection of cultural amenity values.

The explanation sets out that the discharge of contaminants to air can have adverse effects on sites or resources of significance to tāngata whenua, or the values associated with them. With the deposition of air pollutants onto mahinga kai, wāhi tapu or marae requiring specific consideration in regional policies on air; as air pollution can adversely affect the ability to smell the sea, hear the waves, or have undisturbed celestial darkness. It can also compromise the ability to enjoy and appreciate natural and cultural landscapes, including views of important landmarks such as maunga. In this case, the chosen location is located close to the Kaituna River, but any odour or dust associated with the activity will not adversely effect the River or its maunga, any discharges are localised and are not considered to adversely affect any of the values described in the Mahaanui Iwi Management Plan.

5.3.2 Wai Maori (Water)

Ngā Paetae Objectives

(2) Water quality and quantity in groundwater and surface water resources in the takiwā enables customary use mō tātou, ā, mō kā uri ā muri ake nei.

(3) Water and land are managed as interrelated resources embracing the practice of Ki Uta Ki Tai, which recognises the connection between land, groundwater, surface water and coastal waters.

The new proposed 100% composting feed barns do not result in the production of effluent, thus avoiding adverse effects on groundwater sources as a result of effluent discharge.

The most relevant policy (to an individual resource consent application as is the present case), is set out in WM6.11:

WM6.11 Consented discharge to land activities must be subject to appropriate consent conditions to protect ground and surface water, including but not limited to:

(a) Application rates that avoid over saturation and nutrient loading;
(b) Set backs or buffers from waterways, wetlands and springs;
(c) Use of native plant species to absorb and filter contaminants; including riparian and wetland establishment and the use of planted swales; and
(d) Monitoring requirements to enable assessment of the effects of the activity.

The Applicant has planted significant riparian planting along the Kaituna River adjacent to the existing farm base area. The activity will be undertaken in a manner that ensures the on-going protection of surface water.

5.3.3 Papatuanuku (Land)

Ngā Paetae Objectives

(4) Rural and urban land use occurs in a manner that is consistent with land capability, the assimilative capacity of catchments and the limits and availability of water resources.

Ngā Kaupapa / Policy

P11.1 To assess proposals for earthworks with particular regard to:

(a) Potential effects on wāhi tapu and wāhi taonga, known and unknown;

(b) Potential effects on waterways, wetlands and waipuna;

(c) Potential effects on indigenous biodiversity;

(d) Potential effects on natural landforms and features, including ridge lines;

(e) Proposed erosion and sediment control measures; and

(f) Rehabilitation and remediation plans following earthworks.

The proposed use of the land is an evolution of the pattern of rural land development established in the area. The earthworks required are for the most part a "site scrape" to form the building platforms for the proposed feed barns. The excavation of the wastewater treatment pond is not of a large scale and will be controlled by regional council rules to ensure that any potential impacts on the Kaituna River are avoided.

The proposed changes to built form and feed barn system (from 80% composting to 100% composting) will not require the establishment of an effluent treatment system or of concreted feed lanes and wash lanes, thus reducing any potential adverse effects resulting from earthworks and avoiding any potential adverse effects resulting from effluent treatment.

The site where the activity is to take place is not known to be within a culturally sensitive area, however, the Applicant is happy to volunteer/accept an Accidental Discovery Protocol as set out in Appendix 3 of the Iwi Management Plan.

5.3.4 IMP Summary

The application site is not known as being of any cultural significance. Notwithstanding, the proposed changes to the activity set out to avoid, remedy or mitigate adverse effects. The soil material will be retained on site. For the reasons set out above the proposal is not considered to challenge the resource management outcomes sought by the IMP.

6 Consultation/Notification

Sections 95A to 95E of the RMA, outline the decision process to be followed by consent authorities in deciding the notification pathway, and identifying affected persons, for applications in accordance with the RMA. These provisions of the RMA apply to this application to change conditions of consent as section 127(3) states that sections 88 to 121 apply to such applications. In addition, as discussed in **Section 3.4** of this application, section 127(4) of the RMA provides guidance for determining affected parties in relation to applications to change conditions of a resource consent.

Section 95A outlines the steps to be followed when deciding whether or not to publicly notify an application. Wongan Hills Ltd has not requested public notification and the requirements of section 95A(3)(b) and (c) do not apply (Step 1). The activity is not for a controlled activity (section 95A(5)(b)(i)), nor is it covered by the other subsections in Step 2. Public notification is not required by the rule, or rather section 127 of the RMA, which applies to the activity (section 95A(8)(a)), the effects are not more than minor (section 95A(8)(b) and 95D) and therefore there are no special circumstances that are considered to warrant public notification of the application (section 95A(9)).

Although public notification is not required, section 95A(9)(b) requires the provisions of section 95B to be assessed to determine whether or not limited notification is required. An assessment of the relevant provisions of section 95B finds:

- This application to change the conditions of consent does not affect any of the groups or persons listed under Step 1 of section 95B;
- The application is not one where limited notification is precluded under the 'certain circumstances' outlined in section 95B(6);
- Section 95B(7), under Step 3, does not apply to this application;
- There are no affected persons under section 95B(8) and 95E as the adverse effects associated with this application, as assessed in **Section 4**, are not minor or more than minor on any persons; and
- Special circumstances do not apply that warrant notification to other parties not already identified (section 95B(10)).

In addition to the above assessment in accordance with sections 95A to 95E of the RMA, section 127(4) provides additional guidance on determining who is adversely affected by applications to change the conditions of consent. Section 127(4) states that in identifying affected parties a consent authority must consider every person who made a submission on the original application and persons who may be adversely affected. In this instance, as the effects of the change being sought have been assessed as being less than minor, it is considered that there are no affected parties.

Based on the above assessment, public notification of this application is not required, and as the adverse effects on any person, in accordance with section 95E, **is less than minor,** this application can be processed on a non-notified basis.

7 Conclusion

The proposed changes to Condition 1 and Condition 2 of resource consent RMA/2021/1675 (**Appendix 1**) will enable Wongan Hills Ltd to implement the proposed revised approach providing for four 100% composting feed barns at its Kaituna site.

Furthermore, the potential effects generated as a consequence of the amendments will overall be no greater than those for which consent was granted and indeed will be significantly less. Accordingly, it is considered appropriate for this application to be processed as a change of condition application pursuant to section 127.

On the basis of the assessment in **Section 4.1**, it is considered that any potential adverse effects on the environment as a result of the proposed change of conditions will be **less than minor**

and consistent with the relevant objectives and policies of the Christchurch District Plan, Canterbury Regional Policy Statement and the Mahaanui Iwi Management Plan (IMP).

Overall, the proposed change of condition, provides for the sustainable management of area's resources as sought by the relevant planning documents, and therefore is in accordance with the purpose and principles of Part 2 of the RMA.

APPENDIX 1:

Consent RMA/2021/1675

Resource Management Act 1991

Christchurch City Council

Report / Decision on a Resource Consent Application
(Sections 95A, 95B and 104 / 104C)

Application number: RMA/2021/1675
Applicant: Wongan Hills Limited

Site address: The overall property address in Council records is 2651 Christchurch Akaroa Road, however the specific address for that part of the property considered the site is 297 Kaituna Valley Road, Kaituna Valley.

Legal description: While numerous legal descriptions apply to the overall property, the parcel affected by the application is Pt Lot 2 D.P. 1631. This parcel is 28.0703 hectares in area, whereas the property holding in Council records is 3,361 hectares, although I note that the applicant advises that the overall farming property comprises 4,106 hectares, and includes land in Prices Valley, Waikoko Valley and Kaitorete Spit, in addition to the land in Kaituna Valley.

Zone: Rural Banks Peninsula

Overlays and map notations: Liquefaction Management Area

Activity status: Restricted Discretionary Activity

Application: To undertake intensive farming, including the construction of two composting cattle feed barns and other ancillary sheds/structures.

Proposed activity

The proposal is described in detail at Section 3 of the application. The key aspects are:

- The establishment of an intensive beef farming operation based around two composting feed barns of a maximum of 12,000 m^2 for each barn, and each capable of accommodating around 800 to 1000 cattle. Each building will be a maximum height of 15 metres.
- The feed barns will be finished in mist green or a closely related colour with a Light Reflectance Value (LRV) of 25 per cent.
- Complementing the barns will be various ancillary sheds and structures consisting of grain/feed silos, wastewater storage and treatment system, as well as associated vehicle access and gravel curtilage. The ancillary building comprise around 330 m^2 of building footprint. However, I note that the applicant states that an effluent tank may be used as an alternative to an effluent pond. The applicant advises that such a tank would be no more than 4 metres in height, and given that it would replace the proposed 600 m^2 effluent pond, would be of the same or similar size.
- The animals will be housed on a 700-800 mm deep layer of composting sawdust within each barn, which is designed to absorb waste. This compost is maintained at temperatures between 40 to 60 degrees which kills bacteria and "cooks off" liquid effluent.
- The compost is mechanically aerated once a day when the animals are moved into feed lanes for five hours. Waste from the feed lanes is flood washed into a screw press where the solids are removed, while the wastewater is sent to the treatment pond for further settling before reuse in the washdown process. Once no longer useable the wastewater is spread onto pastures as fertiliser.

- The sawdust is renewed every 18-24 months, with waste sawdust being added to the solid waste from the feed lanes and then used as fertiliser on the farm.
- With respect to the spreading of effluent as fertiliser, the applicant advises that this is within the nutrient budget of the applicant's landholding and that the applicant is in the process of seeking an amendment to their existing discharge consent from Environment Canterbury (ECAN) to authorise the discharge. The applicant also advises that a further consent from ECAN may be required for the earthworks for the wastewater pond in relation to the Kaituna River, but this will depend on the depth of groundwater at the final site chosen and its distance to the river.

Description of site and existing environment

The application site and surrounding environment are described comprehensively at Section 3.0 (The Receiving Environment) of the Landscape Assessment Report prepared by Rough and Milne Landscape Architects, which forms part of the application. I adopt the applicant's description for the purposes of this report. That being said, the summary provided in that report nicely encapsulates the character of the landscape and values present and I repeat an excerpt from it here:

> "*Overall the site is rural in character and forms part of a wider rural working landscape. It is enclosed by the hillside, poplars, amenity trees and is immediately north of the farm base area. The site along with the farm base area are well contained to this area. As such, they do not otherwise compromise the open rural character of the Kaituna Valley.*"

The nature of the site and surrounding area are illustrated in the images at **Figures 1** and **2** below. The latter is a view to the site from the south from Kaituna Valley Road.

Figure 1: Site and surrounding area

The building that can be seen to the left of Kaituna Valley Road comprise two dwellings and various farm buildings and yards, all of which are owned by the applicant. It should be noted that the dwelling shown on the heavily wooded site in the centre of the image is no longer present, having burnt down recently.

As set out in the application, the paper road that traverses the feed barn site is in the process of being stopped and in this regard the applicant is working with Council staff on this. I understand that a new section of legal road will vest in Council that diverts around the barn location to ensure ongoing continuity in the paper road network as a replacement for the portion to be stopped.

Figure 2: View from the south to the feed barn site from Kaituna Valley Road

A site visit was undertaken on the 15th of June, 2021, with those present being:

- Mr Brent Thomas – applicant,
- Mr Matt Iremonger – applicant,
- Mr Nick Boyes – consultant planner for the applicant,
- Mr Jeremy Head – landscape architect on behalf of Council, and
- Myself.

The applicants conducted all parties to the site of the feed barns, but the site was also viewed from Kaituna Valley Road and from land on the eastern side of the road owned by the applicant. In the case of the latter, all present walked up close to the boundaries of 12 and 16 Okana Road adjacent to the dwellings on those properties, in order to understand any effects on those property owners.

Activity status

Christchurch District Plan

The site is zoned Rural Banks Peninsula in the Christchurch District Plan. This zone provides for farming and rural based productive activities, along with conservation and recreational activities as permitted activities. However, while anticipated, more intensive animal based activities require an assessment on a case by case basis through a consent process to ensure that rural amenity values will be upheld.

The proposal requires resource consent for a Restricted Discretionary Activity under the following rules:

Activity status rule	Standard not met	Reason	Matters of control or discretion	Notification clause
Rule 8.9.2.3. RD1	Rule 8.9.2.1. P1	The proposed earthworks for the wastewater pond will exceed the 100 m^3 volume and 600 mm depth standards, given that works extend to a depth of 3 metres over an area of 600 m^2.	Rule 8.9.4 (as relevant): • Nuisance, • Resources and assets, • Land stability, • Amenity, • Indigenous biodiversity, natural character and landscape features.	May be limited notified but not publicly notified.
Rule 17.4.1.3. RD1	Rules: • 17.4.2.2 (Building reflectivity), • 17.4.2.9. (Site coverage), • 17.4.2.10. (Building footprint). • 17.4.2.7 (Building setback from internal boundaries)	The proposed northern-most feed barn will be located around 5 metres from the adjoining title boundary, thus breaching the 10 metre internal boundary setback. The proposal breaches the maximum permitted site coverage of 2000 m^2, as around 24,330 m^2 is proposed. Similarly, the 300 m^2 maximum building footprint will be breached as each feed barn will be a maximum of 12,000 m^2 in area, and an effluent tank could be up to 600 m^2 in area. Finally, the accessory sheds and silos will be constructed of galvanised steel which will breach the maximum reflectivity standard of 40%.	Rule 17.11.1.4. – Building setbacks from internal boundaries. Rule 17.11.1.6. – Site coverage and building footprint. Rule 17.11.1.9. – Building reflectivity.	No.
Rule 17.4.1.3. RD6 – Intensive Farming		Consent is required for Intensive Farming as a Restricted Discretionary Activity.	Rule 17.11.2.3 – Intensive Farming, Rule 9.2.8.2 – Significant features and rural amenity landscapes.	

For completeness I note that:

- An open drains runs to the north of the proposed development and that access track upgrading will involve earthworks in proximity to it and the installation of a culvert within it. This was a matter discussed on site with Mr Boyes who subsequently addressed it (inter alia) in his letter to Council of the

24th of June, 2021. In that letter Mr Boyes sets out that the drain could either be a Network Waterway or a Banks Peninsula Waterway and goes on to make the appropriate assessments.

Having examined the District Plan provisions I am of the view that the drain does not fall under any of the listed categories of waterways. Specifically, it cannot be a Network Waterway as it does not drain into the public stormwater network or the coastal environment, and cannot be a Banks Peninsula waterway as the setback standards for these waterways tell us that setbacks are to be measured from the banks of rivers and streams on Banks Peninsula. This waterway is neither, but is instead a manmade drain. Finally, it cannot be a Hill Waterway, as it must have a gradient of steeper than 1 in 50 to qualify as such, and in this case I estimate that the gradient is closer to 1 in 100, based on site levels provided in the application. Consequently I do not intend to trigger a breach of any District Plan rules in relation to the drain. Having said that, I am grateful for Mr Boyes assessment of this matter.

- That the site is not located within a Site of Ngai Tahu Cultural Significance.
- The Liquefaction Management Area provisions have no relevance to this proposal.
- I have not triggered a breach of the road boundary setback in relation to the paper road that traverses the site of the proposed feed barns as in order for the proposal to proceed that road must be stopped. That process is underway with Council.

National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES)

The NES controls soil disturbance on land where an activity on the Hazardous Activities and Industries List (HAIL) is being carried out, has been carried out, or is more likely than not to have been carried out.

The application site has not been identified as HAIL land, although I note that the site has been used for intensive horticulture. Having said that, and having examined historical aerial photographs dating back to 1941, there is no evidence to suggest that any buildings that may have been used to store agrichemicals ever occupied the site, as all of the farm buildings for this part of the property are located close to Kaituna Valley Road. Furthermore, and based on advice from Ms Isobel Stout, the proposed change of use is unlikely to create a pathway that could result in harm to human health, even should there be residual agrichemicals present in the soil. Consequently I am satisfied that the NES is not applicable to this proposal.

Written approvals [Sections 95D, 95E(3)(a) and 104(3)(a)(ii)]

No written approvals have been provided with the application.

NOTIFICATION ASSESSMENT

Adverse effects on the environment and affected persons [Sections 95A, 95B, 95E(3) and 95D]

When assessing whether adverse effects on the **environment** will be, or are likely to be, more than minor, any effects on the owners and occupiers of the application site and adjacent properties must be disregarded (section 95D(a)). The assessment of **affected persons** under section 95E includes persons on adjacent properties as well as those within the wider environment.

As a restricted discretionary activity, assessment of the effects of this proposal is limited to the matters of discretion for the rules breached.

The objectives and policies in the District Plan set the context for assessing the effects of the application. The relevant provisions can be found in Chapter 17 (Rural Zones). They are as follows:

17.2.1.1 Objective – The Rural Environment
a. Subdivision, use and development or rural land that:

i. Supports, maintains and, where appropriate, enhances the function, character and amenity values of the rural environment and, in particular, the potential contribution of rural productive activities to the economy and wellbeing of the Christchurch District;

iv. Maintains and enhances the distinctive character and amenity values of Banks Peninsula and Port Hills, including indigenous biodiversity, Ngai Tahu cultural values, open space, natural features and landscapes, and coastal environment values.

17.2.2.1 Policy – Range of activities on rural land

a. Provide for the economic development potential of rural land by enabling a range of activities that:

i. Have a direct relationship with, or are dependent on, the rural resource, rural productive activity, or sea based aquaculture;

ii. Have a functional, technical or operational necessity for a rural location;…

17.2.2.2 Policy – Effects of activities utilising the rural resource

a. Ensure that activities utilising the rural resource avoid significant adverse effects on areas of important natural resources and avoid, remedy or mitigate other adverse effects on rural character and amenity values.

Policy 17.2.2.3 sets out that elements contributing to rural character and amenity values (as relevant to this proposal) include a landscape dominated by openness and vegetation, buildings integrated into a predominantly natural setting and natural character elements of waterways and natural landforms.

17.2.2.4 Policy – Function of rural areas

a. Ensure the nature, scale and intensity of subdivision, use and development recognise the different natural and physical resources, character and amenity values, conservation values and Ngai Tahu values of rural land in the Christchurch District, …

Sections 95D(b) and 95E(2)(a) allow the adverse effects of activities permitted by the District Plan or an NES to be disregarded (the "permitted baseline"). There is no relevant permitted baseline in this case, given that largest permitted single building in the zone is 300 m^2.

In the context of this planning framework, I consider that the potential effects of the activity relate to:

- Visual and landscape effects,
- Odour, noise and dust
- Earthworks,
- Traffic effects, and
- Building setbacks.

Each of the above will be discussed in turn.

Visual and Landscape Effects

The most important consideration in relation to visual and landscape effects relates to the very large scale of the buildings proposed. Relevant assessment matters for this aspect of the proposal are to be found under Rule 17.11.2.3. for Intensive Farming, Rule 9.2.8.2. for Rural Amenity Landscapes, and even more specifically, under Rule 17.11.1.6. in relation to site coverage and building footprints.

Under Rule 17.11.2.3. relevant matters include existing and proposed landscaping, the sensitivity of the receiving environment, any proposed visual screening and the extent to which the proposal will maintain rural amenity values, including built form standards.

In summary, the relevant assessment matters under Rule 9.2.8.2. are as follows:

- Whether the proposal will maintain rural amenity values,

- Whether the proposal will be visually integrated into the landscape, including a consideration of any mitigation measures such as plantings,
- The visibility from public viewing points, including the significance of the viewing point,
- Whether landforms and vegetation mitigate the visibility of the development,
- The capacity of the landscape to absorb the change,
- Any cumulative effects that may arise,
- Whether the proposal will support the continuation of farming activities, and
- Whether the proposal has a technical or operational need for its location.

The assessment matters under Rule 17.11.1.6. seek to ensure the maintenance of rural amenity values and that sites remain dominated by open space rather than buildings and generally repeat the matters set out above.

A comprehensive visual and landscape assessment has been undertaken by Mr Paul Smith of Rough and Milne Landscape Architecture for the applicant and that assessment forms part of the application. In addition, the proposal and that assessment has been reviewed by Mr Jeremy Head of WSP on behalf of Council. It is my intention to rely on the advice of Mr Smith and Mr Head.

Before considering their advice it is necessary to understand the site and its context, and consequently the visibility of the proposed buildings. This is probably best illustrated by imagery from the Rough and Milne assessment, and I refer the decision maker to the series of viewpoints in the Graphic Attachment to the assessment. What is apparent is that the site for the barns is tucked at the base of a hill in a paddock that is to a large extent surrounded by a mature ring of poplars and that along with roadside vegetation and existing buildings along Kaituna Valley Road (the road), views to the building site are often obstructed. Exceptions to this comprise two viewing points along the road to the south of the site and a further view through a gap in the poplar belt when viewing the site from the north.

