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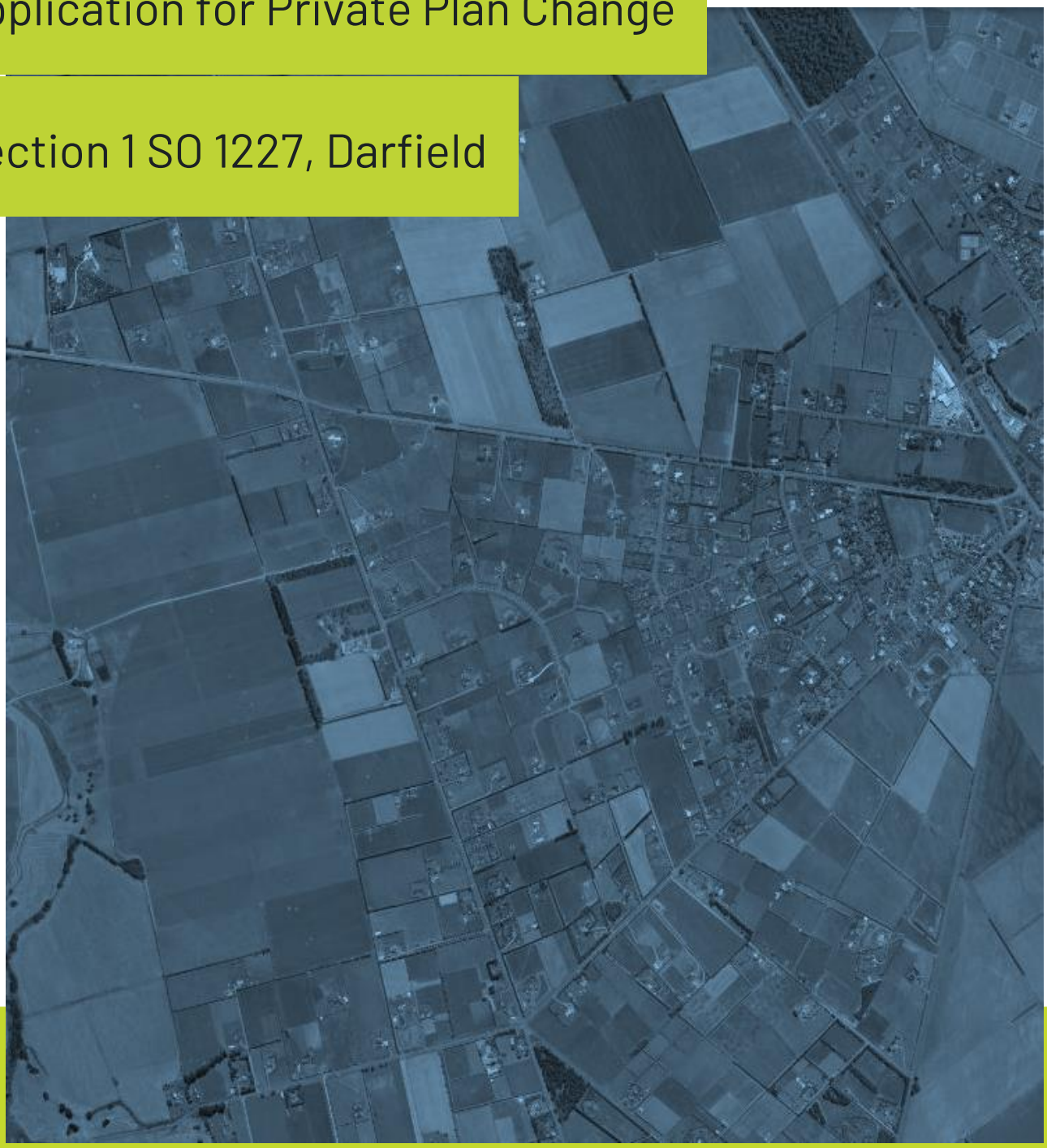
Application for Private Plan Change

Section 1 SO 1227, Darfield



CLIENT

Rupert and Catherine Wright

ADDRESS

Corner Creyke Road and SH73, Darfield

REFERENCE

6096

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Report Information

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Contents

1 Executive Summary

Under s73(2) of the Resource Management Act 1991, Rupert and Catherine Wright ("the Applicant") request a change to the Selwyn District Plan (the District Plan).

The plan change application proposes to rezone approximately 30.76 hectares (ha) located east of Darfield on a segment of land bound by West Coast Road (SH73) and the intersection of Crekye Road, from Rural Outer Plains to a mix of Business 2 and a Living 1 (Darfield East) zone. The Plan Change seeks to insert an Outline Development Plan (Darfield East ODP) with site-specific rules to facilitate the development of a business zone adjacent to SH 73 and up to than 35 residential sections on the south boundary with an average density of 1,950 m^2.

The application site has been identified in the Malvern Area Plan as area DAR6, suitable for low density residential development or business development. A number of potential constraints have been identified through investigations including effects arising from previous use of the site generating potentially contaminated soils; use of business zoned land across SH73 for an intensive farming operation and for the discharge to air associated with a clay brick factory; and the proximity of new business zoned land to existing and proposed residential land uses.

The proposed Darfield East ODP and associated rule amendments to the District Plan provides for mitigation measures to either avoid or mitigate potential effects arising from the future use of the site as business or residential use. One of the key measures is a landscaping buffer around the business zoned land that serves as a visual screen and provides physical separation between the application site and surrounding land to the north, east and west. The landscaping also serves as a physical separation buffer for the proposed residential zone to the south of the application site. Traffic effects are managed through the proposed upgrade of the intersection of State Highway 73 and Creyke Road prior to any large scale development of the ODP area.

Once rezoned, the site can be developed in accordance with the various statutory requirements of the Canterbury Land and Water Plan and the Living and Business zone standards of the Selwyn District Plan. An Outline Development Plan (ODP) has been developed for the site observing the principles of the Urban Design Protocol (Ministry of the Environment, 2005) as well as the national guidelines for Crime Prevention Through Environmental Design (Ministry of the Environment, 2009).

The assessment under section 32 of the Resource Management Act and the appended reports validate the suitability of the site for rezoning for the use of residential and business zoning and assesses the effectiveness and efficiency of the proposed methods to achieve this rezoning.

2 Summary of Application Details

This report is an application for privately initiated plan change (including a description of the actual and potential effects on the environment) for land legally described as Section 1 SO 1227 Darfield. This application has been prepared in accordance with Schedule 1 of the Resource Management Act 1991 ('RMA' or 'the Act').

Applicant:	Rupert and Catherine Wright
Land Owner:	Rupert Jack Wright and Catherine Elizabeth Wright
Owner's Address:	13B Mulholland Drive, Darfield, 7571
Site Address:	Corner Creyke Road and State Highway 73, Darfield
Legal Description:	Section 1 SO 1227, Darfield
Record of Title:	CB39B/123 (attached in Appendix 1)
Site Area:	30.76 hectares
District Plan Zoning:	Selwyn District Plan Outer Plains Zone
Proposed Activity:	This application seeks a plan change under s72(1) of the Resource Management Act 1991 to rezone the application site from Outer Plains to Business 2 and Living 1 zones in accordance with the Outline Development Plan attached in Appendix 2.

3 Overview

3.1 Purpose of the plan change

The purpose of the Plan Change is to allow for the rezoning of 30.76 ha of land on the eastern edge of Darfield township form its current Rural (Outer Plains) zoning to a Business 2 (17.5 ha) and Living 1 (Darfield East) Residential Zone (7.1 ha) and the balance area (6.61 ha) in roading and road reserve. This land is identified in Selwyn District Council's Malvern Area Pan as being suitable location for future residential and/or business use. The new residential zone includes site specific controls to provide densities lower than the standard Living 1 zone in Darfield. The new business zone will form a symmetrically zoned and coherent business entrance to the township along SH 73.

The rezoning of the land represents a sustainable and efficient use of the land resource in that it will not limit future growth or create adverse effects with surrounding rural land. The location is optimal in respect to integrating with existing and proposed residential land to the south and west of the site and promotes a self-realising environment for business development on the periphery of the township.

The proposed rezoning is consistent with the objectives and policies of the Selwyn District Plan and gives effect to the Canterbury Regional Policy Statement. The business zone is consistent with the Malvern Area Plan and the residential land will make provision for residential accommodation without creating inefficient use of land or infrastructure.

The plan change request provides for the sustainable and integrated provision of business land and residential land with use of an Outline Development Plan (ODP) to ensure coordinated and well planned outcomes that take into consideration the surrounding existing environment.

3.2 Reason for request

The reason for this plan change request is to provide for business and residential development in one of the preferred locations identified in the Malvern Area Plan following a detailed assessment of planning outcomes for the region, associated consultation and public submission process.

Selwyn is the second fastest growing District in the South Island[1] with this growth primarily occurring within easy commuting distance of Christchurch City and Rolleston. To inform the development of the 2018-2028 Long Term Plan Council has updated its population projections out to 2048. The projections for Darfield are illustrated below:

[1] https://www.selwyn.govt.nz/services/planning/population

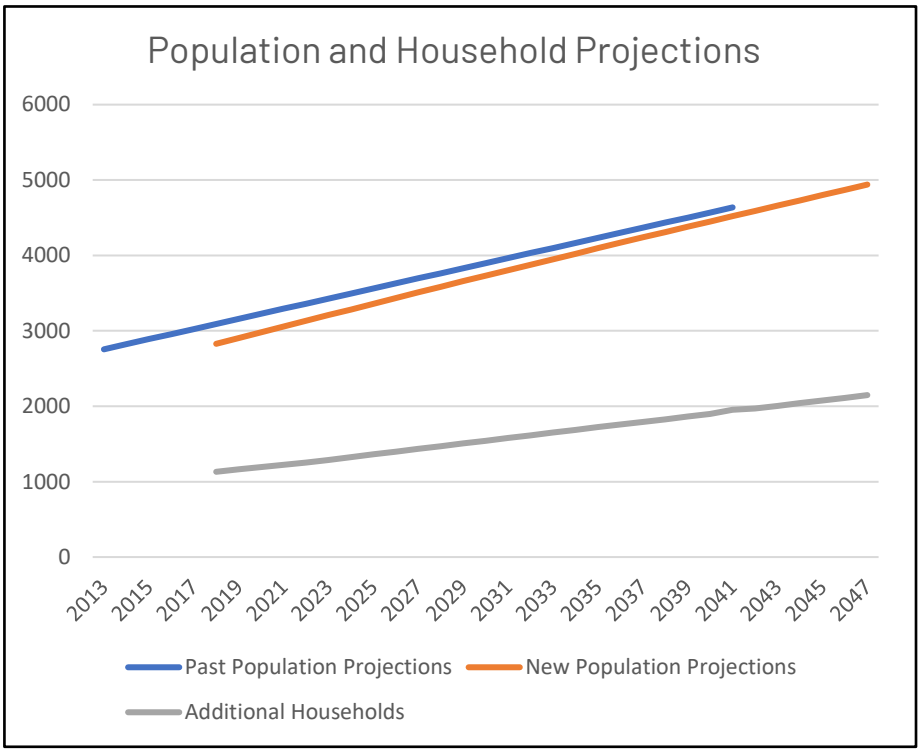

Figure 1 - Darfield Population and Household Projections 2013-2047

The total population growth estimated for Darfield is 2,187 persons over the next 30 years or 1,047 additional households[2].

The proposed rezoning will assist in meeting the demand for residential sections in Selwyn District including Darfield, through the provision of an additional 35 residential sections that avoid adverse effects with surrounding commercial uses in the existing environment. The rezoning will also provide additional business or commercial land within close proximity to other business land, which will create synergies with servicing and supplying. Business land has been designed to be self-supporting and not detract from existing business zones within the centre of Darfield.

[2] https://www.selwyn.govt.nz/__data/assets/pdf_file/0016/234223/Projections-website.pdf

4 Statutory Framework

4.1 Resource Management Act

Under subsection 2 of Section 73, and under Clause 21 of Schedule 1 of the RMA, any person may request a territorial authority to change a District Plan and the Plan may be changed in the manner set out in Schedule 1 of the Act. Clause 22 of Schedule 1 states that:

(1) A request made under clause 21 shall be made to the appropriate local authority in writing and shall explain the purpose of, and reasons for, the proposed plan change to a policy statement or plan and contain an evaluation under section 32 for any objectives, policies, rules, or other methods proposed.

(2) Where environmental effects are anticipated, the request shall describe those effects, taking into account the provision of Schedule 4, in such detail as corresponds with the scale and significance of the actual or potential environmental effects anticipated from the implementation of the change, policy statement, or plan.

In making a determination on the request under Clause 25(2) of the Frist Schedule the territorial authority may adopt the request as if it were a proposed plan by the territorial authority, or accept the request in whole or part, and proceed to notify the request.

It is requested that the proposed Plan Change request be accepted in accordance with Clause 25(2)(b) of the First Schedule of the Act and that the territorial authority proceed to publicly notify the request under Clause 26. It is considered that there is no reason(s) to reject the request in whole or part under Clause 25(4) of the First Schedule.

Section 74 of the RMA requires that the Council, when amending its plan has regard to the provisions of Part 2 of the RMA, its function under section 31 and its duties under section 32. Section 74 also states that regard must be had to management plans and strategies prepared under Acts.

Section 75 of the Act states that a district plan must give effect to a regional policy statement.

4.2 Legal Framework

The Resource Management Act ("RMA" or "the Act") is the principal legislation for the management of the natural and physical resources of New Zealand. The Act provides a framework within which a privately initiated plan change may be exercised.

The proposed plan change is subject to the provisions of Part 2 (Sections 5, 6, 7 and 8) of the Act that set out the purpose and principles that guide this legislation.

4.3 Section 5 - Purpose

The term "sustainable management" is defined in the RMA as meaning:

...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 well-being 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.

Section 5 of the Act identifies the purpose of the Act as being the sustainable management of natural and physical resources. The proposed plan change is able to satisfy the purpose and principles of the Act, by providing for residential land and land for business in an appropriate location. The proposed plan change will promote the

integrated development of the land with any environmental effects able to be adequately controlled and mitigated through the use of new and existing District Plan rules, and through the use of the ODP.

The proposal to zone 7.1 ha of land to Living 1 and 17.5 ha to Business 2 land meets the enabling purpose of the Act. Further the Act seeks the development of land occurs in a way that ensures that any adverse effects on natural and physical resources can be mitigated whilst safeguarding the life supporting capacity of air, water, soil and ecosystems will be protected. The servicing report (attached in Appendix 3) for the proposal site envisages the future use of best practice stormwater and wastewater treatment and disposal systems and as such the life supporting capacity of the surrounding and wider environment will not be compromised.

4.4 Section 6 – Matters of National Importance

Section 6 of the Act requires certain matters to be recognised and provided for in relation to managing the use, development and protection of natural and physical resources. No matters of national importance are considered to be relevant to this proposal. The site is not adjacent to any coastline or waterway although there is a stock water race along the southern boundary. The site does not contain significant landscapes or significant indigenous vegetation, does not contain any known historic or cultural sites.

4.5 Section 7 – Other matters of the RMA

Section 7 of the act requires particular regard is had to certain matters in relation to managing the use development and protection of natural and physical resources. Of particular relevance to this Proposed Plan Change are matters (b), (c) and (f);

(b) the efficient use and development of natural and physical resources:
(c) the maintenance and enhancement of amenity values:
(f) maintenance and enhancement of the quality of the environment:

The proposal to utilise the land for residential and commercial purposes is considered to be an efficient use and development of a natural and physical resource as it is located adjoining an existing township and will achieve the aims of numerous strategic planning documents for the area. It has been demonstrated throughout this application that the maintenance and enhancement of amenity values will be achieved through considered landscape design, appropriate business zone building setbacks, the positioning of residential sections on the southern portion of the application site to avoid reverse sensitivity effects, and through appropriate boundary fence treatments along Creyke Road.

The proposal will maintain the quality of the environment by ensuring that water supply, wastewater and stormwater disposal can occur in a manner that does not adversely affect groundwater or surface water bodies.

4.6 Section 8 - Treaty of Waitangi.

Section 8 requires the Council to take into account principles of the Treaty of Waitangi. It states:

> *In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).*

The application site is not located in an area that contains significant cultural values identified in the District Plan. The proposal will not result in adverse effects on the health of water, groundwater, land or air, and therefore is unlikely to conflict with known cultural values in the region. It is anticipated that the plan change will be notified to local iwi specifically as part of the notification process.

4.7 Proposed National Planning Standards

In 2017 the New Zealand Government introduced legislation to establish national planning standards that standardise parts of district and regional plans, and to avoid significant variation between different district and regional Councils. The first set of changes were introduced in April 2019 with specific timeframes in place for councils to comply with the changes within their plans. The first set of changes include standardisation of zones that can be adopted across New Zealand.

Selwyn District Council is in the process of reviewing its district planning framework in line with the national planning standards and have identified two living zones for urban Darfield, a Living 1 zone and Living 2 zone. The proposed plan change seeks consistence with these anticipated zonings and avoids an additional new zone in Selwyn to accommodate the specific requirements of the proposed Darfield East ODP area. Controls in the ODP enable a Living 1 Zone with lower densities that the standard Darfield Living 1 Zone.

4.8 Assessment against relevant regional planning documents

Canterbury Regional Policy Statement

Under section 75(3)(C) of the RMA, district plans are required to give effect to regional policy statements, therefore an application to change a district plan must also enable the district plan, once changed, to continue to give effect to the regional policy statement.

The Canterbury Regional Policy Statement (CRPS) became operative on 15 January 2013, Chapter 6 of was inserted into the CRPS on 6 December 2013. The CRPS defines Greater Christchurch as including part of the Selwyn District. However, the geographic extent of Greater Christchurch as shown on Map A of the CRPS does not include the township of Darfield. Therefore, the objectives and policies of Chapter 6 of the CRPS are not relevant to the application site.

The objectives and policies of Chapter 5 – Land use and Infrastructure, provide the direction for the development of residential activities. The relevant objectives and policies of the CRPS are assessed in Appendix 7. The proposed plan change will not result in the District Plan no longer giving effect to the CRPS.

Canterbury Land and Water Regional Plan (CLWRP)

The Canterbury Regional Council has prepared a regional plan to manage the land and water resources of the region. The Land and Water Regional Plan (LWRP) was made operative on 13 August, 15 October 2015, 8 December 2016 and 23 February 2017, except for rules relating to Plan Change 5 Nutrient Management. The LWRP effectively replaces the provisions of the Natural Resources Regional Plan (NRRP) unless activities relate to nutrient management.

The proposed plan change does not include any of the matters still governed by the NRRP and therefore only consideration of the current LWRP is considered necessary.

The purpose of the LWRP is to identify the resource management outcomes or goals (objectives in this Plan) for managing land and water resources in Canterbury to achieve the purpose of the Resource Management Act 1991 ("RMA"). It identifies the policies and rules needed to achieve the objectives and provides direction in terms of the processing of resource consent applications. Although this application is not for a resource consent the objectives are applicable when considering the effects of implementing the proposed Outline Development Plan.

Pursuant to Section 75(4) of the RMA, the District Plan must not be inconsistent with any relevant regional plan. The proposed plan change does not seek to change any of the existing objectives and policies of the Selwyn District Plan and is considered to be consistent with these existing provisions (see Appendix 8 for a full assessment).

Currently it is generally accepted that the operative provisions of the Selwyn District Plan are not inconsistent with the LWRP and therefore this will also be true for the proposed plan change.

Development of the site at the time of subdivision will still need to comply with the provisions of the LWRP, or resource consents obtained for any non-compliances. The servicing strategy attached in Appendix 3 sets out that servicing on-site for stormwater and wastewater is feasible given the current ground conditions in the immediate area. Resource consents may be required under the LWRP for on-site wastewater disposal given the potential size of future residential allotments within the proposed Living 1 Zone less than 4 ha. However, there is a lack of reticulated services in Darfield for wastewater disposal that limits the potential options for all residential development in Darfield and it is generally recognised by Environment Canterbury that suitably designed on-site wastewater systems are acceptable in Darfield.

Mahaanui Iwi Management Plan 2013

The Mahaanui Iwi Management Plan (IMP) 2013 was released on 1 March 2013. It was prepared by the six Papatipu Rūnaka of the takiwā that extends from the from the Hurunui River in the north, to the Hakatere/Ashburton River in the south, inland to Kā Tiritiri o Te Moana (the Southern Alps), and including Te Pātaka o Rākaihautū (Banks Peninsula), and the coast. These parties are:

- Ngāi Tūāhuriri Rūnanga
- Te Hapū o Ngāti Wheke (Rāpaki) Rūnanga
- Te Rūnanga o Koukourārata
- Ōnuku Rūnanga
- Wairewa Rūnanga
- Te Taumutu Rūnanga

The IMP is a tool for tangata whenua to express their identity as manawhenua and their objectives as kaitiaki, to protect their taonga and resources, and their relationships with these. The IMP seeks to ensure that these taonga and resources are recognised and protected in the decision-making of agencies with statutory responsibilities to tangata whenua. Importantly it is also a tool that assists Papatipu Rūnanga representatives to articulate their values, issues and policy into statutory processes.

The IMP includes both general objectives and policies that includes the management of land, air, and water, and also includes region specific objectives and policies including for the Te Waihora area, which includes Darfield.

With respect to general objectives and policies the proposed plan change and application site will not affect landscapes or sites of cultural heritage or significance (Chapter 5.8). The application site does not contain any areas of significant biodiversity, and the proposal seeks to include increased landscaping around the perimeter of the business zone adding to the overall biodiversity of the Canterbury Plains consistent with Chapter 5.5 of the IMP.

The proposal includes the use of on-site wastewater disposal however there is sufficient separation distance to groundwater to ensure that there will not be adverse effects on groundwater or surface water. More than sufficient space within residential sections ensures separation from the water race along the southern boundary of the site can be achieved, and stormwater can be disposed of to ground consistent with the objectives and policies contained in Chapters 5.3 and 5.4 of the IMP. The proposal does not preclude individual land owners from installing rainwater collection and use from roof areas at the time of building development.

Chapter 6.11 is the area specific section for the Te Waihora area and has a key theme of Ki Uta Ki Tai (from the mountains to the sea) with respect to effects on Te Waihora/ Lake Ellesmere. Essentially the policies and objectives

of this section aim to reduce effects on the river and streams that flow into the lake. The proposed plan change has been designed taking into consideration the potential effect of resultant subdivision and development on the rivers and streams that flow into Te Waihora/Lake Ellesmere with generous section sizes to facilitate setbacks from the stock race along the southern boundary of the application site.

Regional Land Transport Plan 2015-2025

The Regional Land Transport Plan 2015-2025 (RLTP) became operative June 2016 and presents the strategic context for the Canterbury transport system and sets out the trends and drivers of the transport sector, now and into the future, and the associated challenges these raise for transport providers.

One of the key challenges identified in the RLTP is:

"effectively managing traffic growth to ensure that accessibility is maintained and that the region's economic performance is not adversely affected[3]*"*

The issue identified as increased demand for key roading infrastructure as population growth occurs and advances in vehicle technology make it easier to be reliant on private cars. The RLTP solution to this issue is to promote multi modal methods of transport, and to ensure that existing key networks are resilient. The proposed plan change will contribute additional residential development in Darfield, which is likely to increase the use of private motor vehicles within Darfield and between Darfield, Christchurch City and the wider Selwyn District. To promote multi-modal methods of transport the ODP includes additional pedestrian/cycle connections to enable access back to the centre of Darfield by way of foot and cycle to enhance local access to the proposed business zone for work opportunities. This is consistent with the intention of the RLTP.

The proposed plan change includes the upgrade of the intersection between Creyke Road and SH 73 to provide for additional traffic likely to be using this intersection. This will ensure that the performance of the key infrastructure (SH 73) is enhanced consistent with the RLTP aims.

Selwyn District Plan

The Selwyn District Plan recognises that its urban areas are valued for their sense of spaciousness when compared to metropolitan areas in Christchurch City[4]. Spaciousness is achieved by ensuring there is sufficient public reserve space, and by ensuring a range of section sizes are developed to provide for ample open space within private land. The use of site coverage as a management tool to create the sense of open space is also utilised within urban areas.

The District Plan also recognises that subdividing land in the rural zone is one of the most significant issues facing the District[5]. This needs to be managed in a way that does not result in significant loss of rural land for primary production and does not place additional pressure on Council for infrastructure, particularly in new, non-urban locations.

The District Plan strategy for the development of new business zones outside of the defined Greater Christchurch area is to rely on privately initiated plan changes such as this one to create growth[6].

[3] RLTP – page 17

[4] Section B4.1 Growth of Townships, residential density issues – Townships Volume, Selwyn District Plan

[5] Section B4.1 Growth of Rural Area, Residential Density and Subdivision - Rural Volume, Selwyn District Plan

[6] Section B4.3 Residential and Business Development - Township Volume, Selwyn District Plan

Overall the proposal includes an ODP that provides spacious residential sections consistent in scale with adjoining residential sections that have ample opportunity to create open space and maintain the sense of spaciousness valued in the Selwyn's urban areas. This is further enhanced by the proposed landscaping associated with the development that will provide for an increased sense of open space and amenity value. The proposal seeks to utilise existing rural zoned land adjoining Darfield, as oppose to land that is isolated from existing urban areas, thus enabling the extension of infrastructure including established roading, power and telecommunication networks. A full assessment of the proposal against the objectives and policies of the Selwyn District Plan are provided in Appendix 8.

Selwyn 2031: District Development Strategy

The Selwyn 2031 District Development Strategy (Selwyn 2031) was adopted by the Selwyn District Council 4 November 2014. The purpose of Selwyn 2031 is to provide an overarching strategic framework for achieving sustainable growth across the District to 2031. The Strategy seeks to provide higher quality living environments; innovative business opportunities; maintain the district's iconic rural character; explore opportunities to enhance social and cultural wellbeing and better manage the District's natural resources.

Key actions identified in Selwyn 2031 relevant to the proposed plan change include:

- Strengthen key economic activities by protecting the function of Rolleston, Lincoln, Darfield and Leeston as Key Activity Centres;
- Retain the district's sense of rural identity by adopting a consolidated approach to urban growth;
- Reinforce and enhance the character of each township by requiring outline development plans and the use of good urban design principles within new development areas.
- Provision of a range of housing types to meet the diverse range of social, cultural and economic needs of the community.
- Achieve safe, functional and attractive living and business environments by requiring new development to occur in accordance with outline development plans, design guidelines and to give effect to higher level strategic planning documents.

Consolidating urban growth in and around existing townships, rather than creating new or isolated settlements, is an important strategic direction of the Selwyn 2031. The district already has 21 townships, the majority of which are not large enough to supply employment for residents and many do not have sufficient population to sustain basic business services and community facilities, or to fund basic utilities, such as reticulated sewage treatment and disposal.

There are also a number of isolated pockets of rural-residential development (identified as Existing Development Areas in the District Plan) and clusters of small titles throughout the rural area. Whilst the Council recognises the presence of this historical zoning and smaller rural titles of at least 4 hectares, it does not wish to see this dispersed settlement pattern being duplicated or expanded in the future. Rather, it is envisaged that all new urban development will occur in or adjacent to existing townships. A consolidated growth pattern will promote the efficient and effective provision of both service and social infrastructure and maintain an urban/rural contrast to protect the interests of both urban and rural communities.

Darfield is identified as a Key Activity Centre in the Strategy and is identified as existing commercial/business centres that are focal points for employment, community activities. More specifically Darfield will also have a range of retail and commercial services but will play a secondary role to the Lincoln activity centre in the overall activity centre network. These centres will likely have a rural focus on the goods and services provided compared to

Rolleston and Lincoln. They will serve a large rural area and, in some cases, smaller townships in the surrounding area of each town.

The proposal seeks to utilise a site adjoining Darfield township to provide the sense of consolidation sought by Selwyn 2031. The ODP provides a mix of residential and business zoned land to enable further employment opportunities in the urban area, and to provide space for business activities that can serve the surrounding rural activities.

Malvern Area Plan

The Malvern Area Plan was adopted by Selwyn District Council in September 2016. The purpose of the plan is to provide high-level planning direction to guide the growth and sustainable management of each township in the Malvern area through to 2031. The Plan identifies initiatives to assist in the delivery of the Selwyn 2031: District Development Strategy (Selwyn 2031) vision, which is:

> *"To grow and consolidate Selwyn District as one of the most liveable, attractive and prosperous places in New Zealand for residents, businesses and visitors."*

Within the Malvern Area Plan, Darfield is identified as the primary settlement and is categorized as a service township in Selwyn 2031.

Issues identified in the Malvern Area Plan for the townships include:

- Preserving groundwater quality, treatment of storm water and wastewater;
- Promoting growth that reflects the form and function of townships; and
- The need to provide for a range of lot sizes and housing types to better meet the needs of the community, particularly in Darfield.

The following underlying growth concepts are also identified in the Malvern Area Plan and are applicable to the site:

- Establishing a town network
- Establishing an activity centre network
- Encouraging increased levels of self-sufficiency.

The location of the business zone is seen as appropriate as it signifies the entrance to the township and builds on the existing synergies of the Business 2 zone on the northern side of the State Highway. The business zone also provides additional and diverse employment opportunities within Darfield that will contribute to the service township function and will aid in creating increased levels of self sufficiency, without detracting from the core business zone in Darfield.

The residential sections provide a logical transition between the ODP area to the south consisting of Living 1 and Living 2A zoning and the area to the west, with deferred Living 2 zoning. The sections are larger than the standard Living 1 zone and will be sufficient to accommodate the treatment of storm water and wastewater in the protection of ground water. Creyke Road acts as a natural boundary on the eastern edge of the township and creates a concentric residential growth pattern in this area in a manner that reflects the form and function of the township. Pedestrian networks further integrate the site into the Darfield Township.

5 Site and Surrounds

Darfield is located some 25 kilometres northwest of Rolleston and 45 kilometres west of Christchurch. It is the main town between Christchurch and the West Coast.

Darfield had its origin in the railway, which opened to Sheffield in 1874. The township grew with the expansion of the Midland Line railway and as a rural service centre. From 1874, it was known as White Cliffs Junction, then Horndon Junction from 1876 to 1879 and finally Darfield, to avoid confusion with Hornby Junction. Residential sections were advertised in 1878.

Darfield serves the Malvern Ward's arable and pastoral farming area. Within the township there are farming suppliers, primary and high schools, numerous shops and cafés, a library and Selwyn District Council service centre, a hospital, volunteer fire brigade and hotel and motel accommodation.

Darfield's population growth over recent years can be attributed to a number of factors, including growth in the dairy industry on the Canterbury Plains, more lifestyle blocks and people moving out from Christchurch to the new subdivisions. It is a gateway to the scenic attractions of the Waimakariri and Rakaia Rivers and the Southern Alps, a popular lift-off location for hot-air balloons and the home of Selwyn Gallery, a showcase for the district's arts.

New industry has established in the township, with the Fonterra Dairy factory located kilometres north-west of Darfield on State Highway 73. The township remains popular as a destination and stop off for snow sports.

The land to which the Plan Change relates is legally described as Section 1 SO 1227, Darfield, and is located approximately 300 m east of the current urban extent of the Darfield Township. The site is contained in Register of Title CB39B/123, which is attached as Appendix 1 to this application.

5.1 Site Details

The application site has a total area of 30.7561 ha. The site has approximately 1,190 m of frontage to State Highway 73 (West Coast Road) and approximately 458 m of frontage to Creyke Road. The eastern most corner of the site abuts the intersection of State Highway 73 with Creyke Road. The site is currently zoned Rural - Outer Plains.

The site does not currently contain any buildings and is used for agricultural purposes. The site has been used for grass/grazing crop since it was purchased and has been used for this purpose since, both by the applicant and through leasing. The northern boundary of the site along SH73 and the eastern boundary adjoining Living 2A deferred zoned land, is lined with pine tree hedging.

There are two access points to the application site, one from Creyke Road and one from SH73 at the western end of the road frontage to the site. These access points provide for farm access and are not formed or sealed in any formal manner. Aerial photographs indicate what appears to be a building located in north western corner of the site, this is a shipping container being stored on the site. In the north eastern corner of the site adjacent to Creyke Road is a set of cattle yards for the sorting and loading of stock. This area does not include any sheep dip activities.

There is a water race running along the southern boundary of the property. A topographical survey of the site has been carried out and is attached in Appendix 4. This shows that the site is generally flat, and outlines where the hedges, water race and other topographical features on the site are located.

Historically the site has been planted in forestry trees and a small portion of the site at the western end was used for the disposal of possum carcasses. There is a dip in the ground at the western end of the site that represents the area of the possum disposal activities. Additionally, historical photographs indicate that uncontrolled fill may have been present at the western end of the site.

The location of the site is shown in Figure 2 below with the existing zoning shown in Figure 3 below:

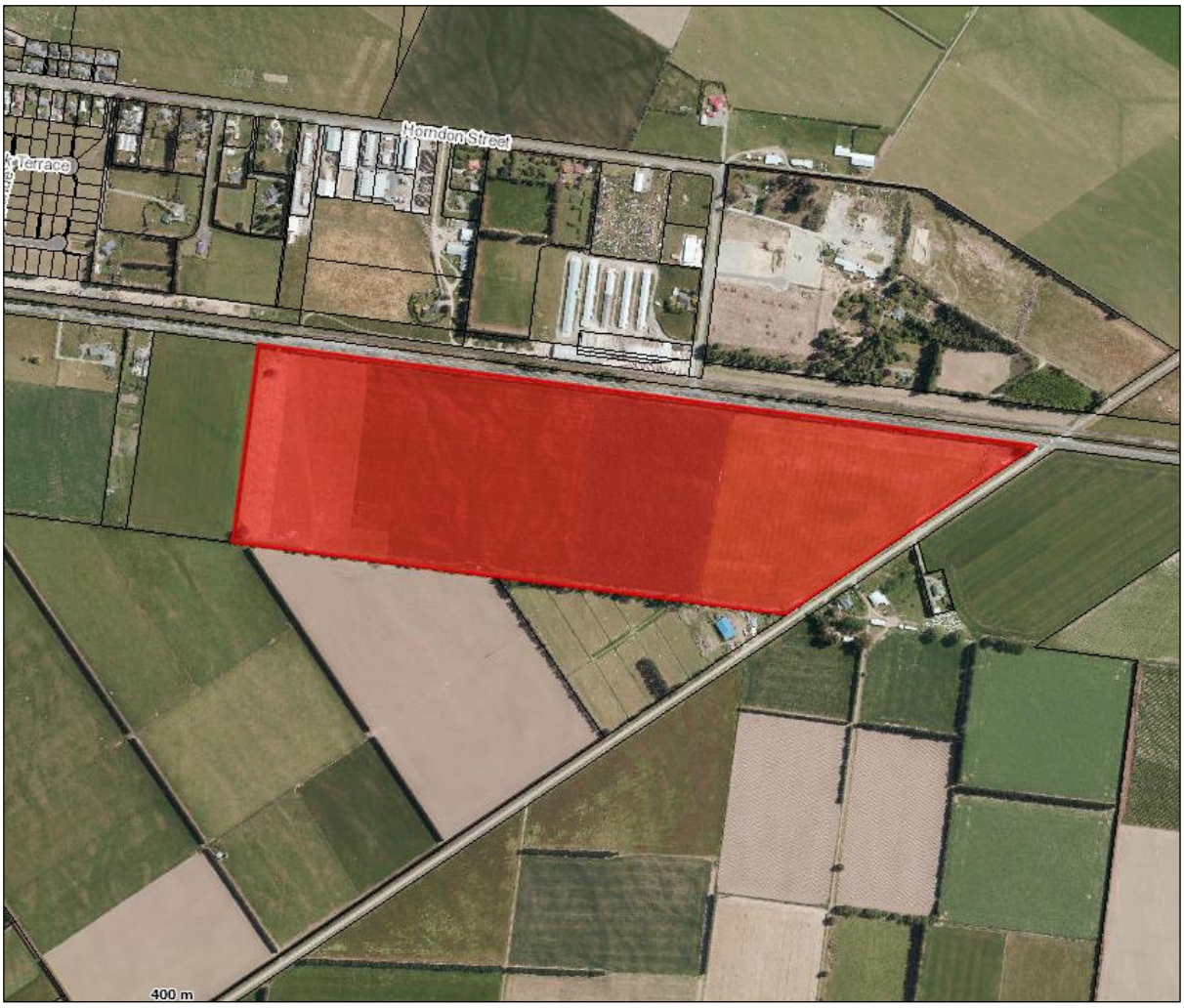

Figure 2: Plan Change site shown in Red

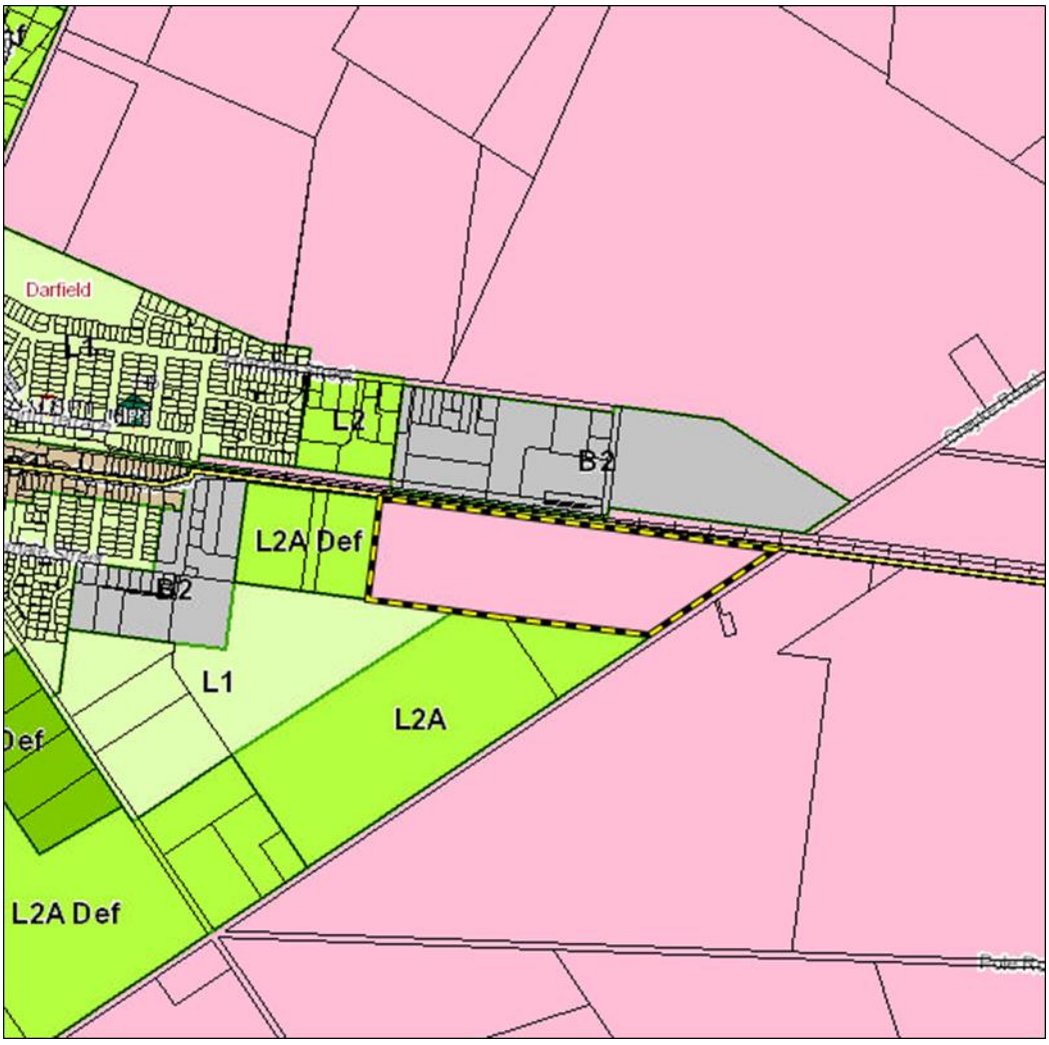

Figure 3 - Zoning of application site, identified by black and yellow outline

5.2 Surrounding Area

Immediately north of the application site (across SH73) for the majority of the site frontage, is zoned Business 2. This is separated from the application site by the width of SH73 and by the Midland Railway Line located on the opposite side of the road from the application site. The Business 2 Zone on the northern side of SH73 contains a clay brick factory, an intensive farming operation, and a number of other industrial businesses. There are also some residential dwellings within the Business 2 Zone.

Adjoining the southern boundary of the application site is the area that was subject to Plan Change 24. This plan change (now operative) resulted in the deferral being removed and an area of Living 1 zoned land closest to Darfield centre and an area of Living 2A zoned land. Both the Living 1 and Living 2A zones now adjoin the southern boundary of the application site. Subdivision of this adjoining land along Creyke Road has begun with a number of titles issued.

Immediately west of the application site is zoned Living 2A Deferred. There are currently two dwellings within this area located at 3277 and 3283 West Coast Road (SH 73) and only have access to the State Highway. The Living 2A deferred zoning in this area allow 1 ha sites and is deferred until such time as an outline development plan has been

included in District Plan to show how the area can be developed in a coherent fashion, and to show that the area can be provided with the relevant infrastructure services, primarily potable water.

On the opposite side of Creyke Road the land is zoned Outer Plains. Creyke Road forms an inherent outer growth boundary for the Darfield Township. The area across Creyke Road includes a dwelling located on a 2,500 m^2 site, which is surrounded by a site containing approximately 110 ha and a dwelling with associated farm sheds.

5.3 Site investigations

The site has been subject to a number of specific investigations to determine its suitability for development and identify any constraints to development. The following outlines the investigations undertaken and the outcomes of those investigations.

Site Survey

A topographic Survey of the site was completed by Clark Land Surveyors November 2017 and is included as Appendix 4 to this application. The survey identifies the bank of the water race running along the southern boundary of the site and that the site is generally level with no significant topographic constraints present.

Geotechnical Investigation

A Geotechnical Investigation of the site was undertaken by LandTech Consulting December 2017 and included as Appendix 5 to this application. The Geotechnical Investigation Report did not identify any areas of erosion on the site and concluded liquefaction is not likely to occur within the site. The Geotechnical Investigation concludes the site is not at risk of natural hazards, due to the topographic and geological setting.

Preliminary Site Investigation

A Preliminary Site Investigation (PSI) for the site was undertaken by Malloch Environmental Ltd December 2017 and is included as Appendix 6 of this application. The PSI has identified two areas within the application site having a risk of soil contamination: a former poisoned possum disposal pit, and an area of uncontrolled fill and waste material related to a former quarry pit, both in the western most portion of the site.

The PSI has recommended a Remediation Action Plan (RAP) be developed for the former possum pit and remediation should occur as part of the overall development of the site. With respect to the area of uncontrolled fill the PSI recommends a Detailed Site Investigation (DSI) for the potential fill area identified. Both the RAP and DSI for the areas identified can be undertaken at the time of future subdivision as the PSI states neither of the risk areas identified would preclude the proposed plan change from occurring.

Traffic Environment

Carriageway Consulting Ltd have carried out an Integrated Transport Assessment (ITA) for the proposal, which is included in Appendix 9. The ITA addresses issues associated with the potential effects of the rezoning on the operation of the road network as well as discussing consistency with relevant transport related District Plan matters, an evaluation of the plan change including change in travel patterns, any potential adverse effects, and ways adverse effects can be resolved. The report also integrates best practice by incorporating other transport modes such as travel walking, cycling and public transport. The ITA describes the roading network as follows:

> *The proposed roading connection into the plan change area is via the eastern end of the site, and onto Creyke road. In this location, Creyke Road has a flat and straight alignment, and a sealed carriageway width of 6.5 m but with no*

centreline or edgeline markings. There is a 0.5m metalled shoulder on each side of the road, and then grassed verges to the road boundary. The road is subject to a speed limit of 100km/h, and the legal road width is 20m.

At the northeastern corner of the site, Creyke Road meets State Highway 73 at a four-arm priority ('stop') controlled intersection, with Creyke Road forming the fourth approach towards the north. The intersection has an auxiliary turning lane for the movement from south to west but no right-turn or left-turn lanes on the highway for drivers turning into Creyke Road.

Creyke Road continues to the north of the intersection. Around 20m north of the intersection, the road crosses the railway at a level crossing, which has flashing lights and bells, but no barriers. The road rises up in order to cross the railway.

State Highway 73 is described as follows:

State Highway 73 has a flat and straight alignment and is subject to a speed limit of 100km/h. There is one traffic lane in each direction of 3.6m width and a sealed shoulder of 0.7m on each side, and the carriageway is marked with edgelines and a centreline. There are grassed verges on each side of the highway, with the Midland Railway Line running parallel to the highway towards the north, some 20m away.

Non-car modes of travel are described as follows:

There is no specific infrastructure for walking or cycling in the immediate area of the site, although the wide berms are suitable for walking and the low traffic flows on Creyke Road mean that cyclists can share the road with motorised traffic.

The ITA also includes photographs of the road scene and important features.

The ITA concludes the following:

- *The traffic generated by the development arising from the plan change can be accommodated on the adjacent roading network without any capacity or efficiency issues arising.*
- *The existing road network operates safely and efficiently, as indicated by crash history. However, in view of the increased traffic flows arising from the proposal, an area should be set aside at the north-eastern corner of the site so that the Creyke Road approach can be straightened up in order to improve the ability of emerging drivers to see vehicles approaching from their left.*
- *Upgrades to the State Highway 73 / Creyke Road intersection to provide auxiliary turning lanes are justified with a right-turn lane needed at 10% of the site being developed and a left-turn lane required at 85% development. The associated seal widening will result in the sightlines at the intersection moving 3.5m further south and they will therefore pass across land outside the road reserve. There are a number of ways in which this can be addressed.*
- *The ODP will meet (or is capable of meeting) the transportation requirements of the District Plan, although compliance depend on speed limits which are not yet known.*

The ODP includes provisions to incorporate the recommendations from the ITA.

Existing Servicing

An engineering servicing report (Appendix 4) has been completed by Baseline Group Limited, (dated July 2019) to investigate the serving requirements for the proposed plan change and subsequent subdivisions. The engineering servicing report outlines the following:

Water

The existing Darfield water supply does not have sufficient capacity to service the application site to allow for subdivision. Selwyn District Council have indicated a preference for the identification of a suitable allotment within any future development of the site to install a bore and water treatment. This would provide unrestricted potable and fire-fighting water supply to the application site.

Wastewater

There is currently no existing reticulated wastewater system available in Darfield which the application site could connect to. Any new allotments will require on-site wastewater disposal, which can be accommodated within the proposed allotment size averages of 1,950 m^2. Any new allotment created when subdividing the application site in accordance with the proposed Outline Development Plan will require a discharge consent from the Canterbury Regional Council. The layout of the site does not preclude reticulated services should they be available at the time of subdivision.

Stormwater

There is no existing stormwater network in Darfield which the application site could connect to. Due to the presence of low groundwater levels and lack of reticulated stormwater network it is proposed stormwater from the site can be discharged to ground via soak pits. Discharge to ground is assessed as a discretionary activity under the Canterbury Land and Water Regional Plan and stormwater discharge consents would be required for any allotments created by future subdivision at the time of engineering approvals. This does not preclude individuals seeking to install rainwater collection from roof areas for use within their own sites at the time of developing residential dwellings.

Electricity and Telecommunications

Both Orion and Chorus NZ Ltd have confirmed the application site can be serviced with reticulated power and telecommunications respectively from existing networks. The details of such connections would be confirmed at the time of future subdivision.

Air Quality

Due to the presence of the Clay Brick Factory on the land opposite SH 73 from the application site, and its discharges to air associated with the manufacture of clay bricks on the site, the applicant commissioned an air quality report from NZ Air, attached in Appendix 10 to this application. The purpose of this report was to identify if there was a likely air quality effect over the application site, arising from the existing lawful clay brick manufacturing activities that might generate an adverse effect leading to potential reverse sensitivity effects for sensitive residential activities.

This report concludes that the discharges generated from the clay brick manufacturing are less than consented volumes, even when considering the worst-case situation. Given this report it is considered that the air discharges arising from the existing lawful clay brick manufacturing business will not affect residential activities within the Living 1 zone of the proposed plan change site.

Odour

An investigation of the surrounding area has highlighted the presence of the Poultry Producing Company (an intensive farming operation) located at 15 Hordon Street behind the clay brick factory. This has the potential to generate odour that may be noticeable from the application site. Pursuant to Rule 3.13.1.5 of the Rural Volume of

the District Plan requires new buildings for sensitive activities, including residential dwellings, to be located 300 m from existing lawfully established intensive farming operations. There is not a similar rule contained in the business or living zone rules of the Township Volume.

6 Proposed Plan Change

Under subsection 2 of Section 73, and under Clause 21 of Schedule 1 of the RMA, any person may request a territorial authority to change a District Plan and the Plan may be changed in the manner set out in Schedule 1 of the Act. Clause 22 of Schedule 1 states that:

> *(1) A request made under clause 21 shall be made to the appropriate local authority in writing and shall explain the purpose of, and reasons for, the proposed plan change to a policy statement or plan and contain an evaluation under section 32 for any objectives, policies, rules, or other methods proposed.*
>
> *(2) Where environmental effects are anticipated, the request shall describe those effects, taking into account the provision of Schedule 4, in such detail as corresponds with the scale and significance of the actual or potential environmental effects anticipated from the implementation of the change, policy statement, or plan.*

The plan change application has been prepared in response to an identified need for residential land in the Selwyn District and particularly in the Darfield Area, and in response to the preferred growth pattern for Darfield identified in the Malvern Area Plan. Darfield has been identified as being an important service township, key activity centre and a projected growth area through strategic planning documents. The projected growth was identified in the Malvern Area Plan, which indicates a 39% growth in population over a 16 year period.

It is noted in the Malvern Area Plan that in regard to business development;

> *"there are opportunities for further business and / or industrial growth, given Darfield's status under Selwyn 2031 where there is already a broad range of services available and the function that the township plays to the wider Malvern Area".*
>
> *"There is good access to adjoining State Highway 73 and the wider transport network for either residential or business activities".*

In regard to residential development it is further noted in the Malvern Area Plan:

> *"the area is relatively close to Darfield town centre and provides a compact and concentric urban development pattern consistent with adjacent urban areas".*

The plan change seeks to rezone the site with a mix of Business 2 zoned land along the northern portion of the site and an area of Living 1 zoned land along the southern portion of the site in accordance with the ODP attached in Appendix 2. An evaluation of the proposed plan change under Section 32 of the RMA has been undertaken and the results are attached in Appendix 13.

6.1 Residential Zone

The residential zone is proposed to apply to approximately 7.1 ha of the application site, comprising 23% of the overall development area. Given the proximity to the proposed Business 2 zone, it is appropriate that the residential portion of the application site contain larger allotments than the traditional 650 m^2 average allotment size in the Living 1 zone at Darfield. This will provide for more choice for allotment owners to place dwellings further back from the business zone within each allotment. It will also enable greater consistency with the mix of Living 1 and Living 2 zones adjoining the southern boundary of the site and the Outer Plains zone to the east across Creyke Road. The ODP specifies that the allotments will have an average allotment size of 1,950 m^2 and that there will no more than 35 residential allotments in this ODP area. By specifying the number of allotments, there is certainty as to the extent of water supply required for the residential dwellings.

For residential allotments adjoining Creyke Road, appropriate boundary fencing consistent with that located south of the application site along Creyke Road is appropriate. This is open rural style fencing of post and rail or post and wire fencing. Such fencing is included as a requirement by way of a note on the ODP in the same manner as the approved ODP contained in Appendix 41 of the Selwyn District Plan.

The utilisation of the Living 1 zone, but including larger average allotment sizes, ensures that the proposal can achieve allotment sizes that are appropriate for the interface of a mix of residential and business zones, but continue to fit within the intended residential zones for Darfield under the anticipated District Plan Review and in light of the direction given with National Planning Template provisions.

6.2 Commercial / Business Zone

The proposed plan change area includes approximately 17.6 ha of Business 2 land across the northern portion of the application site. This area adjoins State Highway 73 along the full road boundary of the application site. This area makes up 57.7% of the overall ODP area and will enable business/commercial use. This area will be subject to the Business 2 zone activity rules that restrict the types of activities permitted in the area, and in particular, restrictions on those that generate noise dust or odour are to be set back from residential activities. Further restrictions are proposed in this plan change to set buildings back 10 m from boundaries.

This proposed business zone adjoins the existing Business 2 zone across State Highway 73, although no direct vehicle access to this road is proposed. The existing informal farm entrance on the north western side of the site to SH73 will be closed. The location of the Business 2 zone along the northern portion of this site precludes residential activity in this area with the exception of residential activity associated with custodial purposes. This will limit the exposure of residential activities to the permitted intensive livestock farming activities and any noise, dust or odour effects generated from the existing Business 2 zone across SH 73.

Principal building setbacks from road and internal boundaries of 10 m within the business zone will provide for the proposed landscaping strip within this area, and a new rule that prevents fences or structures within this landscape area is also proposed. These mechanisms will encourage any effects arising from the permitted use of the business zone to remain internal to the business zone. Existing building recession plane rules, and other noise, dust and odour rules within the current planning framework will also provide direction for the permitted use of the proposed business zone in a manner that avoids adverse effects on the surrounding neighbourhood.

6.3 Roading

The roading layout has been designed in consultation with the NZTA[7] who have specified that no direct access from the site to SH 73 is preferred. They have also indicated that the existing roading layout at the corner of SH 73 and Creyke Road is problematic in terms of clear sight lines and that a solution through the ODP roading layout is encouraged.

As shown on the ODP in Appendix 2, the site contains an internal road structure to facilitate separate traffic movement to the business area and the residential area. The road through the residential area will provide future connect opportunities with the adjoining allotment to the west. There will be only one external access point to the site from Creyke Road. No connection is proposed to the State Highway.

The roads have been designed to accommodate pedestrian and cycle pathways that provide connection from the residential zone, both within the application area and to the residential area south, through to the business zone. The pedestrian links will be approximately 10 m wide with landscaping.

[7] A record of this consultation is attached in Appendix 11

The proposal includes an external road connection to Creyke Road located 400 m southwest of the intersection with State Highway 73. It is proposed that this will provide access to the business zone and will terminate in a large cul-de-sac. A secondary road off this will provide for the residential allotments on the southern portion of the application site and will also provide a future connection to the Living 2A Deferred land to the west of the application site.

It is also proposed to realign the intersection of Creyke Road and SH73 to provide for clearer sight lines and improved functioning at this intersection. The details of the proposed realignment and the reasons for this are set out in the Transportation Assessment contained in Appendix 9. This realignment will enable the traffic from the application site to integrate into the surrounding traffic environment in a safer manner. A new rule in both the business zone chapters and the living zone chapter of District Plan sets out that prior to large scale development of the ODP are the intersection is to be upgraded. This rule allows for some subdivision development to occur, in recognition that the road has some capacity to absorb development without the need to upgrade the road network.

The Transport Assessment contained in Appendix 3 considers how a future subdivision might meet the current roading standards of the Selwyn District Plan as part of any future subdivision (section 8 of that report). The specific details of any future roading design will need to be considered at the time of subdivision, however the visual elevations of the street environment provided in Appendix 12 make it clear that an appropriate roading environment can be achieved in the proposed road network.

6.4 Landscaping

There will be a 10 m wide amenity landscaping along the length of the SH 73 boundary replacing the existing Pinus Radiata hedge bordering this road boundary. The amenity landscaping will extend down Creyke Road to the main entrance to the site and will continue to run the length of the business zone along the spine road and its interface with the residential zone on the western boundary. There will be a 10 m building setback within the business zone to provide for this landscaping strip. This will result in a 30 m separation between the proposed business zone and the proposed residential zone that includes the landscaping strip and the road width.

Along SH 73 the amenity strip will act as both a physical separation from the road network and a visual screening for the public on this main road. The proposal seeks a business zone adjoining the State Highway for the full length of the road boundary.

The landscaping strip is to be planted prior to the development of a principle building on a site within the business zone and is to be irrigated for 2 years to enable appropriate establishment. Any planting is to be carried out in accordance with the planting layout specified in the ODP in Appendix 2. This shows the use of varied planting heights across the width of the landscaping strip and the use of a single row of upright trees able to grow to a height of 10m.

A separate 1 m maximum height low growing area around the Creyke Road/SH 73 intersection is proposed that provides for sight clearance for vehicles using this intersection in accordance with the recommendations of the Transport Assessment contained in Appendix 9. Plants in this area will be limited in height to specifically enable clear visibility when exiting Creyke Road onto SH 73. Visual images of the landscaping details and the overall anticipated appearance of the site are attached in Appendix 12.

6.5 Services

An engineering servicing report has been prepared for the application site and is included as Appendix 4 to this application. Provision of services to the site are summarised as follows:

Water

Selwyn District Council have indicated a preference for the identification of a suitable allotment within any future development of the site to install a bore and water treatment to augment current reticulated supply to Darfield. This would provide unrestricted potable and fire-fighting water supply to the application site. The current rules structure of the Plan requires that water supply is available at the time of subdivision. A suitable solution to augment the current water network will be required to be installed as part of the subdivision and given the ground conditions of the site a bore is anticipated to provide the necessary supply. The proposal does not preclude individuals from collecting rainwater from their roof areas to utilise within their own properties.

Wastewater

Any new residential allotments will require on-site wastewater disposal, which can be accommodated within the proposed allotment size averages of 1,950m^2 as is occurring elsewhere in Darfield. Specifically, designed wastewater disposal for business activities will need to be considered at the time of development and specific for the nature of the activities within each allotment. Any new allotment created when subdividing the application site in accordance with the proposed ODP will require a discharge consent from the Canterbury Regional Council at the time of subdivision.

Should reticulation be established in Darfield prior to any subdivision of the application site then reticulation can be installed at the time of development.

Stormwater

Due to the presence of low groundwater levels and lack of reticulated stormwater network it is proposed stormwater from the site is discharged to ground via soak pits. Discharge to ground is assessed as a discretionary activity under the Canterbury Land and Water Regional Plan and stormwater discharge consents would be required for any allotments created by future subdivision at the time of engineering approvals. This does not preclude individuals from collecting rainwater from roof areas for use at the time of residential development within sites.

Electricity and Telecommunications

Both Orion and Chorus NZ Ltd have confirmed the application site can be serviced with reticulated power and telecommunications respectively from existing networks. The details of such connections would be confirmed at the time of future subdivision.

7 Proposed District Plan Amendments

It is considered that the most appropriate means to achieve the proposed Plan Change is to largely adopt the existing provisions of the Business 2 zone of the Selwyn District Plan, as well as including some additional rules relating to landscaping and setbacks within this area. Additional new rules relating to the timing of the upgrade of Creyke Road and SH 73 is also proposed. No new objectives or policies are proposed as part of the Plan Change as it relates to either the Business or Living zones.

The changes sought to the Selwyn District Plan in order to enable the proposed rezoning to proceed are outlined in Table 1 below.

Text that is proposed to be added is shown as ***bold italics and underlined***. Deletions are shown as ***bold italics with a ~~strikethrough.~~***

Table 1: Proposed District Plan Amendments

Amendment 1: New Appendix	Add ***Appendix X ODP - Darfield East*** to Township Volume - containing Outline Development Plan contained in Appendix 2 of this plan change. *Note: This is referred to as "Appendix X" for the purpose of this rules table but should be inserted as the next relevant appendix number in the District Plan.*
Amendment 2:	Amend Planning Maps to rezone the application site from Rural (Outer Plains) to Business 2 and Living 1 consistent with the proposed ODP.
Amendment 3:	Amend Rule 12.1.3.16 as follows: Any subdivision of land within the area shown in Appendix 47 - Living 2A Darfield - Bangor Road Outline Development Plan, ***~~and~~*** within the area shown in Appendix 41A - Living 2 Darfield - Creyke Road Outline Development Plan, ***and within the area shown in Appendix X - ODP- Darfield East,*** shall comply with the layout and contents of that Outline Development Plan and shall comply with any standards referred to in the Outline Development Plan.
Amendment 4:	Insert new rule after Rule 12.1.3.16 as follows: ***No subdivision of land in the Living 1 zone shown in the ODP - Darfied East in Appendix X shall take place until a potable water supply is available that is capable of serving lots within the subdivision.***
Amendment 5:	Insert new rule after rule 12.1.3.16 as follows: ***Prior to any development within the Business 2 Zone, or prior to the development of the 18th residential allotment within the Living 1 Zone (whichever occurs first) shown in the ODP – Darfield East in at Appendix X, the intersection of Creyke Road and State Highway 73 shall be upgraded in accordance with the ODP.***
Amendment 6:	Insert New Rule after 16.1.4 as follows: ***Any principal building in that part of the Business 2 Zone located south of the State Highway and west of Creyke Road shown as Business 2 Outline***

	Development Plan (Darfield East) at Appendix X if the following standards are met: ***All landscaping along the external perimeter of the Business 2 Zone as depicted on the Outline Development Plan at Appendix X, shall be landscaped to the following standards:*** ***- A landscaping strip shall be established along the Business 2 Zone side of the common boundary to a depth of 10 metres.*** ***- Landscape planting and an irrigation system shall be undertaken in accordance with the Outline Development Plan at Appendix X. Irrigation is to be provided for a minimum of 2 years following the establishment of the landscaping.*** ***- All landscaping, once matured, shall meet the minimum heights depicted in the ODP East Darfield in Appendix X.*** ***- The landscaping planted shall be maintained and if dead or diseased or damaged, shall be removed and replaced.*** ***- No accessory buildings, fences, or structures shall be erected within the10 metre landscape strip.*** ***- Before any principal building is erected on any parcel of land subject to Rule 16.1.4, all of the landscape planting, irrigation system and fencing shown on the Outline Development Plan at Appendix X on that allotment shall be completed.***
Amendment 7:	Insert new rule after Rule 16.7.2.10 as follows: ***In that part of the Business 2 Zone located at the corner of State Highway 73 and Creyke Roads, Darfield, as depicted on the Outline Development Plan at Appendix X:*** – ***Road boundaries: 10 metres*** – ***Internal boundaries adjoining a residential zone: 10 metres***
Amendment 8:	Insert new rule after 22.13 as follows: ***22.14 - Development within the Business 2 Zone East Darfield ODP*** ***22.14.1 Prior to any development within the Business 2 Zone, or prior to the development of the 18th residential allotment within the Living 1 Zone (whichever occurs first) located at the corner of State Highway 73 and Creyke Roads, Darfield, as depicted on the Outline Development Plan at Appendix X, the intersection of Creyke Road and State Highway 73 shall be upgraded in accordance with the ODP.***

8 Description of Environmental Effects

In accordance with Clause 22, Schedule 1 of the RMA, the following is a description of the actual and potential effects on the environment arising from the proposed activity. This assessment includes consideration of the relevant matters set out in Clauses 6 and 7 of the Fourth Schedule.

The potential effects of the activity can be categorised into the following key areas:

- Effects on the form and function of Darfield
- Residential or rural character and amenity
- Neighbourhood and wider community effects
- Effects on ecological values
- Natural and physical resources
- Traffic effects
- Cumulative effects
- Positive effects

8.1 Effects on the Form and Function of Darfield

A potential effect of establishing Business 2 zone and a new Living zone along SH 73 out to the Creyke Road boundary is the elongation of the township. This has the potential to distribute the focus of commercial activities from the existing village area.

The proposed plan change area has been identified as a logical progression to the built form of the town through the various planning documents. These documents have sought to increase levels of self-sufficiency for the district's townships. The rezoning of the area will provide a known and sustainable pattern of development for Darfield. The Business 2 zone will provide a symmetrically zoned entrance to the township from the east, thereby both confirming a start point for the town and a natural end point.

The proposed ODP utilises an entrance point to the application site from Creyke Road and avoids access from the State Highway. This along with the landscaping along the boundary with SH 73 will encourage patterns of development within the business zone that are inward facing rather than fronting SH 73. This will discourage the use of the area for business development that would compete with or detract from the existing Business 1 Zone in the centre of Darfield. The proposed access and landscaping provisions within the ODP encourages the use of the site in the manner anticipated under the Business 2 Zone to provide services to the rural activities surrounding Darfield and to existing business activities within Darfield.

Darfield is a rural township that experienced steady population increase through the early part of the millennium. Following the Canterbury Earthquake sequence, the population of Darfield has increased as a result of displaced residents seeking residential properties and lifestyle blocks for new dwellings. The proposed rezoning will provide both residential and commercial opportunities to support that growth and help build a sense of self-sufficiency in terms of local employment opportunities.

8.2 Residential and Rural Character

The proposed plan change will have effects on the rural character of the existing site and surrounding area. It is proposed to enable the application site to change from rural use to business and residential use. The effects of this change will have a positive effect for the growth of Darfield in a concentric and compact manner.

It is noted in terms of surrounding context on the western and southern boundaries of the site, these have been rezoned for residential use. To the north of the application site is zoned commercial and to the east is Outer Plains. The surrounding areas has already been altered from a distinct rural character to a somewhat urban environment by the existing urban zonings located on three sides of the application site. The proposed plan change seeks to complement the existing urban zonings immediately adjoining it by seeking larger allotment sizes for residential activities that coordinate with the adjoining Living 1, Living 2 and Business 2 zonings, and to provide for the development of Darfield out to Creyke Road as a logical extension to the urban area of Darfield.

Physical changes may involve the loss of rural pastures and erection of dwellings and commercial businesses and associated roads and infrastructure. It is proposed to maintain and enhance the level of landscaping along the State Highway frontage and provide additional landscaping along Creyke Road and the buffer area between the business and residential zone. The residential allotments will have gardens, hard stands and driveway paving associated with dwellings and outbuildings. In essence, the allotments will appear to be an extension of the existing village environment and will not retain rural character values.

Residential allotments along Creyke Road will be required to have similar fencing treatment as the adjoining development created under Plan Change 24 to provide for the continuity of treatment along this road frontage and to maintain the sense of rural character that ties into the Rural Outer Plains Zoning, east across Creyke Road.

Restrictions as to the size and number of residential allotments, their boundary treatment along Creyke Road frontage and the areas of landscaping along boundaries adjoining the proposed business zone will avoid significant effects on the surrounding rural character to the east of the application site, or to the residential character to the west and south of the application site.

8.3 Neighbourhood and Wider Community Effects

Reverse Sensitivity

An assessment of potential effects on the neighbourhood and wider community includes consideration of potential 'reverse sensitivity' effects that could be generated as a result of rezoning the site. Reverse sensitivity effects can occur following the establishment of a new residential activity, whereby any new resident may have an issue with noise, odour, dust, or other effects arising from existing activities on adjoining sites, thereby creating conflict.

The Malvern Area Plan identifies the site of the proposed Plan Change as 'suitable' for either rural residential development or business zone, notwithstanding its proximity to an intensive farming operation across SH 73.

In the rural zone, the District Plan provides rules to ensure a 300 metre set back distance for sensitive activities including dwellings near intensive farming operations. In this sense any residential building within 300 m would be subject to a resource consent process, conversely any building within the 300 m set back should be non-residential. For this reason, it is proposed to use the business zone and its associated landscaping requirements as a physical buffer to the residential sites from the existing intensive farming operation. The existing road and rail network and the buildings associated with the Clay Brick Factory provide additional physical separation between the residential component of the proposed plan change area and the existing poultry farm. This separation will avoid the likelihood of effects associated with the legal operation of the poultry farm adversely affecting new residential activities within the proposed living zone on the application site. There are a number of residential dwellings within 300 m of the poultry farm presently who do not appear to be adversely affected by the intensive farming operation suggesting it does not generate significant adverse effects. Given this it is considered that the approximate 250 m setback to the edge of the proposed Living 1 zone created by the proposed plan change will also avoid any adverse effects.

Similarly, a reverse sensitivity effect is possible where the proposed Business 2 zone has an interface with the proposed Living 1 zone. The Business 2 zone is a zone which allows a wide range of commercial and industrial activities to establish as a permitted activity. These activities that could be established by right, could have a detrimental effect on the amenity of the proposed residential neighbours. The mitigation measures are illustrated in the ODP and include a landscaping strip and a 20 m wide road formation between the proposed business and living zones within the site and a 10 m wide landscape strip between the proposed business zone and the adjoining living zone to the west. A 10 m building setback from boundaries with residential zones is also proposed as a new rule within the district plan to provide for business activities to be set back from adjoining residential neighbours. There are existing rules within the business zone designed to mitigate effects across business/living zone boundaries that will be applicable to any activity seeking to establish adjacent to the residential zones. Given these measures, it is considered that any effects between the proposed Business 2 zone and the proposed and existing surrounding living zones will not be significant.

A potential reverse sensitivity effect may arise from the lawful operation of the Clay Brick Factory across SH 73. In this case an assessment by NZ Air has been carried out to determine if the discharges from the factory are likely to have an effect on the proposed residential zone in a manner that would create the potential for reverse sensitivity effects. The report determined that the Clay Brick Factory, operating in a manner that generates the greatest level of discharge (i.e. the worst-case scenario), it is still unlikely to have an effect that would be discernible from within the proposed living zone. Given this, it is considered that these is no potential for adverse effects arising from the lawful operation of the Clay Brick Factory.

Character and Amenity

The District Plan seeks that in rural zones, rural character is maintained and sets out a preferred growth option for Darfield which generally provides a concentric pattern of development with lower density residential development on the periphery and graduated higher densities towards the center of the township.

The site has been identified in the Malvern Area Plan as area DAR6 in anticipation of future development. Given this identification, a reduction in rural character has been signaled as appropriate for the township and recognises that Creyke Road as a development boundary to accommodate future growth. Any increase in density across the site will give the site a more enclosed appearance and reduce the open space character experienced in traditional rural farmland. Despite this, the sense of rural character can be maintained across the site and when viewed from public roads and adjoining land. It is proposed to require residential dwellings along Creyke Road to utilise similar fencing treatments as other properties along Creyke Road consistent with the ODP for Plan Change 24. This will maintain the sense of rural character already anticipated along Creyke Road in conjunction with larger residential allotments. The proposal also seeks to utilise larger allotments with an average of 1,950 m^2 and to limit the number of allotments within the zone to 35. This will ensure the goal of larger allotments towards the periphery of Darfield is achieved, while maintaining the allotment structure anticipated to be imposed within Darfield under the National Planning Template provisions.

The ODP includes landscaping treatments within the proposed Business zone to retain and enhance the amenity values of the surrounding area. The use of large building setbacks by way of a new rule will provide a 10 m building setback combined with required landscaping treatments. This will ensure that new business zone activities do not adversely detract from the surrounding character and amenity values.

Visual Amenity

The site currently has a rural zoning and the development of the site will change the appearance of the site from open farmland surrounded by shelterbelts to a business zone and residential activities. It is noted that the principle

northern and western elevations is currently lined with a 4 – 5 m high Pinus Radiata hedge that encloses the site from public view from SH73 and land adjoining to the west. This hedge is proposed to be retained through the ODP provisions.

Given the presence of the pine hedge along SH73 and the western boundary, there will be little change in the visual appearance of the site. From the east and south the change will be from open space to built form. The large allotment sizes outlined in the ODP with an average of 1,950 m^2 ensures there is a sense of space retained along the southern boundary. Fencing treatment along Creyke Road provides consistency with adjoining Living 2 zoned land to the south. Landscaping required on the ODP along the eastern boundary of the proposed business zone will provide a high level of visual amenity when viewing the site from Creyke Road and east along SH 73.

Overall it is considered that although the visual amenity will change, the proposed rezoning includes sufficient provision for landscaping, fencing treatment and open space at a scale that will not detract from the overall high quality visual amenity of the site consistent with urban spaces within Darfield and other towns in the Selwyn District.

8.4 Ecological Effects

The application site has been used primarily for agricultural purposes and is significantly altered from any natural state which it may have once had. There are no areas of ecological significance identified on the site, nor are there any waterways with ecological significance identified.

8.5 Natural and Physical Resource

The soils across the Canterbury Plains are versatile and well suited to cropping and grazing and the application site is consistent with this. Once rezoned, the land will no longer available for rural production. However, the location of the site surrounded on three sides by urban zoned land and adjoining an existing urban area also makes it a logical extension of Darfield. The site has been identified as appropriate for urban development through the Malvern Area Plan.

The location of the site in the immediate vicinity of Darfield and the increase in demand for safe, stable land in proximity to Christchurch, are considered to mitigate any argument for the retention of soils for productive purposes in this case. The proposal will provide for the consolidated development of the township and will assist in avoiding the need for non-rural activities to establish in the rural zone beyond Creyke Road.

Rural Land

The proposed plan change will enable the development of the site from farmland into residential and business activities. This change in activities on the site will have an effect on the overall physical farmland resource of the entire district. It is well known that as development occurs in the Canterbury Plains, there is a threat to the amount of economically viable farmland remaining. Such farmland is considered to be an important physical resource for the region as a whole, providing meat, milk and fibre for national and international consumption.

It is for this reason that regional and district policies and strategies have been established to ensure development occurs in a manner that retains the farmland resource. The focus of many of these documents is to promote sustainable development within or adjoining existing settlements. The proposed plan change is located adjoining the existing township of Darfield, and while there will be a loss of productive rural farmland as a result of the proposed rezoning, it is considered that the location of this site, and its adherence to the policies and strategies designed to protect rural farmland, this loss of rural farmland will not have a significant adverse effect on the overall quality and area of rural farmland in the Selwyn District, but rather will provide for the demand for housing and business land without compromising larger more viable farming enterprises.

Infrastructure

The plan change will enable the development of land to accommodate 35 new residential sites and a range of business activities that will be relying on water supply and on-site wastewater disposal. With the large number of existing on-site wastewater disposal systems in Darfield of various ages and under varying degrees of maintenance, there are questions as to the potential effect existing wastewater systems are having on the quality of groundwater passing underneath the township. The proposed plan change will enable 35 additional residential allotments over 7.1 ha and a range of business activities over 17.5 ha that may require onsite wastewater disposal. Owners of these allotments will be required to obtain resource consents from Environment Canterbury at the time of development to provide for on-site systems. In each case, systems will be designed usitlising best practice guidance from Environment Canterbury to minimise potential effects on groundwater, including cumulative effects. Systems such as Oasis Clearwater systems provide on-site wastewater disposal that can achieve the quality of outputs anticipated by Canterbury Regional Council.

The low residential density proposed across the site, the ability to install high quality wastewater systems, and the large depth to ground water, means that there are unlikely to be any actual effects on groundwater arising from onsite wastewater systems. Consideration of specific design will be required to be made as part of any application to the Canterbury Regional Council.

In terms of the business zone it is unknown what future activities will establish within this zone and what the likely waste discharge requirements will be, however any activity will require consent from Canterbury Regional Council for any discharge and adverse effects on the environment will be considered at that time. Future activities on this site will be limited by the ability to obtain discharge consents required.

Energy

The development of residential activities on the site will change the nature and rate of energy consumption in the area. However, given modern house design codes and best practices, it is considered that the overall ODP area will be more energy efficient than older parts of the Selwyn District.

The use of non-motorised transport is promoted by creation of walkway and cycling tracks that will provide a connection to the proposed Business area and activities. By being able to choose readily available walking and cycling routes, overall energy consumption will be reduced when compared to the sole use of motorised transport.

8.6 Traffic Effects

The proposed change of use on the site as a result of rezoning for business and residential use will increase the volume of traffic within the site and surrounding road network, including the road intersection between Creyke Road and SH 73. An assessment of the transportation effects has been provided by Andy Carr of Carriageway Consulting Ltd and is included in Appendix 9 of this application. The Carriageway report concludes that the nature and volume of traffic generated from the development of the site is likely to change as a result of this plan change but can be accommodated on the adjacent roading network without safety, capacity or efficiency issues arising.

As a result of the transport assessment, the ODP proposed as part of the Plan Change includes provisions for pedestrian and cycle access internally between the proposed business zone and residential zone road networks and potential links to adjoining land to the south. This will provide alternative forms of transport as prioritised by the CRPS, and by the objectives and policies of the District Plan.

The ODP also makes provisions for the realignment of Creyke Road where it intersects with SH 73 to straighten the approach to the Highway from Creyke Road and enable improved sight lines in accordance with the recommendations of the transport assessment. Landscaping provisions as part of the proposed rules and ODP seek

to plant only up to 1 m within proximity to the intersection to also allow for improved sight lines at the intersection. The effect of increase traffic will not occur immediately when the first residential section is subdivided, but rather will increase as development of the site increases. In recognition that some development of the site can occur without compromising the Creyke Road/SH73 intersection a new rule that enables up to 17 residential allotments (being just under half of the total 35 allowed) to be developed will ensure any developer has sufficient funds to contribute towards the upgrade of the intersection. However, given the uncertain nature of any future business activities within the proposed Business 2 Zone, it is proposed that prior to any development of this area the intersection be upgraded. This mechanism will avoid significant adverse effects on the road network.

Subject to the compliance with the road alignment changes and landscaping restrictions provided for in the ODP and proposed rules, any traffic effects generated by enabling the rezoning of the application site will be able to be provided for within the surrounding road network.

8.7 Cumulative Effects

This plan change provides for the change of land currently used as farmland to be developed into residential activities. It is noted that this will add to the total area in the Selwyn District being converted from farmland into residential dwellings in a cumulative manner, however such growth is anticipated by strategic planning documents Malvern Area Plan. This document seeks to ensure that such development occurs in a manageable and sustainable manner.

Given that the proposed plan change will enable development that is anticipated by strategic planning documents and includes sufficient measures to avoid adverse environmental effects on the site and surrounding area, it is considered that the rezoning of the application site will not have an adverse cumulative effect.

8.8 Positive Effects

The application site represents the logical eastern expansion of the Darfield township and will reinforce Cryeke Road as the urban containment boundary for the township. The proposed Plan Change will allow for the application site to be developed in future for residential and commercial purposes, increasing the rate payer base for the District of Selwyn and helping to meet the future demand for business and housing in the area. It will provide high quality living and working opportunities in a location which presents excellent connection to Rolleston and Christchurch.

8.9 Effects Summary

The proposed plan change has a range of actual and potential effects on the environment.

The key environmental effects relate to loss of productive land, reverse sensitivity, character and amenity and the implications of rezoning the site to a combination of business and residential zones.

The location of the application site adjacent to the existing township ensures compact urban form. The separation between residential activities and the existing clay brick factory and intensive farming operation across SH73 avoids reverse sensitivity effects. The use of similar boundary fencing treatment of residential sections along the length of Creyke Road continues the sense of rural character established in this area by the Living 2 A zoned land south of the application site. The proposed landscaping around the business zone ensures amenity values are maintained and enhanced.

Given the assessment above, it is considered that the overall effects on the environment are able to be accommodated in this area. The proposal represents a sustainable and practical extension to Darfield Township.

9 Urban Design and the Outline Development Plan

Urban design is a process used to provide direction for growth, conservation and change. The Outline Development Plan (ODP), which can be used as a framework for new development on a long-term basis, is the instrument to display such design directions.

The District Plan provides a definition of an Outline Development Plan as being:

> *A plan of a specified area including in the District Plan, which identifies, in a general manner, the road layout, any storm water facilities, reserve areas or other matters required to be provided for, or included in any subdivisions or development within the area of the Outline Development Plan.*

The attached ODP in the Appendix 2 provides the overall layout of the road network, the road side reserve areas, and the proposed living a business zones. It identifies areas where landscaping is required and shows the altered Crekye Road layout.

It is anticipated that as part of the plan change process, the ODP will be incorporated into the Selwyn District Plan. Any future development of the site will be undertaken in general accordance with the ODP, as reflected in the new rules proposed by the plan change which refer specifically to the ODP.

The ODP is in keeping with the design qualities of the Ministry for the Environment's Urban design Protocol and the principles, objectives, policies and rules of the Selwyn District Plan. It provides a coordinated concept for the development of the site while also providing mechanisms to mitigate adverse environmental effects.

9.1 Objectives of the Outline Development Plan

The Canterbury Regional Policy Statement requires that development of greenfields residential growth shall occur in accordance with an outline development plan. In order to effectively co-ordinate and integrate a number of separate but interrelated structural and design elements, separate network layers are required to be developed. When overlaid, the individual networks layers are required to demonstrate a high level of alignment and cohesion that both support and complement each respective function and aim.

The ODP that accompanies this application has the following basic objectives:

- To provide an attractive living environment for future residents.
- To provide an attractive business environment for future tenants.
- To provide a safe living environment for future residents.
- To provide efficient and safe movement of people through the area, utilising both motorised and non-motorised forms of transport.
- To provide effective and efficient servicing for the area.
- To maintain or enhance the visual character of the area by increasing the amount of landscaping and adding specific design elements.

Green Network objectives

The Green Network refers to the system of public open space provision throughout the site. These spaces offer a wide range of amenity and recreational experiences, and their location and alignments are often intrinsically linked to both the underlying land use and the Blue Network in respect of stormwater management and public access. The objectives of the green network are:

1. Conveniently accessible, appropriately sized recreation reserve and safe public areas having a high degree of co-ordination and integration with existing open space areas.
2. Retention, utilisation and enhancement of existing natural ground features.
3. Provision of public open space within walking distance of residential dwellings.

Blue Network Objectives

The Blue Network refers to the 'above ground' system designed to meet the future anticipated stormwater quality and quantity requirements for greenfields residential growth. It includes swales and other surface drainage paths as well as treatment and detention facilities within existing surface drainage paths and natural basins and depressions. It is important for the Blue Network to recognise the local or physical conditions of a site.

Design of the Blue Network should incorporate and utilise these features appropriately. Engineering solutions that ignore local conditions in order to maximise residential yields are to be avoided. The objectives of the blue network are:

1. A complementary approach whereby surface stormwater treatment areas are located nearby green network spaces.
2. An outline development plan with integrated stormwater management that utilises best practice low impact techniques, which will result in sensitive stormwater quality and quantity requirements except where local conditions make engineered stormwater management techniques a necessity.
3. Utilisation of the land/water edge potential to enhance amenity and natural values, including habitat values, particularly along any existing and future waterways and surface drainage paths.

Movement networks

The Movement Network refers to the system of public roads, cycle ways, pedestrian pathways, public transportation and linkages throughout any Greenfield residential growth. This system often has a strong correlation with the Green and Blue Networks in respect of providing for essential pedestrian and cycle way linkages. The distribution of land uses and residential densities across a greenfield residential growth site has a strong association with this network. The objectives of the movement network are:

1. A transportation network that integrates greenfield residential growth into the surrounding transportation network and makes available to that area maximum multi modal transport opportunities.
2. A well connected, comprehensive Movement Network to, through and from greenfield residential growth which provides public transport routes and safe vehicle, pedestrian and cycle movements that is highly accessible through the formation of a network that:
    - Integrates with the strategic transportation infrastructure.
    - Is legible, well connected and clearly demarcated in a hierarchy that incorporates as many movement modes as possible.
    - Efficiently and effectively disperses traffic throughout greenfield residential growth and minimises adverse traffic effects of new growth on surrounding existing urban developments.

Overall, given the relatively straight forward nature of the proposed plan change layout, the Green, Blue and Movement Networks are very basic (see the layers provided in Appendix 2). The proposal does not include any significant reserve areas outside of the road reserve, and there are no reticulated services in terms of the blue

network. The proposal includes two key roads, one that provides for potential future access to the residential area to the west of the application site, and one that serves the business zone exclusively.

9.2 Assessment against the Seven Cs

The New Zealand Urban Design Protocol (2005) identifies seven essential design qualities that can act as guiding considerations in the structure planning process. These are referred to as the seven Cs and are as follows.

- **Context**: seeing buildings, places and spaces as part of whole towns and cities
- **Character**: reflecting and enhancing the distinctive character, heritage and identity of our urban environment
- **Choice**: ensuring diversity and choice for people
- **Connections**: enhancing how different networks link together for people
- **Creativity**: encouraging innovative and imaginative solutions
- **Custodianship**: ensuring design is environmentally sustainable, safe and healthy
- **Collaboration**: communicating and sharing knowledge across sectors, professions and with communities.

The proposal is assessed against the seven Cs as follows:

Context	The ODP shows the development east of Darfield will be a coherent development, which provides a natural extension and termination of the township. Development within the ODP area will be of sufficient size and orientation to be recognised as an appropriate neighbourhood within Darfield.
Character	The ODP area is able to fit in with the existing urban character of Darfield. However, as a result of a relatively low density subdivision, it will create its own distinctive character due to the opportunity for open space within residential sites for garden planting. The adjoining business zone will create a distinct and symbiotic commercial environment at the entrance of Darfield to the signifying an arrival to the township, although this will be largely separated through distinctive landscaping.
Choice	Choice in residential development is limited by the zoning in the District Plan and potential direction from the National Planning Framework. The ODP provides for greater choice within the Darfield Township for the residential market to uptake sections in between the existing Living 1 and Living 2 zones. There is good access to open spaces for all future residents. Similarly, the business zone will provide for an array of options for future land owners, with the complementing business zone nearby.
Connections	The main connections for motor vehicles will be via the road connection to Creyke Road. This is anticipated by the ITA to adequately service the population in the area. The proposal also includes potential future access for land to the west of the application site, to enable this land to be developed without having to access SH73. Pedestrians and cyclists have the same options as motor vehicles, and also the alternative linkages through from the residential zone, which connects with the proposed new roads.
Creativity	A range of designers, including architectural professionals and housing companies will inevitably design dwellings. It is anticipated that the future landowners will express their creativity through their individual requirements of house or building design. Furthermore, the large residential sections will enable future owners to express their own landscaping creativity.
Custodianship	The development will enhance the built environment by integrating with the existing pattern of development on Creyke Road and providing enhanced amenity through the use of the subject site, which is in close proximity to Darfield.
Collaboration	There have been several discussions between the applicant, their consultants and the Selwyn District

	Council. Consultation was also undertaken with the New Zealand Transport Agency. Wider consultation was not undertaken as there is ample opportunity for public involvement through the notification and hearings process.

9.3 Conclusion

The proposed Plan Change inserts an Outline Development Plan into the Selwyn District Plan. The ODP is consistent with the design standards within the New Zealand Urban Design Protocol. It is also consistent with the seven C's of Urban Design, which have been assessed against the proposal.

10 Consultation

Clause 1(h) of the Fourth Schedule the Act requires that persons affected by the proposal are to be identified, along with the "consultation undertaken, if any and any response to the views of any person consulted".

It is noted that Clause 1AA of the Fourth Schedule states that:

> *To avoid doubt, clause 1(h) [of the Fourth Schedule] obliges an applicant to report as to the persons identified as being affected by the proposal, but does not*
> *a) Oblige the applicant to consult with any person; or*
> *b) Create any ground for expecting that the applicant will consult with any person*

Clause 25 of Part 2 of the First Schedule of the Act requires that should the Council agree to accept the plan change request, the proposal must be publicly notified for submissions. Public notification is a form of consultation and it is important to recognise that a greater number of persons may be notified than may have been involved in the initial consultation process.

A short summary on consultation undertaken to date is provided below:

10.1 Selwyn District Council

Meetings were held with Selwyn District Staff during the preparation of this Plan Change during which the applicant was working with adjoining neighbours There have been several discussions between the applicant, their consultants and the Selwyn District Council.

10.2 NZTA

A draft ODP of the Plan Change was supplied to NZTA. Their initial comments raised concerns with the intersection of Creyke Road and SH 73 and indicated that they did not want access from the application site to SH73. Subsequent redesign of the original ODP were made including the realignment of Creyke Road included into the proposal as part of the overall layout. A letter confirming that these changes are acceptable to NZTA has been attached as Appendix 11.

10.3 Canterbury Clay Bricks

A draft ODP and outline of the draft text amendments and Plan Change was supplied to Canterbury Clay Bricks and concern was raised as to the reverse sensitivity effects on the lawful operation of the Clay Brick activities. An assessment of air quality associated with the operation of the clay brick factory has been carried out and the report is attached in Appendix 10 that demonstrates that there is unlikely to be an adverse effect on the residential areas of the plan change site. As a result of the concerns raised the applicant amended the overall layout of the site, increasing the business zone and decreasing the living zone to better alleviate any reverse sensitivity concerns raised by Canterbury Clay Bricks.

11 Conclusion

This application seeks to change the Selwyn District Plan to accommodate Living 1 zoned land for up to 35 allotments and Business 2 zoned land within the application site at the corner of Creyke Road and State Highway 73 in Darfield. The application site has been identified in the Malvern Area Plan as suitable for future growth of Darfield. The application seeks to rezone the site using the Living 1 zoning consistent with the anticipated Selwyn District Plan review and the National Planning Template requirements.

The overall development of the ODP has been refined through consultation with NZTA and the Clay Brick Factory to the north of the application site, and amendments have been made accordingly. Landscaping, business building setbacks and residential boundary fence treatments have been included within the ODP to maintain and enhance the amenity of the site and to ensure there the changes within the site do not significantly detract from the overall character and amenity values within immediately surrounding land.

The assessment contained within this application identifies the site as appropriate for business and residential development within the limits established by the ODP and proposed rule amendments or additions. The proposed plan change is consistent with existing planning documents including the objectives and policies of the Selwyn District Plan and the Canterbury Regional Policy Statement.

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Appendix 1: Record of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

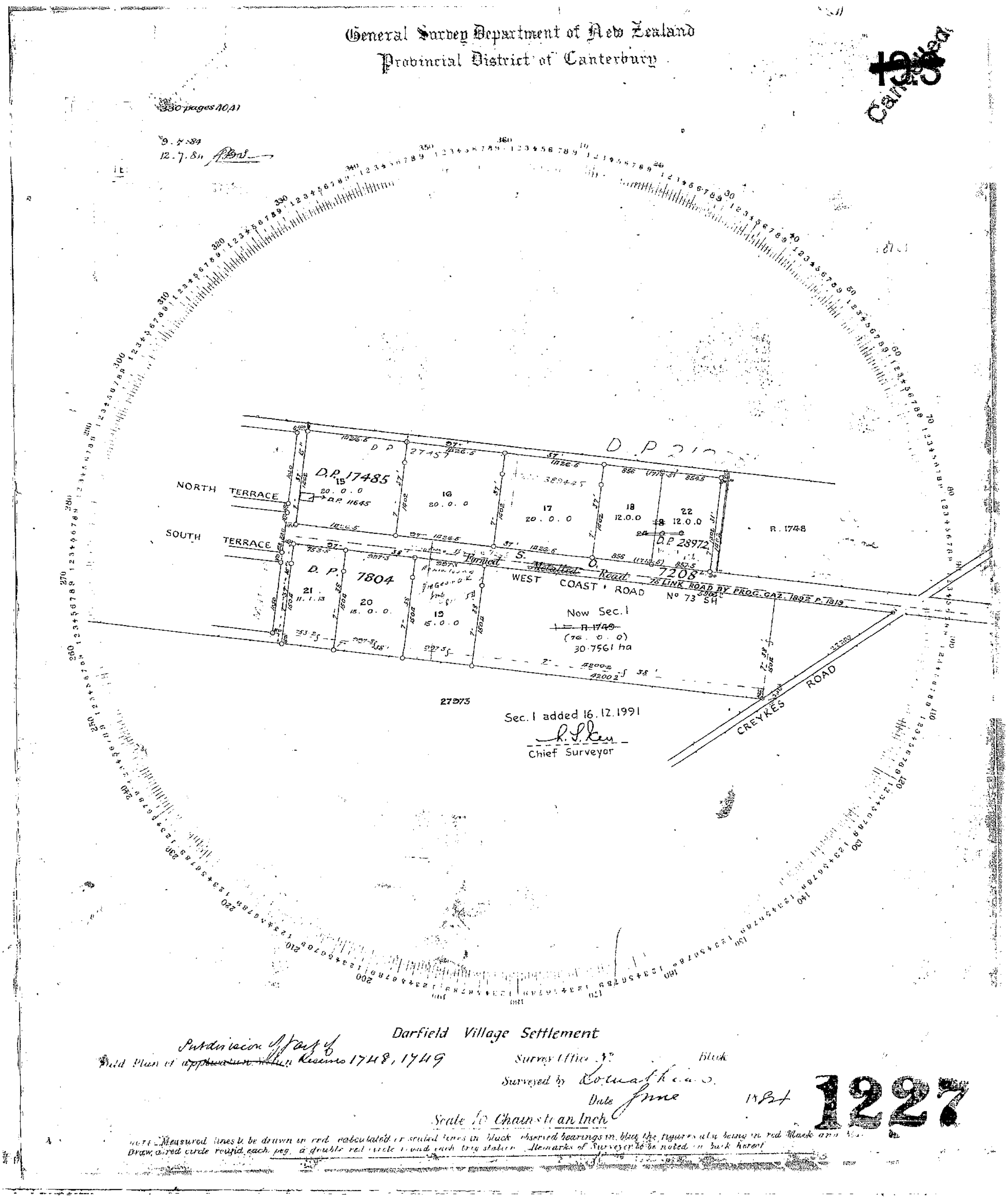
Identifier	**CB39B/123**
Land Registration District	**Canterbury**
Date Issued	02 June 1994

Prior References
GN A113380.1

Estate	Fee Simple
Area	30.7561 hectares more or less
Legal Description	Section 1 Survey Office Plan 1227

Registered Owners
Rupert Jack Wright and Catherine Elizabeth Wright

Interests


General Survey Department of New Zealand
Provincial District of Canterbury
Cancelled
D.P. 17485
NORTH TERRACE
SOUTH TERRACE
D.P. 7804
D.P. 28972
WEST COAST ROAD
R. 1748
CREYKES ROAD
Now Sec. 1
30·7561 ha
Sec. 1 added 16.12.1991
Chief Surveyor
Darfield Village Settlement
Subdivision of part of Reserves 1748, 1749
Scale 10 Chains to an Inch
1227

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Appendix 2: Outline Development Plan

Note

1) There shall be no more than 35 residential allotments created in the Living 1 zoned area, and these shall have a minimum average allotment area of 1,950m^2.