It is also worth noting that Mr Smith's assessment was undertaken when the poplars were in leaf and provided a more comprehensive visual screen to the site. The image below at **Figure 3**, looking to the site from the north-east, provided by Mr Head, illustrates the visual screening that will be provided when the poplars are not in leaf. As can be seen, the trees will only be a partial screen during the cooler months of the year. The other point to note is that the trees in the image are around 25 to 30 metres in height, with the result that no part of the proposed buildings will be seen unobstructed by the trees, with the exception of from the gap areas mentioned above.

Figure 3: View to the site from the north-east adjacent to the house on 16 Okana Road

The above image also illustrates the gap in the trees where a direct view into the site is visible. By way of comparison the image at **Figure 4** (Courtesy of Jeremy Head), shows a view to the site opposite the dwelling on 12 Okana Road.

Figure 4: View to the site from the north-east opposite the dwelling at 16 Okana Road.

Turning now to Mr Smith's assessment, his conclusions are set out at Section 6.0 of his assessment. In summary they are that:

- The proposal will have a very low to low degree of adverse effects on landscape values of the site and surrounds given that open space values of the wider landscape will be maintained, it will not affect the natural character values of the Kaituna River and the development will be located where it will be associated with and in keeping with the adjoining farm base operations.
- The proposal will have a very low to low degree of adverse effects on the existing visual amenity that is experienced when travelling along two short sections of the road, where the development will be directly visible, and will have low adverse effects on visual amenity experienced from 12 and 16 Okana Road.
- Overall, the proposal satisfies the District Plan as it will maintain the landscape values and qualities of the rural amenity landscape of Kaituna Valley.

As stated earlier, Mr Head reviewed the application and Mr Smith's assessment. In summary, Mr Head agreed in principle with Mr Smith's conclusions, and specifically that the visual and amenity values of the Rural Amenity Landscape will be maintained and that there will be low to very low adverse landscape / character effects.

It is worth noting at this point that Mr Head's views about the development are premised to some degree on experience of actual feed barns in operation at Chertsey, as the applicant, his agents, myself, Mr Head and Ms Kirsten Rayne (Council Environmental Health Officer) undertook a site visit on the 18th of February, 2021 to view those barns in operation. Mr Head comments in his review about those buildings as set out below:

> "*During the Couplands farm site visit, it was generally agreed between Council and the applicant that the feed barns did not appear as large constructed as what was expected given their large size. This was due to a combination of recessive colour, low open sides, internal shadow created by the openness of the building, rather than vertical reflective walling and surrounding planting.*"

Figure 5 below shows a view of the Coupland feed barns. What is evident is that the buildings, while large, do not appear obtrusive in the landscape (which is aided by the recessive colour) and that the relatively young poplar shelter belts surrounding the buildings are quite effective in breaking their visual mass.

Figure 5: View of the Coupland feed barns at Chertsey

The plantings in the above image are a close approximation of the effectiveness of the existing poplar plantings on the subject site when they are not in leaf. Mr Head states that those trees will "buffer" the buildings at those times, rather than visually screening them. I agree with that view, and would also note that plantings on the subject site are more mature than the plantings shown in the image at **Figure 5**, and hence will be quite effective in breaking the visual mass and form of the proposed buildings.

Mr Head does, however, go on to raise a number of areas where the proposal could be improved, these being in relation to colour and further mitigation plantings. Specifically, three gaps in shelterbelts surrounding the site were identified which would provide views to the site from Kaituna Valley Road which would benefit from additional plantings, the colour of the feed barns should be changed from Mist Green to Sandstone Grey (LRV of 27 per cent), as this would provide better visual integration year round, particularly when the poplar shelter belts were without leaves, and that clarification of the feed barn sizes should be provided.

Mr Boyes responded to these matters in his letter of the 24th of June, 2021, in which an amended landscape plan was provided that showed additional plantings of Lombardy poplars in the three gap areas. That plan also set out that those plantings would be watered with an automatic irrigation system for the first three years. Mr Head was satisfied with this response. As to the colour of the barns, the applicant advised that they were willing to accept a condition requiring that either colour be used, but that they needed to ensure that if Sandstone Grey was chosen that it would still allow the barns to operate within acceptable temperatures. Finally, Mr Boyes clarified that each barn will be:

- "*approximately 200m long x 60m wide (12,000m^2 in area).*"
- "*will be approximately 15m tall.*"

Mr Boyes explained that the slightly larger size of the buildings than shown on the plans was to provide the applicant with some flexibility and avoid the need for a subsequent variation to any consent, and that the buildings would likely be built to the size shown on the plans. Mr Head was of the view that the slightly larger size specified by Mr Boyes was of no moment as the buildings would be very large regardless of which size they were built to.

Mr Head then went on to discuss effects on adjoining property owners at 12 and 16 Okana Road. Mr Head generally agrees with Mr Smith's conclusion that any effects on the owners of these properties would be low in the short term and during winter and very low or negligible during summer after 7 to 10 years when the additional trees have matured sufficiently to fill the gaps.

Advice provided to this Council previously from Mr Head was that:

> *"It is generally understood that 'less than minor' effects are equivalent to very 'Very Low' and 'Low' effects are equivalent to 'minor' effects in an RMA 1991 context within the NZ Landscape Guidelines…"*

However, in discussion with Mr Head on this point he advised that the Seven Point Landscape Assessment used by Mr Smith does not exactly align with the statutory effects framework of the Resource Management Act 1991 (RMA) and that 'Low' effects could be less than minor, or minor effects under the RMA, depending on the circumstances.

In my view there are two elements to the effects on owners and occupiers of 16 Okana Road, the first being the direct view of the buildings that will be afforded by the existing gap in the poplar shelter belt, and the second, effects arising from the views of the buildings during the winter months when the trees only provide partial screening. Mr Head describes effects arising from both as 'Low'. Notwithstanding that I believe they can be distinguished.

Turning to the matter of the gap in the trees, it is my view that the effect on owners or occupiers of 16 Okana Road would be minor as a direct view of the buildings would be afforded to them from both the dwelling and the outdoor living areas around the dwelling and the remainder of their property until such time as the proposed landscape plantings had matured sufficiently to screen the buildings. Consequently that would necessitate identifying them as affected parties from whom written approval would need to be obtained in order for the application to be processed on a non-notified basis.

This matter was discussed with the applicant and Mr Boyes responded by way of email of the 2nd of August, 2021. That advice included an addendum to the Landscape Assessment report from Mr Smith wherein it was proposed that a four high stack of large rectangular hay bales be placed in the gap in the shelter belt until such time as the additional screen plantings have matured. The bales will achieve a height of no less than four metres. Mr Smith is of the view that the introduction of the hay bales will reduce the view through the gap by half from 12 Okana Road and by more than half for 16 Okana Road and as a result any effects on the owners of the aforementioned properties will be very low. Mr Head has assessed Mr Smith's addendum and agrees with his findings. I accept the findings of Messrs Smith and Head. In this regard, while the hay bays will not completely block views of the proposed buildings sufficient of the visual mass and form will be blocked to render any effects less than minor on other parties.

The second matter is the views to the buildings through the trees during the winter months, and effects that may arise from that. It is my view that these effects will be less than minor for the following reasons:

- The existing plantings will provide sufficient screening to effectively break up the visual mass and form of the buildings.
- Once the gap in the trees has been filled, no clear view of the buildings will be available.
- The buildings will be gable end on when viewed from 16 Okana Road, thus presenting their smallest profile to view.
- The recessive colour of the buildings will visually integrate them into the landscape.
- They will be viewed from a distance of around 710 metres, thus reducing the apparent scale of the buildings.

Mr Head's visual simulation of alternative colours provides a useful simulation in assessing effects on parties at 16 Okana Road. The image at **Figure 6** below shows a view to the site with the proposed building profiles modelled in Sandstone Grey and Mist Green. Regardless of the colour if one imagines those profiles behind the trees I am of the view that any effects on other parties, including owners and occupiers of 12 Okana Road further to the north, will be less than minor for the reasons given above.

Figure 6: View to the site from adjacent to 16 Okana Road, with modelled profiles.

In summary it is my view that any visual effects or landscape effects will be less than minor and consequently that no other parties need to be identified as affected parties. On this point I note that views to the site from the property at 230 Kaituna Valley Road are blocked by existing extensive vegetation on the subject property, hence they will not be affected by the proposal. Having said that, there is often a degree of uncertainty when assessing visual effects, particularly when a development is not modelled in the landscape, and to this end the use of a review condition was discussed with the applicant to address any unforeseen visual effects. This was agreed to by the same, who supplied wording for the condition, and consequently I have recommended such a condition. That condition will allow Council to review the application and require additional landscape plantings as screening should it be deemed necessary.

I am also satisfied that any effects arising from the views of the site from the two gaps along Kaituna Valley Road to the south of the site will only provide transitory and brief views of the development and as such any effects will be less than minor on persons passing up and down the road. That is not to say that there will be no effects and to this end the applicant has indicated that additional plantings will be undertaken to fill those gaps. Both myself and Mr Head believe that will be beneficial to maintaining rural amenity values, particularly since these buildings are of an industrial scale and will be placed in a rather intimate and enclosed rural landscape. This is in contrast to the expansive, open landscape at Chertsey where the buildings were absorbed to a large degree by the expansiveness of that setting.

It is also necessary to consider the possibility set out in the application that effluent may be held in a tank rather than a pond. The nature of any such tank is not discussed in the application, but given that the proposed pond will be in the order of 600 m^2 in area, a tank could be of a similar size. Having discussed this matter with the applicant, I was advised that any such tank would be no more than 4 metres in height. Both Mr Head and myself are of the view that any tank will be effectively screened for the most part by the existing poplar shelter belts and that, as a result, the scale will not be out of keeping from a rural perspective. Having said that, we are also of the view that it will be important that any tank be finished in a recessive colour with a light reflectance value of 40

per cent or less to ensure that it can be visually integrated into the landscape, particularly when the poplar trees are not in leaf, as it will be a large building in its own right, even though small compared to the proposed fattening sheds. This will also be beneficial in managing any cumulative visual effects in relation to the other proposed buildings.

I am of the view that the proposal satisfies the relevant assessment matters set out at the beginning of this section of this report, in so far as I believe it has been established that the development can be visually absorbed by the landscape, that rural amenity values will be maintained, that views from public viewing points are transitory, that by locating the development close to the existing farm buildings open space will be maintained, and that while some cumulative effect will arise this is mitigated by the circumstances of the site (i.e. the visual screening), and that the development clearly has both a technical and operational need to be located in the proposed location. On this point, while the barns do not need to be located in this precise location, it is necessary that they be located on rural farmland that forms part of the overall farming property, as stock from that property will pass through the barns. In addition, a rural location is required to provide the necessary space for the operation.

Finally, there is the matter of the breach of the reflectivity standards for the ancillary sheds and silos, which are to be finished in galvanised steel, which I anticipate would have reflectivity values around 65 per cent. Notwithstanding that, I am of the view that the breach will not give rise to any meaningful effects due to the location proposed for these buildings being extensively screened by existing poplar shelter belts. I am also mindful that they will weather within a few years to a dull grey.

Odour, Noise and Dust

Having visited operational barns at Chertsey it was apparent that effects arising from odour, noise and dust were negligible and no different from that would arise from a normal farming operation. In this regard the effluent pond and solid waste were largely odourless. Ms Rayne was satisfied that the operation was not giving rise to effects that would constitute a nuisance for other parties. Consequently, I accept Mr Boye's assessment that any effects will be less than minor.

However, it is also important, given the scale of the proposed buildings, that construction noise is appropriately managed. Consequently, conditions to this effect have been recommended.

Earthworks

As set out in the application, earthworks will be necessary to create a level platform for the proposed buildings and curtilage area, which in total is around two hectares. In addition, earthworks of up to three metres in depth, over an area of 600 m^2 will be necessary if an effluent pond is to be created. This pond would be located no closer than 50 metres from the Kaituna River in order to comply with Rule 5.175 of the Canterbury Land and Water Regional Plan.

The applicant advises that no spoil will be removed from the site, but will retained on site for use in earth bunds, which will then be grassed, or otherwise stockpiled on site for use elsewhere on the farm. Any stockpiles will be no more than 6 metres in height to reduce effects from windblown material. Finally, earthworks are to be undertaken in accordance with an Erosion and Sediment Control Plan (ESCP) prepared by a suitably qualified expert.

I am satisfied that as long as earthworks are undertaken in accordance with a competently prepared ESCP and standard conditions that any effects will be less than minor, as the site is effectively flat, hence any potential for sediment discharges will be low, and it is well separated from adjoining properties in separate ownership.

Traffic Effects

I accept Mr Boye's assessment of traffic effects for the purposes of this application and that any effects will be less than minor. Having said that, it will be imperative that the access off Kaituna Valley Road, which is to be upgraded, is formed to an appropriate standard, along with the access track itself, to ensure that traffic safety is maintained on that road, that extraneous material is not tracked onto the road and that the carriageway of the road is not damaged. I have recommended conditions to achieve this. It is also apparent that clear sight lines are

available in excess of 100 metres in either direction from the access point, hence the access is appropriate with respect to visibility.

I note that for the most part the access to the site is formed to a sturdy gravel formation and that it will likely only be the last section of the track, comprising around 120 metres, that will need additional formation. That will include a culvert crossing of the drain discussed earlier in this report. While I am of the view that no consent is required for earthworks in proximity to this drain, it will still be important that any works undertaken do not give rise to discharges of sediment that might enter the Kaituna River, hence I have included an advice note to this effect, and in particular, suggested that the works be undertaken when the drain is not flowing.

While construction stage traffic has not been addressed in the application I have discussed this with Mr Boyes, who advised that vehicle movements for construction workers would occur early in the morning and again at the end of the day, and that for the remainder of the day vehicle movements would be minimal. In addition, he advised that construction materials would be brought to the site on a staggered basis as required throughout the construction period and would not generate frequent vehicle movements. Having also discussed this with Mr Andy Milne (Council Senior Transport Planner) it was agreed that a Traffic Management Plan was not necessary in this instance given the low vehicle numbers associated with the construction of the barns and the low volume of traffic on Kaituna ValleyRoad. Mr Milne also confirmed that a Corridor Access Request was not necessary in relation to the aforementioned road, even though the upgrading of the access would occur in part within the legal road corridor, as the access was existing.

Boundary Setbacks

A breach of the 10 metre internal boundary setback arises in relation to a title boundary immediately to the north of the proposed feed barns as those buildings are proposed to be located around 5 metres from this boundary. This is effectively a technical breach as the applicant owns both the subject site and the adjoining land to the north, and as a result is the only party likely to be affected by the breach, hence no more needs to be said about this.

Conclusion

Overall, I consider that any adverse effects on the wider environment will be less than minor and that there will be no affected persons.

Notification tests [Sections 95A and 95B]

Sections 95A and 95B set out the steps that must be followed to determine whether public notification or limited notification of an application is required.

PUBLIC NOTIFICATION TESTS – Section 95A	
Step 1: Mandatory notification – section 95A(3)	
➢ Has the applicant requested that the application be publicly notified?	**No**
➢ Is public notification required under s95C (following a request for further information or commissioning of report)?	**No**
➢ Is the application made jointly with an application to exchange reserve land?	**No**
Step 2: If not required by Step 1, notification is precluded if any of these apply – section 95A(5)	
➢ Does a rule or NES preclude public notification for all aspects of the application?	**No**
➢ Is the application a controlled activity?	**No**
➢ Is the application a boundary activity?	**No**
Step 3: Notification required in certain circumstances if not precluded by Step 2 – section 95A(8)	
➢ Does a rule or NES require public notification?	**No**

➢ Will the activity have, or is it likely to have, adverse effects on the environment that are more than minor (discussed above)?	**No**
Step 4: Relevant to all applications that don't already require notification – section 95A(9)	
➢ Do special circumstances exist that warrant the application being publicly notified?	**No**

In accordance with the provisions of section 95A, the application **must not be publicly notified.**

LIMITED NOTIFICATION TESTS – Section 95B	
Step 1: Certain affected groups/persons must be notified – sections 95B(2) and (3)	
➢ Are there any affected protected customary rights groups or customary marine title groups?	**No**
➢ If the activity will be on, adjacent to, or might affect land subject to a statutory acknowledgement - is Te Rūnanga o Ngāi Tahu an affected person in this regard?	**No**
Step 2: If not required by Step 1, notification is precluded if any of the following apply – section 95B(6)	
➢ Does a rule or NES preclude limited notification for all aspects of the application?	**No**
➢ Is this a land use consent application for a controlled activity?	**No**
Step 3: Notification of other persons if not precluded by Step 2 – sections 95B(7) and (8)	
➢ Are there any affected persons under s95E, i.e. persons on whom the effects are minor or more than minor, and who have not given written approval (discussed above)?	**No**
Step 4: Relevant to all applications – section 95B(10)	
➢ Do special circumstances exist that warrant notification to any other persons not identified above?	**No**

In accordance with the provisions of section 95B, the application **must not be limited notified**.

Notification recommendation

That, for the reasons outlined above, the application be processed on a **non-notified** basis pursuant to sections 95A and 95B of the Resource Management Act 1991.

Reported and recommended by: Kent Wilson – Senior Planner **Date:** 11th of August, 2021

Notification decision

That the above recommendation be accepted for the reasons outlined in the report.

Commissioner:

Name: David Mountfort

Signature: 

Date: 13 August 2021

SECTION 104 ASSESSMENT

Actual and potential effects on the environment [Section 104(1)(a)]

The adverse effects on the environment are assessed in the preceding section 95 discussion, and that assessment is equally applicable here.

Overall, I consider that the effects on the environment are able to be mitigated through compliance with recommended conditions such that they will be less than minor and acceptable.

Relevant objectives, policies, rules and other provisions of the Plan [Section 104(1)(b)(vi)]

Regard must be had to the relevant objectives and policies in the District Plan. The relevant provisions are set out in the Section 95 report and will not be repeated here.

It is clear from the policy framework that rural productive activities (which include intensive farming) are contemplated within rural zones, particularly given the potential contribution they will make to the local economy. However, they should have a demonstrated justification for a rural location, and at the same time maintain rural amenity values.

Based on the assessment in the Section 95 report I am satisfied that the proposal is in accord with the all of the relevant objectives and policies.

Relevant provisions of a National Environmental Standard, National Policy Statement, Regional Plan, Regional Policy Statement or Coastal Policy Statement [Section 104(1)(b)]

As set out in the Section 95 report the National Environmental Standard for managing contaminants in soil to protect human health is not relevant to this application.

The District Plan gives effect to the relevant higher order documents referred to in s104(1)(b), including the Regional Policy Statement and Regional Plans. As such, there is no need to specifically address them in this report.

Part 2 of the Resource Management Act [Section 104(1)]

Taking guidance from the most recent case law[1], the District Plan is considered to be the mechanism by which the purpose and principles of the Act are given effect to in the Christchurch District. It was competently prepared through an independent hearing and decision-making process in a manner that appropriately reflects the provisions of sections 5-8 of the Act.

Accordingly no further assessment against Part 2 is considered necessary.

Section 104(3)(d) notification consideration

Section 104(3)(d) states that consent must not be granted if an application should have been notified and was not. No matters have arisen in the assessment of this application which would indicate that the application ought to have been notified.

[1] *R J Davidson Family Trust v Marlborough District Council* [2018] NZCA 316

Section 104 Recommendation

That, for the above reasons, the application **be granted** pursuant to Sections 104, 104C, 108 and 108AA of the Resource Management Act 1991, subject to the following conditions:

1. The development shall proceed in accordance with the information and plans submitted with the application (including the amended landscape plan dated 24/6/2021), recorded in Council records as RMA/2021/1675 – Approved Plans (12 pages).

Landscaping

2. The proposed landscaping shall be established in accordance with the Landscape Plan labelled RMA/2021/1675 Page 12 of the Approved Plans.

3. The existing landscaping comprising a single row of Lombardy Poplar trees and coloured blue on the Landscape Plan, shall be maintained in perpetuity.

4. The proposed landscaping shown as orange and yellow on the Landscape Plan shall be established on site within the first planting season (extending from 1 April to 30 September) following the issuing of this consent and be irrigated for the first three years thereafter.

5. All landscaping required for this consent shall be maintained. Any dead, diseased, or damaged landscaping shall be replaced by the consent holder within the following planting season (extending from 1 April to 30 September) with trees/shrubs of similar species to the existing landscaping.

6. Within 12 months of issue date of this consent the consent holder must submit photographic evidence, of sufficient quality and detail, to demonstrate compliance with Condition 4. This should be sent via email to rcmon@ccc.govt.nz, Attention: Compliance Officer.

7. That a stack of hay bales no less than four high and attaining a minimum height of 4 metres be placed in the gap in the Poplar shelter belt beside the proposed accessway to the proposed fattening sheds and maintained in that location until such time as the proposed additional landscape plantings for this location have reached a minimum height of 5 metres.

Review Condition

8. Pursuant to Section 128 of the Resource Management Act 1991, the Council may review consent conditions by serving notice on the consent holder within a period of 12 months from the date of consent commencement, to deal with any unforeseen adverse visual effects of the feed barns on the environment which may arise from the exercise of this consent. Any such review is to be limited to the provision of additional screen planting to be undertaken by the Consent Holder to further reduce the visibility of the feed barns from beyond the application site.