2) For residential sites fronting Creyke Road fencing is to be generally consistent along the length of the frontage and to be of open rural style, such as post and rail or post and wire.

3) There shall be no direct access from the Business 2 zone to Creyke Road or State Highway 73.

Legend

- Proposed 10m wide landscape strip
- Proposed 10m wide landscape restricted area (Planting under 1m height)
- Existing shelter belt to be removed before site construction start
- Existing shelter belt
- Existing trees to be removed
- Existing low level area (See site image 1)
- Visual analysis (Attached with view point plan)
- Street elevations (Attached with street elevation plan)
- Planting elevations (Attached with planting elevation plan)

Site Image 1
Existing low level area

Darfield Plan Change

Scale	1:500 @A1, 1:1000@A3
Date	28 Feb 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	Note adding

Revision A

Sheet 2

Planting Elevation A-A

Proposed planting presented as matural grows height in elevation, approximate will take 15-35 years grow to the matural height

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Darfield Plan Change

Scale	1: 25@A1, 1: 50@A3
Date	5 Mar 2019
Design	EL
Drawn	EL
Review	MV

Rev.	Date	Amendment
A	18/06/19	

Revision A

Sheet 4

6m wide proposed planting combination for amenity, biodiversity, noise barrier and long term screening	Existing pine shelter belt. To be removed once reached maximum life span

Planting Elevation A1-A1

Proposed planting presented as matural grows height in elevation, approximate will take 15-25 years grow to the matural height

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Darfield Plan Change

Scale	1: 25@A1, 1: 50@A3
Date	05 Mar 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	

Revision A

Sheet 5

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10m

8m

6m

4m

2m

1m

0m

10m wide planting under 1m to meet the planting restriction on the intersection corner. NZ native tussock and groundcover combination

Planting Elevation A2-A2
Intersection planting heihgt restriction zone

Proposed planting presented as matural grows height in elevation, approximate will take 2-10 years grow to the matural height

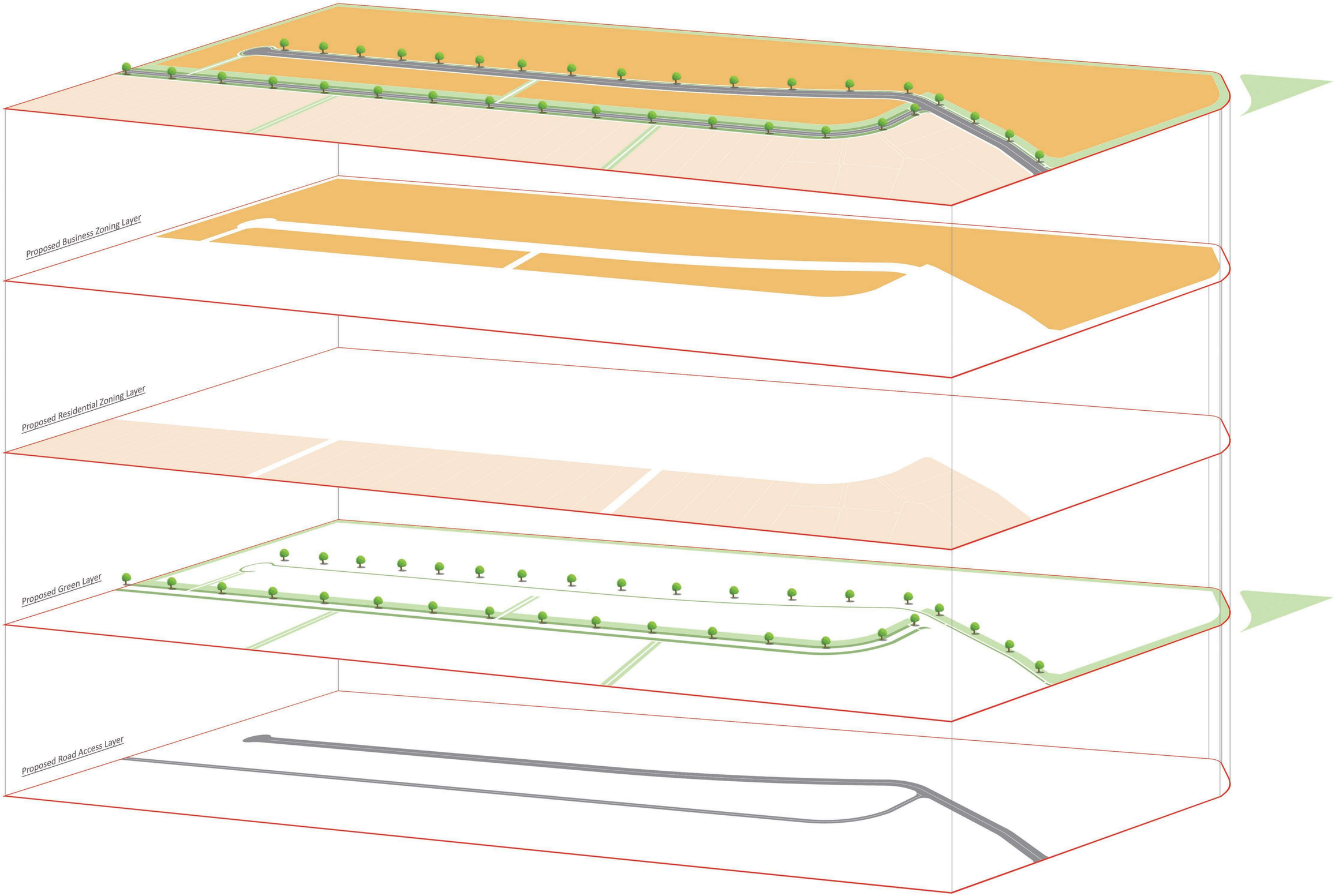
Darfield Plan Change

Scale	1: 25@A1, 1: 50@A3
Date	5 Mar 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	

Revision A

Sheet 6



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Darfield Plan Change

Scale	Not to Scale @A1
Date	12 Mar 2019
Design	EL
Drawn	EL
Review	MV

Rev.	Date	Amendment

Revision

Sheet

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Appendix 3: Servicing Report

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Engineering Servicing Report

Darfield Plan Change

CLIENT	ADDRESS	REFERENCE
Rupert and Catherine Wright	13 Mulholland Drive, Darfield	6096

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Report Information

Reference:	6096
Title:	Darfield Plan Change - Servicing Report
Client:	Rupert and Catherine Wright
Filename:	6096- Darfield Plan Change - Servicing Report
Version:	2
Date:	**7/25/2019**
Prepared by:	Jalesh Devkota/James Hopkins
Reviewed by:	Clayton Fairbairn

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Contents

1 Introduction

1.1 Report Purpose

This purpose of this report is to demonstrate the serviceability of the proposed plan change area in Darfield that is outlined in Figure 1, below. This report has been prepared to support the application for a private plan change, to enable rezoning of the land for residential and commercial use.

This report will address wastewater, stormwater and water supply. Roading and natural hazards have been addressed in separate reports.

The proposed development will comprise approximately 35 residential allotments with the balance as commercial allotments. The site is located east of the Darfield township and has been identified as having potential for low density residential development (DAR 6) in the Malvern Area Plan 2031.

Figure 1: Proposed Plan Change Area

2 Wastewater

2.1 Existing Infrastructure

There is no existing wastewater reticulation and treatment system in Darfield. Hence, there is no wastewater network servicing the subject site. Existing dwellings are connected to on site treatment and disposal systems.

2.2 Possible disposal methods

The following methods of wastewater disposal are possible for the plan change area.

2.2.1 On site wastewater treatment and disposal

Sewer from each lot can be treated by an aerated treatment facility such as, but not limited to, the Oasis Clearwater system. Treated effluent will then be disposed of via effluent fields. Consent to discharge wastewater into the ground will be required from Canterbury Regional Council (ECan).

2.2.2 Reticulated system

A gravity or pressure reticulation network, discharging to a centralised wastewater treatment facility is possible. It is considered unnecessary given the ability to service the plan change area by on site treatment and disposal systems.

As there are no existing wastewater reticulation and treatment facilities in Darfield. Baseline Group (BLG) have completed a field visit and investigated possible routes and location for a sewer treatment system. It was concluded that it was not viable to install a new treatment system as it was too land intensive and cost prohibitive.

2.2.3 Reticulated system, pumping to Rolleston

A gravity or low pressure reticulation network, discharging to the existing wastewater treatment plan in Rolleston is an option. It is however that this is unnecessary given the ability to service the plan change area by on site treatment and disposal systems.

2.3 Proposed disposal method

It is proposed that the plan change area is serviced by individual on site disposal systems.

2.4 ECan consent requirements

It is noted that the proposed residential allotments are in the order of 2,000m^2. These will require consent from ECan due to not complying with the requirements of rule 5.8 of the Land and Water Regional Plan (LWRP).

3 Stormwater

3.1 Existing Infrastructure

There is no existing stormwater network in Darfield. Soils in the area are typically free draining and stormwater in this region is primarily discharged into the ground via soak pits installed at each property.

3.2 Ground Water

A review of local ECan wells in the ECan GIS viewer indicates that the water table is at least 80 m below the ground (Refer to Table 1 below). This does not however, preclude the existence of perched groundwater tables within the underlying strata. In addition to that, the groundwater levels within the site will be prone to some fluctuation. The levels are expected to rise during periods of prolonged and/or heavy rainfall and fall during dry weather. Groundwater levels will also be connected to seasonal river levels, and groundwater recharge from the alps and foothills. However there is no evidence that such fluctuations will result in groundwater levels compromising the ability to dispose of stormwater to ground.

Well	Location	Highest Measured Groundwater Level (below GL)	Lowest Measured Groundwater Level (below GL)
BX22/0051	1.08 km east from site	85.22	85.22
L35/0624	477m north from site	127.94	127.94
L35/1163	968m south from site	90.63	90.63
L35/0213	1.43km north from site	91.56	98.74

Table 1: ECan Well Logs

3.3 Proposed Stormwater Disposal Method

Owing to the presence of low ground water levels and lack of reticulated stormwater, it is proposed that stormwater from the plan change area will discharge into the ground via soak pits.

Roof water from dwellings and associated hard stand runoff will be directed to individual soak pits installed at the time of building consent and allowed to infiltrate into the ground.

Standard kerb and channels will be installed either side on each carriageway to collect stormwater and convey to sumps. Runoff from the roads in the proposed plan change area will drain through kerb and channel to sumps. Sumps will be constructed with a nominal storage depth below the outlet pipe to promote settling of sediment and be fitted with submerged Y-junctions to reduce hydrocarbons. Each sump will discharge into an appropriately sized soak pit, positioned adjacent to the sump to allow runoff to discharge to ground.

Roof and hardstand areas within individual lots of the commercial area can also be designed to dispose to ground (with treatment if necessary depending on the nature of the operation within the site).

Discharge to ground is assessed as a discretionary activity under the ECan LWRP, and a stormwater discharge consent will be required.

4 Water Supply

4.1 Existing Infrastructure

The Darfield water supply provides reticulated potable water from two deep bores to both the Darfield Township (unrestricted supply) and two restricted supply zones to rural properties surrounding the township. Water is being supplied to the north of the plan change area site via DN150 pipe in Horndon St and a DN75 PE80 pipe along the northern side of West Coast Road (SH73). To the east of the plan change area Creyke Road is serviced by DN50 PE80 diameter pipe. A Selwyn District Council (SDC) as-built plan is attached as Appendix 1.

4.2 Proposed Servicing

The SDC water supply Activity Management Plan (AMP) indicates that the water supply in Darfield is operating at its consent limit (83 l/s). Reservoir storage (located at the corner of SH73 and Kimberley Rd) and higher distribution pumping capacity helps meet peak hour flow demand in excess of the consented abstraction capacity for short durations. Despite this, the existing Darfield water supply scheme does not have enough capacity to service the proposed plan change area.

Discussions with SDC identified that the supply will need to be augmented for servicing the plan change area. It was agreed to find a suitable land nearby the proposed subdivision or in the subdivision itself, where a new bore, pumps, reservoir and treatment facility will need to be installed. It is anticipated that the bore will need to be extended to a depth in excess of 100m, anecdotally other bores in the area extend to 200m below existing ground to ensure continuity of supply with groundwater fluctuations. A new network of pipes will be installed on the subdivision and water will be supplied to the individual lots from this network. This new reticulation can connect to the existing SDC network as required.

4.3 Water Supplies for Firefighting

For firefighting purposes, the classification for the residential portion of the plan change area will be FW2 (from SNZ PAS 4509:2008 New Zealand Fire Service Firefighting Water Supplies Code of Practice), based on all properties being residential, non-sprinklered structures. This classification requires at least one fire hydrant to be located within 135 m of any dwelling, and two hydrants located within 270m of any dwelling. Each hydrant must have the capacity to provide a minimum of 12.5 L/s with a minimum residual pressure of 100 kPa.

New mains, fire hydrant and water supply pipes need to be installed on the proposed development site. Pipe sizes and positioning of fire hydrants will satisfy the criteria of SNZ PAS 4509:2008.

As the firefighting classification of the individual buildings commercially zoned portion of the plan change is unknown this would need to be ascertained and managed at the time of building consent. This will be managed at the time the new water infrastructure is designed and constructed to ensure there is sufficient capacity to service the likely commercial development within the zone.

5 Electrical and Communications

5.1 Electrical

Orion have confirmed the application site can be serviced with reticulated power from the existing network. A copy of the letter from Orion confirming the ability to connect has been received and is included as Appendix 2 of this report.

5.2 Communications

Chorus NZ Ltd have confirmed the application site can be serviced with telecommunications from the existing network. A copy of the letter from Chorus confirming the ability to connect has been received and is included in Appendix 3.

Each lot will be serviced by underground utilities

6 Conclusion

6.1 General

This servicing report has been prepared to accompany the private plan change application. Based on the preliminary design and discussions to date, the proposed subdivision can be serviced in accordance with the requirements of SDC Engineering Code of Practice, NZS 4404:2010 - Land development and subdivision infrastructure and engineering best practice.

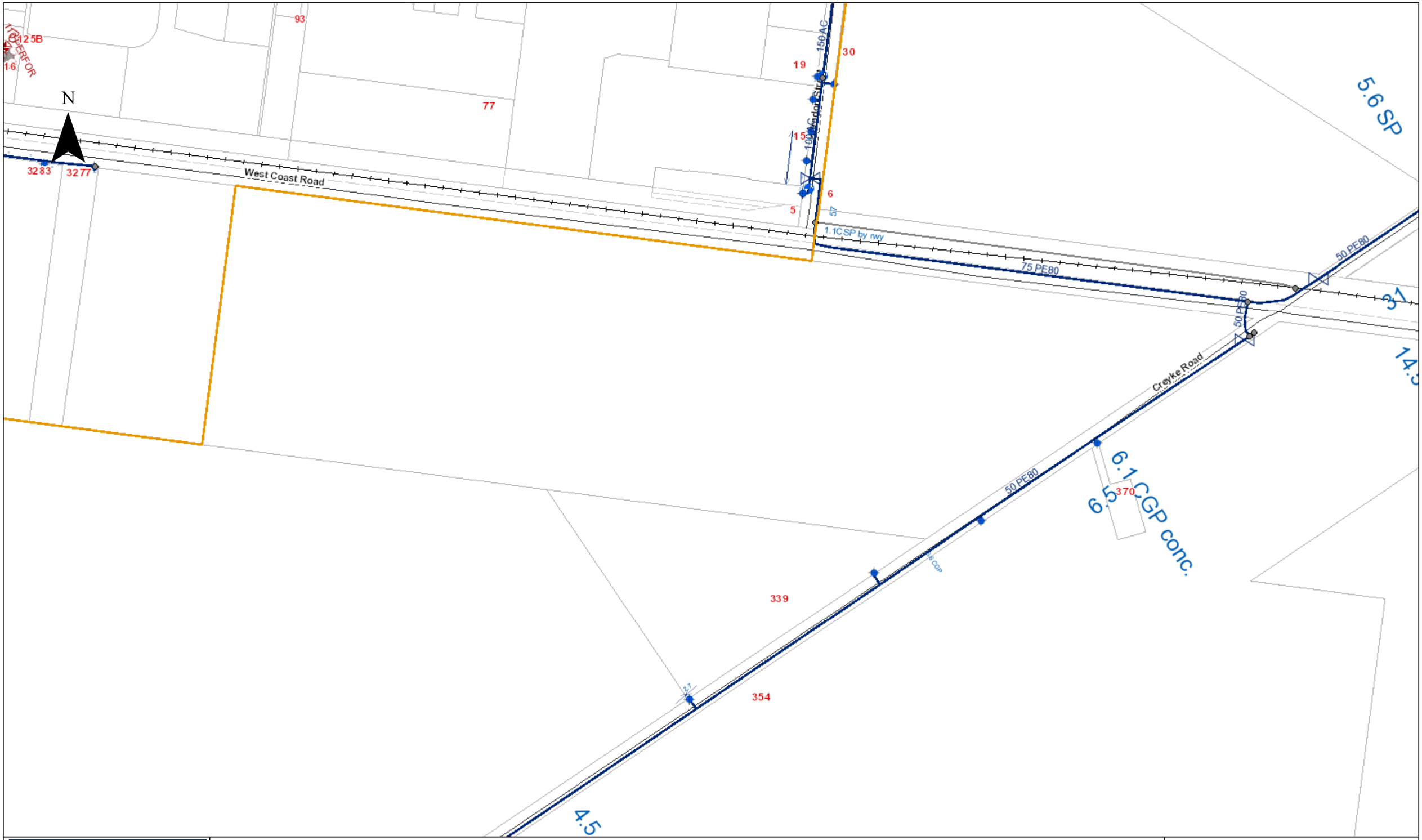
6.2 Services

Wastewater from each lot can be treated and disposed of utilising on site systems. Stormwater from all roof and hardstand areas can discharge into the ground via soak pits. An augmentation of the existing Darfield water reticulation with a new bore and pump within or adjacent to the plan change area will provide adequate flows and pressures to the plan change area. New water mains, submains and laterals along with new fire hydrants will need to be installed at the proposed subdivision site for water supply and firefighting purposes.

BASELINEGROUP

Appendix 1: Water Supply As-Built plan

LocalMaps Print



0 110 220 330 440

Metres

22/08/2017
Cadastral Information dervided from Land Information New Zealand's Digital Cadastral Database (DCDB)

Data Projection: NZGD2000 New Zealand Transverse Mercator

BASELINEGROUP

Appendix 2: Orion Confirmation Letter

Direct: +64 3 363 9722
Email: craig.marshall@oriongroup.co.nz
Ref: **ES336580**

21 August 2017
Re: West Coast Road, Darfield

C/O
Jalesh Devkota
Baseline Group
Level 1 140 Welles Street
Christchurch 8011

jalesh@blg.nz

Dear Sir,

Proposed sub-division connection to the Orion network
CT39B/123, corner of West Coast and Creyke Roads, Darfield.

I refer to your letter and the above named property(s). I have investigated your request and comment as follows;

1. Orion has the capacity on the network to meet your request
2. There are no specific connections available for this subdivision; however,
3. A connection could be made available for one or more dwellings with alteration to the Orion network.
4. There will be costs associated in providing the connection(s). These costs will be the responsibility of the property owner, not Orion.
5. To comply with Orion's network security conditions an alternative feed from adjoining developments may also be required.
6. This type of work would be a typical design build project. If you decide to proceed; have your designer forward their proposal to Orion for approval. Orion will forward Terms and Conditions for acceptance.

The terms and conditions presented to the applicant will encompass Orion's policies and practices current at the time.

Please don't hesitate to contact me on (03) 363 9722 if you have any questions, or email me at craig.marshall@oriongroup.co.nz.

Yours faithfully

Craig Marshall
Reticulation Support Engineer

Orion New Zealand Ltd
565 Wairakei Road
PO Box 13896
Christchurch 8141
+64 3 363 9898
oriongroup.co.nz

BASELINEGROUP

Appendix 3: Chorus Confirmation Letter

Chorus Network Services
PO Box 9405
Waikato Mail Centre
Hamilton 3200
Telephone: 0800 782 386
Email: tsg@chorus.co.nz

Sub Div Ref: DRF42085

21 August 2017

Your Ref:

Baseline Group

Attention: Jalesh
Dear Sir / Madam

SUBDIVISION RETICULATION – DRF: West Coast Road, Darfield. 154 Lots - Estimate Only

Thank you for your enquiry regarding the above subdivision.

Chorus is pleased to advise that, as at the date of this letter, we would be able to provide ABF telephone reticulation for this subdivision. In order to complete this reticulation, we require a contribution from you to Chorus' total costs of reticulating the subdivision. Chorus' costs include the cost of network design, supply of telecommunications specific materials and supervising installation. At the date of this letter, our estimate of the contribution we would require from you is $283,360.00 (including GST).

We note that (i) the contribution required from you towards reticulation of the subdivision, and (ii) our ability to connect the subdivision to the Chorus network, may (in each case) change over time depending on the availability of Chorus network in the relevant area and other matters.

If you decide that you wish to undertake reticulation of this subdivision, you will need to contact Chorus (see the contact details for Chorus Network Services above). We would recommend that you contact us at least 3 months prior to the commencement of construction at the subdivision. At that stage, we will provide you with the following:

- confirmation of the amount of the contribution required from you, which may change from the estimate as set out above;

- a copy of the Contract for the Supply and Installation of Telecommunications Infrastructure, which will govern our relationship with you in relation to reticulation of this subdivision; and

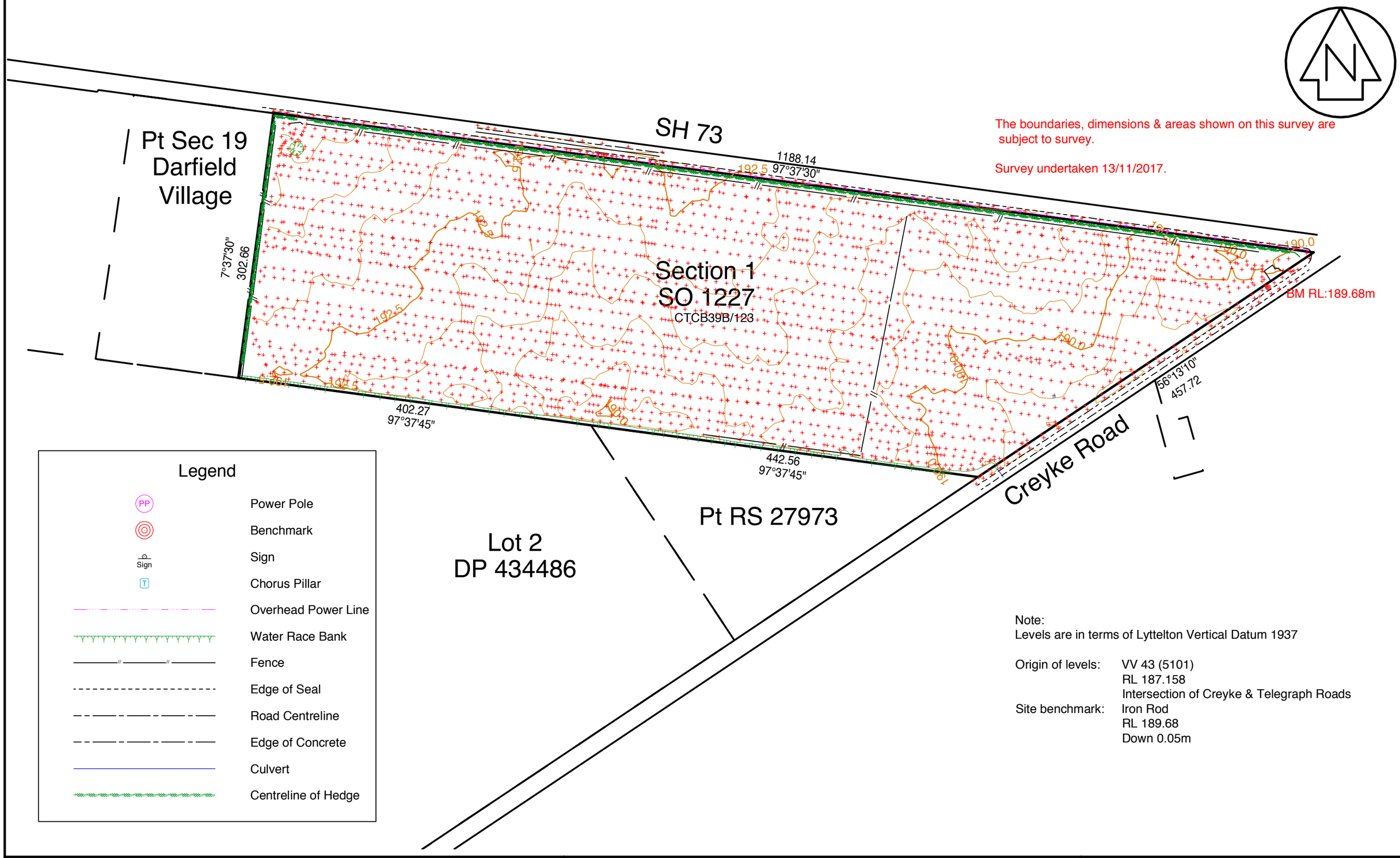
- a number of other documents which have important information regarding reticulation of the subdivision, including - for example - Chorus' standard subdivision lay specification.

Yours faithfully

Reid McKenzie
Network Services Coordinator

BASELINEGROUP

Appendix 4: Topographical Survey



The boundaries, dimensions & areas shown on this survey are subject to survey.

Survey undertaken 13/11/2017.

Legend

- Power Pole
- Benchmark
- Sign
- Chorus Pillar
- Overhead Power Line
- Water Race Bank
- Fence
- Edge of Seal
- Road Centreline
- Edge of Concrete
- Culvert
- Centreline of Hedge

Note:
Levels are in terms of Lyttelton Vertical Datum 1937

Origin of levels: VV 43 (5101)
RL 187.158
Intersection of Creyke & Telegraph Roads

Site benchmark: Iron Rod
RL 189.68
Down 0.05m

Clark Land Surveyors Ltd
Registered Surveyors - Land Development Consultants

Unit 6, 11 Print Place
PO Box 8177, Riccarton
CHRISTCHURCH
PH (03) 3390401 FAX (03) 3390408
email: cls@cls.co.nz

Site Survey of Section 1 SO 1227

CT CB39B/123
Catherine & Rupert Wright
Corner of Creyke Road & SH 73, Darfield

Scale:1:4000
At A3

File Ref:171103

C:\12d Synergy\2\171103_179\Survey\CAD\171103 Site Survey 20171201.dwg

Saved:12/1/2017 9:25:07 AM

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Appendix 5: Geotechnical Report

GEOTECHNICAL INVESTIGATION REPORT

FOR PROPOSED LAND USE CHANGE

Corner of Creyke & West Coast Roads (Section 1 SO 1227), Darfield

Client: Rupert Jack & Catherine Elizabeth Wright

Project Reference:	LTCL17312
Revision:	A
Date:	22 December 2017

Documentation Control:

LandTech Consulting Ltd

Postal Address:
PO Box 119
Christchurch 8013

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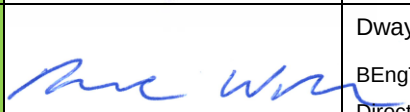
Christchurch 8023

P. 03 390 1371
E. info@landtech.nz
W. www.landtech.nz

Document Title:	**Geotechnical Report for Proposed Land Use Change**	
Address:	Corner of Creyke & West Coast Roads (Section 1 SO 1227), Darfield	
Revision:	Revision A	
Client:	Rupert Jack & Catherine Elizabeth Wright	
Project Reference:	LTCL17312	
Author:		Liam Stewart, Associate Engineering Geologist BSc, PGDip (Geology)
Reviewed/Authorised:		Dwayne Wilson, Senior Geotechnical Engineer BEngTech (civil), MEngSt (geotechnical), CPEng, Director

REPORT DISTRIBUTION:		
Recipient	**Release Date**	**Document Type**
Rupert Jack & Catherine Elizabeth Wright	22 December 2017	PDF
Baseline Group	22 December 2017	PDF

Table of Contents:

Appendices:

1.0 Introduction

1.1 Project Brief

LandTech Consulting Ltd. (LandTech) were engaged by Rupert Jack & Catherine Elizabeth Wright (the Client) to carry out a geotechnical investigation on the corner of Creyke & West Coast Roads, Darfield. The geotechnical investigation is in relation to the proposed land use change of the property from rural to residential and commercial.

The geotechnical investigation has been carried out to determine a geological model of the site, assess the future land performance (i.e. during seismic events) and assess the suitability of the proposed land use change from a geotechnical perspective. Where applicable assessment and reporting has been conducted in accordance with the Ministry of Business, Innovation and Employment document; Repairing and rebuilding houses affected by the Canterbury Earthquakes, dated December 2012 (MBIE Guidelines, 2012), and any relevant updates.

This geotechnical report summarises the findings of our investigation and assessment. It includes our evaluation of natural hazards, suitability of the proposed development, and may be used to support a Land Use Change Application to the Selwyn District Council.

1.2 Scope of Works

The geotechnical investigation for the proposed subdivision included the following:

- Desktop review of existing geological, geotechnical and natural hazard information;
- Detailed walkover inspection;
- Intrusive field investigation (i.e. testpit excavations);
- Geotechnical assessment and natural hazard evaluation; and
- Preparation of this geotechnical report, detailing all of the above and recommendations.

2.0 Site Description

The investigation site is located on the corner of Creyke & West Coast Roads (State Highway 73), Darfield and is legally described as Section 1 SO 1227. The property is approximately trapezoid shaped in plan view and 30.8ha in total area (the site area has been sourced from https://mapviewer.canterburymaps.govt.nz/, accessed 14 December 2017); as shown in Figure 1 and on the LandTech *Site Plan*, Drawing No. LTCL17312/ 1 (attached in Appendix A). The site is bound to the north by West Coast Road and Creyke Road runs adjacent the eastern site boundary. At present the property comprises a rural/pastoral setting and the ground surface is generally near level to undulating with a gradual fall toward the south. An open drainage channel flows along the southern boundary and is indicated on the LandTech *Site Plan* (referenced above).

Figure 1: Aerial photograph of investigation site

(Source: https://mapviewer.canterburymaps.govt.nz/, accessed 14 December 2017)

3.0 Proposed Development

Baseline Group have provided a drawing titled: *Outline Development Plan – Section 1 SO 1227, Plan Change – Darfield*, Sheet 1/1, Revision 1, dated 3 June 2016. The drawing indicates it is proposed to change the current land use from rural to commercial and residential. The proposed development following an approved land change by the Selwyn District Council will include the construction of commercial buildings (with associated car parking and landscaping), a community centre, low and medium density residential properties.

4.0 Area Geology

Reference has been made to the various maps and resources made available by GNS and NZGD (for example, the *New Zealand Geology Web Map*, http://data.gns.cri.nz/geology/, accessed 14 December 2017). The reviewed sources indicate that the site is underlain by Late Pleistocene River Deposits. These materials generally comprise rounded to subrounded gravel and cobble sized particles deposited via the lateral and vertical migration of the past and present river systems, from the Southern Alps, out toward the east coast.

The characteristics of the River Deposits can vary widely over small distances. These variances include vertical and horizontal differences in both soil particle size distribution and consolidation. It is discussed above that these materials generally comprise gravel and cobbles; however, interbedded horizons of fine to coarse grained sand, silt and clay can also exist.

4.1 Faults in Canterbury

New Zealand rests on the boundary between the Pacific and the Australian Tectonic Plates. This boundary is marked by a series of surface expressions through the Marlborough, North Canterbury, Wairau, Awatere, Clarence and Hope Faults. These faults converge near Otira and form the Alpine Fault. In places away from these major faults are smaller/minor faults that act in taking up some of the tectonic plate movements (for example the active Porters Pass Fault). These faults, and unknown unmapped faults below the Canterbury Plains contribute to the seismic hazard of the region.

The tectonic plates are constantly moving with respect to one another, and the Earth's crust can only accommodate a certain level of stress/strain before rupture occurs. This has been demonstrated during the recent Canterbury Earthquake Sequence (CES) and Kaikoura Earthquakes. The ruptures will generally emerge along a fault line and result in an earthquake. Depending on the nature and depth of the fault, an earthquake needs to be larger than approximately Mw 6.0 to 6.5 for the rupture to break through to the surface.

For the purpose of our investigation we have referred to a Selwyn District earthquake fault report compiled by GNS Science and Environment Canterbury (ECan). The referenced report is titled:

- General distribution and characteristics of active faults and folds in the Selwyn District, North Canterbury, GNS Science and Environment Canterbury, dated July 2013.

The sourced report gives a general outline of the nature of geologically active areas within the Selwyn District; indicating that the site is located approximately 10.0Km north of the mapped Greendale Fault.

The Greendale Fault and associated blind faults of the Darfield earthquake sequence have been defined by GNS Science via field inspection, aerial photograph interpretation and regional geologic mapping. The reference source indicates that these faults were unknown prior to 2010 and the ages of previous ruptures (if any) are also not known. The slip rate of the Greendale Fault has not been established and the Recurrence Interval is estimated to be 5,000 years or greater.

Potential hazards related to the Greendale Fault and other unknown faultlines is 1) strong ground motion and 2) the effects of abrupt ground surface offset or buckling which may result. With this being said, the reference report states that "of the later villages and towns, Springfield and Hororata are the only ones that lie close to known or suspected active faults" (GNS Science & ECan, 2013: 29).

5.0 Geotechnical Data Review

For the purpose of our desktop study/geotechnical data review we have referred to a number of sources including:

- New Zealand Geotechnical Database (NZGD); https://www.nzgd.org.nz/;
- Environment Canterbury (ECan): http://canterburymaps.govt.nz/; and
- Selwyn District Plan: http://eplan.selwyn.govt.nz/#!Property/3303741 (accessed 5 September 2017).

The following text summarises the findings of our data review:

- NZGD indicates that the site is located within Green Zone (CERA Residential Zoning Maps) and is classified as N/A – Rural & Unmapped according to Ministry of Business, Innovation and Employment (MBIE).

- The ECan Liquefaction Hazard Map (2012) shows that the site is located in an area where damaging liquefaction is unlikely.

- The Selwyn District Plan shows that the site rests within the *Outer Plains Planning Zone*. In these areas the Council specify that only one house is to exist per 20ha of land.

- The GNS Science Post 4 September 2010 & Post 22 February 2011 Observation Maps do not indicate the occurrence of liquefaction at the surface within the site (or surrounding area) as a consequence of the two referenced earthquakes.

- Local ECan well log data indicate that the area is underlain by river gravels from the surface and to a depth of at least 200m (based on Well L35/0624 & BX22/0051). This is in concurrence with the geology described by GNS Science and described in Section 4.0 (Area Geology).

6.0 Field Investigation

The field investigation for the site was carried out 19 December 2017; it comprised the following components:

- Detailed walkover inspection; and
- Excavation of 16 testpits;

The density of testing was determined in accordance with Part D of the MBIE Guidelines (2012) for Land Use Changes in Canterbury. Where in areas of known dense gravel and deep groundwater, shallow investigations in leu of boreholes and CPT's are suitable.

All field tests have been measured in via Garmin hand held GPS and are therefore approximate only. The test locations are shown on the LandTech *Site Plan*, Drawing No. LTCL17312/ 1 (attached in Appendix A).

The testpits were excavated by Francis Ward Ltd. via 8T digger and the soil conditions encountered were logged by a LandTech Engineering Geologist. The soil was logged in accordance with New Zealand Geotechnical Society *Guideline for the Description of Soil and Rock for Engineering Purposes* (2005). The field logs are attached in Appendix B.

7.0 Subsurface Conditions

The sites subsurface conditions mostly comprised a surficial layer of topsoil (and occasional Loess Deposits) underlain by gravel River Deposits. This is generally consistent with the geology described in Section 3.0 (Area Geology) and Section 5.0 (Geotechnical Data Review). Geologic summaries are given in Table 1 and detailed geologic descriptions follow in the subsequent sections.

Table 1: Subsurface summary

Testpit ID	Easting	Northing	Testpit Depth	Depth of Topsoil	Depth of Loess	Groundwater Level
TP01	1529278	5184289	3.0	0.3	NE	NE
TP02	1529436	5184283	3.0	0.3	NE	NE
TP03	1529688	5184253	3.0	0.4	NE	NE
TP04	1529971	5184198	3.0	0.3	NE	NE
TP05	1530131	5184185	3.0	0.3	NE	NE
TP06	1530353	5184142	3.0	NE	0.7	NE
TP07	1529232	5184178	3.0	0.2	NE	NE
TP08	1529430	5184145	3.0	NE	0.4	NE
TP09	1529669	5184102	3.0	0.4	0.7	NE
TP10	1529948	5184090	3.0	0.2	NE	NE
TP11	1530221	5184042	3.0	0.4	0.7	NE
TP12	1529232	5184036	3.0	0.4	NE	NE
TP13	1529431	5184006	3.0	NE	0.4	NE
TP14	1529656	5183976	3.0	0.4	NE	NE
TP15	1529948	5183939	3.0	0.2	0.5	NE
TP16	1530108	5183969	3.0	0.3	0.7	NE

Table notes: Coordinates are New Zealand Trans Mercator 2000 (NZM2000)
Measurements are in metres (m) below present ground level (bpgl)
NE = Not Encountered

7.1 Topsoil

Topsoil was encountered as a surficial deposit within most test locations. These materials were generally only up to 0.4m below present ground level (bpgl) and comprised brown silt with minor fractions of sand and gravel.

The topsoil is not considered suitable for the support of pavement, buildings or other permanent structures. This is due to its variable composition and strength characteristics that bear the potential for differential settlement.

7.2 Loess Deposits

Loess was encountered at a number of locations (indicated in Table 1) between the upper topsoil mantle and the underlying River Deposits and up to 0.7m bpgl. It is a windblown deposit, common around the Canterbury Plains and generally comprised major fractions of silt with subordinate and minor fractions of fine to coarse grained sand, and fine to coarse grained rounded to subrounded river gravel.

The Loess Deposits are described as yellowish brown/grey, very stiff to hard, non-plastic and moist. Scala penetrometer test results within these materials were mostly higher than 4 blows/100mm penetration.

7.3 River Deposits

River Deposits were encountered underlying the surficial topsoil and Loess Deposits to the termination depth of all testpits (i.e. 3.0m bpgl). These materials generally comprised horizons of fine to coarse grained rounded to subrounded gravel, with subordinate and minor fractions of fine to coarse grained sand, silt, rounded to subrounded cobbles and occasional boulders.

The density of these materials has been described as “tightly packed”; this term is a tactile field description defined as material that requires a pick for removal, either as lumps or as disaggregated material (NZGD, 2005).

7.4 Groundwater

The groundwater table was not encountered during our field investigation, however layers within the River Deposits have been described as moist to wet. A review of local ECan wells via https://mapviewer.canterburymaps.govt.nz/ (accessed 20 December 2017) indicates that the water table is approximately 80m below the ground; however, this does not preclude the existence of perched groundwater tables within the underlying strata.

It is inferred that groundwater levels within the site will be prone to fluctuation. For example, levels are expected to rise following periods of prolonged and/or heavy rain fall and fall during drier times. Groundwater levels will also be connected to seasonal river levels, and groundwater recharge from the alps and foothills.

7.5 Site Seismicity

For the purpose of applying requirements of NZS 1170.5:2004 the site subsoil is Class D – Deep or Soft Soil Site. This classification is based on depths of soil exceeding the limits of Table 3.2 of the reference standard. The seismic hazard factor (Z) for the site is 0.3 as per the standard.

8.0 Qualitative Liquefaction Assessment

The MBIE & New Zealand Geotechnical Society Inc. report titled *Earthquake geotechnical engineering practice, Module 3: Identification, assessment and mitigation of liquefaction hazards* (2016) explains that the evaluation of the geologic susceptibility of liquefaction is a key aspect in the assessment of liquefaction potential at a given site.

Based on our desktop study and field investigation, we have established that the site is generally underlain by Late Pleistocene horizons of tightly packed gravel (i.e. River Deposits) with groundwater levels generally below 80.0m depth. In addition to this the GNS Science Post 4 September 2010 & Post 22 February 2011 Observation Maps do not indicate the occurrence of liquefaction at the surface within the site (or surrounding area) as a consequence of the two referenced earthquakes.

8.1 Land Classification

The region comprises a rural/unmapped Residential Foundation Technical Category (based on MBIE); however, is considered an area that is not likely to be susceptible to liquefaction induced damage. This is based on the geology underlying the site (i.e. Late Pleistocene Aged River Deposits), the previously referenced reports and maps, and the qualitative assessment. Based on our assessment, we consider that the site can be classified as Technical Category 1 (TC1), and consider the property suitable for land use change from a geotechnical perspective.

9.0 Natural Hazard Evaluation

The following assessment addresses geo-hazards outlined in Section 106 of the RMA. These geo-hazards should be contemplated when making an application for subdivision of land (following the pending land use change). When considering the required geo-hazards, we have made our evaluations with respect to the proposed land use change with the potential for subdivision.

9.1 Erosion

The surface of the property is near level to undulating and the topography generally falls toward the southern direction. During our field investigation, we did not observe any obvious signs of erosion from concentrated surface runoff. Furthermore, we do not consider the proposed site developments will increase the erosion potential provided stormwater is disposed of in a controlled manner subject to usual Council Consenting procedures.

9.2 Flooding

For the purpose of our investigation the Selwyn District Council District Plan has been accessed (weblink: http://eplan.selwyn.govt.nz/, accessed 20 December 2017). The District Plan indicates that the site is located within *Outer Plains Planning Zone*, and is not located within an area of flood risk.

9.3 Liquefaction Induced Subsidence and Inundation

It is discussed in previous sections of this report, liquefaction is not likely to occur within the investigation site. This means that liquefaction induced ground damage (i.e. subsidence and inundation) is not likely to occur. Other forms of land subsidence are also not considered to be associated with the site, with the underlying ground conditions exhibiting a competent and stable nature.

9.4 Falling Debris and Slippage

No tall standing slopes exist in the vicinity of the investigation site, therefore falling debris hazard is non-existent, similarly, with risk of slippage (i.e. near level site).

10.0 Geotechnical Suitability

The site is not considered to be at risk of natural hazards, due to the topographic and geologic setting. Our qualitative assessment has found the property is equivalent to the residential classification TC1. This is with respect to liquefaction potential.

Based on the results of our field investigation, the natural ground below any surficial topsoil is considered to meet the criteria of "good ground" in accordance with Verification Method B1/VM1 of the New Zealand Building Code. In saying this, additional geotechnical investigations of appropriate spatial density will be needed during future Subdivision/Building Consent application stages of the development.

The competent and stable nature of the subsurface conditions mean that standard land development engineering, and follow-on building and foundation construction, is considered applicable for this site; this is from a geotechnical perspective.

Therefore, it is our professional geotechnical opinion that the proposed land use change for the site, from rural to commercial and residential, is suitable. The future proposed developments are not considered to be at risk of natural hazards and the local territorial authorities can rely on this when considering the Land Use Change application.

11.0 Limitations

This geotechnical report has been prepared for our Client, Rupert jack & Catherine Elizabeth Wright, for the purposes of supporting Consent applications to the Selwyn District Council. This report shall not be extrapolated for other nearby sites, or used for any other purposes without the express approval of LandTech and their Client.

This report has been based on the results of tests at point locations; therefore, subsurface conditions could vary away from the assumed geotechnical model. Should exposed soil conditions vary from those described herein we request to be informed to determine the continued applicability of our recommendations.

Industry investigation, research and analysis of Christchurch's seismic events has resulted in modifications to the building codes (including MBIE Guidelines, 2012). Because of this, further changes are to be expected with time. The findings and recommendations of this geotechnical report may require modification to accommodate any changes before building works are implemented. In these circumstances, it is recommended that LandTech is engaged to review the findings of this report are reviewed.

The geotechnical investigation was confined to geotechnical aspects of the site only and did not involve the assessment for environmental contaminants. In addition, our investigation and analyses have also not taken into account possible fault rupture that may cause deformations and displacements of the ground directly below the site. This type of assessment is outside of the scope of our geotechnical engagement.

END OF REPORT

Appendix A
Site Plan

Lot 2
DP 337806

Lot 1
DP 69875

Lot 2
DP 303118

Lot 1
DP 376965

Lot 4 DP 55935

Lot 2 DP 376965

Hordon Street

Section 1
SO 2368

North

West Coast Road (State Highway 73)

TP01
TP02
TP03
TP04
TP05
TP06
TP07
TP08
TP09
TP10
TP11
TP12
TP13
TP14
TP15
TP16

194m
193m
192m
192m
191m
190m

Lot 1
DP 23653

Lot 2
DP 434486

Part RS
27973

Part Lot 1
DP 6651

Creyke Road

KEY:

TP 1 — Approximate LandTech Testpit Locations, excavated 19 December 2017

Existing boundary

Major contours (1.0m)

Minor contours (0.5m)

Open drainage channel (approx)

Existing buildings

AMENDMENTS		
DATE	REV	DESCRIPTION
20/12/2017	A	Initial drafting - LS

Geotechnical Site Plan

Corner of Creyke & West Coast Roads
(Section 1 SO 1227)
DARFIELD

LandTech CONSULTING

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Drawing No.	Drawn by:	Date:
LTCL17312/ 1	L Stewart	20 Dec 2017
Scale: 1: 3,000 (A3)	Checked by: D Wilson	Revision: A

Filename: LTCL17312 Site Plan LS.dwg

Appendix B
Field Investigation Logs

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP01
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529278 N5184289	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005
TOPSOIL	0.5		SILT, minor fine to coarse sand, trace fine to coarse rounded to subrounded gravel, brown, very stiff, moist, non-plastic [TOPSOIL]
RIVER DEPOSITS	1.5		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brownish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions [RIVER DEPOSITS]
	2.5		Fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand to sandy, brownish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions
	3.0		Fine to coarse sandy GRAVEL, brownish grey, tightly packed, moist to wet, trace rounded to subrounded cobble inclusions
	5.0		End of Testpit 3.0m [TARGET DEPTH]

Groundwater Level (m): NOT ENCOUNTERED

In-situ Field Testing

Depth (m)	Shear Strength (kPa) Peak: / Remoulded: (0)	Dynamic Cone Penetrometer Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
0.5		-0.1	5	
1.0		-0.2	14	
1.5		-0.3	12	
2.0		-0.4	20+	
2.5		-0.5		
3.0		-0.6		
3.5		-0.7		
4.0		-0.8		
4.5		-0.9		
5.0		-1.0		
		-1.1		
		-1.2		
		-1.3		
		-1.4		
		-1.5		
		-1.6		
		-1.7		
		-1.8		
		-1.9		
		-2.0		
		-2.1		
		-2.2		
		-2.3		
		-2.4		
		-2.5		
		-2.6		
		-2.7		
		-2.8		
		-2.9		
		-3.0		
		-3.1		
		-3.2		
		-3.3		
		-3.4		
		-3.5		
		-3.6		
		-3.7		
		-3.8		
		-3.9		
		-4.0		
		-4.1		
		-4.2		
		-4.3		
		-4.4		
		-4.5		
		-4.6		
		-4.7		
		-4.8		
		-4.9		
		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP02
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529436 N5184283	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005
TOPSOIL			SILT, some fine to medium sand, trace fine to coarse rounded to subrounded gravel, brown, very stiff, moist, non-plastic [TOPSOIL]
RIVER DEPOSITS	0.5		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, grey, tightly packed, moist [RIVER DEPOSITS]
	1.0		
	1.5		Fine to coarse rounded to subrounded gravelly fine to coarse SAND, grey, tightly packed, moist to wet
	2.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, grey, tightly packed, moist to wet
	2.5		
	3.0		
	3.5		End of Testpit 3.0m [TARGET DEPTH]
	4.0		
	4.5		
	5.0		

Groundwater Level (m): NOT ENCOUNTERED

In-situ Field Testing

Shear Strength (kPa)

Peak:

Remoulded:

0

Dynamic Cone Penetrometer

Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
-0.1	4	
-0.2	5	
-0.3	20	
-0.4		
-0.5		
-0.6		
-0.7		
-0.8		
-0.9		
-1.0		
-1.1		
-1.2		
-1.3		
-1.4		
-1.5		
-1.6		
-1.7		
-1.8		
-1.9		
-2.0		
-2.1		
-2.2		
-2.3		
-2.4		
-2.5		
-2.6		
-2.7		
-2.8		
-2.9		
-3.0		
-3.1		
-3.2		
-3.3		
-3.4		
-3.5		
-3.6		
-3.7		
-3.8		
-3.9		
-4.0		
-4.1		
-4.2		
-4.3		
-4.4		
-4.5		
-4.6		
-4.7		
-4.8		
-4.9		
-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP03
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529688 N5184253	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:, 0)	In-situ Field Testing: Dynamic Cone Penetrometer Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
TOPSOIL			SILT, some fine to medium sand, brown, very stiff, dry, non-plastic, trace fine to coarse rounded to subrounded gravel inclusions [TOPSOIL]	NOT ENCOUNTERED			-0.1	3	
							-0.2	4	
							-0.3	6	
							-0.4	20+	
RIVER DEPOSITS	0.5		Fine to coarse rounded to subrounded GRAVEL, minor to some fine to medium sand, minor silt, grey, tightly packed, moist [RIVER DEPOSITS]		0.5		-0.5		
							-0.6		
							-0.7		
							-0.8		
							-0.9		
	1.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, minor silt, grey, tightly packed, moist, trace rounded to subrounded cobble inclusions		1.0		-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5				1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brown and grey mottles, tightly packed, moist to wet, trace rounded to subrounded cobble inclusions		2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0				3.0		-3.0		
			End of Testpit 3.0m [TARGET DEPTH]				-3.1		
							-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP04
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529971 N5184198	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:, 0)	In-situ Field Testing: Dynamic Cone Penetrometer Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
TOPSOIL			SILT, minor fine to medium sand, trace fine to coarse rounded to subrounded gravel, brown, very stiff, dry, non-plastic [TOPSOIL]				-0.1	4	
							-0.2	7	
							-0.3	20 +	
	0.5		Silty fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand, yellowish grey, tightly packed, moist [RIVER DEPOSITS]		0.5		-0.4		
							-0.5		
							-0.6		
							-0.7		
							-0.8		
							-0.9		
	1.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brownish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions		1.0		-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5				1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0				2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
RIVER DEPOSITS	3.0		Fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand to sandy, brownish grey, tightly packed, moist to wet	NOT ENCOUNTERED	3.0		-3.0		
							-3.1		
							-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0		End of Testpit 3.0m [TARGET DEPTH]		5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP05
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1530131 N5184185	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005
TOPSOIL			SILT, some fine to coarse sand, trace fine to coarse rounded to subrounded gravel, brown, very stiff, moist, non-plastic [TOPSOIL]
RIVER DEPOSITS	0.5		Silty fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand to sandy, yellowish grey, tightly packed, moist [RIVER DEPOSITS]
	1.0		Fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand, minor silt, brownish grey, tightly packed, moist
	1.5		
	2.0		
	2.5		
	3.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brownish grey, tightly packed, moist to wet, trace rounded to subrounded cobble inclusions
	3.5		End of Testpit 3.0m [TARGET DEPTH]
	4.0		
	4.5		
	5.0		

Groundwater Level (m): NOT ENCOUNTERED

In-situ Field Testing

Shear Strength (kPa)

Peak:

Remoulded:

0

Dynamic Cone Penetrometer

Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
-0.1	6	
-0.2	6	
-0.3	20+	
-0.4		
-0.5		
-0.6		
-0.7		
-0.8		
-0.9		
-1.0		
-1.1		
-1.2		
-1.3		
-1.4		
-1.5		
-1.6		
-1.7		
-1.8		
-1.9		
-2.0		
-2.1		
-2.2		
-2.3		
-2.4		
-2.5		
-2.6		
-2.7		
-2.8		
-2.9		
-3.0		
-3.1		
-3.2		
-3.3		
-3.4		
-3.5		
-3.6		
-3.7		
-3.8		
-3.9		
-4.0		
-4.1		
-4.2		
-4.3		
-4.4		
-4.5		
-4.6		
-4.7		
-4.8		
-4.9		
-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP06
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1530353 N5184142	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*, NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:)	Dynamic Cone Penetrometer: Depth (m)	Blow Count	Scala Blow Count / 100mm
LOESS DEPOSITS	0.0		SILT, minor fine to medium sand, yellowish brown, very stiff, hard, moist, non-plastic [LOESS DEPOSITS]	NOT ENCOUNTERED	0.0		-0.1	4	
							-0.2	5	
							-0.3	6	
							-0.4	12	
	0.5		minor fine to coarse rounded to subrounded gravel		0.5		-0.5	14	
							-0.6	20+	
RIVER DEPOSITS			Silty fine to coarse rounded to subrounded GRAVEL, some fine to medium sand, grey, tightly packed, moist [RIVER DEPOSITS]				-0.7		
							-0.8		
	1.0				1.0		-0.9		
							-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5		trace rounded to subrounded cobbles		1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0		some fine to coarse sand		2.0		-2.0		
			Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, grey, tightly packed, moist, trace rounded to subrounded cobble inclusions				-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0				3.0		-3.0		
			End of Testpit 3.0m				-3.1		
			[TARGET DEPTH]				-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP07
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529232 N5184178	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:)	Dynamic Cone Penetrometer: Depth (m)	Blow Count	Scala Blow Count / 100mm
TS	0.0		SILT, minor fine to medium sand, brownish grey, very stiff, moist, non-plastic, trace fine to coarse rounded to subrounded gravel [TOPSOIL]	NOT ENCOUNTERED	0.0		-0.1	4	
RIVER DEPOSITS	0.5		Fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand, minor silt, grey, tightly packed, moist [RIVER DEPOSITS]		0.5		-0.2	9	
	1.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brownish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions		1.0		-0.3	20+	
	1.5				1.5		-0.4		
	2.0				2.0		-0.5		
	2.5				2.5		-0.6		
	3.0		trace rounded to subrounded boulder inclusion		3.0		-0.7		
	3.5		End of Testpit 3.0m [TARGET DEPTH]		3.5		-0.8		
	4.0				4.0		-0.9		
	4.5				4.5		-1.0		
	5.0				5.0		-1.1		
							-1.2		
							-1.3		
							-1.4		
							-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
							-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
							-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
							-3.0		
							-3.1		
							-3.2		
							-3.3		
							-3.4		
							-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
							-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
							-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
							-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP08
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529430 N5184145	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:)	Dynamic Cone Penetrometer: Depth (m)	Blow Count	Scala Blow Count / 100mm
LOESS			SILT, minor fine to medium sand, yellowish brown, very stiff to hard, non-plastic, trace fine to coarse rounded to subrounded gravel inclusions [LOESS DEPOSITS]				-0.1	5	
							-0.2	5	
							-0.3	9	
							-0.4	20+	
RIVER DEPOSITS	0.5		Silty fine to coarse rounded to subrounded GRAVEL, minor to some fine to coarse sand, yellowish brown and grey mottles, tightly packed, moist [RIVER DEPOSITS]	NOT ENCOUNTERED	0.5		-0.5		
			trace rounded to subrounded cobble inclusions				-0.6		
							-0.7		
							-0.8		
							-0.9		
	1.0		moist to wet		1.0		-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, minor silt, grey, tightly packed, moist to wet, trace rounded to subrounded cobble inclusions		1.5		-1.5		
							-1.6		
			trace rounded to subrounded boulder inclusions				-1.7		
							-1.8		
							-1.9		
	2.0				2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0				3.0		-3.0		
			End of Testpit 3.0m				-3.1		
			[TARGET DEPTH]				-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP09
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529669 N5184102	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*, NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak / Remoulded, 0)	Dynamic Cone Penetrometer: Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
TOPSOIL			SILT, some fine to medium sand, brown, very stiff, non-plastic, trace fine to coarse rounded to subrounded gravel inclusions [TOPSOIL]	NOT ENCOUNTERED			-0.1	2	
							-0.2	5	
							-0.3	5	
							-0.4	10	
LOESS	0.5		Fine to coarse rounded to subrounded gravelly SILT, minor to some fine to medium sand, grey, hard, moist [LOESS DEPOSITS]		0.5		-0.5	20+	
							-0.6		
							-0.7		
							-0.8		
							-0.9		
RIVER DEPOSITS	1.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brown and grey mottles, tightly packed, moist to wet, trace rounded to subrounded cobble inclusions [RIVER GRAVELS]		1.0		-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5				1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0				2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0				3.0		-3.0		
			End of Testpit 3.0m [TARGET DEPTH]				-3.1		
							-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP10
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529948 N5184090	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*, NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:, 0)	In-situ Field Testing: Dynamic Cone Penetrometer Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
TS			SILT, minor fine to medium sand, trace fine to coarse rounded to subrounded gravel, brown, very stiff, moist, non-plastic [TOPSOIL]	NOT ENCOUNTERED			-0.1	3	
							-0.2	3	
							-0.3	5	
							-0.4	20+	
RIVER DEPOSITS	0.5		Fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand, minor silt, yellowish grey, tightly packed, moist [RIVER DEPOSITS] trace rounded to subrounded cobble inclusions		0.5		-0.5		
							-0.6		
							-0.7		
							-0.8		
							-0.9		
	1.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brownish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions		1.0		-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5				1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0		Fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand, brownish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions		2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brownish grey, tightly packed, moist to wet		3.0		-3.0		
							-3.1		
			End of Testpit 3.0m				-3.2		
			[TARGET DEPTH]				-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP11
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1530221 N5184042	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*, NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:)	In-situ Field Testing: Dynamic Cone Penetrometer Depth (m)	Blow Count	Scala Blow Count / 100mm
TOPSOIL	0.0		SILT, some fine to medium sand, brown, very stiff, dry, non-plastic, trace fine to coarse rounded to subrounded gravel inclusions [TOPSOIL]	NOT ENCOUNTERED	0.0	0	-0.1	3	0 5 10 15 20
							-0.2	5	
							-0.3	6	
							-0.4	5	
LOESS	0.5		SILT, minor fine to medium sand, yellowish brown, very stiff to hard, moist, non-plastic, trace fine to coarse rounded to subrounded gravel inclusions [LOESS DEPOSITS]		0.5		-0.5	6	
							-0.6	20+	
RIVER DEPOSITS	1.0		Silty fine to coarse rounded to subrounded GRAVEL, yellowish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions [RIVER DEPOSITS]		1.0		-0.7		
							-0.8		
							-0.9		
							-1.0		
			Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, minor silt, grey, tightly packed, moist				-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5				1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0		trace rounded to subrounded boulder inclusion		2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0				3.0		-3.0		
			End of Testpit 3.0m				-3.1		
			[TARGET DEPTH]				-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP12
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529232 N5184036	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:, 0)	In-situ Field Testing: Dynamic Cone Penetrometer Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
TOPSOIL			SILT, trace fine to medium sand, brown, very stiff, moist, non-plastic [TOPSOIL]	NOT ENCOUNTERED			-0.1	3	
							-0.2	5	
							-0.3	6	
							-0.4	12	
	0.5		Silty fine to coarse rounded to subrounded GRAVEL, minor fine to coarse sand, yellowish grey, tightly packed, moist [RIVER DEPOSITS]		0.5		-0.5	20+	
RIVER DEPOSITS			Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, brownish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions				-0.6		
							-0.7		
							-0.8		
							-0.9		
	1.0				1.0		-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5				1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0				2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0				3.0		-3.0		
			End of Testpit 3.0m [TARGET DEPTH]				-3.1		
							-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP13
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529431 N5184006	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:, 0)	In-situ Field Testing: Dynamic Cone Penetrometer Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
LOESS			SILT, minor fine to medium sand, trace fine to coarse rounded to subrounded gravel, yellowish brown, very stiff, moist, non-plastic [LOESS DEPOSITS]	NOT ENCOUNTERED			-0.1	5	
							-0.2	4	
							-0.3	8	
							-0.4	13	
RIVER DEPOSITS	0.5		Silty fine to coarse rounded to subrounded GRAVEL, yellowish grey, tightly packed, moist, trace rounded to subrounded cobble inclusions [RIVER DEPOSITS]		0.5		-0.5	20+	
							-0.6		
							-0.7		
							-0.8		
							-0.9		
	1.0		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, grey, tightly packed, moist to wet, trace rounded to subrounded cobble inclusions		1.0		-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5				1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0				2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5		trace rounded to subrounded boulder inclusion		2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0				3.0		-3.0		
			End of Testpit 3.0m [TARGET DEPTH]				-3.1		
							-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP14
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529656 N5183976	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*, NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)	In-situ Field Testing: Shear Strength (kPa) (Peak: / Remoulded:, 0)	In-situ Field Testing: Dynamic Cone Penetrometer Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
TOPSOIL			SILT, minor fine sand, trace fine to coarse rounded to subrounded gravel, brown, very stiff, moist, non-plastic [TOPSOIL]				-0.1	2	
							-0.2	4	
							-0.3	7	
							-0.4	20+	
RIVER DEPOSITS	0.5		Silty fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand, grey, tightly packed, moist [RIVER DEPOSITS]	NOT ENCOUNTERED	0.5		-0.5		
							-0.6		
							-0.7		
							-0.8		
							-0.9		
	1.0		moist to wet		1.0		-1.0		
							-1.1		
							-1.2		
							-1.3		
							-1.4		
	1.5				1.5		-1.5		
							-1.6		
							-1.7		
							-1.8		
							-1.9		
	2.0				2.0		-2.0		
							-2.1		
							-2.2		
							-2.3		
							-2.4		
	2.5				2.5		-2.5		
							-2.6		
							-2.7		
							-2.8		
							-2.9		
	3.0				3.0		-3.0		
			End of Testpit 3.0m [TARGET DEPTH]				-3.1		
							-3.2		
							-3.3		
							-3.4		
	3.5				3.5		-3.5		
							-3.6		
							-3.7		
							-3.8		
							-3.9		
	4.0				4.0		-4.0		
							-4.1		
							-4.2		
							-4.3		
							-4.4		
	4.5				4.5		-4.5		
							-4.6		
							-4.7		
							-4.8		
							-4.9		
	5.0				5.0		-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP15
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1529948 N5183939	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*, NZ Geotechnical Society Inc., 2005
TS			Fine to medium sandy SILT, trace fine to coarse rounded to subrounded gravel, brown, very stiff, dry, non-plastic [TOPSOIL]
LOESS	0.5		Fine to coarse rounded to subrounded gravelly SILT, some fine to medium and, yellowish brown, very stiff to hard, dry to moist, non-plastic [LOESS DEPOSITS]
RIVER DEPOSITS	1.0		Fine to coarse rounded to subrounded GRAVEL, some silt, minor to some fine to coarse sand, grey, tightly packed, moist [RIVER DEPOSITS]
	1.5		some fine to coarse sand to sandy, minor silt
	2.0		trace cobble inclusions, moist to wet
	2.5		minor fine to coarse sand, trace silt
	3.0		some fine to coarse sand to sandy
	3.5		End of Testpit 3.0m [TARGET DEPTH]
	4.0		
	4.5		
	5.0		

Groundwater Level (m): NOT ENCOUNTERED

In-situ Field Testing

Shear Strength (kPa)

Peak:

Remoulded:

0

Dynamic Cone Penetrometer

Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
-0.1	2	
-0.2	4	
-0.3	5	
-0.4	20+	
-0.5		
-0.6		
-0.7		
-0.8		
-0.9		
-1.0		
-1.1		
-1.2		
-1.3		
-1.4		
-1.5		
-1.6		
-1.7		
-1.8		
-1.9		
-2.0		
-2.1		
-2.2		
-2.3		
-2.4		
-2.5		
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-4.7		
-4.8		
-4.9		
-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

LandTech CONSULTING	Client: Rupert Jack & Catherine Elizabeth Wright Project: Geotechnical Investigation for Proposed Land Use Change Address: Cnr Creyke & West Coast Roads (Section 1 SO 1227), Darfield	Testpit No.	TP16
		Sheet No.	1 of 1

Excavator Type:	9T Digger	Project No:	LTCL17312	Logged By:	L Stewart
Excavated By:	Francis Ward Ltd.	Coordinates:	NZTM2000 E1530108 N5183969	Shear Vane No:	NA
Date Started:	19-Dec-17	Ground Conditions:	Near level/undulating, pasture	Calibration Factor:	NA
Date Finished:	19-Dec-17	Groundwater Level (m):	Not Encountered	Calibration Date:	NA

Stratigraphy	Depth (m)	Graphic Log	Soil description in accordance with *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes* , NZ Geotechnical Society Inc., 2005	Groundwater Level (m)	Depth (m)
TOPSOIL	0.0		SILT, minor fine to medium sand, brown, very stiff, dry, non-plastic, trace fine to coarse rounded to subrounded gravel inclusions [TOPSOIL]	NOT ENCOUNTERED	0.0
LOESS	0.5		SILT, some fine to medium sand, trace fine to coarse rounded to subrounded gravel, yellowish brown, hard, moist, non-plastic [LOESS DEPOSITS]		0.5
RIVER DEPOSITS	1.0		Fine to coarse rounded to subrounded GRAVEL, some fine to coarse sand, some silt, trace rounded to subrounded cobbles, grey, tightly packed, moist [RIVER DEPOSITS]		1.0
	1.5		Fine to coarse sandy fine to coarse rounded to subrounded GRAVEL, grey, tightly packed, moist, trace rounded to subrounded cobble inclusions [RIVER DEPOSITS]		1.5
	2.0		minor silt		2.0
	2.5				2.5
	3.0				3.0
	3.5		End of Testpit 3.0m [TARGET DEPTH]		3.5
	4.0				4.0
	4.5				4.5
	5.0				5.0

In-situ Field Testing

Shear Strength (kPa)

Peak:

Remoulded:

0

Dynamic Cone Penetrometer

Depth (m)	Blow Count	Scala Blow Count / 100mm (0 5 10 15 20)
-0.1	4	
-0.2	5	
-0.3	4	
-0.4	3	
-0.5	3	
-0.6	10	
-0.7	20 +	
-0.8		
-0.9		
-1.0		
-1.1		
-1.2		
-1.3		
-1.4		
-1.5		
-1.6		
-1.7		
-1.8		
-1.9		
-2.0		
-2.1		
-2.2		
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-4.7		
-4.8		
-4.9		
-5.0		

In-situ field testing in accordance with the following Standards:

Scala Penetrometer Testing: NZS 4402:1988, Test 6.5.2, Dynamic Cone Penetrometer

Shear Vane Testing: Guideline for Hand Held Shear Vane Test, NZGS, August 2001

BASELINEGROUP

Appendix 6: Preliminary Site Investigation

Soil Contamination Risk
Stage 1 - Preliminary Site Investigation Report

West Coast Road,
Darfield

December 2017

Malloch Environmental Ltd

801 East Maddisons Road, Rolleston 7614

021 132 0321

www.mallochenviro.co.nz

Asbestos Surveys • Soil Contamination Investigations • Environmental Planning

CONTENTS

APPENDICES

1 Executive Summary

The subject site involves a single rural lot on West Coast Road. The site is the subject of a proposed plan change, with an outline development plan indicating a mix of residential, recreational and commercial areas. This will involve a change in use and subdivision and disturbance of soils in the future. The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Health) Regulations 2011 (NESCS) require an assessment of the likelihood of soil contamination being present. It is noted also that Malloch Environmental Ltd is obligated to consider the requirements of Section 10 of the Health and Safety at Work (Asbestos) Regulations 2016. This report details the work undertaken to assess the risks.

The investigations undertaken have identified a risk of soil contamination associated with a former poisoned possum disposal pit, and other potential waste material disposed to a former quarry pit. Both of these areas are on the western side of the site and affect only a small portion of the overall site. These are confirmed HAIL activities and there may be a risk to human health from potentially contaminated soils.

A Remediation Action Plan for the possum pit should be developed and remediation should occur as part of the overall development of the site. It is also recommended that a Detailed Site Investigation, in terms of the Ministry for the Environments Contaminated Land Management Guidelines, be undertaken on the area to the south where potential fill may have been placed. It is noted that neither of these risk areas would preclude the proposed plan change from occurring. Any remediation required to ensure safe future uses could be physically and economically achieved within the total development.

The rest of the subject site has been used for general pastoral or rural residential use for all its known history. This use is not considered to pose a risk to human health or the environment. No further investigation is considered to be required for the majority of the subject site.

In terms of planning status at the time of writing of this report, the NESCS does apply to the identified risk areas of the site and resource consent is required for activities listed in the NESCS.

2 Objectives of the Investigation

This report has been prepared in accordance with the Ministry for the Environment's "Contaminated Land Management Guidelines No 1: Reporting on Contaminated Sites in New Zealand". This report includes all requirements for a Stage 1 preliminary site investigation report. This is one of the methods described in Section 6(3) of the NES to establish whether the regulations apply. The objective is to determine whether there is any risk of potential contamination that would warrant further investigation.

3 Scope of Work Undertaken

The scope of the work undertaken has included:

- Review of Selwyn District Council property files
- Obtaining ECan data from the Listed Land Use Register (LLUR)
- Search of LINZ NZ orchard database
- Review of historic aerial photos
- Review of historic titles
- Preparation of report in accordance with MfE guidelines

4 Site Identification

The site is located adjacent to West Coast Road bounded on the east by Creykes Road as shown on the plan in **Figure 1** below. The site is legally described as Section 1 SO 1277 and has a total area of approximately 30.7561Ha.

Figure 1 – Location Plan

5 Site Description and Surrounding Environment

The subject site is generally flat rural land on West Coast Road. There are no buildings or structures on the subject site. The subject site is clearly defined by existing hedges and fences. It is bounded by rural properties to the west, south and east. To the north, across West Coast Road, is a poultry farm. The centre of Darfield township lies approximately 930m to the west.

6 Geology and Hydrology

The ECan GIS describes the soils as Lismore stony silty loam. Wells in the area indicate that topsoils are underlain by layers of gravels, claybound gravels and sandy silty gravels. Soil trace elements are 'Regional, Yellow Brown Stony'.

The site lies over the unconfined/semiconfined gravel aquifer system. Ground water levels recorded on nearby bore logs are between 91.3 and 129.8m deep. The direction of ground water flow is generally in a south easterly direction.

The ECan GIS indicates that an open drain runs along the southern boundary of the subject site. Another open drain runs along the opposite side of the West Coast Road for part of the northern boundary.

7 Site History

7.1 Previous Site Ownership and Use

Historic Certificates of Title were searched and the following relevant ownership information was obtained:

Aug 1875 - Made into a Reserve for Provincial Government purposes
Jun 1994 - Selwyn Plantation Board for plantation purposes
Nov 2010 - Rupert Jack Wright and Catherine Elizabeth Wright

Copies of the Historic Titles are included in **Appendix A.**

7.2 District Authority Records

The Selwyn District Council property file was requested and was reported to be empty.

7.3 Regional Council Records

The ECan Listed Land Use Register Statement lists the subject site for 'G3 – Landfill sites'. A landfill site was noted in 1975 to 1998 aerial photographs. The site is defined as 'Verified HAIL has not been investigated'. Three nearby sites are also listed:

- 1-7 Horndon Street, Darfield for 'A17 – Storage tanks or drums for fuel, chemicals or liquid waste'. Two 2,273L tanks were installed circa 1975. One contains diesel the other petrol. The site is defined as 'Verified HAIL has not been investigated'.
- 15 Horndon Street, Darfield for 'A10 – Persistent pesticide bulk storage or use'. The site has been used as a poultry farm from around 1975 until the present day. The site is defined as 'Verified HAIL has not been investigated'
- 354 Creyke Road, Darfield for 'A8 – Livestock dip or spray race operation'. A livestock dip or spray race was noted in aerial photographs from 1975 to the present day. The site is defined as 'Verified HAIL has not been investigated'

An investigation on an adjacent lot to the south-west found most of that site does not contain contamination. The north-west corner of that site has been subject to migration of arsenic from a neighbouring site but this does not exceed residential soil guideline values and is distant from the current subject site.

See LLUR Statement in **Appendix C.**

Resource consent information was sourced from the GIS mapping system. There are no active resource consents on the subject site. There is an active resource consent to the north to discharge contaminants to the air from two brick firing kilns fired with either a mixture of diesel and re-refined oil or with coal. There are also multiple resource consents nearby to discharge domestic sewage tank effluent into ground and to discharge stormwater generated from roofs.

7.4 LINZ Records

The LINZ Orchard layer does not show the subject site or adjacent sites as having listed orchards.

7.5 Review of Historic Aerial Photographs

A total of eight aerial photos (see copies in **Appendix B**) have been used to assess the historic use of the site as detailed below:

- The earliest photo is from **1941** and has been sourced from ECan's GIS. There are no buildings or structures on the subject site. Most of the site is covered in small trees. In the north-west corner is a cleared area, possibly a gravel pit. The surrounding area is mainly pasture farmland. There are two dwellings adjacent to the subject site on Creykes Road. One is to the south of the subject site, the other is to the east and has associated farm buildings. Another dwelling lies to the north of the subject site across West Coast Road at the western end of the subject site. North of the subject site at its eastern end an area appears to be used for forestry.
- A photo from **1958** is sourced from ECan's GIS and shows the site is covered with trees except for a strip along the western boundary that is grassed. There is an oval depression in the north-west corner, and a nearby linear depression parallel with the western boundary, indicating gravel extraction has occurred. A dwelling has been built to the north of the subject site adjacent to the forestry area. Two long sheds have been built next to the dwelling south of the subject site along Creykes Road. In the homestead area to the east of the subject site one of the farm buildings has been removed and a new long shed added further east. Another barn or shed appears to be under construction closer to the dwelling.
- A photo from **1965** is sourced from ECan's GIS and shows no significant changes to the subject site. North of the subject site and to the east of the forestry area are a number of small structures. The barn on the farm to the east of the subject site is now complete. A line of baleage can be seen to the east of the farm buildings. A dwelling and garage have been built north-east of the farm.
- A photo from **1975**, sourced from ECan's GIS, shows the trees on the subject site have been cut. The excavated areas in the west of the site may have been filled. A dwelling has been built approximately 160m beyond the subject site to the west. North of the subject site four long sheds plus a dwelling and garage have been built for the poultry farm. Between the poultry farm and West Coast Road are sheds and stockpile areas for the brick manufacturing business. East of these the trees also appear to have been cut. On the farm to the east of the subject site there appears to be a livestock dip adjacent to the barn. One of the farm buildings has been removed.

- A photo from **1985**, sourced from ECan's GIS, is overexposed in places and detail hard to discern. A bright spot in the north-west corner of the subject site could indicate renewed extraction or filling. New trees have been planted across the rest of the site. Approximately 240m north of the subject site new buildings have been added along Horndon Road.
- A photo from **1995** is sourced from ECan's GIS and shows the extracted/filled area of the subject site is now grassed over. North of the subject site at its western end the dwelling has gone. On the poultry farm to the north the three shorter sheds have been extended. Sheds have been built within the forestry area north of the subject site. In the homestead area to the east of the subject site the barn has been extended over where the livestock dip was seen. A new shed has been built to the south of the farmhouse. South of the subject site long sheds have been removed and replaced with a larger shed.
- A photo from **2004** is sourced from ECan's GIS and shows the trees have been removed from the subject site. The subject site is now all pasture farmland. There are no significant changes to the surrounding area.
- The most recent aerial photo reviewed, dated **2012**, sourced from ECan's GIS show the subject site has been divided up into smaller fields. There are some small structures in the south-west corner, of a size that they are possibly bee hives.

7.6 Local Knowledge

The current owner, Catherine Wright, advised the following relevant information:

"Re the contaminated site - there is an old possum pit at the Darfield (west) end of the site, it can still be made out as a slight dip in the ground. It was used in the 1980's and capped with concrete. It was used by the council to dispose of poisoned (1080?) possums, I don't know quantities. …… The rest of the site was a forestry block so was in trees for years, harvested (approx 10-15 years ago) then put back into agricultural use and it has just been used to grow grass and lucerne ever since."

8 HAIL Uses and Possible Types of Contaminants Associated with Past Use

The Hazardous Activities and Industries List (HAIL) compiled by The Ministry for the Environment include the following categories (*in italics*) that could be associated with the historical uses of the site with a summary of the risk of these activities having been carried out on the site.

A - Chemical manufacture, application and bulk storage

10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds

The majority of the site has been used for forestry until sometime between 1995 and 2004. Since then is has been used for pastoral activities. The normal uses of fertilisers and pastoral weed controls associated with these uses are unlikely to have caused soil contamination that would pose a risk to human health. It is unlikely that persistent agrichemicals or fuels were used or stored on the site in any significant volume.

G – Cemeteries and waste recycling, treatment and disposal

3. Landfill sites

Aerial photographs have shown an area in the north-west corner of the subject site has probably been used to extract gravel and then filled. The current owner has indicated that in the 1980s this was used to dispose of poisoned possums. If the poison used was 1080 (sodium monofluoroacetate), research data indicates that degradation in the soil takes 1-4 weeks under favourable conditions. In extreme conditions of cold and drought, degradation takes several months. It is also highly water soluble so leaching out of the soil is possible, but limited at this site due to the concrete capping. There was no evidence able to found on effects or degradation time for burials of large quantities of poisoned animals. However, as the burial occurred more than 20 years ago the risk of significant concentrations of 1080 being found is likely to be low.

The other areas identified as possible gravel pits may also have had fill placed in them. Contaminants of concern include heavy metals, TPH, PAH, OCP, landfill gas.

H - Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment

It is considered unlikely that any contaminants would have migrated onto the subject site from either the brick kilns or poultry farm to the north of the subject site. It is also considered unlikely that the subject site will have been subject to migration of contaminants from the livestock dip noted in the 1975 aerial to the east of the subject site. The subject site is separated from the dip by a road and there is no indication that any livestock would have passed through the dip and onto the subject site.

9 Basis for Soil Guideline Values (SGV)

9.1 Activity Description

This report has been written for the following potential activities:

- A proposed planning change that involves a change of use of the land from rural to a mixture of residential, recreational and commercial use
- Future subdivision of the site
- Earth disturbing activities associated with the above use and development of the site

9.2 Zoning

The subject site is currently zoned Rural Outer Plains.

9.3 Soil Guideline Values

Human health soil contaminant standards for a group of 12 priority contaminants were derived under a set of five land-use scenarios, and are legally binding under The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Health) Regulations 2011 (NES). These standards have been applied where applicable. For contaminants other than the 12 priority contaminants, the hierarchy as set out in the Ministry for the Environment Contaminated Land Management Guidelines No 2 has been followed. For soil, guideline values are predominantly risk based, in that they are typically derived using designated exposure scenarios that relate to different land uses. For each exposure scenario, selected pathways of exposure are used to derive guideline values. These pathways typically

include soil ingestion, inhalation and dermal adsorption. The guideline values for the appropriate land use scenario relate to the most critical pathway.

The land-use scenarios applicable for the proposed use of this site and any associated earth disturbing activities include 'residential 10% produce', 'recreational' and 'commercial /industrial/outdoor workers' both for the commercial areas and as a proxy value to protect the health of construction workers. The appropriate guideline value for any given area of the site should be selected once development plans are finalised.

10 Site Characterisation and Recommendation

The majority of the subject site has been used for forestry and then general pastoral use for all its known history and this use is not considered to pose a risk to human health or the environment. There is no evidence of HAIL activities or industries having occurred on the majority of the subject site, now or in the past. This part of the subject site is considered suitable for residential use with no further investigations required.

However, the investigations undertaken have indicated two possible risk areas at the western end of the site. These areas are shaded red on **Figure 2** below. In the north-west corner of the subject site is a confirmed landfill area. This is known to have been used to dispose of poisoned possums but could also contain other waste. South of this area is another potential former quarry pit which may have been filled with waste. These are confirmed HAIL activities and there may be a risk to human health from potentially contaminated soils.

The confirmed possum pit area is likely to pose geotechnical issues as well as possible contamination risks. Once confirmed development proposals are known a remediation action plan to excavate the pit and dispose of any possum remnants and contaminated soils is recommended.

It is also recommended that a Detailed Site Investigation, in terms of the Ministry for the Environment's Contaminated Land Management Guidelines, be undertaken on the area to the south where potential fill may have been placed.

Figure 2 – Risk Areas Plan

11 Planning Status

In terms of the NESCS section 5 (7) states that the land is considered to be covered if an activity or industry described in the HAIL is being undertaken on it; or has been undertaken on it; or it is more likely than not that an activity is being or has been undertaken on it. Section 6 describes the methods for determining whether the land is as described in section 7. Method 6 (3) is to rely on a Preliminary Site Investigation.

This Preliminary Site Investigation has found that there is evidence of an activity or industry described in the HAIL occurring on the subject site now or in the past. In terms of planning status at the time of writing of this report, the NESCS does apply to the identified risk areas of the site and resource consent is required for activities listed in the NESCS.

12 Conclusion

The investigations undertaken have identified a risk of soil contamination associated with a former poisoned possum disposal pit, and other potential waste material disposed to a former quarry pit. Both of these areas are on the western side of the site and affect only a small portion of the overall site. These are confirmed HAIL activities and there may be a risk to human health from potentially contaminated soils.

A Remediation Action Plan for the possum pit should be developed and remediation should occur as part of the overall development of the site. It is also recommended that a Detailed Site Investigation, in terms of the Ministry for the Environments Contaminated Land Management Guidelines, be undertaken on the area to the south where potential fill may have been placed. It is noted that neither of these risk areas would preclude the proposed plan change from occurring. Any remediation required to ensure safe future uses could be physically and economically achieved within the total development.

The rest of the subject site has been used for general pastoral or rural residential use for all its known history. This use is not considered to pose a risk to human health or the environment. No further investigation is considered to be required for the majority of the subject site.

13 Limitations

Malloch Environmental Limited has performed services for this project in accordance with current professional standards for environmental site assessments, and in terms of the client's financial and technical brief for the work. Any reliance on this report by other parties shall be at such party's own risk. It does not purport to completely describe all the site characteristics and properties. Where data is supplied by the client or any third party, it has been assumed that the information is correct, unless otherwise stated. Malloch Environmental Limited accepts no responsibility for errors or omissions in the information provided. Should further information become available regarding the conditions at the site, Malloch Environmental Limited reserves the right to review the report in the context of the additional information.

Opinions and judgments expressed in this report are based on an understanding and interpretation of regulatory standards at the time of writing and should not be construed as legal opinions. As regulatory standards are constantly changing, conclusions and recommendations considered to be acceptable at the time of writing, may in the future become subject to different regulatory standards which cause them to become unacceptable. This may require further assessment and/or remediation of the site to be suitable for the existing or proposed land use activities. There is no investigation that is thorough enough to preclude the presence of materials at the site that presently or in the future may be considered hazardous.

Report written by:

Frances Hobkirk
Environmental Scientist

Report reviewed and certified by a suitably qualified and experienced practitioner as prescribed under the NES (soil):

Nicola Peacock, CEnvP
Principal Environmental Engineer

Appendix A – Historic Certificates of Title

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Historical Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB39B/123**
Land Registration District	**Canterbury**
Date Issued	02 June 1994

Prior References
GN A113380.1

Estate	Fee Simple
Area	30.7561 hectares more or less
Legal Description	Section 1 Survey Office Plan 1227
Purpose	plantation

Original Proprietors
Selwyn Plantation Board Limited

Interests

Land Covenant in Transfer A141854.1 - 29.10.1994 at 11.45 am

6182948.1 Revocation of Covenant A141854.1 - 14.10.2004 at 9:00 am

6247341.1 Departmental dealing correcting the estate by deleting the purpose of Plantation - 9.12.2004 at 2:21 pm

8629529.1 Transfer to Rupert Jack Wright and Catherine Elizabeth Wright - 18.11.2010 at 12:15 pm

References
Prior C/T
Gazette Notice A113380/1
Transfer No.
N/C. Order No. A115916/1

Land and Deeds 69

REGISTER

No. 39B/123

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 2nd day of June one thousand nine hundred and ninety four under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that SELWYN PLANTATION BOARD for plantation purposes ---

is seised of an estate in fee-simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 30.7561 hectares or thereabouts being Section 1 Survey Office Plan 1227 ---

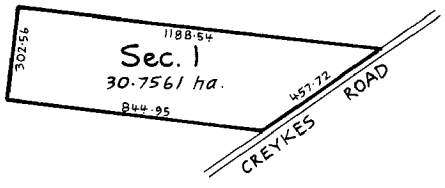
DISTRICT LAND REGISTRAR

ASSISTANT LAND REGISTRAR CANTERBURY N.Z.

Transfer A141854/1 to Selwyn Plantation Board Limited at Darfield (Covenant) - 29.10.1994 at 11.45am

for A.L.R.

Selwyn District



No. 39B/123

Ref: S.O. 1227
Measurements are Metric

ARC

CERTIFICATE OF TITLE No. /

NEW ZEALAND

GOVERNMENT GAZETTE

PROVINCE OF CANTERBURY.

Published by Authority.

VOL. XXII. MONDAY, AUGUST 9, 1875. No. XXXVI.

PROCLAMATION.

IN accordance with the recommendation of the Provincial Council in that behalf, I, WILLIAM ROLLESTON, Superintendent of the Province of Canterbury, do hereby with the advice of the Executive Council, make the following Reserves of the extent and for the purposes indicated in the Schedule hereunto attached, and do hereby direct that the said Schedule, together with a complete description of the said Reserves shall be published in the *Government Gazette* of the Province.

Given under my hand at Christchurch, this 19th day of June, one thousand eight hundred and seventy-five.

WM. ROLLESTON,
Superintendent.

No. in Red.	Quantity. (More or less) A. R. P.	Description.	Road District.
		boundary of section 19185, on the westward by I.P.Rs. on run No. 65, and on the southward by a line parallel to and fifteen chains distant from the northern boundary. Subject to roads. For Provincial Government purposes.	
1748	226 0 0	Situate in the Upper Christchurch District; bounded on the southward by reserve No. 1332 (in red), on the eastward by Creyke's road, on the westward by reserves Nos. 1333 and 1334, and on the northward by a line parallel to and fifteen chains distant from from the southern boundary. Subject to roads. For Provincial Government purposes.	Courtenay
1749	202 0 0	Situate in the Upper Christchurch District; bounded on the northward by reserve 1332 (in red), on the eastward by Creyke's Road, on the westward by the road forming the south-eastern boundary of section 19215, and on the southward by a line parallel to and fifteen chains distant from the northern boundary. Subject to roads. For Provincial Government purposes.	Courtenay
1750	52 0 0	Situate in the Upper Christchurch District; bounded on the eastward by the Telegraph Road, on the southward by reserve 1332 (in red), on the westward by section 17452, and on the northward by a line parallel to and fifteen chains distant from the southern boundary; save and except reserve No. 1512 (in red), which is included within the above-described boundaries. Subject to roads. For Provincial Government purposes.	Courtenay
1751	315 0 0	Situate in the Upper Christchurch District; bounded on the south-eastward by reserve No. 1748 (in red), on the south-westward by reserve No. 1333 (in red), on the north-westward by section No. 18815, and on the north-eastward by I.P.R Z., on run No. 49, and also by a line parallel to and fifteen chains distant from the south-western boundary. Subject to roads. For Provincial Government purposes.	Courtenay
1752	90 0 0	Situate in the Oxford District; bounded on the northward by reserve No. 727 (in red), and a line in continuation of the southern boundary thereof, and also by the road forming the southern boundary of section 8894, on the south-west by the Coal Tramway Reserve, on the southward by section 16807, on the eastward by section 21233, and also by section 8894, above mentioned. Subject to roads. For Provincial Government purposes.	Courtenay
1753	42 0 0	Situate in the Upper Christchurch District; bounded on the south-westward by the Coal Tramway Reserve, on the south-eastward by reserve 1328 (in red), and on the north-westward by section 21624, and on the north-eastward by a line parallel to the south-western boundary, and fifteen chains distant therefrom. Subject to roads. For Provincial Government purposes.	Courtenay
1754	790 0 0	Situate in the Upper Christchurch District; bounded on the north-eastward by the Coal Tramway Reserve, on south-eastward by the road forming the north-western boundary of section 7578, on the north-westward by the road forming the eastern boundary	Courtenay

No. 971988/1 Change of appellation whereby part of the within land is now Section 1 S.O. 1227 (30.7561 ha) — 23.12.1991 at 9.01am (added 21.6.94)

OCT A115916/1 2.6.1994 } C.T. 39B/123 issued for Section 1 S.O. 1227

IN THE MATTER of the Land Transfer Act 1952

Particulars entered in the Register at the date and at the time recorded below.

~~District~~ Assistant Land Registrar of the District of Canterbury

CANTERBURY

PAGE 279 PROVINCIAL GAZETTE 1875

To: The District Land Registrar

Please register as to Reserve 1749 only.

BUDDLE FINDLAY

Per:

John Buchan

11.53 19.MAY94 A 113380/1

PARTICULARS ENTERED IN REGISTER

LAND REGISTRY CANTERBURY

BUDDLE FINDLAY
SOLICITORS
CHRISTCHURCH

Appendix B – Historic Aerials

canterbury maps

1941 Aerial

N

0 0.06 0.12 0.18 0.24 Kilometres

Scale: 1:6,000 @A4

Map Created by MEL on 12/1/2017 at 2:22:50 PM

canterbury maps

1958 Aerial

N

0 0.06 0.12 0.18 0.24 Kilometres

Scale: 1:6,000 @A4

Map Created by MEL on 12/1/2017 at 2:23:18 PM

canterbury maps

1965 Aerial

N

0 0.06 0.12 0.18 0.24 Kilometres

Scale: 1:6,000 @A4

Map Created by MEL on 12/1/2017 at 2:22:12 PM

canterbury maps

1975 Aerial

N

0 0.06 0.12 0.18 0.24 Kilometres

Scale: 1:6,000 @A4

Map Created by MEL on 12/1/2017 at 2:24:32 PM

canterbury maps

1985 Aerial

N

0 0.06 0.12 0.18 0.24 Kilometres

Scale: 1:6,000 @A4

Map Created by MEL on 12/1/2017 at 2:26:30 PM

canterbury maps

1995 Aerial

N

0 0.06 0.12 0.18 0.24 Kilometres

Scale: 1:6,000 @A4

Map Created by MEL on 12/1/2017 at 2:27:32 PM

canterbury maps

2004 Aerial

N

0 0.06 0.12 0.18 0.24 Kilometres

Scale: 1:6,000 @A4

Map Created by MEL on 12/1/2017 at 2:32:56 PM

canterbury maps

2012 Aerial

N

0 0.06 0.12 0.18 0.24 Kilometres

Scale: 1:6,000 @A4

Map Created by MEL on 12/1/2017 at 2:28:49 PM

Appendix C – LLUR Statement

Property Statement
from the Listed Land Use Register

Visit www.ecan.govt.nz/HAIL for more information about land uses.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

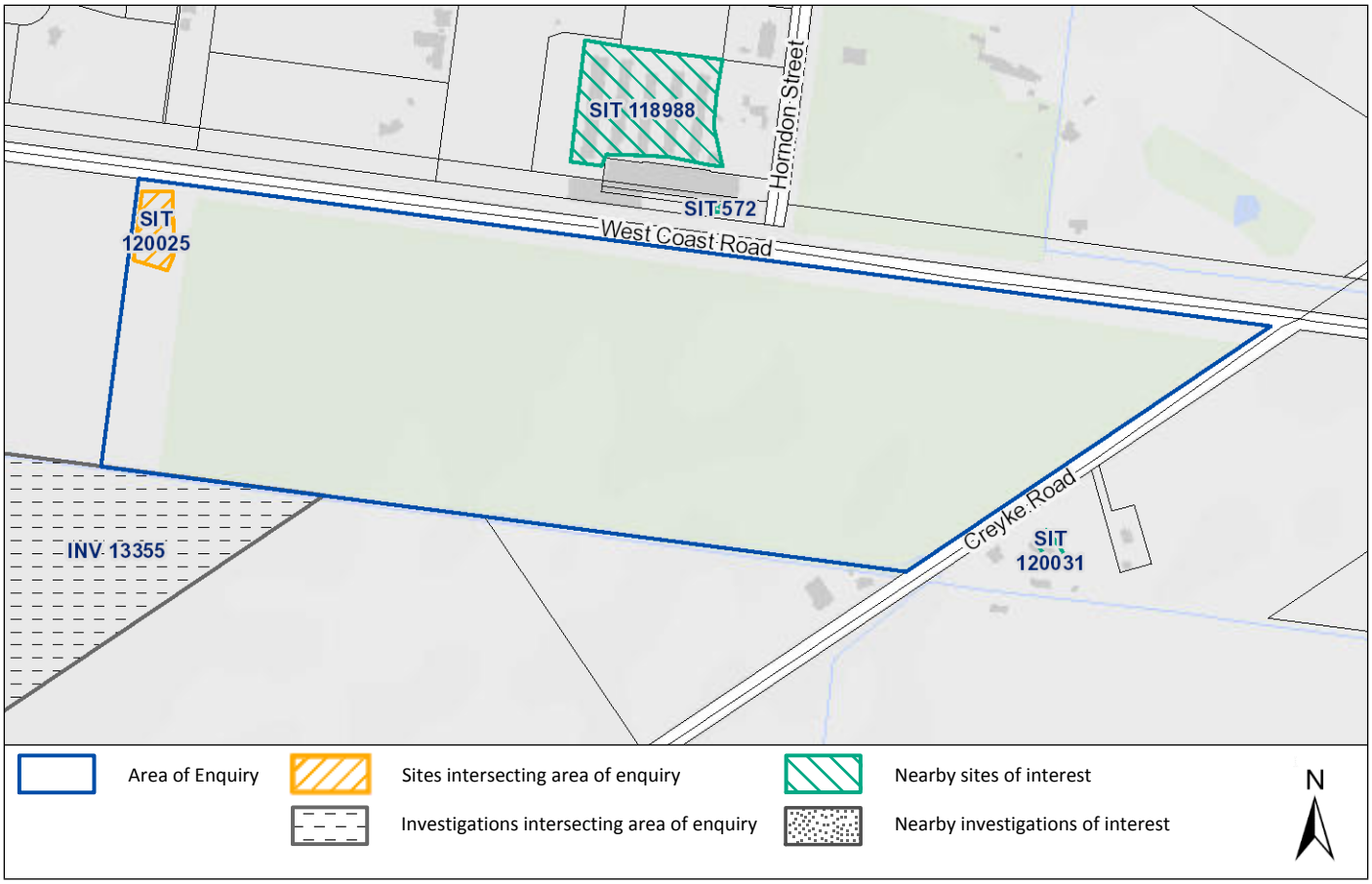
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Date:	01 December 2017	
Land Parcels:	Section 1 SO 1227	Valuation No(s): 2420009402



The information presented in this map is specific to the area within a 100m radius of property you have selected. Information on properties outside the serach radius may not be shown on this map, even if the property is visible.