   Condition Note: The date of commencement for the purpose of this condition is the date on which the Council issues the Code Compliance Certificate for any feed barn authorised under this consent.

Building Colour

9. That the feed barns be finished in either Mist Green or Sandstone Grey, but preferably the latter, as it will allow the barns to visually blend in better during the winter when they are most visible.

10. Should an effluent tank be used instead of an effluent pond any such tank must be finished in a recessive colour with a light reflectance value of 40 per cent or less.

Noise/ Hours of Operation/ Vibration

11. No construction work, other than maintenance of dust and erosion and sediment control measures, shall be undertaken on Sundays, Public Holidays or outside the hours of 7.30am to 6.00pm Monday to Saturday, without the Council's prior consent.

12. All construction work (including any demolition and/or site preparation works) shall be designed, managed and conducted to ensure that construction noise complies with the requirements of NZS 6803:1999 Acoustics – Construction Noise for residential / rural / industrial / commercial areas (see applicable Table on Page 11 of this standard).

13. Vibration from construction work shall not exceed the limits of, and shall be measured and assessed in accordance with, German Standard DIN 4150 1999-02 Structural Vibration – Effects of Vibration on Structures.

Access

14. That the existing gravel entranceway be formed to a two coat chip seal standard in a fish tail shape extending for a distance of ten metres down the existing access (i.e. into the subject site) from the edge of the seal in Kaituna Valley Road, in accordance with Figure 12 of Appendix 7.5.10 of the District Plan.

Earthworks

15. All earthworks shall be carried out in accordance with a site specific Erosion and Sediment Control Plan (ESCP), prepared by a suitably qualified and experienced professional, which follows the best practice principles, techniques, inspections and monitoring for erosion and sediment control contained in Environment Canterbury's Erosion and Sediment Control Toolbox for Canterbury http://esccanterbury.co.nz/. The ESCP must be held on site at all times and made available to the Council on request.

16. The consent holder must notify Christchurch City Council no less than three working days prior to works commencing, (via email to rcmon@ccc.govt.nz) of the earthworks start date and the name and contact details of the site supervisor. The consent holder shall at this time also provide confirmation of the installation of ESCP measures as per the plan referred to in Condition 15 above.

17. Run-off must be controlled to prevent muddy water flowing, or earth slipping, onto neighbouring properties, legal road, or into a river, stream, drain or wetland. Sediment, earth or debris must not fall or collect on land beyond the site.

18. No earthworks shall commence until the ESCP has been implemented on site. The ESCP measures shall be maintained over the period of the construction phase, until the site is stabilised (i.e. no longer producing dust or water-borne sediment). The ESCP shall be improved if initial and/or standard measures are found to be inadequate. All disturbed surfaces shall be adequately topsoiled and vegetated or otherwise stabilised as soon as possible to limit sediment mobilisation.

19. Dust emissions shall be appropriately managed within the boundary of the property in compliance with the Regional Air Plan. Dust mitigation measures such as water carts, sprinklers or polymers shall be used on any exposed areas. The roads to and from the site, and the site entrance and exit, must remain tidy and free of dust and dirt at all times.

20. All loading and unloading of trucks with excavation or fill material shall be carried out within the subject site.

21. Any surplus material from the project works shall be formed into bunds and stabilised with grass, or if stockpiled, be located out of public view, with stockpiles to be no greater than six metres in height. Any

such stockpiles shall also be stabilised with grass to minimise potential dust emissions. Grass seeding of bunds and stockpiles shall occur no later than two weeks following the completion of the bund or the stockpile.

Accidental Discovery Protocol

22. In the event of the discovery/disturbance of any archaeological material or sites, including taonga (treasured artefacts) and koiwi tangata (human remains), the consent holder shall immediately:

    - Cease earthmoving operations in the affected area of the site; and
    - Advise the Council of the disturbance via email to rcmon@ccc.govt.nz
    - Advise appropriate agencies, including Heritage New Zealand Pouhere Taonga and the local Mana Whenua (Ngāi Tūāhuriri Rūnanga or swap in relevant rūnanga) of the disturbance.

Advice Notes

- This site may be an archaeological site as defined and protected under the provisions of the Heritage New Zealand Pouhere Taonga Act 2014. Archaeological sites are defined in the HNZPTA as any place in New Zealand where there is physical evidence of pre-1900 occupation, regardless whether the site is known or not, recorded in the NZAA Site Recording Scheme or not, or listed with Heritage New Zealand or the local council. Authority from Heritage New Zealand is required for any work that affects or may affect an archaeological site. **Please contact the Heritage New Zealand regional archaeologist on 03 363 1880 or archaeologistcw@heritage.org.nz before commencing work on the land.**

  It is unlawful for any person to destroy, damage, or modify the whole or any part of an archaeological site without the prior authority of the Heritage New Zealand Pouhere Taonga. This is the case regardless of the legal status of the land on which the site is located, whether the activity is permitted under the District or Regional Plan or whether a resource or building consent has been granted. The Heritage New Zealand Pouhere Taonga Act 2014 provides for substantial penalties for unauthorised damage or destruction.

  Refer also to the Accidental Discovery Protocol (ADP) set out in Appendix 3 of the Mahaanui Iwi Management Plan (IMP).

- It is recommended that any works to form the access in proximity to, or across the existing drain running to the north-east of the feed barn site be undertaken during dry weather when the drain is not running and there is no immediate prospect of it doing so.

- The Council will require payment of its administrative charges in relation to monitoring of conditions, as authorised by the provisions of section 36 of the Resource Management Act 1991. The current monitoring charges are:

  (i) A monitoring programme administration fee of $102.00 to cover the cost of setting up the monitoring programme; and

  (ii) A monitoring fee of $175.50 for the first monitoring inspection to ensure compliance with the conditions of this consent; and

  (iii) Time charged at an hourly rate if more than one inspection, or additional monitoring activities (including those relating to non-compliance with conditions), are required.

- The monitoring programme administration fee and initial inspection fee / documentation fee / inspection fees will be charged to the applicant with the consent processing costs. Any additional monitoring time will be invoiced to the consent holder when the monitoring is carried out, at the hourly rate specified in the applicable Annual Plan Schedule of Fees and Charges.

- This resource consent has been processed under the Resource Management Act 1991 and relates to District planning matters only. You will also need to comply with the requirements of the Building Act 2004 and any other legislative requirements (including but not limited to Environment Canterbury Regional Plans,

health licence, liquor licence, archaeological authority, certificate of title restrictions such as covenants, consent notices, encumbrances, right of way or easement restrictions, landowner approval where required).

- For more information about the building consent process please contact our Duty Building Consent Officer (phone 941 8999) or go to our website https://ccc.govt.nz/consents-and-licences/

Development Contributions Assessment

This proposal has been assessed for development contributions (DCs) under the provisions of the Christchurch City Council Development Contributions Policy (DCP). The proposal has been found to create additional demand on network and community infrastructure or reserves.

To help fund community facilities, the Local Government Act 2002 (LGA) allows a council to require development contributions if the effect of a development requires the council to provide new or upgraded infrastructure.

This Notice informs you of the DCs required by the Council for the development but is not a request for payment. An invoice will be issued by the Council when it requires payment of the DC's. Payment will be required before issue of a code compliance certificate for a building consent, commencement of the resource consent activity, issue of a section 224(c) certificate for a subdivision consent or authorisation of a service connection, whichever is first. An invoice can be issued earlier at your request. Council may also issue an invoice, at its discretion, if it considers the development is already utilising Council infrastructure for which DCs are being required.

Development contribution assessment summary

DEVELOPMENT CONTRIBUTIONS SUMMARY

Customer Name	Wongan Hills Limited	**Application Ref:**	RMA/2021/1675
Project Address	297 Kaituna Valley Road		ASSESSMENT
Assessment Date	30/06/2021		

Assessment Summary

Activity	Catchment	Existing HUE (Credit) A	Proposed HUE (Demand) B	Discount C	Assessed HUE After Discount D	Chargeable HUEs E	DC HUE Rate (incl GST) F	DC Charge (incl GST) G	Reduction (incl GST) H	Net DC Charge (incl GST) I
Network Infrastructure										
Water supply	District-wide	0.00	0.00	0.00%	0.00	0.00	$2,395.45	$0.00	$0.00	$0.00
Wastewater collection	District-wide	0.00	0.00	0.00%	0.00	0.00	$6,349.15	$0.00	$0.00	$0.00
Wastewater treatment & disposal	District-wide	0.00	0.00	0.00%	0.00	0.00	$2,904.90	$0.00	$0.00	$0.00
Stormwater & flood protection	Southern Bay	0.00	0.00	0.00%	0.00	0.00	$724.50	$0.00	$0.00	$0.00
Road network	Rest of Banks	0.00	0.24	0.00%	0.24	0.24	$907.35	$215.68	$0.00	$215.68
Active travel	District-wide	0.00	0.24	0.00%	0.24	0.24	$425.50	$101.14	$0.00	$101.14
Public transport	District-wide	0.00	0.24	0.00%	0.24	0.24	$717.60	$170.57	$0.00	$170.57
Total Community and Network Infrastructure								$487.39		$487.39
Reserves										
Regional parks	District-wide	1.00	1.00			0.00				$0.00
Garden & heritage parks	District-wide	1.00	1.00			0.00				$0.00
Sports parks	District-wide	1.00	1.00			0.00				$0.00
Neighbourhood parks	Rest of Banks	1.00	1.00			0.00				$0.00
Total Reserve Contributions										$0.00
							GST 15%			$63.57
							Total Development Contribution			**$487.39**

Where both a resource consent and building consent are required as part of the same development, a development contribution (DC) assessment will be undertaken for both consents. However the applicant need only pay for one assessment. As a result, the Council will only invoice in accordance with either the assessment on the resource consent or the assessment on the building consent, whichever is the lower of the two (after any corrections or reassessments undertaken in accordance with the DCP).

The DC assessment is valid for 24 months from the date the assessment is issued (usually with the consent). If the original assessment expires before payment is made, reassessment of the DCs required will be carried out at the same time the invoice is generated.

Reassessments will incorporate any increases to the development contribution requirement in line with the Producers Price Index (PPI) as described in Parts 2.9 and A.7.3 of the DCP. PPI adjustments will incorporate all years between the original application and the time the reassessment is carried out.

Reconsideration and Objections

Under section 199A of the Local Government Act 2002 you can request that the Council reconsider the required DC on the following grounds:

- the development contribution was incorrectly calculated or assessed under the DCP; or
- the Council incorrectly applied its DCP; or
- the information used to assess your development against the DCP, or the way the Council has recorded or used it when requiring a development contribution, was incomplete or contained errors.

A Request for Reconsideration form must be lodged with Council within 10 working days of receiving this DC Notice.

Under section 199C of the Local Government Act 2002 you can object to the assessed DC requirement on the following grounds:

- the development contribution was incorrectly calculated or assessed under the DCP; or
- the territorial authority incorrectly applied its DCP; or
- the information used to assess your development against the DCP, or the way the territorial authority has recorded or used it when requiring a development contribution, was incomplete or contained errors.

An Objection to DCs form must be lodged with the Council within 15 working days of receiving this DC Notice or a reconsidered assessment. A deposit of $1,000.00 will be required to lodge an objection.

A form to request a reconsideration or lodge an objection can be found on our website.
To request an invoice please contact a Development Contributions Assessor by phone on (03) 941-8999 or email developmentcontributions@ccc.govt.nz. Once an invoice has been issued payment is required within 30 days. Please quote the project number with all correspondence.

Further information regarding development contributions can be found on our website www.ccc.govt.nz or by contacting a Development Contributions Assessor on (03) 941-8999.

Reported and recommended by: Kent Wilson – Senior Planner **Date:** 11th of August, 2021

Section 104 Decision

That the above recommendation be accepted for the reasons outlined in the report.

☑ I have viewed the application and plans.

☑ I have read the report and accept the conclusions and recommendation.

Commissioner:

Name: David Mountfort

Signature: D. L. Mountfort

Date: 13 August 2021

APPENDIX 2:

Records of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Guaranteed Search Copy issued under Section 60 of the Land Transfer Act 2017

R.W. Muir
Registrar-General
of Land

Identifier **859202**

Land Registration District **Canterbury**

Date Issued 12 April 2019

Prior References

CB13F/462 CB14B/1029 CB29A/171

Estate	Fee Simple
Area	204.5388 hectares more or less
Legal Description	Lot 2 Deposited Plan 529737 and Lot 1 Deposited Plan 33960 and Lot 4 Deposited Plan 49740 and Part Lot 2 Deposited Plan 1631

Registered Owners

Wongan Hills Limited

Interests

Subject to a right of way over part Lot 1 DP 33960 coloured red on DP 13409 created by Transfer 285897 - 30.8.1948 at 11:50 am

Subject to a right of way on foot and a right to convey water over part Lot 4 DP 49740 marked B on DP 49740 specified in Easement Certificate 619764.4 - 30.6.1986 at 10:30 am

The easements specified in Easement Certificate 619764.4 when created will be subject to section 309(1)(A) Local Government Act 1974

Subject to Section 241(2) Resource Management Act 1991 (affects DP 529737)

Subject to a right to convey electricity over part Lot 2 DP 529737 marked D, and over part Lot 4 DP 49740 marked B, and a right to convey water over part Lot 2 DP 529737 marked C, and over part Lot 4 DP 49740 marked B all on DP 529737 created by Easement Instrument 11409166.3 - 12.4.2019 at 11:36 am

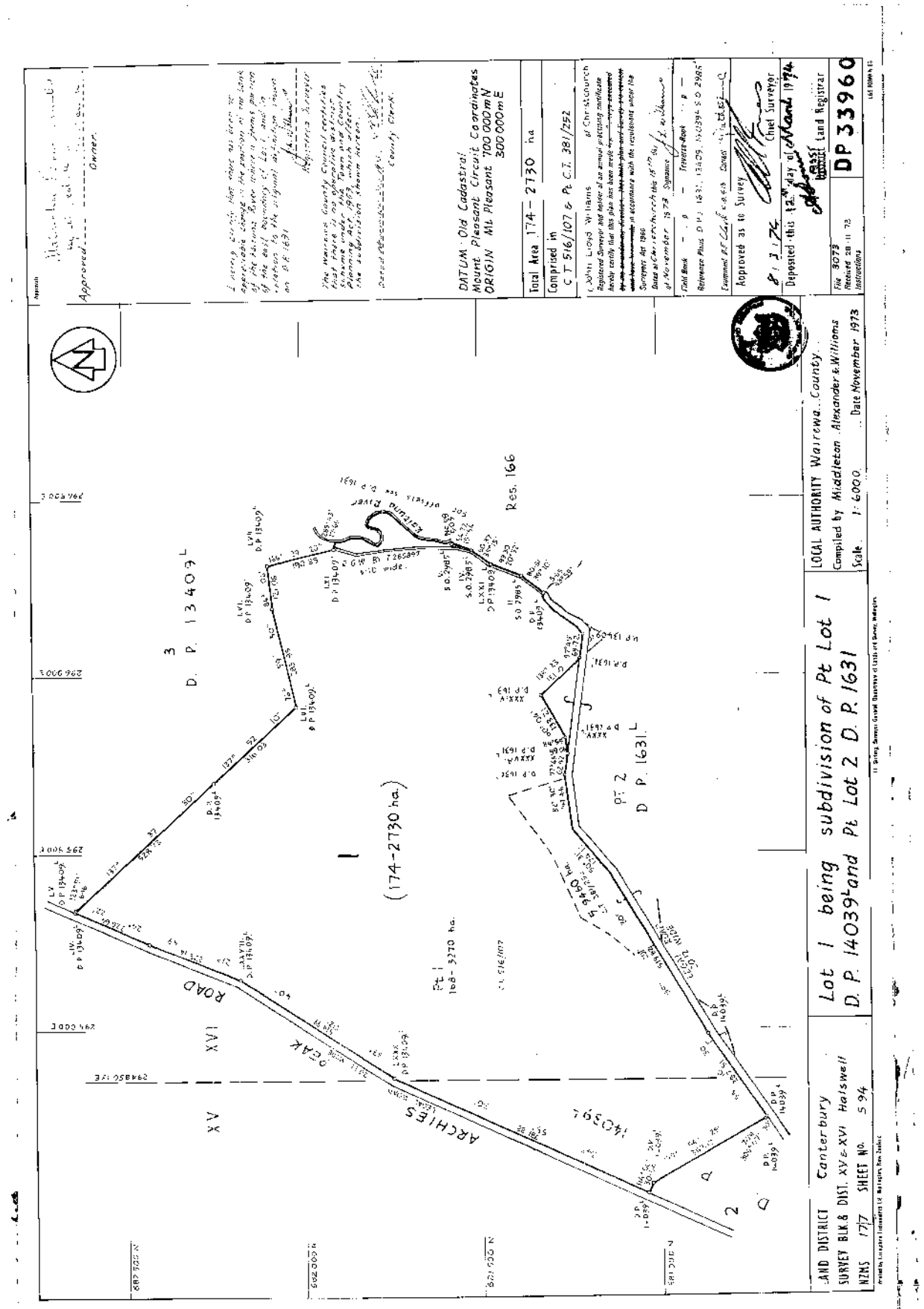
Appurtenant to Lot 2 DP 529737 is a right to drain sewage created by Easement Instrument 11409166.3 - 12.4.2019 at 11:36 am

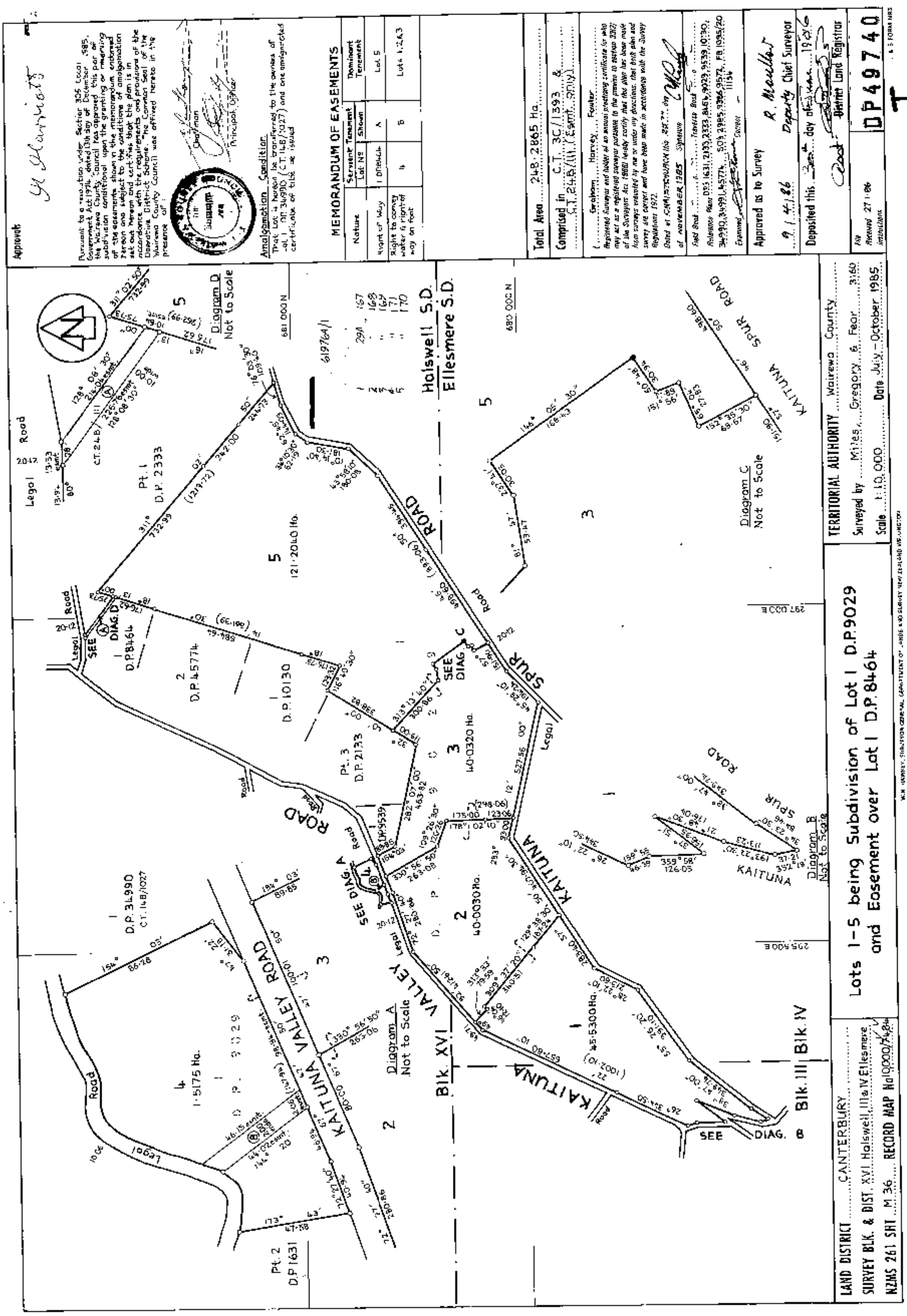
Some of the easements created by Easement Instrument 11409166.3 are subject to Section 243 (a) Resource Management Act 1991 (DP 529737)

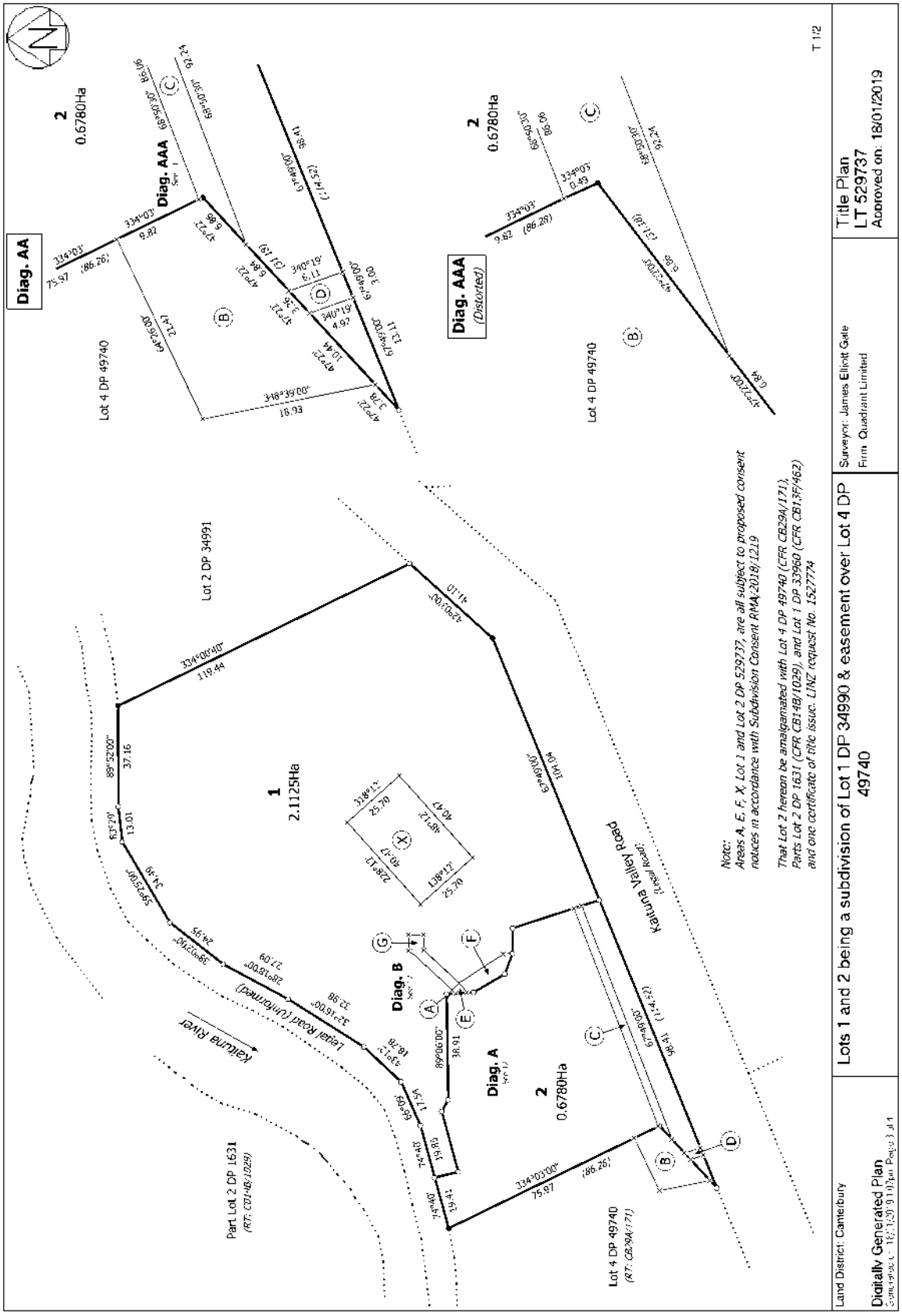
11409166.4 Consent Notice pursuant to Section 221 Resource Management Act 1991 - 12.4.2019 at 11:36 am

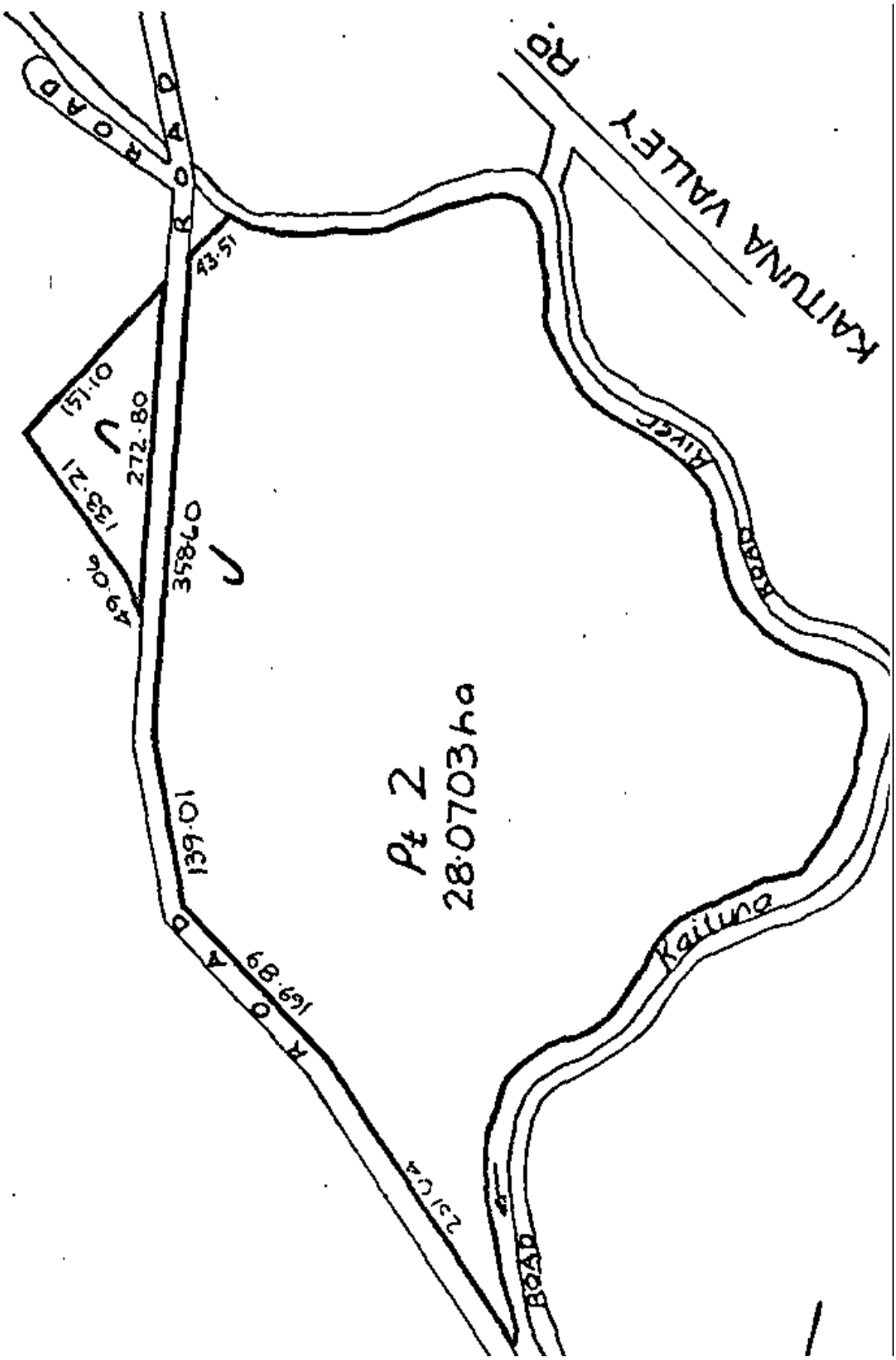
Land Covenant in Covenant Instrument 11409166.5 - 12.4.2019 at 11:36 am (Affects Lot 2 DP 529737)

11929916.1 Notice pursuant to Section 195(2) Climate Change Response Act 2002 - 16.11.2020 at 3:53 pm (affects Lot 1 DP 33960)


Lot 1 being subdivision of Pt Lot 1 D.P. 14039 and Pt Lot 2 D.P. 1631
LOCAL AUTHORITY Waimea County
Compiled by Middleton Alexander & Williams
Scale 1:6000 Date November 1973
LAND DISTRICT Canterbury
SURVEY BLK & DIST. XV & XVI Halswell
NZMS 1/17 SHEET NO. S94
DP 33960
Deposited this 12th day of March 1974
Land Registrar
Chief Surveyor
Approved as to Survey
Total Area 174-2730 ha
Comprised in C.T. 516/107 & Pt C.T. 381/252
DATUM: Old Cadastral
Mount Pleasant Circuit Coordinates
ORIGIN Mt Pleasant 700 000mN 300 000mE
Res. 166
D.P. 13409
Pt Lot 2 D.P. 1631
(174-2730 ha.)
Pt 1 168-3270 ha.
ROAD
OAK
ARCHIES
14039
XVI
XV


Lots 1-5 being Subdivision of Lot 1 D.P.9029 and Easement over Lot 1 D.P.8464
MEMORANDUM OF EASEMENTS
Approvals
Amalgamation Condition
TERRITORIAL AUTHORITY Wairewa County
LAND DISTRICT CANTERBURY
DP49740
KAITUNA VALLEY ROAD
SPUR ROAD
KAITUNA SPUR ROAD
Halswell S.D.
Ellesmere S.D.
Diagram A Not to Scale
Diagram B Not to Scale
Diagram C Not to Scale
Diagram D Not to Scale
Blk. XVI
Blk. III Blk. IV
Total Area 248.2865 Ha.


Diag. AA
Diag. AAA
Diag. AAA (Distorted)
Diag. A
Diag. B
Lot 4 DP 49740
Lot 2 DP 34991
Part Lot 2 DP 1631
(RT: CD148/1029)
Lot 4 DP 49740
(RT: CB394/171)
Kaituna River
Kaituna Valley Road
Legal Road (Unformed)
1
2.1125Ha
2
0.6780Ha
2
0.6780Ha
2
0.6780Ha
Note:
Areas A, E, F, X, Lot 1 and Lot 2 DP 529737, are all subject to proposed consent notices in accordance with Subdivision Consent RMA/2018/1219
That Lot 2 hereon be amalgamated with Lot 4 DP 49740 (CFR CB294/171), Parts Lot 2 DP 1631 (CFR CB148/1029), and Lot 1 DP 33960 (CFR CB135/462) and one certificate of title issue. LINZ request No. 1527774
Land District: Canterbury
Digitally Generated Plan
Lots 1 and 2 being a subdivision of Lot 1 DP 34990 & easement over Lot 4 DP 49740
Surveyor: James Elliott Gale
Firm: Quadrant Limited
Title Plan
LT 529737
Approved on: 18/01/2019
T 1/2


ROAD
43·51
KAITUNA VALLEY RD
(51·10
272·80
133·21
90°64'
35840
RIVER
ROAD
Pt 2
28·0703ha
139·01
68·69
ROAD
Kaituna
BOAD

APPENDIX 3:

Amended Plans

FUTURA
STEEL BUILDING SYSTEMS

PROPOSAL

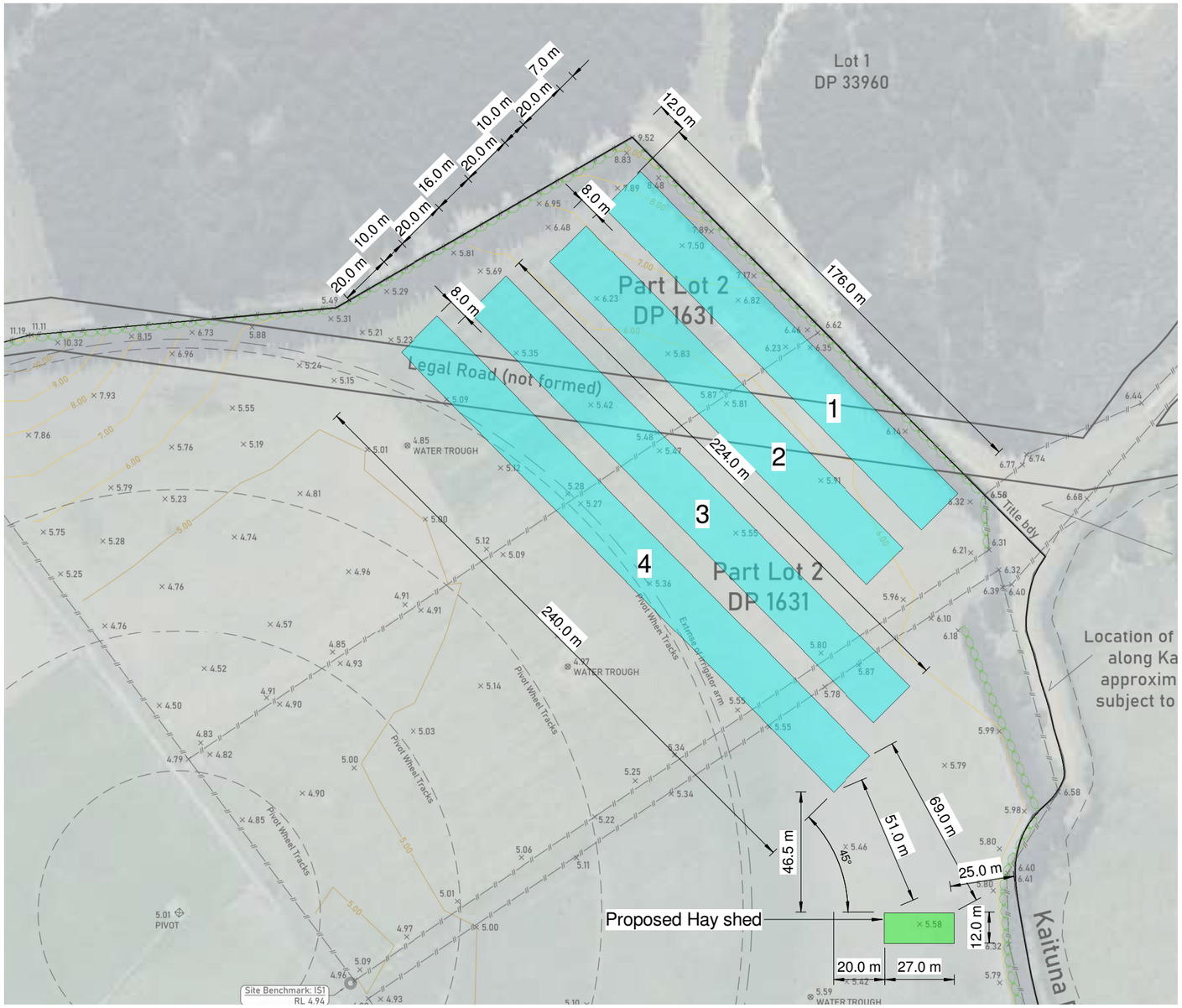
Futura - *a division of Zeala Ltd*

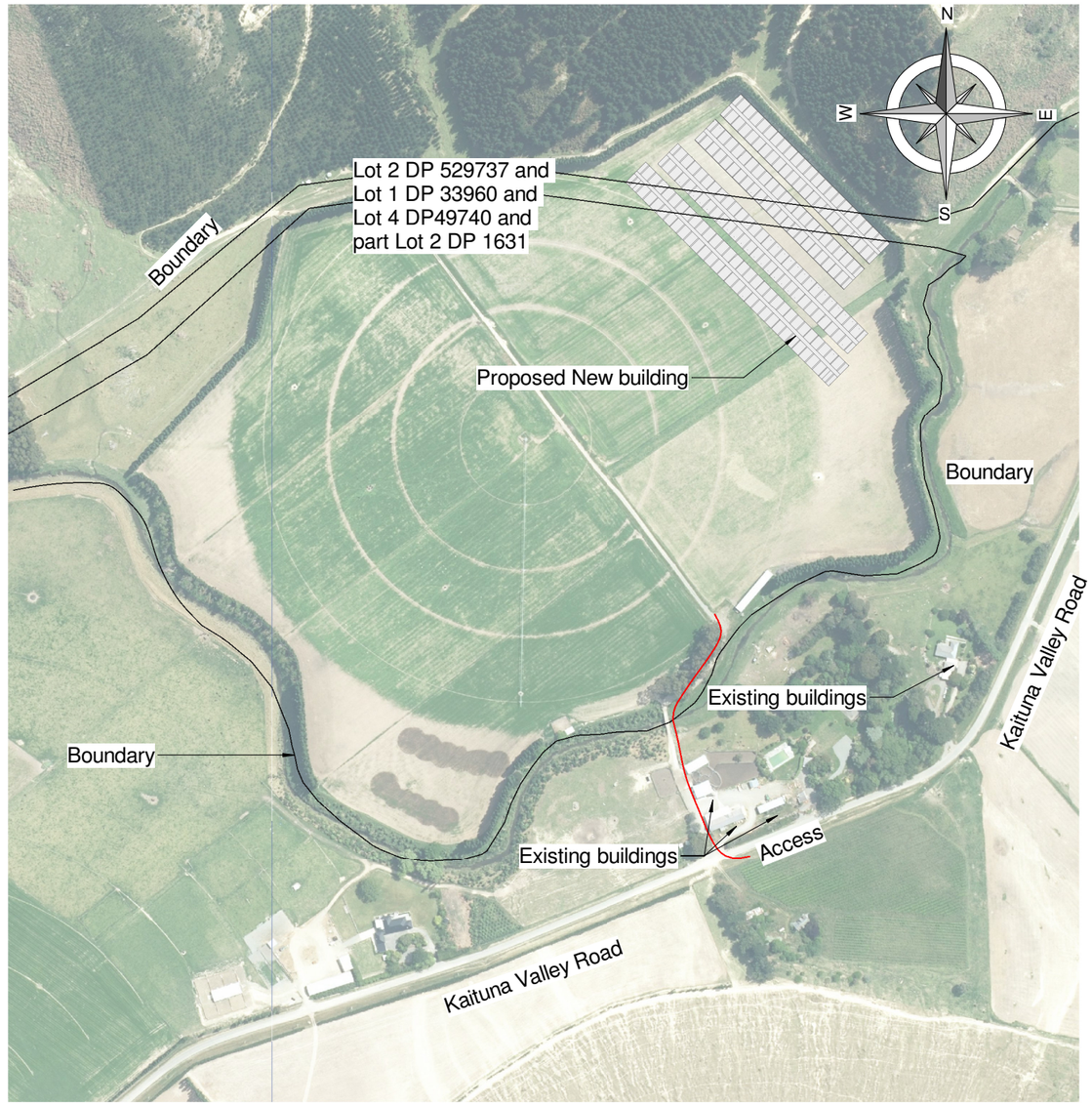
PROPOSAL No. F 17907
Date: 4/04/2022
Prepared for: Hero International Limited c/o Gavin Liu (Deal Ref. 6942251149)

Build Specifications

4x Buildings total, Same design, Varied lengths.