Summary of sites:

Site ID	Site Name	Location	HAIL Activity(s)	Category
572	W.D. Boyes & Sons Limited	1-7 Horndon Street, Darfield	A17 - Storage tanks or drums for fuel, chemicals or liquid waste;	Not Investigated
118988	15 Horndon St	15 Horndon St	A10 - Persistent pesticide bulk storage or use;	Not Investigated
120025	Section 1 SO 1227, West Coast Road	Section 1 SO 1227, West Coast Road	G3 - Landfill sites;	Not Investigated
120031	354 Creyke Road, Darfield	354 Creyke Road, Darfield	A8 - Livestock dip or spray race operations;	Not Investigated

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry within a 100m buffer.

Information held about the sites on the Listed Land Use Register

Site 572: W.D. Boyes & Sons Limited (Within 100m of enquiry area.)

Site Address:	1-7 Horndon Street, Darfield
Legal Description(s):	Lot 4 DP 55935

Site Category:	Not Investigated
Definition:	Verified HAIL has not been investigated.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1975	Current	Storage tanks or drums for fuel, chemicals or liquid waste

Notes:

23 Mar 1998 2 tanks: both 2273 litres, one holds diesel, the other petrol, probably put in in 1975

Investigations:

There are no investigations associated with this site.

Site 118988: 15 Horndon St (Within 100m of enquiry area.)

Site Address:	15 Horndon St
Legal Description(s):	Lot 1 DP 376965

Site Category:	Not Investigated
Definition:	Verified HAIL has not been investigated.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1975	Present	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

5 Nov 2014 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

5 Nov 2014 Poultry farm

5 Nov 2014 Area defined from 1975 to Present aerial photographs. A poultry farm (persistent pesticides) was noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Site 120025: Section 1 SO 1227, West Coast Road (Intersects enquiry area.)

Site Address:	Section 1 SO 1227, West Coast Road
Legal Description(s):	Section 1 SO 1227

Site Category:	Not Investigated
Definition:	Verified HAIL has not been investigated.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1942	1998	Landfill sites

Notes:

7 Dec 2015 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

7 Dec 2015 Area defined from 1975 to 1998 aerial photographs. A landfill site was noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Site 120031: 354 Creyke Road, Darfield (Within 100m of enquiry area.)

Site Address:	354 Creyke Road, Darfield
Legal Description(s):	Part Lot 1 DP 6651

Site Category:	Not Investigated
Definition:	Verified HAIL has not been investigated.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1975	Present	Livestock dip or spray race operations

Notes:

7 Dec 2015 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

7 Dec 2015 Area defined from 1975 to Present aerial photographs. A livestock dip or spray race was noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Information held about other investigations on the Listed Land Use Register

1 Aug 2012 **INV 13355: Preliminary Site Investigation, Darfield Development, Creyke Road, Darfield, Canterbury**
(Preliminary Site Investigation)
Golder Associates

Summary of investigation(s):

Investigation objective: An assessment of the site history was undertaken to assess the residential property. The site consists of a dwelling and extensive gardens. A new dwelling is to be placed on the site, and there is the potential that the site may be subdivided in future.

The site history was assessed using historical certificates of title and aerial photographs, LINZ records of orchards, regional and district council records, and soil contamination investigations for nearby properties. The review appears to have been undertaken generally in accordance with best practise. The report identifies that the site appears to have been pastoral until the house and associated buildings were constructed in the 1970s. It is noted that a sheepdip was located on land adjacent to the north-west.

The report identifies that it appears unlikely that a sheep dip or persistent pesticide application has been undertaken at the site. Burning rubbish and migration from the sheep dip on the adjacent property were considered to be potential sources of contamination.
A targeted investigation was undertaken in a low point in the north-western corner of the site, near the water race, where it was thought most likely that contamination would be present if there had been migration from the sheep dip on the neighbouring site. In addition, the investigation was targeted to a number of burn piles on the eastern part of the site. Soil sampling was primarily undertaken using an X-ray fluorescence spectrometer (XRF). XRF analysis was undertaken at three locations in the north-western corner at 50-100mm and 300mm depths in each location. XRF analysis was also undertaken at 5 locations in the eastern part of the site where burning had been undertaken. The XRF analysis was undertaken for arsenic, chromium, copper, lead, mercury, nickel and zinc. Laboratory analysis was undertaken for arsenic only from five samples; and for a suite of seven metals (arsenic, cadmium, chromium, copper, nickel and zinc) and polycyclic aromatic hydrocarbons (PAHs) in one sample collected from the burn pile near the proposed house location.
Results: The soil sampling results indicated that arsenic was elevated above background levels in the north-western corner of the site, suggesting that there has been some migration from the nearby sheep dip site; however, no samples exceeded the soil contaminant standards for residential land-use with 10% produce consumption or rural-residential land-use. The XRF sampling results did not indicate elevated concentrations of contaminants in soil in the burned areas, which could have arisen from burning of treated timber or other materials. A sample from only one of the burn piles was analysed for PAHs; however, the sample result was below the laboratory limit of detection.

Conclusions: The report concludes that the majority of the site does not contain contamination, but that the north-western corner of the site has been subject to migration of arsenic from the neighbouring site. It is agreed that the risk of contamination from the burn piles is relatively low, and the investigation has provided sufficient information to indicate that the burn pile areas should not be considered a HAIL activity.

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ185813.

Appendix 7: Assessment of CRPS Objectives and Policies

Objective 5.2.1 Integration of land-use and regionally significant infrastructure (Entire Region)

Development is located and designed so that it functions in a way that:

1. *achieves consolidated, well designed and sustainable growth in and around existing urban areas as the primary focus for accommodating the region's growth; and*
2. *enables people and communities, including future generations, to provide for their social, economic and cultural well-being and health and safety; and which:*
   - *(a) maintains, and where appropriate, enhances the overall quality of the natural environment of the Canterbury region, including its coastal environment, outstanding natural features and landscapes, and natural values;*
   - *(b) provides sufficient housing choice to meet the region's housing needs;*
   - *(c) encourages sustainable economic development by enabling business activities in appropriate locations;*
   - *(d) minimises energy use and/or improves energy efficiency;*
   - *(e) enables rural activities that support the rural environment including primary production;*
   - *(f) is compatible with, and will result in the continued safe, efficient and effective use of regionally significant infrastructure;*
   - *(g) avoids adverse effects on significant natural and physical resources including regionally significant infrastructure, and where avoidance is impracticable, remedies or mitigates those effects on those resources and infrastructure;*
   - *(h) facilitates the establishment of papakāinga and marae; and*
   - *(i) avoids conflicts between incompatible activities.*

The proposed plan change seeks to enable residential and business activities to be developed adjoining an existing township. This will provide for long term future growth needs for the region. It is proposed to develop the site in such a manner that good linkages can be made to the proposed business zone and to the surrounding residential environment. The provision of larger sections within the residential area and appropriate boundary fence treatments along Creyke Road will mitigate any potential conflict with rural land uses further to the east of the site and will enable a range of housing choices within Darfield and the Selwyn District. The proposed business zone will provide an appropriate setback for residential activities from the intensive farming activity to the north of the site. Given the site of the proposed plan change adjoining the township, the change in activity status from rural activities to residential activities will not significantly reduce the rural productivity of the wider area.

Objective 5.2.2 Integration of land-use and regionally significant infrastructure (Wider Region)

In relation to the integration of land use and regionally significant infrastructure:

1. *To recognise the benefits of enabling people and communities to provide for their social, economic and cultural well-being and health and safety and to provide for infrastructure that is regionally significant to the extent that it promotes sustainable management in accordance with the RMA.*

2. *To achieve patterns and sequencing of land-use with regionally significant infrastructure in the wider region so that:*
   a. *development does not result in adverse effects on the operation, use and development of regionally significant infrastructure.*
   b. *adverse effects resulting from the development or operation of regionally significant infrastructure are avoided, remedied or mitigated as fully as practicable.*
   c. *there is increased sustainability, efficiency and liveability.*

The proposal will not compromise the existing State Highway road network given there is no direct access to the highway, and given the proposal includes realignment of the Creyke Road/SH 73 intersection to improve visibility. The proposal is considered to be consistent with this objective.

Objective 5.2.3 Transport network (Wider Region)

A safe, efficient and effective transport system to meet local regional, inter-regional and national needs for transport, which:

1. *supports a consolidated and sustainable urban form;*
2. *avoids, remedies or mitigates the adverse effects of transport use and its provision;*
3. *provides an acceptable level of accessibility; and*
4. *is consistent with the regional roading hierarchy identified in the Regional Land Transport Strategy.*

The proposal includes an internal road network that provides for a future connection to land to the west, supporting a consolidated and sustainable urban form, and provides good accessibility for both residential and business zoned land. Local road status is likely for these roads, consistent with the roading hierarchy.

Policy 5.3.1 Regional growth (Wider Region)

To provide, as the primary focus for meeting the wider region's growth needs, sustainable development patterns that:

1. *ensure that any*
   (a) *urban growth; and*
   (b) *limited rural residential development occur in a form that concentrates, or is attached to, existing urban areas and promotes a coordinated pattern of development;*
2. *encourage within urban areas, housing choice, recreation and community facilities, and business opportunities of a character and form that supports urban consolidation;*
3. *promote energy efficiency in urban forms, transport patterns, site location and subdivision layout;*
4. *maintain and enhance the sense of identity and character of the region's urban areas; and*
5. *encourage high quality urban design, including the maintenance and enhancement of amenity values.*

The proposed plan change is located on the eastern edge of Darfield Township, and seeks to provide an area of residential development that has clear links to the township and wider community. The use of a limited number of allotments will ensure allotments are of a lower density. Use of the Living 1 zone encourages a continuation of the existing township character located to the immediate south of the application site as well as providing consistency with larger Living 2 A zoned land also adjoining the southern boundary. By developing this area, there will be greater choice for housing types within the township, and the development will provide for future growth of the area while promoting energy efficiency through links to transport networks and appropriate urban form.

Policy 5.3.2 Development conditions (Wider Region)

To enable development including regionally significant infrastructure which:

1. *ensure that adverse effects are avoided, remedied or mitigated, including where these would compromise or foreclose:*
   - *(a) existing or consented regionally significant infrastructure;*
   - *(b) options for accommodating the consolidated growth and development of existing urban areas;*
   - *(c) he productivity of the region's soil resources, without regard to the need to make appropriate use of soil which is valued for existing or foreseeable future primary production, or through further fragmentation of rural land;*
   - *(d) the protection of sources of water for community supplies;*
   - *(e) significant natural and physical resources;*
2. *avoid or mitigate:*
   - *(a) natural and other hazards, or land uses that would likely result in increases in the frequency and/or severity of hazards;*
   - *(b) reverse sensitivity effects and conflicts between incompatible activities, including identified mineral extraction areas; and*
3. *integrate with:*
   - *(a) the efficient and effective provision, maintenance or upgrade of infrastructure; and*
   - *(b) transport networks, connections and modes so as to provide for the sustainable and efficient movement of people, goods and services, and a logical, permeable and safe transport system.*

The proposal is located adjoining an existing township and residential area, thus not fragmenting rural land. It is proposed to supply the site with a suitable potable water supply, and appropriate stormwater and sewage disposal system to ensure there is no adverse effects on community water supply. Although onsite wastewater disposal for resulting allotments is anticipated due to the lack of reticulation in Darfield, the proposal does not preclude the installation of a system should it become available.

The application site does not contain any known natural hazards and is not prone to flooding. The location of the proposed residential zone to the south of the site and the business zone to the north with associated landscaping buffers ensures reverse sensitivity effects with surrounding land uses will not occur.

The ODP has been designed to ensure there is adequate movement for vehicles and pedestrians within the site and externally to the wider road network.

Policy 5.3.3 Management of development (Wider Region)

To ensure that substantial developments are designed and built to be of a high-quality, and are robust and resilient:

1. *through promoting, where appropriate, a diversity of residential, employment and recreational choices, for individuals and communities associated with the substantial development; and*
2. *where amenity values, the quality of the environment, and the character of an area are maintained, or appropriately enhanced.*

The proposed plan change provides both residential and business zoned land that will contribute to employment opportunities in Darfield. The layout shown in the ODP includes setbacks and landscaping for the business zone to provide for the amenity, quality of the environment, and residential character of the surrounding residential activities.

Policy 5.3.5 Servicing development for potable water, and sewage and stormwater disposal (Wider Region)

Within the wider region, ensure development is appropriately and efficiently served for the collection, treatment, disposal or re-use of sewage and stormwater, and the provision of potable water, by:

1. *avoiding development which will not be served in a timely manner to avoid or mitigate adverse effects on the environment and human health; and*

2. *requiring these services to be designed, built, managed or upgraded to maximise their on-going effectiveness.*

The proposed servicing for the site can be accommodated either on-site or where reticulation is available via augmented Council reticulated services.

Policy 5.3.6 Sewerage, stormwater and potable water infrastructure (Wider Region)

Within the wider region:

1. *Avoid development which constrains the on-going ability of the existing sewerage, stormwater and potable water supply infrastructure to be developed and used.*
2. *Enable sewerage, stormwater and potable water infrastructure to be developed and used, provided that, as a result of its location and design:*
   (a) the adverse effects on significant natural and physical resources are avoided, or where this is not practicable, mitigated; and
   (b) other adverse effects on the environment are appropriately controlled.
3. *Discourage sewerage, stormwater and potable water supply infrastructure which will promote development in locations which do not meet Policy 5.3.1.*

The proposed servicing for the site is discussed in the attached servicing report. Servicing occur without having an adverse environmental effect.

Policy 5.3.7 Strategic land transport network and arterial roads (Entire Region)

In relation to strategic land transport network and arterial roads, the avoidance of development which:

1. *adversely affects the safe efficient and effective functioning of this network and these roads, including the ability of this infrastructure to support freight and passenger transport services; and*
2. *in relation to the strategic land transport network and arterial roads, to avoid development which forecloses the opportunity for the development of this network and these roads to meet future strategic transport requirements.*

The proposal includes the realignment of Creyke Road so that it intersects with SH73 on an angle that improves the safe, efficient and effective functioning of the road network.

Policy 5.3.9 Regionally significant infrastructure (Wider Region)

In relation to regionally significant infrastructure (including transport hubs):

1. *avoid development which constrains the ability of this infrastructure to be developed and used without time or other operational constraints that may arise from adverse effects relating to reverse sensitivity or safety;*
2. *provide for the continuation of existing infrastructure, including its maintenance and operation, without prejudice to any future decision that may be required for the ongoing operation or expansion of that infrastructure; and*
3. *provide for the expansion of existing infrastructure and development of new infrastructure, while:*
   a. *recognising the logistical, technical or operational constraints of this infrastructure and any need to locate activities where a natural or physical resource base exists;*
   b. *avoiding any adverse effects on significant natural and physical resources and cultural values and where this is not practicable, remedying or mitigating them, and appropriately controlling other adverse effects on the environment; and*
   c. *when determining any proposal within a sensitive environment (including any environment the subject of section 6 of the RMA), requiring that alternative sites, routes, methods and design of all components and associated structures are considered so that the proposal satisfies sections 5(2)(a) – (c) as fully as is practicable.*

The proposal will not limit the current regionally significant infrastructure in place and will not preclude the development of infrastructure in the future. In particular, there is ample opportunity to install reticulated sewer services at the time of subdivision should reticulated services be available in Darfield.

Policy 5.3.8 Land use and transport integration (Wider Region)

Integrate land use and transport planning in a way:

1. *that promotes:*
   - *(a) the use of transport modes which have low adverse effects;*
   - *(b) the safe, efficient and effective use of transport infrastructure, and reduces where appropriate the demand for transport;*
2. *that avoids or mitigates conflicts with incompatible activities; and*
3. *where the adverse effects from the development, operation and expansion of the transport system:*
   - *(a) on significant natural and physical resources and cultural values are avoided, or where this is not practicable, remedied or mitigated; and*
   - *(b) are otherwise appropriately controlled.*

The proposal has been designed to connect to and integrate pedestrian pathways into existing modal transport networks. In particular, the proposal includes the realignment of Crekye Road to provide for a safe, efficient and effective road network, and the ODP includes pedestrian access points to promote walkability. It is therefore considered that the proposal gives effect to Policy 5.3.8.

Policy 5.3.12 – Rural production (Wider Region)

Maintain and enhance natural and physical resources contributing to Canterbury's overall rural productive economy in areas which are valued for existing or foreseeable future primary production, by:

1. *avoiding development, and / or fragmentation which;*
   - *(a) forecloses the ability to make appropriate use of that land for primary production; and / or*
   - *(b) results in reverse sensitivity effects that limit or precludes primary production.*
2. *enabling tourism, employment and recreational development in rural areas, provided that it:*
   - *(a) is consistent and compatible with rural character, activities, and an open rural environment;*
   - *(b) has a direct relationship with or is dependent upon rural activities, rural resources or raw material inputs sourced from within the rural area;*
   - *(c) is not likely to result in proliferation of employment (including that associated with industrial activities) that is not linked to activities or raw material inputs sourced from within the rural area; and*
   - *(d) is of a scale that would not compromise the primary focus for accommodating growth in consolidated, well designed and more sustainable development patterns. and;*
3. *ensuring that rural land use intensification does not contribute to significant cumulative adverse effects on water quality and quantity.*

Only part one of this policy relates to the proposed plan change as the proposed plan change seeks to provide for residential growth in a manner which does not further fragment rural land. The extent of the plan change area is consolidated within a rural block, bound by State Highway 73 and Creyke Road. However, this change will prevent the use of the site for primary production. It is considered that when read in conjunction with all of the policies in the CRPS, the loss of a small area of land on the edge of existing development is more appropriate than alternative locations which may create rural land fragmentation issues and/or infrastructure and servicing issues. It is considered that the inclusion of the proposed plan change in to the District Plan gives effect to the this policy when considered in balance with other policies in the CRPS.

Objective 17.2.1 Protection from adverse effects of contaminated land

Protection of people and the environment from both on-site and off-site adverse effects of contaminated land.

Policy 17.3.2 Development of, or discharge from contaminated land

In relation to actually or potentially contaminated land, where new subdivision, use or development is proposed on that land, or where there is a discharge of the contaminant from that land:

1. *a site investigation is to be undertaken to determine the nature and extent of any contamination; and*
2. *if it is found that the land is contaminated, except as provided for in Policy 17.3.3, the actual or potential adverse effects of that contamination, or discharges from the contaminated land shall be avoided, remedied or mitigated in a manner that does not lead to further significant adverse effects.*

The application site includes some identified contaminated land areas. The area affected is small and the nature of the contaminants means that this area can easily be remedied prior to and as part of any subdivision of the site without having adverse effects on human health. An appropriate DSI and RAP will be required at the time of subdivision.

Appendix 8: Assessment of District Plan Objectives and Policies

Under Schedule 4, Clause 2(g) of the RMA, the following is an assessment of the proposed plan change against the relevant objectives and policies of the Selwyn District Plan.

Natural resources

Objective B1.1.2

New residential or business activities do not create shortages of land or soil resources for other activities in the future.

The location and size of the application site means that it will not significantly reduce the land and soil resources available for other activities.

Policy B1.1.1

Ensure activities do not contaminate soil.

The proposed plan change will not result in land uses that contaminate soil.

Policy B1.1.3

Avoid adverse effects on people's health or well-being from exposure to contaminated soil.

A PSI of the application site has been completed and concludes it is safe for the proposed zoning and associated permitted uses, subject to appropriate remediation.

Policy B1.1.5

Ensure activities do not create unstable land.

A geotechnical investigation of the site has been undertaken and confirmed it is suitable for the uses proposed and is unlikely to create unstable land.

Policy B1.1.8

Avoid rezoning land which contains versatile soils for new residential or business development if:

- *the land is appropriate for other activities; and*
- *there are other areas adjoining the township which are appropriate for new residential or business development which do not contain versatile soils.*

As has been discussed previously, most of the land around Darfield Township is reasonably versatile by virtue of being located on the Canterbury Plains, and therefore may not meet the first part of Policy B1.1.8. However, given the location of the proposed plan change adjoining existing and proposed developments of the township, and given this area is not more or less versatile than other areas adjoining the township, it is considered that the proposal site is an appropriate location for the expansion of the township. Further, it is noted that the site has been identified as appropriate for residential activity as evidenced in the Malvern Area Plan DAR6 demarcation. It is for these reasons that the proposal is consistent with the second part of Policy B1.1.8.

While the proposal does constitute a minor loss in versatile soils, it is considered to be an appropriate area for the development of Darfield due to its location, because it is outside any hazard zones, and the decreased probability of liquefaction induced ground damage (i.e. subsidence and inundation) with the underlying ground conditions exhibiting a competent and stable nature. Therefore, the application is considered to be consistent with Objective B1.1.2 and Policy B1.1.8.

Objective B1.2.1

Expansion of townships in Selwyn District maintains or enhances the quality of ground or surface water resources.

As has been discussed in the servicing section of this application, stormwater and wastewater can be managed in a manner that maintains the quality of groundwater resources. Furthermore, the site is not precluded from being part of any future sewer reticulation in Darfield should this occur. Appropriate provisions for water supply to increase the availability of water can be made without adversely affecting ground water resources. Therefore, the application is considered to be consistent with Objective B1.1.2 and Policy B1.1.8.

Objective B1.2.2

Activities on land and the surface of water in Selwyn District:

- *Do not adversely affect ground or surface water resources;*
- *Do not adversely affect waahi tapu or waahi taonga;*
- *Maintain or enhance the ecological and habitat values of waterbodies and their margins;*
- *Maintain or enhance the water quality and ecological values of sites of mahinga kai (food gathering); and*
- *Promote public access along rivers and streams, where appropriate.*

The proposal includes the disposal of stormwater and wastewater to ground in a manner that does not have an adverse effect identified in Objective B1.2.2 and will be subject to the provisions of Environment Canterbury's Land and Water Regional Plan. The application site is not identified or recorded as containing any waahi tapu or waahi taonga sites.

Policy B1.2.1

Ensure all activities in townships have appropriate systems for water supply, and effluent and stormwater treatment and disposal to avoid adverse effects on the quality of ground water or surface waterbodies.

The proposed rezoning will result in a future residential expansion area for the township of Darfield. The servicing assessment provided as part of this Plan Change identifies that a solution for water supply, wastewater disposal and stormwater disposal can be achieved without having an adverse effect on the quality of ground water or surface waterbodies. The Plan Change does not preclude reticulated sewer disposal should it become available for Darfield in the future.

Policy B1.2.2

Ensure land rezoned to a Living or Business zone can be serviced with a water supply and effluent and stormwater disposal without adversely affecting groundwater or surface waterbodies.

The proposed rezoning will result in a future residential expansion area for the township of Darfield. The servicing assessment provided as part of this Plan Change identifies that a solution for water supply, wastewater disposal and stormwater disposal can be achieved without having an adverse effect on the quality of ground water or surface waterbodies. The Plan Change does not preclude reticulated sewer disposal should it become available for Darfield in the future.

Policy B1.2.3

Require the water supply to any allotment or building in any township, and the Living 3 Zone, to comply with the current New Zealand Drinking Water Standards and to be reticulated in all townships, except for sites in the existing Living 1 Zone at Doyleston.

Water to augment the existing Darfield supply will be required to meet this standard before it can be connected. Groundwater in the area has already been sourced to supply Darfield that meets this standard.

Policy B1.2.4

Recognise and promote the need for protection zones around water supply bores, to reduce the risk of contamination from land uses.

Any new water bore to facilitate the expansion of Darfield will be required to have a protection zone. There is ample room within the application site to provide this if required.

Objective B1.4.1

The expansion of townships does not adversely affect the values of outstanding natural features and landscapes.

There are no outstanding natural features identified on the site or in the immediate surrounding area. Therefore, the proposal is consistent with this Objective.

Objective B1.4.4

The distinction between the landscapes of the rural area and townships on the Canterbury Plains is maintained.

The proposed plan change will enable the development of residential allotments and a business zone adjoining an existing township and will be bounded by roads on the northern and eastern edges. This will provide distinction to the edge of the township and the adjoining rural land, thus remaining consistent with Objective B1.4.4.

Physical Resources

Objective B2.1.1

An integrated approach to land use and transport planning to ensure the safe and efficient operation of the District's roads, pathways, railway lines and airfields is not compromised by adverse effects from activities on surrounding land or by residential growth.

Objective B2.1.2

An integrated approach to land use and transport planning to manage and minimise adverse effects of transport networks on adjoining land uses, and to avoid "reverse sensitivity" effects on the operation of transport networks.

Objective B2.1.3

Future road networks and transport corridors are designed, located and protected, to promote transport choice and provide for: a range of sustainable transport modes; and alternatives to road movement of freight such as rail.

The Integrated Transport Assessment for the proposed plan change has identified that the effects on the surrounding road network can be accommodated without capacity or efficient issues arising. This includes the realignment of Creyke Road to improve safety and efficiency, pedestrian connections to external sites, and a future road connection to integrate with potential future development to the west. No direct access to the State Highway is proposed to avoid adverse effects on the operation of that network. The proposal is considered to be consistent with Objectives B2.1.1, B2.1.2 and B2.1.3.

Objective B2.1.4

Adverse effects of land transport networks on natural or physical resources or amenity values, are avoided, remedied or mitigated, including adverse effects on the environment from construction, operation and maintenance.

Policy B2.1.3

Recognise and protect the primary function of roads classified as State Highways and Arterial Roads in Part E, Appendix 7, to ensure the safe and efficient flow of 'through' traffic en route to its destination.

The proposal will gain entrance from Creyke Road on the eastern boundary. There will be a through connection to the adjoining Living 2A Deferred zone to the west. There will be no connection directly from the state highway network to the application site, to ensure the efficiency of the network is maintained. It is considered the proposal is consistent with Objective B2.1.4 and Policy B2.1.3.

Policy B2.1.4(a)

Ensure all sites, allotments or properties have legal access to a legal road which is formed to the standard necessary to meet the needs of the activity considering:

- *the number and type of vehicle movements generated by the activity;*
- *the road classification and function; and*
- *any pedestrian, cycle, public transport or other access required by the activity.*

Policy B2.1.4(b)

Avoid adverse effects on the safe flow of traffic along State Highways and Arterial Roads from new property access, where the speed limit is more than 70 km/hr.

The proposal will enable all future allotments to have access to a legal road. The proposed new road through the site will provide access for the residential allotments. Internal footpaths, pedestrian and cycle access will provide a range of circulation methods within the site. The business zone will be serviced by an appropriate access road to facilitate and complement future options for this zone.

State Highway 73 along the frontage of the application site has a speed limit of 100 km/h. There are no proposed connections to the Highways network, therefore the proposal is considered consistent with Policy B2.1.4 (a) and (b).

Policy B2.1.5

Ensure the development of new roads is:

- *integrated with existing and future transport networks and land uses; and*
- *is designed and located to maximise permeability and accessibility;*

through achieving a high level of connectivity within and through new developments to encourage use of public and active transport; whilst having regard to the road hierarchy.

One new road is proposed to link the existing Creyke Road through to anticipated future roads to the west of the site associated with the Living 2A Deferred, Area 3 in Appendix 25 of the Selwyn District Plan. This provides for a co-ordinated and integrated roading network for the site, and the surrounding existing and anticipated road network, flowing back into Darfield's Town Centre. A new cul-de-sac will provide access to the business area. This will contribute to efficient transport outcomes in practice. The proposal is therefore consistent with Policy B2.1.5.

Policy B2.1.6(a)

Require activities to have adequate on-site carparking and loading facilities to minimise potential adverse effects from roadside parking and to require adequate on-site manoeuvring area to avoid the need for reversing onto or off roads particularly State Highways and Arterial Roads...

The proposal provides for allotment sizes that can accommodate necessary parking and loading facilities. The layout of the ODP means that no activity has direct access to the highway.

Policy B2.1.7

Provide for pedestrian safety, security, circulation and access within parking areas by considering the interaction of vehicle access and manoeuvring, circulation, loading and parking, with likely pedestrian routes onto the site, including for users of public transport, and between car and cycle parks, and building entrances.

Pedestrian and cycle routes have been identified and provided for throughout the ODP area.

Policy B2.1.9

Ensure buildings are set back a sufficient distance from road boundaries to maintain good visibility for all road users including motorists, cyclists and pedestrians, and to allow safe access and egress and to mitigate reverse sensitivity effects on land adjoining the State Highway.

Building setback has been included in the overall ODP for the site and proposed rule changes. Additionally, low planting is proposed close to the intersection of Creyke Road and SH 73 to provide for improved visibility.

Policy B2.1.10

Ensure vehicle crossings, intersections, pathways, roadside signs and noticeboards are designed and positioned to ensure good visibility for all road users, and to allow safe passage, access and egress.

All the proposed lots will have access on to a legal road, with vehicle crossings being constructed to meet District Plan requirements. The intersections will be designed to ensure there is clear visibility, and the plans change makes provision for the Creyke Road/SH73 intersection to be upgraded and improved.

Policy B2.1.12

Address the impact of new residential or business activities on both the local roads around the site and the District's road network, particularly Arterial Road links with Christchurch City.

The proposal will result in an increase in the number of vehicles using Creyke Road and the intersection between Creyke Road and SH73. The attached Traffic Assessment identifies that there is sufficient capacity within the existing network to accommodate increased traffic. Furthermore the traffic assessment recommends upgrades to Creyke Road which are embedded into the ODP.

Policy B2.1.13

Minimise the effects of increasing transport demand associated with areas identified for urban growth by promoting efficient and consolidated land use patterns that will reduce the demand for transport.

Application site is identified as a future urban expansion area with Crekye Road forming an urban containment boundary for the township of Darfield to the east.

Policy B2.1.14

Encourage people to walk or cycle within and between townships by providing a choice of routes for active transport modes and ensuring there is supporting infrastructure such as parking for cycles, at destinations.

Policy B2.1.15

Require pedestrian and cycle links in new and redeveloped residential or business areas, where such links are likely to provide a safe, attractive and accessible alternative route for pedestrians and cyclists, to surrounding residential areas, business or community facilities.

There are multiple cycle and pedestrian accessways and links to facilitate the anticipated volume of walking and cycling in the area. Connections have been made through to the business area to ensure people can live and work in this area. Therefore, the proposal is considered to be consistent with Policy B2.1.15.

Policy B2.1.23

Where a township is already largely developed on both sides of a State Highway or railway line:

- *Discourage new residential or business development from extending the township further along the State Highway or railway line if there are alternative, suitable sites; or, if not,*
- *Restrict new residential or business areas to extending further along one side of the State Highway or railway line only.*

Proposed plan change area will not extend the Darfield township beyond that which is already identified an anticipated by Selwyn District planning policy and documents. Creyke Road provides a logical urban containment zone for Darfield and this proposal enables this mechanism. Therefore, the proposal is consistent with Policy B2.1.23.

Utilities

Objective B2.2.3

The provision of utilities where any adverse effects on the receiving environment and on people's health, safety and wellbeing is managed having regard to the scale, appearance, location and operational requirements of the facilities.

Policy B2.2.1

Require that the need to supply utilities and the feasibility of undertaking, is identified at the time a plan change request is made to rezone land for residential or business development.

This plan change application includes confirmation from electricity and telecommunications providers that future connections for both residential and commercial use can be provided.

Policy B2.2.2

Ensure activities have access to the utilities they require at the boundary prior to any new allotment being sold; or prior to any new activity taking place on an existing allotment.

The provision of utilities will be confirmed at the time of any future subdivision.

Policy B2.2.4

Ensure provision is made for the ongoing maintenance and repair of utilities which do not vest in the Council, and that the users of these utilities are informed of any responsibility they have for ongoing maintenance or repair.

It is anticipated that all utilities will vest in council as part of future subdivision and use of the site.

Objective B2.3.1

Residents have access to adequate community facilities.

Objective B2.3.2

Community facilities do not adversely affect residential amenity values or other parts of the environment.

Policy B2.3.1

Encourage co-ordination between the provision of community facilities, and new residential and business development.

The proposal includes suitable access networks to ensure residents are able to access existing community facilities in Darfield, which includes the recently upgraded community service centre and library. Development of this size, on the outer edge of the urban area do not warrant providing additional community facilities. However, the business zoning does not prohibit community facilities from being developed in the future. The proposal is consistent with Objective B2.3.1 and B2.3.2, and Policy B2.3.1.

Objective B2.4.2

Adverse effects on the environment from the collection, treatment, storage or disposal of waste are reduced.

Policy B2.4.4

Ensure land rezoned for new residential or business development has a regular solid waste collection and disposal service available to residents.

The proposal adjoins Darfield, which has a regular solid waste collections and disposal service available. It is very likely that future residents (once developed) will be serviced by this system and therefore the proposal is consistent with Objective B2.4.2 and Policy B2.4.4.

Policy B2.4.7

Regard any land used to treat or dispose of solid waste or to spread effluent as a potentially contaminated site, until it is tested.

The application site is identified on the Listed Land Use Register as having an area of HAIL contamination on it. A Preliminary Site Investigation has been undertaken and concluded that a former poisoned possum pit, and other potential waste material disposed to a former quarry pit exist over a small area on the western side of the site. The PSI recommends a Remediation Action Plan for the possum pit and that a detailed site investigation for the area affected by the disposal of material in the historical quarry pit at the western end of the site. The report notes the rest of the subject site has been used for general pastoral or residential use for all of its known history. This use is not considered to pose a risk to human health or the environment. No further investigation is required for the majority of the site. The report concludes the NESCS does apply to the identified risk areas of the site and resource consent is required for activities listed in the NESCS.

The proposal is not inconsistent with Policy B2.4.7 as testing has occurred on site.

B3 People health and safety

Natural Hazards

Objective B3.1.1

Ensure activities do not lead to or intensify the effects of natural hazards.

Objective B3.1.2

Ensure potential loss of life or damage to property from natural hazards is mitigated

Objective B3.1.3

Ensure methods to mitigate natural hazards do not create or exacerbate adverse effects on other people or the environment

Policy B3.1.2

Avoid allowing new residential or business development in areas known to be vulnerable to a natural hazard, unless any potential risk of loss of life or damage to property is adequately mitigated.

Policy B3.1.7

Ensure any residential or business development does not adversely affect the efficiency of the District's land drainage system or the risk of flooding from waterbodies.

The proposal site does not contain any identified natural hazards, nor does it contain any of the District's land drainage system. The site is not located in an area at risk from flooding from any waterbodies.

A geotechnical report indicating the impact of earthquakes on this site has been included as part of this application. It is considered that there is a very low risk of natural hazards occurring on this site, or that the development of the site might exacerbate adverse effects from natural hazards on other people or the environment. Therefore, it is considered that the proposal is consistent with Objectives B3.1.1, B3.1.2 and B3.1.3 and Policies B3.1.2 and B3.1.7.

Quality of the Environment

Objective B3.4.1

The District's townships are pleasant places to live and work in.

Objective B3.4.2

A variety of activities are provided for in townships, while maintaining the character and amenity values of each zone.

The proposal includes 35 residential sections along the southern portion of the site. These are of sufficient size to ensure that the character and amenity of Darfield is maintained. Provisions for open style fencing along the eastern boundary on Creyke Road will ensure the appearance along this road length is consistent with land to the south. The proposal also includes detailed landscaping requirements to ensure that future development provides amenity value to the township. This will ensure that the township is a pleasant place to work and live. It is considered that the proposal is consistent with Objectives B3.4.1 and B3.4.2.

Objective B3.4.3

"Reverse sensitivity" effects between activities are avoided.

The proposal includes a business zone which will be positioned within the separation distance created by the intensive livestock production activity. As such there will be no residential activities in this area. When combined with amenity planting and the likelihood that future residents will be understanding of the nature of rural activities, it is considered that it is unlikely to be any reverse sensitivity issues, Therefore the proposal is consistent with Objective B3.4.3.

Objective B3.4.4

Growth of existing townships has a compact urban form and provides a variety of living environments and housing choices for residents, including medium density housing typologies located within areas identified in an Outline Development Plan.

Objective B3.4.5

Urban growth within and adjoining townships will provide a high level of connectivity both within the development and with adjoining land areas (where these have been or are likely to be developed for urban activities or public reserves) and will provide suitable access to a variety of forms of transport.

Policy B3.4.2

To provide for any activity to locate in a zone provided it has effects which are compatible with the character, quality of the environment and amenity values of that zone.

Policy B3.4.3

To provide Living zones which:

- *are pleasant places to live in and provide for the health and safety of people and their communities;*
- *are less busy and more spacious than residential areas in metropolitan centres;*
- *have safe and easy access for residents to associated services and facilities;*
- *provide for a variety of living environments and housing choices for residents, including medium density areas identified in Outline Development Plans;*
- *ensure medium density residential areas identified in Outline Development Plans are located within close proximity to open spaces and/or community facilities and*
- *ensure that new medium density residential developments identified in Outline Development Plans are designed in accordance with the following design principles:*
  - *access and connections to surrounding residential areas and community facilities and neighbourhood centres are provided for through a range of transport modes;*
  - *block proportions are small, easily navigable and convenient to encourage cycle and pedestrian movement;*
  - *streets are aligned to take advantage of views and landscape elements;*
  - *section proportions are designed to allow for private open space and sunlight admission;*
  - *a subdivision layout that minimises the number of rear lots;*
  - *layout and design of dwellings encourage high levels of interface with roads, reserves and other dwellings;*
  - *a diversity of living environments and housing types are provided to reflect different lifestyle choices and needs of the community;*
  - *a balance between built form and open spaces complements the existing character and amenity of the surrounding environment and;*
  - *any existing natural, cultural, historical and other unique features of the area are incorporated where possible to provide a sense of place, identity and community.*

The proposal seeks to provide low density residential sections as well as business zone across 30 hectares to provide for lifestyle choices and needs of the community. The Living 1 zone provides spacious, open sections to enable for residential activities with larger than standard section sizes for the Living 1 zone consistent with the mix of adjoining living zones to the south. The area will be less busy than metropolitan areas and will provide a pleasant place to live set back from business activities to the north.

Policy B3.4.6

(a) *To provide Business 2 and 2B Zones with few requirements for aesthetic or amenity values, but which have sufficient provisions: to safeguard people's health and well-being and to avoid pollution of natural resources or potential 'reverse sensitivity' effects.*
(b) *To provide a Business 2A Zone which can cater for business activities requiring large footprint buildings and/or sites but which have sufficient provisions to safeguard people's health and well-being and avoid pollution of natural resources or potential 'reverse sensitivity' effects.*

The proposal seeks to create a business 2 zone that will be surrounded by landscaping buffer strip on the north, south, east and west boundaries to distinguish the area from the residential zone. A 10 m building setback is also proposed to ensure that activities do not create reverse sensitivity effects with surrounding residential activities. Peoples health and wellbeing will be ensured through these measures and the measures embedded in the District and Regional Plans around odour, dust and discharges.

Landscaping and Amenity Planting

Policy B3.4.32

> *Encourage sites in Business 2, 2A and 2B Zones and the Business 3 Zones which adjoin a road to have the road frontage of the site landscaped or screened.*

Landscaping around the external boundary of the business zone will be required at the time of development, ensuring that road frontages are landscaped.

Reverse Sensitivity Effects

Policy B3.4.36

> *Encourage Business 2, 2A and 2B Zones to be consolidated in one area, in each township.*

The proposed Business 2 Area for the application site is located opposite an existing Business 2 Zone, providing a consolidated area, although separated by a highway and a railway line. Therefore, the proposal is consistent with this policy.

Policy B3.4.38

> *Where Living zones and Business 2 Zones adjoin, ensure any new activity occurring along the boundary in either zone, includes measures to mitigate any potential 'reverse sensitivity' effects on existing activities.*

The proposal includes an amenity landscaping strip around the periphery of the business zone to mitigate any adverse effects. The road network and building setbacks within the business zone will provide around 40 m of physical separation between the proposed business zone and the proposed residential properties.

Policy B3.4.39

> *Avoid rezoning land for new residential development adjoining or near to existing activities which are likely to be incompatible with residential activities, unless any potential 'reverse sensitivity' effects will be avoided, remedied or mitigated.*

The intensive livestock production zone has been recognised as an activity that requires a separation distance. As such it is proposed to accommodate a business zone along the state highway boundary which will act as a buffer to the residential zone beyond and establish a transition area between the respective activities.

Growth of Townships

Residential Density

Objective B4.1.1

A range of living environments is provided for in townships, while maintaining the overall 'spacious' character of Living zones, except within Medium Density areas identified in an Outline Development Plan where a high quality, medium density of development is anticipated.

The provision of a Living 1 zone with a minimum average of 1,950 m^2 will ensure that the overall spacious character of the surrounding environment to the west and south and greater township is maintained. The proposal is consistent with Objective B4.1.1.

Objective B4.1.2

New residential areas are pleasant places to live and add to the character and amenity values of townships.

Policy B4.1.10

Ensure there is adequate open space in townships to mitigate adverse effects of buildings on the aesthetic and amenity values and "spacious" character.

The Outline Development Plan created for the application site includes open amenity areas throughout the site for both residential uses and the commercial areas.

Policy B4.1.11

Encourage new residential areas to be designed to maintain or enhance the aesthetic values of the township, including (but not limited to):

- *Retaining existing trees, bush, or other natural features on sites; and*
- *Landscaping public places.*

As the application site has been used for agricultural purposes and does not have any area of extensive vegetation that could be retained, nor does it have any natural features. Landscaping is proposed in public places as shown on the Outline Development Plan.

Subdivision of Land

Policy B4.2.10

Ensure that new residential blocks are small in scale, easily navigable and convenient to public transport services and community infrastructure such as schools, shops, sports fields and medical facilities, particularly for pedestrians and cyclists.

The proposal site is of a scale that it is easily navigable by residents. Links to existing and proposed pedestrian and cycleways will be made available in permeable materials for alternative modes of transport. It is noted the site is adjacent to a railway line, should commuter transport ever be advanced to the township, Christchurch or the wider Selwyn District. The proposal is consistent with Policy B4.2.10.

Residential and Business Development

Objective B4.3.1

The expansion of townships does not adversely affect:

- *Natural or physical resources;*
- *Other activities;*
- *Amenity values of the township or the rural area; or*
- *Sites with special ecological, cultural, heritage or landscape values.*

Objective B4.3.2

For townships outside the Greater Christchurch area, new residential or business development adjoins existing townships at compatible urban densities or at a low density around townships to achieve a compact township shape which is consistent with the preferred growth direction for townships and other provisions in the Plan.

The proposal site is located outside the greater Christchurch area, and adjoins both the Living 1 and Living 2A zone on the southern boundary. Residential densities are proposed within the application site a rate that enables a compact township shape and does not adversely affect the amenity values of the township or rural area. Other activities to the north of the application site have specifically been considered when developing the ODP including the State Highway and commercial activity north of the application site.

Darfield Specific Growth Policies

Policy B4.3.25

Discourage individual property access from new Living or Business zones to State Highway 73 or State Highway 77 (Bangor Road) and manage the number and location of any new subdivisional road on to these routes.

The proposal site is adjacent to State Highway 73, however there are no direct access points to the Highways Network. All access to the application site will be via Creyke Road. The proposal is consistent with Policy B4.3.25.

Policy B4.3.27

Ensure any land rezoned for new residential or business development does not create or exacerbate 'reverse sensitivity' issues in respect of activities in the existing Business 2 Zones or the Midland Railway.

The proposal includes a business zone positioned to create a separation between existing activities to the north that may generate a reverse sensitivity effect for proposed residential activities. The modified ODP is in response to the potential effects generated by these lawfully established activities. Additional landscaping required around the business zone will provide a greater sense of separation and will reduce potential reverse sensitivity effects with the rural land to the east. Therefore, the proposal is consistent with Policy B4.3.27.