Building Location:	229 Kaituna Valley Road, Ataahua, Christchirch	
Building Style:	**Gable- Frame only proposal**	
	Non-clearspan Box Beam steel rafters elsewhere with timber poles supports	
	Please Note; (Supply of timber poles are included)	
Building Depth: (All buildings)	20.0 m	
Internal Pole Spacings:	10.0 - 10.0 m	
No. of Bays and Bay Width:	Building 1 & 2:	22 Bay(s) at 8.00m
	Building 3:	28 Bay(s) at 8.00m
	Building 4:	30 Bay(s) at 8.00m
Overall Building Lengths:	Building 1 & 2:	176.0 m
	Building 3:	224.0 m
	Building 4:	240.0 m
Combined Building Area:	16,320.0 m2	
Building 1 & 2 Area: (Each)	Over poles: 3520.0m / Over Roof Framing: 4224.0m	
Building 3 Area:	Over poles: 4480.0m / Over Roof Framing: 5376.0m	
Building 4 Area:	Over poles: 4800.0m / Over Roof Framing: 5760.0m	
Height: (All buildings)	5.50 - 8.75 - 5.50 m	**Roof Pitch:** 18.0 °
Cladding Extent: (All buildings)	Framed to be enclosed on roof & gable ends down to 4.2m above ground level, (3.6m above concrete level), - Cladding by others.	
Roof Cladding Type:	Framed for 0.40mm 5 Rib steel cladding - (Not Included)	
Purlin Type:	Galvanized Steel Box Beam Purlins	
Wall Cladding Type:	Framed for 0.40mm 5 Rib steel cladding - (Not Included)	
Wall Framing Type:	Galvanized Steel Box Beam Girts	
Steel Box Beam Member Finish:	Extra Durability Galvanized Coating	
2.0m Roof Overhang:	On both sides of building, 3.60m min clearance under rafters, no fascia cladding	





LOCATION PLAN

1 : 5000

LEGAL DESCRIPTION:
Lot2 DP 529737 and Lot 1 DP 33960 and Lot 4 DP 49740 and Part Lot 2 DP1631

SITE AREA:
204.5000ha

SITE COVERAGE CALCULATION:
Existing buildings: 2500 m²
Proposed building: 21760 m²
Total GFA: 24260 m² = 1.19%

STORMWATER
Stormwater to be disposed with Ø150 down pipes to water tanks with overflow to existing pond, as per stormwater design. All storm water pipe work by others

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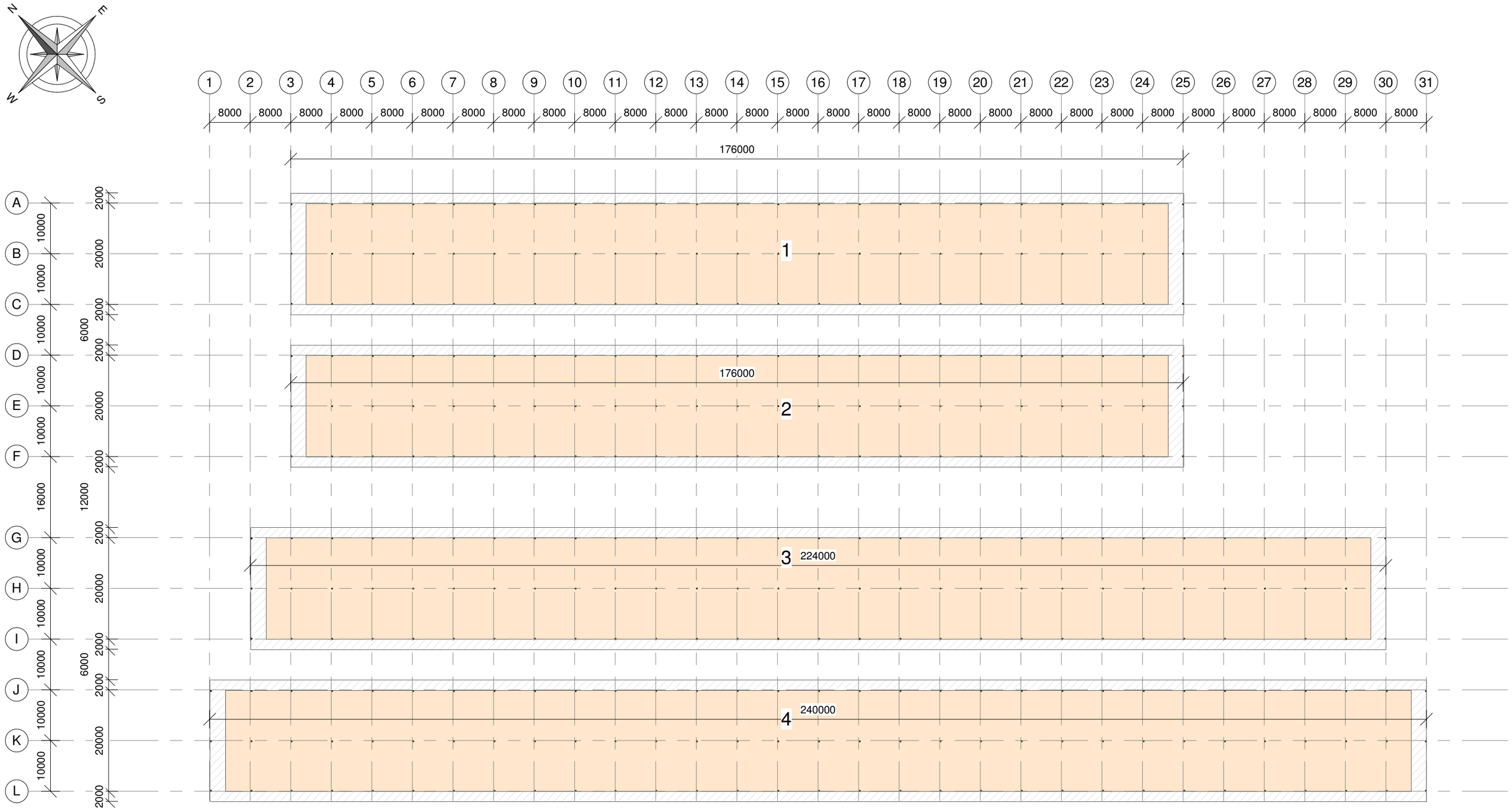
FUTURA
STEEL BUILDING SYSTEMS
222 Peake Rd, Leamington, Cambridge, 3493
P 0800 222 080
E hello@futura.nz

Client

PROPOSED BARN
FOR WILLESDEN FARM
AT 297 KAITUNA VALLEY ROAD

REV	DATE	REVISION DESCRIPTION	DRAWN BY
0	14.04.2022	Consent	RL
A	24.03.2022	Concept	RL

Project name: HERO-WILLESDEN
Sheet name: SITE PLAN
Date: 14.04.2022
Scale @ A3: As indicated
Drawing status: CONSENT
Project: C2397
Sheet: 100
Revision: 0



OVERALL LAYOUT

1 : 750

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222 Peake Rd, Leamington,
Cambridge, 3493
P 0800 222 080
E hello@futura.nz

Client

PROPOSED BARN
FOR WILLESDEN FARM
AT 297 KAITUNA VALLEY ROAD

REV	DATE	REVISION DESCRIPTION	DRAWN BY
0	14.04.2022	Consent	RL
A	24.03.2022	Concept	RL

Project name: HERO-WILLESDEN

Sheet name: OVERALL LAYOUT

Date: 14.04.2022

Scale @ A3: 1 : 750

Drawing status: CONSENT

Project	Sheet	Revision
C2397	A101	0

ROUGH MILNE MITCHELL LANDSCAPE ARCHITECTS LIMITED

DO NOT SCALE, ALL DIMENSIONS TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK

INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE COPYRIGHT OF ROUGH MILNE MITCHELL LANDSCAPE ARCHITECTS AND IS NOT TO BE PRODUCED WITHOUT THEIR PERMISSION

REV	DATE	NOTES
A	24/06/2022	
B	17/03/2022	

LEGEND

An existing single row of Lombardy Poplar trees are to be maintained in perpetuity. If a tree dies or becomes diseased it shall be replaced with a Lombardy Poplar in the first available planting season.

Existing trees are to be maintained until the proposed Lombardy Poplar trees along Kaituna Valley Road reach 5m tall.

Proposed single row of Lombardy Poplar trees. These trees are to be planted in the first available planting season following the granting of this Resource Consent. These trees are to be planted at 1m spacings. If a tree dies, it shall be replaced with a Lombardy Poplar in the first available planting season. The proposed Poplar trees shall be irrigated for the first 3 years using an automatic irrigation system.

Proposed infilling of the single row of Lombardy Poplar trees. These trees are to be planted in the first available planting season following the granting of this Resource Consent. These trees are to be planted at 1m spacings. If a tree dies, it shall be replaced with a Lombardy Poplar in the first available planting season. The proposed Poplar trees shall be irrigated for the first 3 years using an automatic irrigation system.

Approximate alignment of the accessway.

Approximate extent of the compacted gravel area.

NORTH

RMM

ROUGH MILNE MITCHELL
LANDSCAPE ARCHITECTS

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AUCKLAND +64 27 642 3342
DUNEDIN +64 27 498 8795
rmmla.co.nz info@rmmla.co.nz

LANDSCAPE PLAN
Willesden Farms
229 Kaituna Valley Rd

JOB No.	21037
SCALE	1:1500 @A3
DATE	17/03/2022
DESIGNED	RMM
DRAWN	CD, RG
CHECKED	PS
STATUS	DRAFT
DRAWING No.	REVISION
2	B
SERIES	
2 of 2	

APPENDIX 4:

Landscape Assessment

RMM

ROUGH MILNE MITCHELL
LANDSCAPE ARCHITECTS

rmmla.co.nz

Kaituna Feed Barns, Kaituna Valley, Christchurch

19 April 2022

Landscape Comment

Proposed Kaituna Feed Barns, Kaituna Valley

Introduction and Proposal

Willesden Farms Ltd (**the Applicant**), in 2021, gained Resource Consent (RMA2021/1675) to locate two feed barns, their ancillary buildings, hard stand areas, access and landscape mitigation within their property at 229 Kaituna Valley Road.

I prepared a Landscape Assessment Report, dated 21 May 2021 and an Addendum Report, dated 30 July 2021 which assessed the actual and potential landscape, natural character and visual effects of that proposal.

Since gaining Resource Consent the Applicant has changed the building design, which requires a variation to their Resource Consent. Plans illustrating the new shed design, layout and location is outline in this variation to the Resource Consent Application, that this Landscape Comment forms part of. Also, an updated landscape plan to reflect these changes forms part of this variation.

The purpose of this Landscape Comment is to provide a landscape assessment of the proposed design when compared with the consented design.

The methodology used to prepare this landscape comment follows the methodology in the Draft Aotearoa New Zealand Landscape Assessment Guidelines[1]. This is consistent with the two previous landscape assessment reports.

Landscape and Visual Effects

From a landscape and visual effects perspective, when comparing the consented environment with the proposal, I note that:

- The eave and the open sided design of the building continues to be approximately 4.7m above finished floor level. The height of the roof has reduced from 15m to 8.75m above finished floor level. Therefore, the vertical height of the Mist Green Colorsteel cladding has significantly reduced from being 10.3m tall to approximately 4m tall. The overall reduction in height also reduces the overall bulk and scale of built form.
- The footprint of the buildings has increased by 1,067m^2 compared to those shown in the application. However, I note that the application actually enabled the establishment of two composting feed barns of a maximum of 12,000m^2 for each barn. Therefore, the footprint enabled by the application is some 24,000m^2 and the proposal is some 6,200m^2 less than this. The general location of the buildings has not changed. They continue to be situated at the toe of the hillside which provides a backdrop to the north and west, and the scale of this hillsides continues to assist in absorbing the scale of the buildings into the landscape.
- The proposed buildings new footprint will not change any of the vegetation that is used for visual screening purposes. The existing and proposed vegetation, the Kaituna River and its riparian margin planting will continue to afford further physical and visual containment of the site and will ensure that the proposal will be well integrated into the landscape.
- The visual screening provided by the proposed vegetation will come into effect much sooner, due to the reduction in the building's height. This positively reduces the temporary visual effects.
- When seen from the southern part of Kaituna Valley Road (Viewpoints 1 and 2), the proposed buildings will be noticeably lower, which will assist in reducing their visual prominence. However, due to its

[1] 'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines'. [Final Draft subject to final editing, graphic design, illustrations, approved by Tuia Pito Ora/NZILA 5 May 2021].

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increase in length, it will continue to be seen as a generally large building. Overall, the degree of adverse visual amenity effects will continue to be at most, very low.

- When seen from the northern part of Kaituna Valley Road (Viewpoints 3 – 6), built form will continue to be seen through the small gap in the poplar shelterbelt. However, it will be less noticeable because the buildings height has reduced. When seen it will appear more in scale with a typical farm shed. This is considered to reduce the potential degree of adverse visual amenity effects when seen from this stretch of road. Overall, the degree of adverse visual amenity effects will continue to be nil.

Conclusion

Overall, the reduction in the buildings height and the sheds continuing to have an overall footprint less that what is consented will not result in additional adverse landscape or visual effects. In some instances, these adverse effects are reduced.

Paul Smith
Senior Landscape Architect | NZILA Registered
Rough Milne Mitchell Landscape Architects

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APPENDIX 5:

Letter from Wongan Hills Ltd to Christchurch City Council (25 March 2022)

Willesden Farms Ltd
229 Kaituna Valley Rd, Ataahua,
RD2, Christchurch 7672
PO Box 973, Christchurch 8140

25th March 2022

Kent Wilson
Resource Consents Planner
Christchurch City Council
CHRISTCHURCH 8140

WITHIN SCOPE APPLICATION TO EXISTING CONSENT RMA/2021/1675 – WONGAN HILLS LIMITED

Dear Kent

I refer to Dean Chrystal letter to you dated 18th March 2022. I understand that you have spoken to Dean and are seeking some further information / background to our proposed change in method of feed barn management to a 100% composting barn.

As you will be aware from your visit to the feed barn in Chertsey we had been modelling our feed barn on this composting system which is based around 80% of the animal effluent in the compost bedding and the other 20% of effluent in the wash lane while the animals were feeding or when they had been pushed on to wash lane while cultivation was being carried out. This system works well, and the wash lane effluent is run through a screw press to separate solids and then liquid is recycled several times before going through the effluent system and then spread on land. The only disadvantages of this system is the need for a effluent processing system and costs associated with that and the increased cost of the building due to the large concrete area.

As part of our research in early 2020 we met with Professor Keith Woodford who has been researching composting feed barns for some time. At that time he suggested 100% composting feed barns to us but at that stage we had not visited or talked to any operators using the 100% composting system and we felt the Chertsey system was suitable.

In the period between being granted consent and now we have been doing extensive research on the composting design between the Chertsey example and 100% composting systems. We have also been trying

to reduce the height and cost of the buildings to make them more economic. As a result, we have visited several 100% composting beds. As recently as 2 weeks ago we visited Murray Coates barn on the West Coast where he is running a 100% composting barn for his dairy farm, it has been so successful he is just about to commission a second 100% composting barn (see photos attached as Appendix 1).

100% composting barn system explained:

The previous design was based on a compost bedding area of ***5.5 sq metres*** per animal that allowed for 80% of animal effluent to be absorbed and composted with the remaining 20% run through wash lanes as liquid effluent while the animals were grazing.

The 100% composting system allows for ***8.0 sq metres*** per animal meaning there is a larger area to absorb the additional 20% effluent that was going down the wash lane. It's important to increase the area or compost per animal so as not to overwhelm the composting system.

The 100% composting system area works exactly as the Chertsey system does but reduces the need for a wash lane. The key element is too cultivate daily the woodchip to ensure the system remains aerobic.

Below is a extract from Professor Keith Woodfords August 2021 report (attached as Appendix 2):

The fundamental principle of composting mootels and shelters is that cows spend a proportion of their time under a roof structure where they lie on plant-based bedding materials which can be sawdust, wood shavings, wood-chip or other plant materials that have a lignin component. The urine and dung in association with the bedding are transformed to compost, generating considerable heat, with the moisture evaporating and exiting predominantly through a roof vent. The bedding is tilled once or twice daily to create aeration and aerobic fermentation. In a successful operation, the bedding remains warm and dry, and can remain in place for a year and in some situations longer.

A full copy of Keith Woodfords report is attached with this letter. His report is focused on the dairy industry, but the same principles are applied to the beef industry.

For our 100% composting design – the pens are 12 metres x 20 metres. When cultivation is carried out each pen of animals is pushed into a 10 metre pen and a gate is swung shut leaving an open run along one side of the shed. This open run is cultivated and then the opposite is carried out where the gate is opened, and the animals are moved on the just cultivated 10 metre strip and the gate is shut behind them and this open run

is then cultivated. Once the second run has been cultivated the gates are folded back to form the 12 x 20 pen.

Compost material is topped up in most cases monthly and typically is emptied out every 12-24 months as a dry organic compost. This organic compost will be spread on Wongan Hills owned paddocks and is excellent to help build up organic matter. The spreading of the barn compost is a permitted activity under rule CLWRP 5.29 – the nitrogen content of compost is expected to be 0.68% based on analysis of composting barn material by Durie et al, 2019.

Overall the 100% composting system in our view is a superior system to the previously proposed system and provided the following advantages.

- There is no need for a liquid effluent system and therefore a reduction in N leaching
- There is no need for internal feed lanes and wash lanes meaning smaller buildings with regards to height and width while allowing a similar building footprint and animals farmed.
- There is a significant reduction in building cost.
- Animal health is improved due to reduced risk of slipping in concrete wash lanes.
- A 41% reduction in height than the consented proposed buildings.

If you require any further explanation, please let me know.

Regards,

Brent Thomas
Director/Owner
0274 526 418
brent@willesdenfarms.co.nz

Appendix 1

Photos of West Coast 100% Composting barn. These sheds are 45 metres wide with 2 x 20 metre composting areas and a 5 metre center feed lane. Barns at Kaituna are utilising feed lanes on outside of building and have no centre feed lane and are 20 metres wide in total.

Murray Coates showing us the importance of smooth concrete for feed lane so cows tongue is licking a dinner plate surface rather than sandpaper surface

Murray Coates new shed just having laid woodchip

Cows eating silage directly off composting area.

Cows just returning from being milked.

Cows were off being milked when this photo was taken and the cultivation had just been completed.

Appendix 2

AgriFood Systems Ltd

Composting Mootels, Composting Shelters and Duration-Controlled Grazing as Transformational Technologies for New Zealand Dairying

A pathway to the future

A report to AGMARDT focusing on current New Zealand end-user innovation and RDE&E requirements

Supported by AGMARDT Innovation Grant 21014

Keith Woodford (M Agr Sci, PhD)
AgriFood Systems Ltd
https://keithwoodford.wordpress.com
Email: kbwoodford@gmail.com
Mobile 021 2688 343

August 2021

Contents

Executive Summary

This report addresses the potential for composting mootels and composting shelters, in association with duration-controlled pasture-based grazing systems, to transform the New Zealand dairy industry. In essence, it is a report on current New Zealand end-user innovation, together with the laying out of a framework that can underpin more formalised research, development, extension and education (RDE&E) relating to these systems within the New Zealand context.[1]

'Composting mootel' and 'composting shelter' are used here as complementary and overlapping terms. Both relate to roofed 'shed-type' structures in which cows spend time resting, defecating and urinating on bedding which is tilled daily to encourage aerobic composting. The term 'barn' is avoided because of confusion related to other types of barn structure which present a totally different set of issues (physical, animal welfare, environmental, economic) and the consequent misunderstanding that arises from use of the word 'barn' in relation to these composting structures.

Throughout this report, the term 'mootel' is used to capture situations where some feeding occurs within the structure. The term 'shelter' is used for situations where all feeding is external to the structure. Time will tell whether this distinction between the terms 'mootel' and 'shelter' becomes embedded within the industry lexicon, and indeed more generally as to the development of lexicon for the specific situations pertaining in Aotearoa New Zealand.

Many of the issues dealt with in this report apply equally to both composting mootels and composting shelters. However, there are some issues that are different according to whether the structural design allows for feeding within the structure and they will be considered separately.

The key message of this report is that there is great potential for dairy composting structures in association with duration-controlled grazing to address current issues of environmental non-sustainability, together with animal welfare issues, plus mitigation of some greenhouse gas issues, and for all of this to be achieved in a way that is financially viable for farmers. However, the composting technologies are complex and more knowledge is essential. Accordingly, this report sets out what is known and what needs to be further investigated within a research, development, extension and education (RDE&E) framework.

As background, New Zealand has an export-focused economy with dairy the most important source of export earnings. However, New Zealand dairy systems are constrained by issues of environmental sustainability. These issues include nitrogen leaching, phosphorus runoff, and soil loss, together with greenhouse gas emissions of methane and nitrous oxide. Aligned to this, there are animal-welfare issues associated with some of the common wintering systems.

Accordingly, there is a fundamental clash between the economic importance of the dairy industry and its lack of environmental sustainability.

[1] The assistance of New Zealand farmers who have been developing these systems is acknowledged. Without the information provided by these people, this report would not have been possible.

Key paradigms of New Zealand dairying systems include a reliance on pasture-based grazing systems and an absence of cow-housing. These features have been fundamental to both the high level of cost efficiency and associated high levels of economic outcomes that have been achieved.

There is also an associated and deeply embedded belief-system within the industry that the fundamental characteristics of grazing systems, together with the practice of non-housed cows, should be retained. However, these key features have also become the 'Achilles' heel in a world where both realities and perceptions have changed, with a much stronger emphasis on environmental matters, many of which were not previously recognised.

It is specifically in this context that composting mootels and composting shelters provide the key technology that, in association with duration-controlled grazing, can transform the New Zealand dairy industry towards long-term sustainability.

The fundamental principle of composting mootels and shelters is that cows spend a proportion of their time under a roof structure where they lie on plant-based bedding materials which can be sawdust, wood shavings, wood-chip or other plant materials that have a lignin component. The urine and dung in association with the bedding are transformed to compost, generating considerable heat, with the moisture evaporating and exiting predominantly through a roof vent. The bedding is tilled once or twice daily to create aeration and aerobic fermentation. In a successful operation, the bedding remains warm and dry, and can remain in place for a year and in some situations longer.