BASELINEGROUP

Appendix 9: Transport Assessment

RJ and CE Wright

Proposed Private Plan Change Darfield

Transportation Assessment

CARRIAGEWAY CONSULTING
traffic engineering | transport planning

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1. Introduction

1.1. RJ and CE Wright propose to submit a private plan change request to Selwyn District Council to rezone an area of land in the settlement of Darfield. If the plan change is approved, it will result in the site being rezoned from Outer Plans to a combination of Living 2A and Business 2.

1.2. This Transportation Assessment sets out an evaluation of the transportation issues associated with the development of the plan change area including changes in travel patterns that are likely to arise. Where potential adverse effects are identified, possible ways in which these can be addressed are set out.

1.3. This report is cognisant of the guidance specified in the New Zealand Transport Agency's '*Integrated Transport Assessment Guidelines'* and although travel by private motor vehicle is addressed within this report, in accordance with best practice the importance of other transport modes is also recognised. Consequently, travel by walking, cycling and public transport is also considered.

2. Site Overview

2.1. Location

2.1.1. The development site is located on the eastern side of Darfield and is presently zoned as Outer Plans in the Selwyn District Plan ('*District Plan*').

2.1.2. The location of the site in the context of the local area is shown in Figure 1 and in more detail in Figure 2.

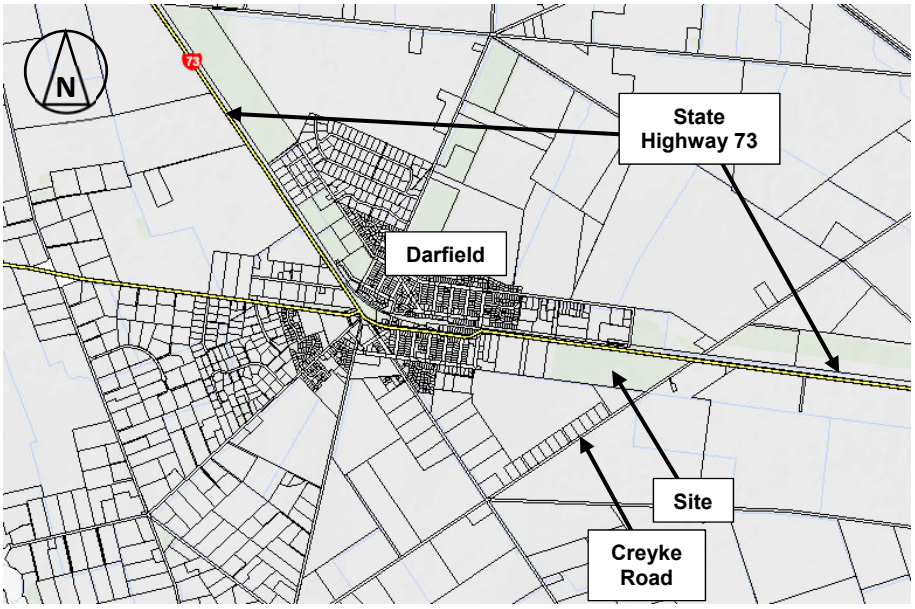

Figure 1: General Location of Development Site

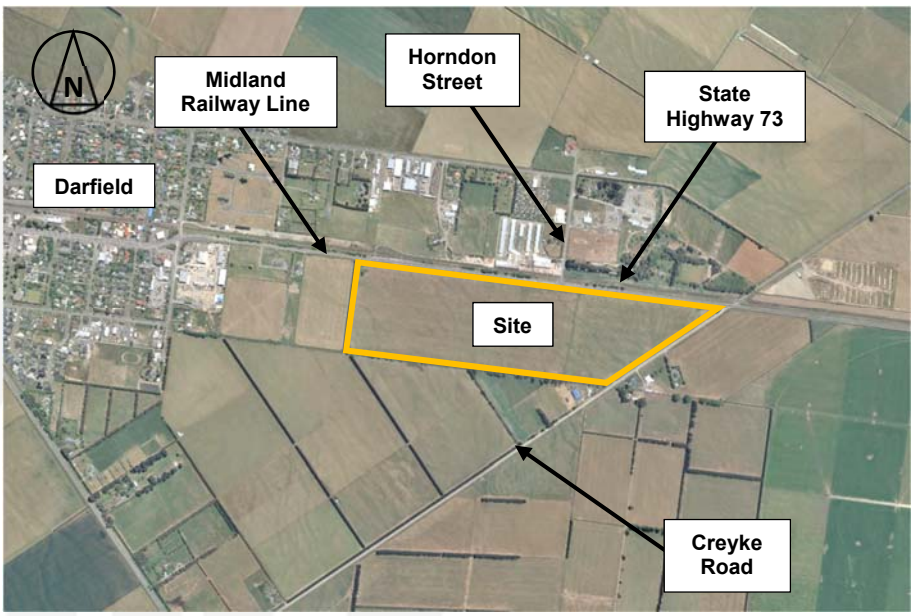

Figure 2: Aerial Photograph of Site and Environs

2.2. Road Hierarchy

2.2.1. Under the District Plan, State Highway 73 is a highway which is "*the highest in the roading hierarchy*" and "*required to accommodate connections of arterial roads, collector and local roads in a very controlled manner. Due to the higher volume and speed of traffic, the function of State Highways to carry 'through' traffic takes precedence over other functions of these roads*" (District Plan Policy B2.1.1, Explanation and Reasons).

2.2.2. Creyke Road and Horndon Street are Local Roads, whose function "*is almost entirely to provide for access to properties and adjoining land uses"* and which *"are not intended to act as main through routes for traffic and generally have lower traffic volumes*" (District Plan Policy B2.1.1, Explanation and Reasons).

3. Current Transportation Networks

3.1. Roading Network

3.1.1. The proposed roading connection into the plan change area is via the eastern end of the site, and onto Creyke Road. In this location, Creyke Road has a flat and straight alignment, and a sealed carriageway width of 6.5m but with no centreline or edegline markings. There is a 0.5m metalled shoulder on each side of the road, and then grassed verges to the road boundary. The road is subject to a speed limit of 100km/h, and the legal road width is 20m.

Photograph 1: Creyke Road Looking South (Site on Left)

3.1.2. At the northeastern corner of the site, Creyke Road meets State Highway 73 at a four-arm priority ('stop') controlled intersection, with Creyke Road forming the fourth approach towards the north. The intersection has an auxiliary turning lane for the movement from south to west but no right-turn or left-turn lanes on the highway for drivers turning into Creyke Road.

Photograph 2: State Highway 73 / Creyke Road Intersection Looking South (Site Centre-Right)

3.1.3. The minor approaches to the intersection are at 40 degrees to the highway, rather than the more usual 90 degrees. This means any driver turning right has to look over their left shoulder and through the rear passenger-side window rather than the front window.

3.1.4. Sight distances at the intersection are affected by an overgrown shelter belt towards the west. However cadastrals show that the edge of the nearest traffic lane is 5.5m from the highway boundary, and since sightlines are measured at 5.5m from the edge of the nearest traffic lane, this means that if the shelterbelt is trimmed, the sightline would lie wholly within the highway reserve (the shelterbelt currently reduces this 5.5m distance to 3.5m).

Photographs 3 and 4: Sight Distances along State Highway 73 from Creyke Road at 5.5m Back from Traffic Lane Showing Effect of Shelterbelt

Photographs 5 and 6: Sight Distances along State Highway 73 from Creyke Road at 3.5m Back from Traffic Lane Showing Excellent Distances

3.1.5. State Highway 73 has a flat and straight alignment and is subject to a speed limit of 100km/h. There is one traffic lane in each direction of 3.6m width and a sealed shoulder of 0.7m on each side, and the carriageway is marked with edgelines and a centreline. There are grassed verges on each side of the highway, with the Midland Railway Line running parallel to the highway towards the north, some 20m away.

Photograph 7: State Highway 73 Looking West (Site on Left)

3.1.6. Towards the west, the highway passes through Darfield and other townships before running through Arthurs Pass and providing a connection to the West Coast. To the east, the highway connects to State Highway 1 and terminates in Upper Riccarton in Christchurch.

3.1.7. Creyke Road continues to the north of the intersection. Around 20m north of the intersection, the road crosses the railway at a level crossing, which has flashing lights and bells, but no barriers. The road rises up in order to cross the railway.

Photograph 8: Creyke Road Level Crossing Looking North

3.1.8. To the north and south of the site, Creyke Road connects to the district roading network around Darfield which provide access to a number of rural activities.

3.2. Non-Car Modes of Travel

3.2.1. There is no specific infrastructure for walking or cycling in the immediate area of the site, although the wide berms are suitable for walking and the low traffic flows on Creyke Road mean that cyclists can share the road with motorised traffic.

3.3. Future Changes

3.3.1. The land to the immediate south of the site is addressed in an Outline Development Plan ("*ODP*") set out in Appendix 41 of the District Plan, for development as residential lots. The ODP does not show any direct connection between that area and the proposed plan change area.

Figure 3: Approved ODP for Area South of Site

3.3.2. This area of land is presently not subdivided into lot sizes that would result in an intensification of the traffic flows. Accordingly, for the purposes of this analysis it is anticipated that the development of the land would require resource consents, and so any increases in traffic flows arising from development have not been taken into account within this assessment.

4. Current Transportation Patterns

4.1. Traffic Flows

Prevailing Traffic Flows

4.1.1. The New Zealand Transport Agency ("NZTA") carries out regular traffic counts on the state highway network throughout the country. The closest count sites to the proposed plan change site are located within Darfield (between Clinton and Russell Streets) and west of Aylesbury, some 11km from the site. Neither location is likely to be fully representative of traffic volumes past the site – in the case of the Darfield counter this is because it will record local trips within the town, and in the case of the Aylesbury counter, this is because the settlement of Kirwee lies between the counter and the site. However both are helpful indicators of traffic flows.

4.1.2. The most recent two-way traffic flows recorded at each counter are as follows:

Location	Weekday		Saturday		Sunday	
	Daily	Peak Hours	Daily	Peak Hour	Daily	Peak Hour
Darfield	5,225	420 (AM) 500 (PM)	4,550	425	3,850	375
Aylesbury	5,125	505 (AM) 550 (PM)	4,675	400	4,175	375

Table 1: Traffic Flows on Adjacent Road Network

4.1.3. It can be seen that there is little difference between the two locations. In practice this is likely to be due to an offsetting effect – the Darfield counter will record local movements which will not be present at Aylesbury, and the Aylesbury counter will record movements to/from Kirwee which will not be present in Darfield. However neither the local movement, nor the movements to/from Kirwee, will be present on the highway adjacent to the site and consequently the volume passing the site will be less than shown above. As a result, using the recorded data means that any analysis of the site will be robust, and this is the approach which has been taken.

4.1.4. Selwyn District Council carries out regular traffic counts on the key vehicle routes throughout the district. Data recorded in the NZTA Crash Analysis System, which in turn is sourced from Council RAMM databases, shows that the traffic flows on Creyke Road at the site are in the order of 200 vehicles per day (two-way), with 600 vehicles per day north of the highway.

4.1.5. Peak hour volumes are usually around 10% to 15% of the daily flows, meaning that peak hour volumes past the site on Creyke Road will be 20 to 30 vehicles (two-way) and 60-90 vehicles (two-way) north of the highway. This level of traffic is commensurate with the extent of development served by the road.

Traffic Growth

4.1.6. Data from the NZTA counters shows that traffic on the highway has grown by an average rate of 5.3% within Darfield and 3.6% at Aylesbury each year for the past five years. It is likely that the latter reflects through-traffic growth with the former including a higher number of local trips made within Darfield. Consequently the lower growth rate has been used within this analysis.

Roading Performance

4.1.7. The Austroads Guide to Traffic Management Part 3 ('*Traffic Studies and Analysis'*) sets out a process by which the level of service of a road can be calculated. This shows that under these traffic flows, Creyke Road (north and south of the highway) provides Level of Service A at peak times, which is the best level of service possible (the scale runs from A to F). State Highway 73 provides Level of Service B at peak times. Both of these represent stable flow conditions and where drivers can largely select their own speeds on the roads.

4.1.8. The Austroads Guide to Traffic Management Part 3 ('*Traffic Studies and Analysis'*) also sets out thresholds regarding the need for detailed traffic analyses at intersections, and the traffic flows below which detailed analyses of unsignalised intersections are unnecessary. An extract from this is replicated below.

Major Road Type	Traffic Volumes (Vehicles Per Hour)	
	Major Road	Minor Road
Two lane road	400	250
	500	200
	600	100

Table 2: Extract from Table 6.1 of Austroads Guide to Traffic Management Part 3 (Intersection Volumes below which Capacity Analysis is Unnecessary)

4.1.9. Based on this, no analysis has been carried out at the State Highway 73 / Creyke Road intersection because it falls below these thresholds and will therefore operate under free-flow conditions.

4.2. Non-Car Modes of Travel

4.2.1. Given that the area around the site is largely rural, it can reasonably be expected that it will be relatively infrequently used by pedestrians and cyclists. As such, the current levels of provision are considered to be adequate.

4.2.2. There are no scheduled public transport services that operate within Darfield, but there is a service which provides a connection between Darfield and Christchurch to the east. This operates twice a day – once in the morning travelling eastbound and departing Darfield at 7:15am, and once in the evening travelling westbound and arriving at Darfield at 6:30pm.

4.3. Road Safety

4.3.1. The NZTA Crash Analysis System has been used to establish the location and nature of the recorded traffic crashes in the vicinity of the development site. All reported crashes between 2009 and 2018 were identified, for the following sections of road:

- Creyke Road, from 250m north of State Highway 73 to 200m south of the site southern boundary; and
- State Highway 73 for 250m either side of Creyke Road.

4.3.2. This showed that there were three reported crashes:

- One crash occurred on State Highway 73 around 200m west of Creyke Road when a driver lost control on black ice and slid off the highway. It resulted in minor injuries; and

- Two crashes occurred on Creyke Road at the level crossing some 30m north of State Highway 73 when drivers failed to stop and struck the side of a train. Neither crash resulted in any injuries.

4.3.3. No crashes have been reported at the State Highway 73 / Creyke Road intersection or on Creyke Road south of the intersection over this ten-year period.

4.3.4. It is therefore considered that there are no safety-related deficiencies in the roading network.

5. Proposal

5.1. The proposed plan change will facilitate a change of activity to enable residential and business activities to establish on the site. This will include:

- Living 2A: 35 rural residential lots of an average 2,500sqm each; and
- Business 2: An area of 19ha for business/industrial use

5.2. Access into the site will be via a new roading connection located around 400m southwest of the State Highway 73 / Creyke Road intersection (and around 400m northeast of the access into the approved ODP area towards the south). However in view of the increased traffic loading on the State Highway 73 / Creyke Road intersection, the ODP makes allowance for amendments to the geometry of this intersection, as discussed in more detail below.

5.3. The ODP for the area is shown below.

Figure 4: Outline Development Plan (Extract from Baseline Group Drawing)

6. Traffic Generation and Distribution

6.1. Traffic Generation

Residential Development

6.1.1. Traffic generated by residential developments is known to vary for a variety of reasons, with one such reason being the proximity (or otherwise) to employment and community facilities. Where a dwelling is some distance from these types of facilities, the traffic generation rates tend to be lower than for residences that are closer due to 'trip chaining', that is, the tendency of a resident to carry out multiple visits to different destinations during the same trip away from the dwelling.

6.1.2. In this case, there are community facilities within Darfield, which are relatively close to the site, but employment opportunities are limited and so there will also be a proportion of residents who need to commute for work.

6.1.3. Typical residential dwellings each generate 8-10 vehicle movements per day, dwellings and the lower rate has been used within this assessment to account for trip-chaining. An allowance has been made for each dwelling to generate 0.9 vehicles movement in the peak hours.

Business / Industrial

6.1.4. It is understood that there are no rules for site density in the Business 2 zone, but there is a maximum building height (15m) plus also the need to provide for adequate car parking.

6.1.5. The bulk of standard traffic generation rates are based on floor area rather than total site area, and since there is no fixed site layout, this is not known. However the plan change which facilitated the Ashburton Business Estate adopted rates as follows:

Industry Type	Trip Generation Rates (Vehicle Movements Per Hectare)					
	Morning Peak Hour		Evening Peak Hour		Daily	
	In	Out	In	Out	In	Out
Light	13.9	2.5	5.4	12.7	53.5	53.5
Heavy	8.5	7.3	4.9	5.5	40.5	40.5

Table 3: Traffic Generation Rates for Industrial Activities

6.1.6. It can be seen that the light industrial activities typically have a greater traffic generation than heavy industrial activities, and therefore these rates have been used within this assessment.

Summary

6.1.7. On the basis of the traffic generation rates set out above, the traffic anticipated to arise from development of the site is as follows:

Activity	Trip Generation (Vehicle Movements)					
	Morning Peak Hour		Evening Peak Hour		Daily	
	In	Out	In	Out	In	Out
Residential	3	29	21	11	140	140
Business	264	48	103	241	1,017	1,017
Total	267	77	124	252	1,157	1,157

Table 4: Traffic Generation of Development of Plan Change Area

6.2. Trip Distribution

6.2.1. Because of the location of the site, it is considered likely that the bulk of drivers would seek to reach the state highway. The ODP allows for a future roading link toward the west of the site, but from a transportation perspective the greatest potential for adverse outcomes would arise if all traffic was to pass through the State Highway 73 / Creyke Road intersection.

6.2.2. Consequently for the purposes of this analysis, a distribution of 45% of traffic turning to/from the east at this intersection has been allowed for, with 45% turning to/from the west and 10% associated with movements to/from the north.

7. Effects on the Transportation Networks

7.1. Roading Network Capacity

7.1.1. The traffic flows generated by the site indicate that traffic flows could change as follows, allowing not only for development of the plan change area but also increased background traffic flows of 36%[1]:

Road	Traffic Volumes					
	Morning Peak Hour		Evening Peak Hour		Daily	
	Without Plan Change	With Plan Change	Without Plan Change	With Plan Change	Without Plan Change	With Plan Change
State Highway 73	680	835	750	920	7,100	8,150
Creyke Road (south of SH73)	25-40	370-385	25-40	405-415	270	2,390
Creyke Road (north of SH73)	85-125	115-155	85-125	120-160	820	1,050

Table 5: Change in Traffic Flows on Adjacent Road Network

7.1.2. Again using the Austroads Guide to Traffic Management Part 3 (‘*Traffic Studies and Analysis’*), Creyke Road (north of the highway) would continue to provide Level of Service A at peak times, which is the best level of service possible. Creyke Road (south of the highway) would provide Level of Service B, which still represents a very good level of service. State Highway 73 would provide Level of Service C in the morning peak hour and Level of Service D in the evening peak hour. These are both within the zone of stable flow, and are not unusual for a highway in the peak hours.

7.1.3. The State Highway 73 / Creyke Road intersection has been modelled using the computer software package Sidra Intersection, and the results are summarised below (for the existing intersection layout, but with an additional ten years of background traffic growth).

Road and Movement		Morning Peak Hour			Evening Peak Hour		
		Avg Delay (secs)	95 %ile Queue (veh)	Level of Service	Avg Delay (secs)	95 %ile Queue (veh)	Level of Service
State Highway 73 (east)	R	7.9	1	A	7.2	0	A
Creyke Road (north)	L/T	21.9	1	C	19.2	1	C
	R	19.1	1	C	19.9	1	C
State Highway 73 (west)	R	8.3	2	A	8.7	1	A
Creyke Road (south)	L/T	20.4	1	C	24.4	3	C
	R	21.2	1	C	25.0	3	C

Table 6: Performance of State Highway 73 / Creyke Road with Full Development of Plan Change Area

7.1.4. It can be seen that queues and delays are modest, and levels of service remain good on each approach.

[1] That is, ten years at 3.6% each year

7.2. Revisions to Existing Roads

7.2.1. As set out previously, the minor approaches of Creyke Road presently meet the highway at an acute angle. Consequently, the ODP makes allowance for the southern approach to the intersection to be straightened up and meet the highway at 90 degrees (or thereabouts), and hence meet current guides for such angles.

7.2.2. Given that the development of the plan change area will result in a significant increase in traffic emerging onto the intersection, it is considered that this realignment should be put in place prior to any development of the site, and a Rule included in the plan change provisions to this effect.

Figure 5: Illustrative Example of Road Realignment Approaching the Intersection

7.2.3. The warrants for the provision of turning lanes at intersections are set out in the Austroads Guide to Traffic Management Part 6 ('*Intersections, Interchanges and Crossings'*). Using these, the full development of the plan change area justifies both a right-turn and a left-turn auxiliary lane at the intersection.

7.2.4. A more detailed assessment has been carried out of the thresholds at which the turning lanes are required. This shows that the right-turn lane is required at 10% development of the plan change area, with the left-turn lane required at 85% development of the plan change area. On this basis, it is possible to include a 'trigger' rule within the plan change provisions to require upgrading once certain thresholds (10% and 85% respectively) are reached.

7.2.5. It should be noted that these thresholds are influenced by whether any access to the plan change area is available from the west, and the extent of any development within the ODP area towards the south. At present, there is no such connection able to be formed, nor is any development proposed towards the south.

7.2.6. Due to the proximity of the railway level crossing and because the road rises to cross the railway, the much (if not all) of the seal widening to create the auxiliary turning lanes would need to be formed on the southern side of the highway. In turn, this means that the position for sightline measurements moves south by around 3.5m. This then means that the required

sightlines towards the east and west along the highway may potentially pass over private land on each side of the intersection[2].

7.2.7. The extent of land affected by such a restriction depends on the detailed design of the road realignment, and this has not yet been determined. As a general principle, as the end of Creyke Road is moved further west, there is less potential that land towards the east will be required for the sightline. Irrespective of the exact location of the realignment though, land towards the west of the intersection will be certainly required for the sightline. The ODP makes allowance for this by imposing a restriction on the height of any objects within the affected area.

7.2.8. To illustrate the extent of land which may be required, a very preliminary assessment has been undertaken.

Figure 6: Land Potentially Required for Sightline towards East of (Realigned) Intersection (in Yellow)

Figure 7: Land Potentially Required for Sightline towards West of (Realigned) Intersection (in Yellow)

[2] The requirement is to measure the sight distance at 5.5m from the edge of the nearest traffic lane. The current edge of the traffic lane is 5.5m from the southern boundary of the highway, meaning that the sightline is (just) wholly within the legal highway. Moving the edge of the traffic lane south by 3.5m means that the point of measurement of the sightline moved south by 3.5m and hence the sightline near the intersection is outside the highway reserve.

7.2.9. ***If*** any land is required on the eastern side of the intersection (and noting that this cannot be addressed until the road realignment is confirmed), one possibility is a land swap with the superfluous road reserve for Creyke Road. By way of example, the area shown on Figure 6 is 95sqm, compared to around 120sqm which would become unused through the road realignment.

7.2.10. Creyke Road to the south of the highway would carry in the order of 2,300 vehicles per weekday when the site is fully developed. As such, it is considered that the status of the road would be better reflected by it becoming a Collector Road, and the higher traffic flows may in turn result in widening of the carriageway. However the 20m legal width means that any necessary widening can be accommodated within the existing road corridor (other than the northern section of the road where it is to be realigned, as discussed above). Any widening would be a matter for assessment when subdivision consents are sought.

7.2.11. Similarly there are no reasons why a suitable intersection design into the site from Creyke Road, or internal roading layout, could not be constructed to meet the requirements of the District Plan and other relevant guides, since a 20m width is ample for all types of priority intersection.

7.2.12. One other further matter is whether under such a scenario the existing 100km/h speed limit remains appropriate, particularly with the potential for an increased proportion of large, slower-moving vehicles to be travelling between the highway and the site. In order to reduce the speed differential between light and heavy vehicles, it is considered that there is merit in reducing the speed limit to 80km/h over this section of Creyke Road (and possibly further, depending on whether any development takes place within the ODP area to the south). However reducing the speed limit is a process which is outside the Resource Management Act and cannot be addressed within a plan change request.

7.2.13. No changes are considered necessary for Creyke Road north of the highway. Flashing lights and bells remain the appropriate treatments for the railway level crossing, and the increase in traffic flows is insufficient to justify any widening. There is no change to the left and right turning movements at the intersection and hence no requirement for any auxiliary turning lanes.

7.3. Non-Car Modes of Travel

7.3.1. It is likely that development of the plan change area will lead to increased volumes of walking and cycling in the area, but the location of Darfield means that these trips will either be within the township or for longer-distance recreational purposes. Since the extent of development is modest, any increase in walking and cycling will be similarly low, and can be accommodated within the existing transportation networks.

7.3.2. The ODP makes allowance for walking/cycling links towards the south so that any residents in that area would be able to walk to employment in the proposed Business 2 zone rather than having an extended journey distance by having to use the roading network. Similarly, two links are provided through the residential area to facilitate non-car links into the approved ODP for the southern area (shown on Figure 3 above).

7.3.3. The internal roads within the site are anticipated to meet the District Plan requirements, with footpaths provided as appropriate.

7.4. Road Safety

7.4.1. The crash history in the vicinity of the site indicates that there are no particular features or factors that would be affected by the proposed development. It is anticipated that the proposed roads and intersections associated with development of the plan change area will meet current guides and standards, and as such, can be expected to function safely.

7.4.2. It is not anticipated that there will be any deficiencies in respect of sight distances at any of the intersections, and the proposed realignment towards the northeast of the DP area addresses an existing deficiency on the roading network associated with the acute angle that Creyke Road (south) approaches the highway.

8. District Plan Matters

8.1. Introduction

8.1.1. The District Plan sets out a number of transportation-related Rules with which any development is expected to comply. Although this is a plan change request, a review against these has been undertaken in order to ensure that the proposal is able to comply with the relevant Rules, or whether exemptions to the Rules should be considered as part of the plan change provisions.

8.2. Rule 5.1: Road and Engineering Standards

8.2.1. The land is relatively flat and so the slope (Rule 5.1.1.1) and road gradients (Rule 5.1.1.2) will be compliant.

8.2.2. The road formation is required to meet Appendix E13.3.1 and E13.3.2. The first of these relates to the provision of new roads (as is expected to occur) and the 'green field' nature of the plan change area means that these provisions can be achieved.

8.2.3. The road within the Business 2 area is shown on the ODP as being a cul-de-sac and this permitted (Appendix E13.3.1.4). Since access is expected to be predominately towards the highway, it is not expected that a cul-de-sac formation will result in any poor transportation planning outcomes in practice.

8.2.4. Appendix E13.3.2 addresses intersection spacing. In this case the intersection onto Creyke Road is 400m from the highway, compared to an 800m spacing required under this provision. However, as set out above, there is a technical case to reduce the speed limit on Creyke Road to promote road safety, and with a lower maximum speed, the requirements of this rule will be met.

8.2.5. Within the site, the speed limits are not yet known. However the separation of intersections is in the order of 140-150m which is appropriate for a 50-60km/h speed limit.

8.3. Rule 5.2: Vehicle Accessways

8.3.1. The proposed lots will all have access onto a legal road (Rule 5.2.1.1) and all of the lots will have access onto the internal roading network which will be a Local Road (Rule 5.2.1.2). The site is relatively flat so achieving appropriate gradients should not be problematic (Rules 5.2.1.3 and 5.2.1.4).

8.3.2. The crossings are required to meet Appendix E13.2.1, which stipulates the requirements for the minimum widths. These can all be achieved.

8.3.3. There is no reason why more than six lots should share a private accessway, rather than being accessed by a road (Rule 5.2.1.7).

8.4. Rule 5.3: Vehicle Crossings

8.4.1. Any vehicle crossing is required to meet Appendices E13.2.2, E13.2.3, E13.2.4 and E13.2.5.

8.4.2. Appendix E13.2.2 addresses the separation of accesses and intersections. For intersections between Local Roads, a 10m separation distance is required and there are no reasons why this cannot be achieved.

8.4.3. Appendix E13.2.3 addresses sight distances from vehicle crossings, but this depends on the speed limit(s) which are not yet known. That said, it seems likely at this stage that the required sight distances will be met.

8.4.4. Appendix E13.2.4 addresses the design and siting of vehicle crossings. One crossing per site can be achieved (Appendix E13.2.4.2), and the distance between crossings and the crossing width can be achieved (Appendix E13.2.4.5).

8.4.5. Appendix E13.2.5 addresses the standard of vehicle crossings, which can be provided according to the nature of the activity served.

8.4.6. The crossings can be sealed (Rule 5.3.1.2) and will not gain access directly onto a state highway or arterial road (Rule 5.3.1.4).

8.5. Rule 5.4: Traffic Sight Lines – Road/Rail Crossings

8.5.1. The site is not sufficiently close to the road/rail crossing for these provisions to apply.

8.6. Rule 5.5: Vehicle Parking and Cycle Parking

8.6.1. The number of parking spaces per lot can be achieved and the spaces can be designed to be accessible at all times (Rule 5.5.1.1 / Appendices E13.1.1 and E13.1.2).

8.6.2. Regarding the design of the parking spaces and maneouvring areas (Rule 5.5.1.2), there are no reasons why pedestrian areas will be obstructed (Appendix E13.1.5.2), parking spaces / garages can be of the appropriate size (Appendix E13.1.6), and the site is relatively flat and so gradients will not be exceeded (Appendices E13.1.7 and E13.1.8).

8.6.3. For on-site maneouvring, the layouts are able to be designed to ensure that vehicles do not reverse from the site unless this is a permitted activity, and the parking spaces can be designed to be accessed with just one reverse movement (Appendix E13.1.9). Queuing space can be provided (Appendix E13.1.10) and illumination can be provided as required (Appendix E13.1.11).

8.7. Summary

8.7.1. The ODP for the site is capable of complying with the requirements of the District Plan, although compliance with Rule 5.1 (and Appendix E13.3.2) depends on the speed limit(s) on Creyke Road and on the internal roads, which are not yet confirmed. However the ability to amend speed limits is not within the scope of the Resource Management Act.

9. Conclusions

9.1. This report has identified, evaluated and assessed the various transportation matters of a proposed plan change to facilitate residential and business development within the settlement of Darfield.

9.2. Overall it is considered that the traffic generated by the development arising from the plan change can be accommodated on the adjacent roading network without capacity or efficiency issues arising. Queues and delays remain low at the State Highway 73 / Creyke Road intersection.

9.3. The crash history in the vicinity of the plan change area does not indicate that there would be any adverse safety effects from the proposal. However in view of the increased traffic flows arising from the proposal, the ODP makes allowance for the southern Creyke Road approach to be straightened up to better achieve current design standards and best practice through meeting the highway at an angle of 90-degrees or thereabouts.

9.4. Upgrades to the State Highway 73 / Creyke Road intersection to provide auxiliary turning lanes are justified with a right-turn lane needed at 10% of the site being developed and a left-turn lane required at 85% development. These improvement measures can be addressed through Rules within the plan change provisions.

9.5. The associated seal widening for the improved intersection will result in the sightlines at the intersection moving 3.5m further south and they will therefore pass across land outside the road reserve. An area within the site close to the intersection has been identified where there will be a height restriction in order to ensure that sight distances towards the west are maintained. ***If*** the sightlines pass over land towards the east, there are a number of ways in which this can be addressed.

9.6. Creyke Road may require widening to accommodate the increased traffic flow and there may also be a case for reducing the current speed limit. These can be addressed when subdivision consents are sought, and there are no constraints to achieving the requirements of the District Plan due to the ample legal width. However it is noted that changing a speed limit is beyond the scope of a plan change request.

9.7. New transportation infrastructure which will be provided will meets appropriate guides and standards (or exemptions from the District Plan will be sought when subdivision consents are applied for). Walking/cycling routes are provided within the ODP which ensure good non-car connections to the area towards the south.

9.8. The ODP will meet (or is capable of meeting) the transportation requirements of the District Plan, although compliance depends on speed limits which are not yet known.

9.9. Several potential rules for the plan change package have been suggested within this assessment:

- The Creyke Road approach to the state highway should be straightened-up prior to any development taking place;
- A right-turn auxiliary lane should be provided at the State Highway 73 / Creyke Road intersection at 10% development of the site;
- A left-turn auxiliary lane should be provided at the State Highway 73 / Creyke Road intersection at 85% development of the site; and

- Provision should be made to ensure the appropriate sightlines are available to the east and west for drivers emerging from Creyke Road.

9.10. There are two provisions to support the plan change which are not within the remit of the plan change request:

- Creyke Road from the highway to the site access should be reduced from a 100km/h to 80km/h speed limit; and
- Creyke Road from the highway to the site access should be designated as a Collector Road within the road hierarchy.

9.11. Overall, and subject to the preceding comments, the proposed plan change can be supported from a traffic and transportation perspective.

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February 2019

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BASELINEGROUP

Appendix 10: Air Quality Report

AIR QUALITY ASSESSMENT

Canterbury Clay Bricks Furnace Operation

6 July 2018

AIR QUALITY ASSESSMENT

Canterbury Clay Bricks Furnace Operation

Table of Contents

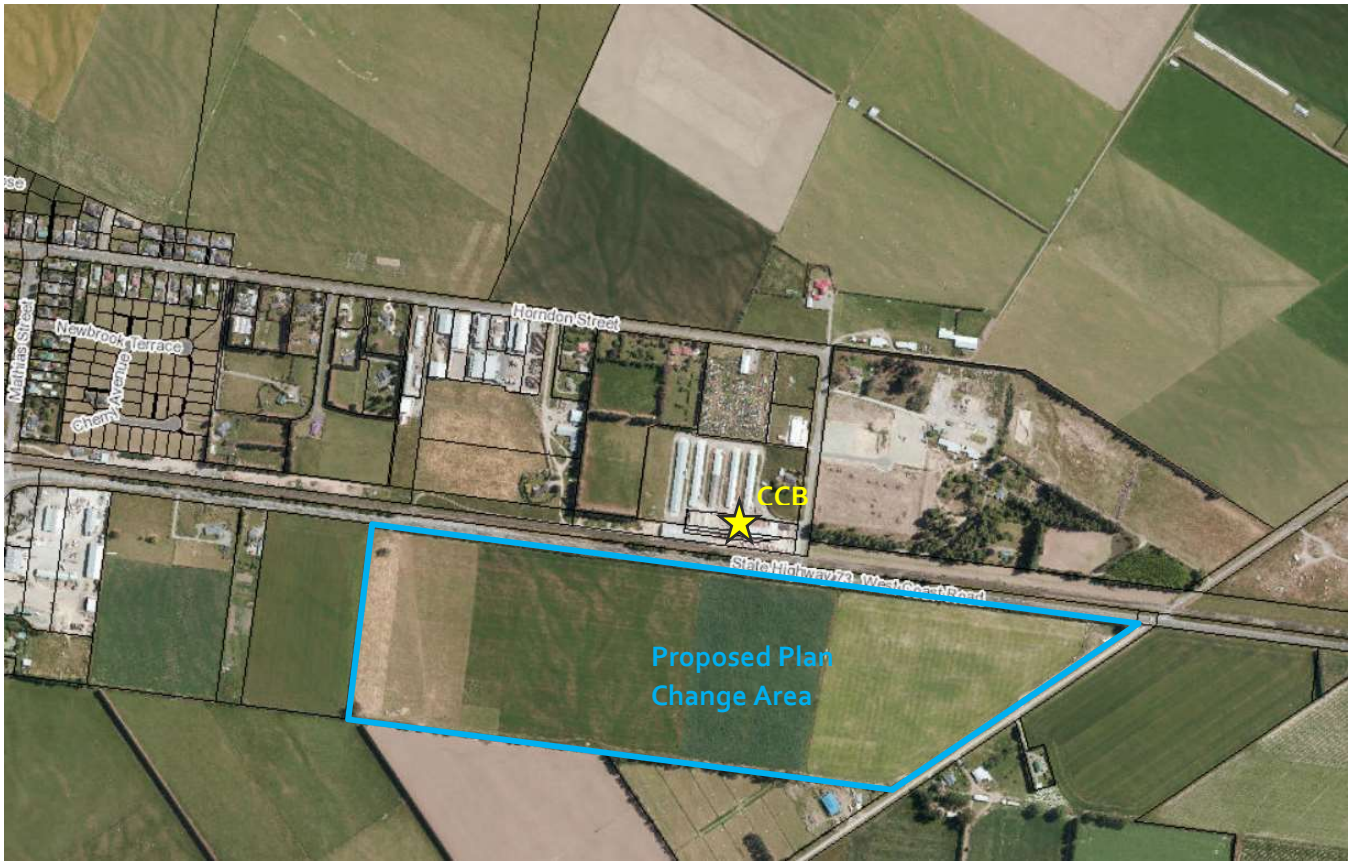
NZ Air is an air quality consultancy specializing in expert evidence, air discharge consent applications, odour assessments, nuisance dust assessments, air quality monitoring and air dispersion modelling.

1. Introduction

Baseline Group Limited (**BGL**) have a client whom is proposing to undertake a private plan change to land located south of the Canterbury Clay Bricks (**CCB**) factory on Horndon Street, Darfield (see **Figure 1**). As a part of this process BGL would like to identify any potential adverse air quality effects that may exist within the proposed plan change area as a result of the brick works discharges to air.

NZ Air Limited (**NZ Air**) has obtained a copy of the assessment of environmental effects (**AEE**) which supported the application for air discharge consent held by CCB. This AEE produced by Glasson Potts Fowler in 2005 (attached as **Appendix A**) is now 13 years old. BGL has requested that NZ Air supply an updated air dispersion modelling assessment, which uses current assessment techniques, and compare the assessment results against the current regulatory requirements.

FIGURE 1 SITE



CCB holds an air discharge consent (CRC921703.1) for its current discharges to air. Within this consent there is authorisation to burn coal, diesel or re-refined oil in two brick kilns.

NZ Air has used air dispersion modelling to assess the potential peak concentrations of pollutants in the environment surrounding the CCB facility, with a particular emphasis on potential effects within the proposed plan change area.

2. Assessment Criteria

Sources of Air Quality Assessment Criteria

The Ministry for the Environment's (**MFE**) Good Practice Guide (**GPG**) on Assessing Emissions to Air from Industry[1] recommends an order of priority when reviewing air quality assessment criteria. This order of priority is as follows:

- Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality) Regulations, 2004 (**NES**)[2];
- Ministry for the Environment, Ambient Air Quality Guidelines (2002 update) (**AAQG**)[3];
- Regional Air Quality Targets (**RAQT**); and,
- World Health Organisation air quality guideline (**WHO AQG**) Global Update 2005[4].

National Environmental Standards

The MfE promulgated National Environmental Standards for Air Quality (**AQNES**)[5] as regulations under the Resource Management Act (**RMA**) on 6 September 2004 which are based on the potential for health effects. These health effects are described in the MfE New Zealand Ambient Air Quality Guidelines (**AAQG**)[6]. The AQNES applies standards to five air pollutants; particulate matter less than 10 µm in diameter (**PM_{10}**), carbon monoxide (**CO**), nitrogen dioxide (**NO_2**), sulfur dioxide (**SO_2**), and ozone (**O_3**). The AQNES also places restrictions on home heating appliances, hazardous waste combustion, etc.

Table 1 presents the AQNES ambient air quality assessment criteria relevant to this assessment.

TABLE 1 AQNES AMBIENT AIR QUALITY STANDARDS RELEVANT TO ASSESSMENT

Pollutant	Threshold Concentration (µg/m³)	Averaging Period	Number of Exceedances Allowed Each Year
NO_2	200	1-hr	Nine 1-hr periods
SO_2	350	1-hr	Nine 1-hr periods
	570*	1-hr	None
CO	10,000	8-hr	One 8-hr period
PM_{10}	50	24-hr	One 24-hr period

*not to be exceeded

[1] Ministry for the Environment Good Practice Guide for Assessing Discharges to Air from Industry, 2016
[2] Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality), Regulations 2004
[3] Ministry for the Environment, Ambient Air Quality Guidelines (2002 update)
[4] Air quality Guidelines for Europe Second Edition, 2000
[5] Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality), Regulations 2004
[6] Ministry for the Environment, Ambient Air Quality Guidelines (2002 update)

Ambient Air Quality Guidelines

The AAQG were published by the MfE in 2002 following a comprehensive review of international and national research, and are widely accepted among New Zealand air quality practitioners. The AAQG criteria provide the minimum requirements that ambient air quality should meet in order to protect human health and the environment.

AAQG levels for pollutants and averaging periods not superseded by the AQNES are still relevant and should be considered as part of any assessment. The AAQG criteria set for the protection of human-health are presented in **Table 2**.

TABLE 2 AMBIENT AIR QUALITY GUIDELINES RELEVANT TO ASSESSMENT

Pollutant	Threshold Concentration (µg/m³)	Averaging Period
NO_2	100	24-hr
SO_2	350	1-hr
	120	24-hr
CO	30,000	1-hr
PM_{10}	20	Annual
Lead	0.2	3-month moving average*
Arsenic	0.0055	Annual
Chromium VI	0.0011	Annual

*Calculated monthly

There is a potential for Cadmium to be present in the re-refined oil, however there is no New Zealand ambient air quality criteria for this pollutant. Therefore, for the purposes of this assessment NZ Air have used the conservative long term exposure Texas Effects Screening Level (**Texas ESL**) of 0.0033 µg/m^3 as an annual average criteria for Cadmium.

Regional Air Quality Targets

Canterbury Regional Council (**CRC**) have recently made the Canterbury Air Regional Plan (**CARP**) fully operative. Within the CARP there are no longer regional air quality targets.

Ecosystem Based Guidelines

In addition to effects on human health there is also the potential for air pollutants to have effects on ecosystems. However, these effects are generally only noticed when concentrations reach high levels, higher than those used as assessment criteria for determining adverse health effects. Levels of air pollution in New Zealand rarely reach these ecosystem effect levels and therefore it is reasonably assumed that providing pollutants are below the health based effects assessment criteria then there are unlikely to be effects on the environment or ecosystems.

Summary of Assessment Criteria

The air quality standards and guidelines relevant to this assessment are summarised in **Table 3**.

TABLE 3 SUMMARY OF RELEVANT AIR QUALITY CRITERIA

Pollutant	Averaging Period	AQNES (µg/m³)	NZAAQG (µg/m³)
NO_2	1-hr	200	-
	24-hr	-	100
SO_2	1-hr	350	
		570*	
	24-hr		120
CO	1-hr	-	30,000
	8-hr	10,000	-
PM_{10}	24-hr	50	-
	24-hr	Increase <2.5 within a gazetted airshed	
	Annual	-	20
Lead	3-month moving average**		0.2
Arsenic	Annual		0.0055
Chromium VI	Annual		0.0011
Cadmium	Annual		0.0033***

*Not to be exceeded
**Calculated monthly
*** Texas ESL

3. Assessment Methodology

Identification of Sensitive Receptors

A desktop study was undertaken to identify discrete receptors for the purposes of assessing potential off-site effects resulting from the CCB discharges. The nearest sensitive receptors assessed are summarised in **Table 4**.

The Site and surrounding sensitive receptors are illustrated in **Figure 2**.

Figure 2 Site and Location of Boilers and Sensitive Receptors

Aerial imagery sourced from Google Earth June 2018

Table 4 Location of Receptors located close to the Project Site

Receptor Name	Receptor Type	Distance from stacks (m)	Direction Relative to the Site
Proposed plan change area	Residential	70 - 635	South
R1	Residential	110	Northeast
R2	Residential	300	Northeast
R3	Residential	270	Northwest

4. Discharges to air

The CCB factory is consented to operate two brick making kilns, referred to as the “batch kiln” and the “tunnel kiln”.

The two kilns can be fired on three different fuel types; diesel, re-refined oil and coal. Each of these fuel types has differing potential emission parameters. The burning of each fuel types will produce products of combustion. The products of combustion which are relevant to this assessment and controlled through New Zealand legislation are; PM_{10}, NO_2, CO, and SO_2. In addition, the combustion of re-refined oil may discharge trace concentrations of metals present in the oil.

NZ Air has gathered the required air dispersion modelling input information primarily from the 2005 AEE and the existing consent. Where required information has not been available, NZ Air has made conservative estimates of various input factors.

NZ Air have used the air dispersion model AERMOD in the assessment. AERMOD is a steady-state dispersion model designed for short-range dispersion of air pollutant emissions from stationary industrial sources.

On 9 November 2005 the model was adopted by the US Environmental Protection Agency (**EPA**) and promulgated as its preferred regulatory model for both simple and complex terrain and as of the 1 January 2014 the model replaced Ausplume as EPA Victoria regulatory model.

Even though the kilns don't run 24 hours a day 7 days a week, to be conservative, NZ Air have assumed that both kilns are running every hour of every day modelled. This will demonstrate very conservative worst case potential impacts associated with the current consented operation.

Additionally, NZ Air have modelled the emissions based on each kiln operating at its maximum consented fuel burning rate as stipulated in the consent. The calculated emission rates of PM_{10}, NO_2, CO, and SO_2 are highest when burning coal. Therefore NZ Air have only modelled the predicted worst case off-site concentrations of these pollutants for the operation of the kilns at peak coal burning rates. The predicted off-site concentrations for burning diesel or re-refined oil in the kilns will be significantly lower, due to the lower calculated emission factors.

The SO_2 emission rates have been conservatively estimated based on the maximum consented coal sulfur content of 1.8%. The coal fuel burn rate for each kiln has been estimated to be proportional to the consented peak fuel burn rates for diesel/re-refined oil, i.e. the batch kiln has a burn rate of 27.4 kg/hr and the tunnel kiln has a burn rate of 122.6 kg/hr (total equals consented coal burn max of 150 kg/hr).

The modelled stack locations and dimensions for the two kilns on-site have been based on the information provided in the 2005 AEE, available aerial imagery, and Google Street View images. The modelled exit velocities and temperatures were estimated based on stoichiometric calculations assuming the burning of bituminous coal.

Coal burning emissions have been based on published emission factors within Chapter 1.1 of the USEPA AP42 emission factors. It has been conservatively assumed that the emission factors from a spreader stoker coal combustion device are representative of worst case emission from the CCB kilns. These emission factors are elevated in comparison with other coal burning devices. As NZ Air is not aware of the actual coal burning devices on-site, these higher emission factors have been conservatively assumed.

The modelling inputs for the coal burning scenario are included in **Table 5**.

TABLE 5 COAL BURNING MODELLING INPUTS

Kiln	Fuel burn rate (kg/hr)	Stack height (m)	exit diameter (m)	exit velocity (m/s)	exit temp (deg C)	NO_2 (g/s)	CO (g/s)	PM_{10} (g/s)	SO_2 (g/s)
Batch Kiln	27.4	21.3	0.6	1.22	503	0.042	0.019	0.050	0.260
Tunnel Kiln	122.6	15.5	0.5	7.84	503	0.187	0.085	0.225	1.165

To estimate the potential increase in metal concentrations off-site, NZ Air have also modelled a conservative re-refined oil burning scenario. This modelling scenario was based on the maximum consented concentrations of pollutants in the re-refined oil (i.e. the specification listed in Section 279.11 of the United States Federal Regulation for the Management of Used Oil).