This dairy composting technology was developed in the American Mid-West over the last 20 years in association with cut-and-carry confinement systems. It is operational and well-tested on some hundreds of American confinement farms. However, in the New Zealand climate and context, the technology aligns with a totally different paradigm of dairying that retains a fundamental reliance on pasture-grazing systems.

An important feature of composting mootels and composting shelters is the simplicity of design. There is no internal fit-out of stalls like there is in a free-stall barn. Also, from within the composting structure itself, there is no liquid effluent to deal with. In contrast, managing liquid effluent is a major issue for all traditional barn systems that do not include efficient in-shed composting. When the compost is removed, it can either be returned immediately to the paddocks as fertiliser, or else stored temporarily before returning it to the paddocks typically over spring and summer.

As a consequence of all of these factors, the cost of composting infrastructure can be much less than free-stall or other barn systems which have complex fit-out together with major effluent infrastructure.

The hours of use of these composting structures depend on location and specifics of the farming system. During winter, the cows will typically spend most of any 24-hour period in the mootel or shelter. Feeding can be either within the structure, or on an associated feed-pad, or alternatively cows may still go out to pasture for say two to six hours per day.

At calving time, the shelters provide an excellent welfare and husbandry environment. At times of the year other than winter, shelters may be used primarily during wet periods to

reduce pasture damage and enhance animal welfare. The shelters are also highly effective in providing summer shade, with this being relevant at any temperature above 20 degrees Celsius. In autumn, overnight use of the shelters can considerably reduce subsequent winter leaching from grazing-associated urine patches.

The environmental benefits of composting mootels and composting shelters stem from the duration-controlled grazing system, which minimises urine-related leaching and also greatly reduces pugging damage to pastures. There are further potential environmental benefits from these systems given the likelihood that nitrous oxide emissions will be considerably lower than more traditional grazing systems, or indeed from other barn systems where nitrous oxide is emitted from effluent ponds. However, quantitative measures are required of this. There is also scope for bio-filtration of methane emitted by the cows while in the barn, but this requires development of new technology and new-science stretch.

Currently in New Zealand, there are approximately 30 farms or perhaps a few more that have shed structures in which some composting occurs. However, in many of these farms the structures were not specifically designed to facilitate composting. Hence, the composting has been an accidental outcome rather than a pre-planned outcome. On some other farms, the composting outcomes have been intentional, but the design has been less than optimal.

Fortunately, there are also exemplar farms that demonstrate outstanding physical and financial performance results with the composting system, albeit with ongoing learnings. Accordingly, the evidence of these farms is that composting mootels and shelters in association with duration-controlled grazing systems can be an economic solution based on improved animal productivity, as well as a transformational technical solution to the fundamental problems of New Zealand dairying.

Currently, investigations and outreach activities of composting mootels and shelters are not well embedded within formal RDE&E systems. Instead, it is forward thinking farmers who are leading the movement through 'end-user innovation'. This situation needs to change with all groups working together.

Although I am familiar with the extant scientific literature from overseas, I have not attempted to provide any significant review thereof within this report. This is because the overseas focus is within farming systems that are very different to the directions being taken within New Zealand end-user innovation. *With technologies like composting, then context is fundamental.* The key message of relevance to New Zealand is that American-style compost barns are a proven system within their 24/7 confinement systems and there are probably more than 200 such farms operating, with the key constraint to expansion apparently being availability of suitable lignin-based bedding.

For those who wish to access the overseas scientific literature, it can be accessed via Google Scholar using search terms 'compost' and 'barn', and supplemented by use of "compost-bedded pack". For those wanting visual material, then YouTube is the place to start using the same terms, but recognising that this too can be highly misleading for the New Zealand context.

Priority RDE&E domains for New Zealand include the following, with potential for multiple projects within these domains.

1. Nutrient leaching and associated losses within composting mootel and composting shelter farming systems
2. Farm system and economic studies of dairy composting systems
3. Investigating and enhancing the supply of bedding materials for composting mootels and composting shelters and the associated farming systems
4. Composting processes within composting mootels and shelters
5. Optimal design studies of composting infrastructure
6. Greenhouse gas emissions within dairy composting farming systems
7. Education and Extension

It is normal for research projects to not only create new knowledge but also a new set of research questions. Current New Zealand pasture-based systems have evolved over a period of approximately 150 years and the search for improvement is never ending. It will be the same for systems incorporating composting infrastructure and associated duration-controlled grazing systems.

Most of the RDE&E needs relate to improving a system that is already operational on exemplar farms. However, the logistical issue of adequate supplies of bedding material has potential to become an absolutely limiting factor to the system roll-out. Clearly there is a range of alternative bedding materials, some of which come from the forestry industry and others, such as miscanthus that can be grown on-farm. *Addressing the issue of bedding supply is critical.*

The other key issue in early stages of the system roll-out is misunderstanding and mis-information about both the technologies and the related farming systems. It would seem that some existing negativity towards the system stems in part from terminology and an antipathy within New Zealand dairying to the notion of 'barns'. The term 'barn' is widely associated with structures that are expensive to construct, that are expensive to operate, and that have animal welfare concerns. Accordingly, dairy composting infrastructures in this report are referred to as 'composting mootels' and 'composting shelters', rather than as barns, to minimise these errors of association.

*The overarching conclusion is that the composting infrastructure technologies in association with duration-controlled grazing have the potential to transform the on-farm systems of the New Zealand dairy industry**. There is a pathway to the future**.*

However, relying predominantly on end-user innovations is not efficient. The pathway ahead includes major incorporation within New Zealand's formal New Zealand RDE&E systems, including overarching integration thereof.

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Background and Introduction

The genesis to this project lies in my own observations of two 'compost barns' (as they were termed) in the very high rainfall region of Tillamook in coastal Western Oregon at a latitude of approximately 45 degrees North. This occurred in May 2017 during a study trip to USA and the Netherlands to investigate dairy infrastructure, led by me and accompanied by three managers from building company Calder Stewart. Visiting two 'compost barns' in that particular environment was a chance event, but it was the most fundamental learning from our study tour.

The fundamental principle of a compost barn in the USA is that cows spend most and typically all of their time 24/7/52 within the barn except during milking operations. Cows lie on plant-based bedding materials which can be sawdust, wood-shavings, wood-chip or other plant materials that have a lignin component. The urine and dung in association with the bedding are transformed to compost, with the moisture evaporating and exiting predominantly through a roof vent. The bedding is tilled once or twice daily, often at the time the animals are being milked, to create aerobic composting. In a successful operation, the bedding remains warm and dry and can remain in place for a year and in some situations longer.

On returning to New Zealand from the 2017 study tour, I made the observation to my Calder Stewart colleagues that I thought they had built their last free-stall barn. It was not going to be a case of simply transferring to New Zealand the compost barn technologies and farming systems that we had seen, but I had no doubt that we had identified the essence of a technology that could not only transform New Zealand dairying, but do so within the existing New Zealand paradigm of pasture-based dairying.

The fundamentals of the technology itself are not new and they have been practiced by some American farmers in the Mid-West for approximately 20 years within that context of 24/7/52 housing. I had myself been aware of the technology for more than ten years prior.

However, it was only when I saw it operating in a high-rainfall maritime environment, including one farm which adopted a hybrid 'pasture-grazing plus barn' system that the 'light-bulb moment' occurred. I knew that there would be lots of adaption to fit within the New Zealand system, but I also knew that it was going to work.

The key reasons why I knew the technology was going to be particularly relevant to New Zealand were because of the challenges New Zealand faces with pasture-based systems in winter. The specifics vary across the New Zealand regions, but winter-leaching of nitrogen deposited in concentrated form within urine patches is an issue of fundamental importance on most New Zealand dairy farms. Also, there are major issues of cow welfare during winter on many New Zealand farms when paddocks turn rapidly to mud. Aligned to this, there are also pasture productivity issues related to pasture pugging. Further, although the specifics might seem less obvious, it was also apparent to me that there could be very positive implications for reducing nitrous oxide emissions to the atmosphere. There might also be possibilities of decreasing the methane-emission intensity per unit of dairy output.

On returning to New Zealand, I wrote one of my regular columns in the rural media, also published both at https://www.interest.co.nz and my own website

https://keithwoodford.wordpress.com, where I expounded on what we had learned at Tillamook in Oregon.

That article referred both to composting barns (or simply 'compost barns' as I then called them in line with American terminology) and also to hybrid 'barn-plus-pasture' systems. I then received separate emails from both Sue Macky and Bryan McKay, business partners at DairyPro based in the Waikato, but operating nationally, who told me that they had clients who were already using these technologies.

Some weeks later on a cold wet Waikato winter day I was hosted by Sue Macky and Bryan McKay. Late in the afternoon, Sue and Bryan took me to the farm of Tony and Fran Allcock who had a composting mootel on their farm. I was more than a little damp from being out in the rain on dairy farms that day and my feet were very cold, but within minutes of stepping into the barn I could feel the warmth coming up through my gumboots. The cows that were lying sprawled out in the bedding were also clearly of the opinion that this was all rather pleasant.

The Allcock farm is a key New Zealand exemplar of the technology that I will be referring to regularly in this report. In more than four years since my first visit, I have directed many farmers and other industry folk to visit the Allcocks as the starting point for understanding the principles of the system. The Allcocks and I have also shown the system to a Cabinet Minister.[2]

Given the importance of the Allcock operation to this report, some specific background is relevant. Their farm is typical of many Waikato farms being of modest size (98 ha effective) but with rainfall at the higher end for Waikato, with rainfall ranging from around 1200mm per year, or perhaps even a little less in dry years, up to 2000mm in a wet year.

It was Fran Allcock who had first voiced the perspective that while the humans, the dogs, the cat and the hens all had shelter at the farm, the cows that did all the hard work of producing the milk were out in the cold and the rain on those miserable winter days and nights. It was Fran who then decided that the cows should have their own cow house. It was Fran who also came up with the term 'mootel' which I use widely throughout this report.

When the Allcock mootel was first built there was no prior expectation that composting would occur therein. It started happening all by itself. So, at that point it became a 'composting mootel'. Sue Macky, using her American experience, then advised as to how to crank the system up to maximise the composting benefits.

Given the sequence of events, with the composting being an outcome rather than an initially designed feature, the design of the Allcock mootel is not fully optimal. If starting again, the Allcocks would do a few things slightly differently. However, the 'big picture' message is that the mootel has been remarkably successful from all of bio-physical, animal welfare and economic perspectives. In reference to the economics, I make that statement having had access to all of the historical and current farm accounts.

[2] The Allcocks were also filmed in late 2020 for 'Seven Sharp', with that segment available here. https://www.tvnz.co.nz/one-news/new-zealand/waikato-couples-dairy-farm-bucks-tradition-environmentally-friendly-mootel.

The mootel has now been operative for seven seasons and the Allcocks are very clear that they would not be without it. Looking at all of the farm records, I am very clear that the effects have been profoundly for the better.

Another farm that I make extensive reference to in this report as a 'composting shelter' is a new first-year composting operation in Canterbury that I have been fortunate to observe throughout the design, building and first-season operation. Both I and the farmer have learned a lot during that process, and there will be additional leanings over coming years. I expect that farm to become another exemplar.

The contents of this report have also been greatly influenced by a range of other farmers across New Zealand working with composting mootels and shelters which I have not further identified. Some of those people prefer to work quietly away from the glare of publicity, so I have chosen not to identify them despite acknowledging their impact both on my own knowledge and also what I report here.

In this report, I have made a considered decision to *not include* a review of the overseas scientific literature relating to compost barns and compost-bedded packs. However, I have added references throughout the report to specific science underpinnings that are relevant to the New Zealand context.

This approach reflects that much of the overseas experience is with different environmental conditions to New Zealand and the farming systems are also fundamentally different. *In essence, this is a report of New Zealand end-user innovation, what we know that is of relevance, and what else we now need to learn about.*

For those who wish to inform themselves specifically in regard to the overseas literature, then a starting point is to search 'Google' and also 'YouTube' using 'compost' and 'barn' as key words, with 'compost-bedded pack' being a supplementary term. For those who wish to quickly separate out the scientific literature from the popular literature, the same terms should be used with Google Scholar. Just remember, context is ultra-important. The New Zealand dairy context is very different to either USA or Europe.

Fundamental Issues of Terminology, Farming System and End-User Innovation

In the more than four-year period since my first visit to the Allcocks, one of my challenges has been to try and inform other New Zealanders as to the potential of the composting set of technologies within pasture-based systems.

One of the key learnings for me over those years is that many New Zealanders have a profound dislike for the notion of barns. This dislike arises from a fundamental belief that cow barns are not the way to go in New Zealand. However, extending this negative attitude towards the composting mootel and composting shelter concept is also driven by fundamental ignorance in relation to the principles and structure of these structures and the associated systems.

Some of my interactions have been with people who have visited what are called 'compost barns' in European countries, and they think they understand the technology and system that is being developed in New Zealand through end-user innovation. My direct experience has been that people who claim to understand the technologies and systems from European observations have in fact not understood the principles of the 'composting mootel' or 'composting shelter' as is being developed in New Zealand. *This is one reason why I now try and avoid the term 'compost barn'*.

A 'compost barn' in the European context typically involves using compost as the bedding but with limited and in some cases minimal composting occurring while the bedding is *in situ*. This is a totally different technology to what is focused on in this report. Typically, there is little heat generated in these European compost barns and the bedding material has to be regularly dried either by compression or artificial heating to remove the moisture and then recycled. These are the reasons why Bryan McKay advised me early on in relation to the New Zealand context to always use the term 'composting' rather than 'compost'.

In contrast to Europe, within the American Mid-West the term 'compost barn' does refer to barn systems where the composting occurs *in situ* and with significant warmth generated by that process. Accordingly, there have been multiple learnings relevant to New Zealand from understanding those American systems. However, once again the American Mid-West experience can also be highly misleading within the New Zealand context.

As a starting point, American winters are typically very cold and predominantly dry. In contrast, the American summers are typically hot and often very humid. The barns themselves tend to be very enclosed, which is very different to what we are talking about for New Zealand. And in the Mid-West the cows are typically in the barn '24/7/52' apart from the twice or thrice-daily milking in adjacent facilities.

The differences between New Zealand and the American Mid-West are encapsulated by the fundamental reality that America has a continental climate of extremes whereas New Zealand has a temperate maritime climate. That distinction alone encapsulates why American dairy systems take a very different form than New Zealand dairy systems.

New Zealand dairy systems are based heavily on *in situ* pasture grazing. Within those systems, there is considerable variation as to supplementation strategies and supplementation extent. Accordingly, DairyNZ has over the years promoted a classification system from '1'to '5' ranging from low-input fully self-contained systems to high-input systems with use of some purchased feed at all seasons.

Although the Allcock farm has transited in the last seven years from a typical System 3 Waikato farm to a much higher System 5 input system, this is not fundamental to the overall concept. For example, there is a composting shelter in its first year of operation in Canterbury where the focus is on wintering with grass silage, which will in all future years be home-grown and which is fed-out on feed-pads adjacent to the shelter.

The family owners of this Canterbury exemplar farm are very clear that their system will remain a pasture system without any major purchases of supplements from off-farm. The barn is currently being used 24/7 during the winter and for calving, except when cows go out each

day to eat silage on the feed-pad, but for the rest of the year it will only be used occasionally when the paddocks are wet and on those days the cows will still do their resting (and hence much of their pissing and pooing) within the composting structure. It may also be used on a partial basis in late autumn as this is a critical time to minimise subsequent winter leaching of late-autumn urine patches. All of the modelling by the farm consultant indicates that this is going to work from a feed-management perspective, and I too am confident. Although the fundamental principles are the same as for the Allcock mootel, some of the specifics of the infrastructure are significantly different. It is from working with this Canterbury farming family that the use of the term 'composting shelter' has derived.

My expectation is that this Canterbury composting shelter is also going to become an exemplar. However, at this stage the farming couple do not seek widespread publicity as they develop their own learnings from the system, and so I do not identify the family further. However, I have, with their permission, included photos and details of the structure in more detail later in this report.

There are multiple other farmers in New Zealand who have structures which they and others now call 'composting barns' or in some cases 'composting mootels' . Most of these were built without an expectation that composting would occur but were built with an objective of being able to get cows off the paddock either for part or all of winter. It is only in the last 18 months that significant numbers of farmers have commenced building structures specifically focused on optimising the composting therein.

All such structures where the composting process has been opportunistic suffer from designs that are less than optimal relative to what I consider to be 'best practice' given current knowledge. Some of these composting barns work with acceptable levels of effectiveness that improve overall farm performance and the results are impressive. However, others are operating poorly with inadequate composting relating to poor design and some misunderstandings about the technology.

Key metrics include that the compost should be at a temperature close to 50 degrees C, or even up to 60 degrees Celsius, at a depth of 30 centimetres. There should be no condensation from the roof. There should also be no smell in the barn. If any one of these conditions are not met then there are issues to address. Later sections of this report discuss these metrics in more detail.

I summarise this section by emphasising that the concepts presented in this report are specific to New Zealand and pasture-based farming. They are relevant to both low-input and high-input systems. The appropriate structures and associated systems are very different to barn farming in European, American or indeed almost all other dairy farming environments across the world.

I note here that the specific terminology may evolve over time, but at the very least we should not use the terminology of 'compost barn' because of the confusion it creates with overseas systems that are very different. The term 'composting barn' identifies that the composting occurs within the structure but this may be too subtle for the uninformed to recognise the difference. Also, the term 'barn' has very wide negativity associated with it in New Zealand.

I have a personal liking for both 'composting mootel' and 'composting shelter' as appropriate terminology. Both terms distinguish the infrastructure and associated systems from very different systems overseas. They also imply a highly appropriate emphasis on cow comfort and the environmental benefits.

The Purpose of this Report

The purpose of this report derives directly from the background and terminology issues outlined above. It reflects a perspective that in New Zealand our dominant export industry is dairy and that we face major challenges relating to environmental issues. *We must deal with these issues*.

Aligned with the above reality is that we have a technology that has potential to address these systemic issues in ways that are both transformational and economic. However, the technologies and the appropriate use thereof are not widely understood.

Indeed, the path forward has been significantly blocked by misunderstanding, such that the banner is being carried forward by innovative farmers who are end-user innovators, while the formal research, development, extension and education (RDE&E) system, together with Government, is largely standing back, in many cases being prisoners of prior deeply-seated perceptions.

The first purpose of this project is therefore to bring together existing knowledge in relation to dairy composting infrastructure and associated dairy systems as a transformational pathway for New Zealand dairying that will enhance both business and environmental sustainability.

This first purpose is essentially an exercise in communication. It is directed to farmers, the R&D community, policy leaders, the Government, educators, financial-lending institutions and also the general public, given that transformational technologies for our most important industry are relevant to everyone.

The second purpose is to document the issues that we do not know enough about. We have existing knowledge that tells us that this set of technologies can be effective and transformational, but much of the knowledge is empirical to specific situations. Although we have a good understanding of the fundamental science so as to be able to explain why the composting processes work in the observed fashion, we lack the applied knowledge needed to operationalise the rollout of the technology and associated farming systems across Aotearoa New Zealand in a way that minimises mistakes and maximises efficient adoption.

The third purpose follows on directly from the second purpose. This purpose is to identify the foci for appropriate research programs and individual projects therein that can contribute to applied operational knowledge, and with a particular emphasis on operational knowledge that can guide adoption strategies and actions.

This third purpose does *not* extend here in this report to developing specific research projects *ready for funding*. That will come later. But it is intended that the material relating to this

purpose will provide guidance to those members of the RDE&E community who will subsequently put forward those applications.

The Technology Fundamentals and Associated Farming Systems

All information in this section is generic material for explanatory purposes. It is not intended as advice for specific investments in particular locations. Rather, in regard to those specific investments it is intended as a starting point for discussions. *If people do assume that the material in this section provides specific advice for specific farms, there is great potential for failure*. I am seeing too many examples of people who think they know enough to proceed without detailed discussions with those who do understand the technologies. Seeing is believing, but simply seeing successful operations is not in itself a pathway to success.

The Composting System

Within a dairy composting system, the first operational goal is to promote an aerobic composting process using thermophilic bacteria, with plant material (the bedding) plus urine and dung as the feedstocks. To ensure that the composting is aerobic, it is important that the compost is tilled either once or twice daily, with frequency depending on circumstances. The compost should be at least 500mm deep, and my current recommendation to farmers, which may change with further experience, is that a design allowing 800mm depth is best practice. It is essential that the high-humidity air created in this process can readily escape from the composting mootel or shelter.

Infrastructure Design

There are two fundamental designs currently being used in New Zealand.

The first is an inverted-V metal roof, with preferred pitch at least 18 degrees, with an opening at the apex running the length of the structure and with this opening being approximately 1.5% of the width of the structure. Typically, there is a cap above the apex opening to minimise rain entry. The cap needs to be placed such that exiting warm air does not have to turn a sharp corner. Correct placement and breadth of the cap is important to maximise air extraction and minimise entry of rain.

The second fundamental design is a hoop-like or tunnel structure. Some caution here relates to these structures being less efficient than the inverted-V structure in moving air towards the central apex vent. A second caution is that some designs provide a long and narrow shed and this unduly reduces the height of the apex and hence the volume of air above the cows and above the compost. Both of these factors can lead to condensation on the roof and any condensation will impact negatively on the overall composting process.

As a generalised statement, I prefer short and squat structures in preference to long and narrow. Another issue with narrow structures is that boss-cows can influence herd distribution. Consideration also needs to be given to the management of individual groups within the structure, for example early and late calvers. In that context, multiple entry and exit points are very helpful. Either gates or hot-wires can be used to keep groups separate within the structure.

Both designs (metal inverted-V or tunnel design) need free movement of air into the structure, preferably achieved with open walls of at least two metres in height. Walls significantly higher than this will increase the risk of rain entering thestructure.

I am cautious to advise as to appropriate directional location of the structure without site inspection. Factors to consider include wind, rain and sun. These factors play out differently in different regions of New Zealand.

I have observed one tunnel-type structure that is wide and hence with a reasonably high apex but actually has no vent at the apex. It is effective. However, it is sited in an extremely windy position and it is in a lower rainfall and lower humidity zone than some parts of New Zealand. This illustrates that at times rules can be broken. However, with each rule that is broken the chance of failure increases.

Internal Layout

The first question in relation to layout is whether feeding of animals is to be in-shed and whether or not drinking troughs are to be in-shed. The attached photos in this report of the Allcock mootel (in-shed feeding but drinking troughs outside) and the Canterbury composting shelter (external feed pads; drinking troughs outside but readily accessible) show something of the diversity of options. I have visited another farm where the feeding is outside and the drinking troughs are inside. There is a logic to all of these arrangements and all can work.

The Allcock mootel design has a laneway down the centre for a feeding wagon, with feed troughs on each side of this laneway and also along the outer walls of the overall structure. The covered mootel floor area is approximately 60 metres long and 41 metres wide. Each bay is 18 metres wide, with two metres of concrete for the cows to stand on when feeding, and 14 metre width of compost. The central feeding laneway is 5 metres and there are four feed trough rows, two internal and two at the outer wall. These dimensions give a feed face of 0.8 metres per cow aligned to 5.5 sq metres of compost per cow and assuming 270 cows. *Note that it is the 14-metre width of compost that gives the proportional relationship of 0.8 metres feed-face to 5.5 square metres of compost. If the desired area per cow is more than 5.5 square metres (and in some regions of New Zealand and with 24/7 use in winter this will be crucial) then the width of the compost within the mootel will also need to increase.* The minimum required feed-face will be determined by whether it is necessary for all cows to have access to feed at the same time and might also be influenced by cow size.

In relation to the two metres of concrete for the cows to feed on, this works well for the Allcocks, but Tony Allcock has said that if he were starting again he might increase the cow standing area when they are feeding to 2.4 metres.

However, regardless of the width of the concrete that cows stand on to feed, the area at the interface between the concrete and the compost may tend to get wet if urine flows off the concrete to the interface.

Another structure that I have visited with internal feeding does not have a central laneway. Hence, there is insufficient feed face for all cows to feed at the same time, and additional feed troughs are placed outside. This structure also has support structures in the middle of the

shed which have to be passed around when tilling the compost. *In structures without the central laneway, my strong preference is for no central posts as these inhibit effective and efficient tilling.* Some but not all construction companies can supply steel structures to at least 45 metres in width without central posts and without impacting in any major way on construction costs.

In contrast, at the Canterbury composting shelter referred to extensively in this report, all of the area under the roof is compost. Cows are held in four groups and they side-exit to four feed pads. The gates separating the groups open out to allow efficient tilling of the barn in one 'land'. The drinking troughs are located just outside the compost area on concrete. This structure has a length of 130 metres, plus eaves of approximately 1.5 metres and a width of 31 metres. An advantage of this system is the cost efficiency of the roof structure per cow given that all of the area under the roof (except eaves) has compost. Also, there is no reason with this system for cows to concentrate at the edges of the barn.

With external feed-pads it is also possible to have cow groups feeding sequentially rather than simultaneously. This can significantly decrease feed-pad infrastructure costs. Alternatively, it may allow staging of these feed-pad costs.

Drainage systems

The Allcock mootel has a piped system to collect any moisture which seeps through to the bottom of the compost and thereby collects underneath the compost. In seven years, there has been no liquid outflow. This reflects the reality of an efficient composting system. If there is any liquid seeping out from a composting structure then the thermophilic composting bacteria have long failed their job and the compost will have already become a nasty smelly mess.

The specific requirements for fail-safe drainage systems will be determined by individual environmental councils and soil types. The flooring of the Canterbury composting shelter has been approved on the basis of cement-stabilised pit shingle which has passed infiltration tests.

A key message in this section is that effluent management can be very simple in a dairy composting system. The dung is incorporated into the compost together with the nitrogen from the urine. The water content in the urine evaporates out of the system. *This situation contrasts markedly with free-stall barns and similar where the infrastructure costs and hassles associated with effluent management are a very major issue*. There will, however, still be effluent issues to be managed for any external stand-off pads.

Dairy plus beef

The predominant focus in this report is on composting mootels and composting shelters for dairying situations. However, I find myself increasingly in discussions with beef farmers who are looking at these structures for finishing of beef cattle for approximately 100 days and linked to a steady supply of finished animals over the 12-months of the year.

Photo Section

Photo 1. The Allcock Mootel in the Waikato.

The roof pitch is less than ideal. The cap system requires exiting air to turn a sharp corner. Subsequently a gap was cut in the cap to facilitate air movement and the impact was readily apparent. However, it also now allows some rain in through the top. Despite some limitations, the overall system is very successful.

Photo 2. Cows at rest in the Allcock Mootel

Photo 3. Tony Allcock and cows inspecting the compost

Photo 4. Tilling underway in the Allcock mootel, while the cows are out to pasture

Photo 5. Allcock cows grazing Waikato pastures

Photo 6. Pasture discussions.

These pastures have only been receiving compost as fertiliser in recent years and have thickened up considerably

Photo 7. Canterbury composting shelter on a dull winter day.
Cows are outside the shelter towards the left of photo eating their ration of silage.

Photo 8. Cows waiting to be let out from the composting shelter to feed on silage

This grouping does not occur at other times; security camera evidence (not shown here) is that cows are spread out and lying down until they hear the tractor.

Photo 9. Feed-pad troughs external to the shelter

Photo 10. Internal shelter gates.

These gates separate the groups in the composting shelter but are opened for daily tilling.

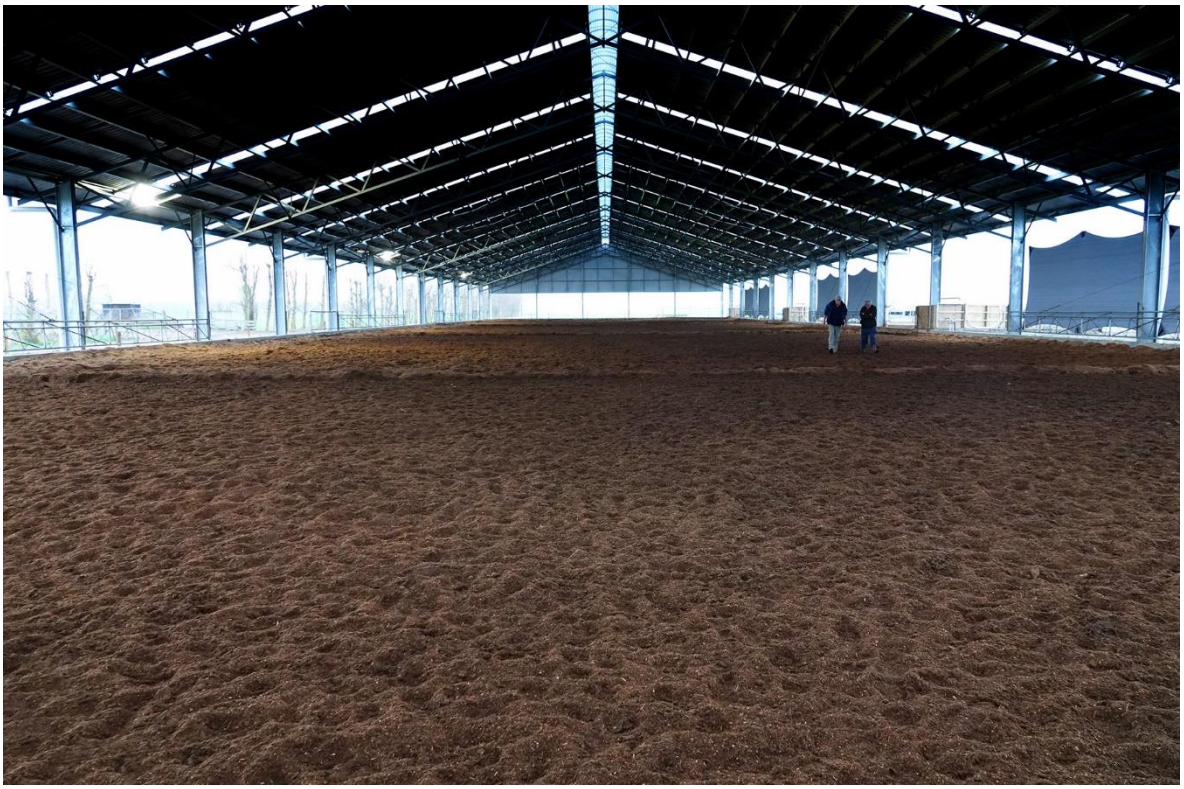

Photo 11. Tilling is about to start

Photo 12. Tilling can generate a lot of steam as moisture escapes

Photo 13. A spader used for tilling.

There is a range of tilling equipment that can be used. The key issue is it must generate aeration.

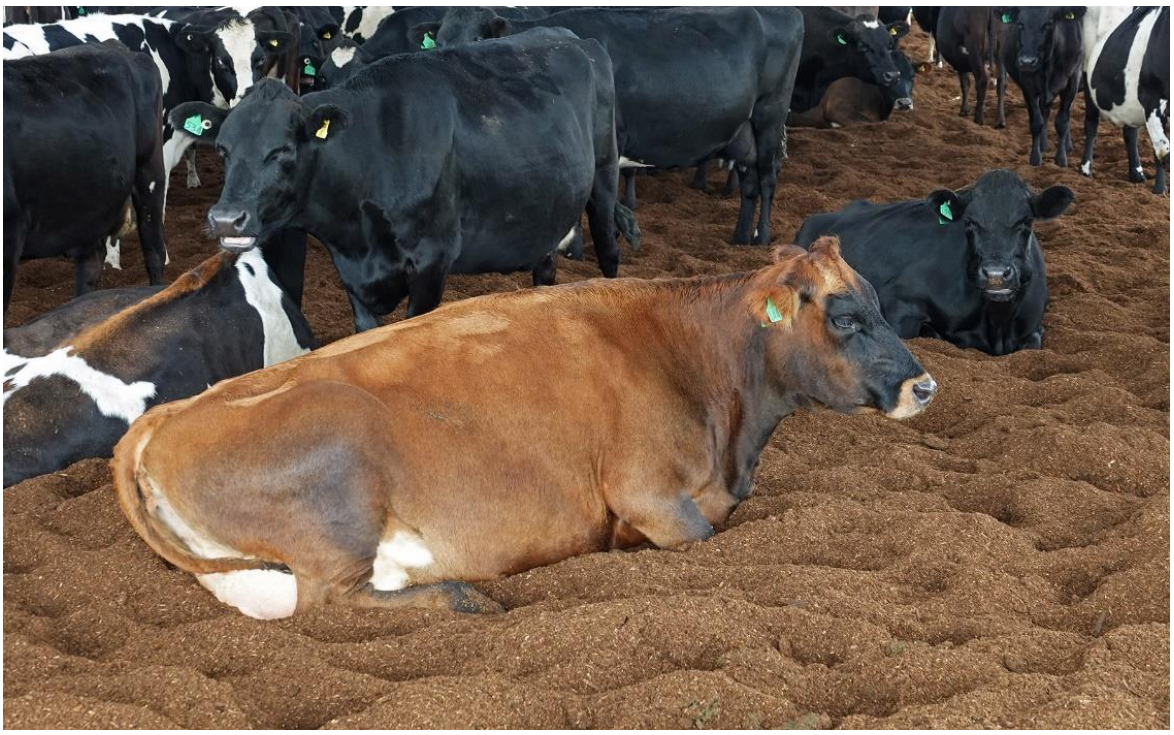

Photo 14. Cows back in the tilled shelter

Photo 15. Shade sails used to reduce wind and rain on exposed sides.

These side structures are proving remarkably effective in reducing both wind and rain, and also can be very cost efficient. The material is weather-resilient and similar to a trampoline. In other situations, roll-up structures may give flexibility for air movement.

Photo 16. A North Island hoop structure in a windy site.

Note internal water troughs, wood-chip bedding, and external feed pads. Works well in this location

Bedding Materials and Composting Processes

The key insight is that the bedding material must include plant materials that include lignin. Lignin is the form of plant material that allows trees and tall plants of say three metres and above to stand upright. In contrast, cereal straws from crops such as wheat and barley are not suitable, at least by themselves, as once they get wet they will turn to mush.

As a starting point, suitable bedding materials include sawdust, wood shavings and wood chip. The Allcocks have a strong preference for sawdust and wood shavings relative to woodchip. However, some other farmers speak well of their experience with woodchip. If using woodchip, then small and thin is going to be superior to large chips.

Other materials that will compost very well include miscanthus stems, or more specifically *Miscanthus x giganteus*, with this being a sterile (non-seeding) perennial hybrid from within the Miscanthus genus which grows to a height each year of around four metres. The leaves drop in late autumn and the stems can then be harvested any time up to October when the plant starts to grow again (It is a C4 photosynthesis plant, with seasonal growth that approximates the growing season of maize). The plant will grow throughout New Zealand but yields will be lower in southern districts. There is an extensive literature from many parts of the world including New Zealand on the use of miscanthus for bedding, shelter and bio-fuel with much of this freely available on the internet.

A farmer-trial of miscanthus at the Allcocks, for which I received funding from Synlait, demonstrated that miscanthus composts quickly – it is a fast burn. The composting bacteria love it!

Photo 17. Early to mid-season miscanthus in Canterbury

The hurd (stems) from hemp will also compost with considerable efficiency. This is known from overseas experience.

A small trial at the Allcocks using biochar did not generate the temperatures we were looking for. Based on those results, I cannot recommend biochar.

One of the Tillamook farmers that I visited was using a combination of cereal straw (because of low cost) combined with sawdust (which was more expensive). This combination was working for him but with regular top-ups of both straw and sawdust. I would be cautious of recommending this without further farm trials here in New Zealand. However, there may well be particular merit in having cheap straw on hand to deal with a high moisture content in late winter. I have some confidence this can work but efficiency parameters remain to be ascertained.

The greatest concern of farmers who have existing composting structures is that if everyone starts building these structures then there will be a shortage of suitable bedding materials. There are potential solutions, including forestry wastage, and growing special high-yielding crops such as miscanthus. *However, the issue of bedding availability is the most important practical issue to be addressed if composting shelters are to become mainstream in the dairy industry.*

Managing the compost

This is a critically important issue, with temperature being the 'canary in the mine'. I tend to advocate twice daily, but in most cases farmers are only tilling once, and as long as that is working for them then that is fine. The key test is temperature and as long as the temperature in the compost pack at 15 to 30 cm depth is between 50 and 60 degrees Celsius, then there is no problem.

Recently, I have had reason to consider whether temperatures somewhat lower than the 50 to 60 degrees C that I have recommended above may still be satisfactory. I have noted that super-efficient aeration with implements that create a fluffy light surface can lead to the temperature in the top 30+ centimetres dropping by five to ten degrees Celsius in a matter of minutes following tilling, with this associated with a thick cloud of steam as water evaporates. Accordingly, somewhat lower temperatures than 50 degrees Celsius may be satisfactory.

I strongly advise any farmer investing in a composting mootel or shelter to purchase a thermometer probe that can give instant readings while walking through the barn. Also, at least in the learning phase, these readings should be taken at least once a week.

If the 'temperature canary' is not 'chirping' nicely at the desired temperature then something needs to be done urgently. It might be that more bedding needs to be added or it might be that cow-stocking rate has to be reduced or both. If a farmer calls me and says that the compost seems to be dying, then I say these are the two actions (more bedding or less cows) that need to be taken 'today' while we figure out the long-term solutions. Once compost dies then bringing it back to life is unlikely without new bedding being added.

Another 'canary in the mine' is whether the udder and teats of the cows are staying clean. If the udder and teats are not clean, with bedding sticking to them, then moisture levels are too high.

The tilling system is a function of bedding material and use. The key aim is to achieve aeration, both to ensure the composting processes are aerobic and also to facilitate evaporation. There is a range of implements that farmers use. These include tyned implements, power harrows, rotary implements and a spading implement. Rotary implements that tend to consolidate rather than aerate are not a good choice with sawdust, but may be useful initially for miscanthus, particularly if the miscanthus has not been chopped sufficiently finely at the outset. *Whatever implement is chosen, the aim has to be aeration and avoidance of a pan.*

Area requirements

This issue is tricky as it depends so much on the infrastructure system and also the farming system and hours of use of the barn. About the only simple statement I can make is to ignore any data relating to the area of compost per cow coming from either Europe or America where the cows are typically in the barn '24/7/52' apart from when they are being milked. These overseas cows are also larger than typical New Zealand cows, and with considerably higher feed intake associated not only with their size but also to meet lactation requirements while housed in the barn. In addition, many of these overseas structures have been influenced by prior experience with free-stall barns, and using a similar configuration of bedding area plus alley ways that fails to make use of the full potential of the composting system.

The Allcock mootel operates efficiently with cows of 500+ kg liveweight with 5.5 sq metres of compost per cow. My calculations using information provided by Tony Allcock are that they get approximately 25 cow days (i.e., 600 cow hours) per sq metre of compost per annum. Also, they get about 40 cow days per year per cubic metre of bedding. My expectation is that if the bedding was 800 mm in depth, then the number of cow days per cubic metre would not change greatly but the number of cow-days per annum per square metre might increase considerably.

Other composting structures that I have visited have not achieved the same efficiency of use as the Allcocks and are typically operating at around seven square metres of compost area per cow. This is a function both of infrastructure, tilling system, hours of usage and choice of bedding. We know that composting can work throughout New Zealand but we have more to learn to quantify a range of key factors

The key point in this section is that the necessary area is a function of a range of factors regarding design, bedding material, bedding depth, tillage system and hours of use over the year. The crucial period is likely to be winter when usage is higher. It is particularly important to recognise that the composting efficiency and moisture removal is determined more by the composting temperature rather than the external ambient temperature. Some farmers think that the composting actually works best when the ambient temperature outside the barn is cool rather than warm. This may well be correct, because low ambient temperature may enhance the expulsion of air through the roof venting. *When composting is working well it seems very simple, but there are crucial tipping points*. Particularly in the South Island, there is minimal natural evaporation in winter and it all relies on the composting process.

I consider there is merit in farmers with large herds giving consideration to multiple but adjacent composting shelters, and staggering the construction thereof. The performance of the first shelter can then influence the size of the second one. As a general rule, there are

animal behaviour and management benefits from two separate sheds, although one farmer has been adamant that he wants just the one shed. One point I am reasonably firm on is that a long narrow shed is not a good idea. I personally favour shelter units of around 300 cows, alternatively side-exiting options for larger sheds.

I note that the Allcocks typically do their annual bedding change in mid-winter and then store the removed compost on concrete until spring. I see merit in this, given that winter is the period of maximum pressure within the shelter or mootel to keep the bedding dry.

I am sometimes asked whether it is possible to have a composting system without a roof. The simple answer is 'No'. Shelter from rain is essential. This includes protection from rain blowing into the shed under storm conditions.

Animal Performance

Animal Health

American experience is that animal health is generally superior in a compost barn to free-stall barns. In the New Zealand context, the key issue is that cows that are warm, dry and appropriately fed will be healthy cows. There should be no significant metabolic issues – indeed considerably less than under common pasture conditions.

The one issue that needs to the emphasised is the risk of what happens if the compost dies. The key risk is *E. coli* mastitis, which is a very nasty form of mastitis that at best greatly damages the udder and at worst kills the cows. Vaccination is an option – the drugs are off-label in New Zealand but can be supplied under veterinary supervision. However, although the vaccination should prevent death it will not prevent infection. The key issue is to keep the compost warm and well aerated, in which case *E*. coli and other anaerobic organisms should not be an issue.

Milk production

Previous research published in 2015 into the use of wintering barns (non-composting) in New Zealand indicates that on 14 case study farms the production per farm increased on average by 23% (range 6% to 41%) and per cow by 20% (range 6% to 38%) after incorporation of a barn.[3]. Many of the barns were within their first two years of operation and hence the post-barn production had not necessarily stabilised. The purpose of presenting that summary data here, *albeit not relating to composting structures*, is simply to acknowledge the reality that farmers who have wintering barns do typically change their farming systems such that the combined effects of the barn plus a change in farming system do lead to production increases.