The re-refined oil burning rates were also based on the maximum burn rates within the existing consent. The exit temperatures and velocities were based on the information supplied in the 2005 AEE.

The modelling inputs for the re-refined burning scenario are included in **Table 6**.

TABLE 6 RE-REFINED OIL BURNING MODELLING INPUTS

Kiln	Fuel burn rate (l/hr)	Stack height (m)	exit diameter (m)	exit velocity (m/s)	exit temp (deg C)	Arsenic (g/s)	Cadmium (g/s)	Chromium (g/s)	Lead (g/s)
Batch Kiln	22	21.3	0.6	0.6	300	0.000031	0.000012	0.000061	0.00061
Tunnel Kiln	99	15.5	0.5	15.3	300	0.000137	0.000055	0.000275	0.00275

Deposition rates of the various metals were also modelled utilising the 'total deposition' tool in AERMOD. For the purposes of the deposition modelling all particles were assumed to be PM_{10} or less. It has been conservatively assumed that re-refined oil with the maximum content of metals is burned at maximum consented fuel burn rates to ascertain the annual off-site maximum deposition rates.

Meteorological Data

Given the lack of measured representative meteorological data, NZ Air has obtained a three year (2015 – 2017 inclusive) meteorological data file representative of the project site generated in MM5 (5th-generation Mesoscale Model). MM5 is a prognostic meteorology model developed by Pennsylvania State University and the U.S. National Centre for Atmospheric Research (**NCAR**). The model is a limited-area, non-hydrostatic, terrain-following sigma coordinate model designed to simulate or predict mesoscale and regional-scale atmospheric circulation. The MM5 data was used to generate surface output data and upper air output data for input into the dispersion modelling study discussed below.

The modelled meteorological data is presented as a wind rose in **Figure 3**. A wind rose displays wind speed and wind direction data in a graphic form. The percentage of wind blowing from 16 wind directions are annotated by the length of the bars in the rose. The proportion of wind speeds within this wind direction category is illustrated by the coloured segments within the bars. The wind frequency data for the MM5 generated data is presented in **Table 7**.

FIGURE 3 AERMET DATA OUTPUT FOR 2015 TO 2017

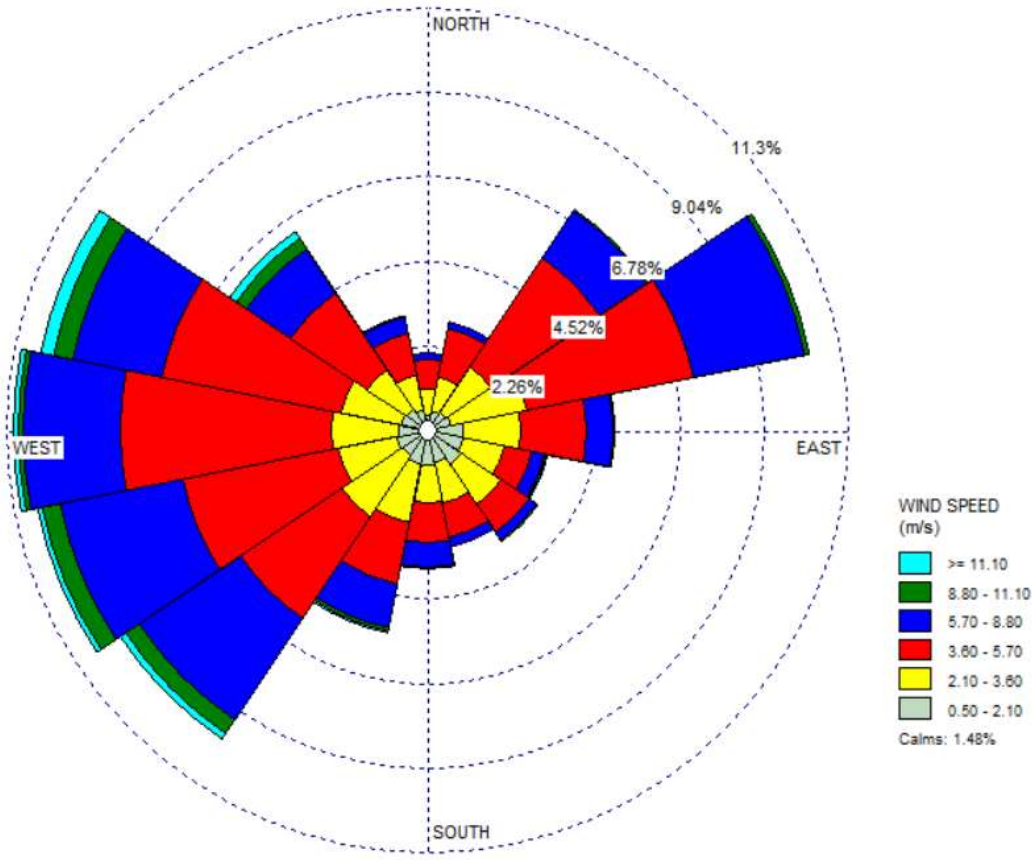


TABLE 7 MM5 2015 - 2017 WIND FREQUENCY DISTRIBUTION PERCENTAGES

Wind Direction	Percentage of Winds from Wind Speed Bands						Total
	0.5 – 2.1 m/s	12.1 – 3.6 m/s	3.6 – 5.7 m/s	5.7 – 8.8 m/s	8.8 – 11.1 m/s	>11.1 m/s	
North	0.94	1.52	1.89	0.40	0.02	0.00	**4.77**
Northeast	1.27	2.96	6.89	3.26	0.10	0.01	**14.49**
East	1.83	3.20	4.09	2.32	0.07	0.01	**11.53**
Southeast	2.05	2.28	1.68	0.41	0.09	0.03	**6.54**
South	1.92	2.28	2.13	1.33	0.06	0.05	**7.76**
Southwest	1.75	3.75	6.22	5.73	0.85	0.28	**18.58**
West	1.62	3.36	10.76	5.25	0.53	0.32	**21.84**
Northwest	1.35	2.52	5.04	2.97	0.70	0.43	**13.01**
Sub Total	**12.74**	**21.87**	**38.70**	**21.67**	**2.43**	**1.12**	**98.52**
Calms							**1.48**
Missing Data							0
Total							**100**

AERMOD Atmospheric Dispersion Model

The AERMOD modelling domain was centred on the project site at UTM 591541 m East (E), 5184054m South (S), zone 59 south. A 4 km by 4 km Nested grid was used at resolutions of 50, 100 and 200 m. Discrete receptors were used to represent the sensitive receptor locations.

AERMOD was run utilising default settings. The parameters used in the AERMOD modelling are summarised in **Table 8**.

TABLE 8 PARAMETERS USED IN AERMOD FOR THIS PROJECT

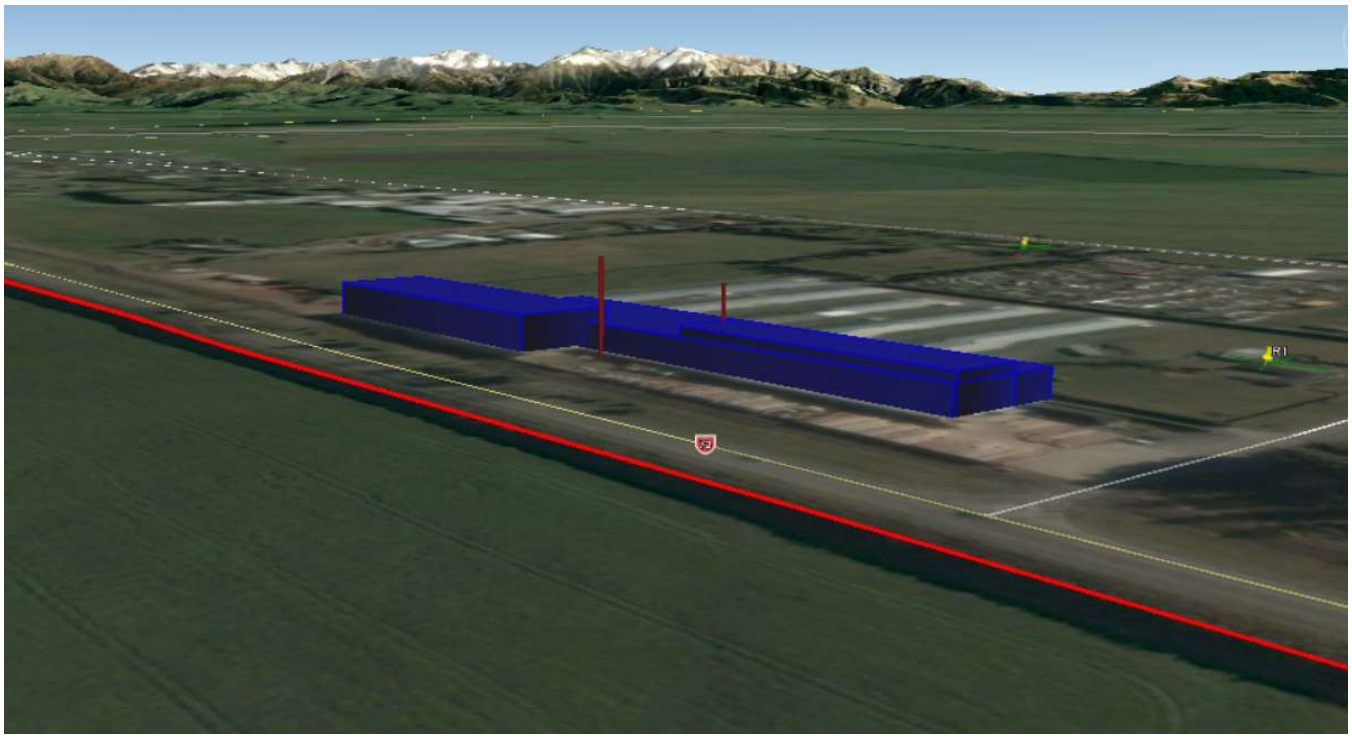
AERMOD	
Model version	9.5.0
Grid size	4.0 km x 4.0 km
Number of grid points	1084
Grid Spacing (m)	50, 100 and 200 m.
Year(s) of analysis	2015 to 2017
Centre of grid	UTM 591541 m East (E), 5184054m South (S), zone 59 south
Terrain Data	Elevated
Dispersion Co-efficient	Rural

Building downwash or building wake effects are generated because airflow around buildings is very complicated and can create zones of strong turbulence and downward mixing on the lee side of a building. This effect is known as building downwash or a building wake effect. In such cases, the entrainment of exhaust gases released by short stacks or rooftop vents in the wake of a building can result in much higher ground-level concentrations close to the source than the model would otherwise predict. It is generally accepted that if a stack is 2.5 times higher than any nearby building, then building downwash is unlikely to occur.

Within AERMOD a building input tool called Building Profile Input Programme (**BPIP**) is used to input all of the building dimensions close to the stack. Then a building wake effect model called Plume Rise Model Enhancements (**PRIME**) is used to calculate the resulting building wake effects on stack emissions.

As the stacks are not 2.5 times the height of a number of nearby buildings BPIP and Prime were used in the modelling approach. The largest/nearest buildings surrounding the proposed stacks were entered into the model and are illustrated in blue on **Figure 4**.

FIGURE 4 BUILDING PROFILES AND STACK LOCATIONS



The modelling input files are available from NZ Air on request.

5. Modelling Results

Background Concentrations

A search of the CRC records shows that there are only two air discharge consents in close proximity to the CCB factory. Approximately 400 m to the north west is a consent for a seed cleaning operation which is only likely to produce nuisance dust emissions. No combustion based activities are consented from this seed cleaning facility. The other consented air discharge is approximately 1.3 km to the west. It is a spray painting booth consented to discharge solvents and isocyanates. It is not expected that any of these discharges will result in cumulative impacts with the CCB emissions.

Home heating and vehicle emissions are likely to be the primary contributors to background levels of PM_{10}, NO_2 and CO in the surrounding environment. However, given that CCB is on the fringe of Darfield and traffic volumes on State Highway 73 are not very high, it is expected that these background concentrations will be relatively low.

NZ Air is not aware of any publicly available ambient air quality monitoring data for the Darfield region and therefore estimation of actual background concentrations of criteria pollutants surrounding the CCB factory is difficult.

Results

Coal Burning Scenario

The maximum predicted off-site pollutant concentrations associated with the modelled coal burning scenario are presented in **Table 9** and compared to the relevant air quality criteria. **Figure 5** presents a contour plot of the predicted PM_{10} concentrations associated with the modelled coal burning operation.

TABLE 9 PREDICTED PEAK CONCENTRATIONS: COAL COMBUSTION

	PM_{10} µg/m³		SO_2 µg/m³		NO_2 µg/m³		CO µg/m³	
Averaging period	**24 hour**	**Annual**	**1 hour 99.9%ile**	**24 hour**	**1 hour 99.9%ile**	**24 hour**	**1 hour 99.9%ile**	**8 hour**
Max off-site	29.3	4.5	279.9	151.6	45.0	24.4	20.46	15.5
Max in proposed plan change area	14.4	1.5	182.2	73.3	29.3	11.8	13.32	9.46
R1	19.7	3.0	164.3	102.3	26.4	16.5	12.01	10.66
R2	9.6	1.0	158.8	49.7	25.5	8.0	11.61	6.2
R3	7.7	0.3	86.6	39.8	13.9	6.4	6.33	4.38
Criteria	50	20	350	120	200	100	30,000	10,000

Note all NOx emitted from the kilns has been conservatively assumed to be NO_2.

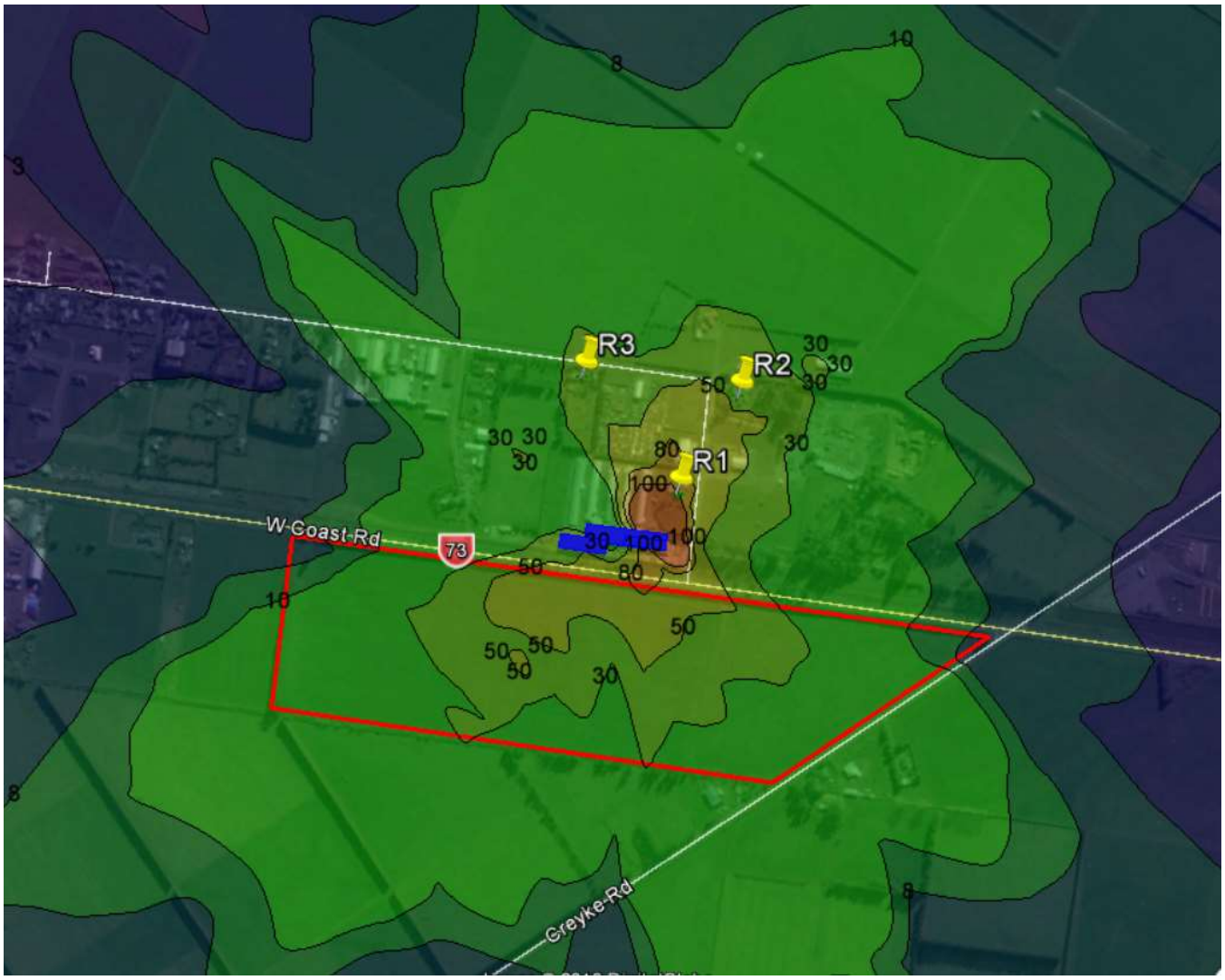
The very conservative predicted increase in maximum 24 hour PM_{10} concentration off site (29.3 µg/m³) and within the proposed plan change area (14.4 µg/m³) are within the relevant ambient air quality criteria. However, within a number of Canterbury airsheds the PM_{10} NES standard (50 µg/m³) is regularly exceeded in winter months, primarily due to home heating emissions. The peak CCB contribution to PM_{10} concentrations in the proposed plan change area only exceeds 10 µg/m³ in a relatively small portion of the site. For the vast majority of the time it is expected that the contribution of the CCB emissions will be much lower than this and relatively minor in comparison to other potential background contributions (i.e. home heating emissions from Darfield or outdoor burning).

The conservatively predicted SO_2 concentrations do not exceed the 1 hour average criteria, and only exceed the 24 hour criteria in a very small area just off-site (see **Figure 6).** It is anticipated in this semi rural environment that the background concentrations of SO_2 will be very low. Although the conservative modelling does indicate that the CCB factory may under the worst case coal burning scenario contribute to elevated levels of SO_2 within the proposed plan change area, it is unlikely that these will exceed the relevant ambient air quality criteria, even with a conservative background level added.

The peak concentrations of CO and NO_2 within the proposed plan change area are well below criteria.

FIGURE 5 PREDICTED PM10 24 HOUR AVERAGE CONCENTRATIONS (µG/M^3): COAL BURNING

FIGURE 6 PREDICTED PEAK SO2 24 HOUR AVERAGE CONCENTRATIONS (µG/M^3): COAL BURNING



The modelled results are very conservative, it is unlikely that CCB is burning coal 24/7 at the maximum consented burn rates. Additionally, it is unlikely that CCB is burning coal with the maximum sulfur content continuously. Furthermore, it is unlikely that the actual emissions from the stacks are as high as the conservatively high emission factors which NZ Air has utilised in this modelling assessment. Therefore, it is considered that these modelling results will overpredict the potential off-site impacts beyond the site boundary.

The modelled off-site impacts from the very conservatively assessed coal burning scenario demonstrate that there is a potential for degraded air quality within the proposed plan change area as a result of the CCB operation, however the levels are unlikely to result in exceedances of any of the relevant health based New Zealand air quality criteria.

Re-refined Oil Burning Scenario

The maximum predicted annual concentrations of Arsenic, Cadmium, Chromium and Lead in air have been conservatively modelled and the results are presented in **Table 10**. Note that for Lead, monthly concentrations have been modelled as there is no capacity for modelling three month rolling averages in AERMOD. Utilising peak monthly Lead averages is considered conservative.

TABLE 10 PREDICTED PEAK CONCENTRATIONS IN AIR: RE-REFINED OIL COMBUSTION

	Arsenic		Cadmium		Chromium VI*		Lead	
Averaging period	**Annual**	**Annual total deposition**	**Annual**	**Annual total deposition**	**Annual**	**Annual total deposition**	**Month**	**Annual total deposition**
Units	µg/m3	g/m2	µg/m3	g/m2	µg/m3	g/m2	µg/m3	g/m2
Max predicted	0.0033	0.0125	0.0013	0.0052	0.0020	0.0077	0.14	0.27
Max in proposed plan change area	0.0007	0.0030	0.0003	0.0010	0.0003	0.0018	0.03	0.07
R1	0.0010	0.0100	0.0008	0.0030	0.0012	0.0030	0.06	0.01
R2	0.0005	0.0030	0.0003	0.0005	0.0003	0.0006	0.02	0.03
R3	0.0001	0.0008	0.0001	0.0003	0.0001	0.0003	0.01	0.01
Guideline	0.0055		0.0033		0.0011		0.2**	

*based on 2005 AEE assumption that 30% of total Chromium discharged is Chromium VI

** 3 month moving average

All of the very conservatively predicted concentrations of metals in air are below the relevant guidelines except for Chromium VI levels in a very small area surrounding the CCB factory. It is noted that this predicted exceedance is extremely unlikely to occur given the conservatism in the modelling approach. Moreover, this exceedance does not extend to land within the proposed plan change area, which is the subject of this report.

The maximum predicted annual deposition rates of Arsenic, Cadmium, Chromium and Lead have been conservatively modelled and the results are presented in **Table 11.**

For the purposes of this assessment and associated calculations, NZ Air have assumed that the top 0.1 m of soil is the area of most likely impact. Also assumed is a soil density of 1,000 kg/m^3, as presented in the 2005 AEE.

Table B2 in the 'Ministry for the Environment. 2012. Users' Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.' (reproduced below) contains the New Zealand NES soil contaminant standards for health.

NZ Air have conservatively compared the deposition rates against the rural residential/lifestyle block standards, which are the strictest within this Table.

Table B2: Soil contaminant standards for health ($SCSs_{(health)}$) for inorganic substances

	Arsenic	Boron	Cadmium (pH 5)[1]	Chromium		Copper	Inorganic lead	Inorganic mercury
				III	VI			
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Rural residential / lifestyle block 25% produce	17	>10,000	0.8	>10,000	290	>10,000	160	200
Residential 10% produce	20	>10,000	3	>10,000	460	>10,000	210	310
High-density residential	45	>10,000	230	>10,000	1,500	>10,000	500	1,000
Recreation	80	>10,000	400	>10,000	2,700	>10,000	880	1,800
Commercial / industrial outdoor worker (unpaved)	70	>10,000	1,300	>10,000	6,300	>10,000	3,300	4,200

Notes: All concentrations refer to dry weight (ie, mg/kg dry weight).

[1] Default value is for soil that is pH 5. Concentrations increase with increasing pH (see *Methodology*).

TABLE 11 PREDICTED PEAK TOTAL ANNUAL DEPOSITION: RE-REFINED OIL COMBUSTION

	Arsenic		Cadmium		Chromium VI		Lead	
Averaging period	**Annual total deposition**	**Annual increase in soil**	**Annual total deposition**	**Annual increase in soil**	**Annual total deposition**	**Annual increase in soil**	**Annual total deposition**	**Annual increase in soil**
Units	g/m2	mg/kg	g/m2	mg/kg	g/m2	mg/kg	g/m2	mg/kg
Max off-site	0.0125	0.1250	0.0052	0.0524	0.0077	0.0770	0.27	2.7
Max in proposed plan change area	0.0030	0.0300	0.0010	0.0100	0.0018	0.0180	0.07	0.7
R1	0.0100	0.1000	0.0030	0.0300	0.0030	0.0300	0.01	0.1
R2	0.0030	0.0300	0.0005	0.0050	0.0006	0.0060	0.03	0.3
R3	0.0008	0.0080	0.0003	0.0030	0.0003	0.0030	0.01	0.1
NES Standard		**17**		**0.8**		**290**		**160**
Background*		**2.37**		**0.5**		**30**		**23**
Years to reach guideline in plan change area		**488**		**30**		**14,444**		**196**

*as presented in the 2005 AEE

The very conservative results presented in **Table 11** demonstrate a low level potential maximum impact in the proposed plan change area. Additionally, the number of years that it would take for cumulative deposition of the assessed metals to generate potentially hazardous levels in the soils inside the proposed plan change area is significant. Note, that in reality the deposition rates used in the modelling are likely to be much higher than those actually emitted from the site, as re-refined oil with the maximum consented metal concentrations is unlikely to be burnt 24/7. Additionally, as outlined in the 2005 AEE a portion of these metals are likely to be deposited on the bricks themselves and not emitted from the stacks.

6. Conclusion

NZ Air have undertaken an assessment of potential air quality impacts associated with the operation of the existing CCB factory. In particular NZ Air have focussed on the potential for adverse health effects within the proposed plan change area. NZ Air has adopted a very conservative approach in the assessment based on available information.

The results of the conservative air dispersion modelling assessment, demonstrate that the maximum predicted off-site concentrations of controlled pollutants are below the relevant air quality criteria within the proposed plan change area. Although some of the SO_2 modelled results are elevated, it is anticipated that the actual peak off-site concentrations will be well below the peak levels presented in this report, primarily due to the fact that other consented fuels have a much lower maximum sulfur content than coal, and therefore much lower emission factors.

Appendix A – Glasson Potts Fowler 2005 AEE

GLASSON POTTS FOWLER

8700CCB
04 July 2005

EC - CHCH		
FILE REF: CO6C/2289		
DOCUMENT No. 40604 - 5 JUN 2005	ACTION	INFO
L. Davidson		

The Chief Executive
Environment Canterbury
P O Box 345
CHRISTCHURCH

Dear Sir

RESOURCE CONSENT VARIATION APPLICATION – W D BOYES & SONS LIMITED

Please find enclosed an application for a variation to an existing resource consent (CRC921703) which permits the discharge contaminants into the air from clay brick manufacturing (including combustion processes) on a site at Darfield owned and operated by W D Boyes & Sons Limited.

A cheque for the deposit amount ($1,125 incl. GST) is enclosed. Please forward a receipt for this amount through to us at the above address.

Yours sincerely
GLASSON POTTS FOWLER LIMITED

Sarah Smith

Sarah Smith
Senior Environmental Scientist
sarah.smith@gpf.co.nz

Enc:

GLASSON POTTS FOWLER

W D BOYES & SONS LIMITED

Horndon Street
Darfield

Resource Consent Variation Application & Assessment of Environmental Effects

July 2005
8700CCB-1C

Glasson Potts Fowler Limited
Surveying, Land Development, Environmental Engineering, Science & Resource Management Consultants
(Incorporating Miles, Fowler & Fear Ltd and Glasson Potts Group Ltd)
BNZ Armagh, 137 Armagh Street, PO Box 13875, Christchurch 8031. Ph (03) 374 6515, Fax (03) 374 6516, Email chch@gpfl.co.nz

W D BOYES & SONS LIMITED

Horndon Street
Darfield

Resource Consent Variation Application & Assessment of Environmental Effects

Report prepared by:

Glasson Potts Fowler Limited
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137 Armagh Street
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CHRISTCHURCH 8031

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Email sarah.smith@gpf.co.nz

Version No.	**1C – final**
Authors	**S J Smith**
Reviewer	R J Potts
Approved for Issue	R J Potts
Date	**04 July 2005**

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Form 9

APPLICATION FOR RESOURCE CONSENT UNDER SECTION 127 OF THE RESOURCE MANAGEMENT ACT 1991

TO: Environment Canterbury

W D Boyes & Sons Limited applies for a variation to an existing resource consent as described below.

1. **THE NAME AND ADDRESS** of the owner of the land to which the application relates is:

   Owner: W D Boyes and Sons Limited
   Main West Road
   Darfield

   Occupier: As above (trading as Canterbury Clay Bricks)

2. **THE LOCATION** of the proposed activities is as follows:

   Horndon Street
   Darfield

   Legal Description: Sec 24 Pt Sec 22 Darfield Village Settlement BLK VII Hawkins SD
   Map Reference: NZMS 260 L35: 398-460

3. **THE TYPE** of resource consent sought from Environment Canterbury is:

   - Variation to an existing resource consent (CRC921703) that permits discharge of contaminants into the air.

4. **A DESCRIPTION** of the activities to which the application relates is:

   Discharges into the air from combustion sources, to be fuelled with a mixture of diesel and re-refined oil (currently consented to be fuelled with coal).

5. **AN ASSESSMENT** of environmental effects in the detail that corresponds to the scale and significance of the effects that the proposed activities may have

on the environment, in accordance with the Fourth Schedule to the *Resource Management Act 1991*, is attached.

6. **THAT ASSESSMENT** also contains other such information required to be included in the application by the district plan, the regional plan, the *Resource Management Act 1991* or any regulations made under that Act.

Signed on behalf of applicant

Sarah Smith
Glasson Potts Fowler Limited

Dated this 4th day of July 2005.

ADDRESS FOR SERVICE of Applicant:

W D Boyes & Sons Limited
C/- Glasson Potts Fowler Limited
P O Box 13-875
CHRISTCHURCH

Ph: (03) 374 6515
Fax: (03) 374 6516
Email: sarah.smith@gpf.co.nz

All correspondence relating to this consent application should sent to W D Boyes & Sons Limited, c/- Glasson Potts Fowler Limited at the above address. All contact and correspondence relating to this resource consent variation application should be sent only to the above address.

1. INTRODUCTION

W D Boyes & Sons Limited, trading as Canterbury Clay Bricks, ("*the applicant*") owns and operates a clay brick and pipe manufacturing business on the corner of West Coast Road and Horndon Street, Darfield.

The applicant currently holds a resource consent which permits discharges into the air from the site, as follows:

- Consent CRC921703, which permits discharges into the air from brick and pipe manufacture, including contaminants from burning of up to 150 kg/hour of coal for kiln firing and heating purposes. This consent was granted on 15 September 1993 with various special conditions attached to it.

A copy of the current resource consent is included in Appendix A. The consent is currently being exercised. It has an expiry date of 30 August 2028.

The applicant has recently decided to modify the kiln burners to allow them to be fuelled with a mixture of diesel and re-refined oil.

Accordingly, W D Boyes & Sons Limited is making application to Environment Canterbury (ECan) for a variation to the resource consent, to permit this change in discharges to air.

1.1 Project Scope

Glasson Potts Fowler Ltd (GPF) were engaged to prepare a resource consent application and Assessment of Environmental Effects (AEE) for the proposed discharges to air from the kiln burners running on diesel and re-refined oil, to support an application for variation to the current resource consent being made to Environment Canterbury (ECan).

2. SITE DESCRIPTION

2.1 Location

The site is located on the corner of West Coast Road and Horndon Street, Darfield. The topography of the site and locality is flat.

2.2 Receiving Environment

The receiving environment details around the proposed discharge locations are shown in Table 1.

Table 1 Receiving Environment Details

Direction	Land Use	Approx. Distance from Stack Location metres
North	Dwelling	115
	Farmhouse	200
	Public road (Horndon Street)	290
East	Plantation forestry	150
	Public road (Horndon Street)	135
South	Railway line	35
	Public road (West Coast Road)	50
	Plantation forestry	60
West	Pasture farmland	65

2.3 Wind Conditions

A windrose, generated from wind data gathered at the Rangiora EWS meteorological station from 1999 - 2003, indicates prevailing winds expected in the environment would be from the west and north-east. A copy of the windrose is included in Appendix B.

Given the site's location (which is inland and south-west of Rangiora), local wind directions may be slightly different. Given the proximity of the location to the Southern Alps foothills, katabatic drainage may also occur at night.

2.4 Local Air Quality

The ECan GIS database was reviewed to establish the location of discharge consents granted for discharges into the air in the environment surrounding the discharge stack location on the applicants site.

The database review indicated that there are three air discharge consents currently granted within a one kilometre radius of the applicant's site location.

There is one consent that permits discharges into the air from combustion processes. This is the consent granted to the applicant for the activities on its site.

The other two consents are for discharges into the air from a spray-painting booth and a seed and grain handling, cleaning and packaging business.

There will be discharges into the air from home heating appliances in nearby Darfield township. These could be fuelled with coal, wood, diesel or other organic fuels.

3. STATUTORY ASSESSMENT

3.1 Overview

The operative regional plan is the *Transitional Regional Plan* (TRP), constituted under section 368 of the *Resource Management Act 1991*. This plan includes rules governing the discharges of contaminants into the air. ECan has also released its *Proposed Canterbury Natural Resources Regional Plan, Chapter 3: Air Quality* (NRRP).

3.2 Transitional Regional Plan

The TRP includes provisions governing the discharges of contaminants into the air, via the *Clean Air Act 1972* (CAA).

The Second Schedule of the CAA is part of the TRP. This schedule defines various industrial and commercial activities, and classes them according to the requirement for discharge permits.

In terms of the proposed activity, the Second Schedule of the CAA defines any combustion process involving fuel burning equipment, not otherwise specified or described in the Schedule, having a heat release exceeding 40 kW as a Part C process (subsection 1).

Based on the activity the applicant proposes to undertake on the site (as detailed in the consent application), the proposed activity falls under the jurisdiction of Part C of the Second Schedule of the CAA. The TRP does not mention the burning of diesel or re-refined oil as a specific activity.

It is therefore considered that a resource consent for air discharges from the proposed combustion of diesel and re-refined oil in the kiln burners would be required under the TRP.

3.3 Proposed Natural Resources Regional Plan

Discharges into the air from the proposed activity are addressed in the *Proposed Natural Resources Regional Plan* (NRRP) *Chapter 3: Air Quality*, which ECan released on 01 June 2002 for public submissions. Submissions closed in 2004 and hearings on the submissions started in October 2004. ECan have indicated (via their website) that the hearings will probably conclude in August 2005. Decisions on the submissions will likely be released several months later, so this chapter is unlikely to become fully operative for some time.

Chapter 3 has, as its focus, the maintenance and improvement of ambient air quality and the reduction of nuisance effects. Policies seek the avoidance, remediation, or mitigation of adverse effects resulting from discharges of contaminants into air.

A review of the maps accompanying Chapter: 3 indicates that the applicant's location is outside the Christchurch Clean Air Zones 1 and 2.

Chapter 1: Overview of the NRRP defines a large scale fuel burning device as:

> *...any boiler, furnace, engine or other device designed to burn fuel for the primary purpose of energy production having a net heat or energy output of more than 40 kilowatts, but excluding motor vehicles, boats and aircraft.*

The applicant's units are considered to fall within this definition.

The relevant NRRP rule, in terms of the applicant's proposed activity, is:

- AQL27 - this makes the discharge of contaminants into the air from burning, outside the Christchurch Clean Air Zones 1 and 2, any fuels in any large scale fuel burning device which is not classed as a permitted or controlled activity under rules AQL22 to AQL26 (which govern large scale fuel burning appliances outside the Christchurch Clean Air Zones 1 and 1) a discretionary activity.

  One of the applicant's proposed fuels would fall under the jurisdiction of rules AQL22 to AQL26 (diesel), but the other proposed fuel (re-refined oil) would not. Therefore, the applicant's proposed activity falls under the jurisdiction of rule AQL27.

It is therefore considered that a resource consent for air discharges from the proposed combustion of diesel and re-refined oil in the kiln burners would be required under the NRRP.

4. ACTIVITY DESCRIPTION

4.1 Unit Specifications

The two units are:

- A tunnel kiln for continuous brick firing, rated at 820 kW; and
- An intermittent kiln, rated at 176 kW, which is used for batch brick runs.

The applicant has indicated that the units will be run on a mixture of diesel and re-refined oil, with diesel percentages varying from 30 - 80% and re-refined oil percentages varying from 20 - 70%. The percentages vary depending on the brick appearance required (some brick colours and effects need a higher percentage of re-refined oil, to achieve the required colour/effect).

The details of the two units are shown in Table 2.

Table 2 Individual Unit Details

Unit	Tunnel kiln	Batch kiln
Rating, kW	820	176
Max diesel usage rate, L/hour (calculated maximum)	103	23
Max re-refined oil usage rate, L/hour (calculated maximum)	99	22

4.2 Discharge Nature

4.2.1 Diesel

When run on a fuel mixture that is primarily made up of diesel, the appliances are likely to discharge:

- Particulate matter;
- Nitrogen oxides, including nitrogen dioxide (NO_2);
- Sulphur oxides, mainly sulphur dioxide (SO_2);
- Carbon monoxide (CO); and
- Unburned organic compounds.

Diesel is included in the fuel category known as *distillate oils*. The United States Environmental Protection Agency (USEPA) describes distillate oils as relatively volatile, having negligible nitrogen and ash content and generally less than 0.3% sulphur by weight.

Diesel combustion results in contaminant discharges that depend on the fuel quantity burned, fuel contaminant concentrations, and combustion conditions.

- Heat

Heat will be released from the combustion process.

- Odour from Fuel Burning

Odour associated with diesel combustion will be released as part of the proposed activity.

- Organic Compounds

Organic compounds are discharged into the atmosphere when some fuel remains unburned or is partially burned during combustion. The quantities of total organic compounds (TOC) discharged can be extremely variable.

4.2.2 Re-refined Oil

When run on a fuel mixture that is primarily made up of re-refined oil, the appliances are likely to discharge:

- Particulate matter;
- Sulphur oxides (SO_x);
- Nitrogen oxides (NO_x);
- Carbon monoxide (CO);
- Metals and metalloids (present in the re-refined oil fuel);
- Organic compounds (present in the re-refined oil fuel); and
- Hydrogen chloride (HCl) (as a result of halogens present in the re-refined oil fuel).

Burning re-refined oil as a fuel in a combustion appliance produces emissions that reflect the compositional variation inherent in such a product.

4.3 Contaminant Emission Rates

4.3.1 General Comments

Emission rate calculations allow contaminant computer dispersion modelling and ground level concentration prediction.

The United States Environment Protection Agency (USEPA) publishes emission factors for many activities emitting contaminants to atmosphere. These emission

factors are generally regarded as being robust and applicable. Diesel-fuelled combustion appliance emission factors (*Chapter 1.3 – Fuel Oil Combustion*) were published in 1998. Emission factors for burning waste and re-refined oils (*Chapter 1.11- Waste Oil Combustion*) were published in 1996.

In Chapter 1.11, the emission factors presented are indicated as being suitable for use where waste (or re-refined oil) comprises the majority of the fuel combusted. The chapter indicated that if virgin oil comprised the majority of the fuel combusted, the emission factors presented in Chapter 1.3 should be used instead.

So the approach taken in this assessment is:

- For the scenario where re-refined oil comprises the majority of the fuel being combusted, emission rates based on Chapter 1.11 emission factors were used; and
- For the scenario where diesel comprises the majority of the fuel being combusted, emission rates based on Chapter 1.3 emission factors were used.

This approach is considered conservative, as the real situation is likely to be somewhere in between the two cases assessed in this report.

4.3.2 High Percentage Diesel Emission Rates

The contaminants of primary concern were assessed as:

- Inhalable particulate less than ten microns in diameter (PM_{10});
- Sulphur oxides, principally sulphur dioxide (SO_2); and
- Carbon monoxide (CO).

Assumptions made when calculating contaminant emission rates for this scenario were:

- All fuel used is diesel;
- Maximum diesel burning rates were as given in Table 2;
- A diesel sulphur content of 0.05%; and
- Diesel specific gravity was 0.83.

Emission factor calculations were undertaken using the 1998 USEPA emission factors and kiln burner kilowatt rating.

Calculated emission rates are shown in Table 3.

Table 3 Calculated Emission Rates - Diesel

Contaminant	Calculated Emission Rate Tunnel kiln g/s	Calculated Emission Rate Batch kiln g/s
PM_{10}	0.003	0.001
Sulphur dioxide	0.026	0.006
Carbon monoxide	0.017	0.004

4.3.3 High Percentage Re-refined Oil Emission Rates

The contaminants of primary concern were assessed as:

- Inhalable particulate less than ten microns in diameter (PM_{10});
- Sulphur oxides;
- Heavy metals and metalloids (arsenic, cadmium, chromium, lead);
- Hydrogen chloride; and
- Carbon monoxide (CO).

Assumptions made when calculating contaminant emission rates for this scenario were:

- All fuel used is re-refined oil;
- Maximum re-refined oil burning rate were as given in Table 2;
- The applicant's fuel supplier has indicated that the heavy metal/metalloid and halogen levels in the fuel are those specified in the United States federal regulations governing the management of used oil. A copy of the applicable limits is included in Appendix C;
- All sulphur oxides emitted are assumed to be sulphur dioxide;
- An ash content of 0.5%, based on re-refined oil data;
- A sulphur content of 0.8% (maximum sulphur content specified by the applicant's fuel supplier); and
- Re-refined oil specific gravity was 0.9 (specified by applicant's fuel supplier).

Emission factor calculations were undertaken using the USEPA emission factors, the US federal regulations contaminant limits (for heavy metals and metalloids) and kiln burner kilowatt rating. Calculated emission rates are shown in Table 4.

The US federal regulations did not indicate if the chromium value specified was total chromium, or one of the two chromium species (Cr III or Cr VI). For this assessment, it was assumed to be total chromium.

Table 4 Calculated Emission Rates – Re-refined Oil

Contaminant	Calculated Emission Rate Tunnel kiln g/s	Calculated Emission Rate Batch kiln g/s
PM_{10}	0.09	0.02
Sulphur dioxide	0.39	0.09
Carbon monoxide	0.02	0.004
Hydrogen chloride	0.022	0.005
Arsenic	0.00014	0.00003
Cadmium	0.0001	0.00001
Chromium	0.0003	0.0001
Lead	0.003	0.0006

4.4 Stack Details

4.4.1 Tunnel Kiln

The tunnel kiln stack extends above the roof of the main factory building. It is 15.5 metres high and has a diameter of 0.5 metres. The tip of the stack is 9.5 metres above the roof of the factory building.

4.4.2 Batch Kiln

The batch stack is free standing next to the south side of the factory building. It is 21.3 metres high and has a diameter of 0.6 metres. The tip of the stack is 15.3 metres above the roof of the adjoining factory building.

4.5 Efflux Velocities

4.5.1.1 Tunnel Kiln

The stack diameter, at the exit point, is 0.5 metres and the stack discharge area was calculated as 0.196 m^2. The applicant advised that the gas flowrate is 3 m^3/s (due to air volumes injected into the tunnel kiln for firing and cooling purposes), so the calculated efflux velocity is 15.3 m/s.

4.5.1.2 Batch Kiln

The stack diameter, at the exit point, is 0.6 metres and the stack discharge area was calculated as 0.28 m^2. The gas flowrate, when the batch kiln is fuelled with diesel, was calculated as 0.17 m^3/s, so the calculated efflux velocity is 0.9 m/s.

4.6 Discharge Method

The kiln burners will discharge contaminants into the air via two existing stacks, which have no devices that would obstruct the vertical movement of exhaust gases (like a "Chinaman's hat"). The tips of the stacks are between 9 - 15 metres higher than the factory building.

4.7 Building Dimensions

Literature indicates that buildings that are greater than 40% of the stack height within a radius of five times the stacks height will influence the stack discharges (by causing downwash effects).

An assessment of the surrounding buildings found that the factory building was the only building that could influence the stack discharges, when assessed against the above criteria. A map showing the location of the building relative to the stacks is included in Appendix D.

4.8 Air Quality Modelling

The atmospheric dispersion model AUSPLUME v6 (with the PRIME building downwash algorithm activated) was used to assess the effects of the additional contaminant discharges. This Gaussian plume dispersion model is commonly used in New Zealand to predict contaminant ground level concentrations (GLCs) discharged from stack sources in cases with simple terrain (which is the case here).

Conservative assumptions were used when calculating emission rates and selecting model parameters. As a result the model is more likely to over-predict than under-predict peak concentrations.

A review indicated no site-specific meteorological data was available for the Darfield area. A standard screening meteorological data set was considered (METSAMP) but averaging periods longer than one hour were unable to be generated, rendering it useless for this application.

A set of real meteorological data was used (Christchurch 1997-98; Release 2; 2000), which was obtained from ECan. Even though it is not strictly applicable to Darfield, it contains a full set of meteorological conditions likely to be experienced, so it was used in this assessment as a "best-fit" data set (allowing for it not being site specific).

5. ALTERNATIVES ASSESSMENT

The applicant considers that the use of the proposed fuels is itself an alternative to the current use of coal, which can emit significantly higher levels of some contaminants.

There are positive benefits accruing from recovery, refining and re-use of waste lubricating and hydraulic oils which could otherwise be potentially disposed of into local council wastewater or stormwater networks, or into the Canterbury Waste Services Kate Valley landfill.

The discharges will be through existing stacks on the site. The applicant considers that there are no alternatives to this discharge method and considers it 'best practice' for contaminant dispersion at the location.

6. ASSESSMENT OF ENVIRONMENTAL EFFECTS

6.1 Contaminant Nature

The contaminants considered in this assessment are combustion products, metals and halogen compounds. The effects of these contaminants on the receiving environment are discussed below.

In terms of comparisons of predicted values with guidelines, the Ministry for the Environment (MfE) (MfE, 1997) notes that ambient air quality guidelines should not be seen as a limit to pollute up to, but should be regarded as minimum requirements for air quality.

6.2 Receiving Environment Sensitivity

The receiving environment around the proposed site has mixed land uses, with rural, commercial and extensive forestry uses present. ECan aerial photography indicated that the closest residential dwelling was about 115 metres to the north, with the main residential area of Darfield township about one kilometre to the west of the site. The area is considered to have low to moderate sensitivity, given the nature of surrounding activities.

The receiving environment uses downwind under the prevailing winds (as shown on the wind rose) are:

West	Plantation forestry (Selwyn Plantation Board) Public road (Horndon Street)
North-east	Railway line Public road (West Coast Road) Plantation forestry

6.3 Ground Level Contaminant Effects

6.3.1 General Comments

Ground level contaminant concentrations arising from the two scenarios detailed in section 4.3.1 will be assessed.

The cumulative effects from the discharges were assessed using monitoring information obtained from the ECan air quality monitoring station in Rangiora for the period 27 February–31 December 2004. ECan does not routinely monitor ambient air quality in Darfield township. The Rangiora station was considered to have the

closest similarity to Darfield, in terms of land uses and potential impacts on air quality.

New Zealand guideline literature (MfE, 2004) suggests the most sensible approach, when assessing cumulative impacts, is to add the maximum or 99.9th%tile predicted concentration to the average background concentration. This is the approach used here, which has been accepted by ECan for previous applications for combustion activities.