This situation is also reflected in data from the Allcock mootel which shows total farm production increasing from approximately 360 – 380 kg Milksolids (MS)[4] per cow (fat plus

[3] https://www.agfirst.co.nz/wp-content/uploads/2016/02/Economic_Analysis_of_Wintering_Barns.pdf ,p33.

[4] The capitalisation of 'Milksolids' and 'MS is consistent with industry usage in that the term includes fat plus protein but not other milk solids such as lactose and minerals, and capitalisation is to identify this.

protein) prior to construction of the mootel to 550-600 kg MS per cow in the most recent years, without any change in farm area or in their case from any change in cow numbers.

Some of the factors contributing to increased production in a composting mootel or shelter *can* be as follows:

1) Milking cows closer to the calving date. For example, it is normal practice in Europe and the USA to milk cows to within 45-50 days of calving. This leads to an increase in biological efficiency of the system as long as cow condition and hence feeding is adequate. It can shift mean lactation length, still within a seasonal pattern, to in excess of 300 days compared to the New Zealand average of approximately 268 days (DairyNZ 2020)[5].
2) Increased production from better-conditioned cows
3) An older herd through better fertility and hence decreased annual replacement rate
4) Increased pasture production from reducing or eliminating pasture pugging
5) Increased feeding levels and less feed wastage
6) Improved animal health.

These issues are taken up in more detail in the next section.

Feed and biological efficiency

Farming systems with dairy composting structures provide multiple options for feed. One option for winter feed is that cows still paddock-graze every day but return to the shelter after two to six hours. A second option is to provide some or all winter feed within the structure. Within each of these overarching categories, there are multiple choices of specific feed depending on location and cost.

Most farmers using barns of various types find that their winter feed requirements drop considerably. For example, Southland farmers advise me that their winter feed requirements in a free-stall barn can be reduced from a daily allowance of 14-15 kg DM (and in some cases more) down to about 9-10 kg. These reductions reflect both a substantial reduction in wastage and also reduced maintenance requirements in a barn environment. In the case of a composting mootel, the feed requirements will be similar to a free-stall barn (or perhaps a little less because of the warmth generated within the compost) but with much cheaper infrastructure and without the effluent management issues. Initial evidence I have from a new Southland composting structure going through its first winter provides confidence that the estimate of 9-10 kg may be on the generous side (i.e., less may be needed) assuming good quality feed. Feed requirements as set out at https://www.dairynz.co.nz/feed/nutrition/ assuming minimal wastage provide a good starting estimate.

Within the Overseer nutrient modelling program, utilised pasture is calculated as a back calculation from inputs of animal stocking rate, animal liveweights, animal outputs and supplementary feed purchases. Back in 2017, these calculations indicated for the Allcock property that pasture consumed had increased over 40 percent compared to the pre-mootel situation. In reality, this is likely to be a significant over-estimate given that Overseer will not

[5] DairyNZ *2020. New Zealand Dairy Statistics 2019/20*. https://www.dairynz.co.nz/media/5794073/nz-dairy-statistics-2019-20-dnz.pdf

have allowed for reduced animal maintenance within the composting system. However, the size of this increase is a measure of the overall higher biological efficiency of the system on this property taking into account both improved pasture management as a consequence of using the mootel as a management tool, including greatly reduced pugging, plus saving in animal requirements.

The purpose here is not to lay down specific systems and associated production increases. Rather, it is simply to identify that there is both logic and empirical data indicating that positive changes occur to milk production, feed efficiency and biological efficiency within dairy composting systems in association with duration-controlled grazing compared to traditional paddock-based wintering.

Labour implications

The labour implications of dairy farm systems that incorporate composting infrastructure will depend greatly on the specific system. In the case of the Allcock composting mootel, the specific new labour requirement is daily tilling of the mootel. There are, however, also labour savings. For example, by using a batt-latch system during the milking season, the cows self-muster to the mootel an hour or two before milking and are all ready to be walked across to the milking shed. In the particular case of the Allcock mootel, average per cow production has increased from 360-380 kg MS (depending on year) to between 550 –600 kg MS (but also depending on year) and this has had a highly favourable impact on labour inputs per unit of production.

A number of farmers report very favourably on composting structures as a highly superior environment for calving.

Nitrogen leaching

There is a significant body of New Zealand research showing that nitrogen leaching within New Zealand pasture-based dairy systems is urine-related[6, 7]. Within this body of evidence there is also clarity that this leaching is predominantly a function of the nitrogen deposited in urine patches during the second half of autumn and throughout winter.

A 2019 modelling exercise using Overseer v6.3.0 conducted on the Lincoln University Dairy Farm (Durie 2018) and with which I was associated estimated that controlled-duration grazing linked to use of a composting barn could reduce *urine-related* leaching from 42 kg N/ha/yr down to 3 kg N/kg/yr [8]. The specific grazing system was for cows to paddock-graze for six

[6] Christensen CL, Hedley MJ, Hanly JA, Horne DJ. (2019) Duration-controlled grazing of dairy cows. 1: Impacts on pasture growth, cow intakes and nutrient transfer. *New Zealand Journal of Agricultural Research*, 62:1, 23-47, DOI: 10.1080/00288233.2017.1418395

[7] Christensen CL, Hedley MJ, Hanly JA, Horne DJ. 2019. Duration-controlled grazing of dairy cows. 2: nitrogen losses in sub-surface drainage water and surface runoff. *New Zealand Journal of Agricultural Research,* 62:1. DOI: 10.1080/00288233.2017.1418396

[8] Durie, R., Woodford, K., and Trafford, G., 2019. Modelling of nitrogen leaching within farming systems that incorporate a composting barn: a case study of the Lincoln University Dairy Farm. In: Nutrient loss mitigations for compliance in agriculture. (Eds L.D. Currie and C.L. Christensen). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 32. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand.

hours in April and September, four hours May to August and 12 hours October to March, with cows for the remainder of each 24-hour period being in the composting barn except when they were being milked.

As part of that modelling exercise, and to provide the necessary winter feed for the cows that would now be in the milking platform during winter rather than on a separate runoff, it was assumed that fodder beet and maize silage would be grown on the milking platform. This resulted in what Overseer terms 'other' N-leaching increasing from 5 to 29 kg N/ha/yr averaged across the whole farm. This is consistent with previous research relating to fodder beet and maize cropping (Ledgard et al., 2006[9]; Smith et al., 2012[10]; Shepherd et al., 2012[11]), with those losses attributed both to a lack of plants available to soak up excreted N during the winter drainage season in grazed crops, plus soil N mineralisation during cultivation, and with earlier research on those issues coming from Di and Cameron (2002)[12].

There are two key insights of importance in relation to composting barns that arise from this modelling. The first is that urine-related leaching can be greatly reduced by a composting mootel or similar. This finding derives directly from published empirical research on duration-controlled grazing which is incorporated within the Overseer modelling process. However, incorporation of cropping systems on the milking platform creates new sources of leaching on these platforms with these activities previously undertaken on runoffs.

At the Canterbury composting shelter, the chosen solution is to rely on pasture silage as the main winter feed. This will eliminate any cropping activities. Overseer modelling of this system is not currently available but will be forthcoming.

There is also a range of other results from Overseer in relation to composting infrastructure situations on other farms. The 'big picture' from these analyses is that major reductions in nitrogen leaching are feasible. However, these analyses, undertaken by different analysts and with different assumptions and typically linked to regulatory purposes, lack the consistency of method to provide anything more specific. It is also of relevance here that within Overseer there are no modules specific for composting motel or shelter situations and hence various work-arounds are necessary.

There is a lot more information that is now needed in relation to the N-leaching outcomes that can be achieved on multiple soils in multiple locations and with multiple farming systems. This will be taken up in a later section of this report.

[9] Ledgard, S., Sprosen, M., Judge, A., Lindsay, S., Jensen, R., Clark, D., & Luo, J. (2006). Nitrogen leaching as affected by dairy intensification and mitigation practices in the Resource Efficient Dairying (RED) trial. In Currie, L.D., & Hanly J.A. (Eds.), Occasional Report No. 19 (pp. 263-268). Fertiliser and Lime Research Centre, Massey University.

[10] Smith, L.C., Orchiston, T., & Monaghan, R.M. (2012). The effectiveness of the nitrification inhibitor dicyandiamide (DCD) for mitigating nitrogen leaching losses from a winter grazed forage crop on a free draining soil in northern Southland. Proceedings of the New Zealand Grassland Association 74: 39-44.

[11] Shepherd, M., Stafford, A., & Smeaton, D. (2012). The use of a nitrification inhibitor (DCNnTM) to reduce nitrate leaching under a winter-grazed forage crop in the Central Plateau. Proceedings of the New Zealand Grassland Association 74: 103-108.

[12] Di, H.J., & Cameron, K.C. (2002). Nitrate leaching in temperate agroecosystems: sources, factors and mitigating strategies. Nutrient Cycling in Agroecosystems 64(3): 237-256.

Greenhouse Gases

There are no empirical data on the effect of dairy composting infrastructure on greenhouse gas emissions. However, to the extent that the composting mootel and shelter system leads to higher production per animal compared to other New Zealand systems, then the methane-emission intensity will decline.

In relation to nitrous oxide, then logic suggests that nitrous oxide emissions will decline. This is because the nitrogen emitted in urine and cow faeces is incorporated into the compost which is spread evenly across the paddocks. The consequent emissions will be less than if the urine and faeces are directly deposited on the soils in concentrated form, or stored anaerobically in effluent ponds. It is particularly notable that composting structures that are operating effectively have no ammonia smell which gives considerable confidence that a very high proportion of the nitrogen is being captured within the compost.

The issue of greenhouse gases is another issue to be taken up in later sections of this report.

Costs and economics

I am cautious about generic statements relating to the economics as these outcomes depend to a great extent on the specifics. This is illustrated by the diversity of IRR returns ranging from +16% to -10% for the 14 wintering barn case studies undertaken by Journeaux and Newman (2015)[13]. I emphasise here that those case studies were not of composting barns (except for one new one at that time with very limited data) and so the specific numbers are of close to zero relevance. What is relevant is the diversity of outcomes demonstrating 'that it all depends'.

My own perspective is that the only way forward in relation to economics is to work with farmers on specific cases. Accordingly, the comments that follow are designed as input to such analyses rather than as 'headline-type' answers.

Infrastructure costs

The essential infrastructure of a composting mootel or composting shelter is very simple. It comprises a roof structure with a gap in the roof at the apex to allow warm air to exit. The cost of the metal-roof structure and long-life metal supports is currently of the order of $160 -$180 per square metre. As one example, assuming a compost area of 5.5 square metres per cow then the total cost of this structure is of the order of $1000 per cow.

Depending on the particular farm, its location, and its existing infrastructure, this per cow cost of the roofing structure may be as little as one third of the total investment, or it may be close to the total investment.

For example, one farming group I am associated with that is giving consideration to composting infrastructure already has a covered feed pad and all the necessary equipment for

[13] Journeaux, P. and Newman, M. (2015). *Economic & Environmental Analysis of Dairy Farms with Barns*. https://www.agfirst.co.nz/wp-content/uploads/2016/02/Economic_Analysis_of_Wintering_Barns.pdf

feeding. For this farming group, the additional costs over and above the fundamental roof structure will be minor.

Flooring requirements will depend on location. Stabilised pit shingle is an example I have referred to earlier. Clay is an option in some locations. A key factor is the reality that if the compost system is operating appropriately then all moisture generated within the composting structure will evaporate and there will be no seepage.

Caution is appropriate when comparing alternative types of structure, for example tunnel houses, that the comparisons are 'like-for-like' in terms of both the included items and the associated performance.

Tax Depreciation

The current taxation rate for depreciation of 'barns' according to the IRD website would appear to be 8.5% DV or 5% CP, and the 8.5% rate is what was used by Journeaux and Newman (2015) (*op cit*) in their study of non-composting wintering barns. Note that these are the specified generic rates for 'barns'. Taxation issues can be complex and farmers should take specific advice from their accountant.

Economic depreciation

It is important to note that the issue of financial depreciation for taxation purposes is a separate issue to the question of appropriate economic life which leads in turn to the effective economic depreciation. *An understanding of this principle is fundamental to any analysis of alternative farming systems*.

In determining the appropriate economic life of a composting structure, it needs to be recognised that the structure itself has minimal short-life components, and a physical life of 50 years is realistic and indeed conservative. Also, the non-specialised nature of the structure means there may be alternative uses independent of dairying. This is in contrast to free-stall barns where there is a major specialised internal fit-out component to the barn plus major effluent investment.

In contrast, tunnel-house structures that have plastic or other non-metal components are likely to have component replacement costs which need to be factored in.

Cost of production

Once again, the only generic answer is that 'it all depends'.

The 'big picture' experience with the Allcocks includes that in the year prior to building the mootel, they installed in-shed feeders. The accounts demonstrate that the cost of production per kg MS immediately increased. However, once the composting mootel was built, the in-shed feeders became unnecessary and the cost of production for each kg MS declined to a comparable figure to the prior situation. The key insight is that although supplementary feed costs have increased, other costs such as labour and fixed costs are now spread over many more kg MS. Also, fertiliser requirements have reduced. My 'big picture' calculations indicate that an overall investment approximating $1 million, including feed bunkers and machinery, have led to additional net income per annum in the order of $150,000, together with

improved environmental outcomes. Debt per kg MS for this farm is remarkably low by average New Zealand dairy farm standards, leading to considerable milk price resilience.

Financing Issues

My experience is that lending institutions are currently wary of any capital expenditure on farms that have debt above $20 per kg MS. In addition, lending institutions can be particularly wary of lending for anything that is a 'barn', without necessarily appreciating the fundamental difference of a composting structure to other barn structures.

Research, Development, Education and Extension (RDE&E) needs

The previous section of this report has sought to demonstrate that there is great potential associated with composting motel and shelter technologies in association with duration-controlled grazing and that these technologies are already being implemented by some innovative farmers with considerable success. However, the technologies and associated farming systems are not incorporated yet in any meaningful way within industry research, development, education and extension systems, hereinafter referred to as RDE&E.

In the New Zealand context, the specific published literature relates to two papers published by the Farmed Landscapes Research Centre (previously Fertilizer and Lime Research Centre) at Massey University for which I am part of the authorship teams (Woodford *et al* 2018[14]; Durie *et al* 2019[15]). There is also a Lincoln University honours project exploring design and performance aspects of a composting mootel at Lincoln University (Durie, 2018)[16] of which I was a co-supervisor. There is also a range of what might be called 'popular literature' almost exclusively written by myself and archived at https://keithwoodford.wordpress.com/category/composting-mootels/ . The time has come for a much more structured RDE&E approach.

It was back in February 2018 I summarised this situation as follows.

> "There is a need for a structured R&D program to assist the early adopters and then communicate the learnings more widely. Investigations need to span the farming system, but with particular focus on composting processes and outcomes using a range of bedding materials, and in different geographical locations. Also, investigations are needed of biological processes and nutrient losses within the composting lifecycle, together with the effect of adding composted nutrients to

[14] Woodford, K., Roberts, A. and Manning., M., 2018. Dairy composting barns can improve productivity, enhance cow welfare and reduce environmental footprint: A synthesis of current knowledge and research needs. In: Farm environmental planning – Science, policy and practice. (Eds. L. D. Currie and C.L. Christensen). http:flrc.massey.ac.nz/publications.html. Occasional Report No. 31. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand.

[15] Durie, R., Woodford, K., and Trafford, G., 2019. Modelling of nitrogen leaching within farming systems that incorporate a composting barn: a case study of the Lincoln University Dairy Farm. In: Nutrient loss mitigations for compliance in agriculture. (Eds L.D. Currie and C.L. Christensen). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 32. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand

[16] Durie, R. (2018). The Economic and Environmental Implications of Incorporating Composting Barns into New Zealand Dairy Systems. B Agr Sci Honours Dissertation, Lincoln University, NZ.

soils at different C:N ratios and across different soil types, together with greenhouse gas emissions for these systems. More generically, further quantification of N-leaching losses under a diversity of controlled-duration grazing systems and for various soil types is necessary. Although monitoring of commercial farms can provide major insights, structured investigations are also needed within more formal R&D settings."

(Woodford *et al* 2018, *op cit.*)

In the more than three years since then, there has been minimal structured progress on any of these fronts. Rather, it has been farmers and associated industry firms that have been attempting, each in their own way, without any formal co-ordination or overarching dairy-industry support, to push out the current frontiers of knowledge.

Here I outline seven broad categories of research programme that are needed. This list should not be considered exclusive. Although the projects are listed separately, arguments can be mounted for bringing at least some of them together. In a perfect world, there would be an overarching program with its own governance, with many sub-programs and individual projects therein.

In reality, it is normal for research projects to not only create new knowledge but also a new set of research questions. Current New Zealand pasture-based systems have evolved over a period of approximately 150 years and the search for improvement is still ongoing. It will be the same for systems incorporating composting structures in association with duration-controlled grazing.

Seven identified domains of RDE&E follow.

1. Nitrogen leaching within composting mootel and composting shelter farming systems

    a) *Modelling studies with Overseer across soil types, climates and farming systems*. These might be undertaken for approximately ten regions (for example Northland, Waikato, Bay of Plenty, Central Plateau, Taranaki, Manawatu, Hawkes Bay/Wairarapa, Nelson, West Coast, Canterbury/North Otago, Southland/South Otago). The chosen farms will be 'real farms' with data for their existing conventional system including Overseer data and the subsequent data for a dairy composting system will be modelled under various scenarios as to specific feeding systems and pasture-grazing duration. The key research question will be to what extent can nitrogen leaching be reduced and minimised within a composting system linked to duration-controlled grazing, estimated using the principles embedded within the Overseer system.

    b) *In-depth field investigations, including lysimeters, on a range of properties with in situ composting structures and associated duration-controlled grazing systems* This component arises from acknowledged limitations within the Overseer modelling system, and hence the need for further validation and incorporation within biophysical models.

2. Farm system and economic studies of dairy composting systems

a) *Existing infrastructure systems and related farming systems*
This study requires in-depth analysis of biophysical and economic performance of farms that are using composting technologies. Initially this will be constrained by the number of available case studies on commercial farms. However, in all likelihood more than ten appropriate farms exist for such a study.

b) *Demonstration farms*
There is a key need for the composting infrastructure technologies and duration-controlled grazing systems to be incorporated within demonstration farms and there are several existing farms in New Zealand where this could occur. The advantages of a demonstration farm associated with an RDE&E institution are the diversity and depth of biophysical and financial data which can be collected, analysed, published and then linked into education and extension programmes.

c) *Bio-economic modelling of dairy composting systems*
The specific scenarios to be investigated could be informed by early results of the N-leaching study and will also be informed by the study of existing structures and systems and over time by demonstration farms. A well-structured programme should form the basis for ongoing analyses over many years. Accordingly, this would be a long-term programme, including strong links into education and extension.

3. Investigating and enhancing the supply of bedding materials for composting systems
There is need for a comprehensive analysis of bedding resources both currently and potentially available, and the actions that are necessary to augment these. These resources can be by-products and waste from the timber industry or specially grown crops such as miscanthus. The key requirements of this project include inventory analyses of existing and potential feed sources and leading though into actions for enhancement.

4. Composting processes within composting mootels and shelters
It is clear from empirical experience that there are complex interactions between bedding type, tilling system, stocking rate, infrastructure design and air movement. There is a need for more information as to how the composting systems and organisms (aerobic and anaerobic) within these systems respond to these factors. This project should ideally include a team with expertise that spans composting biology and factors affecting the physical movement of air both within the composting shelter and within the compost itself.

5. Optimal design studies of composting infrastructure
Current knowledge of optimal infrastructure design is experiential. There needs to be

more engineering science in relation to air movement and the factors that influence that movement, with this linking back to specific design features such as height of walls, roof pitch, venting systems and directional location. This research domain links closely to research on composting processes.

6. Greenhouse gas emissions within dairy composting farming systems
   a) *Nitrous oxide*
      There is a need to measure 'whole of system' nitrous oxide emissions within the composting structure (expected to be low with N incorporated into the compost) and within the overall shelter/compost/soil/pasture/animal system, using case study farms and empirical measurement. This is best undertaken within a system dynamics framework (stocks, flows, connectors and converters). It is realistic to postulate that nitrous oxide emission will be considerably lower than both traditional grazing systems and non-composting barn systems.

   b) *Biofiltration of methane emitted within composting mootels and related structures*
      This is the topic of a 'Smart Ideas' application to Government led by University of Canterbury that is currently under second stage assessment. This is an issue of 'science-stretch' with fundamental questions still to be answered.

7. Education and Extension
   The above domains of research do not automatically lead through to industry uptake. Hence there is a need for overall integration of findings within an industry development framework incorporating extension and education.

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