6.3.2 Contaminant Guideline Values

Particles

Deposited particulate matter constitutes larger-sized particles (greater than 20 μm diameter) that are rapidly removed from the atmosphere by gravity. Total suspended particulate (TSP) is the fraction less than 20 μm diameter. Particles less than ten microns in diameter (known as PM_{10}) are able to be inhaled into the lungs.

The MfE *Ambient Air Quality Guidelines* (AAQG) (MfE, 2002) value for inhalable particles is given in terms of PM_{10}, as this fraction is known to cause health effects. The relevant guideline value is 50 $\mu g/m^3$ (24-hour average).

Sulphur Oxides

Sulphur oxide emissions (primarily sulphur dioxide, SO_2) generated during combustion depend on fuel sulphur content and fuel quantity burnt.

Inhalation of high ambient SO_2 concentrations can cause nerve stimulation in the air passages, resulting in a reflex cough, irritation, and chest tightness. Airway resistance increases with increasing SO_2 concentration, over an extremely large range of sensitivity. The effect is heightened by exercise. It can also cause air passage narrowing, particularly in people with asthma and chronic lung diseases.

The New Zealand AAQG (MfE, 2002) SO_2 value is based on World Health Organisation (WHO) measurements of the lowest SO_2 concentration at which adverse effects were observed. The relevant SO_2 AAQG value is 350 $\mu g/m^3$ (one-hour average).

Carbon Monoxide

Carbon monoxide (CO) is formed when combustion conditions do not allow full oxidation of hydrocarbons to carbon dioxide (CO_2). This can occur when there is not enough oxygen near the burning fuel or when combustion temperatures are too low.

The presence of CO in the blood reduces its oxygen carrying capacity by binding to the haemoglobin molecules inside each red blood cell. Cumulative CO exposure can produce substantial CO levels in the bloodstream.

The relevant MfE AAQG value (MfE, 2002) is 30 mg/m^3 (one-hour average).

Hydrogen Chloride

In terms of hydrogen chloride guideline values, the MfE guideline document contains no values. ECan air quality investigating officers have previously indicated that, in the absence of appropriate guideline values in the MfE document, they would then seek suitable guideline values from the State of Victoria (SoV) *State Environment Protection Policy (Air Quality Management)*[1] document. The guideline values are referred to as *Design Ground Level Concentrations* (DGLCs) in the SoV document.

The SoV document lists one guideline value for hydrogen chloride. The SoV guideline value (toxicity-based) is 250 µg/m^3 (three minute average).

Longer term hydrogen chloride guideline values were then sought from other suitable guideline documents. The Standards Development Branch of the Ontario Ministry of the Environment has published Point of Impingement Limit (POI) and Ambient Air Quality Criteria (AAQC) values for various contaminants. The POI values are equivalent to the DGLC values in the SoV document.

The Ontario document lists two hydrogen chloride guideline values. The POI value is 100 µg/m^3 (30 minute average), which is based on corrosion as the limiting effect. The AAQC value is 20 µg/m^3 (24 hour average), based on health as the limiting effect.

Heavy Metals/Metalloids

In terms of heavy metals and metalloid guideline values, several different documents were consulted, to find short and longer term guideline values.

- Arsenic

  The SoV document lists one guideline value which covers arsenic and its compounds. The guideline value is based on arsenic's classification as an IARC Group I carcinogen. The SoV DGLC value is 0.00017 mg/m^3 (0.17 µg/m^3) (three minute average).

[1] State of Victoria (2001): *State Environment Protection Policy (Air Quality Management).*

The MfE document lists two longer-term arsenic guideline values. The inorganic arsenic value is 0.0055 $\mu g/m^3$ (annual average) and the arsine (formula AsH_3) value is 0.055 $\mu g/m^3$ (annual average).

- Cadmium

The MfE document does not list any cadmium guideline values.

The SoV document lists one short-term guideline value which covers cadmium and its compounds. The SoV DGLC value is 0.000033 mg/m^3 (0.033 $\mu g/m^3$) (three minute average).

The Ontario document lists two guideline values for cadmium and its compounds. The POI value is 5 $\mu g/m^3$ (30 minute average) and the Ambient Air Quality Criteria value is 2 $\mu g/m^3$ (24 hour average).

- Chromium

The SoV document lists two guideline values for the two chromium valency states.

The SoV DGLC value for trivalent chromium (Cr III) is 0.017 mg/m^3 (17 $\mu g/m^3$) (three minute average). The guideline value is toxicity-based.

The SoV DGLC value for hexavalent chromium (Cr VI) is 0.00017 mg/m^3 (0.17 $\mu g/m^3$) (three minute average). The guideline value is based on it's classification as an IARC group I carcinogen.

The MfE document lists two longer-term chromium guideline values, also based on valency states. The Cr III value (which also includes chromium metal) is 0.11 $\mu g/m^3$ (annual average) and the Cr VI value is 0.0011 $\mu g/m^3$ (annual average).

- Lead

The SoV DGLC value for lead is 0.003 mg/m^3 (3 $\mu g/m^3$) (three minute average). The guideline value is toxicity-based.

The Ontario document lists two guideline values for lead. The POI value is 6 $\mu g/m^3$ (30 minute average) and the Ambient Air Quality Criteria value is 2 $\mu g/m^3$ (24 hour average)

The MfE document lists a longer-term lead guideline value. The lead value is 0.2 $\mu g/m^3$ (three month moving average, calculated monthly).

6.3.3 High Diesel Scenario

Concentrations of various contaminants generated during the combustion of fuel which is predominantly diesel within the two kilns (so-called "high diesel" scenario) was modelled using the atmospheric dispersion modelling program AUSPLUME v6 (with the PRIME building downwash algorithm activated) and the 1997-1998 Christchurch meteorological data set.

The following conservative assumptions were used:

1. The burners operate at 100% of their Maximum Capacity Ratings (MCRs) throughout the 24 hour averaging period;
2. The kilns operate 24 hours a day, seven days a week. This is conservative, as the batch kiln processes discrete batches of bricks, so it is not a constant emission source;
3. The emission rates were as given in section 4.3.2;
4. The efflux velocities were as given in section 4.5;
5. The discharge from the stack occurs as detailed in section 4.4;
6. As <50% of surrounding area (a three kilometre radius around proposed activity's location) is high-density urban, following examination of aerial photography, *Irwin Rural* wind profile exponent values were used. This is consistent with New Zealand dispersion modelling guideline literature (MfE, 2003));
7. The surface roughness height category selected was *Flat rural* (0.1 metres), given the surrounding land profile;
8. The PRIME building downwash algorithm was activated;
9. Emissions are constant over the various averaging periods used;
10. The minimum distance selected for the Cartesian receptor grid was ten metres;
11. For longer-term averaging periods (24 hours or greater), the Maximum Ground Level Concentration (MGLC) values were used for comparative purposes;
12. For shorter-term averaging periods (i.e. three minutes) the 99.9th%tile ground level concentration was used for assessment against the relevant guideline value. This is so any rogue or errant meteorological conditions could be excluded, and a comparison made to a more realistic concentration; and
13. The main factory building is considered to potentially cause downwash effects (as explained in section 4.7).

The predicted values for the high diesel scenario, and likely background contaminant values, are shown in Table 5.

Table 5 Predicted Ground Level Concentrations – High Diesel Scenario

Contaminant	Predicted GLC µg/m³	Average Ambient Background Value µg/m³	Predicted + Background µg/m³	Guideline Value µg/m³
PM_{10} [1]	0.074	16	16.1	50
Sulphur dioxide[3]	1.1	0.82	1.9	350
Carbon monoxide[3]	0.69	170	171	30,000

Notes:
1. Maximum ground level concentration
2. µg – microgram
3. 99.9th%tile value

The modelling assumed that the batch kiln operates 24 hours a day, every day of the year. In reality, the batch kiln will operate only as required (to produce custom brick batches) so the modelling assessment is considered conservative. The temperature of the batch kiln discharge was assumed to be constant but in reality, it increases as the batch of bricks inside the kilns is processed, up to a maximum of 300°C (the temperature used in the modelling assessment).

The applicant has indicated that the batch kiln only runs for 50% of the time, as for 50% of the time it is cooling down from processing a batch of bricks.

It is considered that the impacts from running the two kilns on diesel would result in less impacts than the impacts from the current operations (coal fuel used in both kilns), as the diesel proposed for use has a lower sulphur content and will result in less inhalable particulate emissions than coal.

Given the predicted values (when considered in combination with typical background levels already present in the airshed) are significantly less than the relevant guideline values and given the sensitivity of the receiving environment, it is considered that the cumulative effects of discharges from both kilns running on fuel that is predominantly diesel should be less than minor at ground level.

6.3.4 High Re-refined Scenario

Concentrations of various contaminants generated during combustion of fuel which is primarily re-refined oil within the two kilns (referred to as the "high re-refined oil" scenario) was modelled using the atmospheric dispersion modelling program AUSPLUME v6 (with the PRIME building downwash algorithm activated) and the 1997-1998 Christchurch meteorological data set.

The assessment used the same conservative assumptions as the diesel assessment.

The predicted ground level concentrations for the high percentage re-refined scenario, and likely background values are shown in Tables 6 and 7. An isopleth plot showing predicted ground level PM_{10} concentrations is included in Appendix D. This

plot indicates that the level of inhalable particles decreases with distance from the stacks, with low PM_{10} levels predicted in the surrounding environment.

Table 6 Predicted Ground Level Concentrations – High Re-refined Scenario

Contaminant	Predicted GLC µg/m³	Average Ambient Background Value µg/m³	Predicted + Background µg/m³	Guideline Value µg/m³
PM_{10} [1]	2.01	16	18.01	50
Sulphur dioxide[3]	15.8	0.82	16.6	350
Carbon monoxide[3]	0.78	170	171	30,000
Hydrogen chloride[3]	1.47	-	-	250 (3 min av.)
	1	-	-	100 (30 min av.)

Notes:
1. MGLC – maximum ground level concentration
2. µg – microgram
3. 99.9th%tile value

Table 7 Predicted Ground Level Metal Concentrations – High Re-refined Scenario

Contaminant	Predicted GLC µg/m³	Guideline Value µg/m³
Arsenic	0.009	0.17 (3 min av.)
	0.0008	0.0055 (annual av.)
Cadmium	0.0059	0.033 (3 min av.)
	0.0041	5 (30 min av.)
Chromium[4]	0.015	Cr III - 17 (3 min av.)
	0.0013	Cr III – 0.11 (annual av.)
	0.007	Cr VI – 0.17 (3 min av.)
	0.0006	Cr VI – 0.0011 (annual av.)
Lead	0.19	3 (3 min.av.)
	0.13	6 (30 min av.)

Notes:
1. GLC – ground level concentration
2. µg – microgram
3. 99.9th%tile value
4. In order to assess chromium impacts, it was conservatively assumed that 70% of total chromium emissions released will be in Cr III form and 30% will be in Cr VI form (this assumption is derived from Australian national pollutant inventory data).

The modelling assumed that the batch kiln operates 24 hours a day, every day of the year. In reality, the batch kiln will operate only as required (to produce custom brick batches) so the modelling assessment is considered conservative. The temperature of the batch kiln discharge was assumed to be constant but in reality, it increases as the batch of bricks inside the kilns is processed up to a maximum of 300°C (the temperature used in the modelling assessment).

The assessment assumed that all metals present in the re-refined oil were emitted to atmosphere. This is considered conservative, as the applicant has indicated that most

of the metals present in the oil will be absorbed as a visible colouring on the surface of the finished bricks.

The predicted values are all below relevant guideline values. No ambient monitoring for metals and metalloids have been undertaken in the Darfield area, but given the lack of heavy industries and other major potential sources of such contaminants in the area, it can be concluded that the levels of heavy metals and metalloids in the Darfield airshed would be low.

Given that predicted values (when considered in combination with expected background levels already present in the airshed) are less than the relevant guideline values, it is considered that the cumulative effects of discharges from both kilns running on fuel that is predominantly re-refined oil should be less than minor at ground level.

6.4 Effects on Local Air Quality

The discharges from the proposed fuel changes in the two kilns will include odour and combustion products. The effects on local air quality beyond the boundary will be minor, given the low contaminant levels being emitted. The low contaminant levels anticipated in the discharges are not considered to cause adverse effects on the local air quality surrounding the site.

6.5 Effects on People and Community

All the guideline values used for comparative purposes were developed on a health protection basis. Given that the predicted contaminant concentrations are below these guidelines, it is anticipated that the effect of the proposed combustion of diesel and re-refined oil in the two kilns on the health of people, flora and fauna in the surrounding receiving environment should be minor.

6.6 Specific Cumulative Effects

6.6.1 Metals

Soils under and around the applicant's site are classified as *Chertsey sub-hygrous yellow-grey earths*. Relevant literature was consulted which listed heavy metal and metalloid levels present in such soils in the Canterbury region at various depths. It is considered that the surface depths (<0.1 m) would be of most relevance when discussing deposition from the applicant's proposed discharge.

The above literature did not give any specific values for arsenic in Canterbury soils. Other literature indicated that New Zealand rural soils belonging to the *Yellow grey*

earth soil type category have arsenic concentrations in the range 0.73-7.33 mg/kg, with a mean arsenic concentration of 2.37 mg/kg (at a soil depth of 7.5 cm).

Relevant data is presented in Table 8.

Table 8 Soil Heavy Metal/Metalloid Levels

Contaminant	Depth m	Range mg/kg	Mean Value mg/kg
Arsenic	0.075	2 - 30	2.37
Cadmium	<0.1	-	0.5[1]
Chromium	<0.1	15 - 40	30
Lead	<0.1	18 - 29	23

Notes:

1. No range given for less than four samples determined.

In order to assess the impact of metal deposition from the proposed discharge, the following conservative assumptions were made:

- Deposition was based on the maximum or 99.9th%tile predicted values given in Table 7;
- It was assumed that at each location, the total predicted metal mass at that location was deposited onto an area of one metre by one metre;
- It was considered that the topsoil would be of most interest in terms of potential impact, so a soil depth of 0.1 metres was assumed for calculation purposes;
- A soil density of 1,000 kg/m^3 was assumed;
- Deposition over a period of one year was assessed; and
- Background heavy metal/metalloid concentrations in soils given in Table 8 were used.

Predicted maximum annual increases in soil metal/metalloid concentrations are shown in Table 9. Relevant guideline values for various metals and metalloids are also shown for comparison.

Table 9 Predicted Annual Metal/Metalloid Concentration Increases in Soil

Metal	Mean Background Concentration mg/kg	Assumed Background Mass mg	Predicted Annual Deposited Mass mg	Background + Predicted Deposited mg	% Increase	Conc. mg/kg	Guideline Value mg/kg	Time to reach Guideline years
Arsenic	2.37	237	1.6	239	0.68	2.4	30[1]	1,727
Cadmium	0.5	50	0.07	50.07	0.14	0.51	1[2]	714
Chromium	30	3,000	3.9	3010	0.13	30.1	600[3]	14,615
Lead	23	2,300	2.3	2,303	0.1	23.3	300[4]	12,043

Notes:

1. *Combined exposure pathways* guideline value, human health protection basis, MfE Health and Environmental Guidelines for Selected Timber Treatment Chemicals, 1997.
2. *All pathways* guideline value, human health and ecological receptors protection basis, NZ Biosolids Guidelines 2003.
3. *All pathways* guideline value, assumes all chromium is present as Cr III, human health and ecological receptors protection basis, NZ Biosolids Guidelines 2003.
4. *Residential with garden/soil access* guideline, human health protection basis, NZ Biosolids Guidelines 2003.

The results show that, even with the addition of deposited metals from the proposed discharge, the concentration of various heavy metals and metalloids in the soil does not exceed relevant guideline values.

Cadmium levels are likely to be elevated in Canterbury soils, as a result of widespread superphosphate application (phosphate rocks used in New Zealand superphosphate production have elevated cadmium content).

It is therefore concluded that the deposition of metals from the proposed discharge should not cause adverse effects.

7. MITIGATION

The applicant will ensure that regular maintenance is undertaken, to ensure that contaminant discharges are minimised and fuel efficiency maximised.

Monitoring is also proposed as outlined below in Section 8.

8. MONITORING

The following monitoring measures are proposed by the applicant:

- A record of all fuel volumes used in the kilns, for both diesel and re-refined oil, to be supplied to ECan once per year;
- An analysis of a sample from a typical re-refined oil delivery, for sulphur, total halogens, metals and arsenic, with reporting of the results (including a comparison to the relevant United States federal regulations) to ECan once per year;
- A record of all complaints received about the running of the units, including details of measures undertaken to minimise any effects, following a complaint being received. This complaints record would be made available to ECan staff upon reasonable request, and a copy of the complaints record would be forwarded to ECan once per year; and
- Implementation of a regular maintenance programme. Records of all maintenance undertaken would be retained and made available to ECan staff for viewing upon reasonable request.

9. SUMMARY

W D Boyes & Sons Limited is applying for the variation of an existing resource consents, to permit the discharge of contaminants into the air from the proposed fuelling of two existing brick production kilns on a combination of diesel and re-refined oil, at their brickworks site near Darfield.

The units are used to provide heat for the production of kiln-fired bricks for the building industry.

To permit the discharges from the two kilns when running on a mixture of diesel and re-refined oil, variation to the existing resource consent is required.

An assessment of the discharges into the air from the two units, when fuelled with diesel and re-refined oil, was undertaken using dispersion modelling techniques.

The results of the assessment showed that the predicted contaminant levels were below relevant guideline values, both singly and when considered in combination with background levels, in the general receiving environment around the applicant's site.

Given the modelled predictions for contaminants, the low level of contaminants anticipated in the receiving environment, the sensitivity of the receiving environment and the proposed operating scenario (batch kiln only operating intermittently), the effects of the discharge of contaminants from the kilns, when fuelled with a mixture of diesel and re-refined oil, are anticipated to be minor.

The modelled results show that, even with the addition of deposited metals from the proposed discharge using very conservative assumptions, the concentration of various heavy metals and metalloids in the surrounding soil will not exceed relevant guideline values for many years. Cadmium levels are likely to be elevated in Canterbury soils, as a result of widespread superphosphate application.

The expiry date for the variation is requested to be consistent with the existing expiry date for the current consent (30 August 2028).

REFERENCES

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Percival H J , Webb T H and Speir T W (1996): *Assessment of background concentrations of selected determinands in Canterbury soils.* Manaaki Whenua - Landcare Research contract report LC9596/133 prepared for Canterbury Regional Council.

State of Victoria (2001): *State Environment Protection Policy (Air Quality Management).*

National Archives and Records Administration (2005): *Code of Federal Regulations, Title:40 Protection of Environment, Part 279 - Standards for the Management of Used Oil.*

United States Environmental Protection Agency (1998): *Compilation of Air Pollutant Emission Factors; Volume 1 – Stationary Point and Area Sources; Chapter 1.3 - Fuel Oil Combustion.* Publication AP-42.

United States Environmental Protection Agency (1996): *Compilation of Air Pollutant Emission Factors; Volume 1 – Stationary Point and Area Sources; Chapter 1.11 - Waste Oil Combustion.* Publication AP-42.

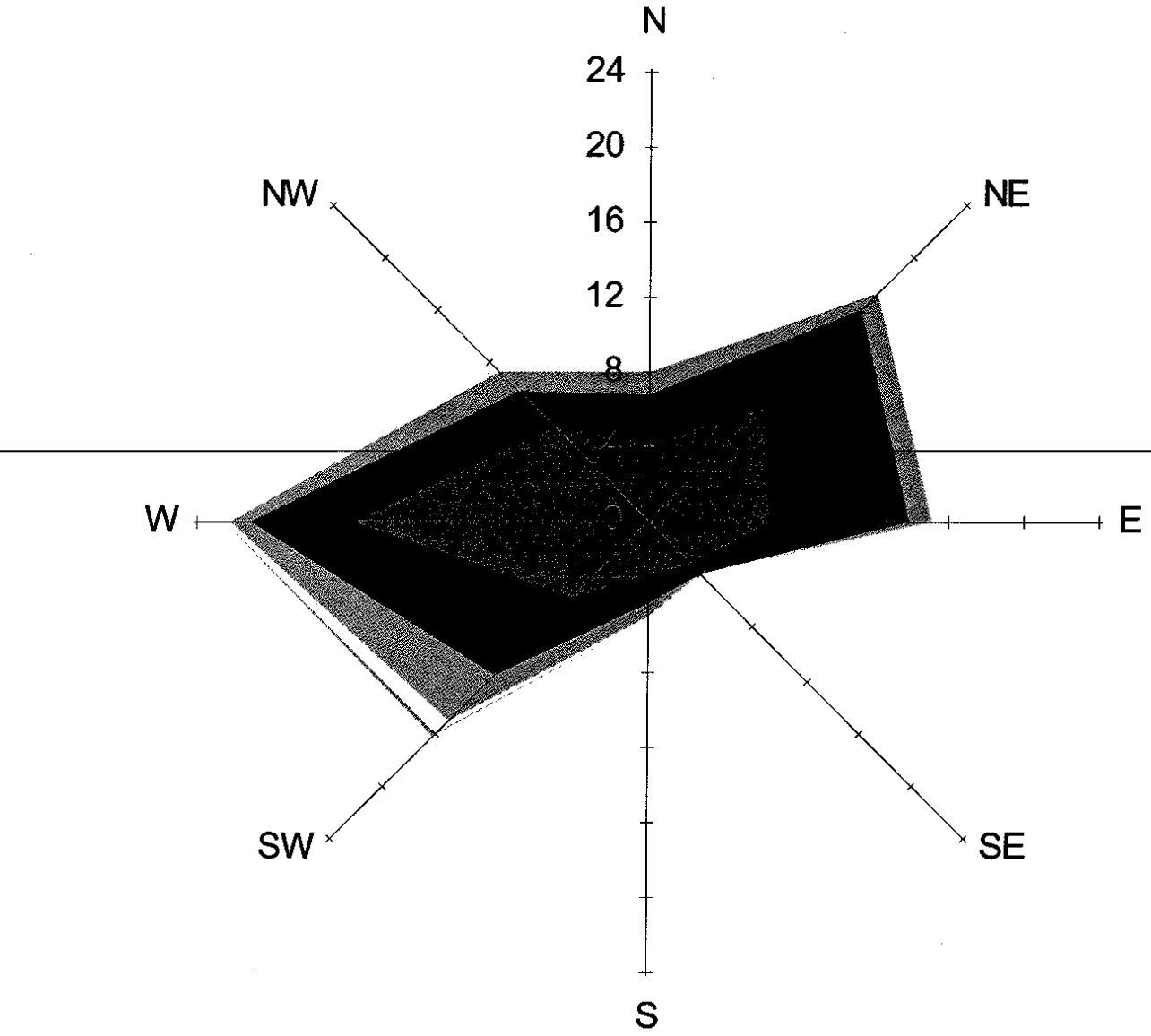
Resource Consent Details

Record No CRC921703
Consent Summary
Client Name W D Boyes & Sons Limited
To discharge contaminants to air associated with the manufacture of bricks and pipes, at or about map reference L35:398-440.
Location Horndon Street, Darfield
LegalDesc SEC 24 PT SEC 22 DARFIELD VILLAGE SETTLEMENT BLK VII HAWKINS SD
Status Current
Events
15 Sep 1993 Consent Commenced
15 Sep 1993 Consent Issued
15 Sep 1995 Lapse Date if consent not given effect to
30 Aug 2028 Consent Expires

Subject to the following conditions:

1 The coal and clay delivery, storage and conveyance procedures, and combustion processes shall be operated; and the operations and plant maintained by the consent holder either using dust and particulate control processed in place at the time of application for this consent, or using methods which produce at least an equivalent level of control.
2 The amount of coal burned shall not exceed 1250 tonnes per annum, with a maximum consumption rate of 150 kg/hr. The sulphur content of the coal shall be less than or equal to 1.8%.
3 The chimney height shall be greater than 10 metres above ground level.
4 There shall be no visible emissions from the coal fired kiln (visible smoke is defined as smoke with an opacity of greater then 10% except i) For a continuous period not exceeding 2 minutes in any one hour. ii) In the case of intermittent emissions, an aggregate period not exceeding 4 minutes in any one hour. iii) For the purpose of lighting up from cold, a period not exceeding thirty minutes.
5 The Canterbury Regional Council may annually, on or about the last working day of March each year, serve notice of its intention to review the conditions of this consent for the purposes of:i) Dealing with adverse effect on the environment which may arise from the exercise of the consent: or ii) requiring the adoption of the best practicable option to prevent or minimise any adverse effect on the environment: or iii) complying with the requirements of a regional plan for air quality management. iv) ensuring that condition (3) related to chimney height is adequate.
6 Charges, set in accordance with section 36(2) of the Resource Management Act 1991, shall be paid to the Regional Council for the carrying out of its functions in relation to the administration, monitoring and supervision of this resource consent and for the carrying out of its functions under section 35 of the Act.

Station: H32364 - Rangiora EWS
Lat: 43° 20' S **Long:** 172° 37' E **Alt:** 12m AMSL
Data period: Feb 1999 to Nov 2003



Mean speed 11.2 Km/h
Calm 0.1%
>50 Km/h
41-50 Km/h
31-40 Km/h
21-30 Km/h
11-20 Km/h
1-10 Km/h

NIWA
Taihoro Nukurangi

279.11 Used oil specifications.

Used oil burned for energy recovery, and any fuel produced from used oil by processing, blending, or other treatment, is subject to regulation under this part unless it is shown not to exceed any of the allowable levels of the constituents and properties in the specification shown in Table 1. Once used oil that is to be burned for energy recovery has been shown not to exceed any specification and the person making that showing complies with §§279.72, 279.73, and 279.74(b), the used oil is no longer subject to this part.

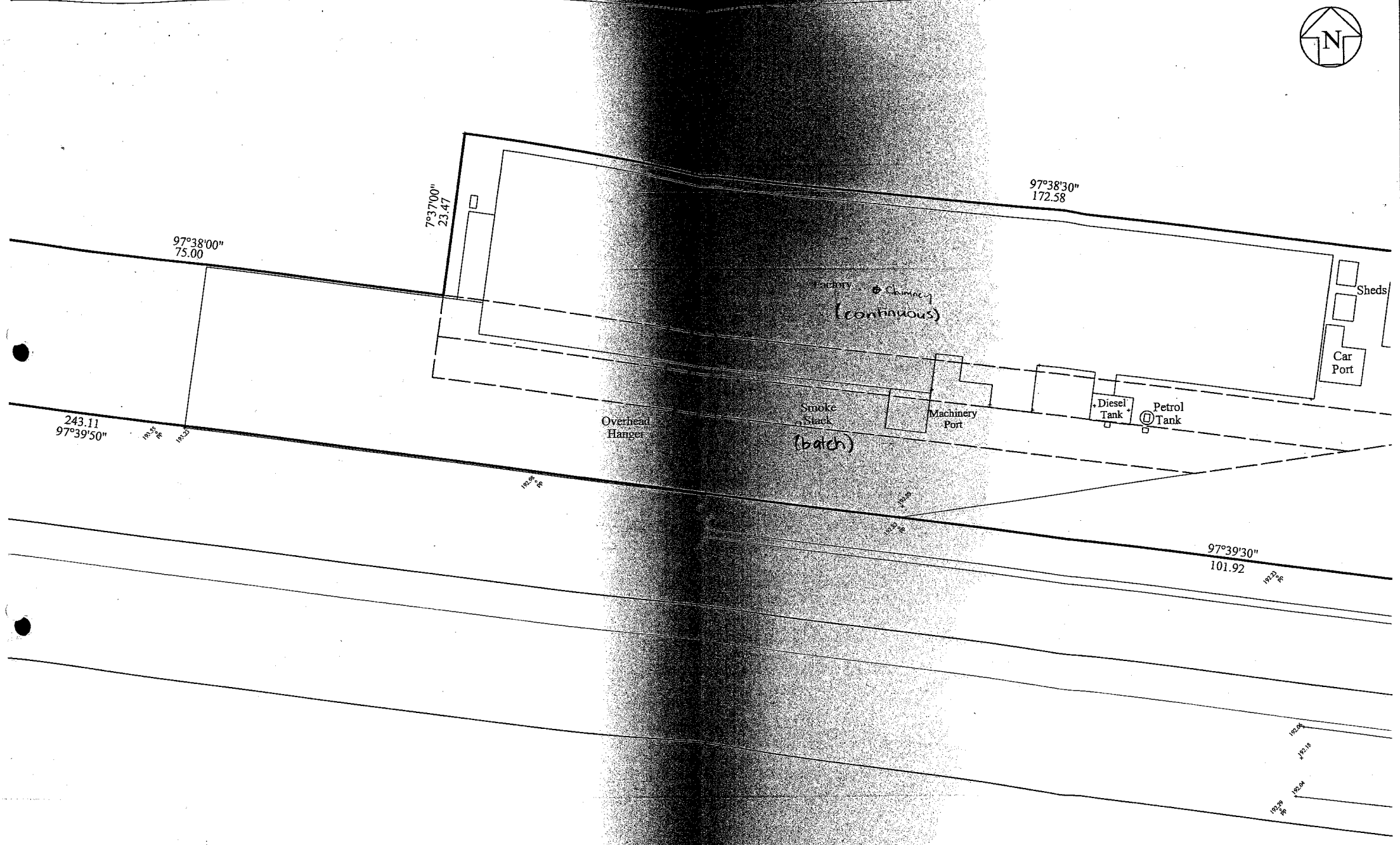
Table 1_Used Oil Not exceeding Any Specification Level Is Not Subject to This Part When Burned for Energy Recovery \1\

Constituent/property	Allowable level
Arsenic	5 ppm maximum.
Cadmium	2 ppm maximum.
Chromium	10 ppm maximum.
Lead	100 ppm maximum.
Flash point	100 °F minimum.
Total halogens	4,000 ppm maximum.\2\

Note: Applicable standards for the burning of used oil containing PCBs are imposed by 40 CFR 761.20(e).

\1\ The specification does not apply to mixtures of used oil and hazardous waste that continue to be regulated as hazardous waste (see § 279.10(b)).

\2\ Used oil containing more than 1,000 ppm total halogens is presumed to be a hazardous waste under the rebuttable presumption provided under § 279.10(b)(1). Such used oil is subject to subpart H of part 266 of this chapter rather than this part when burned for energy recovery unless the presumption of mixing can be successfully rebutted.

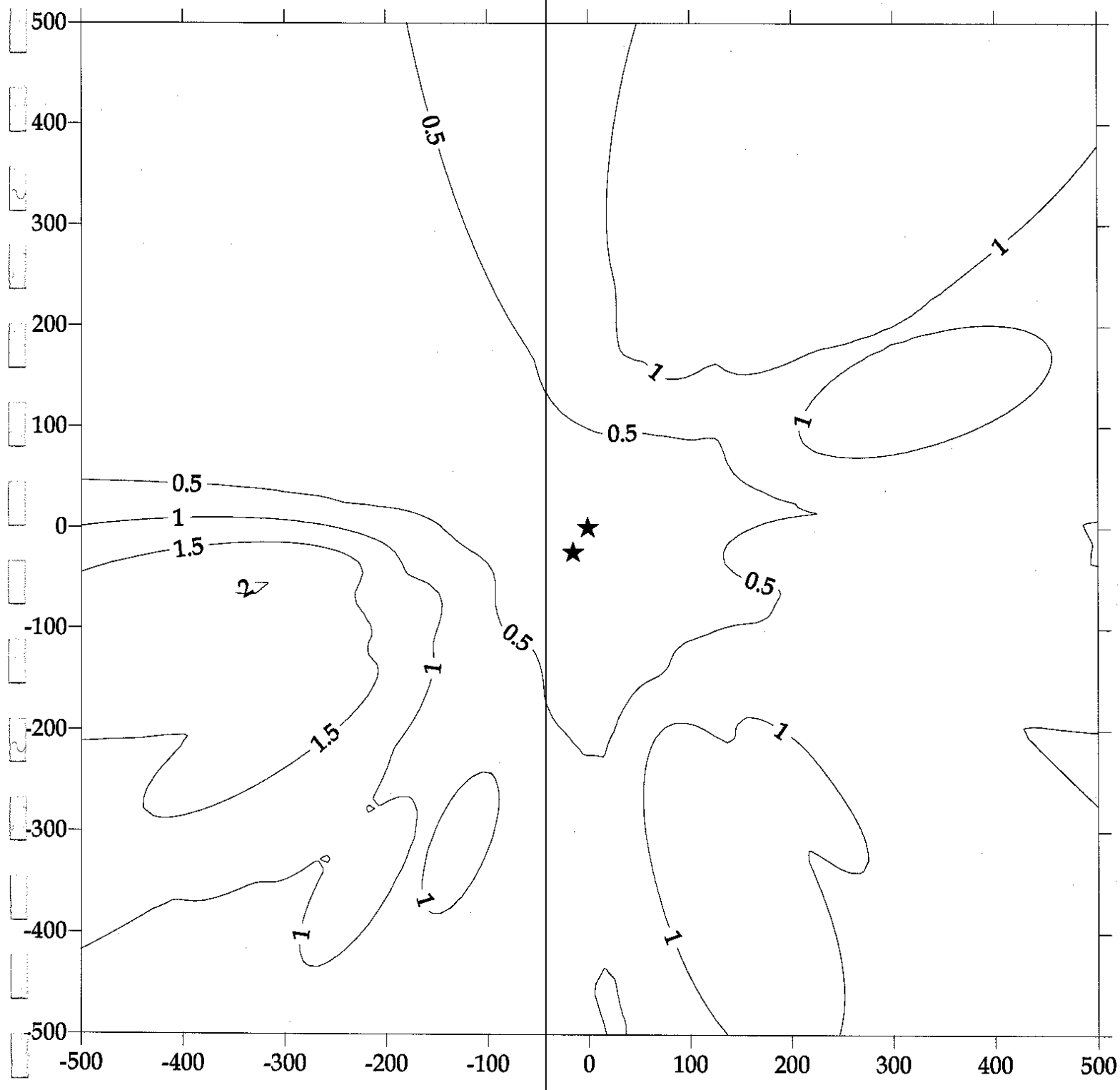


ev	Date	By	Amendments
k	16/05/05	PTC	Preliminary

Site Survey
Horndon Street, Darfield
Canterbury Clay Bricks

Philip Conway Surveyor Ltd
Surveying, Land Development, Resource Management
Level 5, 153 Hereford St
P.O. Box 13-464
Christchurch
Ph (03) 366 7030
Fax (03) 366 7031
office@pcsurvey.co.nz

Scale	Job Ref
1:500	1898/30
Date: May 2005	Sheet: 2 of 2
Revision: sk	A3



Rerefined Scenario - Predicted Ground Level PM10 Concentrations

Units: micrograms/m^3

Key: ★ emission source

BASELINEGROUP

Appendix 11: Consultation with NZTA

Level 1, BNZ Centre
120 Hereford Street
PO Box 1479
Christchurch Mail Centre
Christchurch 8011
New Zealand
T: 64 3 964 2800
F: 64 3 964 2793
www.nzta.govt.nz

11 April 2019

Andy Carr
Carriageway Consulting
PO Box 29623
Christchurch 8540

Dear Andy

PROPOSED DARFIELD PRIVATE PLAN CHANGE

The NZ Transport Agency (NZTA) appreciates the opportunity to be able to provide feedback at an early stage on a potential proposed private plan change in Darfield.

The NZTA has now had the opportunity to review the proposed plan change provisions and has received technical comment from our North Canterbury Network Contractors. As a matter of principle, and subject to the controls in the plan change provisions, we are generally comfortable that the plan change will not lead to adverse efficiency or safety effects on the operation of the State Highway network. However, we are presently giving further consideration to the proposals to upgrade the State Highway 73 / Creyke Road intersection. We agree that the intersection upgrade is required as part of the plan change, but we are undertaking additional work to determine whether the proposed thresholds for the upgrade are appropriate or whether the upgrading should take place at an earlier time. We will write to you in due course once we have formed a view on this matter.

We note that there is an existing direct access onto the highway towards the northwest of the site. The NZTA is of view that it would not be appropriate for this access to remain in place if the land was to be rezoned, and that the access should be formally closed if/when the plan change is confirmed. We would be grateful if you could clarify that you are agreeable to the closure of this access.

In addition to above, we would also be seeking that the detailed design of the intersection upgrade is approved by the NZTA before the development begins. This can be included as a condition of the plan change.

Again, we appreciate the opportunity to provide comment at the pre-application stage of the potential proposed plan change and we will be in touch once we form our view on the intersection upgrade thresholds.

Kind regards,

Stuart Pearson
Planning Advisor
NZ Transport Agency – System Design & Delivery
DDI 64 3 964 2836 / **M** 021 584 227
E stuart.pearson@nzta.govt.nz / **w** nzta.govt.nz

BASELINEGROUP

Appendix 12: Landscape Details

KEY

- Plan Change Boundary
- Proposed Business Zone
- Proposed Residential Subdivision Area at Average 1950m²
- Proposed Planting Strategy Area
- Berm
- Indicative Street Trees
- Indicative Street Lights

BASELINEGROUP

Darfield Plan Change

Scale	1:500 @A1, 1:1000@A3
Date	5 Mar 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	
B	05/08/19	

Revision B

Sheet 1

BASELINEGROUP

Street Elevation B-B
Scale 1: 40@ A1

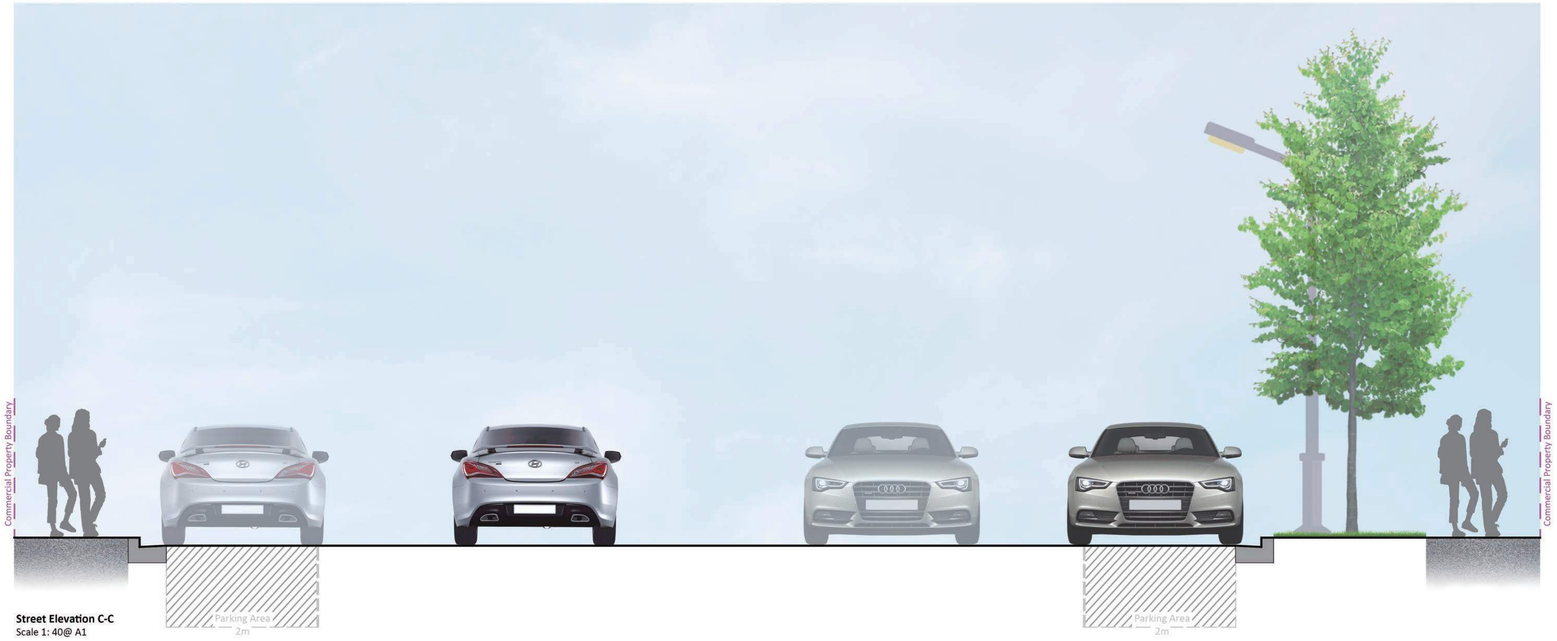
Darfield Plan Change

Scale	1:40 @A1
Date	5 Mar 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	

Revision A

Sheet 7



Street Elevation C-C
Scale 1: 40@ A1

Street Elevation D-D
Scale 1: 40@ A1

BASELINEGROUP

Darfield Plan Change

Scale	1:40 @A1
Date	5 Mar 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/18	

Revision A

Sheet 8

Existing Visual Point 1

Proposed Visual Point 1

Darfield Plan Change

Scale	Not to Scale
Date	5 Mar 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	

Revision A

Sheet 9

Existing Visual Point 2

Proposed Visual Point 2

BASELINEGROUP

Darfield Plan Change

Scale	Not to Scale
Date	5 Mar 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	

Revision A

Sheet 10

Existing Visual Point 3

Proposed Visual Point 3

BASELINEGROUP

Darfield Plan Change

Scale	Not to Scale
Date	28 Feb 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	

Revision A

Sheet 11

Existing Visual Point 4

Proposed Visual Point 4

Darfield Plan Change

Scale	Not to Scale
Date	28 Feb 2019
Design	EL
Drawn	EL
Review	AB & MV

Rev.	Date	Amendment
A	18/06/19	

Revision A

Sheet 12

Appendix 13: Section 32 Assessment

Introduction and RMA requirements

Rupert and Catherine Wright (the applicants) are requesting a change to the operative Selwyn District Plan (SDP) to change the zoning of the application site from Rural Outer Plains to a mix of Business 2 and Living 1 zoned land.

This application has outlined the background to and reasons for the requested Plan Change. The amendments to the SDP are outlined in Section 7 of this application. No environmental effects are anticipated by the change of zoning, however the potential environmental effects of implementation of the proposed plan change have been described in Section 8 of this application.

Any change to a plan needs to be evaluated in accordance with section 32 of the Resource Management Act. Section 32 states:

32 Requirements for preparing and publishing evaluation reports

(1) An evaluation report required under this Act must—
(a) examine the extent to which the objectives of the proposal being evaluated are the most appropriate way to achieve the purpose of this Act; and
(b) examine whether the provisions in the proposal are the most appropriate way to achieve the objectives by—
(i) identifying other reasonably practicable options for achieving the objectives; and
(ii) assessing the efficiency and effectiveness of the provisions in achieving the objectives; and
(iii) summarising the reasons for deciding on the provisions; and
(c) contain a level of detail that corresponds to the scale and significance of the environmental, economic, social, and cultural effects that are anticipated from the implementation of the proposal.

(2) An assessment under subsection (1)(b)(ii) must—
(a) identify and assess the benefits and costs of the environmental, economic, social, and cultural effects that are anticipated from the implementation of the provisions, including the opportunities for—
(i) economic growth that are anticipated to be provided or reduced; and
(ii) employment that are anticipated to be provided or reduced; and
(b) if practicable, quantify the benefits and costs referred to in paragraph (a); and (c) assess the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the provisions.

(3) If the proposal (an amending proposal) will amend a standard, statement, national planning standard, regulation, plan, or change that is already proposed or that already exists (an existing proposal), the examination under subsection (1)(b) must relate to—
(a) the provisions and objectives of the amending proposal; and
(b) the objectives of the existing proposal to the extent that those objectives—
(i) are relevant to the objectives of the amending proposal; and
(ii) would remain if the amending proposal were to take effect.

Objectives of the Proposed Plan Change

The objective of the proposed plan change is to change the zoning of the application site from Rural Outer Plains to Business 2 and Living 1.

Implementation of the proposed plan change will enable;

- Provide for additional housing and business land choice in Darfield at densities that complement the immediately surrounding land without compromising the character or amenity of that land.
- Provide for future subdivision and development that will contribute to the growth of Darfield, while not detracting from existing central Darfield businesses.
- Provide for concentrated development around an existing township in a manner that enables efficient use of existing and future infrastructure and current land resources.

Identification of options

In determining the most appropriate means to achieve the objective, options were explored that would take into consideration the findings of the investigations and key issues identified in Section 5.3 of this report and achieve the sustainable management purpose of the Act. These options were:

Option 1: Status Quo/do nothing

Do not rezone the application site from Rural Outer Plains to Living 1 and Business 2.

Option 2: Rezone the whole site for residential use

Seek to rezone the whole site for residential use, either Living 1 or 2 zone.

Option 3: Rezone the site partially for residential use and partially for business use (preferred option)

Rezone the site to both Business 2 and Living 1 Zones.

Option 4: Subdivision Consent

Subdivision of the application site through a non-complying subdivision consent for residential use.

	Option 1: Status quo/do nothing	Option 2: Rezone the whole site for residential use	Option 3: Rezone the site partially for residential use and partially for business use (preferred option)	Option 4: Subdivision Consent
Cost	None	Time and money cost to applicant for plan change. Increased hearings costs due to resistance from existing intensive farming activity.	Time and money cost to applicant for plan change. Costs to upgrade the intersection between SH73 and Creyke Road.	Time and money cost to applicant to seek a non-complying subdivision consent application
Benefit	Ongoing rural production on the application site.	Additional house stock contributing to the growth of Darfield.	Improved road safety at the intersection of Creyke Road and SH73. Additional business zone provides work opportunities to provide for township self-sufficiency. Additional housing stock contributing to the growth of Darfield.	No plan change required.
Efficiency/Effectiveness	No additional business land is provided for Darfield and the application site remains an ineffective piece of rural land surrounded by urban activities. Development occurs elsewhere around Darfield in a manner that does not achieve consolidated development.	Site specific constrains such as proximity to intensive farming activity are not considered resulting in reverse sensitivity effects for future landowners – low effectiveness as it may put pressure on intensive farming activity to cease. Increased servicing for wastewater and water supply is required as part of future subdivision. Does not provide for additional business land in Darfield.	High efficiency as it enables site specific constrains to be considered and avoids potential for reverse sensitive effects. Facilitates both residential and business activities in Darfield. Effective as it utilises rural land currently surrounded on three sides by urban activities to also be used for urban activities and completes the natural physical extent of township.	Low efficiency as subdivision of the site into allotments less than the zone minimum would be contrary to the Plan and set a precedence.
Risk	Site is used for ongoing rural activities that conflict with adjoining residential activities.	Allowing higher residential use could result in reverse sensitivity effects with business zone land to the north and may encourage access to State Highway 73 creating an unsafe road environment.	Increased pressure on surrounding road network requiring the upgrade of roads and intersections.	Subdivision consent is not granted and the application site remains as rural land.